Watershed Interventions for Kurlod and Botoshi

Phase III



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Executive summary

Background

The thirteen habitations of Kurlod and Botoshi villages in Mokhada taluka, Palghar district, face severe water stress in the summers despite having an annual rainfall of 2-3 meters. Through a joint collaboration between Aroehan, Siemens CSR, and Technology and Development Solutions Cell (TDSC) at IIT Bombay, a series of watershed interventions were planned to alleviate the stress. The aim of the project was to increase water availability for both drinking and livelihood opportunities, and was planned to be implemented in three phases over three years. Most of the work proposed in first and second phase has been completed. This report presents interventions planned for Phase III, and completion status report of interventions planned for Phase I & II.

TDSC Outputs

The table below summarizes the interventions planned for Phase III.

Area Type	Location	Intervention	Remarks:
	In Forest compartment	Gully plug	
Ridge area	At base of hill	Contour bund	
	Bhelpada s3	No intervention	All LBS is good shape
	Bhospada s1	20 LBS + Side channel	
	Bhospada s2	1 CNB	LBS and Gabion is not
			suitable as flow is large
	Bhospada s1+s2+s3	4 LBS + 3 Gabion	
	Botoshi s1	7 LBS + Nala training	
	Kirkirewadi s1	6 LBS	Small stream
	Markatwadi s1	3 LBS	Small stream
	Waspada s1	4 LBS + 2 Gabion + Nala	Large part is not suitable
		training	for LBS due to high flow
	Manipada s1	8 LBS + 5 Gabion + Nala	Many farms near stream
		training	and stream embankment
Stream line			is weak, hence nala
			training and embankment
			strengthening required
	Manipada s2	4 LBS + 2 Gabion	
	Kurlod s1	1 CNB	Proposed in earlier phase
	Jhambhulpada s1	9 LBS + side channel at farm	
	Shedyachepada s1	No intervention	Have good farm bunds
			and LBS
	Raipada Shedyachepada s1	3 LBS + 3 Gabion + Nala	
		training	
	Pethyachepada s1	3 LBS + 1 Gabion	
	Kapsepada s1	4 LBS + side channel	
	Kapsepada s2	5 LBS+ side channel	

Table 1 Planned interventions Phase III for Kurlod -Botoshi

	Kapsepada s s1 S2	No intervention	Lower part not suitable
			for LBS due to high flow,
			2 CNB Under construction
	Kapsepada main stream s3	5 LBS + 3 Gabion + CNB	
	In each farm	Farm bund	
Farm land	At farm streams, at	Side channel	
	locations of high flow		
		Reforestation in compartment	
		119, 121, 122, 123, 124, 125	
Forest land	Manipada streams	Stream line treatment in	
Forestianu		Manipada streams	
	Upper ridge line in all	Ridge line treatment on first	
	compartments	and second order Stream	

1 Introduction

The Kurlod-Botoshi watershed project is planned as a joint collaboration between Aroehan, Siemens CSR, and Technology and Development Solutions Cell (TDSC) at IIT Bombay. Kurlod and Botoshi are neighboring tribal villages in Mokhada block, Palghar district that face severe water scarcity, particularly from February till June. The aim of earlier phase I & II was to increase water availability in the area for drinking and livelihood purposes, and was planned to be implemented in two phases, over two years. This report presents the watershed interventions proposed for phase III, since most of work proposed in earlier phases has been constructed.

The report begins with a short background on Kurlod and Botoshi. This report presents the current status of water assets and proposed interventions for each habitation and area treatment intervention for phase III of watershed intervention. This report concludes with a summary of all proposed interventions.

1.1 Kurlod and Botoshi

Kurlod and Botoshi have a combined population of approximately 2600 souls, split over 13 habitations with individual populations ranging from 15 to 450. Kurlod is approximately 158 km from Mumbai (a 5-hour drive), and 55 km from Kasara (a 2-3-hour drive). Botoshi is closer to Kasara by an hour.



Figure 1 Map showing geographical location of Kurlod village.

1.2 Water resources of KB

The habitations are all either close to the Pinjal River, seen in the image below, or by a stream that drains into the river. Neither the streams nor Pinjal are perennial; though these habitations get plenty of rainfall

in monsoon, this area is not water secure throughout the year. Water resources, both natural resource like river or intervention resources (man-made structure like bund), are discussed next.



Figure 2 Google Earth image showing layout of habitations in Kurlod and Botoshi.

1.2.1 Natural resources

1.2.1.1 <u>River</u>

Pinjal river which is a tributary of Vaitarana, pass through this area and is main water source. Most of habitations of Kurlod and Botoshi are on the banks of this river. There are many streams which join Pinjal as shown in figure 2.

1.2.2 Intervention resources

Habitations also have intervention resources like well and bund build mainly by governmental agency. TDSC have conducted assessment of their status, utility and proposed intervention on some of them in earlier phases.

1.2.2.1 <u>Well</u>

Table 2 Details of all well in Kurlod -Botoshi area

Sr	Well name	Location	Nearest	Water lasts	Primary well	Remarks made in
No			habitation	till month	/Not	earlier phase
1	BO-W1	Near river	Botoshi	January		
2	BO-W2		Botoshi			
3	BO-W3	Nearest to	Botoshi	January		
		village				
4	BO-W4	On Farm land	Botoshi	February		
5	BO-W5	Near road	Botoshi	March	Primary well	Not selected for
		towards bund				solar pumping as
						recharge cannot be
						increased
6	BO-W6	Newly	Botoshi		Primary well	
		constructed			for solar	
		jackwell near			pumping	
		river				
7	KIR –W1	Near river	Kirkirewadi	Whole year,	Primary well	Well height
				poor quality		increased to avoid
						flood level
8	MAR-W1	Near	Markatwadi	December	Primary well	
		habitation				
9	MAR-W2	Nearest to	Markatwadi	January	Incomplete	
10		river				
10	MAR-W3	On farm land	Markatwadi	December	Shallow	
		near river			depth	
11	BHEL-W1	On drainage	Bhelpada	March		
		through field				
		near				
12		Near stream	Dhachada		Drimory	
12	BHO-W1	Near stream	впоѕраца		for color	
12	RHO_\//1b	Near stream	Bhospada		Shallower	
13	010-0010	iveal stream	впозраца		than W/1	
14	BHO-W/2	Nearest to	Bhosnada		Shallow	
14	BIIO W2	village	Dhospada		denth	
15	BHO-W3	Nearest to	Bhospada		Shallow	
		village stream	211039400		depth	
16	BHO-W4	Nearest to	Bhospada		Shallow	
		village stream			depth	
L					3000	

17	BHO-W5	Near stream,	Bhospada		May have	
		downstream			good	
		of broken			prospect	
		bund				
18	KUR-W1	Near samshan	Kurlod	March	Low social	
		bhumi			acceptance	
19	KUR-W2	On farm land	Kurlod	October		
20	KUR-W3	Nearest to	Kurlod	February		
		habitation				
21	KUR-W4	Near stream	Kurlod	May	Primary well	Bund repair is
		joining Pinjal			for solar	proposed to
					pump	strength the well
22	WAD-W1		Wadpada	October		
23	WAD-W2		Wadpada	March	Primary well	Solar pumping from
						Manipada W2
24	MANI-W1	On farm land	Manipada	October		
25	MANI-W2	Near river,	Manipada	Whole year,	Primary well	For Wadpada too
		upstream of		poor quality	for solar	
		government			pump	
		bund				
26	RAI-W1	Near stream	Raipada	Whole year,		
				poor quality		
27	RAI-W2	Submersed,	Raipada		Primary well	Revival done
		near stream				
28	SHED-W1		Shedyachepada	Whole year,		
				poor quality		
29	JAM/SHED-		Shedyachepada	Whole year,		
	W1			poor quality		
30	PETH-W1	Near	Pethyachepada	Whole year,	Primary well	Downstream bund
		Kapsepada		high	for solar	is constructed
		stream		siltation	pump	
31	PETH-W2	Near stream,	Pethyachepada	Whole year,		
		Near road		poor quality		
32	PETH-W3	Near stream	Pethyachepada	January -	Primary well	Recharge Prospect
				February		are better for W1
33	KAP-W1		Kapsepada		Primary well	
34	KAP-W1		Kapsepada			
35	KAP-W1		Kapsepada			
36	KAP-W1		Kapsepada			
37	KAP-W1		Kapsepada			

1.2.2.2 <u>Bund</u>

Sr	Bund name	Nearest	Location	Status	Interventions
No		habitation/			
		Stream			
1	Kurlod Bund B1	Kurlod	Near KUR W4	Leaking	Plastic repair
2	Manipada bund	Manipada	Near MANI W2	Embankment	Embankment
				eroded	strengthening and
					core wall extension
					proposed in this
					phase
3	Bhospada Bund B1	Bhospada	Downstream of	Leaking	No intervention, low
			BHO W1		utility of water
4	Bhospada Bund B2	Bhospada	Upstream to	Completely	New bund at same
				broken	site
5	Raipada Bund B1	Raipada	Downstream of	leaking	Plastic repair
			new well RAI W2		
6	Pethchepada	Pethchepada	Downstream of	Good	New Bund,
	stream Bund B1		PETH W1		
7	Pethchepada river	Pethchepada	Upstream to point	Good	New Bund
	Bund B2		where Kapsepada		
			stream joins Pinjal		
8	Botoshi river Bund	Botoshi	Near road and way	Good	New Bund
	B1		to Botoshi		

2 Construction Status of Interventions Proposed in Earlier Phases

2.1 Back ground

Since TDSC previously proposed interventions in earlier two phases and Aroehan has constructed most of them, an exercise of assessing interventions proposed in earlier phases was also done in this phase.

2.2 Rain Water Harvesting Structure

Sr	New Well/	Name of	Habitation	Status	Remarks
No	Well-repair	well			
1	New Well	RAI-W2	Raipada	Complete	Good water availability, almost to
					ground level
2	New Well	BO-W6	Botoshi	Complete	Good water availability due to
					proximity of river
3	Well repair	KIR-W1	Kirkirewadi	Complete	Good water availability
4	Well repair	PETH-W1	Pethyachepada	Complete	Good water availability due
					downstream bund on stream
5	Well repair	MANI-W2	Manipada	Complete	Good water availability
6	Well repair	BHO-W1	Bhospada	Complete	Good water availability
7	Well repair		Markatwadi	Complete	Water availability is good but
					increasing depth from current 3m to
					5m will make at same level as riverbed
					which is better for source sustainability

2.2.1 Proposed new well/ well-repair

Table 4 Details of Proposed Intervention on Well

2.2.2 Proposed new bund/ bund repair

Table 5 Details of Proposed Bunds

Sr	New Bund/	Habitation	Status	Remarks
No	Bund repair			
1	New Bund	Pethyachepada	Complete	
2	New Bund	Pethyachepada	Complete	
3	Bund Repair	Kurlod	Complete	Plastic repair alone is not sufficient, Plastic
				repair should be embedded in concrete.
4	New Bund	Wadpada	Not started	May be omitted as Drinking water is
				proposed to be pumped from Manipada
5	Bund Repair	Raipada	Not started	
6	New Bund	Raipada	Not started	

7	New Bund	Botoshi	Complete	
8	New Bund	Markatwadi	Not started	Water is availability is good in large river
				pocket, may be omitted
9	New Bund	Bhospada	Not started	Bhospada stream is big and not suited for
				area treatment structures as Gabion/ LBS.
				Hence this bund should be high priority
10	New Bund	Kapsepada	Under progress	
11	New Bund	Kapsepada	Under progress	

2.3 Solar pump-tank-filter setup

Table 6 details of Solar	pump-tank-filter setup
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Sr No	Habitation	Status	Remarks
1	Bhospada	Functional	
2	Botoshi		
3	Bhelpada	Under construction	Pipe cover is low, should be at least 60 cm
4	Markatwadi	Under construction	Pipe cover is low, should be at least 60 cm
5	Kurlod	Functional	
6	Pethyachepada	Functional	
7	Manipada	Functional	Dysfunctional as pump cannot handle river water
			level fluctuations
8	Wadpada	Under construction	Pipe cover is low, should be at least 60 cm

2.4 Lessons Learnt from Interventions in Earlier Phases

2.4.1 Well construction:

Site selection with people's input is extremely helpful as proven in construction of new well in Raipada. Out of two wells separated by 50m, one is affected by iron impurity and other is not. With people's input TDSC selected right well for renovation.

2.4.2 Bund construction:

Extension of core wall and back side wall till hard rock is extremely important for preventing embankment erosion. Innovative work during construction is also required. Construction team at Pethyachepada stream found a good water source within the intended body of bund and with their innovation they constructed a well embedded in the bund.

2.4.3 Solar pumping and filter set:

Non-submersible pump is not good for pumping at high suction depths (above 3 m) with fluctuation of water level. As is evident from dysfunction of these pumps for large duration at a greater frequency. Fence around filter and tank gets damaged frequently and is not essential to the setup, thus need not be erected.

2.4.4 Plastic bund:

Plastic repairing of Kurlod stream bund have proved useful for holding water but for longer life, plastic should be covered by concrete layer.

3 Area Treatment Interventions

After focusing on drinking water security and irrigation water security in earlier phases, planning of phase 3 focused on area treatment activities to improve overall water availability in the area. All interventions are divided into non-exhaustive categories of Ridge-area treatment, Stream-line treatment, Farmland treatment and Forest land treatment. TDSC has identified and assessed these areas and proposed intervention on them. Details of these are given in this chapter.

3.1 Objectives of Area Treatment Interventions

Objectives of area treatment are

- 1. To reduce soil erosion
- 2. To trap silt at regular intervals
- 3. To increase groundwater availability
- 4. To prolong life for rivers and storages (duration of storage)
- 5. To improve of local soil moisture profile

3.2 Methodology of planning:

TDSC has adopted identify, assess and propose strategy for each intervention in each area. Preliminary identification of interventions was done in the field with help of secondary data like toposheet, contour map, revenue map, and on google earth.

3.2.1 Field visit activities: TDSC site visits:

With support from Aroehan, the TDSC team visited Kurlod and Botoshi over multiple trips in order to complete the following steps for each habitation:

- Verify and update construction status of interventions proposed in phase I & II and record lessons learnt through these.
- Study key areas to determine feasibility and suitability of various possible area treatment watershed interventions, and discuss options with villagers and Aroehan staff.
- Collect data and observations on topology, land use, and hydro-geological properties at planned intervention sites to finalize and produce detailed recommendations.
- Possible interventions on stream-line were marked in the field with paint and marked on map.
- Interventions in farm land (Farm bund, terracing), Ridge area (Gully plug, Contour Bund) and forest land(Reforestation) are large in number and difficult to mark on the field. All the necessary map and demarcation for planning these interventions has been prepared for these areas. Technical training for planning will be provided by TDSC.

Since January 2017, TDSC made several visits all habitations as summarized below.

Visit Dates (2017)	Habitations visited	Agenda	
Jan 11-12	Botoshi, Bhospada Pethechapada,	Kick-off visit: Out of all area treatment identifying	
(2 days)	Kurlod, Manipada, Wadpada	possible intervention suitable for this area	
Jan 17-19	Potoshi Markatwadi Kirkirowadi	Marking stream line interventions on field by	
(3 days)	Botoshi, Markatwadi, Kirkirewadi	paint in Botoshi village	
Jan 24-25	Phoenada Pholpada Wadnada	Marking stream line interventions on field by	
(2 days)	Bhospaua, Bheipaua, Waupaua	paint in Botoshi village and Wadpada	
Feb 8-9 (2 days)	Kapshipada, Shedyachapada, Raipada, Pethyachpada, Manipada	Marking stream line interventions on field by paint in Kurlod village	

Table 4 - TDSC site visit details

3.2.2 Protocol of area treatment intervention adopted

Gully plug, contour bund and plantation is effective for ridge treatment. Contour trench is not effective in these areas as it may increase soil erosion. LBS, Gabion and Concrete Nala Bund, Nala training are effective for stream line treatment where flow is low. As soil cover is present only in farmlands, drainage management of farm land is very important in this area. Effectiveness of area treatment may be enhanced if supported by support interventions of area treatment.

3.3 Support interventions

3.3.1 Guided grazing

Villages use guided grazing of livestock during rice cultivation season but due low cultivation in rabbi season, majority's interest is not aligned with guided grazing. Thus, it is absent everywhere in rabbi. Many farmers with good water availability site this as a reason for not cultivating in rabbi. This vicious cycle needs to be broken to increase rabbi cultivation. Community grazing farm may be developed on Government/ community land or forest land.

3.3.2 Home grazing

Culture of home grazing does not exist in this area. Home feeding of livestock can be encouraged if livestock can provide livelihood support like milk production.

3.3.3 Farmland drainage management

Since the entire area doesn't have enough soil cover, farm land with greater soil cover is potential source of soil erosion. It also has greater utility of increased soil moisture if area treatment activity is done. Hence farm drainage management becomes extremely important in this area. Additionally, farming is done on minor streams which have greater flow in monsoon and in general farm land have some local farm ridge and water flow in the certain primary first order stream which are farm streams.

3.3.4 Alternative agriculture for firewood

Due to low adoptation of modern cooking methods (Induction chulha, LPG) in this area, forests are primary supplier of cooking fuel which is firewood. Villagers primarily use trees like aain as firewood. Alternative agriculture of good firewood material needs to be promoted to reduced stress on forests.

These support interventions should be tested on pilot basis.

3.4 Types of area treatment Interventions

The following table summarizes the types of interventions planned for Kurlod and Botoshi, and each type's purpose and intended impact.

Intervention	Purpose	Intended impact	Key parameters
Туре			
Gully plug	1. Reduce Soil erosion	Increase ground water	At first or second order stream at
	2.Trap silt at regular	recharge due to low	regular interval
	intervals	and prolonged flow	
Contour Bund	1. Reduce Soil erosion	Increase ground water	At first or second order stream at
	2.Trap silt at regular	recharge due to low	regular interval, at base of hill
	intervals	and prolonged flow	before beginning of farm land
Plantation/	1. Reduce Soil erosion	Increase forest cover,	Plantation to support livelihood at
Afforestation		microclimate stability,	farm land, social forestry along
		forest services	roads, Reforestation of forest land
Loose Boulder	1. Trap silt at regular	life of stream is	Good embankment on both side,
Structure	intervals	enhanced	low upstream slope, low flow in
	2. Enhance ground		the stream
	water recharge		
Gabion Bund	1. Trap silt at regular	life of stream is	Good embankment on both side,
	intervals	enhanced	low upstream slope, low flow in
	2. Enhance ground		the stream
	water recharge		
Concrete Nala	1.Storage	surface water storage	Distance to fields and nearby wells,
Bund	2. Enhance ground	for rabbi and/or	width of stream at bund location,
	water recharge	recharging nearby well	properties of embankment,
	3. Enhance stream life		catchment area of bund, rainfall
Farm drainage	1.Soil moisture profile	Better soil moisture	Farm land at each farm, side
management	improvement	for Rabbi/ vegetables	channel if farm land is on stream

Table 7 Types of interventions proposed for Kurlod and Botoshi
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3.5 Intervention proposed in the area

3.5.1 Intervention in ridge area

3.5.1.1 Identification

Ridge area in Kurlod Botoshi was identified with help of contour data and field visits. These areas were marked in google earth. Most of ridge area is also forest area. Ridge area mainly contain first and second order streams which can be easily identified in the field.

3.5.1.2 Intervention proposed

Intervention proposed in these areas are:

3.5.1.3 Gally plug:

Gully plug should be constructed at every 3-meter vertical interval on each first and second order stream in the field

3.5.1.4 Plantation:

Plantation should be done wherever it is possible at higher slope along with contour bunding.

3.5.1.5 Contour Bund:

Contour bund should be constructed at every 3-meter vertical intervention.

Since site selection of gully plug, planation and Contour bund is very intuitive and these interventions have to be constructed in large number, site selection must be done at construction stage hence on ground marking of intervention in ridge area has not been done. General area demarcation is done.

3.5.2 Intervention in Stream line

3.5.2.1 Identification

Streamline Ridge in Kurlod Botoshi has been identified with help of contour data, stream data and field visits. All major streams have been marked in google earth. Most streams flow through revenue area, only one stream manipada stream flows mainly in forest area. Stream line mainly contain third or higher order streams which can be easily identified in the field.

3.5.2.2 Intervention proposed

With knowledge of stream flow from people's perception and stream width, interventions proposed in these lines are summarized in table below.

Stream name	Interventions proposed
Bhelpada s3	No intervention
Bhospada s1	20 LBS + Side channel
Bhospada s2	One CNB +
Bhospada s1+s2+s3	4 LBS + 3 Gabion
Botoshi s1	7 LBS + Nala training
Kirkirewadi s1	6 LBS
Markatwadi s1	3 LBS
Waspada s1	4 LBS + 2 Gabion + Nala training
Manipada s1	8 LBS + 5 Gabion + Nala training
Manipada s2	4 LBS + 2 Gabion
Kurlod s1	1 CNB
Jhambhulpada s1	9 LBS + side channel at farm
Shedyachepada s1	No intervention
Raipada Shedyachepada s1	3 LBS + 3 Gabion + Nala training
Pethyachepada s1	3 LBS + 1 Gabion
Kapsepada s1	4 LBS + side channel

Table 8 Stream line intervention for Kurlod Botoshi

Kapsepada s2	5 LBS+ side channel
Kapsepada s s1 S2	No intervention
Kapsepada main stream s3	5 LBS + 3 Gabion + CNB

3.5.3 Intervention in Farm land

3.5.3.1 Identification

Every big patch of farms is identified on ground and named after nearby habitation. Farmland has been marked on google earth as polygons. First and second order streams going through farms are also marked.

3.5.3.2 Intervention proposed

With knowledge of flow pattern from people's perception and stream line maps, intervention proposed in these lands are:

3.5.3.3 <u>Terracing</u>:

Farmers in this area use land with higher slope to grow Nagali and Warai. With terracing, these farms can be converted to rice field. Since terracing does not require greater engineering input and but require farmer consent hence exact site should be selected at time of construction through farmer interaction. TDSC has identified potential sites for terracing.

3.5.3.4 Farm drainage management:

Since the entire area doesn't have enough soil cover, farm land with greater soil cover is potential source of soil erosion. It also has greater utility of increased soil moisture if area treatment activity is done. Hence farm drainage management becomes extremely important in this area. Additionally, farming is done on minor streams which have greater flow in monsoon and in general farm land have some local farm ridge and water flow in the certain primary first order stream which are farm streams.

Three types of interventions can be implemented in farmlands:

Farm bund: Each farm should have at least one farm bund (preferably of stone) on the draining side of farm.

Farm ponds: to retain farm moisture, avoid damage due to sudden flooding and provide distress irrigation at the spots where water enters into the farm. This area typically remains flooded and has lower productivity. If this is sacrificed, overall farm productivity can be improved.

Side channel: If there is a history of greater flow through field or farm is on some stream (farm filled with smaller stones is evident) side channel with gully plugging at regular interval should be constructed. To prevent excess flooding and soil loss.

3.5.4 Interventions in forest

3.5.4.1 Identification

TDSC has followed official demarcation of forest department for planning. Official nomenclature for forest covered under various official units are Division, Range, Beats, and Compartment in decreasing order of area. Since smallest unit of forest is compartment, TDSC has chosen compartment as planning unit for interventions. Compartments are given number as their identity. Entire forest area in revenue boundary of Kurlod and Botoshi village is listed under Ujjani range of Jawhar division.



Figure 3 Forest map with three beat of Botoshi, Kurlod and Patherdi

Redline indicates Range boundary, Blue line indicates Beat boundary, yellow line indicates compartment boundary in above figure. Number shown in figure indicates compartment number. Forest area in Kurlod Botoshi are covered under Kurlod beat (Compartment number 122,123,124), Botoshi beat (Compartment number 121,125) and Pathardi beat (Compartment number 118,119,120).

3.5.4.2 <u>Compartment 118</u>



Figure 4 Compartment with Kurlod-Botoshi revenue boundary

Boundary of Kurlod and Botoshi is shown in green colour, light green colour demarcates the compartments.

Assessment and intervention

Since compartment number 118 lies outside of Kurlod Botoshi revenue boundary, it was not considered for planning interventions.

3.5.4.3 Compartment 119



Figure 5 Compartment 119 with stream line

Streamlines are shown in dark green colour, light green colour shows the compartment boundaries and green colour is the village boundary.

Left half of compartment 119 lies in Kurlod-Botoshi boundary. Only first order or second order stream is present in area. Ridge line treatment of gully Plug and contour bund should be constructed at each first and second order stream.

Deforestation assessment: forest left only at ridge line as evident of figure 5.

3.5.4.4 Compartment 120



Figure 6 Compartment 120 with stream line

Streamlines are shown in dark green colour, light green colour shows the compartment boundaries and green colour is the village boundary.

Small area of compartment lies in Kurlod-Botoshi boundary. Only first order or second order stream is present in area. Ridge line treatment of gully Plug and contour bund should be constructed at each first and second order stream.

Deforestation assessment: forest cover is good, no reforestation is required

3.5.4.5 <u>Compartment 121</u>



Figure 7 Compartment 121 with stream line

Streamlines are shown in dark green colour, light green colour shows the compartment boundaries and green colour is the village boundary.

large area of compartment lies in Kurlod-Botoshi boundary. Many first order or second order streams present in area. Ridge line treatment of gully Plug and contour bund should be constructed at each first and second order stream. One major stream meets pinjal in manipada. Intervention on that stream are covered in stream line intervention.

Deforestation: Forest cover is good in upper part of compartment but degraded forest is present near rivers. Forest department has also allotted patta of land to villagers of Korlod Botoshi in this compartment.

3.5.4.6 Compartment 122



Figure 8 Compartment 122 with stream line

Streamlines are shown in dark green colour, light green colour shows the compartment boundaries and green colour is the village boundary.

All area of compartment lies in Kurlod-Botoshi boundary. Many first order or second order streams present in area. Ridge line treatment of gully Plug and contour bund should be done at these streams. No major stream is present here. Raipada- shedyapada stream originates from this compartment.

Deforestation assessment: forest good in most parts, no reforestation required.

3.5.4.7 Compartment number 123



Figure 9 Compartment 123 with stream line

Streamlines are shown in dark green colour, light green colour shows the compartment boundaries and green colour is the village boundary.

All area of compartment lies in Kurlod-Botoshi boundary. Many first order or second order streams are present in area. Ridge line treatment of gully Plug and contour bund should be constructed at each first and second order stream.

Deforestation assessment: very high only little forest left at ridge, Reforestation is required

3.5.4.8 Compartment number 124



Figure 10 Compartment 124 with stream line

Streamlines are shown in dark green colour, light green colour shows the compartment boundaries and green colour is the village boundary.

All area of compartment lies in Kurlod-Botoshi boundary. It is the biggest compartment in Kurlod-Botoshi.

Many first order or second order stream are present in area. Ridge line treatment of gully Plug and contour bund should be done at these streams. Two major streams are also present: one is pethyachapada farm stream which meets Kapsepada stream upstream to Pethyachepada stream bund and other is Kurlod stream which meets Pinjal at Plastic bund.

Deforestation assessment: Deforestation is very high, only little forest left at ridge. Reforestation in required in this compartment.

3.5.4.9 Compartment number 125



Figure 11 Compartment 125 with stream line

Streamlines are shown in dark green colour, light green colour shows the compartment boundaries and green colour is the village boundary.

All area of compartment lies in Kurlod-Botoshi boundary. Many first order or second order streams are present in area. Ridge line treatment of gully Plug and contour bund should be made at each first and second order stream Two major streams are present: Botoshi forest farm stream and Wadpada stream meeting Pinjal at markatwadi.

Deforestation assessment : Deforestation is very high, only little forest left at ridge. Reforestation in required in this compartment.

3.5.5 Intervention specific for soil conservation

Stone bunding at site of heavy soil erosion: Nala training and embankment strengthening is proposed in streams with high erosion.

Contour bund at ridge line: Contour bund at ridge area, especially as base of hills is proposed for reduction in soil erosion.

Farm drainage management: drainage management in farm land with construction of side channel and farm bund has been proposed to reduce soil erosion.

3.6 Summary of interventions

Summary of all area treatment interventions for phase 3 of Kurlod-Botoshi project are as given below

Area Type	Location	Intervention	Remarks:
Ridge area	In Forest compartment	Gully plug	
-	At base of hill	Contour bund	
	Bhelpada s3	No intervention	All LBS is good shape
	Bhospada s1	20 LBS + Side channel	
	Bhospada s2	One CNB +	LBS and Gabion is not suitable as flow is large
	Bhospada s1+s2+s3	4 LBS + 3 Gabion	
	Botoshi s1	7 LBS + Nala training	
	Kirkirewadi s1	6 LBS	Small stream
	Markatwadi s1	3 LBS	Small stream
	Waspada s1	4 LBS + 2 Gabion + Nala training	Large part is not suitable for LBS due to high flow
Stream line	Manipada s1	8 LBS + 5 Gabion + Nala training	Many farm are nearby stream and stream embankment is not good ,hence nala training and embankment strengthen is required
	Manipada s2	4 LBS + 2 Gabion	
	Kurlod s1	1 CNB	Proposed in earlier phase
	Jhambhulpada s1	9 LBS + side channel at farm	
	Shedyachepada s1	No intervention	Have good farm bund and LBS
	Raipada Shedyachepada s1	3 LBS + 3 Gabion + Nala training	
	Pethyachepada s1	3 LBS + 1 Gabion	
	Kapsepada s1	4 LBS + side channel	
	Kapsepada s2	5 LBS+ side channel	
	Kapsepada s s1 S2	No intervention	Lower part is not suitable for LBS due to high flow, 2 CNB Under construction
	Kapsepada main stream s3	5 LBS + 3 Gabion + CNB	

Table 9 Summary of interventions

	In each farm	Farm bund	
Farm land	At farm stream, at location of high flow	Side channel	
		Reforestation in	
		compartment 119, 121,	
		122, 123, 124, 125	
Forost land	Manipada streams	Stream line treatment	
Forestianu		in Manipada streams	
	Upper ridge line in all compartment	Ridge line treatment on	
		first and second order	
		Stream	

We have used nomenclature of LBS even for farm bund on farm which are on some stream. All stream line intervention has been marked in the field with paint. Pilot planning other type of intervention will the conducted with Aroehan staff. Monitoring of pilot of each intervention will be conducted at appropriate time.