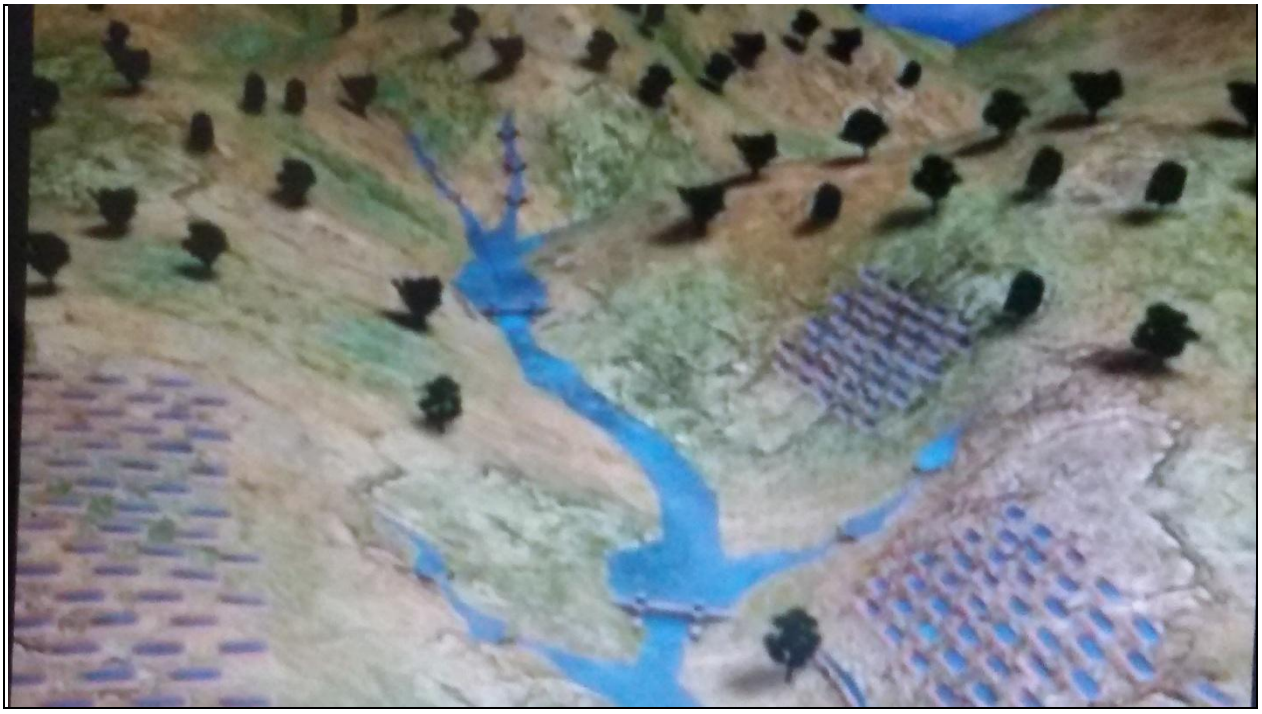
ONLINE LEARNING OF MGNREGA WORKS

MODULE 1: NATURAL RESOURCES MANAGEMENT



Ridge Area

(1) WATERSHED INTERVENTIONS

This module aims to enable registered participants to identify location specific soil – moisture and water harvesting structures and also equip them with knowledge and skills for designing various structures in the following areas:

1. Non-arable lands
2. Drainage lines
3. Arable lands on the basis of ridge to valley concept.

Participants have to take up following steps:

1. Take pre-test
2. Read the text
3. View Video
4. Take post-test
5. Evaluate yourself

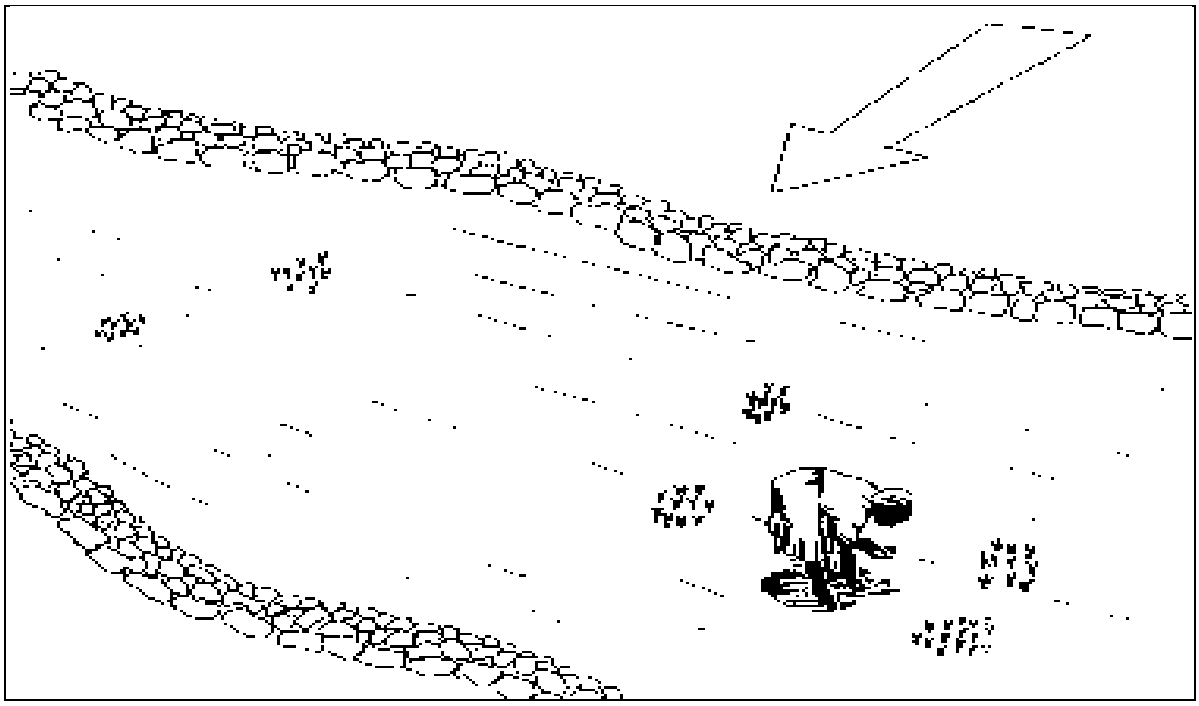
Watershed Interventions in Non-arable/Ridge area

1. Diversion Drains

2. Continuous Contour Trench

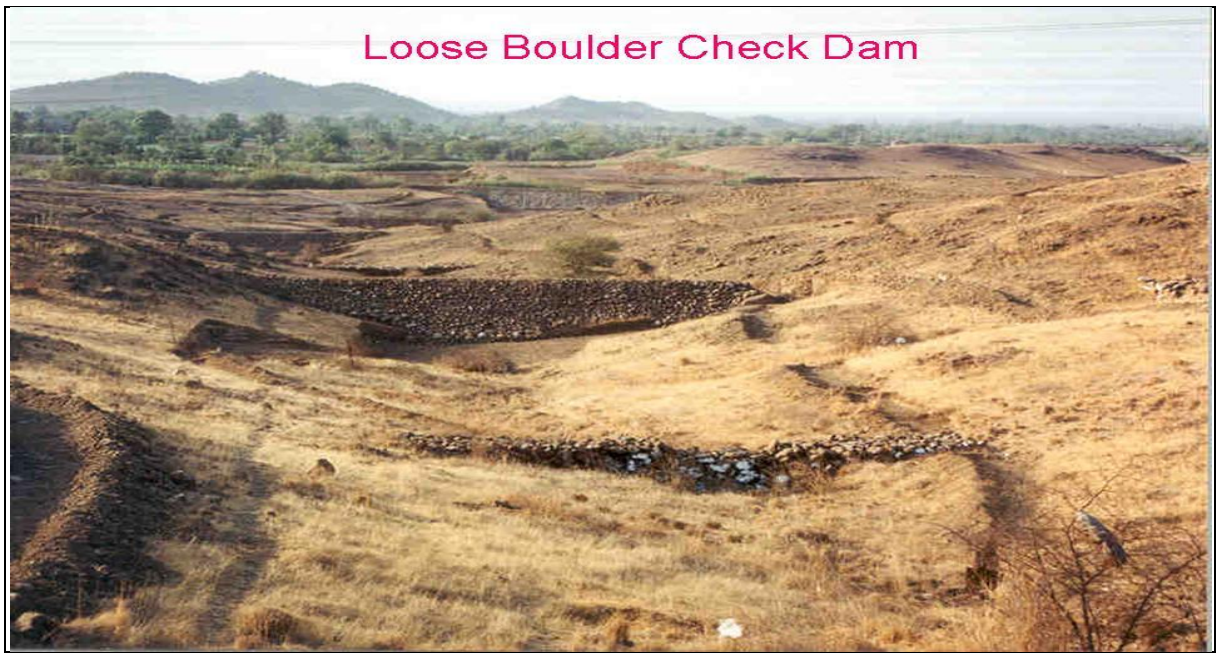
3. Staggered Contour Trench

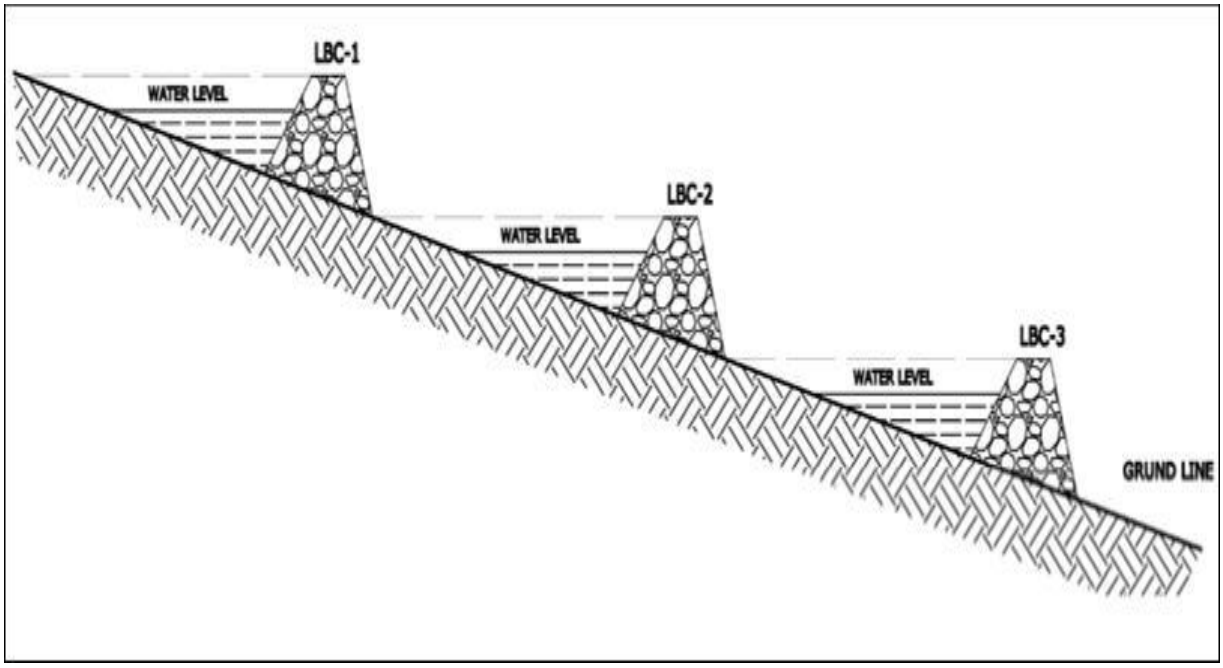
4. Loose Boulder Bunding



Watershed Interventions in Drainage Lines

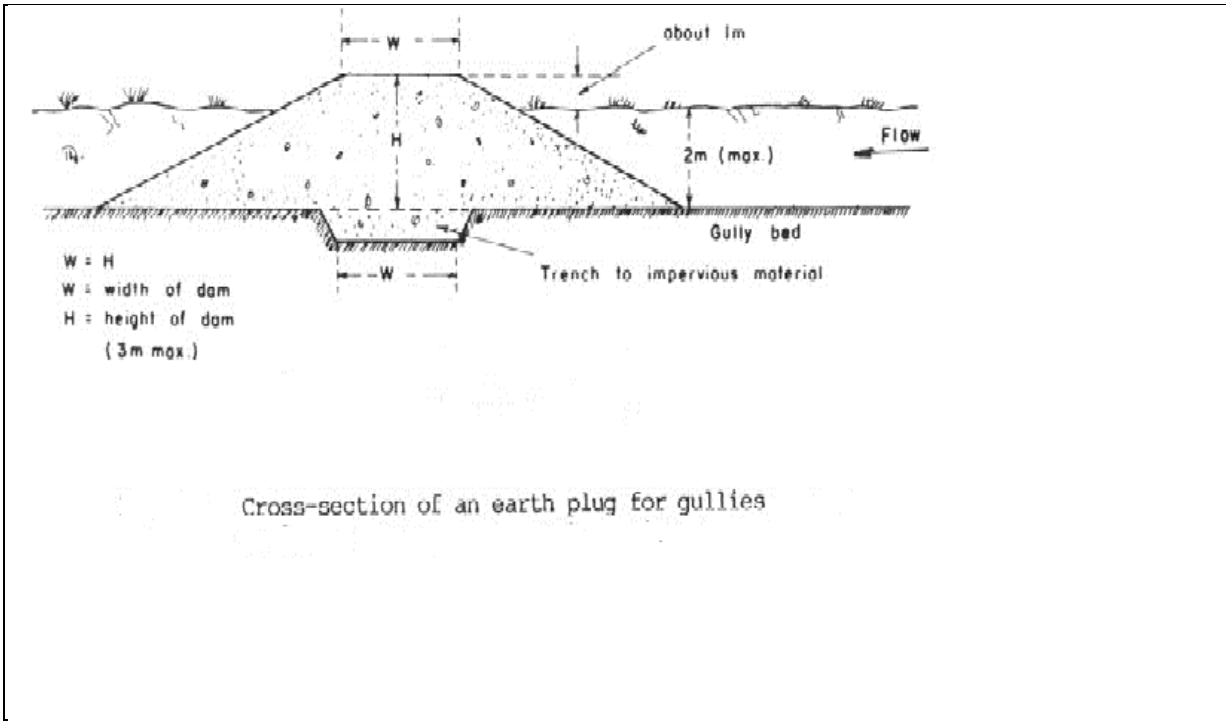
1. Loose Boulder Checks





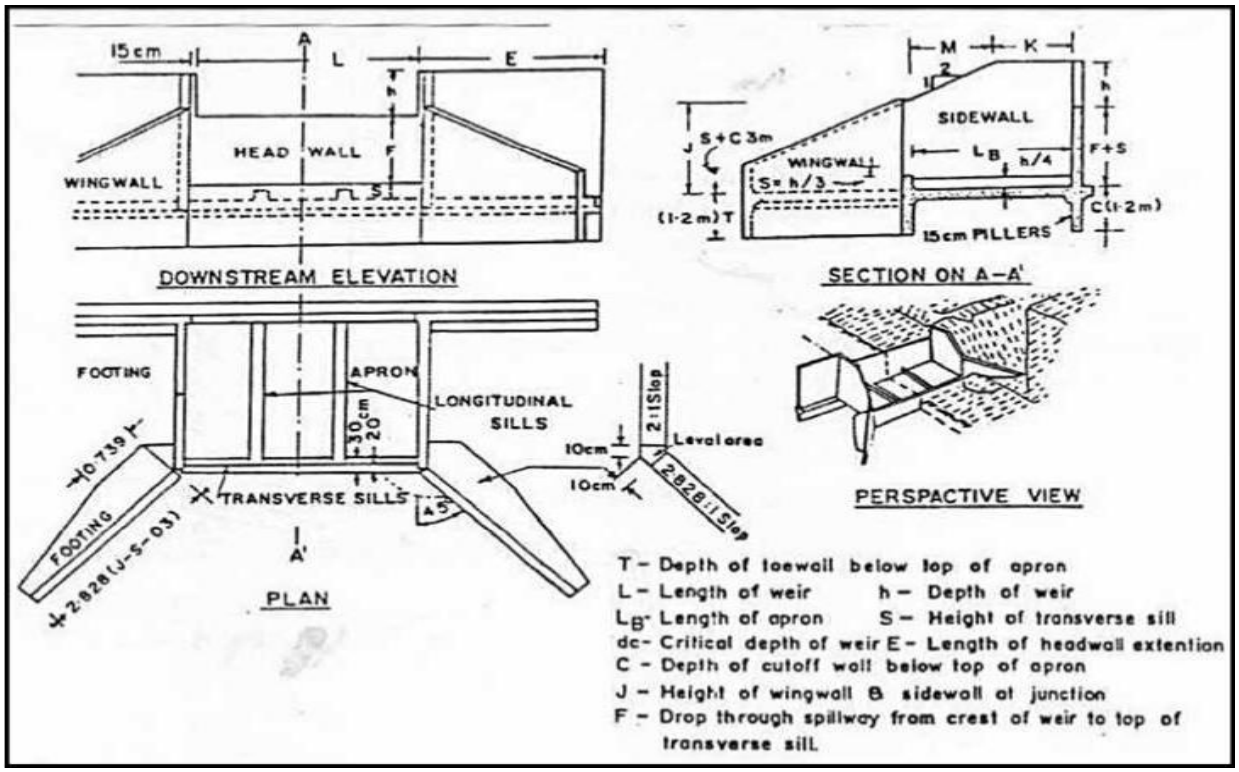
2. Gabion Structure

3. Earthen Gully Plugs



Cross-section of an earth plug for gullies

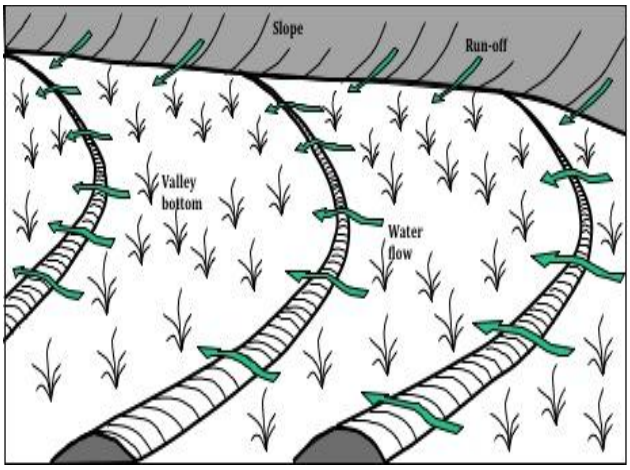
4. Drop Spillway



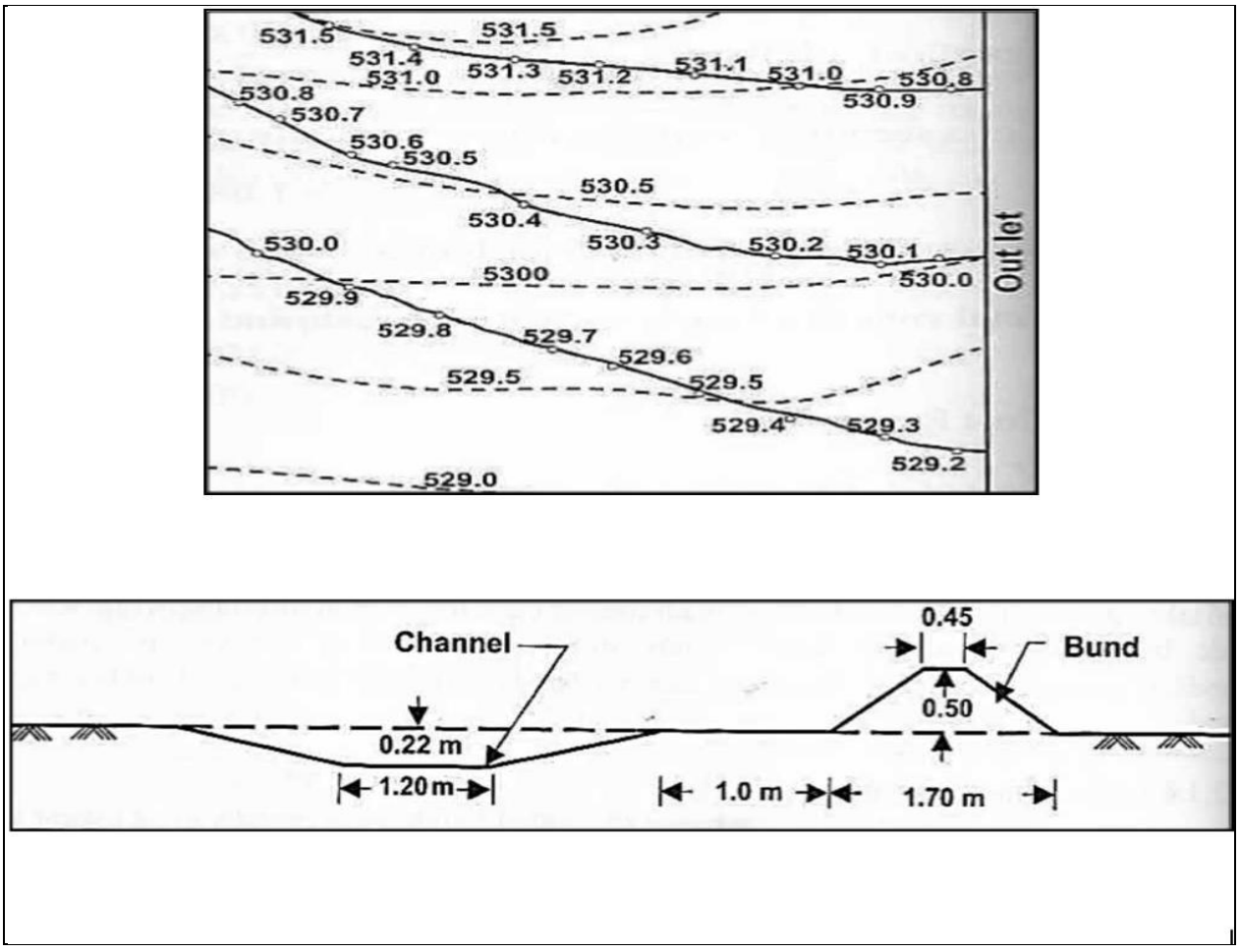
5. Earthen Dam

Watershed Interventions in Arable Lands

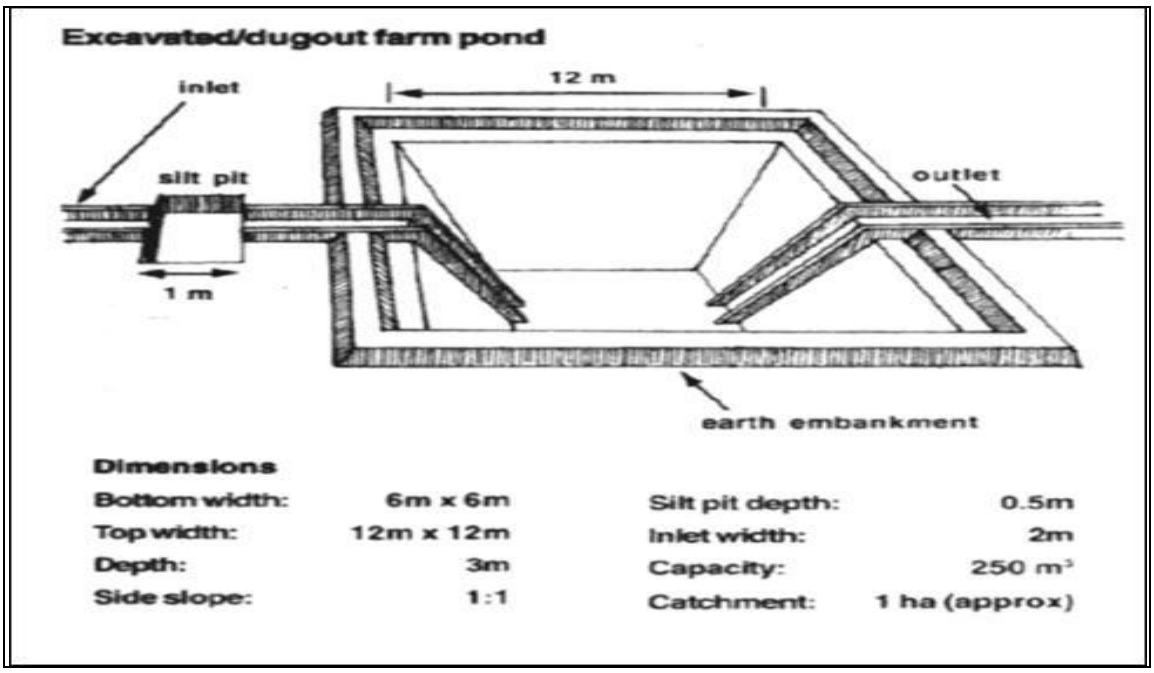
1. Contour Bunding



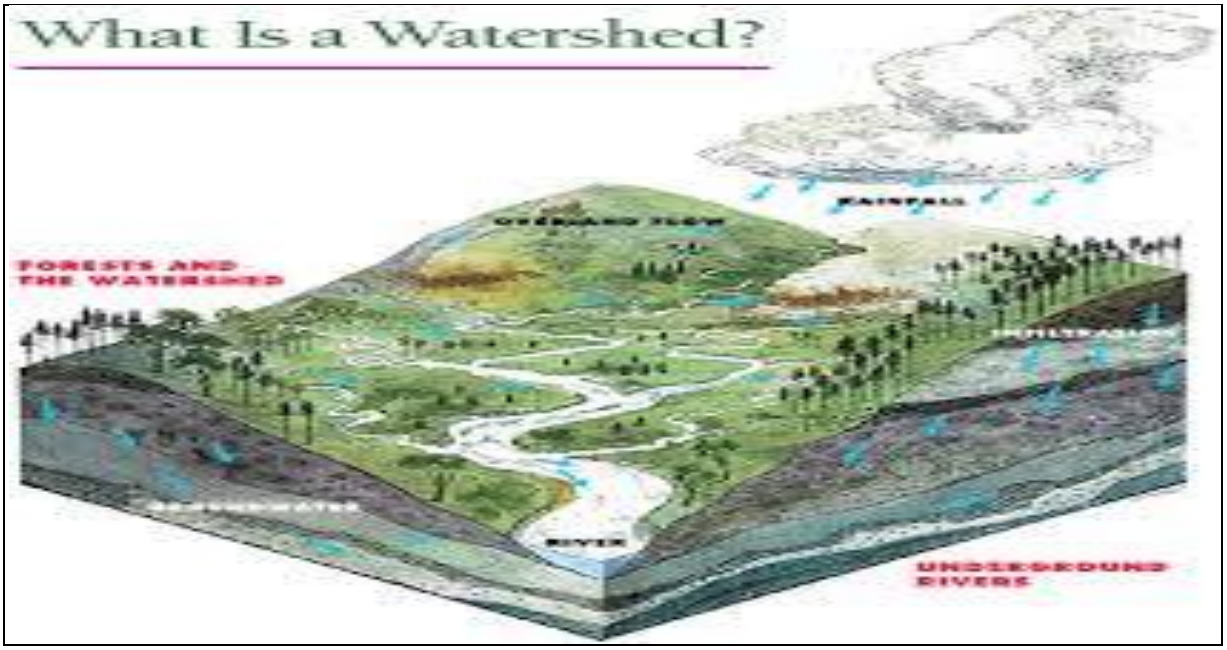
2. Graded Bunding



3. Dug Out Ponds

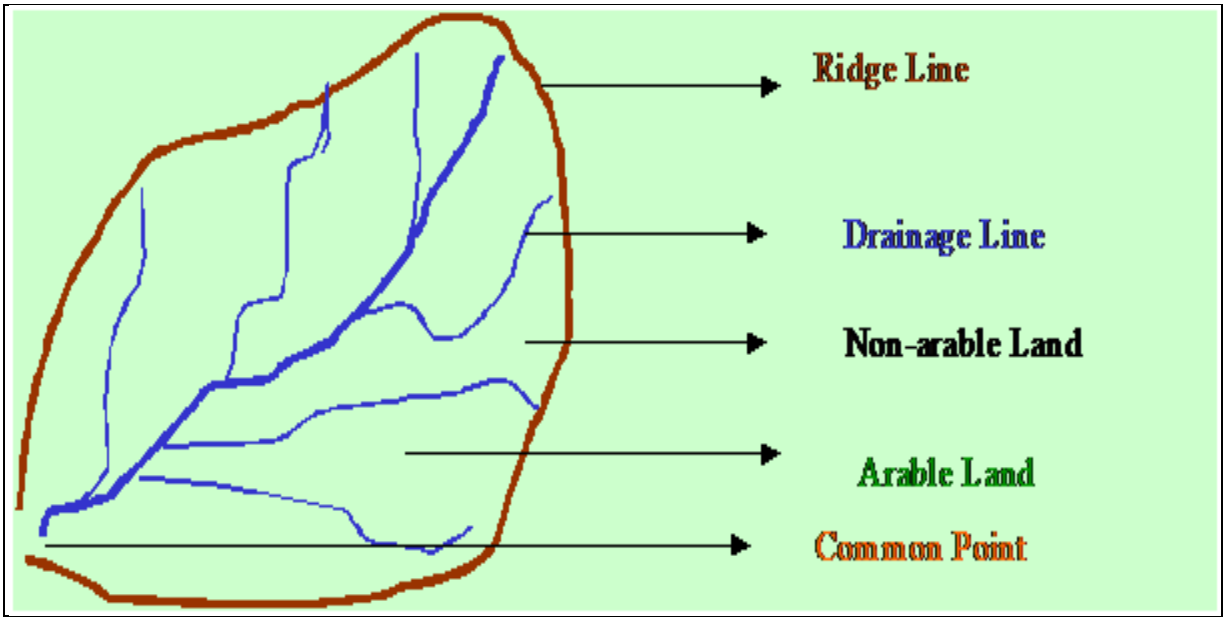


Watershed



1. **Watershed** is a geo-hydrological unit of an area draining to a common outlet point. The undulating land area of any region forms several such units, each of which is called watershed.

2. The top of a watershed from where the slopes start is called **the ridge**, because it is the dividing line that partitions one watershed from another.



3. In a watershed, the slopes falling from the ridge to the beginning of the plain/ arable, area called the **ridge area.**

Non-arable land

Arable land

4. The channels which carry the rainwater in to the drains are called drainage lines. Gullies, streams and rivers are all **drainage lines.**

GULLY

5. The size of a watershed may vary from a few hectares to thousands of square kilometers.

System of classification of watersheds in India

Category	Number	Size Ranges (‘ooo Ha.)
Regions	6	25,000-100,000
Basins	35	3,000-25,000
Catchments	112	1,000-3,000
Sub-Catchments	500	200-1,000
Watersheds	3,237	50-200
Sub-watersheds	12,000	10-50
Milli-watersheds	72,000	1-10
Micro-watersheds	400,000	0.5-1

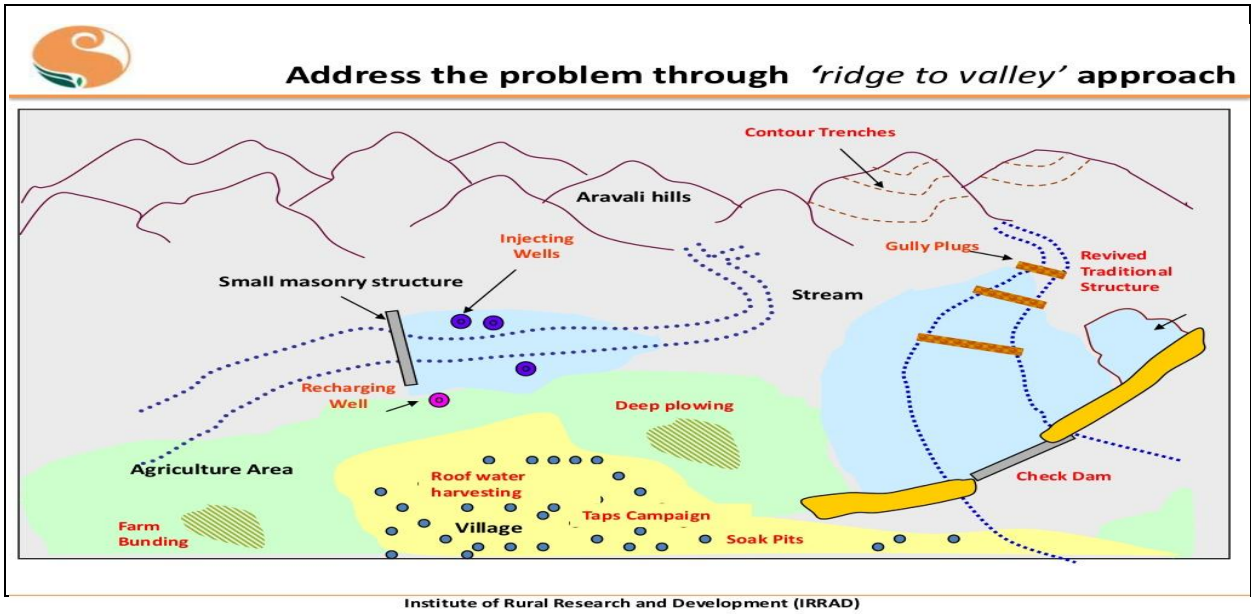
Watershed Development

Most of the works permitted under Mahatma Gandhi NREGA, at Para No. 4(1) of Schedule-1, MGNREGA are such that the rain fed area can be developed to bring the area under production and to increase the productivity through watershed management works.

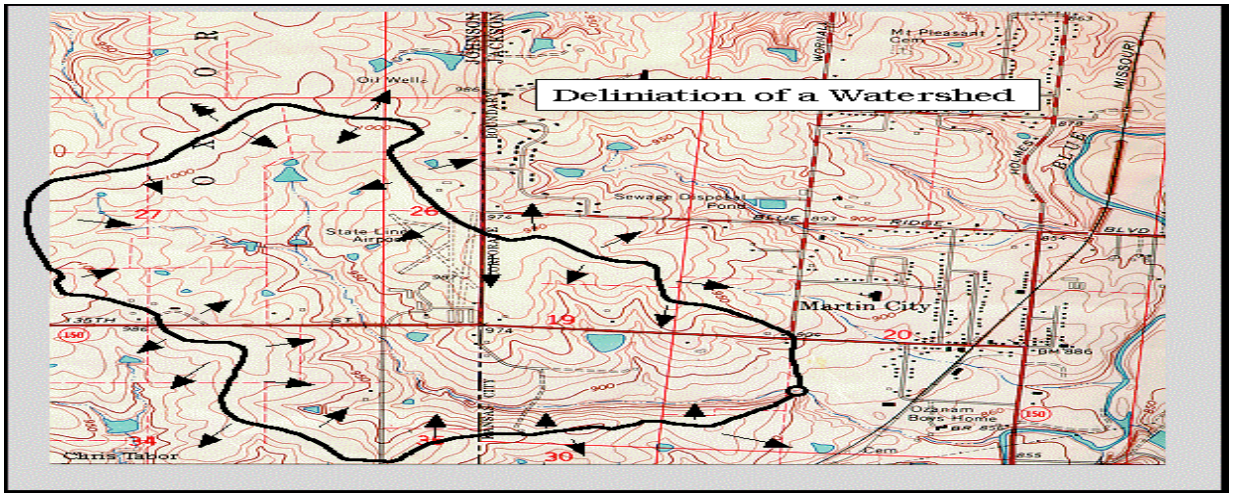
RAINFED AREA

WATERSHED MANAGEMENT WORKS

It has been recommended by various technical Committees and established by implementation of different Watershed Management Programmes, that for integrated development of rain fed area and drought proofing; area treatment from ridge to valley on watershed approach is the only solution. This will lead to natural resource conservation, increasing the productivity of the land, bringing additional area under agriculture, employment generation and social upliftment of community living in the rural area. Therefore, to achieve the objective of the scheme and optimum utilization of MGNREGA funds in rain fed area, the projects are to be prepared on watershed approach with ridge to valley concept.



While planning for rain fed area, the sub/micro watershed area covering a Gram Panchayat or a village can be a unit for planning. For planning of works the revenue map of the village should be superimposed on the G.T. Sheet or Watershed Atlas of the area by enlarging or reducing the scale of the maps to bring on similar scale for superimposition. Watershed should be delineated and marked on this superimposed map.



Thereafter, planning of works on watershed approach with ridge to valley concept and water budgeting should be made. Once, the planning is completed the execution of works should start from ridge to valley.

Convergence of MGNREGS with other ongoing schemes in rain fed area:

i) As per Operational Guidelines of MGNREGA, an annual plan and a District Perspective Plan to facilitate advance planning and to provide a development perspective for the district is to be prepared. These plans in the district are to be coordinated by the District Programme Coordinator i.e. the Collector. The District Planning Committee, whose chairman is District Collector, has also to approve the perspective and annual action plan relating to Watershed projects in the district. Therefore, at the stage of preparing and approving perspective and annual action plan relating to MGNREGS and IWMP, the District Collector should coordinate in such a way that with the convergence of ongoing schemes in the area a comprehensive project of village watershed,

incorporating / integrating all the works / activities required for the integrated development of the village on watershed approach is prepared.

In this regard Ministry has recently issued Joint Convergence Guidelines MGNREGS & IWMP vide letter No. 11017/17!2008-NREGA (UN), dated 11th August, 2014, which is available on MGNREGA web site.

ii) For integrated development of rain fed area on watershed approach, it is necessary that the project! perspective plan of a village is prepared with a Watershed approach integrating all the activities into a whole project. In this project, the works permitted under MGNREGA is planned/covered under MGNREGA and works not permitted under MGNREGA is covered under ongoing IWMP of DoLR (MoRD). Identify all the works! activities to be covered under MGNREGS and under ongoing IWMP, separately with size of area! Work, estimated cost and the year in which proposed.

Vide Ministry Circular No. 11017/17/2008-NREGA (UN), dated 11th August, 2014 guidelines have also been issued to take up watershed management works independently under MGNREGA, that: Watershed management works can be taken up independently under MGNREGA where there is no IWMP project sanctioned. These works shall be subject to the following guidelines:

a) Watershed management works can be taken up only after a comprehensive assessment of the entire watershed in the GP and shall address all issues of soil erosion, rainwater retention and afforestation.

Soil Erosion

Rain water Retention

b) Standalone works in the above category without a comprehensive watershed plan shall not be permitted.

c) In order to treat the entire watershed, the entire land shall be treated, without limiting to the lands of small and marginal farmers.

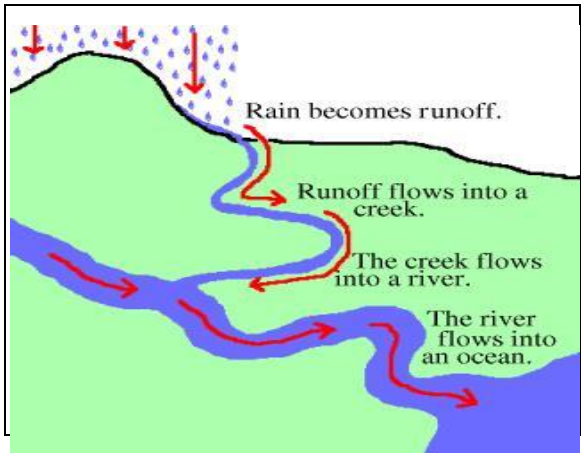
d) The comprehensive watershed plan shall be prepared in accordance with the concepts of ridge –to-valley treatment; and after proper verification of land utilization and capabilities through a participatory approach. It is recommended to use the satellite imagery for this planning work.

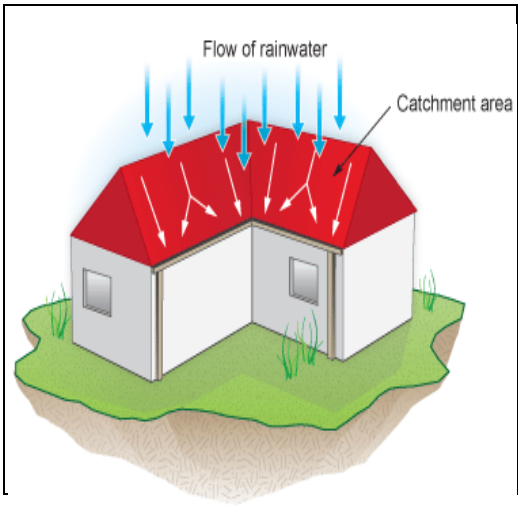
Water Budgeting

Water budgeting is the process of assessing the volume of additional rain water to be harvested in the watershed area and to plan harvesting structures accordingly. It also involves calculating the volume of water required for human, livestock, agriculture and for maintaining the ecological balance sustainably.

i) THE POINTS TO BE CONSIDERED WHILE CALCULATING THE AMOUNT OF WATER TO BE HARVESTED ARE:

a) Calculation of total annual volume of runoff with respect to catchment area, rainfall, runoff co efficient (Qt)





b) Existing storage capacity of the area (B)

c) Water requirement by human life including agriculture purposes, livestock and to maintain ecology keeping 20 yrs. projection in mind (C)

d) Runoff available for harvesting (D) = (Qt)- (B)

e) Generally, maximum 75 % of balance available run-off (E)= 0.75x(D) is to be harvested and rest 25 % runoff water allowed to flow in the drainage line

f) Check whether (E) => (C), if not then make alternative plans like reducing water demand, mobilizing from neighboring water sufficient area etc.

Calculation of total annual volume of runoff in a watershed (surface water yield)

To calculate the annual volume of surface runoff water available in an area, we will need to multiply the annual rainfall with the area on which it falls and the coefficient of run off for that area.

Thus, $Q_t = C \times R \times A$ **.... (2.1)**

Where,

Q_t = annual volume or quantum of surface run-off (in cubic meters)

C = is the co-efficient of run-off (Please refer table given below) R = is the annual rainfall (in meters) and,

A = is the area on which the rain falls (in square meters)

This is also known as the surface water yield of a watershed

Table: Coefficient for Estimating Run-off

Land Use & Slope	Sandy Loams	Clay/Silty Loams	Silty Clay
Cultivated			
0- 5%	0.30	0.50	0.60
5- 10%	0.40	0.60	0.70
10 - 30%	0.52	0.72	0.82
Pasture Land			
0- 5%	0.10	0.30	0.40
5- 10%	0.16	0.36	0.55
10 - 30%	0.22	0.42	0.60
Forest Land			
0- 5%	0.10	0.30	0.40
5- 10%	0.25	0.35	0.50
10 -30%	0.30	0.50	0.60

WATERSHED DEVELOPMENT PLANNING:

Watershed development plan should be prepared with active participation of villagers through IPPE (Intensive Participatory Planning Exercise), so that their problems and priorities are addressed while addressing the issues of natural resources.

a) DIFFERENT COMPONENTS FOR WATERSHED PLANNING:

- **Size & selection of watershed:** Watershed boundaries are already defined naturally, but to make it a workable size around 500-1000 hectare area is preferred. One may refer to the watershed Atlas available with states.
- **Basic resource Survey:** Base line/bench mark surveys like climate, type of soils and its fertility status, rainfall pattern and runoff volume, present land use and problems, vegetation coverage and its quality. This will not only help us in planning but also in measuring the outcome of the programme.
- **Community Organization & People Institution:** Active participation of people is very crucial for planning & implementation of watershed development programme, so that it becomes community driven and community managed/owned. Government, NGOs and other stakeholders' roles are just to facilitate the process and to provide required resources like socio-technical and financial. The community must be aware about the concept of watershed and prepare their own watershed management plan through village level meetings, where representatives from SHGs, landless, ST & SC families, small and marginalized farmers participate.
- **Land Capability Classification:** Land capability classification (LCC) for management of land based ecological factors such as soil texture, soil depth, slope, water availability, erosion etc., are required for

watershed development planning.

- **Preparation of Micro level Plan:** Micro level planning is prepared through the following steps:

  - Village wise social map, Resource map, present land use and problem maps are prepared through PRA exercise.

  - Different possible options/ solutions are discussed and finalized through village meetings. Through these processes, treatment plan is prepared for fallow/ non-arable & arable lands including drainage lines and infrastructural development. Emphasis should be given to rain water harvesting and massive plantation on community land/ along roads as well as private lands.

- **Convergence Approach:** The watershed development programme aims at holistic development of the area encompassing different types of activities. This requires convergence of resources and support from different departments to meet out financial, technical and other support services.

- **PRA as an important methodology of planning process:** Participatory Rural Appraisal (PRA) is the combination of different tools (Like Social mapping, Resource mapping, seasonal mapping, transact walk etc.) and techniques (focus group discussion etc.) which enables community to articulate and analyze their own situation, generating options and finalizing their plan based on their needs and priorities. This ensures identification of cost effective and appropriate interventions with greater ownership, sustainable use and management by the community.

One may refer to IPPE manual issued from the Ministry for details of conducting PRA exercise in the villages.

WATERSHED INTERVENTIONS:

Watershed Interventions are defined and designed based on the situation, context and needs of the inhabitants. Different types of structural measures are designed based on different types of land. In a watershed the land can be divided into three broad areas based on their position i.e. ridge area, on farm mostly arable and drainage area like streams, nalla etc. Based on land slope, rainfall and present land use/ problems, different types of structural and vegetative measures are proposed which are as follows.

Non-arable lands are those lands which are generally unsuitable for cultivation of agricultural crops. In the ridge area the problems are mostly high slope, soil erosion, rocky nature, shallow soil depth etc. Manmade activities like road construction and mining on steep hill slopes have rendered large areas denuded. Quite often, establishment of vegetation on these highly degraded lands is difficult due to high runoff/debris movement, lack of moisture and absence of fertile soils. Structural measures are, therefore, often needed before undertaking re-vegetation programme to stabilize the slopes and create conditions conducive for plant growth by arresting fertile soil and improving moisture regime.

The monsoon in India is typically constituted into two spells of intensive rain. Rain falls very intensively within a few hours, within a few days, within a few months of every year. The number of rainy days does not average 40 – 50 days in most parts of the country. The challenge is to find ways of using this water is very tall. For years, our development planners have announced the rain falls in every village of our country to flow out into the rivers as runoff and then try to bring this water back to the villages by building large and expensive dams and canal networks.

Watershed development aims to precisely reverse this process to stop and conserve water where it falls within every village so that it can be retained and used for a longer period of time. Watershed area can be visualized as a landscape shape unevenly like a bowl or a basin. Where it rains, water flows down from the top of this bowl to collect at the bottom so that hills, valleys, forests and seas that inserted the falling rain and guided to its streams and rivers all from the enclosure that is the watershed. The catchment area is where a river catches this water. The size of a watershed may vary from a few hectares to thousands of square kilometers. A unique feature of watershed approach is that it is very location specific within a watershed there can be very different conditions in terms of soil, slope and vegetation.

Watershed interventions vary according to the variations in each of these. But, broadly watershed interventions follow a basic principle of ridge to valley approach treating the entire area from ridges to valleys in a watershed. We thus have a progressive series of ecological units each a watershed at a particular level of group of interventions. Within a watershed area, the slopes falling from ridges area are called the ridge area. The many channels that flowing rain water drain into are called drainage lines. Gullies, streams and rivers are all drainage lines. The difference between a gully and stream or a river is the size of its catchment area i.e the larger the expanse of land that collects and drains water into a channel, the bigger the stream of water will be. Since the primary concern of watershed development is to catch the rain, we have to understand the nature of rain. How much of it falls and the quantum of rain that will actively flow as runoff. These parameters are critical for planning the size and location of watershed structures.

A meticulous calculation is done for a watershed area prior to designing of the actual work. For this, it is very important to plot the area on a topographical map of that particular region. The area is calculated with the help of a graph paper and then runoff is derived according to the type of geology of the region. The slope , soil and rainfall together will determine the runoff. Once, we know how much water is expected to flow into the structure, we need to design it so that the structure either slows down the speed of runoff or can store in optimal proportion of this water. Here, we must accept that it is neither possible nor desirable to harvest every drop of rain that falls in the micro watershed. Some water must be allowed to flow for use in villages downstream. This flow is also vital to sustain the ecosystem including the monsoon cycle itself. The approach of watershed must be tied up with the principle of balance. Whatever we draw from mother earth, we must return to her.

Watershed Interventions must begin at the ridges. A technical mistake is to begin by constructing water harvesting structures in the lowest part of watershed without treating upper part of catchment. The result is a rapid silting up of the storage capacity created because of soil erosion in the upper portion of catchment. Thus, we must begin with the treatment

of ridge area followed by a smallest drain moving on to larger and larger drains into watershed arresting the runoff at each point. Since watershed works essentially tries to regulate the momentum of water flowing down the slope, the calculation of elevations and slopes is essential for deciding on the type of watershed structure appropriate for each location.

On slopes greater than 25%, the only intervention possible is to protect natural vegetation and plant variety of species appropriate and native to the area as no man-made structures will be able to withstand the speed of flowing water.

On slopes of between 10 to 25%, we construct contour trenches. Contour trenches are trenches dug along contour lines. Contour lines are lines joining points of same height. Trenches are a simple method of reducing speed of water running down the slope. This improves local soil moisture and traps silt. As we move further down the ridge area **on the slopes less than 10%** we construct contour bunding and these are simple, low cost mud structures checking the velocity of water running down the ridge area of any watershed. Like trenches, contour bunds check soil erosion and improve local soil moisture.

On small drainage lines or seasonal streams, we construct boulder checks or gully plugs. Boulder checks are very small dams made of loose rocks or boulders. **They are made on small seasonal streams where bed slopes of the stream are less than 20 % and the catchment area of stream is less the 50 ha**.Each boulder check will not have independent catchment area of more than 1 to 2 ha.Boulder checks are usually made as a series on a drainage line. The main objective of constructing these rock dams is not for much to harvest rain water but to reduce speed of water flowing through stream. This helps to reduce soil erosion and increase duration of water flow in the stream.

On the bigger streams with the catchment areas of 50 – 500 ha, we construct gabions. These are streams where the volume and velocity of runoff is too high for loose boulder checks. Gabions are also boulder dams but they are much bigger than the boulder checks and have rocks are held together with wire mesh. Like boulder checks, gabions also slow down the water rushing through the stream helping to increase the duration of water flow and recharge ground water. They also trap silt that reduces the rate of sedimentation in dams built downstream. These structures hardly cost a few thousands of rupees, but their accumulated impact truly remarkable. These structures built up in the ridge area reduce soil erosion, increase duration of water flow and rejuvenate dried up streams. They also induce base flow and recharge water harvesting structures downstream even after monsoon. By arresting silt in the ridge areas they help increase life of these dams.

In this way, ridge area treatment slows the money spent on building dams in the lower reaches of watershed gives us maximum result. One of the key interventions in any watershed programme is the **earthen dam** built on the mainstream of watershed Earthen dams are constructed on a relatively flatter portion of the main watershed stream **where the bed slope is less than 5 %.** Earthen dams are simple, small, low-cost structures.

This is how, with watershed approach, rain water can help drought proof agriculture, transform land slopes and bring

about a dramatic improvements in rural livelihoods.

On the flatter lands, **in the farm fields, ponds** are constructed to harvest rain water which otherwise would have flowed out of farm. The main objective of such structures is to provide protective irrigation to monsoon crops. There are several days in succession in the rainy season when there is no rain, such dry spells may actively ruin the kharif crop. Dugout pond protect against such crisis.

A very important watershed intervention in the watershed area is the farm bunding which arrests the soil erosion. These bunds also help into soil moisture profile by arresting rain water otherwise flow out of farm.

Rain water carries off precious top soil due to this action of rain water, rills are formed in the fields which soon become small drains.

Every year in our country, 6.6 billion tones of top soil and 5 to 8 million tones of nutrients are lost due to soil erosion. India is losing soil 30 to 40 tonnes faster than the natural replenishment rate. It actively takes over 10,000 years to form 2.5 cm of fertile soil. If these soil losses are prevented, the productivity of agriculture can raise by 30 – 40 %. These watershed structures made out of locally available material are very simple, and they can be expected and mastered by the local people themselves. Creating permanent assets for the area. The aim of watershed management is not to pose mastery over nature, but to seek solution in achieving environmental regeneration to create livelihood, food security and people's empowerment.