WATER HARVEST THROUGH KEYLINE DESIGN

Learning Objectives

The learner will...

- ...understand the basics of keyline design.
- ...review opportunities for different types of water storage and water delivery systems.

Purposes of Keyline Design

- Maximize water resources through systems designed to catch, direct, and store water in ponds and soil
- Use gravity to move water
- Provide a system of whole farm design, including all roads and surfaces that drain water

Background

- History: P.A. Yoemans of New South Wales, Australia developed the keyline method to stretch water resources available on his ranch in its arid climate. The practice became a model for sustainable agriculture.
- Important definitions:
    - *Keypoint* - any point in a watershed where the slope changes by 5% or more
    - *Keyline* - the counter line which would intersect a keypoint
- Theory: Keypoints are typically places where water tends to collect. This point may be a spring, a point of increased stream flow, or simply underground water nearer the surface. The keypoint and keyline serve as points to harvest water into catchment systems or soils in the desired area.

Water Storage in Ponds and Reservoirs

- Placement
    - Pond should be designed so that the elevation of its maximum water level is slightly below the elevation of the water source. Typically, a drop in elevation of 1 vertical foot for every 100-300 horizontal feet is used.
    - Pond should be placed out on a ridge, away from the drainage in a watershed. Ponds placed in-stream will always blow out. Ponds placed out on the slope maximize the amount of land available to be gravity irrigated.

- Sources of catchment

- All road surfaces inwaled to direct water into system
- Spring or stream flow captured in pipe and delivered with gravity to system
- Rainfall: slopes carry water to system
- Increase catch area: using small gently sloping ditches, direct water shed from adjacent slopes to the system

- Lining
  - *Earth lined*: best for ponds that can be kept full. Clay or bentonite seals will crack when exposed to long periods of sun and dry.
  - *Plastic liner*: good for ponds where water resources are scarce

- Delivery Systems
  - *Siphon*: using suction to pull water through a pipe over the dam wall and to an irrigation system at the head of a field below
  - *Lock pipe*: draining water from the bottom of the pond to field via a pipe buried beneath the dam wall.
  - *Pump*: using solar, gas, or electricity to power a pump to pull water out of the pond and to the field.

- Considerations
  - Local codes and requirements
  - Need for engineer in pond design
  - Careful, professional construction of all systems

<u>Water Storage in Cisterns and Tanks</u>

- Ideal for runoff that is easily directed into a pipe- i.e. roof via a gutter system
  - Can be made of cement, plastic, or wood
  - Placement: same as pond
  - Source: same as pond

<u>Water Storage in the Soil</u>

- Soil contouring via swales
  - A swale is a ditch laid out on contour so that it holds water instead of drains water.
  - The long-term effect of a swale is the same as that of an unlined pond – to create an underground stored lens of water, which deep-rooted plants are able to tap.

- Soil cultivation

- All fields laid out on contour to minimize erosion and maximize water storage capacity
- Soil is ripped with subsoil or chisel plow on counter, slowing the flow of water off of a slope, encouraging water to seep into rips.

- Benefits
  - Increases water holding capacity of soil
  - Breaks up hardpan and loosens clay soil
  - Encourages formation of topsoil
  - Retains soil structure – passive tillage does not invert soil
  - Enables better root growth of crops
  - Lifts rocks out of soil

Mulch

- Regulates soil temperature
- Reduces water evaporation from soil surface
- Smothers weeds

Assessment/Review

- What is a keyline and a keypoint?
- What are the three basic water storage methods discussed in this section?
- What practices can increase the soil's ability to store water?