Land Formation

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Land Formation: Key Concepts

1. **Site Selection**
2. **Field Development**
3. **Land Leveling:**
   - Allows for improved water management
   - Better weed control
   - Due to movement of soil, fertility issues may arise
4. **Levees**:
   - Allow for division of fields into smaller areas (“checks”)
   - Can make water management easier
   - Spacing must be considered for irrigation management
     - Irrigation is gravity-fed, so slope and fall between checks is important

Site Selection

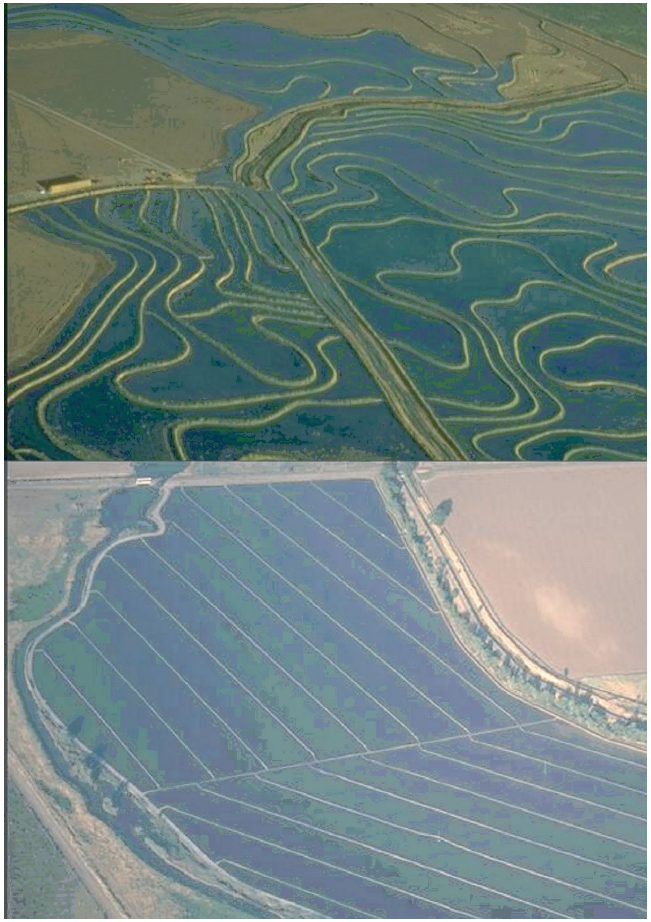
- **Soil:**
  - Ability to pond water
  - Low infiltration rates are necessary to prevent excessive water use
  - High clay content (35 to 60%) in the topsoil or subsoil
  - And/OR cemented layer or hardpan in the subsoil.
  - Deeper topsoils (higher production)
  - Shallower soils IF crop nutrition needs are adequately met
- Fields developed along the edges of the Sacramento Valley and near streams often have more variable soil types across short distances, which should be factored into the development plan.
- Fields formed from naturally flat topography benefit from less disturbance of topsoils compared to fields developed on steeper land where less fertile subsoils are exposed during leveling.
- Calcareous or sodic subsoil have chemistry problems that are difficult to correct.

Field Development

- Configuration of the field shape and surface slope
- Installation of water control structures to optimize water management and crop production
- Water management:
  - Water application, depth, and drainage
  - Crop growth is improved
  - Weeds are controlled
- Water conservation:
  - Increases in water use efficiency
  - Minimizing the likelihood of accidental drainage
- Efficient use of land, tillage, and harvest equipment:
  - Reducing the number of levees
  - Straightening the levees
  - Making levees smaller

Land Leveling

- Laser leveling became widespread in the 1970's:
  - Resulting shift from contour to parallel levees
  - Larger field sizes, increased yields by about 10%
  - Increased efficiency of irrigation and equipment use
- GPS leveling: more recent
  - More accurate than laser leveling
  - Less impacted by weather (dust and wind)
- Grade should be close to 0% for rice only
- For rotation: slope might be 1-2%

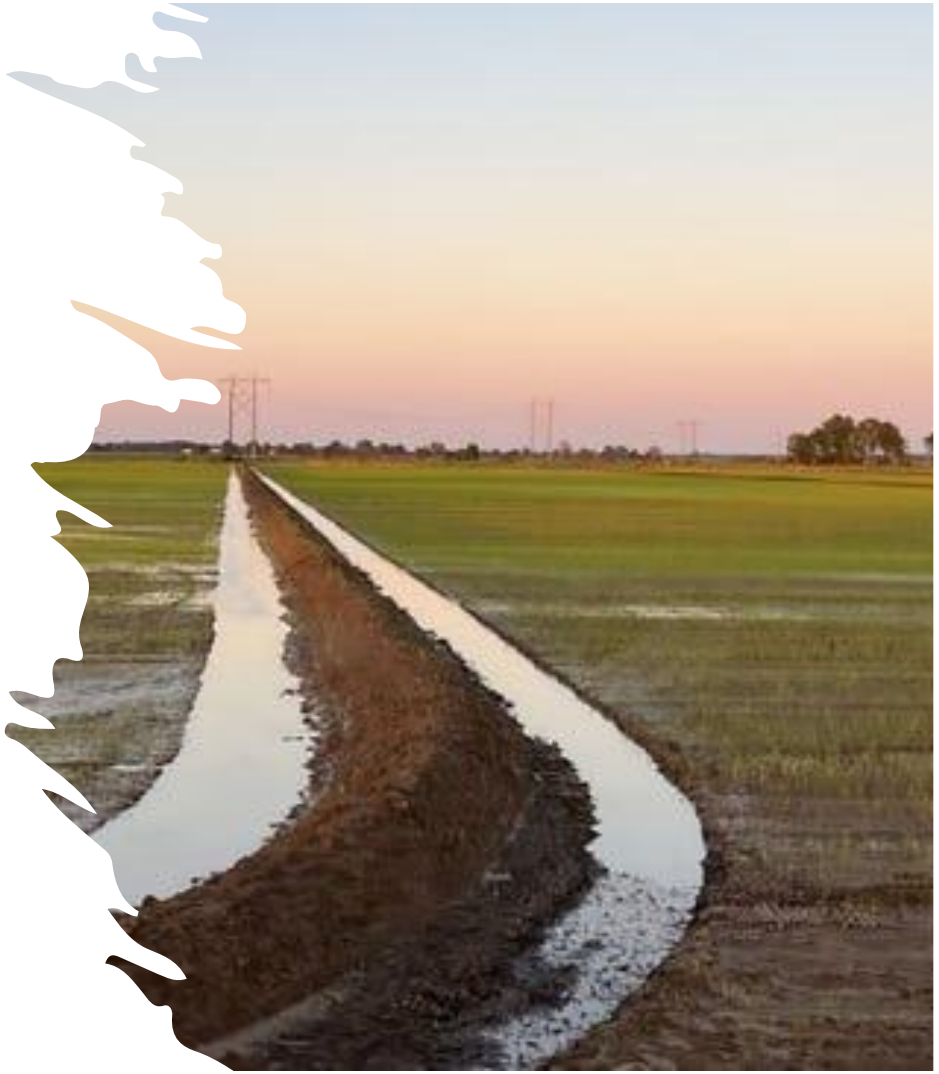


Levees

- **Permanent**
  - Integrated with leveling plan because they are larger and require more soil
  - ***Benefits***: no annual installation, road access, no borrow-pits, and roll-overs.
  - ***Disadvantages:*** perennial weeds which may contaminate the crop, rodents establish and cause leaks
  - Some annual repair work is necessary to keep weeds and rodents under control, using herbicides, rodent baits, traps, and discs to repair holes.
- **Temporary**
  - ***Disadvantages:*** installed or taken down annually and reinstalled each spring, requiring extra work, and to prevent seepage, requires the construction of two parallel levees with a borrow pit (indentation) between them
  - ***Benefits:*** usually free of perennial weeds and rodents, can be constructed after soil preparation, making it easier to quickly prepare a large field
  - When knocked down and the field worked, soil returns to its original position
  - Fields in a rotation usually need a fresh levee survey when coming back into rice
  - Irrigation boxes usually reinstalled each year, some growers leave the boxes in from year-to-year and just remove the levee

Levees

- Built by pulling a large disk ridger or levee squeeze across the prepared field, gathering soil from a width of 11 to 13’
  - Ridger can work in unplowed soil, but takes several passes to gather sufficient soil for the levee
  - Squeeze or crowder requires that the ground be loosened first by plowing and drying, then a single pass will create the levee

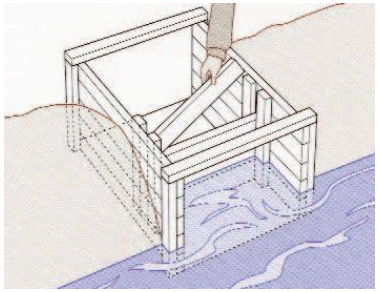


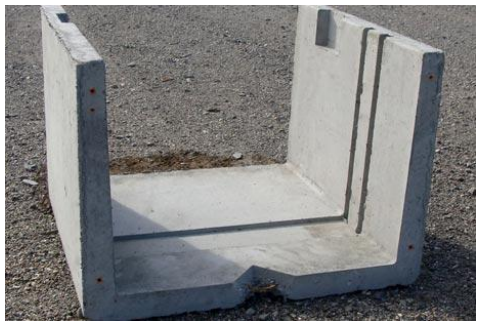
Levees Continued…

- All types (permanent, temporary, road) use approximately the same amount of land:
  - Leveled (3-5% of land)
  - Unleveled field with contour (as much as 10%)
- Orientation of levees relative to wind direction if basins are large:
  - May cause erosion damage to field sides and levees, and sometimes breaches in levees
  - Deeper water may impact rice growth and possibly uproot plants.
- Levees that are crosswise to the wind help reduce the damaging effects
- Larger basins are more susceptible to the effects of wind but are more efficient in many respects, so some compromises are necessary

Irrigation Boxes

- Weir boxes in each levee are the primary means of regulating water flow and depth
- Several materials are used:
  - Wood, steel, cement, plastic, and fiberglass
  - Redwood is cheap and easily repaired and is useful in fields where levees and boxes are removed annually.
- Fields with permanent levees often use more durable materials such as corrugated plastic pipes connected to steel drop boxes





Irrigation Boxes

- All have common properties:
  - Flume or pipe to move water from one side of a levee to the other
  - Removable ‘flash boards’ which hold water back to a given depth and let the excess flow over the top
  - Water level in the basin above the box is regulated by adding or removing boards
- Weir boxes are usually placed near the ends of levees, often on both ends, and sometimes opposite ends in adjacent levees to promote water circulation. The size and number of rice boxes are dependent on the required capacity to move water from one basin to another.
- Rice boxes are typically 18” high, 48” long, and 24-48” wide
- Pipe diameter in permanent rice weirs is usually 12-18”