POND CONSTRUCTION
AND MAINTENANCE

Presented By:
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Pond Construction and maintenance

- Building a pond on your land
  - Types of Ponds
  - Pond Water Sources
  - Pond Sizing
    - Capture your rotation from Irrigation District
    - Size to Irrigate acreage of crops
  - Pond Location for Gravity Pressure
- Do’s and Don’ts of Pond Construction and Repair
Building a Pond on your Land

- Contact Oregon Water Resources Department before you build a pond, they will educate you on your necessary permits and your allotted water rights.
- Contact your irrigation district and ask about ponds. Especially if you plan to use irrigation water to fill up a pond.
- As an Irrigation Designer and a district employee, I am not able to design an irrigation system from an illegal or non-permitted water source, or for someone without water rights.
Building a Pond on your Land

- Many Types of Ponds
Water Sources for your Pond

- Proper Pond site has a good water source
  - Water Table
Water Sources for your Pond

• Surface Water
Water Sources for your Pond

• Springs and Wells
Water Sources for your Pond

• Irrigation
Sizing a Pond based on your Irrigation Rotation from Irrigation District

• This pond type is described as a ‘Bulge’ in your irrigation system

• Capturing water you receive during your rotation and spreading it out over time.

• These ponds are sometimes at the same level as the irrigation canal so that when the pond is full, overflow can go back into the irrigation canal
Water Source

• Irrigation Districts decide volume and scheduling of your irrigation water

• Contact your Irrigation District to ask about your schedule, flow rate and ponds

• Talk with downstream neighbors
Some Thoughts about Ponds for Irrigation

- Ponds are great for irrigating small acreages, on sprinkler or drip, for short periods of time.
- Ponds quickly turn into large reservoirs when irrigating larger properties or when holding water to irrigate for entire growing season.
- Reservoirs and lakes are used for flood irrigation. Ponds typically used for sprinkler and drip.
- Ponds are sometimes expensive to build and maintain.
- A pond will not solve all your irrigation problems.

Let's look at some example pond sizes.
Sizing a Pond Based on your Irrigation Rotation Example:

**ASSUME:**
- 20 acre field is allotted 3.5 cfs flow rate from the irrigation ditch for a time of 48 hrs.
- You want to Capture all the water to slowly use it more efficiently over the next 2 weeks. You are tired of seeing all that wasted water running off your field.

- How big of a pond do you need??
Pond Sizing Example:

- Flow = 3.5 CFS
- Time = 48 Hrs

- Volume of Water = CFS x Hrs x 3600

- $= 3.5 \times 48 \times 3600 = 604,800$ Cubic Feet of Water

- Equivalent to: 13.9 Acre-ft

- **Too Big.** Hire an engineer and get special permits.
Size your pond based on the crops you want to irrigate

• Still on 2 week rotation from irrigation district
  • You want to catch your rotation in a pond and use a sprinkler over time to save water.

• Crop: Pasture
• Acres: 10 acres
• Irrigation Type: Sprinkler

• Irrigation Efficiency (ie water beneficially used by plants) = %75
Calculations I am Doing

• Using the Maximum crop water use/day during the summer (from Agrimet)

• Dividing by the irrigation efficiency and multiplying by the area

• Allowing 15% more pond storage volume to account for seepage, evaporation, leaks, and minimum freeboard
Example 2 Result:

- We Have: 10 acres of Pasture on 2 week Irrigation Rotation
- The Necessary Storage Volume is still quite a lot.
- **Pond Volume = 5 Acre-ft**
  - 200’ x 200’ pond Average 5 ft deep

- To irrigate 10 acres of pasture for 2 weeks using Sprinkler irrigation
- May need to pump out of pond, or use natural elevation to get pressure to sprinkler (will go over gravity pressure later)
Sizing a Pond Based on your desirable Irrigated land on a smaller scale.

- Crop: Strawberries
- Acres: 0.5
- Irrigation Type: Drip
- Irrigation Efficiency: 90%

- Same Scenario as before.
  - Maybe you have a small area for vegetable around your house
  - Limited in terms of pond location
0.5 acres of Strawberries Irrigated for 2 weeks

- Pond Volume = 0.26 Acre-ft = 84,760 Gallons

- To irrigate 0.5 acres (147’ x 147’ plot) of strawberries for 2 weeks during the summer using drip irrigation

- Pond could be avg. 6ft deep, 1,900 square feet.

- This makes more sense for the small landowner.
Sizing a Pond for a small Greenhouse

- Crop: Strawberries
- Area: 100 square feet
- Irrigation Type: Drip
- Irrigation Efficiency: 90%

(Remember rule of thumb of 0.2 to 0.4 gallons per sq ft per day for greenhouses)
Strawberry Greenhouse Example

- **Storage Volume = 322 – 644 Gallons**

To irrigate 100 sq feet of strawberries for 2 weeks during the summer using drip irrigation

- Uses 20-40 gallons per day during summer
Sizing a Pond Considerations

• If your Pond is Sized for a specific crop and acreage, you are stuck.

• Pond may take up valuable agricultural space

• Pond size may be bound by location, soil type, property boundaries etc.

• Crop size is easier to adjust than pond size

• The Larger the Pond, the more expensive it is.
Pond Location

- If using a sprinkler or drip system from pond, you must have access to a pump, or significant elevation drop

- Pressure Options:
  - Gravity Pressure
    - Covered on next slide
  - Solar pump
  - Electric Pump
  - Diesel Pump
Basic Pond Siting for Gravity Fed Pressure

- Inflow
- Evaporation
- Spillway
- Reservoir
- Seepage
- Sedimentation
- Outlet

Elevation Drop

Filter

Sprinkler or Drip Emitter
What elevation Drop do I need for Sprinkler or Drip Pressurized Irrigation?

- Approx. Minimum of **80 Feet** Elevation for Sprinkler
  - 25 psi sprinkler head, 5 psi conveyance losses and 5 psi filtration losses.

- Approx. Minimum of **40 Feet** Elevation for Drip Emitters
  - 7 psi drip emitters, 5 psi conveyance loss, 5 psi filtration loss
Do’s and Don’ts of Pond Construction

- Site Selection
- Availability of needed Inputs
- Regulatory issues
- Pond Construction
- Maintenance and Repair
Site Selection

- Soil
  - Min 20% clay content. Cores should have more clay.
  - Sand, Loamy Sand, Sandy Loam, Loam, Silty loam, Silty Clay Loam are generally too permeable.
  - Sufficient layer of clayey soil
  - Sufficient clay on site to build dam
Site Selection

- Water
  - Sufficient Quantity of Water available to fill your determined pond size and keep it full
  - Good water quality
Site Selection

- Topography
  - Locate where largest storage volume can be obtained with least amount of earth fill and excavation
  - Use to determine dam length and height needed
    - Is cost of construction too much for this site?
Site Selection

• Recreation and Aesthetics
  • Is pond easy to see from living area
  • Can people of all ages access the pond?
Site Selection

- Don’t select a site where:
  - Land is too steep and rocky, soil is sandy, water is of poor quality
  - Inputs are unavailable
  - Access is poor
  - Water rights are not available
  - Regulatory issues will be a major constraint
  - Failure of the dam could harm people, livestock or property
Pond Construction

- An ounce of Prevention is worth a pound of cure.

- **Avoid at All costs:** Dam washout or blowout
Pond Construction

- **Do**
  - Have all required rights and permits in hand prior to beginning
  - Permit for Floodplain alteration
  - Permit to Use water and store water
  - Permit to fill or remove over 50 cubic yards in wetlands, streams or other state waters
  - Dam Safety review. If over sized.
  - Water Quality Certification
  - Federal, State and Local Agencies may require other permits
Pond Construction

- Work with Engineers or Experienced contractor to design pond
  - Include core in all dams
  - Include drain/overflow
  - Include emergency spillway and diversion ditches
  - Allow for appropriate ‘freeboard’
Pond Construction

• When Beginning work
  • Clear area of vegetation and topsoil
  • Incorporate core trenches under all dams; use clay soil to pack core.
  • Install drain at deepest part of the dam (usually at bottom of old stream bed). Use anti-seep collars to prevent seepage along drain line
  • Deepen edges around pond perimeter to lessen weed growth
Pond Construction Cont.

- Always install emergency spill way to lead overflow water well around the end of the constructed dam
  - Never allow water to overtop dam
- Compact dam in six-inch layers, before spreading the next. A sheep's foot roller works well.
- Finish the dam with topsoil and establish vegetation
Pond Construction

• Don’t
  • Don’t use topsoil in the dam construction
  • Don’t make slopes of dams too steep; 2:1 less are best
  • Don’t skimp on the Dam core, overflow and drain, emergency spillway, or diversion ditch
  • Don’t encourage growth of woody plants, trees or shrubs near dam or dikes
Maintenance and Repair

• Catching small problems early will prevent them from turning into big expensive problems
Maintenance and Repair Activities

• Monitor dam
• Mow, fertilize or graze vegetation on the dam and spillways to promote soil stability and reduce weeds. Be careful with livestock.
• Get rid of any trees or brush growing on dam, dikes or spillways
• Repair erosion in spillways and repair wave erosion use erosion mats or riprap.
• Control rodents.
Repairs

- Leaking Ponds
- Slumping dikes
- Washed out dams
Repairs

• Leaking Ponds
  • If no core was installed, try adding a repair core on the inside slope
  • If seepage is due to poor soils or rock layers, add a layer of compacted clayey soil. May need to be up to 2ft thick to seal large seepages in rock layers.
  • Add bentonite (follow instructions)
  • Use a plastic liner that is designed correctly.
Repairs

• Slumping dikes
  • Rebuild with more gentle slope and try to use soil with higher clay content
  • Watch out for the rodents
Repairs

- Washed out Dams
  - Caused usually during flood events
  - Spillway or diversion ditch failed or clogged
  - Seepage collars were installed incorrectly
  - Have to rebuild failed section
  - Build or enlarge spillway
On Site Advice

- JSWCD
- USDA- Natural Resource Conservation Service
- US Fish and Wildlife Service
- Oregon Department of Fish and Wildlife
- Oregon Water Resources Department

- Contact your local Office
Thank You Very Much

- Any Questions, Comments or Concerns?

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