Chapter 2

Planning Considerations

CHAPTER 2 PLANNING CONSIDERATIONS

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CHAPTER 2

PLANNING CONSIDERATIONS

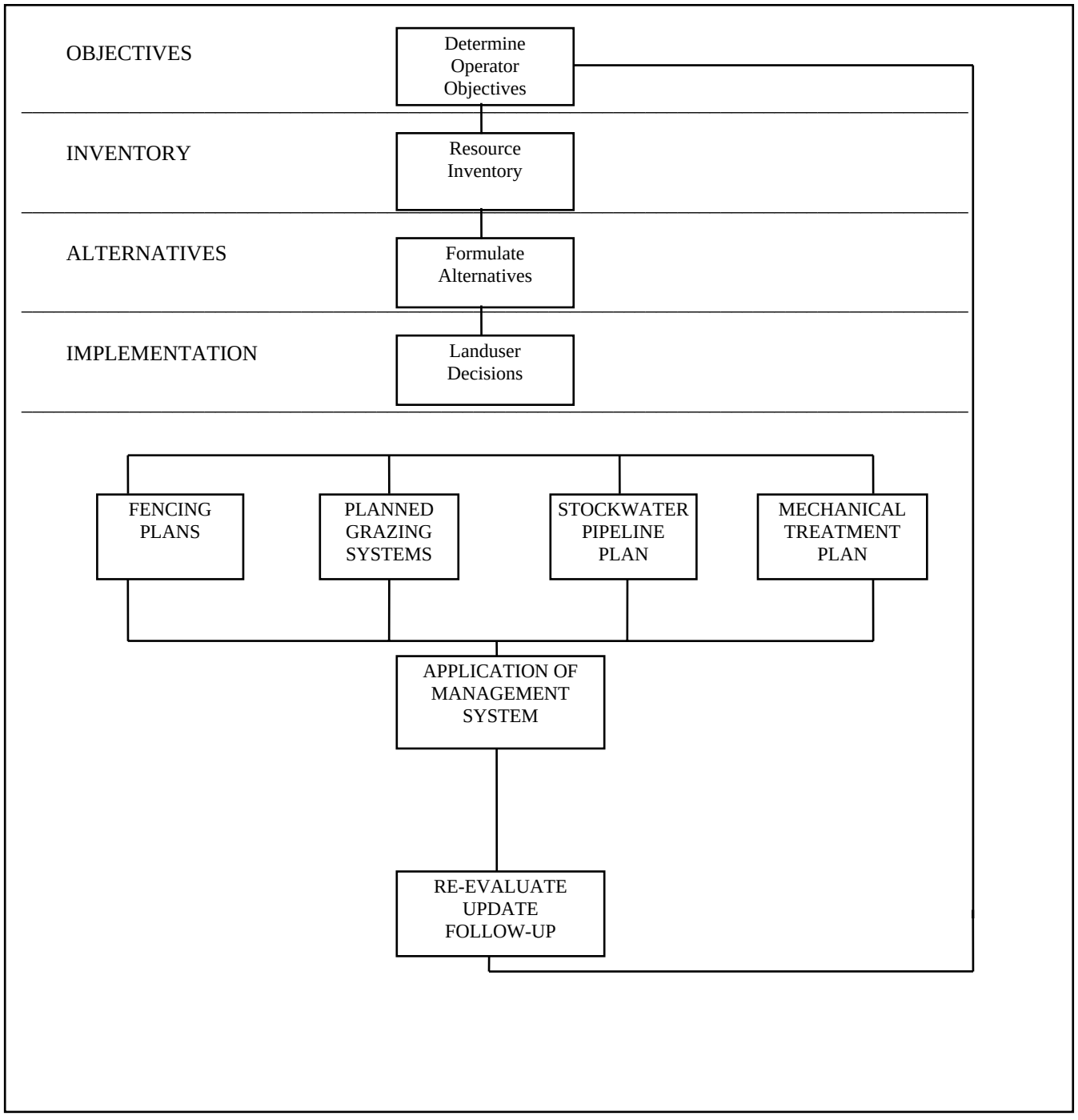
2.1 GENERAL

When planning a stockwater pipeline, it is always important to follow good resource planning procedures. Figure 2.1 illustrates the NRCS planning process as it relates to livestock watering systems. The planning processes must be followed, even when NRCS is involved with a system where the landowner knows exactly what is wanted and NRCS is in a rush to get the job done.

To do otherwise frequently leads to such problems as:

- System that does not meet resource conservation needs
- System that does not meet needs of the cooperator
- System that cannot later be expanded
- System that requires excess maintenance
- An overly expensive system

Figure 2.1
STOCKWATER PIPELINE PLANNING PROCEDURE



2.2 PLANNING PROCEDURE

2.2.1 Objectives

Find out about the landowner's objectives. Do they want a more dependable supply of water, better grazing distribution, better water, or what? NRCS needs to remember the involvement and objectives. These are to maintain the resource base, to maintain quality in the standard of living and to maintain or enhance the environment. This is accomplished by aiding the landuser in the development of a Resource Management System (RMS). These objectives should be clearly in mind before starting the next step.

2.2.2 Resource Inventory

Information which must be obtained when planning a stockwater pipeline system includes:

- The annual grazing period, including whether or not the pipeline will need to operate in freezing weather.
- The types and maximum number of livestock which will use water at any given time.
- The type of grazing system to be used.
- The area to be serviced by the pipeline.
- Location and details of existing water sources in the area to be serviced by the pipeline.
- Reliability and quality of existing water sources in the area to be serviced by the pipeline.
- Location, reliability and quality of water source or sources which may be used as a supply for the pipeline.
- Desirable watering locations, based on an analysis of pasture use patterns, pasture conditions, geology and topography.
- Geologic considerations including location of shallow bedrock, unstable soils, coarse gravel subsoils, old slide areas, wetland areas, sharp breaks in slope, etc.
- If wetland areas are to be traversed, a determination as to requirements or limitations involved in crossing the wetland.
- Property line and ownership considerations.
- Topographic information, including any necessary engineering surveys or study of topographic maps.

2.2.3 System Alternatives

Even though the landowner may have a very specific system in mind, take an overall planning look at all reasonable alternatives to make sure the alternative the landuser wants is the appropriate one.

Economic considerations are usually a major factor in determining stockwater system alternatives. It is important not to overlook upgrading existing water sources, such as ponds and

spring developments as alternatives to an extensive stockwater pipeline system or as a backup to the pipeline system in the event of failure.

The use of average per foot cost data, computer spreadsheets and specialized computer programs can be an aid to making quick analysis of various pipeline alternatives. These aids should be used whenever they will save time and effort.

2.2.4 Landuser Decisions

It is important to obtain the landuser's complete decisions before proceeding with detailed pipeline design. Good, appropriately timed communication with the landuser is always critical to success of the project. To do otherwise will usually waste time and money.

2.2.5 Implementation

Implementation of the Resource Management System includes all necessary preparation of detailed plans for such practices as fencing, pasture reseeding and planned grazing system as well as design and preparation of stockwater systems and tank drawings, specifications, quantities, cost estimates and operation and maintenance plans for the stock watering system. It also includes supervision during application and construction.

2.2.6 Follow-up

Stockwater systems can be complex and may sometimes experience problems. NRCS must be constantly alert for problems such as water hammer, freezing pipes, erosion, low flows and improperly functioning valves so that the problem can be corrected and avoided in future jobs. This means that NRCS must maintain contact with the landowner and re-visit at least some of the systems after being operated for a period of time.

2.3 WATER QUANTITY REQUIREMENTS

Design the system to deliver and or store enough water to meet peak demand i.e. summer time drinking for the projected numbers of animals. Peak demand is defined as 30 gallons per day (at 90 degrees F) per 1000 lbs. liveweight. Exceptions to this design criterion are pipelines feeding limited access tanks where gallons per minute becomes the design criterion of choice (see section 2.4) and pasture (animal operated) pumps where the animal access (number of head per appliance) becomes the limiting parameter (see section 2.5)

Animal consumption rate figures vary widely among the information resources available on the subject. The above figure volume will adequately water dairy cows to chickens; animals in confinement, to intensively managed grazing systems to open range foraging.

2.4 Pipeline Delivery Rates

Water delivery requirements will vary depending on the water source available, how it is conveyed to a tank from which the animal will access the water, and how much storage capacity is designed into the system. The previous information will address the following situations:

1. Pumped pressure systems and gravity forced systems from ponds and high flow springs with delivery to open tanks.

2. Pumped pressure systems and gravity forced systems from ponds and high flow springs delivering water to limited access waterers, e.g. barrel tanks, “freeze proof” tanks.

Pipelines under pressure from a pump or gravity forced lines from a pond or high flow springs feeding open water tanks should be sized to provide the peak demand for the herd in 12 hours.

Pipeline in pumped pressure systems and gravity forced systems from ponds and high flow springs delivering water to limited access waterers should be sized for rapid recharge due to the limited reservoir capacity. Multiply the number of the herd that can access the tank times 2 gallons per minute. Future expansion of herd size should be considered in designing the system. Reference the University of Missouri, "Missouri Grazing Manual" which states that cattle will drink at a rate of 2 gallons per minute for 4 minutes per drink and will come to water 5-7 times per day depending on the distance traveled to water.

2.5 WATER STORAGE REQUIREMENTS

Where source flow volume or the delivery system is too low to meet criteria noted in the preceding two sections storage must be designed into the system to provide for peak herd demand. The following situation(s) are addressed in this section:

1. Low source flow volume or low delivery flow systems such as low flow springs, hydraulic rams, and windmills.

2. Pasture pumps

3. Sizing water tanks for animal access and water storage volume

4. Backup storage

In low source flow volume or low delivery flow systems such as low flow springs, hydraulic rams, and windmills the water tanks should be sized to store 30 gallons per 1000 pounds live weight minus the flow or delivery volume in the system (gallons per day) times the average grazing period (number of days). These systems will only water a limited number of animal units.

Backup storage volume of 1-3 days of the herd requirement should be considered in the event water supply, power, pump, or pipeline failure where ponds, springs, creeks, or hauled water are not available or not feasible.

There are several considerations for sizing water tanks where delivery or flow are not limited by the water source or delivery system. These are: distance animals must travel to water, access space at the tank, time of year the tank will be in service, and animal traffic patterns to get to tank and loitering time (animal traffic damage) at the watering point.

Generally animals won't die if a tank is not sized according to the following suggestions but time to water the herd, hoof damage and loitering time (manure deposition) at the watering point will be affected. Both access space (tank perimeter) and storage volume should be considered.

Distance animals have to travel to get to water affects herd behavior as related to the social event of going to the water hole and the amount of water consumed. According to cow psychologists, cattle go to water less frequently and go as a herd or large grazing groups if water is farther than 800 feet from the pasture. If water is closer animals tend to go to water more often and as singles, pairs, or small groups (especially in flat or gently rolling terrain

where they can keep sight of their buddies. The exception to this rule is yearling cattle new to the farm. Producers receiving new lots of cattle frequently should size the tanks as if water was far from the pastures. These young cattle will graze and water as a herd or large grazing groups despite the proximity to water.

If distance to water is greater than 800 feet, size the tank volume for 1/3 of the daily herd requirement. The thought process is that the herd will go to water in small groups (herd number divided by 10) and will water more frequently (5 times per day).

If water is close, size the tank for 1/50 of the herd requirement. The thought process is that cattle will make 5 trips to water in small groups.

Estimate access space by multiplying 1/3 or 1/10 of the herd number, depending on proximity of water to the pastures, by 15 inches. Then check to see that the circumference or perimeter of the tank needed to provide the volume of water also has enough access space. Usually it does, but in some cases where high numbers of stockier cattle were being grazed access space became the determining factor in sizing the tank.

The design delivery rate should be the maximum available or maximum required whichever is less. The tank size should be made bigger for low delivery systems. History has shown that oversized tanks work well with few problems.

Livestock tank capacities are shown in Chapter 8 and Appendix C. Access makes the energy free, freeze proof, (including concrete bunkers often embedded in the backslope of ponds), limited access tanks less desirable if they are used in grazing cells that will be used in the summer.

Pasture pumps can be a very effective method for watering livestock. If this system is used the
design criteria is to divide the number of head by 30 to determine the number of appliance needed. Claims of number of animals served per unit varies from manufacturer to manufacturer.

2.6 SOURCE OF WATER

Water should be tested for adequate quality. Contaminates such as iron or sand will clog pipelines. Sulfur waters are corrosive and have a bad odor.

2.6.1 Springs

Springs often have varying degrees of dependability. If it is proposed that an extensive pipeline be run from a spring, the spring should be developed and used for a couple of years to prove its yield and dependability before installing an extensive pipeline.

Sediment, moss, scum, fish, frogs, mice and other solids must be excluded from spring pipelines to the extent possible. Where the spring collection system allows entry of this type of material, a spring box with screened pipe inlet must be employed. If a gravel/pipe type of collection system is used, a spring box is usually not necessary.

2.6.2 Surface Source

Special care must be used to exclude scum and sediment from pipelines using a surface water as a source. A screening or filtering device should always be used at the entrance to the pipeline. If sediment is a problem, consider constructing a settling pond at the entrance to the pipeline.

2.6.3 Well

Some wells produce considerable amounts of sand. A sand separator should be installed at the beginning of the pipeline in such a case. Sand separators are available through trickle irrigation supply sources.

2.6.4 Rural Water

Rural water is a reliable source of water with which to supply livestock. Pipeline flow rates for systems fed by rural water pressure should be designed using the criteria described in Section 2.4 Backflow valves shall be used to prevent contamination of the rural water supply. In most cases rural water districts require an air gap because backflow valves are not safe enough.

2.6.5 Water Quality

The most common factors to consider are salinity and nitrates. Tables 2.1 and 2.2 describe tolerable levels of these elements..

Table 2.1
USE OF SALINE WATER FOR LIVESTOCK

Total Dissolved Solids mg/l	
1,000-3,000 mg/l	Very satisfactory for all classes of livestock. May cause temporary and mild diarrhea in livestock not accustomed to them.
3,000-5,000 mg/l	Satisfactory for livestock but may cause diarrhea or be refused at first by animals not accustomed to them.
5,000-7,000 mg/l	Can be used with reasonable safety for dairy and beef cattle, sheep, swine, and horses. Avoid use for pregnant or lactating animals.
7,000-10,000 mg/l	Considerable risk in using for lactating cows, horses, sheep, or for the young of these species. In general, use should be avoided although older ruminants, horses, and swine may subsist on them under certain conditions.
Over 10,000 mg/l	Risks with these highly saline waters are so great that they cannot be recommended for use under any conditions.

Table 2.2
EFFECTS OF NITRATES ON LIVESTOCK

Nitrate Concentration (mg/l NO_3 as N)	Effect
10-30	Slight possibility of harm
30-50	Risky, especially over a long period of time
50-100	Interference syndrome likely (trembling, weakness, discolored urine)
100-145	More serious; possible acute losses
145-195	Increased acute loses, secondary diseases
195 up	Acute losses.