Long-Term Vision for the Future of Water Supply in Kansas:

Technology Needed to Improve Water Use Efficiency at Livestock Facilities

Livestock production is an important and substantial part of the Kansas economy. This is especially true in Western Kansas, where most of the large feeding facilities and processing plants are located. The climate of the High Plains is favorable for livestock production, especially for cattle. The rural population of the area makes it feasible to build and operate large livestock facilities that take advantage of economies of scale. A beneficial economic relationship has become established between feed grain and forage producers and livestock feeders. The presence of large numbers of livestock creates a demand for feed, which improves the basis for local producers that are located far from terminal markets. An abundant feed supply keeps the livestock operations efficient and competitive.

The depletion of the Ogallala aquifer is well known and is of utmost concern in Western Kansas. Extensive research efforts have been directed toward increasing irrigation efficiency and decreasing water use. This is logical since irrigation represents the vast majority of groundwater use in the region. However, as depletion limits the amount of groundwater available is specific locations, it becomes imperative to implement efficiency and conservation measures to extend the water supply of high-value facilities, such as beef cattle feed yards and dairies. While feed can be and is readily imported to a feeding facility, it is rarely feasible to import the quantities of water needed to sustain large numbers of livestock. Therefore, there is a need for technology that will increase water use efficiency and allow for reuse of wastewater. A very limited amount of research and technology development has been dedicated to water use in livestock facilities. This technology is a critical component of any long range plan that would stabilize the livestock production sector in Western Kansas.

One unique aspect of the open-lot cattle feed yard and dairy facilities in Western Kansas is the amount of wastewater generated and captured by each facility. Discharges of stormwater runoff from these facilities are prohibited by state and federal regulations. All runoff must be contained in wastewater retention ponds located within the boundaries of the facility. Even in the dry climate of Western Kansas, the average annual runoff volumes amount to millions of gallons of water. This runoff is considered to be wastewater because it comes in contact with livestock manure and may transport both manure and soil particles to the wastewater retention pond. This wastewater is typically used for irrigation. The runoff quantities represent a substantial portion of the average annual water consumption by livestock confined in the facility. This wastewater is a potential resource that, if reused, could decrease the demand for water supplied by groundwater pumping. Having this resource available would provide a more secure water supply and likely extend the life of the livestock facility.

Some technology exists that can be used to treat this wastewater. The methods include distillation, mechanical filtering and chemical treatment, and a combination of filtering technologies that includes the use of thin membranes and reverse osmosis processes. All of these technologies are expensive, complicated, and require considerable maintenance. At this point in time, they have been determined to be infeasible for livestock facilities. New technologies have been identified which are potentially feasible for livestock wastewater treatment. One technology uses a proprietary process that vaporizes wastewater and recovers a large portion of it as clean water, with the remainder being a concentrated wastewater solution. This process has been tested to treat wastewater to levels satisfactory for human consumption in military applications. The treatment level for livestock consumption is less stringent and no information is available

for this application. Research needs include: (1) determination of process modifications to achieve treatment and water quality levels suitable for livestock consumption, (2) determination of scalability to provide the production of treated water required at a livestock facility, and (3) quantification of energy requirements to power the process at a feasible rate.

Recommendation: Research and develop wastewater treatment technologies which provide water quality and quantity suitable for livestock consumption to promote reuse of wastewater generated by livestock facilities.

Estimated research cost: $800,000 - $1,000,000

Discharges from overflow water tanks are another source of wastewater generated by livestock facilities. These discharges occur in the winter months when the tanks that supply water for livestock consumption are set to produce small overflows to prevent freezing. Our experience indicates that these overflows typically represent 5 to 15 percent of the wastewater generated by an open-lot facility.

There are a number of different devices installed in the tanks to produce these overflows. Some are simple valves that produce small continuous flows. Others are valves controlled by thermocouples that open and close based upon water temperature. All of these devices have functional limitations and typically require frequent maintenance. Some specific needs and goals have been identified that would result in reduced overflow volumes and water conservation:

1. Develop a mechanical device to open and close an overflow valve that is not susceptible to plugging or failure. Plugging with sand particles is an important issue in some locations.

2. Develop electronic sensors and controls to open and close overflow valves based upon temperature conditions. One desired feature is to have the valve open when the water temperature is less than 33 degrees F and then close when the temperature rises above this level.

3. Develop sensors to determine when water tanks are frozen or flowing at excessive rates. In the case of frozen conditions, the sensor would alert staff to take actions to thaw the tank. Detection of an excessive flow rate would signal a device malfunction and alert staff to repair the device.

Recommendation: Research and develop sensors, controls and mechanical devices that will reliably control and limit wintertime overflows from livestock water supply tanks.

Estimated research cost: $300,000 - $500,000

Respectfully submitted,

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