

Wood Chip Pads for Livestock

– A Case Study –



Figure 1 – Project Location



Wood chip pad on 4/17/19
(confinement day #108)



Concrete, covered feed lane
adjacent to wood chip pad



Subgrade with ridge-valley
shape to expedite drainage



Clean #57 stone being
placed over perf. pipe.



Ready for wood chip
placement over stone

Introduction

Wood chip surfaces can offer an alternative to concrete for stabilizing livestock heavy use areas. Livestock confinement often stresses producers, animals, and natural resources. Traditional concrete surfaces work well, but are costly, and continual use significantly stresses livestock. Dewy Meadows Farm in Warren Center, Bradford County, PA, a 50 head cow/calf, grass fed, rotationally grazed beef operation, partnered with the Bradford County Conservation District to install and operate this demonstration wood chip pad. The project was partially funded by USDA Natural Resources Conservation Service’s Conservation Innovation Grant. Construction was completed in December 2018, and the first confinement season spanned December 30, 2018 – May 17, 2019 (139 days).

The key to the wood chip pad is drainage - moving water away from livestock. The wood chip pad is constructed with an impermeable clay subgrade and perimeter berm containing a grid of perforated pipes under 18 inches of clean #57 stone, overlain with 12 inches of screened, large size wood chips for a wearing surface. Precipitation and liquid waste collected on the open-air pad drains through the wood chips and stone and is collected for treatment. Collected effluent can be placed in a manure storage facility. In this case it is applied to a vegetated treatment area via sprinkler irrigation.

Planning

The wood chip pad was conservatively sized for 50 Animal Units (AU) @ 200 ft² each (1 AU = 1,000 lb live weight). Other sources suggest sizing at 100 ft²/AU ([Woodchip Pads for Livestock – University of Vermont Extension Fact Sheet](#)). Wood chip pad dimensions are 100’ x 100’. Feed and water must be provided on an adjacent, hardened area, where manure can be routinely removed. High manure concentrations at feed and water locations would overwhelm and eliminate drainage functions of the wood chip pad. The wood chip pad can be constructed adjacent to existing infrastructure. In this case a new concrete feed lane and adjacent manure stacking area were constructed.

Subgrade

An impermeable subgrade is necessary to protect ground water and to contain nutrients for collection and utilization. The site chosen was on high clay content soils suitable for an impermeable subgrade. A perimeter drain was installed to lower the seasonal-high water table. To maximize drainage from the pad, the subgrade was constructed with a ridge-and-valley pattern at 10-foot intervals, with a run of perforated drainpipe to be placed in each “valley”. Geotextile was placed over the entire subgrade to maintain separation between drainage materials and the clay subgrade.

Drainage and Wood Chip Surface

Four-inch perforated pipe is placed in each “valley” of the undulating subgrade, sloping toward a solid PVC manifold collection pipe, which carries effluent to a 2,000-gallon concrete tank. On top of the perforated pipe is placed 18” of clean, #57 stone, which is considered essential for protection of pipes and longevity of drainage. A 12-inch thick layer of wood chips is placed directly on top of the stone. Wood chips must be large enough and screened to be free of fine particles and long fibers that would impede drainage. Look for chips processed for commercial heating applications, called “bole” chips. Recommended chip size is 2” x 2” x 0.25”. square. Wood chip species is not as important. Hardwoods are expected to last longer, absorb less water, and produce more runoff. In this case, chips are predominantly ash with some red maple, approximately 1” square and supplied by Wagner Millwork, Owego, NY.

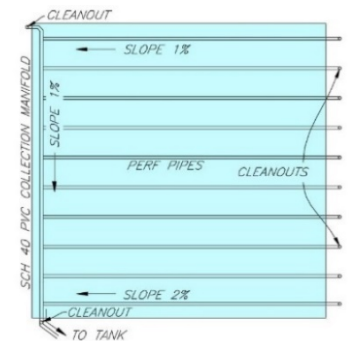


Figure 3 - Plan view of the pipe drainage system beneath the wood chip pad.

Cost

Construction cost of the wood chip pad portion alone totaled \$32,200 for the 10,000 ft² area (\$3.22/ft²). For stocking rates ranging between 100 ft² – 200 ft²/AU, construction cost equates to \$322/AU - \$645/AU. A cost estimate for a comparable concrete barnyard sized for 50 AUs @ 75 ft² each totals \$37,245 (\$745/AU, or \$9.93/ ft²).

Table 1 - Wood chip pad cost breakdown

Item	Quantity	Cost
Excavation	Lump Sum	\$ 9,027.00
Goetextile	2 rolls	\$ 965.00
Pipe	1,100 ft	\$ 647.50
#57 Stone	602 ton	\$ 9,968.97
Wood Chips	aprx 95 ton (385 yd ³)	\$ 4,820.00
Perim Drain	532 ft	\$ 4,942.07
Labor	Lump Sum	\$ 1,857.00
Total		\$ 32,227.54

Performance

The wood chip pad received no maintenance intervention during the entire confinement period. The pad dried quickly following precipitation events, providing a relatively dry bedding surface throughout the confinement period. Cattle cleanliness has been rated very good which is expected to contribute to livestock growth performance. Evaluation of the wood chip pad during confinement showed that the top four inches of wood chips were soiled with manure while the lower eight inches remained clean. Time lapse photography of the confinement period gives a sense of drainage performance (www.bccdpa.com/woodchip).



Wood chips soiled to 4" depth. Clean chips and stone beneath.

Wood chip pad maintenance was performed in July. Soiled wood chips were removed from the surface using a tractor and back-blade, requiring the removal of approximately six inches of wood chips. Soiled wood chips were piled in the empty manure stacking area until field application in November. New wood chips totaling 50 ton (200 yd³) were delivered in July and spread to bring the wood chip pad back to its original 12-inch thickness. Cost of annual wood chip pad maintenance totaled \$3,180 which equates to \$32 - \$64/AU.



Six inches of soiled chips removed with back-blade.

Conclusions to Date

The effluent volume collected equates to 73% of precipitation volume for this period. Analysis of collected effluent shows a nutrient content of 5.06 lb N – 0.49 lb P₂O₅ – 7.65 lb K₂O (lbs/1,000 gal).

When compared with traditional concrete, wood chip pads can:

- Offer implementation cost savings and superior livestock comfort and performance.
- Provide livestock more room but require a larger footprint and may increase wastewater handling costs.
- Reduce daily maintenance time but will require above average attention to management details.

Project related videos along with the full report can be viewed at www.bccdpa.com/woodchip.

The Bradford County Conservation District thanks these partners for making this project possible: [Dewy Meadows Farm](#), [University of Vermont Extension](#), [USDA-NRCS Conservation Innovation Grant](#), [PA DEP Small Business Advantage Grant](#), [PA Dept of Agriculture REAP tax credit program](#)