Manure Storage and Compost Facilities
for operations with limited numbers of livestock

Inside you'll find:
✓ three design blueprints
✓ materials list for designs
✓ manure composition chart
✓ step-by-step calculations to estimate your manure storage needs

Produced by Washington Co. Soil and Water Conservation District through the United States Department of Agriculture Natural Resources Conservation Service Environmental Quality Incentives Program.
By properly storing animal waste you can:

- Keep water clean and safe to drink
  
  When rainwater, snow melt, or other water contacts manure, the water is contaminated with the nutrients phosphorus, nitrate, and ammonia, and with harmful bacteria and organic matter.

- Protect salmon and trout habitat
  
  Salmon and trout need oxygen in the water to survive. Nutrients from manure make algae grow which results in inadequate dissolved oxygen in streams. This can kill fish, especially young ones. Preventing runoff from livestock waste will protect fish, wildlife, our economy, and your health.

- Avoid fines and liabilities
  
  Many streams have problems listed with excessive nitrogen, phosphorus, bacteria, sediment, and heat in the streams. Where animal manures contact public waters, livestock owners are subject to fines. Many Oregon watersheds have or are developing water quality management rules under Senate Bill 1010. Landowners who are managing wastes under farm plans approved under SB1010 through their Conservation District are provided safe haven.

- Reduce odor
  
  Confining manure will significantly reduce odor. By storing manure properly, your facilities will be more pleasant for you and your neighbors.

- Produce a good quality fertilizer with lower costs
  
  By accounting for fertilizer values in manure spread at the proper time and rates, you can produce excellent soils, reduce fertilizer costs, & avoid runoff. Manure is best spread from April to July when plants are actively growing, though limited volumes may be spread from March to October if managed carefully and incorporated into the soil. Avoid spreading when runoff is likely.
**MANURE IS GOOD FERTILIZER**

Total Nutrient Values for 6 Months Manure Accumulation Stored under Roof

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BEEF</td>
<td>1000</td>
<td>10,740</td>
<td>84%</td>
<td>33</td>
<td>15</td>
<td>28</td>
<td>1.0-0.3-0.5</td>
</tr>
<tr>
<td>SHEEP</td>
<td>100</td>
<td>730</td>
<td>77%</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>1.2-0.3-0.6</td>
</tr>
<tr>
<td>HORSE</td>
<td>1000</td>
<td>9,100</td>
<td>82%</td>
<td>35</td>
<td>8</td>
<td>31</td>
<td>1.5-0.7-0.9</td>
</tr>
<tr>
<td>ALPACA</td>
<td>130</td>
<td>910</td>
<td>1%</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>1.4-1.0-1.2</td>
</tr>
</tbody>
</table>

*Nutrient values vary greatly with the feed used. Testing of manure is recommended at a certified lab.

The values above are for manure only. Adjust for bedding. Nutrients are leached by rain if pile is uncovered.

**Manure Storage Tips**

Site storage on higher ground, away from drainage ways, above flood levels and

- At least 100 feet from wells and streams.
- Place on concrete floor with curbing, or store on dry ground.
- Cover with roof or tarp.
- Use roof gutters and downspouts to carry clean water away from pile.

**Before you build consider:**

1. What facilities do you currently have available for storage? Complete “Estimating Manure Storage Needs” pg. 10 to see what your needs are.
2. Can you add on to an existing building, or would you need to build a separate new structure?
3. Will manure be used by or for?
   - Pasture or field crop fertilization. Manure costs less, and improves soil structure better than commercial fertilizer. However, repeated spreading on small acreage can build excessive levels of phosphorus and potassium. Test soils in each field at least every 36 months.
   - Home garden - Adds nutrients, improves tilth.
   - Selling or giving away - Many nurseries and home gardeners will use a dry consistent product.
   - Hauling waste to composting facility.
4. Will you compost or use fresh manure? Compost is more easily used and is in greater demand.
5. Is manure collected for all day, or only part of the time? -
   (“Estimated needs” pg. 10 is for total manure produced by the animal)
NOTE: ALL POSTS TO BE PRESSURE TREATED TO 0.6 LB. DENSITY

PLAN VIEW

NOTE: LANDOWNER ASSUMES RESPONSIBILITY FOR MATERIALS AND WORKMANSHIP.
COMMENTS:

1) CONCRETE PAD SLOPES TOWARDS BACK 1/8":1 (4" THICK AT BACK, 7" AT FRONT).
2) CONCRETE CURB IS 6" X 6" AT FRONT AND 9" X 6" AT BACK TO COMPENSATE.
3) CONCRETE RAMP AT END SLOPES 4":10.
4) CONCRETE CURB SURROUNDS POSTS BUT IS 13" THICK ON INSIDE OF POST.
5) CONCRETE CURB IS FLUSH WITH INSIDE OF 2X6 RAILS.
6) THE 2X6 RAILS ARE ON THE INSIDE OF THE POSTS.
7) CONCRETE REINFORCED WITH #4 BARS AT 16" O.C. EACH WAY.
8) BACKFILL POST HOLES WITH CRUSHED, WELL COMPACTED GRAVEL.

END VIEW

THIS STRUCTURE WILL STORE 1480 CUBIC FEET OF MANURE AND BEDDING
COMMENTS:

1) CONCRETE PAD IS LEVEL (4" THICK).
2) CONCRETE CURB IS 6" WIDE X 4" HIGH.
3) CONCRETE RAMP CAN BE ADDED AT FRONT.
4) CONCRETE CURB SURROUNDS POSTS.
5) CONCRETE CURB IS REINFORCED WITH REBAR.
6) THE 2X6 RAILS ARE ON THE INSIDE OF THE POSTS.
7) CONCRETE REINFORCED WITH #4 BARS AT 16" OC. EACH WAY.
8) BACKFILL POST HOLES WITH CRUSHED, WELL COMPACTED GRAVEL.

END VIEW

THIS STRUCTURE WILL STORE 575 CUBIC FEET OF MANURE AND BEDDING.
2 x 6 blocking attached to existing building

24'-0" out of roof to out of roof

PLAN VIEW

2 x 4 purlins at 16" O.C., attach to joists with 2 x 6 rough blocking
2 x 4 braces

2 x 6 corbel blocks, attach with (4) 16d nails
2 x 4 brace
2 x 6 P.T. railing provide 2" space between rails
6 x 6 P.T. hem-fir poles, typical

LOW SIDE VIEW

NOTE: LANDOWNER ASSUMES RESPONSIBILITY FOR MATERIALS AND WORKMANSHIP.
COMMENTS:

1. Concrete pad is level (4" thick).
2. Concrete curb is 6" wide x 4" high.
3. Concrete ramp can be added at front.
4. Concrete curb surrounds posts.
5. Concrete curb is reinforced with rebar.
6. The 2x6 rails are on the inside of the posts.
7. Concrete reinforced with #4 bars at 16" OC each way.
8. Backfill post holes with crushed, well compacted gravel.

END VIEW

This structure will store 1540 cubic feet of manure and bedding.
# MATERIALS LIST

To build the enclosed designs the following materials are needed. Notice not all items are needed for each design.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Free Standing</th>
<th>Three Bin</th>
<th>Lean-To</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; X 6&quot; X 10' Hem. Fir #2 pressure treated posts</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>6&quot; X 6&quot; X 12' Hem. Fir #2 pressure treated posts</td>
<td>—</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>6&quot; X 8&quot; X 16' Hem. Fir #2 pressure treated posts</td>
<td>3</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>6&quot; X 8&quot; X 18' Hem. Fir #2 pressure treated posts</td>
<td>3</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2&quot; X 6&quot; X 8' Doug. Fir pressure treated rails</td>
<td>—</td>
<td>45</td>
<td>—</td>
</tr>
<tr>
<td>2&quot; X 6&quot; X 10' Doug. Fir pressure treated rails</td>
<td>—</td>
<td>—</td>
<td>8</td>
</tr>
<tr>
<td>2&quot; X 6&quot; X 12' Doug. Fir pressure treated rails</td>
<td>24</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2&quot; X 6&quot; X 8' Doug. Fir pressure treated blocks (8@ 4')</td>
<td>—</td>
<td>4</td>
<td>—</td>
</tr>
<tr>
<td>2&quot; X 6&quot; X 12' Doug. Fir pressure treated blocks (2@6')</td>
<td>1</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>2&quot; X 6&quot; X 12' Doug. Fir #2 &amp; better rafters</td>
<td>—</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>2&quot; X 4&quot; X 8' Doug. Fir pressure treated angle braces</td>
<td>10</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2&quot; X 6&quot; X 12' Doug. Fir #2 &amp; better joists</td>
<td>8</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2&quot; X 4&quot; X 8' Doug. Fir #2 &amp; better purlins</td>
<td>—</td>
<td>21</td>
<td>—</td>
</tr>
<tr>
<td>2&quot; X 4&quot; X 12' Doug. Fir #2 &amp; better purlins</td>
<td>22</td>
<td>—</td>
<td>19</td>
</tr>
<tr>
<td>2&quot; X 4&quot; X 8' Doug Fir #2 &amp; better braces (cut to 4'long)</td>
<td>6</td>
<td>—</td>
<td>2</td>
</tr>
<tr>
<td>2&quot; X 6&quot; X12' Doug. Fir #2 &amp; better joist blocking (cut to 2' long)</td>
<td>2</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>2&quot; X 6&quot; X rough Doug. Fir purlin blocking (cut to 1' pieces)</td>
<td>32 ft.</td>
<td>20 ft.</td>
<td>19 ft.</td>
</tr>
<tr>
<td>2' X 12' metal roof sheets with self-drilling fasteners</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>1/2&quot; X 12&quot; long machine bolt with heavy plated washers</td>
<td>—</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>1/2&quot; X 14&quot; long machine bolt with heavy plate washers</td>
<td>6</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**Materials needed for each design:**
- 1 box 16d common galvanized nails for majority of nailing
- 24 ft. of roof gutter & 1 downspout to divert rain water from manure

**Other materials for Lean-To design only:**
- 168 feet of 1 X 6 flat for sheeting attachment
- 300 sq. ft. build. paper for between 1 X 6 flat metal sheets
- 12d nails to attach 1 X 6 flat to purlins

**Other materials for Three Bin design only:**
- 300 sq. ft. building paper for between metal purlins and metal sheeting

**Other materials for Free Standing design only:**
- (9) 4' X 8' plywood - sheeting with exterior glue
- 300 sq. ft. build. paper for between plywood and metal sheeting
- nails to attach plywood sheeting to purlins - 1' on center nailing

**Manure use and application ideas:**

- Arrange with a crop producing farmer to spread on their field as fresh manure and till into soil, or spread on your own pastures in the spring.
- Compost for fertilizer to sell or use on your own land.
- Spreading manure or compost on field can replace most of the commercial fertilizer you normally use, but high applications may build phosphorus and potassium to excessive levels with continuous use. Test soils periodically to determine nutrient levels.
- Continue to test manures until rates of N, P, and K become stable and predictable.
Manure Storage Capacity - Estimate Worksheet

<table>
<thead>
<tr>
<th>Type</th>
<th>Average Lbs.</th>
<th>6 mon. storage needs</th>
<th>Type</th>
<th>Average Lbs.</th>
<th>6 mon. storage needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>900</td>
<td>150 cu.ft.</td>
<td>Sheep</td>
<td>90</td>
<td>10 cu.ft.</td>
</tr>
<tr>
<td>Beef</td>
<td>500</td>
<td>80 cu.ft.</td>
<td>Growing pig</td>
<td>65</td>
<td>13 cu.ft.</td>
</tr>
<tr>
<td>Horse</td>
<td>1200</td>
<td>175 cu.ft.</td>
<td>Gestating sow</td>
<td>275</td>
<td>27 cu.ft.</td>
</tr>
<tr>
<td>Poultry</td>
<td>7</td>
<td>1 cu.ft.</td>
<td>Alpaca</td>
<td>130</td>
<td>16 cu.ft.</td>
</tr>
</tbody>
</table>

Sample Calculations - Your Animals Are:
Type & average weight X # of animals X ft.3 per 6 months = ____ ft.3 storage needed
Horse - 1200 lbs. X 4 X 175 ft.3 = 700 ft.3 storage needed

If your animals are larger or smaller than the weights listed, adjust storage accordingly. For example, if your horse weighs 600 lbs. assume it will produce ½ of 175 ft.3 or 88 ft.3 of manure.

Approximate Bedding Volumes -
Fresh Hay 0.24 ft.3 / lb. Fresh Straw 0.35 ft.3 / lb.
Fresh Wood shavings 0.11 ft.3 / lb. Fresh Sawdust 0.08 ft.3 / lb.

Lbs./month X ft.3 / lb. = ft.3/month X 6 months = ____ X 0.5 compaction = _______
i.e. 48 lb straw/month X 0.35 ft.3 / lb. = 16.8 ft.3 / mon. X 6 mo. = 101 ft.3 X 0.5 = 51 ft.3
____ X ____ = _____ ft.3 / mon. X 6 mon. = _____ ft.3 X 0.5 = ______ ft.3

Approximate Storage Needs:
Manure ________ + Bedding ________ = Total Storage Needed ________ ft.3

*When uncertain on sizes needed, it is better to build a structure a bit too large.
For information on facility designs, composting, livestock management, current rules, financial assistance available, or other rural resource matters, contact your local Soil & Water Conservation District or the nearest office of USDA Natural Resource Conservation Service.

More information is available from your local Conservation District and from these websites:

http://or.nrcs.usda.gov/
http://www.netncct.net/community/oacd/fs00safs.htm
http://www.ag.ohio-state.edu/~ohioline/agf-fact/
http://www.agf.gov.bc.ca/croplive/anhlth/horse/horsehome.htm
http://gaia.ageng.umn.edu/extens/ennotes/enwin95/manure.html
http://coopext.cahe.wsu.edu/infopub/eb1713/eb1713.html
http://eesc.orst.edu/
http://gaia.ageng.umn.edu/extens/ennotes/enwin95/manure.html
http://coopext.cahe.wsu.edu/infopub/eb1713/eb1713.html
http://smallfarms.orst.edu/about.htm
http://texnat.tamu.edu/pubs/b-5035/b-5035-1.htm
http://www.capital.ous.edu/oes/ruralwater.html

Scroll down for Oregon Small Acreage Fact Sheets
Small acreage fertilizer, streams, pasture, mud, more
Pasture, Forage, Manure & Nutrient Management
Horses, pasture, arenas, environmental
Pollution potential of livestock manure
Managing Livestock on Small Acreage
OSU online publications and links
Pollution potential of livestock manure
Managing Livestock on Small Acreage
Small Farms
Small Acreage Ethics
Resource management guides

This guidebook was developed cooperatively by USDA-NRCS & Washington Co. Soil & Water Conservation District, Hillsboro, Oregon.

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