

TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE STATE OF COLORADO NATURAL RESOURCES CONSERVATION SERVICE

BIOLOGY TECHNICAL NOTE NO. 43

April 2018

Wildlife Escape Ramps

for watering facilities and open storage tanks to enhance wildlife safety and access

While a variety of wildlife depend on livestock troughs and tanks for water, many also drown attempting to use these structures; particularly when water levels are low and escape structures are absent or inadequate. Mortality rates cannot be reliably estimated, but anecdotal evidence suggests that such wildlife drowning are frequent and widespread. Preventing wildlife fatalities at water troughs conserves our wildlife and helps maintain a clean, uncontaminated water source which is critical for healthy livestock operations.

This note provides guidelines for the planning, design and installation of a successful escape ramp and provides examples of ramp designs. It compliments, and is required for, the planning of NRCS conservation practice standard Watering Facility (614) and Structures for Wildlife (649).



CRITERIA - An effective wildlife escape ramp will:

- be built of grippable, long-lasting materials, such as: expanded metal, roughened fiberglass or high strength plastic composites, roughened concrete, or rock-and-mortar.
Why? Small animals have small claws and a short reach; they need a roughened surface to easily grip.
- have a slope no steeper than 45 degrees, in all directions.
Why? Animals will be fatigued from swimming and will have a hard time pulling themselves up a slope.
- extend down the inside wall of the tank/trough (in both directions), making contact with the bottom of the tank. There should be no gaps where a small animal could swim under the ramp.
Why? Drowning animals will mainly swim the edges of the tank. A ramp that doesn't connect to the tank edge will generally not be found by drowning animals (they will miss it by swimming underneath it). The ramp needs to be available at all water levels (the majority of drowning occur at low water levels).
- be placed at least every 30 linear feet of tank edge (every 15 feet is ideal). See Appendix B for a quick guide.
Why? Many small animals cannot swim more than 30 feet before they become exhausted and drown.
- be firmly secured to the tank.
- be located to cause minimal interference with other uses (i.e. livestock access and inlets/outlets).
- be installed in all aboveground or beneath ground open water tanks.

Types of Wildlife Escape Ramps

Expanded-Metal Structures

Expanded metal ramps are well-suited to troughs that are less than four feet deep, but can be adapted to most tanks. The expanded metal should be 14-10 gauge, with 1/2 to 3/4 inch rigid mesh, finished with a rust inhibiting, non-toxic, paint or coating. In general, the size of the metal square determines the height of the ramp, which should roughly equal the depth of the tank. See Appendix A for an example of a building design.

- Where ramp damage may occur, reinforce the underside of the ramp with rebar or flat metal, or use a concrete/rock-and-mortar ramp.
- For tire tanks (or irregular sided tanks) the ramp can be fitted by cutting the edges (the “wings”) of the ramp, so the ramp comes in contact with the entire depth of the tank wall. The overhanging tire edge may also be trimmed a few inches to accommodate the ramp. See Figure 2.
- In rectangular tanks, escape ramps should be placed at one end of the trough so they minimize interference with bats and birds swooping in to drink. The recommended ramp is one that extends the short width of the tank; so that it touches each side of the tank wall. See Figure 3.
- An alternative method is to use a strip of expanded metal to form an inverted “v”; held in place by a welded bar and tank clamp. The width of the ramp must be at least 4” wide and secured to the bottom and/or sides to ensure it makes contact with the tank wall at a less than or equal to 45 degree slope ($\leq 45^\circ$). See Figure 4.
 - ✓ This design does not allow escape of large birds or mid-sized mammals; it is not authorized in the lesser prairie-chicken or sage grouse range or where other similar sized at-risk species may occur.
- Expanded metal ramps may be designed to provide for deeper, open-water storage tanks. Several design options are available: 1] a large standard ramp can be further extended by building a concrete or rock/mortar ramp leading from the tank base up to the ladder; which will allow an animal to reach the metal ramp; 2] a long “v” ramp can be designed, which curves with the shape of the tank (the bottom of the ramps may touch, but not cross); 3] any other that meets the basic guidelines. An alternative option is to cover the storage tank with a hard cover (such as fiberglass or metal) or thick (>1.5mm) membrane (such as a lagoon liner) which will not allow wildlife access to the water and which will not pose an entanglement and/or drowning hazard.

Installation. Ramps must be firmly attached to the trough. A metal-tapping screw and washer is effective, or a bracket with a bolt and wing nut (allows easier removal for trough maintenance).

Operation & Maintenance. Check ramps periodically to ensure proper function; clean off any algae or debris. These ramps should last at least 5 to 10 years if properly painted or coated.

Fig. 1, expanded metal ramp

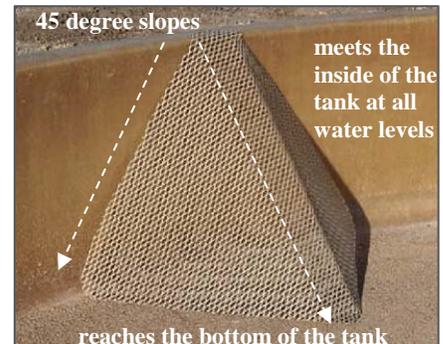


Fig. 2 - Tire Trough Expanded Metal Ramp



Fig. 3- Rectangle Expanded Metal Ramp



Fig. 4 - Alternative “v” ramp



Types of Wildlife Escape Ramps

Concrete and Rock-and-Mortar Escape Structures

Escape ramps made of concrete or rocks-and-mortar can be effective and durable, and can be used in a variety of troughs. These ramps are especially useful in concrete troughs or those with irregular shaped tanks sides (i.e. tire tanks), where ramp damage is anticipated, or where larger wildlife may become trapped in a tank. Two primarily used designs are provided below:

Rock-and-mortar ramps can usually be made of local rock, reducing expenses for materials and transportation. Set rocks firmly in mortar to form a less than or equal to 45 degree ($\leq 45^\circ$) ramp from the bottom of the trough to the rim. The ramps must be capped with concrete unless the rock is rough surfaced and provides a 45 degree slope in its entirety. Capping will also lessen livestock damages. During curing, the concrete must be deeply etched (a wire brush works well) or aggregated added to provide a graspable surface.

Concrete ramps are built in much the same way, using concrete mixed on-site and poured into a wood mold to produce a concrete ramp with slopes less than or equal to 45 degree ($\leq 45^\circ$) from rim to bottom. Rebar is needed to strengthen the concrete in larger ramps (refer to manufactures instructions). During curing, the concrete must be deeply etched (a wire brush works well) or aggregated added to provide a graspable surface.

Like other wildlife escape structures, rock-and-mortar and concrete ramps must meet the interior sides of the trough and have a maximum slope of 45 degrees. If a ramp is not stable enough to attach firmly to the tank wall, a metal plate should be set into the concrete and bolted/welded to the trough. Some key items to consider:

- Recalculate the livestock watering needs before installing a concrete or rock/mortar ramp; the ramp will reduce the water storage capacity of the tank.
- For tire tanks, the concrete or rock/mortar must extend completely into the tire bead. The overhanging tire edge may be trimmed a few inches at the ramp to prevent a ledge obstacle.
- A cone-shaped ramp may be placed in the center of a large tank, provided that the inside rim of the tank also has appropriate escape ramps.

Operation & Maintenance. Escape structures should be checked periodically to ensure proper function; clean off any algae or debris. These ramps should last the duration of the tank life-span.

Commercial Structures (*fiberglass, polyethylene, recycled materials etc.*)

Fiberglass or recycled material escape ramps are offered commercially as an attachment for fiberglass tanks or as a built-in feature. Some surfaces may still need to be roughened to increase traction.

- Some designs (such as Fig. 5, 6) do not allow escape of large birds or mid-sized mammals; it is not authorized in the lesser prairie-chicken or sage grouse range or where other similar sized at-risk species may occur.

Poly mesh escape ramps are offered commercially in the same design as the expanded metal ramps.

Ensure the product meets the criteria provided on page one; in addition, ensure the materials are UV stabilized, and are freeze and crack resistant.

Fig. 5 - tank with built-in ramp.



Fig. 6 – commercial ramp



Additional Considerations

- I. Fencing material should not extend across the water surface. Wildlife that skim across the water, such as bats, can accidentally hit wires or poles and fall into the water. If fencing across the water is necessary it should be made highly visible (e.g. PVC coated).
- II. Ramps may be designed to cover float valves or discharge pipes for additional structural protection.
- III. Consider designing the tank to promote wildlife use: 1] a larger diameter tank provides more accessibility (≥ 10 " dia.), 2] which is not bisected by a fence and doesn't contain overhead wires, posts or other structures, 3] where algae is controlled and 4] where the long axis of the tank is parallel to the prevailing wind direction (promotes in-flight drinking safety).

REFERENCES

Garcia, C. 2006. [614/645 Watering Facility Wildlife Escape Ladder Design](https://birdconservancy.org/). Rocky Mountain Bird Observatory (<https://birdconservancy.org/>)

Taylor, D. et.al. 2012. "Water for Wildlife. A Handbook for Ranchers and Range Managers". Bat Conservation International (<http://www.batcon.org/>).

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APPENDIX A

Material Criteria

Escape ramps shall be constructed of graspable¹⁾, long-lasting materials, such as: expanded metal, roughened fiberglass, sand-embedded composite, roughened concrete, or rock-and-mortar.

¹⁾Graspable for small wildlife (i.e. bats, songbirds) so they can easily climb the ramp. Avoid smooth ramp surfaces or footholds that are more than 0.75 inch apart.

Design Criteria

- Ramps must be designed so that wildlife swimming the tank edge (in either direction) will make contact with a ramp. A multi-directional ramp is required.
- The design must prevent wildlife from missing the ramp (by swimming underneath or around it).
- Ramps must have a 45 degree slope or less ($\leq 45^\circ$).
- The ramp must extend from the tank rim to the tank bottom (allowing escape at any water level).
- Allow the ramp to be securely attached to the tank.

Ramps constructed of expanded metal are an effective and practical approach to meet this criteria. Provided below is construction guidance for these ramps. However, alternative or fabricated ramps may be used if they meet the criteria provided above.

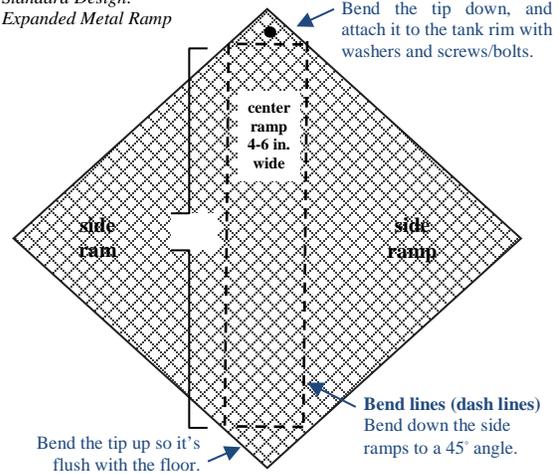
Ramp Size and Quantity Criteria

There must be at least one ramp for every 30 linear feet of tank edge (recommended at every 15 feet).

Tank #: _____	
Tank Edge (ft.): _____	Depth (in.): _____
(diameter x 3.14) or (L x W)	
Min. Ramp Size (in.): _____ (rim to floor at a 45° slope)	
<input type="checkbox"/> Installed every 30 ft. = _____ ramps (<i>minimum</i>)	
<input type="checkbox"/> Installed every 15 ft. = _____ ramps (<i>recommended</i>)	

Standard Design:

Expanded Metal Ramp



Suggested Technique to Make Escape Ramps

MATERIALS

1. 10-14 gauge expanded metal with 1/2 to 3/4 inch openings
(Recommend is 13 gauge, flattened with 1/2" openings)
2. Rust-Proof Paint (non-toxic)
3. Washers & self-tapping metal screws (for installation)

TOOLS

- Heavy mallet or light sledgehammer,
- If metal is not pre-cut, grinder and suitable cutting tool,
- Tape Measure, (2) 2x6 Boards, Clamps, Sawhorse, and
- Safety Equipment.

CONSTRUCTION

Step 1. If metal is not pre-cut, cut the metal to the design dimensions and grind the sharp edges.

Step 2. Bend the side ramps to 45 degrees. Use two 2x6 clamped boards (as shown here) to make bends easier. Use a hammer or mallet to finalize the bends.



Step 3. To reduce deterioration of the material, coat the ramp with rust-proof, non-toxic paint.

Installation

The ramp must be securely attached to the tank, making contact with the tank sides (from the top to the bottom).

Operation and Maintenance (O&M)

- Maintain the tanks full of water. If this is not an option, then take the "full or dry" approach; avoid half-full troughs that are attractive traps for wildlife.
- Periodically (at least annually) check the ramps to ensure they are functioning as intended by:
 - clearing any debris from the ramp (such as leaves, twigs and algae), and
 - ensuring the ramps are securely attached and flush along the sides of the tank (no gaps).
- Repair or replace any damaged ramps.
- Contact NRCS if there is evidence of wildlife mortality or injury.

References

USDA, Natural Resources Conservation Service. 2018. Wildlife Escape Ramps for Watering Facilities & Open Storage Tanks. Biology Technical Note, No. 43. Colorado.

Trough or Tank Wildlife Escape Ramp to Reduce Wildlife Mortality and Injury

APPENDIX B

Quick Guide to Quantity of Ramps per Tank or Trough

Round Tank Diameter (feet)	Tank Circumference (feet)	Tank Area (sq. feet)	Minimum Number of Escape Ramps (every 30 LF of rim length)	Recommended Number of Escape Ramps (every 15 LF of rim length)
≤4	≤12.6	≤12.6	1	1
5	15.7	19.6	1	2
6	18.8	28.3	1	2
7	22.0	38.5	1	2
8	25.1	50.3	1	2
9	28.3	63.6	1	2
10	31.4	78.5	2	3
11	34.6	95	2	3
12	37.7	113	2	3
13	40.8	132.7	2	3
14	44.0	154	2	3
15	47.1	176.7	2	4
16	50.3	201	2	4
17	53.4	227	2	4
18	56.5	254.5	2	4
19	59.7	283.5	2	4
20	62.8	314.2	3	5
21	66.0	346.4	3	5
22	69.1	380.1	3	5
23	72.3	415.5	3	5
24	75.4	452.4	3	5
25	78.5	490.9	3	6
26	81.7	530.9	3	6
27	84.8	572.6	3	6
28	88.0	615.7	3	6
29	91.1	660.5	4	7
30	94.2	706.9	4	7

