Instructions
Concrete Block Watering Trough

General Description

This standard detail is a water tight trough of 2 ft depth and 6 ft by 6 ft interior dimensions. The capacity is approximately 530 gallons. The dimensions are such that a fence could cross the center of the trough so that a single trough could provide water for two paddocks of a managed grazing system. An enclosed float control opens a valve when the tank needs to be replenished. The standard detail depicts the tank located on a gravel pad with buried lines delivering water to it.

The standard detail meets the NRCS requirements for Watering Facility, practice code 614. The practice lifespan is 20 years. A project installation would often include Fence, practice code 382; Heavy Use Area Protection, practice code 561; and Pipeline, practice code 516.

Construction is a cast in place floor with concrete block walls. The horizontal steel between the block courses is #3, or 3/8" diameter. This fits nicely within the standard 3/8" mortar joint. The interior of the tank is lined with plaster for water tightness. The block cells are completely filled with grout. Use of blocks is often less complex than casting concrete in forms.

Design Criteria and Specifics

No structural analysis was done on the 2 ft high trough wall as hydrostatic loads are negligible. The minimum temperature and shrinkage steel requirements are met. ACI 318-08, section 7.12.2, page 99 for grade 40 steel in slabs and 0.0014 minimum any and everywhere.

The size of the trough is not based on any storage computation as the installation presumes full time water supply. Concrete masonry units are nearly universally available as is cement, aggregate, reinforcing steel and small size (less the 1 ½ " diameter) pipe and plumbing fixtures

Quantities

1. 8"X8"X16" Concrete Blocks - 74 each
2. 3,000 psi Concrete (for floor pad and cast-in-place bond beam) 1.0 cubic yard
3. 3,000 psi Grout/Mortar - 1.3 cubic yards
4. Total rebar weight (40ksi) - 2,504 pounds
5. 2" dia. PVC Schedule 80 Nipple - 1 each (may vary in number and size with the system configuration).
6. Excavation and Fill (Native Soils) - To be determined; the amount of earthwork is dependent on the particulars of the site.
7. Select Backfill – The drawings show 10 cubic yards, this would be about one dump truck load per installed trough. Adapting the trough to the site may cause this number to be erroneous. The user of the standard detail should adjust the value if it is different.

Limitations

The structure is built of near universally available materials and is stout enough to last the design life with little or no maintenance other than draining occasionally to clean and remove mold algae and perhaps the odd item that can find itself in open troughs.

Site Specific Additions

The single sheet of the drawings should be clear enough for any contractor or proficient, "do it yourselfer," to construct. Any change in the inlet and outlet to the tank needs to be carried on the drawings including the quantities and through to the engineer's estimate. The drawing can from a print of the pdf be modified with white out and a good pen. Those proficient with and having access to AutoCadd may opt to modify the standard detail digitally, even to importing the model into digital topographic surfaces and creating a single .dwg file for the project. Other practices affiliated with the Watering Facility will need to be detailed as part of a "project." Again, pipeline and fence are commonly associated with watering facility. A cover sheet with the details of where the project is and the review and acceptance signature blocks is an essential part of a design package. The location of the trough(s) on the operation needs to be shown. If pipeline is part of the project, the route of the pipeline, installation details, specifications for the pipe, etc. will also be needed. Compute the excavation and backfill quantities if they're significant. Add them to the quantities and engineer's estimate for the project. You should be using local costs. Be sure to amend the title block to include the sheet number (corresponding to the detail's position in the final set of construction drawings), the cooperator name and the Soil & Water Conservation District we are working with.

Safety MUST be considered in the design process. Even a two ft rebar protruding from the cast floor represents an impalement hazard and should be addressed in accordance with OSHA.

Construction

During construction it is important to make sure that the trough is placed on well compacted material. Site preparation may involve removal of soft material and replacing it with compacted gravel. Settlement of the trough may occur if this is not done properly. The settling of the tank could cause a leak in the pipeline and that could be difficult and expensive to repair.

The concrete and steel in the floor are the most critical feature of the trough. Good quality well consolidated concrete will protect the rebar from excessive moisture, reduce the opportunity for cracking later, and bring longevity even beyond the practice life of 20 years. **It is an OSHA requirement that any protruding steel be secured to prevent the possibility of impalement. Let us have no tragedies on our projects.** Finally, be sure that provisions are made for the moist cure called for by the construction notes.

We should be visiting the site to witness the grout placement. grout is introduced and consolidated in the hole until the column of cells is completely filled. A 1/4" mortar/plaster facing shall be applied on the interior walls for liquid-tightness. There are products available for sealing the interior of troughs such as this. If an owner/builder requests such a substitution, ask for a submittal that includes the directions for use, then review and if the design approver is in concurrence that it is adequate, allow the change. The important point is that the interior needs to be watertight so that rebar isn't subjected to increased rates of corrosion because of constant wetness.

Concrete is to be prevented from drying for at least 7 days after pouring. Exposed surfaces need to be kept continuously moist for the entire period. Moisture can be maintained by sprinkling, wet rags covered with plastic, wet organic matter (leaves) or flooding. Formed

surfaces need to be thoroughly wetted immediately after forms are removed and should be kept wet until patching and repairs are completed. Not removing the forms for the week will reduce water loss. Curing compounds can be used. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged. The high water content of masonry grout and the partial absorption of this water by the masonry units will generally provide adequate moisture for grout curing.

Operation and Maintenance: The O &M plan for the component needs to include at least the design volume, the expected frequency of trough emptying and procedures, periodic maintenance and cleaning requirements, and instructions to contact NRCS if there are problems.

References: ACI 318 – Concrete Strength Design; Engineering Field Manual (National Engineering Handbook part 650 Chapter 17 – Materials), Section IV of the USDA NRCS Pacific Islands Area FOTG; Hawaii Stockwater Handbook