NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WATER HARVESTING CATCHMENT

(no.)
CODE 636

DEFINITION

A facility for collecting and storing precipitation.

PURPOSE

To provide water for livestock, fish and wildlife, recreation, or other purposes.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to areas where there is a need for additional water. The contributing area must have a potential to furnish the quantity and quality of water required for the intended use.

Scope

This standard applies to the sealing of watersheds or contributing areas to increase runoff, and to collect and store water for future use. It also applies to simple curbs and diversions constructed to collect and store runoff from such high runoff areas as rock outcrops or existing paved or impervious areas.

CRITERIA

Each water harvesting catchment must be designed according to a plan suited to the water requirements and the site conditions. The following points shall be considered in designing water harvesting catchments:

Water quality and quantity. The quality and quantity of water collected and stored must be adequate for the planned use. The most important consideration in the design of a rainfall harvesting system is the dependability of the water supply.

Storage volume. The storage facility shall be large enough to carry a supply of water through a period of no rainfall considering beneficial use, season of use, and evaporation losses. The probability of filling the storage facility shall be considered in determining the volume of storage.

Catchment area. The volume of storage needed for a selected probability of having water in storage is also affected by the size of the catchment area. The area of the catchment shall be sufficient to insure a dependable supply in the storage area or basin based on use and local rainfall patterns. The catchment area may include the roofs of buildings or other structures which have gutters to collect rainfall.

Catchment materials. The catchment area should be smooth and impervious so that it will deliver the maximum possible amount of the rainfall it receives to the storage facility. Earth, treated earth, wax, rubber, asphalt, concrete, steel, and other suitable materials are acceptable for this purpose.

Rainsheds. Rainsheds are structures specifically constructed to provide roofs for collecting rainfall. Usually a water storage tank is located under these structures. Hawaii Technical Notes - Engineering No. 2, "Rainsheds," may be used as a reference for the design of these structures.

Outside runoff. Provisions shall be made for diverting uncontrolled outside runoff

away from the catchment area and/or storage facility to prevent damage and excessive sedimentation. The drainage area that will contribute runoff water to the storage facility will consist only of the area of the catchment and the storage facility. Outside water from other sources may be delivered to the storage facility if the flow is controlled by a pipe or other structures.

Conveyance to storage facility. Runoff may flow directly from a catchment area to storage facility or it may be transported through a pipe conduit. If a pipe is used between the catchment area and the storage facility provisions shall be included for protecting the catchment area from damage by runoff in excess of the capacity of the pipe. An overflow pipe or emergency spillway may be used.

If outside water from other sources is transported to a storage facility by a pipe or other structure, the need for a sediment trap between the source and the storage facility shall be considered.

Storage facility. A storage facility may be an earth or rock basin, tanks of steel, concrete, wood, fiberglass, butyl rubber; or a similar facility.

Tanks. Tank materials and construction shall conform to the Design Criteria for Water Storage Tanks in the Hawaii Standard for **Watering Facility** (Code 614).

Earth or Rock Storage Basins

Hazard. Storage basins shall be located so that failure of an embankment will not result in loss of life, in damage to homes, commercial or industrial buildings, main highways, or railroads; or in interruption of the use or service of public utilities. The design criteria in this standard applies to embankments up to 20 feet high. Structures with fill heights exceeding 20 feet shall be designed according to the design criteria in the Hawaii Standard of **Pond** (Code 378).

Embankment. Embankments for storage basins may be constructed using earth or rock fills. Rock embankments must contain enough rock to insure a rock to rock contact. In most cases this requires at least 2/3 of the fill material to be rocks.

Lining. Seepage control is to be included if the structure is built on soils with excessive permeability rates so that adequate water cannot be stored or if a rock embankment is used. Seepage control may be accomplished by lining the storage basin. Linings installed shall conform to Hawaii Standard 521, **Pond Sealing or Lining**. Rock embankments need a blanket of fine grained material between the rock fill and the lining. If the storage basin is not lined, the provisions for foundation cutoff and seepage control in the Hawaii Standard for **Pond** (Code 378) shall apply.

Top width. The minimum top width of the embankment is shown in Table 1. If the embankment top is to be used as a public road, the minimum width shall be 16 feet for one-way and 26 feet for two-way traffic. Minimum top width for private roads or maintenance roads shall be 12 feet. Guardrails or other safety measures shall be used where necessary and are to meet the requirements of the responsible road authority.

Table 1

Total Height of Embankment (feet)	Top Width (feet)
10 or less	6
11 to 14	8
15 to 19	10
20	12

Note: For this standard, the maximum height of the embankment is 20 feet.

Side slopes. If the maximum depth of water against the embankment is 3 feet or more, the combined upstream and downstream side slopes of the settled embankment shall not be less than 5 horizontal to 1 vertical for earth embankments, and 4 horizontal to 1 vertical for rock embankments. And, neither slope shall be steeper than 2 horizontal to 1 vertical for earth embankments, and 1.5 horizontal to 1 vertical for rock embankments. All slopes must be designed to be stable, even if flatter side slopes are required.

Freeboard. Embankments shall have at least 1 foot of freeboard above design high water.

Allowance for settlement. The design height of the earth or rock fill shall be increased 10 percent for embankments constructed with dozers and 5 percent when rubber-tired earth moving equipment or rollers provide compaction.

Spillways. Storage basins having a design high water level of 3 feet or more above natural ground shall be provided with an emergency spillway or overflow pipe to prevent overtopping.

Spillway capacity. The minimum capacity of constructed spillways shall be that required to pass the peak flow expected from the 10-year, 24-hour storm or from that obtained by routing the 10-year, 24-hour storm through the reservoir and spillway.

For emergency open channel spillways, the sizing may be obtained from the charts in the Hawaii Supplement to the EFM, Chapter 11. The area if any catchment not controlled by a pipe or other structure must be included in the area of the pond when using these charts.

For emergency overflow pipes, routing may be accomplished by using the storage versus discharge curves in the Hawaii Supplement to the EFM, Chapter 8. The area of any catchment not controlled must be included in the drainage area when using these curves.

The spillway capacity must be increased to include the capacity of any pipe bringing water from outside sources to the pond.

Emergency open channel spillways. Emergency spillways shall be trapezoidal and will be located in undisturbed or compacted earth. The side slopes shall be stable for the material in which the spillway is to be constructed. Lining material will be placed in the spillway, if needed, to prevent erosion from low flows.

Constructed spillways that are open channels usually consist of an inlet channel, control section, and an exit channel. The grade of the exit channel of an open channel spillway shall fall within the range established by discharge requirements and permissible velocities. If the exit channel is on the embankment, it will be lined.

Emergency overflow pipe. The diameter of the pipe shall not be less than 6 inches. Pipe outlets shall be corrugated metal pipe or PVC plastic pipe, 1120 or 1220, Class 160 or stronger.

Antiseep collars are not needed for lined basins. If a conduit is installed through the lining, a watertight collar shall be installed between the pipe and the lining. For storage basins that are not lined, antiseep collars shall be installed to meet the Hawaii Standard for **Pond** (Code 378).

Drain pipe. A pipe with a suitable valve shall be provided to drain and storage basin where needed for proper management. The pipe spillway conduit may be used as storage basin drain when so located as to accomplish this function.

Water supply pipes. For lined storage basins, supply to watering troughs or other uses may be installed as a siphon over the top of the embankment or through the

embankment. Supply pipes through the lining shall have a watertight collar installed between the lining and the pipe.

Supply pipes through lined or unlined embankments shall have an inside diameter of not less than 1-1/4 inches.

Evaporation. The need for evaporation repression should be considered, such as rock filling and floating covers.

Protection. Adequate protection to prevent damage from weather, animals, vandals, wildlife, and traffic should be considered. Fencing may be necessary.

PLANNING CONSIDERATIONS FOR WATER QUANITY AND QUALITY

Water Quantity

- Effects of trapping or catching of water on surface and ground water, Factors include changes in evaporation, timing of releases form the catchment, and the impact of the type of catchment on surface water versus ground water decreases.

Water Quality

- Potential improvement in surface water quality resulting from flow reduction's contribution to reducing erosion and sediment yield. Consider the size of the harvest area and the impact of associated structures, such as sediment traps.
- Effects of reduced dilution water on water quality factors such as dissolved substances, waste assimilation capacity, and dissolved oxygen.
- Effects of loss of ground water dilution and the reduction of input of dissolved salts and chemicals on ground water quality.

MAINTENANCE

Adequate provisions should be included in the plan for maintaining the catchment area, the conveyance system, the overflow devices, and the storage facility.

CONSTRUCTION PLANS

Plans for water harvesting catchments shall be in keeping with this standard and shall describe the requirements for installing the practice to achieve its intended purpose.

Catchment area. Construction plans shall include layout and dimensions of the catchment area. The materials for sealing or surfacing the catchment area shall be specified on the plans. The structural requirements for rainsheds shall also be shown on the plans.

Storage basin. Construction plans shall include a layout, dimensions of storage basin, profile and cross sections of any embankment, dimensions of the spillway or outlet pipe, and inlet and outlet pipe materials requirements. If a lining is used, the plans for the lining may be incorporated into the plans for the earth storage basin.

Specifications. In addition to the Hawaii Water Harvesting Catchment Specification, the NRCS-Hawaii **Pond Sealing or Lining** (Flexible Membrane) Specification (Code 521-A) may be used for flexible membrane lining installation in earth storage basins. Water tanks can be installed according to NRCS-Hawaii **Watering Facility** (Code 614).