



'Navigation Tool' to access information in the Water Research Commission (WRC) Materials

Introduction

This 'tool' is designed to help access the critical information relating to Rainwater Harvesting and Conservation (RWH&C) in the 2 key materials:

WH&C – Water Harvesting and Conservation (Volume 2, part 1)

AWHGS – Agricultural Water Use in Homestead Gardening Systems (Volume 2, Parts 1, 2 and 3)

The Tool also identifies the references to this and related information in six (6) supplementary materials:

- **SUGSAG** - Sustainable Use of Greywater in Small-scale Agriculture and Gardens in South Africa
- **MRFA** - A Manual for Rural Freshwater Aquaculture
- **PGALV** - Production Guidelines for African Leafy Vegetables
- **STPWHC** - Sustainable Techniques and Practices for Water Harvesting and Conservation and their Effective Application in Resource-poor Agricultural Production
- **GBMPRWH&C** - Guidelines on Best Management Practices for Rainwater Harvesting and Conservation (RWH&C) for Cropland and Rangeland Productivity in Communal Semi-arid Areas of South Africa
- **IRLBG** - Improving Rural Livelihoods through Biogas Generation using Livestock Manure and Rainwater Harvesting (Volume 2)

3 Forms of Information

This information can be found in three (3) forms in the materials:

- As Handouts (**H**)
- As Case Studies or Stories (**CS**)
- As information in the Text (**T**)

4 Kinds of Activity or Practice

The Tool is arranged around four (4) different kinds of Activity or Practice associated with RWH&C:

1. **General Activities (Skills) Applicable to and Underpinning Many of the Key Practices**
2. **Collecting, Reducing Loss and Holding Rainwater**
3. **Storing Rainwater**
4. **Using Rainwater for Irrigating Crops**

Definition of levels ascribed to the other factors

***Low:**

- Technologies – basic gardening equipment;
- Skills and understandings – as required for basic gardening;
- Cost R0 – R1000;
- Maintenance – none or one or two days a year, simple repairs

****Medium:**

- Technologies – simple testing or measuring kits, tanks, pipes;
- Skills and understandings – as required for small-scale business;
- Cost R1000 – R10,000;
- Maintenance – regular but infrequent checking/repair, 7 – 10 days/year, technical repairs.

*****High:**

- Technologies – specialised equipment (tractors, mechanical pumps, laboratories etc.);
- Skills and understandings – as required for professional specialists;
- Cost >R10, 000;
- Maintenance – essential regular and frequent checking and repair, up to 50 days/year, complex technical repairs

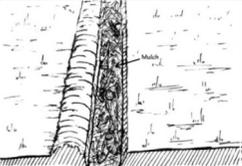
Much of the information in this Tool is adapted from the Overview of WHC Methods (pages 13 – 18) in Water Harvesting and Conservation, Volume 2 Part 1, Technical Manual and Farmer Handouts. Information is also drawn from the other WRC materials.

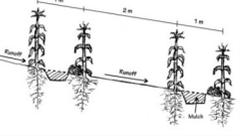
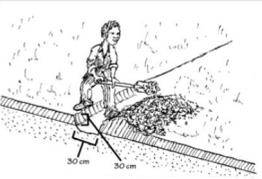
General Activities (Skills) Applicable to and Underpinning Many of the Key Practices				
Practice (and other names)	Type and Scale (1,2 or 3)	Main Purpose and Description	Other Factors	WRC Materials: Text (T), Case Studies (CS), Handouts (H)
Constructing and using 'A-frame'	Preparatory Activity 1 and 2	To set levels and help mark out contours Constructing a simple tool for assessing levels	*Low technology, local materials, low level skills and understandings, low cost, low maintenance	WH&C (T: Pp115-121 & H), AWHGS (CS: Vol.2, Part1, P2-83 and H: Vol.2, Part2, Chap.5,H1, P5) MRFA (T: P19)
Constructing and using a 'line-level'	Preparatory Activity 1 and 2	To set levels and help mark out contours Constructing a simple tool for assessing levels	*Low technology, local materials, low level skills and understandings, low cost, low maintenance	WH&C (T: Pp116,122-123 & H), AWHGS (CS: Vol.2, Part1, P2-83)
Identifying soil types	Preparatory Activity, All	To identify soils appropriate for different RWH&C practices Fairly simple methods for assessing soil types	Low to **medium technology, some specialised materials/equipment, low to medium skills and understandings	WH&C (T: Pp79-108 & H), AWHGS (T: Vol.2,Part3, Pp.6-3 to 6-10), MRFA (T: P19), STPWHC (T: Pp 1-3) GBMPRWH&C (T: Pp 4-6)
Calculating slope	Preparatory Activity, All	To calculate the slope of the land Simple method for calculation of slopes	Low to medium technology, some specialised materials/equipment, medium skills and understandings	WH&C (T: Pp113-118 & H), AWHGS (T: Vol.2,Part2, Pp5-38 to 5-42),
Establishing precipitation (rainfall) amounts	Preparatory Activity, All	To calculate the amount of rain falling on the land. Fairly simple methods for rainfall calculations	Low to medium technology, some specialised materials/equipment, medium skills and understandings	WH&C (T: Pp31-33), AWHGS (T: Vol2.Part1, P1-23),
Calculating storage requirements	Preparatory Activity, All	To estimate how much rainwater storage is needed. Quite detailed calculations of storage volume needs	Medium to high skills and understandings	WH&C (T: Pp158-160 & 163), AWHGS (T: Vol 2 Part 2, Pp 5-80 &5-81)
Calculating irrigation (watering) requirements	Preparatory Activity, All	Estimation of crop water needs Quite complex calculations for estimating water needs	Medium to ***high skills and understandings	WH&C (T: Pp161-162), AWHGS (T: Vol.2,Part2, Pp 5-70 to 5-79)

Collecting, Reducing Loss and Holding Rainwater

Practice (and other names)	Type and Scale (1,2 or 3)	Main Purpose and Description	Other Factors	WRC Materials: Text (T), Case Studies (CS), Handouts (H)
<p>Saaidamme (Wadi floodwater system, flood spate)</p> 	<p>Harvest, conserve and use. Floodwater harvesting. (3)</p>	<p>Involves the diversion of floodwater from non-permanent rivers into a series of flat basins which are used for cropping. Diverted water from the flooding river is channelled into the fields and completely submerges the land for 1 to 3 days, where it fully saturates the soil.</p>	<p>Medium to high technology, medium skills and understandings, medium to high cost (depending on scale), medium to high maintenance</p>	<p>WH&C (T: Pp 169-170, CS: P7)</p>
<p>Dome Water Harvesting (Rock Catchment)</p> 	<p>Harvest, on a large (macro) scale for diversion to where the water is needed (3, possibly 2)</p>	<p>Used to intercept and direct rainwater runoff from impermeable rock domes into a reservoir, or directly to a field where the water is stored in the soil. The method provides valuable drinking water in arid areas. Can be very effective for agricultural use where rock surfaces are located close to agricultural lands.</p>	<p>Low to medium technology, low to medium skills and understandings, low to medium cost, medium maintenance</p>	<p>WH&C (T: Pp167-168)</p>
<p>Ploegvore (pitting)</p> 	<p>Harvest, conserve and use. Can be done by hand on a small scale for crops. (1 and 2)</p>	<p>Involves creating numerous small, well-formed pits or "imprints" in the soil that collect rainwater runoff, seed, sediment and plant litter. This provides a relatively sheltered microclimate in which seed and seedlings can grow.</p>	<p>Medium to high technology, medium skills and understandings, medium to high cost (mostly labour), low maintenance</p>	<p>WH&C (T: P166)</p>

<p>Roofwater Harvesting</p> 	<p>Harvest Mainly used for domestic supply. Surplus can be used in home gardens. (1)</p>	<p>Collecting water from roofs for household and garden use is widely practiced across South Africa. Tanks and containers of all types – from brick reservoirs to makeshift drums and buckets – are a common sight in urban and rural areas. Also for Biogas production</p>	<p>Low to medium technology, low to medium skills and understandings, medium cost, medium maintenance</p>	<p>WH&C (T: Pp156-165), AWHGS (T: Vol.2, Part2,Pp5-83 to 5-90 and H: Vol.2,Part2, Chap.5,H1, Pp9-11), STPWHC (T: Pp 19-21), IRLBG (T: 26-34)</p>
<p>Greywater Harvesting (Recycling, re-use)</p>	<p>Harvest Includes the water used for bathing, washing, cleaning, cooking and rinsing. Used in home gardens. (1)</p>	<p>The practice of using non-toilet wastewater produced in a household to water the root zone of the soil. Usually requires some kind of filtering process. Also used for Biogas production.</p>	<p>Low technology, low to medium skills and understandings, low cost, low maintenance</p>	<p>WH&C (T: Pp154-155 & H, CS: Pp2-6), AWHGS (T:Vol2,Part1,Pp4-60 & 4-61) SUGSAG (T : Whole Report, esp Pp11-42), IRLBG (T: 26-34)</p>
<p>Fertility pits (banana circles, circular swale)</p> 	<p>Harvest, conserve and use. Micro-system which can be a soakaway around buildings – to absorb greywater or surface rainwater. (1)</p>	<p>Enables runoff water to be captured and conserved in 1m deep pits that are filled with organic matter such as compost or manure. The organic matter increases the fertility of the soil and minimises the loss of water from evaporation.</p>	<p>Low technology, low skills and understandings, low cost, low maintenance</p>	<p>WH&C (T: Pp124, 151-152 &H), AWHGS (CS: Vol2,Part2, P5-22),</p>
<p>Terraces (Benches)</p>	<p>Harvest, conserve and use. Micro-system used on steeper slopes (1 and 2)</p>	<p>Used in home gardens and smallholder fields. Mainly used in steeper-sloping areas for cropping and orchards. A level strip of soil built along the contour</p>	<p>Low to medium technology, medium skills and understandings, low to medium cost (mostly labour),</p>	<p>WH&C (T: Pp148-150 & H, CS: Pp2-6), AWHGS (CS: Vol2,Part2, P5-22)</p>

		<p>of a slope and supported by an earth or stone bund, or rows of old tyres filled with soil. Terraces create flat planting areas and stabilize slopes which would otherwise be too steep for crop production.</p>	<p>medium maintenance</p>	
<p>Stone Bunds (stone lines, stone banks, contour banks)</p> 	<p>Harvest, conserve and use. The contour ridges collect water from adjacent slopes. (2, possibly 3)</p>	<p>Rows of tightly packed stones built along contour lines. Used to improve grazing land. Slow down, filter and spread out runoff water. Increase infiltration and reduce soil erosion. Sediment is slowly captured on the upper sides, forming natural terraces.</p>	<p>Low to medium technology, medium skills and understandings, low to medium cost (mostly labour), medium maintenance</p>	<p>WH&C (T: Pp 140-142 & H)</p>
<p>Swales (Bunds, contour ridges, berm 'n basin, contour ditches)</p> 	<p>Harvest, conserve and use. Often used with diversion furrows and mulching. (1 and 2)</p>	<p>An earth bank constructed along the contour with a furrow on the up-slope side – this is filled with dry leaves, compost and soil. The top of the earth bank is levelled off to allow planting. The swale intercepts runoff, spreads it out and helps it infiltrate deep into the ground. Used in home-gardens and smallholder fields. Widely used within permaculture systems. Good groundwater recharge.</p>	<p>Low to medium technology, medium skills and understandings, low to medium cost (mostly labour), medium maintenance</p>	<p>WH&C (T: Pp145-146 &H), AWHGS (CS: Vol2, Part2,P5-25 and H: Vol.2,Part2, Chap.5,H1, Pp6-7),</p>
<p>Tied Ridges (In-field RWH, cross-ridges)</p>	<p>Harvest, conserve and use. Can be used with diversion furrows and mulching.</p>	<p>Built along the contour at 3 m spacings. Crops are planted on either side of the ridge. Runoff from the unplanted area is caught in the furrow and infiltrates into the root zone.</p>	<p>Low to medium technology, medium skills and understandings, low to medium cost (mostly labour), medium maintenance</p>	<p>WH&C (T: Pp 143-144 &H), STPWCH (T: Pp 7 – 18),</p>

	(1 and 2, possibly 3)	Used in home gardens and on smallholder fields; when mechanised, used on a large commercial scale. The system has been fine-tuned to South African conditions, and is called “in-field RWH” in local publications.		GBMPRWH&C (T: Throughout much of document)
<p><i>Gelesha</i> / Infiltration (Ripping)</p>	Harvest, conserve and use. Preparing the ground (All)	Practice of turning the ground ready to receive the rain before planting.	Low to medium technology, low skills and understandings, low to medium cost (depending on scale), low maintenance	WH&C (T: P18)
<p>Diversion Furrows (run-on ditches, run-on or ex field RWH)</p> 	Harvest. Diversion of runoff water onto cropland. Brings water from an external catchment to the field. (All)	Directs rainwater runoff from gullies, grasslands or hard surfaces (such as paths or roads) to a cropped area or to a storage tank. This increases the water available to the plants. Used for fieldcrops and in gardens. Additional water diverted directly to soils and crops. Additional water stored in underground tanks for later watering.	Low to medium technology, medium skills and understandings, low to medium cost (mostly labour), medium maintenance	WH&C (T: Pp 132-133 &H),
<p>Trench Beds (Deep trenching, fertility trenches)</p> 	Harvest, conserve and use. Trench beds are usually connected to diversion furrows, which collect water from adjacent areas and direct it to the trenches. (1)	Trench beds are 1 m wide and 2 m long. They are dug to 1 m deep then packed with dry grass/leaves, compost, manure and soil. Used in food-gardens. Create highly fertile soils which can absorb and store water. Provide an immediately usable planting bed even on shallow or poor soils. Often used with diversion furrows and mulching.	Low technology, low skills and understandings, low cost, low maintenance	WH&C (T: Pp124, 134-139 &H), AWHGS (CS:Vol.2, Part1,Pp28&29, 2-80 and T:Vol.2.Part3, Pp6-59 to 6-63)

<p>Mulching</p> 	<p>Conserve and use, Water conservation method. (1 and 2)</p>	<p>The practice of spreading organic material like compost, straw, manure, dry leaves, grass clippings or wood chips onto the surface of the soil. Can be used on all crops and orchards, not pastures Improves plant growth. Reduces evaporation from the soil surface. Improves soil temperature. Limits weed growth and makes watering easier by protecting the soil.</p>	<p>Low technology (unless plastic sheet mulching), low to medium skills and understanding, low cost, low maintenance</p>	<p>WH&C (T: Pp124, 137-138 & H), AWHGS (T: Vol.2,Part3, Pp6-34 & 6-35), STPWHC (T : P55)</p>
<p>Cover Crops</p>	<p>Conserve water in the ground, reduce erosion (1,2 and 3)</p>	<p>Ensuring that the ground is always covered by vegetation, which can include green manures or short-term crops between main crops.</p>	<p>(Depending on farming scale) Low to medium technology, low to medium skills and understandings, medium cost (but some returns possible), low to medium maintenance</p>	<p>STPWHC (T: P56)</p>
<p>No/Low Till</p>	<p>Conserve soil moisture and organic matter, reduce erosion (1, 2 and 3)</p>	<p>Avoiding, or using minimum cultivation (ploughing etc.) to limit disturbance to the soil structure, reducing loss of soil through erosion, soil water and organic matter</p>	<p>(Depending on farming scale) Low to medium technology, low to medium skills and understandings, low cost, low to medium maintenance</p>	<p>GBMPRWH&C (T: P13)</p>
<p>Mechanised Basin</p>	<p>Conserve water, reduce erosion (mostly 2)</p>	<p>Basins formed by Mechanised Basin plough, including some penetration to increase infiltration</p>	<p>Medium to high technology, medium to high skills and understandings, medium cost, low to medium maintenance</p>	<p>GBMPRWH&C (T: P9)</p>

Storing Rainwater				
Practice (and other names)	Type and Scale (1,2 or 3)	Main Purpose and Description	Other Factors	WRC Materials: Text (T), Case Studies (CS), Handouts (H)
Dams	Harvest and store Simple storage of runoff in purpose-built ponds. (3 and 2)	Generally fairly large-scale storage ponds from which water can be taken for either crops irrigation or used directly for livestock (or aquaculture)	Medium technology, specialised equipment, medium skills and understandings, medium to high cost (depending on scale). Medium to high maintenance	WH&C (T: P18), AWHGS (Vol.2,Part2, CS : P5-85 and H : Vol.2, Part2, Chap.5,H1, P11), MRFA (T: Pp 19-26)
<i>Matamo/ipitsi</i> (homestead ponds)	Harvest and store. Simple ponds for homestead gardens (1, possibly 2)	Small-scale storage ponds to catch and store surface run-off. Water used for irrigation or livestock (or aquaculture).	Low technology, basic equipment, low skills and understandings, low cost, low to medium maintenance	WH&C (T: P18, CS : Pp2-6), AWHGS (H : Vol.2, Part2, Chap.5,H1, P11), MRFA (T: Pp 19-26)
Underground tanks	Store. Tanks located underground to store surface run-off (1, possibly 2)	Relatively small-scale water storage for irrigating small to medium cropping areas.	Medium technology, specialised materials and equipment, medium skills and understandings, medium cost, medium maintenance	AWHGS (T: Vol.2,Part2, Pp5-84 and H : Vol.2, Part2, Chap.5,H1, Pp11-12),
Roof Tanks	Store. Tanks usually above ground to store roof run-off.	Relatively small-scale water storage for domestic use or irrigating small to medium cropping areas.	Medium technology, medium skills and understandings, medium cost, low maintenance	WH&C (T: P158), AWHGS(T: Vol.2,Part2, P5-84 and H : Vol.2, Part2, Chap.5,H1, Pp9-11), V : DVD1

Using Water: Irrigation Practices				
Practice (and other names)	Type and Scale (1, 2 and 3)	Main Purpose and Description	Other Factors	WRC Materials: Text (T), Case Studies (CS), Handouts (H)
Drip/trickle Irrigation	Low water-use, highly focussed irrigation (All)	Water-saving. Delivers water directly to the plants, most useful for orchards and other long-term crops, but can be used for vegetables.	Low to medium technology, medium skills and understandings, medium cost, medium to high maintenance	AWHGS (Vol.2,Part2, T: P5-95, CS:Pp5-97 to 5-102 and H: Chap.5, H2,Pp3-5), PGALV (T: P7)
Buried pipes	Low water-use, reduced evaporation (1 and 2)	Water saving. Delivers water to crop roots. Mainly used in small-medium scale vegetable production	Low to medium technology, medium skills and understandings, medium cost, medium to high maintenance	AWHGS(T&H: Vol.2,Part2, Chap.5, H2,P6)
'Spaghetti lines'	Low water-use. (1 and 2)	Water-saving. Small pipes taking the water from a central pipe to the plants. For orchards or vegetables	Low to medium technology, medium skills and understandings, medium cost, medium maintenance	AWHGS(T&H: Vol.2,Part2, Chap.5, H2,P7)
Sponge lines and string lines	Low water-use. (1 and 2)	Water-saving. A trickle irrigation system, using sponge or sting in the holes in the pipes to reduce water flow.	Low to medium technology, medium skills and understandings, medium cost, medium maintenance	AWHGS(T&H: Vol.2,Part2, Chap.5, H2,Pp7-8)