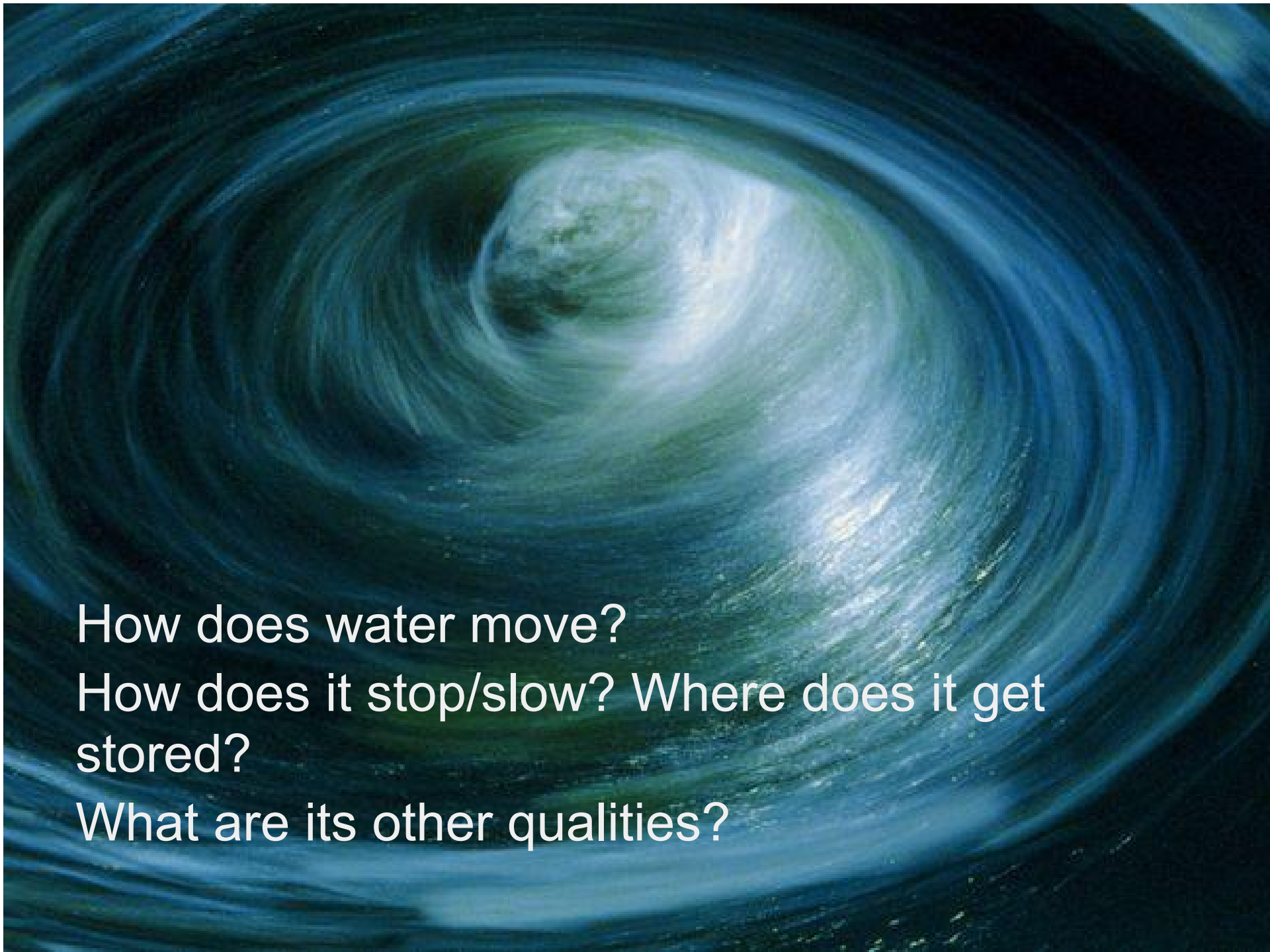
Water

Patterns of water
Austin water issues
Principles
Cistern design and installation
Your water budget
Household water mgmt
Earthworks
Aquaculture



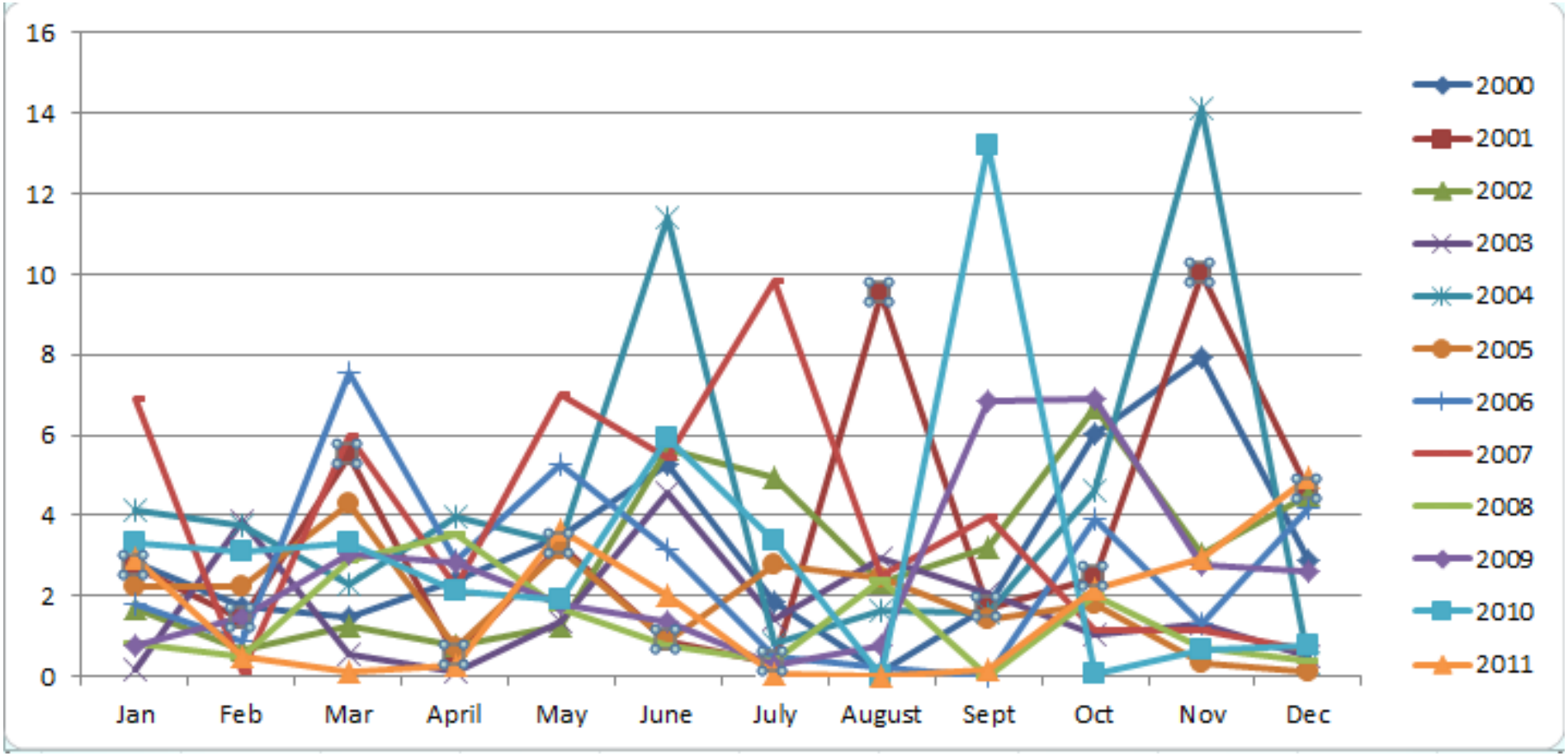
How does water move?

How does it stop/slow? Where does it get stored?

What are its other qualities?

Flows downhill, underground, gathers speed and soluble materials with straight lines/speed, slows with curved lines, on level ground, when stored in tanks and ponds, soil bodies, cacti, clouds air, and trees, pH, greywater, contaminents, solubility, source of life for everything, calming, connects most things (soil, food, health, life, fungus, bacteria, heat, cold) . . .

Austin Rainfall Patterns



Qualities of Austin Water

pH of 8
Source? Lake Travis
Chlorine/Chloramine
Cancer connection (93%)
Floride - Florisis

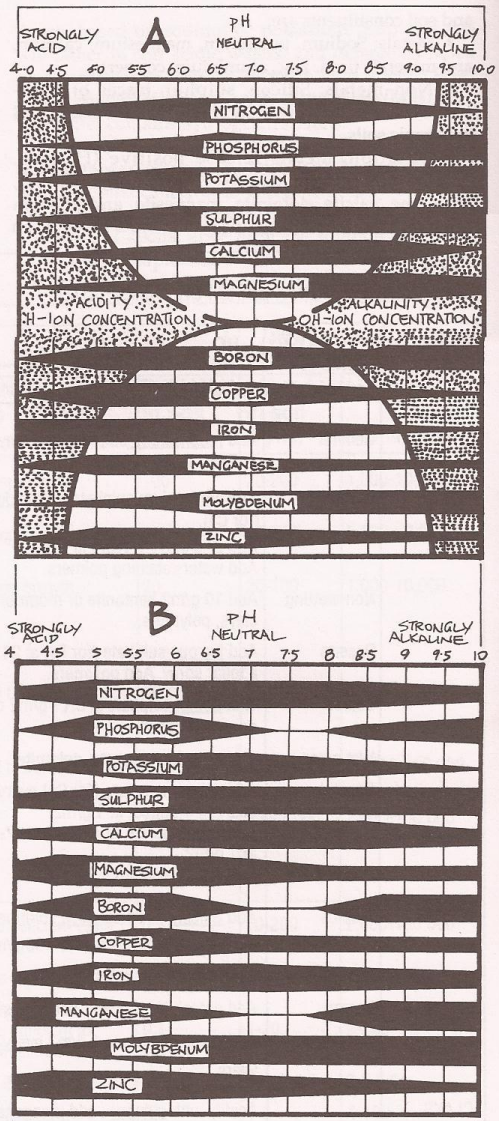


FIGURE 8.4
INFLUENCE OF pH ON AVAILABILITY OF PLANT NUTRIENTS
A In inorganic (mineral) soils. The widest parts of the black areas indicate maximum availability of each element. The curves represent pH values.
[After Nelson, L. B., (Ed.), *Changing patterns of fertiliser use,* Soil Science America, Madison, WI (1968)].

B In organic soils. The widest parts of the black areas indicate maximum availability of each element.
[After Lucas, R. E., amd J. F. Davis, "Relationships between pH values of organic sols and availability of 12 plant nutrients", *Soil Science,* 92:17-182 (1961)]

Designing with H20

What is the goal of water management in a PC design?

What principles of or PC best apply to water?

What are some general rules we can use when thinking about water systems ?

Catch it high, use it low: gravity and quality

Integrate rather than segregate: greywater systems, microclimates, stacking functions

Small changes for a big result: Earthworks, soil health

Create redundancy: use many methods, there is no silver bullet

PLAN FOR OVERFLOW!!!

Demo earthworks

Rainwater Harvesting: Cisterns

600 X in rain = annual potential per 1000 sq ft

Considerations

Size? Rapid depletion, or saving for a dry day?

Location? microclimates, insualtion, gravity, foundation of structure, overflow plan

Material? Ferrocement, polyethelene, fiberglass, 55 gallon drums, metal

Quality: screen, sunlight, first flush, vent

Pros
easy to install, make, move. Ubiquitous

Cons
Ugly, empties quickly, known to breed mosquitos as the eggs are laid through the screen, often lack a first flush system

Pros

Economical, available in the western world, portable, larger sizes (up to 3000 gal)

Cons

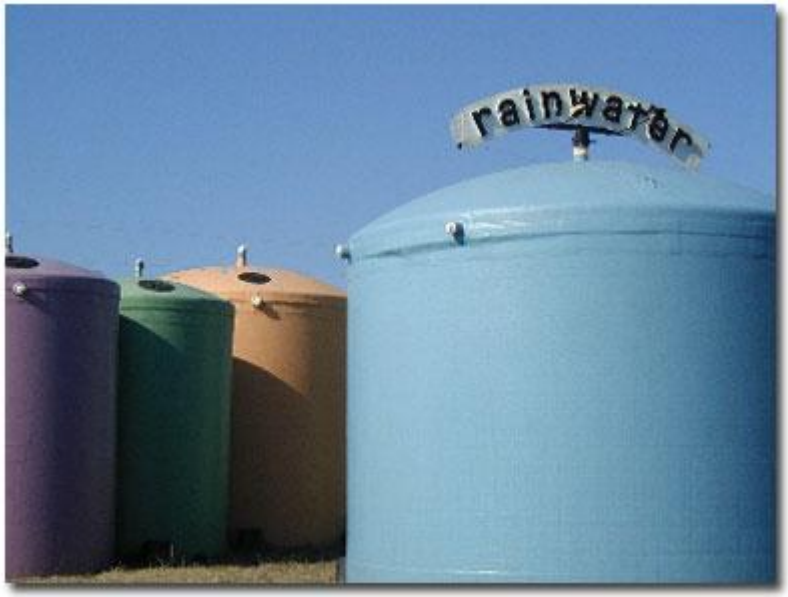
UGLY! plastic (ick), not always an option in remote regions

Pros

HUGE! 10,000 gallons etc . . not plastic, economical, durable

Cons

Gross material to work with, or needs to be delivered, still pretty ugly,



Pros:

inert material (no leeching), custom shapes and sizes - can be artwork!, simple materials with low cost, can be built even in remote areas if there is sand, cement, water, and wire.

Cons

LOTS of labor, don't hold up to freezing in more temperate zones, proper techniques needed to assure quality

Location

Catch it high - use gravity, wet standpipes

Stack functions - Make a microclimate, insulate the W side of a structure

Quality - sunlight, screens, vents

Plan for overflow! 100 year flood!

Designer Challenge

Where should our hosts put their rainwater harvesting system? Why?

How big should it be? Why?

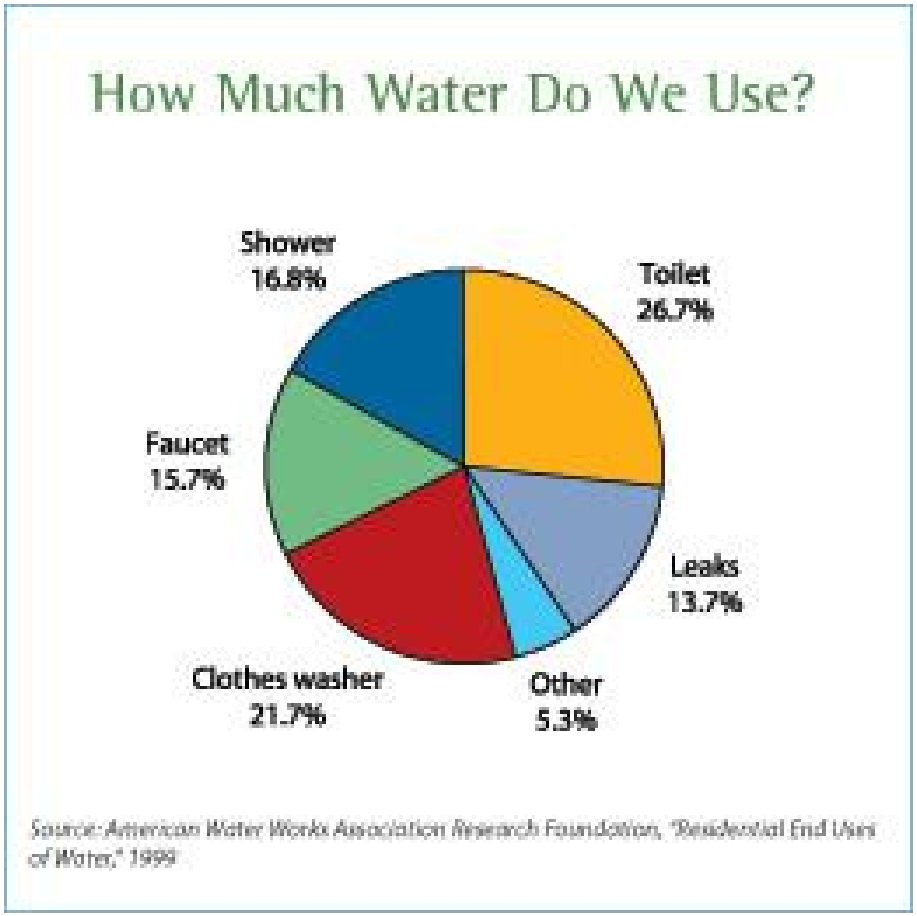
Material recommendations? Reasons?

Water Budget!

Average American? 176 gallons!

Average water wise American? 30-60 gallons

Average African: 5 gallons



Catchment potential (24 inches) - usage

1000 ft2: 14,400/365 = 20 gallons a day


watson wick

Greywater

Radical plumbing: gravity rules, Art Ludwig

Get it gone!: greywater and bacteria

Soaps to avoid: borox, sodium,

Applications for everyone: laundry to landscape, simple outdoor showers

Laundry system video

Kitchen water: the "grey area" of greywater

Composting Toilets!

- No smell! NOT an outhouse!
- Get creative
- Safer when done RIGHT
- Free download: Humanure Handbook, Jenkins

Table 7.14

PATHOGEN SURVIVAL BY COMPOSTING OR SOIL APPLICATION

Pathogen	Soil Application	Unheated Anaerobic Digestion	Composting Toilet (Three mo. min. retention time)	Thermophilic Composting
Enteric viruses	May survive 5 mo	Over 3 mo.	Probably elim.	Killed rapidly at 60C
Salmonellae	3 mo. to 1 yr.	Several wks.	Few may surv.	Dead in 20 hrs. at 60C
Shigellae	Up to 3 mo.	A few days	Prob. elim.	Killed in 1 hr. at 55C or in 10 days at 40C
E. coli	Several mo.	Several wks.	Prob. elim.	Killed rapidly above 60C
Cholera vibrio	1 wk. or less	1 or 2 wks.	Prob. elim.	Killed rapidly above 55C
Leptospires	Up to 15 days	2 days or less	Eliminated	Killed in 10 min. at 55C
Entamoeba histolytica cysts	1 wk. or less	3 wks or less	Eliminated	Killed in 5 min. at 50C or 1 day at 40° C
Hookworm eggs	20 weeks	Will survive	May survive	Killed in 5 min. at 50C or 1 hr. at 45C
Roundworm	Several yrs.	Many mo.	Survive well	Killed in 2 hrs. at 55C, 20

Watson Wick

Irrigation: If you can't eat it, why water it!

- Ollas
- Earthworks/Passive Rainwater harvesting
- Drip systems
- Mulch
- Wicking beds
- Hugelkultur
- Soil health/soil food web

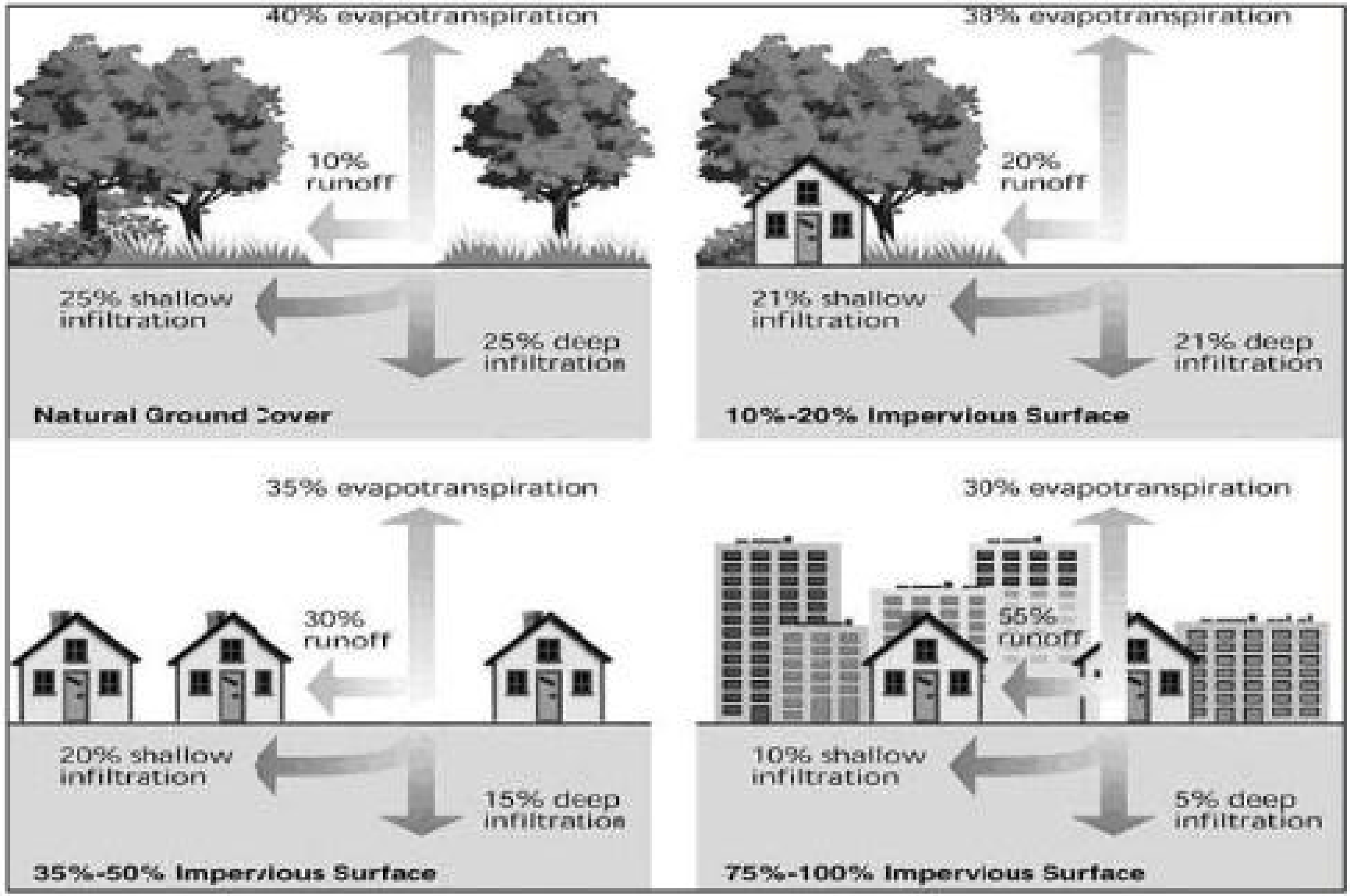


Figure 1: Changes in site hydrology with increasing impervious cover (US EPA)

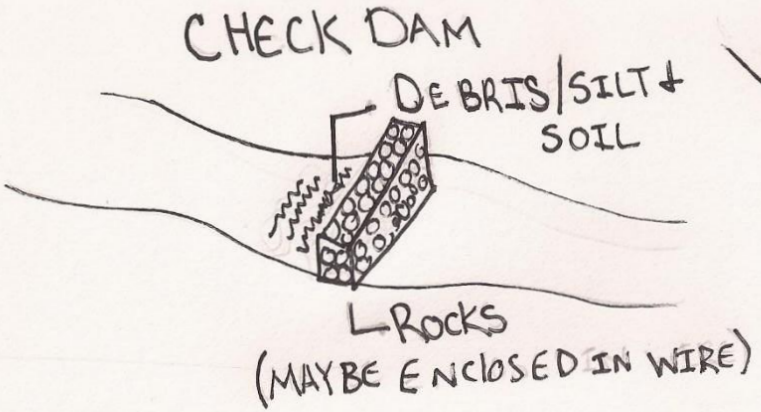
Earthworks

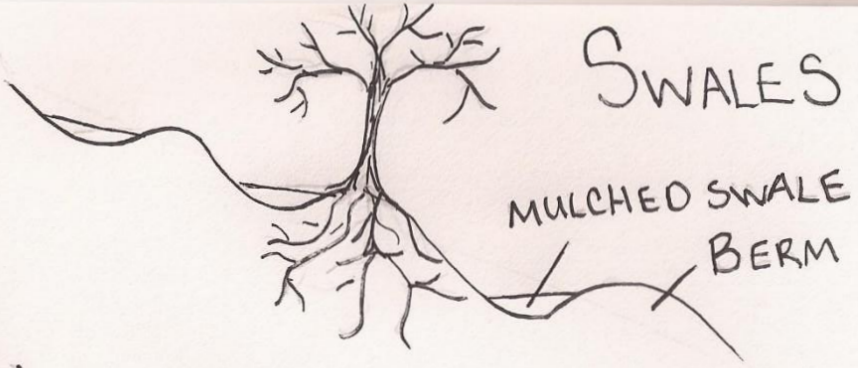
Resources: Brad Lancaster's Rainwater harvesting

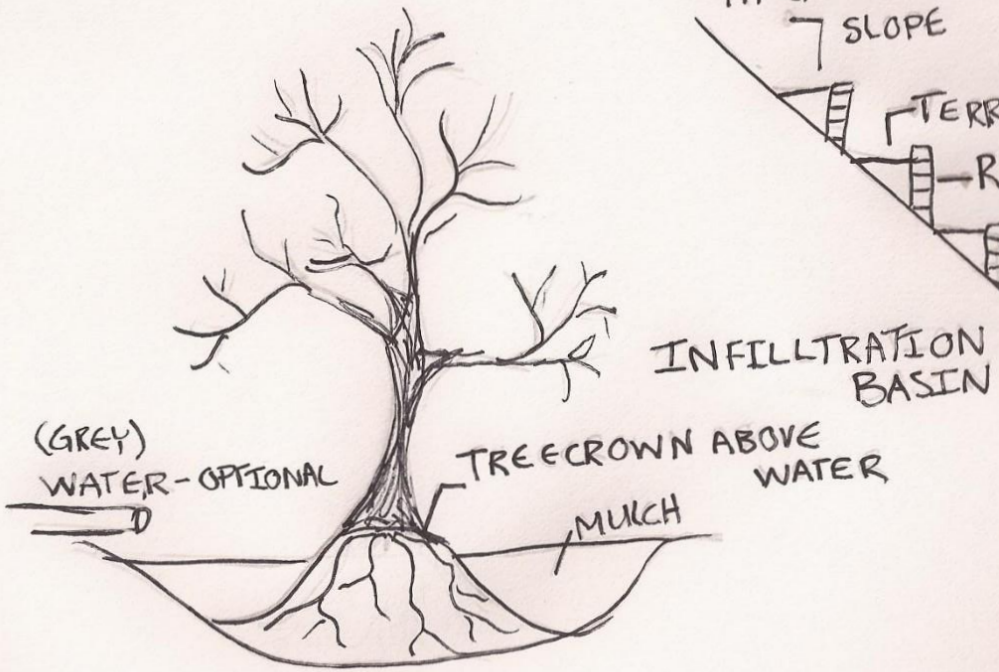
Earthworks tool belt:

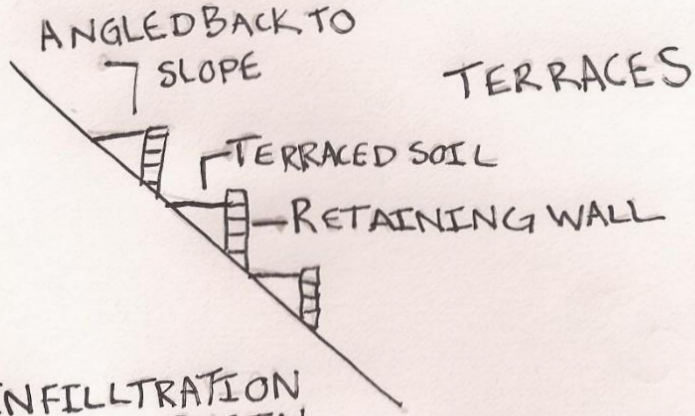
basins, swales, french drains, check dams, curb cuts, logs on contour, chinampas

Greening the desert


CHECK DAM
DEBRIS/SILT + SOIL
ROCKS
(MAYBE ENCLOSED IN WIRE)


SWALES
MULCHED SWALE
BERM


(GREY) WATER - OPTIONAL
TREECROWN ABOVE WATER
MULCH
INFILLTRATION BASIN


ANGLED BACK TO SLOPE
TERRACES
TERRACED SOIL
RETAINING WALL

Aquaculture

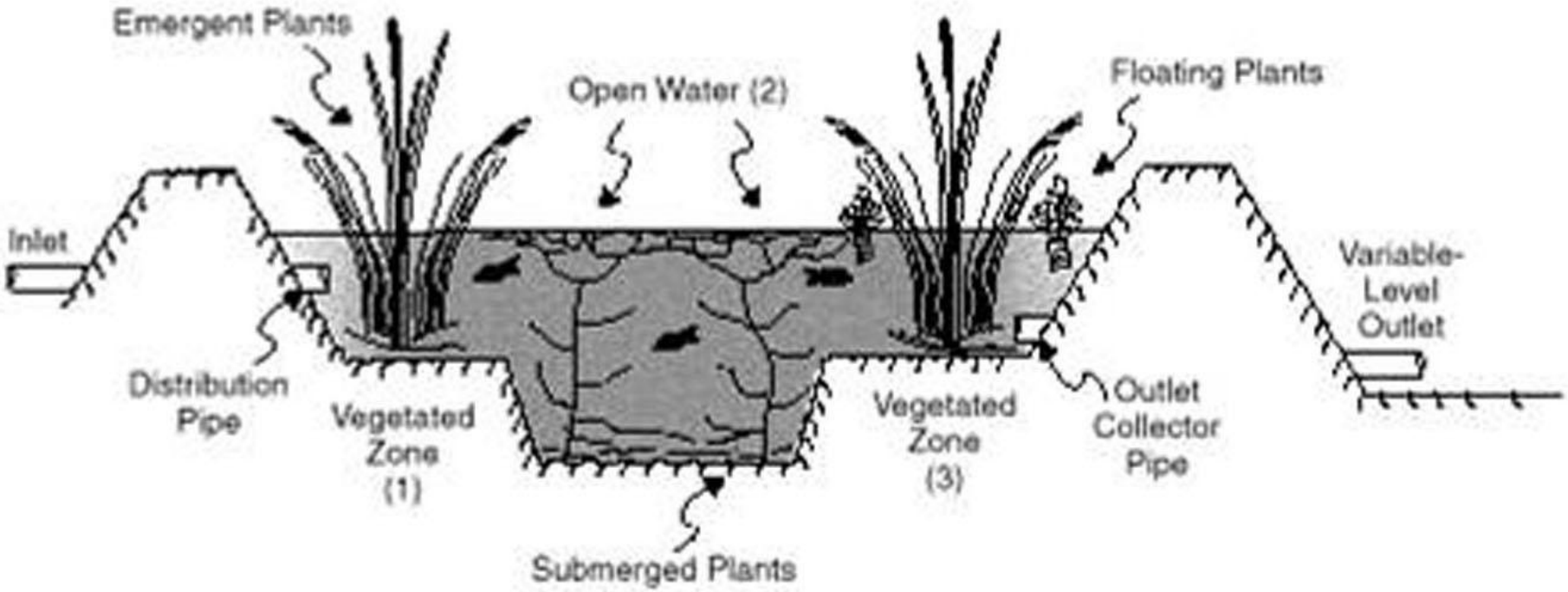
Natural patterns of water bodies

-range of depths

-curved edge - edge is the action

-variety of plant life, (floaters, sinkers, and edgers)

-Aeration, pH, Temperature



http://www.youtube.com/watch?v=_hRIvFFe6sQ BBC natural swiming pools