

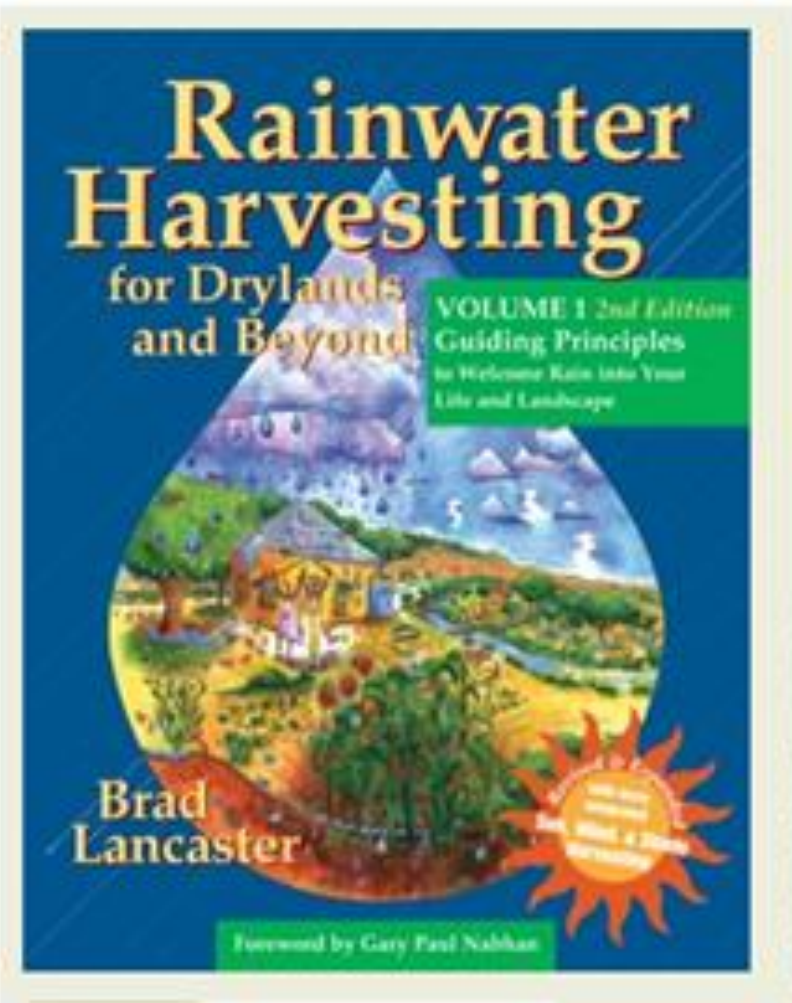
EARTHWORKS AND LANDSCAPE DESIGN FOR WATER CONSERVATION



**USING EARTHWORKS TO
SAVE OUR TREES, RESTORE
SOIL BIOLOGY , AND GROW
OUR FOOD**

TYING IT ALL TOGETHER—PREVIOUS 2015 PRESENTERS

- **Edwin Marty—Local Food**
- **Meredith Gray and Chris Sanchez—
Hugelkultur**
- **Dick Peterson—Brad Lancaster and berms**
- **Vincent Debrock—Capturing 100% of a 2”
storm on-site**



One of several earthworks installed on Dripping Springs property after inspiring talk by Brad Lancaster



MAMA TREE THAT PROVED THE VALUE OF EARTHWORKS



Bunyip water level used to determine grades for depth of basins, contours, emergency spillways

WATERSHED MANAGEMENT GROUP TRAINING CLASS, OCT. 2013



Brad Lancaster's residence
in Tucson: 1994 and 2013

Tucson's average
annual rainfall—
12"

2013 amount-6"





Curb cuts divert polluted runoff into rain garden, nurturing desert willow, mountain laurel and salvia

Conventional detention pond converted to rain garden by extending flow path and planting with native species





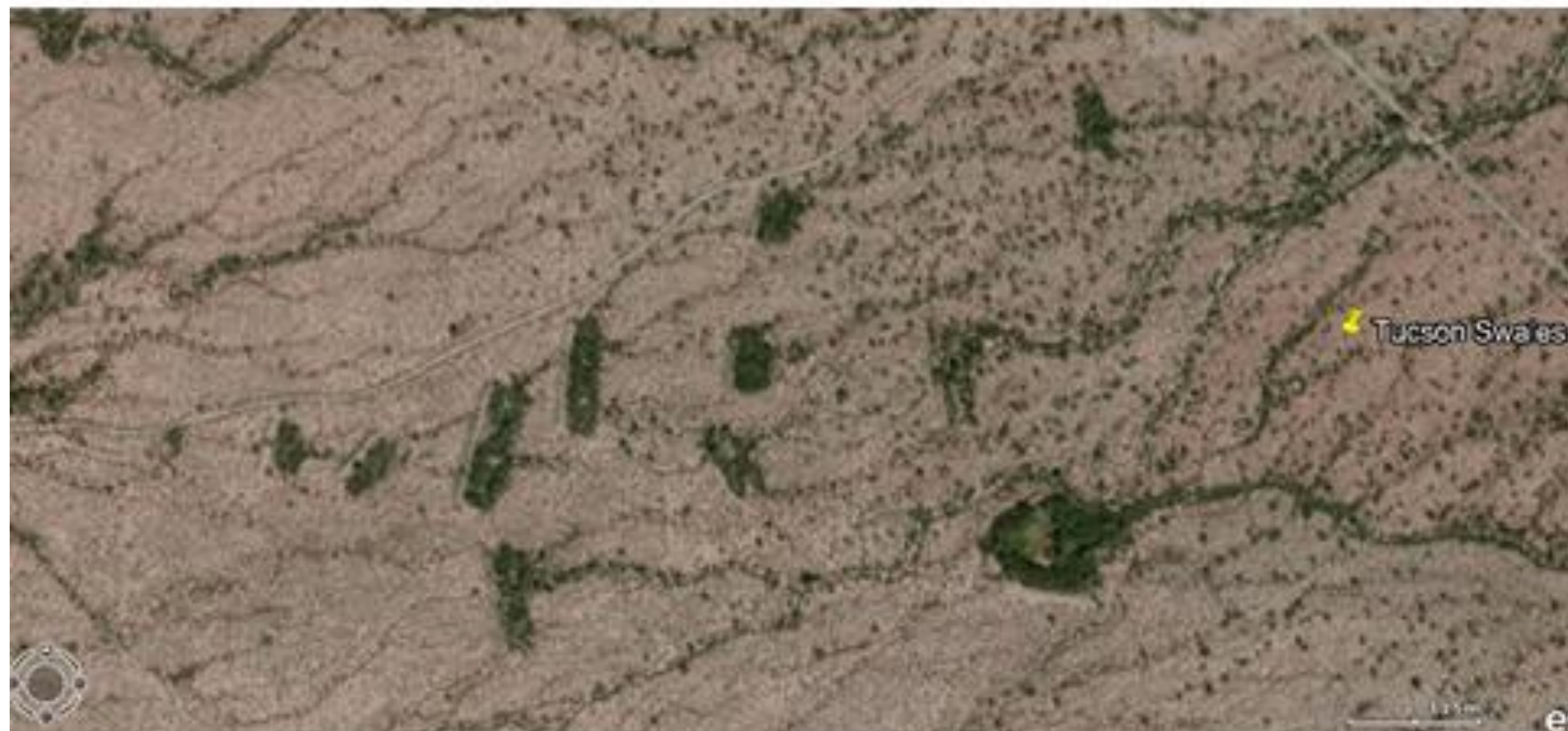
Zuni Waffle Gardens

Johad in India—earthen check dam that catches the monsoon rains



EARTHWORKS ARE AN ANCIENT CONCEPT

Google Earth image of Tucson swales built by CCC in 1930s



Next several images courtesy of Geoff Lawton Permaculture
"Discovering An Oasis in the American Desert"



Rain for the Earth (1937)

“Rain will fall, and when it falls, it must be saved.”

- CCC concepts:**
- (1) Give men the opportunity to work**
 - (2) Let results of their labor be of permanent value**



1947

**South of Tucson, AZ: 70+ years after series of swales
were built by CCC**



Going over the top of the berm



Inside catchment area of the swale



Inside catchment area of the swale



8" of topsoil built in 80 years...what is the conventional wisdom ?



LANDSCAPE LEVEL VERSION OF THE CCC BERMS



Fig. 2.14B. A successful level berm with a planned, stabilized overflow (above the bottom of the basin) allows surplus water to exit the berm 'n basin, while the majority of the water is harvested within the earthwork.

Images from [Rainwater Harvesting for Drylands and Beyond](#) by Brad Lancaster

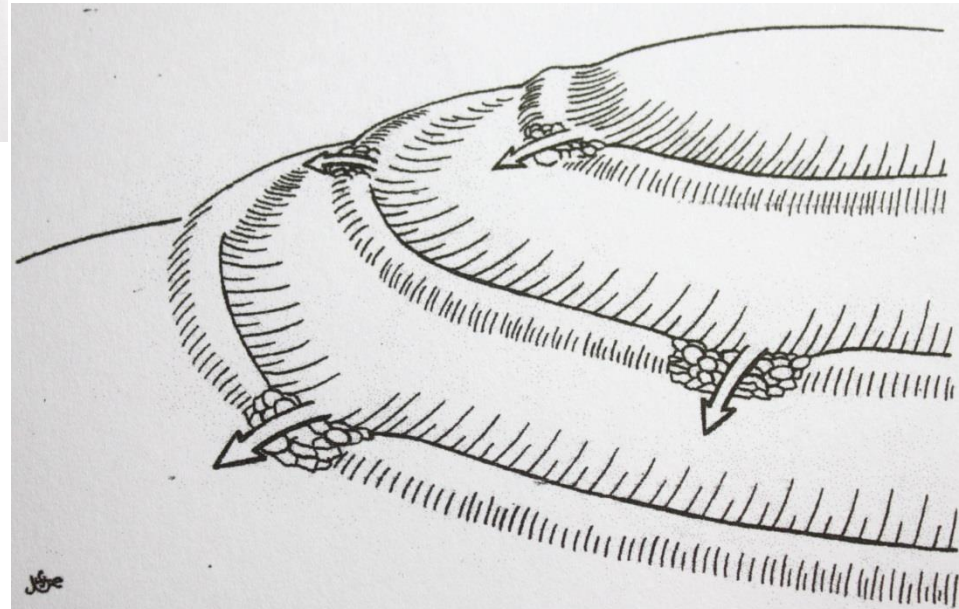


Fig. 2.17. Zig-zagging overflow spillways to spread and infiltrate more of the water's flow

Benefits of earthworks:

- Restores soil biology health
- Creates self-maintaining landscapes
- Utilizes on-site materials that reduce overall costs
- Reduces use of fossil fuels, artificial fertilizers, and pesticides

What does a healthy soil food web provide?

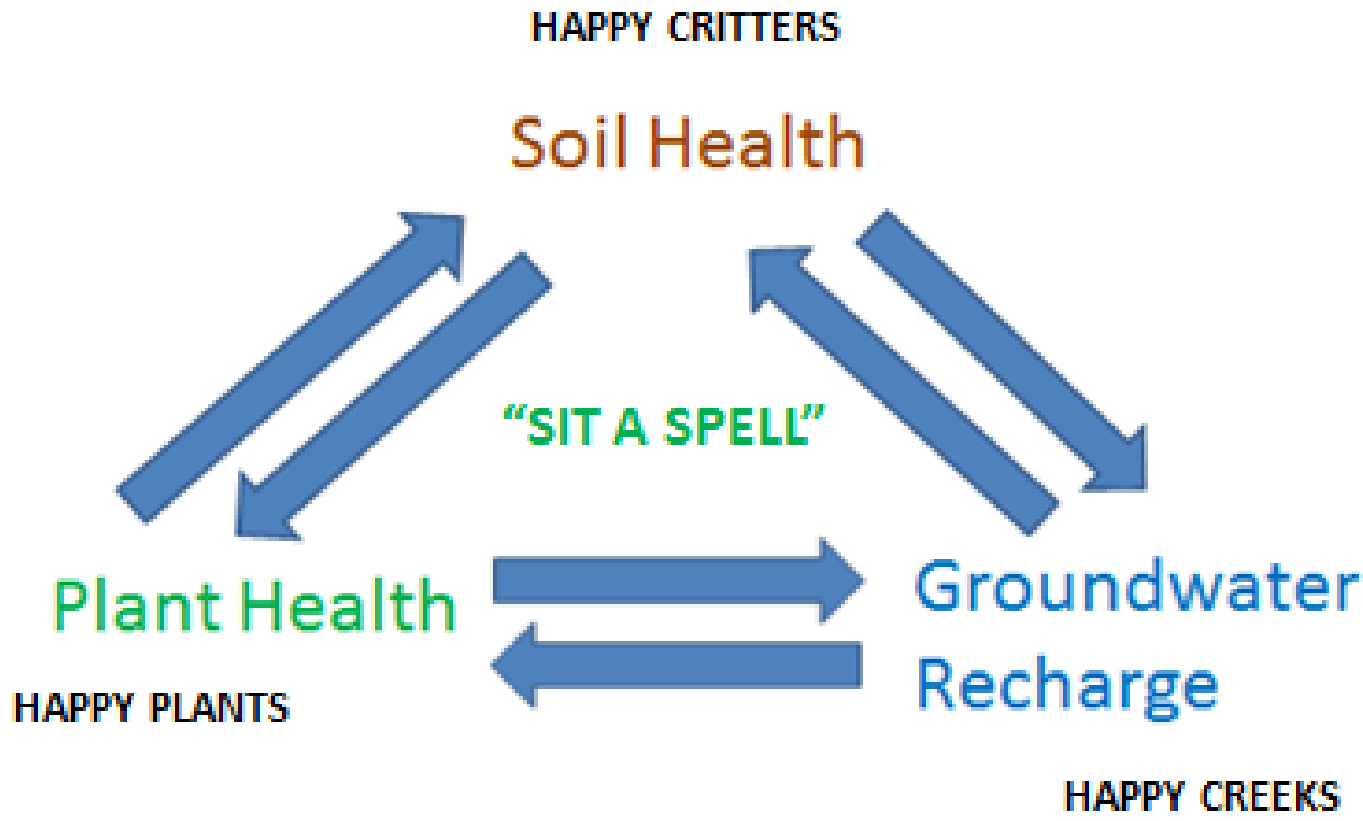
- Better nutrient retention
- Improved soil structure (and greater water retention)
- Defense against insects and diseases
- Soil pH in rhizosphere is adjusted toward plant's preference

Soil organisms reproduce and do their work during any window of optimum moisture!

In Central Texas with its poor, thin soils, the windows are very narrow.

Therefore, we need to create more areas that will hold moisture longer.

Fertility and plant health increases dramatically when those organisms are given optimum conditions.

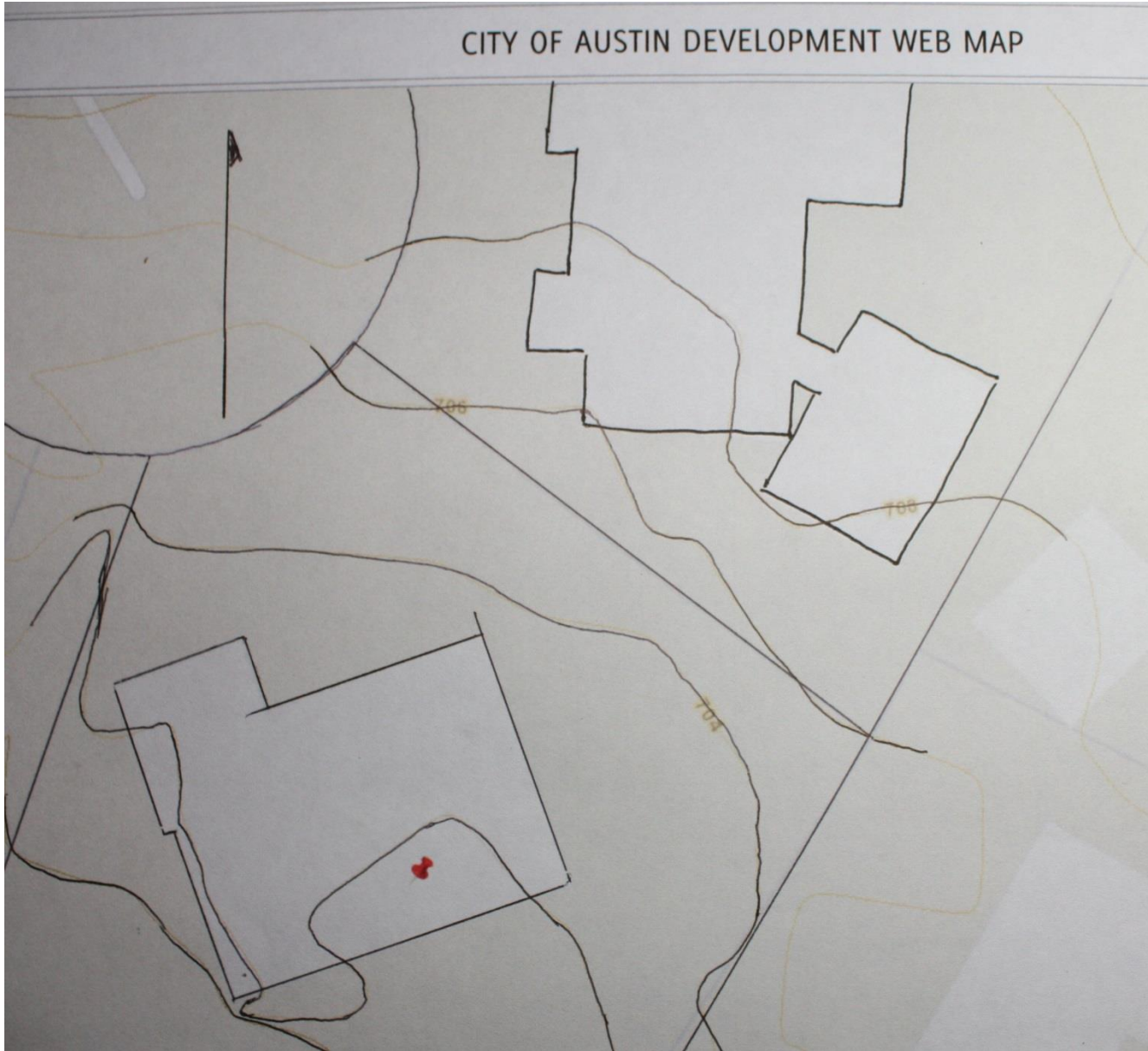


Inside catchment area of the swale



THIS WILL BE YOUR RESULTS!

#1



RESIDENCE IN SW AUSTIN WITH LOCALIZED FLOODING ISSUE



BEFORE PHOTOS

**ENGINEER'S
SOLUTION: A
CONCRETE
DRAINAGE SWALE**





AFTER PHOTOS

**EMERGENCY SPILLWAY DIVERTS
ALL EXCESS RUNOFF PAST THE
FOUNDATION**

**ENOUGH STORAGE
VOLUME WAS CREATED TO
HOLD ALL THE
NEIGHBOR'S RUNOFF
FROM A 1" RAIN
(APPROX. 3000 GALLONS)!**



IT'S TIME FOR A PARDIGM SHIFT: INSTEAD OF LOOKING AT RUNOFF AS A PROBLEM, EMBRACE IT AS A RESOURCE!

When Life Gives You Lemons

**THE
HOMEOWNER
PLANS TO
INSTALL FRUIT
TREES AND A
VEGGIE
GARDEN IN THE
NEW
RESERVOIR**



#2



Compacted, dead soil from

- **2011 wildfire**
- **Construction traffic without any vegetation**
- **Wind exposure**



**780 CFT OF STORAGE
VOLUME CAPTURES
ALL RAIN EVENTS OF
3" OR LESS (5000
GALLONS)**

Pine Hugelkultur serving 2 purposes:
earthworks berm to prevent erosion,
and provide blueberry patch



2014- 2 MONTHS AFTER PLANTING



Plants inoculated with mycorrhizae at planting time



2015





FIG IS THRIVING FROM ROOF RUNOFF OF 120 GALLONS/INCH OF RAIN; ORANGE NEEDS TO BE MOVED A LITTLE HIGHER...PLACED ON SOUTH SIDE NEAR THE BUILDING FOR WARMER MICROCLIMATE

#3



HYBRID EARTHWORKS/HUGELKULTUR/RAIN GARDEN



**EMERGENCY SPILLWAY
WAS MOVED JUST PRIOR
TO 'MONSOON' PERIOD**



RAIN GARDEN RECEIVES RUNOFF FROM 16X24 GREENHOUSE AND ADJACENT WOODS



FLOOR OF POND

TOP OF BERM

EMERGENCY SPILLWAY

- TOP OF BERM IS 6" LOWER THAN GREENHOUSE BASE**
- EMERGENCY SPILLWAY IS 10" LOWER THAN GREENHOUSE BASE**
- RAIN GARDEN FLOOR IS 14" LOWER THAN GREENHOUSE BASE**



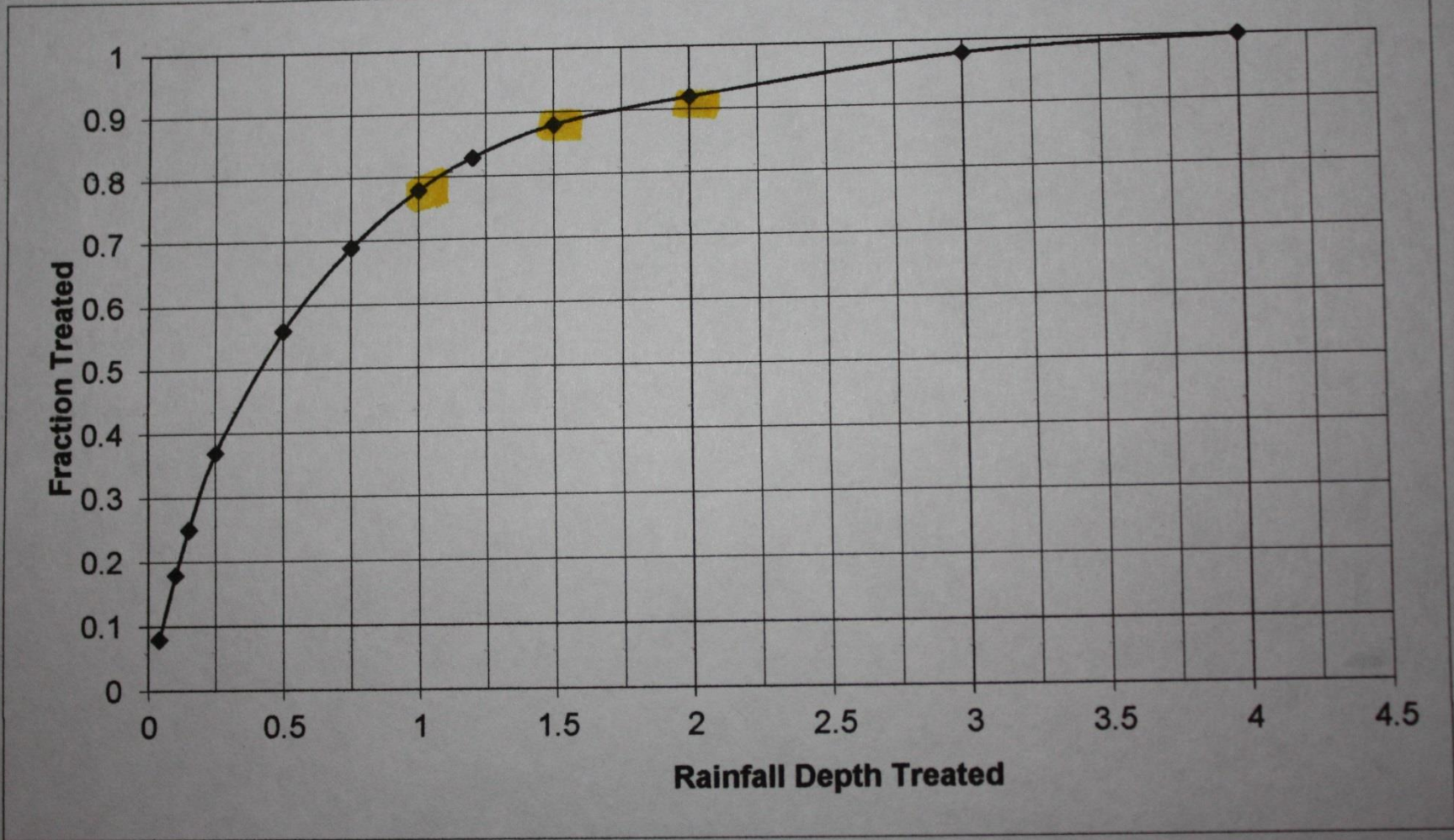


Figure 2-1: Historical rainfall pattern in the Central Texas region and resulting runoff volumes treated.

CITY OF SAN MARCOS LID MANUAL

THE MAJORITY OF RAIN EVENTS ARE SMALL. IF YOU CAN STORE THE 1" RAIN STORM, YOU WILL STORE 80% OF ALL RAIN EVENTS.

CALCULATIONS:

**AMOUNT OF RUNOFF THAT CAN BE CAPTURED IN A 1”
RAIN ***

**210 GALLONS FROM THE GREENHOUSE ROOF +
1250 GALLONS FROM ADJACENT WOODS = 1460
GALLONS**

STORAGE VOLUME OF RAIN GARDEN

**2 AREAS: UPPER AND LOWER POOL = 204 CFT
204 CFT X 7.48 GAL/CFT = 1525 GALLONS**

**THIS RAIN GARDEN WILL CAPTURE THE RUNOFF FROM ALL
STORMS OF 1” OR LESS**

*** ASSUME WET MOISTURE CONDITIONS; IF DRY, RUNOFF FROM THE
WOODS WILL OCCUR ONLY IN A 4” OR GREATER RAINFALL**

LOCAL EXAMPLES

- **HOW MUCH RUNOFF CAN WE/SHOULD WE CAPTURE?**
- **CRITICAL ELEVATIONS**
- **BE AWARE OF THE CONCEPT OF INITIAL ABSTRACTION WHEN FIGURING RUNOFF FROM PERVIOUS AREAS**
- **ARMORED EMERGENCY OVERFLOWS**
- **MAINTENANCE ISSUES**
- **CONSIDER GROWING FOOD WITH THE CAPTURED WATER!!**

PREVIOUS RAIN GARDEN IS SUPPORTING:

- **3 POMEGRANATES**
- **1 DWARF PEACH**
- **1 LOQUAT**
- **NUMEROUS HERBS**
- **NATIVE PLANTS THAT PROVIDE HABITAT**
- **EXISTING LARGE MATURE OAKS AND BEAUTYBERRIES**

IF YOU CAN'T INSTALL EARTHWORKS, YOU CAN STILL CONSERVE WATER BY YOUR PLANT CHOICES



ECHINACEA AND SILVER PONYFOOT



**JACOB'S WELL NATURAL
AREA LANDSCAPE
INSTALLATION—WATER
CONSERVATION AND
WILDLIFE HABITAT**





PLANTING DAY WITH THE HAYS COUNTY MASTER NATURALISTS



RAIN GARDEN—GREGG'S MISTFLOWER AND BIG MUHLY



INLAND SEA OATS AND MEALY BLUE SAGE 'HENRY DUELBERG'



**TURK'S CAP—ALSO GREAT
WITH INLAND SEA OATS**



DAMIANITA AND SKULLCAP



**MEXICAN PLUM—
WONDERFUL FRAGRANCE;
NICE IN COMBINATION
WITH REDBUD**





LYRE LEAF SAGE

FROGFRUIT



POINTS TO REMEMBER:

- **GROUP PLANTS ACCORDING TO THEIR WATER AND SUNLIGHT NEEDS**
- **NATIVE PLANTS ARE NATURAL SURVIVORS, AND THEY PROVIDE NEEDED HABITAT FOR WILDLIFE**
- **ADD SOIL ORGANIC MATTER TO RETAIN MOISTURE**
- **INSTEAD OF FIGHTING WEEDS WITH CHEMICALS, CONSIDER OVERPLANTING WITH ASSERTIVE NATIVE PLANTS (INLAND SEA OATS, LYRE LEAF SAGE, TURK'S CAP, GREGG'S MISTFLOWER)**



We are drowning in information, while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information at the right time, think critically about it, and make important choices wisely.

E.O. Wilson, evolutionary biologist

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- ◆ Earthworks
- ◆ Water-wise Designs
- ◆ Hugelkultur and Edibles