Heritage Institute of Sustainability LLC

Providing Sustainable Solutions to Today's Business Challenges

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Education:

- Oklahoma State University BSME
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Licensure:

- Professional Engineer State of Texas, ICP Project Mgmt. & Quality Assessment, Certified Water Harvesting Practitioner

Organizations:

- ASHRAE 18-Years
- Fellow American College of Healthcare Executives
- Vice President of North Texas Association of Energy Engineers
- Board Member of Helping Restore Ability

Awards:

- TCEQ: Innovative Operations, Best Business Operations
- D-Magazine: Healthcare Innovation
- STAR: Outstanding Sustainable Materials Management, Best Recycling Partnership

Water Management for Texas

- Why you should care about water conservation in Texas?
- Little known facts about water.
- The components of a water management program.
- Approaches for water management.

Why Do We Care About Water In Texas?

Key facts about Water in Texas

- Texas's population is expected to increase more than 70% between 2020 and 2070, from 29.5 million to 51 million"
- Existing Water supplies are expected to decline by approximately 11% between 2020 and 2070
- If we do not plan, estimated annual economic losses from water shortages could range from 73 billion in 2020 to 151 billion in 2070

Ref: Texas Water Development Board 2017 State Water Plan

Little Known Facts About Water

Do I Own The Water On My Property and In My Well?

- You own the pump, and you own the well casing, but in the United States water resources are held in trust for the public by the state and local governments for the benefit of all present and future citizens,
- Controls vary from state to state. Most states have a water development board that regulates ground water. Permits required.
- You may not have water under your property!
- Did you know the lakes in North Texas are tied together through massive underground pipe systems?
- Lots of information may be found on the Texas Water Development Board website.

Reference: American Ground Water Trust https://agwr.org

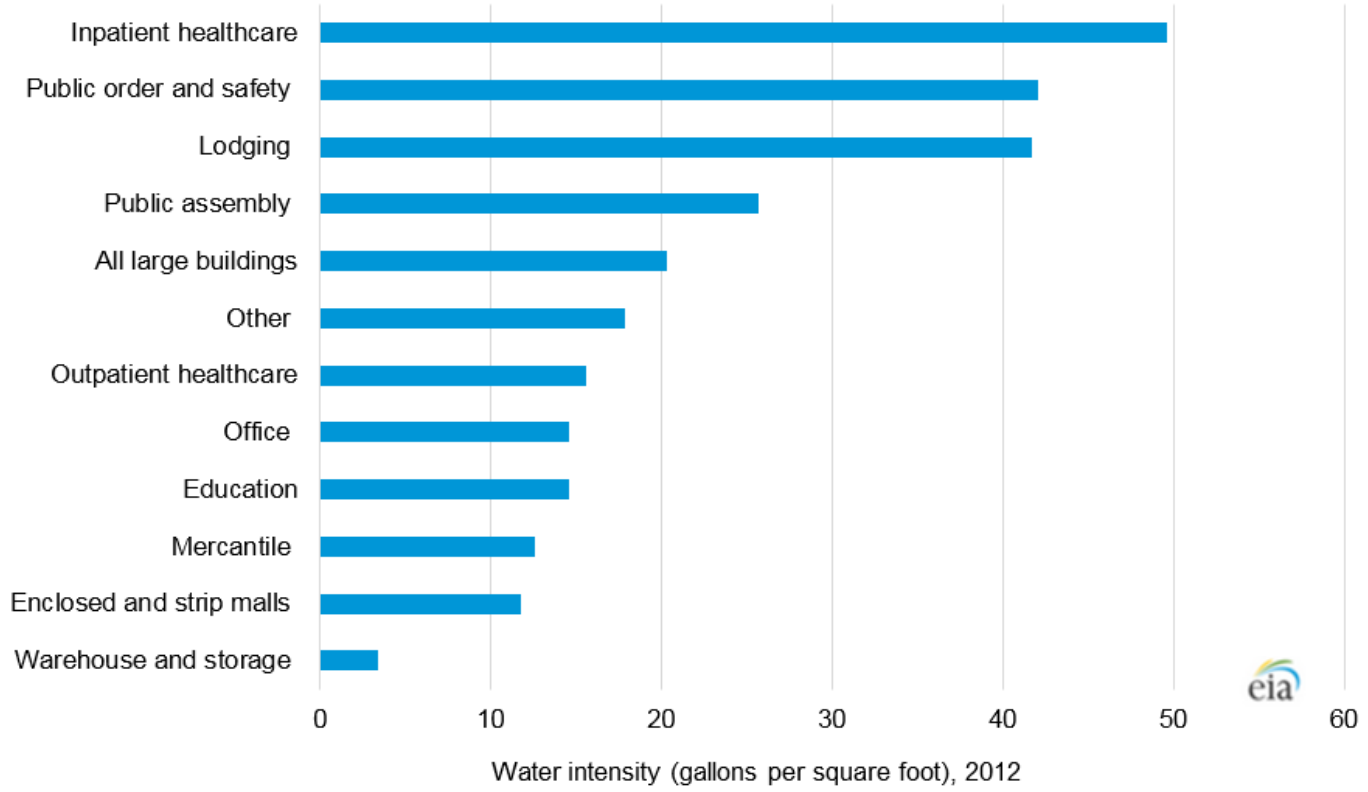
More Little Known Facts about Water

- 45% of water resource in Europe cools thermoelectric plans
- 41% of the water in the US is used to cool thermal power plants
- Some economists estimate industrial water consumption will double by 2050 in rapidly industrializing countries such as China
- Air cooled systems will save 75% of the water but the energy consumption may increase 4-5% with DX cooling

Reference: Power Engineering International 06/22/2016 Saving water in power plants
Research on the Status of Water conservation in the Thermal Power Industry in China Science Direct 3068-3074 , 2017

Water Intensity Use in Commercial Buildings

Figure 1. Inpatient healthcare buildings were the most intensive users of water among large commercial buildings in 2012



https://www.eia.gov/consumption/commercial/reports/2012/water/

How Much Do Water Rates Really Change?

- 2017 Water 5.33 Sewer 4.78 Total 10.11
- 2016 Water 5.25 Sewer 4.70 Total 9.96
- 2014 Total 8.67
- 2013 Total 6.061

- 66% increase in 4 years!! So in 2021 it could potentially cost $16.86/1000 gallons!! (Already cities in south Texas charging $13 or more per 1000 gallons)

Reference: City of Dallas Water Utilities Division Water and Wastewater Rate Sheets 5/8th inch meter

Integrated urban water management

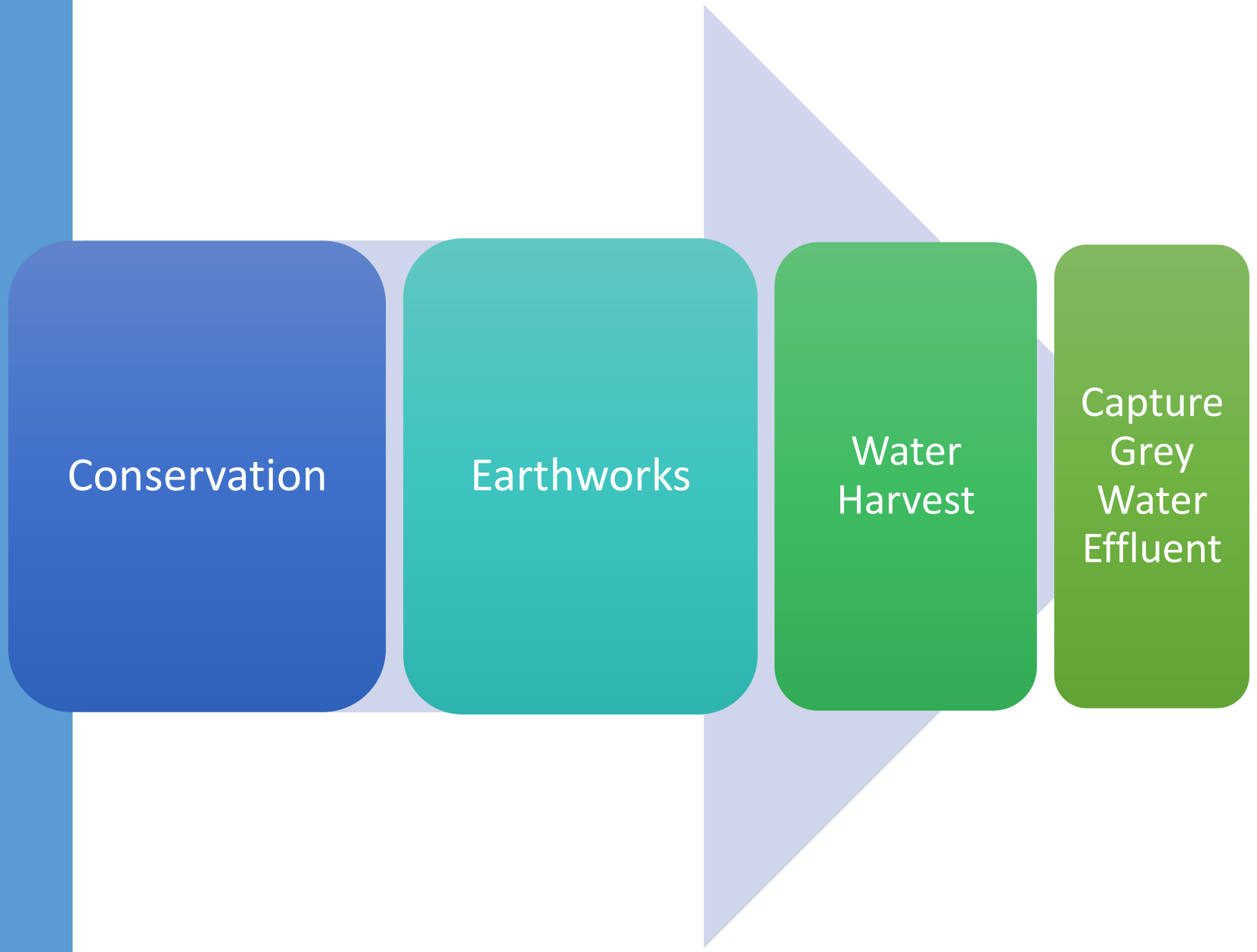
Contents

- Components of Water Management
- Approaches/Options for Water Management
- Examples
- Challenges

Components

- Plan
- Gather Data
- Stakeholder Engagement
- Decide on an approach
- Retain Expert Advice
- Plan
- Implement
- Reassess

Approaches


Conservation
Earthworks
Water Harvest
Capture Grey Water Effluent

Example: Conservation

If you live in a City where you can get a free audit like Dallas or Fort Worth, engage the City and take advantage!

- Sprinkler Systems
- Kitchens
- Laboratories
- Domestic Fixtures
- Process Systems
- Cooling Towers

Know what you have, where you are using water, and create a use index. W/GSF, Water/Employee, Water/Acre, Water/Bed, Water/Population

What do you see here?

1.
2.
3

Do you know the codes?

- GPF Toilets: 1.28
- GPF Urinals: 0.5 gpf
- Sink Aerators: 0.5 gpm
- Cooling Towers: nlt 5 cycles
- Boilers: Conductivity controller, heat recovery
- Vacuum and Process systems: Must recycle water
- Sterilizers: Must recycle water
- Kitchens: Garbage disposers bad news! Compost food waste!
- Washing Machines: Energy star saves 30-60%/load (required by code)
- Pools are a huge waster if you do not have a cover to protect from evaporation
- Sprinkler Systems: Extensive standards on metering, and design

Ref: SECO: State Energy Conservation Design Standards 2017

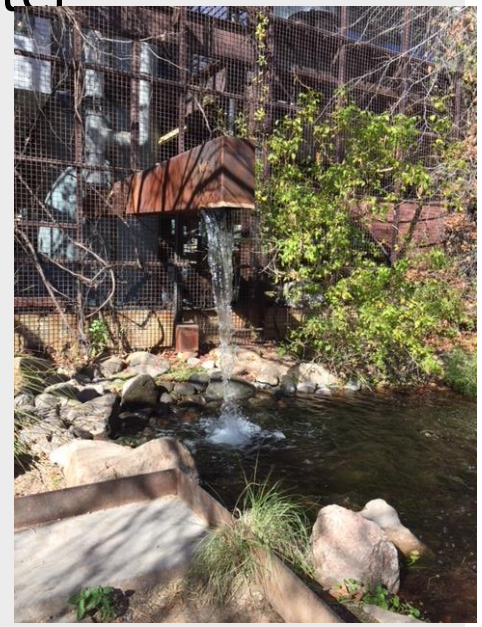
Conservation

- Awareness
- Education
- Behavior Change

Watershed Management Group Tucson, AZ

Example Earthworks

- Long and thoughtful observation
- Start at highest point of you watershed and work your way down
- Start small and simple
- Spread and infiltrate the flow of water
- Plan an overflow route
- Create a living sponge
- Stacking functions
- Feedback loop



Reference: Rainwater Harvesting for Drylands and Beyond Volume 2, Brad Lancaster

The Effect of Earthworks on Water Flow

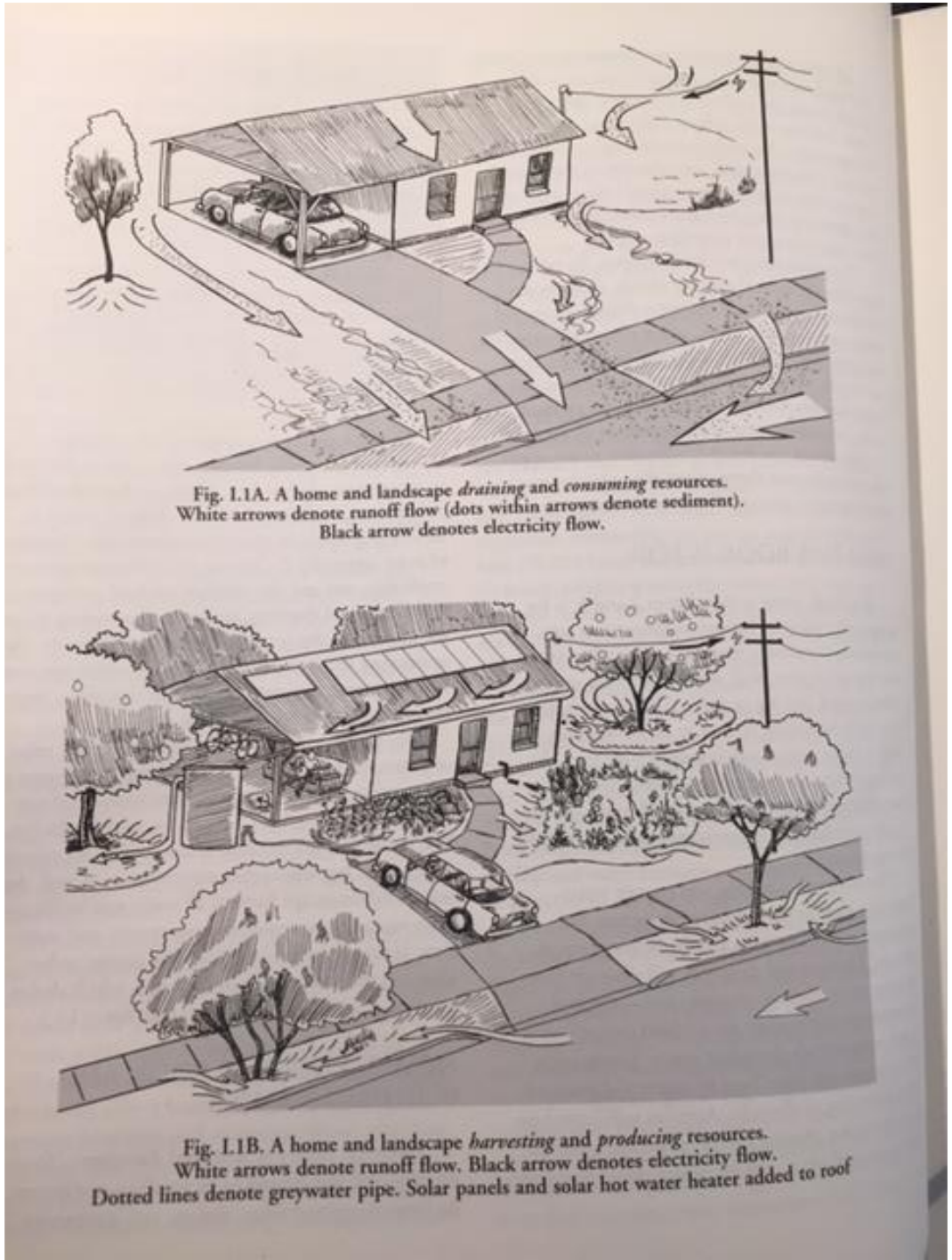


Fig. I.1A. A home and landscape *draining* and *consuming* resources.
White arrows denote runoff flow (dots within arrows denote sediment).
Black arrow denotes electricity flow.

Fig. I.1B. A home and landscape *harvesting* and *producing* resources.
White arrows denote runoff flow. Black arrow denotes electricity flow.
Dotted lines denote greywater pipe. Solar panels and solar hot water heater added to roof

Earthworks

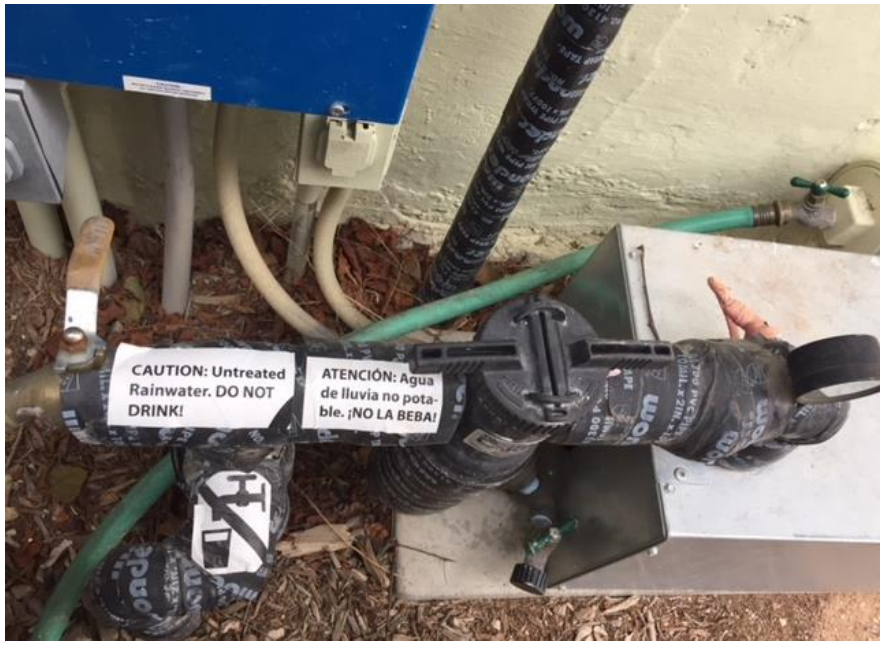
Kemp Watershed

- Bridge Runoff
- Rainwater Capture
- Paths/Gardens
- Permeable Soils
- Butterfly Garden

Example Water Harvesting

- Roof square footage
- Driveways and hard surface runoff
- Runoff from adjacent properties
- Runoff from land
- Air handling unit condensate is clean and can be captured and returned through chw return lines or condensate return pumps

Water Harvesting: Small Volume Home



Harvesting Control System

Water Harvesting: Large Volume Commercial

Example Greywater Capture

- Washing Machines
- Bathroom Sinks
- Bathtubs/Showers

Greywater Plumbing

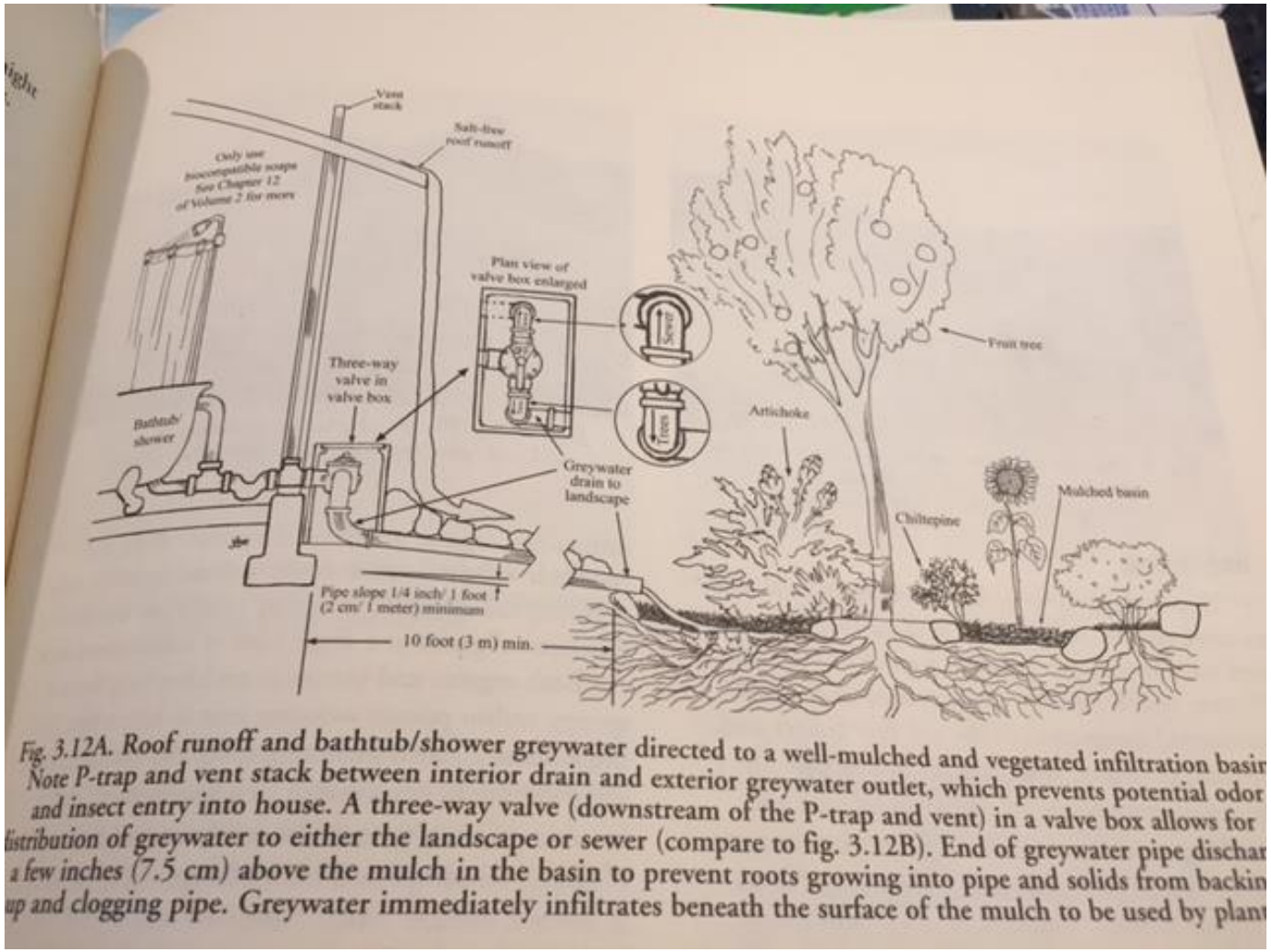


Fig. 3.12A. Roof runoff and bathtub/shower greywater directed to a well-mulched and vegetated infiltration basin. Note P-trap and vent stack between interior drain and exterior greywater outlet, which prevents potential odor and insect entry into house. A three-way valve (downstream of the P-trap and vent) in a valve box allows for distribution of greywater to either the landscape or sewer (compare to fig. 3.12B). End of greywater pipe discharging a few inches (7.5 cm) above the mulch in the basin to prevent roots growing into pipe and solids from backing up and clogging pipe. Greywater immediately infiltrates beneath the surface of the mulch to be used by plants.

Greywater Capture

Infiltration Basin:

- Calc. Water Volume
- Perk Test Soil
- Design Basin

Challenges

- Knowing where to start
- Start small
- Knowing your constituents
- Resistance to change

Rain Barrel with First Flush and Overflow

Before……..

Cost of Pumping Water

$C = 0.746\ Q\ h\ c\ /\ (3960\ \mu_p\ \mu_m)$ (1)

Definitions:

- C = cost per hour (USD)
- Q = volume flow (gpm)
- h = head (ft)
- c = cost rate per kWh ($/kWh)
- μ_p = pump efficiency (0 - 1)
- μ_m= motor efficiency (0 - 1)
- 3960 is 33000 (foot lbs./bhp) / 8.33 (weight of water)
- $.002=.746*10*10*.1/3960*.9*.9

Cost of Heating Water

Input=Output/EFF

Output=GPH*8.34*DT*Specific Heat

Definitions:

- GPH Gallons Per hour
- 8.34 pounds per gallon
- Delta T- Heating Water Temperature – Incoming Water temperature
- Specific Heat
- Eff=Efficiency of Heat Transfer
- 81,800=120*8.34*82*1
- 23.8kW * $.10= $2.38 assumes 100 % efficiency
- Take Output/Efficiency to get heat input
- Assume 85% efficiency $2.80 to heat the 120 gallons in the tank

Works cited

1) Texas Water Development Board 2017 State Water Plan
2) American Ground Water Trust https://agwr.org
3) City of Dallas Water Utilities Division Water and Wastewater Rate Sheets 5/8th inch meter
4) SECO: State Energy Conservation Design Standards 2017
5) Rainwater Harvesting for Drylands and Beyond Volume 1 2nd Edition, Brad Lancaster.
6) Rainwater Harvesting for Drylands and Beyond Volume 2, Brad Lancaster.
7) Create an Oasis with Greywater, 6th Edition, Art Ludwig

Questions???