



RAINWATER HARVESTING

Michael Braili

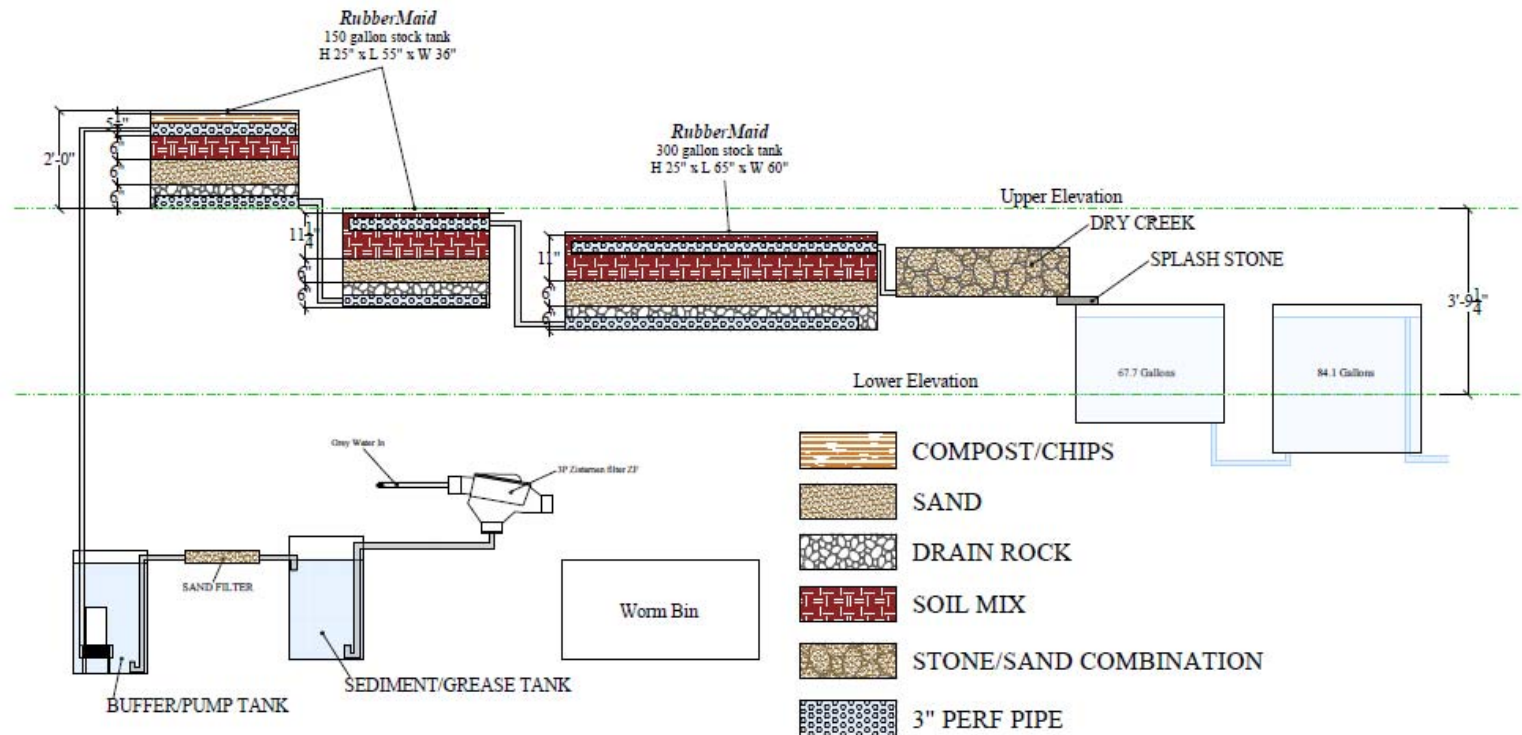
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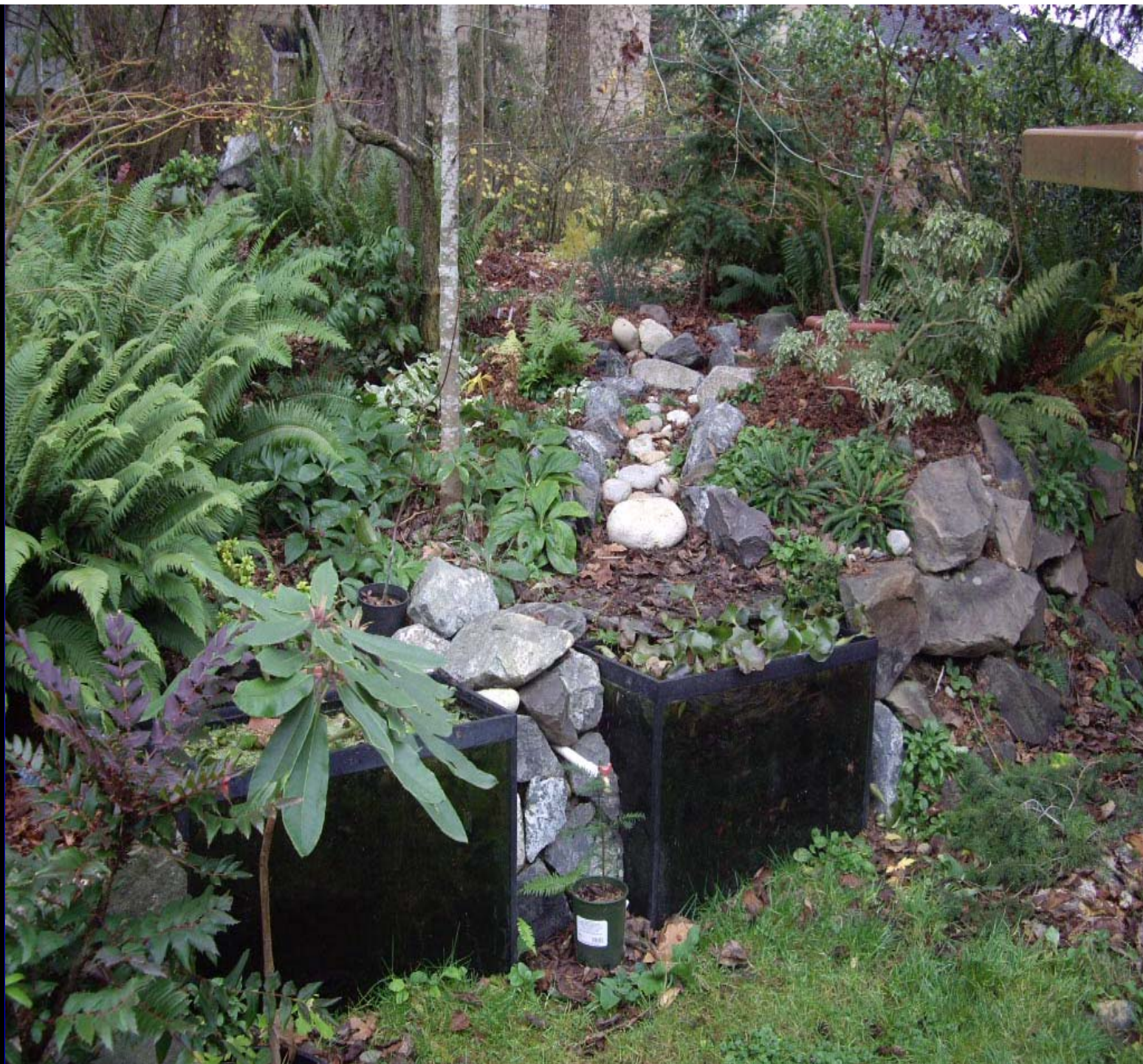
mike@harvestrain.net

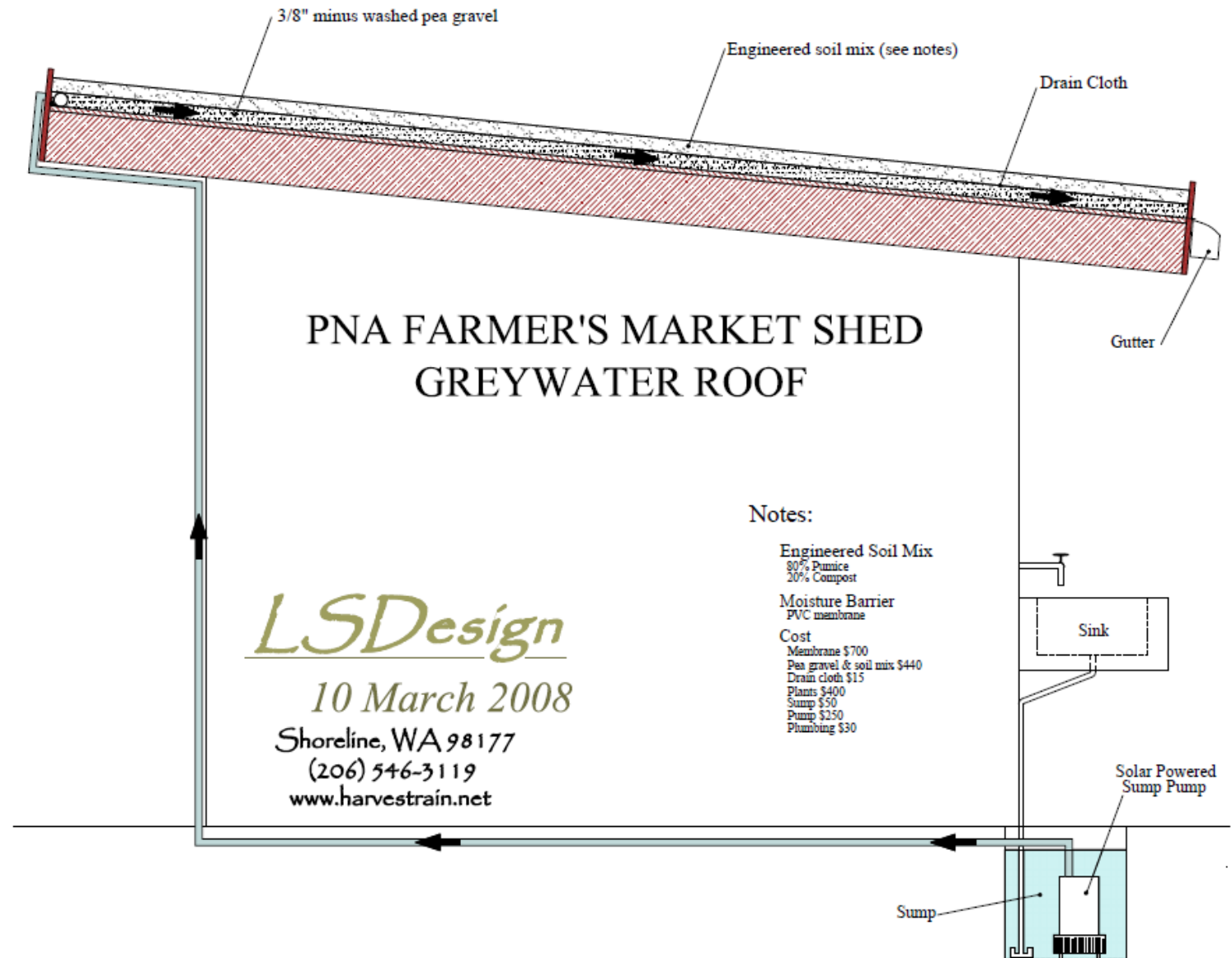
LID IS
ABOUT
CLOSING
THE LOOP



GREYWATER SYSTEMS









WHAT DO
YOU KNOW
ABOUT YOUR
WATERSHED?

What is your source of water?

In Seattle either the Tolt or Cedar Rivers

Average annual rainfall.

In Seattle area it is 37.06" annually (2002)

Three municipal systems.

Potable, Sewer & Stormwater

How much water do you use per day?

Between 80 & 100 gallons

Seattle's daily water consumption.

126 million gallons a day as of February 2005

Who owns the rain that lands on your roof?

The State of Washington

WHY
HARVEST
RAINWATER?

Reduce runoff
Reduce water bill
Protect streams
Restore site hydrology
Self sufficiency
Separate CSOs

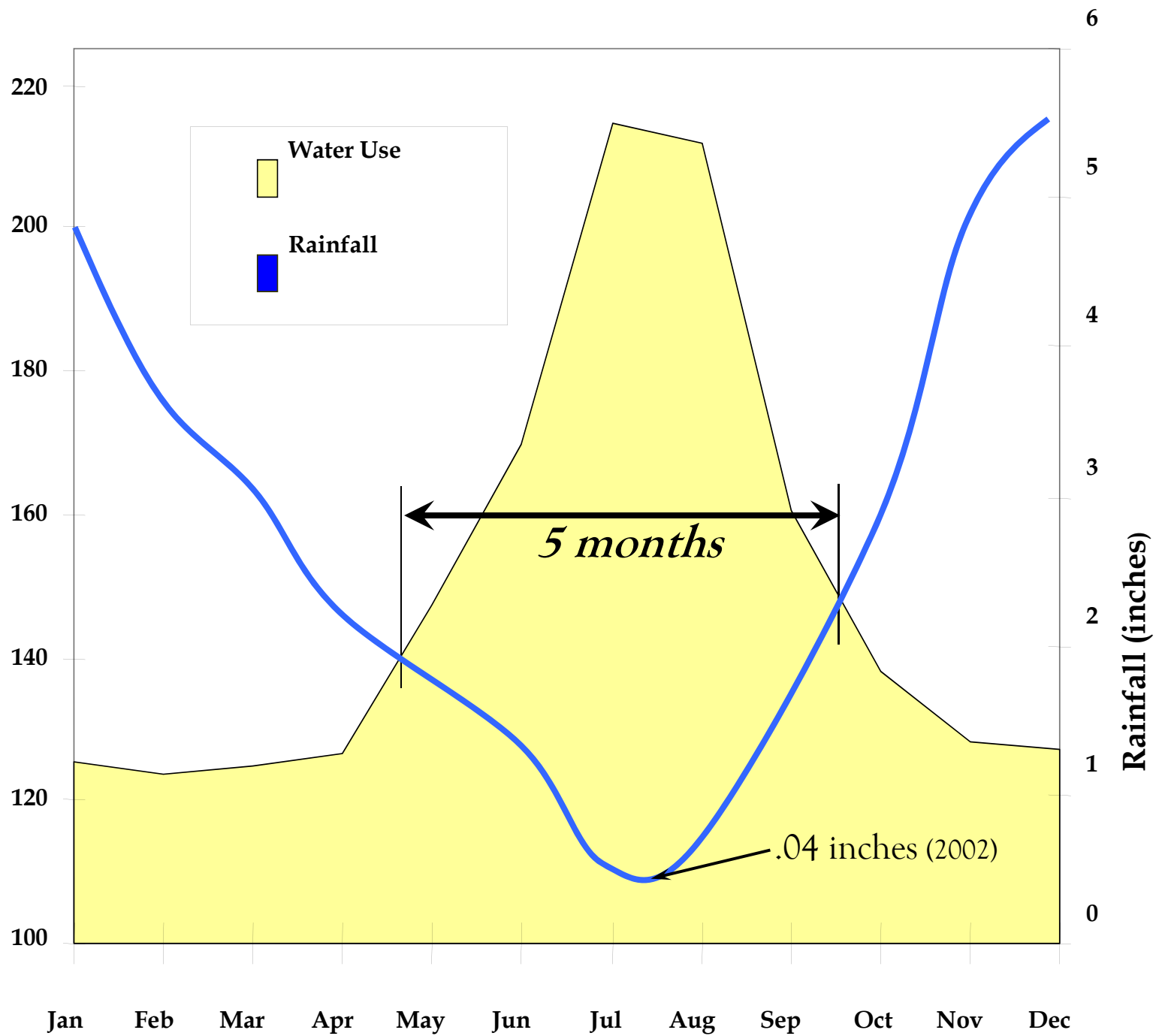
WATER FACTS

One inch of rain on a thousand square feet = 623 gallons

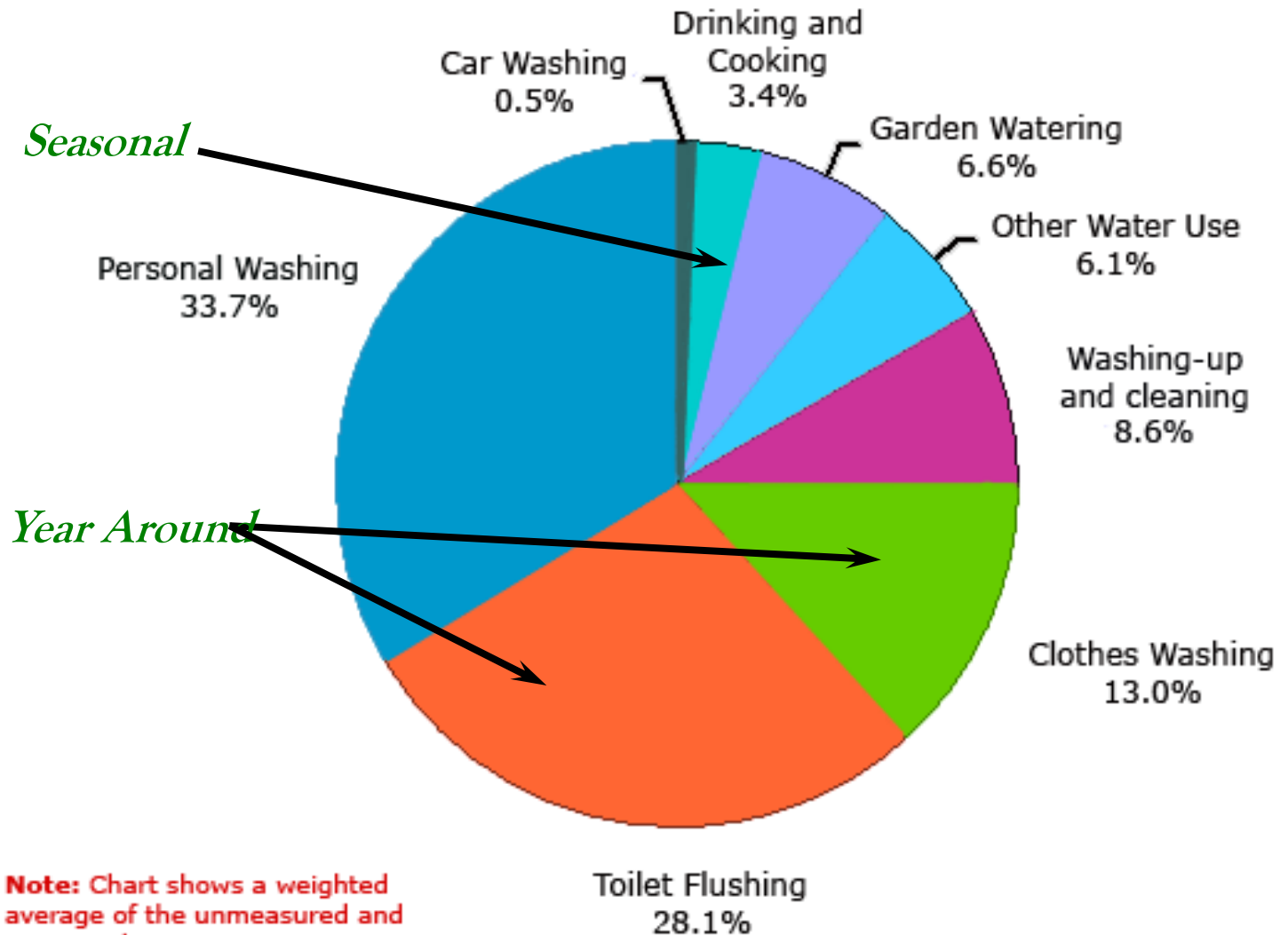
One inch of rain on one acre = 27,151 gallons

One cubic foot of water = 7.5 gallons

One gallon of water weights = 8.5 pounds

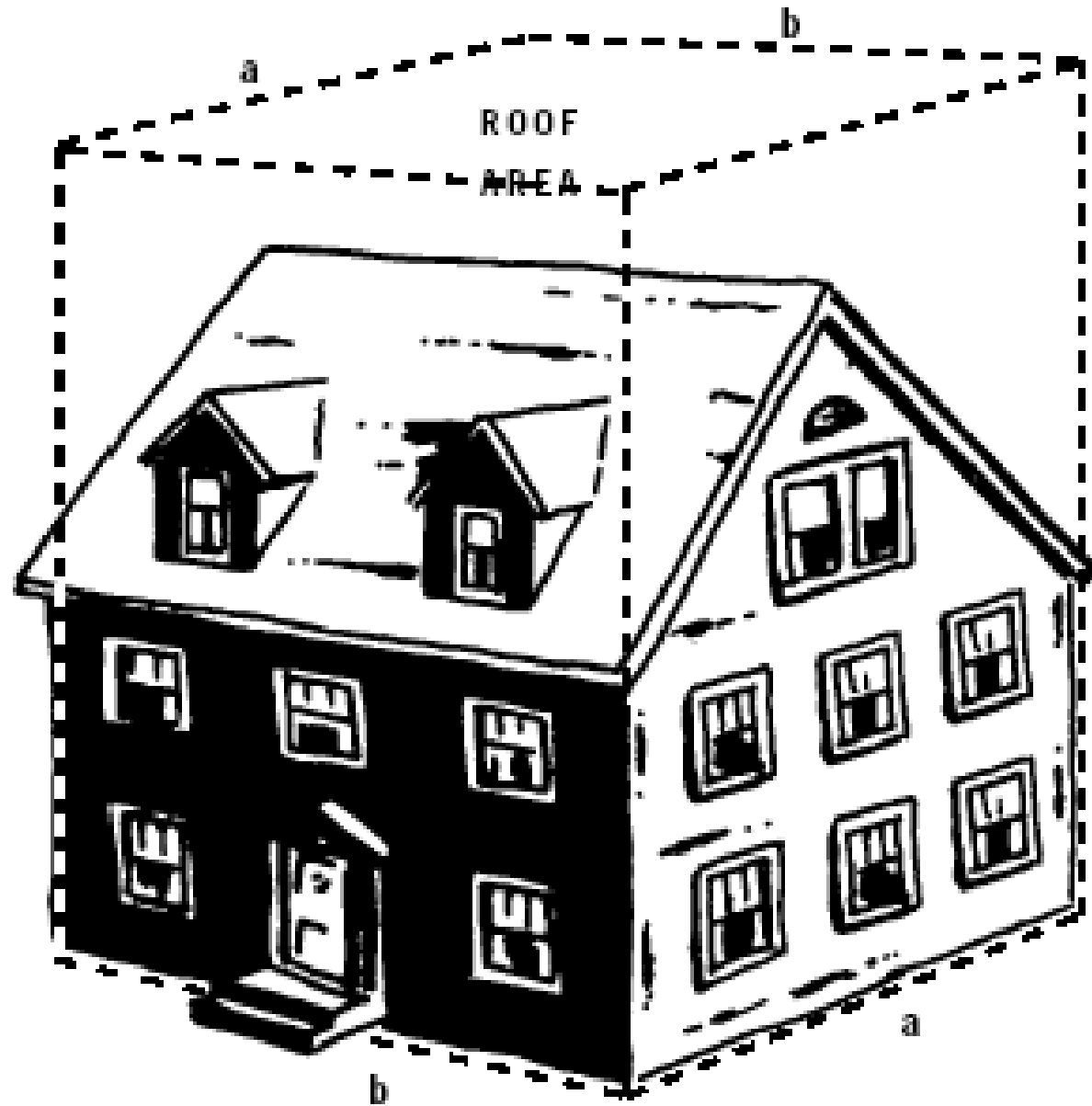


Domestic water use by activity 2002/03



Note: Chart shows a weighted average of the unmeasured and measured per capita consumption components.

CALCULATING CATCHMENT AREA



WATER & SEWAGE RATES

2012 Residential Commodity Charge per CCF (100 cubic feet)

	Inside Seattle	Outside Seattle	Shoreline & Lk. Forest Park*
Off-Peak Usage (Sept. 16 - May 15th)	\$4.04	\$4.61	\$4.90
Peak Usage (May 16th - Sept. 15th)			
Up to 5 CCF per month	\$4.34	\$4.95	\$5.26
Next 13 CCF per month	\$5.15	\$5.87	\$6.25
Over 18 CCF per month	\$11.80	\$13.45	\$14.31

* These rates apply to the Cities of Shoreline and Lake Forest Park, not the water districts.

Sewer Rates

For 2011 and 2012, wastewater rates are as follows:

Residential & Commercial	2011	2012
Rate per CCF (100 cubic feet)	\$10.28	\$10.68
Typical Monthly Residential Bill	\$44.20	\$45.92

- 1 CCF equals 748 gallons.
- The typical single family residential customer generates 5.2 CCF of wastewater per month.
- Most residential customers are billed every two months.
- There is a one CCF minimum charge per premise per month.

WATER BUDGET

System Data	
No. Residents	3
Collection Area (sq.ft.)	1,500
Cistern Size (gal)	8,000
Collection efficiency (%)	95%

Water Rates (\$ per 100 cubic feet)	
Peak (May 16 - Sept 15)	\$ 3.35
Off-peak (Sept 16 - May 15)	\$ 2.62
Sewer	\$ 7.75

Per capita Usage (gpd)	
Toilets	
Washer, Dish	
Washer, Clothes	10
Shower	8.8
Faucets	10.8
Leaks & Other	
	29.6
Consumption (gpd)	88.8

Rainfall Monthly Average (in.)	
October	3.24
November	5.57
December	5.05
January	5.24
February	4.09
March	3.92
April	2.75
May	2.03
June	1.55
July	0.93
August	1.15
September	1.61
	37.13

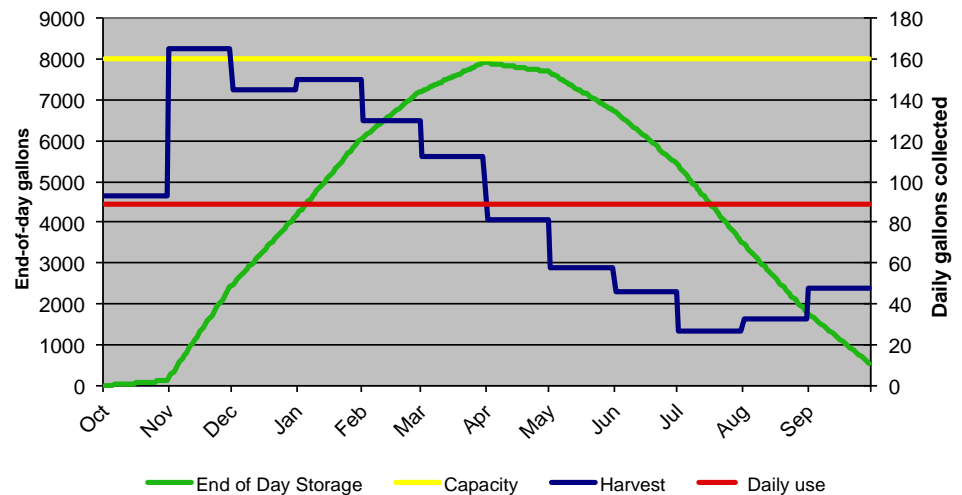
Results

PEAK savings	\$ 162.07
OFF PEAK Savings	\$ 297.90
Total Annual Savings	\$ 459.98

Annual Water Use	32,412
Potential Annual Harvest (gal)	32,983
Actual Annual Harvest	32,974
Lost harvest due to cistern size	9
Substitute water needed	-
Unmet need (% of use)	0%

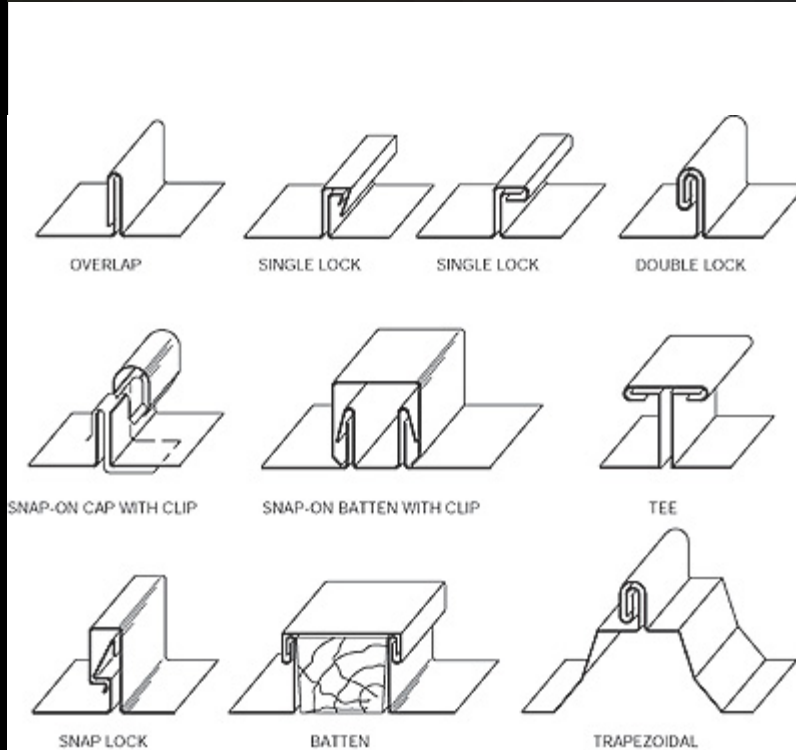
No. of days short of cistern capacity to harvest all rain	1
No. of days usage greater than available volume	0
Water left at end of year (gal)	562
Max. one day harvest (gal)	165

Cistern Storage and Rain Harvest



ROOFING MATERIALS









**LIVING
SYSTEMS
DESIGN**

Integrated Water Management





A close-up photograph of a corrugated metal roof. The metal is coated with a layer of small, irregular stones or pebbles, giving it a textured, stone-like appearance. The lighting creates strong shadows in the valleys of the corrugations, emphasizing the three-dimensional texture of the coating.

Steel coated with stone

GUTTER FILTRATION



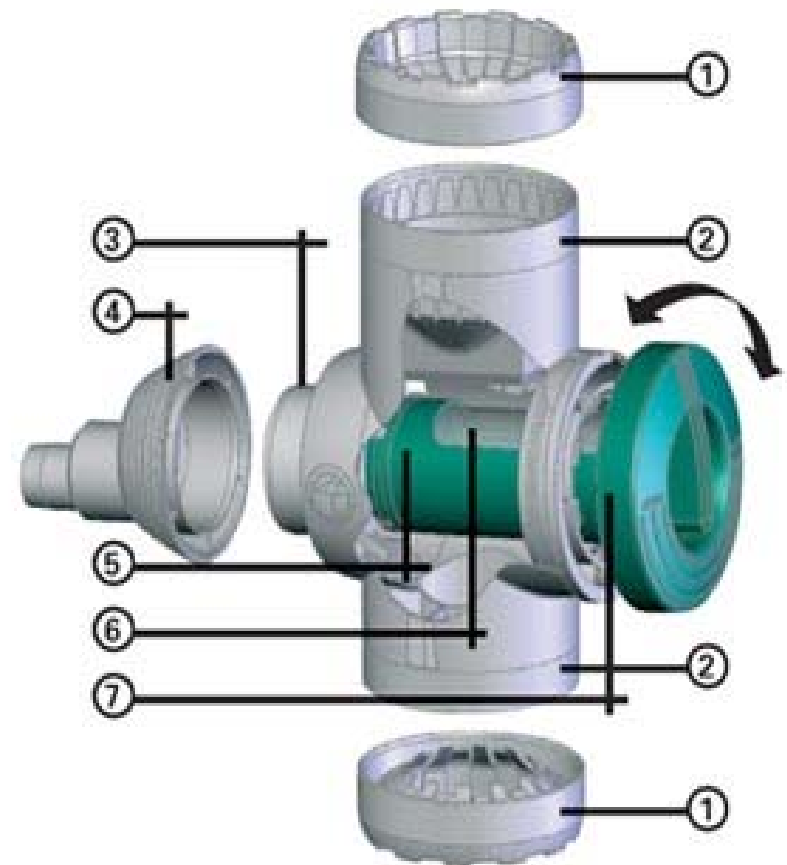




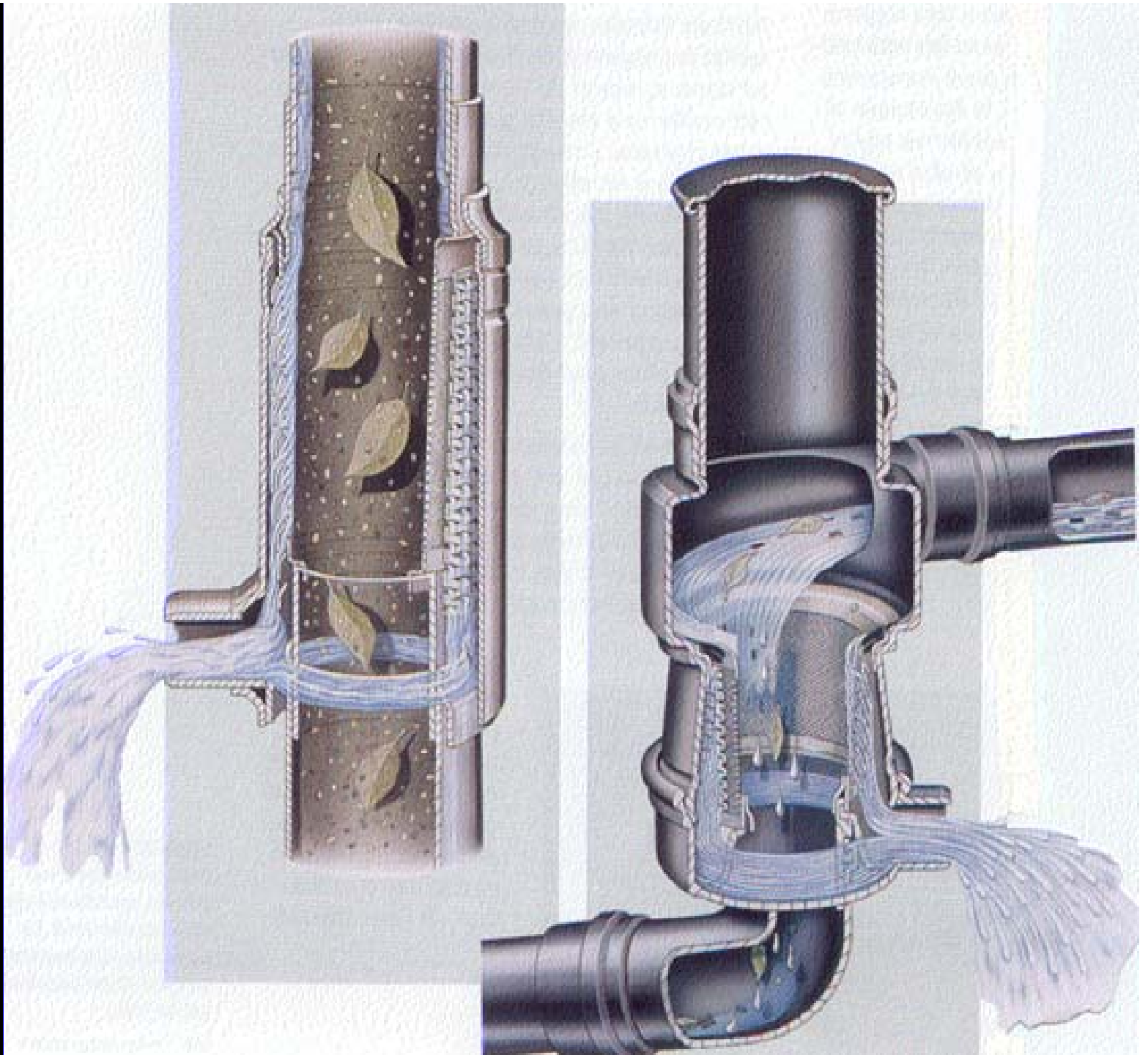
DOWNPIPE FILTRATION

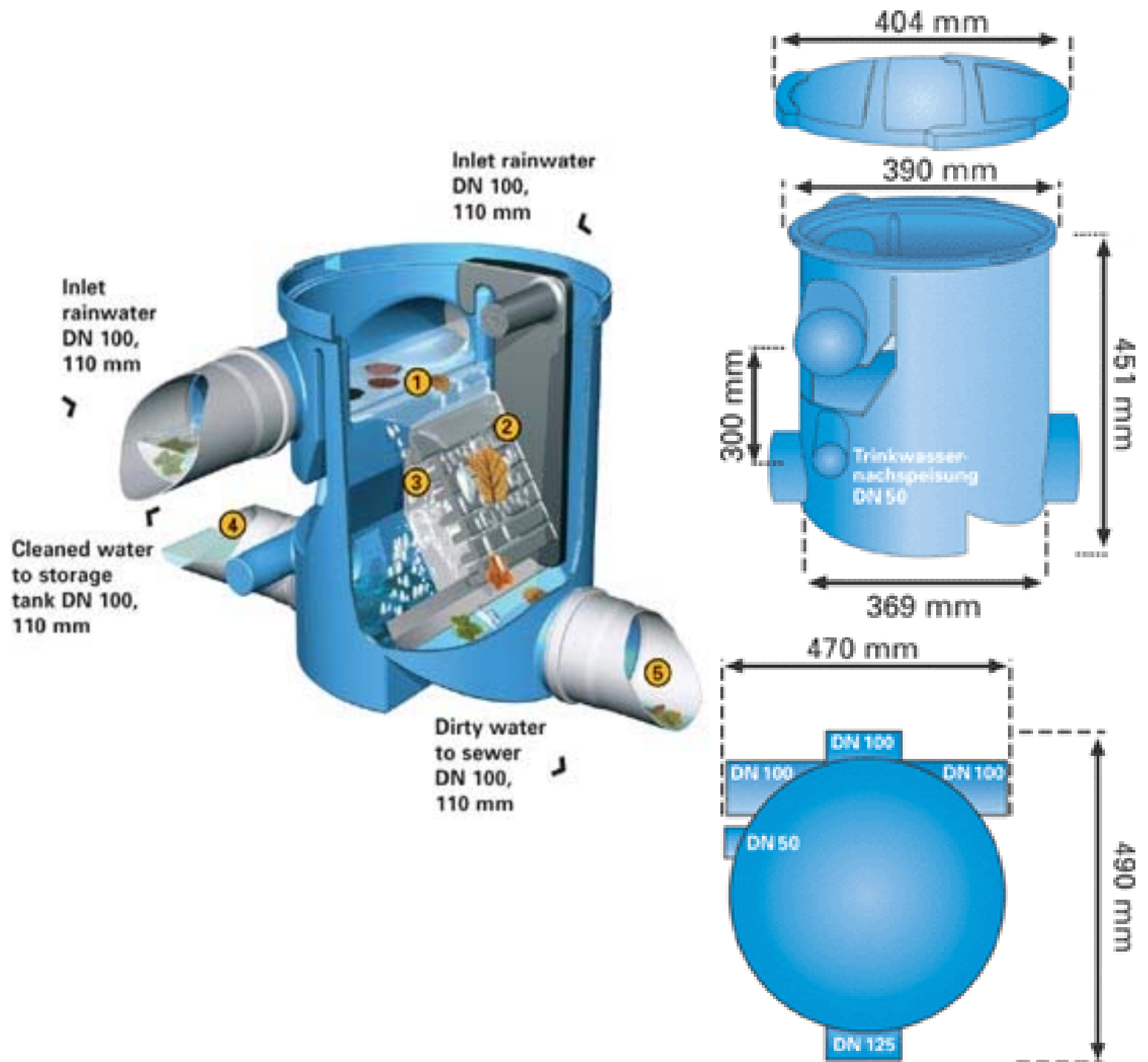












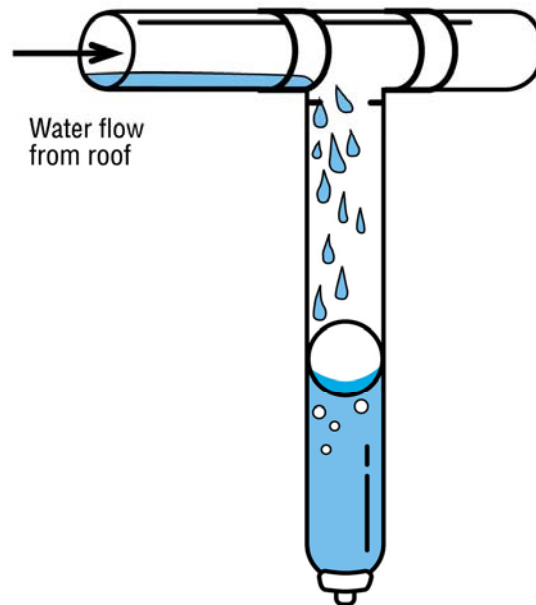




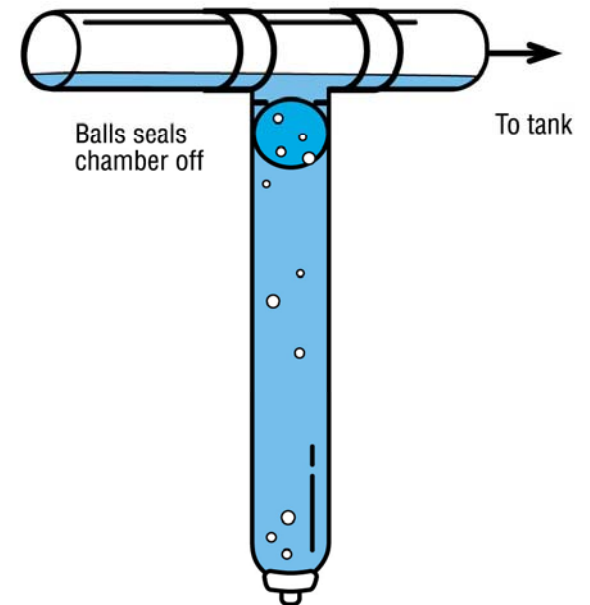


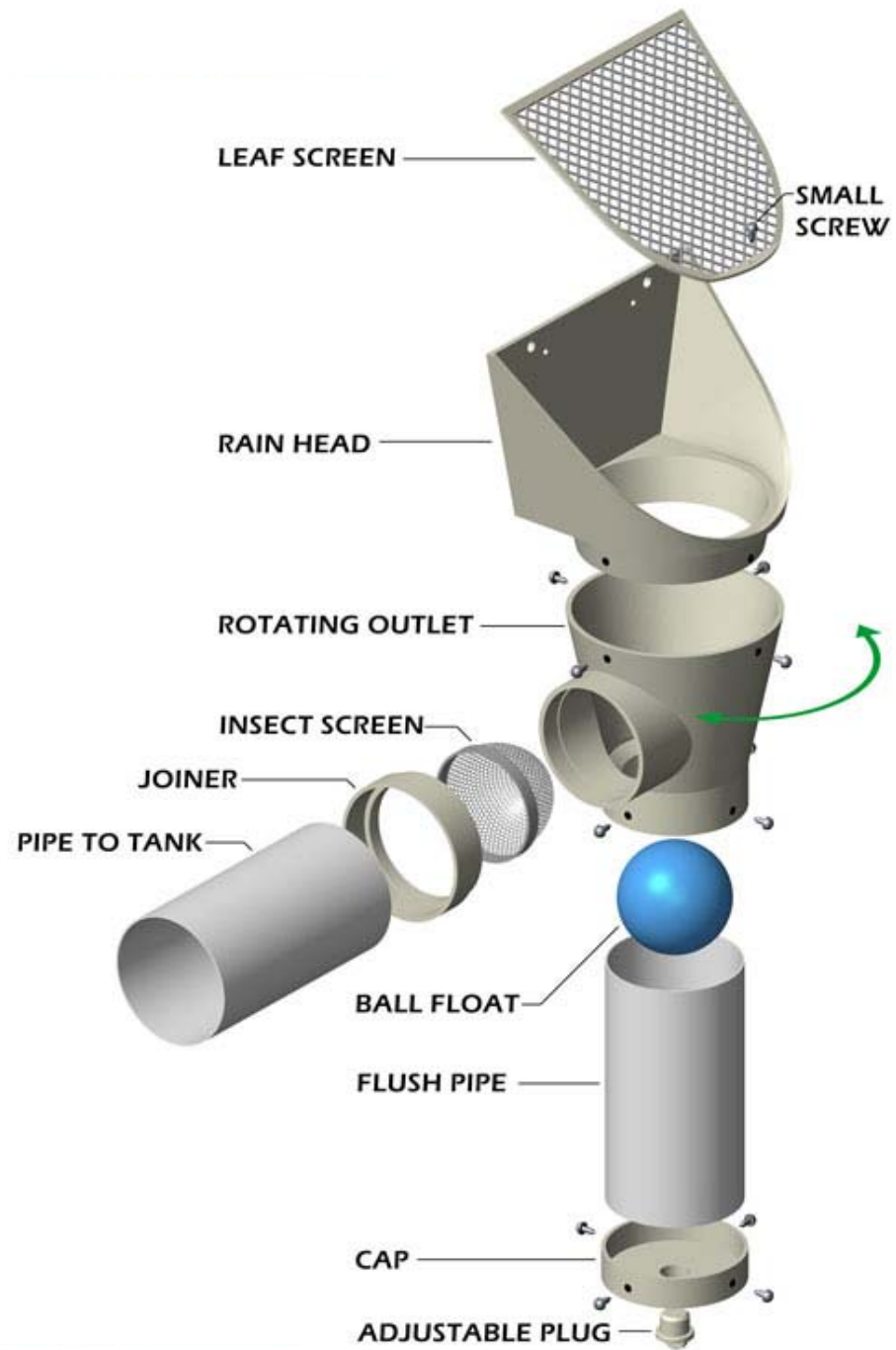
ROOF WASHER

First flush of contaminated water is
diverted into chamber



Once chamber is full, fresh water
flows to tank









STORAGE











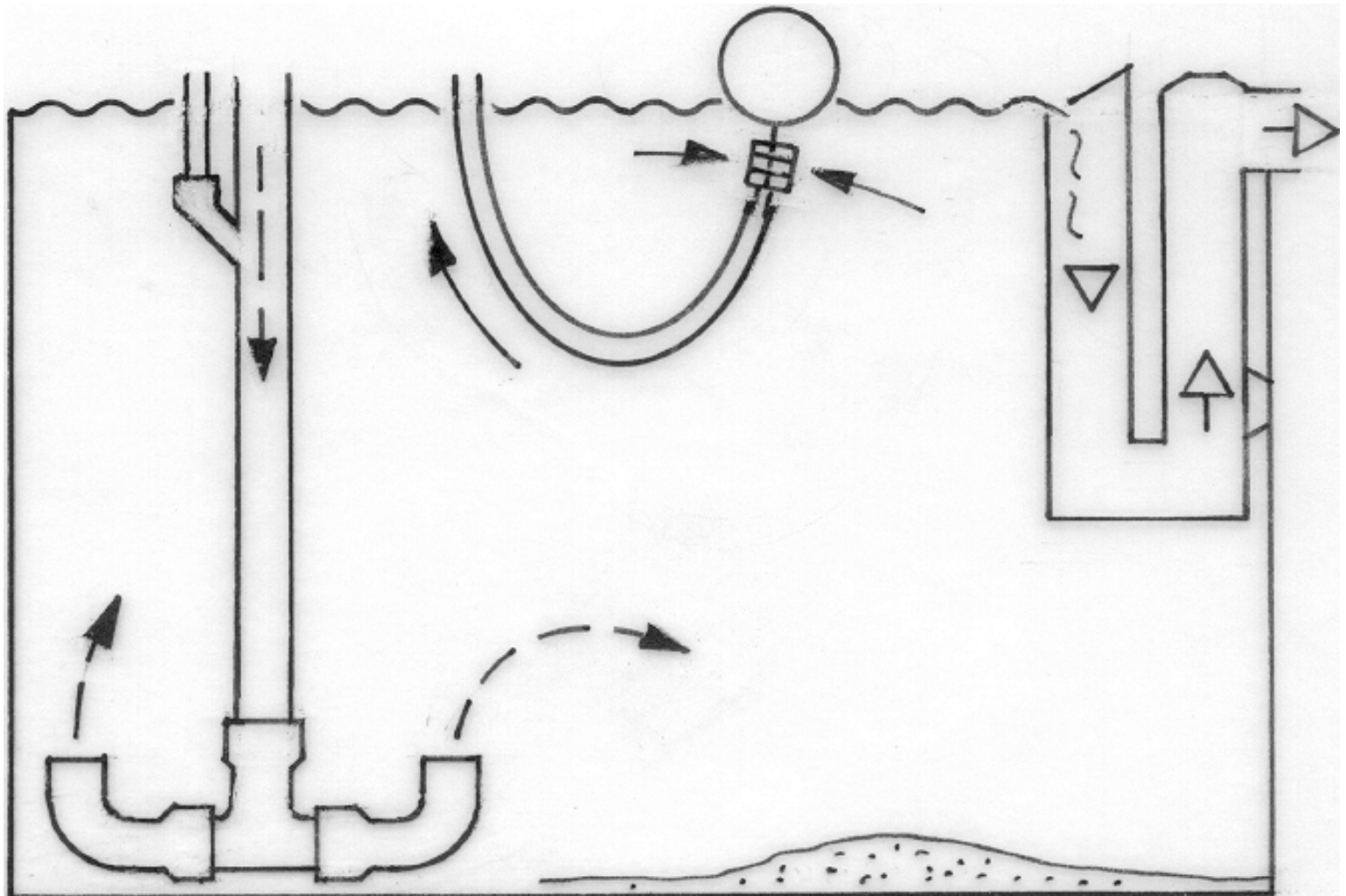


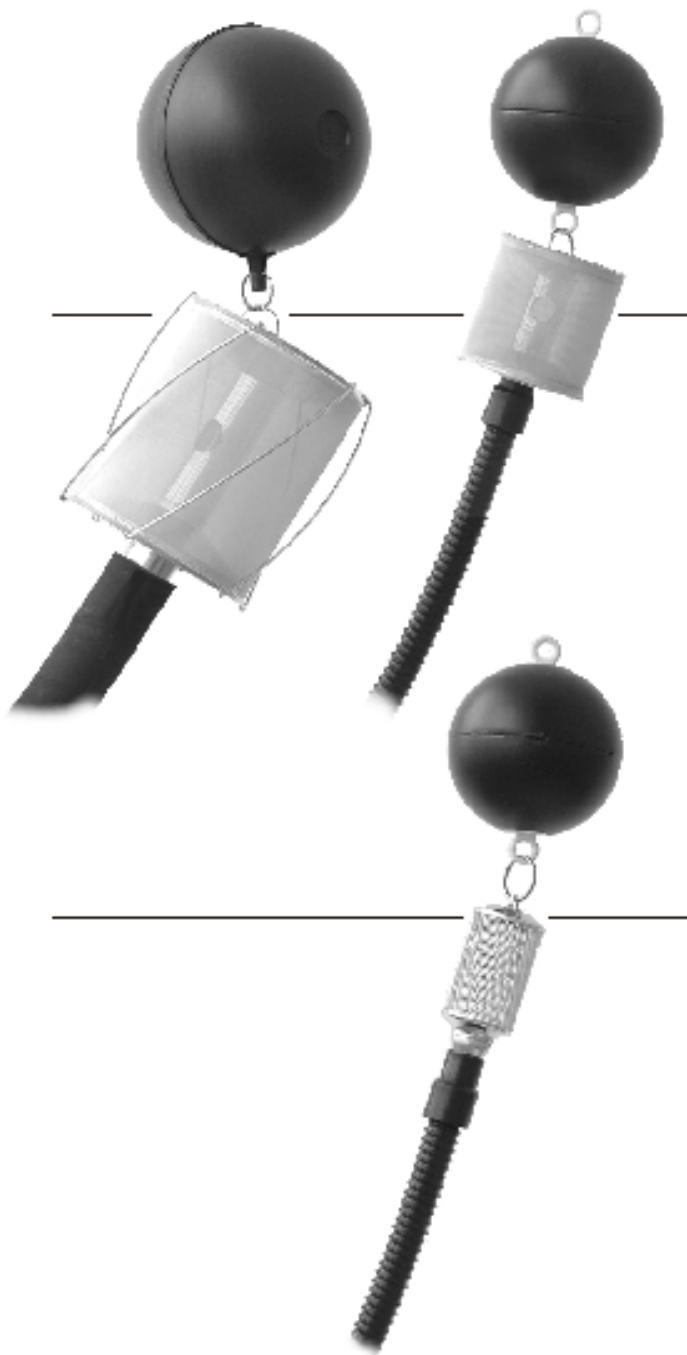




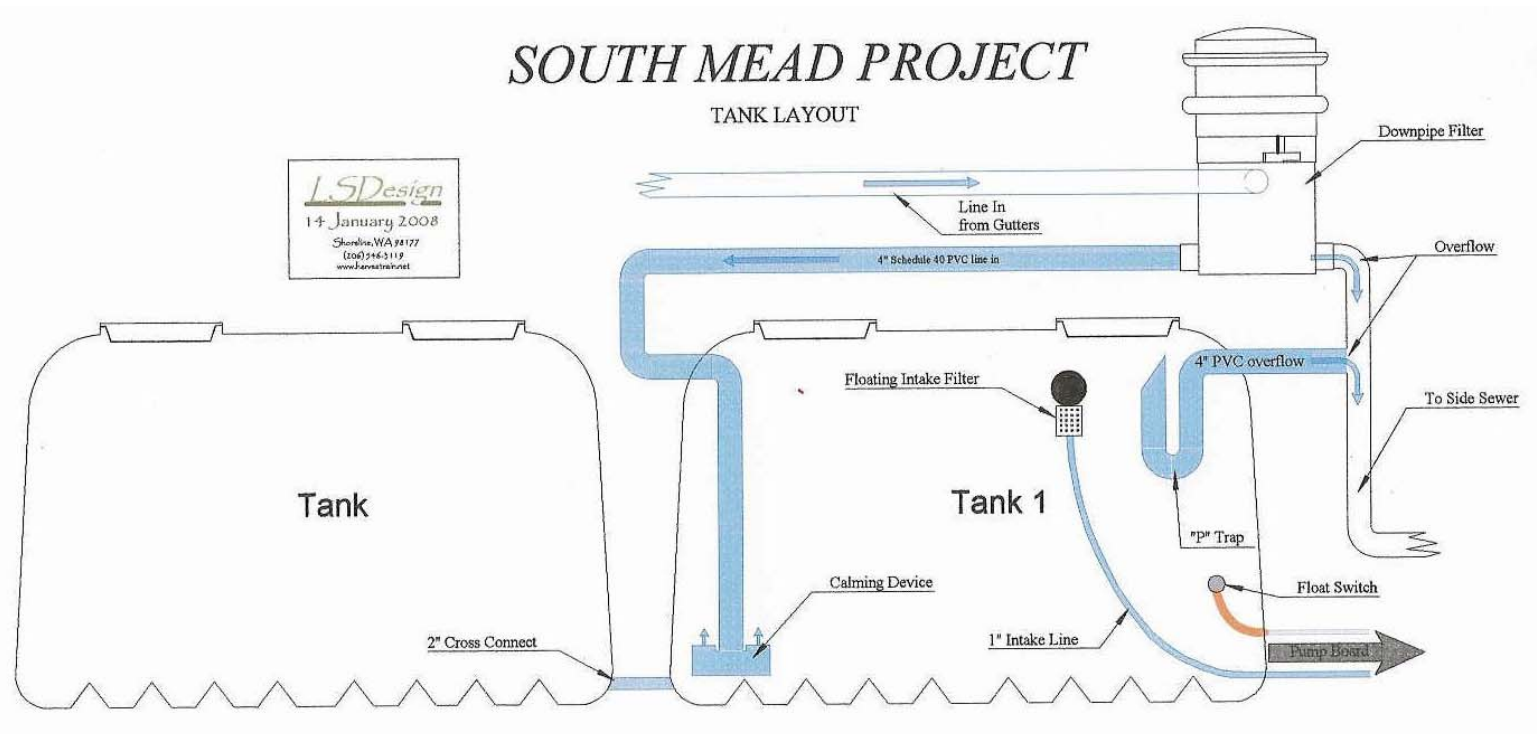


IN TANK DESIGN



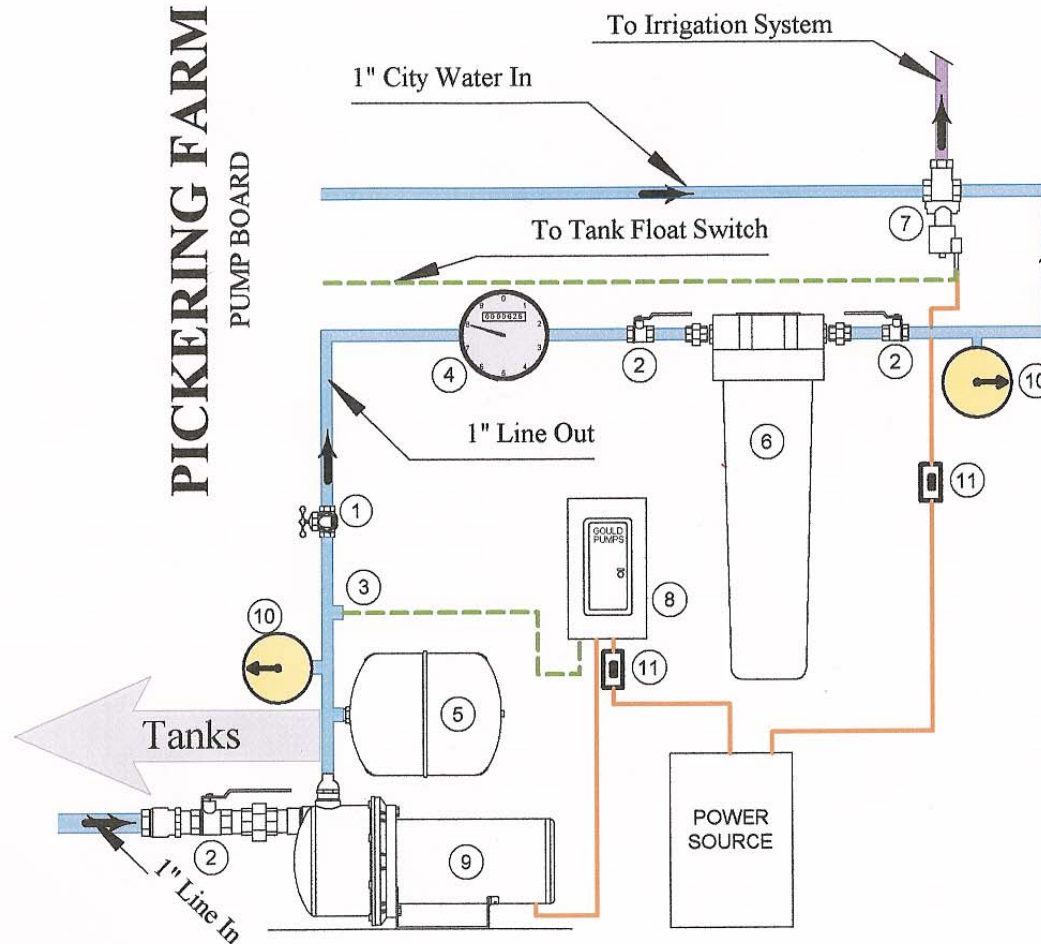


DESIGN



PICKERING FARM

PUMP BOARD

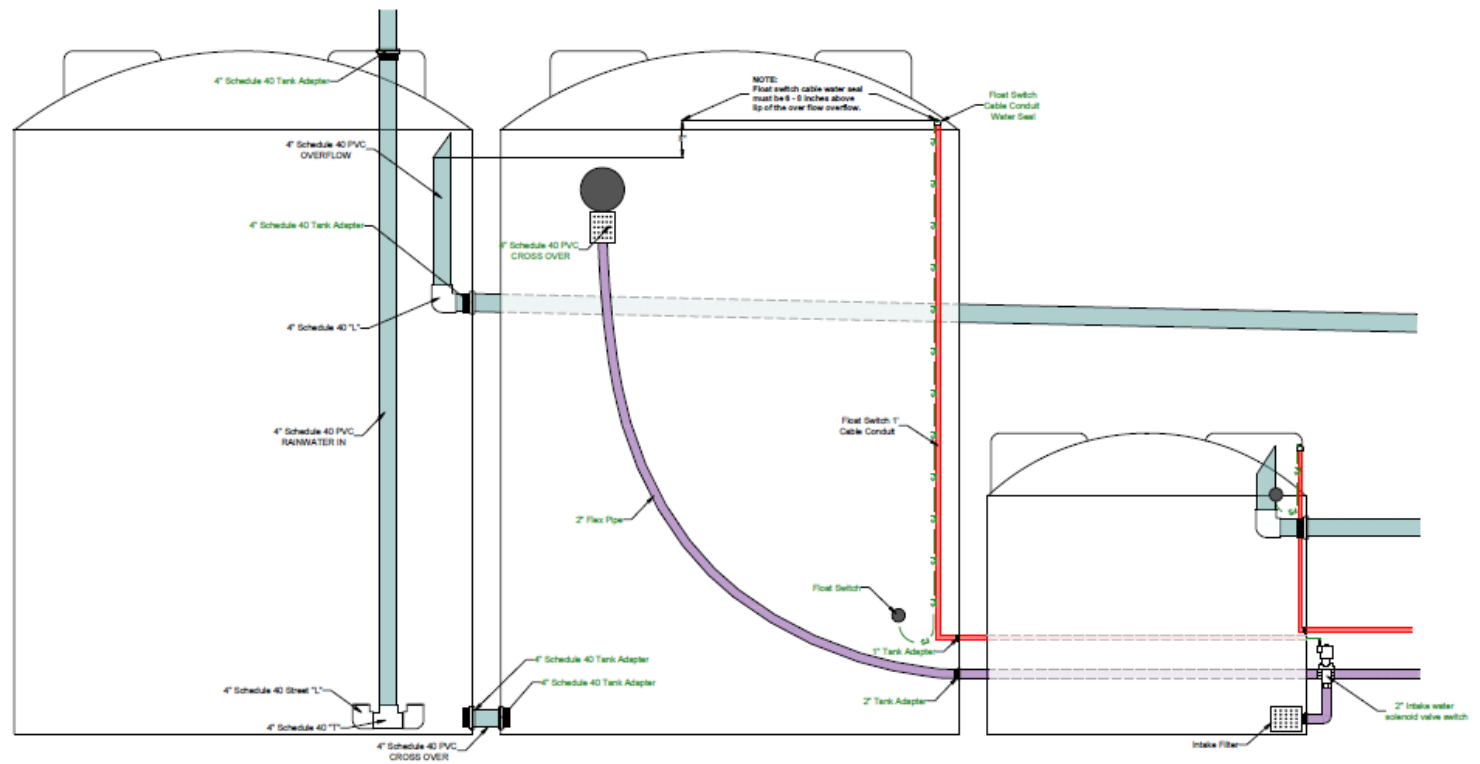


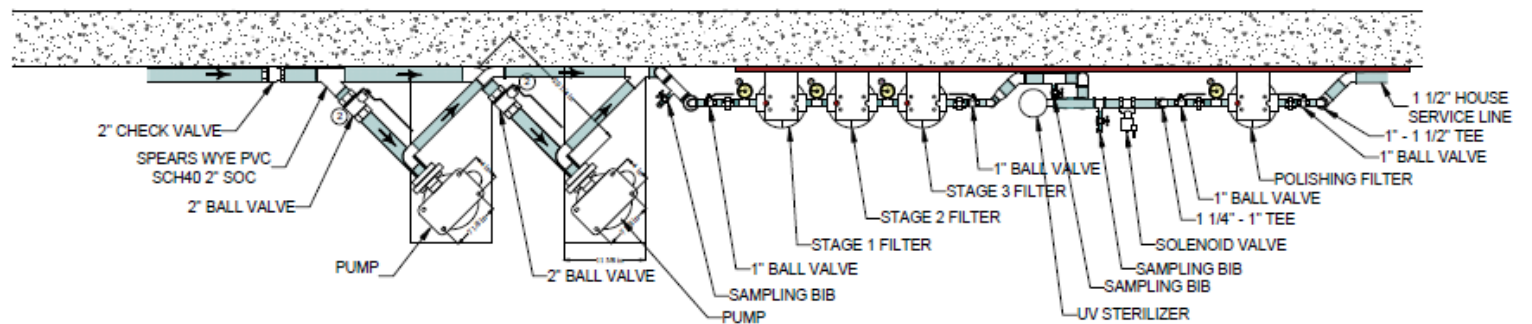
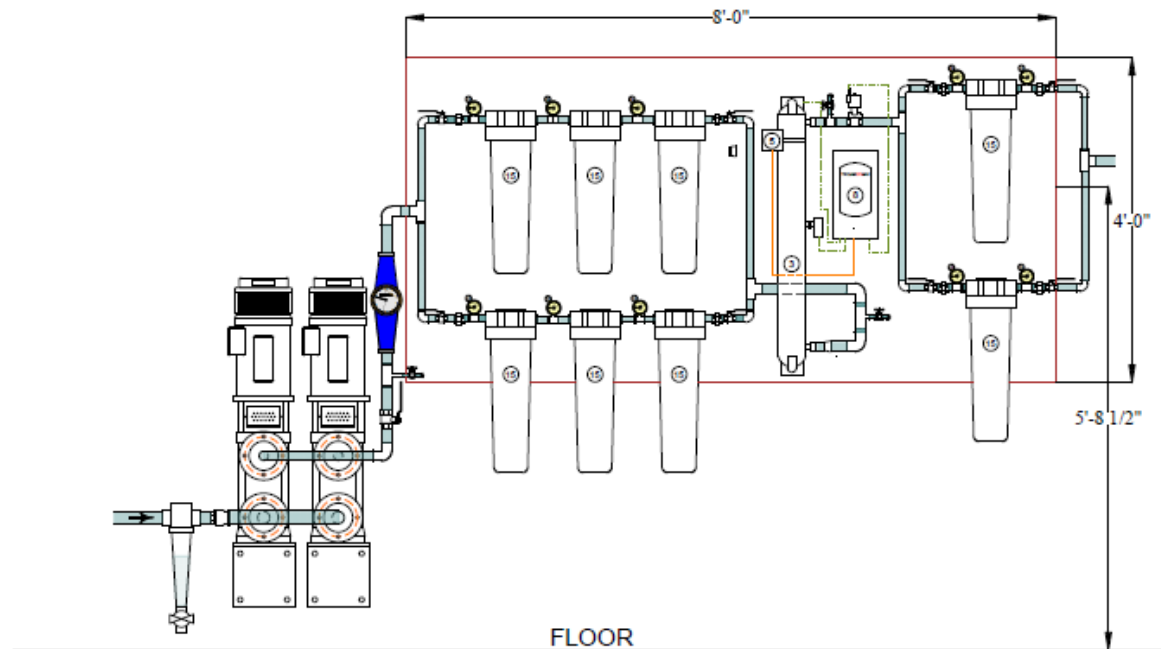
- ① Sample valve
- ② Shut-off valve
- ③ Sensor
- ④ Water meter
- ⑤ Pressure tank
- ⑥ Filter
- ⑦ Three-way solenoid valve
- ⑧ Control panel
- ⑨ Pump
- ⑩ Pressure gauge
- ⑪ 2-way switch
- 120 volt feed
- - - Signal feed

LSDesign

30 June 2008

Shoreline, WA 98177
(206) 546-3119
www.harvestrain.net





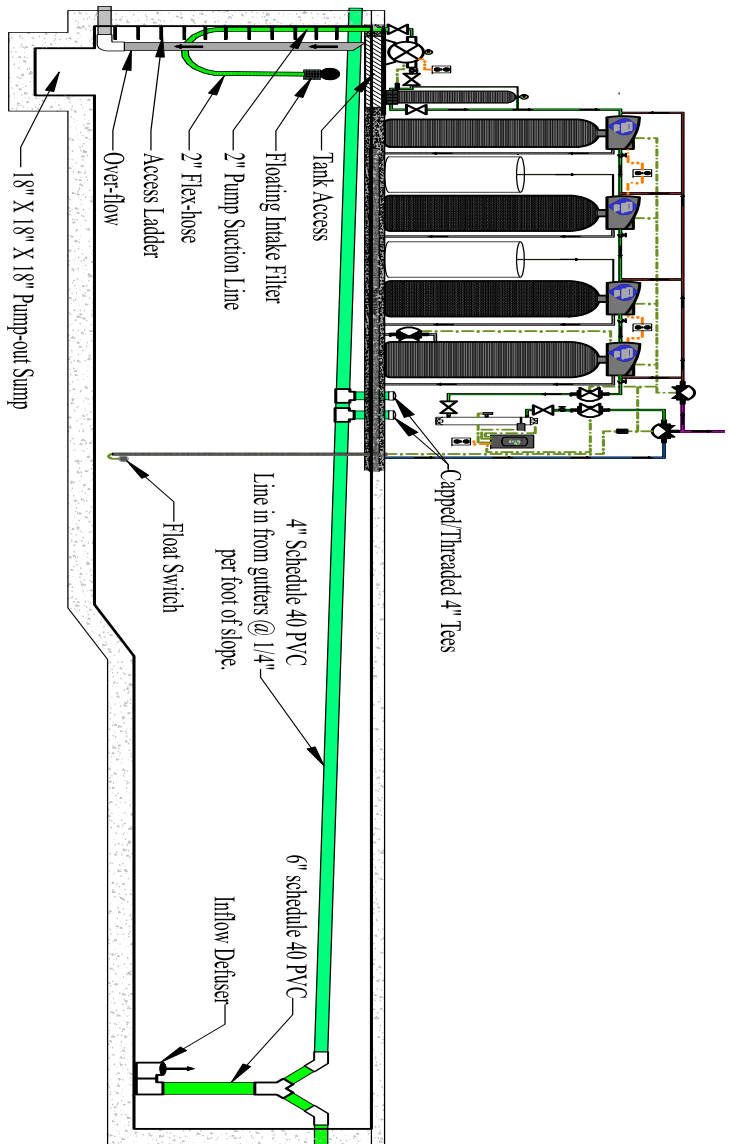
BROSSMANN RESIDENCE
10101 Radford Ave, NW
Seattle, WA 98177

POTABLE RAINWATER
HARVESTING SYSTEM

DATE:	02/23/14
DRAWING ISSUE:	DATE:
TANK PROFILE 02/23/14	
TANK PROFILE 02/27/14	

SHEET TITLE:	TANK PROFILE
SHEET NUMBER:	

RW 1.2



NOTES:

A plumbing permit is required prior to installation and inspection. You must submit your design along with your application for the permit. Allow 5 working days for the review.

Harvested rainwater may be used for both potable and non-potable services. Other uses may be allowed when first approved by Public Health - Seattle & King County. Note: Exterior downspouts discharging to rain barrels used for outside irrigation do not require permits or inspection by Public Health.

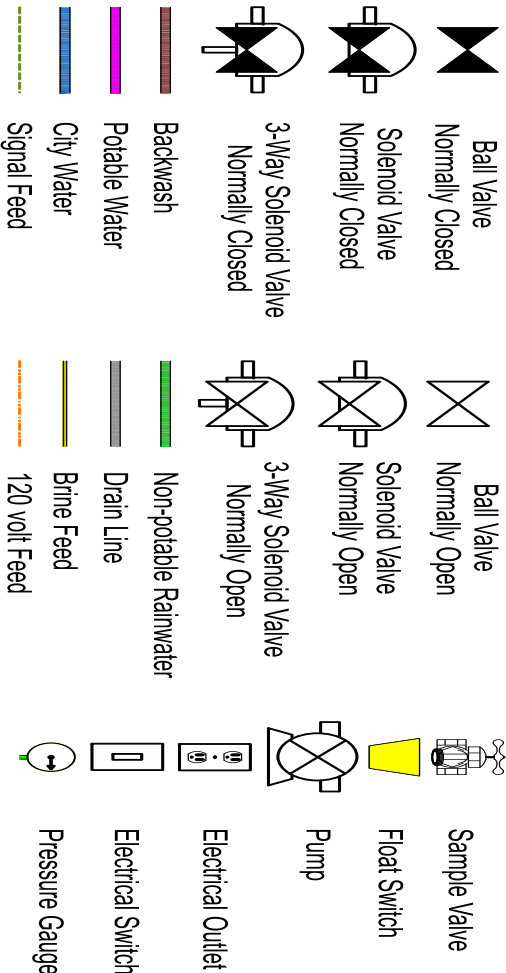
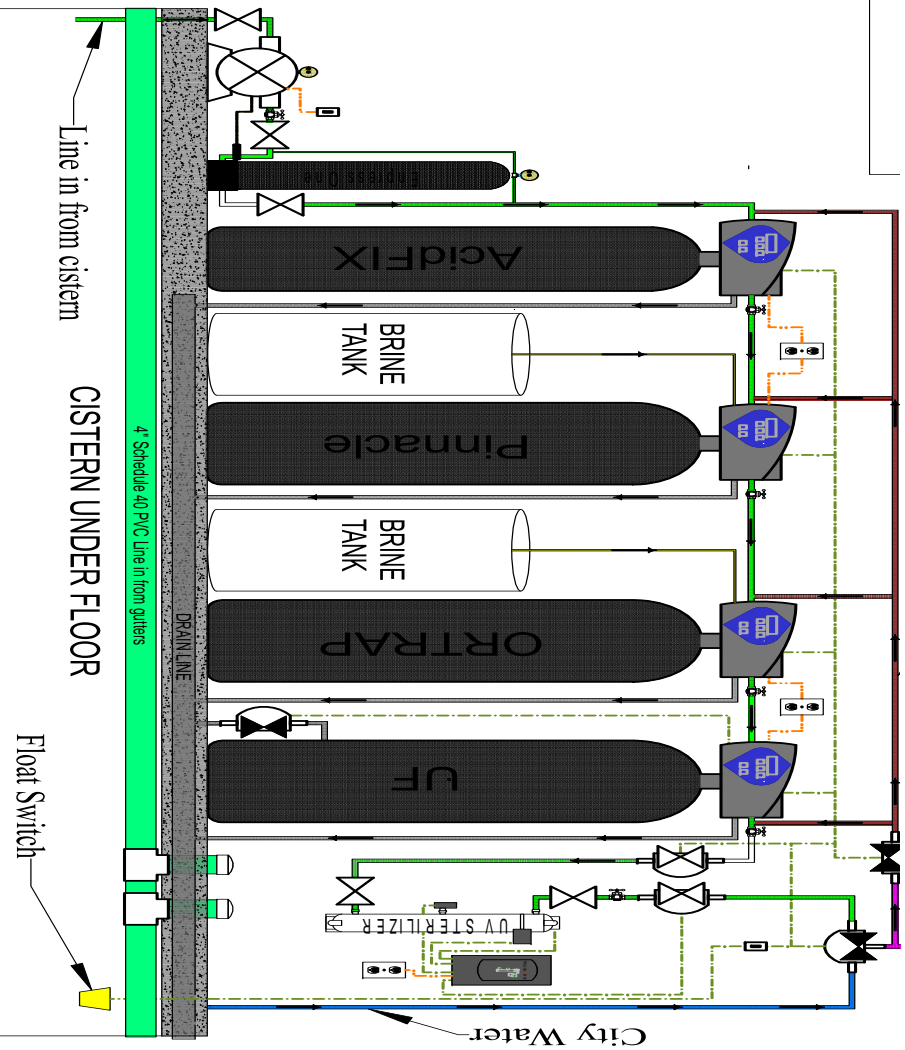
Backflow protection (premise isolation) is generally required by the water purveyor, regardless of the required backflow protection installed for make-up water connections to the rainwater harvesting system.

Piping materials shall meet the requirements of the 2009 Uniform Plumbing Code. Roof drain piping located inside a building must be DWV type.

GENERAL NOTES:

PIPE SHALL MEET ASTM F2848. JOINTS AND SIPS SHALL MEET ASTM F2848. GASKET CONNECTIONS SHALL MEET ASTM D1068 GRADE 242. ALL GASKETS AND CONNECTIONS SHALL BE FABRICATED BY MANUFACTURER.

MATERIAL FOR PIPE PRODUCTION SHALL BE AN ENGINEERED COMPOUND OF VIRGIN AND RECYCLED HIGH DENSITY POLYETHYLENE CONFORMING WITH MINIMUM REQUIREMENTS OF CELL CLASSIFICATION AS DEFINED AND DESCRIBED IN ASTM D3350.



211 NW 21st Street
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(206) 546-1119
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BROSSMANN RESIDENCE
10101 Radford Ave, NW
Seattle, WA 98177

POTABLE RAINWATER
HARVESTING SYSTEM

DATE: 02/18/14

DESIGN ISSUE: DATE:

FLOW SCHEMATIC: 02/18/14

FLOW SCHEMATIC: 02/20/14

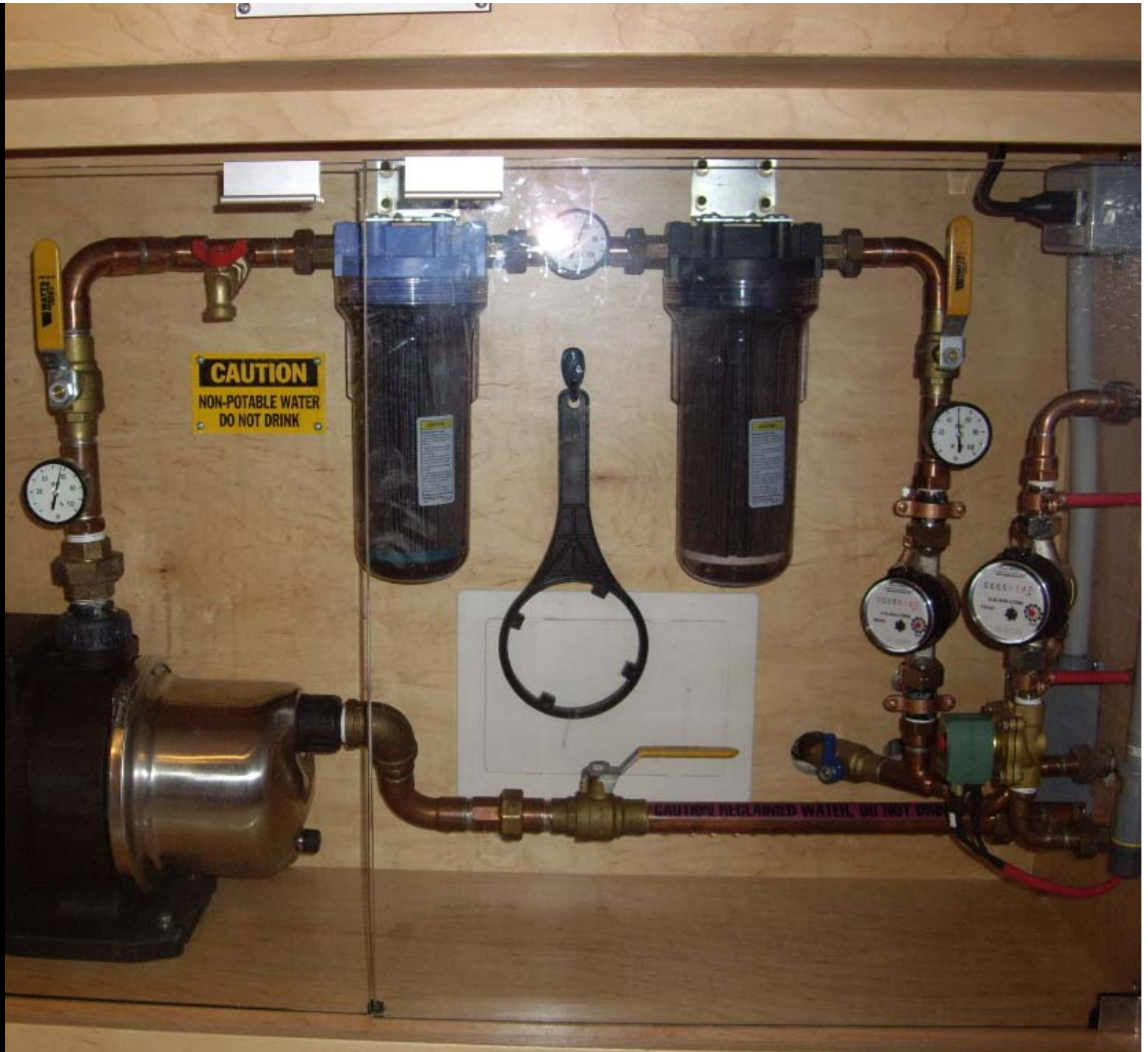
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FLOW SCHEMATIC

SHEET NUMBER:

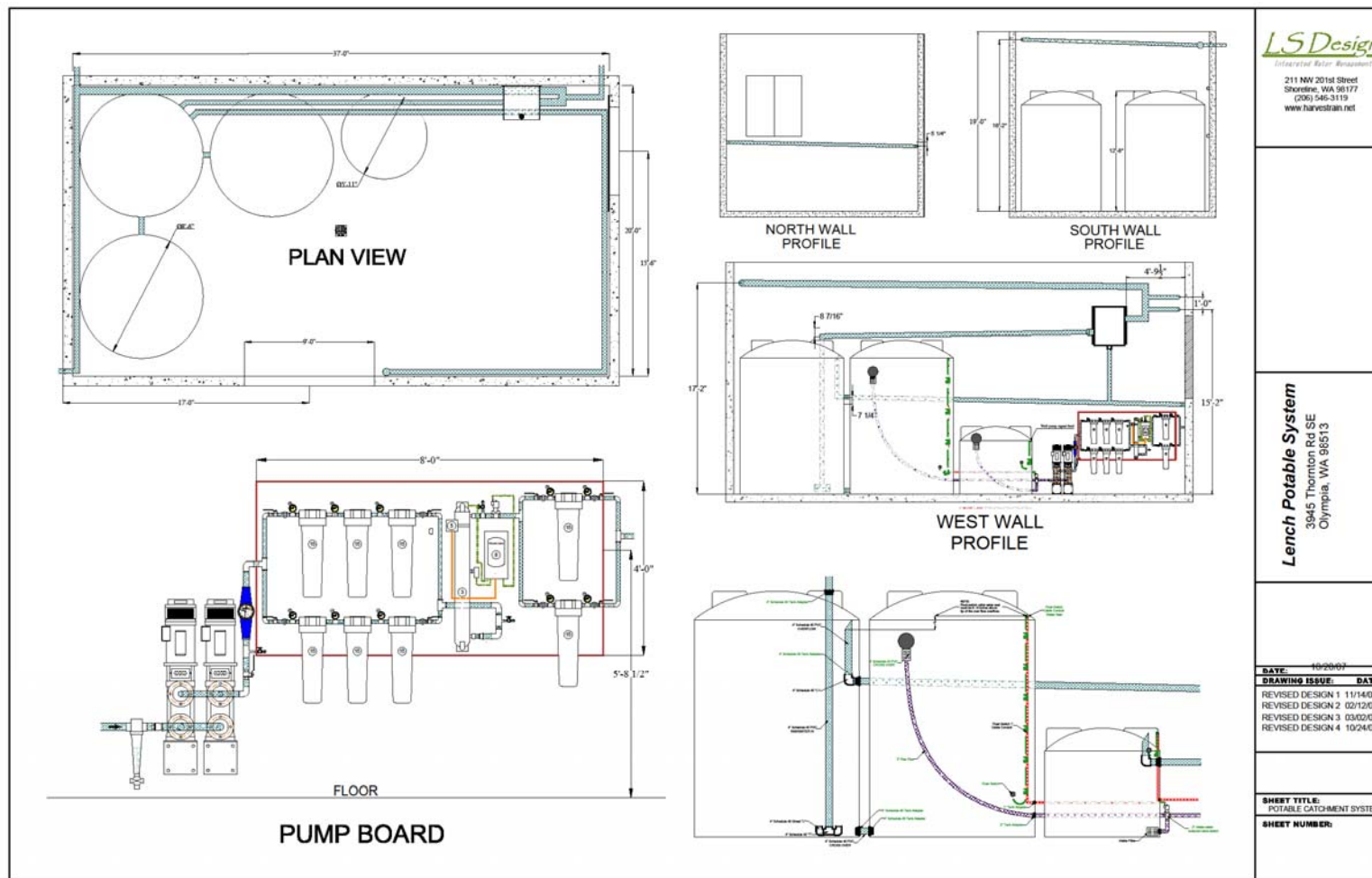
RW 1.1











LSDesign
Integrated Water Management

211 NW 20th Street
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Lench Potable System
3945 Thornton Rd SE
Olympia, WA 98513



RESOURCES

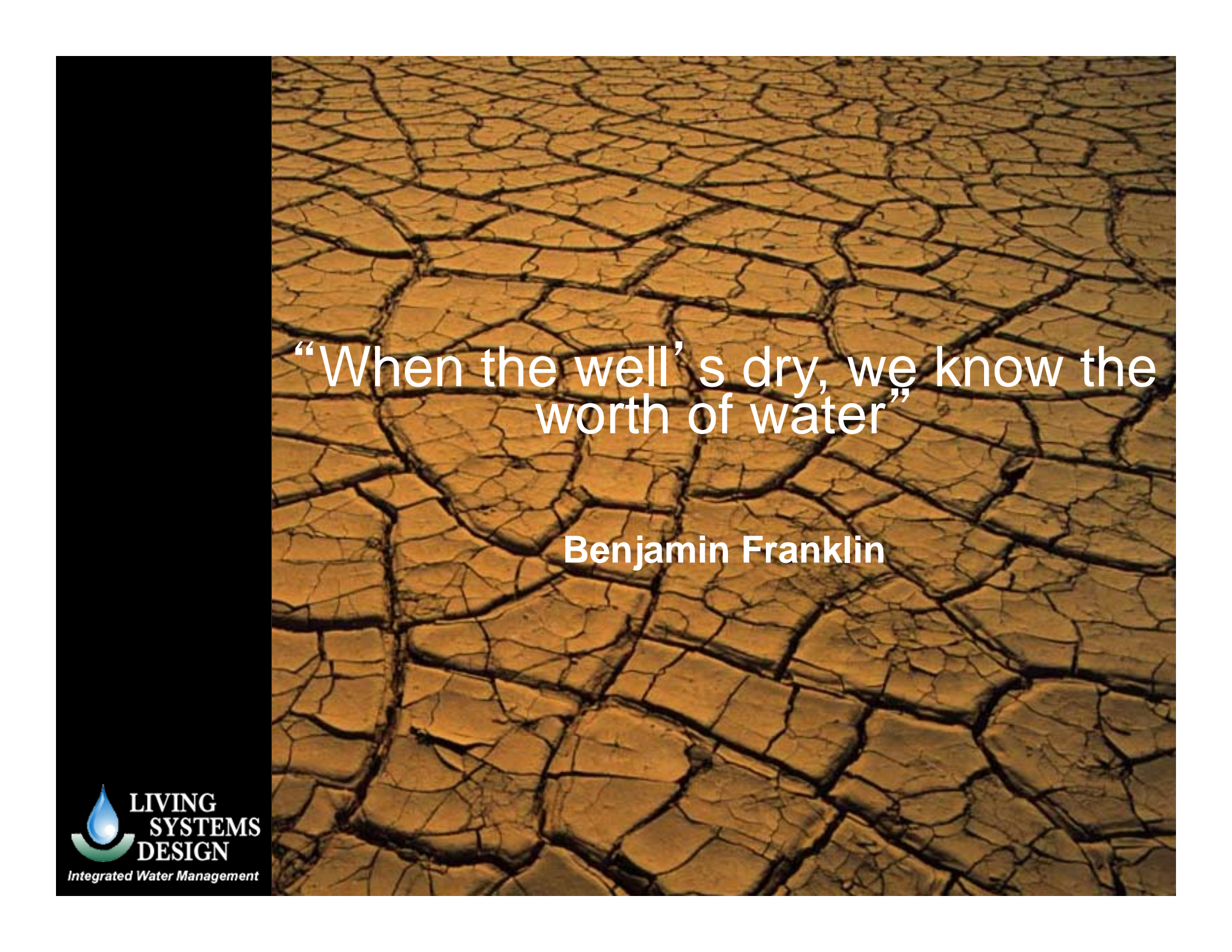
<http://www.arcsa-usa.org/>

<http://www.seattle.gov/DPD/Publications/CAM/CAM520.pdf>

http://www.ecy.wa.gov/programs/wr/hq/pdf/texas_rw_harvestmanual_3rdedition.pdf

http://www.ecy.wa.gov/programs/wr/hq/pdf/GARainWaterGdIns_040209.pdf

<http://www.ecy.wa.gov/programs/wr/hq/rwh.html>



“When the well’s dry, we know the
worth of water”

Benjamin Franklin