Commercial Rainwater and AC Condensate Collection Systems

Uses

- Landscape irrigation ***
- Cooling tower make-up water
- Toilet flushing
- Commercial and industrial processes
- Other non-potable uses

Benefits

- Reduction of the need for potable water
  - Reduced monthly costs
  - Avoid water use restrictions
  - More potable water available for other uses
  - Reduced City infrastructure needs (eventually)
- Tax incentives (Section 151.355 of the Texas Tax Code) and local rebates (?)
- Stormwater management
- Reduction of City wastewater charges
- Rebates

Concerns

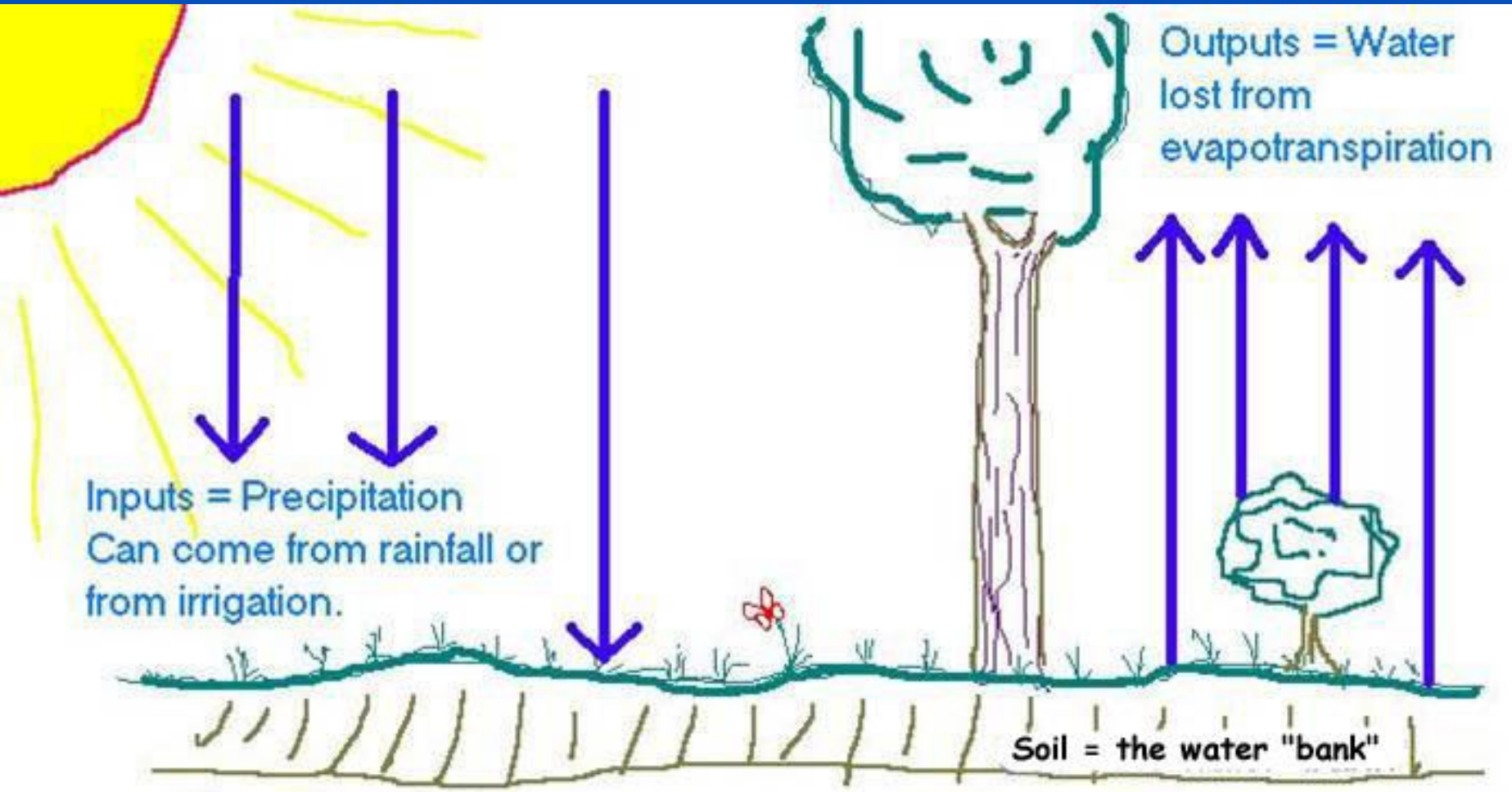
- Accurate projections of demand, primarily, amount of water needed for landscape irrigation
- Accurate projections of supply
  - Rainwater/stormwater collection
  - AC condensate collection
- Appropriate sizing of storage capacity
- Components
  - Type of storage and maintenance
  - Pump selection and maintenance
- Water quality
- Permits and code requirements
- Maintenance

Demand

Accurate projection of demand – Landscape Irrigation

- Demand is determined by the water lost from the landscape via a process called “evapotranspiration” or ET.
- Other losses which will increase demand can occur as a result of leaks, runoff, poor soil conditions, improper scheduling and others
- Focus here is on ET

Replace Evapotranspiration (ET)



Factors which influence ET include solar radiation, wind, temperature, relative humidity and soil moisture content.

http://texaset.tamu.edu/

Texas A&M AgriLife Extension

Irrigation Technology Program
Texas ET Network

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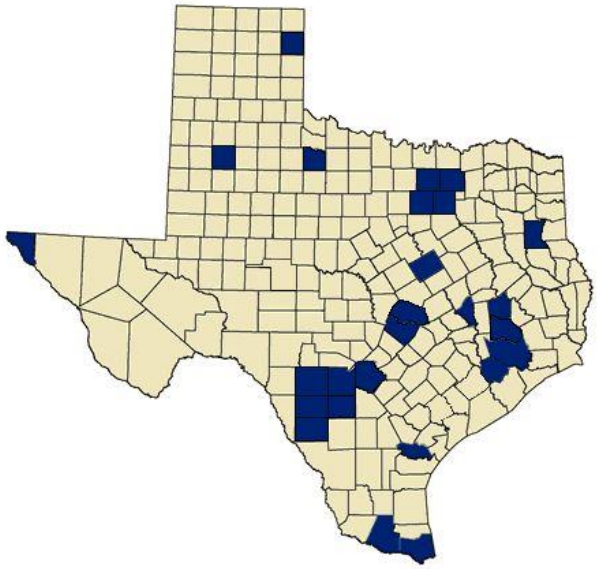
TexasET contains weather information, current and average evapotranspiration data, and irrigation watering recommendations.

Current Stations: Select a Station ... **Historic Stations:** Select a Station ...

You may either select the station nearest you from the drop down menu above, click on the station on the map below, or login with your profile. For more information on why you should create a profile click here.



Yesterday's Weather Summary

Station	ETo (in)	Max Temp (f)	Min Temp (f)	Min RH (%)	Solar Rad. (MJ/m2)	Rainfall (in)	Wind 4am (mph)	Wind 4pm (mph)

Note that “inputs” and “outputs” are both in INCHES

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Home Watering | Turf/Landscape Irrigation | Crop Irrigation



San Antonio North Weather Station
***Station Sponsored by :* San Antonio Water System**

Date	ETo PET (in)	Tmax (F)	Tmin (F)	RHmin (%)	Solar (MJm2)	Rain (in)	Wind 4am (mph)	Wind 4pm (mph)
2013-09-14	0.23	94	70	33	21.07	0.03	0.00	8.67
2013-09-15	0.21	92	73	40	16.18	0.00	0.17	12.94
2013-09-16	0.11	85	72	68	8.45	0.54	0.00	1.29
2013-09-17	0.15	88	73	56	11.93	0.17	0.20	9.49
2013-09-18	0.18	91	73	47	16.88	0.43	0.73	9.97
2013-09-19	0.18	91	74	51	17.05	0.11	0.00	9.20
2013-09-20	0.07	80	71	83	5.27	0.32	1.32	10.10
7 Day Summary	**1.13**	**89**	**72**	**54**	**13.83**	**1.60**	**0.35**	**8.81**

Note: Reported are the average hourly values, not the absolute highs and lows.

3 day summary | 5 day summary | 7 day summary | other day range

Detailed Weather and Heat Units

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Converting INCHES to GALLONS

- 1 acre-foot = 325,851 gallons
- 1 acre-inch = 27,154 gallons
- 1 acre = 43,560 square feet
- 1 inch of water landing on 1,000 sq ft =
  27,154 X (1,000 ÷ 43,560) = 623.4 gallons
- 1 inch of water landing on 1 sq ft = .62 gal

Net Landscape Demand, High Quality Turf, No Adjustment

San Antonio - 2011, 1,000 Sq Ft Landscape							
				Gallons Demand		Gallons Supplied	Δ
	PET	K_c	ET	per 1000 sq ft	RAIN	per 1000 sq ft	Gal
January	3.06	0.60	1.84	1144.56	2.00	1246.8	102.24
February	3.91	0.60	2.35	1462.50	0.23	143.382	-1319.11
March	5.65	0.60	3.39	2113.33	0.00	0	-2113.33
April	7.83	0.60	4.70	2928.73	0.00	0	-2928.73
May	8.59	0.60	5.15	3213.00	0.63	392.742	-2820.26
June	7.70	0.60	4.62	2880.11	1.74	1084.716	-1795.39
July	10.79	0.60	6.47	4035.89	0.23	143.382	-3892.51
August	10.21	0.60	6.13	3818.95	0.06	37.404	-3781.54
September	8.93	0.60	5.36	3340.18	1.16	723.144	-2617.03
October	5.66	0.60	3.40	2117.07	2.17	1352.778	-764.29
Novemeber	4.38	0.60	2.63	1638.30	1.34	835.356	-802.94
December	2.32	0.60	1.39	867.77	2.24	1396.416	528.64

Cooling tower make-up water

- Make-up = Evaporation + Blowdown + Drift
- "Condensate recovery ranges from 5% to 15% of required cooling tower makeup water"[1]
- Probably more used as supplemental source for make-up water when available.

[1] Guz, Karen. 2005. "Condensate Water Recovery." *ASHRAE Journal*, 47 (6): 54-56

Flushing toilets

- **OSU Uses Harvested H2O**

- Oregon State University (OSU) also opted to install a rainwater reclamation system on its new Kelley Engineering Center (KEC).
- The conventional gutter system diverts rainwater into planters that contain native and drought-tolerant plants, which act as bio-filters for the rainwater, before sterilization, storage, and use inside the building. "Stormwater from the roof and the planters plumb through a filter under the plaza and into three 4,500-gallon tanks," he explains. "The water recirculates through a UV filter and is used in the toilets and urinals, which flush to the sanitary sewer."

- http://www.buildings.com/article-details/articleid/11333/title/flush-rainwater-not-money-down-your-toilets.aspx

Data: 260 work days per year

300 male workers, 200 female workers

10 male toilets, 15 urinals

25 female toilets

Male Toilet Flush Quantities:

260 days X 300 males X 0.5 toilet flushes/day = 39,000 toilet flushes/year

39,000 flushes / 10 toilets = **3,900 flushes/year/male toilet**

39,000 flushes x 1.6 gpf = 62,400 gallons

Male Urinal Flush Quantities:

260 days X 300 males X 2.5 urinal flushes/day = 195,000 urinal flushes/year

195,000 flushes / 15 urinals = **13,000 urinal flushes/year/urinal**

13,000 urinal flushes x 0.25 gpf = 3,250 gallons

Female Toilet Flush Quantities:

260 days X 200 females X 3 toilet flushes/day = 156,000 toilet flushes/year

156,000 flushes / 25 toilets = **6,240 flushes/year/female toilet**

6,240 flushes x 1.6 gpf = 9,984 gallons

Total = 75,634 gallons

(http://www.allianceforwaterefficiency.org/office_buildings.aspx)

Supply

Accurate projections of rainfall supply

- Very unpredictable!
- Rainfall events sometimes too large to capture all the water that's available
- Total reliance on rainfall is possible but not often practical

AC condensate supply

- Very difficult to predict accurately but must consider:
  - Outdoor air conditions (relative humidity)
  - Indoor air condition set points
  - HVAC system type and settings
  - Building type
  - Building use

(San Antonio Condensate Collection and Use Manual for Commercial Buildings, Dr. Diana Glawe, p. 37)

AC Condensate Rules of Thumb

- "The amount of condensate water can range from 3 to 10 gallons per day (gpd) per 1000 square feet (sq ft) of air conditioned space."

Alliance for Water Efficiency, "Condensate Water Introduction." http://www.allianceforwaterefficiency.org/Condensate_Water_Introduction.aspx

- … large buildings during summer months in San Antonio as 0.1 to 0.3 gallons per hour (gph) of water per ton of cooling or a peak rate of 0.5 to 0.6 gph per 1000 sq ft of cooled area
- Guz, Karen. 2005. "Condensate Water Recovery." *ASHRAE Journal*, 47(6) : 54-56.

Components

- Type of storage and maintenance
- Pump selection and maintenance
- etc

Water Quality

- AC condensate is much like distilled water, has a pH of around 5.8 and can cause reactions with metals, iron and steel
- Pathogenic organisms are of greater concern
  - *Legionella* proliferates in warm water such as storage tanks
  - For this reason, above ground irrigation with collected water may be regulated by local ordinance

(San Antonio Condensate Collection and Use Manual for Commercial Buildings, Dr. Diana Glawe, p. 37)

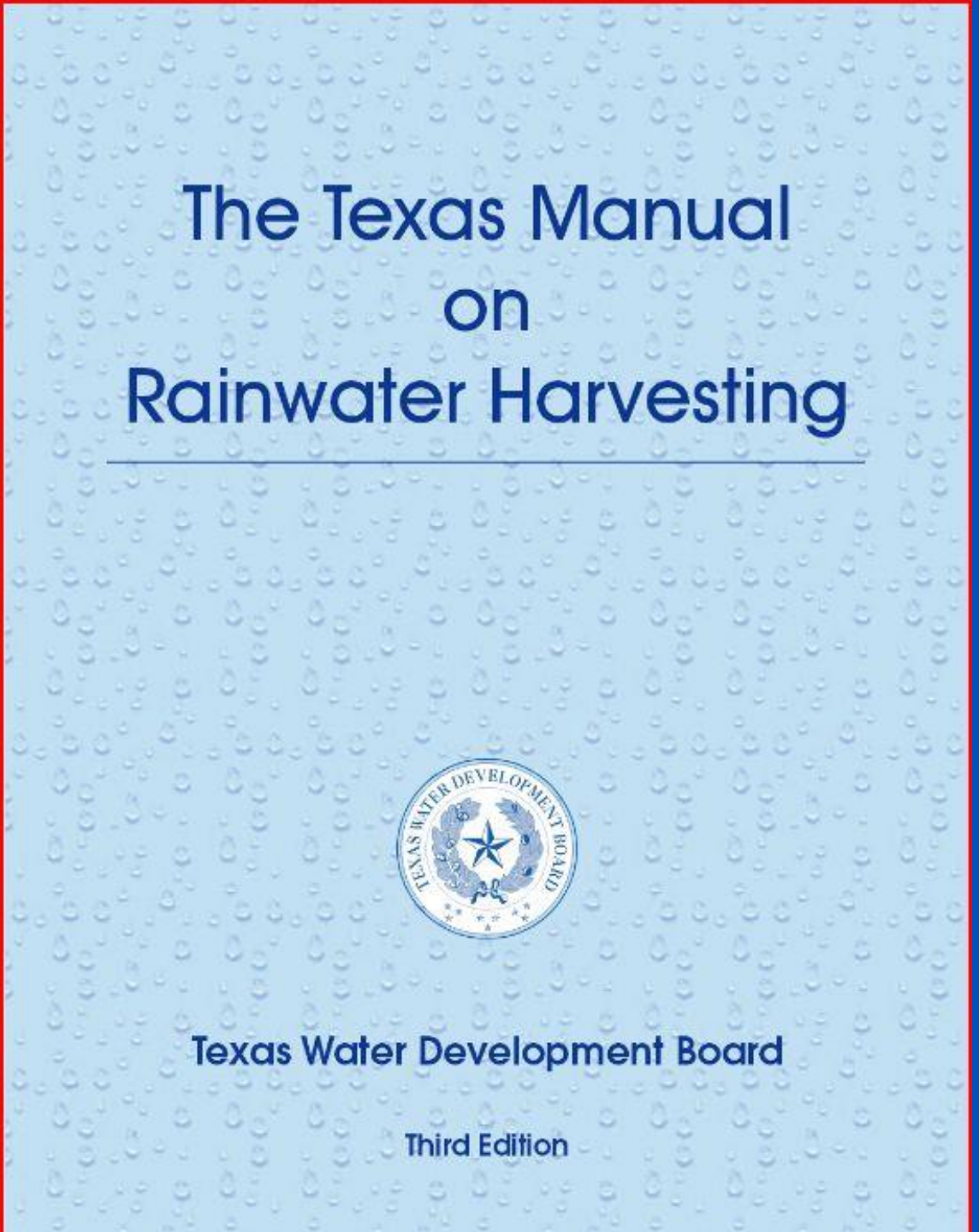
Permits and code requirements

- Check with your local jurisdictions
- Vary from one city to another

MOST IMPORTANTLY OF ALL

DESIGN

Resources



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http://www.twdb.state.tx.us/publications/reports/rainwaterharvestingmanual_3rdedition.pdf

ARCSA & TRCA

- American Rainwater Catchment Systems Association
- http://www.arcsa.org/
- **Texas Rainwater Catchment Association**
- http://www.texrca.org/

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City of Austin

- Can commercial properties receive a rebate for rainwater harvesting systems used to satisfy water quality credit?

- Commercial applicants using rainwater harvesting as an Innovative Water Quality Control will only be rebated for storage in excess of the water quality volume capacity used to receive water quality credit.
- To learn more about rainwater harvesting as an Innovative Water Quality Control, view Section 1.6.7 of the City of Austin Environmental Criteria Manual.
- http://www.austintexas.gov/sites/default/files/files/Water/Conservation/Rainwater_Harvesting_Rebate_FAQ_5-2012.pdf