ONE-PAGE PLACE ASSESSMENT: AMARILLO, TEXAS

LOCATED IN THE LOWER CANADIAN & RED HEADWATERS SUBWATERSHEDS WITHIN THE ARKANSAS-WHITE-RED WATERSHED

CLIMATE ⚐1

AVERAGE HIGH & LOW TEMPERATURES[1] — *1948 – 2013*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
°F HIGH	49.8	53.6	61.8	71.3	79.4	88.2	91.5	89.6	82.4	72.3	59.5	50.9	70.9
°F LOW	22.4	26.3	32.7	42.0	51.9	61.4	65.8	64.3	56.6	45.0	32.3	24.5	43.8
°C HIGH	9.9	12.0	16.6	21.8	26.3	31.2	33.1	32.0	28.0	22.4	15.3	10.5	21.6
°C LOW	-5.3	-3.2	0.4	5.6	11.1	16.3	18.8	17.9	13.7	7.2	0.2	-4.2	6.6

RECORD HIGH[1]: 111° F | 43.9° C | *June 26, 2011*

RECORD LOW[2]: -16° F | -26.7° C | *February 12, 1899*

SUN ⚐2

LATITUDE: 35.2°

ELEVATION: 3,672 FT / 1,120 m

	MAR 21	JUN 21	SEP 21	DEC 21
DEGREES N or S of DUE EAST THE SUN RISES[3]	0°	30°N	0°	28°S
DEGREES N or S of DUE WEST THE SUN SETS[3]	0°	30°N	0°	28°S
SOLAR-NOON ALTITUDE ANGLE (ABOVE HORIZON)[a,3,4]	55°	78°	55°	31°

SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO[b]: 1 : 1.64 ...AND AZIMUTH[c]: 0°

9AM & 3PM WINTER-SOLSTICE SHADOW RATIO[b,3]: 1 : 3.16 ...AND AZIMUTH[c,3]: 43°

WIND ⚐3

MAX SPEED[2]: 84 MPH | 135 km/h

PREVAILING WIND DIRECTION (FROM WHERE)[d,5] & AVERAGE SPEED[5]

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
	SW	SSW	SSW	SSW	SSE	S	S	S	S	SSW	SW	SW	S
MPH	12.3	13.2	14.4	14.9	14.0	13.9	12.6	11.7	12.1	12.6	12.8	12.5	13.1
km/h	20	21	23	24	23	22	20	19	19	20	21	20	21

WATER ⚐4

AVERAGE RAINFALL (GAIN)[1] — *1948 – 2013*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	0.59	0.58	1.08	1.24	2.55	3.28	2.77	2.94	1.87	1.44	0.69	0.61	19.64
mm	15.0	14.7	27.4	31.5	64.8	83.3	70.4	74.7	47.5	36.6	17.5	15.5	498.9

AVERAGE PAN EVAPORATION (POTENTIAL LOSS)[e,6] — *1956 – 1970*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	2.99	3.22	5.65	8.26	10.77	11.27	11.54	10.30	7.67	6.51	3.91	3.14	85.23
mm	75.9	81.8	143.5	209.8	273.6	286.3	293.1	261.6	194.8	165.4	99.3	79.8	2,164.8

WETTEST YEAR'S RAIN[2]: 39.75 INCHES | 1010 mm | *1923*

DRIEST YEAR'S RAIN[1]: 7.01 INCHES | 178 mm | *2011*

LONGEST PERIOD WITH NO MEASURABLE PRECIPITATION[7]: 75 DAYS: *October 21, 1956 – January 3, 1957*

RAINFALL INCOME[f]: 476 GPCD / 1803 lpcd

AREA[g,8]: 99.48 SQ MILES / 258 km²

POPULATION[g,8]: 195,250 *2012 est.*

UTILITY-WATER USE[h,9]: 230 GPCD / 871 lpcd

HISTORICAL: 156 FT | 47.6 m | *1929*

DEPTH TO GROUNDWATER[i,10]: 218 FT | 66.5 m | *1995* CURRENT

CURRENT GROUNDWATER EXTRACTION > NATURAL GROUNDWATER RECHARGE[j,11]

WATERGY ⚐5

% of CITY OF AMARILLO'S MUNICIPAL ENERGY USED TO MOVE & TREAT WATER[k,12]: 20%

TOTEM SPECIES ⚐6

INSECT: Prairie sphinx moth *(Euproserpinus wiesti)* MAMMAL: Black-footed ferret *(Mustela nigripes)*

FISH: Arkansas River shiner *(Notropis girardi)* MEGAFAUNA: Gray wolf *(Canis lupus)* PLANT: Mexican mud-plantain *(Heteranthera mexicana)*

BIRD: Interior least tern *(Sterna antillarum athalassos)* REPTILE: Texas horned lizard *(Phrynosoma cornutum)* AMPHIBIAN: [l,13,14]

FOR MORE INFORMATION & HOW TO APPLY IT

⚐**1.** For more CLIMATE information, see the introduction, chapters 1, 2, & 4, and appendix 5 of *Rainwater Harvesting for Drylands and Beyond (RWHDB), Volume 1, 2nd Edition*

⚐**2.** For more SUN information, see chapters 2 & 4 and appendices 5 & 7

⚐**3.** For more WIND information, see chapters 2 & 4 and appendices 5 & 9

⚐**4.** For more WATER information, see the introduction, chapters 1–4, and appendices 1–5

⚐**5.** For more WATERGY information, see chapters 2 & 4 and appendix 9

⚐**6.** For more TOTEM SPECIES information: the ethics, principles, and strategies throughout *RWHDB* help us shift from a negative to a positive impact on these species and their habitats and ecosystems, on which our quality of life also depends.

AMARILLO'S PLACE-ASSESSMENT NOTES

a. The solar-noon altitude angle (a.k.a., solar-noon elevation angle) refers to the number of degrees the sun is located above the equator-facing horizon at solar noon on the given date. In the northern hemisphere, the equator-facing horizon is to the south. In the southern hemisphere, the equator-facing horizon is to the north.

b. The solar-noon winter-solstice shadow ratio is the object's height : length of object's shadow cast on December 21 at noon (the longest noontime shadow of the year). The ratio is 1 : x, where x = 1 ÷ tangent (90 - (latitude + 23.44)).

c. Azimuth is the angle formed between a reference direction (here, due south) to the point on the horizon directly below a given object. Solar noon is the time on any day when the sun's azimuth is 0°. The 9 am & 3 pm winter-solstice azimuth indicates the sun's deviation, in degrees, east/west of due south at those times (–/+ 3 hours from solar noon) on December 21.

d. The prevailing wind direction was interpreted from the wind roses as the cumulative, not absolute, prevailing wind direction (e.g., in December the absolute prevailing wind direction was due N, but the cumulative effect of SWbW & SWbS was greater.

e. An evaporation pan holds water whose depth is measured daily as water evaporates. These data allow us to determine evaporation rates at a given location. Compare average rainfall (water gain) to potential water loss via evaporation by looking up pan-evaporation rates for your area. According to one definition, if pan-evaporation rates exceed rainfall rates, you are in a dryland environment. Another definition states that drylands are "land areas where the mean annual precipitation is less than two thirds of potential evapotranspiration (potential evaporation from soil plus transpiration by plants), excluding polar regions and some high mountain areas which meet this criterion but have completely different ecological characteristics" (Greenfacts.org). The higher the ratio of potential evaporation to rainfall, the more important evaporation-reducing strategies such as mulch, windbreaks, shading, and covered water storage become.

f. Calculated in situ w/ average rainfall, area, & population

g. City proper

h. This gpcd was from 2011, the driest year on record in Amarillo. The consumption for *all* fresh water uses in 2011 was 264 gpcd. Subtracting out-of-town industries & City of Canyon results in an in-town usage of … 230 gpcd, compared to an in-town gpcd of under 200 in a "normal" water usage year (ref. 9).

i. Well ID #TX001 350906101544111 UY-06-49-911, located at 35°09'06", -101°54'41". This well was selected due to its longest apparent period of record among the wells featured on the USGS site within Amarillo city limits. Not all city wells showed an increase in depth to groundwater. However, data from city well fields north of the Pantex plant showed an even greater increase in depth to groundwater. One such well with a long period of record (well ID #TX001 352217101325103 DA-06-44-203) shows a reading of 402' to groundwater in 1954, and 545' to groundwater in 2011. Other wells in this area show similar data.

j. The Ogallala Aquifer is the major drinking water resource for this part of the Texas High Plains region. The highest volume use, however, is for irrigation. [...T]he City of Amarillo's water well field [is] located just north of the Pantex Plant northern The water well field and irrigation in the region also locally controls the level of the Ogallala; the water table shows a higher rate of decline in the northern monitoring wells at Pantex, than for those located at the southern boundary. Regionally, water levels have been dropping for the Ogallala, as irrigation for agricultural purposes has expanded, outpacing natural recharge…(ref. 11).

k. In fiscal year 2013 (10/1/2012 to 9/30/2013) the City of Amarillo used 107,834,594 kWh for municipal purposes. Of that energy, 21,035,459 kWh were used to pump & treat water. 21,035,459 kWh for water ÷ 107,834,594 kWh total = 20% of total (ref.

l. Black-footed ferret's habitat is destroyed by oil & natural-gas exploration (watergy connection)

CREDITS: Brad Lancaster, Resource concept **|** **Megan Hartman,** Resource creation, research

AMARILLO'S PLACE-ASSESSMENT REFERENCES

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2. Amarillo Climate Notes, www.srh.noaa.gov/ama/?n=rec_norm_ama, accessed 3/5/2014

3. Rainwater Harvesting for Drylands & Beyond, Vol 1, or esrl.noaa.gov/gmd/grad/solcalc, accessed 3/5/2014

4. RWHDB Vol 1, or Mar 21 = 90–latitude, Jun 21 = 90–(latitude–23.44), Sep 21 = 90–latitude, Dec 21 = 90–(latitude+23.44)

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7. Kyle Brehe, User Services Climatologist, SRCC, via phone 2/24/2014

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