ONE-PAGE PLACE ASSESSMENT: SUPERIOR, ARIZONA

LOCATED IN THE MIDDLE GILA SUBWATERSHED WITHIN THE COLORADO RIVER WATERSHED

CLIMATE ⚐1

AVERAGE HIGH & LOW TEMPERATURES[a,1] — 1920 – 2006

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
°F HIGH	60.9	64.1	68.5	76.4	86.1	95.6	97.7	95.4	92.3	82.5	69.8	61.6	79.2
°F LOW	43.2	45.4	48.2	54.4	62.7	72.0	75.7	74.2	71.2	62.0	51.1	44.0	58.7
°C HIGH	16.1	17.8	20.3	24.7	30.1	35.3	36.5	35.2	33.5	28.1	21.0	16.4	26.2
°C LOW	6.2	7.4	9.0	12.4	17.1	22.2	24.3	23.4	21.8	16.7	10.6	6.7	14.8

RECORD HIGH[a,1] 112° F | 44.4° C | *July 29, 1995* — RECORD LOW[a,1] 19° F | -7.2° C | *December 8, 1978*

SUN ⚐2

LATITUDE 33.3°

ELEVATION 2,852 FT / 870 m

	MAR 21	JUN 21	SEP 21	DEC 21
DEGREES N or S of DUE EAST THE SUN RISES[2]	0°	29°N	0°	28°S
DEGREES N or S of DUE WEST THE SUN SETS[2]	0°	29°N	0°	28°S
SOLAR-NOON ALTITUDE ANGLE (ABOVE HORIZON)[b,2,3]	57°	80°	57°	33°

SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO[c] 1 : 1.52 ...AND AZIMUTH[d] 0°

9AM & 3PM WINTER-SOLSTICE SHADOW RATIO[c,2] 1 : 2.91 ...AND AZIMUTH[d,2] 43°

WIND ⚐3

MAX SPEED[e,4] 29 MPH | 47 km/h

DOMINANT WIND DIRECTION & AVERAGE SPEED[e,4]

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
	E	E	E	W	W	E	E	ENE	E	E	E	E	E
MPH	1.4	1.1	1.2	1.5	1.4	1.6	1.2	1.1	1.2	1.4	1.0	1.3	1.3
km/h	2.3	1.8	1.9	2.4	2.3	2.6	1.9	1.8	1.9	2.3	1.6	2.1	2.1

WATER ⚐4

AVERAGE RAINFALL (GAIN)[1] — 1920 – 2006

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	2.00	1.98	2.02	0.80	0.34	0.26	1.91	2.80	1.48	1.18	1.41	2.11	18.29
mm	50.8	50.3	51.3	20.3	8.6	6.6	48.5	71.1	37.6	30.0	35.8	53.6	464.6

AVERAGE PAN EVAPORATION (POTENTIAL LOSS)[f,5] — 1905 – 2005

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32	96.49
mm	62.0	89.9	149.9	219.5	303.8	368.3	364.7	311.7	256.5	172.2	93.5	58.9	2,450.8

WETTEST YEAR'S RAIN[1] 35.77 INCHES | 909 mm | *1978* — DRIEST YEAR'S RAIN[1] 4.90 INCHES | 124 mm | *2002*

LONGEST PERIOD WITH NO MEASURABLE PRECIPITATION[6]: 152 DAYS: *December 30, 1971 – May 29, 1972*

RAINFALL INCOME[g] 543 GPCD / 2,055 lpcd

AREA[h,7] 1.87 SQ MILES / 4.8 km² — POPULATION[h,7] 2,999 *2016 (est.)*

UTILITY-WATER USE[g] 182 GPCD / 689 lpcd

HISTORICAL 10.20 FT | 3.11 m | *1985* — DEPTH TO GROUNDWATER[1,9] 10.29 FT | 3.14 m | *1997* CURRENT

CURRENT GROUNDWATER EXTRACTION ≈ NATURAL GROUNDWATER RECHARGE

WATERGY ⚐5

of AVG AZ HOMES THAT COULD BE POWERED w/ENERGY USED TO MOVE & TREAT SUPERIOR'S WATER[i,10]

TOTEM SPECIES ⚐6

MEGAFAUNA: Bighorn Sheep *(Ovis canadensis)* **MAMMAL:** Lesser Long-Nosed Bat *(Leptonycteris yerbabuenae)*
FISH: Gila Topminnow *(Poeciliopsis occidentalis)* **BIRD:** Yellow-Billed Cuckoo *(Coccyzus americanus)* **REPTILE:** Gila Monster *(Heloderma suspectum)*
AMPHIBIAN: Lowland Leopard Frog *(Lithobates yavapaiensis)* **PLANT:** Arizona Hedgehog Cactus *(Echinocereus arizonicus)*

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.

SUPERIOR PLACE-ASSESSMENT NOTES

a. While the station metadata for temperature are not at all robust, the given average monthly temperatures were very similar to those provided by other resources that do not cite their period of record or metadata at all; therefore the researcher elected to use this resource in the absence of a superior substitute.

b. 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.

c. 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)).

d. Available period of record: June 2017 – May 2018. Maximum measured wind gust occurred December 7, 2017.

e. 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.

f. 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.

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

h. City proper

i. USGS Well ID #331640111090801 D-02-12 07ABA located at latitude 33°16'40", longitude -111°09'08". Both years' readings are from December to avoid possible seasonal fluctuation. This is the only USGS well shown within a 10-mile radius of Superior.

j.

CREDITS: Brad Lancaster, Resource concept **| Megan Hartman,** Resource creation, research **| Dara Heward, Boyce Thompson Arboretum,** Research

SUPERIOR PLACE-ASSESSMENT REFERENCES

1. Superior station (#028348), Western Regional Climate Center, wrcc.dri.edu, accessed 4/10/2018

2. Rainwater Harvesting for Drylands & Beyond, Vol 1, or esrl.noaa.gov/gmd/grad/solcalc, accessed 4/10/2018

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

4. Boyce Thompson Arboretum weather station via WeatherLink.com, accessed by D. Heward, BTA staff, 6/7/2018 and 6/14/2018

5. "Arizona Monthly Average Pan Evaporation," Western Regional Climate Center, wrcc.dri.edu/Climate/comp_table_show.php?stype=pan_evap_avg, accessed 4/26/2018

6. "Number of Consecutive Days Precipitation < 0.01 for SUPERIOR, AZ," SC ACIS, scacis.rcc-acis.org, accessed 4/26/2018

7. "Superior, Arizona," Wikipedia, en.wikipedia.org, accessed 4/10/2018

8. "GPCD, L&U, Flex Balance prepared for Arizona Water Co - Superior, 56-002002.0000 for Report Year 2016," infoshare.azwater.gov/docushare/dsweb/Get/GWDoc-62322/56-002002.0000_2.pdf, accessed 5/15/2018

9. "Groundwater levels for the Nation," U.S. Geological Survey's National Water Information Sysytem, nwis.waterdata.usgs.gov/nwis/gwlevels?site_no=331640111090801&agency_cd=USGS&format=html, accessed 5/17/2018

10.

11.

12.