Appendix 3—Supplemental Information and Computations for Select Comparisons to Results of U.S. Geological Survey Scientific Investigations Report 2012–5051

Appendix 3 provides supplemental computations of comparisons to selected results of U.S. Geological Survey Scientific Investigations Report 2012–5051 (Bumgarner and Thompson, 2012). These comparisons rely on numerical examples and descriptions.

The initial comparison of treatable ashe juniper acreage can be made and is in reference to the section titled "Extensive Brush-Management Scenarios (Treatable Ashe Juniper)" in the main text. Bumgarner and Thompson (2012, table 6) provided 23 scenarios for "brush-management subbasins," and the results are spatially depicted in Bumgarner and Thompson (2012, fig. 8). The Bumgarner and Thompson (2012) table lists (1) subbasin area and (2) percentage of subbasin for which numerical replacement of treatable ashe juniper with grasslands was made. The arithmetic mean subbasin area ("Subbasin area [acres]") listed in Bumgarner and Thompson (2012, table 6) is about 39,900 acres, and the mean percentage of the total basin simulated as treated for ashe juniper is 22 percent, which was applied across all watersheds. The 22 percent across-the-watershed rate for treatable percentage can be derived from the arithmetic mean of column 4 ("Percent of subbasin modified") of Bumgarner and Thompson (2012, table 6). The total study area for Canyon Lake is 1,432.25 square miles (mi^2) (as numerically used within the Guadalupe River Water Availability Model), which is about 917,000 acres. For the 100-percent scenario of this investigation, the estimated treatable acreage is about 202,000 acres. In diminishing order, the estimated treatable acreages are about 161,000 acres; 121,000 acres; 80,700 acres; and 40,300 acres for the 80-, 60-, 40-, and 20-percent scenarios, respectively. These estimated acreages, albeit from ad hoc computations, can be compared to the actual treatable acreage as used in the five scenarios for SWAT simulations reported in the main text. The actual treatable acreages (rounded to nearest acre as seen within digital processing) are 197,504 (100 percent); 157,991 (80 percent); 118,482 (60 percent); 78,981 (40 percent); and 39,487 (20 percent). These computed values are in relative agreement with the estimates from the ad hoc approach. The agreement shows that the extensive brush-management scenarios of the 2013 investigation were developed by using methods matching or similar to those used by Bumgarner and Thompson (2012).

Another comparison concerning cumulative volume in Canyon Lake can be made and is in reference to the section titled "Total Inflow to Canyon Lake, 1995–2010" in the main text. Cumulative volume into Canyon Lake for the simulation period for the baseline scenario and has a value of 6,760,000 acre-feet. Bumgarner and Thompson (2012, table 3) report that the mean streamflow for the hydrologic calibration of the upper Guadalupe River SWAT for the Spring Branch streamgage is

531 cubic feet per second. By using appropriate unit conversion factors, a total volume equivalent of about 6,155,000 acre-feet for the 16-year simulation period for the streamflow is obtained.

The Spring Branch streamgage has a drainage area of 1,314.70 mi^2 (as numerically used within the Guadalupe River Water Availability Model). The drainage-area ratio method may be used to compute a rudimentary estimate of the total volume. By using an exponent of 0.9 (Asquith and others, 2006), the total volume into Canyon Lake equivalent from the Bumgarner and Thompson (2012) calibration may be computed with the drainage-area ratio method as $6{,}155{,}000\left(\frac{1{,}432.25}{1{,}314.70}\right)^{0.9} =$ $6{,}650{,}000$ acre-feet for the 16-year simulation period.

The percent change from 6,760,000 acre-feet to 6,650,000 acre-feet computed by the drainage-area ratio method is about −1.6 percent. This percentage of change is small considering the potential uncertainties and scaling-up streamflow from the Spring Branch streamgage to Canyon Lake. The computations demonstrate recovery of the baseline scenario for the upper Guadalupe River SWAT by Bumgarner and Thompson (2012) from U.S. Geological Survey archives at the Texas Water Science Center in Austin. Further, these computations also indicate reliability and demonstrate the processing of the two SWAT output (RCH and SUB) files by using single-purpose, custom Perl programming language scripts.

A last comparison concerning treated ashe juniper yields can be made and is in reference to the section titled “Total Inflow to Canyon Lake, 1995–2010” in the main text. The difference in cumulative volume for the baseline to the 100-percent scenario is about 330,000 acre-feet (7,090,000–6,760,000 acre-feet). The ad hoc computations of relative treatable area in this appendix indicated a total of about 202,000 acres in treatable area from the baseline to the 100-percent scenario. The ratio between 330,000 acre-feet and 202,000 acres produces a value of 532,000 gallons per acre over the course of the 16 years of simulation. This value equates to approximately 33,300 gallons per acre per year from treatable ashe juniper and is similar to the 34,700 gallons per acre per year reported by Bumgarner and Thompson (2012, p. 17). Numerical compatibility between the two studies thus is shown.

References Cited

Asquith, W.H., Roussel, M.C., and Vrabel, Joseph, 2006, Statewide analysis of the drainage-area ratio method for 34 streamflow percentile ranges in Texas: U.S. Geological Survey Scientific Investigations Report 2006–5286, 34 p., 1 appendix.

Bumgarner, J.R., and Thompson, F.E., 2012, Simulation of streamflow and the effects of brush management on water yields in the upper Guadalupe River watershed, south-central Texas, 1995–2010: U.S. Geological Survey Scientific Investigations Report 2012–5051, 25 p.