Appendix 6: Description of Spatial Datasets Accompanying the Conceptual Model of the Great Basin Carbonate and Alluvial Aquifer System

By Susan G. Buto

Appendix 6 of
Conceptual Model of the Great Basin Carbonate and Alluvial Aquifer System

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
gallon (gal)	0.003785	cubic meter (m^3)
gallon (gal)	3.785	cubic decimeter (dm^3)
cubic foot (ft^3)	28.32	cubic decimeter (dm^3)
cubic foot (ft^3)	0.02832	cubic meter (m^3)
acre-foot (acre-ft)	1,233	cubic meter (m^3)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
	Flow rate	
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year (m^3/yr)
acre-foot per year (acre-ft/yr)	0.001233	cubic hectometer per year (hm^3/yr)
foot per year (ft/yr)	0.3048	meter per year (m/yr)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
cubic foot per day (ft^3/d)	0.02832	cubic meter per day (m^3/d)
gallon per minute (gal/min)	0.06309	liter per second (L/s)
	Hydraulic conductivity	
foot per day (ft/d)	0.3048	meter per day (m/d)
inch per day (in./d)	25.38	millimeter per day (mm/d)
	Transmissivity*	
foot squared per day (ft^2/d)	0.09290	meter squared per day (m^2/d)

Note: The conversion factors given above are for the entire report. Not all listed conversion factors will be in any given chapter of this report.

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
°F=(1.8×°C)+32

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:
°C=(°F-32)/1.8

Temperature in kelvin (K) may be converted to degrees Fahrenheit (°F) as follows:
°F=1.8K-459.67

Temperature in kelvin (K) may be converted to degrees Celsius (°C) as follows:
°C=K-273.15

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

*Transmissivity: The standard unit for transmissivity is cubic foot per day per square foot times foot of aquifer thickness [(ft^3/d)/ft^2]ft. In this report, the mathematically reduced form, foot squared per day (ft^2/d), is used for convenience.

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The U.S. Geological Survey (USGS) Water Resources Discipline (WRD) maintains a clearinghouse for publicly available geographic information system (GIS) data on the USGS WRD National Spatial Data Infrastructure (NSDI) node. The NSDI is a physical, organizational, and virtual network designed to enable the development and sharing of digital geographic information resources (Federal Geographic Data Committee, 2007). GIS datasets created in conjunction with the Great Basin carbonate and alluvial aquifer system (GBCAAS) study have been placed on the WRD NSDI node for public access. Brief descriptions of the datasets are included below. Complete dataset descriptions including source documentation and processing steps can be accessed in the metadata documents accompanying the datasets on the WRD NSDI node. The datasets are in GIS format and require specialized software to view.

Estimated Outer Extent of Areas of Groundwater Discharge to Evapotranspiration

This dataset consists of vector polygons mapped at 1:1,000,000 scale. The polygons represent the outermost extent of areas where groundwater discharge as evapotranspiration likely occurs within the GBCAAS study area. The data are based on 1:1,000,000-scale boundaries updated with more recent, larger scale data where available. The boundaries were not independently field verified during the course of this study. Because of the scale of this dataset, horizontal positional error in these boundaries may exceed ±1,600 ft. This dataset can be downloaded from the WRD NSDI node at http://water.usgs.gov/GIS/metadata/usgswrd/XML/sir2010_5193_GWdisch1000.xml.

Basin Characterization Model Data

Total estimated groundwater recharge from the Basin Characterization Model (BCM) is the summation of in-place recharge and an assigned percentage of runoff (Flint and Flint, 2007). The data are output from the BCM described in Appendix 3 of this report. The BCM is a distributed-parameter, water-balance accounting model that is run on a monthly time step. The BCM incorporates spatially distributed parameters (monthly precipitation, monthly minimum and maximum air temperature, monthly potential evapotranspiration, soil-water storage capacity, and saturated hydraulic conductivity of bedrock and alluvium) to determine where excess water is available in a basin and if the excess water is stored in the soil or infiltrates downward into underlying bedrock.

BCM In-Place Recharge

This dataset represents average annual 1940–2006 BCM in-place recharge for the GBCAAS study area. In-place recharge is calculated as the annual volume of water that can drain from the soil zone directly into consolidated bedrock or unconsolidated deposits. This dataset can be downloaded from the WRD NSDI node at http://water.usgs.gov/GIS/metadata/usgswrd/XML/sir2010_5193_BCM.xml. Estimated in-place recharge values output from the BCM were adjusted for water-balance calculations used in the GBCAAS study. Details of the adjustments can be found in Chapter D and table Auxiliary 3A of this report.

BCM Runoff

This dataset represents average annual 1940–2006 BCM runoff for the GBCAAS study area. Runoff is calculated as the annual volume of water that runs off the mountain front or becomes streamflow. This dataset can be downloaded from the WRD NSDI node at http://water.usgs.gov/GIS/metadata/usgswrd/XML/sir2010_5193_BCM.xml. Estimated runoff values output from the BCM were adjusted for water-balance calculations used in the GBCAAS study. Details of the adjustments can be found in Chapter D and table Auxiliary 3A of this report.

BCM Saturated Hydraulic Conductivity

This dataset represents the spatial distribution of saturated hydraulic conductivity (K) of bedrock and unconsolidated basin fill in the GBCAAS study area, which is temporally invariable input data for the BCM (Flint and Flint, 2007). The dataset was developed by applying assumed K values to geologic formations derived from 1:500,000-scale digital geologic maps for Nevada (Stewart and others, 2003), Utah (Hintze and others, 2000), Oregon (Walker and others, 2002), Idaho (Johnson and Raines, 1996), and Arizona (Hirshberg and Pitts, 2000) and 1:750,000-scale digital geologic maps for California (Saucedo and others, 2000). Saturated K values in the study area range between 0.05 and 4,100 mm / day. This dataset can be downloaded from the WRD NSDI node at http://water.usgs.gov/GIS/metadata/usgswrd/XML/sir2010_5193_BCM.xml.

Hydrogeologic Framework

This dataset represents the modeled top surface altitude and extent for each of the hydrogeologic units within the study area. The dataset was constructed from a variety of data sources including digital elevation data, digital geologic map and hydrogeologic framework data from previous studies, drill-hole stratigraphic data, geologic map cross-section contacts, and regional geophysical depth to basement datasets. See Appendix 1 of this report for a detailed description of the dataset sources and framework construction. The information is also outlined in detail in the metadata accompanying the digital dataset on the WRD NSDI node at http://water.usgs.gov/GIS/metadata/usgswrd/XML/sir2010_5193_3D_HGF.xml.

Hydrographic Areas and Hydraulic Flow Boundaries

This dataset consists of vector polygons and lines mapped at 1:1,000,000 scale. The data represent hydrographic area (HA) polygons and boundary lines. The data are modified from HAs published in paper map form by the U.S. Geological Survey (Harrill and others, 1988) and later released in digital GIS format (Buto, 2009). The subsurface hydrogeologic framework layers described above were used as a basis to infer the likelihood of hydraulic connections accross HA boundaries. An attribute identifying the relative likelihood of hydraulic connection is included with the HA boundary lines. This dataset can be downloaded from the WRD NSDI node at http://water.usgs.gov/GIS/metadata/usgswrd/XML/sir2010_5193_ha1000.xml.

Potentiometric Contours and Control Points

This dataset consists of vector lines and points mapped at approximately 1:1,000,000 scale. The line data represent the potentiometric contours or groundwater altitude in the study area. The point data represent control points used to draw the contours.

The control points are based on well and spring locations and water-level measurements from the USGS National Water Information System (NWIS; Mathey, 1998) in addition to estimates of water-level altitudes in select mountain streams from National Hydrography Dataset (USGS, 1999) stream reaches and stream-gage information from NWIS. The water-level altitudes from NWIS were averaged for the period of record. This dataset can be downloaded from the WRD NSDI node at http://water.usgs.gov/GIS/metadata/usgswrd/XML/sir2010_5193_potentiometric1000.xml.

References Cited

Buto, S.G., 2009, Digital representation of 1:1,000,000-scale Hydrographic Areas of the Great Basin: U.S. Geological Survey Data Series Report 457, 5 p., available at http://pubs.usgs.gov/ds/457/.

Federal Geographic Data Committee, 2007, accessed December 4, 2008 at http://www.fgdc.gov/.

Flint, A.L., and Flint, L.E., 2007, Application of the Basin Characterization Model to estimate in-place recharge and runoff potential in the Basin and Range carbonate-rock aquifer system, White Pine County, Nevada and adjacent areas in Nevada and Utah: U.S. Geological Survey Scientific Investigations Report 2007–5099, 30p.

Harrill, J.R., Gates, J.S., and Thomas, J.M., 1988, Major ground-water flow systems in the Great Basin region of Nevada, Utah, and adjacent states: U.S. Geological Survey Hydrologic Investigations Atlas HA–694–C, 2 sheets, scale 1:1,000,000.

Hintze, L.F., Willis, G.C., Laes, D., Sprinkel, D.A., and Brown, K.D., 2000, Digital geologic map of Utah: Utah Geological Survey Map 179DM.

Hirshberg, D.M., and Pitts, S.G., 2000, Digital geologic map of Arizona: A digital database derived from the 1983 printing of the Wilson, Moore, and Cooper 1:500,000-scale map: U.S. Geological Survey Open File Report 00–409, 67 p., 3 sheets, also available at http://geopubs.wr.usgs.gov/open-file/of00-409/.

Johnson, B.R., and Raines, G.L., 1996, Digital representation of the Idaho state geologic map, a contribution to the Interior Columbia Basin Ecosystem Management Project: U.S. Geological Survey Open-File Report 95 –690, 24 p with two datasets, available at http://pubs.usgs.gov/of/1995/of95-690/.

Mathey, S.B., ed., 1998, National Water Information System (NWIS): U.S. Geological Survey Fact Sheet 027–98, 2 p., accessed January 14, 2009 at http://pubs.usgs.gov/fs/FS-027-98/fs-027-98.pdf.

Saucedo, G.J., Bedford, D.R., Raines, G.L., Miller, R.J., and Wentworth, C.M., 2000, GIS data for the geologic map of California: California Geological Survey, CD 2000–07.

Stewart, J.H., Carlson, J.E., Raines, G.L., Connors, K.A., Moyer, L.A., and Miller, R.J., 2003, Spatial digital database for the geologic map of Nevada: U.S. Geological Survey Open-File Report 03–66, version 3.0, 32 p. 2 sheets, with database, available at http://pubs.usgs.gov/of/2003/of03-66/.

Soil Conservation Service, 1991, State soil geographic data base (STATSGO), data user's guide: Washington, D.C., Miscellaneous Publication 1492, 88 p.

U.S. Geological Survey, 1999, National Hydrography Dataset: U.S. Geological Survey Fact Sheet 106–99, accessed March 2007 at http://erg.usgs.gov/isb/pubs/factsheets/fs10699.html.

Walker, G.W., MacLeod, N.S., Miller, R.J., Raines, G.L., and Connors, K.A., 2002, Spatial digital database for the geologic map of Oregon: U.S. Geological Survey Open-File Report 03–67, version 2.0, 21 p., available at http://pubs.usgs.gov/of/2003/of03-067/.