DRAFT PRELIMINARY – MATERIALS FOR REVIEW AND COMMENT

Report on the Development of a Use Case for Surface Water – Groundwater Interactions Data Dashboard for Texas

Introduction

Experts on data for surface water – groundwater interactions in Texas were identified and invited to participate in a workshop to develop a Use Case on surface water – groundwater interactions (Table D-1). In advance of the workshop, participants were asked to review reference materials about past efforts to develop an internet of Texas water data and to learn about developing Use Cases and using a template for assembling Use Case information (for links to all reference materials see: https://usecase.water-texas.org/reference-material/). Also in advance of the workshop, participants were asked to fill in an online database of data available and data needs that could be used in a Use Case on surface water – groundwater interactions. That database was used to develop the Use Case description.

Workshop

Workshop participants started by discussing and then listing Use Case topics related to the subject of surface water – groundwater interactions in Texas. Participants were provided with initial direction that the Use Case be applicable statewide, but that scaling it back geographical or by relevant project limits type could be done later pending available resources. They were also informed that while it may be appealing to recommend collection of new data or research, setting up projects to collect new data may be outside the practical scope of a Use Case for Texas at this time.

Participants developed an initial list of specific topics for the Use Case as a means to begin focusing discussion (Table SG-2). These topics were placed into general categories. While there were eight unique studies recommended as potential topics, six workshop participants recommended that the Use Case be directed at developing a data dashboard or a user accessible database for a multitude of surface-water and groundwater data sets. The Use Case was formed around discussion on these recommended topics. It was clear there was general agreement that the Use Case be developed around the topic of a data dashboard for surface water and groundwater and interactions in Texas. Participants then defined specific objectives for the project, data requirements, and actions to design and build the dashboard. Participants also addressed the question of who would –own– the dashboard. There was a general feeling that such a dashboard would need to be held by Texas Water Development Board (TWDB). Many of the data sets that participants recommended for possible inclusion in the dashboard are already held by or accessible through the TWDB (Table SG-3).

The Use Case is described in Table SG-3.

Table SG-1. Participant list and workshop attendance.

First Name	Last Name	Affiliation	Workshop
Aaron	Abel	Brazos River Authority	Yes
Kathy	Alexander	Texas Commission on Environmental Quality	Yes
Tim	Finley	Dow Chemical-Freeport	No
Larry	French	Texas Water Development Board	Yes
Marcus	Gary	Edwards Aquifer Authority	Yes
Ron	Green	Southwest Research Institute	Yes
Sam	Hermitte	Texas Water Development Board	No
Michelle	Lapinski	Earth Genome	No
Cindy	Loeffler	Texas Parks and Wildlife Dept.	Yes
Glen	Low	Earth Genome	Yes
Robert	Mace	Meadows Center	No
Leah	Martinsson	Texas Alliance of Groundwater Districts	No
Brooke	Mcgregor	Texas Commission on Environmental Quality	Yes
Ali	Saleh	Texas Institute for Applied Environmental Research	Yes
Sarah	Schlessinger	Texas Water Foundation	Yes
Raghavan	Srinivasan	Texas A&M AgriLife Blackland Research & Extension Center	Yes
Moore	Stephanie	Daniel B. Stephens & Associates	Yes
Darrel	Tremaine	UT Environmental Science Institute	No
Andy	Weinberg	Texas Water Development Board	Yes
Mark	Wentzel	Texas Water Development Board	Yes
Gary	Westbrook	Post Oak GCD	Yes

Table SG-2. List of topics for a surface water - groundwater interactions Use Case, grouped by general topic area (minor editing only applied).

List of Recommended Topics for a Surface Water / Groundwater Interactions Use Case
A Use Case to develop a **dashboard/database** for surface water / groundwater interactions
• Develop a surface water - groundwater interactions dashboard: use the relationship between groundwater withdrawals in Val Verde County on surface flows in Devils River, or a similar example, as a pilot in conjunction with building the surface water - groundwater interactions dashboard. Focus on similar hot topics that are geographically diverse
• Build a dashboard to display correlations of springflow and groundwater level, by county or river basin
• Develop a groundwater - surface water dashboard: a use case that leads to a more efficient use of both groundwater and surface water
• Build a groundwater availability dashboard: a use case to view how much groundwater is available by desired future conditions, groundwater conservation districts permits, pumping reports, and static groundwater levels
• Provide data storage (banking), maintenance, and accessibility/access for different users with specific needs and formats through a readily accessible internet-based user interface
• Combine groundwater level, streamflow, extraction/use into a database
A Use Case to investigate a specific aspect of interactions between groundwater and surface water
• Quantify spring flows and discrete recharge to the Middle Trinity and Edwards aquifers in the Blanco River Basin using existing USGS gage data
• Estimate long-term trends of surface water and groundwater fluxes across alluvial aquifers in Texas
• Establish relationships between river flows and water surface elevation in connected aquifers (and vice versa), completing water budgets for specific systems
• Determine ground water quality and quantity as affected by surface water
• Delineate and quantify the recharge zones for all the major and minor aquifers.
• Establish the relationship of groundwater basins versus surface water basins as a means to determine the impact of groundwater pumping on surface flow
• Quantify the potential of redirecting excess flood flows (surface water) to recharge aquifers (groundwater)
• Stream gage locations relative to the outcrop areas of major and minor aquifers. Records of groundwater withdrawals in these areas

Table SG-3. Use Case details.

Use Case Title	Surface Water - Groundwater Data Dashboard for Texas: A Use Case to compile existing surface water - groundwater data and make it available in a FAIR[1], georeferenced database to which new data and data sets can be added over time, including addition by contributors where data are subject to review and verification. [1]FAIR: F=Findable, A=Accessible, I=Interoperable, and R=Reusable
Objective	To design and build a surface water - groundwater data dashboard for Texas that thoroughly considers key stakeholder input in the design, build and uses of the dashboard, including input from the general public to aid in making the dashboard universally valuable in enabling users to make better decisions about managing their water resources.
Description	• The Use Case will collect and display available groundwater and surface-water data stratified by river basin, including permitted water rights (groundwater and surface water) and in-stream flow targets (or environmental flow targets) as appropriate by groundwater conservation district and stream reach. • The dashboard build will start with FAIR data, add basic comparison functions, then over time add more water quality data that will enable identification of future data needs. • Populate the dashboard with data sets that will initially focus on high priority or high profile river basins or locations, such as San Felipe Springs, Devil's River, Blanco River, Brazos, Colorado River near San Saba, Balmorhea/San Solomon Springs. include areas where there is large data sets. • Initial work will also define who is expected to use the dashboard. These stakeholders or stakeholder groups will be identified and asked to provide input on what they need and how they would use such a dashboard. The project would also develop an example dashboard, or mock-up to start the discussion with stakeholders and help define and test needs and desires, potentially allowing development of multiple entry points to data sets for different levels of users or users with different needs, including delivery of information synthesized for public use.
Participants	In the initial target areas: • Groundwater conservation districts and other groundwater managers • River authorities and other surface-water managers • Regional water planners • Water rights holders/ownership • Counties and major cities government and elected officials • Water providers • Texas Water Development Board and collaborating Texas state and federal agencies • Texas Commission on Environmental Quality • A representative group of the general public

Regulatory Context	There are no regulatory matters involved in development of an information dashboard. Development of public information portals is not subject to regulatory or statutory oversight. However, there will be interest by elected officials at all levels of Texas government and agency regulators in having surface-water and groundwater information and predictive data about interactions affecting water availability made more widely accessible and understandable to local and state-wide decision makers and elected officials, water managers, water utility operators, regulated water users and permit holders, and to the general public
Workflow	Identify potential funders and make initial contact where possible and appropriate. Develop a framework work plan and budget for the Use Case. Using the plan and budget as a guide develop a proposal for funding by potential funders. Develop the work plan to design and build the dashboard, including architecture, function, tools, interface, and backend Develop a mock-up dashboard to provide a working example for stakeholder education, testing and input. Identify initial river basins or locations to serve as initial subjects for populating the dashboard with FAIR data. Focus the following efforts on each basin or location as work proceeds. Repeat as new basins or locations area added, with data fit for each new specific purpose adding to the evolution and iterative building of a comprehensive dashboard. • Create and use a local stakeholder network or advisory group for project review and input on development of locally desired features and functionality of the dashboard by area, as opposed to relying only on technical experts and programmers. • Gather and add relevant data sets relevant to each location, gradually building a comprehensive dashboard. • Develop/adapt a mock-up dashboard for each new area to provide a working example for stakeholder education, testing and input. • Develop a marketing plan to describe the benefits/results of better management of water by users of the decision support tools available on the dashboard.
Data Sources	

Data Category	Description	Availability	Data source	Access Method	Added Characteristics
Weather, river stage	Real-time temp, precipitation, wind chill, heat index, humidity, wind, soil moisture, soil temp, river flow, river stage	Accessible	Texas Water Development Board, TexMesoNet	https://www.texmesonet.org/	
Groundwater levels	Daily water level (feet below ground surface) for 234 wells across the state	Accessible	Texas Water Development Board	www.waterdatafortexas.org/groundwater/	Daily water level (feet below ground surface) for 234 wells across the state; Few (in any?) of these wells are in alluvial aquifers; Priority could be placed on instrumenting at least some wells in alluvial aquifers in the future.
Field studies of Colorado River and Carrizo-Wilcox Aquifer in Central Texas	Report prepared to support the update of the groundwater availability model of the Central Carrizo-Wilcox Aquifer	Accessible, data may not be readily interoperable	Texas Water Development Board	http://www.twdb.texas.gov/groundwater/models/gam/czwx_c/Final_BBASC_083117.pdf?d=1566575514973	
Surface water and aquifer relationships in the Brazos River Alluvium	Report prepared to document the conceptual model of the groundwater availability model of the Brazos River Alluvium	Accessible	Texas Water Development Board	http://www.twdb.texas.gov/groundwater/models/gam/bzrv/BRAA_AQUIFER_GAM_REPORT_ALL.PDF	
Texas aquifers	Both major (9) and minor (22) aquifers as defined by TWDB	Accessible	Texas Water Development Board	http://www.twdb.texas.gov/mapping/gisdata.asp	Available shapefiles; Website includes many other pertinent GIS data (e.g. river basins, rivers, reservoirs, etc.)
Summary report of groundwater-surface water interaction in Texas	Estimated groundwater flow to surface water based on historical baseflow data from nearly 600 USGS stream gauging stations.	Accessible	• Texas Water Development Board • U.S. Geological Survey	http://www.twdb.texas.gov/groundwater/docs/studies/TexasAquifersStudy_2016.pdf?d=1566575164951	• Base flow from USGS stream gauges, TWDB aquifer properties and map • Report prepared by TWDB at the direction of the 84th Texas Legislature (H.B. 1232)
Spring discharge	stage/discharge relationships and time series groundwater elevation and spring discharge records	Limited availability	Limited; some springs included in TWDB groundwater database	https://www.twdb.texas.gov/groundwater/data/index.asp	• Few spring discharge values available • Spring rating curves linking stage and discharge generally not available
GW pumping data	Time series volume of water pumped by well (spatially explicit), covering all well types (including exempt wells)	Limited availability	• Texas Water Development Board • Groundwater Conservation Districts • Others		• Pumping data are scarce • Estimates by different agencies are mixed and use a number of assumptions to estimate

Data Category	Description	Availability	Data source	Access Method	Added Characteristics
Soil moisture	Remotely sensed soil moisture products (e.g. SMAP products) and modelled soil moisture from the NLDAS suite of models.	Accessible, variable coverage	• Texas Water Development Board • Natural Resources Conservation Service, Soil Climate Analysis Network	www.texmesonet.org; NRCS-SCAN sites	• Soil moisture data are currently available only from a few point measurements. The TexMesonet stations are collecting soil moisture. However, there needs to be a much wider spatial coverage of in-situ observations. • Remotely sensed soil moisture products (e.g. SMAP products) and modelled soil moisture from the NLDAS suite of models. These are available from NASA's DAACs and from Mirador but it would be nice to collate the data and have it accessible as soil moisture maps and other value-added products (e.g. soil moisture anomalies for a given month or season). While these datasets are replacements for in-situ data they can be used in tandem with in-situ data. The plus point for the remotely sensed or modelled products is that they provide continuous surfaces and may provide useful information on soil moisture variability across the state.
Potential areas with SW/GW interaction	SW/GW interaction evaluation for 22 Texas River Basins	Accessible but generally not in a database; many numbers/studies in published papers and reports	Texas Natural Resource Conservation Commission	https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/Surface-Groundwater_Interaction.pdf	• Assessment of SW/GW interaction for river segments. Points out areas of the state where interaction is expected to occur (and relative degree of interaction) • Data is dated (circa 1999). Qualitative more than quantitative
Streamflow gain/loss	Streamflow measurements along a reach to define interactions between surface water and groundwater	Accessible, usability variable	U.S. Geological Survey	https://pubs.usgs.gov/of/2002/ofr02-068/	• Three-hundred sixty-six streamflow gain-loss studies in 249 unique reaches • Highly variable results • Snapshot in time measurements don't reflect groundwater dynamics • Data does not address bank storage; Existing methods are difficult and expensive; new methodologies needed. Doesn't include results from studies completed after 2000.

Data Category	Description	Availability	Data source	Access Method	Added Characteristics
Stream and spring discharge	Real-time stream and spring discharge	Accessible	U.S. Geological Survey	https://waterdata.usgs.gov/tx/nwis/current/?type=flow	• Stream flow at 640+ sites. Spring flows for 10 springs including (Chalk Ridge Falls, Felps, Barton, San Marcos, Comal, Hueco, Jacobs Well, Giffin, San Solomon, and Las Moras) • Data do not exist for many springs in Texas
Groundwater levels	Real-time groundwater elevations	Accessible	U.S. Geological Survey	https://waterdata.usgs.gov/tx/nwis/current/?type=gw	• 15-minute data for water level for 35 wells across the state; Few (in any?) of these wells are in alluvial aquifers • Priority could be placed on instrumenting at least some wells in alluvial aquifers in the future.
Geodatabase	Geologic and hydrogeologic information for a geodatabase for the Brazos River Alluvium Aquifer	Accessible	U.S. Geological Survey	https://pubs.usgs.gov/of/2007/1031/ https://pubs.usgs.gov/sim/2989/	• Data were compiled primarily from drillers and borehole geophysical logs from government agencies and universities, hydrogeologic sections and maps from published reports, and agency files • Provides estimate of alluvial aquifer extent and thickness for one alluvial aquifer in Texas. Much less data available for other alluvial aquifers in the state.
Streamflow gain/loss	Gain/loss study for Colorado River in Burnett and San Saba Counties	Accessible	U.S. Geological Survey	https://pubs.er.usgs.gov/publication/sir20155098	• Traditional gain/loss study on about 10 miles of the Colorado River • Typical gain loss study with use of ADCPs to make flow measurements. Example of study completed after #3 and #10 above.
Streamflow gain/loss	Gain/loss study for Guadalupe River in Gonzales County	Accessible	U.S. Geological Survey	https://pubs.er.usgs.gov/publication/fs20183057	• Gaining and losing sections of river determined using floating geophysical methods • Methods provide an indication of gaining or loosing but don't quantify the amount. Map the length of segment (not just individual points).

Data Category	Description	Availability	Data source	Access Method	Added Characteristics
Streamflow gain/loss	Gain/loss study for the Brazos River from McLennan County to Ft. Bend County	Accessible	U.S. Geological Survey	https://pubs.er.usgs.gov/publication/sir20075286	Base flow (1966-2005) and streamflow gain and loss (2006) of the Brazos River, McLennan County to Fort Bend County, Texas
Streamflow gain/loss	Gain/loss study for the Brazos River from NM-Texas State Line to Waco, Texas	Accessible	U.S. Geological Survey	https://pdfs.semanticscholar.org/92e0/bbbaf13ceb477442ac9d9a2f966714151776.pdf?_ga=2.107396166.51329	Base flow (1966-2009) and streamflow gain and loss (2010) of the Brazos River from the New Mexico□Texas State Line to Waco, Texas
Spring locations	USGS database of Texas springs	Accessible	U.S. Geological Survey	https://doi.org/10.3133/ofr03315	
SW/GW relationship	Estimate of groundwater outflow versus Medina Lake stage	Accessible, unknown usability	U.S. Geological Survey	https://pubs.er.usgs.gov/publication/fs20173008	• Regression equations for GW outflow vs. stage based on measurements from 1955-64, 1995-96, and 2001-2002 • Example of the type of data that needs to be collected to estimate GW recharge from surface water bodies
Surface Water quantity/quality	Data related to surface water quality and quantity at field and watershed scales	Accessible	Texas Institute for Applied Environmental Research, Tarleton State University	Contact at Saleh@tarleton.edu	• Over 25 years of water quality and quantity data collected from number of watersheds in Texas for data analysis and modeling • Data related to interaction of surface and ground water quality and quantity; Surface water quality and quantity data for many locations are of limited use
Overview of the impacts of GW/SW interactions on water quality and quantity	Groundwater-surface water interactions in Texas	Accessible, use limited by location	Bureau of Economic Geology, University of Texas	http://www.beg.utexas.edu/staffinfo/pdf/scanlon_gwswr2005.pdf	Data limited to certain locations in state.
Streamflow/River Forecasts	Times series of river stage forecasts and streamflow at certain USGS gaging stations during certain conditions.	Accessible, use limited	West Gulf River Forecast Center	https://www.weather.gov/wgrfc/obsfcst#	• Depending on conditions forecasts of river stages and associated streamflow and various USGS gaging stations • Currently, streamflow forecasts are not typically available for "normal" and "dry" conditions
	Spring flow targets where already specified	Accessible, where specified as desired future conditions			May be policy-oriented target value

Data Category	Description	Availability	Data source	Access Method	Added Characteristics
	Environmental flow targets	Available but not in a publically accessible database	TCEQ	Database in development with TPWD	May be policy-oriented target values, not collected data
	Desired future conditions	Available but not in a publically accessible database	TWDB	https://www.twdb.texas.gov/groundwater/management_areas/index.asp	May be policy-oriented target values, not collected data
	Base flow separation using water chemistry - better data.				• Data not now generally available • A data need
	GAM and WAM models outputs as well as inputs	Available but not wholly FAIR	TWDB and TCEQ	https://www.twdb.texas.gov/groundwater/models/gam/index.asp	
	Remote sensing ET data over a period of time	Not generally available			• Data not now generally available • A data need

Acronym definitions.

GCD	Groundwater Conservation District
IBWC	International Boundary and Water Commission
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
PUC	Public Utility Commission of Texas
SCAN	Soil Climate Analysis Network
TCEQ	Texas Commission on Environmental Quality
TIAER	Texas Institute for Applied Environmental Research
TNRCC	Texas Natural Resource Conservation Commission
TNRIS	Texas Natural Resources Information System
TWDB	Texas Water Development Board
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UT	University of Texas
GCD	Groundwater Conservation District
IBWC	International Boundary and Water Commission
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
PUC	Public Utility Commission of Texas
SCAN	Soil Climate Analysis Network
TCEQ	Texas Commission on Environmental Quality
UI/UX	User interface/user experience