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Arizona Department of Water Resources
Assured and Adequate Water Supply Program
Attn: Mr. Frank Corkhill
3550 N. Central Avenue
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RE: Comments on ADWR's "Hydrologic Data and Draft Recommendations Related to the Review of 100-Year Physical Availability Depth Criteria for Demonstrating Adequate Water Supplies" % SB 1575

Drear Mr. Corkhill,

I truly appreciated the opportunity to have participated as a stakeholder in support of ADWR's policy development effort. However, upon my and Mr. Walker's review of the draft document it became apparent that additional input and clarification of thoughts may be helpful. Please consider the following discussion and comments prior to finalizing the above referenced draft recommendations in support of policy development.

General Comment:

I am concerned that hydrgeological complexity, a general sparseness of data in northern Arizona (due to limited private land), and limited hands on experience with northern regional aquifers has been taken to formulate a far too conservative position at the Department. The reader finds one's self considering that ADWR has very little confidence in the presence of regionally extensive and/or viable aquifers in northern Arizona and has therefore developed a policy to prove this. The presumption appears particularly pointed at bedrock environments where impractical requirements, such as, 30 day pumping tests and the application of large scale geophysics are required. Such pumping tests have little purpose other than to stress a well/aquifer to a point never to be observed in real world operations, resulting in the creation of an over pumped and/or what I call a "false boundary" condition. While geophysics are useful, they are not a "one size fits all" application.

An apparent reluctance to consider northern Arizona aquifers at the Department is due in part to a lack of experience with them and a "stigma" assigned to northern Arizona via case histories from chronically water short areas such as Pine and Williams, for example. It is strongly suggested that the Department not only reference recent investigations in these areas but acknowledge the positive results from exploration and testing which have clearly demonstrated that deep regional aquifers do, in fact, exist and are quite extensive

(multiple studies by USGS % Bills, Parker, et all, HydroSystems Inc. (projects in Bellemont and Flagstaff), Highland Water Resources Consulting Inc. (Regional aquifer wells in Pine), Mogollon Rim Water Resources Management Study (Bureau of Reclamation, 2008 including works by: Gaeaorama's Conway , UofA's Eastoe, and HydroSystems' Small)). In further consideration of case histories in light of the above studies the Department should acknowledge that many areas with chronic water shortages had them for two reasons: 1) Costs relative to complications when drilling into deeper sources, resulting in few truly deep wells, and therefore 2) A reliance on numerous competing low yield wells and drought sensitive shallow perched aquifers and/or partially penetrating (low efficiency) regional aquifer wells.

Though well yields from northern Arizona's deep regional aquifers can be variable and are an order of magnitude or two less than typical basin and range valley fill aquifers (as expected) this does not linearly correlate with lower long-term sustainability and over-all storage. In fact, what these northern regional aquifers lack in high well yields and local storage variability, relative to valley aquifers, is by far made up by regional extent and documented renewable recharge rates (MRWRMS and USGS Parker & Bills studies). Particularly when considered in light of 1) The availability of potentially developable land vs. the vastness of the northern regional aquifers (C-aquifer, R-aquifer, and X-aquifer (R and X are connected)) and 2) The amount of recharge these aquifers receive on an annual average basis, ones perspective of the situation changes. However it would be wise for ADWR to remain conservative by adopting rules for well spacing, based not only on locally derived data but regionally available information, to prevent localized over-development of these aquifers.

Long-term Pumping Tests:

There is much discussion within the draft concerning the radius of influence of a well as related to proposed long-term pumping test requirements. Within the context of 100 year projections, so long as analyses are conducted properly and conservatively, a 7 day continuous pumping test is more than adequate. By analyzing conservatively, I mean to suggest that boundary conditions observed during 7 day testing result in a temporary steeper slope than when no boundary is being encountered. In such instances, the steeper slope of drawdown at the boundary (or dual porosity effect) should be considered for the 100 year projection alongside the "normal" drawdown slope. This leads the hydrologist to project a range of drawdown out to 100 years with the "boundary slope" being the worst case drawdown or "drought" scenario while the "normal" is a "no drought" scenario. So long as the maximum depth to water is not exceeded at 100 years in the "boundary" or "drought" scenario the water supply can then be designated adequate (See Strawberry Hollow Hydrogeological Investigation, ADWR file 22-401908). Again, the only purpose for pumping longer is to identify boundary conditions that would otherwise not be encountered under normal operation of the well. Therefore, testing longer than 7 days is wasteful, impractical, and ultimately cost prohibitive, particularly for deep wells in northern Arizona (See well testing costs provided by Mr. Gary Small in draft). It should be recalled that the purpose of a well test is not only to generate data for long-term projections but also to develop data for aquifer characteristics. There is plenty of such

data generated for this purpose within 7 days of pumping and 7 days of recovery. The equations that are utilized to evaluate groundwater flow require logarithmic based analyses. This limits the useful resolution of data beyond a 7 day period, due to scale. So too, in my experience with alternative analysis methods for fracture media, I have found that they are no better at arriving at acceptable aquifer parameters than standard methods. Therefore, they do not warrant the additional time, data, and expense required to work with them. Though somewhat out of date, Mr. Walker and I have felt that you may wish to review a copy of Payson's old groundwater testing guidelines. The process, developed by Southwest Groundwater Consultants Inc. for Payson, proved valuable for our considering new groundwater sources in the recent past.

Percentage of Aquifer Saturation Relative to Pumping Test Requirements:

It is curious how one can establish such criteria w/o first conducting an aquifer test and analyses. There seems to be a "chicken or egg" issue here.

Geophysics Requirement:

Though locally quite helpful and a good exploration tool, a requirement for surface geophysics should not remain in policy as not all sites are suitable for the application of geophysical techniques. So too, to be effective they must be conducted over a large area to be useful. Such studies may be cost prohibitive to employ.

Closing Suggestions and Comment:

A stepped 24 hour pumping test followed by a 7 day pumping tests (with 7 day recovery), at no more than 80% of a well's capacity (estimated via step test), is more than sufficient for 100 year projections. To add reassurance here, it is suggested that ADWR not only adopt locally relevant well spacing rules but require resource management to minimize demands to within an areas sub-regional "safe yield". For example: No more than 80% of estimated safe yield and/or local groundwater flux within capture by the well(s) may be committed to build-out demand. If an area's sub-regional "safe yield" is unknown ADWR should consider establishing an initial estimate based on existing data and then refining it as new wells and test results warrant. This could be done to encourage the development of data for future numerical modeling. I also would like to suggest that not only water quality but isotopes be considered to further support conceptual model development for northern Arizona's aquifers. Once a solid conceptual model is complete numerical modeling can then follow.

A link of supply and demand should be recognized further via ADWR AWS policy. Assumptions utilized in 100 year projections are based on a demand that could be reined-in through per capita usage targets and limits on out-door water use, which could be linked to maintaining a 100 year adequacy designation. So too, a recharge provision for reclaimed water returned directly to the aquifer would be helpful.

I am hopeful that the concepts and comments outlined above will help ADWR to formulate a policy which will conserve resources and promote sustainability while also encouraging the gathering of much needed data. As currently proposed I fear the process would discourage data collection by being publicly and technically perceived as wasteful and ultimately would be cost prohibitive. Many lessons have been learned through both success and failure regarding bedrock aquifers hear in Payson. The Payson Water Department would like to share our philosophy that brought us our success in developing and maintaining fractured bedrock groundwater supplies as a renewable resource in northern Arizona. We would be honored to serves as a model for ADWR to consider and potentially utilize in policy development. Thank you for your time and consideration.

Regards

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cc
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Attachment