



June 19, 2020

**TECHNICAL MEMORANDUM**

TO: Dave Doran  
President  
UBSCGWMD Board  
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FROM: Mike Wireman  
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SUBJECT: Issues / Concerns related to use of septic tank effluent as a source of water for replacing depletions related to pumping from the Denver Basin bedrock aquifers within Designated Groundwater Basins

Pursuant to CRS 37-90-107 appropriation of groundwater from the Denver Basin bedrock aquifers within Designated Groundwater Basins requires a water rights determination (basin determination, BD) be completed by the Colorado Groundwater Commission. Based on the BD the CGWC establishes an annual allocation from each underlying bedrock aquifer. Rule 53.6.2 of the Designated Basin Rules requires replacement of depletions associated with pumping not-nontributary bedrock groundwater. For not-nontributary wells located more than one mile from the point of contact between the aquifer and the stream including its alluvium, 4% of the annual withdrawal must be replaced. For not-nontributary wells located within one mile of this point of contact, actual depletions must be replaced. According to the Groundwater Commission Staff determination, all high capacity wells within the UBSC Designated Groundwater Basin, that pump from the Dawson aquifer, are required to replace full depletions. Estimated depletions are calculated using a standardized model developed by the Colorado Division of Water Resources.

As required in water rights determinations, replacement plans include, among other things, information on the proposed source of replacement water, the method of introducing the water to the stream or associated alluvial aquifer, and reporting submitted to the CGWC for approval. Currently the CGWC allows discharge effluent from septic systems as a source of replacement water for both 4% replacement requirements and full replacement requirements.

There is increasing concern from the Upper Black Squirrel Board of Directors that approving septic tank discharge as a source of replacement water to replace depletions is not appropriate because:

1. The annual discharge from the septic tank is not measured and is assumed to be 90% of in-house water use. The basis for this assumption is unknown. There has apparently been no effort to verify this assumption with empirical monitoring data. In addition, estimates of annual in-house use are also subject to uncertainty if totalizing flow meters are not required on all bedrock wells.
2. There is uncertainty related to the calculation of the estimated annual depletions to overlying alluvial aquifers or streams that results from pumping the Denver Basin bedrock aquifers. The depletions are estimated using a Colorado Division of Water Resources groundwater model (AUG3) - which assures compatibility -but does not address the inherent uncertainties. Again, there has apparently been no effort to verify the results of the modeling with empirical monitoring data. This uncertainty is a general concern for all Denver Basin pumping depletions regardless of the replacement source.
3. Flow away from septic systems can be complicated due to the inherent heterogeneity of the subsurface. Flow paths, flow velocities and saturation conditions can vary significantly. There is some uncertainty as to whether all the discharge from a septic system will reach the nearby stream or alluvium prior to discharging to the surface or evaporating. Applicants often use a groundwater flow model – the Alluvial Water Accounting System (AWAS) developed by Colorado State University) to calculate estimated volume and timing of accretions (recharge) to the stream or alluvial aquifer from the septic system discharge. This model is simplistic and is more appropriate for estimating stream depletions due to pumping from a well producing from the adjacent alluvial aquifer. The model is not capable of simulating the complexity of the stream-alluvial system which results in significant uncertainty.
4. Treatment effectiveness can vary significantly among septic systems depending on the quality of wastewater delivered to the system. There is significant uncertainty regarding the transport and fate of dissolved and suspended constituents in the septic system discharge. Biological and geochemical conditions in the unsaturated and saturated zones will vary spatially and temporally. This results in uncertainties regarding the contamination of the alluvial aquifer and or receiving stream.
5. Long-term maintenance of individual septic systems is often inadequate which also effects treatment effectiveness.
6. Current CGWC policies do not adequately consider the cumulative effect of septic system discharges in a region of the aquifer. Little consideration is given to the location of septic systems within the alluvial groundwater flow system nor the potential for attenuation of contaminants in the subsurface that will become a source of residual contamination. In areas where there is a high density of individual septic systems this could be a significant issue.
7. It is difficult to enforce the requirement that the bedrock well owners record annual withdrawal from the wells and report data to the CGWC and the UBSCGWMD by February 15 of following year.
8. There is an administrative assumption that once approved, the replacement plan will be adequate for replacing depletions for at least one hundred years. There is no safeguard aimed at determining if a particular septic system discharge is not complying with the replacement requirements nor is there any guidance for modifying a replacement plan if necessary.