

A Method for Determining the Functional Condition of Shallow Domestic Pumped Water Wells with a Declining Water Table that Is Applicable to the IWV Basin.

(This report supports Data Gap agenda item 3c.i) of the 11/1/2018 IWVGA TAC meeting.)

By Dr. Don Decker, IWV Domestic Well Owner Association representative, 11/2/2018

1) Introduction This note provides specific details of a method to determine the present and likely future functional condition of drilled water wells prepared in accord with American Water Works Association (AWWA) guidelines for domestic wells in unconfined aquifers. These guidelines are widely followed and specifically include the IWV Basin. Such wells are drilled to a depth so as to provide 100 feet of standing water in the completed well. As is ordinarily required by code, the well will then be cased to provide durability and sanitary protection and the bottom 40 feet of casing in such a well will be perforated to provide access by the aquifer water to the well bore. At the time of completion, there is then 60 feet of water in the well above the top of the perforated section.

The purpose of this report is to provide details of a method of evaluation of the functional condition of IWV Basin shallow domestic wells that will ultimately be incorporated into a Sustainability Management Plan. The approach suggested in this report is viable even when fully documented well construction information is not available.

2) Summary of typical domestic well pump installation A portion of this 60 feet will be taken by a certain amount of water coverage to ensure that the pump intake is always submerged. In a properly developed and functioning low horsepower domestic well, the pumping water level will be no more than a few feet below the static level. If the water table were stable in time, the minimum static safe intake coverage then might be as low as 10 feet. However, 20 feet is far safer, particularly with further consideration of the inevitable consequences of the seriously declining water levels in the critically over-drafted IWV basin. Many wells in the IWV Basin are experiencing declines in the range of 1.5 to 2 ft/yr. Most IWV domestic well motor/pump life is reported to be in the 10 to 15 year range. It can easily be seen that a minimum coverage of 20 feet is necessary even for a planned short 10 year motor/pump life. A not very conservative 40 ft of freeboard is thus available under these conditions in a newly drilled well prepared to AWWA recommendations under present conditions in the IWV Basin.

3) Well end of life The practical end of life of a well is reached when the pump intake is located in the casing perforated zone. At this point, it is very likely that the pump production of fines will significantly increase, resulting in an accelerated wear of pump impeller eye seals and bearings and mechanical failure. Even as serious as this condition is, it is customary to assume that the pump will function for its usual full life. The intake coverage is designed accordingly and is identical to the earlier value described above. With these assumptions and observations, the projected life of a new AWWA based well in the IWV is a very short 27 years even for water level declines of 1.5 ft/yr (40 ft/1.5 ft/yr). For declines of 2 ft/yr the projected life is only 20 years. If a more conservative pump inlet coverage than 20 ft is assumed, these numbers become even smaller. These well life numbers illustrate the reason so many shallow domestic wells in the IWV basin have already failed or will do so shortly.

4) Use of existing reported data In the IWV Basin with nearly continuous declining water levels for the past 50 years and more, it is essential for both individual well owners and Basin Management Authority to track the functional condition of wells to provide input to an assessment of the operational health of personal and overall Basin wells respectfully. The details of the well construction are sometimes not known but the standard practices of the well drillers in a given area

are easily discovered by an examination of the wells for which completion data is available. The AWWA guidelines are very often followed and such is the case in the Indian Wells Valley Basin. The great majority of domestic, co-op and mutual wells in this Basin were drilled by Kirschenman Well Drilling from 1970 to 2000+ following AWWA guidance. These wells were drilled with permits from the Kern County Health Department and the date of completion is part of the well report. This report also provides confirmation of the well design and location and depth to water. Most IWV Basin wells are located on properties of 10 acres or less. The well location is often a street address. A location description for a well within a 10 acre area is more than adequate for most parcels for the purpose described herein.

The Kern County Water Agency (KCWA) has provided biannual water level measurement data for about 30 years. This data is readily available and covers in considerable detail all of the productive area of the Basin. For those wells being monitored, wellhead elevation has been carefully measured by GPS. For wells monitored by KCWA and for which permits can be found, the assessment process is simple. Present measured water levels can be compared to the elevation of the top of the perforated section and using the observed local rates of groundwater decline, a projected remaining life easily calculated using the pump coverage guidance above.

5) Analysis of well condition where no well construction data is available For wells for which permits cannot be found and which are not being monitored by KCWA, it is still possible to infer well condition under certain circumstances. One will assume that the AWWA guidelines were followed and the KCWA water depth contours can be used to estimate present depths to water and rates of water level decline. It is possible to infer the depth of the top of the perforated section by indirect means. If the well completion date can be determined from real estate, tax or other records, it is easy to calculate the depth (or elevation) of the top of the screened section using KCWA water elevation data appropriate for the time of completion. With these assumptions, a well completion date and KCWA data it is easy to estimate the remaining life of the well, again using the intake coverage guidance above.

6) Perceived deficiencies in available well data and a summary It has been repeatedly claimed that lack of reporting by domestic well owners of well documentation is a serious omission that must be addressed by the Groundwater Authority (GA). At this point in time, the GA does not have the legal power to demand registration and well data disclosure for de minimis wells. Even if such authority did exist, many de minimis well owners do not have knowledge of their well. As has been pointed out by this author repeatedly, this omission does not limit the development of an overall well health assessment and the claims to the contrary are not helpful. This report does provide detailed instruction of a reliable assessment method which can be implemented even when full well records are not available. Enough domestic wells are in the KCWA monitoring program to provide a substantial starting point for analysis. A “data gap” does not actually exist in this Basin knowledge area.

Note: It is also easily possible to develop an overall Basin contour plot showing shallow domestic well life based on the measured rates of decline in water levels and an assumed initial well water free board based on AWWA well construction recommendations. Such information will be most valuable, independent of any other analysis. One could directly show calculated well life contours plotted on a basin map.

It obviously would be possible to show similar results for other well types including deeper commercial and municipal wells. This map could then be replotted to show amortized costs of replacement for different classes of wells. Such a map will be very revealing and invaluable for strategic planning.