Analysis of the Groundwater Substitution Portion of the Yuba County Water Agency-CALFED Environmental Water Account/Department of Water Resources and State Water Contractor 2005 Transfer

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The Yuba County Water Agency (YCWA) plans to transfer up to a total of 125,000 acre-ft of water in 2004. YCWA plans to transfer at least 62,000 acre-ft of this water to the California Department of Water Resources (DWR) for the CALFED Environmental Water Account (EWA), and the balance to DWR for EWA or DWR's 2005 water transfer program. The transfer is planned for to occur between June and October 2005. A portion of the water transfer will be from storage in New Bullards Bar Reservoir and a portion may be from substitution of groundwater for surface water deliveries by several member districts of YCWA.

The maximum amount of water for the transfer that would be derived from groundwater substitution is 85,000 acre-feet. Based on the analysis described herein, no significant negative impacts are expected from the transfer of this amount of water. The extraction of this amount of water will result in conditions that are within an acceptable range for the groundwater basin. Operations of the 2005 groundwater substitution transfer and the projected post-transfer basin conditions will not cause significant or unreasonable impacts to the environment. These expected conditions along with the basin management procedures implemented by YCWA and member districts will result in no significant unmitigated third-party impacts to other groundwater users within the basin.

YUBA COUNTY GROUNDWATER SUBBASIN

The 2005 YCWA groundwater substitution transfer will take place within the Yuba County groundwater subbasin. The subbasin lies entirely within the Sacramento Valley groundwater basin, within the overlying political boundary of Yuba County. The county boundary also partially defines the Yuba County groundwater subbasin. The subbasin extends from the Sierra Nevada foothills on the east to the Feather River on the west. The southern boundary is the Bear River and the northern boundary is Honcut Creek. The Yuba County groundwater subbasin encompasses an area of approximately 270 square miles. Information provided herein has been excerpted from the report titled *Groundwater Resources and Management in Yuba County* (Bookman-Edmonston, 1992) and other studies conducted over the past decade.

Geologic Setting

The subbasin area is bounded on the east by the impermeable rocks of the Sierra Nevada Mountain Range. These same rocks and younger consolidated rocks extend beneath the subbasin at a gradually increasing depth toward the Feather River and

beyond to the trough of the Sacramento Valley. Fresh groundwater is stored in this wedge-shaped body of alluvial material to depths of 1,000 feet. Beneath these alluvial deposits are consolidated rocks that may contain saline water and are effectively nonwater-bearing.

Physical Structure of Freshwater-Bearing Formation

The subbasin water-bearing units are thinnest to the east and thicken to the west. The structure is thickest along the Feather River and thinnest along the Sierra Nevada boundary. The thickness varies from 1,000 feet in the southwest corner near the Bear River to less than 300 feet at the base of the Sierra foothills. All of the stratified alluvial deposits slope gently to the west. No faults or folding of strata are known to occur within the freshwater-bearing area.

Description of Geologic Formations

All alluvial deposits and adjacent nonwater-bearing rocks are subdivided into geologic units called formations, which are described below in sequence of age from oldest to youngest. They range in age from the very old Paleozoic Sierran bedrock to the overlying alluvial materials that are still being deposited. Between these are the nonwater-bearing Eocene and Cretaceous Age rocks and the two principal water-bearing formations, the Laguna Formation and the Older Alluvium Formation, that together comprise over 95 percent of the subbasin water storage volume. The remaining volume includes the superficial stream channel and floodplain deposits.

Sierra Nevada Bedrock Formation

The Sierra Nevada Bedrock Formation does not store or yield significant amounts of groundwater. Shallow domestic wells can obtain small quantities of water from the weathered zone in these rocks, but the supply is not usually dependable. These rocks form the eastern boundary of the Yuba County groundwater subbasin and extend beneath the subbasin and Sacramento Valley to a considerable depth. At the west end of the dredger tailings, these rocks were found at a depth of 1,222 feet. Along the eastern boundary, north of the Yuba River, they occur within the subbasin as “islands” of bedrock surrounded by alluvial materials. These rocks are found beneath dredger tailings at a shallow depth upstream from Daguerre Point Dam.

Volcanic rocks are included with the Sierran bedrock formations within the property of Beale Air Force Base. They may be an important source of groundwater, but very little is known about their occurrence because well drillers tend not to recognize or record their volcanic origin.

Cretaceous Age Formations

Rocks from Cretaceous Age formations are common to the entire Sacramento Valley and occur at a depth of about 600 feet in the Goldfields area, although they are typically found at much greater depth. Marine in origin, they originally contained saline water;

however, it is believed that through most of the subbasin, the salt water in these formations has been mostly flushed out toward the valley trough.

Eocene Age Formations

Underlying nearly all the Yuba County groundwater basin and overlying Cretaceous Age formations are rocks of Eocene Age. These rocks are probably nonmarine in origin. Although well drillers have given the Eocene rock various names depending upon their location in the valley, the Ione Formation is considered the most commonly occurring formation name. Typically a clay, samples of this formation have been found at depths of 255 to 483 feet in the easterly thinner area of the groundwater subbasin.

Laguna Formation

The Laguna Formation is the thickest and most extensive water-bearing unit in the Sacramento Valley groundwater basin. The formation is exposed intermittently along the east side of the valley from Oroville south to Stockton. In Yuba County, the Laguna Formation is well exposed all along the foothills adjacent to the eastern boundary of the groundwater basin. It is also exposed in isolated hills between Beale Air Force Base and Wheatland, where the thin surrounding younger sediments allow the Laguna Formation to be exposed in "windows." Farther west, the formation is only found in deep wells.

The overall composition of the formation is silts to sandy silts with abundant clay. Gravel or sand deposits are uncommon in surface exposures. In the subsurface, well logs indicate that the formation is predominantly blue clay. Sand and gravel layers are thin and discontinuous and are commonly cemented. Although the amount of coarse-grained material appears to decrease toward the north and south away from the Yuba River vicinity, considerable coarse materials occur in the Yuba River vicinity between depths of 150 to 600 feet.

The overall low permeability of the Laguna Formation provides low well yields in comparison to the overlying younger deposits. In addition to the formation's fine-grained character, permeability is also reduced because much of the thin sand and gravelly zones are cemented.

The Laguna Formation varies in thickness from 400 feet toward the center of the Yuba County groundwater subbasin to 1,000 feet in the southwestern portion of the basin.

Older Alluvium Formation

The Older Alluvium is the predominant surficial geologic formation. It extends from Dry Creek north to Honcut Creek, interrupted only by the wide floodplain of the Yuba River. On the west, it is bounded by the Older Floodplain Deposit Formation and on the east by the Laguna Formation.

This formation was created by alluvial materials laid down into alluvial fans by streams flowing from the Sierra Nevada. The alluvial materials were created through erosion of

the Sierra Mountains by streams. When compared to the Laguna Formation, this formation has a greater proportion of sands and gravels.

The Older Alluvium Formation is comprised of loosely compacted silt, sand, and gravel with some clay. The deposits occur in lenticular beds and are more stratified than the Laguna Formation. Gravel deposits are more concentrated in the upper 150 feet of the formation. The amount of gravel and the thickness of the layer decrease in a westward downstream direction as the distance from the Yuba River increases.

The thickness of the formation varies widely. It is difficult to distinguish the contact of this formation with the Laguna Formation. Based on the concentration of gravel and sand deposits, it appears that the formation is about 150 feet thick in the Yuba River vicinity and thins to less than 100 feet to the south.

Wells drilled into this formation may yield up to 2,000 gpm. In water-bearing character, the Older Alluvium Formation is moderately permeable throughout, except at its surface, where hardpan and claypan soils have developed. Hardpan soils, a characteristic of the formation, provide an impediment to the infiltration of precipitation and unconsumed applied water. Nearly all domestic wells and shallow irrigation wells in the Yuba County groundwater subbasin have been drilled and completed in this formation because the gravels found in this formation usually provide adequate yields. Several wells with depths of less than 150 feet are known to yield 1,000 to 1,200 gpm. Higher-yielding wells in these areas are usually much deeper and obtain their additional yield from the underlying Laguna Formation.

Older Floodplain Deposit Formation

Bordering the Feather River adjacent to more recent alluvium is a 1- to 2-mile-wide bank of gravelly sand, silt, and clay deposited during flooding events. These deposits predate the younger stream and overbank deposits of the Feather River and overlie the Older Alluvium Formation on the east. Well logs show 5 to 15 feet of “topsoil” often overlying hardpan that is probably the buried surface of the Older Alluvium Formation. The formation is too thin to store appreciable amounts of groundwater and has no value as a source of extractions. Its moderate permeability, however, provides for the infiltration of precipitation and return of unconsumed irrigation water to the water table unless they are prevented by buried hardpan soils.

Stream Channel and Floodplain Deposit Formation

The alluvial materials in the Stream Channel and Floodplain Deposit Formation are of recent age and are made up of coarse sand and gravels along the present stream channels of Honcut Creek and the Yuba, Bear, and Feather Rivers. They also occur as abandoned overflow channels two to five miles south of the Yuba River. The greatest volume of coarse gravel occurs along the Yuba River in a band up to three and one-half miles in width. Huge quantities of rounded, very coarse, boulder- and cobble-sized gravel were laid down in the upper reach of the Yuba River after it flowed out of its canyon in the Sierras. Farther downstream in the agricultural areas, thick deposits of

highly permeable sands and gravels provide large quantities of water to wells. These deposits are up to 110 feet thick. All of the stream channels and floodplain deposits along the Yuba River act as a large water intake area for recharge of the subbasin.

Dredger Tailings

In the upper reach of the Yuba River, extending from the Sierras for 15 miles downstream, are large piles of very coarse gravels and cobbles that have been extensively dredged for gold. The thickness of the dredged gravels in the eastern area above Daguerre Point Dam is 60 to 80 feet. West and southwest of Hammonton, for a distance of one or two miles, the dredger tailings are 100 to 125 feet thick. In this central area of tailings, the gravels are underlain by white sands and clays, as revealed by mineral exploration bore holes. Here the underlying fine-grained sedimentary materials are probably part of the Laguna Formation.

GROUNDWATER OCCURRENCE AND DEVELOPMENT

Groundwater occurs generally under water table or unconfined conditions throughout most of the groundwater subbasin. Well drillers report no changes in water levels during the drilling in many wells, both moderately deep and shallow, indicating a lack of confinement. In some areas, the water levels in cable-tool-drilled holes are reported to rise after water was first encountered. This condition is more common in the deeper wells, particularly in the Laguna Formation, where groundwater is considered to be confined by overlying clay layers. Confinement probably occurs at depths in excess of 300 to 400 feet.

Well Yields

Well yields and water level drawdowns are known through the testing of industrial, irrigation, and community supply wells soon after they are drilled by either well drillers or pump installers. These yields may be recorded along with the well logs on the "Well Drillers Report" filed with the Department of Water Resources. Ninety-two driller reports filed with the Department of Water Resources and reviewed for the report *Groundwater Resources and Management in Yuba County* (Bookman-Edmonston, 1992) have production data. The average well yield per township area (36 square miles) ranges from 1,000 to 2,300 gpm, and the average specific capacity can range from 16 to 74 gallons per minute per foot.

The area of highest well yields is in the Stream Channel and Floodplain Deposit Formation of the Yuba River. Wells with depths of 200 to 400 feet can yield 2,000 to 4,000 gpm, with most of the yield derived from the upper 100 feet or more of sand and gravel. The area with the lowest yield can be found on the Beale Air Force Base property. Wells near the property range in depth from 264 to 354 feet and supply an average of 1,000 gpm per well.

Irrigation wells commonly produce between 1,000 to 2,000 gpm and range in depth from a few hundred feet to 700 feet. Typically, the well yield is primarily derived from

the Older Alluvium Formation because the underlying Laguna Formation is much less permeable.

Specific Capacity

Specific capacity is a measure of a well's productive capability, accounting for both aquifer and well construction characteristics. Specific capacity is determined by pumping a known rate from a well and measuring the resulting drawdown in water levels. Specific capacity is computed by dividing the pumping rate (in gallons per minute) by the drawdown (in feet). Because variations in specific capacity can reflect both aquifer and well construction characteristics, some care must be used in their interpretation. Depending on the source of specific capacity data, average specific capacity varies from 40 to 67 gpm.

Storage Coefficient

In general terms, the storage coefficient quantifies the volume of water that is stored or released from storage when groundwater levels rise or fall. The ability of water-bearing material to store water is quantified by the storage coefficient. The storage coefficient is defined as the volume of water that an aquifer releases or takes into storage per unit surface area of the aquifer per unit change in water levels. The storage coefficient has no units and is frequently expressed as a percentage. Under confined conditions, the storage coefficient reflects only the expansion of water and compression of the aquifer that occur with changes in water levels. Both of these effects are relatively small and the confined storage coefficient is very low, ranging from 0.5 to 0.005 percent.

Specific Yield

The average specific yield in the groundwater basin is 6.8 percent. Specific yields will vary greatly as a result of the predominant geologic formation present at a particular location. For example, the Laguna Formation, which is present on the east side of the basin, has specific yields that range from 4 to 5 percent. The highest specific yields are 10 to 12 percent in the upper zones located in the middle of the study area along the Yuba River. Yields in all parts of the basin decrease with depth where the Laguna Formation and other older, more cemented formations are present.

Transmissivity

Transmissivity has been estimated to be approximately 260,000 gallons per day per foot of aquifer width for the majority of the groundwater basin. Estimated transmissivities for the western border of the groundwater basin are higher. Along the Feather River, transmissivities are about 390,000 gallons per day per foot. High transmissivities along the Feather River reflect the thick deposits (over 100 feet) of highly permeable stream channel sediments there. An area of low transmissivities reflects the presence of the poorly permeable Laguna Formation.

Groundwater Storage

Specific yield can be used to estimate the amount of groundwater storage. Average specific yield amounts by depth zone for the subbasin were estimated in studies by the U.S. Geological Survey that were presented in Bulletin No. 6 of the State Water Resources Control Board. Estimates of storage capacity for equivalent depth zones are presented separately in Table 1 for the Yuba North and Yuba South Basins. The Yuba River hydraulically divides the Yuba groundwater basin into the Yuba North Basin and the Yuba South Basin. These storage capacity estimates were computed directly from the area of each subarea, average specific yield in each depth zone, and the thickness of each depth zone.

Table 1
Estimated Storage Capacities and Specific Yields

	Depth Zones (feet)			
	20 to 50	**50 to 100**	**100 to 200**	**20 to 200**
Yuba North Basin				
Specific Yield (percent)	8.9	8.3	5.5	6.9
Storage Capacity (acre-feet)	130,000	210,000	280,000	620,000
Yuba South Basin				
Specific Yield (percent)	8.0	7.4	6.2	6.8
Storage Capacity (acre-feet)	210,000	330,000	550,000	1,090,000
Study Area Total Storage by Depth Zone (acre-feet)	**340,000**	**540,000**	**830,000**	**1,710,000**

For the groundwater basin north of the Yuba River, the groundwater storage capacity estimated to a depth of 200 feet is 620,000 acre-feet. Storage capacity in the groundwater basin south of the Yuba River is estimated to be 1,095,000 acre- feet. The total storage capacity in the study area is estimated as 1,710,000 acre-feet. This amount represents the entire quantity of groundwater contained to a depth of 200 feet. As can be seen from Table 1, if the transfer uses only that portion of the subbasin between 20 and 50 feet in depth, the operable storage would be about 340,000 acre-feet. If the 20- to 100-foot-deep range is used, the operable storage would increase to about 540,000 acre-feet. Caution should be taken when using these numbers because they do not represent the operational characteristics such as recharge rate, recharge origin, and pumping effects. However, they do indicate that a significant body of water from which to draw is available under various operational scenarios.

GROUNDWATER STORAGE CONDITIONS

As shown above, the Yuba North and Yuba South Basins provide 40 percent and 60 percent, respectively of the total groundwater storage capacity of the Yuba groundwater subbasin. Historically, irrigation demands in the Yuba North Basin area were sufficiently supplied with diversions from the Yuba River, except in the Ramirez Water District. Ramirez started receiving surface water in the last 1970's. Because of

the historical surface supply in the Yuba North Basin, unlike the South Basin, the North Basin has not been drawn down extensively. However, the North Basin was historically significantly lower in storage than the pre-2001 transfer groundwater storage. After the late 1970's the storage of the basin increased, mainly due to the increased delivery of surface water in Ramirez Water District and the wetter conditions that occurred at that time after a severe two-year drought from 1976 to 1977. For the Yuba North Basin, the historical low groundwater storage condition occurred in the mid 1960's and again in the late 1970's Conversely, in the Yuba South Basin surface water deliveries were limited until the South Yuba Canal was developed in 1983. Prior to this time groundwater was used extensively for irrigation in the Yuba South Basin. This basin was in overdraft until 1983 and groundwater levels have substantially increased since that time.

Yuba South Basin

Historically, agricultural and urban water uses in the Yuba South Basin area relied heavily on groundwater supplies, resulting in a large pumping depression near the Wheatland area. Since the construction of the South Yuba Canal, and delivery of surface water by the YCWA to the member districts of Brophy Water District, South Yuba Water District, and, more recently, Dry Creek Mutual Water Company, groundwater storage has recovered to the extent that current groundwater storage in the Yuba South Basin area probably exceeds that of 1960 and is nearing the levels of the pre-development era. This condition remains today.

By 1997, the depth and extent of the depression in the Yuba South Basin area near Wheatland had been significantly reduced. The 1997 groundwater contours suggest that the groundwater basin in the Yuba South Basin area is primarily recharged by accretion from the Yuba River above the Marysville gage and by deep percolation of irrigation water and precipitation. The leveled groundwater contours near the Feather River suggest low accretion to the groundwater basin, if any, from this River.

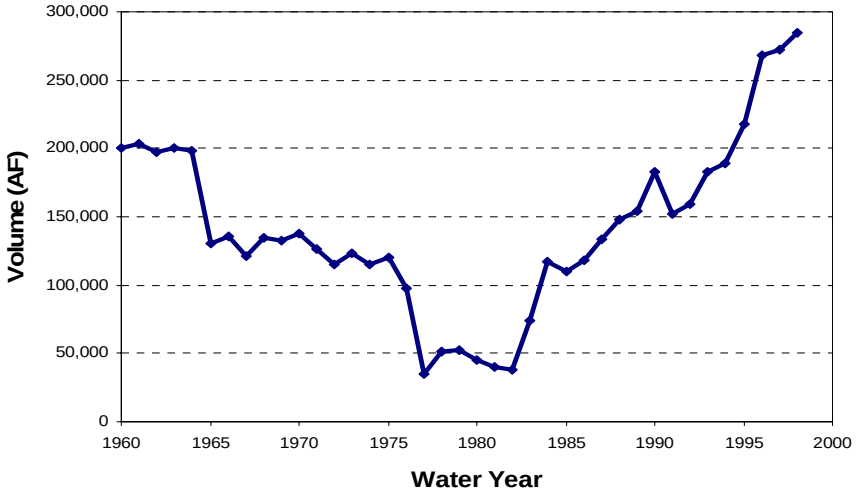
Figure 1 shows the amount of groundwater storage in the Yuba South Basin area for water years 1960 to 1998, assuming 200,000 acre-feet of storage in 1960 as a reference point. After 1983, most of the yearly storage changes are positive, implying a net gain in the groundwater basin. There are several significant changes in the historical trace of groundwater storage. These changes are as follows:

- The abrupt decrease in 1965, although the cause is unclear.
- The abrupt decrease in the 1976-1977 period was a result of the extensive drought in California.
- The beginning of a significant rebound of groundwater storage in 1983 was a result of the new water supply from YCWA through the South Yuba Canal.
- The storage decrease in 1991 was a result of a conjunctive use operation for the Department of Water Resources' Drought Water Bank, through which

80,000 acre-feet of groundwater was extracted and used for local supply, thus allowing an equivalent amount of surface water to be transferred.

Based on this information, the estimated increase in the annual groundwater storage for the Yuba South Basin area since construction of the South Yuba Canal ranges from 15,100 acre-feet to 21,200 acre-feet, depending on hydrologic conditions of the basin.

Figure 1. Estimated Groundwater Storage in the Yuba-South Basin Area from 1960 to 1998 (based on 200,000 acre-feet of storage in 1960)



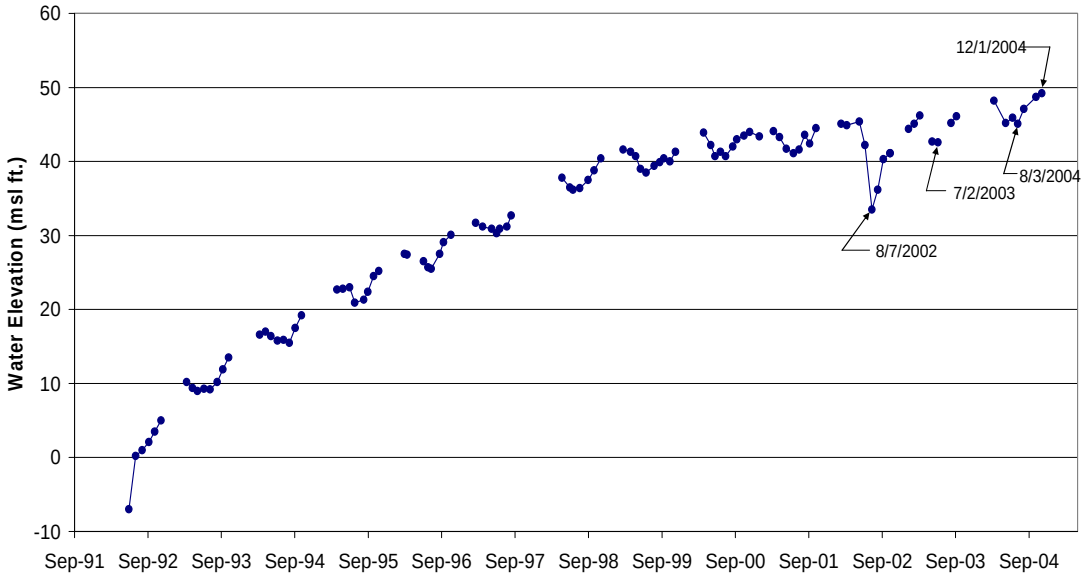
In 2001, two districts in the Yuba South Basin participated in a groundwater substitution transfer to the EWA and 2001 DWR Dry Year Water Purchase Program, pumping slightly more than 17,000 acre-feet from this basin. In addition, 2001 was a critically dry year in the Yuba River watershed. This added pumping for the transfer represents about one year's net recharge to the basin and therefore, as storage conditions were good prior to 2001, the basin had substantial storage that could be utilized in 2002. For the 2002 transfer the total pumping was about 24,000 acre-ft and included pumping in Brophy Water District as well as South Yuba Water District and Dry Creek Mutual Water Company. Table 2 is a listing of the pumping by District for the 2001 and 2002 groundwater substitution transfers. No water was pumped for groundwater substitution transfer in 2003 of 2004.

Table 2. Groundwater Substitution Transfer Pumping by South District

District	2001 Transfer	2002 Transfer
Brophy WD	0	10,727
South Yuba WD	8,600	8,062
Dry Creek Mutual WC	8,500	5,330
TOTAL	**17,100**	**24,119**

Prior to 2001, the last time a Yuba South Basin district has participated in groundwater substitution for a water transfer, was in 1991 (only Yuba North Basin districts participated in groundwater substitution for the 1994 transfer). Therefore, since 1991, eleven years of recharge in mostly wet conditions occurred. For this reason, groundwater levels following the 2002 transfer were still considerably higher than the levels observed following the 1991 transfer. Since no water was pumped in 2003 or 2004 for groundwater substitution transfer, levels are even higher today than they were in the spring of 2001, which is prior to the two transfer years of 2001 and 2002. Even with the 1991 transfer and resulting groundwater levels, no significant or unmitigated local impacts occurred at that time and with those lower levels. Since the 2002 groundwater substitution transfer, the basin has continued to recharge to above pre-2001 levels. Figure 2 is a graph of water elevation in a monitoring well in the central portion of the South Basin, in Brophy Water District. The figure shows that the fall 2004 level is about three feet above the the early summer 2002 level, is about four feet higher than the spring 2001 level and is substantially above the level of 1991 when a groundwater substitution transfer took place during the summer of that year. The lowest groundwater levels that are expected to occur with a 2005 transfer are higher than the levesl that occurred in 2001 or 2002.

Figure 2. Water Elevation in Monitoring Well #15N04E25H003M



Yuba North Basin

Unlike the Yuba South Basin, storage conditions have not fluctuated as dramatically in the Yuba North Basin. However, the storage and resulting groundwater levels underwent a generally moderate decline starting in the early 1950s, held to a moderately lower level through to the 1970s, and then increased in the late 1970s and early 1980s. The reduction in groundwater levels in the Yuba North Basin were mainly caused by the expansion of groundwater development for agriculture in the 1950s for this area.

The decline was small compared with the overdraft conditions seen in the Yuba South Basin. In addition to these long-term trends, hydrographs of groundwater levels from monitoring wells have clearly shown effects of drought conditions and of two previous groundwater substitution transfers in 1991 and 1994.

In 2001 and in 2002 Browns Valley ID, Cordua ID, Hallwood ID and Ramirez WD pumped groundwater in the Yuba North Basin in lieu of some surface water deliveries. In 2001, districts in the Yuba North Basin participated in a groundwater substitution transfer to the EWA and 2001 DWR Dry Year Water Purchase Program, pumping about 47,500 acre-feet from this basin. In 2002 pumping for groundwater substitution transfer to these two programs totaled about 31,000 acre-ft. The amounts of groundwater substitution transfer pumping by each District for those two years are listed in Table 3. No water was pumped in the Yuba North Basin for groundwater substitution transfer in 2003 and 2004.

Table 3. Groundwater Substitution Transfer Pumping by North District

District	2001 Transfer	2002 Transfer
BVID	3,500	6,017
Cordua ID	12,000	9,213
Hallwood ID	14,000	7,263
Ramirez WD	18,000	8,646
TOTAL	**47,500**	**31,139**

Figure 3 is a graph of groundwater levels measured in a monitoring well for the spring of each year in the central portion of the Yuba North Basin and is representative of the basin conditions at this location. The graph shows the historical low levels in the 1960's to the early 1980's then increase of levels in the early 1980's as described above. The fall 2004 groundwater level, when examined in context with the historical water levels for the monitoring well, provides a reference for the current state of the Yuba North Basin. As shown in the figure, the current water level is lower than in recent years, but somewhat higher than the levels that were experienced historically. Based on the fall 2004 groundwater level in this well, the spring 2005 level is expected to be somewhat higher than the spring 2004 level, reflecting an increase in storage resulting from the absence of groundwater substitution pumping in 2003 and 2004.

Figure 4 shows water elevations in monitoring well 16N04E17R002M, which is located in the south-central portion of the North Basin. The water levels in this monitoring well show that the reduction in basin levels in this area in response to the 2001 and 2002 pumping were moderate and totaled less than 10 feet. The recharge of the basin in 2003 and 2004 in this area as a result of no groundwater substitution transfer pumping is also clear.

Figure 3. Spring Water Elevation in Monitoring Well 17N04E33Q01M

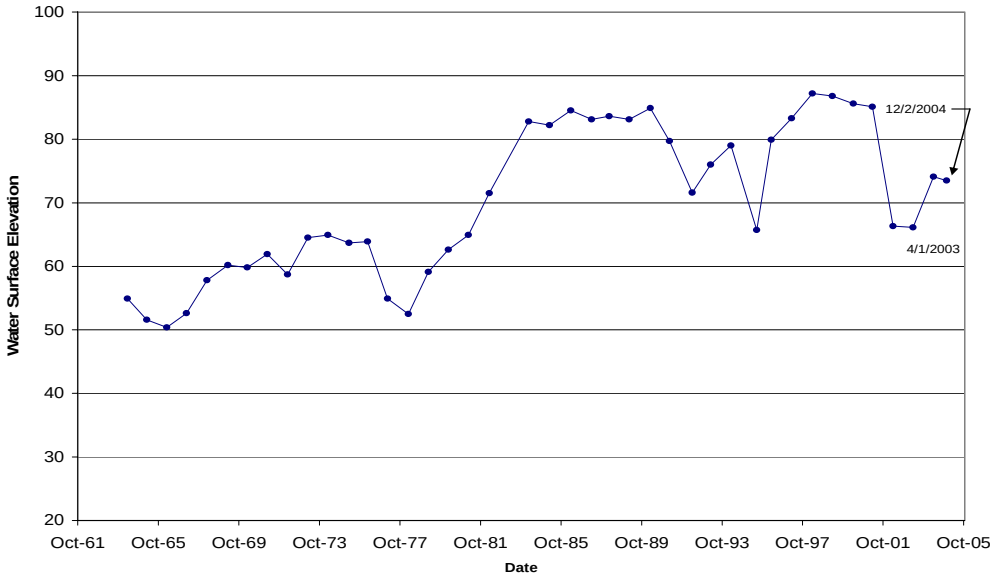
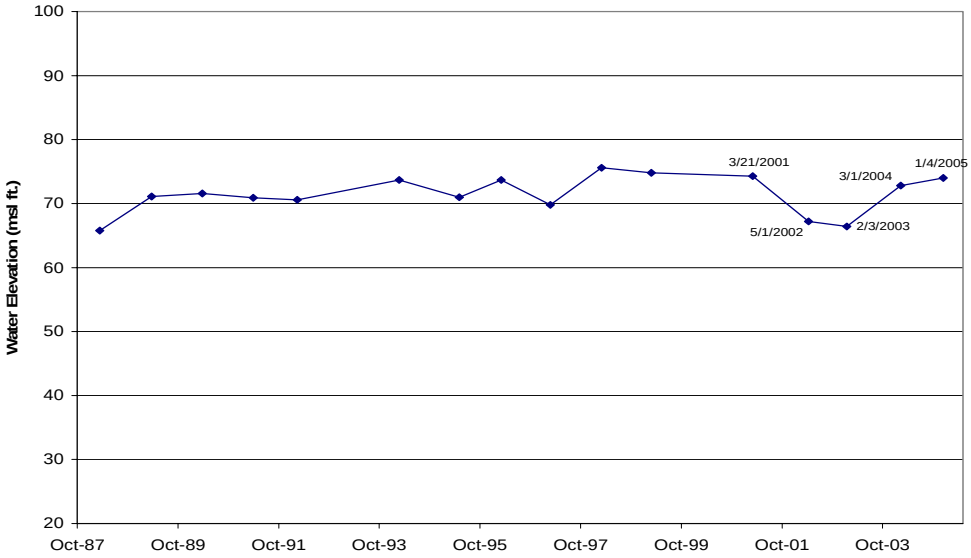


Figure 4. Spring Water Elevation in Monitoring Well 16N04E17R002M



Based on review of well hydrographs for the Yuba North Basin, it is apparent that levels have declined more in the northern portion of this basin that in other areas due to the 2001 and 2002 transfers, but no impacts have been reported for the northern area. In addition, since no pumping has occurred in 2003 and 2004, the northern portion of the basin has recharged slightly more than half of the storage reduction of the 2001 and 2002 transfers. Review of groundwater levels in more western portions of the basin, but still within the area of YCWA member districts, shows that the effects of the 2001 and

2002 operations are even less than in the hydrographs shown above. The monitoring well information suggests that the basin storage and recharge conditions are such that operations for 2001 and 2002 did not significantly reduce the overall storage in the basin. Examination of the response of the North Basin to the 2001 and 2002 transfers indicate that transfer operations for 2005 will not significantly draw down the basin storage to levels that would have significant negative impacts.

The current transfer petition of up to 85,000 acre-feet, which is to be split between both the north and south subbasins, would represent only 4 to 5 years of recharge of the south subbasin alone. The information presented and additional information that was reviewed for the preparation of this report shows that the Yuba South basin is a gaining one and the North Basin has substantially recovered from the effects of the 2001 and 2002 transfer, and both basins are in good health. Therefore, the transfer would not strain the water supply and overall conditions of the Yuba North or Yuba South basins, and will not contribute to, or result in conditions of overdraft.

POTENTIAL IMPACT TO PUMPERS IN THE SUBBASIN

With regard to the issue of known pumpers who might be impacted by the transfer, several items address this issue. First, a similar (over 80,000 acre-feet) transfer was accomplished in 1991, at a time when the Yuba South Basin was at a significantly lower level and the Yuba North Basin was somewhat lower. At that time, only a few impacts to residential wells were experienced, and within days of the impact, the situation was remedied by YCWA and member districts by the extension of the affected wells to greater depth. In 2001 several wells experienced lower water levels in the North Basin and in response to the reported impacts the affected wells were deepened or pumps were lowered. In 2002 one well in the North Basin was affected and it was immediately deepened. In addition, like the operations of 1991, 2001 and 2002, should any local groundwater users be significantly impacted by the 2005 transfer groundwater substitution operations, immediate remedial action would be taken to mitigate any impacts.

In preparation for the 2004 transfer YCWA and member districts refined the program for responding to groundwater users who raise issues of impact due to the potential affects of the transfer, even though eventually no pumping for transfer occurred in that year. That refined program will be implemented for the 2005 transfer. As part of the transfer monitoring and mitigation plan, YCWA and member districts have implemented a rapid response program to immediately investigate any claim of a potential impact. The process involves; 1) immediate response, 2) collection of relevant information, 3) analysis of the information and a determination of the likely cause and, 4) if appropriate, implementation of mitigation measures. A key part of this program is the designation of a point of contact at YCWA and at each member district that will respond so that no time is lost in addressing the issue.

The DWR and YCWA will be contractually agreeing to monitor the basins extensively and investigate any instances of potential impact and to address these issues. As to known pumpers who would be impacted by the transfer, other than temporary,

somewhat lower groundwater levels equal to those experienced in past years within the basin, there are no known potentially significantly impacted pumpers.

One area that was closely monitored for the 2002 operations was the Las Quintas area in the Yuba North Basin. This area, located at the start of the foothills on the eastern side of the basin, consists of a hill that has been recently developed as a residential subdivision. Because of this recent development, many of the homes in this area, which rely on individual domestic wells, have not experienced the groundwater levels that were reached in 1991 or 1994 or the extended lower levels of the 1950s to the 1970s. Several of the wells in this area were constructed to extend only a short distance into the water table. As water levels have, in recent years, been higher than historical levels, and these wells were recently constructed, they were not constructed to pump water when the water table is at the lower historical levels. The area did see the effects of the 2001 transfer operations, and lower groundwater levels did occur in this area. Because of the lower levels, either reduced well pumping capacity or loss of pumping capacity did occur and in response, the Cordua Irrigation District (the member district for this area) lowered the pumps and/or deepened the wells for five residences. Thus, no significant unmitigated impacts to the residents of this area occurred.

For the 2002 operations, residents had expressed concern about the effects of groundwater substitution transfers. Therefore, YCWA and the Cordua Irrigation District have met with, and are continuing to work with, these residents to address their concerns.

GROUNDWATER MANAGEMENT

Through previous transfers Yuba County has learned that conjunctive use operations can and sometimes do cause isolated and site-specific effects. If immediate response is provided, significant short term or long term impacts can be avoided completely.

Over the past decade, YCWA and its member districts have taken an active and progressive role in managing the groundwater resources of the subbasin. YCWA also works with DWR in monitoring the basin and has been instrumental in extending the monitoring network of wells in the basin. Several of the districts in Yuba County have adopted groundwater management plans and YCWA has a plan under consideration. In the interim, YCWA and the districts participating in the transfer meet regularly to discuss the management of the basins. As part of basin management, YCWA, DWR, and the member districts have instituted a monitoring plan to record in detail the water levels and water quality of the basins. The monitoring plan, which will be included in the contract for the transfer with DWR, is attached as Exhibit A of this report.

The groundwater management approach for groundwater substitution transfers in Yuba County is embodied in three principles as follows:

1) Closely monitor conditions to watch for any potential significant impacts and to gain a better understanding of the groundwater resource

2) Immediately respond to any significant impacts that occur and mitigate those impacts with appropriate measures

3) Utilize the transfer and associated activities to further the goal of effective management of the water resources of Yuba County through conjunctive use of groundwater and surface water.

SUMMARY

Based on the information presented herein, the groundwater substitution component of the proposed 2005 transfer to the EWA and DWR will not have any significant negative unmitigated impacts on the groundwater resources of Yuba County or on the residents and groundwater users of Yuba County, or surrounding areas. The quantities of water to be derived from groundwater pumping for local use, in lieu of surface water, are reasonable for the storage conditions of the basins. The expected water levels resulting from the 2005 transfer operations are within acceptable levels, and the groundwater levels throughout the basins will be closely monitored.