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Consolidated Irrigation District

Urban Impacts

White Paper

Summers Engineering, Inc.
Consulting Engineers
Hanford, California

November 2007

Background on the District

Consolidated Irrigation District (CID) is located in the San Joaquin Valley, on the eastern side of Fresno County and in portions of Kings and Tulare Counties. Figure 1 is a map of the overall District boundary with CID's (main) Class A canals indicated. CID is comprised of approximately 145,000 acres (gross) of irrigable land. Approximately 95,000 acres are capable of receiving surface water through the District's diversion from the Kings River. CID's average annual surface water deliveries are approximately 238,000 acre feet. The remaining 50,000 acres (gross) obtain a water supply exclusively from groundwater.

CID's water delivery system is comprised of approximately 350 miles of open channels, which include constructed ditches and channelized natural drains and sloughs. The water system also includes more than 50 dedicated recharge basins with a total surface area of approximately 1,300 acres. Irrigation deliveries are diverted from the Kings River to eligible District growers through the system of ditches and laterals. These deliveries typically occur in the spring and summer and their annual duration and volume are dependent upon runoff conditions in the Kings River. The River is regulated by Pine Flat Dam, which is located upstream of CID's diversion point. When there are flood releases from the dam, which typically occur during the winter and spring, CID diverts a portion of the flood flow into its recharge basins through the same system of ditches and laterals that are otherwise used for irrigation deliveries. The native soils in the District are sandy and allow relatively rapid infiltration through dedicated recharge basins, unlined canals, or the ground surface of agricultural lands. The groundwater basin is also largely unconfined, which means infiltration at the surface provides a direct contribution to the groundwater basin.

On an average annual basis, the land in CID that is eligible for surface water deliveries (approximately 65% of total CID acreage) receives a little over half of its irrigation supplies from imported Kings River water. All other irrigation in the District is supplied with pumped groundwater. Therefore, protecting and maintaining groundwater supplies in the District is crucial for CID's growers. All of the incorporated cities, urban areas, and commercial-industrial water users in the District also rely on pumped groundwater for one-hundred percent (100%) of their municipal and industrial supplies.

CID maintains a system of approximately 80 groundwater monitoring wells located on a 2 mile square grid pattern throughout the District. The water levels in these wells have been measured and recorded by District staff multiple times per year since 1923. When the average depth to groundwater in the monitoring wells is plotted over the period of record, there is a definite downward trend, indicating that groundwater overdraft is occurring. The District is located within the Kings sub-basin, and the California Department of Water Resources has published bulletins which list the Kings sub-basin as being subject to critical conditions of overdraft. Also, a Groundwater Impacts Analysis prepared by WRIME for CID and the Integrated Regional Water Management Plan prepared by WRIME for the Upper Kings River Water Forum each indicate there is groundwater overdraft in CID and that the rate of overdraft will continue to increase with future urban development.

Almost all of the acreage in CID has historically been used for agricultural purposes. The incorporated cities of Fowler, Kingsburg, Parlier, Sanger, and Selma, as well as several unincorporated urban communities such as Caruthers and Del Rey, are within the exterior boundaries of CID. In recent years the growth rate of these urban areas has increased dramatically. Growth projections indicate the rate of urban growth in this region of California will remain high for at least the next 10 to 20 years.

In the past, the District has typically maintained a cooperative relationship with city governments and developers. With the lower urban growth rates of the past and relatively small urban areas, CID was able to adapt its operations to accommodate the growth that did occur. However, even these small incremental impacts have accumulated over the years, resulting in difficult operating conditions, strained budgets, and increased risk to public safety. The conversion of agricultural land that uses imported surface water to urban land that is supported exclusively with groundwater also has a significant cumulative impact on groundwater supplies. In the past, the District was less concerned about the impacts urban development had on groundwater because growth rates were much lower. However, the cumulative impacts on groundwater from more rapid urban growth are now a major concern to the District because its users rely on groundwater supplies to either supplement the imported surface water they receive for irrigation, or provide all of their irrigation water. With the current accelerated rate of urban growth, impacts on the District have become much more severe and caused the District to seek mitigation measures from new urban developers.

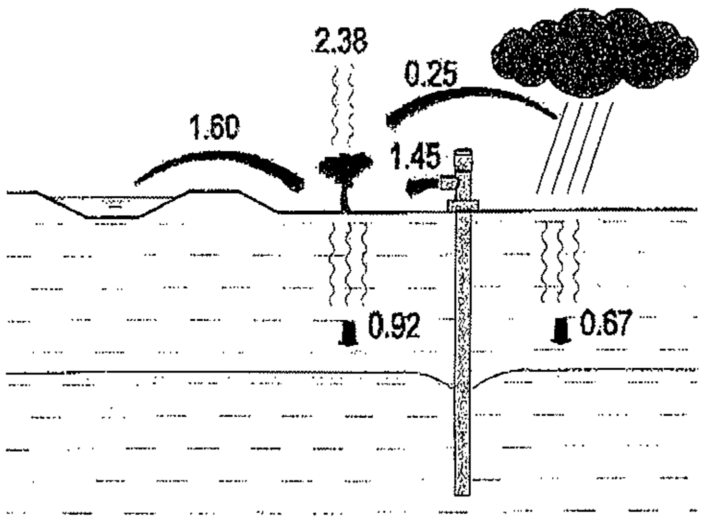
Preparation of an Engineer's Report and Nexus Study on urban impacts was commissioned by CID in 2007. In July 2007 a draft of the report was circulated to the cities and counties in the District. The Engineer's Report identifies the impacts urban development has on CID and provides a basis for quantifying mitigation fees proposed by the District. A table of the proposed mitigation fees is attached. This White Paper summarizes the following key findings of the Engineer's Report and provides conceptual solutions for mitigating the impacts to CID from urban development.

Impacts of urban development

- Groundwater and Water Supplies
- District Operation and Maintenance
- Urban Storm Water
- Public Safety and Operating Efficiency

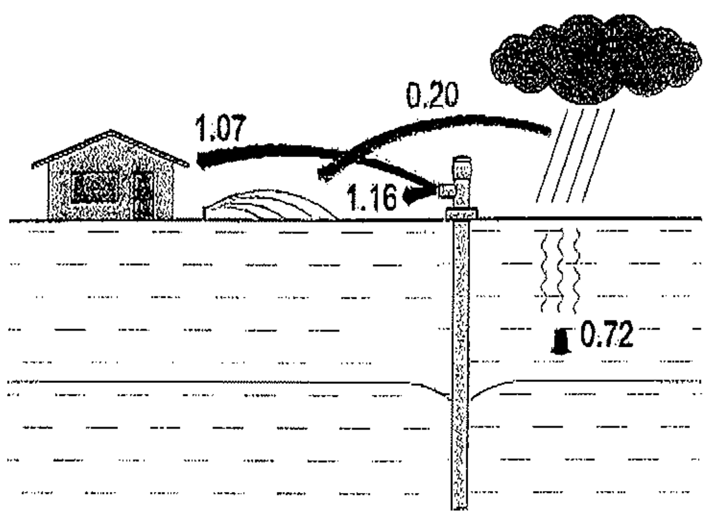
Impacts of Urban Development on Groundwater and Water Supplies

When agricultural land in CID is irrigated with surface water and groundwater, there is a small net contribution to groundwater. The average annual balance of groundwater use is illustrated and calculated as follows:



Irrigation Demand = 1.60 + 1.45 = 3.05 ac-ft/ac
Net Groundwater Contribution = 0.92 + 0.67 - 1.45 = 0.14 ac-ft/ac

When land in CID is used for urban housing, the annual net consumption is about 1.5 acre-feet per acre, illustrated and calculated as follows:



Water Demand = 1.07 + 1.16 = 2.23 ac-ft/ac
Net Groundwater Consumption = 1.07 + 1.16 - 0.72 = 1.51 ac-ft/ac

Two main factors cause the difference in net consumption between urban and agricultural land use. (1) Agricultural users import approximately one-half of their demands. Urban users do not import any surface supplies. (2) Permeable soil conditions result in approximately 30% of the water applied for irrigation being returned as useable groundwater, while much less of the urban water is returned.

Some portion of the urban water that is used indoors is transported off-site to regional waste water treatment plants. These treatment plants percolate and evaporate their effluent water in ponding basins, but the effectiveness of this water source as a means for mitigating groundwater impacts is minimal. The Cities of Selma, Kingsburg, and Fowler are served by the regional SKF treatment plant located near the southerly boundary of the District. Since groundwater in the District migrates from northeast to southwest, water percolated at the SKF plant primarily effects the areas immediately around the plant and to the southwest. That water is effectively lost for the purposes of mitigating the groundwater impacts from urban development occurring along the Highway 99 corridor in the cities of Fowler and Selma. It is also noteworthy that the effluent from waste water treatment plants in CID is of much poorer quality than other sources of groundwater recharge such as imported Kings River water and rainfall. The effects from this poorer quality recharge water are an increasing concern of the Regional Water Quality Control Board. Urban water that is not returned to a wastewater treatment plant is less likely to percolate into the groundwater because it is subject to evaporation on sidewalks and streets.

Imported surface water cannot be delivered to thirty-five percent (35%) of the agricultural land in CID, so the net annual groundwater consumption for these lands is approximately equal to that of urban land (3.05 - 0.92 - 0.67 = 1.46 ac-ft/ac).

The following district-wide water balance was determined using the values of net groundwater consumption calculated above together with the corresponding acreages of land use. Agricultural land with an entitlement for "Church Water" has a higher net contribution to groundwater than other land that receives imported surface water because irrigation deliveries to these lands typically occur over a longer period of the spring and summer.

Water Service	Acreage	Unit Consumption (ac-ft/ac/yr)	Annual Consumption (ac-ft/yr)
CID Gravity	86,002	-0.14	-12,000
Church Gravity	7,892	-1.00	-7,900
Pump	47,866	1.46	69,900
Other	635	-0.90	-600
Total Ag Consumption			49,400
City	10,197	1.51	15,400
Total annual overdraft			64,800

Deliveries of Kings River water into CID's ponds during the months of September through March account for an average annual recharge of 31,000 acre-feet. During periods of very high run off in the Kings River, such as March 1981 through January 1984, deliveries to the ponds can occur throughout the entire year. Also, operation of the District's unlined canals for irrigation or recharge deliveries results in seepage losses that provide groundwater recharge. Therefore, it is estimated that the total average annual recharge provided by CID through the operation of its canals and recharge basins is 51,000 acre-feet (31,000 recharge basins Sep. to Mar. + 20,000 recharge basins Apr. to Aug. and canal seepage).

On an average annual basis CID is recharging a little more than the total net consumption of the agricultural users in the District (51,000 ac-ft recharge vs. 49,400 ac-ft net consumption). Conversely, the cities in CID do not provide any imported water supplies to offset their net consumption of 15,400 acre-feet per year. The analysis demonstrates that urban groundwater consumption is primarily responsible for the average annual overdraft of groundwater in CID. It also shows how urbanization of agricultural land that was irrigated with imported surface water results in an impact on groundwater supplies of 1.65 acre-feet per acre (1.51 urban consumption – (-0.14) ag contribution).

The water balance does not include consumption or recharge values for rural residential water use. Rural homes in the District rely on small domestic wells for their water supplies and they typically discharge their sewer water to septic tanks with leach fields. Since only a portion of the water pumped is returned through the septic systems, there is a net consumption of groundwater by these users. Inclusion of this additional consumption in the water balance would increase the average annual overdraft in the District, but it would not change the calculated impact that urban development has on groundwater supplies.

Mitigating the cumulative impacts urban development has on groundwater supplies will require the construction of additional recharge facilities and, if practical, seeking additional sources of surface water for recharge. CID currently recharges as much of the available flood water from the Kings River as it possibly can. The majority of CID's existing recharge basins are in the western half of the District and are served by the Fowler Switch Canal, which is one of the two main canals in the District. When flood water is available, the Fowler Switch Canal and the recharge ponds served by it, operate at or near their capacities. To mitigate impacts from urban development in Sanger and Parlier and along the Highway 99 corridor will require additional recharge up-gradient of Highway 99. CID possesses only a few relatively small recharge basins in this region. The District's other main canal, the C&K Canal, would have capacity during non-irrigation periods to deliver additional flood water if there were more basins available to recharge the water. Appendix D of the Engineer's Report identifies eight (8) specific capital projects that would increase CID's recharge capacity east of Highway 99. The projects include land purchase and construction of levees and regulating structures for new recharge basins that can be served through the C&K Canal. The recharge projects would be funded and constructed using mitigation fees collected over the next 20 years.

In addition to capital improvements, mitigation of groundwater impacts includes paying the market value of the water and paying CID to deliver the additional supplies through its canals. These costs are calculated in the Engineer's report and they are based on the replacement value of the District's water system and the fraction of the District's total delivery capacity that will be utilized.

During the past two years CID has raised the issue of urban development's impact on groundwater and water supplies through the CEQA process. CID is not opposed to new urban development if it includes a long term sustainable water supply that is sufficient to support the land use. The cities in CID have not demonstrated that such water supplies are being provided for new development. CID as an affected agency has repeatedly responded through CEQA that cities should not approve new developments without provisions for a long term sustainable water supply, or appropriate mitigation of new development's impact on groundwater.

Impacts of Urban Development on District Operation and Maintenance

Urban development impacts CID's operation and maintenance (O&M) activities by limiting access to its canals, increasing the trash that accumulates in canals, and generally reducing the efficiency of CID's O&M. Residential and commercial developments adjacent to District canals require fencing and gates to restrict public access and provide some measure of public safety. These barriers limit the District's access to its own facilities. Urban streets and sidewalks further limit the District's access compared to rural agricultural areas.

Urban development brings more people in close proximity to CID's facilities. Consequently the amount of trash that accumulates in CID's canals increases directly with urban development. This accumulation requires more time and effort by District operators to access the canal structures and remove the additional trash that accumulates at bar screens and control structures. Greater population near CID's facilities results in more vandalism of the facilities. Vandalism of operating canals impacts the District's operations because it must be addressed immediately to prevent a canal bank failure or breach. The same type of vandalism can occur in rural areas of the District, but with much less population density, the amount of vandalism per unit of canal length is noticeably less.

New development increases property value and subsequently increases the District's liability risk from a canal breach or break. Therefore, more patrols of the canals are needed in urban areas. Canal breaches that result in flooding of urban areas can threaten public safety. Canal breaches that occur in rural areas can also cause serious problems, but the consequences are typically much less severe.

District operators patrolling urban areas come in contact with a greater number of homeowners or trespassers than they do in rural areas. This additional interaction with the public inevitably causes operator delays and reduces efficiency.

The impacts on O&M are difficult to quantify and it would require a prohibitively expensive study over a period of years to determine the precise impact urban development has on O&M expenses. The Engineer's Report quantifies the impacts based on specific budget expenses and estimates of reduced efficiency made by District Operations staff. Mitigation of the impacts on O&M will require compensation to CID for associated increases in labor and equipment costs.

Impacts of Urban Development on Storm Water

Agricultural land in CID typically does not drain a significant percentage of local storm water offsite because the topography is generally flat and the sandy soils quickly percolate surface water. Urban development, which includes the addition of impervious surfaces such as roofs and street paving, reduces percolation and requires the storm water to be collected and disposed in basins or in irrigation channels that are not in use or not operating at capacity.

Use of CID's channels for this purpose impacts CID's ability to deliver imported surface water into its recharge basins and requires CID to maintain adequate capacity downstream of the storm water connections into its system. When rain is anticipated or falling, canals with limited flow capacity must be constantly patrolled to check the status of city storm water pumps and the levels of the canal. If only recharge water is being delivered, two patrols per day are adequate. Urban storm water conveys additional trash into the canal that must be removed at bar screens and structures. Discharge points cause channel erosion and sediment deposits. In years when recharge water is not available to CID, storm water inundates canals that might otherwise remain dry. The cycle of wetting and drying throughout the winter promotes more weed growth than would occur without the storm water, which increases maintenance costs.

In the five (5) incorporated cities in CID there are 37 storm water connections to CID's canal system. Each new development that connects to a city's storm water system has the potential to increase the amount of storm water discharged to CID's system. Proposed mitigation of urban storm water impacts from new development would require a fee based on the replacement value of applicable CID facilities and the fraction of those facilities' flow capacity that is utilized to dispose of the urban storm water.

CID is also concerned about the quality of urban storm water that is discharged into its canals because run off from city streets is prone to contaminates such as oils and heavy metals. In addition to the proposed mitigation measures, cities must demonstrate to CID that their storm water discharges are legally permitted by the State and comply with water quality standards for such permitted discharges. Heretofore, no such evidence or documentation has been provided to CID.

Impacts of Urban Development on Public Safety and Operating Efficiency

In recent years urban developers have generally complied with CID in mitigating site specific impacts. Typically these mitigation measures involve undergrounding some existing open canals with pipelines, installing fences along other open canals, and providing well defined rights-of-way for District facilities. These mitigation measures address public safety and the District's operating efficiency within the boundaries of a development project. However, they do not address CID facilities that may be located directly adjacent to the development project. Concentrated urban populations can be located in close proximity to unprotected open ditches which were never intended to operate in an urban environment. There are also older urban development projects that were permitted without undergrounding of CID's canals.

In addition to the public safety risk, these development scenarios have resulted in the District's delivery system being segmented into short sections of open canal and pipelines, which are more difficult to patrol and maintain than contiguous sections of either.

Because these facilities are located in urban areas where no further development will occur over or adjacent to the canals, there is little chance that a future urban development will construct the needed improvements to CID's facilities. However, additional urban development in the general vicinity of these unprotected facilities will increase the population that will potentially come in contact with the facilities through increased vehicle and foot traffic, and it will further restrict the District's ability to access its facilities for O&M.

In Appendix D of the Engineer's Report, seven (7) specific capital improvement projects are defined that would mitigate impacts on public safety and operating efficiency of District facilities in critical urban areas. The projects involve piping sections of smaller open canals and installing remote water level monitoring equipment on large canals where piping is infeasible. The projects would be funded and constructed using mitigation fees collected over the next 20 years.

<u>De-annexation</u>

One of the issues raised in connection with the conversion of agricultural land to urban uses has been whether or not that land at the time it is being annexed to a city should or should not be de-annexed from the District. The existing policy has been to remove the urbanized land from the District. That policy reflects the District's primary mission, which is to provide irrigation water to farmers in accordance with the practices and water rights established over many decades by appropriation and diversion of water from the Kings River on to land within the District. A key factor in the present policy is the election of the District's Board of Directors by residents of the District. CID's directors are elected by division so residents who are eligible to vote in a particular division select the director from that division. Section 21585 of the California Water Code requires those divisions to be "as nearly equal in area and population as may be practicable" (a requirement that seems to presume a typical rural area inhabited by scattered farmsteads). More recently, Section 22000 of the California Election Code requires that the District adjust the boundaries of each division after each federal decennial census. More importantly, in the case of CID and other governmental entities that include within their boundaries land located in Kings County, such a delineation of the divisions must be approved in advance by the United States Department of Justice to ensure compliance with the federal Voting Rights Act. To receive such pre-approval, the District must assure the Department of Justice that the division boundaries do not disadvantage any voter who is a member of a protected class. That assurance involves a complicated process of demographic analysis and division rearrangement. In sum, the issue of de-annexation involves understanding that (1) having more urban voters with no connection to irrigation could impact the District's primary mission, and (2) increasing the total number of voters in the District with concentrated areas of urban voters can intensify an already expensive federal pre-approval process.

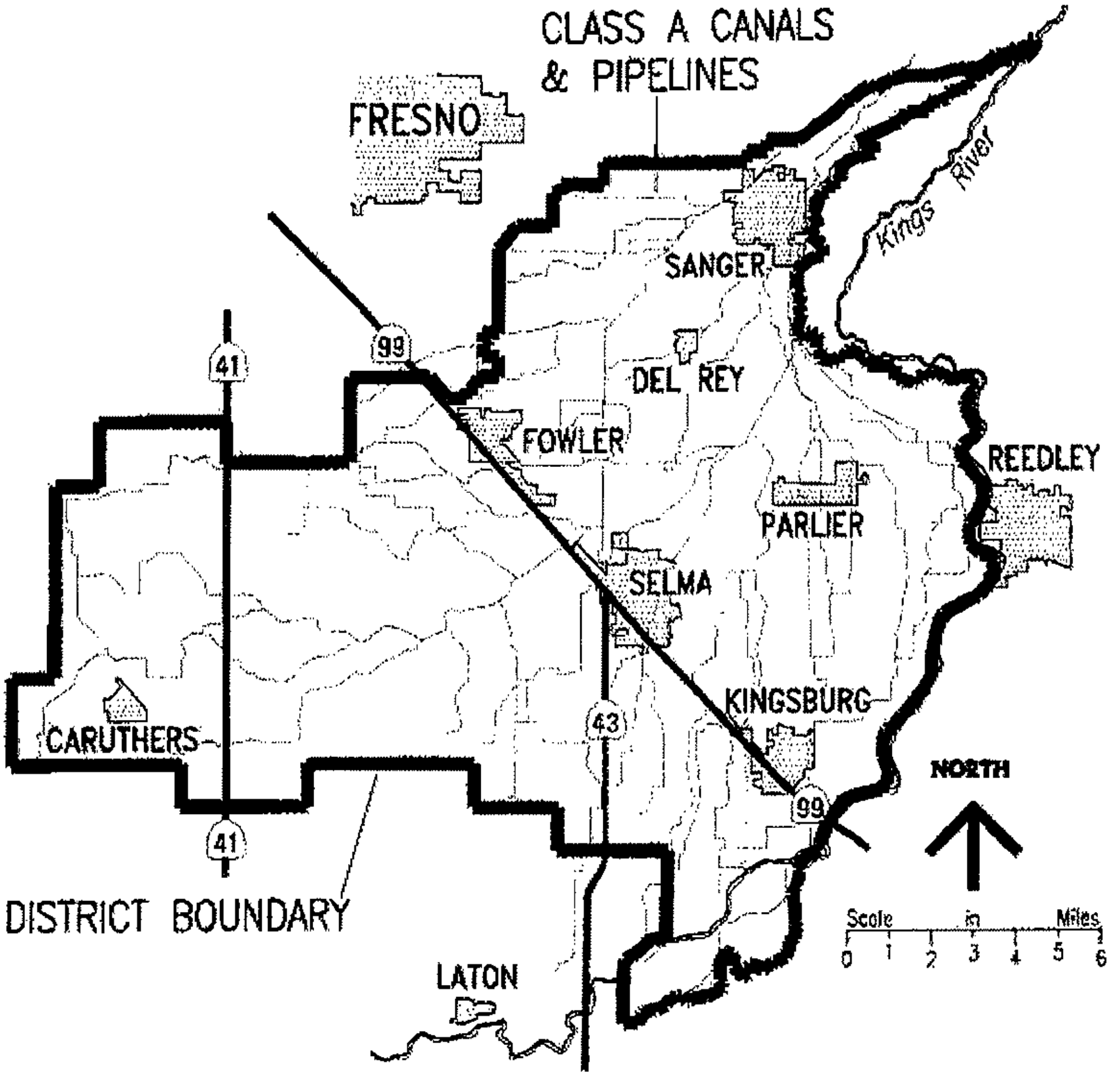
Alternative Solutions

CID has recently discussed with officials from the cities in the District possible alternatives for mitigating urban impacts. One suggestion is for cities to pay CID a volumetric rate for the groundwater they pump in return for CID delivering an equal supply of imported surface water into the District. The imported supplies would be a combination of water that is purchased (when available) and flood water that is diverted to new recharge facilities. An advantage this solution would have over mitigation fees is that the total groundwater overdraft caused by urban use could be addressed versus only the impacts from new development. Impacts on O&M and public safety would still need to be addressed through a fee imposed on new development, but the total amount of that initial fee could be much less. Additional details about this type of alternative are discussed in the attached August 9, 2007 memorandum. The memorandum was presented to CID's Board and made available to the public at CID's August 2007 Board meeting, which was attended by several representatives from cities in CID.

A possible alternative for mitigating the impacts from urban storm water would be for the cities to pay an annual standby fee for each storm water connection to the District's system plus a volumetric rate for the storm water that is actually discharged. This alternative would be more equitable (than a district-wide mitigation fee) for urban developments in cities that only have one or two storm water connections. The volumetric charge would also address cities making interconnections from new storm water basins to the existing District connections. Implementing the volumetric charge will require the installation of meters at the storm water connections.

CID is encouraged by the discussions with the cities and is open to alternative solutions that adequately mitigate urban impacts. Cooperative agreements were established between CID and the cities in the early 1980's. CID has recently notified the cities that these agreements, which are renewed annually, do not adequately address the current impacts of urban development and that the agreements will be maintained on only an interim basis until new provisions can be established. CID believes the cooperative nature of the existing agreements should be maintained, but the terms and provisions for mitigating impacts must be updated.

Figure 1



CONSOLIDATED IRRIGATION DISTRICT

CONSOLIDATED IRRIGATION DISTRICT

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MEMORANDUM

TO: Consolidated I.D. Board

CC: City Managers

FROM: District General Manager, Mark Gilkey

DATE: August 9, 2007

SUBJECT: Utility Mitigation Rate Alternative to Urban Impact Fees

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Following a recent meeting with the city managers within the District, Staff and Summers Engineering made an analysis to determine a water utility mitigation rate for certain urban impacts to CID. The utility mitigation rate would presumably be charged to all domestic water users that are served groundwater extracted by the various city water systems located within CID's overall boundary. The approach used to determine the mitigation rates was based on the following assumptions:

- CID constructs recharge pond projects such as those identified in the Urban Impacts Study prepared by Summers Engineering.
- CID's goal would be to deliver water when feasible to these facilities to offset existing urban groundwater extractions.
- The water supply would come from excess flood flows in the Kings River which currently cannot be diverted due to limits on CID's recharge capacity. Also, surface water could be purchased when feasible.
- CID would explore ways to raise the initial capital needed to construct the projects through bond sales, loans, or grants.
- In addition to the initial recharge facilities, CID would continue to pursue construction of additional recharge ponds to offset new urban groundwater extractions.
- After all facilities are constructed and paid for, groundwater should be in balance on an average annual basis.

Table A indicates the revenue that is needed to fund the recharge expansion projects. Each city's proportional share of the first year cost is listed. A 3% annual escalator would be applied to these amounts in subsequent years. The table also indicates the cost for CID to deliver the recharge water. This charge is based on the replacement value of CID's system and the portion of its delivery capacity needed to offset the urban extractions. Table A also includes storm water disposal charges, assuming they are applied uniformly throughout the District and recouped through the water utility mitigation rates. Alternatively, a mitigation charge could be determined for each city based on the quantity and size of its connections to CID's system. Cities could choose whether the storm water charge is paid through water utility mitigation rates or other revenue sources.

The number of municipal water services was estimated for each city based on population data, and this was used to calculate monthly water utility mitigation rates that would generate the required revenue. The utility mitigation rate would need to be charged per family unit equivalent (FUE) so that large commercial and industrial water users would pay their proportional share. Typical municipal water rate schedules set the number of FUE's by connection size. For instance a 1½" connection might be rated at 8 FUE's and a 2" connection 13 FUE's. This means that 1½" and 2" connections have the potential to use 8 and 13 times as much water, respectively, as a connection to a single residence. Assuming the above FUE ratings, the monthly utility charge for a 2" commercial connection would be 13 times more than the charge for a single residence.

Population data provides a good basis for estimating the number of residential service connections, but it does not provide an indication of commercial / industrial connections. Therefore, the FUE's for commercial / industrial connections had to be estimated based on total water demands. If this estimate is significantly different than the actual number of FUE's, the monthly rates shown in Table A would need to change accordingly. In other words, if there are much fewer FUE's than estimated, the monthly mitigation rates would need to increase.

The proposed water utility mitigation rates would not address other impacts to CID that are identified in the Urban Impacts Study. Impacts to assessment revenue and operation and maintenance could still be mitigated through an urban development fee. The system improvements (pipeline projects) identified in the Urban Impacts Study to mitigate impacts on public safety and operating efficiency in critical urban areas could also be implemented through an urban development fee. The total amount of the development fee (if used in conjunction with water utility rates) would be about $1750 per acre or $470 per new home.

Table B is a comparison of annual revenue that could potentially be generated through the urban development fees proposed in the Urban Impacts Study versus the revenue generated through water utility mitigation rates or a combination of water utility rates and lower urban development fees. The revenue estimates in Table B are based on the average annual increases in urban acreage over the past five years and the utility rates indicated in Table A.

Table A

City	Capital Recharge Projects		Water Recharge		Storm Water Disposal		Totals	
	Cost/yr [1]	$/mo/FUE	Cost/yr	$/mo/FUE	Cost/yr	$/mo/FUE	Cost/yr	$/mo/FUE
Fowler	$40,000	$1.11	$83,000	$2.32	$63,000	$1.75	$186,000	$5.18
Kingsburg	$76,000	$1.11	$157,000	$2.32	$119,000	$1.75	$352,000	$5.18
Parlier	$88,000	$1.11	$183,000	$2.32	$138,000	$1.75	$409,000	$5.18
Sanger	$151,000	$1.11	$313,000	$2.32	$236,000	$1.75	$700,000	$5.18
Selma	$157,000	$1.11	$326,000	$2.32	$247,000	$1.75	$730,000	$5.18
Totals	$512,000		$1,062,000		$803,000		$2,377,000	

[1] Initial annual cost indicated would escalate 3% per year.

Table B

Potential annual revenue from proposed development fees	$3,297,000
Annual revenue from utility rates	$2,377,000
Annual revenue from utility rates + reduced development fees	$2,851,000

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MEMORANDUM

To:	Mark Gilkey, General Manager	**CC:**	Elias Tijerina, Reza Namvar
From:	Matt Zidar	**Date:**	July 5, 2007
Subject:	**Groundwater Impact Analysis**		
Project Reference:	200.T03.00		

INTRODUCTION

The purpose of this analysis is to quantify the potential regional and local groundwater effects of urban growth in the CID service areas. WRIME was retained to evaluate and quantify the potential groundwater effects of the urbanization using the Kings Basin Integrated Groundwater Surface Water Model (Kings IGSM) to compare the 2005 Existing Conditions and the 2030 Baseline Conditions.

RESULTS

The groundwater level responses to the two different land use conditions were evaluated using a representative 41 year hydrologic period and comparing the water level hydrographs, water level contours, and water budgets. The total groundwater pumping for urban uses increases from an average of 18.7 Thousand Acre Feet per year (TAF) under the 2005 Existing Conditions, to 43.0 TAF under the 2030 Baseline Conditions, an annual increase of 24.3 TAF of additional groundwater pumping. In addition to the increase in groundwater pumping there is a decrease of 46.7 TAF of surface water applied for agricultural purposes as a result of urban development between the 2005 Existing Conditions and the 2030 Baseline Conditions. This results in a decrease in recharge to the groundwater basin from the applied surface water of 11.7 TAF. Both the increase in pumping and decrease in irrigation applied surface water result in changes to the groundwater elevations and storage.

If the 2005 land use conditions were to continue into the future, the water levels at the end of the 41 year period would decline an average of 10 feet throughout the CID area. The effects vary within the CID area, ranging from a decrease of 32 feet in the Caruthers area in the west, to a decline of 2 to 3 feet in the Parlier and Kingsburg areas closer to the Kings River. The groundwater impacts are more prominent along the 99-corridor under the 2030 Baseline Conditions and water levels would decline an average of an additional 5 to 9 feet as compared to the 2005 Existing Conditions. The water level declines indicate groundwater overdraft. This means that on the average more water is removed from groundwater storage than is put into groundwater storage each year. Despite efforts from CID's groundwater recharge program, the District has an average annual overdraft of 24.5 TAF from 1964 to 2004. Continuing urban development will add an additional annual overdraft is approximately 36.0 TAF/yr under 2030 baseline conditions.

MODELING ASSUMPTIONS AND INPUT SUMMARY

The King IGSM model was used to evaluate two future land and water use conditions based on 2005 Existing Conditions and 2030 Baseline Conditions. The model input files for the two land use conditions were developed using projected data for the cities or water purveyors, and based on assumptions listed in Table 1. The Kings IGSM model can vary the model inputs for each subregion. This allows for varying land use and water supply assumptions within specific geographic areas.

Table 1. CID Assumptions Summary

	2005 Existing Conditions	**2030 Baseline Conditions**
Land Use	2004 Land Use	2030 Land Use
Agricultural Water Demand	Based on: - 2004 Land Use and Crop Acreage - 1964-2004 Hydrology	Based on: - 2030 Land Use and Crop Acreage - 1964-2004 Hydrology
Crop Acreage	- 2004 Crop Acreage	- 2030 Crop Acreage (2004 crop acreage minus agricultural areas converted to urban)
Recharge Ponds	2004 Conditions	Same as 2005 conditions
Urban Water Demand	2004 Urban Demand	2030 Urban Demand
Wastewater Treatment Plants Flows	Use 2004 conditions for SKF WWTP	Same as 2005 conditions
Pine Flat Reservoir Operations	Historical releases and flows	Same as 2005 conditions
Surface Water Deliveries - Kings River	Historical deliveries and diversions	Same as 2005 conditions
Initial Conditions	- Use End of Sep 2004 values for GW levels, soil moisture, unsaturated soil moisture, and small watershed soil moisture	Same as 2005 conditions

The CID has senior Kings River water rights that allow for diversion and distribution within the CID jurisdictional area ('place of use'). Lands that annex to the city upon development detach