

Technical Memorandum 6

Summary of Alternatives for Initial Estimation

This Technical Memorandum (TM) summarizes the alternatives considered for determining the estimated overdraft volume that each GSA in the Kings Subbasin should initially include in their respective GSPs related to the unconfined aquifer. This TM utilizes the information presented in TMs 1, 2, 3, 4 and 5 from the Kings Basin Coordination Effort.

Alternatives

The following is a description of the alternatives developed for initial consideration. Attachment 1 to this memo includes a table showing the values for each Alternative.

Alternative 1 – Equal Distribution

Alternative 1 includes equal distribution of the total estimated overdraft in the basin. The estimated total storage change from TM4 (122,000AF for the Spring 1997 to Spring 2012 base period) was divided by the total acreage within the Kings Subbasin (981,541 acres) to determine a per acre responsibility. That per acre responsibility was multiplied by the total acreage within each GSA to determine that GSA's responsibility. This alternative was primarily prepared for reference as it does not factor in location or water supply and was not agreeable to GSAs that have an adequate surface water supply.

Alternative 2 – Storage Change Only

Alternative 2 uses the storage change values per GSA that were estimated in TM4. This alternative does not consider boundary flows, which historically occurred but over time have changed significantly within the basin as a depression has formed in the McMullin GSA, as well as the impact from neighboring basins.

Alternative 3 – Storage Change less Recent Boundary Flows

Alternative 3 uses the Storage Change values per GSA estimated in TM4 and also factors in the recent internal boundary flows during the base period estimated in TM5. The average annual boundary flow across internal Kings basin GSA boundaries for the base period of years were determined in TM5 and included in this alternative. The entire boundary flow across a GSA boundary as estimated in TM5 was credited back to the upgradient GSA. Crediting back the entire amount of boundary flow to the upgradient GSA was considered excessive as this assumption ignored the historic boundary flow in the region. It is important to note that the totals shown in this alternative are not adjusted for external boundary flows. External boundary flows in the unconfined aquifer were estimated in TM5, and groundwater flow across the external Kings Basin boundary is predominantly away from the Kings Basin. An adjustment for external basin boundary flows was not included in this alternative as discussions with neighboring basin GSAs is necessary for consideration.

Alternative 4 – Storage Change less the difference between Recent and Historic Boundary Flows

Alternative 4 was developed as a variation of Alternative 3 with the additional consideration of historic boundary flows within the subbasin. The boundary flows from 1925 were determined in TM5 using the same method that was used to estimate recent boundary flows during the base period. This alternative utilized the Storage Change values per GSA from TM4 as a starting point,

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but then adjusted these values based on the difference between recent (average of all base period years) boundary flows and the historic (1925) boundary flows. This alternative includes as much recent data as possible in estimating current boundary flow conditions and recognizes that some groundwater historically flowed from higher elevations to lower elevations and that the downgradient GSAs should only be responsible for the increased groundwater flow caused by pumping. Similar to Alternative 3, external basin boundary flows are not factored into the totals included in this alternative.

Recommendation

From discussion with GSA representatives in the Kings Basin coordination effort, Alternative 4 is the preferred alternative for GSAs to use in setting an initial target overdraft volume for each GSA to include in their respective GSPs. A table showing the total for each GSA is included below.

GSA	Proposed Initial Responsibility (AF)
Central/South	-7,100
James	16,700
Kings River East	-11,000
McMullin	-91,100
North Fork	-50,300
North Kings	20,800
Total	-122,000

Although specific values are identified, it is critical to understand there is significant margin of error in calculating both storage change and boundary flows. It is recommended for GSAs to consider at least a 20% contingency range when considering projects and programs for implementation to correct the overdraft in the basin. These values do not consider James pumping in McMullin GSA. These initial values will also be compared to estimates developed from the basin water budget development. It is important to remember that these overdraft estimates are only for the unconfined aquifer and do not include any external boundary flow estimates, from either the unconfined or confined aquifer, as the GSAs will need to discuss how these external boundary flows are going to be addressed with the neighboring basin GSAs. The GSAs will need to evaluate and adjust these values regularly in future years as additional information is collected and estimates of storage change are updated.

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Attachment 1
Alternatives Table



Kings Basin Methodology Alternatives for Proportionment of Storage Change
10/24/2018

Column #	1	2	3	4	5	6	7
	Alt 1		Alt 2	Alt 3		Alt 4	
Methodology	Equal Distribution		Storage Change Only	Storage Change +/- Recent Boundary Flows		Storage Change +/- Difference between Historic and Recent Boundary Flows	
Column Calculation				3 - 4		3 - (4 - 6)	
GSA	Acreage	Total Basin Storage Change 97-12 divided by Total Basin Acreage multiplied by GSA Acreage (AF)	Storage Change Estimation (Spring 97-12) from TM4 (AF)	Average of Base Period (97-12) Internal Boundary Flows ¹ (AF)	Total w/Recent (Base Period) Average Internal Boundary Flows (AF)	1925 Internal Boundary Flows from TM4 ¹ (AF)	Storage Change less difference between Int Flows only (AF)
Central/South	160,870	-19,995	-17,000	-20,400	3,400	-10,500	-7,100
James	29,051	-3,611	-5,000	-19,200	14,200	2,500	16,700
Kings River East	191,126	-23,756	-11,000	0	-11,000	0	-11,000
McMullin	120,580	-14,987	-16,000	91,700	-107,700	16,600	-91,100
North Fork	168,187	-20,905	-49,000	14,900	-63,900	13,600	-50,300
North Kings	311,728	-38,746	-24,000	-67,000	43,000	-22,200	20,800
Total	981,542	-122,000	-122,000		-122,000		-122,000

Notes: 1) A negative boundary flow value means the total sum of flow is out of or away from the GSA. A positive value means flow into the GSA.