

IMPLEMENTATION OF THE RE-USE OF IRRIGATION WATER IN IGSM2

IGSM2 Users Group Meeting

July 8, 2005

Can Dogrul

California Department of Water Resources



RE-USE OF IRRIGATION WATER: DEFINITION

- The amount of irrigation water not consumed within one irrigation unit (farm, irrigation district, etc) that is captured and used in another irrigation unit
- Subsurface drainage as well as surface return flow (i.e. irrigation tailwater) from one irrigation unit can be captured and re-used in another unit
- Decreases the required amount of “prime” irrigation water (sum of groundwater pumping and surface water deliveries) to be applied to an irrigation unit



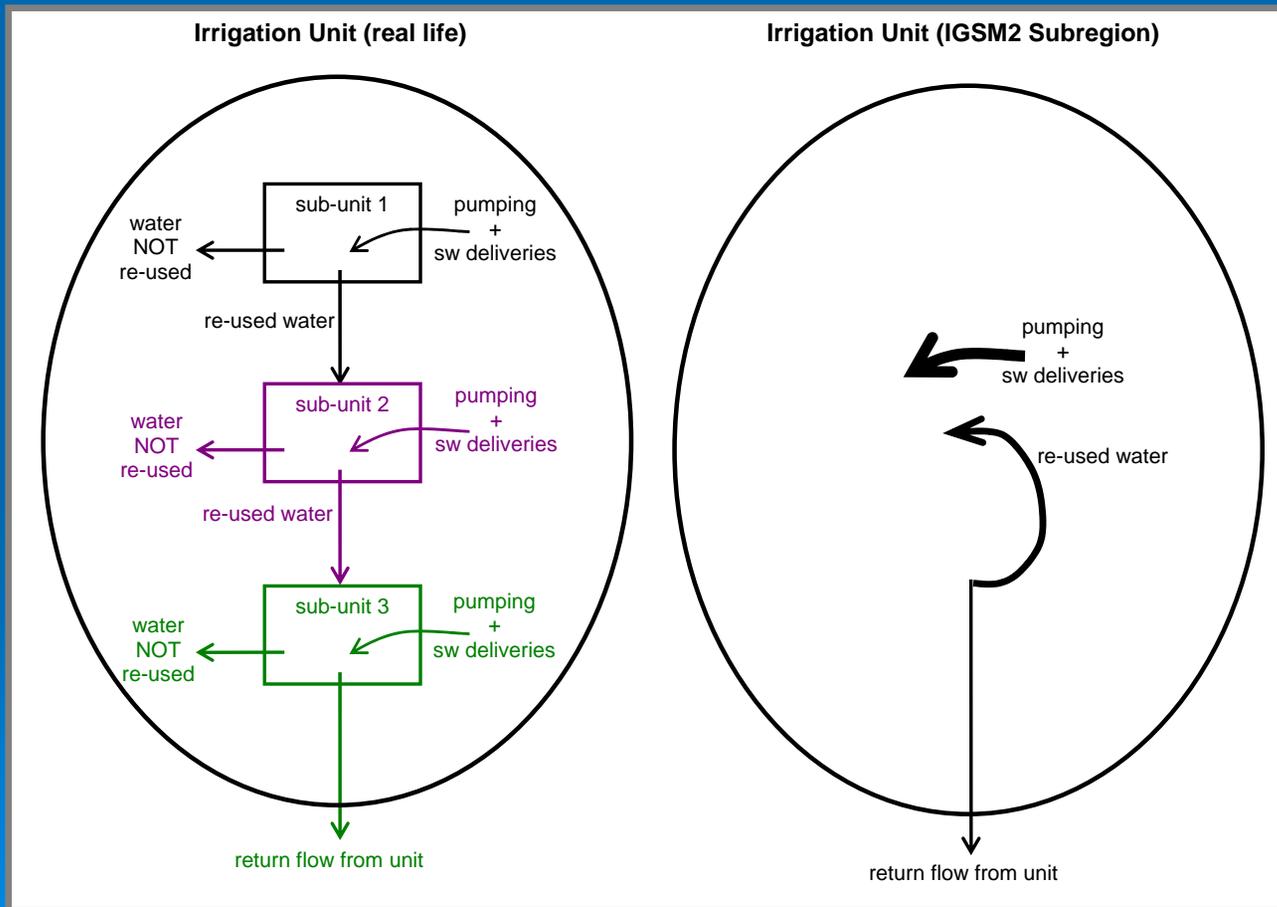
IMPLEMENTATION IN IGSM2

- Only re-use of return flow (irrigation tailwater) is considered
- Re-use is specified by the user for each subregion through a re-use factor
- A sequential algorithm is used to compute the re-use of irrigation water:
 1. Given the amount of applied water, compute infiltration and return flow as a function of soil moisture
 2. Route soil moisture through the zone (i.e. compute ET, deep percolation and root zone soil moisture)
 3. Re-apply the specified percentage (i.e. re-use factor) of the return flow and route it through the root zone
- Re-use of re-used water is not simulated



IMPLEMENTATION IN IGSM2 (*continued*)

- Re-used water is not routed from one sub-unit to another in IGSM2



IMPORTANT EXPRESSIONS

(after Solomon and Davidoff, Trans. ASAE, 42(1), 115-122, 1999)

$$W_{as} = \frac{CUAW_{as}}{IE_{as}} \quad IE_{as} = \frac{IE_t}{1 - \rho_t(1 - IE_t)}$$

$$\Rightarrow W_{as} = \frac{CUAW_{as}}{IE_t} - CUAW_{as} \frac{(1 - IE_t)}{IE_t} \rho_t$$

where

W = required irrigation water

IE = irrigation efficiency (named as ICUC in Solomon and Davidoff, 1999)

CUAW = consumptive use of applied water

ρ = re-use factor as a fraction of the return flow

as = subscript for aggregate values

$$\left(\text{e.g. } W_{as} = \sum_{i=1}^n W_i \quad \text{where } n \text{ is the number of sub-units} \right)$$

t = subscript for "typical" values (e.g. $W_t = \frac{1}{n} W_{as}$)



RE-USE FACTOR

- Re-use factor in IGSM2 is specified as the fraction of the return flow that is captured and re-applied in a subregion
- Communications with people in the water community show that re-use factor is commonly expressed as the fraction of the total irrigation water that is captured and re-applied in an irrigation unit
- Rule of thumb:
 - re-use factors of 0.5 and up are factors as IGSM2 expects
 - re-use factors below 0.5 are commonly expressed factors
- User should make sure that factors input to IGSM2 are computed as the fraction of the return flow (i.e. IGSM2 style factors)



MODIFIED INPUT and BUDGET FILES

- Main control file ([Unit 5](#))
- Parameter input file ([Unit 7](#))
- Irrigation water re-use factor data file ([Unit 29](#))
- Land and water use budget table ([with re-use](#) – [without re-use](#))
- Root zone moisture budget table ([with re-use](#) – [without re-use](#))



CONCLUSION

- The simulation of the re-use of irrigation water is implemented in IGSM2
- IGSM2 version that includes the simulation of re-use of irrigation water is still being tested and has not yet been released to the public
- This version can be obtained from California DWR for beta testing upon request

