# Using Constructed Wetlands to Treat Agricultural Runoff

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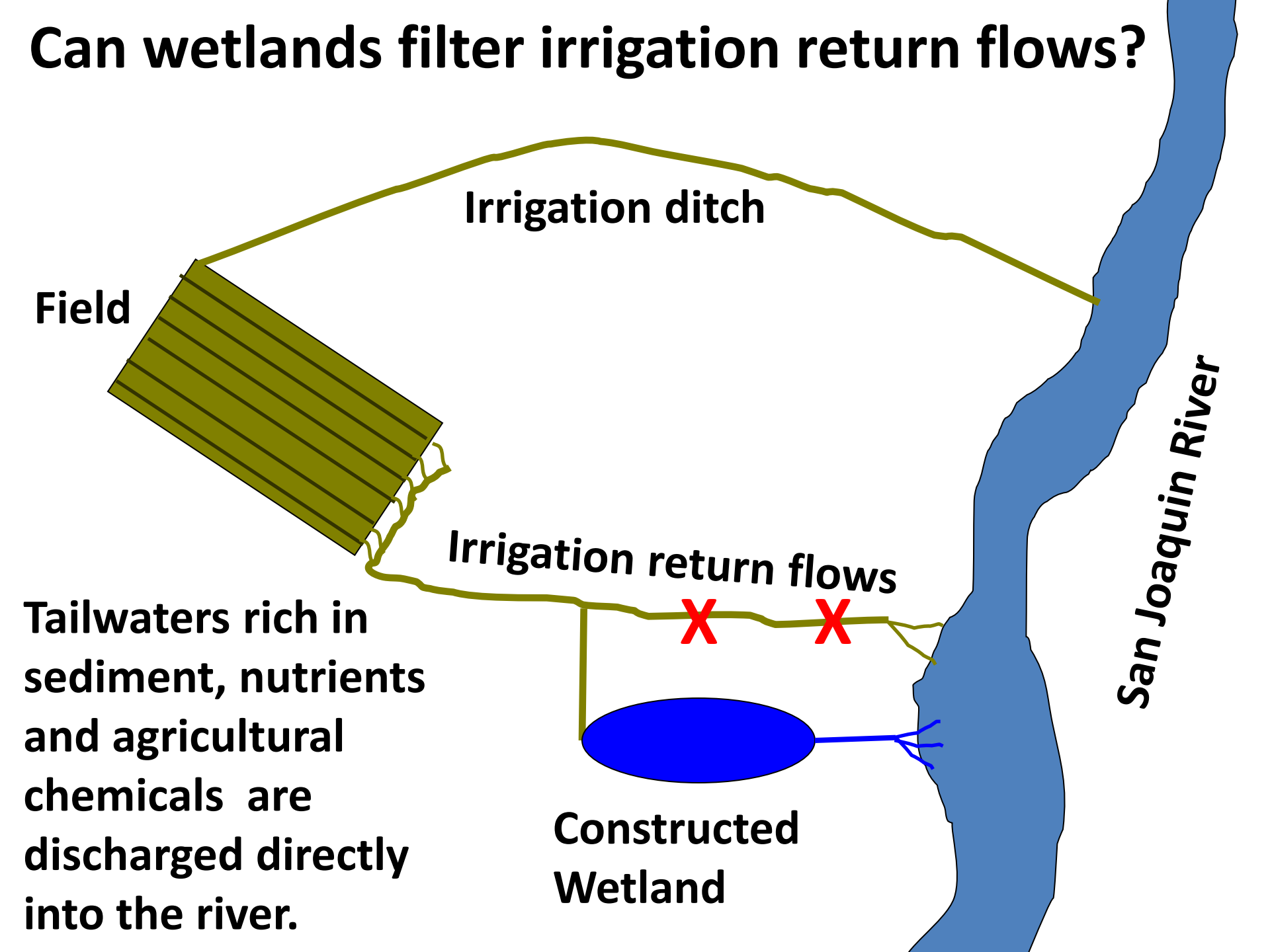
# Can wetlands filter irrigation return flows?



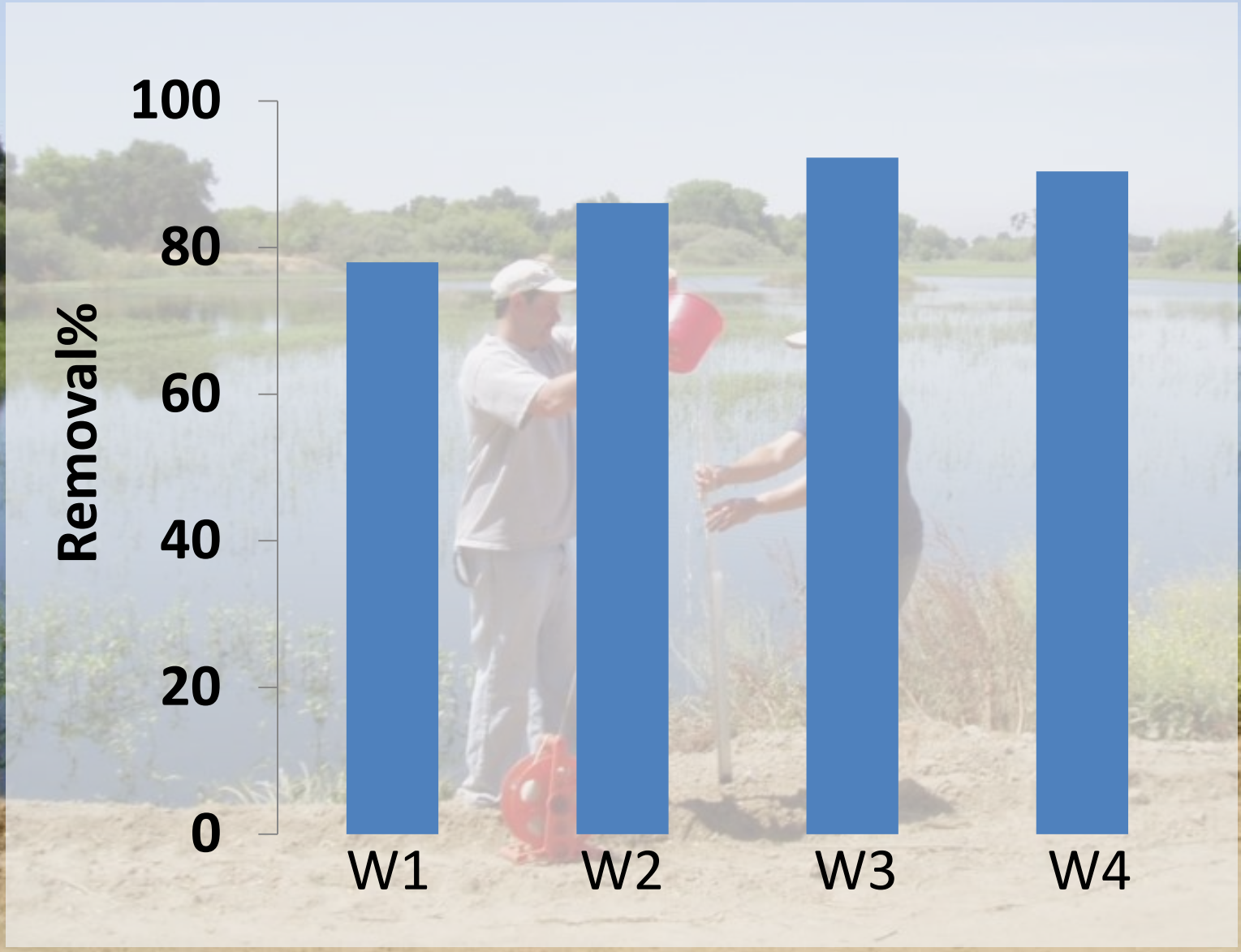

Tailwaters rich in sediment, nutrients and agricultural chemicals are discharged directly into the river.

# Constructed/Restored Wetland Characteristics

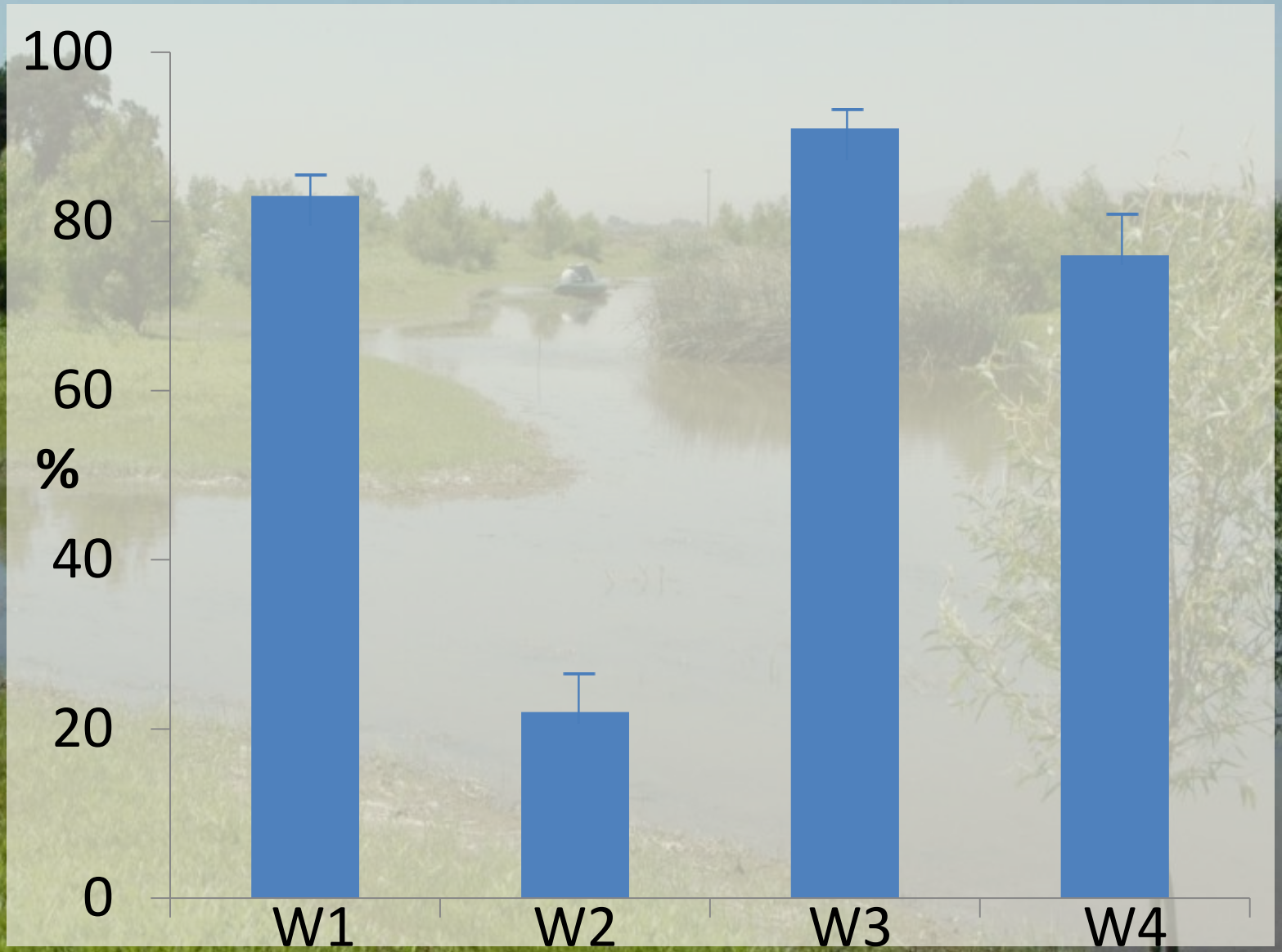
| | Size (Ac) | HRT (Day) | Flow | Design |
|---|---|---|---|---|
| W1 | 5.7 | 1 | Continuous | Dendritic |
| W2 | 11 | 2.5 | Continuous | Open water |
| W3 | 370 | 11.6 | Continuous | Open water |
| W4 | 383 | 20 | Flood pulse | Open water |

# Considerations: Dendritic vs open water, vegetative cover, hydrology, amount and type of contaminants, adverse effects on water quality

# Total Suspended Solids Removal Efficiency

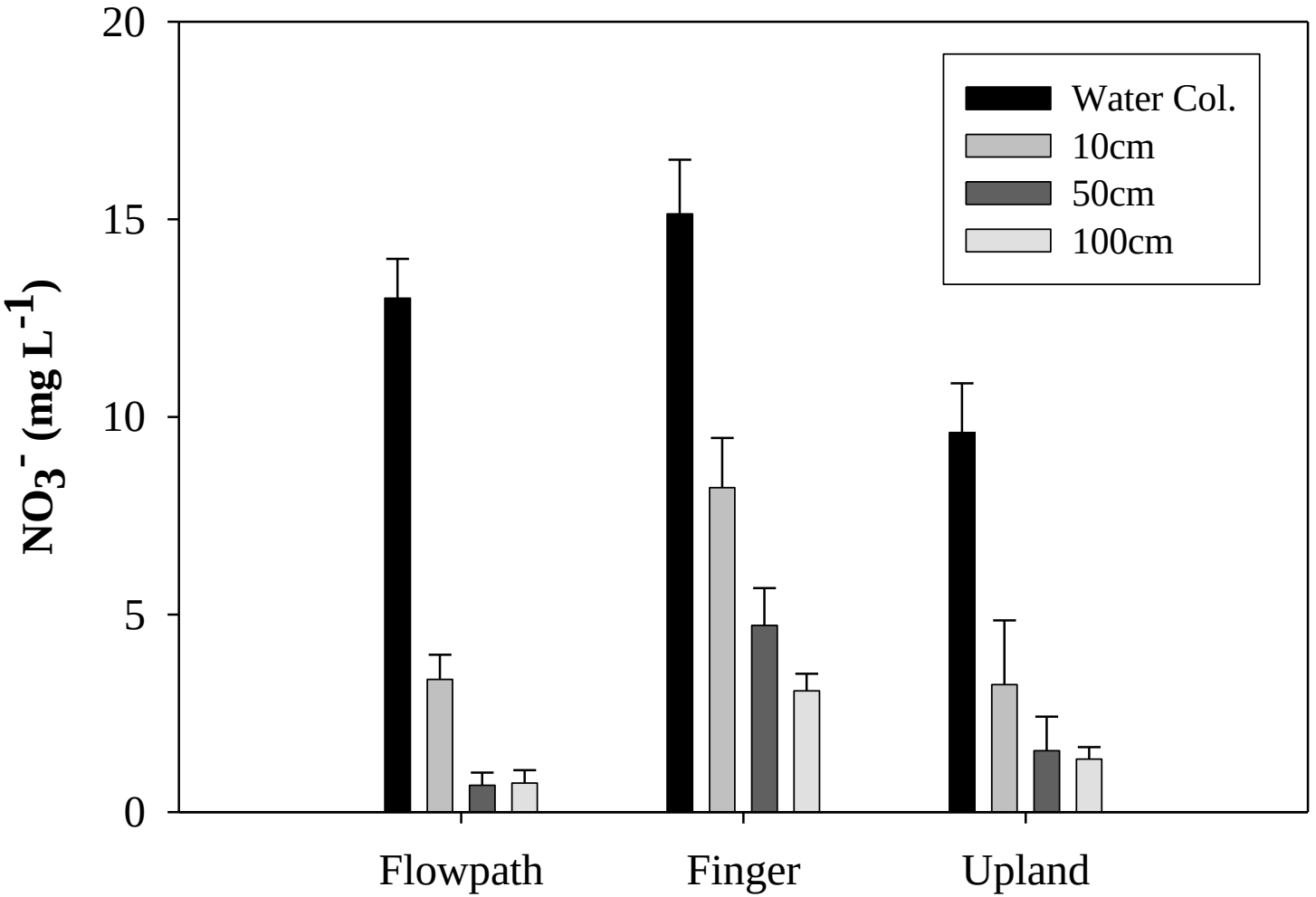


# Nitrate-N Removal Efficiency

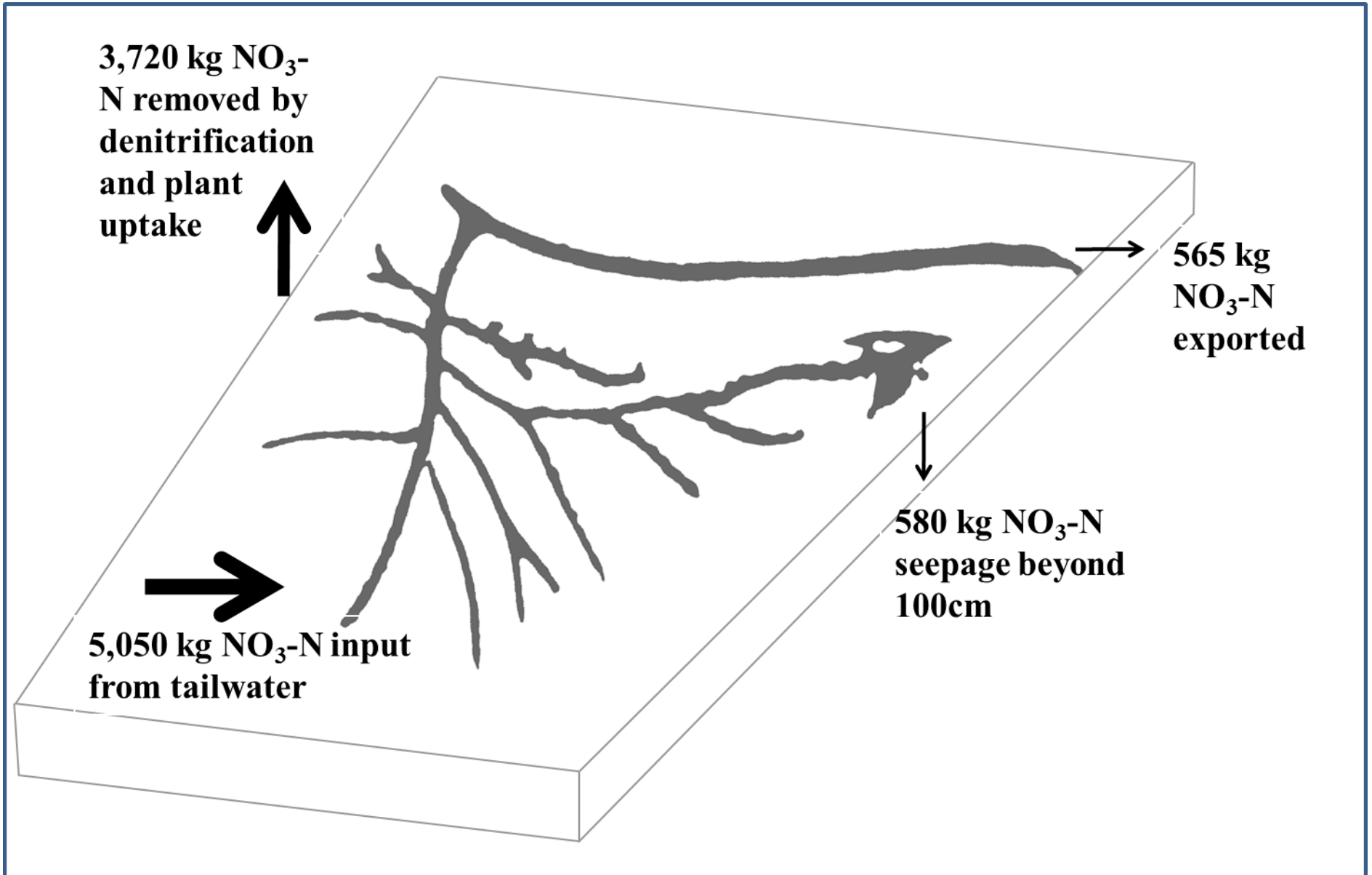



$NO_3^-$ in input water was usually at or above the water quality standard

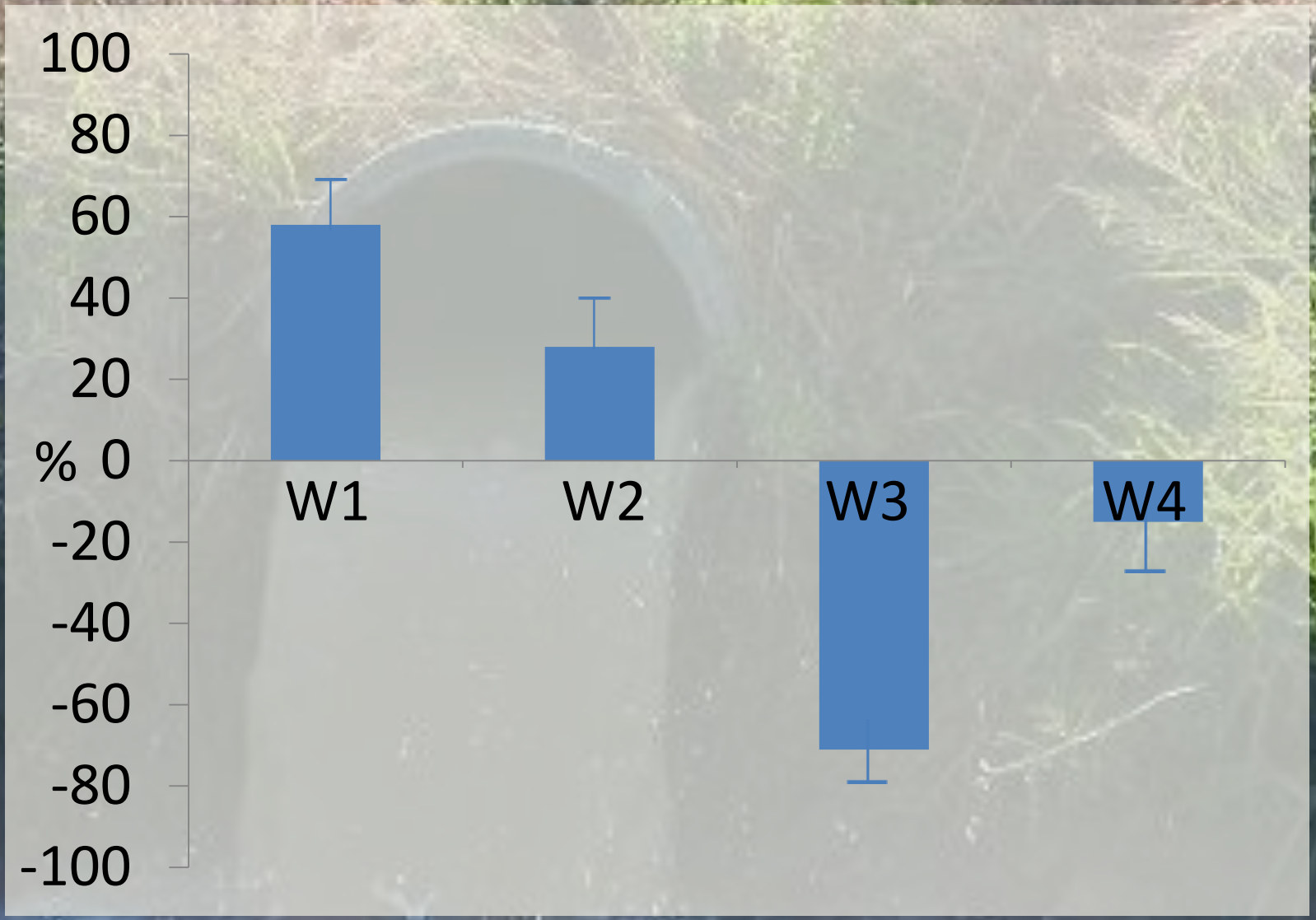
# Is deep seepage a concern for nitrate groundwater contamination?



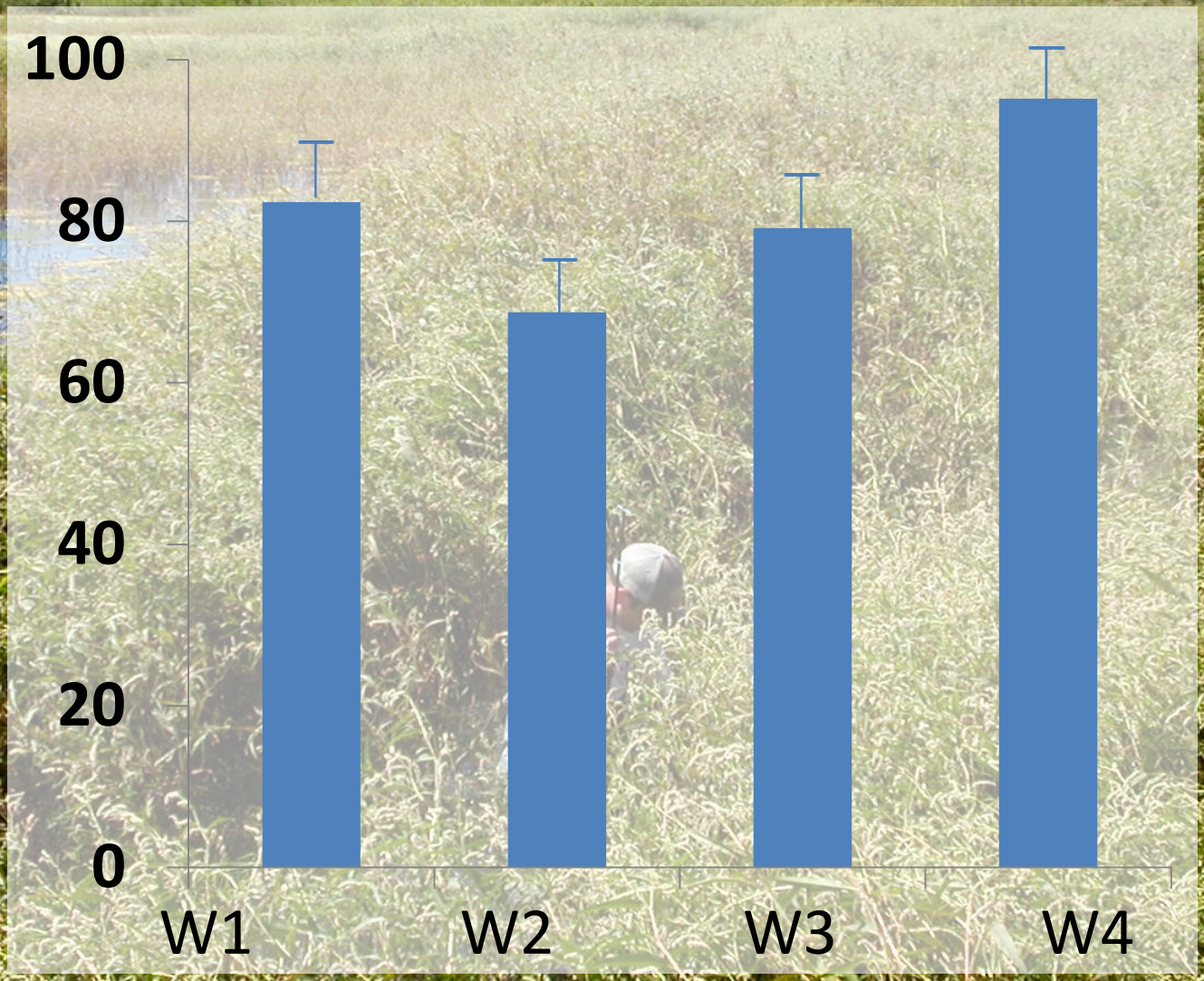
# Nitrate-N budget for the 2007 irrigation season at W1



# Phosphate Removal Efficiency



# E. *coli* Removal Efficiency



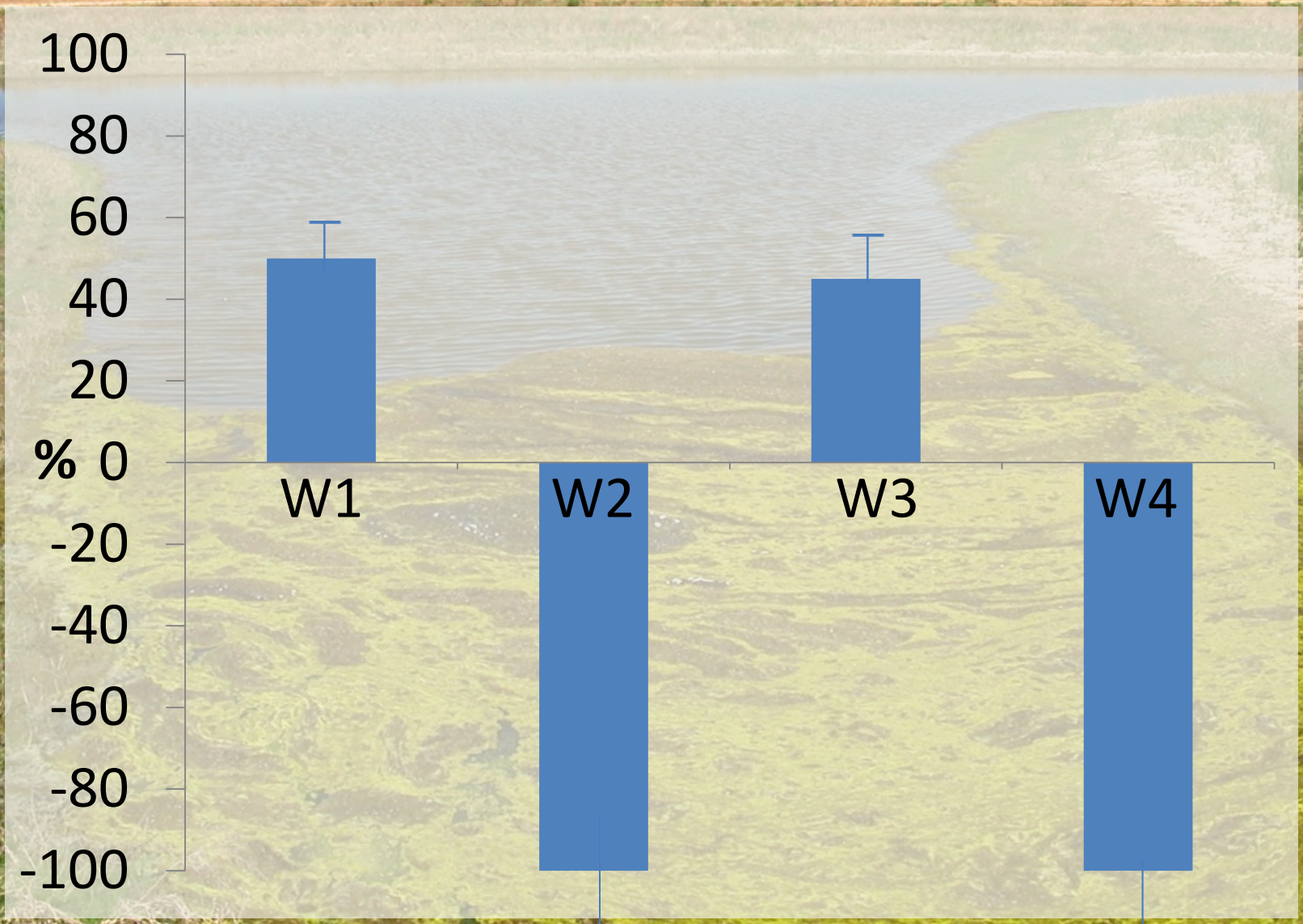

Input levels typically exceeded water quality standards

# Pyrethroid Removal Efficiencies at W1

| Compound | Concentration in water (ng $l^{-1}$) | | Removal % |
|---|---|---|---|
| | Inlet | Outlet | |
| Bifenthrin | 2.60 | 0.21 | 84 |
| Cyhalothrin | 3.26 | 0.17 | 90 |
| Cypermethrin | 20.5 | 3.61 | 64 |
| Esfenvalerate | 0.89 | 0.03 | 77 |
| Permethrin | 77 | 5.82 | 94 |
| Chlorpyrifos | 3.03 | 1.62 | 52 |
| Diazinon | 19.45 | 3.65 | 82 |

*Budd et al., 2009, Environmental Science and Technology*

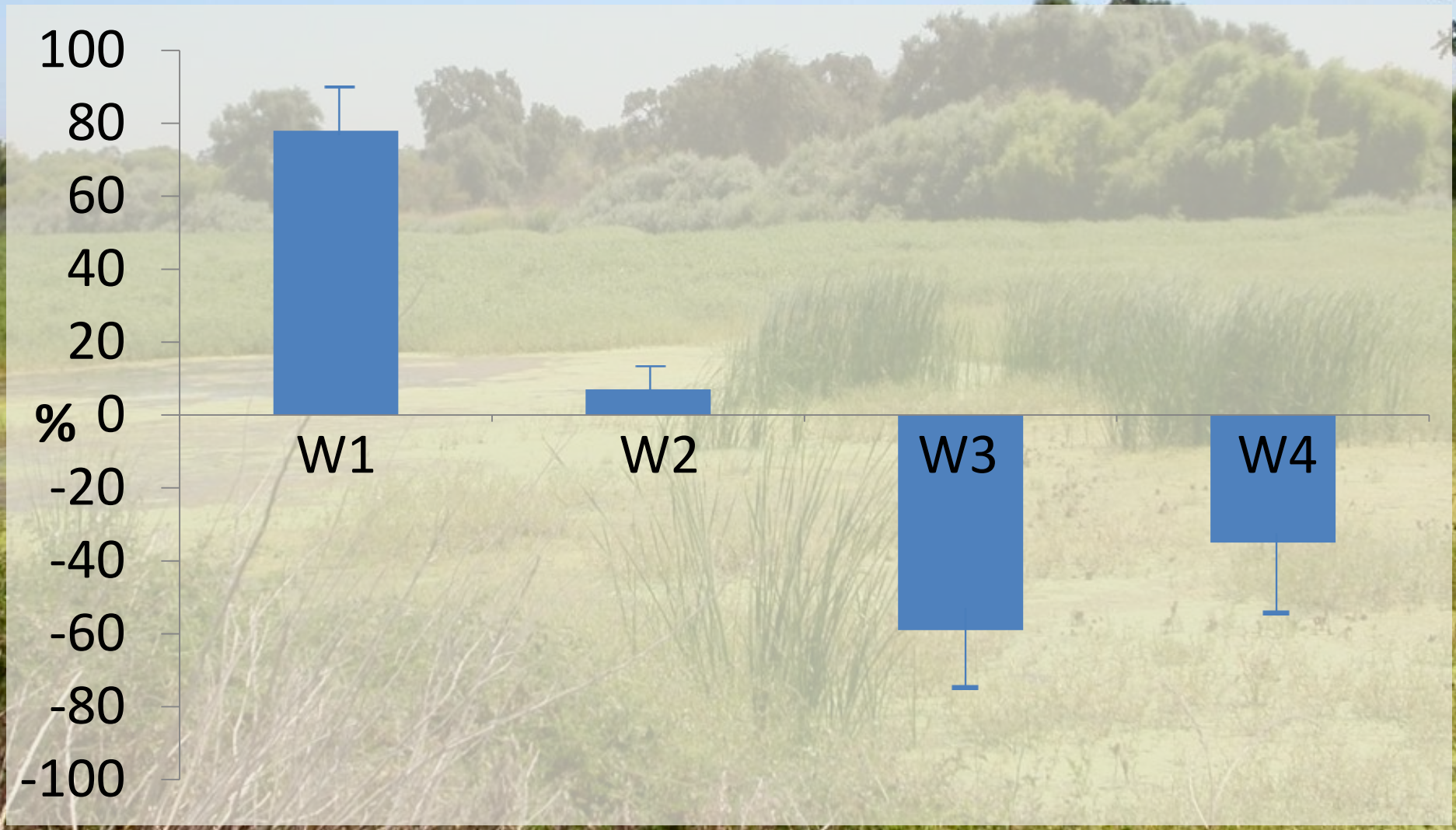
# Algae Removal Efficiency

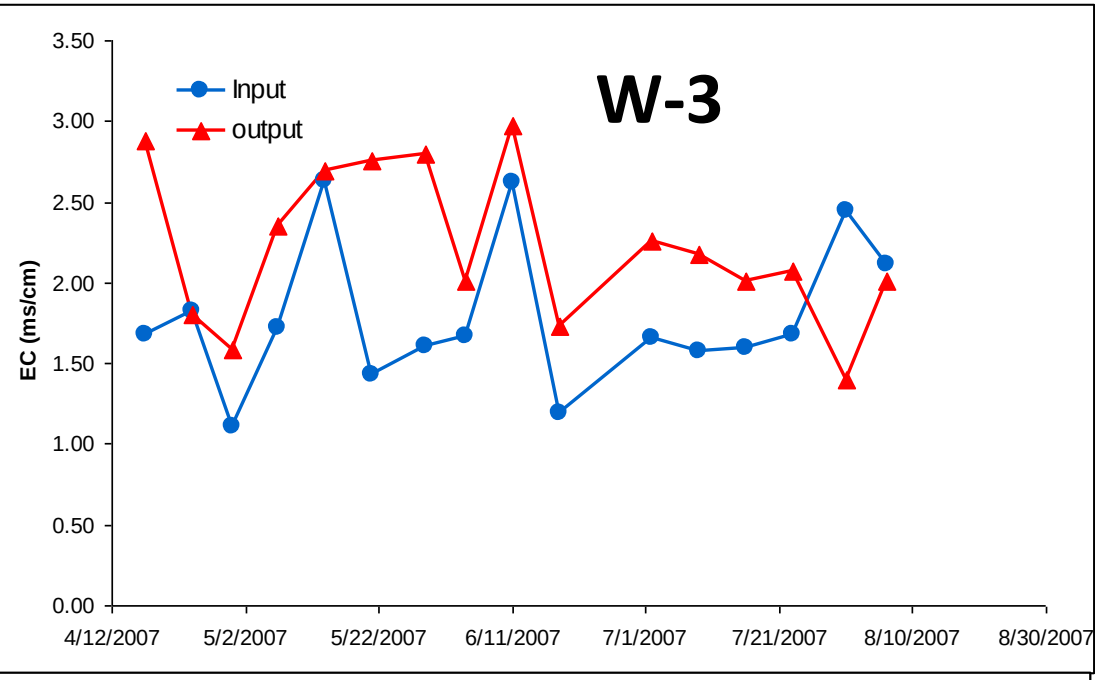


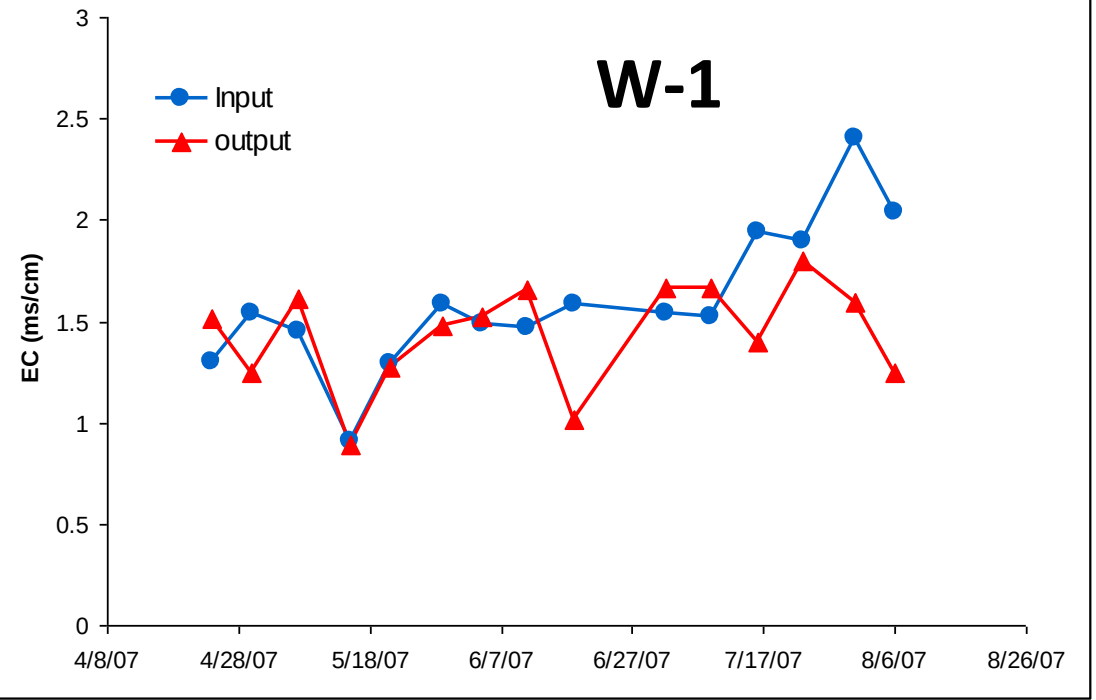
# Algae removal efficiency increases with canopy cover



# Dissolved Organic Carbon Removal Efficiency: A Precursor for DBPs



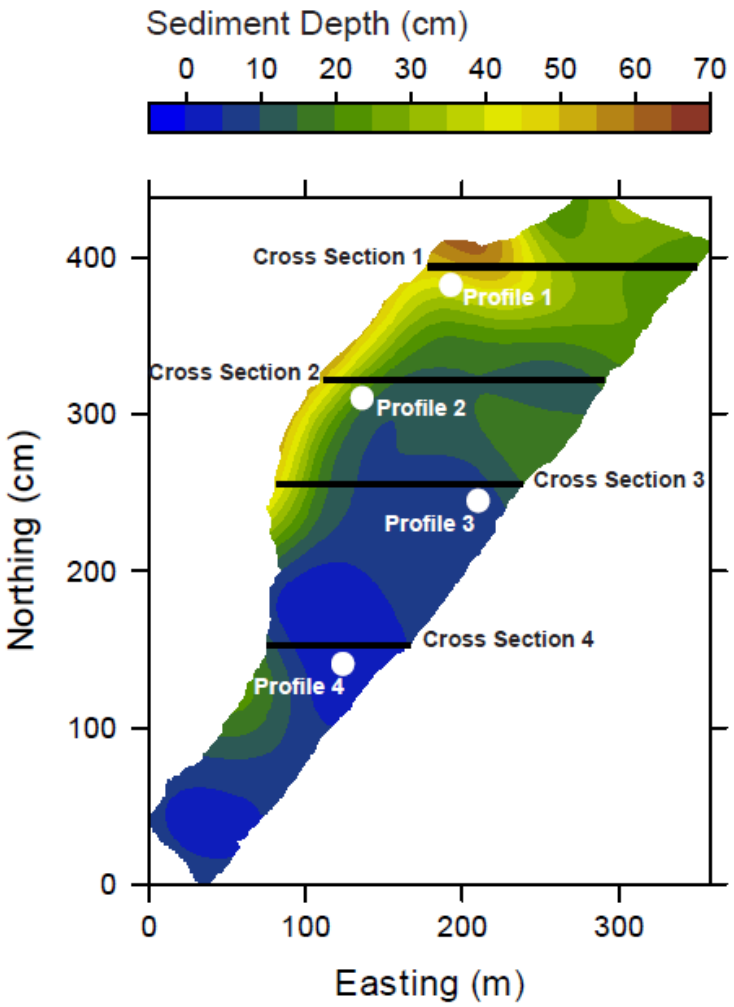


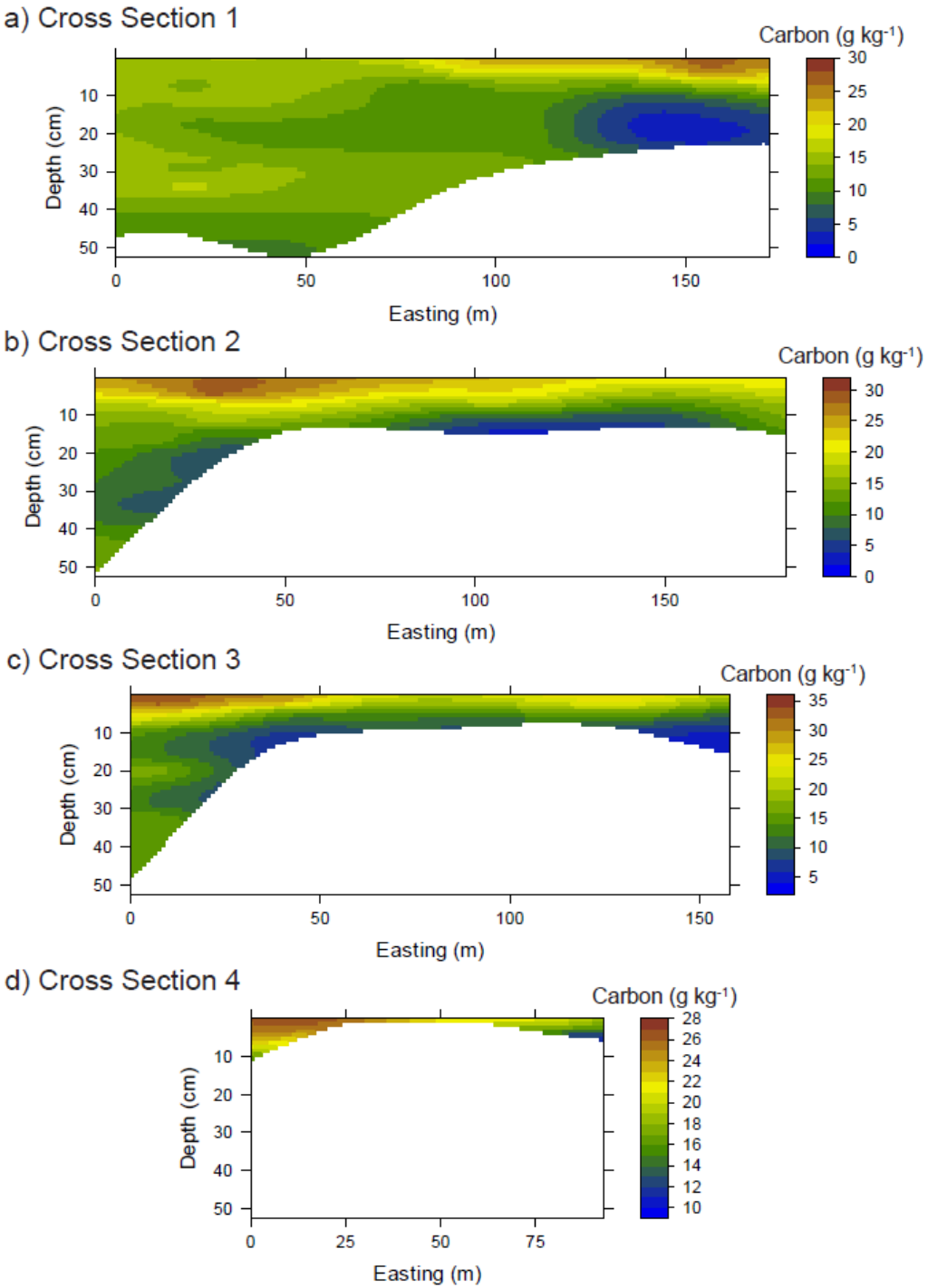




# Salinity

**Long residence times (> 3 days) increase salinity in effluent by a factor of 1.2 to 2.0**

# Carbon Sequestration




**3 kg C m$^{-2}$ over an 8-yr period totaling 156,000 kg-C**

# Summary

-Wetlands remove a wide variety of contaminants

-Contaminant removal is function of HRT, design and vegetation

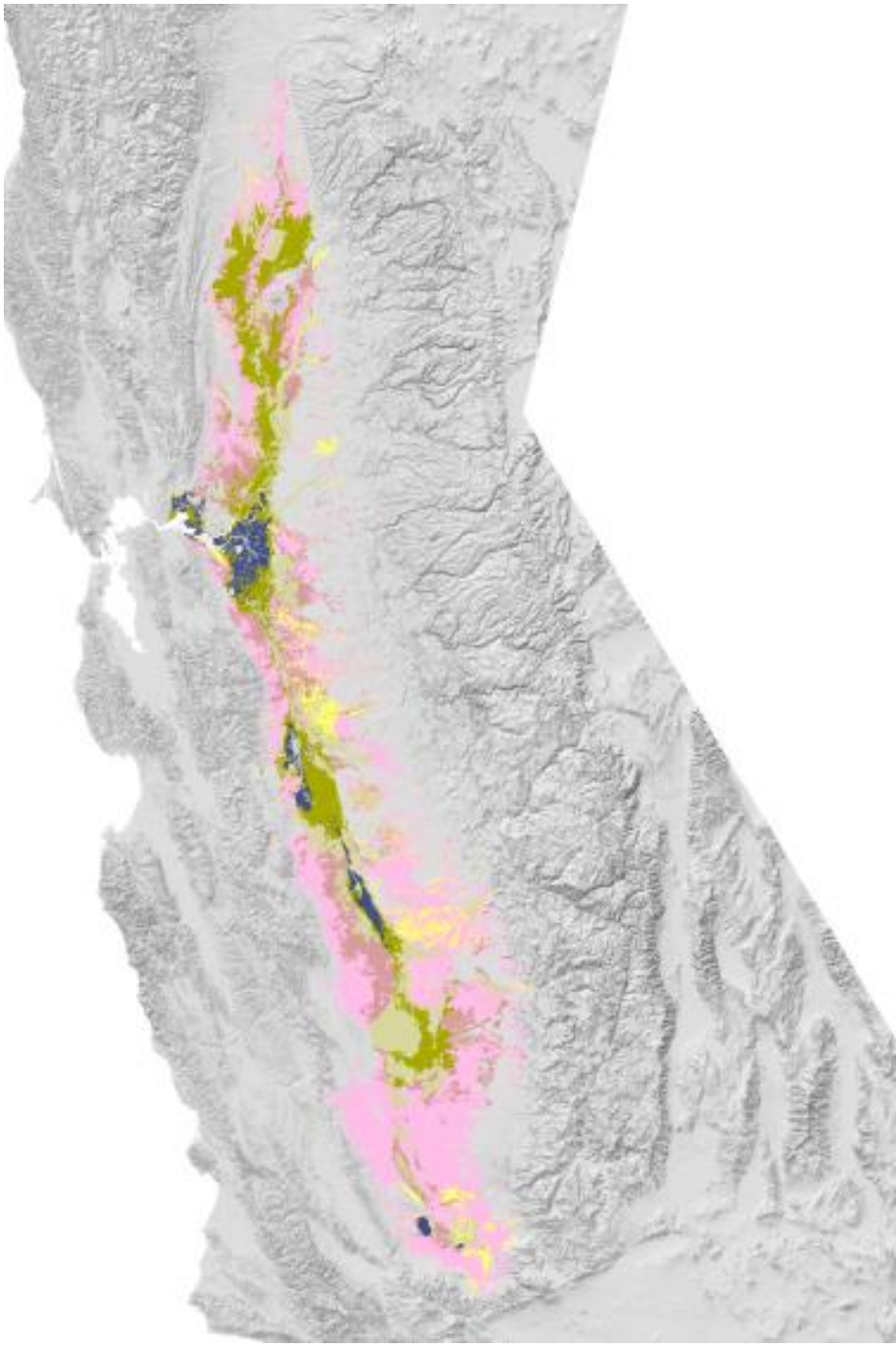
-Wetlands with short HRT's minimize adverse effects (salinity, DOC, P)

-Wetlands do not cause groundwater nitrate contamination

-Wetlands can store carbon but much of it is eroded carbon from cropland

# Future Work

**BMP Suitability Indices: Identify landscape characteristics that influence the selection and function of BMPs.**



# Thank you

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