Prioritized Water Rights Allocation in RiverWare

New Development

Purpose

Given hydrologic (natural) inflow, allocate the flow to water rights in priority order. This is typically done before project deliveries.

- Rights include diversion rights, storage rights and instream flow rights
- Accounts may have multiple rights
- Storage rights may depend on d.s. unmet senior rights
- Instream Flow rights may vary according to beginning-of-year storage at a reservoir
- Instream Flow rights may be met by project water

Approach

Provide a rules function that does the network computation and sets the account diversions.

- Function allocates to all rights that are linked to a specified "supply chain" (indicated by water type)

- Solution is computed by iterative application to a cloned network of the account chain with simplified links for faster computation.

- Instream flow rights are not "taken" in first solution; solution is re-visited after project water is distributed (by subsequent rules).

- Solution is set in slots by the rule (still under discussion)

Multi-Object Solution

Computational SubBasin is RiverWare's mechanism for offering multi-object solutions.

New category: Water Rights Allocation

With method: Pure Prior Appropriation

New rule function SolveWaterRights() operates on accounts in computational subbasin.

Rule Function

SolveWaterRights(

subbasin,

priority date range,

supply chain of interest,

allow/disallow calls from instream flow rights)

- Rule invocation causes cloning of accounts; clones used for intermediate results.
- Rule solution values are copied to the original accounts.
- Accounting system solves as side-effect of rule function.

Extensions to Legal Water Accounts

- <u>Right</u> (flow or volume) series slot
- <u>Shortage</u> (flow) series slot
- <u>Multiple priority dates</u>
- Priority dates granularity = <u>minute</u>
- User-selectable methods for <u>Calculation of Water Right</u>: (<u>Right is Input</u>, <u>Right is Seasonal</u>)
- <u>Priority</u> scalar slot (temporary slot)
- Subordination clauses (not defined yet)

InstreamFlow Account

- New legal water account type
- Can sit only on control point object, may have sibling pass-through accounts
- <u>Flow</u> slot contains sum of all inflows to all accounts on the containing object.
- <u>Call Limit</u> slot models natural flows found on first call to SolveWaterRights()
- Additional water right calculation method: <u>Reservoir Beginning-of-Year Storage</u>: right is seasonal *and* depends on storage at beginning of year in a designated reservoir.

Extensions to Diversion Accounts

- New category: <u>Calculation of Return Flow</u> with methods: Diversion Minus Depletion (existing solution), <u>Return Flow is Input</u>, or <u>Percentage Return Flow</u>

- <u>Return Flow Lag</u>: scalar slot, value is number of time steps

Extensions to Storage Accounts

- Additional water right calculation method: <u>Unmet Downstream Rights</u> : similar to Right is Seasonal but it adds in unmet downstream senior rights to compute its "demand".

Changes to Pass-Through Accounts

- Lags allowed only on Reaches and and Distribution Canals
- Slot inflows only on reaches and reservoirs
- Diversions and return flows only on reaches, reservoirs, distribution canals
- Transfers not on control points
- Gain/loss only on reaches, reservoirs, distribution canals

New Accounting GUI Work

- Support for InstreamFlowAccount
- New configuration dialogs
- New account display/edit dialogs
- All in Qt

Summary

- <u>Multi-Object solution</u>: involves relationships among accounts on same and different objects
- <u>Uses Computational SubBasin</u>, new method categories, methods
- <u>Uses Cloning</u> as in hypothetical simulation, extended to clone accounts
- New <u>rule</u> functions
- New <u>InstreamFlowAccount</u> type
- <u>Extensions</u> to all account types
- New <u>GUI work</u> for accounting