Practice note: Representing and sourcing demand data

This practice note is one of a set developed to provide consistency and transparency of river system models being used within the Murray-Darling Basin. The notes cover modelling practices, such as naming conventions for folder structures, to model methods, such as for flow routing and residual inflow estimation, and have been developed through a collaboration between the MDBA, Basin States and CSIRO.
This practice note, ‘Representing and sourcing demand data’, describes agreed general principles and recommended practices for representing key demands in eWater Source river system models; the sourcing, and quality assurance, of the data used to represent these key demands; and provides examples of implementing the conventions.

**Background**

Modelling of demands (e.g. irrigation, urban, stock and domestic, industrial, environmental) is a key component of any river system model. Observed diversions are used to force diversions during flow calibration and in the calibration of demand models.

Within eWater Source, demands are modelled using water user nodes. This is described in the User Guide at [https://wiki.ewater.org.au/display/SD41/Water+Demands](https://wiki.ewater.org.au/display/SD41/Water+Demands).

Unlike climate and flow data, information to model demands comes from multiple sources and talking to key stakeholders is essential to understand the data and its quality.

Practice notes covering the modelling of individual demand types, including disaggregation from annual, seasonal or monthly to daily time scale, are under development.

**General principles**

1. The best available demand data should be collected to support flow calibration and calibration of demand models.

2. Observed diversions data should be at a spatial and temporal scale commensurate with the required model complexity.

3. Demand data should be grouped based on the location of use and demand type, not on the location of the entitlement. This acknowledges trade impacts on the location of water use.

4. Observed diversion data should be quality controlled to make sure they are sensible. It is important to understand the source of the diversion data and any limitations with the data.

5. Demand data should be disaggregated to the appropriate time step for the different stages of calibration.
   a. Observed diversions (disaggregated to the appropriate time step) should be used during flow calibration
   b. Observed diversions should be used to calibrate demand models.

**Conventions for representing and sourcing demand data**

6.3.1 Representing demands in the model

The spatial scale for each demand model should be defined. This should consider the different types of diversions (e.g. irrigation, urban, environmental). The spatial scale and representation adopted should be agreed with stakeholders and should strike a balance between representing processes, model complexity, and the likely significance of the demand to policy decisions.
The recommended practice for representing demand is:

1. Irrigation demands
   a. Model major irrigation entities separately
   b. Lump other irrigation demands to the reach scale
2. Town water supply demands
   a. Model major towns as separate nodes, based on the geographic location of the town.
   b. Modelling of demand should be based on population, climate and response to water restrictions
3. Stock and domestic demands
   a. Determine whether stock and domestic demands can be lumped with irrigation or town water supplies. Where this is not appropriate, model as single nodes at the reach scale. This demand should be responsive to climate signals.
4. Environmental demands
   a. Locations will vary based on needs in any given year. There may be a need for custom rules to capture environmental watering strategies.

It is important to know if the data are observed (i.e. metered) or based on a historical pattern. For each reach the following information should be summarised and reported:

1. Type of diversion data. e.g.
   a. Town Water Supply
   b. Irrigation – regulated water
   c. Irrigation – supplementary water
2. Source of data and method of collection
3. Time step of available data (e.g. daily, monthly, annually)
4. Period of available record
5. Mean annual diversions (July to June)
6. Maximum annual diversions (July to June)
7. Minimum annual diversions (July to June)

Diversion data should be separated into type of diversion (regulated and opportunistic diversion) to help with calibration and reporting against entitlement type.

Judgement is required to determine if your diversion data are the best available. It should be assumed that diversion data provided from state-based diversion databases provide the best source of available data, however this should still be checked (See Section 6.3.5)

6.3.3 Obtaining other data required for demand modelling calibration

In addition to diversion data, other data required for demand modelling is summarised in Table 1. Sources of these data need to be investigated and in some cases assumptions must be made (and documented) if observed data are not available.
Table 1: Data required for demand modelling in addition to detail of historical water use

<table>
<thead>
<tr>
<th>Demand Type</th>
<th>Data required</th>
<th>Representation in model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation - major irrigation entities and reach based irrigation demands</td>
<td>Land use/ crops types, Area of crops planted and planting dates, Rainfall and Evapotranspiration, Soils data, Irrigation efficiency, Water availability, Details of trades</td>
<td>Crop area based model, takes into account actual use as a result of trade, etc</td>
</tr>
<tr>
<td>Town water supplies</td>
<td>Location of TWS, Change in population with time, Value for Critical Human Water Needs (CHWN), Details of water restrictions, Rainfall and evaporation</td>
<td>See Practice Note on 'Modelling Urban Water Demands'. CHWN is included in the model as a minimum water requirement. Monthly pattern, based on population, response to water restrictions, climate and season</td>
</tr>
<tr>
<td>Stock and Domestic</td>
<td>Details of stock and domestic diversion</td>
<td>A monthly pattern where stock and domestic allocations are not lumped with town water supplies or irrigation entities</td>
</tr>
<tr>
<td>Environmental demands</td>
<td>Details of trades, Environmental water use and location of use</td>
<td>Environmental demand model</td>
</tr>
</tbody>
</table>

Determining the appropriate time step for aggregation or disaggregation of diversion data

1. For flow calibration – observed diversions should be disaggregated to the daily time step (see practice note on disaggregation of diversion data).
2. Demand calibration should focus on matching the time step of the observed data, not on a disaggregated time series.

Quality control for diversion data

1. Diversion data should be comparable with other sources on information such as annual reports.
2. Diversion data should be within reasonable bounds (e.g. compare irrigation usage in ML/ha with published number for main crop types).
3. Check that the sum of the entitlements reflects the water sharing plan or bulk entitlement.
4. Check the spatial aggregation (e.g. down the some of the components = expected total).

Companion Practice Notes

- Modelling urban water demands