# MAKING DEMAND VISIBLE: FROM SCADA DATA TO OPERATIONAL INSIGHT

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**ABSTRACT**

Riverina Water operates a regional supply network where demand can change rapidly during hot weather and rural peak use. Flow and reservoir telemetry already existed in SCADA, but demand was calculated only for the Wagga Wagga system using around 22 readings entered manually each day. That method reported 85% of system demand as a single aggregate figure and left the rural network uncalculated. This paper describes how water-balance calculations were built in WaterOutlook Synthetic SCADA workbooks and published through a repeatable weekly System Demand Report. The report now covers the full network, presenting daily demand, seven-day trends, four major demand systems, 38 local demand categories, 14 treatment facilities and 13 pump stations. It required no new instrumentation, hydraulic model or capital expenditure, and removed the need for daily manual data entry. A January 2026 case study at Pleasant Hills demonstrates its operational use. The reservoir fell to 28.9% at 22:00 on 9 January while its supply pump station operated above design capacity and the same path carried the Osborne scheme. Operators transferred Osborne to Milbrulong on 10 January, reducing the load on the Pleasant Hills path, after which storage recovered. During the same week, rolling seven-day demand crossed the thresholds used to trigger Stage 2 water restrictions. The result is one report that supports operational, engineering and executive decisions from the same underlying data.

## 1.0 INTRODUCTION

Riverina Water County Council supplies safe, reliable drinking water to more than 77,000 people across approximately 15,000 square kilometres in the Wagga Wagga, Lockhart, Greater Hume and Federation local government areas of regional New South Wales [1]. The network includes urban supply, trunk-connected rural systems, independent villages, 14 treatment plants, 13 pump stations, 80 reservoirs and multiple operational transfer arrangements [2].

The problem was not a lack of telemetry. Production meters, transfer meters and reservoir levels were already available in SCADA, but they did not directly show demand at the operating boundaries used by staff. A falling reservoir, for example, could reflect high local demand, inadequate transfer capacity or a wider source limitation. Operators needed a consistent way to distinguish between these conditions.

Before this project, demand was calculated in a spreadsheet for the Wagga Wagga system only. It used the same water-balance principle described in this paper but relied on approximately 22 readings entered manually each day across four production meters, fourteen reservoir levels and four metered exits. The result was one aggregate demand figure for Wagga and no calculated demand for the rural network. The project therefore aimed to extend the calculation across the full system, automate it using existing telemetry, retain traceability to the underlying measurements and present the results in a form that supports routine operational decisions.

## 2.0 DISCUSSION

### 2.1 From telemetry to calculated demand

Operating boundaries were defined first, followed by the SCADA tags required to represent each boundary. Calculations were then built as Excel formulas within WaterOutlook Synthetic SCADA workbooks. WaterOutlook pre-populates these workbooks with SCADA input data, executes the user-defined formulas and stores the results as queryable tags that can be used in reports like live measurements. Each workbook was downloaded and inspected before its calculated tags were accepted, allowing the formula logic and intermediate values to be checked against known operating conditions.

The outputs were published through a WaterOutlook Special Report, which draws data from multiple plants and utilities into a single report. Synthetic SCADA tags are included alongside raw SCADA tags, while a custom Excel base workbook controls the layout and formatting that WaterOutlook populates each time the report is run.

Each system or subsystem was represented as a water balance around its operating boundary. For interconnected areas, demand was calculated as total inflow minus total outflow minus the change in reservoir storage. For independent systems with no boundary outflow, this reduces to inflow minus storage change. Inputs included treatment plant outlet meters, trunk and transfer totalisers, pump station flows, reservoir levels and storage relationships, with measured level converted to stored volume where required. Each area was calculated separately before aggregation so every result remained traceable to its inflow, outflow and storage terms.

Calculation and publication were kept separate. The calculation layer converts telemetry into interval flows, storage changes, daily demand and utilisation values; the report presents those outputs in a consistent format. Demand is calculated from midnight to midnight, with the report generated after the calculation window closes. This reduces the risk of late-arriving data understating the previous day and allows calculation logic to be corrected without changing the report used by operators.

### 2.2 Validation and data integrity

The main implementation challenge was data integrity rather than the water-balance equations. Communications gaps, meter faults, totaliser resets, flow-direction errors, reservoir level spikes and temporary network changes can all produce a plausible but incorrect demand value. Because the Synthetic SCADA workbooks are Excel files, the formulas and intermediate steps remain visible, making them practical to inspect and verify before calculated tags are accepted.

Validation focused on traceability and consistency with known system behaviour. Each result was checked against the inflow, outflow and storage terms defining its boundary, compared with legacy morning readings, and reviewed against operator knowledge. Abnormal values were also checked against outage and maintenance records, while reservoir drawdown and recovery trends were compared with the calculated demand.

Negative demand, abrupt step changes and missing intervals were investigated rather than removed automatically. An unusual result could represent a real event, a telemetry fault or an incorrect model boundary. Distinguishing between them often required operator knowledge of valve states, temporary supply paths and abnormal field conditions that were not visible in the data record.

### 2.3 The weekly demand report

Validated Synthetic SCADA outputs are published in a four-page weekly System Demand Report structured from system-wide to local information. The first page shows total system demand and the rolling seven-day trend. The second breaks demand into four major systems and 38 local categories, while the third and fourth compare production across 14 treatment facilities and flow through 13 pump stations against capacity. Staff investigating an unusual condition can therefore start at system level and work down to the relevant category or asset. Figure 1 shows the summary page for the week discussed in Section 2.4.

For the week ending 16 August 2026, total daily demand ranged from 24.61 to 26.09 ML/d and the rolling seven-day total ranged from 178.45 to 186.15 ML [4]. Over that week, the Wagga Wagga system accounted for 85% of total demand. Under the previous method, that 85% was reported as one number and the remaining 15%, averaging 3.8 ML/d across the Southern Trunk, Western Trunk and Independent Villages, was not calculated. The report now resolves the full network into 38 local demand categories and reports utilisation for every treatment facility and pump station. It also removes the 30 to 60 minutes of manual data entry previously required each day, equivalent to roughly 3.5 to 7 hours per week. The report is distributed to operators, supervisors, management and the executive team, giving all four groups the same demand and asset-use information rather than separate spreadsheets and individual SCADA trends.

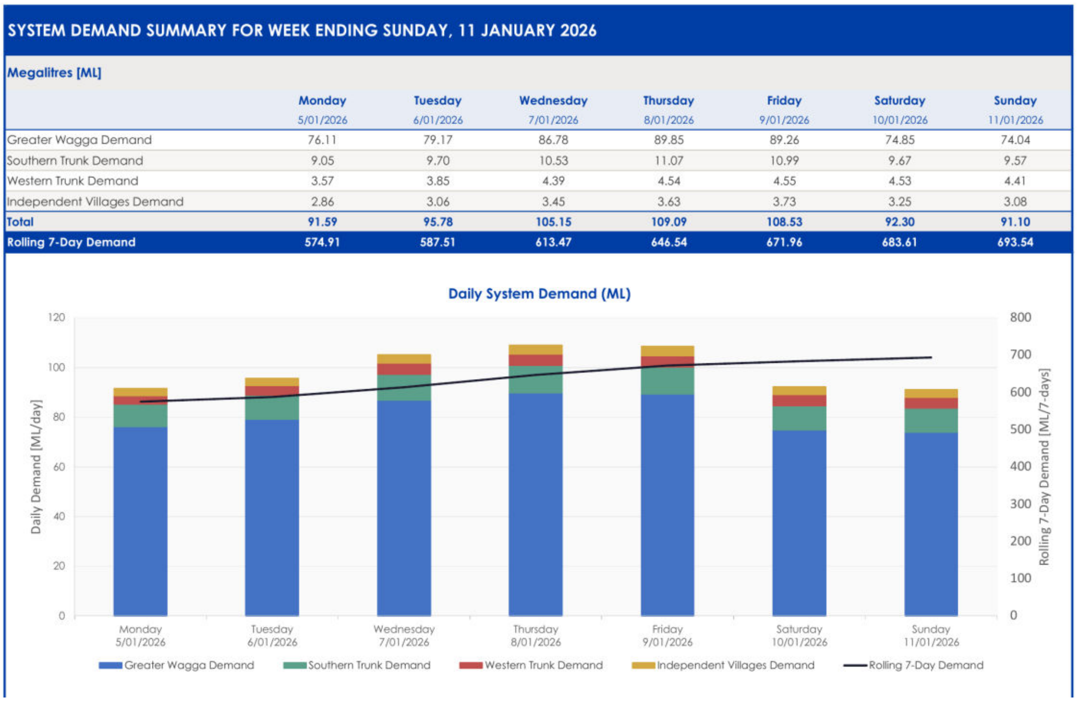
| Measure | Previous method | Weekly System Demand Report |
|---|---|---|
| Systems covered | Wagga Wagga only | 4 major demand systems |
| Local demand categories | 1 aggregate figure | 38 |
| Treatment facilities reported | None | 14 |
| Pump stations reported | None | 13 |
| Share of system demand calculated | 85% | 100% |
| Manual readings entered per day | Approximately 22 | None |

**Table 1:** ***Demand reporting coverage before and after the project, week ending 16 August 2026.***

## 2.4 Pleasant Hills case study - transferring Osborne load during extreme heat

Pleasant Hills is a small rural system within the Southern Trunk network, with a nominal reservoir capacity of 0.5 ML [5]. Under normal operation, Pleasant Hills receives supply from the Southern Trunk and also carries the Osborne scheme, while Milbrulong is supplied from the Southern Trunk along a separate path. A normally closed interconnection allows Osborne to be transferred between the two paths.

From 7 to 9 January 2026, Wagga Wagga AMO recorded maximum temperatures of 41.0 °C, 43.1 °C and 41.4 °C [3]. Over the same period, Pleasant Hills Reservoir failed to recover between demand peaks and fell to 28.9% at 22:00 on 9 January [5]. Operating data showed that the Pleasant Hills path was under sustained load while also carrying Osborne demand.


SYSTEM DEMAND SUMMARY FOR WEEK ENDING SUNDAY, 11 JANUARY 2026

Megalitres [ML]

| | Monday 5/01/2026 | Tuesday 6/01/2026 | Wednesday 7/01/2026 | Thursday 8/01/2026 | Friday 9/01/2026 | Saturday 10/01/2026 | Sunday 11/01/2026 |
|---|---|---|---|---|---|---|---|
| Greater Wagga Demand | 76.11 | 79.17 | 86.78 | 89.85 | 89.26 | 74.85 | 74.04 |
| Southern Trunk Demand | 9.05 | 9.70 | 10.53 | 11.07 | 10.99 | 9.67 | 9.57 |
| Western Trunk Demand | 3.57 | 3.85 | 4.39 | 4.54 | 4.55 | 4.53 | 4.41 |
| Independent Villages Demand | 2.86 | 3.06 | 3.45 | 3.63 | 3.73 | 3.25 | 3.08 |
| Total | 91.59 | 95.78 | 105.15 | 109.09 | 108.53 | 92.30 | 91.10 |
| Rolling 7-Day Demand | 574.91 | 587.51 | 613.47 | 646.54 | 671.96 | 683.61 | 693.54 |



**Figure 1:** *System demand summary page for the case study week, ending Sunday 11 January 2026. The report also contains demand breakdown, production and pump station utilisation pages [6].*

The weekly report placed the event in its wider network context. Between Monday 5 and Friday 9 January, total system demand increased from 91.59 to 108.53 ML/d and treatment production reached 90% of operational capacity, leaving limited scope to increase supply into the Southern Trunk [6]. Local storage offered little buffer against that. With demand approaching 1 ML/d against 0.5 ML of reservoir capacity, Pleasant Hills held roughly twelve hours of supply at peak rates.

Pump station utilisation showed the local constraint more clearly. Pleasant Hills Pump Station has a design capacity of 0.821 ML/d. During the case study week it operated above design capacity on all seven days, averaging 115% and peaking at 119% on 11 January, the highest utilisation of any pump station in the network. Under the existing configuration, the pump had no additional capacity to increase supply to Pleasant Hills. The practical response was therefore to reduce the load carried by that path. Milbrulong, by contrast, stayed below 0.05 ML/d throughout, so the Southern Trunk-Milbrulong path could absorb the Osborne demand.

| **Measure** | **Mon 5 Jan** | **Fri 9 Jan** |
|---|---|---|
| Treatment production, % of operational capacity | 70% | 90% |
| Pleasant Hills demand (ML/d) | 0.94 | 0.98 |
| Pleasant Hills pump station, % of design capacity | 110% | 114% |
| Milbrulong demand (ML/d) | 0.044 | 0.038 |

**Table 2:** ***Network and Pleasant Hills conditions during the case study week [6].***

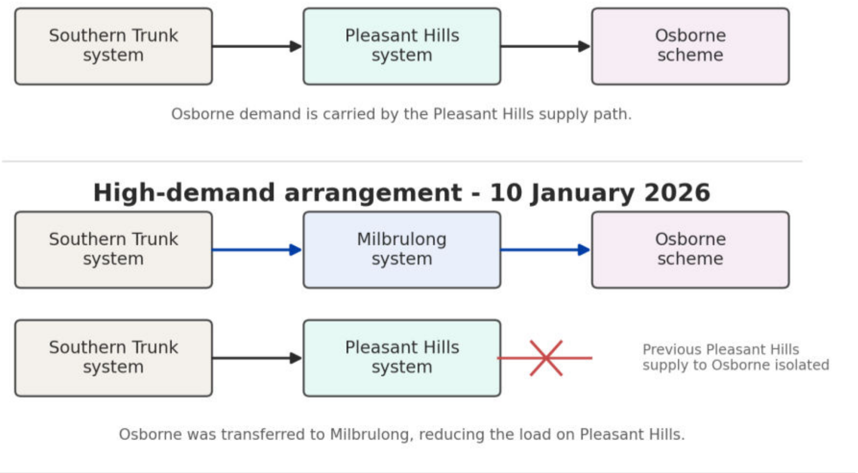



**Figure 2:** ***Pleasant Hills and Osborne supply arrangements before and during the 10 January 2026 changeover.***

On 10 January, operators transferred Osborne from the Pleasant Hills path to Milbrulong through the normally closed interconnection. Pleasant Hills continued to receive supply from the Southern Trunk, while Osborne demand moved to the Southern Trunk-Milbrulong path. The response did not add water to Pleasant Hills; it removed a load from a stressed supply path. This distinction is important because the mechanism supporting subsequent reservoir recovery was reduced demand on the Pleasant Hills path, not increased supply.

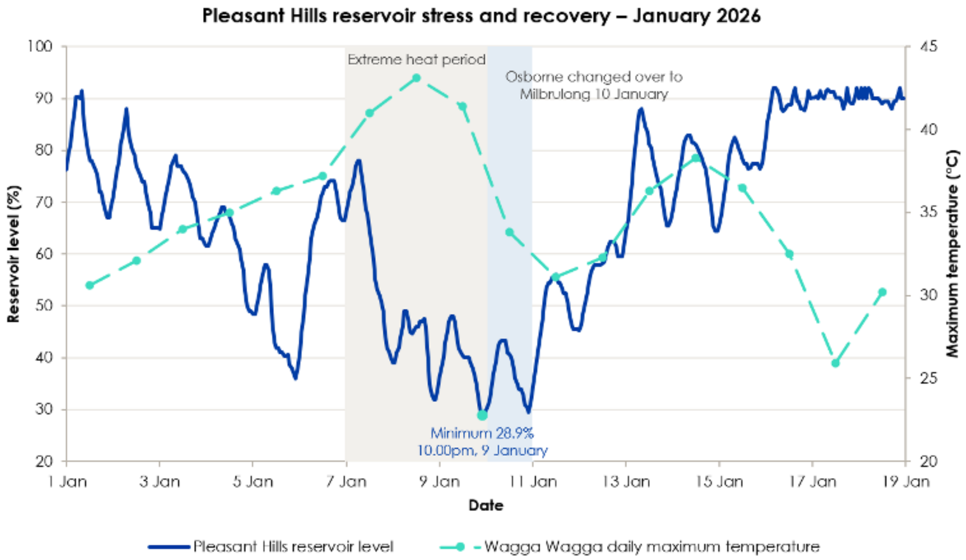



**Figure 3:** ***Pleasant Hills reservoir level and Wagga Wagga AMO daily maximum temperature, 1-18 January 2026. Osborne was changed over to Milbrulong on 10 January after the reservoir reached 28.9% at 22:00 on 9 January.*** *Source: Riverina Water SCADA [5] and Bureau of Meteorology [3].*

Storage remained low through 10 January, rose above 50% on 11 January, first exceeded 80% on 13 January and was operating around 90% by 16 January [5]. Temperatures also fell after 9 January before increasing again to 36-38 °C from 13 to 15 January [3]. The exact changeover time and transfer flow through the interconnection were not recorded, so the effect of the load transfer cannot be separated quantitatively from the reduction in demand as temperatures eased. The evidence therefore supports the narrower conclusion that transferring Osborne to Milbrulong reduced the load on the Pleasant Hills path and was followed by reservoir recovery.

## 2.5 Supporting operational, engineering and executive decisions

The report supports decisions at three levels, and the case study week illustrates all three. Operationally, it shows where demand is concentrated and which assets are approaching or exceeding capacity, as the Pleasant Hills response demonstrates. For engineering, sustained utilisation helps distinguish a genuine capacity constraint from an isolated difficult week. Pleasant Hills Pump Station exceeded design capacity on all seven days of the case study week, having done so only five times in the preceding three months and all within the four weeks immediately before. That concentration points to a seasonal capacity shortfall rather than a single heat event and provides evidence for assessing augmentation. The same measurements can also support deferring work where utilisation proves lower than assumed.

At executive level, the rolling seven-day figure on the report's first page is the metric used by Riverina Water's Water Restrictions Policy to trigger restrictions. Demand is the appropriate basis for that assessment because it measures the water absorbed by the system rather than the water produced; the two diverge whenever reservoir storage is being drawn down, which is when a trigger matters most. Stage 2 may be implemented when average daily rolling weekly usage exceeds 90 ML/d or weekly usage exceeds 600 ML, under delegation to the Chief Executive Officer and Director Engineering [7]. During the case study week, the weekly total passed 600 ML on 7 January and the rolling average passed 90 ML/d on 8 January, reaching 99.1 ML/d by 11 January [6]. Stage 2 restrictions followed on 27 January as conditions continued [8]. The report therefore places the trigger metric directly in front of the officers holding that delegation, calculated consistently without manual assembly.

Reporting frequency can be adjusted to operating conditions. The calculations use hourly data, allowing the report to be issued weekly during normal operation and daily during a heat event, at the resolution required by the decision.

## 2.6 Lessons and future development

Three practical lessons emerged. First, the difficulty lies in defining the boundary, not in the arithmetic. The equations are simple subtraction; the real work is deciding which meters sit inside each boundary, which valves were open at the time and which reservoirs belong to each system. A broken formula usually produces an obvious fault. A wrong boundary can produce a plausible answer, making boundary errors far harder to detect. Second, calculated data does not replace operator knowledge. Temporary supply paths, outages and abnormal field conditions are often absent from the data record. Third, reporting must match the decision, which is why the report moves from whole-system demand to local demand and asset utilisation.

The project also shows that useful demand reporting does not require new instrumentation or a full hydraulic model. No capital expenditure was involved; the only cost was staff time to define the boundaries, build the workbooks and validate the outputs. Existing telemetry can provide practical decision support when calculations are transparent, results are checked against operating conditions and the model is maintained as the network changes. The largest systems were modelled first so a working report reached staff early, with coverage expanded from there.

Further development will focus on diurnal demand views, clearer flags for suspect data, alerts for abnormal demand and reservoir non-recovery, and short-term forecasting using weather and day-of-week patterns. The most important ongoing requirement is change control. Any change to a meter, SCADA tag, reservoir relationship or capacity value must be reflected promptly or the model will drift from the network it represents.

## 3.0 CONCLUSION

Riverina Water developed a repeatable, network-wide view of demand from telemetry that already existed. Operating boundaries were defined, water-balance calculations were built in WaterOutlook Synthetic SCADA workbooks, outputs were checked against operating conditions and operator knowledge, and the results were published through a weekly report. This extended demand calculation from one system covering 85% of total demand to the full network across 38 local categories, removed the need for around 22 manual readings per day, and required no new instrumentation or capital expenditure.

The Pleasant Hills case study shows the value in practice. With the reservoir at 28.9% on the evening of 9 January, the report showed its supply pump station operating above design capacity throughout the week while the same path also carried Osborne demand. Operators transferred Osborne to Milbrulong on 10 January, reducing the load on the Pleasant Hills path, and the reservoir subsequently recovered. Although the contribution of the transfer cannot be isolated from the easing temperatures, the event shows how calculated demand, reservoir trends and operator knowledge can be combined to identify and respond to a network constraint.

The same week shows the wider value of a common demand view. While operators addressed Pleasant Hills, the rolling seven-day figure crossed both thresholds used to trigger Stage 2 restrictions. One report supported an operator deciding which supply path to use, an engineer assessing whether a pump station requires augmentation, and an executive considering restrictions across the supply area.

For other utilities, the barrier is rarely a lack of telemetry. It is more often the absence of a defined boundary, a transparent calculation and a report that staff can use. With those three in place, existing measurements can be converted into decision-ready information without waiting for new instrumentation or a full hydraulic model.

## 4.0 ACKNOWLEDGEMENTS

The author acknowledges Riverina Water operations, electrical, water quality and engineering staff whose system knowledge, field experience and feedback shaped the framework described here. Validation relied heavily on operator understanding of normal system behaviour, high-demand conditions, outages and temporary supply arrangements. That knowledge was essential for distinguishing meaningful results from telemetry artefacts.

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