VWP CIA Summary (TEMPLATE)

JK

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This is an R Markdown document. This will serve as the template for VWP Project Model Summaries moving forward. For related GitHub issue see <https://github.com/HARPgroup/vahydro/issues/317>.

# VAHydro Model Boilerplate:

## VAHydro

The comprehensive VAHydro hydrologic model is used to evaluate surface water supply availability for permitting projects throughout Virginia. The VAHydro model simulates streamflow with inputs such as precipitation, climate, land use, and topography, as well as local data collected through DEQ water supply planning and reporting programs including all known withdrawals and discharges, as well as operational rules of VWP permits and major hydrologic features such as reservoirs.

The VAHydro model is built on rainfall-evaporation-runoff (RER) time-series from the Chesapeake Bay Model Phase 6 which runs from 1984-2014 in the Chesapeake Bay watershed drainage, and 1984-2005 in the rivers flowing outside of the Chesapeake Bay watershed, aka the “southern rivers.” The VAHydro model features high-resolution hydrologic subsections called “river segments” (over 600 river segments in total), roughly the size of HUC 10 hydrologic units, with additional high-resolution segments added for VWP modeling projects as needed.

## CIA

DEQ assesses water supply sustainability through Cumulative Impact Analysis (CIA) modeling. CIA is a modeling and analysis approach that takes into account the varied hydrologic process occurring throughout a river network (including meteorology and human water use). By simulating a daily water balance for every individual river segment within a watershed, DEQ is able to evaluate the potential “cumulative impact” of all streamflow changes occurring upstream of any location within the river network, as well as the downstream impact of individual permitted withdrawal operations.

The goal of the folloing analysis was to estimate the potential impacts of the requested water withdrawal upon existing beneficial uses, including both in-stream and off-stream uses.

# Project Introduction (To be provided by permit writer)

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## Location Map

*No location map available for this facility model*

# Model Overview and Scenario Descriptions

The Blue Ridge Shadows golf course is modeled as a pump-store facility with a local impoundment having no direct drainage area, and an intake on Crooked Run to refill when water is available. The impoundment is estimated to have a maximum storage of 21.84 acre-feet. The previous permit featured a static MIF below which no pumping was possible. Model scenarios were selected in order to explore “percent of flow” type withdrawal limits in order to mimic natural flows, and also provide operational flexibility.

The following model scenarios were simulated in order to determine the most effective means of meeting the project need and all other in-stream beneficial uses:

* **Existing permit conditions** (Current Permit) - The existing permit scenario has a static minimum instream flow of 4.13 cfs, which means that all withdrawal must cease from Crooked Run when flow drops below 4.13 cfs.
* **Proposed permit conditions with 90% flowby** (90% Flow-by) - The 90% flow-by scenario limits the daily withdrawal from Crooked Run to no more than 10% of the flow in the stream, based on the previous days simulated flow.

# Model Summary Results - Conclusion/Recommendation

* **Existing permit conditions** - During the summer months of 1999, average flow in Crooked Run drops below 4 cfs for nearly 3 months, coinciding with the period of greatest demand for this facility. As a result, available irrigation storage drops to zero for several weeks.
* **Proposed permit conditions with 90% flowby** - The 90% flow-by scenario results in more flexibility to pump under extremely dry conditions, as compared to the current static MIF permit condition. As a result, the operation is able to meet offstream need during all simulated periods, with a small amount of water remaining during the lowest simulated flow.

# Stats Comparison Table:

| **Description** | **400** | **600** |
| --- | --- | --- |
| scenario | Draft Permit Term Max + Current, full time period | Draft Permit Term Max w/Proposed, full time period |
| River Segment Model Statistics: |  |  |
| Flow Out (cfs) | 17.30 | 17.29 |
| Flow Baseline (cfs) | 17.41 | 17.42 |
| Minimum Days of Storage Remaining |  |  |
| 30 Day Low Flow (cfs) | 0.03 | 0.03 |
| 90 Day Low Flow (cfs) | 0.26 | 0.23 |
| Consumptive Use Fraction | 0.01 | 0.01 |
| Cumulative Withdrawal (mgd) | 0.08 | 0.08 |
| Cumulative Point Source (mgd) | 0 | 0 |
| Facility Model Statistics: |  |  |
| Withdrawal (mgd) | 0.04 | 0.04 |
| Point Source (mgd) | 0 | 0 |
| Maximum 30 day potential unmet demand (mgd) | 0.10 | 0.04 |
| Richness Change (abs) | No elfgen Available | No elfgen Available |
| Richness Change (%) | No elfgen Available | No elfgen Available |

# Reservoir Storage Plots:

## This property does not exist

[1] “No riverseg impoundment for run id 400”

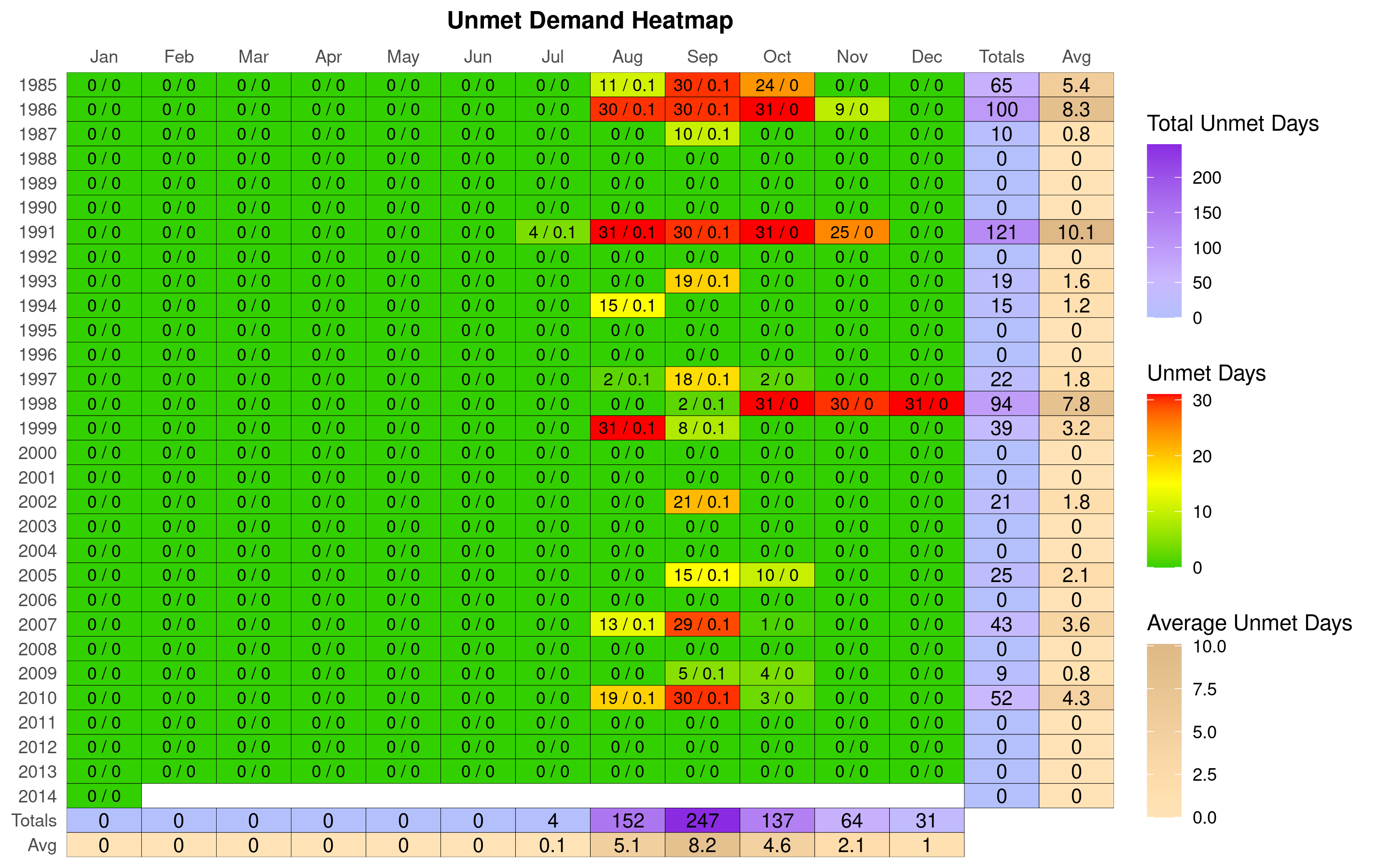
## This property does not exist

[1] “No riverseg impoundment for run id 600”

# Unmet Demand Heatmaps:

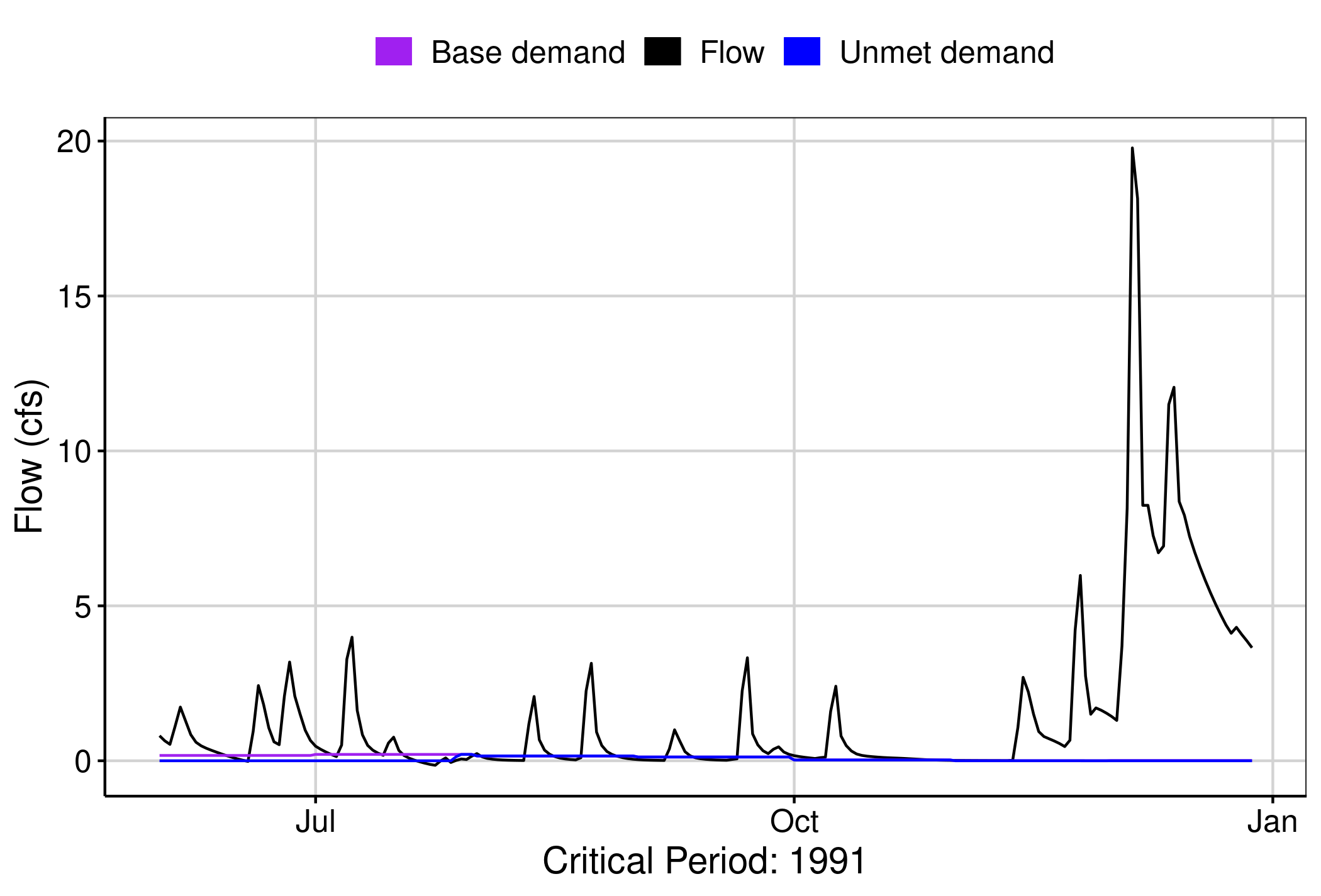
## Number of properties found: 1

## Reservoir Storage: run 400



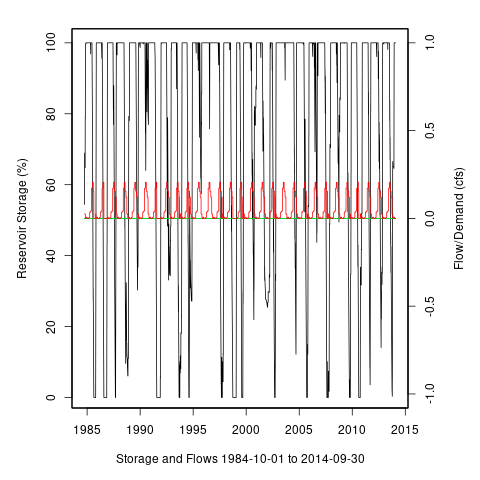
## Number of properties found: 1

## Unmet Demand: run 400



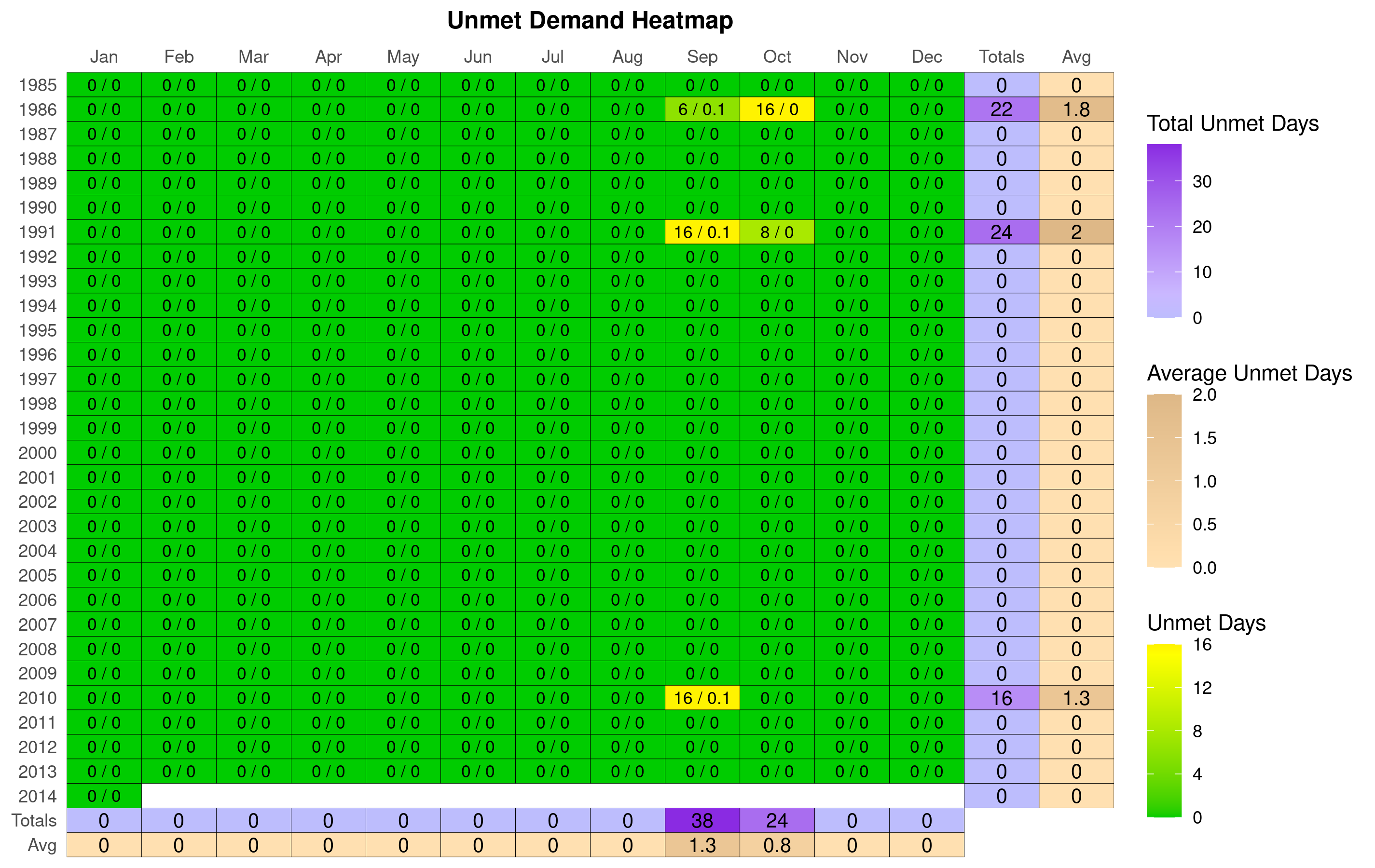
## Number of properties found: 1

## Reservoir Storage: run 400



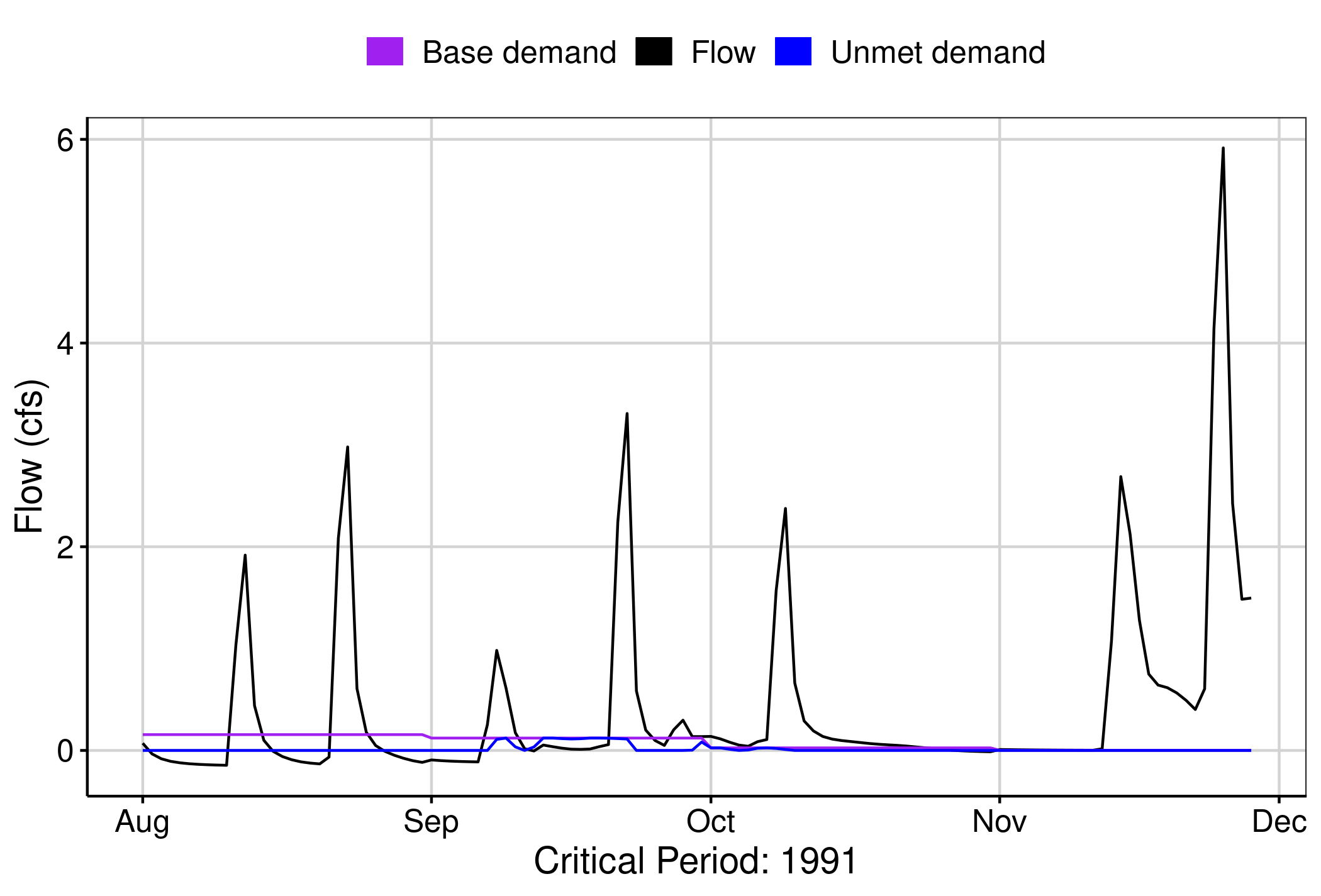
## Number of properties found: 1

## Reservoir Storage: run 600



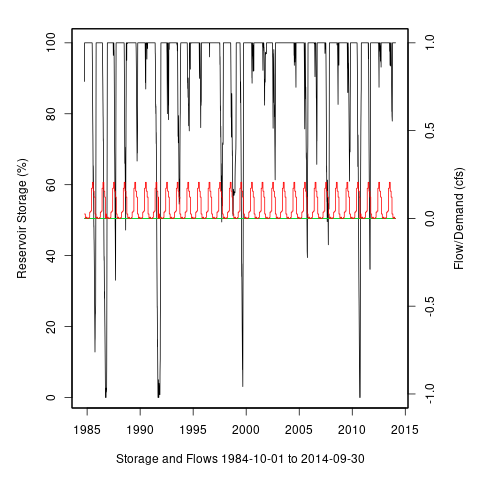
## Number of properties found: 1

## Unmet Demand: run 600



## Number of properties found: 1

## Reservoir Storage: run 600



# Ecological Impacts Assessment:

## Elfgen:

*No elfgen plot available for this model*

## Habitat (If Applicable):

# Additional Sections

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