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Section 6

Model Calibration and Validation

6. Model Calibration and Validation

6.1 Dry Weather Flow

6.1.1 The CRD's Flow Monitor

There are three flow monitors on the CRD trunk sewer, Meaford, Aldeane, and Parsons. Meaford measures total flows in the CRD trunk sewer that enters into Colwood from the upstream user (City of Langford). Parsons measures total outflows in the CRD trunk sewer before it enters into the downstream city (Town of View Royal). Aldeane measures total flows from the City's Sooke Rd sewer before it discharges into the CRD trunk sewer at Aldeane Ave. The total flow from Colwood is calculated as the difference between the Parsons and Meaford flows.

1-hour time step flow data from Oct, 2007 to Jan, 2011 is available for Meaford and Parsons. Data from Jun 2007 to Feb 2012 at 5-minute time step is available for Aldeane. As the measured flows at Aldeane are primarily from the existing residential developments with minimum ICI flow contribution, the Aldeane flow data is then used for the base sanitary flow calibration and the Parsons flow data is used for verification of the calibrated model.

It is noted that the measuring weir at Meaford was removed on Apr 28, 2010 and was put back on Jun 06, 2010, flow data for this period was re-built based on a data regression analysis for Meaford and Craigflower (a CRD meter in View Royal). After Jun 06, 2010, the flow signals also showed abnormities thus were also re-built based on a temporary FLO-DAR® meter. For the purpose of model verification, the dry weather flow data measured at Meaford in the summer of 2009 was used as input to simulate the starting flow in the CRD trunk sewer. The modeled dry weather outflow at Parsons will be compared with the Parsons' 2010 dry weather flow, taking into account the increased flow due to population growth from 2010 to 2011.

The selected time periods are:

- Aldeane Flume (CRD): August 01 – August 05, 2011, for model calibration; and
- Parsons (CRD): July 26 – 31, 2010, for model verification / validation.

6.2 Dry Weather Flow Calibration

The recommended tolerances for dry weather flow calibration are detailed in the following table.

Table 6-1: Recommended Dry Weather Flow Calibration Tolerances

Parameter	Recommended Accuracy
Volume of Flow (24-hour)	+/- 10%
Peak Flow (1-hour)	+/- 5%
Peak Timing	+/- 1 hour
Shape	Representative of observed flow or depth pattern

Using different per capita loading rate for BSF, the results from the model were compared against the flow monitoring data for the Aldeane Flume site, and compared according to the above parameters, as well as visually by overlaying the hydrograph results. The model calibration exercise resulted in a per capita loading rate of 195 L/cap/day, with which the modeled flow closely matches the observed flow in terms of 24-hour flow volume, peak hourly flow, and peak timing. Although 195 L/cap/day reaches the upper bound of the typical range of 140 – 200 L/cap/day calculated for each pump station sub-

catchment, it is considered a reasonable value when comparing to the typical value of 225 L/cap/day in the capital region.

The calibration results are presented in Table 6-2, and the hydrographs are displayed at the end of this section.

Table 6-2: Model Dry Weather Flow Calibration Results Summary

	Modelled	Measured	Difference	Difference (%)	Note
ADWF (L/s)	7.6	7.9	-0.3	-3.8%	
PDWF (L/s)	17.4	15.8	1.58	10.0%	
Peaking Factor of BSF	2.15	2.3			
Peak Timing	8:45 AM	9:55 - 10:25 AM	1.5 hour		for typical days

As can be seen in the above table that the modeled peak flow is about 10% higher than the observed peak flow, it is considered acceptable. This is because the model was run with 1-second hydraulic time step in order to better simulate pumps' operation, thus creating numerous flow spikes due to pumping. Also, the residential diurnal pattern was derived from the upstream Metchosin PS flow signals (1-hour time step flow) which have a peak time at 7 am, resulting in the modeled peak time earlier than the observed.

6.3 Model Verification and Validation

The model verification / validation process is an exercise performed to justify that a calibrated hydraulic model is capable of providing sufficient accuracy when used to predict the performance of the real-world system that it represents. The validation of the model also verifies all the assumptions made in the model loading development and model calibration phases. This is done by comparing the modeled total ADWF with the observed ADWF at the Parsons meter, as there are significant flow contributions to the CRD trunk sewer downstream of the Aldeane flume.

Comparison results of the modeled and observed ADWF at Parsons are summarized in Table 6-3, and the hydrographs are displayed in Figure 6-2.

Table 6-3: Model Dry Weather Flow Verification Results Summary

	Modelled	Measured	Difference	Difference (%)	Note
ADWF Flow (L/s)	79.2	80.2	-1	-1.2%	
PDWF (L/s)	109.2	114.3	-5.1	-4.5%	
Peak Timing	11:20 AM	11:00 AM	< 1 hour		for typical day

Table 6-3 demonstrates that the modeled ADWF also closely matches the observed ADWF at the Parsons meter, in terms of 24-hour total flow volume, peak flow and time to peak. Therefore the calibrated model is capable of performing hydraulic analysis with sufficient accuracy and forms the basis for future development scenarios.

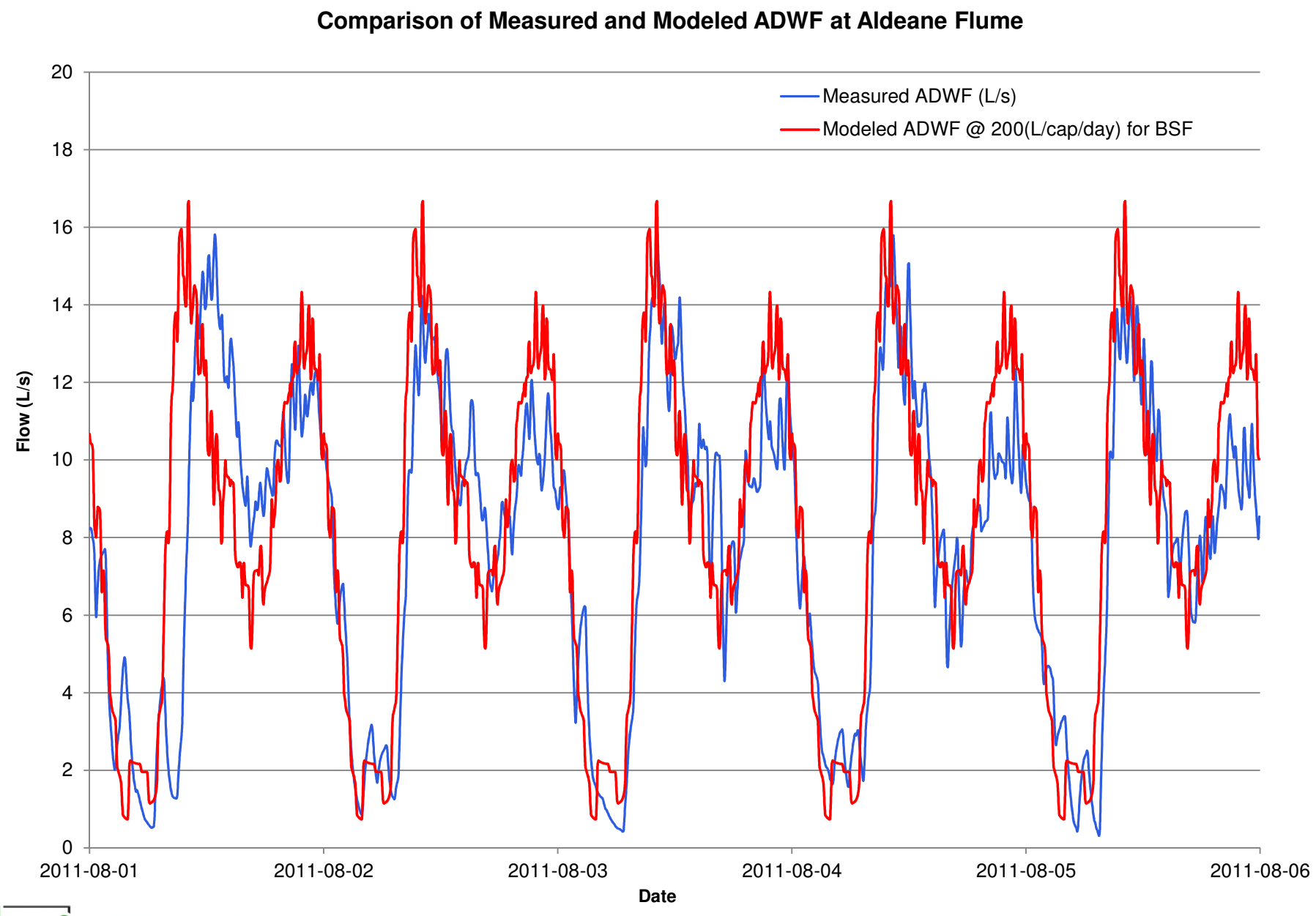

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Figure 6-1

Comparison of Measured and Modeled ADWF at Parsons Meter

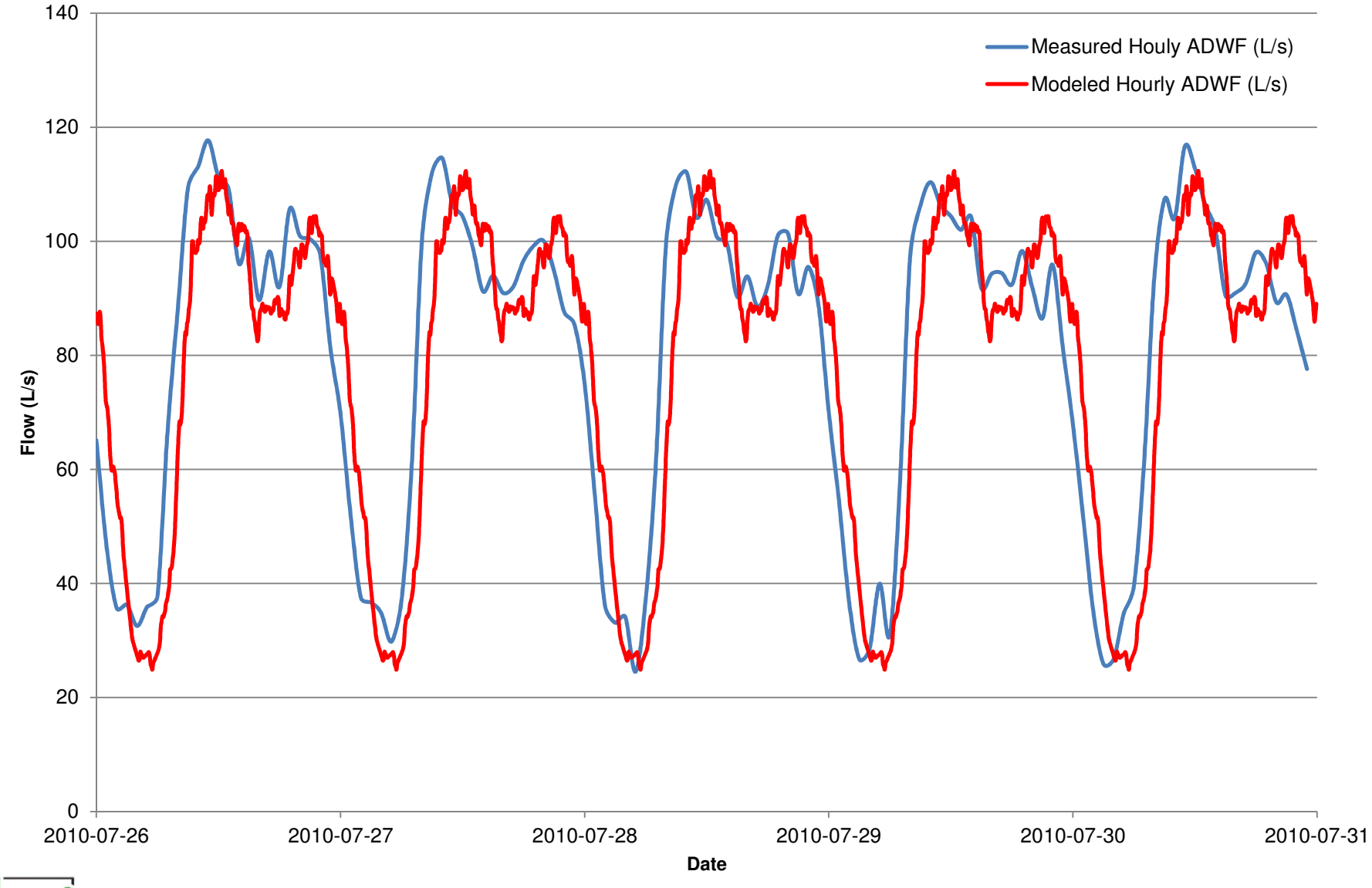

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Figure 6-2