4.8 Surface Water Flow Measurement Program by Environmental Protection

Executive Summary

- The project is designed to obtain low flow measurements for all streams across the Island.
- The data will primarily be used in to assess future impoundment licence applications, to ensure that adequate flows are maintained in streams.
- Future measurements will provide stream level-discharge rate relationships for selected stream coastal outfalls that will be used in the assessment of variations in bathing water quality.

1. Overview of surface water flow measurement project

Jersey Water has monitored stream flow discharge rates for the major streams which feed their reservoirs since the 1950s. However, no stream discharge measurements have been undertaken on the minor streams in the Island or the tributaries of the major streams.

This project, carried out during the summer months of 2010 is primarily designed to collect baseline data on low flows in the Island's streams to use in the future when assessing applications to impound surface waters to modify existing impoundments. The information will be vital to ensure that a minimum flow is maintained in such streams, thereby protecting the aquatic environment and protecting the flora and flora that are dependant on that resource.

The initial stream flow survey will also provide the basis for developing a time-series dataset of surface water discharge rates at coastal outfalls which are not currently monitored on a regular basis. Additional monitoring will be undertaken at selected coastal outfalls (at locations where bathing water quality is monitored) and other study sites, during periods of higher stream flow to build up a series of measurements that relate stream level (stage) with discharge rates.

Bathing water quality is known to be adversely affected during periods of high surface water discharges into the sea. The measurement of stream discharges at selected coastal outfalls has a direct relevance to bathing water quality monitoring and additional flow discharge monitoring will be undertaken at selected coastal outfalls and other study sites, to establish up a stream stage (level) discharge relationships.

2. Legislation

2.1 States of Jersey Legislation

The Water Resources (Jersey) Law 2007 (the Law) came into force in January 2009 and requires that functions under the Law shall be carried out as far as practical according to the best environmental practice and according to a precautionary principal whereby harm to the environment should be prevented.

The Law also requires that water resources in Jersey be monitored and continuing scientific and technical research be undertaken. The stream flow measurement project collects relevant basic data toward the effective implementation and enforcement of the Law, as well as providing relevant data to other aspects of environmental monitoring undertaken by Environmental Protection.

2.2 The Water Framework Directive

The Water Framework Directive (Directive 2000/60/EC) is aimed at the long-term sustainable water management based on the protection of the aquatic environment Environmental objectives are at the core of the Directive and the definition of 'good ecological status' is essential. One aspect of achieving 'good ecological status' is the maintenance of adequate water levels and flows in rivers and streams, thereby preventing deterioration of the status of the aquatic environment.

Although Jersey is not obliged to comply with the provisions of the Water Framework Directive, the States of Jersey have made an undertaking to achieve EU Standards where possible. The Directive provisions allow compliance with 'best environmental practice' requirements as required under the Water Resources (Jersey) Law 2007.

3. Monitoring undertaken by Environmental Protection

Stream flows/discharge rates have been measured at approximately 130 locations on Island streams. In most cases, there has only been an initial measurement of flow and this will be adequate to assess future impoundment licence applications. It is intended that additional measurements will be made at selected locations in future years under particularly dry conditions, to establish an absolute minimum flow rate in those streams. Additional measurements will be obtained at coastal outfalls to establish the stage/discharge relationship for these streams that discharge in the vicinity of bathing water quality monitoring points. The methodology is provided in Appendix 1.

4. Budget, manpower and resources considerations

Two temporary staff were employed during the summer of 2010 under the States of Jersey Internship Scheme to undertake the survey of low flows in the island's streams. Additional monitoring will be undertaken in the future at selected sites and at times of higher stream flow by Environmental Protection staff.

The overall cost of the initial survey in 2010 was approximately £15,000, including manpower costs and the purchase of specialist equipment. Ongoing periodic measurements at selected sites will be undertaken at a minimal cost and within the existing budget.

Appendix 1 Low Stream Flow Project Methodology

Abstract

This project obtained measurements of local stream base flows to assist with implementation of the Water Resources (Jersey) Law (2007). Initial monitoring took place during the summer months of July and August when stream flow was likely to be close to a minimum. Eight previously proposed Water Resources Management Areas (catchments) were sampled.

Stream discharge measurements were obtained along the length of the main streams in each catchment. In addition, for the benefit of additional studies (specifically the Diffuse Pollution Pilot Scheme (DPP) and the Bathing Water Quality Project), measurement locations also included beach outfalls, DPP sites, SSIs and close to the location of existing water quality autosamplers.

Discharge data calculated by project will be used as the basis of future long-term discharge record and, potentially, the development of a long-term stream stage/discharge relationships for these selected locations. Data will also be used to aid decisions regarding the assessment of new water abstraction licenses and future impoundment licence applications. The resulting base flow data will be vital to identify the potential environmental impacts of new abstractions or impoundments that could adversely affect downstream stream discharge.

Methodology

Stream systems within the island are organised into eight defined catchments using the Proposed Water Resources Management Areas. Data was collected from one catchment at a time, starting at the coastal outflows and working upstream to the source. In the longer streams, such as Vallée des Vaux, Grand Vaux and St Peters Valley, measurements were taken at approximately four locations, whilst for the much shorter streams (such as those in the southeast of the island); one measurement at the outflow is considered sufficient.

Topographic maps were used to identify stream sections where it was desirable to obtain discharge measurements. For example, the point where a stream passes under a road may be particularly suitable due to its easy accessibility.

On arrival at the identified stream section, the site was assessed to determine if the conditions were suitable for taking measurements. Such factors as the permanency of the stream banks and bed (to allow reoccupation of the site for additional measurements), safety of accessing the stream bed, changing water levels, or debris obstructing the stream cross section will be considered. In some circumstances, appropriate equipment was used to remove any vegetation that hindered data collection.

Once identified as a suitable location to measure flow rate, the most appropriate equipment was be selected. Flow within a well defined stream channel was measured using a SENSA RC2 water velocity meter. If the stream banks and bed were not suitable for reproducible measurements or for reoccupation in the future, flow measurements in a culverted or piped section of the stream were used. In these cases, it was necessary to use the universal joint attachment to angle the sensors correctly. There were also be conditions, particularly where flow rates via a pipe are very low, where it will be more appropriate to measure the length of time taken to fill a three gallon bucket to obtain a discharge measurement. Data collected in each of these methods will require different standard methods of analysis to achieve the discharge calculations.

All relevant measurement site details were entered on pre-prepared field record sheets, as were simple discharge measurements (of the type obtained using a bucket or a single flow measurement within a pipe, see Appendix 2). Where it was possible to take multiple flow measurements over the stream cross-section, this data was recorded on the water velocity record sheet, together with details of the stream width and water depth at the selected measurement intervals across the stream width (Appendix 3). The multiple flow velocity values were entered into an Excel spreadsheet to calculate the mean section discharge for each location. In addition to numerical data, a description of the location, including coordinates and details regarding the measuring point, were noted and photographs taken, to allow future measurements to be taken at the same location and entered on other spreadsheets contained within an Excel workbook that will be set up for each monitoring site.

Finally, relevant details for each site and the associated discharge measurement were be entered on a further Excel spreadsheet, in a format that is compatible with the WQMIS Database (Environmental Protection water quality database), for later importation into that database.

Appendix 2 Recording sheet- discharge measurements using a bucket or a single flow measurement within a pipe

Date:	/ /2010	Site name:		Site Code:	
Start Time:	:	Start Stage:	cm		

Finish Time:	:	Finish Stage:	cm	Width					
			Minimum No. Intervals:	<50 cm	50-100 cm	100-300 cm	300-500 cm	500-1000 cm	>1000 cm
Width:	cm			5-6	6-7	7-10	10-12	12-22	>22

Position	Position (cm)	Depth (cm)	0.6*Depth (cm)	0.4*Depth (cm)	Velocity 1 (m/s)	Velocity 2 (m/s)	Velocity 3 (m/s)	Stage (cm)	Note stage regularly only if the stream is rising or falling rapidly during the rating
Bank 1	0				0	0	0		
2									
3									
4									
5									
6									
7									

Appendix 3 Water velocity record sheet

Date:	**Catchment:**
Site Name:	**Site No:**
	Photo's: Yes/No
	Numbers:
Site Description:	
Stage Measuring Point Details:	
Stream Width at Water Surface (cm):	
Stream Bed Width (cm):	
Average Water Depth (cm):	**Stage Level (cm):**
Calculated stream cross section (m^3):	
Flow velocity measured (m/s):	
Discharge (m^3/s)	**(l/s)**
Measured discharge (m^3/s)	