

## **Appendix P**

Additional Monitoring Station Details of  
Stream Gauging Stations S1, S2, S3, S4, and S5 and  
Hydrological Monitoring Results of Stream Gauging Stations



## **STATION S1**

**Date: Oct 06, 2011**



\*Looking downstream

### **Location**

Station *S1* is located at the exit of Narrow Lake approximately 10 m upstream of the access trail on the right bank. The coordinates (UTM NAD83) of the station are northing 5859719.680 and easting 632232.086.

### **Rationale**

Station *S1* will provide baseline flow data at the exit of the watershed that contains the Rose Pit and the Rose North waste rock disposal area. This station can also be used to monitor the watershed during construction, operation and decommissioning of the mine.

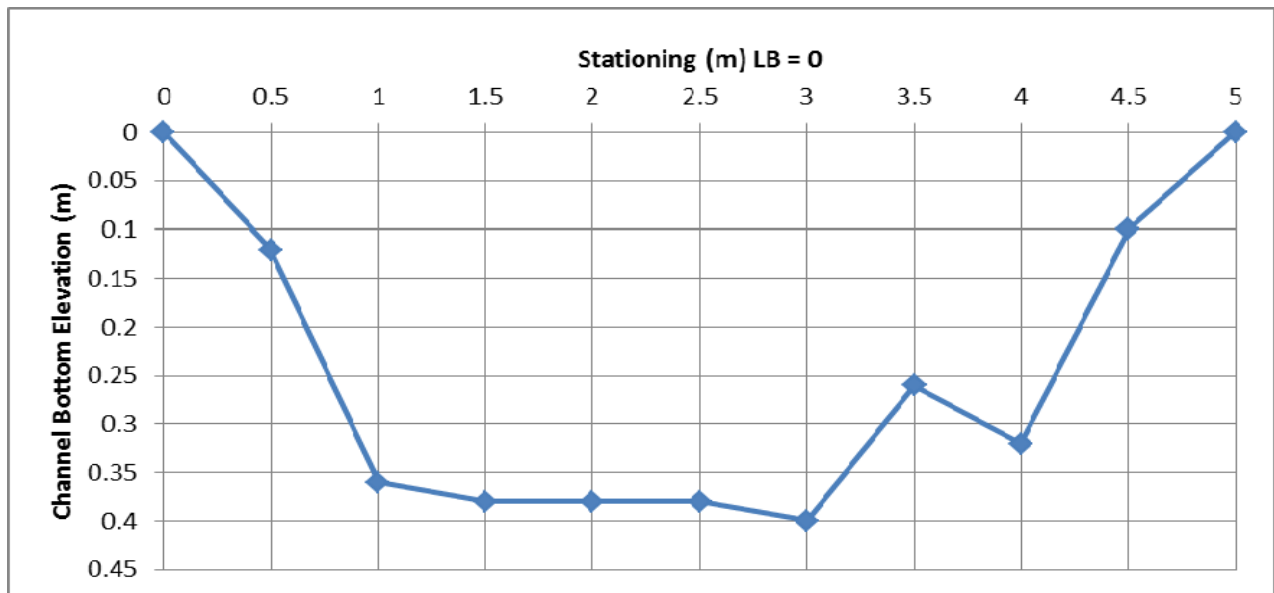
### **Access**

Station *S1* is accessible by land (all terrain vehicle only) following access points A2 and A3 (coordinates included at the end of this summary). Faster access can be provided by helicopter.

## Instrumentation

Station *S1* contains a Levelogger installed in a stilling well for continuous water depth monitoring with a 10 minute interval. Station *S1* is also a water quality sampling location. This station was installed in Oct. 6, 2011. The Levelogger was installed with RV antifreeze about 20 cm below the channel bed on the right bank.

## Cross Section



Channel profile starting at left bank looking downstream, units in m.  
Flat flood plain about 10 cm higher.

## Flow Measurement

A flow measurement was conducted using a Sontek Flowtracker on October 6, 2011 at 4:30 PM.

$$Q = 0.282 \text{ m}^3/\text{s}$$

## Channel Slope and Stream Bottom

Water surface -%

- 14 m upstream of station to 11 m downstream of station
- Upstream Thalweg -15cm
- Downstream Thalweg -38 cm

Stream has bottom consisting mainly of gravel-cobbles-boulders.

## **Spot Water Quality Measurements at Station S1**

October 8, 2011 at 9:00 AM

Temp. = 3.57 °C

Specific Conductance = 65 µS/cm

Electrical Conductivity = 38 µS/cm

TDS = 0.042 g/L

Salinity = 0.03

DO = 90.1 %

DO = 11.93 mg/L

pH = 9.00

pHmV = -85.0



## **STATION S2**

**Date: Oct 07, 2011**



\*Looking downstream

### **Location**

Station S2 is located at the exit of Rose Lake and just upstream of Narrow Lake (approximately 150 m upstream). The coordinates (UTM NAD 83) of the station are northing 5856173.459 and easting 632802.882.

### **Rationale**

Station S2 will provide baseline data and further flow monitoring capabilities immediately at the exit of the watershed that contains the Rose Pit and partially the Rose North waste rock disposal area.

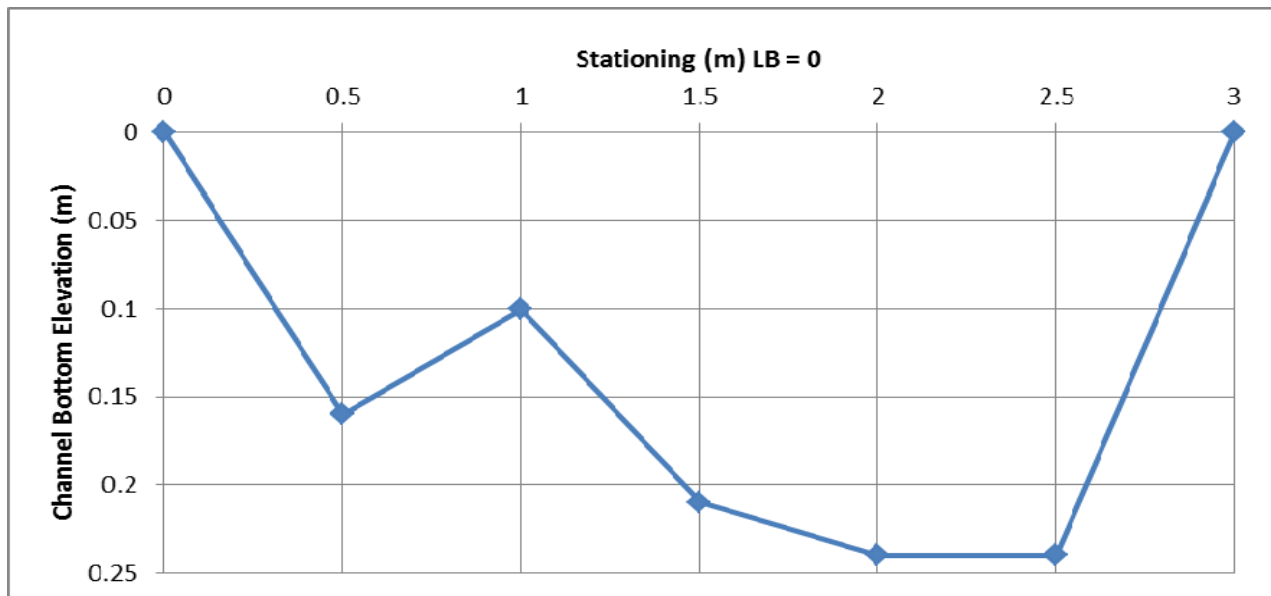
## Access

Station S2 can be accessed from the road to the proposed Rose Pit (following access point A4 and turning right on coordinates (UTM) N 5855966.109 and E 633587.110 and N 5855701.659 and E 633099.105.

## Instrumentation

Station S2 contains a Levellogger (serial #22001599) and a Barologger (serial #11064953). Both instruments are installed in a stilling well for continuous water depth and atmospheric pressure monitoring with a 10 minute interval. Station S2 is also a water quality sampling location. This station was installed in Oct. 7, 2011. The Levellogger was installed with RV antifreeze on the right bank.

## Cross Section



Channel profile starting at left bank looking downstream, units in m.

Flat flood plain about 40 cm higher.

## Flow Measurement

A flow measurement was conducted using a Sontek Flowtracker on Oct 7, 2011 at 11:00 am.

$$Q = 0.0874 \text{ m}^3/\text{s}$$

## Channel Slope and Stream Bottom

Water surface -%

- 5 m upstream of station to 7m downstream of station
- Upstream Thalweg -13cm

- Downstream Thalweg -17 cm

Stream has bottom consisting mainly of cobbles-boulders.

### **Spot Water Quality Measurements at Station S2**

Oct 7, 2011 at 1:00 pm

Temp. = 1.85 °C

Specific Conductance = 111  $\mu\text{S}/\text{cm}$

Conductivity = 62  $\mu\text{S}/\text{cm}$

TDS = 0.072 g/l

Salinity = 0.05

DO = 103.4%

DO = 14.36 mg/l

pH = 8.90

pHmV = -81.7



## **STATION S3**

**Date:** Oct 08, 2011



\*Looking upstream

### **Location**

Station S3 is located on a small tributary and approximately 150 m upstream of Molar Lake. The coordinates (UTM NAD83) of the station are northing 5851832.982 and easting 632431.028.

### **Rationale**

Station S3 is located to provide baseline data and monitor the exit of the watershed that contains the Rose South waste rock disposal area.

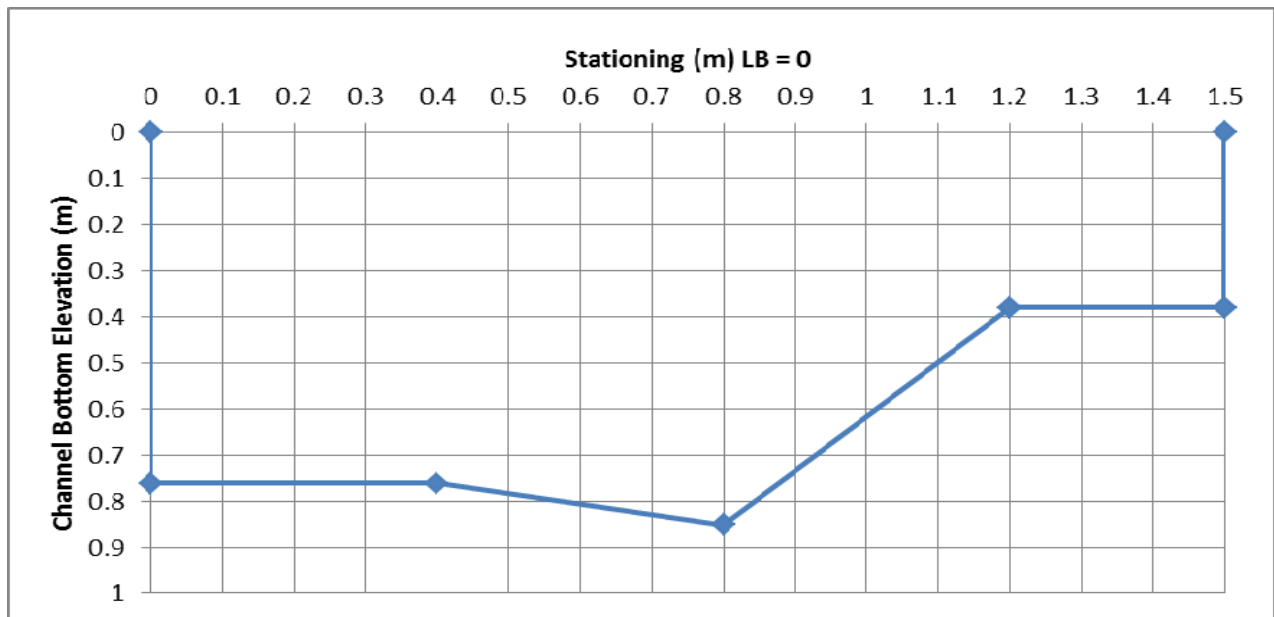
### **Access**

Station S3 can be accessed only by helicopter. Landing coordinates are northing 5851777.851 and easting 632518.039.

## Instrumentation

Station S3 contains a Levellogger (serial #22001511). The Levellogger is installed in a stilling well for continuous water depth monitoring with a 10 minute interval. Station S2 is also a water quality sampling location. This station was installed in Oct. 8, 2011. The Levellogger was installed with RV antifreeze on the right bank.

## Cross Section



Channel profile starting at left bank looking downstream, units in m.

Flat flood plain about 35 cm higher.

## Flow Measurement

A flow measurement was conducted using a Sontek Flowtracker on October 8, 2011 at 10:00 AM.

$$Q = 0.0223 \text{ m}^3/\text{s}$$

## Channel Slope and Stream Bottom

- Very low slope channel, slope was not measured
- Stream is well defined with soft turf/moss on banks
- Bottom at cross section is sandy-cobble (mostly sand)
- Other reaches have boggy/organic bottom

### **Spot Water Quality Measurements at Station S3**

Oct. 8, 2011 at 10:00

Temp. = 3.64 °C

Specific Conductivity = 56 µS/cm

Electrical Conductivity = 33 µS/cm

TSS = 0.037g/L

Salinity = 0.03

DO = 87.6%

DO = 11.59 mg/L

pH = 9.10 ph

pHmV = -90.0



## **STATION S4**

**Date:** Oct 7, 2011



\*Looking upstream

### **Location**

Station S4 is located in the stream that connects Molar Lake to Mills Lake adjacent to the access road bridge (upstream side). The coordinates (UTM NAD83) of the station are northing 5853070.825 and easting 634296.231.

### **Rationale**

Station S4 was setup to provide baseline flow data and to monitor the outflow of Molar Lake which is just downstream of the Rose South waste rock disposal area and discharges into Mills Lake.

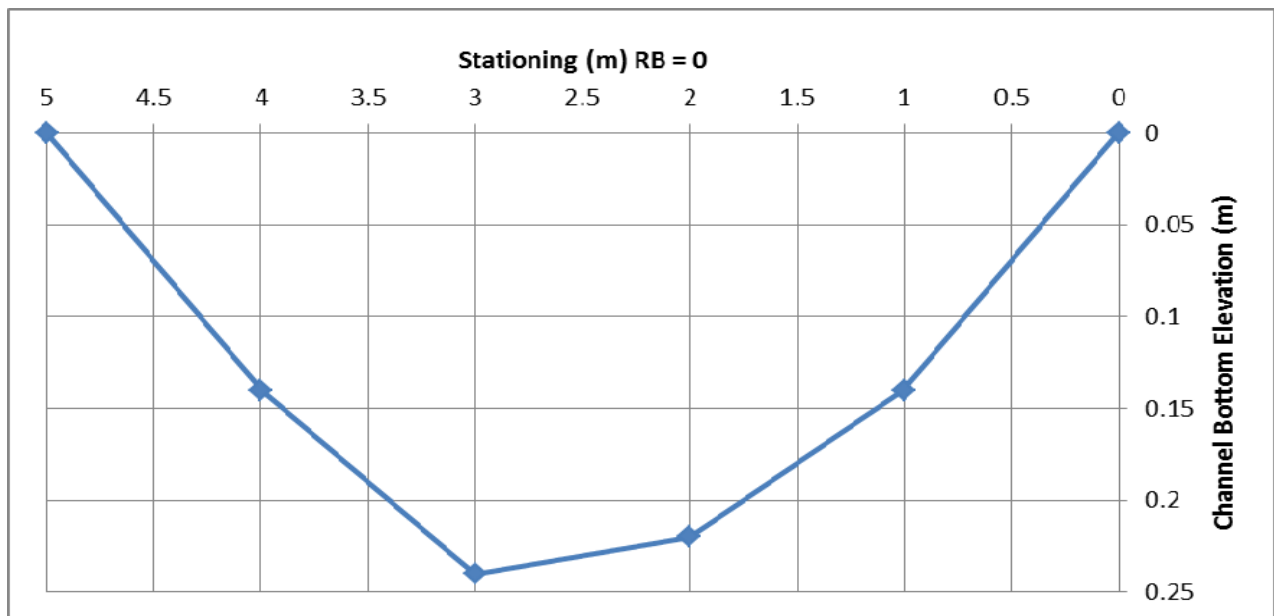
## Access

Station S4 can be accessed by all terrain vehicle, snowmobile or by helicopter depending on road and snow conditions. The station is located approximately 1 km after access point A6 (keep left at this access point).

## Instrumentation

Station S4 contains a Levelogger (serial #22001617). The Levelogger is installed in a stilling well for continuous water depth monitoring with a 10 minute interval. Station S2 is also a water quality sampling location. This station was installed in Oct. 7, 2011. The Levelogger was installed with RV antifreeze on the left bank.

## Cross Section



Channel profile starting @ right bank looking downstream, units in m.  
Flat flood plain about 90 cm higher.

## Flow Measurement

A flow measurement was conducted using a Sontek Flowtracker on Oct 8, 2011 at 4:30 PM.

$$Q = 0.103 \text{ m}^3/\text{s}$$

## Channel Slope and Stream Bottom

Channel meandering obstructed the measurement of slope. Channel bottom is mainly gravel-cobbles-boulders.

## **Spot Water Quality Measurements at Station S4**

Oct. 7, 2011 at 4:30 PM

Temp. = 7.0 °C

Specific Conductance = 57 µS/cm

Electrical Conductivity = 38 µS/cm

TDS = 0.037 g/L

Salinity = 0.03

DO = 100.5%

DO = 12.18 mg/L

pH = 8.94

pHmV = -83.2



## **STATION S5**

**Date: Oct 8, 2011**



\*Looking downstream

### **Location**

Station S5 is located in a tributary that feeds to the southern end of Long Lake (upstream side of lake). The coordinates (UTM NAD83) of the station are northing 5856368.709 and easting 637517.073.

### **Rationale**

Station S5 is located downstream of the proposed tailings impoundment and other mine infrastructure to collect baseline flow data and monitoring data during different project phases.

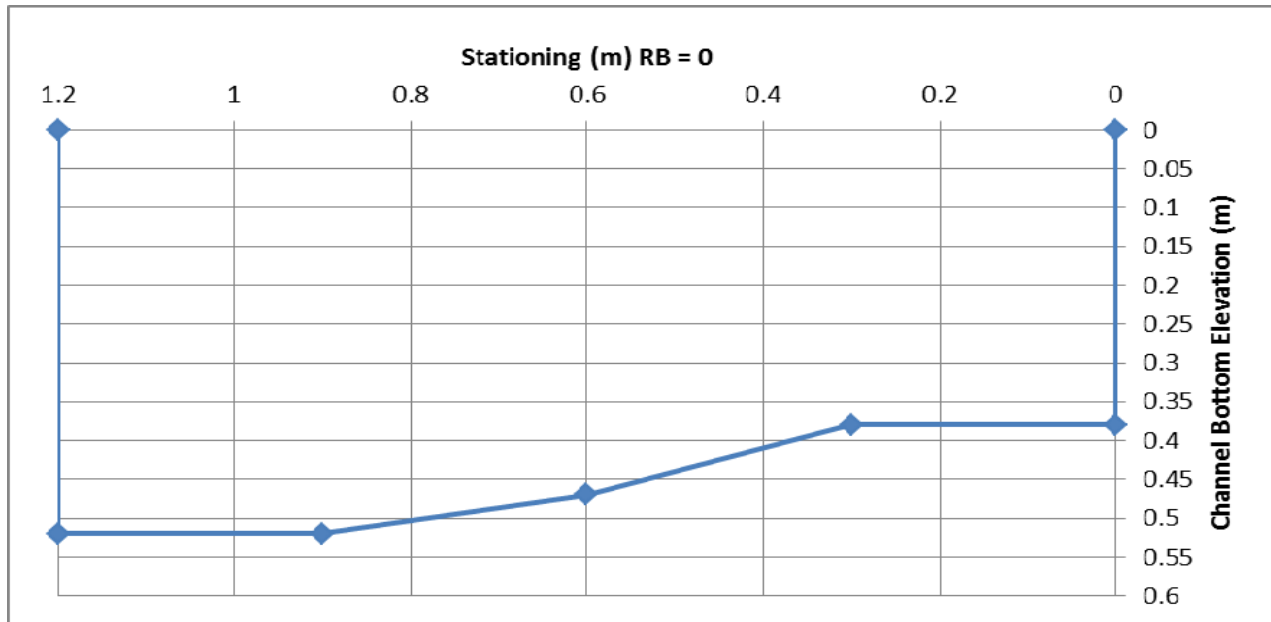
### **Access**

Station S5 can be accessed by helicopter or by boat from Long Lake. The landing coordinates are 5856445.012 and easting 637473.843.

## Instrumentation

Station S5 contains a Levelogger (serial #21063654) and a Barologger (serial #11064951). Both instruments are installed in a stilling well for continuous water depth and atmospheric pressure monitoring with a 10 minute interval. Station S5 is also a water quality sampling location. This station was installed in Oct. 8, 2011. The Levelogger was installed with RV antifreeze on the left bank.

## Cross Section



Channel profile starting @ left bank looking downstream, units in m.  
Flat floodplain about 30 cm higher.

## Flow Measurement

A flow measurement was conducted using a Sontek Flowtracker on Oct 8, 2011 at 1:50 PM.

$$Q = 0.0047 \text{ m}^3/\text{s}$$

## Channel Slope and Stream Bottom

Channel slope was not measured. Meandering channel with bottom comprised of sand and boulders with lots of woody debris.

## Spot Water Quality Measurements at Station S5

Oct. 8, 2011 at 2:25 pm

Temp. = 4.72 °C

Specific Conductance = 156  $\mu$ S/cm

Electric Conductivity = 95  $\mu$ S/cm

TDS = 0.101 g/L

Salinity = 0.07

DO = 87.8%

DO = 11.29 mg/L

Ph = 9.07

pHmV = -88.8

## **STATION L1**

**Date:** Oct 7, 2011



### **Location**

Station *L1* is located near landing for snowmobiles next to two cottages on the Mills Lake shore. The coordinates (UTM NAD83) of the station are northing 5853238.290 and easting 634702.660.

### **Rationale**

Station *L1* was setup to monitor the level at Mills Lake which is the receiving waterbody for some project components.

### **Access**

Station *L1* can be accessed by all terrain vehicle approximately 1 km south of access point A6 taking a left turn before continuing to Station *S4*.

## **Instrumentation**

Station *L1* contains a Levelogger installed in a stilling well for continuous water depth monitoring with a 10 minute interval. Station *L1* is also a water quality sampling location. This station was installed in Oct. 7, 2011. The Levelogger was installed with RV antifreeze on the lake.

## **Spot Water Quality Measurements at Station *L1***

Oct. 7, 2011 at 5:45 pm

Temp. = 6.73 deg. °C

Specific Conductance = 66 µS/cm

Electrical Conductivity = 43 µS/cm

TDS = 0.043 g/L

Salinity = 0.03

DO = 101.1 %

DO = 12.35 mg/L

pH = 9.13

pHmV = -93.0

Estimated Water level at Levelogger at 6:25 pm = 60 cm



## **STATION L2**

**Date:** Oct 8, 2011



### **Location**

Station *L2* is located at the southern end of Long Lake at the mouth of a stream that feeds Long Lake (where station *S5* is installed). The coordinates (UTM NAD83) of the station are northing 5856468.955 and easting 637498.601.

### **Rationale**

Station *L2* measures water levels at Long Lake which is the largest waterbody within the project area and also receives runoff from a large portion of the project. Because of its size, Long Lake can also be considered as the receiving body for the project effluent.

### **Access**

Station *L2* can be accessed by helicopter or by boat on Long Lake. Landing coordinates (UTM) are northing 5856445.012 and easting 637473.843.



## **Instrumentation**

Station L2 contains a Levellogger installed in a stilling well for continuous water depth monitoring with a 10 minute interval. Station L2 is also a water quality sampling location. This station was installed in Oct. 8, 2011. The Levellogger was installed with RV antifreeze on the lake.

## **Spot Water Quality Measurements at Station L2**

Oct. 8, 2011 at 1:20 pm

Temperature = 5.0 °C

Specific Conductance = 157 µS/cm

Electric Conductivity = 97µS/cm

TDS = 0.102 g/L

Salinity = 0.07

DO = 93.2%

DO = 11.91 mg/L

pH = 9.06

pHmv = -88.4

Shallow embayment of long lake at south end with very shallow sandy bottom

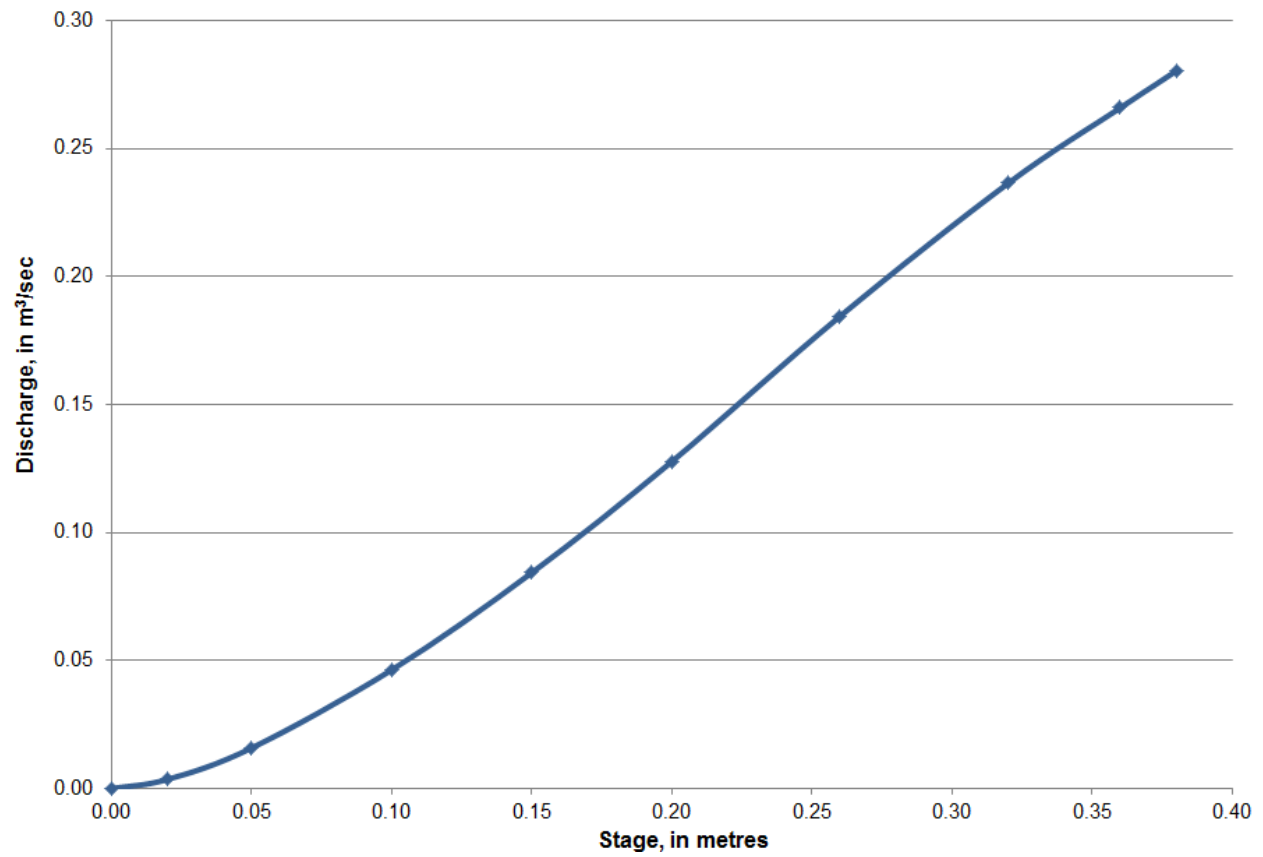
Estimated Water level at Levellogger at 1:20 pm = 80 cm

Distance from water surface to 1<sup>st</sup> rebar= 0.6m

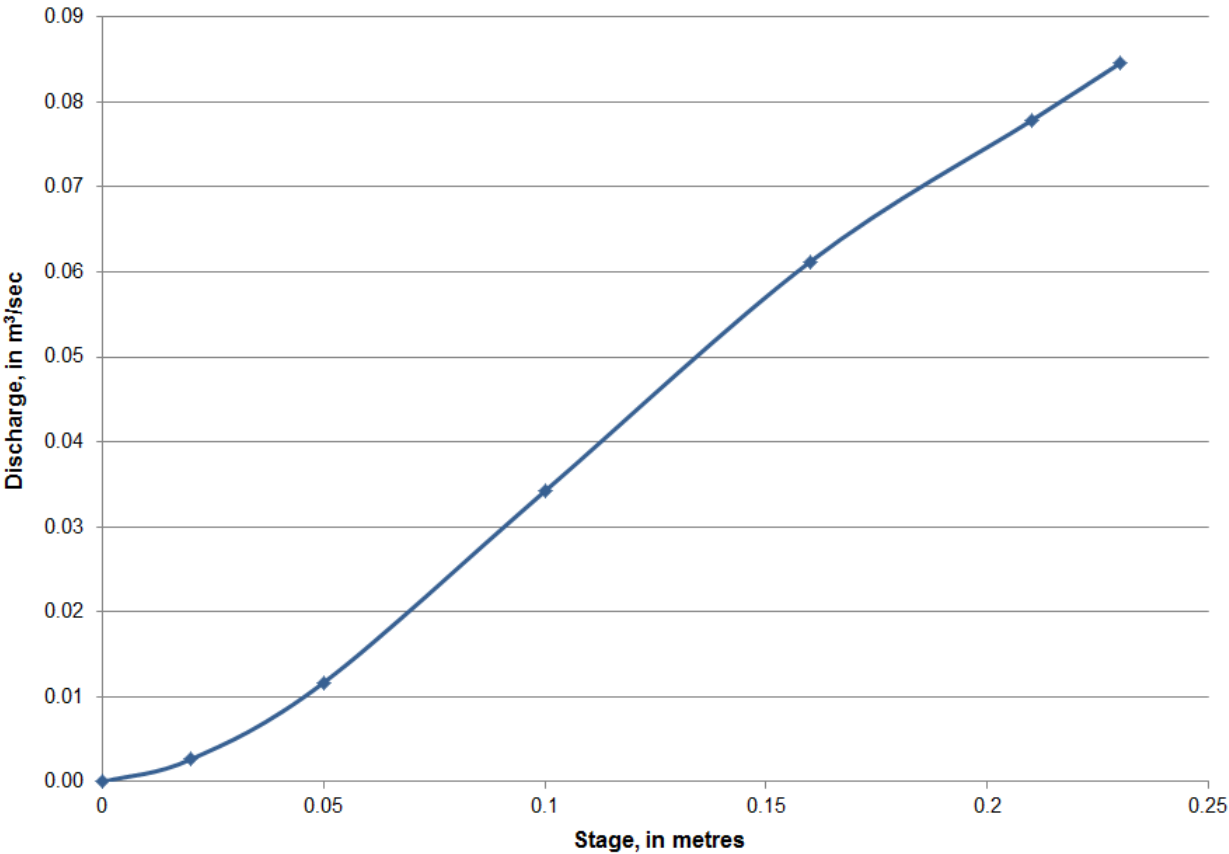
**Access Point Coordinates (UTM NAD83)**

ID	Easting	Northing
A1	627361.6758	5857387.03
A2	632169.6043	5863385.92
A3	633933.9818	5862172.91
A4	634132.4742	5859217.58
A5	634044.2554	5855005.13
A6	633889.8723	5853836.23

**Figure 17C.1 Rating Curve of Stream Gauging Station S1**



**Figure 17C.2 Rating Curve of Stream Gauging Station S2**



**Figure 17C.3 Rating Curve of Stream Gauging Station S3**

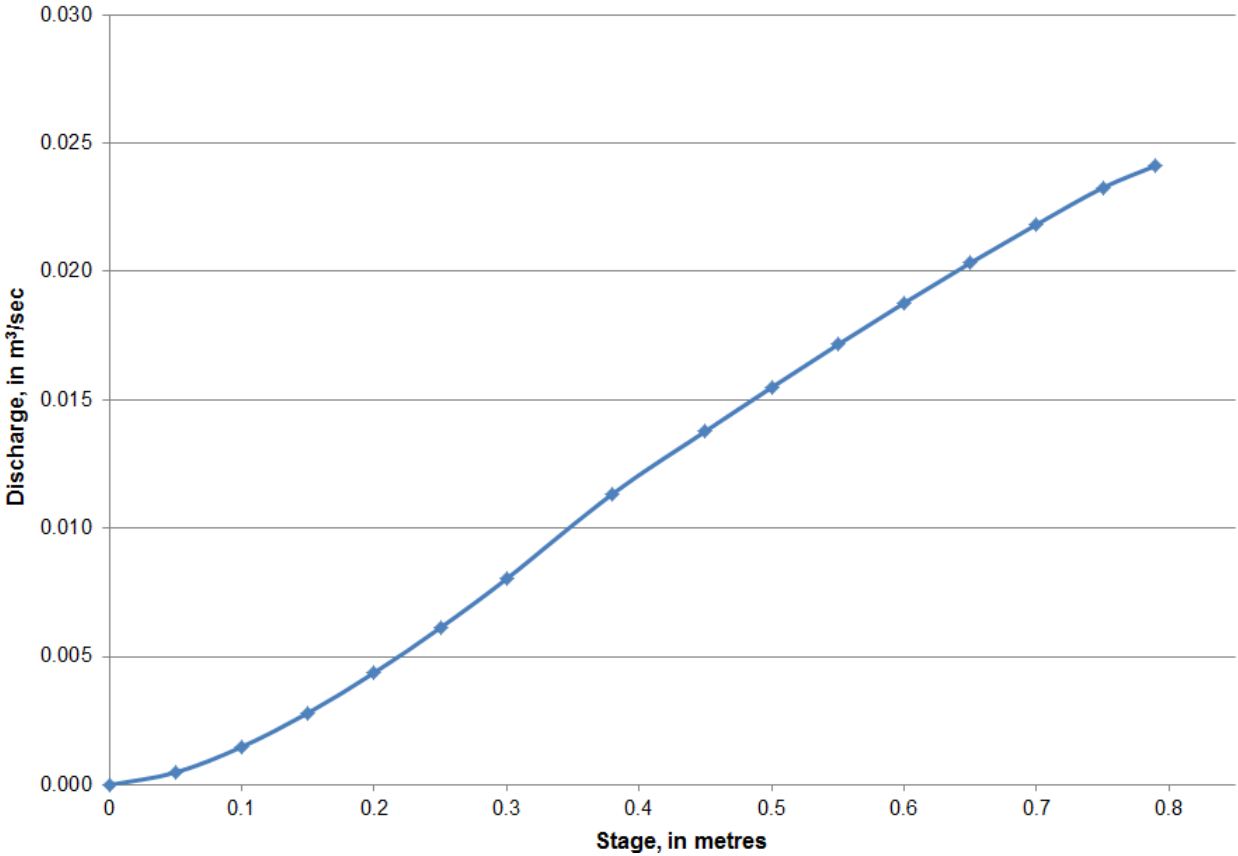
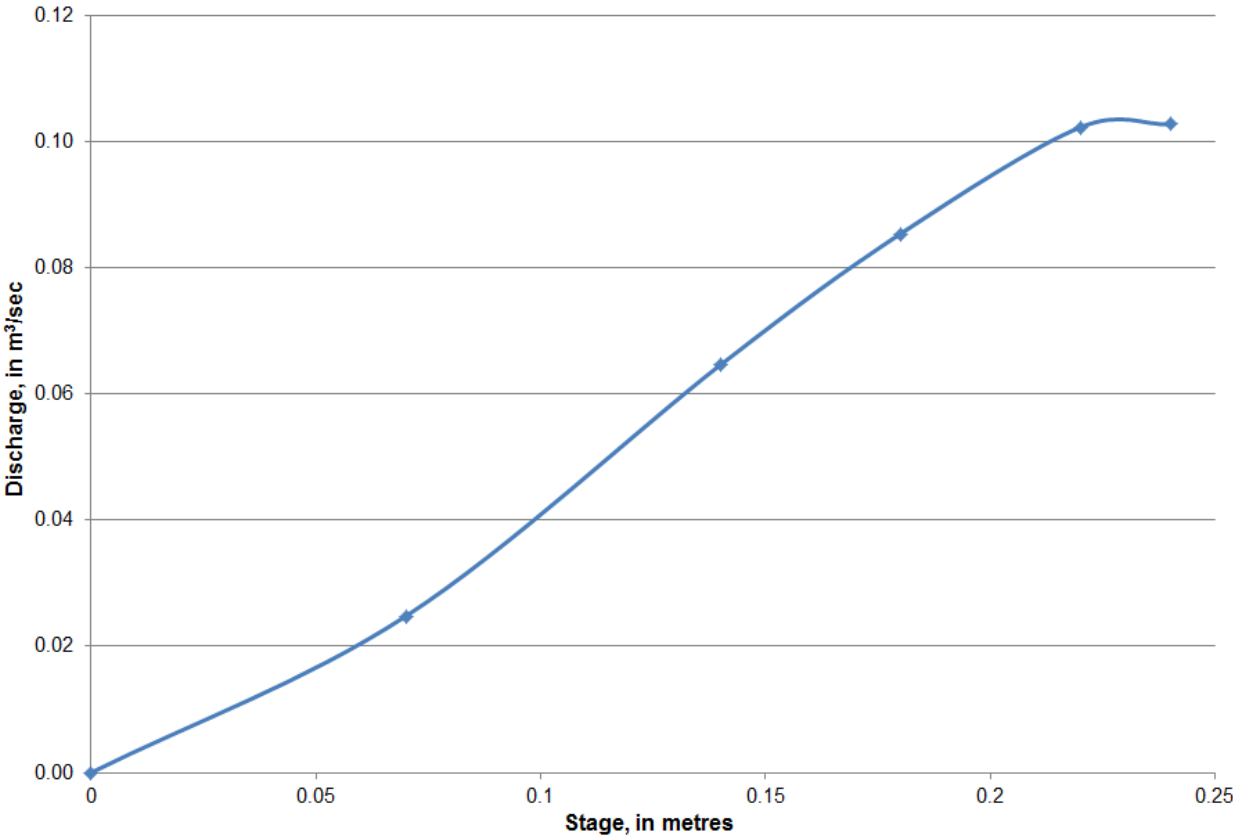
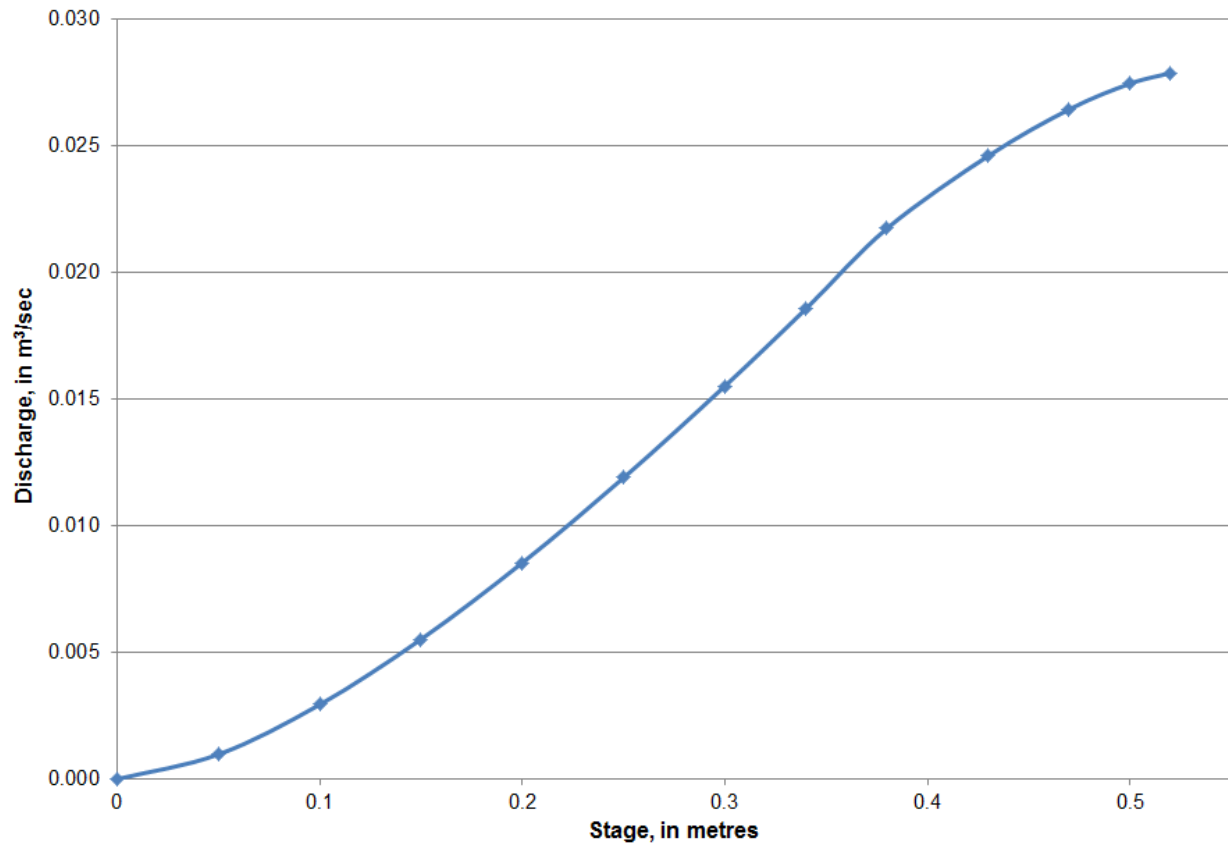


Figure 17C.4 Rating Curve of Stream Gauging Station S4

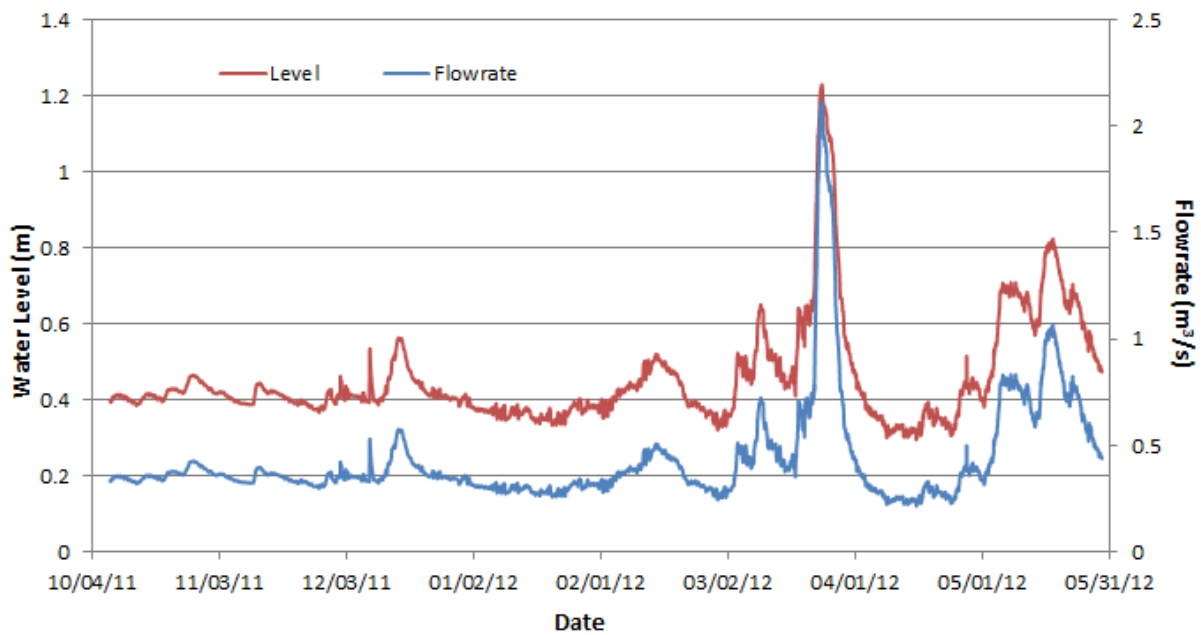




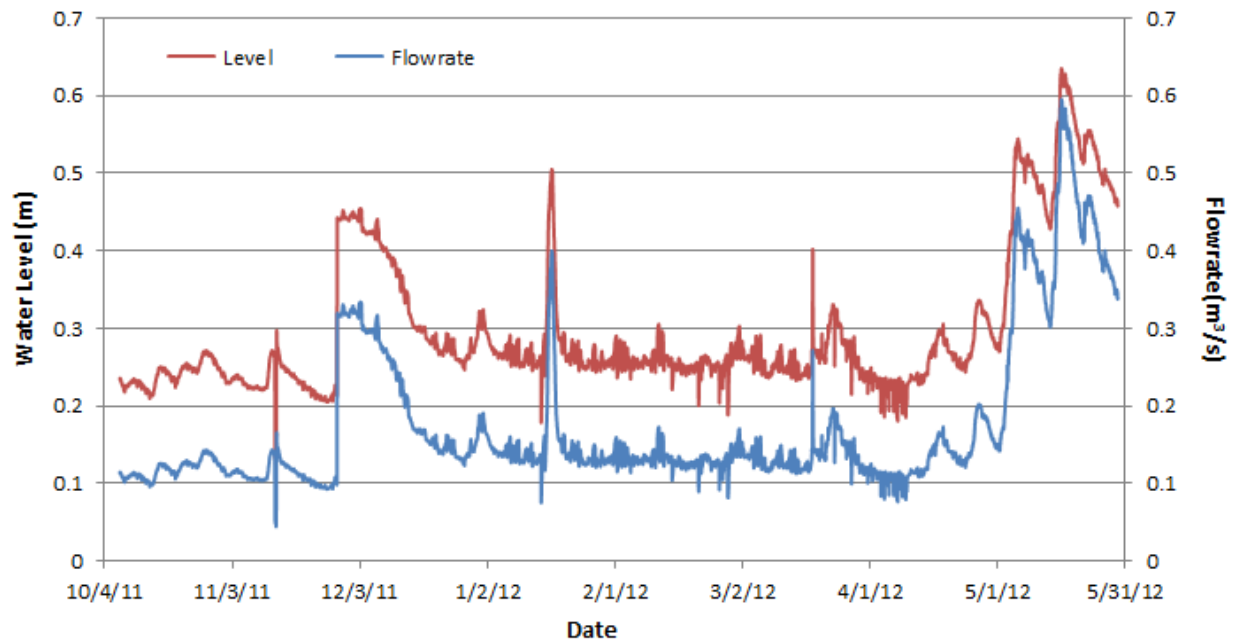
**Figure 17C.5 Rating Curve of Stream Gauging Station S5**



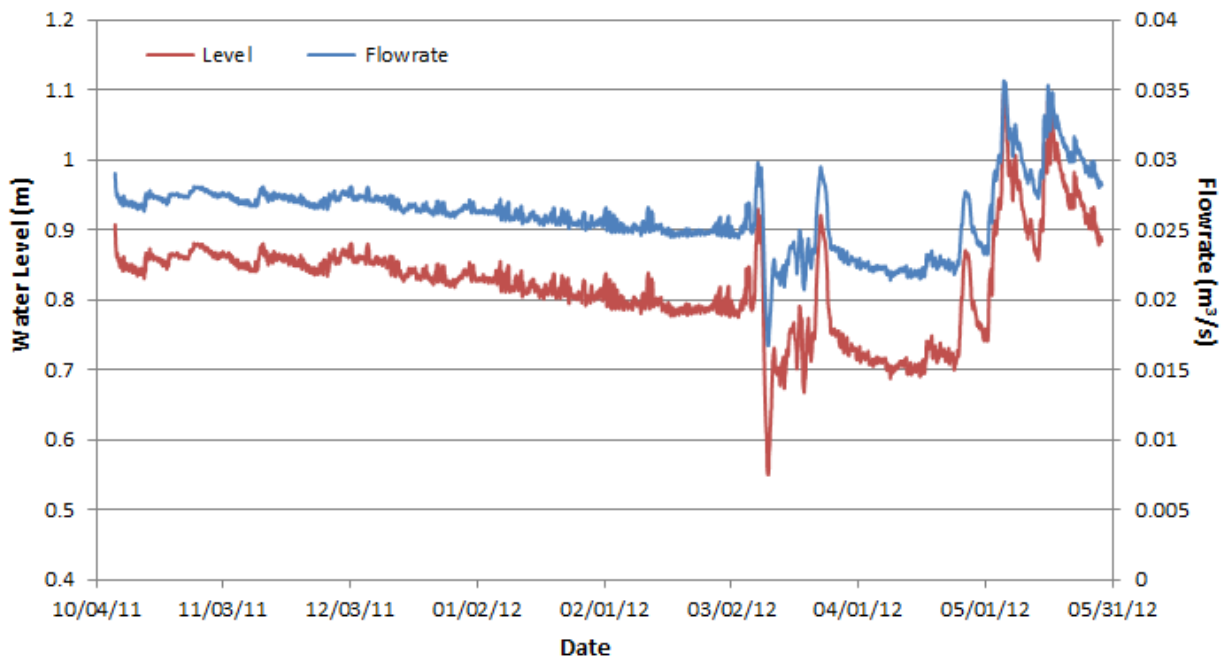
**Figure 17C.6 Water Level and Streamflow at Station S1**



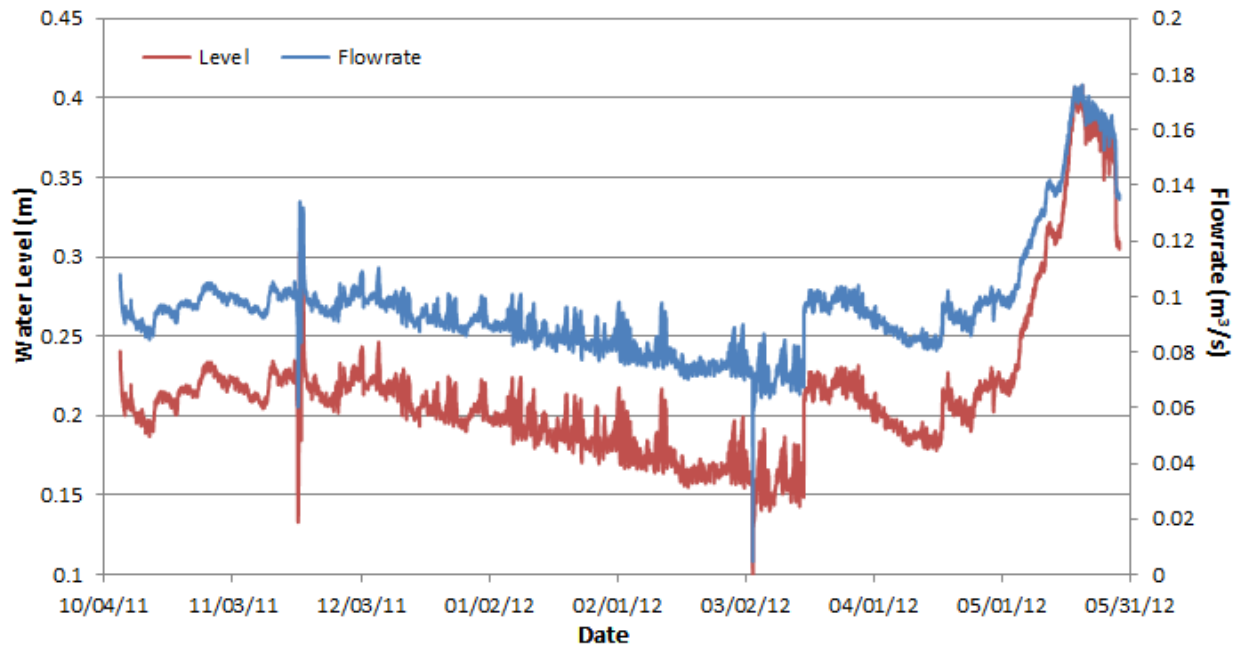
**Figure 17C.7 Water Level and Streamflow at Station S2**



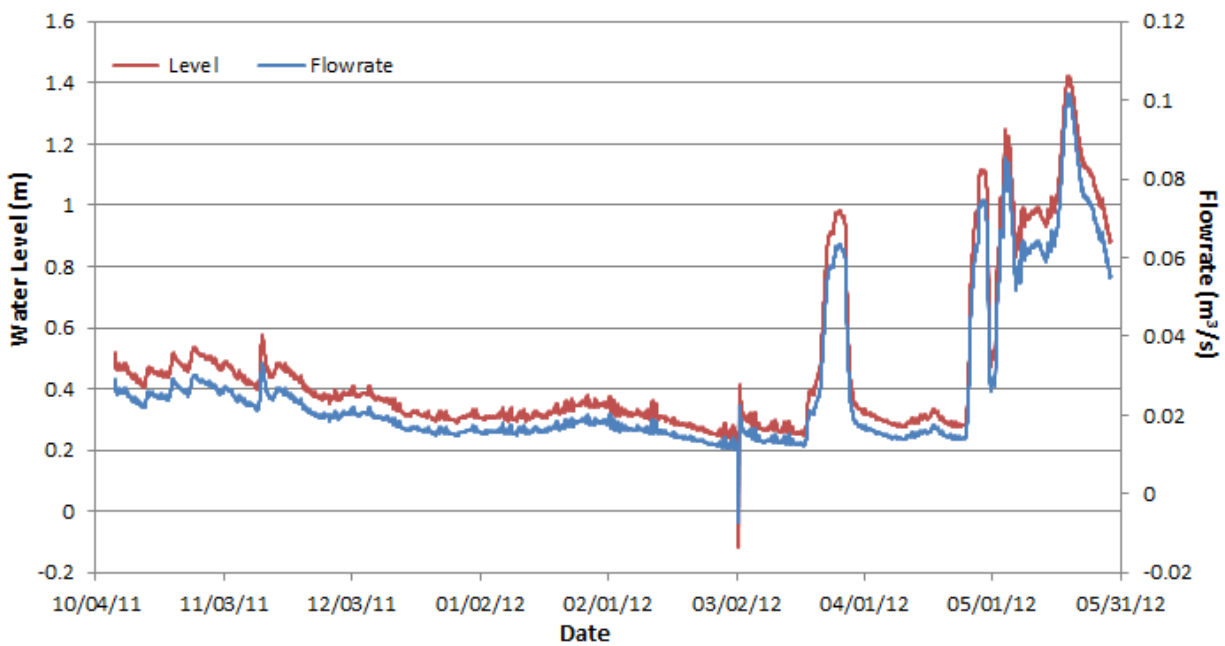
**Figure 17C.8 Water Level and Streamflow at Station S3**



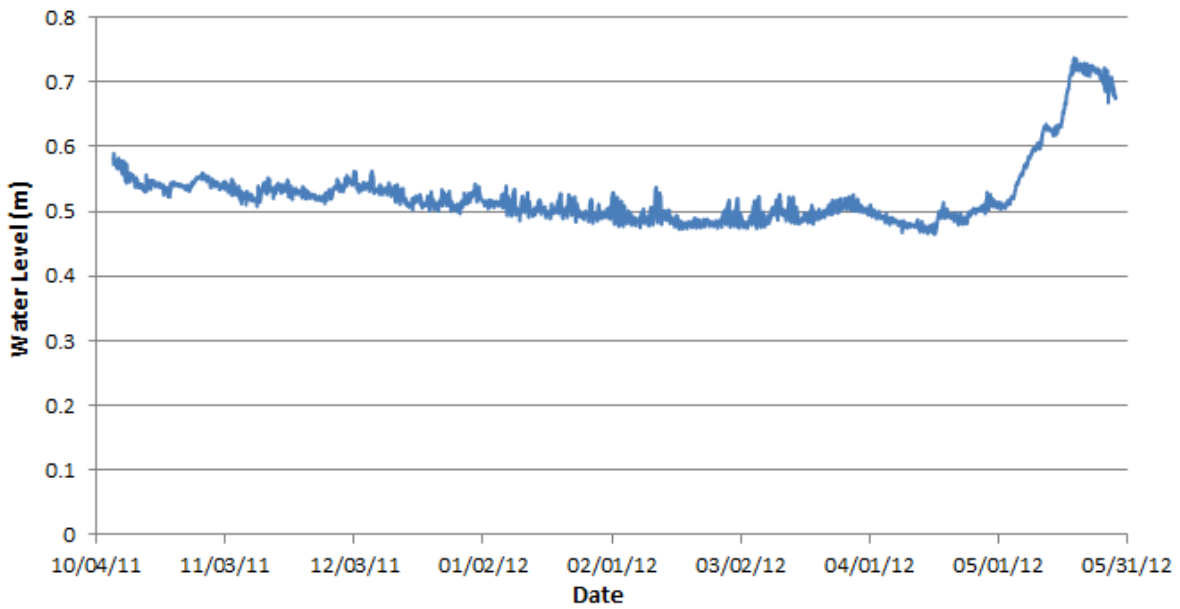
**Figure 17C.9 Water Level and Streamflow at Station S4**



**Figure 17C.10 Water Level and Streamflow at Station S5**



**Figure 17C.11      Water Level at Station L1**



**Figure 17C.12      Water Level at Station L2**

