Archiving Sontek Stationary Gaugings

Overview:

Horizons carries out several different types of gaugings across the region. As part of the Quality Assurance process of the gaugings, the raw data (gauging file) is processed, the gauging is then quality coded, reviewed and assured, and handed on to the Data Analysts ready to be archived. This Standard Operating Procedure (SOP) details the Archiving of Sontek Stationary Gaugings, specifying the key areas to verify that the gauging was conducted, processed and Quality Assured appropriately.

The presumption is that the gauging has been quality coded and all the information is present and/or accounted for before the archiving process begins.

Considerations:

At present, there is no SOP detailing how to Quality Assure Sontek Stationary Gaugings. Therefore when undertaking Archiving of Sontek Stationary Gaugings extreme care is required to make sure the below information is correct as it may have been missed due to a lack of documentation explaining how it should be carried out. Furthermore this SOP acts as a request to create said procedure, outlining what information is needed to successfully Archive Sontek Stationary gaugings.

Preparation:

You need to have the following in front of you in order to Archive the gauging:

1) Physical gauging facecard (preferably already quality coded)
2) Discharge Measurement Summary (DMS) print out
3) Hilltop printout sheet of the gauging loaded into the appropriate Regional Gauging location
4) Hilltop Manager open with the gauging that is to be archived located in the correct Region location

If any of these are missing then the gauging needs to be returned to the Technician with a note explaining what needs to be added.

Extras with the gauging may include a Weighted Mean Stage Height printout, particularly if the gauging was conducted during high flow events, or photographs if an object or obstruction impacted the gauging that would be relevant for the end user to know about.

Checking the Information:

Key information Check List:

Detailed below and illustrated with diagrams is the information that needs to be checked off to ensure the paperwork and the digital file contain the same information, the correct information, and assigned the correct Quality Code to subsequently be Archived appropriately. To save time, it is recommended that the printed out paperwork be assessed and compared first to verify that information is all correct and then compare the Facecard information with the digital file, rather than trying to verify all the information (digital and paperwork) at the same time.

If any of the information does not match up that is listed below please return to the Technician with a note explaining what needs to be corrected

- Gauging number, Date & Time – these should <u>all be the same</u>, filed to the exact time
- Site name
- Instrumentation used with serial number – on the Hilltop printout & digital file there is a 'Method Code' section which needs to have the number '45'. On the Facecard and DMS the meter type and serial number shall be recorded
- Filed Stage height – this is **<u>not</u>** on the Discharge Measurement Summary Printout

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Facecard Information Check List:

Along with the key information check list outlined above, the following is specific information required on the Facecard and refers to Diagram 1:

- 'Party' shall have the names and/or initials of those who conducted the gauging
- 'Measured by…' shall have 'Other' circled with 'Sontek-Stationary' written beside it
- 'Meter Type' shall have the instrument serial number recorded. The version used to process the Sontek Gauging shall be recorded in the 'Prop no' section
- Number of verticals done and method used – Method should be '45'
- ;Measured from….' shall have one of the options circled
- 'Measured….' shall have the distance, in metres, noted in respect to where the gauging was conducted from, with either 'above, below, at' circled
- Wind speed and direction noted and circled, otherwise a line shall be drawn through it
- Angle on current shall be circled
- Water Temperature recorded – if a handheld temperature value was used the instrument that measured it shall be noted next to the number
- The colour of the water circled – either 'discoloured' or 'clear'
- The Start & End times of the gauging shall be noted in the 'Stage Readings' section – if a Logger is set up at the site the Water Level readings shall be recorded at 5 minute punches during the gauging Start & End time. If no continuous data is available this shall be left blank.
- The 'Derived S.H.' is the middle Water Level point of the gauging that the associated discharge will be filed against – if the gauging occurred during a rise or fall of recorded Water Level a Weighted Mean Stage Height needs to be calculated, with the appropriate evidence attached to the gauging. If no continuous Water Level data is recorded at the site the Derived S.H. is '-1'. The Time of the Gauging shall be recorded next to the derived Stage Height
- The 'Computed Data' section shall be filled out – this includes the Discharge, Stage height change, Rate of rise/fall, Area, Width, Max. Depth and Mean Velocity – this information is obtained from the Hilltop Printout & Digital files – the DMS information should not be written here
- Under the 'Remarks' section anything of particular importance or interest for the end user should be noted. Examples include if changes were made to the site during the inspection that would impact the Water Level readings (clearing weirs, moving debris), ways the data may have been corrected (azimuth degrees, verticals excluded) or potential conditions affecting the quality of the gauging (bad section, stopped half way through).
- The person who computed the Gauging shall record their name and/or initials on the bottom of the Facecard
- The person who checked the gauging (i.e. Reviewed/Quality Assured it) shall record their initials/name at the bottom right corner of the gauging card

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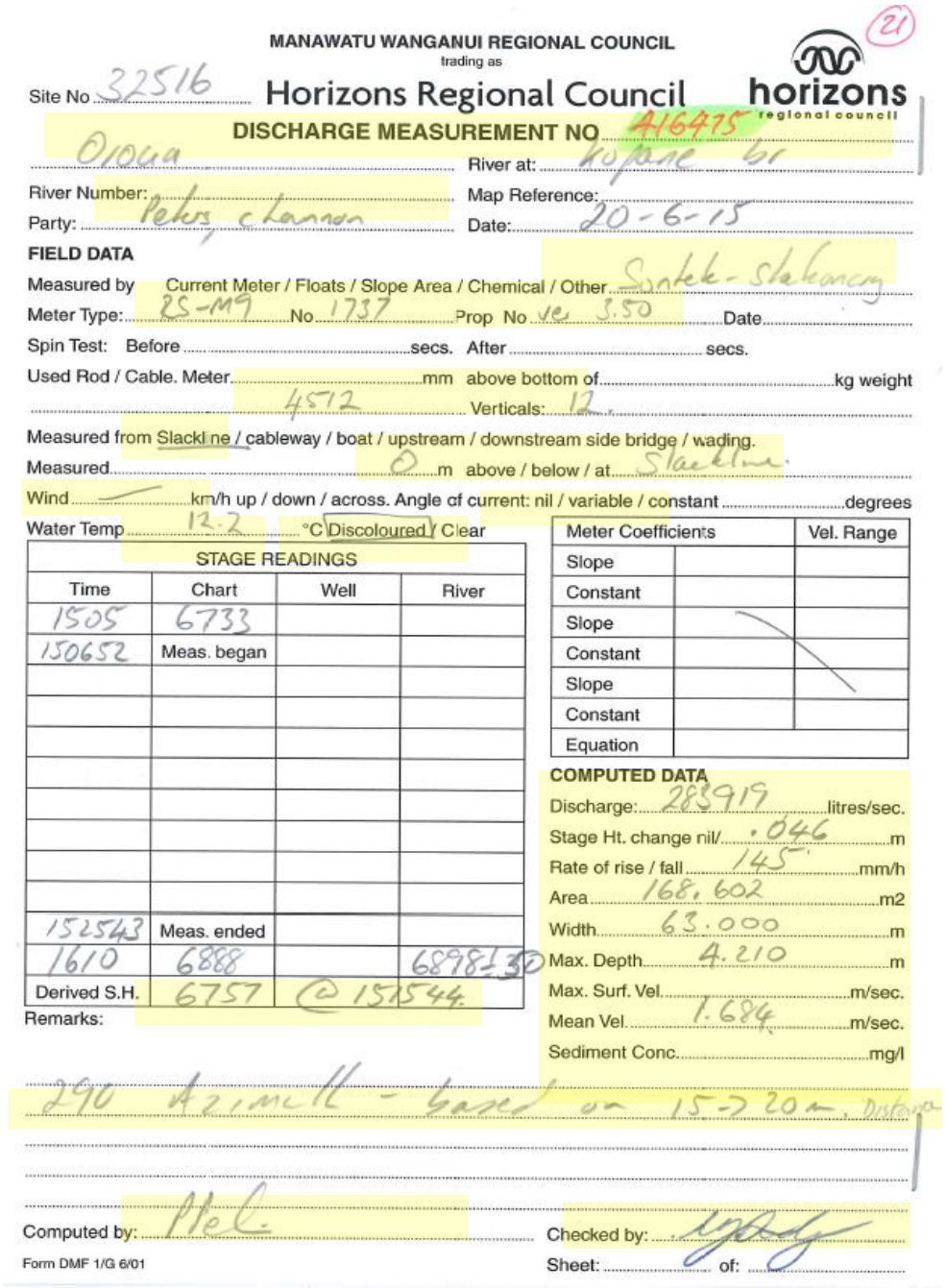
Diagram 1: Example of a Facecard for a Sontek Stationary Gauging



MANAWATU WANGANUI REGIONAL COUNCIL
trading as
Horizons Regional Council

Site No 32516

DISCHARGE MEASUREMENT NO 416475

Otaua — River at: Kopane 61

River Number: — Map Reference:

Party: Peters, Channon — Date: 20-6-15

FIELD DATA

Measured by Current Meter / Floats / Slope Area / Chemical / Other Sontek - Stationary

Meter Type: RS-M9 No 1737 Prop No Ver 3.50 Date

Spin Test: Before secs. After secs.

Used Rod / Cable. Meter mm above bottom of kg weight

4512 Verticals: 12

Measured from Slackline / cableway / boat / upstream / downstream side bridge / wading.

Measured 0 m above / below / at Slackline

Wind — km/h up / down / across. Angle of current: nil / variable / constant degrees

Water Temp 12.2 °C Discoloured / Clear

STAGE READINGS			
Time	Chart	Well	River
1505	6733		
150652	Meas. began		
152543	Meas. ended		
1610	6888		6898±30
Derived S.H.	6757	@ 151544	

Meter Coefficients		Vel. Range
Slope		
Constant		
Slope		
Constant		
Slope		
Constant		
Equation		

COMPUTED DATA

Discharge: 283919 litres/sec.

Stage Ht. change nil/ .046 m

Rate of rise / fall 145 mm/h

Area 168.602 m2

Width 63.000 m

Max. Depth 4.210 m

Max. Surf. Vel. m/sec.

Mean Vel. 1.684 m/sec.

Sediment Conc. mg/l

Remarks:

290 Azimuth - based on 15-20m. Distance

Computed by: Mel

Checked by:

Form DMF 1/G 6/01

Sheet: of:

Areas highlighted in yellow need to have their respective sections filled in. If not, send the whole gauging back to the Technician who computed the gauging for it to be corrected. The information highlighted also needs to match what is in the Hilltop digital file, the Hilltop printed out file and parts of the Discharge Measurement Summary (DMS) sheet*

*Calculations of the gaugings will differ from the Hilltop values which are the ones that are archived.

NOTE: The Date & Time and Gauging Number should be checked first as this must be the same across all documentation – if not send back

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Archiving Sontek Stationary Gaugings

Discharge Measurement Summary Check List:

Along with the key information check list, the following is specific information required on the Discharge Measurement Summary (DMS) print outs and refers to Diagrams 2 & 3:

NOTE: The Date but not the time is on the DMS at present.

- The location of the recorded file path shall be recorded on the DMS – ideally this should be printed but if not can be hand written so future end users can locate where the Sontek file is stored.
- 'Site Information' tab the Site name, Station number and Location shall be completed correctly for the relevant site.*
- 'Measurement Information' tab the Party, Boat/motor and Meas. Number shall be completed for the relevant site*. The Boat/motor refers to what the Sontek was placed in e.g. float, kayak with the Meas. Number being the Gauging number.
- 'System Information' tab shall have the system type, serial number and firmware version used – **NOTE this should be the same as what is written on the Facecard – if not, hand back to the Technician.**
- 'System Setup' must have the Tagline Azimuth (deg) if one was applied and the ***Discharge Method must be mid-section otherwise there will be issues with the gauging***
- 'Units' tab shall have the units used. These shall be metric (metres, degrees Celsius etc.)
- 'Discharge Calculation Settings' tab shall have ……. XXXXX
- '**Discharge Results' tab there are two key values that need to be checked. These need to match what is on the Facecard, Hilltop Printout & digital file**:
  - Total Width
  - Mean Water Temperature
- '**Measurement Results' tab requires manually checking the 'Location', 'Depth' and 'Mean Velocity' columns match exactly what is on the Hilltop printout & digital files**. It is these values that are recorded by the Sontek that Hilltop then uses to calculate the area and the discharge for the gauging and therefore what is copied to the Hydrometric Archive.
- 'Compass Calibration' tab shall have information regarding if it passed the calibration and what M and Q value it obtained**.
- 'System Test' tab shall have a system test passed – if not this needs to be investigated

***** If this information is not entered upon doing the gauging in the field it cannot be added back in the office so maybe blank. In this case the person computing the gauging should write the information onto the hard copy of the DMS sheet.

** A compass calibration needs to happen and pass for the gauging to obtain the maximum possible QC (600) – if it fails or has a low number we should consider lowering the overall Quality Code. A matrix shall be created to determine when it is appropriate to reduce the quality of the gauging based on this information.

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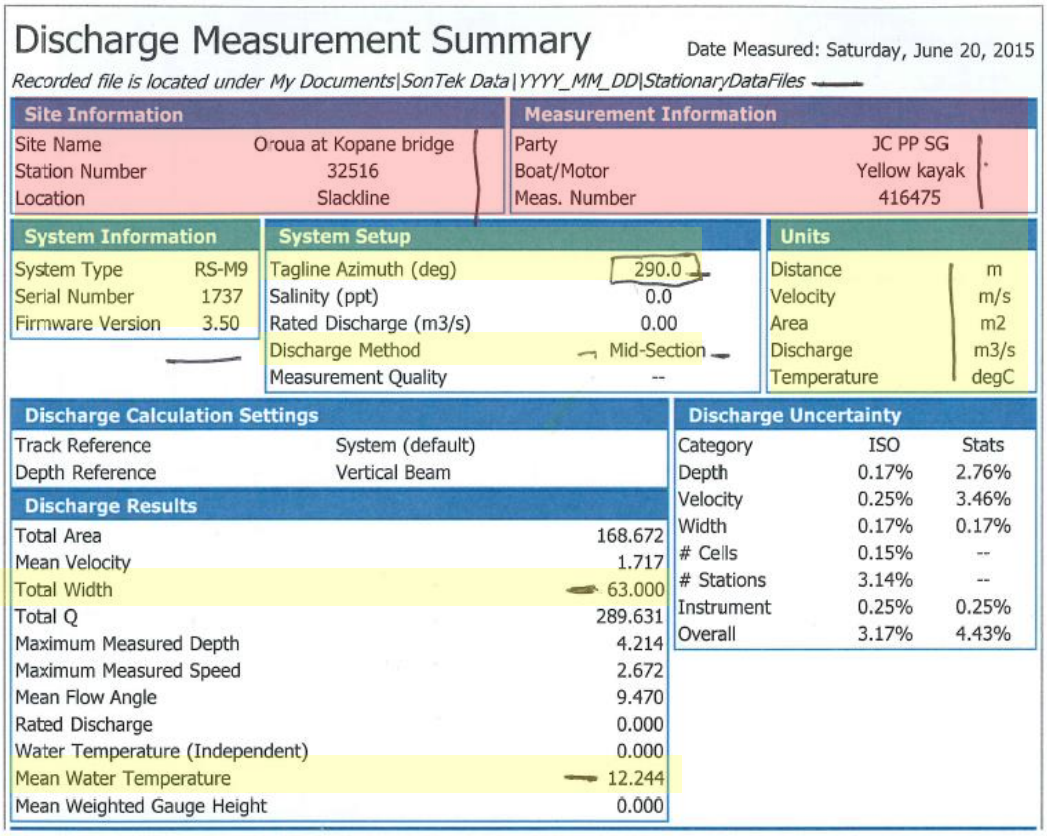
Diagram 2: Example of the first page of a Discharge Measurement Summary printout of a Sontek Stationary Gauging



Discharge Measurement Summary

Date Measured: Saturday, June 20, 2015

Recorded file is located under My Documents\SonTek Data\YYYY_MM_DD\StationaryDataFiles

Site Information	
Site Name	Oroua at Kopane bridge
Station Number	32516
Location	Slackline

Measurement Information	
Party	JC PP SG
Boat/Motor	Yellow kayak
Meas. Number	416475

System Information	
System Type	RS-M9
Serial Number	1737
Firmware Version	3.50

System Setup	
Tagline Azimuth (deg)	290.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	0.00
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.17%	2.76%
Velocity	0.25%	3.46%
Width	0.17%	0.17%
# Cells	0.15%	--
# Stations	3.14%	--
Instrument	0.25%	0.25%
Overall	3.17%	4.43%

Discharge Results	
Total Area	168.672
Mean Velocity	1.717
Total Width	63.000
Total Q	289.631
Maximum Measured Depth	4.214
Maximum Measured Speed	2.672
Mean Flow Angle	9.470
Rated Discharge	0.000
Water Temperature (Independent)	0.000
Mean Water Temperature	12.244
Mean Weighted Gauge Height	0.000

Areas highlighted in yellow need to have their respective sections filled in. If not, send the whole gauging back to the Technician who computed the gauging for it to be corrected. The information highlighted also needs to match what is in the Hilltop digital file, the Hilltop printed out file and the Facecard.

Areas in red ideally should be filled out but if they were not done in the field it cannot be edited – Technician should hand write this information on if missing.

NOTE: The Time is currently not displayed on the DMS printout.

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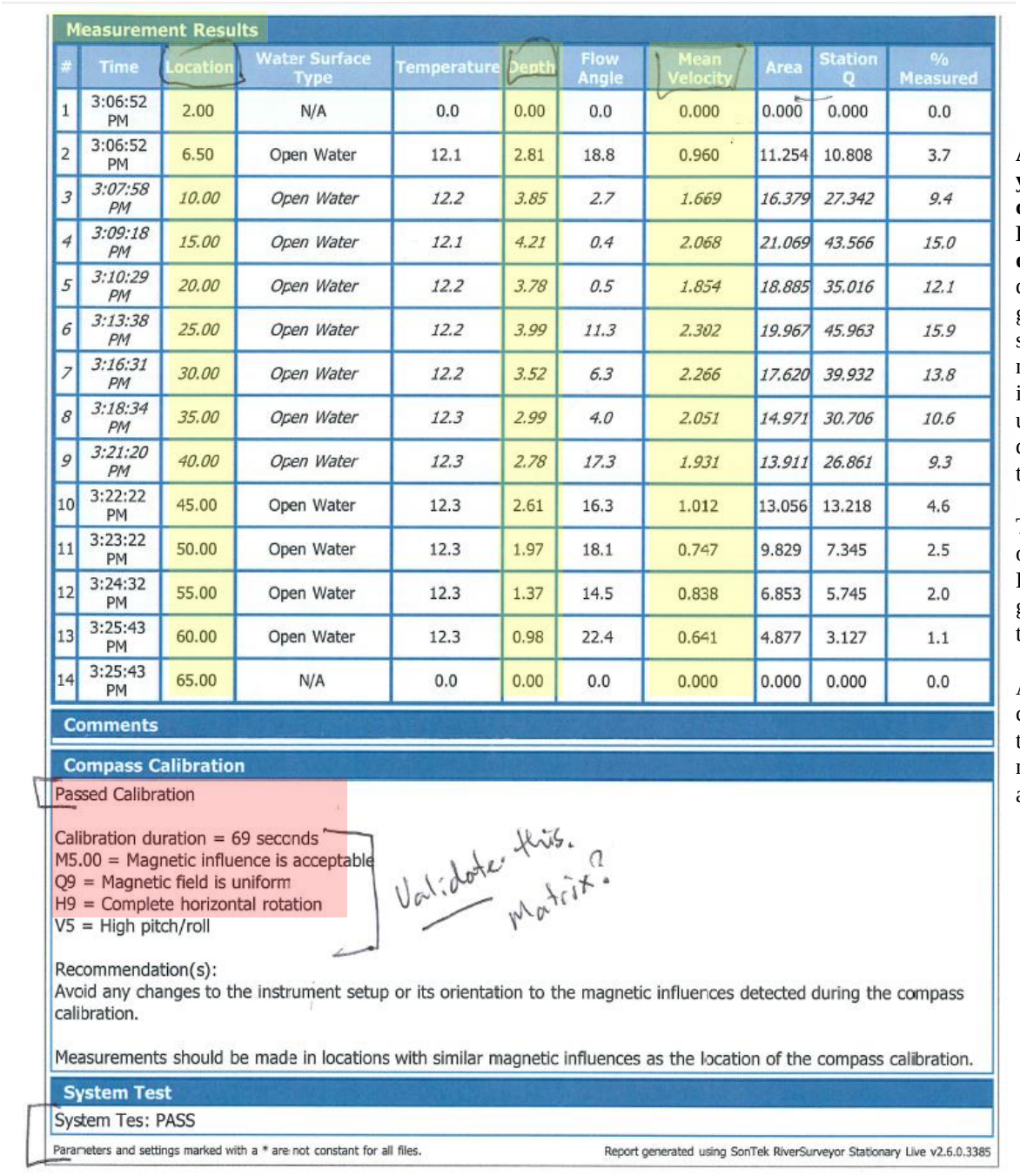
Diagram 3: Example of the second page of a Discharge Measurement Summary printout of a Sontek Stationary Gauging



Measurement Results

#	Time	Location	Water Surface Type	Temperature	Depth	Flow Angle	Mean Velocity	Area	Station Q	% Measured
1	3:06:52 PM	2.00	N/A	0.0	0.00	0.0	0.000	0.000	0.000	0.0
2	3:06:52 PM	6.50	Open Water	12.1	2.81	18.8	0.960	11.254	10.808	3.7
3	3:07:58 PM	10.00	Open Water	12.2	3.85	2.7	1.669	16.379	27.342	9.4
4	3:09:18 PM	15.00	Open Water	12.1	4.21	0.4	2.068	21.069	43.566	15.0
5	3:10:29 PM	20.00	Open Water	12.2	3.78	0.5	1.854	18.885	35.016	12.1
6	3:13:38 PM	25.00	Open Water	12.2	3.99	11.3	2.302	19.967	45.963	15.9
7	3:16:31 PM	30.00	Open Water	12.2	3.52	6.3	2.266	17.620	39.932	13.8
8	3:18:34 PM	35.00	Open Water	12.3	2.99	4.0	2.051	14.971	30.706	10.6
9	3:21:20 PM	40.00	Open Water	12.3	2.78	17.3	1.931	13.911	26.861	9.3
10	3:22:22 PM	45.00	Open Water	12.3	2.61	16.3	1.012	13.056	13.218	4.6
11	3:23:22 PM	50.00	Open Water	12.3	1.97	18.1	0.747	9.829	7.345	2.5
12	3:24:32 PM	55.00	Open Water	12.3	1.37	14.5	0.838	6.853	5.745	2.0
13	3:25:43 PM	60.00	Open Water	12.3	0.98	22.4	0.641	4.877	3.127	1.1
14	3:25:43 PM	65.00	N/A	0.0	0.00	0.0	0.000	0.000	0.000	0.0

Comments

Compass Calibration

Passed Calibration

Calibration duration = 69 seconds
M5.00 = Magnetic influence is acceptable
Q9 = Magnetic field is uniform
H9 = Complete horizontal rotation
V5 = High pitch/roll

Validate this. Matrix?

Recommendation(s):
Avoid any changes to the instrument setup or its orientation to the magnetic influences detected during the compass calibration.

Measurements should be made in locations with similar magnetic influences as the location of the compass calibration.

System Test

System Tes: PASS

Parameters and settings marked with a * are not constant for all files.

Report generated using SonTek RiverSurveyor Stationary Live v2.6.0.3385

Areas highlighted in yellow need to be compared with the Hilltop printout & digital files – if these do not match then the gauging needs to be sent back as this is the most crucial information that Hilltop uses to derive the total discharge and area for the gauging.

Ticking these off (either on this sheet or the Hilltop printout) is a good way of showing that it has been checked

Areas in red need to be checked to make sure they have passed. If not, may result in lower QC assigned to the gauging.

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Hilltop Printout Check List:

Along with the key information check list, the following is specific information required on the Hilltop Printout (and therefore should be in the same digital file) and refers to Diagram 4.

- All of the Summary Results shall have the appropriate information next to it. This information shall match what is on the Facecard, specifically the:
  - Filed Stage Height
  - Flow
  - Area
  - Mean Velocity
  - Maximum Depth
  - Stage Height change and Rate of rise/fall if Stage Height did change
  - Method and number of verticals
  - Verticals
  - Meter Serial Number
  - Slope & Intercept (should be 0 for both and therefore left blank on Facecard in Meter Coefficients section)
- As described in the Discharge Measurement Summary (DMS) the Location (called 'Offset' on the Hilltop Print out) Depth, and Mean Velocity need to match – if not send back to the Technician. Ticking next to the numbers is a good way of showing that it was verified
- Check the uncertainty values (ISO748:2007). Under the National Environmental monitoring Standards (NEMS) 2013 v1. When the uncertainty is ≤ 5% maximum quality code is QC 600, >5 % but <10% is QC 500 and > 10% is QC 400. Make sure the Quality Code assigned to this gauging is in line with the uncertainty requirements. For further information of Quality Coding refer to the NEMS Open Channel Flow Quality Codes system. If a Quality Code has not been assigned this can be used as a starting point of what the final QC will be for the gauging. Other factors may cause the final QC to be downgraded (poor section, not enough verticals, no compass or system calibration). See Document on QC for gaugings

Digital Hilltop Check List:

Once all the paper work has been checked and contains the correct information and is all the same, check the digital hilltop file matches the Facecard & Hilltop Printout. The information to check is as follows:

- Date, Time and Gauging Number
- Party (who did the gauging)
- Instrument, Serial Number used and correct slope & constant
- Location of gauging
- Wind (if any)
- Angle of current (if any) – if there was none, the 'Nil' option shall be chosen
- Water Temperature
- Colour of water
- Filed Stage Height
- Correct Method selected (45)
- Start & end times of gauging, with associated logger & river readings (if any)
- Disharge, Area, Width, Max depth and Mean velocity all matching

Once again, if the digital file does not match the paperwork this needs to be sent back to the Technician as it indicates that the digital gauging file has been edited since the documents were printed out.

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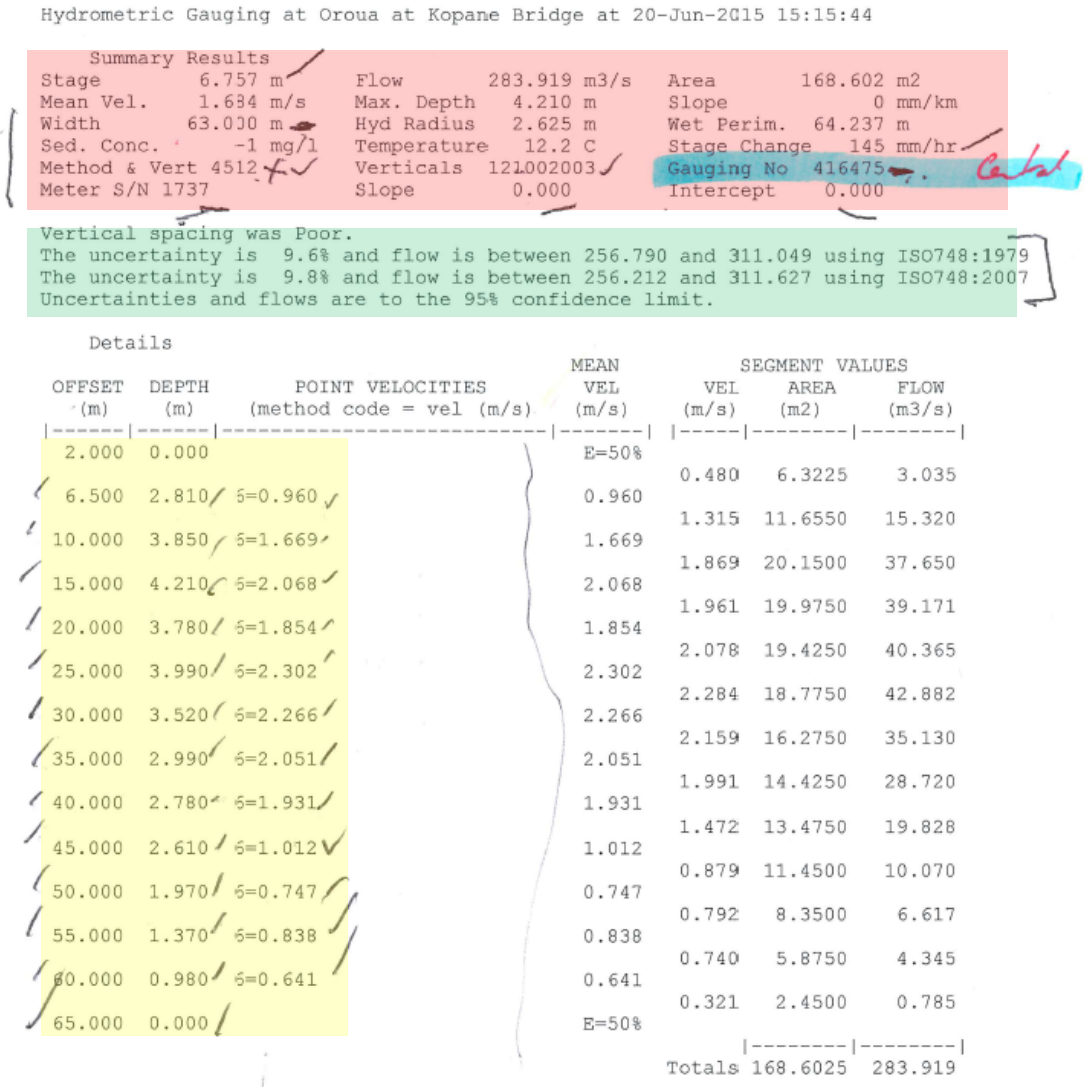
Diagram 4: Example of the Hilltop Printout Sheet for a Sontek Stationary Gauging



Hydrometric Gauging at Oroua at Kopane Bridge at 20-Jun-2015 15:15:44

Summary Results

Stage	6.757 m	Flow	283.919 m3/s	Area	168.602 m2
Mean Vel.	1.684 m/s	Max. Depth	4.210 m	Slope	0 mm/km
Width	63.000 m	Hyd Radius	2.625 m	Wet Perim.	64.237 m
Sed. Conc.	-1 mg/l	Temperature	12.2 C	Stage Change	145 mm/hr
Method & Vert	4512	Verticals	121002003	Gauging No	416475
Meter S/N	1737	Slope	0.000	Intercept	0.000

Vertical spacing was Poor.
The uncertainty is 9.6% and flow is between 256.790 and 311.049 using ISO748:1979
The uncertainty is 9.8% and flow is between 256.212 and 311.627 using ISO748:2007
Uncertainties and flows are to the 95% confidence limit.

Details

OFFSET (m)	DEPTH (m)	POINT VELOCITIES (method code = vel (m/s)	MEAN VEL (m/s)	SEGMENT VALUES VEL (m/s)	AREA (m2)	FLOW (m3/s)
2.000	0.000		E=50%			
				0.480	6.3225	3.035
6.500	2.810	6=0.960	0.960			
				1.315	11.6550	15.320
10.000	3.850	6=1.669	1.669			
				1.869	20.1500	37.650
15.000	4.210	6=2.068	2.068			
				1.961	19.9750	39.171
20.000	3.780	6=1.854	1.854			
				2.078	19.4250	40.365
25.000	3.990	6=2.302	2.302			
				2.284	18.7750	42.882
30.000	3.520	6=2.266	2.266			
				2.159	16.2750	35.130
35.000	2.990	6=2.051	2.051			
				1.991	14.4250	28.720
40.000	2.780	6=1.931	1.931			
				1.472	13.4750	19.828
45.000	2.610	6=1.012	1.012			
				0.879	11.4500	10.070
50.000	1.970	6=0.747	0.747			
				0.792	8.3500	6.617
55.000	1.370	6=0.838	0.838			
				0.740	5.8750	4.345
60.000	0.980	6=0.641	0.641			
				0.321	2.4500	0.785
65.000	0.000		E=50%			
				Totals	168.6025	283.919

Areas highlighted in yellow need to be compared with the DMS print out.

Areas in Red need to be checked against the Facecard and parts of the DMS (not the Discharge & area of the DMS!)

Ares in green are used as the main indication of what the final Quality code will be – check that this makes sense e.g. if 9.6% uncertainty gauging cannot be QC 600!

Archive the Gauging:

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Archiving Sontek Stationary Gaugings

If all the information on the printouts and digital file matches and makes sense the gauging can be copied to the Hydrometric Archive.

For more information regarding copying to the Hydrometric Archive refer to the 'Archive Gaugings' SOP.

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