Appendix Q

TYPICAL GAUGE COMPONENTS

Equipment

Item	Purpose	Varieties	Comments	Cost	Life Expectancy
Gas cylinder	Allows water level to be measured without having electronics in the water course. The gas cylinder pushes compressed nitrogen down a capillary line run from the cylinder to the river bed. As the water level changes it exerts back pressure in the capillary line. A water level reading can be inferred from this back pressure using a pressure transducer.	A variety of cylinder sizes are available	This is an older style system, robust and reliable but the cylinder needs to be replaced annually and there are EH&S issues associated with replacing them	500+	Refill of gas at least once a year
Gas regulator	The gas regulator ensures the gas coming from the cylinder is coming at a constant rate - this ensures accurate readings	HS-22, HS-23, Electromech		$2,000+	10+ Years
Pressure Transducer	The pressure transducer outputs an electrical current dependant on the pressure being exerted on it. It is attached to the capillary line and thus outputs a current relative to the water level.	Drucks, Uniq 5000	There are many manufacturers and variations of pressure transducers. The choice of which is dependant on required water level range, signal output, build materials etc....	$500+	5+ years
Shaft Encoder	The shaft encoder uses a float to drive a while backward and forward as the water level changes. They are commonly installed in dams and float wells.	AD375Q, H-3301	Less commonly used in streams due to the large install costs of float wells.	$2000+	10 + years
Electromechanical gas compressor	This unit takes the place of the Gas cylinder and gas regulator and can also be purchased with an internal pressure transducer.	Ott CBS, HS-40, HS-30, WaterLog	These units are being rolled out to replace the gas cylinders still being used by councils.	$5,000+	5+ years
Rain Gauge Tipping Bucket	The rain gauge tipping bucket measures rain in varying increments depending on the calibration used. As rain falls into the bucket, it runs through a filter and syphon to slow the rate of delivery onto a pair of small buckets. As one bucket fills up to the calibrated amount, it pivots, emptying the water and allowing the other bucket to fill. As it pivots past the middle point it pulls a magnetic read switch which is recorded by the datalogger/ALERTs canister.	0.1mm, 0.2mm, 0.5mm, 1.0mm bucket sizes available. Common manufacturers are McVan and Hydrological Services.	Not all stream gauge sites have tipping buckets.	$800+	10+ years
ALERT Canister	The ALERT canister receives the electrical signal from the transducer, turns it into a water level reading and sends the water level, rainfall and battery readings via radio telemetry to either a repeater or a base station	5 Watt, 25 Watt and repeater options available	The ALERT unit doesn't log data, if the radio transmission is interrupted in any way, loss of data occurs.	$3,000+	5+ years
Dataloggers	A datalogger will often be used if the site is not installed near to an ALERTs network or the ALERTs network is impractical for the application. The logger will record the data and use radio/3G/satellite communications to deliver the data to a third party or direct to the Bureau or council.	Datataker and Campbell Scientific are the most common logger manufacturers found in flood sites in Queensland	DNRM use Campbell Scientific CR800 dataloggers. They deliver the data via 3G/satellite to their servers and pass on the information to the Bureau. Dataloggers are often used where sites require a more functionality than offered by the ALERT canisters.	$2,500+	5+ years
3G modems/Satellite modems	Often used by councils which do not have the resource to maintain Enviromon or the size, geographical features of the council are prohibitive of a radio network	There are many manufacturers of 3G and satellite data modems. This has not been standardised as yet in the industry.	ongoing telemetry costs need to be considered as an ongoing cost for these sites. Depending on the data delivery method, there may be service subscription fees as well. In addition, the Bureau will not fully service this gear unless they installed the modems and wrote the logger program.	$600+	5+ years
Power systems	Predominantly, most stations are solar charged battery powered. 240V mains is an EH&S issue and require a fully certified electrician to service.	Most gauges will have a 2.5-20W solar panel and somewhere between a 12-28 Ah battery. The canisters have an internal solar regulator but if a datalogger is used, generally a separate regulator will be used.		Around $500 for a full battery, solar and regulator setup	2+ years

Station Types					
Item	**Purpose**	**Varieties**	**Comments**	**Cost**	**Life Expectancy**
Bureau Flood Towers	3m flood towers with a stainless steel cabinet	Based off a standard drawing but there are slight variations depending on the manufacturer	The Bureau have recently released a few new designs for higher and stronger towers		20+ years
Rain Tree	3m high, 300mm aluminium tubes for rain only applications. Due to the siting of these gauges they are often used as repeater stations as well.	One manufacturer means there aren't many variations on these sites.			20+ years
Stainless steel cabinet only	The stainless steel cabinet used on the 3m flood towers can also be installed directly onto a concrete slab or besser blocks if elevation is not required and vandalism risks are minimal.	There are a few varieities of the stainless steel cabinet, again dependant on the manufacturer			20+ years
DNRM Shed	Co-habitation of the DNRM sheds is common to save on installation costs. Some instrukmentation may also be shared (bubbler system etc…).	The DNRM sheds are fairly standardised although slight changes between sites are observed depending on the age of installation	DNRM are rolling out Ott CBS bubblers across their monitoring sites. Some newer ALERT canisters don't read the signal correctly from the Ott and so a separate water level system is required for council to receive data.		20+ years
DNRM Float Wells	Again, co-habitation of the DNRM float well sites is common. Many of the shaft encoders are being superceded by the Ott CBS bubblers	The float wells are again farily standard between sites.			20+ years
Manual River Gauges	Generally read by a local landholder or council staff member, the manual gauges are read and relayed to either the Bureau or the Council at regular intervals which increase during events		There are issues around the reliability of the data as well as safety concerns reading staff gauges during events		5+ years
Manual Rain Gauges	Generally read by a local landholder, the manual gauges are read and relayed to either the Bureau or the Council at regular intervals which increase during events		Once again, data accuracy and reliability of delivery has meant these are not an attractive option		10+ years

Station Design	Purpose	Varieties	Pros	Cons	Cost	Maintenance
BoM Tower with ALERTs	This is the standard (and Bureau preferred) design for stream monitoring. The tower design has slight differences depnding on the age of installation as well as the manufacturer.	Electromechanical gas compressor (Ott's are not suitable), gas cylinder with transducer. Some sites may or may not have a rain gauge.	The use of the radio frequency means no ongoing cost. The canister is simple to use, meaning the Bureau technicians are able to remotely assist with helping local council staff set them up. This being the preferred Bureau station design, the sites can be readily connected to a councils existing Enviromon.	The ALERTs canister doesn't provide much 'smarts', so integration of other equipment (cameras/flashing signs) requires a second set of loggers/modems to run. The council has to have or install Enviromon, which requires a council staff member to run part time, smaller (in population councils find this difficult to resource. Large (in area), remote councils will also require a large repeater array to get data into Enviromon, which may be too costly to consider	ALERT flood towers can cost anywhere between $25,000 to $60,000, depending on remoteness, access, length of run from tower to creek and also how many sites are to be installed in one time (sharing overheads). There is minimal difference to cost between compressed gas or the newer gas compressors	5-10% of installed value
BoM Towers with 3G/Satellite	Generally a BoM tower will be used for stream gauge installation for flood warning purposes - even if the ALERTs option is not viable. The Bureau will more readily accept data from stations that are as close to Bureau spec as possible	Generally a electromechanical gas compressor will be used as the sites will most likely be remote - limiting access to swap out gas canisters when needed. In terms of loggers/modems, commonly Campbell Scientific units will be used in conjunction with one of the wide and varied modem suppliers there are.	No need for Enviromon to be run by council. No need for repeaters. The stations can be expanded to encompass a much larger amount of systems (cameras/lights/water quality). There are less compatibility problems between smarter loggers and other sensors than compared to the ALERT canister.	Ongoing telemetry costs. Will most likely require a third party delivery mechanism which will come with added costs. The Bureau may deem some installations to be unsuitable for import into their website. The use of smarter loggers also limits the ability of a 'lamen' to set up, maintain or reconfigure a system even with remote assistance.	The pricing is fairly similar to ALERTs systems although there is need for subscription costs for third party data delivery (around $50-$100 per month) and telemetry fees for 3G SIMs ($10 per month) and satellite connections ($50-$100 per month)	5-10% of installed value
ALERT Raintree	Again, standard design for rain gauge. Will also be used as a repeater station dependant on siting.	This has been a standard design for quite some time. There are minimal variations to this. The McVan rain gauge is the only rain guage used in this setup.	The use of the radio frequency means no ongoing cost. The canister is simple to use, meaning the Bureau technicians are able to remotely assist with helping local council staff set them up. This being the preferred Bureau station design, the sites can be readily connected to a councils existing Enviromon.	The ALERTs canister doesn't provide much 'smarts', so integration of other equipment (cameras/flashing signs) requires a second set of loggers/modems to run. The council has to have or install Enviromon, which requires a council staff member to run part time, smaller (in population councils find this difficult to resource. Large (in area), remote councils will also require a large repeater array to get data into Enviromon, which may be too costly to consider	Raintrees vary in price, again dependant on remoteness, access and number of sites to be installed (shared overhead). They can cost anywhere between $10,000 - $20,000.	5-10% of installed value
3G/Satellite Rain Station	Raintrees again can be used with 3G/Sat telemetry. More frequently than the BoM tower, the station design can vary to minimise costs.	More often HS tipping buckets are used due to the cost. The station may be setup within a council building or shed with the bucket installed on the roof with the smarts inside the building or a simple cabinet.	No need for Enviromon to be run by council. No need for repeaters. The stations can be expanded to encompass a much larger amount of systems (cameras/lights/water quality). There are less compatibility problems between smarter loggers and other sensors than compared to the ALERT canister.	Ongoing telemetry costs. Will most likely require a third party delivery mechanism which will come with added costs. The Bureau may deem some installations to be unsuitable for import into their website. The use of smarter loggers also limits the ability of a 'lamen' to set up, maintain or reconfigure a system even with remote assistance.	Pricing can be a little cheaper for install but still varies. Anywhere between $5,000 to $20,000 is common depnding on remoteness, access and number of sites. Data costs are to be considered as well - similar to the 3G/Sat flood sites.	5-10% of installed value
DNRM Shed integration	This is commonly accepted as a cheaper alternative to installing a full monitoring station.	Dependant on the equipment used by DNRM, the water level sensor and tipping buckets data can be read by both council and DNRM.	Much cheaper than installing a dedicated monitoring station. Regular visits by DNRM mean the sites are generally well maintained (including the equipment if shared).	There may need to be ongoing checks with DNRM to ensure their tests are removed from the data set. Coordination with DNRM is good but is still another step in the process.	Depnding on what can be shared with DNRM, the cost to fit out ALERTs equipment will vary between $10,000 and $30,000.	5-10% of installed value