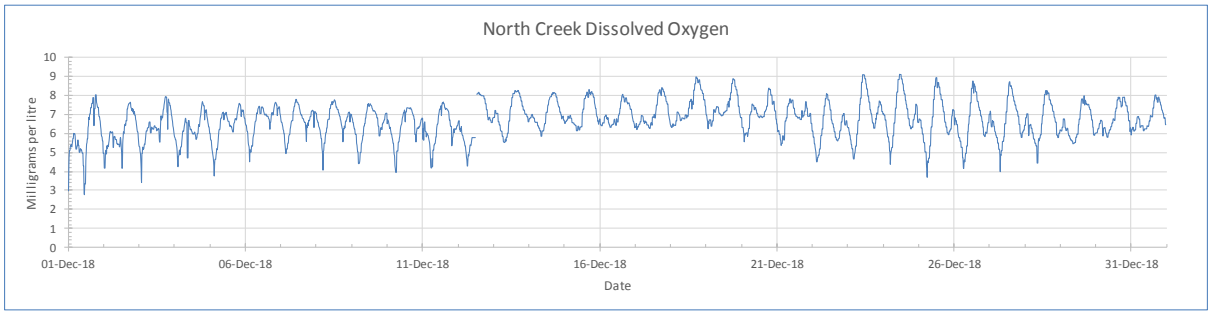
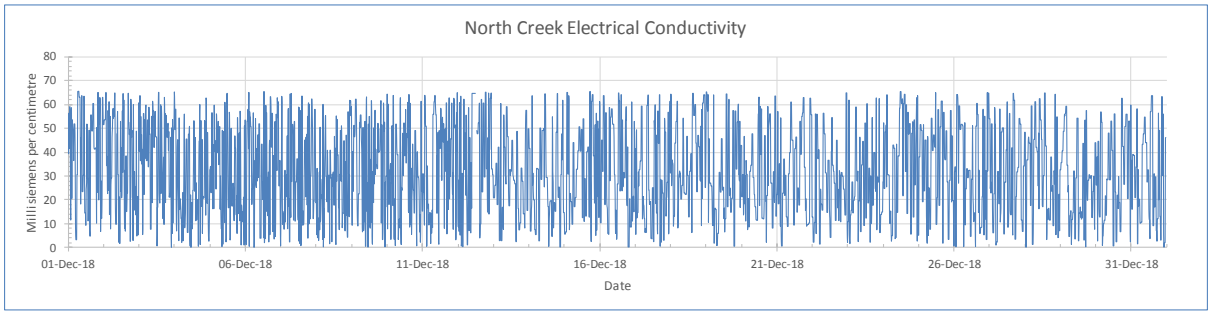
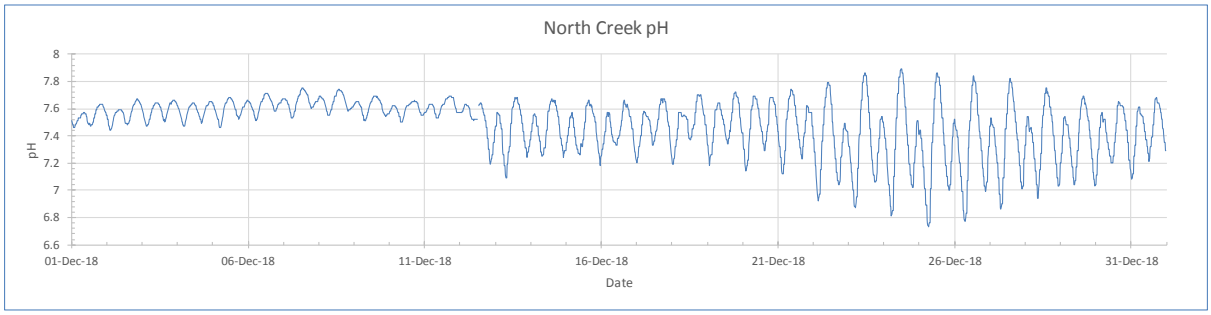
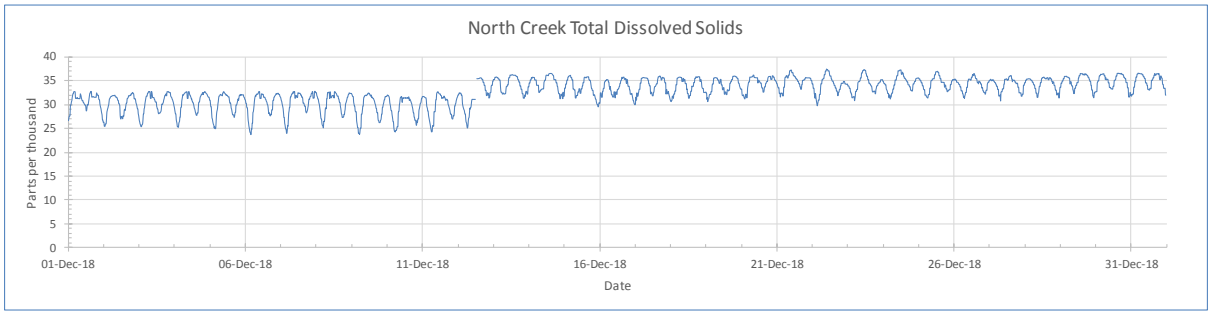
North Creek water quality – December 2018

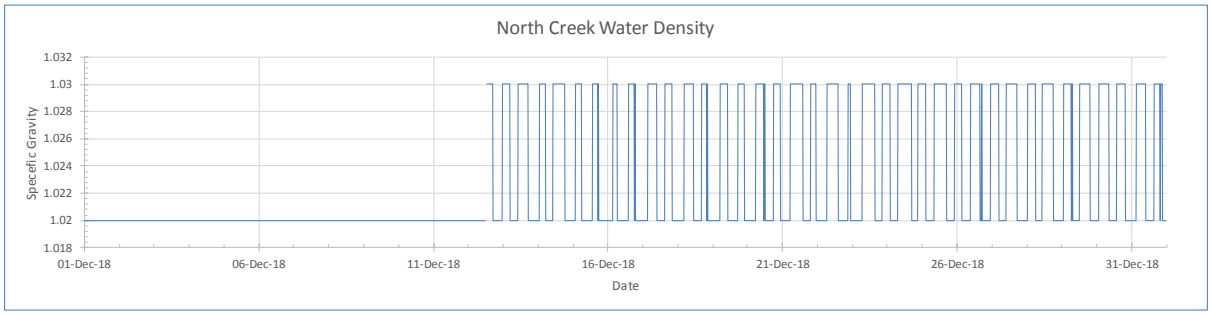
Data logger located in North Creek near airport.

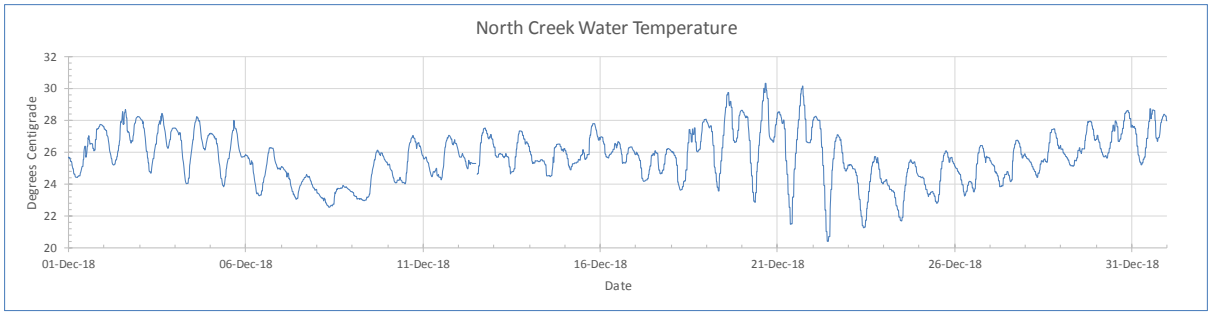


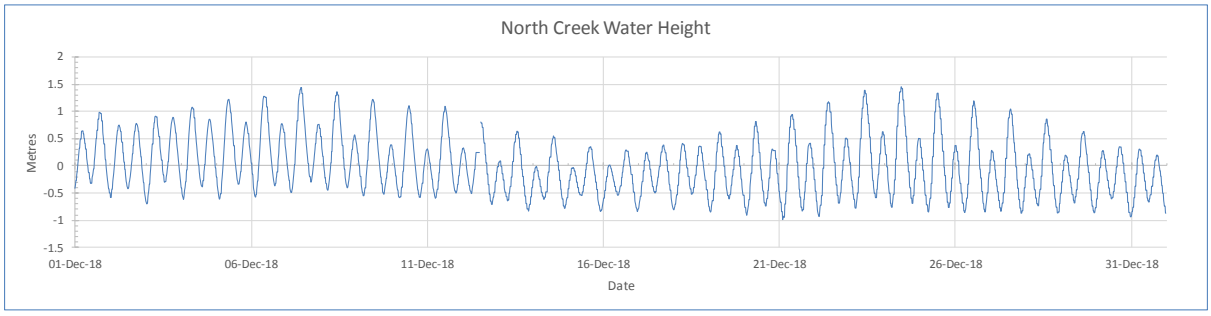


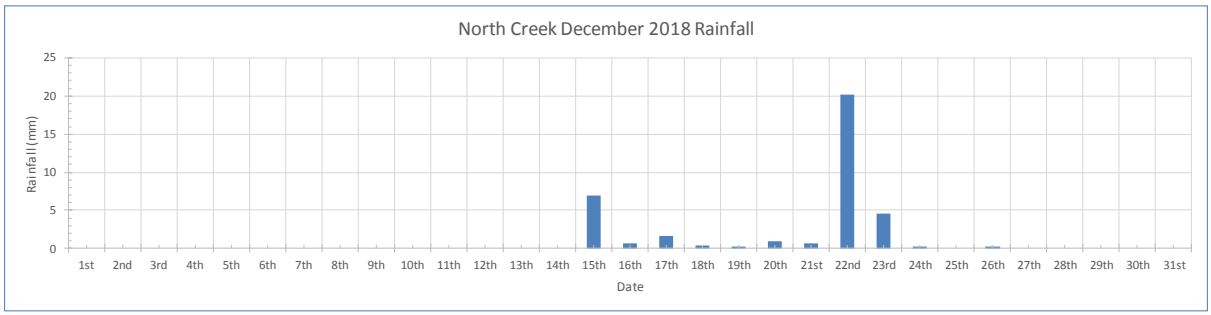












Interpretation

*Note – EC is showing large random variations and there are depth and TDS errors which have required correction. The unit requires repair from the manufacturer and a replacement unit for January 2019 is being sought.

- **Dissolved oxygen* (DO)** for December was recorded from 2.7 to 8.9 mg/L with an average of 6.7 compared to the November average of 5.9 due to reduced rainfall and runoff. Levels below 3 mg/L are considered critical to fish, while between 3 and 6 mg/L is considered marginal and above 6 mg/L is optimal. DO is influenced by temperature, rainfall, tidal movement, chemical and biological oxygen demand. DO at North Creek is influenced by runoff from drains following rain.

- **Electrical conductivity (EC)** for December is showing large random variations since it was reinstalled on 27th Sept, which is due to a fault and will require the unit to be sent back to the supplier. Levels below 1.8 ms/cm are considered freshwater, while from 1.8 to 4.8 is considered brackish and above 4.8 ms/cm saline with seawater equivalent to approximately 60 ms/cm. EC is influenced by rainfall, runoff, temperature and tidal movement.

- **pH** for December was recorded between 6.7 and 7.9 with an average of 7.5 which is alkaline and has risen compared to the November average of 7.4 due to reduced rainfall. Peaks of pH normally occur on high tide with increasing salinity while troughs occur on low tide as acid drains discharge. River water under normal conditions is generally near neutral (pH 7), while saline water moving upstream during high tides will be higher. pH is measured on a logarithmic scale with each consecutive whole number different by a factor of 10.

- **Total dissolved solids (TDS)** is a measure of the combined content of all inorganic and organic dissolved molecular, ionized or suspended micro-granular substances in the water, including minerals, salts or metals measured in parts per thousand (ppt). TDS was recorded in December between 23.8 and 36.5 ppt averaging 32.7 which has risen compared to the November average of 26.4 ppt due to reduced rainfall and increased tidal exchange. TDS is highest on high tide as salinity increases and lowest on low tide as freshwater is discharged from North Creek. TDS is influenced by tidal movement, rain and runoff.

- **Density** also called specific gravity (SG) is the ratio of the weight of a sample compared to that of fresh water at +4.0^{o}C. For December density was recorded between 1.02 and 1.03 with an average of 1.02 compared to the November average of 1.02. Fresh water is normally close to 1.0, while sea water is slightly denser at 1.027g/cm^{3}, which leads to the formation of salt wedges and acid water is even denser (Sulfuric acid SG = 1.94 g/cm^{3}). Density varies with temperature with maximum density occurring at +4.0^{o}C, while tides, rainfall, runoff and acid discharges also affect density.

- **Water temperature** for December was recorded between 20.4 and 30.0^{0}C averaging 25.7^{0} which has increased by 1.4^{0} from the November average of 24.3 deg C due to seasonal change. Water temperature is influenced by season, air temperature, solar radiation, cloud cover, day/night, turbidity, tidal movement and rainfall.

- **Water height** was recorded in December between -1.0 and +1.41 and averaging 0.0 m which compares to the November average of +0.13 m however the data has been adjusted for errors and uncalibrated so no comparison can be made. The highest tide of the month at 1.93 m occurred on 24th December at 10:15 am at Evans Head while the peak at the logger at 1.41 m was recorded on 24th at 11:15 am resulting in a delay of 60 min. The delay in tidal peak along North Creek is caused by restrictions in water entering North Creek due to width and depth, which also reduces the maximum tide height and range. The delay is reduced with higher tides due to the greater depth of water over sand banks allowing more water to enter faster. Dredging of North Creek would allow more water to enter, increasing the tidal height and reducing the delay in high tide. The logger has not yet been surveyed in to the Australian Height Datum (AHD) so all heights are relative. Zero AHD approximates to mean sea level or a 0.925 m tide height and the readings have been adjusted to approximately AHD. Water height can be affected by river level, floods, tides, storm surge and rainfall and to a lesser extent temperature, wind and barometric pressure.

- **Rainfall** recorded during December at the Ballina Airport Automatic Weather Station (AWS) situated 1.8 km to the west of the North Creek logger was 36.6 mm falling over 11 days, which compares to the November rainfall of 106.0 mm over 6 days. The December average for Ballina AWS is 133.6 mm therefore rainfall was well below average. Peak December 24-hour rainfall of 20.2 mm was recorded between 9:00 am on 21st and 9:00 am on 22nd. During December the Tuckean site 4 data logger located 19 km to the SW recorded 46.2 mm over 12 days, while the Rocky Mouth Creek data logger located 37 km to the south-west recorded 80.2 mm over 19 days with a number of records attributed to dew.