

## Water & Wastewater Performance Background Information

### **Water Supply & Distribution:**

The Operating Licence sets standards of service requirements for -

- a Water Quality - Microbiological  
- Chemical/Physical
- b Continuity (supply interruptions)
- c Low pressure

Data is collected and reported for the current month, year to date in the current licence period and for the performance over the last twelve months. Note that for water quality, compliance must be achieved separately for each of the Corporations geographical areas (Central, Southern and Northern Regions) as well as the Corporation as a whole.

### **Water Supply & Distribution - Water Quality:**

The key issue for our customers is the quality of water delivered to their property. Hunter Water undertakes '**system performance monitoring**' to ensure that the National Drinking Water guideline standards are being met. This monitoring is undertaken at the property boundary and the results are used for assessing compliance with the guidelines.

For performance reporting purposes the Corporation reports against the **2004 NHMRC/ARMCANZ Australian Drinking Water Guidelines**. The guidelines specify both chemical/physical and microbiological quality targets to be met and imposes standards for water quality that are considered safe for people to drink over their full lifetime.

The guidelines include a range of characteristics that can be found in water, recommended sampling frequencies and locations and give a guideline figure for each characteristic. Whilst results of the more frequently measured characteristics are included in the report, the Corporation tests for a large number of characteristics that are not routinely reported. A summary statement of the range of characteristics tested and compliance with guidelines is given in Appendix C.

The Operating Licence stipulates that the key guideline parameters must be met on a Regional basis, not just a total Corporation basis. This ensures greater uniformity of results across the Corporation. The three regions for which results are reported are Central (Newcastle Council area less Beresfield/Tarro), Southern (Lake Macquarie Council area) and Northern (Maitland/Cessnock/Port Stephens Councils plus Beresfield/Tarro).

## Microbiological Water Quality

The key measures of the microbiological quality of drinking water as specified in the Australian Drinking Water Guidelines prepared by the National Health and Medical Research Council (NHMRC) and the Agriculture and Resource Management Council of Australia & New Zealand are the percentage of samples in a twelve (12) month period that are free of *E. coli*. The requirement is for at least 98% of samples to be free of *E. coli*.

*E. coli* is present in very high numbers in the faeces of warm-blooded animals. It is relatively easy and inexpensive to detect and has similar survival times to that of pathogenic bacteria. Monitoring of specific bacterial, viral and protozoan pathogens is usually complex, expensive and time consuming and may fail to detect their presence. It may take weeks to determine whether a sample contains a particular pathogen and as such the indicator micro-organism *E. coli* is used as the primary measure of microbiological quality of drinking water. Only a few strains of *E. coli* are themselves pathogenic; however, this is irrelevant to the use of *E. coli* as an indicator bacteria. Both pathogenic and non-pathogenic strains are equally significant as indicators of faecal contamination.

The presence of *E. coli* in drinking water indicates recent faecal contamination because the organism does not readily multiply in drinking water systems. *E. coli* is the most common thermotolerant coliform present in faeces, and is regarded as the most specific indicator of recent faecal contamination.

The guidelines specify that for samples representative of the water quality supplied to consumers, performance can be regarded as satisfactory if over the preceding 12 months:

- at least the minimum recommended number of samples (based on population) has been tested for *E.coli* , and
- At least 98% of the scheduled samples (as distinct from repeat or special purpose samples) contain no *E. coli*

It should be noted that there is no compliance measure for daily, weekly or monthly purposes; it is over a twelve (12) month period.

The current guidelines do not specify at what level a positive result could cause a concern. As such, from a guideline point of view any positive sample is included when assessing annual compliance. The Health Department have requested notification of **any** positive *E.coli* result recorded from our scheduled samples as well as notification of any positive protozoa result.

In the event of a positive *E.coli* result being recorded for samples representative of the water quality supplied to consumers, protocols that are adopted are as follows:-

1. Health Department is notified;
2. A repeat sample is initiated immediately the positive is identified and an investigation is undertaken to identify possible causes of contamination eg. check operation of upstream chlorinators, and integrity of the upstream system, and rectify any potential source of contamination. If the repeat sample again returns positive, then disinfection is increased and a full sanitary survey of upstream facilities is undertaken, eg the integrity of reservoirs and high level tanks is assessed to investigate possible sources of contamination. Rectification of potential sources of contamination is undertaken. Actions continue until resample results are clear.

### **Blue Green Algae**

The Corporation routinely analyses its raw water in surface storages (ie Chichester and Grahamstown Dams) for levels of blue-green algae. The raw water results for blue-green algae are used as an indicator as to whether or not additional treatment processes need to be activated. This practice is in accordance with state and draft national alert level system. This system of alerts has three levels.

#### Alert Level 1

This level is triggered when counts of potentially toxic blue-green algae are in the range of 500 to 2,000 cells per millilitre of water (with biovolumes less than 0.25 mm<sup>3</sup>/L). Increased monitoring occurs if the routine sample shows an upward trend.

#### Alert Level 2

This level is triggered when counts of potentially toxic blue-green algae are in the range of 2,000 to 15,000 cells per millilitre of water (with biovolumes in the range of 0.25 -2 mm<sup>3</sup>/L). Once counts enter this range, the protocol requires the commencement of testing for blue-green algae toxins as well as for the cells themselves.

#### Alert Level 3

This level is triggered at counts greater than 15,000 cells of potentially toxic algae per millilitre of water and (with biovolumes greater than 2 mm<sup>3</sup>/L). The protocol requires consideration of withdrawing the use of the affected source if there is not a capacity for treatment for the removal of potential toxins.

The approach followed by the Corporation using the alert level framework is in accordance with the guidelines set down by the NSW State Algal Co-ordination Committee for response to results from blue-green algae testing.

## **Protozoan Monitoring**

Results obtained for protozoan testing during January are consistent with all results obtained from past testing. All previous raw water results have either been clear or at low background levels. January results for both Grahamstown and Chichester Dams continued this trend. All water supplied to customers was clear of both *Cryptosporidium* and *Giardia*.

## **Chemical/Physical Water Quality**

Compliance for chemical/physical water quality requires that results for 12 key parameters are within specified guideline figures. Results for the 12 key parameters are reported each month. For each of the 12 key parameters the Corporation must achieve compliance against the guideline values both corporately and also in each of the three regions (Southern, Central and Northern).

Table 1 gives the results for the 12 key parameters nominated in the Operating Licence. The table includes the following information for each parameter:

- Mean result of all samples taken for the month
- Mean result of all samples taken for the last 12 months
- Current licence status against guideline values
- Guideline value to be assessed against
- Whether the parameter is an aesthetic or health parameter

## **Water Supply & Distribution - Reliability:**

### **Continuity:**

The Operating Licence requires that 14,000 properties will not incur interruptions to their water supply for more than 5 hours cumulative duration in any licence year.

The figures in the continuity graphs are for the month when the continuity interruption was suffered. The continuity figures reported in previous months may be modified to take into account continuity reports received after normal report preparation timeframes. That is, some field paperwork may come in later and have to be taken into account. Accordingly, these graphs may show different values to those presented in the past.

To control the extent of supply interruptions the Corporation monitors watermains with high levels of breaks/leaks. Each identified high break/leak area is individually assessed to determine if replacement is economic. The Corporation reassesses replacement needs on a routine basis and has an ongoing program of replacing poorly performing assets.

### **Pressure:**

The Low Pressure Indicator measures the extent of pressure problems experienced by customers and comprises properties falling into the following categories:

- properties which are always below 20 metres (eg high level zones designed to previous

design standards) ie “known low pressure areas”

- properties which for periods, based on system modelling, were below 20 metres due to prevailing demands on the network
- properties from confirmed low pressure complaints outside modelled areas

This indicator counts properties affected within the licence year. Once a property is included in this indicator it will be counted for the balance of the year. This means that the graph will not decline as demand drops, but can only increase as the year progresses.

### **Taste and Odour:**

Routine testing of taste and odour compounds has been undertaken.

These results are recorded for the raw water supply, not water supplied to customers as the results are used to initiate responses if levels rise. Water supplied to customers is also monitored to ensure that levels in the treated water are acceptable to most customers. Additional processes are available at Grahamstown water treatment plant to mitigate the impacts of taste and odour incidents. These processes can be used when required in addition to substituting different sources of supply eg Tomago water if such incidents occur.

### **Wastewater Transportation:**

The compliance measure for the wastewater transportation system performance is based on the number of sewer overflow events where private property is affected in a financial year.

The sewer overflow performance indicator measures all incidents of overflow caused by system blockages and/or capacity problems due to stormwater inflow/infiltration which impact on the Corporation's customers. The vast majority of these incidents are dry weather overflows caused by blockages such as tree roots. Such overflows are of very low volumes and are generally of a very localised nature, being confined to the immediate vicinity of the point of overflow. The environmental impact of dry weather overflows is extremely limited. The sewer overflow indicator is therefore primarily a customer performance indicator, and measures the impact of the Corporation's asset performance on the customer. However, it also includes wet weather sewer overflows. These are generally of more volume but are heavily diluted, as the primary cause of wet weather sewer overflows is the ingress of stormwater into the sewerage system. This overloads the pipe network resulting in overflows during significant storm events.

Dry weather overflows are predominantly the result of tree root blockages. To address this problem the Corporation adopts a number of maintenance practices. These are:

- Use of water jetting to clear blockages. This is carried out in conjunction with a camera inspection (*by closed circuit television*) to ensure the blockage has been removed.
- Where appropriate full replacement of the failed assets.

- Where replacement is not warranted the use of chemical root treatment to minimise the opportunity for regrowth of tree roots.

Wet weather overflows are predominantly caused by ingress of stormwater into the sewerage system. This can be caused by a number of factors with the predominant ones being:

- general surface flooding covering access points (*eg manholes, shafts, yardsinks*) and allowing stormwater into the system
- illegal connection of stormwater (*eg off roofs*) into the sewerage system
- infiltration of groundwater into the sewerage system via cracked pipes and faulty joints in the Corporation's sewers and in privately owned house drains.

To address wet weather overflows the Corporation has embarked on a significant investigation and capital rehabilitation/upgrade program. This is geared at precisely measuring current system performance, identifying deficiencies and determining remedial actions. This is a long term program of works as the sewerage system is an integrated one. It has to be reviewed holistically or else remedial works might simply move the problem from one location to another.

Over the last 5 or so years the Corporation has undertaken a number of actions toward system upgrades. In excess of \$50M has been spent on a combination of investigation/modelling work, design work and actual upgrade work. Work has been concentrated on Newcastle and Lake Macquarie systems which account for around 70% of connected properties. The investigation focus is now shifting to other areas.

The key aspect of wet weather overflow problems is that it is very much a total community issue. This is in a number of respects as briefly outlined below.

1. Sewage pipes owned privately by our customers total about the same length as those owned and operated by the Corporation. That is, the Corporation operates some 4,400 kms of sewermain and therefore is also about 4,000 kms of privately owned house drains. Both groups of assets are susceptible to infiltration which uses up system capacity.
2. In many cases the issue of wet weather overflow results from inflow of stormwater into the sewerage system by way of unintentional and/or deliberate illegal connection of roof drains to the sewerage system.
3. In areas where there are problems with stormwater drainage (*which is a separate system to the sewerage system*) surface flooding can occur sometimes to a point where sewer fittings (*eg manholes, shafts and yard sinks*) can be flooded thus taking up sewerage system capacity with stormwater.

The Corporation undertakes actions such as smoke and dye testing of house drains and its own assets to identify illegal connections, faulty pipes and so on. It also undertakes education programs so that the community are aware of the impact that inappropriately sited trees and shrubs can have on sewer pipes (*eg they can cause pipe cracking and exacerbate infiltration problems*) and information is provided on appropriate trees and shrubs to plant ie 'sewer friendly' trees.

Ultimately this is an issue which will involve actions by Hunter Water but will also require a commitment from Councils, especially with respect to stormwater issues, and also an awareness and a commitment to do the right thing by the broader community.

## **Effluent Quality Performance**

The Corporation's Operating Licence requires compliance with the DEC licence conditions for each wastewater treatment works. The main measures of performance are against the 50 percentile and 90 percentile concentration limits and load limits for Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), pH, Grease, Total Nitrogen (TN), Ammonia, Total Phosphorus (TP) and Faecal Coliforms (FC) specified in the licence for each plant.

In reporting compliance with concentration limit conditions, performance is measured in terms of the number of sample results which exceed a specified target during the year. For example, the majority of treatment plants have licences that specify a weekly testing frequency (ie. 52 tests for specified parameters each year). In such cases if more than five samples exceed the specified target then that would constitute non-compliance against the 90 percentile concentration limit. Greater than 26 samples exceeding the specified target would constitute non-compliance against the 50 percentile limit. It should also be noted that the 50 percentile limit is a harder target (ie. a lower concentration limit) to achieve and so a greater number of exceedances against this tighter limit still gives an acceptable environmental outcome.

The effluent quality table defines three performance measures in terms of:

- Tracking favourably in the licence period year to date. Note this does not always coincide with the financial or calendar years.
- Tracking unfavourably in the licence period year to date, i.e. may not comply with the licence conditions by the end of the licence period.
- Licence limit exceedance which for the month is an exceedance of a 50%ile or 90%ile limit and for annual licence compliance represent a failure of the plant to comply with the licence conditions for the licence period just completed.

## **1. 50 PERCENTILE COMPLIANCE**

The performance for each wastewater treatment works against the effluent quality limits over the full year of each licence is shown as a performance overall trend of 50 %ile and 90%ile limits and in more detail in the attached graphs.

## **2. 90 PERCENTILE COMPLIANCE**

In reporting compliance with the 90 percentile concentration limit conditions, performance is measured in terms of the number of test exceedances during the year. The majority of plants have a weekly testing frequency, thus more than five samples per year exceeding the 90 percentile limit indicates non-compliance.

For plants with six day testing, more than six samples per year exceeding the 90 percentile limit indicates non-compliance, while for plants with 12 day testing, more than three samples per year exceeding the 90%ile limit indicates non-compliance. For plants with monthly testing, more than one exceedance per year indicates non-compliance.

The performance for each wastewater treatment works against the effluent quality limits over the full year of each licence is shown as a performance overall trend of 50 %ile and 90%ile limits.

## **3. LOAD LIMIT PERFORMANCE**

Load limits for BOD, TSS, Grease, nitrogen, phosphorus, heavy metals and pesticides are currently set for 12 of Hunter Water's wastewater treatment plants. Performance against these load limits is assessed by tracking the percentage of the load limit discharged to date versus the percentage through the licence reporting period. This assessment is shown in terms of licence period performance to date (performance is tracked throughout the licence period) for each plant.

The current load limits were set by HWC and the DEC in 2001 and the load limits did not fully account for fluctuations in flows between wet and dry years or process fluctuations. As a result, HWC have initiated a study to review the methodology for establishing load limits.

## **4. BATHING BEACH RESULTS**

The DEC assesses bathing water quality by the number of faecal coliforms (FC) present per 100mL of seawater. A beach is said to comply with primary bathing guidelines (and is therefore generally suitable for swimming) if: -

- The median of the last five sampling results is equal to or less than 150 FC/100mL.

- The second highest of the last five sampling results is less than 600 FC/100mL.

Any non compliances with these beach water quality conditions will be reported as a red dot. Note that this compliance information is also reported in the Newcastle Herald every Wednesday as a star rating.

## **5. EFFLUENT REUSE**

The total dry weather volume of sewage treated at Hunter Water's 17 wastewater treatment plants is currently 49,366 million litres per year. Effluent is used directly from these wastewater treatment plants for a variety of purposes including irrigation of public golf courses and bowling greens, irrigation of farming land, industrial uses (eg washing coal and power generation), irrigation of woodlots and the Karuah irrigation system. In addition, effluent from the Cessnock and Farley plants is used indirectly by farmers extracting flow from creeks downstream of the discharge point for irrigation.

A combined effluent reuse target of 13 % by 2007 was set under the Environmental Management Plan.

To provide a comprehensive view of total effluent reuse in the Hunter, and to be consistent with Hunter Water's Environmental Management Plan target, the estimated volume of "indirect" reuse (downstream of Cessnock and Farley treatment plants) is estimated and identified separately.