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Tweed Shire Council

Bogangar Rugby League Sports Fields Recycled Water Management Plan

October 2007

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Tweed Shire Council

Bogangar Rugby League Sports Fields Recycled Water Management Plan

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1 INTRODUCTION

The Bogangar Rugby League Sports Fields at Bogangar, NSW have been operating an irrigation system with potable water for approximately ten (10) years.

The local Tweed Shire Council (TSC) is reducing the level of recycled water disposal to other site(s) by using recycled water from the local Hastings Point STP for irrigation purposes at the Bogangar Rugby League Sports Fields.

The NSW Department of Environment and Conservation (DEC) encourages substituting effluent (herein named recycled water) for potable water wherever it can be substituted for a purpose which is acceptable.

Tweed Shire Council believes that using recycled water for reuse at Bogangar Rugby League Sports Fields represents a sustainable approach both economically, environmentally and socially. The Department of Environment & Conservation (DEC) NSW and the Tweed Shire Council support the use of recycled water.

A recycled water pipeline runs from a tapping point on the corner of Round Mountain Road and Tweed Coast Road to a storage tank on site beside the playing fields. The tapping point is on an existing effluent rising main originating at the Hastings Point Sewerage Treatment Plant (STP).

1.1 THE RECYCLED WATER MANAGEMENT PLAN

This Recycled Water Management Plan (RWMP) provides the framework upon which recycled water is supplied and managed at the Bogangar Rugby League and Sports Field (Bogangar Rugby Fields) taking into consideration all issues and constraints and providing methods to manage environmental and public health risks.

This recycled water irrigation replaces an existing potable water irrigation scheme.

This RWMP was developed in accordance with NSW DEC Environmental Guidelines for Use of Effluent by Irrigation. The RWMP addresses the environmental performance objectives as outlined in section 1.2 of the NSW DEC Environmental Guidelines for the Use of Effluent by Irrigation (2004).

The scope of this RWMP is to cover the management of the recycled water at the point of reception at the site to the point of distribution of the recycled water across the fields by use of sprinkler irrigation and the potential public contact

The strategy taken in developing the RWMP was to identify and manage the health and environmental risks arising from the various aspects of recycled water use within the confines of the site. Environmental, OH&S risks and public health risks have been addressed.

This is a dynamic document, allowing for continual improvement with increased knowledge and experience.

1.2 LOCATION

This RWMP covers the site known as the Bogangar Rugby League Sport Field located on Tweed Coast Road, Bogangar, NSW, just south of the town. The site has vehicular access from the bitumen road at its southern end. The fields are surrounded by vegetation on all sides, with a thin strip on the east side along the road. Residential areas stop north of the fields.

2 PLANNING AND IMPLEMENTATION

2.1 ASSESSMENT OF WATER QUALITY DATA

Hastings Point STP strives to produce recycled water to a quality that when used, complies with those parameters in the NSW Environmental Guidelines for Use of Effluent by Irrigation (2004) considered relevant to the nature of its receivable, treatment and/or distribution operations. These guidelines compliment other guidelines such as the ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Current licence load limits applied at the Hastings Point STP are outlined in Table 2.1

Table 2.1 Hastings Point STP Current Licence Load Limits

Parameter Pollutant	Units	50th percentile conc. limit	90th percentile conc. limit	100th percentile conc. limit
Oil and Grease	mg/L	-	-	10
Total suspended solids	mg/L	20	25	40
Biochemical oxygen demand	mg/L	20	25	40

An analysis of the quality of recycled water from Hastings Point STP found that the "Classification of Effluent for Environmental Management" of the 'DEC (NSW) Environmental Guidelines: Use of Effluent by Irrigation' classifies the recycled water produced by the Hastings Point STP as low strength. Water quality data (from years 2006 and 2007) are compared against the NSW DEC 'Low Strength' classification in Table 2.2 Comparison of Hastings Point STP Water Quality and NSW DEC Classification

Table 2.2 Comparison of Hastings Point STP Water Quality and NSW DEC Classification

Constituent	Low Classification (NSW DEC) (average concentration mg/L)	Hastings Point STP Recycled Water 2002- 2007 (average concentration mg/L)				
		Minimum	Mean	Maximum	50%ile	90%ile
Total nitrogen	<50	3.48	4.86	7.31	4.8	6.1
Total phosphorus	<10	0.45	1.39	3.22	1.1	2.5
BOD_5	<40	1.2	2.2	5.4	1.8	3.0
TDS	<600	311.3	410.7	468.7	413.3	443
Grease and Oil	< 1,500	2	2.5	5	2	4.4
Thermotolerant coilforms						
- municipal uncontrolled access	<10	2	892	23000	10	24
- municipal control access	<1,000					
- agricultural non-food (turf)	<10,000					

NB: The above constituents were the only measures that enabled direct comparison with the Guideline

The 'DEC (NSW) Environmental Guidelines: Use of Effluent by Irrigation' recommends that:

- Recycled water used to irrigate municipal land with uncontrolled access to have thermotolerant coliform levels of less than 10 cuf/100ml; and
- Irrigation with controlled access recommends termotolerant coliform levels of less than 1,000 cuf/100ml.

2.2 EFFLUENT QUALITY AND IRRIGATION CONSIDERATIONS

Recycled water is a valuable resource of water nutrient and organic matter. It also may have constituents, which could be a potential hazard to soils/plant growth/public health. An analysis of the quality of recycled water from Hastings Point determined its classification of low strength (see Table 2.2 above).

The recycled water supplied to Bogangar Rugby League Sports Fields comes from the nearby Hastings Point STP. The quality of recycled water produced by Hastings Point STP is adequate by international standards but is not high enough for "unrestricted application." It is also subject to variation in quality from time to time. Therefore, there is need for a safe usage and management plan.

However, in order to minimise risks to water quality and safety, Hastings Point STP has developed a quality assurance system at its wastewater plants, which is certified by a third party. It has a monitoring system that provides 24-hour feedback on plant performance. Although Tweed Shire Council is accountable for the quality of recycled water to all customers, it cannot guarantee this quality. The risk of damage to wastewater treatment process from toxic and illegal waste dumping is present (although such events have been rare).

Hastings Point STP recycled water is unfiltered and like all such recycled water, can contain various pathogens in various amounts from time to time. This is partly because unfiltered recycled water contains particles that are large enough and plentiful enough to shield pathogens from disinfectant damage. Additionally, unfiltered recycled water is also capable of containing chlorine resistant pathogens. Information on the day-to-day quality of the recycled water leaving the plant is to be provided by the Plant Supervisor on a daily basis.

Parameters which must be measured and monitored at the STP to assist in maintaining quality for a low to moderate risk for irrigation are:

- Total Nitrogen
- Total Phosphorous
- BOD
- TDS / EC
- Other pollutants (such as metals)
- Turbidity
- Chloride
- Sodium
- Boron
- Bicarbonate
- pH
- Coliforms

Current recycled water thermotolerant coliform levels from the Hastings Point STP exceed low strength 10 cuf/100ml for 10% of the samples. Generally, these exceedences could be related to wet weather flows.

Bogangar Rugby League Fields has uncontrolled public access. The application of irrigated water during the evening minimises public health distribution risks.

Exceedences related to wet weather flows will be avoided by the practice of not irrigating during wet weather or when wet weather is imminent. Recycled water public health distribution risks will be minimised by activating irrigation systems at a convenient time in the evening. Modifications to the existing irrigation system include closer sprinkler spacing for improved distribution uniformity, at reduced pressures to assist in improving the management of sprinkler spray drift on the site, which may be a problem under wind conditions. This has been done despite the site having reasonable buffer zones to residential areas. Spray drift has been a problem in the past and the new system and its management should minimise any further issues. Irrigation is to occur only on areas clearly identified as using recycled water for irrigation with appropriate buffer zones and signage in place.

2.3 APPROVAL AND LICENSING REQUIREMENTS

Under Schedule 1 of the *Protection of the Environment Operations Act 1997* the Hastings Point Sewage Treatment Plant is listed as a NSW Environmental Protection Agency (EPA) licensed activity No.3618 "processing by small plants (<10 000 ML per year).

A review of the Hastings Point Sewage Treatment Plant, Round Mountain Road, Hastings Point (September 2007), confirms that the WWTP is licensed to discharge to the locations outlined in Figure 2-1 under Clause 2 Discharges to air and water and applications. The irrigation system is sought for license approval under the existing Hasting Point Licence No.3618

Figure 2-1 **Hastings Point Environment Protection Licence No.3618**

Section 55 Protection of the Environment Operations Act 1997

Environment Protection Licence

Licence - 3618

Department of **Environment & Climate Change** NSW

Water and land

EPA identi-fication no.	Type of monitoring point	Type of discharge point	Description of location
1		Discharge to waters - dry weather	Exfiltration dune disposal area approximately 100 metres east of the junction of Coast and Round Mountain Roads as shown on locality plan submitted with Licence Information Form dated 20/12/99
2	Wet weather discharge and volume monitoring	Wet weather discharge and volume monitoring	Effluent disposal line to Christies Creek as shown on locality map submitted with Licence Information Form dated 20/12/99. Monitoring by calculation.
3	Effluent quality monitoring		Effluent pumping station
4	Total volume moitoring		Inlet to works
5	Effluent quality monitoring		The first effluent distribution box located at exfiltration dune disposal area approximately 100 metres east of the junction of Coast and Round Mountain Roads as shown on "Fig 2" submitted to the EPA with the Licence Information Form dated 20/12/99.

2.4 SITE CONSIDERATIONS

The site considerations include an assessment of the following:

- Compatibility of surrounding land uses: community amenity, vegetated buffer zones/distanced from residential, central location, and
- Suitability of land for irrigation.

2.4.1 LAND USE COMPATABILITY

The Bogangar Rugby Fields are located south of Bogangar just south of residential areas. It has provided a popular community amenity and includes playing fields, clubrooms, clubhouse, and skateboarding area. The fields are surrounded by low dune scrub with numerous un-official walking paths.

Spray drift from sprinklers (with existing potable supply) has in the past been an issue at times, despite the vegetated buffer zones on the northern edge of the fields being 40 m wide and vegetation mature at a height of 2.5 to 3.0 m. This RWMP will address this issue, providing a means by which the irrigation at the fields to be compatible with the local residences and recommending improvement of the buffer zone.

Size of buffer zones will need to be justified based on the sensitivity of local area. Where spray irrigation gives rise to aerosols near houses, schools, playing fields, and public open space a separation distance of 50m is recommended by the guidelines for low strength recycled water.

2.4.2 COMPATIBILITY SURROUNDING LANDUSE

The Bogangar Rugby League Fields are located on a remnant sand dune of considerable depth. The field has a grassed surface with developing fine sandy topsoil. The surface is planned to be replaced with improved topsoil and turf at a future time.

The rugby field site is flat, with undulating sand ridges and swales in close proximity to the site. A drainage line is located to the east of the field near the bike path, with no other waterways present. The soils are well drained and therefore it will be important to limit deep percolation by using irrigation scheduling management.

The site has been selected as a partial reuse scheme for a number of reasons. Preliminary investigations have found the following points in favour of the site for a partial re-use scheme:

- Proximity to Hasting Point STP;
- Similarity to existing disposal site in terms of dune state;
- Productive use of resource;
- Area of land involved;
- Suitability of recycled water to the type of irrigation;
- Suitability of soils to the type of recycled water; and
- Expected favourable water/nutrient/salt/organic matter balances using the effluent.

2.4.2.1 SOIL PARAMETERS

Soil tests were carried out to determine the suitability for receiving recycled water. The results of these tests are presented in Table 2.3.

Table 2.3 Soil Parameters

Soil Parameter	Soil Test Result at site (Range)	Guideline
Exchangeable Sodium Percentage (ESP) 0-40 cm	1.04 – 14.79% **	Between 0-5
Exchangeable Sodium Percentage (ESP) 40-100 cm	3.85 – 33.33%	Not provided
Conductivity 0-70 cm	0.02-0.07 dS/m (low)	Less than 2 dS/m
Conductivity 70-100 cm	0.01-0.02 dS/m (low)	Less than 2 dS/m
Cation Exchange Capacity 0 – 40 cm	2.89 – 3.59 meq/100g	3-15cmol(+)/kg
Cation Exchange Capacity 70 – 100 cm	0.26 – 0.82 meq/100g	3-15 cmol(+)/kg
Phosphorous sorption	1 – 18 mg/kg	Low (25-36 kg/ha @ 1m depth is critical)
Depth to Watertable	Not encountered	10 m

Depth to Hardpan	No Hardpan encountered	
Soil pH	5 in top 40 cm (natural dunes are pH 4)	6.5 – 7.5 ideal
Nitrogen	Not Tested	Not included as soil based parameter

**NB. Whilst the ESP's are very high, the actual concentrations of sodium are extremely low and no dispersion of the soil is expected given it is very sandy

The soil parameters indicate that there are no limiting factors for irrigation with effluent to the site. Some soil amelioration will be required to increase the pH to ensure applied fertilizers can release nutrients adequately. Despite the low P sorption capacity of the soil, the turf will require more than that which the recycled water supplies. Electrical conductivity is low although this may increase with recycled water application over time and with soil improvement programs, which improve soil moisture holding capability and organic levels.

2.4.2.2 WATER AND NUTRIENT BALANCES

A water and nutrient balance has been undertaken using the MEDLI (Modelling for Effluent Disposal using Land Irrigation) software. The model results identify the risks associated with the application of recycled water to the site, particularly with regard to runoff, deep drainage and excess nutrients.

It is expected that levels of Nitrogen and Phosphorous will be low in the recycled water and will not limit the application of water to the area. It is expected that a fertiliser application management scheme will be required for the turf (for turf it is expected that the levels of N, P & K used is in the ration of 3.5 / 0.3 / 2 as a percentage of average yield of 12 tonne/ha).

The salinity level in the recycled water is considered to be low and will not effect turf growth. Monitoring of the salinity will be carried out as a precaution on an annual basis.

Organic load rates are considered low for the soils at the site (150 kg/ha/yr). In fact, organic application will be needed to improve the water holding capacity and organic microbial activity of the top soil.

Monitoring programs as provided in section 4.0 below will provide a basis to adjust the system management built around the Water and Nutrient Balance Modelling.

3 IRRIGATION DESIGN

The Bogangar Rugby League Sports Fields had an existing irrigation system, which was installed utilising potable water source. The implementation of a recycled water irrigation system has necessitated amendments to the existing system to ensure best management practices for:

- optimal water use;
- water application efficiencies; and
- irrigation scheduling.

This takes into consideration the local conditions or wind, rainfall and soil.

3.1 THE LAYOUT

The design and management of the irrigation system has taken into consideration, buffer zones to residential areas with respect to spray drift, deep percolation to ground water; wet weather management, type of irrigation system, power supply, pumps and pipework.

The existing irrigation system is required to remain in part, as it was not practical or economically feasible to replace it in full. Therefore, the existing system has been modified in order to improve its application efficiencies, and the new irrigation system fits around modifications of the existing layout. Sprinklers have been retained as

the means by which water is applied to the fields, as they can apply water relatively quickly (higher precipitation rate), and are not only more cost effective on sandy soils compared to drip irrigation (drip has high installation costs), but are more likely to provide a more even application (sandy soils have high infiltration rate capability limiting lateral movement of water).

The modifications to the existing irrigation system include closer sprinkler spacing for improved distribution uniformity, at reduced pressures to assist in improving the management of sprinkler spray drift on the site, which may be a problem under wind conditions. This has been done despite the site having reasonable buffer zones to residential areas. Spray drift has been a problem in the past and the new system and its management should minimise any further issues.

3.2 IRRIGATION CONTROL SCHEDULING AND CONTROL UNDER WIND & RAIN CONDITIONS

3.2.1 OPERATING PRESSURES AND SCHEDULING

The irrigation system at Bogangar Rugby League Sports Fields has sprinklers operating at 410kPa between the times of 10pm and 4am. Irrigation scheduling is planned to accomplish the irrigation of the fields in 3.8 hours over 6 nights out of 7, at periods of peak demand.

3.2.2 OPERATION UNDER WIND CONDITIONS

The irrigation system will only operate whilst winds are not above 10 km/hr, in order to prevent excessive wind drift. When the wind drops below the 10 km/hr, the system resumes for the allotted time with any short fall continuing in the following evening. The wind speed of 10 km/hr has been chosen, as being a wind speed in which the distribution uniformity of application is maintained at the sprinkler design spacing (Sprinkler Irrigation, Fifth Edition).

Wind speeds above 16 km/hr are known to have a negative affect on the application efficiencies due to wind drift. However, it is not known what the actual wind speeds are during the designated irrigation times and therefore a device known as a wind click will be installed to suspend the irrigation for wind speed above 10 km/hr.

It is not sufficient that the wind click suspend irrigation at wind speeds at this level. A correlation needs to be determined between the wind speed, wind direction, spray drift and operating time compatibility issues with nearby residences. In order to do this Bogangar Rugby Fields will install an anemometer and data-logger to determine when, how, and why spray drift occurs. The results will provide TSC a means by which continuous improvement of the management of the irrigation can occur.

The data for wind speed for the region has been obtained from the Bureau of Meteorology site at Coolangatta, Qld, and show wind speeds up to 24 km/hr at the sampled times of 9am and 3 pm. It is expected that the wind speeds will drop to a reasonable speed to allow irrigation to occur effectively between the scheduled times of 10 pm to 4 am in the night.

The setting of the wind click, which will be used, can be adjusted to shut down the system at lower or higher wind speeds. If it is required, the system pump station and mainlines allow for the expansion of the number of sprinklers at one time if the need arises such that a more narrow window or shorter time frame of low wind speeds.

3.2.3 OPERATION SUSPENSION DURING RAINFALL CONDITIONS

A rain switch will interrupt scheduling by causing a break in the closed circuit when rainfall occurs. The rain switch simulates evapotranspiration. The settings can be adjusted to allow irrigation to resume the following day if necessary due to the low water holding capacity of the sandy soils.

3.2.4 SOIL WATER HOLDING CAPACITY AND IRRIGATION SCHEDULING REQUIREMENTS

It is estimated that the sandy soil water holding capacity (WHC) is only 5-15%, (and only 2.5 to 5mm AWHC is available). Therefore, irrigation will be required daily unless there is rainfall. It is expected that with turf and soil management, using fertiliser and green manure application, organic matter levels in the top soil will increase, which will improve WHC and reduce the affect of missing one day's irrigation.

The rain switch will be set to the evapotranspiration rate to ensure enough application occurs. Course sandy soils will allow an intensity of up to 25mm/hr or more. This is reduced, depending on the ratio of Course sand / fine sand / silt in the soils.

3.2.5 RECYCLED WATER STORAGE

The site is only a partial re-use scheme and is part of a recycled water management strategy for Hastings Point STP. The onsite tank has enough capacity to hold one day's irrigation water for an area of 2.2ha, at times of peak demand. Water is only stored in the tanks for a maximum of 2 days over weekends. It is possible to irrigate every day of the week if weather conditions require, but scheduling of irrigation is programmed for 6 days of the week at this stage. All other days of the week, the water in the tank will be turned over once every day.

The site only uses the amount of water it needs for adequate irrigation to promote growth of the sports turf. Water will be received on demand from the treatment plant. Additional tanks may be required in the future if the site is expanded.

3.3 ENVIRONMENTAL RISK ASSESSMENT AND RISK CONTROL MANAGEMENT

3.3.1 ASSESSMENT METHOD

The methods used to assess the risks associated with the activity at the site are in accordance with the Australian Drinking Water Guidelines 6, 2004, section 3.2.3 Hazard Identification and Risk.

3.3.2 ACTIVITY IDENTIFICATION AND RISK ASSESSMENT

The environmental risks associated with site activities and their control measures are described below, together with their associated minimum performance levels and monitoring measures where applicable.

For each part / activity / process of the irrigation system, the Irrigation Manager and Irrigation Technician are assigned the responsibilities of maintaining the irrigation system within its normal operating parameters, and undertake monitoring measures to ensure that the site is managed in an environmentally sound manner.

The assessment of risks, their controls, monitoring and corrective action is provided in the attached table titled Activity Risk Assessment and Control (Appendix F). The activities, which are addressed for risk in the table, are:

- Recycled water quality received at site
- Integrity of recycled water pipeline to on-site storage
- Water level control in on site storage tank
- Water quality within the storage tank
- Air quality at site with respect to odours
- Inappropriate recreational activity around tank / pump installation
- Pump operation and performance
- Integrity of pump discharge manifold
- Irrigation filter maintenance
- Water meter correlation with supply volumes
- Irrigation system isolation valve operation
- Irrigation distribution system integrity and operation
- Control system integrity and operation
- Human exposure to direct contact with recycled water or aerosols
- Accidental ingestion of recycled water
- Ponding during irrigation
- Groundwater contamination
- Impact on soil condition

- Impact on turf condition
- Cross connection of potable and recycled water supplies
- Confusion of water source
- Infrastructure maintenance
- Roles and responsibilities
- Emergency preparedness
- Staff training
- Document control

The risk assessment should be reviewed wherever there is any:

- Incident causing or threatening harm to environment.
- Incident causing or threatening harm to human health.
- Change in the operation of the system.

Activities are also described below, in terms of environmental impact. The methods of control and monitoring associated with these activities may be repeated in the Activity Risk Assessment and Control Table (Appendix F).

3.3.3 RISK CRITICAL CONTROL POINT VALIDATIONS

Critical control points are listed in the Activity Risk Assessment and Control Table. Validation of these critical control point or performance level are provided in Appendix G.

3.4 ENVIRONMENTAL IMPACT OF ACTIVITY

3.4.1 AIR QUALITY

No numerical air quality data is available for the Bogangar Rugby Fields. However, air quality in Bogangar is generally regarded as good and typical of coastal locations.

Air quality at the Bogangar Rugby Fields can deteriorate from the generation of dust from normal turf management operations and aerosols from spray drift from sprinklers. The following sections examine these two air quality parameters and provide measures to mitigate any deterioration of air quality.

ODOURS AND THEIR CONTROL

The detection of odours emanating from the Bogangar Rugby Fields is mitigated because the recycled water is contained in an on site enclosed lined panel tank storage. In addition, the water will be turned over in the tank once per day unless there is sufficient rainfall during business workdays and once only over the weekend as programmed. This will minimize the stagnation of water in the tank and the propensity for algal encouraging anaerobic conditions resulting in odours.

Nevertheless, upon occasion, it may be possible to detect odours beyond the storage, and conditions conducive to these events may be from breakdown of equipment such as pipe leakages leading to ponding and septicity and the release of anaerobic (foul) air.

Where wind drift may disperse odours, the prevailing winds are generally from the southeast. These winds blow towards the residential areas of Bogangar.

Meteorological effects and breakdown of equipment are normally rectified within a 24-hour period.

The recommended actions to reduce the impacts of odours from the site relate to the general operation of the irrigation system, which are discussed below.

DUST CONTROL

The potential causes of excessive dust from the Bogangar Rugby Fields are associated with fertilizer application and mowing of the turf / grass periodically.

Excessive dust can be mitigated by maintaining moisture in the soil profile through regular application of the irrigated effluent. Application of fertilizer must only take place at times of no wind and with use of short irrigations to water in the fertilizer. Current operation indicates that with the machinery used, all grass-cutting fines are kept low to ground, settle readily from air and are contained within the confines of the site with a nominal buffer zone of 40 metres to residences in the north.

Any exposed areas may be sprayed with water during dry and windy conditions.

AEROSOLS

Aerosols associated with the break-up of the stream of water from the sprinkler nozzle are a function of the nozzle size, nozzle shape, nozzle pressure and prevailing wind conditions. In order to minimize the quantity of aerosols produced, the irrigation system has been designed to operate at a lower pressure compared to existing. Wind has the effect of breaking sprinkler streams and in doing so exacerbates the problem of aerosols produced and causing the aerosols to drift. Drift has the potential to make contact with humans and this is controlled by shutting down the irrigation system once the wind speed reaches 10 km/hr.

In addition to the design aspects, the 40 m bush buffer zone on the north side of the field provides a natural barrier and catchment of aerosols and spray drift, to the residential area. The buffer zone is required to be maintained and low trajectory stream rotors to assist in the enhancement and maintenance of the buffer zone could provide irrigation.

NOISE CONTROL

The operation of the irrigation system is very quiet. The site is relatively distant from residences (over 40 m from nearest sprinkler) and the potential for noise impact at these residences is very low. A 40 m scrub / bush buffer zone between the fields and nearest residences to the north of the fields assists in buffering any noise.

The irrigation pump(s) are submerged in the storage tank and there is no machinery, engines or motors in the system. Noise from these installations is minimal even at close proximity to the tanks. The tank / pump installation is over 150 m from nearest residences.

3.4.2 EROSION CONTROL

Only a small part of the site would be affected from installation of the irrigation system. The remaining land is bush and is not to be disturbed in any way.

To minimise the potential for soil erosion, the following standard procedures should be undertaken in association with any installation:

- Partial backfilling all open trenches prior to completion of each days work;
- Installation of sediment traps around disturbed areas of the site;
- Washing down equipment in areas which are drawn towards sediment traps;
- Prompt restoration of disturbed areas following completion of earthworks, including re-turfing of exposed areas, and
- Removal of all construction debris, including rubble, spoil and foreign matter and landscaping of affected areas.

To minimise the potential for soil erosion during operation of the irrigation system the following preventative measures are to be implemented:

- Rain switches shut down irrigation if rainfall occurs to prevent ponding

- Rain switch set to match turf evaporation rate to allow controller re-start
- Automatic shut-off of pumps on 'low pressure alarm' if leakage of system occurs due to component failure, creating ponding

3.4.3 SITE CONTAMINATION

Contamination risks include:

- Contamination of groundwater;
- Contamination of surface water, and
- Contamination of soils.

CONTAMINATION OF GROUNDWATER

Baseline sampling was conducted to gather groundwater water quality data prior to the application of recycled water by irrigation to establish benchmark groundwater quality. The establishment of baseline data underpins the risk assessment process and provides a basis for assessing potential impacts of the use of recycled water on the environment and/or public health risks. In particular, monitoring provides for:

- Verification that groundwater quality conditions prior to the application of recycled water by irrigation are in accordance with relevant environmental and public health guideline values;
- Sufficient supporting data to determine, with an acceptable level of confidence, the contamination status of the site relative to indicative guideline values; and
- Subsequent monitoring recommendations.

Two water quality monitoring bores were installed, one up gradient and one down gradient of the site, by Butler Partners Pty Ltd on the 27th August 2007. Well installation and development was based upon the ARMCANZ (2003) Minimum Construction Requirements for Water Bores in Australia. A bore licence for the installation of the wells was issued by NSW Department of Water and Energy on 2nd August 2007 and bore logs were forwarded to NSW DNR to complete licence requirements.

Results for seven indicators exceeded The Australian and New Zealand Environment Conservation Council, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)* guideline trigger values. The laboratory results and discussion are contained within Appendix I of this report. These were biological oxygen demand (BOD) and copper in BH1 and pH, zinc, total phosphorus, total nitrogen and oxidized nitrogen in both BH1 and BH2.

The elevated levels of copper and zinc may be a result of stormwater runoff entering the groundwater system. There are a number of reasons why the groundwater results are elevated for both nitrogen and phosphorus. Excess fertilizer may have been applied to the rugby field or through nearby agricultural practices which could have leached through to the groundwater. There is a possibility that the existing treatment plant outfall in the sand dunes approximately 500 m south of the site may be affecting the groundwater system.

While the total nitrogen levels are only marginally higher than the estuarine or lowland river trigger levels in ANZECC (2000), they are substantially higher than the marine trigger values. BOD is only slightly above the trigger level in BH1 and may be related to catchment land-use practices.

The following strategies are recommended to ensure the long term viability of recycled water irrigation at the site:

- Regular water quality sampling (at least bi-annually);
- Ensuring that grass clippings are removed after mowing. These clippings may return N and P to the soil over the long term. If these clippings are not able to be removed from the site, then we recommend a regular soil sampling and monitoring program (every 3-5 years) is recommended to ensure accumulations of N and P in the soil do not exceed guideline levels; and

- Ensure application rates are sustainable. At 10ML/annum and 20ML/annum, the modelling indicates that very low amounts of nutrient will enter groundwaters. Water movement may be restricted at depth in the soil profile due to the presence of coffee rock and excessive irrigation amounts may cause water tables to rise if permeability is restricted. In any case, regular monitoring of groundwater bore water levels and laboratory analysis of parameters such as nutrients, heavy metals, Ec and pH will be required to determine long term recycled water irrigation sustainability.

CONTAMINATION OF SURFACE WATER

The site has a slightly sloped natural drainage line at the northern end of the fields, which leads to a natural drainage line alongside the Tweed Coast Road. These drainage lines are outside the irrigation zone, grassed / lined with vegetation (natural filter for silt & nitrogen) and are only subject to run-off during rainfall events. Given that the irrigation is a supplementary application applied only when rainfall is not occurring, any surface run-off will be uncontaminated water and no monitoring will be carried out. Management of the irrigation system will be undertaken to prevent over watering and overflows, which reduces the risk of accidental surface water contamination.

The risk of overflows from the site storage tank and / or recycled water supply line is considered remote. The supply line to the storage tank is underground and not highly pressurised. The riser from the pipeline to the tank is galvanized steel pipe, secured to the side of the panel tank and concrete blocked in the ground. A hydraulically activated float valve controls the discharge of recycled water into the tank. The valve shuts off at a set buffer point inside the tank, and only re-opens at a set level below full. The settings are adjustable with a pilot activated float valve. In addition, patrons and irrigation staff on a regular basis, who will be advised to inform management of any abnormal water conditions around the tank, will use the site. Visual inspections of the levels within the tank are to take place through the inspection port once per week.

The irrigation system will operate at night and abnormal discharges and or leakages from the system will not be detected until the following day(s) by irrigation management and patrons. Leakages from pipe work will show as ponding or as erosion of soil at ground level.

In the extreme situation, a pipe could burst which causes total system loss of pressure and high flows off site to drainage lines. In this event, the irrigation control system via the VFD pressure sensor shall shut the system down at a pre-set low-pressure level to minimize this risk.

CONTAMINATION OF SOILS

Hastings Point STP staff are to notify Bogangar Rugby Fields staff in the event of a change in water quality, which may affect the organic loadings on the soils. Irrigation is to be suspended until the water quality has been restored.

An irrigation water balance model was considered, “Model for Effluent Disposal Using Land Irrigation (MEDLI)” to determine sustainable irrigation rates in the short term and long term. This particular model carries out water balance, nutrient/salt loading calculations, and soil water plant relationships.

Two modelling scenarios were run with a view to determining the sustainable loading of irrigation water and nutrients for the site. The differences in the scenarios relate to irrigation application and timing. The first scenario was run to reflect the most logical irrigation strategy, i.e. irrigate at 30% of the drained upper limit of the soil. The drained upper limit is the amount of water that a soil is able to hold after drainage has ceased, usually after 2-3 days. The second scenario was run to reflect conditions if irrigation occurred every day and at a nominal value of 500 mm above the drained upper limit of the soil. This was considered to be a high application rate.

The most relevant results of the modelling relate to:

- Nutrient retention and the uptake of Nitrogen (N) and Phosphorus (P) by the grass ;
- Water movement ; and

- Plant growth.

These results are summarised in the following sections.

Nutrients

The grass uptake of N for both MEDLI Scenarios easily exceeds the amount applied during irrigation. Whilst current Nitrogen levels were not analysed, they are expected to be very low. In terms of the P results, the P added in irrigation will marginally exceed that being uptaken by grass for both MEDLI Scenarios. The laboratory results indicate that P sorption is comparatively low (maximum of 18 mg/kg). Nevertheless, given the small difference between the P applied in the irrigation and that being uptaken by the crop, the soil will be able to absorb the majority of P. Only a very limited amount of P will be leached to the groundwater annually (in the order of 0.2 kg/ha/year). This is a very minimal amount. Given that the model only allows for 3 harvests per annum, a more realistic situation would be that all P would be removed with regular mowing of the grass (i.e. weekly in summer).

Water movement

The modelling indicates that for both MEDLI Scenarios, excess irrigation water will result in deep drainage within the soil profile and eventually move through to the groundwater. The amounts of drainage for the two Scenarios are 1190 and 1622mm/year respectively. With this deep drainage, the amounts of run-off will be very minimal (17.5mm/year average). This means that with increased irrigation, the site can cope with the additional water supply without additional impact to the surrounding environment. Groundwater will be recharged at the amount of 98 m^3/per day for Scenario 2 compared to 72 m^3/day for Scenario 1. There may be an impediment to water movement in the deep parts of the soil profile (3 – 5 m) due to the presence of 'coffee rock' which typically underlie these sands. These coffee rock layers are typically indurated and can be poorly permeable. Over time and with excessive irrigation, water tables may rise close to the surface. Periodic monitoring of water levels in groundwater monitoring bores will determine the extent of this impact.

Plant growth

There are very few limitations to plant growth at the site. Electrical conductivity is low and will not impact upon plant yields. The soil pH may be a moderate limitation to growth but can be adjusted with lime or some other neutralising agent. The growth of the grass will be affected during the winter months due to temperature stress but this will be only for a short period.

A soil-monitoring program will be implemented to provide advance warning of potential soil contamination due to the accumulation of nutrients in the soil profile. See Section 4 for the suggested soil-monitoring regime to be undertaken by the Tweed Council Laboratory services.

3.5 RWMP WITHIN THE ENVIRONMENTAL MANAGEMENT CONTEXT

This Recycled Water Management Plan (RWMP) has been prepared for Tweed Shire Council as the nominated determining authority of the Bogangar Rugby League Sport Fields irrigation scheme using recycled water.

This RWMP demonstrates environmental due diligence by Council in the execution of its duties and responsibilities.

3.6 MANAGEMENT ORGANISATIONAL STRUCTURE AND RESPONSIBILITY

The management of the recycled water assets is shared between two business units as follows:

BUSINESS UNIT	MANAGEMENT RESPONSIBILITIES
Water Unit	Booster pump and rising main along Tweed Coast Road, including the storage tank and irrigation pump.
Recreation Services Unit	Irrigation feeder line and irrigation network, including controls.

The organisational structure with names and positions of personnel, together with their roles and responsibilities is provided in Table 3.1 and Table 3.1

Table 3.1 Water Unit Organisational Structure and Responsibilities

POSITION	INCUMBENT	ROLES AND RESPONBILITIES
Manager Water	David Oxenham	Responsible to Council for the sustained public health of the community through the provision of recycled water facilities.
Operations Engineer	Peter Haywood	Responsible to the Manager Water to ensure that the RWMP is implemented and maintained and to ensure that the Environment Protection Licence framework of these facilities is met.
Bogangar Rugby League Site Manager (Coastal Supervisor)	David Burns	Responsible to the Operations Manager for the operation of the recycled water supply in an environmentally responsible manner and to ensure that the RWMP framework is met.
Water Quality Monitoring Supervisor	Peter Matthews	Responsible to the Bogangar Rugby Fields Site Manager to ensure all controls, monitoring, operation reporting, maintenance, incident reporting and corrective action are carried out.

Table 3.2 Recreational Services Unit Organisational Structure and Responsibilities

POSITION	INCUMBENT	ROLES AND RESPONBILITIES
Manager Recreation Services	Stewart Brawley	Responsible to Council for the sustained public health of the community through the provision of recreational facilities.
Bogangar Rugby League Site Manager (Irrigation Overseer)	Rod Keevers	Responsible to the Manager Recreation Services for the operation of the irrigation supply in an environmentally responsible manner and to ensure that the RWMP framework is met.
Irrigation Technicians	Maintenance Workers	Responsible to the Bogangar Rugby Fields Site Manager to ensure all irrigation controls, monitoring, operation reporting, maintenance, incident reporting and corrective action are carried out.

3.7 ENVIRONMENTAL MANAGEMENT QUALIFICATIONS & TRAINING

The Coastal Supervisor, Irrigation Overseer and Irrigation Technicians have completed the training as shown in Table 3.3, which is relevant to the operations and maintenance of the Bogangar Rugby Fields irrigation system using recycled water.

Table 3.3 Qualifications and Training of Staff for Operations & Maintenance of the Bogangar Rugby Fields recycled water irrigation system

QUALIFICATIONS	Coastal Supervisor	Irrigation Overseer	Irrigation Technician
TRAINING			
Site Induction			
Familiarisation with the Bogangar Rugby Fields RWMP			
Environmental Emergencies Response			

3.8 EMERGENCY CONTACTS AND RESPONSE

Contact details of the various persons and agencies, together with their contact numbers in the event of an emergency, are provided in Table 3.4.

Table 3.4 Persons and Agency Contacts in the event of an Emergency

PERSONS / AGENCY	CONTACT DETAILS
Council Operations (24 hour basis):	
Operations Engineer, Peter Haywood	0427 286 435
Coastal Supervisor, David Burns	0409 396 201
Irrigation Overseer, Rod Keevers	0427 457 757
Water Quality Monitoring Supervisor, Peter Matthews	0417 627 087
Irrigation Technicians	
Emergency Services:	
Police	000
Ambulance	000
Fire Brigade	000
Government Agencies:	
DEC North Coast Region 49 Victoria Street Grafton 2460	Tel (02) 6640 2500 Fax (02) 6642 7743
Tweed Shire Council Administration Offices and Civic Centre Tumbulgum Road Murwillumbah 2484	Tel (02) 6670 2400 Fax (02) 6672 7513
Nearest Residences off Tweed Coast Road	

Residence on North Side: John Richard Finn Melanie Joy Finn	22 Forest Oak Crescent Bogangar 2488 (02) 6676 4360
Residence on north side: Marrian Lois Coffey Marjorie Jean Coffey	33 Como Parade East East Mentone 3194 (03) 9583 1873

The responsibilities of the above emergencies response personnel are incorporated into the procedures outlined in Council's OMS.

The procedures to follow in the event of an environmental hazard, incident, accident or emergency and the steps to follow to minimise environmental damage are referenced in the Table "Activity Risk Assessment and Control" and "Procedures" attached in Appendices G and H.

3.9 ENVIRONMENTAL MANAGEMENT CHECKLISTS AND REPORTING

Standard forms are presented for the commonly used checklists, reports and registers as follows:

3.9.1 SITE INSPECTION CHECKLIST

A template Site Inspection Checklist is attached as Appendix A.

The objectives of this checklist are to record any changes and abnormalities with the environmental management of the site.

An environmental Site Inspection Checklist should record:-

- Date of inspection (to be undertaken once per week)
- Condition of the environmental parameters on site
- Name of the person (Irrigation Technician) who inspected the site
- Name of person (Irrigation Manager) who received the checklist report
- Site Manager's review and comments of the report

3.9.2 **NON-COMPLIANCE AND CORRECTIVE / PREVENTATIVE ACTION** REPORT

A template Non-compliance and Corrective / Preventative Action Report is attached as Appendix B.

The objectives of this report are to record any breaches of the Licence conditions on site and the RWMP.

An environmental Non-compliance and Corrective / Preventative Action Report should record:

- Date of inspection
- Nature of the breach
- Location of the breach
- Name of the person who reported the breach, and contact details
- Site Manager's review and comments
- Recommended actions to resolve the matter
- Organisations contacted regarded the incident
- Date of resolution of the matter
- Type of resolution
- Name of organization and person undertaking resolution

- Site Managers signing off after corrective action completed and reporting to Operations Engineer Hastings Pt STP

3.9.3 COMPLAINTS REGISTER

A template Complaints Register is attached as Appendix C.

The objectives of this register are to record any third party complaints received, either verbally, electronically or in writing and take corrective actions as necessary.

A Complaints Register should record:

- Date of complaint
- Nature of the complaint
- Name and contact details of the person(s) who complained
- Name of person (Irrigation Manager or Site Manager) to whom the complaint is reported to
- The name of the organization / shire section to which the report will be referred to for action, contact name for follow-up, and date of expected reply of notification of complaint from corrective action instigator at Tweed Shire Council

3.9.4 ENVIRONMENTAL INCIDENT REPORT

A template Incidents and Events Register is attached as Appendix D.

The objectives of incident resolution and associated timely corrective actions are for the issue to be resolved in such matter that there is no further incident for the same reason.

An environmental Incidents and Events Register should be maintained, which records:

- Date of incident
- Nature of the incident
- Location of the incident
- Name of the person who reported the incident
- Name of the person (Irrigation Manager) who received the notice of the incident
- Site Manager's review and comments on report
- Name of organization to which the report is referred for corrective action
- Report of recommended corrective actions to resolve the matter by TSC
- Organisations contacted regarding the incident
- Date of resolution of the incident
- Report of Persons / Organisation contacted regarding resolution and date.

3.9.5 ENVIRONMENTAL TRAINING REGISTER

A template Environmental Training Register is attached as Appendix E.

The objectives of this register are to record the various environmental training and development programs that the Supervisors and Operators have attended.

The Environmental Training Register should record:-

- Date of training / development program
- Name of the person who attended the training / program
- Nature of the program

3.10 CORRECTIVE ACTION AND REPORTING

The procedures for dealing with non-compliance with environmental management controls, incidents and emergencies are in Appendix H attached titled Operational Procedures for Corrective Action. The appropriate procedure for the activity requiring corrective action is listed in the Activity Risk Assessment and Control Table (Appendix F).

The templates for reporting of activities requiring action are in the appendices attached as follows:

- Non-compliance and Correction / Preventive Action Reporting (refer Appendix B)
- Complaints Register (refer Appendix C)
- Environmental Incident Reporting (refer Appendix D)

The responsibilities for reporting environmental incidents lie with the person(s) who first encounter the incident (normally the Grounds Staff, Irrigation Technician, Irrigation Manager, Site Manager).

The Operations Engineer has authority for taking appropriate correction / preventative actions through the Site Manager.

4 MONITORING, REVIEW AND AUDITING

4.1 ENVIRONMENTAL MONITORING

Monitoring of the water and soils associated with the irrigation of the Bogangar Rugby Fields is required to provide advance warning in the event of a developing problem due to the accumulation of nutrients in the soil profile and the pollution of the surface, or groundwater.

The following monitoring regime is recommended to be undertaken by the Tweed Shire Council Water Quality Laboratory services:

Effluent Monitoring:

Parameter	**Frequency**
Total and available N	Monthly
Total and available P	Monthly
Electrical conductivity	Monthly
Exchange cations	6 monthly
Chloride	6 monthly
Chemical contaminants	Annually

Soil Monitoring:

Parameter	**Frequency**
pH	Annually
Total and available P	Annually
Electrical conductivity	Annually
Exchange cations	Annually
Chloride	Annually

Groundwater monitoring:

Parameter	**Frequency**
Zinc	6 monthly
Copper	6 monthly
Total and available N	6 monthly

Total and available P	6 monthly
Oxidised Nitrogen	6 monthly
BOD	6 monthly
pH	6 monthly
SAR	6 monthly
Electrical conductivity	6 monthly
Faecal coliforms	6 monthly

Results from baseline sampling conducting early September 2007 found that seven indicators exceeded The Australian and New Zealand Environment Conservation Council, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)* guideline trigger values. These were biological oxygen demand (BOD) and copper and pH, zinc, total phosphorus, total nitrogen and oxidized nitrogen.

Phosphorus is a nutrient which could accumulate in the reuse site soils. Given that the level of phosphorous in the recycled water is lower than the uptake levels of the turf, it is quite likely that additional phosphorous may need to be applied as fertilizer for plant health. Where the above monitoring program shows an increased accumulation of phosphorus, remedial action is required to reduce the fertilizer application rate.

It is recommended that subsequent sampling be conducted in alignment with the September 2007 sampling results (outlined above) and the suite of constituents tested (See Appendix I). Bi-annual testing will refine the sampling constituent list to allow for subsequent monitoring recommendations.

Irrigation System monitoring:

Parameter	**Frequency**
Ponding	Daily
Adequate Irrigation	Daily
Correct Schedule	Weekly
Sprinkler operation	Monthly
Valve Operation	Monthly
Filter Screen	Monthly
Pump operation	Monthly
Isolation Valve operation	Quarterly
Rain Switch	Monthly
Anemometer	Monthly

4.2 REVIEW OF RWMP

This RWMP will be reviewed every 12 months of the operation of the recycled water irrigation system at the Bogangar Rugby Fields.

The Operations Engineer at the Hastings Point STP is responsible for the review process involving feedback from the Bogangar Rugby Fields Site manager, Irrigation Manager, and Irrigation Technician and for implementing the changes arising from the review.

Changes to the RWMP will be communicated to the Bogangar Rugby Fields Site manager, Irrigation Manager, and Irrigation Technician and forwarded to the “Manager Water”, TSC, Murwillumbah, NSW.

4.3 ENVIRONMENTAL AUDITING

Internal environmental audits of the procedures outlined in this RWMP associated with the operations of the Bogangar Rugby Fields irrigation system shall be undertaken annually by the Bogangar Rugby Fields Site Manager to ensure that the objectives of this RWMP are upheld, as outlined in Section 1.1.

The scope of the internal audit will be to verify the completeness of the following procedures as provided in Table 4.1:

Table 4.1 Scope of Internal Environmental Audits

DESCRIPTION	FUNCTION	REFERENCE
Environmental Management Structure	To ensure that the roles and responsibilities of the listed personnel are being met.	
Annual, Exception and Performance Reporting	The timely submission of reports to the Hasting Pt STP Operations Engineer	
Level and Applicability of Skills of Personnel	Particular attention to the recognition of any skill-gaps and training needs.	
Emergency Contacts	The accuracy of details and contact numbers.	
Environmental Schedules	Execution of relevant checklists reports and registers.	
RWMP Review	Continuous improvement through monitoring and non-conformance reports	

The results of the annual internal environmental audits shall be reported to the Manager Water.

Appendix A SITE INSPECTION CHECKLISTS

TWEED SHIRE COUNCIL	WEEKLY SITE INSPECTION CHECKLIST WEEK ENDING……..	Doc No. Sheet 1 of 1 Version 1 Revision 1 Date:

ITEM	RATING / ACTION	ITEM	RATING/ACTION
A. Water Quality:		**G. Pump and Filter:**	
1. STP water quality samples meeting licence conditions 2. Water not in tank for more than two days 3. Tank level inspected		1. Correct operating pressures and flows 2. Filter PD below 50 kPa	
B. Air Quality & Odour:		**H. Valve Operation:**	
1. Dust mitigation 2. Air quality targets being met		1. Isolation valves freely working 2. Field control valves manual on/off integrity	
C. Soils:		**I. Distribution system and Sprinklers:**	
1. Evidence of scouring 2. Turf maintained over soil in irrigated / sports area 3. Returfing of disturbed areas		1. Risers extend and contract as required 2. Nozzle stream clean and unscattered 3. Arc adjustment correct 4. System integrity maintained and no ponding indicators	
D. Noise:		**J. Control System:**	
1. Equipment running normally 2. Boundary noise levels normal		1. Correctly Operating at scheduled times 2. Correctly reporting 3. Check that incident/complaint reports, inspection checklists and worksheets are signed off & filed	
E. Buffer Zone:		**K. Sensors:**	
1. Vegetation maintained		1. Rain sensor clean & operating 2. Wind sensor operating	

		correctly	
F. Flora & Fauna:		**L. Public Safety**	
1. Weeds under control 2. Vermin under control 3. Irrigated turf healthy		1. Visual check of signage, fences, locks and other security measures	

Have any legislative infringement / improvement notices been issued? (Y / N)

Additional comments ……

Distribution

Irrigation Manager's Signature…… Date ……..

Site Manager's Signature …….. Date …….

Operations Engineer Signature …….. Date …….

TWEED SHIRE COUNCIL	DAILY SITE INSPECTION CHECKLIST DATE……..	Doc No. Sheet 1 of 1 Version 1 Revision 1 Date:

ITEM	RATING / ACTION	ITEM	RATING/ACTION
A. Water Quality:		**C. Irrigation System**	
1. Inspect storage tank for visual signs of harmful algal species 2. Obtain daily update of water quality leaving the STP from the plant supervisor		1. daily inspection of pump stations for leakage, ensure that water meter readings are within the +/- 5% range for tank supply 2. Monitoring of irrigation computer readouts against actual manual gauge readings at pump stations 3. Monitor & report breaches of CCP to prevent groundwater contamination from irrigation water moving below root zones	
B. Air Quality & Odour:		**D. Public Safety**	
1. Assess odour levels daily		1. Monitor buffer zone daily for exposure of residential areas to recycled water through spray drift	

Additional comments …….

Distribution

Irrigation Manager's Signature…… Date ……..

Site Manager's Signature …….. Date …….

Operations Engineer Signature …….. Date …….

TWEED SHIRE COUNCIL	LARGE INTERVAL SITE INSPECTION CHECKLIST DATE……..	Doc No. Sheet 1 of 1 Version 1 Revision 1 Date:

ITEM	RATING / ACTION	ITEM	RATING/ACTION
MONTHLY			
1. Inspect storage tank for visual signs of harmful algal species		3. Filter at pump station checked for leakage from filter components	
2. Manually inspect filter screen for build-ups and manual clean			
3 MONTHLY			
1. Test storage tank with NTU meter for turbidity > 5NTU			
6 MONTHLY			
1. Monitor groundwater for signs of contamination		2. Soil tests and professional interpretation of results, fertiliser regimes and RW analysis	
ANNUALLY			
1. Conductivity audits to detect unauthorised connections		4. Review fertiliser application management scheme	
2. Monitor salinity as a precaution to ensure no accumulation in soils		5. Assess organic load and accumulation rates and modify organic application as required	
3. Review MEDLI model results for application of RW for effectiveness and update if required		6. Review monitoring programs for effectiveness and incorporate improvements	

Additional comments …….

Distribution

Irrigation Manager's Signature……. Date ……..

Site Manager's Signature …….. Date …….

Operations Engineer Signature …….. Date …….

Appendix B NON-COMPLIANCE AND CORRECTIVE / PREVENTATIVE ACTION REPORT

TWEED SHIRE COUNCIL	NON-COMPLIANCE & CORRECTIVE / PREVENTATIVE ACTION REPORT	Doc No. Sheet 1 of 1 Version 1 Revision 1 Date:

Date	Description of non-compliance	Reported to	Notified	Preventative action

Appendix C COMPLAINTS REGISTER

TWEED SHIRE COUNCIL	**COMPLAINTS REGISTER** **COMPLAINT NO ……**	Doc No. Sheet 1 of 1 Version 1 Revision 1 Date:

Date	**Corrective Action**	**Complainant Contact Details**
		Name
Description of Complaint		**Address**
		Tel

TWEED SHIRE COUNCIL	**COMPLAINTS REGISTER** **COMPLAINT NO ……**	Doc No. Sheet 1 of 1 Version 1 Revision 1 Date:

Date	**Description of Complaint**	**Complainant Contact Details**
		Name
		Address
		Tel

Appendix D INCIDENTS AND EVENTS REGISTER

TWEED SHIRE COUNCIL	INCIDENTS AND EVENTS REGISTER	Doc No. Sheet 1 of 1 Version 1 Revision 1 Date:

Report No.	Description of Incident	Date Opened	Date Closed

TWEED SHIRE COUNCIL	ENVIRONMENTAL INCIDENT / EVENT REPORT NO……	Doc No. Sheet 1 of 1 Version 1 Revision 1 Date:

Date	Description of Incident	Reported To	Notified	Corrective Action

Appendix E ENVIRONMENTAL TRAINING REGISTER

TWEED SHIRE COUNCIL	**ENVIRONMENTAL TRAINING REGISTER**	Doc No. Sheet 1 of 1 Version 1 Revision 1 Date:

Date	**Name of Participant(s)**	**Description of Training Program**
		Trainer:
		Title of Program:
		Duration:

Appendix F ACTIVITY RISK ASSESSMENT AND CONTROL TABLE

BOGANGAR RUGBY LEAGUE SPORTS FIELDS – ACTIVITY RISK ASSESSMENT AND CONTROL TABLE

Activity or Process Step	Potential Hazards	Control Issues	Critical Controls	Monitoring and/or Control Measures	Corrective Actions
1. Activation of the Hastings Point STP pump to fill the Bogangar Rugby Fields storage tank. Risk Level 1B	Overflow of the Bogangar Rugby Fields tank	Maintain freeboard in tank by use of a level probe	Level Probe setting 200 mm below overflow with alarm activation on 100 mm level	Tank level is inspected weekly. The height level alarm is a flashing red light above the pump shed.	Hastings Pt. STP to be advised by Irrigation Manager of serious spillage or inappropriate usage posing a threat to the environment. Refer Procedure RW-1
	Effluent quality at Hastings Pt. STP fails Quality Assurance specification.	Hastings Point STP Management	Hastings Pt. STP test criteria	HASTINGS POINT STP Wastewater plant is Quality Assured and has notification procedures for effluent customers and Irrigation Manager will be notified same day	STP Operations Engineer to instigate corrective measures. The procedures applying: RW-1
	Leakage to the environment of supply pipe from Hastings Pt. STP to the on-site storage tank	Hastings Pt. STP Pump shuts down on low-pressure alarm. Manual isolation valve prior to tank.	Correlation between incoming RW and outgoing irrigation volumes, taking into consideration un-used volume in on-site storage. Meter readings recorded by Irrigation computer. Variation allowed is +/- 5%	HASTINGS POINT STP monitors flow into Bogangar Rugby Fields. Irrigation Manager also monitors flow pumped. These must agree with-in the CCP. Records revealing usage outside the range permitted infer leakage and require investigation.	The Irrigation Manager and Hastings Pt. STP will investigate significant differences in flow totals. Refer procedure RW-1

BOGANGAR RUGBY LEAGUE SPORTS FIELDS – ACTIVITY RISK ASSESSMENT AND CONTROL TABLE

Activity or Process Step	Potential Hazards	Control Issues	Critical Controls	Monitoring and/or Control Measures	Corrective Actions
2. The Bogangar Rugby Fields effluent storage tank Risk Level 1B	Inappropriate recreational activity at the tank or surrounding areas by patrons or trespassers.	Signage at required level, fencing, and other security measures	Any alteration and or damage to componentry by behaviour	Irrigation Manager visually checks the condition and presence of signage, fences, locks and other security measures weekly. Other staff and/or club officials to notify Irrigation Manager of anything of note.	Public, staff and Irrigation Manager to notify Hastings Pt. STP and the Police if damage noted. Refer Procedures RW-2 & RW-4
	Odours from low dissolved oxygen conditions.	Tank is covered and water is turned over every 2 days	Public nuisance - complaint	Irrigation manager to assess daily as precaution. Any odours are logged on incident report sheet.	Irrigation manager to organise remedial action upon lodged complaint. Refer Procedures RW-2
	Blooms of harmful algal species.	Algal management Plans	Turbidity levels greater than 5 NTU	Irrigation manager to visually inspect storage tank daily as precaution and to test with NTU meter every 3 months. Irrigation manager to report to HASTINGS POINT STP an NTU level greater than 5.	Irrigation manager undertakes turbidity test and implements remedial measures with in 3 working days. Refer Procedures RW-2 Seek outside technical information. Refer Procedure RW-2
	Contamination of Groundwater.	Tank is lined	Piezometer & sampling of ground water indicate salinity greater than 1400 ppm	Irrigation manager is to monitor groundwater quality at 6 monthly intervals.	Test levels indicating rise in salinity and other components above acceptable level require investigation as to verify possible causes. Procedure RW-2

BOGANGAR RUGBY LEAGUE SPORTS FIELDS – ACTIVITY RISK ASSESSMENT AND CONTROL TABLE

Activity or Process Step	Potential Hazards	Control Issues	Critical Controls	Monitoring and/or Control Measures	Corrective Actions
3. Irrigation System Pump Station. Risk level 1A	Leakage from pump station pipes.	Pipes and fittings installed to relevant Australian Standards and by certified installation contractors	Leakage causing pondage. Water meter readings correlation outside accepted (+/- 5%) range for Tank supply	Pump Stations inspected daily by Staff. Report of any malfunction to Irrigation manager	Any leakage incurs investigation, and repair with incident report. Irrigation Manager to organize corrective action. Refer Procedure RW-3
	Excessive pressure leading to system leakages.	Pressure switches	Pump shut down automatically at pressures above 700 kPa	Pump station control system allows for automatic adjustment of pressure of lines to suit conditions. Water meters linked to the irrigation computer will report abnormal flows in the irrigation system. Irrigation manager to monitors readouts against actual manual reading of gauges at pump station	Irrigation Manager investigates abnormal shut-off and or abnormal pressures during operation. Refer Procedure RW-3
4. Filtration Risk level 2C	Clogging of filter screen and poor performance sprinklers.	Manual cleaning of filter screens at set pressure differential	Activation of filter cleaning not occurring when pressure differential >50 kPa	Filtration required preventing clogging of valve solenoid orifices and sprinkler heads but also aids in pathogen reduction. Filter screen to be manually inspected for build-up of contaminants and manually cleaned monthly, unless pressure differential requires more frequent cleaning. Procedure is logged by Irrigation manager	Irrigation Technician Cleans screen & tests Pressure Differential activation. Otherwise organise corrective action Refer Procedure RW-3
	Leakage from Filter components leading to ponding / groundwater contamination	Flush water drains to sewer	Major component failure and or flush valve failure leading to run-off	Filter at Pump Station inspected monthly by Irrigation manager. Checklist report filed with RWMP documents.	Failure of components entails organisation of investigation with in 24 hours in order to schedule maintenance. Refer Procedure RW-3

BOGANGAR RUGBY LEAGUE SPORTS FIELDS – ACTIVITY RISK ASSESSMENT AND CONTROL TABLE

Activity or Process Step	Potential Hazards	Control Issues	Critical Controls	Monitoring and/or Control Measures	Corrective Actions
5. The Computerised Irrigation Control System Risk Level 1A	Failure to deliver irrigation water as per selected regime	Automatic warning from control system with report.	Visual inspection indicates stress in turf and or gardens.	Irrigation manager inspects the Irrigation regularly and watches for system malfunction. The irrigation computer will display alarm messages in the event of abnormal irrigation flows.	Irrigation manager to organise maintenance contractor to investigate and repair within 24 hours of reported failure. Bogangar Rugby Fields have access to expert support for the Irrigation Control software. Refer Procedure RW-4
	Failure to deliver irrigation water as per selected regime	Soil moisture monitor readings	Soil moisture monitoring indicates soil moisture levels at less than 50% of soil Total Available Water Capacity (TAWC)	Irrigation manager inspects the Irrigation regularly and watches for system malfunction. The irrigation computer will display alarm messages in the event of abnormal irrigation flows.	Irrigation manager to organise maintenance contractor to investigate and repair within 24 hours of reported failure. Refer Procedure RW-4
	Failure to deliver irrigation water as per selected regime due to wind	Anemometer used to shut down irrigation under wind conditions	Soil moisture monitoring indicates soil moisture levels at less than 50% of soil Total Available Water Capacity (TAWC)	Irrigation manager inspects the Irrigation regularly and inspects for irrigation applications. The irrigation computer will display alarm messages in the event of abnormal irrigation flows.	Irrigation manager to adjust irrigation schedules otherwise review wind monitoring data to determine any issues relating to the ability of system to supply water. Refer Procedure RW-4

BOGANGAR RUGBY LEAGUE SPORTS FIELDS – ACTIVITY RISK ASSESSMENT AND CONTROL TABLE

Activity or Process Step	Potential Hazards	Control Issues	Critical Controls	Monitoring and/or Control Measures	Corrective Actions
6. Distribution of Recycled Water Risk Level 2B	Ponding and runoff during periods of rainfall	Rain switches shut down irrigation if rainfall occurs.	Rain switch set to match turf evaporation rate to allow controller re-start.	Irrigation manager to ensure that the rain switch is kept free and clean of contaminants – checking & testing weekly. Logging of inspection / maintenance.	Refer Procedure RW-4
6. Distribution of Effluent (cont) Risk Level 2B	Exposure of staff, patrons or other public to direct recycled water contact.	Staff and Public awareness by signage. Appropriate buffer zones, and tree planting	Irrigation only between 10 pm to 6 am outside public hours, except for maintenance & testing.	No irrigation is carried out in the presence of patrons or public. Irrigation occurs only on areas clearly identified as using Recycled Water for Irrigation. The condition and presence of warning signage, and fences is checked weekly.	Exposed skin to be washed. Refer Procedure RW-4.
	Exposure of residential areas to recycled water through spray drift	Anemometer used to shut down irrigation under wind conditions	Anemometer shut-off of distribution for wind speed >10 km/h.	Irrigation to the area where residential property may be downwind occurs only in the early morning when wind speeds are low.	Exposed skin to be washed. Refer Procedure RW-4.
	Exposure of residential areas to recycled water through spray drift from prevailing South-easterly winds	40 m bush / scrub buffer on north side of fields before residential area. West and south sides have large bush buffer zone and the east side has a narrow bush buffer along Tweed Coast Road.	Any damage or deterioration to the 40 m buffer zone.	Buffer zone is monitored daily. Preventative maintenance is to be monthly with report by Irrigation Manager to CEO.	Buffer zone failure or destruction constitutes a breach and requires immediate corrective action. Site Manager to instigate action and investigate cause. Refer Procedure RW-4

BOGANGAR RUGBY LEAGUE SPORTS FIELDS – ACTIVITY RISK ASSESSMENT AND CONTROL TABLE

Activity or Process Step	Potential Hazards	Control Issues	Critical Controls	Monitoring and/or Control Measures	Corrective Actions
	Accidental ingestion of recycled water	Staff and Public awareness by signage. Warning Signage in bilingual languages where needed.	If ingestion, occurs Irrigation Manager Advises immediate corrective action	Patron to call phone number on sign to report and seek advice from HASTINGS POINT STP to log call and issue incident report to Site Manager.	Patron to be advised to seek doctor's advice. Irrigation Manager to investigate incident, report on adequacy of control measures. Refer Procedure RW-4
	Contamination of groundwater caused by Irrigation water moving below the root zone	Wetting Front Detectors report to the irrigation computer.	Wetting Front moves below 400 mm	Reporting procedure in place to trigger schedule adjustment. Irrigation Computer records and reports daily wetting front activity. Irrigation Manager to report breaches of CCP to Site Manager who reports to Hastings Pt. STP Operations Engineer.	Adjust irrigation schedule where needed otherwise organise controller maintenance contractor Refer Procedure RW-4
6. Distribution of Effluent (cont) Risk Level 2B	Leakage of system due to component failure, creating major ponding, ground water contamination	Automatic shut-off of pumps on "low pressure alarm"	Low pressure shut-off set to 500 kPa at pump	Visual Inspection by Irrigation Irrigation Manager followed by incident report.	Shut system down and Irrigation Manager organises repair. Details of repair are logged Refer Procedure RW-4

BOGANGAR RUGBY LEAGUE SPORTS FIELDS – ACTIVITY RISK ASSESSMENT AND CONTROL TABLE

Activity or Process Step	Potential Hazards	Control Issues	Critical Controls	Monitoring and/or Control Measures	Corrective Actions
	Cross Connection to potable supply system.	Registered plumber under Irrigation Manager supervision can only undertake all plumbing activities. Conductivity checks must be performed prior to connection to determine type of water being connected. All pipes and fittings to be colour coded and have written identification. Existing irrigation pipes are all PVC and there is no potable supply to the irrigation system.	When EC exceeds 500ppm	Any works or activities, which occur within 3 m of potable supply line, which is exposed, can only be undertaken with registered plumber and Irrigation Manager present. At completion of activity, both Plumber and Irrigation Manager to sign off on work and connection type. Annual Conductivity audits organised by Irrigation Manager will detect any unauthorised connections. Minimum inspection frequency: ▪ All new services at installation ▪ All services at change of ownership ▪ All services following modifications	Shut off recycled water supply. Irrigation Manager organises audit to identify location of cross connection. Registered plumber to re-instate potable connection & Flush affected pipes and fittings and provide report for logging. Refer Procedure RW-4
	Confusion as to source water from taps.	No taps allowed on Recycled water supply. Backflow prevention devices are on the potable water supply. Registered plumber to do works. Pipes & fittings colour coded	Criteria for water test is EC greater than 500ppm	Irrigation manager to notify Site Manager. Irrigation manager to shut off potable supply and organise a test of all taps.	If test shows high EC – shut off recycled water supply and engage plumber. Log incident report, advise HASTINGS POINT STP and investigate causes of cross connection –revise RWMP Refer Procedure RW-4

BOGANGAR RUGBY LEAGUE SPORTS FIELDS – ACTIVITY RISK ASSESSMENT AND CONTROL TABLE

Activity or Process Step	Potential Hazards	Control Issues	Critical Controls	Monitoring and/or Control Measures	Corrective Actions
6. Distribution of Effluent (cont) Risk Level 2B	Impact on soil condition (including salinity)	Monitoring of mass loadings applied to soil and as listed in Table 2.2 of NSW Environmental Guidelines	Water component levels which are outside the moderate parameters for impact as per Hardie & Hind (1998), (see Table 2.2 in NSW Environmental Guidelines)	Nutrient levels in re-cycled water are below plant requirements and will have no impact. Irrigation manager conducts visual inspection of turf condition. Fertilizer programmes are logged HASTINGS POINT STP monitors conductivity on-line at all plants and has discharge limit. Six monthly soil tests to be carried out. Professional interpretation of results of soil tests and fertilizer regimes and Recycled water analysis.	Negative aspects of soil tests require soil amelioration and or fertilizer regime changes. Irrigation manager to engage soils / agronomist expert to construct and provide a program to implement. Irrigation manager to revise RWMP Refer Procedure RW-4
	Impact on plant life and bio-diversity.	Monitoring turf characteristics on a weekly basis	Turf browning off out of season, exposed soil surface, compaction (difficult for shovel to penetrate, EC tests > 2 dS/m)	Irrigation Manager to undertake visual turf inspection and “shovel” analysis of topsoil.	A report, which points out adverse affects on bio-diversity, necessitates remedial action and programme as defined by turf / soils agronomist. Refer Procedure RW-4
7. Hazard Signage	Missing signs in areas of potential human contact, and for areas of ‘no go’	Presence, legibility in both day and night.	Signage missing for more than 2 days	Preventative maintenance programme. Spare signs to be readily available. Continual loss of signage requires review of method of signage and review of type of landscape use. Irrigation Manager to control	Replacement of signs immediately if possible. Change landscape use type.

BOGANGAR RUGBY LEAGUE SPORTS FIELDS – ACTIVITY RISK ASSESSMENT AND CONTROL TABLE

Activity or Process Step	Potential Hazards	Control Issues	Critical Controls	Monitoring and/or Control Measures	Corrective Actions
8. Document Control	Confusion regarding current risk management procedures.	Lack of documentation.	Inability to provide latest version of documents, and follow trail.	"e" or Digital copies of Recycled Water Management Plan and procedures are "read only". Site Manager has "write" access. All printed procedures must be compared to "e" (Electronic refers to CD), copy to verify version currency. Procedures will show version number and date and should never be altered to lower standards and increase risk. Superseded documents to be shredded.	Irrigation manager to correct and update with Site manager to sign off. Site Manager to undertake internal audit annually and to apply changes to procedures on any failure in audit. Refer Procedure RW-5
9. Roles & Responsibilities	Lack of recorded information to review performance trends and historical system operations	Copies of inspection checklists, incident and complaint reports worksheets signed off and filed.	Copies of Checklist and reports not signed off within one week.	Site Manager to check.	Site Manager is responsible to ensure checklists and audit records filed for 5 years. Refer Procedure RW-5
10. Emergency Preparedness	System failure due to confusion regarding responsibility.	Communication / leadership	Conflict of responsibilities	Site Manager has full responsibility as indicated in procedures. Downward delegation of specific tasks to Irrigation Manager shall occur.	Irrigation Manager to resolve, report to Site Manager to amend RWMP and issue update. Refer Procedure RW-5
11. Personnel training	Confusion arising during serious failure events.	Communication / leadership / serious failure	Inability to cope with in an appropriate time frame.	Procedures contain specific instruction for different levels of failure and indicate contact pathways (internal and external).	Site Manager to review procedure and modify. Refer Procedure RW-5
	System failure due to inexperienced or untrained personnel.	Leadership to set up training.	Emergency due to lack of training and/or preventive action.	Site Manager to ensure that personnel have the required qualifications to carry out assigned roles. Job specific training requirements to be identified and provided by Irrigation Manager as appropriate. Refer competency-testing regime.	Specialist knowledge can be obtained from manufacturer, HASTINGS PT. STP and/or consultant where internal knowledge is inadequate. Retrain personnel. Refer Procedure RW-5

Appendix G CRITICAL LIMIT VALIDATIONS

Validation of Critical Limits For Bogangar Rugby League Sports Fields			
Critical Control Point	Critical or Operational Limit	Validation	Comments
Correlation between, incoming Recycled Water & outgoing irrigation volumes	Within +/- 5% of volumes as read from water meters	Manufacturers allowable variation is +/- 2% on nominal flow (Arad Water Meters Brochure AD-WT/95)	Allowing for the maximum variation of 4% per meter, then a total of 10% variation constitutes corrective action
Algal Blooms - Tanks	Turbidity Levels of between 5 ≤ 20 NTU	ANZECC 2000 Guidelines for Freshwater Lakes – Table 3.3.3, section 3.3.2 Philosophy for Guidelines for Physical & Chemical Stressors	Hastings Pt. STP inflow water is ≤2 NTU. Tank storage generally has low NTU values but will have outside source contamination and is open to light and temperature variations at surface level
Contamination of groundwater	Piezometer sampling of groundwater indicate salinity levels of greater than 1400 mg/L	Hastings Pt. STP EC levels vary only between 1000 to 1300 mg/L	Salinity levels percolating below rootzone are unlikely to vary greatly from the levels in the water. Levels greater than 1400 mg/L require investigation to causes and correction.
Excessive pressure leading to system leakages	Pump shuts down automatically at pressures above 700 kPa	Systems designed to operate below 700 kPa – GCCC Parks & Gardens	Systems usually designed to operate between 450 and 650 kPa, taking into consideration sprinkler operating pressures and friction losses.
Clogging of filter screen	Filter flushing occurs at 50 kPa pressure differential(PD) across screen	Manufacturers and industry accepted practice recommends that PD set to 50 kPa level. (Removing Solids with Auto Filters – 15th Annual Water Seminar, Houston Texas 2005, Amiad Filtration)	The 50 kPa level is to ensure efficient self cleaning of filters. Higher PD may cause filter cake to stick to screen, cycling of flushing and material being pushed through screen.
Failure to deliver irrigation water as per selected regime	Soil moisture monitoring indicates soil moisture levels at 50% of soil Total Available Water Capacity (TAWC)	Irrigation Engineering by Benami & Ofan, 1984, Chapter 1.2.7 Critical Point (CP) and Manageable Allowable Deficit (MAD)	TAWC is the difference between field capacity and critical Point where plants will no longer draw water from the soil. TAWC is between 30 – 70% of soil moisture depending on soil types. Field Capacity ~ 5-25%, Wilting ~2 & 20% and CP is between these extremes and usually is around 60 centibars (Irrigation 5th Edition, pg 94-96, & Irrometer Co.)
Anemometer used to shut down irrigation under wind conditions	Anemometer shut-off of distribution for wind speed >10 km/h.	Wind speeds > 16 km/hr have a negative affect on the application efficiencies due to wind drift. "Irrigation, 5th Ed. 1983, pg223, pg227	Standard practice is to place sprinklers at 50% of wetted diameter, which still allows good DU for winds from 8 – 16 km/hr
Monitoring mass loading applied to soil as listed in Table 2.2 of NSW Environmental Guidelines, Incl. testing for TDS, EC, SAR, B,	Water component levels which are outside the moderate parameters for Irrigation Manager impact as per Hardie & Hind (1998), (see Table 2.2 in	Hardie & Hind (1998), (see Table 2.2 in NSW Environmental Guidelines)	

Validation of Critical Limits For Bogangar Rugby League Sports Fields			
Critical Control Point	Critical or Operational Limit	Validation	Comments
Chloride, pH, P, Hardness, and Nitrate. Also suggested Ca, Al	NSW Environmental Guidelines)		
Monitoring turf characteristics on a weekly basis	Turf browning off out of season, exposed soil surface, compaction i.e. difficult for shovel to penetrate. EC tests > 2 dS/m require investigation	Hardie & Hind (1998), (see Table 2.2 in NSW Environmental Guidelines)	Browning off may be due to season changes in turf species. Out of character browning off needs investigation into soil compaction, EC, root disease, and fertilizer regime.
Cross Connection to potable supply	When EC exceeds 500 mg/L or 780µS/cm	Australian Drinking Water Guidelines – Physical & Chemical Characteristics, 2004	EC greater than 500 mg/L constitutes less than adequate treatment and or cross connection with poorer quality supply and requires action to correct.

Appendix H OPERATIONAL PROCEDURES FOR CORRECTIVE ACTION

Procedure RW-1 – On Site Recycled Water Supply

Aim

To provide information regarding the management of recycled water flow from the Hastings Point Sewerage Treatment Plant into the Bogangar Rugby League Sports Fields irrigation storage Tank.

Procedure

- It is the responsibility of the Irrigation Manager to ensure that the irrigation storage Tank is kept at desirable levels and that overflow is avoided.
- The Irrigation Manager shall collect the water meter readings collected by the computer. The records shall be totalled each month for comparison with HASTINGS PT. STP records. Significant variations (+ or – 5%) are investigated by the Site Manager and HASTINGS PT. STP and will be filed as an incident report.
- Hastings Point STP will inform Bogangar Rugby Fields if recycled water quality is failing to meet quality assurance specifications. Depending on the seriousness of the quality failure, HASTINGS PT. STP may withhold supply. If supply is continued, the Irrigation Manager will decide if the reduced quality warrants the cessation of irrigation by Bogangar Rugby Fields.
- The Bogangar Rugby Fields will contact Hastings Point STP if they have any concerns about the quality of recycled water available to them.
- Hastings Point STP will make available recycled water quality data to the Bogangar Rugby Fields on request or by prior arrangement.
- If any Critical Control Point is breached a Non-Compliance & Corrective / Preventative Action Report sheet will be raised completed, issued, and a copy filed
- Corrective action to be undertaken, documented, reported, and RWMP amended accordingly. Documents to be handled according to Procedure RW-5.

Environmental

The Bogangar Rugby Fields staff is bound by the General Environmental Duty and as such, any action that negatively affects upon the environment should be avoided.

It is the responsibility of the Site Manager at the Bogangar Rugby Fields to ensure all staff are aware of the General Environmental Duty and acting upon advice from the Irrigation Manager, the Site Manager will decide on action to be taken in the event of an environmental incident related to the above activity.

Procedure RW-2 Recycled Water Storage Tank

Aim

To provide information regarding the management of risk related to the recycled water storage Tanks.

Risks

- Inappropriate recreational activity;
- Algal blooms;
- Odours (low dissolved oxygen)
- Contamination of groundwater

Monitoring, Control & Corrective Action

- The recycled water Storage area is signed at all points of likely public access. The signs read:-
    - "Recycled Water
    - Do Not Drink
    - Suitable only for Irrigation
    - For further information contact Hastings Point STP" on Ph:

- It is the responsibility of the Irrigation Manager to ensure that the signage is maintained at all times. Signage control is critical, as it is a major risk mitigation tool in the Recycled Water Safety Plan.
- The risk of incidental exposure of patrons and visitors to the recycled water is minimised. The Bogangar Rugby Fields are not fenced but does have scrub / bush buffer zones and a lockable boom gate at the entrance.
- All staff, guests and visitors are informed that as a precaution, contact with recycled water should be minimised and exposed skin should be washed. The Irrigation Manager is responsible for ensuring the awareness of staff regarding this advice.
- The Irrigation manager and staff will inspect the recycled water storages regularly and any person observing an unusual colour, odour or appearance to the recycled water will bring this to the attention of the Site Manager.
- In the event of an algal bloom, the Irrigation Manager will report to the site manager who reports to the Hastings Point Operations Engineer to determine the action necessary to control the bloom. The dominant algae should be identified and toxicity testing undertaken if appropriate. If the algal bloom is expected to be protracted then harvesting of the algae or the addition of an algaecide will be considered.
- Recycled water with low dissolved oxygen is prone to producing offensive odours as the fermentation process progresses. At the Bogangar Rugby Fields the Irrigation Manager will ensure that turnover of storage is maintained to ensure oxygen levels are sufficient to avoid fermentation. If treatment is required, Irrigation manager is to report to the Site manager to communicate it to Operation Engineer hasting Point STP. Suitable equipment is to be organized and will be operated daily for as long as is needed to remove the anaerobic conditions.
- In an overflow or leakage occurs, the Irrigation manager closes the sluice valve supplying the Tank and organises rectification of the problem. When the system is reinstated, the Irrigation manager shall issue a report to Site manager who reports to HASTINGS PT. STP and Site Manager files copies with the RWMP documents.
- If patrons or trespassers behave inappropriately at the Tank or in surrounds, they should be advised to wash the affected area. The Police and HASTINGS PT. STP should also be advised.
- If any Critical Control level is breached a Non-Compliance & Corrective / Preventative Action Report sheet will be raised completed, issued, and a copy filed.

- Corrective action to be undertaken, documented, reported, and RWMP amended accordingly. Documents to be handled according to Procedure RW-5.

Auditing

Qualified staff from Hastings Point STP may audit this procedure from time to time. In auditing the procedure, evidence of compliance will be sought wherever possible.

Procedure RW-3 Recycled Water Irrigation Pump Station

Aim

To provide information regarding the management of risk at the pump stations.

Background
The pump stations contain pumps, pump start panels, filters and ancillary equipment.

Risks

- Overflow from filter and flush / cleaning facility;
- Leakage from pumps or filters draining to ground creating puddles ;
- Pipe leakage or blow outs caused by excessive pressure control in the pump station.

Monitoring, Control and Correction Action

- The recycled water pumping stations are signed. The sign reads:-
    - "RECYCLED WATER
    - Do Not Drink
    - Suitable only for Irrigation
    - For further information contact Hastings Point STP"Ph:
- It is the responsibility of the Irrigation Manager to ensure that the signage is maintained at all times. Signage control is CRITICAL, as it is a major risk mitigation tool in the Recycled Water Management Plan.
- All staff are informed that as a precaution, incidental contact with recycled water should be minimised and exposed skin should be washed immediately. The Irrigation Manager is responsible for ensuring the awareness of staff regarding this advice.
- The Bogangar Rugby Fields Irrigation Technician and / or maintenance staff shall inspect the pump station pipe work, clean or repair filter and/or self-cleaning mechanism at least monthly and report any observed leakage or damage to the Irrigation manager. In the event of a serious leak in irrigation pipes, a low-pressure sensor shuts down the pumps. An excessive pressure occurrence also shuts down the pumps.
- If any Critical Control Point is breached a Non-Compliance & Corrective / Preventative Action Report sheet will be raised completed, issued, and a copy filed.
- Corrective action to be undertaken, documented, reported, and RWMP amended accordingly. Documents to be handled according to Procedure RW-5.

Procedure RW-4 - Control of Recycled Water Irrigation

Aim

To provide information regarding the management of risk from the distribution of recycled water by the irrigation system.

Background

The irrigation system pumps water from the irrigation storage Tank. The irrigation system is to be operated on the sports field and immediate areas around the fields by a Toro Scorpio upgraded controller. There is no connection to the potable supply with the recycled water irrigation system. The distribution of the recycled water carries with it numerous hazards the most obvious and acute of which is the presence of pathogens. As stated in other procedures, recycled water can contain pathogens. It is not possible to know the amounts or types of pathogens that may be present at any given time and for that reason, recycled water is always regarded as containing significant amounts of pathogens.

Recycled Water Distribution Risks

- Staff may be exposed to recycled water through direct contact, accidental ingestion, handling recycled water contaminated objects, or through the inhalation of aerosols.
- Surrounding water bodies may be polluted by excessive runoff created by inappropriate irrigation practices or water movement from any underground aquifer.
- Ponding of recycled water may occur in certain areas.
- There may be leakage of recycled water from the irrigation system pipe work.
- There is the possibility that an intended potable supply line will be accidentally connected to the recycled water distribution system.
- There is the possibility that the continued use of recycled water may have an adverse impact on soil condition or plant life (e.g. salinity or pH problems).
- New risks will emerge over time and/or a present risk may have been overlooked.

Monitoring, Control and Corrective Action

Monitoring control and corrective action will be addressed in order of the risk appearing above:-

- Irrigation with recycled water occurs late evening and very early in the morning. The Bogangar Rugby Fields staff arrive after the system has operated and are not able to observe the system in operation and any obvious risks. In order to see any obvious issues with the irrigation system, the irrigation manager is to check controller reporting and to test the system monthly. There is signage throughout the grounds advising that reclaimed water is in use. Signage should include extensive use of lilac colouring (the international standard for recycled water), location and placement shall be as follows:-

Sign Location	Sign/Position/Spacing	Unit
Vehicle access to southern gate	A prominently positioned sign	each
Pedestrian entry areas	Every 75	metres
Extents of the Irrigated areas	Every 75	metres
Pedestrian entry/access to site	A prominently positioned sign	each
Recycled water storage areas	A prominently positioned sign	each
Recycled water pump stations	A prominently positioned sign	each

The signs read as follows:-

- "RECYCLED WATER
- Do Not Drink
- Suitable only for Irrigation
- For further information contact Hastings Point STP (provide phone numbers)".

The signs shall be maintained by Bogangar Rugby Fields maintenance staff and located so that workers and visitors can easily see them. The Irrigation Manager holds a plan of where all signs are located and these signs will be checked for presence and condition at least monthly. The Irrigation Manager shall ensure that staff receives timely awareness training regarding safe practices in recycled water reuse facilities. Training details will be noted on the employees file.

Usage in windy conditions is automatically managed or avoided. Buffer zones of the Irrigated area will be inspected at least monthly to ensure the risk of exposure to outside parties has not increased. Staff directly involved in operating and maintaining the irrigation system attend risk minimization sessions including any Training Program organized by Hastings Point STP or TSC, at least yearly. New staff will be initiated with such training before commencing duty.

- In order to minimise the ponding of recycled water, the Irrigation Manager ensures that all sprinkler heads are positioned to minimise the possibility of ponding. Sprinkler run times are set to avoid saturation and subsequent ponding. Sprinkler delivery rates do not exceed the ability of the soil to absorb the recycled water. Irrigation with recycled water does not occur when rainfall is imminent or during rain events. The irrigation program is then rescheduled to suit the site. Tweed Shire Council monitors the condition of surrounding waterways and has the responsibility to investigate elevated nutrient levels or changes in the biological profile of waterways.
- From time to time, the irrigation pipelines may leak and it is important to detect and repair any leak as soon as possible, i.e. within 24 hours of reporting. The controller irrigation is linked to a water meter and it can report abnormal flows, which will trigger an alarm. Visitors can also bring leakage events to the attention of staff.
- Potable water supplied to the Bogangar Rugby Fields is naturally low in conductivity. Hastings Point STP recycled water on the other hand usually has a conductivity of more than approximately 1000 microsiemens. This difference will be exploited to control the risk of accidental connection of lines (intended for potable supply) to the recycled water irrigation system. Any plumbing connection work to be carried out at the Bogangar Rugby Fields must be carried out by a licensed plumber and receive the approval of the Site Manager. The Irrigation Manager will require that a sample of the feed supply be tested for conductivity prior to connection and the new supply tested for conductivity immediately after connection. The connection event will be recorded. Any potable system yielding conductivity generally greater than 780 micro-siemens must be viewed with suspicion, isolated and an investigation carried out. As a further precaution, routine conductivity tests of the potable supply will be carried out every quarter and the results kept by the Irrigation manager. All new lines and fittings carrying recycled water must be colour coded (lilac is the standard colour) and have written identification. Existing equipment shall be colour coded wherever possible i.e. paint valve box lids.
- The long-term use of recycled water, may damage turf over time. To reduce the risk of damage, pH shall be monitored regularly. The Irrigation Manager will arrange for six monthly soil conductivity tests to be carried out. The results of such tests will be considered and the recycled water regime modified if necessary. Recycled water conductivity and ion concentration data is to be made available from Hastings Point STP and this information will assist in predicting and possibly avoiding adverse impacts.
- This recycled water safety plan is subject to audit from time to time. The results of these audits will be made available to the Irrigation Manager who will examine the reports to act upon overlooked or emerging risks. Hastings Point STP will advise the Bogangar Rugby Fields of any risks it considers are not dealt with sufficiently and both the Irrigation Manager and the Site Manager will meet at least yearly to discuss the performance of the recycled water system and review any changes in industry best practice.
    - If any Critical Control level is breached a Non-Compliance & Corrective / Preventative Action Report sheet will be raised completed, issued, and a copy filed

- Corrective action to be undertaken, documented, reported, and RWMP amended accordingly. Documents to be handled according to Procedure RW-5.

Roles and Responsibilities

It is the responsibility of the Site Manager to ensure that all staff receives training regarding safe practices in the presence of a reclaimed water system and that the organisation complies with its General Environmental Duty. It is the responsibility of the Irrigation Manager to ensure that ground staff are properly trained and qualified for their individual tasks and that the risk mitigations listed above are carried out.

Auditing

Qualified Hastings Point STP staff may audit this procedure from time to time and evaluate the results of such an audit. Any person auditing this section of the Recycled Water Safety Plan shall inspect signage and wherever possible seek tangible evidence that each of the risk mitigation strategies listed above are being carried out.

Procedure recycled water 5 – Document Control

Aim

This procedure provides information regarding the control of the Safety Management Plan document (RWMP) and to prevent confusion regarding current risk management procedures.

Risks

Confusion by management or staff in locating and identifying all the current RWMP information.

The information will include-

1. A hard (paper) copy of the RWMP. This will show on the front page an information box showing the issue number and the issue date.
2. A CD containing the RWMP and associated reports in pdf and doc files.
3. Manila folders containing:-
    - Non-Compliance & Corrective / Preventative Action Report sheets (sample attached);
    - Community complaints;
    - Maintenance Checklists etc.
    - Other reports

    These files are scanned and filed in the RWMP's CD.

Procedure

1. It is the responsibility of the Irrigation Manager to add or amend procedures to the (RWMP) made necessary by increases or changes to any risks associated with the use of recycled water.
2. the RWMP contains a page entitled "Document Control" with provision for identifying:-
    - Who prepared it, name title and signature;
    - Who approved it, name title and signature;
    - the revision data;
    - the issue number;
    - A description of the amendment.
3. When the document is first issued, it will be in hard (paper) copy, electronic format saved as both pdf, and doc files on a CD (labelled RWMP) as Issue No. 1.
4. Each time the RWMP is updated the Irrigation Manager shall be responsible for updating the Document Control page and issuing the updated document. The amended RWMP shall also be added to the RWMP CD in pdf and doc format, saved, and dated as the appropriate issue number.
5. When a new issue of the RWMP is issued, hard copies of previous issues shall be collected and destroyed.
6. If any Critical Control Point is breached a Non-Compliance & Corrective / Preventative Action Report sheet will be raised completed, issued, and a copy filed.

7. Corrective action to be undertaken, documented, reported, and RWMP amended accordingly. Documents to be handled according to this Procedure RW-5.

Roles and Responsibilities

The Irrigation Manager shall be responsible for the maintenance of RWMP and any amendments to it subject to the approval of the Site Manager.

Qualified staff from Hastings Point STP may audit this procedure from time to time. In auditing the procedure, evidence of compliance will be sought wherever possible.

APPENDIX I GROUNDWATER QUALITY MONITORING

BOGANGAR RECYCLED WATER REUSE SCHEME

TWEED SHIRE COUNCIL

GROUNDWATER QUALITY MONITORING

REVISION: 1.0 | **PROJECT NUMBER:** A1055100
OUR REFERENCE: Groundwater Quality Monitoring

Bogangar Groundwater Quality Monitoring

Tweed Shire Council engaged MWH to conduct water quality monitoring as part of the Bogangar Recycled Water Reuse Scheme.

Objectives

Primary Objective

To gather groundwater water quality data prior to the application of recycled water by irrigation to establish benchmark groundwater quality.

Secondary Objective

To gather information that will underpin the risk assessment process and provide a basis for assessing potential impacts of the use of recycled water on the environment and/or public health risks.

- To analyse results and provide verification that groundwater quality conditions prior to the application of recycled water by irrigation are in accordance with relevant environmental and public health guideline values;
- To provide sufficient supporting data to determine, with an acceptable level of confidence, the contamination status of the site relative to indicative guideline values; and
- To provide subsequent monitoring recommendations.

Methodology

The following guidelines were used to develop this water quality monitoring methodology:

- NSW Department of Environment and Conservation (2004) *Environmental Guidelines: Use of Effluent by Irrigation*
- NSW Department of Environment and Conservation (2005) *Marine Water Quality Objectives for NSW Ocean Waters*
- National Resource Management Ministerial Council, Environmental Protection and Heritage Council, and Australian Health Ministers Conference (2006) *National Water Quality Management Strategy: Australian Guidelines for Water Recycling – Managing Health and Environmental Risks (Phase 1)*
- ANZECC The Australian and New Zealand Environment Conservation Council *(2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality*
- AS/NZS 5667.11: *Water Quality Sampling Guidance on Sampling of Groundwater*
- AS/NZS 5667.1:1998 Water Quality – Sampling Part 1: *Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples*

Location

Two water quality monitoring bores were installed, one up gradient and one down gradient of the site, by Butler Partners Pty Ltd on the 27th August 2007. Well installation and development was based upon the ARMCANZ (2003) Minimum Construction Requirements for Water Bores in Australia. A bore licence for the installation of the wells was issued by NSW Department of Water and Energy on 2nd August 2007 and bore logs were forwarded to NSW DNR to complete licence requirements.

A site plan of well locations and bore reports including a detailed summary of the wells construction and development are documented in Appendix A of this Groundwater Quality Monitoring document.

Sample Collection

As illustrated in Appendix A of the document, water quality samples were collected from monitoring bores 1 and 2.

The following sampling methodology was used:

- Prior to sample collection the bore was purged to ensure that all stagnant water was removed. Bore purging was conducted in accordance with Groundwater Monitoring, Waterwatch Australia Technical Manual, 2005 and the AS/NZS 5667.11: Water Quality Sampling Guidance on Sampling of Groundwater.
- Sample collection was conducted in accordance with AS/NZS 5667.11: Water Quality Sampling Guidance on Sampling of Groundwater.
- Each well has its own disposable PVC 1 L bailer which was thoroughly cleaned and rinsed between each sample.
- Sample bottles were provided from the Tweed Laboratory Centre consisting of 2 x 220 ml bacterial analysis bottles and 2 x 1 L bottles.
- Two water samples were collected at each well consisting of 1 x 220 ml bacterial analysis bottle and 1 x 1 L bottle.
- Bottles were sealed, labelled with a unique identifier and placed into chilled receptacles for transportation to the laboratory under standard chain of custody protocol.
- Samples were delivered directly to the laboratory within four hours of sampling.

Laboratory Analysis

Laboratory analysis was undertaken by Tweed Laboratory Centre, 46 Enterprise Avenue, Tweed Heads South, NSW. Tweed Laboratory Centre is a NATA accredited laboratory.

Target Criteria / Critical Limits

Due to the site's proximity to the Pacific Ocean and the topography of the land, the Pacific Ocean is the appropriate endpoint for groundwater. Marine water quality objectives from the *Marine Water Quality Objectives for NSW Ocean Waters (DEC 2005)* and indicative guideline levels from the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)* were used to provide a point of reference for establishing the groundwater baseline data. Where indicative guideline levels were not available under the ANZECC 2000 guidelines then the NSW Environmental Guidelines: Use of Effluent 2004 levels were used.

Indicative guideline levels with a 95% level of protection value were used from the ANZECC 2000 Guidelines as the use of the statistically based 95% protection provides a more defensible basis for decisions than use of assessment factors alone. In addition, the 95% protection level is most commonly applied in the ANZECC 2000 Guidelines to ecosystems that could be classified as slightly too moderately disturbed. Due to the disturbed nature of the site, the area generally corresponds with the slightly too moderately disturbed classification as outline in the guidelines.

Constituents

Table 1. Constituents

Constituents	Indicative Guideline Levels	Reference
Dissolved major anions		
Nitrite	-	-
Nitrate	ID[1]	Table 3.4.1[2]
Sulfate	-	-
Chloride	-	-
Fluoride	-	-
Bromide	-	-
Alkalinity	-	-

[1] Insufficient data to derive a reliable trigger value (ANZECC 2000)
[2] Table 3.4.1 Toxicant values for toxicants at alternative levels of protection - Trigger values for marine water (μgL^{-1})[2] Level of protection 95% species[2] (ANZECC 2000)

Constituents	Indicative Guideline Levels	Reference
Total metals		
Iron	ID	Table 3.4.1
Dissolved metals		
Aluminium pH >6.5 pH <6.5	ID	Table 3.4.1
Arsenic - total	ID	Table 3.4.1
Cadmium	5.5 µg/L (B[3]C[4])	Table 3.4.1
Chromium - total	-	-
Copper	1.3 µg/L	Table 3.4.1
Lead	4.4 µg/L	Table 3.4.1
Manganese	ID	Table 3.4.1
Nickel	70 µg/L (C)	Table 3.4.1
Zinc	15 µg/L (C)	Table 3.4.1
Total Mercury Mercury - total Inorganic Methyl	 - 0.4 µg/L (C) ID	 - Table 3.4.1 Table 3.4.1
Ammonia as N Ammonia[5]	 910 µg/L	 Table 3.4.1
Total Nitrogen	120 µgNL^{-1}	Table 3.3.2[6]
Nitrite plus Nitrate as NO_x	5 µgNL^{-1} ([K7])	Table 3.3.2
Total Phosphorus as P	25 µg L^{-1} (N[8])	Table 3.3.2
Biochemical Oxygen Demand (BOD) Municipal uncontrolled access[9] Municipal control access Agricultural non-food (turf)	 ≤2 NTU - -	Table A1[10]
Faecal coliforms	150/100 mL	Table Marine WQO[11]
Electrical conductivity (dS/m)	-	-
pH Lower limit Upper limit	 6.5 8.5	 Table 3.3.2 Table 3.3.2
SAR (mg/L) Sodium Calcium Magnesium	 - - -	 - - -
Potassium	-	-

[3] B = Chemicals for which bioaccumulation and secondary poisoning effects should be considered (ANZECC 2000)

[4] C = Figure may not protect key test species from acute toxicity (and chronic) (ANZECC 2000)

[5] Ammonia as TOTAL ammonia as [NH_3-N] at pH 8 (ANZECC 2000)

[6] Table 3.3.2 Default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems[6] (ANZECC 2000)

[7] K = values of 25 ugL^{-1} for NO_x and 20 ugL^{-1} for NH_4^+ for NSW are elevated due to frequent upwelling events (ANZECC 2000)

[8] Values are 20 ugL^{-1} for TP for offshore waters (ANZECC 2000)

[9] Limit met prior to disinfection. 24 hour mean value. 5 NTU maximum value not to be exceeded (Environmental Guidelines: Use of Effluent by Irrigation, NSW 2004)

[10] Table A1: Guidelines for treatment, disinfection and irrigation controls for the spray application of municipal sewage effluent (Environmental Guidelines: Use of Effluent by Irrigation, NSW 2004)

[11] Table: Primary Contact Recreation - Marine Water Quality Objectives for NSW Ocean Waters (DEC 2005)

Results

Groundwater samples were taken from the bores and submitted for testing and reference should be made to the detailed results included in Appendix B. Table 2. compares the results against trigger levels.

Table 2. Comparison of results against trigger levels

				Results	
Test	Method	Trigger levels	Reference	BH-1	BH-2
Faecal coliforms (membrane presumptive) cfu/100mL	B1	150/100 mL	WQO	<10	<10
pH (pH units)	P1	6.5 – 8.5	Table 3.3.2	5.4	5.4
BOD_5 mg/L	C1	≤ 2 NTU	Table A1	2.4	1.0
Conductivity @ 25ºC μScm^{-1}	P2	-	-	82	178
Sodium Absorption Ratio				1.2	1.0
Sodium mg/L	M8	-	-	12	15
Calcium mg/L	M8	-	-	3.8	9.5
Magnesium mg/L	M8	-	-	2.1	4.6
Potassium mg/L	M8	-	-	<5	<5
Nitrite – N mg/L	C4	ID	Table 3.4.1	<0.05	<0.05
Nitrate – N mg/L	C4	5 μgNL^{-1}	Table 3.4.1	0.09 (90 μgNL^{-1})	1.93 (1930 μgNL^{-1})
Sulphate mg/L	M8	-	-	5.9	32.3
Chloride mg/L	C24	-	-	14.7	25.9
Fluoride mg/L	C36	-	-	<0.1	<0.1
Total Phosphorus – P mg/L	C17	25 $\mu g\ L^{-1}$	Table 3.3.2	0.79 (790µg/L)	0.08 (80µg/L)
Bromide mg/L	M8	-	-	0.05	0.04
Alkalinity mg/L as CaCO3	C10	-	-	13	11
Iron (total) mg/L	M8	ID	Table 3.4.1	3.40	1.31
Aluminium (soluble) mg/L	M8	ID	Table 3.4.1	1.79	1.43

				Results	
Test	Method	Trigger levels	Reference	BH-1	BH-2
Arsenic (soluble) mg/L	M8	ID	Table 3.4.1	<0.005	<0.005
Cadmium (soluble) mg/L	M7	5.5 µg/L	Table 3.4.1	<0.001 (<1 µg/L)	<0.001 (<1 µg/L)
Chromium (soluble) mg/L	M8	-	-	<0.01	<0.01
Copper (soluble) mg/L	M7	1.3 µg/L	Table 3.4.1	0.002 (2 µg/L)	<0.001(<1 µg/L)
Lead (soluble) mg/L	M7	4.4 µg/L	Table 3.4.1	<0.001(<1 µg/L)	<0.001(<1 µg/L)
Manganese (soluble) mg/L	M8	ID	Table 3.4.1	0.02	0.02
Nickel (soluble) mg/L	M8	70 µg/L (C)	Table 3.4.1	<0.01 (<10 µg/L)	0.01 (10 µg/L)
Zinc (soluble) mg/L	M8	15 µg/L (C)	Table 3.4.1	0.09 (90 µg/L)	0.03 (30 µg/L)
Ammonia – N mg/L	C3	910 µg/L	Table 3.4.1	0.08 (800 µg/L)	0.28 (280 µg/L)
Total – N mg/L	C55	120 μgNL^{-1}	Table 3.3.2	3.99 (3990 μgNL^{-1})	3.07 (3070 μgNL^{-1})
Nitrogen – oxidised mg/L	C4	5 μgNL^{-1}	Table 3.3.2	0.086 (86 μgNL^{-1})	1.929 (1929 μgNL^{-1})

Discussion

Results for seven indicators exceeded The Australian and New Zealand Environment Conservation Council, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)* guideline trigger values. The laboratory results and discussion are contained within Appendix I of this report. These were biological oxygen demand (BOD) and copper in BH1 and pH, zinc, total phosphorus, total nitrogen and oxidized nitrogen in both BH1 and BH2.

The elevated levels of copper and zinc may be a result of stormwater runoff entering the groundwater system. There are a number of reasons why the groundwater results are elevated for both nitrogen and phosphorus. Excess fertilizer may have been applied to the rugby field or through nearby agricultural practices which could have leached through to the groundwater. There is a possibility that the existing treatment plant outfall in the sand dunes approximately 500 m south of the site may be affecting the groundwater system.

While the total nitrogen levels are only marginally higher than the estuarine or lowland river trigger levels in ANZECC (2000), they are substantially higher than the marine trigger values.

BOD is only slightly above the trigger level in BH1 and may be related to catchment land-use practices.

Recommendations

The following strategies are recommended to ensure the long term viability of recycled water irrigation at the site:

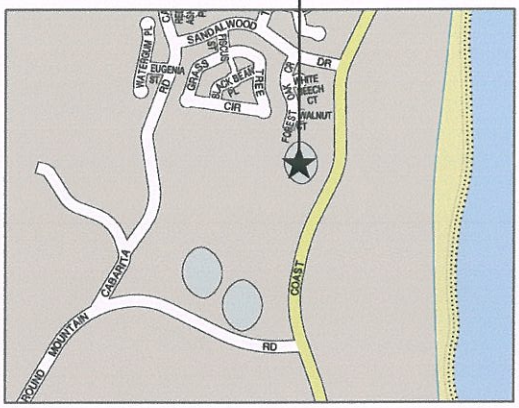
- Regular water quality sampling (at least bi-annually);
- Ensuring that grass clippings are removed after mowing. These clippings may return N and P to the soil over the long term. If these clippings are not able to be removed from the site, then we recommend a regular soil sampling and monitoring program (every 3-5 years) is recommended to ensure accumulations of N and P in the soil do not exceed guideline levels; and
- Ensure application rates are sustainable. At 10ML/annum and 20ML/annum, the modelling indicates that very low amounts of nutrient will enter groundwaters. Water movement may be restricted at depth in the soil profile due to the presence of coffee rock and excessive irrigation amounts may cause water tables to rise if permeability is restricted. In any case, regular monitoring of groundwater bore water levels and laboratory analysis of parameters such as nutrients, heavy metals, Ec and pH will be required to determine long term recycled water irrigation sustainability.

The implementation of the Recycled Water Management Plan for the site and its continual review and improvements provide a mechanism for managing and minimising risk over the site. In particular, the minimisation of over irrigation and ensuring that application rates are sustainable in the short and long term.

APPENDIX A

GROUNDWATER QUALITY MONITORING WELL LOCATIONS, INSTALLATION AND BORE LOGS

SITE



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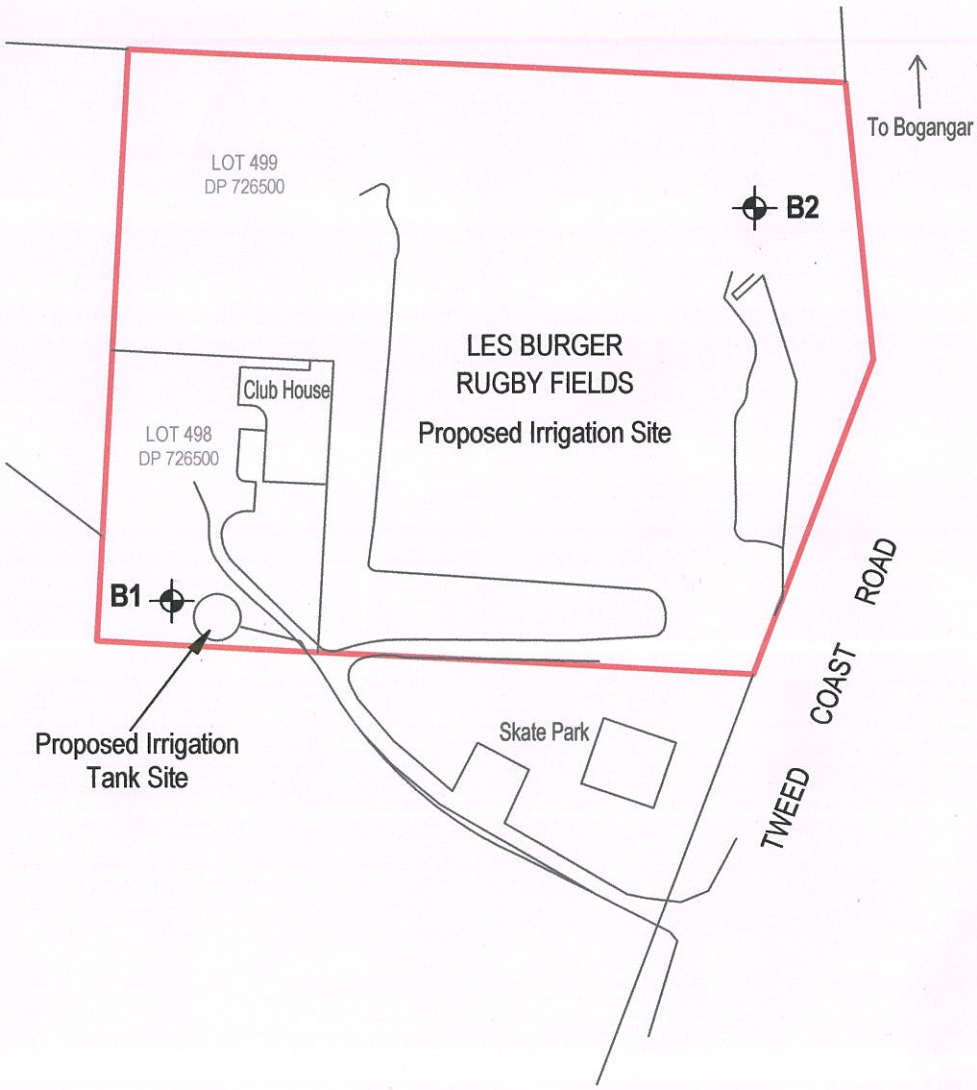
UBD Reference: Map O Ref F11 (51st Edition) N.T.S.

LEGEND

GW1 Groundwater Well

Site Boundary



Reference: MWH's 'Project Site Plan', Drawing No.WT06031/03, dated 20.01.07

ACEA

CLIENT:

MWH AUSTRALIA PTY LTD

BUTLER PARTNERS

79 Doggett Street, Newstead
Queensland 4006 Australia
Telephone 61 7 3852 3800
Facsimilie 61 7 3852 3808

LES BURGER RUGBY FIELDS

TWEED COAST ROAD, BOGANGAR

LOCALITY PLAN AND TEST LOCATIONS

NORTH

0 50 100m

SCALE: 1:2500 (A4)

DATE: SEPTEMBER 2007

DRAWN BY: FD

APPROVED:

PROJECT No: 07182

DRAWING No: 1 REV: A

BORE REPORT

BUTLER PARTNERS

Client: MWH Australia Pty Ltd
Project: Well Monitoring Installation
Location: Les Burger Rugby League Fields, Bogangar
Project No: 07182

BORE 2 - Groundwater

Page No: 1 of 1
Date: 27 August 2007
Ground Surface Level:

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Sample ID	Test Results	Groundwater Bore Details
0	***SAND (SW)*** - dark grey-black, fine grained, dry	0.0						Lock Cover, Concrete, Sand
1	- light-grey, fine grained, moist	-1.0						Blank
2		-2.0						Bentonite
3	- dark brown, fine grained, moist	-3.0						
4		-4.0						Sand
5	- white with black mottling, fine grained, wet	-5.0						
6	***SANDY CLAY (SC)*** - dark brown, fine to medium grained (indurated sand), dry	-6.0						
7	***SANDY CLAY (SC)*** - dark brown, fine grained, moist	-7.0						Slotted 50mm PVC screen
8		-8.0						
9	End of Bore at 9 m	-9.0						End Cap
10		-10.0						

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: EZE-CAT Track Mounted
Drilling Method: 100mm solid flight auger, 200mm hollow flight auger
Groundwater: Groundwater encountered at 2.6m in sand to 5.2m.
Remarks:

BORE REPORT

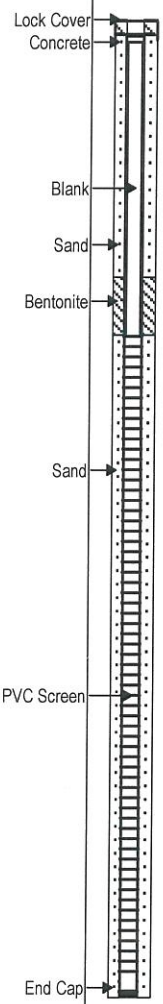
BUTLER PARTNERS

Client: MWH Australia Pty Ltd
Project: Monitoring Well Installation
Location: Les Burger Rugby League Fields, Bogangar.
Project No: 07182

BORE 1 - Groundwater

Page No: 1 of 1
Date: 27 & 28 August 2007
Ground Surface Level:

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Sample ID	Test Results	Groundwater Bore Details
0		0.0						
	SAND (SW) - white, fine grained, dry to moist							
1		-1.0						
2		-2.0						
						2.3		
						2.8		
3	- white, fine grained, moist	-3.0						
4		-4.0						
5	***SANDY CLAY (SC)*** - dark brown, fine to medium grained	-5.0						
	- weathered coffey rock (indurated sand)							
6		-6.0						
7		-7.0						
8		-8.0						
9	End of Bore at 9 m	-9.0						
10		-10.0						



D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: EZE-CAT Track Mounted
Drilling Method: 100 mmm soild flight auger, 200 mm hollow flight auger
Groundwater: Groundwater encountered at 3.0m in sand to 5.6m.
Remarks:

Department of Water and Energy

North Coast Region
Locked Bag 10

Grafton NSW 2460
Phone: (02) 66416500

BORE LICENSE CERTIFICATE
UNDER SECTION 115 OF THE WATER ACT, 1912

30BL184759

New South Wales Government

Tweed Shire Council
P O Box 816
Murwillumbah NSW 2484

LICENSE NUMBER
30BL184759
DATE LICENSE VALID FROM
02-Aug-2007
DATE LICENSE VALID TO
PERPETUITY
FEE
$0.00

ABN 27380445450 GST NIL

LOCATION OF WORKS

Portion(s) or Lot/Section/DP	PARISH	COUNTY
498//726500	Cudgen	Rous

TYPE OF WORKS	PURPOSE(S) FOR WHICH WATER MAY BE USED
Bore	Monitoring Bore

CONDITIONS APPLYING TO THIS LICENSE ARE

As shown on the attached Condition Statement

ORIGINAL

Department of Water and Energy

North Coast Region
Locked Bag 10

Grafton NSW 2460
Phone: (02) 66416500

BORE LICENSE CERTIFICATE
UNDER SECTION 115 OF THE WATER ACT, 1912

30BL184758

New South Wales Government

Tweed Shire Council
P O Box 816
Murwillumbah NSW 2484

LICENSE NUMBER
30BL184758
DATE LICENSE VALID FROM
02-Aug-2007
DATE LICENSE VALID TO
PERPETUITY
FEE
$0.00

ABN 27380445450 GST NIL

LOCATION OF WORKS

Portion(s) or Lot/Section/DP	PARISH	COUNTY
499//726500	Cudgen	Rous

TYPE OF WORKS	PURPOSE(S) FOR WHICH WATER MAY BE USED
Bore	Monitoring Bore

CONDITIONS APPLYING TO THIS LICENSE ARE

As shown on the attached Condition Statement

ORIGINAL

APPENDIX B

LABORATORY RESULTS

TWEED LABORATORY CENTRE

A COMMERCIAL UNIT OF THE TWEED SHIRE COUNCIL ABN 90 178 732 496

46 Enterprise Avenue,
Tweed Heads South NSW 2486.
Phone (07) 5569 3100
Fax (07) 5524 2676

All correspondence:
Tweed Shire Council
PO Box 816
Murwillumbah NSW 2484

LABORATORY REPORT

Lab No: 9890-sw
LIMs No: 07/0771

Client: MWH Australia Pty Ltd
Address: Suite 4
60 Nerang Street
NERANG
Q'LD 4211

Attention: Brigita Arrowsmith
Fax No: 07 5578 4295
Email: Brigita.arrowsmith@mwhglobal.com
Job No: D3550.4626.30000

Sample Description: Hastings Point Recycled Water Study.

Taken By: Client
Date Taken: 04/09/2007
Date Received: 04/09/2007
Date Testing Commenced: 04/09/2007
Date Testing Completed: 05/09/2007

			Results	
Test	**Units**	**Method**	**BH-1**	**BH-2**
Faecal coliforms (membrane presumptive)	**cfu/100mL**	**B1**	<10	<10

Results refer to samples as received at the Laboratory.
All pages of this Report have been checked and approved.

NATA ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025.
Accreditation No: 13538

Dr PJ Wright
(Senior Technical Officer)

Date of Report: 11 September 2007

TWEED LABORATORY CENTRE
A COMMERCIAL UNIT OF THE TWEED SHIRE COUNCIL ABN 90 178 732 496

46 Enterprise Avenue,
Tweed Heads South NSW 2486.
Phone (07) 5569 3100
Fax (07) 5524 2676

All correspondence:
Tweed Shire Council
PO Box 816
Murwillumbah NSW 2484

LABORATORY REPORT

Lab No: 9890-sw
LIMs No: 07/0771

Client: MWH Australia Pty Ltd
Address: Suite 4
60 Nerang Street
NERANG
Q'LD 4211

Attention: Brigita Arrowsmith
Fax No: 07 5578 4295
Email: Brigita.arrowsmith@mwhglobal.com
Job No: D3550.4626.30000

Sample Description: Hastings Point Recycled Water Study.

Taken By: Client
Date Taken: 04/09/2007
Date Received: 04/09/2007
Date Testing Commenced: 04/09/2007
Date Testing Completed: 11/09/2007

		Results	
Test	**Method**	**BH-1**	**BH-2**
pH (pH units)	**P1**	5.4	5.4
BOD_5 mg/L	**C1**	2.4	1.0
Conductivity @ 25°C μScm^{-1}	**P2**	82	178
Sodium Absorption Ratio	**--**	1.2	1.0
Sodium mg/L	**M8**	12	15
Calcium mg/L	**M8**	3.8	9.5
Magnesium mg/L	**M8**	2.1	4.6
Potassium mg/L	**M8**	<5	<5
Nitrite – N mg/L	**C4**	<0.05	<0.05
Nitrate – N mg/L	**C4**	0.09	1.93
Sulphate mg/L	**M8**	5.9	32.3
Chloride mg/L	**C24**	14.7	25.9
Fluoride mg/L	**C36**	<0.1	<0.1
Total Phosphorus – P mg/L	**C17**	0.79	0.08

NATA ACCREDITED FOR TECHNICAL COMPETENCE

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Accreditation No: 12754

Edward Dickson
(Laboratory Coordinator)

Date of Report: 14 September 2007

LABORATORY REPORT

		Results	
Test	**Method**	**BH-1**	**BH-2**
Bromide mg/L	**M8**	0.05	0.04
Alkalinity mg/L as $CaCO_3$	**C10**	13	11
Iron (total) mg/L	**M8**	3.40	1.31
Aluminium (soluble) mg/L	**M8**	1.79	1.43
Arsenic (soluble) mg/L	**M8**	<0.005	<0.005
Cadmium (soluble) mg/L	**M7**	<0.001	<0.001
Chromium (soluble) mg/L	**M8**	<0.01	<0.01
Copper (soluble) mg/L	**M7**	0.002	<0.001
Lead (soluble) mg/L	**M7**	<0.001	<0.001
Manganese (soluble) mg/L	**M8**	0.02	0.02
Nickel (soluble) mg/L	**M8**	<0.01	0.01
Zinc (soluble) mg/L	**M8**	0.09	0.03
Ammonia – N mg/L	**C3**	0.08	0.28
Total – N mg/L	**C55**	3.99	3.07
Nitrogen – oxidised mg/L	**C4**	0.086	1.929

Results refer to samples as received at the Laboratory.
All pages of this Report have been checked and approved.

This Report replaces the Report issued 11 September 2007 (pH results now included).

Edward Dickson
(Laboratory Coordinator)

Date of Report: 14 September 2007