Drinking Water Quality Improvement Plan - Northern Region

Site	Improvement #	Process Step	Issue	Description	Origin of Improvement	Significant Risk	Responsibility	Due for completion	Completed (Y/N)?	Risk Treatment Comments
TDY : Dayboro WTP	DAY1	Bank Filtration	Contamination incident - Intentional contamination - Accidental contamination	An incident involving an elevated risk presented to the wells, such as cattle or ferral animals becoming entrained in the well areas introducing significantly extra faecal load to the surface surrounding the wells occuring and entering the wells via runoff.	Risk Assessment	Medium (8)	Source Protection Planning Unit	30/06/2021	N	Investigate all plant's pathogen reduction requirements (for crypto and viruses) and identify shortcomings with current treatment processes and develop priority list.
TEM : Ewen Maddock WTP	EWM1 EWM2	Intermediate Ozone / BAC	Contamination of BAC from external sources	Introduction of pathogens	Risk Assessment	Medium (8)	Operations - Supply	29/06/2020	N	Erect contamination signage on/at the BAC filters. Work instructions for working over the BAC should also consider the risk of accidental contamination (e.g. from a boot) Investigate further prevention of post barrier contamination to the top of the BAC filters (such as ingress, animals, etc). Covering BACs completely is challenging because of the residual ozone present in the atmosphere. Ozone is heavier than air and invisible to the eye. People and animals can become intoxicated quickly if there is too much ozone in the air. However, there is a potential for contamination of the water on top of the BAC filters (water that has just been ozonated). BAC filters do not provide any log reduction credits for protozoa and as such effectively, anything that contaminates the ozonated water prior to BAC filtration could potentially make its way through to the treated water and the public. There are no further barriers to protozoan. Chlorine disinfection does not get any impact on protozoan parasites. Therefore it is imperitive to - ensure there is no ingress points to the ozonated water prior to BAC and provide an additional treatment barrier for protozoa downstream of the BAC.
TIF : Image Flat WTP	IMF1 IMF2	Raw Water Abstraction	Intake of contaminated raw water during a wet weather event (seasonal)	Increased contaminant loads due to wash-in from the catchments, resulting in contaminated treated water	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. All sources are HBT Category 4 and so source selection alone is not good enough to mitigate the shortfall. Consideration should be given to real-time water quality and flow monitoring of raw water sources, and the introduction of carbon dioxide dosing. This will give the operators the ability to chose the most treatable source and consequently mitigate the associated hazards. For example, there has been occasions when the south maroochy weir became untreatable due to the high colour and turbidity and relatively low alkalinity. This combination made the water particularly difficult to treat as image flat does not have tha ability to introcude carbonic acid (in the form of co2) thus limiting the amount of extra alkalinity that can be introduced. The process of coagulation with alum consumes alkalinity at a rate of 1 mole of alum per 6 moles of bicarbonate. The higher organics load and turbidity load thus requires not only a higher alum dose, but a higher amount of available alkalinity. If the operators had the capacity to see the change in the river in real time, they could move to Wappa, which has some buffer from the rain, or Poona, if manganese and taste and odour are accounted for.
TIF : Image Flat WTP	IMF1	Raw Water Abstraction		Increased contamination load leading to contamination of treated water	Risk Assessment	Medium (9)	Asset Planning	30/06/2023	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. All sources are HBT Category 4 and so source selection alone is not good enough to mitigate the shortfall.
TIF : Image Flat WTP	IMF3	Raw Water Abstraction	Change in raw water source	Contaminant load exceeds treatment capacity	Risk Assessment	Medium (9)	Asset Planning	30/06/2023	N	Short term improvements in the taste and odour treatment capability like an ability to batch more PAC, moving the PAC dosing line further upstream, enhanced coagulation to remove intracellular algae prior to the release of the taste and odour compounds (jar tests have shown that up to 70% of 2-metylisoborneol can be intracellular and thus easily be treated with traditional coagulation + filtration). monitoring filter run times - it has been shown that if the filters are left to run too long before a backwash occurs then some taste and odour produces are able to become entrained and release the taste and odour compounds to the filtrate where it is chlorinated (and thus biodegredation can take longer) .Further to this an Ultrasonic device placed in Poona has been found to have a significant impact on the rate of MIB events in Poona and is recommended as a potential intervention into the high geosmin that occurs in Wappa. Additional simple interventions include identifying and preventing or improving sources of nutrients to Poona, such as local industry or the centrifuge centrate.
TIF : Image Flat WTP	IMF5 IMF1	Supernatant Return	Supernatant return to Poona Dam	Increased contaminant load	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	Additional monitoring of the supernatant return for pathogens, nutrients, algae and toxins could identify precursory issues and prevent risks from becoming realised. An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. All sources are HBT Category 4 and so source selection alone is not good enough to mitigate the shortfall.
TIF : Image Flat WTP	IMF4	PAC	Under dose PAC	Contamination of treated water	Risk Assessment	Medium (9)	Project Delivery	29/06/2020	N	long term planning initiatives to enhnced taste and odour treatment capability such as - membrane bioreactor, ozone/bac and/or advanced oxidation could be considered as a potential extra treatment processes to deal with the extremely elevated MIB concentrations experienced in Poona (>1800 ng/L). Other long term planning options to directly intervene with the Poona system are also under consideration.
TIF : Image Flat WTP	IMF1	Coagulation	Over dosing alum	Potentially high level of soluble aluminium Post flocculation occurs leading to suspended solids coagulation failure	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. All sources are HBT Category 4 and so source selection alone is not good enough to mitigate the shortfall.
TIF : Image Flat WTP	IMF1	Coagulation	Underdose alum	Poor coagulation / flocculation leading to contamination of settled water	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. All sources are HBT Category 4 and so source selection alone is not good enough to mitigate the shortfall.
TIF : Image Flat WTP	IMF1 IMF6	Coagulation	Incorrect Lime dose	Incorrect pH	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. All sources are HBT Category 4 and so source selection alone is not good enough to mitigate the shortfall. The lime clarifier system has issues with dosing pump turndown rates - essentially the dosing pumps are too big for the amount of water that is usually being treated by image. The temporary soda ash dosing system put in place several years ago has been restored in order to assist with the additional alkalinity required and at the lower flow that the plant is producing. A long term solution to this problem is to provide another set of dosing pumps that can meet the required turn down for the lower plant production (but also be able to meet the requirements of the high production expected when lake macdonald is taken offline circa 2020-2021)

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TIF : Image Flat WTP	IMF1 IMF6	Coagulation	Incorrect soda ash dose (Optional Process)	Incorrect pH	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. All sources are HBT Category 4 and so source selection alone is not good enough to mitigate the shortfall. (Responsibility: Asset Planning. Due for completion: 30/06/22. Completed: No) The lime clarifier system has issues with dosing pump turndown rates - essentially the dosing pumps are too big for the amount of water that is usually being treated by image. The temporary soda ash dosing system put in place several years ago has been restored in order to assist with the additional alkalinity required and at the lower flow that the plant is producing. A long term solution to this problem is to provide another set of dosing pumps that can meet the required turn down for the lower plant production (but also be able to meet the requirements of the high production expected when lake macdonald is taken offline circa 2020-2021)
TIF : Image Flat WTP	IMF9 IMF1	Clarification	Clarifier boil ups	This leads to overloading of the filter and probable filter break through	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	Currently there is only one online settled water instrument for each plant -a single online turbidity analyser on clarifier 3 and a single analyser on the outlet of clarifier 1 that "theoretically" represents the settled water coming off both clarifiers 1 and 2. Adding a third settled water analyser on the outlet of clarifier 2 would enhance operator visibility and early detection of issues as well as enable the operators to measure more accurately individual clarifier performance. An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. All sources are HBT Category 4 and so source selection alone is not good enough to mitigate the shortfall.
TIF : Image Flat WTP	IMF7 IMF1	Filtration	Filter break through	Potential contamination of treated water	Risk Assessment	Medium (8)	Project Delivery	30/06/2021	N	Filter Master Valve Replacement - the master valves have been replaced an automated however they still occasionally become misaligned. This could be accounted for by an ongoing pro-active maintenance program. An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. All sources are HBT Category 4 and so source selection alone is not good enough to mitigate the shortfall.
TIF : Image Flat WTP	IMF8	Whole of System	Loss of control systems incl SCADA	Loss of control system	Risk Assessment	Medium (8)	Tactical Asset Maintenance	29/06/2020	N	There is a separate UPS for plant and fluoride PLCs. This has been tested regularly to ensure it can achieve a minimum of 30 minutess power in the event of an outage, giving operators time to react to the power loss. Further, as the Wappa pumpstation draws power from a source independent of the plant, there is a potential for there to be a powerloss at the plant and continued pumping from wappa to the aerators. Since the plant runs on gravity from then there is a potential for the plant to continue operating without dosing. A tactical asset maintenance investigation must be undertaken to remediate the risk of raw water from Wappa going to the plant in the event of a powerloss. An almost identicial situation occured at the old petrie water treatment plant (though in the case of petrie, it was not a gravity plant and so no water left site), where the raw water pump station was on an independent supply to the plant, the plant had ups for the scada and plc (nb - that does not include dosing), and the clarifiers become inundated with uncoagulated water. If a similar series of events were to occur at image flat there is a potential for the water to go through the entire plant and subsequently a much higher risk.
TIF : Image Flat WTP	IMF1 IMF2	Raw Water Intake - SOUTH MAROO	Intake of contaminated raw water during a wet weather event (seasonal)	Increased contaminant loads due to wash-in from the catchments, resulting in contaminated treated water	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. All sources are HBT Category 4 and so source selection alone is not good enough to mitigate the shortfall Consideration should be given to real-time water quality and flow monitoring of raw water sources, and the introduction of carbon dioxide dosing. This will give the operators the ability to chose the most treatable source and consequently mitigate the associated hazards. For example, there has been occasions when the south maroochy weir became untreatable due to the high colour and turbidity and relatively low alkalinity. This combination made the water particularly difficult to treat as image flat does not have tha ability to introcude carbonic acid (in the form of co2) thus limiting the amount of extra alkalinity that can be introduced. The process of coagulation with alum consumes alkalinity at a rate of 1 mole of alum consumes 6 moles of bicarbonate. The higher organics load and turbidity load thus requires not only a higher alum dose, but a higher amount of available alkalinity. If the operators had the capacity to see the change in the river in real time, they could move to Wappa, which has some buffer from the rain, or Poona, if manganese and taste and odour are accounted for.
TIF : Image Flat WTP	IMF1 IMF2	Raw Water Intake - WAPPA DIRECT	No Other Source	Contamination of Poona (eg with MIB) and a lack of capacity on the south maroochy weir	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. All sources are HBT Category 4 and so source selection alone is not good enough to mitigate the shortfall. Consideration should be given to real-time water quality and flow monitoring of raw water sources, and the introduction of carbon dioxide dosing. This will give the operators the ability to chose the most treatable source and consequently mitigate the associated hazards. For example, there has been occasions when the south maroochy weir became untreatable due to the high colour and turbidity and relatively low alkalinity. This combination made the water particularly difficult to treat as image flat does not have tha ability to introcude carbonic acid (in the form of co2) thus limiting the amount of extra alkalinity that can be introduced. The process of coagulation with alum consumes alkalinity at a rate of 1 mole of alum consumes 6 moles of bicarbonate. The higher organics load and turbidity load thus requires not only a higher alum dose, but a higher amount of available alkalinity. If the operators had the capacity to see the change in the river in real time, they could move to Wappa, which has some buffer from the rain, or Poona, if manganese and taste and odour are accounted for.
TJI : Jimna WTP	JIM1	Raw Water Intake	Storm events in the catchment	Intake of raw water that exceeds the treatment capacity of the plant affecting treated water quality.	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment.
TJI : Jimna WTP	JIM1 JIM2 JIM3 JIM4	Clarification (Including Coagulation	Over dosing coagulant	Ineffective coagulation affecting treated water quality.	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. Add alarming and interlock on alum dose pump Investigate validation efficacy behind bespoke pipemixer - investigate other rapid mix options Investigate the need for duty/standby dosing pump arrangement (water demand can be met by tanker, so if the plant did interlock on alum pump failure and could not be restarted, then there would only be a mild operational disruption (ie to begin to tanker)

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TJI : Jimna WTP	JIM1 JIM2 JIM3 JIM4	Clarification (Including Coagulation	Under dosing coagulant	Ineffective coagulation affecting treated water quality.	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. Add alarming and interlock on alum dose pump Investigate validation efficacy behind bespoke pipemixer - investigate other rapid mix options Investigate the need for duty/standby dosing pump arrangement (water demand can be met by tanker, so if the plant did interlock on alum pump failure and could not be restarted, then there would only be a mild operational disruption (ie to begin to tanker)
TJI : Jimna WTP	JIM1 JIM2 JIM3 JIM4 JIM5	Clarification (Including Coagulation	Under dose soda ash	Ineffective coagulation affecting treated water quality.	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. Add alarming and interlock on alum dose pump Investigate validation efficacy behind bespoke pipe flocculator - investigate other rapid mix options Investigate the need for duty/standby dosing pump arrangement (water demand can be met by tanker, so if the plant did interlock on alum pump failure and could not be restarted, then there would only be a mild operational disruption (ie to begin to tanker) Add alarming and interlock on soda ash dosing
TJI : Jimna WTP	JIM1 JIM2 JIM3 JIM4 JIM5	Clarification (Including Coagulation	Overdose soda ash	Ineffective coagulation affecting treated water quality.	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. Add alarming and interlock on alum dose pump Investigate validation efficacy behind bespoke pipe flocculator - investigate other rapid mix options Investigate the need for duty/standby dosing pump arrangement (water demand can be met by tanker, so if the plant did interlock on alum pump failure and could not be restarted, then there would only be a mild operational disruption (ie to begin to tanker) Add alarming and interlock on soda ash dosing
TJI : Jimna WTP	JIM1 JIM2 JIM3 JIM4 JIM5	Clarification (Including Coagulation	Ineffective flocculation	Ineffective flocculation affecting treated water quality.	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. Add alarming and interlock on alum dose pump Investigate validation efficacy behind bespoke pipemixer - investigate other rapid mix options Investigate the need for duty/standby dosing pump arrangement (water demand can be met by tanker, so if the plant did interlock on alum pump failure and could not be restarted, then there would only be a mild operational disruption (ie to begin to tanker) Add alarming and interlock on soda ash dosing
TJI : Jimna WTP	JIM1 JIM2 JIM3 JIM4 JIM5 JIM6	Filtration	Filter break- through Turbidities > 0.3 NTU	Filter break-through impacting treated water quality.	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. Add alarming and interlock on alum dose pump Investigate validation efficacy behind bespoke pipemixer - investigate other rapid mix options Investigate the need for duty/standby dosing pump arrangement (water demand can be met by tanker, so if the plant did interlock on alum pump failure and could not be restarted, then there would only be a mild operational disruption (ie to begin to tanker) Add alarming and interlock on soda ash dosing Add a filter to waste option so that the plant can ripen filters in recovery after there has been a breakthrough
TJI : Jimna WTP	JIM1 JIM7	Whole of system	Unreliable communications	Loss of comms/insufficient alarming	Risk Assessment	Medium (8)	Tactical Asset Maintenance	29/06/2020	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment. Add capability to remotely initiate a scour on the raw water intake. This scour has to occur prior to plant start up due to a build up of manganese that occurs when the plant is offline
TJI : Jimna WTP	JIM1	Whole of system	Raw water contaminant load exceeds treatment capacity	Hazards that are not adequately managed by the barriers in the process	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	An additional Prozoa Treatment barrier is required to address the shortfall against the HBT tier 1 assessment.
TKE : Kenilworth WTP	KEN1 KEN2	Whole of system	Raw water contaminant load exceeds treatment capacity	Hazards that are not adequately managed by the barriers in the process	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	Investigate long term planning options to improve: (1) raw water intake during flood events given the rapid flow of raw water through the shortened sand bed during flood events - CLOSED OUT, plans to maintain tankering during flood events. Planning have looked at this at high level and advised tankering. However, tankering can not always keep up with demand, in particular over the weekends and public holidays. A duty 4 log crypto UV unit has been installed. Reduces pathogen load to an acceptable level under the HBT assessment, assuming that the well reduces the category (cat 4 in the river, and therefore cat 3 in the well). However, this can no longer be rlied upon as the draft adwg implementation does not allow this. Therefore another protozoan barrier should be installed.
TKR : Kirkleagh (Recreation) WTP	KKL1 KKL2	Raw Water Intake (Pumping Pond,	Intake of contaminated raw water during a wet weather event (seasonal)	Contaminant load exceeds treatment capacity	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	Capital upgrade to incorporate UV and or other effective protozoan barriers into the plant Move the offtake away from the contamination sources - eg the recreational area and away from the STP
TKR : Kirkleagh (Recreation) WTP	KKL1 KKL3 KKL4	Clarification (Incorporating Coagula	Incorrect soda ash dose	Incorrect pH for coagulation	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	Capital upgrade to incorporate UV and or other effective protozoan barriers into the plant Incorporate a filter to waste to accommodate the ability for filter ripening post breakthrough Investigate alternative pH adjustment options
TKR : Kirkleagh (Recreation) WTP	KKL1 KKL5	Clarification (Incorporating Coagula	Under dosing alum	Underdose of alum - Poor coagulation / flocculation leading contamination of settled water	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	Capital upgrade to incorporate UV and or other effective protozoan barriers into the plant Install alum dosing flow meter to verify alum going into the process
TKR : Kirkleagh (Recreation) WTP	KKL1 KKL5	Clarification (Incorporating Coagula	Over dosing alum	Over dose of alum - Post flocculation occurs leading to suspended solids in the treated water	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	Capital upgrade to incorporate UV and or other effective protozoan barriers into the plant Install alum dosing flow meter to verify alum going into the process
TKR : Kirkleagh (Recreation) WTP	KKL6	Clarification (Incorporating Coagula	Flocculator failure	Potential filter break through	Risk Assessment	Medium (8)	Tactical Asset Maintenance	30/06/2021	N	Consideration should be given to the installaton of a paddle stirrer failure alarm if one does not already exist.
TKR : Kirkleagh (Recreation) WTP	KKL7 KKL1	Clarification (Incorporating Coagula	Carryover of floc, sludge, algae and/or turbidity in clarified water	This leads to overloading of the filter and probable filter break through	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	Process assessment Capital upgrade to incorporate UV and or other effective protozoan barriers into the plant Incorporate a filter to waste to accommodate the ability for filter ripening post breakthrough
TKR : Kirkleagh (Recreation) WTP	KKL8 KKL1	Filtration	Filter break- through Turbidities > 0.3 NTU	Filter break-through impacting treated water quality.	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	A review of recent filter turbidity data should be undertaken to assess performance and risk in light of the potential protozoa (Crypto) load in the raw water. Capital upgrade to incorporate UV and or other effective protozoan barriers into the plant
TKR : Kirkleagh (Recreation) WTP	KKL1 KKL9	Whole of System	Raw water contaminant load exceeds treatment capacity	Hazards that are not adequately managed by the barriers in the process	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	Capital upgrade to incorporate UV and or other effective protozoan barriers into the plant Determine the log removal required for baseline and event based pathogen loads into this WTP.
TLS : Landers Shute WTP	TBA	Raw Water Intake	Intake of contaminated raw water during a wet weather event (seasonal)	Contaminant load exceeds treatment capacity	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	formal needs analysis required to investigate options for protozoan removal enhancements
TNO : Noosa WTP	TBA	Raw Water Intake (Mary River)	Intake of contaminated raw water during a wet weather event (seasonal)	Contaminant load exceeds treatment capacity	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	Assessed via other events within this assessment - Confirm HBT assessment

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TNO : Noosa WTP	TBA	Coagulation	Overdose lime	Non-optimised coagulation	Risk Assessment	Medium (8)	Process Engineering	30/06/2021	N	investigate lime and alum control with focus on start up and lake only water investigate poly as a floc/settling aid install alum dosing flow meter to verify alum dose investigate CO2 dosing to enable formation of calcium carbonate to a higher degree of reliability includine reactivator importance in coag pH validation and control Capital works to include upgraded protozoan treatment capacity (ie UV)
TNO : Noosa WTP	TBA	Coagulation	Underdosing lime	Non-optimised coagulation	Risk Assessment	Medium (8)	Process Engineering	30/06/2021	N	investigate lime and alum control with focus on start up and lake only water investigate poly as a floc/settling aid install alum dosing flow meter to verify alum dose investigate CO2 dosing to enable formation of calcium carbonate to a higher degree of reliability includine reactivator importance in coag pH validation and control Capital works to include upgraded protozoan treatment capacity (ie UV)
TNO : Noosa WTP	NOO4	Filtration	Filter break-through >0.3 NTU	Potential contamination of treated water	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2022	N	Install appropriate instrumentation, monitoring and control systems to enable effective monitoring and control of filtration. Install /improve filter to waste option Investigate poly dosing as a filter-aid. - potential to introduce air scour
TNO : Noosa WTP	NOO3	Disinfection	Low daily production rates leading to a reduction on pathogen removal efficacy		Risk Assessment	Medium (8)	Operations - Supply	29/06/2020	N	The effiacy of flocculation time and mixing energy should be assessed, along with what effects intermittent operation may have when running at very low daily production rates.
TNO : Noosa WTP	NOO12	Disinfection	Vermin proofing of all plant processes	Bird and animal droppings contaminating the treated water.	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	Investigate vermin proofing at Noosa WTP and install appropriate vermin control measures.
TNO : Noosa WTP	NOO14	Disinfection	Insufficient pathogen log removal	Insufficient removal of baseline pathogen load across the whole process	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	Identify optimal treatment processes to achieve adequate pathogen treatment.
TNP : North Pine WTP	TBA	pH Correction	underdosing caustic	Low pH if not available when additional alum is used affecting coagulation	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	Review monitoring and process interlocks. North Pine is one of the only unmanned sites to not be interlocked on every critical process (or any critical process, for that matter). Instead it relies upon remote monitoring during unmanned operation from the 24/7 control room at mount crosby. This in the past has had some issues and as in accordance with guiding principle 2, " a robust system must include mechanisms or failsafes to accommodate inevitable human errors without allowing major failures to occur."
TNP : North Pine WTP	TBA	pH Correction	overdosing of caustic	High pH affecting coagulation	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	Review monitoring and process interlocks. North Pine is one of the only unmanned sites to not be interlocked on every critical process (or any critical process, for that matter). Instead it relies upon remote monitoring during unmanned operation from the 24/7 control room at mount crosby. This in the past has had some issues and as in accordance with guiding principle 2, " a robust system must include mechanisms or failsafes to accommodate inevitable human errors without allowing major failures to occur."
TNP : North Pine WTP	TBA	Supernatant Return (currently offlir	Increased contaminant load on the treatment plant	Increased in contaminant load potentially resulting in non-compliant treated water	Risk Assessment	Medium (8)	Asset Lifecycle Capability	29/06/2020	N	The old on site STP has been decomissioned and the plant has been connected to the sewer. An online turbidity analyser on the supernatant return is required to return the supernatant and a prior to instigation, a detailed understanding of the potential manganese risk should be acquired in order to consider the risks apportionately.
TNP : North Pine WTP	TBA	PAC	Under dosing PAC	PAC is not dosed or under dosed when required	Risk Assessment	Medium (9)	Process Engineering	29/06/2020	N	Investigate alternative treatments for T & O - current PAC process only achieves a maximum of 1:1 removal efficacy and up to a maximum of 10 ng/L. Above 10 the ratio becomes 2:1 (dose:ng/L) up to about 20 ng/L and beyond that there is no dose theoretically possible to reduce to an acceptable level.
TNP : North Pine WTP	TBA	Coagulation	Over dosing alum	Non-optimal coagulation resulting in filter break-through	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	Review monitoring and process interlocks. North Pine is one of the only unmanned sites to not be interlocked on every critical process (or any critical process, for that matter). Instead it relies upon remote monitoring during unmanned operation from the 24/7 control room at mount crosby. This in the past has had some issues and as in accordance with guiding principle 2, " a robust system must include mechanisms or failsafes to accommodate inevitable human errors without allowing major failures to occur."
TNP : North Pine WTP	TBA	Coagulation	Under dosing alum	Non-optimal coagulation resulting in filter break-through	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	Review monitoring and process interlocks. North Pine is one of the only unmanned sites to not be interlocked on every critical process (or any critical process, for that matter). Instead it relies upon remote monitoring during unmanned operation from the 24/7 control room at mount crosby. This in the past has had some issues and as in accordance with guiding principle 2, " a robust system must include mechanisms or failsafes to accommodate inevitable human errors without allowing major failures to occur."
TNP : North Pine WTP	TBA	Filtration	Filter break- through	Turbidities > 0.3 NTU	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	Review monitoring and process interlocks. North Pine is one of the only unmanned sites to not be interlocked on every critical process (or any critical process, for that matter). Instead it relies upon remote monitoring during unmanned operation from the 24/7 control room at mount crosby. This in the past has had some issues and as in accordance with guiding principle 2, " a robust system must include mechanisms or failsafes to accommodate inevitable human errors without allowing major failures to occur."
TNP : North Pine WTP	TBA	Disinfection	Insufficient Ct - Incorrect pH - Under dose chlorine - Insufficient detention time	Failure to eliminate chlorine sensitive contaminants	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	Review monitoring and process interlocks. North Pine is one of the only unmanned sites to not be interlocked on every critical process (or any critical process, for that matter). Instead it relies upon remote monitoring during unmanned operation from the 24/7 control room at mount crosby. This in the past has had some issues and as in accordance with guiding principle 2, " a robust system must include mechanisms or failsafes to accommodate inevitable human errors without allowing major failures to occur." Install dynamic Ct - the Ct at north pine needs to be carefully monitored in the winter maintenance period when 1 contact tank becomes unavailable, effectively halving the volume size in the contact time calculations. Dynamically calculating the Ct from the volume, flow and mg/L free chlorine would enable operations closer to the true reliability estimate of the plant (as opposed to the current conservative worste case scenario estimate of maximum flow, minimum volume minimum chlorine). this will become increasingly important as north pine production increases to meet the expected increased future demand in the north.

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Site	Improvement #	Process Step	Issue	Description	Origin of Improvement	Significant Risk	Responsibility	Due for completion	Completed? Y/N	Risk Treatment Comments
Supply System	TBA	Treated Water	Elevated conductivity leaving WTP	Treated water with high conductivity leaving the WTPs leading to elevated disinfection Byproducts in the treated water.	Risk Assessment	Medium (9)	Water Quality Unit	30/06/2020	N	Refer to individual WTPs individual risk treatments to reduce this risk.
Supply System	SSM10	Reservoir	Contamination of reservoirs by ingress	Rainwater, vermin, dust etc entering reservoirs leading to out of specification treated water.	Risk Assessment	Medium (8)	Water Quality Unit	30/06/2020	N	Reservoir Inspection Program is to be rolled out to all Supply System Reservoirs.
Supply System	SSM13	Disinfection (secondary)	Breakpoint chlorination	Formation of DBP due to naturally occurring precursors leading to out of specification treated water.	Risk Assessment	Medium (9)	Asset Planning	30/06/2022	N	Roll out of the Secondary Disinfection project actions. Implementation planned in stages between 2019 and 2025.
Supply System	SSM12	Disinfection (secondary)	Release of free ammonia (subsequent conversion to nitrite and/or nitrate)	Caused by systems complexity, water age and temperature leading to out of specification treated water.	Risk Assessment	Medium (9)	Asset Lifecycle Capability	30/06/2021	N	Online ammonia instruments to be installed at Nth Pine, Camerons Hill and key Supply System sites.
TEB : Mount Crosby East Bank WTP	'EBK22	Raw Water Abstraction	Elevated Raw Water Conductivity	Inflows of salty and hard water via creeks downstream of Wivenhoe Dam (problem is exacerbated if a localised storm event occurs in a problem catchment i.e. Lockyer Creek)	Risk Assessment	Medium (9)	Water Quality Unit	30/06/2020	N	- Options to install conductivity meters at the outlets of the Camerons Hill No. 1 & 2 Reservoirs linked back to SCADA should be investigated. - Additional training should be given to Operations Staff with respect to the online visibility now available in regards to the Catchment Groups remote monitoring stations (i.e. at Lockyer and Blacksnake Creeks) and BOM creek and river gauging stations.
TEB : Mount Crosby East Bank WTP	EBK112 EBK113	Raw Water Abstraction	Dirty water event in the catchment (i.e. storm, flood, gravel extraction, land slide etc.)	Intake of raw water that exceeds the treatment capacity of the WTP resulting in out of specification treated water.	Risk Assessment	Medium (8)	Water Quality Unit	30/06/2020	N	'- Undertake HBT Assessment for this site; - Long term planning is underway for this WTP.
TEB : Mount Crosby East Bank WTP	EBK32 EBK33	Coagulation	Incorrect Sodium Hydroxide dose	Underdosing of Sodium Hydroxide resulting in coagulation process failure.	Risk Assessment	Medium (8)	Project Delivery	30/06/2020	N	- There is currently a project in place to install new raw water flow meters to service the inlets to Sedimentation Basins No. 1 and 2 which will result in more reliable flow pacing for caustic soda - Basin 1 is complete, and Basin 2 is to be complete by the end of June 16; completed - Project approval is also being sought to install new raw water flow meters to service the inlets to Sedimentation Basins No. 3 and 4 which will result in more reliable flow pacing for caustic soda into these basins as well - Basin 3 and 4 is to be complete by the end of June 16.
TEB : Mount Crosby East Bank WTP	EBK32 EBK33	Coagulation	Incorrect Sodium Hydroxide dose	Overdosing of Sodium Hydroxide resulting in coagulation process failure.	Risk Assessment	Medium (8)	Project Delivery	30/06/2020	N	- There is currently a project in place to install new raw water flow meters to service the inlets to Sedimentation Basins No. 1 and 2 which will result in more reliable flow pacing for caustic soda - Basin 1 is complete, and Basin 2 is to be complete by the end of June 16; completed - Project approval is also being sought to install new raw water flow meters to service the inlets to Sedimentation Basins No. 3 and 4 which will result in more reliable flow pacing for caustic soda into these basins as well - Basin 3 and 4 is to be complete by the end of June 16.
TEB : Mount Crosby East Bank WTP	EBK37 EBK38	Coagulation	Incorrect Alum dose	Overdose of Alum resulting in ineffective coagulation	Risk Assessment	Medium (8)	Water Quality Unit	30/06/2020	N	- As per the recommendations of an ICAM report, ie Interlocking ; - Updates to CCP procedures and validation standard as per project
TEB : Mount Crosby East Bank WTP	EBK40	Coagulation	Flash mixer failure	Ineffective coagulation, flocculation and sedimentation, filter breakthrough and out of specification treated water	Risk Assessment	Medium (8)	Asset Planning	30/06/2022	N	- Installation of jet flash mixers for Sedimentation Basins No. 3 and 4. - Flow meter upgrade for Sed basins 3 and 4.
TEB : Mount Crosby East Bank WTP	EBK45	Flocculation and Settling	Flocculator Failure	Ineffective flocculation and sedimentation, filter breakthrough and out of specification treated water.	Risk Assessment	Medium (8)	Asset Planning	30/06/2022	N	- There is currently an options analysis being undertaken looking at what works would be required to improve flocculation associated with Sedimentation Basin No. 1 - Options analysis underway. Currently sitting with planning.
TEB : Mount Crosby East Bank WTP	EBK117	Flocculation and Settling	Carryover of floc, sludge, algae and/or turbidity in settled water	Carry over on to the filters and possible filter break through.	Risk Assessment	Medium (8)	Process Engineering	30/06/2020	N	- Investigate what is causing the carryover onto the filters especially Enhanced Coagulation. Action any identified optimisation opportunities associated with the investigation.
TEB : Mount Crosby East Bank WTP	EBK49	Flocculation and Settling	Failure or incorrect operation of a bypass valve around sedimetation basins	Leading to out of specification treated water	Risk Assessment	Medium (8)	Process Engineering	30/06/2020	N	- Identify bypasses and reveiw lockout arrangements so that these bypass valves cannot be accidentally opened, prior to them being blanked off - Plates welded over spindles
TEB : Mount Crosby East Bank WTP	EBK117	Flocculation and Settling	Carryonver of floc, sludge or algae in settled water	Carry over on to the filters and possible filter break through.	Risk Assessment	Medium (8)	Process Engineering	30/06/2020		- Investigate what is causing the carryover onto the filters especially Enhanced Coagulation. Action any identified optimisation opportunities associated with the investigation.
TEB : Mount Crosby East Bank WTP	EBK115	Media Fitration	Incorrect Polymer Dose	Under dose of Polymer resulting in reduced filter performance	Risk Assessment	Medium (8)	Process Engineering	30/06/2020	N	- Improve monitoring and control of the filter aid dosing system.
TEB : Mount Crosby East Bank WTP	EBK56	Media Fitration	Filter breakthrough	Potential contamination of treated water	Risk Assessment	Medium (8)	Project Delivery	30/06/2020	N	- Eastbank filter upgrade project to start in 2019.
TEB : Mount Crosby East Bank WTP	EBK62 EBK114	Media Fitration	Contamination of filtered water cells by ingress	Introduction of pathogens	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	- The location and integrity of the vermin proofing (i.e. frog flaps) associated with the overflow pipes from these cells should be checked as a matter of priority. - Mesh breathers for the filtered water cells needs to be replaced.
TEB : Mount Crosby East Bank WTP	EBK80	Disinfection (primary)	Contamination of Camerons Hill Reservoirs by ingress	Out of specification treated water	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	Improvement to vermin proofing need to be made to CH1 and CH2
TEB : Mount Crosby East Bank WTP	EBK85 EBK91	Disinfection (secondary)	Insufficient mixing	Out of specification treated water	Risk Assessment	Medium (8)	Project Delivery	30/06/2020	N	- There is currently a project to install a mixer to improve mixing. One Monochloramine and free ammonia analyser to be installed 2 sample lines - 1 for CH1 and 1 for CH .- 90% Design.
TLO : Lowood WTP	LOW67	Raw Water Abstraction	Dirty water event in the catchment (i.e. storm, flood, gravel extraction, land slide etc.)	Intake of raw water that exceeds the treatment capacity of the WTP resulting in out of specification treated water.	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	Any upgrade of the control system associated with this WTP should include interlocks that will automatically shutdown the relevant parts of the WTP in the advent of a critical limit being triggered (i.e. raw water turbidity) - 30% of design has been submitted. Switch board upgrade to include alarms if floculator fails and back up power generator or ensure continuity of operations and control. Complete Stage 1 and 2 Plant Upgrade works at Lowood WTP. June 2019 for Stage 1. June 2021 for Stage 2.
TLO : Lowood WTP	LOW67 LOW25	Supernatant Return	Loading exceeds plant capability	Supernatant return volumes exceed treatment capacity leading to out of specification treated water	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	Any upgrade of the control system associated with this WTP should include interlocks that will automatically shutdown the relevant parts of the WTP in the advent of a critical limit being triggered (i.e. raw water turbidity) - 30% of design has been submitted. Switch board upgrade to include alarms if floculator fails and back up power generator or ensure continuity of operations and control. Complete Stage 1 and 2 Plant Upgrade works at Lowood WTP. June 2019 for Stage 1. June 2021 for Stage 2. Consideration should be given to undertaking a mass balance of acrylamide based polymer being used across the WTP under various operating scenarios, to ascertain if there is any potential of exceeding the ADWG health limit for this compound in the treated water. Carried out for stage 2. Completed. study completed implementation delayed.
TLO : Lowood WTP	LOW67 LOW9	Coagulation	Incorrect Lime dose	Underdose of Lime resulting in coagulation process failure	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	Any upgrade of the control system associated with this WTP should include interlocks that will automatically shutdown the relevant parts of the WTP in the advent of a critical limit being triggered (i.e. raw water turbidity) - 30% of design has been submitted. Switch board upgrade to include alarms if floculator fails and back up power generator or ensure continuity of operations and control. Identify improvements for the lime system to make it more reliable.
TLO : Lowood WTP	LOW67 LOW9	Coagulation	Incorrect Lime dose	Overdose of Lime resulting in coagulation process failure	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	Any upgrade of the control system associated with this WTP should include interlocks that will automatically shutdown the relevant parts of the WTP in the advent of a critical limit being triggered (i.e. raw water turbidity) - 30% of design has been submitted. Switch board upgrade to include alarms if floculator fails and back up power generator or ensure continuity of operations and control. Identify improvements for the lime system to make it more reliable.
TLO : Lowood WTP	LOW67	Coagulation	Incorrect Alum dose	Underdose of Alum resulting in ineffective coagulation	Risk Assessment	High (12)	Asset Lifecycle Capability	30/06/2021	N	Any upgrade of the control system associated with this WTP should include interlocks that will automatically shutdown the relevant parts of the WTP in the advent of a critical limit being triggered (i.e. raw water turbidity) - 30% of design has been submitted. Switch board upgrade to include alarms if floculator fails and back up power generator or ensure continuity of operations and control.
TLO : Lowood WTP	LOW67	Coagulation	Incorrect Alum dose	Overdose of Alum resulting in ineffective coagulation	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	Any upgrade of the control system associated with this WTP should include interlocks that will automatically shutdown the relevant parts of the WTP in the advent of a critical limit being triggered (i.e. raw water turbidity) - 30% of design has been submitted. Switch board upgrade to include alarms if floculator fails and back up power generator or ensure continuity of operations and control.
TLO : Lowood WTP	LOW10	Coagulation	Loss of Carrier Water	Ineffective coagulation	Risk Assessment	High (12)	Process Engineering	30/06/2020	N	Identify monitoring options for carrier water.
TLO : Lowood WTP	LOW25	Flocculation and Settling	Incorrect Polymer Dose	Underdose of Polymer resulting in ineffective coagulation, flocculation and settling, leading to filter breakthrough and out of specification treated water.	Risk Assessment	Medium (8)	Water Quality Unit	30/06/2020	N	Consideration should be given to undertaking a calculation of acrylamide based polymer being used across the WTP under various operating scenarios, to ascertain if there is any potential of exceeding the ADWG health limit for this compound in the treated water.
TLO : Lowood WTP	LOW67	Flocculation and Settling	Flocculator failure	Ineffective flocculation and clarification, filter breakthrough and out of specification treated water.	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	Any upgrade of the control system associated with this WTP should include interlocks that will automatically shutdown the relevant parts of the WTP in the advent of a critical limit being triggered (i.e. raw water turbidity) - 30% of design has been submitted. Switch board upgrade to include alarms if floculator fails and back up power generator or ensure continuity of operations and control.

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Site	Improvement #	Process Step	Issue	Description	Origin of Improvement	Significant Risk	Responsibility	Due for completion	Completed? Y/N	Risk Treatment Comments
TLO : Lowood WTP	LOW67	Flocculation and Settling	Carryover of floc, sludge, algae and/or turbidity in clarified water	Due to one or more of the following scenarios, leading to out of specification treated water: - Flow rate changes; - Poor flash mixing; - Flocculator failure; - Floc shearing; - Poor sludge management; - Boil up (temp changes); and - Algae bloom in clarifier.	Risk Assessment	High (12)	Asset Lifecycle Capability	30/06/2021	N	Any upgrade of the control system associated with this WTP should include interlocks that will automatically shutdown the relevant parts of the WTP in the advent of a critical limit being triggered (i.e. raw water turbidity) - 30% of design has been submitted. Switch board upgrade to include alarms if floculator fails and back up power generator or ensure continuity of operations and control.
TLO : Lowood WTP	LOW67	Media Fitration	Filter breakthrough	Leading to out of specification treated water.	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	Any upgrade of the control system associated with this WTP should include interlocks that will automatically shutdown the relevant parts of the WTP in the advent of a critical limit being triggered (i.e. raw water turbidity) - 30% of design has been submitted. Switch board upgrade to include alarms if floculator fails and back up power generator or ensure continuity of operations and control.
TLO : Lowood WTP	LOW67 LOW9	Disinfection (primary)	Incorrect lime dose	Under dosing lime leading to out of specification treated water.	Risk Assessment	Medium (9)	Asset Lifecycle Capability	30/06/2021	N	Any upgrade of the control system associated with this WTP should include interlocks that will automatically shutdown the relevant parts of the WTP in the advent of a critical limit being triggered (i.e. raw water turbidity) - 30% of design has been submitted. Switch board upgrade to include alarms if floculator fails and back up power generator or ensure continuity of operations and control. Identify improvements for the lime system to make it more reiliable.
TWB : Mount Crosby West Bank WTP	'EBK22 EBK23	Raw Water Abstraction	Elevated Raw Water Conductivity	Inflows of salty and hard water via creeks downstream of Wivenhoe Dam (problem is exacerbated if a localised storm event occurs in a problem catchment i.e. Lockyer Creek)	Risk Assessment	Medium (9)	Process Engineering	30/06/2020	N	- Options to install conductivity meters at the outlets of the Camerons Hill No. 1 & 2 Reservoirs linked back to SCADA should be investigated - extension date to 1/7/2016; and - Y1403 Additional training should be given to Operations Staff with respect to the online visibility now available in regards to the Catchment Groups remote monitoring stations (i.e. at Lockyer and Blacksnake Creeks) and BOM creek and river gauging stations.
TWB : Mount Crosby West Bank WTP	EBK112 EBK113	Raw Water Abstraction	Dirty water event in the catchment (i.e. storm, flood, gravel extraction, land slide etc.)	Intake of raw water that exceeds the treatment capacity of the WTP resulting in out of specification treated water.	Risk Assessment	Medium (8)	Water Quality Unit	30/06/2020	N	'- Undertake HBT Assessment for this site; - Long term planning is underway for this WTP.
TWB : Mount Crosby West Bank WTP	WBK80	Disinfection (primary)	Contamination of service water distribution system due to main break or backflow incident.	Potential contamination of treated water	Risk Assessment	Medium (8)	Process Engineering	30/06/2020	N	- Conduct audit of the the service water to ensure that there are adequate measures in place sto stop backflow events.
TWB : Mount Crosby West Bank WTP	WBK63	Whole of System	Failure or incorrect operation of a bypass valve	Leading to out of specification treated water.	Risk Assessment	Medium (8)	Operations - Supply	30/06/2020	N	Consider reviewing lockout arrangements so that these bypass valves cannot be accidentally opened, prior to them being blanked off - Plates welded over spindles -
TWB : Mount Crosby West Bank WTP	WB110	Whole of System	Backflow prevention failure	Leading to out of specification treated water.	Risk Assessment	Medium (8)	Process Engineering	30/06/2020	N	Full audit needs to be undertaken on backflow prevention at Westbank.
TWR : Wivenhoe Dam (Recreation) WTP	WIV75 WIV100	Coagulation	Incorrect Alum dose	Underdose of Alum resulting in ineffective coagulation	Risk Assessment	Medium (8)	Project Delivery	30/06/2020	N	Package plant to replace the existing plant between the raw water tanks and the clear water storage. Expected to be completed Dec 2018. Check to see if coag pH instrument and alum flow meter is included in this package. If not organise installation of these instruments.
TWR : Wivenhoe Dam (Recreation) WTP	WIV75	Flocculation and Settling	Carryover of floc, sludge, algae and/or turbidity in clarified water	The following leading to out of specification treated water. - Flow rate changes; - Poor flash mixing; static - Poor sludge management; - Boil up (temp changes); and - Algae bloom in clarifier.	Risk Assessment	Medium (8)	Project Delivery	30/06/2020	N	Package plant to replace the existing plant between the raw water tanks and the clear water storage. Expected to be completed Dec 2018.
TWR : Wivenhoe Dam (Recreation) WTP	WIV75 WIV102 WIV103	Media Filtration	Filter breakthrough	Leading to out of specification treated water.	Risk Assessment	Medium (8)	Project Delivery	30/06/2020	N	Package plant to replace the existing plant between the raw water tanks and the clear water storage. Expected to be completed Dec 2018. Consideration should be given to ascertaining if it would be practical to installed a first filtered water to waste system, and undertake necessary works if this idea was deamed to be advantageous; Any upgrade of the control system associated with this WTP should retain interlocks that will automatically shutdown the relevent parts of the WTP in the advent of a critical limit being triggered (i.e. filtered water turbidity).
TWR : Wivenhoe Dam (Recreation) WTP	WIV75 WIV100 WIV103 WIV104	Disinfection (primary)	Insufficient C.t	Insufficient C.t resulting from: - Inadequate t10; - Low free chlorine residual; - High pH; and - Low temperature.	Risk Assessment	Medium (8)	Project Delivery	30/06/2020	N	Package plant to replace the existing plant between the raw water tanks and the clear water storage. Also including: Looking at the online analyser requirements for this WTP (i.e. for the primary disinfection step - dosed filtered water free chlorine, pH and temperature, and treated water free chlorine and pH); Ascertain if a standby (or cold standby) sodium hypochlorite dosing pump has been procurred for this WTP and if not, consider purchasing spare; Any upgrade of the control system associated with this WTP should include for primary disinfection, single point of failure alarms (i.e. for free chlorine, temperature, pH, flow rate and reservoir level) and be complemented by an automated real time chlorine C.t calculator with its own operational and HACCP alarm setpoints. Such an upgrade should also incorporate where applicable, interlocks that will shutdown the relevent parts of the WTP in the advent of a critical limit being triggered. Investigate options for increasing C.t at this WTP.
TWR : Wivenhoe Dam (Recreation) WTP	WIV 75 WIV17	Whole of System	Loss of SCADA and/or communications system	Leading to loss of supply and/or out of specification treated water.	Risk Assessment	Medium (8)	Project Delivery	30/06/2020	N	Package plant to replace the existing plant between the raw water tanks and the clear water storage. Jacobs report (October 2015) recommends that Wivenhoe Dam WTP to proceed to preliminary design in the second phase of this project, including: Upgrading the control system.

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THZ : Hinze Dam WTP	TMO-17	Raw Water Abstraction	Rain event in catchment	Intake of increased treatment load that could potentially result in contaminated treated water	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	**Risk Treatment (raised R.A 2017):** Likelihood has been risk assessed as Unlikely due impact of cyc. event in Mar 2017 which requires a review of the HBT source water category for Hinze Dam. Treatement capability remains unchanged however potential increase in source water category results in protozoa log shortfall in addition to the filter performance failures against the HBT criteria for achieving 3.5 protozoa log removal. Risk Treatment Reference is as per Molendinar WTP Risk Treatment Reference. Acknowledge that BoH tank is not filled when raw water quality at lower intake is undesirable. Assessment carried out for Molendinar WTP should incorporate Hinze Dam WTP. Refer Molendinar WTP Risk Improvement Item
THZ : Hinze Dam WTP	HNZ-5	Coagulation	Incorrect coagulant dose	Underdose of ACH resulting in contaminated treated water	Risk Assessment	Medium (8)	Process Engineering	30/06/2021	N	**HNZ5: Risk Treatment (raised R.A review 2015):** Although this is not known to have occurred at Hinze Dam WTP there is occurrences of coag dosing pipe breakages at other WTPs. There is currently a coagulant flow switch interlocked to WTP operation however coag flow monitoring interlocked to WTP operation is required. **Update R.A review 2017:** Confirmed as viable WTP and will continue operating. Project will be pursued by Process Improvement Specialists based on current understanding that WTP will remain for the foreseeable future. To be included in Minor Works upgrade 17/18. Note Control System is very limited in terms of adding any further alarms or monitoring. Sludge upgrade project would trigger upgrade of PLC.
TKO : Kooralbyn WTP	TKO-14	Raw Water Abstraction	Cyanobacteria Bloom	In take of algae or toxins that has an impact on plant operations or water quality from Bigfoot Lagoon	Risk Assessment	Medium (8)	Project Delivery	29/06/2020	N	**Risk Treatment (raised in Bigfoot Lagoon Risk Assessment workshop Feb 2017)**: PAC dosing required when using Bigfoot Lagoon if raw water T&O > acceptable levels. **Update R.A 2017:** Bigfoot Lagoon PAC system being restored to operational however no operational experience at time of R.A. At time of R.A project already in delivery in 17/18 PD Program PID02682 AIC: Mobile Powder Activated Carbon Units. Dosing point location proposed to be at WTP. Effectivess of PAC with short contact time yet to be demonstrated. Operational availability and reliability to be determined.
TKO : Kooralbyn WTP	TKO-15 TKO-16	Raw Water Abstraction	Rain event in catchment	Intake of contaminated water that could potentially result in contaminated treated water	Risk Assessment	Medium (8)	Project Delivery	29/06/2020	N	**Risk Treatment (raised Kooralbyn WTP - pathogen treatment assessment report June 2015 - documented R.A 201):** Assessment of the Kooralbyn WTP treatment capability indicates that the process has the capability to achieve the following 3.5 protozoa log reductions. This represents a protozoa log reduction shortfall of up to 2.0 under the HBT framework. Refer D15/114146 Update R.A 2017: Proposal with WTP Planning to write BC. Not in PD program for delivery 17/18. Expected 18/19. **Risk Treatment (raised in Bigfoot Lagoon Risk Assessment workshop Feb 2017):** Future Control Mitigators and Strategies were identified in the workshop in Feb 2017 to reduce risks associated with running on Bigfoot Lagoon water to acceptable levels including installation of CO2. At time of R.A a project was already in delivery in 17/18 PD program PID02682 AIC: Mobile Powder Activated Carbon Units. Dosing point location proposed to be at WTP.
TKO : Kooralbyn WTP	TKO-17 TKO-18 TKO-15	Coagulation	Incorrect coagulant dose	Underdose of alum resulting in contaminated treated water including incorrect dosed water pH	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	**Risk Treatment (raised R.A 2017):** The primary signal to detect underdose of coagulant is the coagulant flow meter. Second to this is the dosed water pH meter which is critical to monitor coagulation is occurring within the effective pH range and, for Kooralbyn WTP, provides feedback for the caustic dose rate control. Flow to the dosed water instrument is under gravity and blockages of the dosed water sample line have been reported. A flow switch was installed to detect loss of flow to the instrument and subsequently interlock the WTP due to a loss of CCP monitoring and loss of feedback signal to the caustic dosing system. This was caused by longer sample pipe and flocs in sample water block the pipe. The rotameter float was scaled by metal particles and gets stuck in side the rotameter preventing no flow signal alarm dial out. The impact is reduction in reliability of the coagulation process (a critical control point). **Improvement Opportunity (raised R.A 2017):** Kooralbyn does not have any capability for timely and online measurement of changes in raw water quality for adequate pH correction that is needed for a reliable coagulation process. The Operator's work around to this issue is to start and stop the caustic dosing system in order to detect changes in raw water pH. The operator also uses coagulated pH as a lagging indicator of changes to raw water pH. This workarounds is only temporary and does not sufficiantly address the risk because of the number of variables and factors that could influence the pH of the process. **Risk Treatment (raised APDD WQ Report Kooralbyn WTP - pathgoen treatment assessment report June 2015):** Assessment of the Kooralbyn WTP treatment capability indicates that the process has the capability to achieve the following 3.5 protozoa log reductions. This represents a protozoa log reduction shortfall of up to 2.0 under the HBT framework. Refer D15/114146 Update R.A 2017: Proposal with WTP Planning to write BC. Not in PD program for delivery 17/18. Expected 18/19.
TKO : Kooralbyn WTP	TKO-17 TKO-18 TKO-15	Coagulation	Incorrect coagulant dose	Overdose of alum resulting in contaminated treated water including underdose of caustic	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	**Risk Treatment (raised R.A 2017):** The primary signal to detect underdose of coagulant is the coagulant flow meter. Second to this is the dosed water pH meter which is critical to monitor coagulation is occurring within the effective pH range and, for Kooralbyn WTP, provides feedback for the caustic dose rate control. Flow to the dosed water instrument is under gravity and blockages of the dosed water sample line have been reported. A flow switch was installed to detect loss of flow to the instrument and subsequently interlock the WTP due to a loss of CCP monitoring and loss of feedback signal to the caustic dosing system. This was caused by longer sample pipe and flocs in sample water block the pipe. The rotameter float was scaled by metal particles and gets stuck in side the rotameter preventing no flow signal alarm dial out. The impact is reduction in reliability of the coagulation process (a critical control point). **Improvement Opportunity (raised R.A 2017):** Kooralbyn does not have any capability for timely and online measurement of changes in raw water quality for adequate pH correction that is needed for a reliable coagulation process. The Operator's work around to this issue is to start and stop the caustic dosing system in order to detect changes in raw water pH. The operator also uses coagulated pH as a lagging indicator of changes to raw water pH. This workarounds is only temporary and does not sufficiantly address the risk because of the number of variables and factors that could influence the pH of the process. **Risk Treatment (raised APDD WQ Report Kooralbyn WTP - pathgoen treatment assessment report June 2015)**: Assessment of the Kooralbyn WTP treatment capability indicates that the process has the capability to achieve the following 3.5 protozoa log reductions. This represents a protozoa log reduction shortfall of up to 2.0 under the HBT framework. Refer D15/114146 Update R.A 2017: Proposal with WTP Planning to write BC. Not in PD program for delivery 17/18. Expected 18/19.

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Site	Improvement #	Process Step	Issue	Description	Origin of Improvement	Significant Risk	Responsibility	Due for completion	Completed? Y/N	Risk Treatment Comments
TKO : Kooralbyn WTP	TKO-17 TKO-18 TKO-15	Coagulation	Incorrect caustic soda dose	Overdose of caustic soda causing high dosed water pH resulting in contamination of treated water	Risk Assessment	Medium (8)	Process Engineering	30/06/2021	N	**Risk Treatment (raised R.A 2017):** The primary signal to detect underdose of coagulant is the coagulant flow meter. Second to this is the dosed water pH meter which is critical to monitor coagulation is occurring within the effective pH range and, for Kooralbyn WTP, provides feedback for the caustic dose rate control. Flow to the dosed water instrument is under gravity and blockages of the dosed water sample line have been reported. A flow switch was installed to detect loss of flow to the instrument and subsequently interlock the WTP due to a loss of CCP monitoring and loss of feedback signal to the caustic dosing system. This was caused by longer sample pipe and flocs in sample water block the pipe. The rotameter float was scaled by metal particles and gets stuck in side the rotameter preventing no flow signal alarm dial out. The impact is reduction in reliability of the coagulation process (a critical control point). **Improvement Opportunity (raised R.A 2017):** Kooralbyn does not have any capability for timely and online measurement of changes in raw water quality for adequate pH correction that is needed for a reliable coagulation process. The Operator's work around to this issue is to start and stop the caustic dosing system in order to detect changes in raw water pH. The operator also uses coagulated pH as a lagging indicator of changes to raw water pH. This workarounds is only temporary and does not sufficiantly address the risk because of the number of variables and factors that could influence the pH of the process. **Risk Treatment (raised APDD WQ Report Kooralbyn WTP - pathgoen treatment assessment report June 2015):** Assessment of the Kooralbyn WTP treatment capability indicates that the process has the capability to achieve the following 3.5 protozoa log reductions. This represents a protozoa log reduction shortfall of up to 2.0 under the HBT framework. Refer D15/114146 Update R.A 2017: Proposal with WTP Planning to write BC. Not in PD program for delivery 17/18. Expected 18/19.
TKO : Kooralbyn WTP	TKO-16 TKO-15	Coagulation	Incorrect CO2 dose	**Note:** CO2 injection point available however system is not integrated into SCADA Underdose (absence) of CO2 causing high dosed water pH resulting in contamination of treated water	Risk Assessment	Medium (8)	Project Delivery	29/06/2020	N	**Risk Treatment (raised in Bigfoot Lagoon Risk Assessment workshop Feb 2017):** Future Control Mitigators and Strategies were identified in the workshop in Feb 2017 to reduce risks associated with running on Bigfoot Lagoon water to acceptable levels including installation of CO2. At time of R.A a project was already in delivery in 17/18 PD program PID02682 AIC: Mobile Powder Activated Carbon Units. Dosing point location proposed to be at WTP. **Risk Treatment (raised APDD WQ Report Kooralbyn WTP - pathgoen treatment assessment report June 2015):** Assessment of the Kooralbyn WTP treatment capability indicates that the process has the capability to achieve the following 3.5 protozoa log reductions. This represents a protozoa log reduction shortfall of up to 2.0 under the HBT framework. Refer D15/114146 Update R.A 2017: Proposal with WTP Planning to write BC. Not in PD program for delivery 17/18. Expected 18/19.
TKO : Kooralbyn WTP	TKO-15	Flocculation and Settling	Carry over of floc, sludge or algae in settled water	Carry over of floc, sludge or algae on to the filters causing filter break through caused by: - clarifier boil up - inadequate solids removal - incorrect flocculation speed	Risk Assessment	Medium (8)	Asset Planning	30/06/2021	N	**Risk Treatment (raised APDD WQ Report Kooralbyn WTP - pathgoen treatment assessment report June 2015):** Assessment of the Kooralbyn WTP treatment capability indicates that the process has the capability to achieve the following 3.5 protozoa log reductions. This represents a protozoa log reduction shortfall of up to 2.0 under the HBT framework. Refer D15/114146 Update R.A 2017: Proposal with WTP Planning to write BC. Not in PD program for delivery 17/18. Expected 18/19.
TKO : Kooralbyn WTP	TKO-18 TKO-15	Flocculation and Settling	Failure or incorrect operation of a bypass valve	Failure or incorrect operation of a clarifier bypass valve	Risk Assessment	Medium (8)	Operations - Supply	29/06/2020	N	**Improvement Opportunity (raised R.A review 2017):** Tag out bypass to ensure clear identification of valve and prevent accidental use. Refer KOO-TBA for Protozoa reduction Risk Treatment item.
TKO : Kooralbyn WTP	TKO-15	Media Filtration	Filter breakthrough	Fitler breakthrough	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	Refer to KOO-TBA for protozoa log reduction risk treatment
TKO : Kooralbyn WTP	KOO13	Media Filtration	Contamination by animals	Contamination of filtered water tank	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	**Risk Treatment (raised R.A review 2015):** Filtered water tank and treated water tank does not meet standards to prevent ingress/contamination. **Update R.A 2017:** TKO: Replace filter roofs was in 16/17 PD program and is carrying over into 17/18 to address appropriately designed filter roof access hatch.
TKO : Kooralbyn WTP	KOO13	Disinfection (primary)	Contamination by animals	Contamination of treated water tank	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	**Risk Treatment (raised R.A 2017):** There are known gaps around treated water pump assets on reservoir roof. Short term gaps need to be addressed. Long terms PID01709 - TKO: Reservoir roof replacement project in 17/18 PD program.
TRA : Rathdowney WTP	TRA-30	Raw Water Abstraction	Rain event in catchment	Intake of contaminated water that could potentially result in contaminated treated water	Risk Assessment	Medium (8)	Asset Planning	30/06/2021	N	**Risk Treatment (raised Rathdowney WTP – pathogen treatment assessment - documented R.A 2017):** Refer D15/114408. Pathogen log reduction review outcome was need for UV disinfection to meet protozoa log shortfall. Project to commence 17/18. Refer APMP 2017 capital plannig register.
TRA : Rathdowney WTP	TRA-30 RAD 23	Supernatant Return	Superntant return quality exceeds treatment capacity	Supernatant return water exceeds the treatment capacity of the plant due to: - rate of return >10% (pathogen risk) - turbidity > HACCP limits (pathogen risk) - insufficient poly dose	Risk Assessment	Medium (8)	Process Engineering	30/06/2021	N	**Risk Treatment (raised Rathdowney WTP – pathogen treatment assessment - documented R.A 2017):** Refer D15/114408. Pathogen log reduction review outcome was need for UV disinfection to meet protozoa log shortfall. Project to commence 17/18. Refer APMP 2017 capital plannig register. **Improvement Opportunity (raised R.A review 2017):** Supernatant return flow rate maximum is designed to be controlled by SCADA to not exceed 10% of raw water flow. At the time of conducting the R.A review the automation was not enabled and supernatant return flow rate was manually throttled by Operators. Observation is that automation works when WTP running at 5L/s but struggles at current rate of 4 L/s. Process Engineer to investigate improvements to automation control. In addition a return rate of <5 % of the raw water flow is recommended by the AWWA, Water Treatment Alliance and the WaterRA report 1079 Good Practice Guide to the Operation of Drinking Water Supply Systems for the Management of Microbial Risk 2015. Opportunities to meet this requirement using current assets should be investigated with a view to making recommendations for future upgrades if required to meet this target.
TRA : Rathdowney WTP	RAD 18 ALL16	Coagulation	Incorrect coagulant dose	Underdose of Magnasol 589 including loss of carrier water Or Ineffective coagulation due to elevated pH	Risk Assessment	High (12)	Asset Lifecycle Capability	30/06/2022	N	**Risk Treatment (raised R.A review 2015):** Install a flow meter on the magnasol dosing line with interlocks and pump fault alarms. Update R.A review 2017: Coagulant (589) flow monitoring was installed in Sep 2015 and integrated into SCADA including alarming and WTP interlock functionality. A time of R.A review 2017 the flow trend was assessed as being not reliable for alarming therefore risk remains significant. **Risk Treatment (raised R.A review 2017):** Pathogen log reduction review outcome was need for UV disinfection to meet protozoa log shortfall. Project to commence 17/18. Refer APMP 2017 capital plannig register.
TRA : Rathdowney WTP	ALL16	Coagulation	Incorrect coagulant dose	Overdose of Magnasol 589	Risk Assessment	Medium (8)	Asset Planning	30/06/2021	N	**Risk Treatment (raised R.A review 2017)**: Pathogen log reduction review outcome was need for UV disinfection to meet protozoa log shortfall. Project to commence 17/18. Refer APMP 2017 capital plannig register.
TRA : Rathdowney WTP	ALL16 RAD 24	Flocculation and Settling	Carry over of floc, sludge or algae in settled water	Carry over of floc, sludge or algae on to the filters causing filter break through caused by: - clarifier boil up - inadequate solids removal - incorrect flocculation speed	Risk Assessment	Medium (8)	Asset Planning	30/06/2021	N	**Risk Treatment (raised R.A review 2017):** Pathogen log reduction review outcome was need for UV disinfection to meet protozoa log shortfall. Project to commence 17/18. Refer APMP 2017 capital plannig register. **Improvement Opportunity (raised R.A review 2017):** SCADA and dial out alarming on flocculator failure/fault to be enabled.
TRA : Rathdowney WTP	ALL16 RAD 26	Media Filtration	Filter breakthrough	Fitler breakthrough	Risk Assessment	Medium (8)	Asset Planning	30/06/2021	N	**Risk Treatment (raised R.A review 2017):** Pathogen log reduction review outcome was need for UV disinfection to meet protozoa log shortfall. Project to commence 17/18. Refer APMP 2017 capital plannig register. **Improvement Opportunity (raised R.A review 2017):** Develop an oPRP for filter media inspections

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TRA : Rathdowney WTP	ALL16 RAD 27	Media Filtration	Build up of solids leading to elevated turbidity	High turbidity filtered water from backwash water tank used to backwash filter leading to filter breakthrough when filter back online	Risk Assessment	Medium (8)	Asset Planning	30/06/2021	N	**Risk Treatment (raised R.A review 2017):** Pathogen log reduction review outcome was need for UV disinfection to meet protozoa log shortfall. Project to commence 17/18. Refer APMP 2017 capital plannig register. **Improvement Opportunity (raised R.A review 2017)**: implement monitoring/inspections of filtered water tank sludge and/or filtered water tank turbidity to detect sludge build up. Including corrective actions.
TBK : Boonah-Kalbar WTP	TBK-9	Supernatant Return	Superntant return quality exceeds treatment capacity	Intake of supernatant return water that exceeds the treatment capacity of the plant including: - T&O in sludge lagoon impacting treated water T&O - overland flow from surrounding roadside and adjacent farms - rate of return >10% - inadequate poly dose (AN905) into sludge thickener - release of manganese due to low pH and failure to initiate caustic dosing	Risk Assessment	Medium (8)	Asset Planning	30/06/2021	N	**Improvement Opportunity (raised INR-3888: Supernatant Return CCP (DWQMP Regulator Audit Finding 2016):** Supernatant return pumps are fixed flow rate and oversized and the automatic valve can not modulate the flow rate to 10%. Pump is faulted by flow rate control valve installed as part of upgrades in 2015. Supernatant return rate at time of audit was >10%. Operations Team has manually throttled pumps as interime operational work around but need to be vigilant when raw water flows drop that supernatant return rate is not >10%. **Update at R.A 2017:** VFDS not in R&R program for 18/19. Not in PD program for 17/18. WTP Planning are commencing project planning on the sludge system this financial year 17/18. Process Engineers has submitted APIN to WTP Planning July 2017 for VFDs for supernatant pumps at Kalbar WTP 13/07/17. WTP Planning process should also consider formation of T&O in sludge lagoons. Further improvements required to address other operational inefficiencies including the cost of de-sludging lagoons annually.
TBK : Boonah-Kalbar WTP	TBK-17	Disinfection (primary)	Contamination by animals	Contamination of treated water tank	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	**Risk Treatment raised (raised Audit 2017):** Vermin proofing of reservoir required. **Update R.A review 2017:** Emergent works request sumbitted and in EW register.
TMD : Maroon Dam WTP	TMD-18	Raw Water Abstraction	Rain event in catchment	Intake of contaminated water that could potentially result in contaminated treated water	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised 2017)**: HBT Assessment required for this WTP. Conservative assessment made at the time of the R.A based on source water risk (Cat 4) and standard log reduction credits through conventional WTP processes. WTP likely to required additional protoza removal (i.e UV).
TMD : Maroon Dam WTP	TMD-18 MAR9 MAR8	Coagulation	Incorrect coagulant dose	Underdose of alum including inadequate mixing	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised 2017):** HBT Pathogen Assessment is required for this WTP. If WTP cannot achieve log reduction target for Cat 4 then additional barrier will be required (i.e UV disinfection). Likelihood can only be reduced to Rare when UV installed. **Improvement Opportunity (raised 2015):** Recommend conditionally formatting plantdata spreadsheet to prevent excursions being missed. **Risk Treatment (raised 2015):** Lack of alum flow monitorinng is an unacceptable risk due to periods of low RW pH. Alum flow monitoring required (and injection point flow switch or meter if carrier water used) with interlocks to shutdown the WTP. Raw water pH 5th%iles are <7.5 pH which is the validated SPV upper crtiical limit for dosed water pH using alum. Therefore during a rain event when RW pH is low (5% of the time) if alum dosing was lost this would not trigger the upper crtical limit of pH 7.5. In the short term a low dosed water pH limit will be used which should detect alum dosing failure in most circumstances.
TMD : Maroon Dam WTP	TMD-18 MAR9	Coagulation	Incorrect coagulant dose	Overdose of alum leading to ineffective coagulation affecting treated water quality	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised 2017):** HBT Pathogen Assessment is required for this WTP. If WTP cannot achieve log reduction target for Cat 4 then additional barrier will be required (i.e UV disinfection). Likelihood can only be reduced to Rare when UV installed. **Improvement Opportunity (raised 2015):** Recommend conditionally formatting plantdata spreadsheet to prevent excursions being missed.
TMD : Maroon Dam WTP	TMD-19 TMD-18	Flocculation and Settling	Carry over of floc, sludge or algae in settled water	Carry over of floc, sludge or algae on to the filters causing filter break through caused by: - clarifier boil up - inadequate solids removal - Build up of solids in settled water balance tank	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Improvement Opportunity (raised R.A review 2017):** autodesludge on start up would be an operational improvement for this site. **Risk Treatment (raised R.A review 2017):** HBT Assessment required for this WTP. Conservative assessment made at the time of the R.A based on source water risk (Cat 4) and standard log reduction credits through conventional WTP processes. WTP likely to require additional protoza removal (i.e UV).
TMD : Maroon Dam WTP	TMD-23	Disinfection (primary)	Contamination by animals	Contamination of treated water tank	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised R.A 2017):** Undertake reservoir inspection in accordance with Seqwater standard.
TMD : Maroon Dam WTP	MAR15 MAR9	Distribution Pipeline	Elevated water age	Presence of pathogenic bacteria resulting from loss of secondary disnfection barrier	Risk Assessment	Medium (8)	Project Delivery	29/06/2020	N	**Improvement Opportunity (raised R.A review 2015):** Chlorine residuals in distrubution system need to be improved. HACCP action limit for <0.2 mg/L already in place however not being reported against. **Update R.A review 2017:** D17/37461 PID02858 - DMA - Maroon Dam - Upgrade Treated Water Reticulation System - Business Case in delivery in 17/18. **Improvement Opportunity (raised R.A review 2015):** Conditionally format plantdata spreadsheet
TMD : Maroon Dam WTP	TMD-25	Distribution Pipeline	Build up of solids leading to elevated turbidity	Turbidity in distribution system. Causes include: - continuos build up over time due to aging assets - change in flow conditions disturbing biofilms	Risk Assessment	Medium (8)	Project Delivery	29/06/2020	N	D17/37461 PID02858 - DMA - Maroon Dam - Upgrade Treated Water Reticulation System - Business Case in delivery in 17/18. **Improvement Opportunity (raised R.A review 2017):** determine long term maintenance requirements of system to mitigate build up of turbidity and sediments over time.
TMD : Maroon Dam WTP	MAR6	Distribution Pipeline	Contamination due to pipe break	Ingress of contaminants leading to contamination of treated water	Risk Assessment	Medium (8)	Project Delivery	29/06/2020	N	**Improvement Opportunity (raised R.A review 2015):** Assessment of condition of network required to determine need for replacement/renewal of mains as breaks occur every 6-12 months. **Update R.A review 2017:** under DMA: Maroon Dam – Upgrade the Treated Water Reticulation System in delivery for 17/18
TMG : Moogerah Dam WTP	TMG-15	Raw Water Abstraction	Rain event in catchment	Intake of contaminated water that could potentially result in contaminated treated water	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised R.A 2017)**: HBT Assessment required for this WTP. Conservative assessment made at the time of the R.A based on source water risk (Cat 4) and standard log reduction credits through conventional WTP processes. WTP likely to required additional protoza removal (i.e UV).
TMG : Moogerah Dam WTP	TMG-15 MOO5	Coagulation	Incorrect coagulant dose	Underdose of alum including inadequate mixing	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised 2017):** HBT Pathogen Assessment is required for this WTP. If WTP cannot achieve log reduction target for Cat 4 then additional barrier will be required (i.e UV disinfection). Likelihood can only be reduced to Rare when UV installed. **Risk Treatment (raised 2015):** Lack of alum flow monitorinng is an unacceptable risk due to periods of low RW pH. Alum flow monitoring required (and injection point flow switch or meter if carrier water used) with interlocks to shutdown the WTP. Raw water pH 5th%iles are <7.5 pH which is s the validated SPV upper crtiical limit for dosed water pH using alum. Therefore during a rain event when RW pH is low (5% of the time) if alum dosing was lost this would not trigger the upper crtical limit of pH 7.5. In the short term a low dosed water pH limit will be used which should detect alum dosing failure in most circumstances. Alum pump fault alarms and lowering dosed water pH limit are interim measures
TMG : Moogerah Dam WTP	TMG-15	Coagulation	Incorrect coagulant dose	Overdose of alum leading to ineffective coagulation affecting treated water quality	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised 2017):** HBT Pathogen Assessment is required for this WTP. If WTP cannot achieve log reduction target for Cat 4 then additional barrier will be required (i.e UV disinfection). Likelihood can only be reduced to Rare when UV installed.
TMG : Moogerah Dam WTP	TMG-16 TMG-15	Flocculation and Settling	Carry over of floc, sludge or algae in settled water	Carry over of floc, sludge or algae on to the filters causing filter break through caused by: - clarifier boil up - inadequate solids removal - Build up of solids in settled water balance tank	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	**Improvement Opportunity (raised R.A review 2017):** Investigate opportunities to address clarifier sludge build up requiring manual draining and hose out on a regular basis. **Risk Treatment (raised R.A review 2017):** HBT Assessment required for this WTP. Conservative assessment made at the time of the R.A based on source water risk (Cat 4) and standard log reduction credits through conventional WTP processes. WTP likely to require additional protoza removal (i.e UV).
TMG : Moogerah Dam WTP	TMG-19	Disinfection (primary)	Contamination by animals	Contamination of treated water tank	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2022	N	**Improvement Opportunity (raised R.A reveiw 2017):** treated water tank has history of cracks and has not been internally inspected for evidence of ingress. Requires external and internal inspection and engineering assessment. Also need to assess for sediment build up and clean. Following tankering the turbidity increases.
TMG : Moogerah Dam WTP	MOO14	Distribution Pipeline	Build up of solids leading to elevated turbidity	Turbidity in distribution system. Causes include: - continuos build up over time due to aging assets - change in flow conditions disturbing biofilms	Risk Assessment	Medium (8)	Project Delivery	30/06/2021	N	**Improvement Opportunity (raised HACCP Team meeting 2016):** Investigate options for addressing ongoing turbidity (and possibly Mn) water quality issues in distribution system including long term alternative options for supply e.g new mains, rainwater tank supply. **Update R.A review 2017:** PID027772 - DMO - Moogerah Dam - Replace Exisitng Galvanised Steel Treated Water Reticulation Main in delivery 17/18 **Improvement Opportunity (raised R.A review 2017):** determine long term maintenance requirements of system to mitigate build up of turbidity and sediments over time.

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TMG : Moogerah Dam WTP	ALL1	Distribution Pipeline	Contamination due to pipe break	Ingress of contaminants leading to contamination of treated water.	Risk Assessment	Medium (8)	Project Delivery	30/06/2021	N	**Improvement Opportunity (raised 2010):** Map out retic network; Remove all known cross connections; Investigate historical knowledge of network. **Update R.A review 2017:** under DMO: Moogerah Dam – Upgrade the Treated Water Reticulation System in delivery for 17/18
TCP : Capalaba WTP	TCP-27	Disinfection (primary)	Contamination by animals	Contamination of chemical dosing chamber and/or treated water tanks	Risk Assessment	Medium (8)	Project Delivery	30/06/2022	N	**Risk Treatment (raised R.A review 2017; GHD Report 2017):** Refer recommended improvements to Reservoir Condition Assessment Capalaba Reservoir 1 and Reservoir 2 2017
TMU : Mudgeeraba WTP	TMU-29	Raw Water Abstraction	Rain event in catchment	Intake of contaminated water that could potentially result in contaminated treated water (HUI & LND)	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	**Risk Treatment (raised R.A 2017):** Likelihood has been risk assessed as Unlikely due impact of cyc. event in Mar 2017 which requires a review of the HBT source water category. Treatement capability remains unchanged however potential increase in source water category results in protozoa log shortfall in addition to the filter performance failures against the HBT criteria for achieving 3.5 protozoa log removal.
TMU : Mudgeeraba WTP	TMU-30	Taste and Odour Control	Incorrect PAC dose	Underdose or failure to dose PAC when required leading to customer complaints Note: Overdose of PAC not assessed in 2017 as not expected to result in treated water quality issue. Excess PAC will settle out in clarifier resulting in increased sludge production.	Risk Assessment	High (12)	Asset Planning	30/06/2023	N	**Improvement Opportunity (raised R.A 2015):** Source water selection is primary preventative measure for managing T&O at Mudgeeraba WTP. More recently the GCDP could be used to blend or supply some zones through the incident process if T&O was an issue. These source water selection options have been successful in avoiding (rather than treating) T&O in the raw water hence likelihood of high T&O in treated water is Rare however in the event that PAC system is required the effectiveness, reliability and operability of both PAC dosing systems (HUI BoHT and WTP inlet channel) is considered poor. The effectiveness of PAC dosing into the inlet channel was found to be completely ineffective in July 2014 based on raw and treated water results and the HUI system asset condition and reliability is questionable and untested. Therefore the likihood of T&O complaints/results at unacceptable levels when dosing PAC is Likely. **Update R.A 2017:** WTP Planning: The PAC dosing systems (two PAC plants at Mudgeeraba) are known to require upgrades. The existing systems will be reviewed, options for rationalisation will be assessed, and business cases for the recommended upgrades will be prepared. This review addresses an outstanding APIN.
TMU : Mudgeeraba WTP	MUD-22 TMU-36 TMU-37	Media Filtration	Filter breakthrough	Filter breakthrough resulting in hazards not being adequately controlled include failure of filter aid (LT-20) dose	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	**Risk Treatment (raised HACCP Internal audit 2014):** Review of filtration performance at Mudgeeraba WTP to identify inadequacies to Planning. Following the filter optimisation project the individual filtered data will need to be assessed. If operational changes do not improve filter performance then capital improvements such as addressing the filter to waste restriction or an additional process step (eg UV) should be considered as log removal credits under the Health Based Targets standard cannot be applied based on the current HACCP limits. **Update R.A 2017:** Further quantitative assessment in Pathogen Treatment Assessment for Mudgeeraba WTP performed June 2015 (D15/116852) confirmed filters don't meet performance expectations on ripening and overall don't meet the HBT filter performance targets for 3.0 log protozoa reduction. Process Engineering team are preparing to trial an extended terminal sub-fluidisation wash (ETSFW) sequence in the filters to determine whether this improves the ripening issues. D17/120476 Mudgeeraba (TMU) Long Term Planning Report has also captured that for individual filters, ripening times are a significant performance issue. **Improvement Opportunity (raised R.A review 2017):** Develop filter performance reports using continuous online data against the HBT critieria to assist in informing WTP Planning Long Term Planning Report. **Improvement Opportunity (raised R.A review 2017):** Operators note new filter aid is effective at reducing filter run time when on LND and improving filter performance. Dedicated pumps would allow Ops to set pre filter poly dose rates. Currently bleeding into clarifier launder from pipework sending poly to clarifier floc zone. As this was a trial no dedicated pumps initially put in place. Suggest installation of dedicated poly dosing pumps and dose rate control. Include dial out alarm on poly dosing system failure.
TMU : Mudgeeraba WTP	MUD27	Media Filtration	Contamination by animals	Contamination of filtered water outlet vessels	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2022	N	**Risk Treatment (raised R.A 2015):** Filer outlet are open and require covering similar to NSI WTP and in accordance with relevant sections of the standard.
TMU : Mudgeeraba WTP	TMU-40	Disinfection (primary)	Contamination by animals	Contamination of treated water tanks (including CCT, Res 1 and Res 2)	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2022	N	**Risk Treatment (raised R.A 2017; GHD Report 2017):** Refer recommended improvements to Reservoir Condition Assessment Mudgeeraba Reservoir 1 and Reservoir 2 September 2017
TMU : Mudgeeraba WTP	MUD28	Whole of system	Loss of control system	Loss of SCADA system or loss of PLC leading to impacts to treated water quality	Risk Assessment	Medium (8)	Operations - Maintenance	30/06/2021	N	**Risk Treatment (raised 2015):** Alarming to Operator is via external organisation and via the auto dialler. There is a lack of detailed understanding or Functional Description of where alarms are directed. Operators report some alarms not being received. Dial out alarms are currenlty hardwired into annunciator panel. **Update R.A review 2017:** WQ interlocks enable April 2017. There is a general lack of process regarding location, format, responsible areas and updating of Functional Descriptions (and therefore PLC code). This also includes individual validation of alarm delays on startup. MCS Summary Program (D17/159647) activity ID CMF013 lists Mudgeerabah WTP Finish date as Sep 2022.
TMO : Molendinar WTP	MDR10 TMO-17	Raw Water Abstraction	Rain event in catchment	Intake of contaminated water that could potentially result in contaminated treated water	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Improvement Opportunity (raised R.A 2013** - previously Risk Treatment): Vertical Profiler does not dial out when there is a change in turbidity. **Update R.A 2017:** In early 2017 a project was raised to install a dedicated turbitity meter on the raw water main at Hinze Dam. DWQ determined that the risk reduction provided by a turbidity analyser located at the Hinze lower intake for Molendinar WTP was not sufficient to justify the $~100K installation price. This was based on the Hinze raw water being generally stable and when it does change significantly there is a known cause (i.e. significant rain event). There is a water quality profiler located near the lower intake that could be used to inform of changing raw water quality, although it is acknowledged that, at times, is not available. It also requires the Operators to access the intranet as it is not connected to the WTP SCADA. Displaying the VPS data on the Molendinar WTP would be an Improvement Opportunity as per the connectivity from the LHD VPS on Capalaba WTP SCADA. Therefore this item has been reduced from a Risk Treatment to an Improvement Opportunity in 2017. **Risk Treatment (raised R.A 2017):** Likelihood has been risk assessed as Unlikely due impact of cyc. event in Mar 2017 which requires a review of the HBT source water category. Treatement capability remains unchanged however potential increase in source water category results in protozoa log shortfall in addition to the filter performance failures against the HBT criteria for achieving 3.5 protozoa log removal.

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Site	Improvement #	Process Step	Issue	Description	Origin of Improvement	Significant Risk	Responsibility	Due for completion	Completed? Y/N	Risk Treatment Comments
TMO : Molendinar WTP	MDR11 TMO-24 TMO-25	Disinfection (primary)	Insufficient C.t	Insufficient C.t due to: - low chlorine - high pH due to dosed filtered water caustic overdose - insufficient contact time - high treated water turbidity	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised R.A 2017 from Pathogen assessment conducted 2015)**: The CCT level and free chlorine HACCP limits are based on a MAXIMUM of 3 treated water pumps operating to meet a C.t of 8 mg.min/L. If more than 3 treated water pumps are required the Operator must contact DWQ Coordinator to recalculate free chlorine limits and minimum CCT level for higher flows (>3 treated water pumps). Refer to D17/75092 : Molendinar WTP - chlorine disinfection C.t calculation. This is noted in the HACCP Plan Wall Chart Procedure but this is an administrative control that may be oversighted. Engineering controls required such as online C.t monitoring with alarming and interlocks on treated water pumps. Further to this issue is that when four or five pumps are required the operating band of the CCT level is very narrow and likely to result in regular start/stopping of the WTP and/or treated water pumps. In addition, if the source water classification increases from a Cat 3 to a Cat 4 this will place further strain on the CCT level operating band. **Risk Treatment (raised R.A review 2017):** Introduce treated water pump interlocks (and auto gravity valve closure) Disinfection (primary) CCP critical limits as per Fluoridation CCP critical limits. **Improvement Opportunity (riased R.A review 2017):** Review supply configuration to Southport West zone. Southport West zone is direct feed via gravity valve or direct feed when treated water pumps running if gravity valve is closed (supply to Southport West backfeeds from Mol 4 when pumps offline). Due to the location of the Disinfection analyser being at the outlet of the CCT if/when these interlock there is a large volume of water in the CCT that will require re-treatment or wasting resulting in a loss of supply to the Southport West zone over that time. Under the current arrangment (at the time of the R.A) the zone was being fed direct when the treated water pumps were running however this results in reportedly high pressures in the CoGC system increasing risk of mains break. An ideal configuration would be to supply the Southport West zone from the outlet of the onsite Reservoirs.
TMO : Molendinar WTP	TMO-25	Disinfection (primary)	Contamination by animals	Contamination of CCT, Res 3, Res 4, Res 5, Res 6 (Note: Res 7 is supply system asset)	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2021	N	**Risk Treatment (raised R.A 2017)**: CCT vents/overflow structure not compliant. CCT roof hatches are points of ingress. **Risk Treatment (raised R.A 2017; GHD Report 2017):** Refer recommended improvements to Reservoir Condition Assessment Molendinar Reservoirs.
TMO : Molendinar WTP	MDR11	Whole of system	Loss of control system	Loss of SCADA system or loss of PLC leading to impacts to treated water quality	Risk Assessment	Medium (8)	Operations - Maintenance	30/06/2021	N	**Risk Treatment (raised R.A 2015):** Alarming to Operator is via external organisation and via the auto dialler. There is a lack of detailed understanding or Functional Description of where alarms are directed. **Update R.A review 2017**: There is a general lack of process regarding location, format, responsible areas and updating of Functional Descriptions (and therefore PLC code). This also includes individual validation of alarm delays on startup. MCS Summary Program (D17/159647) activity ID CMF012 lists Molendinar WTP Finish date as Sep 2021.
TNS : North Stradbroke Island WTP	NSI 17	Supernatant Return	Superntant return quality exceeds treatment capacity	**For Herring Lagoon:** Supernatant return water exceeds the treatment capacity of the plant due to: - rate of return >10% (pathogen risk) **For Bores:** N/A. Bore process does not include Supernatant Return process	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2022	N	**Improvement Opportunity (raised CL review 2015):** installation of online supernatant return turbidity monitoring to montior for return of supernatant quality. Flow rate is fixed to <10% of raw water flow so dedicated flow monitoring not required. **Update R.A review 2017**: Improvements should also include automation of supernatant return process i.e batch sequence etc control and interlocks on flow and turbidity.
TNS : North Stradbroke Island WTP	NSI8 NSI13	Coagulation	Incorrect lime dose	**For Herring Lagoon (pre lime):** **Underdose of lime into raw water main leading to**: - low alkalinity for coagulation - incorrect dosed water pH **Overdose of lime into raw water main leading to:** - incorrect dosed water pH **For Bores:** N/A. Bore water does not pass through Coagulation Process Step	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	**Risk Treatment (raised R.A review 2015 and DWQ Report to WTP Planning 2015 D14/149372):** It is recommended that the coagulation process at NSI WTP is upgraded. This upgrade should consider: - automatic changeover 'duty'/'standby' lime dosing pumps - feedback trim control of lime dosing from the dosed water pH analysers in the each of the DAF trains **Update R.A 2017:** 1) Operationa South SCADA maintenance team are in delivery of HACCP alarms and WTP interlocks on HACCP critical limits. 2) PID02921 - TNS: MCS Renewal project with PD for delivery in 17/18 program 3) TNS Process Improvement Design Basis and Issues and Needs Report Dec 2016 included improvements to Lime System. Project cancelled Oct 2017. Project to be restarted.
TNS : North Stradbroke Island WTP	NSI8 NSI13	Coagulation	Incorrect coagulant dose	**For Herring Lagoon:** Underdose of alum leading to loss of coagulation **For Bores:** N/A. Bore water does not pass through Coagulation Process Step	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	**Risk Treatment (raised R.A review 2015 and DWQ Report to WTP Planning 2015 D14/149372):** It is recommended that the coagulation process at NSI WTP is upgraded. This upgrade should consider: - paging of dosed water pH alarms to the Operator (Complete 2017) - interlock of WTP operation to dosed water pH alarms. This must include a full WTP HAZOP to ensure that all actions required to facilitate the interlock are identified and actioned, such that other unintentional adverse consequences are avoided - feed forward control of coagulant dose - single set of alum dosing pumps (automatic changeover 'duty'/'standby' arrangement) that are capable of delivering the required dose across the range of flow and alum doses expected - flow meters on the alum dosing line, interlocked to WTP operation, such that the detection of no alum flow will shutdown the WTP - flow pacing of the alum dose to raw water flow meters on the inlet to each DAF train or installation of appropriate control such that the flow to the DAF basins is equal or known - relocation of the alum dosing points to immediately upstream of the inline rapid mixers **Update R.A 2017:** 1) Operationa South SCADA maintenance team are in delivery of HACCP alarms and WTP interlocks on HACCP critical limits. 2) PID02921 - TNS: MCS Renewal project with PD for delivery in 17/18 program 3) TNS Process Improvement Design Basis and Issues and Needs Report Dec 2016 included improvements to Lime System. Project cancelled Oct 2017. Project to be restarted.
TNS : North Stradbroke Island WTP	NSI8 NSI13	Coagulation	Incorrect coagulant dose	**For Herring Lagoon:** Overdose of alum leading to ineffective coagulation **For Bores:** N/A. Bore water does not pass through Coagulation Process Step	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	Refer above for Underdose of alum
TNS : North Stradbroke Island WTP	TNS-24	Dissolved Air Flotation (DAF)	Failure or incorrect operation of a bypass valve	Failure or incorrect operation of bypass from flash mixer to settled water main, or Failure or incorrect operation of bypass from supernatant return line to settled water main	Risk Assessment	Medium (8)	Asset Planning	30/06/2023	N	**Risk Treatment (Raised R.A 2017):** Supernatant return to Filter inlet (bypass Coagulation CCP and DAF oPRP) needs to be removed. Flash mixer to Filter inlet (bypass Coagulation CCP floc zone and DAF oPRP). Under no circumstances would these bypasses be operated.

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Site	Improvement #	Process Step	Issue	Description	Origin of Improvement	Significant Risk	Responsibility	Due for completion	Completed? Y/N	Risk Treatment Comments
TNS : North Stradbroke Island WTP	NSI9/NSI13 TNS-25	Media Filtration	Filter breakthrough	Filter breakthrough resulting in hazards not being adequately controlled resulting from: - Filter breakthrough - Underdose or failure to dose filter aid (AN905-PWG)	Risk Assessment	Medium (8)	Project Delivery	30/06/2021	N	**Risk Treatment (raised R.A review 2015 and Report to Asset Planning D14/149372 and North Stradbroke Island WTP Pathogen treatment assessment for planning D14/63274):** There is limited monitoring and control of the filtration process at NSI WTP. There is no flow monitoring of water leaving each filter or filter outlet valve position, making it difficult to identify, when a filter is 'on line' or filtering to waste. This makes it impossible to validate the treatment performance. It is recommended that appropriate instrumentation is installed to facilitate effective online monitoring of the status of each filter. **Risk Treatment (raised R.A review 2017):** There is no automation to take filters offline when filters are out of spec. Filter automation and interlocks are required. **Update R.A review 2017:** 1) Operationa South SCADA maintenance team are in delivery of HACCP alarms and WTP interlocks on HACCP critical limits. 2) PID02921 - TNS: MCS Renewal project with PD for delivery in 17/18 program 3) TNS Process Improvement Design Basis and Issues and Needs Report Dec 2016 included improvements to monitoring and control of filter process. Project cancelled Oct 2017. Project to be restarted. **Risk Treatment (raised R.A review 2017):** Investigate the risk associated with walking over filters due to significant amount of Kangaroo droppings around the site.
TNS : North Stradbroke Island WTP	NSI10 NSI13	Disinfection (primary)	Insufficient C.t	**When running Borefield and Herring Lagoon through CCT and Res 1 (Res 2 balancing or offline)** Insufficient C.t due to: - low chlorine - high pH due to post lime overdose - insufficient contact time - high treated water turbidity	Risk Assessment	Medium (8)	Operations - Maintenance	30/06/2021	N	**Risk Treatment (raised R.A 2015 and Report to Asset Planning D14/149372):** It is recommended, to mitigate the hazardous event 'insufficient C.t' that control of disinfection is improved. This improvement should consider: - installation of online free chlorine and pH analysers downstream of the chlorine contact tank and lime dosing point at a point that provides suitably mixed and representative water sample, upstream of the Treated Water Reservoir No. 1. (Complete at R.A 2017) - implementation of associated call out alarming and interlocks to WTP operation from these pre-reservoir analysers - trim control of the chlorine and lime dose using the online free chlorine and pH analysers - dynamic monitoring and call out alarming of C.t is introduced in the SCADA. Interlock to WTP operation should also be implemented. - the maximum instantaneous flow rate leaving the WTP and if required installation of additional contact time to enable the minimum C.t to be achieved under worst case conditions. This should include investigation of the hydraulics of the chlorine contact tank and the potential for flooding of the baffles. **Update R.A 2017:** 1) Operationa South SCADA maintenance team are in delivery of HACCP alarms and WTP interlocks on HACCP critical limits. 2) PID02921 - TNS: MCS Renewal project with PD for delivery in 17/18 program 3) TNS Process Improvement Design Basis and Issues and Needs Report Dec 2016 included upgrade and/or additon to the exiting lime dosing system or construction of an alternative means of alkalinity adjustment was captured as a work package. Project cancelled Oct 2017. Project to be restarted. 4) PID02656 - TNS: Renew Chlorine Dosing Lines in Project Delivery 17/18 Program PID02863 - TNS: Replace Chlorinators in Project Delivery 17/18 Program
TNS : North Stradbroke Island WTP	NSI10 NSI13	Disinfection (primary)	Insufficient C.t	**When running Southern Borefield through Res 2 (CCT and Res 1 offline)** Insufficient C.t due to: - low chlorine - high pH due to post lime overdose - insufficient contact time - high treated water turbidity	Risk Assessment	Medium (8)	Asset Planning	30/06/2022	N	Risk Treatment as per Insufficient C.t when running Borefield and Herring Lagoon through CCT and Res 1 (Res 2 balancing or offline).
TNS : North Stradbroke Island WTP	NSI18	Disinfection (primary)	Incorrect lime dose	Underdose of lime resulting in pH <ADWG aesthetic guideline	Risk Assessment	Medium (9)	Asset Planning	30/06/2022	N	**Risk Treatment (raised Report to Asset Planning D14/149372 and IMS audit Feb 2016. Increased from IO to Risk Treatment in R.A review 2017 due to potential for widespread aesthetic impact by grid WTP):** The lime dosing system is a constant operational issues. Numerous incidents, HACCP Critical Limits excursions and HACCP Action Limit excursions have been reported due to lime dosing system faults.
TNS : North Stradbroke Island WTP	TNS-26	Disinfection (primary)	Contamination by animals	Contamination of CCT, Res 1, Res 2	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2022	N	**Risk Treatment (raised R.A 2017):** Refer recommended improvements to Reservoir Condition Assessment NSI Reservoirs (D17/90672, D17/90671). CCT fire hose connect point also requires backflow prevention.
TNS : North Stradbroke Island WTP	TNS-29	Whole of system	Loss of control system	Loss of SCADA system or loss of PLC leading to impacts to treated water quality	Risk Assessment	Medium (8)	Asset Lifecycle Capability	30/06/2022	N	**Improvement Opportunity (raised R.A review 2017):** There is a general lack of process regarding location, format, responsible areas and updating of Functional Descriptions (and therefore PLC code). This also includes individual validation of alarm delays on startup. MCS Summary Program (D17/159647) does not list NSI WTP as an Activity ID. PID02921 - TNS: MCS Renewal project with PD for delivery in 17/18 program
TAP : Amity Point WTP	ALL16 (AMITY)	Disinfection (primary)	Insufficient C.t	Insufficient C.t due to: - low chlorine - high pH due to incorrect Stabilisation pH control - insufficient contact time - high treated water turbidity	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised R.A 2013):** Calculate C.t and ensure that it is adequate through suitable controls including critical alarms/interlocks. C.t calculation currently includes councils town reservoir located near Amity WTP. **Update R.A 2015:** C.t is currently not met at the BSP. WTP Planning preparing a draft options assessment report. **Update R.A 2017:** Concept design complete to achieve C.t and BSP. Consultant engaged. Preliminary design complete.
TAP : Amity Point WTP	AMI-9	Disinfection (primary)	Contamination by animals	Contamination of treated water reservoir	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised R.A 2017):** Undertake reservoir inspection in accordance with Seqwater standard.
TAP : Amity Point WTP		Disinfection (primary)	Contaimination due to backflow	Contamination of treated water tank resulting from backflow from Redland Water network	Risk Assessment	Medium (8)	Asset Planning	30/06/2022	N	Refer to Risk Treatment for insufficient C.t
TDU : Dunwich WTP	DUN6	Disinfection (primary)	Insufficient C.t	Insufficient C.t due to: - low chlorine - high pH due to incorrect Stabilisation pH control - insufficient contact time - high treated water turbidity	Risk Assessment	Medium (8)	Asset Planning	30/06/2022	N	**Risk Treatment (raised R.A review 2015):** Investigate options to meet C.t. Will need ot liaise with Redlands due to 'change' that customers will recieve in free chlorine levels. Options could include increasing min res level. If not able to be reasonably achieved operationally then issue to be handed over to Planning.
TDU : Dunwich WTP	TDU-11	Disinfection (primary)	Contamination by animals	Contamination of treated water reservoir	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised R.A 2017):** Undertake reservoir inspection in accordance with Seqwater standard.
TDU : Dunwich WTP		Disinfection (primary)	Contaimination due to backflow	Contamination of treated water tank resulting from backflow from Redland Water network	Risk Assessment	Medium (8)	Asset Planning	30/06/2022	N	Refer to Risk Treatment for insufficient C.t
TPL : Point Lookout WTP	TPL-10	Disinfection (primary)	Contamination by animals	Contamination of treated water reservoir and balance tank	Risk Assessment	Medium (8)	Water Quality Unit	29/06/2020	N	**Risk Treatment (raised R.A 2017):** Undertake reservoir inspection in accordance with Seqwater standard. Reservoir roof is box gutter design and likely to have points of ingress.
TPL : Point Lookout WTP	ALL1	Disinfection (primary)	Failure or incorrect operation of a bypass valve	Failure or incorrect operation (treated water reservoir bypass	Risk Assessment	Medium (8)	Process Engineering	29/06/2020	N	**Risk Treatment (raised HACCP Team meeting 2016):** Bypass is thought to exist on outlet of 45 kL tank bypassing treated water reservoir. Bypass existance and condition requires confirmation and, if confirmed, removal. Refer REX 724654 Drawing I-DWG-TPL-601 P&ID Treated Water Storage.

Drinking Water Quality Improvement Plan - Overarching DWQMP and Supporting Programs

Site	Improvement #	Other Ref	Process Step	Issue	Description	Origin of Improvement	Significant Risk	Responsibility	Due for completion	Completed? Y/N	Comments
Overarching	DWQ2	Aquality A1.1	Supporting Programs	A1.1 New CEO (after commencement) person to sign WQ Policy. Updated document to go on Q-Pulse and WTP/SS sites (office/foyers)		Aquality	N/A	Governance, Compliance & Internal Audit (Veronica Hajenko)	30-Jun-20	N	Update30 June 2019: Extended to enable new ELT to be recruited and Board to confirm delegation to approve WQ policy statement, review and approve.
Overarching	DWQ5	Aquality A2.2	Supporting Programs	A2.2 A new Water Quality Data Solution (i.e. LIMS) is being procured to replace LIMS1, which better supports Seqwater's water quality data needs and internal laboratory system management. This new LIMS will continue data integration from the multiple historic systems, with the exception of WISKI data, and be a key facilitator to the capture of Operator grab sample data in to a water quality database (refer to A10.3).		Aquality	N/A	Manager Technical Support and Improvement	31-Dec-20	N	Target date set based on planed go live date for the the Water Quality Data Solution
Overarching	DWQ8	Aquality A4.1	Supporting Programs	A4.1 Resource and develop operations manuals and supporting procedures		Aquality	N/A	Operational Excellence Lead	30-Jun-21	N	Target date extended to match the target date for this project
Overarching	DWQ19	Aquality A4.14	Supporting Programs	A4.14 Follow up on Process assessments - process for getting improvements into Seqwater's various systems		Aquality	N/A	Principal Process Engineering	30-Jun-20	N	Improvement to the Capital Planning process is underway that will better capture site risks including input from Process Assessments, as well as other risk based inputs. Site Based Assessments
Overarching	DWQ21	Aquality A4.16	Supporting Programs	A4.16 Determine whether analysers/meters need to be done consistently		Aquality	N/A	Manager Asset Management	31-Dec-19	Y	Completed. Refer PRO-02120
Overarching	DWQ22	Aquality A4.17	Supporting Programs	A4.17 CIS records to be improved for strategic asset maintenance and operational record keeping - simplify the recording arrangement		Aquality	N/A	Manager Asset Management	31-Dec-19	Y	Data capture using mobile platform is in place for Maintainers, simplifying the recording of required inforamtion.
Overarching	DWQ23	Aquality A4.18	Supporting Programs	A4.18 Improve processes for proactive budgeting and replacement of agining and failing equipment		Aquality	N/A	Manager Asset Management Manager Asset Planning	31-Dec-19	Y	Issue & Opportunity Notification (ION) systems implemented and 3 year rolling asset renewal program. Management of Change process implemented
Overarching	DWQ28	Aquality A4.24	Supporting Programs	A4.24 Finalise implementation of chemical delivery procedures across Seqwater assets		Aquality	N/A	Manager Techncial Support & Improvement	30-May-20	N	A process for recieveal of bulk chemcials across Seqwater has been implemented. Chemcial contracts are being varied or entered in to, that include improved chemical quality specifications and quality documentation on delivery. New contracts are expected to be implemented for the majority of bulk chemicals by 30 May 2020.
Overarching	DWQ31	Aquality A5.1	Supporting Programs	A5.1 WQ awareness for reception staff		Aquality	N/A	Principal Water Quality	31-Dec-20	N	Update 30 June 2019: Water quaity awareness training framework being developed for all Seqwater staff. This includes a general awareness training that is planed to be completed in June 2020 with roll out planned to commence in second half of 2020
Overarching	DWQ32	Aquality A5.2	Supporting Programs	A5.2 Non-conformance response procedure to be developed *now linked to investgation procedure*		Aquality	N/A	Principal Water Quality	31-Dec-19	Y	Integrated Incident Investigation Procedure PRO-00793 in place
Overarching	DWQ36	Aquality A7.1	Supporting Programs	A7.1 Re-look at training for senior leadership and PM positions		Aquality	N/A	Principal Water Quality	31-Dec-20	N	Update 30 June 2019: Water quaity awareness training framework being developed for all Seqwater staff. This includes training for senior leadership as well as all staff. Water quality training for Project Managers and all staff and contractors working on Seqwater assests has been implemented in 2018/19
Overarching	DWQ40	Aquality A9.3	Supporting Programs	A9.3 Knowledge management - consider establishing a library or portal to share research proposals and outcomes		Aquality	N/A	Manager PSRI	31-Dec-19	Y	Research summaries and 'story books' are developed and available on REX. Updates on research project progression and outcomes discussed on Yammer and through 'Lunch and Learns'.
Overarching	DWQ46	Aquality A10.3	Supporting Programs	A10.3 Operator experience/set up in business use of TRIM so that all records/spreadsheets can migrate from G:drive to TRIM		Aquality	N/A	Manager Technical Support & Improvement	30-Jun-21	N	Update 30 June 2019 - This Improvement is to be addressed through a new database (Plant Operator Data Management System), which is in procurment phase. This is linked to A2.2 new LIMS database
Overarching	DWQ47	Aquality A11.1	Supporting Programs	A11.1 Business Intelligence Project		Aquality	N/A	ICT Manager	30-Jun-20	N	Refer A2.2 and A10.3. These projects include linkages of water quality data through a single portal
Overarching	DWQ49	Aquality A12.2	Supporting Programs	A12.2 Route for all DWQ improvement items and 'WQ Reports' through Process Engineering		Aquality	N/A	Dapo and Dunc M	31-Dec-19	Y	All capital and operational improvements are now managed through Management of Change, which includes review by Process Engineering representatives