BRISBANE CITY COUNCIL

BRISBANE WATER

Sandgate Water Reclamation Plant

Phosphorus Reduction Project

Volume 5 – Design Reports, Appropriate Records & Appendices

Tenix Alliance

BCC Contract No. BW.70146-3

1 DESIGN DETAILS

Brisbane City Council Water Distribution developed a process design and functional specification for an Acetic Acid Dosing System based on the requirement to reduce the concentration of phosphorus in the plants discharge. Brisbane City Council were responsible for the civil/structural design of the unloading and chemical storage area including the roof structure.

Tenix developed the mechanical design based on the parameters supplied within the contract specification which was derived from the process design.

5.1. Section 2 - Design Criteria

2 DESIGN CRITERIA

The mechanical design was based around the project P&ID (Drawing Number 486/5/5-0051-004) developed and issued by Council. The maximum chemical flow requirement for the system was specified at 150L/hr and the dilution water flowrate was specified as 1000L/hr.

A package dosing skid was procured from Alldos incorporating the required storage tank, duty/standby dosing pumps, specified valves, subsequent pipework and electrical control panels incorporating the Dosing System PLC.

The mechanical design was developed around the requirements of AS3780 – 2008 Storage and Handling of Corrosive Substances and AS1940 – 2004 The Storage and Handling of Flammable and Combustible Liquids. These standards provide the guidelines for unloading and storage requirements relating to the Acetic Acid dosing facility.

Initially the specification requested the design be suitable for the use of Glacial Acetic Acid, however after investigation it was identified that Glacial Acetic Acid is a classified as a flammable liquid under AS1940 -2004, and as such would have required a different design approach to that initially planed. It was then decided to limit the Acetic Acid solution to be stored within the bulk storage tank to a maximum concentration of 80%.

At concentrations of 80% or below Acetic Acid is classified as C1 combustible liquid provided the liquid is not exposed to temperatures greater than 6degC below the liquids flash point as per Section 1 of AS2430.3.3 Classification of Hazardous Areas – Examples of Area Classification – Flammable Liquids. An Orica MSDS for 25-80% acetic acid solution identified a flash point of 67degC for a 75% solution. In order to ensure temperatures of the mechanical equipment would not exceed 60degC it was advised not to keep Acetic Acid onsite without the installation of the roof structure. This was recommended so that the steel items such as pipework, vales or framework would not be heated due to direct exposure with the sun.

The electrical design was based on the requirements of the process design, functional specification and mechanical equipment procured and was built and installed in accordance with AS3000 – 2007 Electrical Installations.

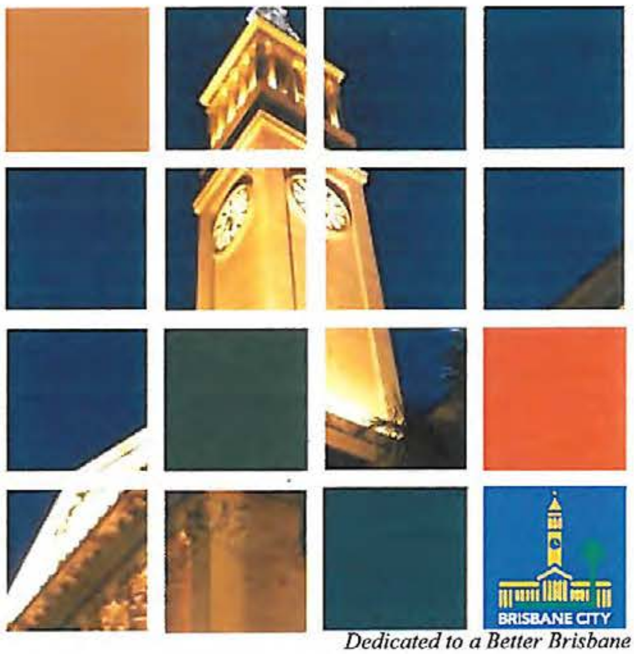
2.1 Geotechnical Investigation

city design

Sandgate WRP
Proposed Acetic Acid Facility

Geotechnical Investigation

August 2008



Dedicated to a Better Brisbane

ground engineering

REPORT

Brisbane City Council

To: **Brisbane Water**	Date: **26/08/08**
Attn: **Mahesha Chandra**	
CC:	
From: **Gary Bruyeres**	
Re: **Sandgate WRP- Proposed Acetic Acid Facility Geotechnical Investigation**	
Ref: **CD/T3-G1/081056PR001Agb**	

City Design
Ground Engineering

Green Square South Tower
505 St Paul's Tce
Fortitude Valley QLD 4006

Phone: 07 3027 4774
Facsimile: 07 3334 0220
Email: Gary.bruyeres@brisbane.qld.gov.au
Internet: www.brisbane.qld.gov.au

1.0 Introduction

The Ground Engineering section of City Design was commissioned by Brisbane Water (BW) to undertake an appraisal of the ground conditions at the proposed site of the Acetic Acid Storage Facility, located within the Sandgate Waste Water Treatment Plant, Sandgate.

The investigation involved one borehole and in-situ testing at the location indicated by BW, as shown on **Figure 1**. This report presents the results of the investigation and all factual field data and includes an assessment of site conditions.

2.0 Site Description

The latest GIS geological mapping information indicates the surface geology at the proposed site to be Quaternary Alluvium comprising sand, silt clay and gravel. The Tingalpa Formation, comprising siltstone, shale and thin coal seams, forms the underlying solid geology.

The elevation of the site is approximately RL4.5 AHD.

3.0 Field Investigation

The geotechnical investigation comprised one borehole drilled using a truck mounted Jacro 350 drilling rig. This hole was advanced using continuous flight augers. A Geotechnical Engineer from the group, who was responsible for nominating and directing all testing and sampling and providing field logs of the soils encountered, directed the fieldwork. The borehole location is shown on **Figure 1**, and the engineering log of the borehole and the accompanying explanation sheets are attached.

The borehole generally encountered a layer of fill material typically comprising, gravelly clay and cobble sized gravel. The fill material was underlain by residual silty and sandy clays with occasional ironstone bands encountered within these materials. SPT 'N' values in the residual soil were typically 11, with a lower value of 10 and a higher value of 34 recorded in this material.

Groundwater seepage was not observed

4.0 Engineering Assessment and Recommendations

It is understood the proposed Acetic Acid storage facility is to be designed as an open steel framed building over a storage tank and loading bay. Drawing (0005-033) supplied shows that the proposed building is to be supported on a pile foundation system, with the 31000 litre tank founded on a slab within the building.

Aerial photos from 2001 indicate that the proposed new storage facility was within the site of an old aeration tank system within the old water treatment plant. Aerial photos from 2007 shows the site has undergone major site works adjacent to the proposed structure, with the removal of the aeration tanks and construction of a large new tank to the east.

Without detailed records of the fill material that was encountered during this investigation, the fill under the proposed Acetic Acid storage facility is considered to be uncontrolled.

For high level foundations, the estimated allowable bearing capacity is 160Kpa. Some settlements would be expected under high level footings, and these could be of the order of 20mm in the short term, with differential settlements of the order of 10-15mm. Some fill consolidation may also occur with time under loads. If the fill is removed and re compacted to 98% standard maximum dry density, consolidation of the order of 1% could be expected. This would equate to 10-20mm over time.

For pile foundations, bored piles to residual soil are recommended, **Table 1 – Preliminary Pile Design Parameters** below outlines possible design parameters for the material encountered in BH1

Table 1– Preliminary Pile Design Parameters

Unit	Ultimate End Bearing Capacity (kPa)	Shaft Adhesion (kPa)	Coefficient of Horizontal Subgrade Reaction (kPa/m)
Fill	**NA**	**Neglect**	**NA**
Residual Soil <4m depth	600	45	12000
Residual Soil >4mdepth	1000	45	24000

Geotechnical strength reduction factor (Φ_g) of 0.45 should be adopted when determining R*g

No acid sulphate potential soil was encountered during the drilling

The bored piles should be inspected by a suitable qualified geotechnical engineer prior to placement of concrete.

Please take the time to read the attached document '**Important Information About Your Geotechnical Engineering Report'.**

Should you have any further queries regarding this report, please do not hesitate to contact the undersigned.

Gary Bruyeres
Principal
Ground Engineering

Chris Thorley

Principal Geotechnical Engineer

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

As the client of a consulting geotechnical engineer, you should know that site subsurface conditions cause more construction problems than any other factor. ASFE/The Association of Engineering Firms Practicing in the Geosciences offers the following suggestions and observations to help you manage your risks.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Your geotechnical engineering report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. These factors typically include: the general nature of the structure involved, its size, and configuration; the location of the structure on the site; other improvements, such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask your geotechnical engineer to evaluate how factors that change subsequent to the date of the report may affect the report's recommendations.

Unless your geotechnical engineer indicates otherwise, do not use your geotechnical engineering report:

- when the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size, elevation, or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership; or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems that may occur if they are not consulted after factors considered in their report's development have changed.

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time of subsurface exploration. Do not base construction decisions on a geotechnical engineering report whose adequacy may have been affected by time. Speak with your geotechnical consultant to learn if additional tests are advisable before construction starts. Note, too, that additional tests may be required when subsurface conditions are affected by construction operations at or adjacent to the site, or by natural events such as floods, earthquakes, or ground water fluctuations. Keep your geotechnical consultant apprised of any such events.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL JUDGMENTS

Site exploration identifies actual subsurface conditions only at those points where samples are taken. The data were extrapolated by your geotechnical engineer who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your geotechnical engineer can work together to help minimize their impact. Retaining your geotechnical engineer to observe construction can be particularly beneficial in this respect.

A REPORT'S RECOMMENDATIONS CAN ONLY BE PRELIMINARY

The construction recommendations included in your geotechnical engineer's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Because actual subsurface conditions can be discerned only during earthwork, you should retain your geotechnical engineer to observe actual conditions and to finalize recommendations. Only the geotechnical engineer who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations are valid and whether or not the contractor is abiding by applicable recommendations. The geotechnical engineer who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Consulting geotechnical engineers prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your geotechnical engineer prepared your report expressly for you and expressly for purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the geotechnical engineer. No party should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.

GEOENVIRONMENTAL CONCERNS ARE NOT AT ISSUE

Your geotechnical engineering report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site. The equipment, techniques, and personnel used to perform a geoenvironmental exploration differ substantially from those applied in geotechnical engineering. Contamination can create major risks. If you have no information about the potential for your site being contaminated, you are advised to speak with your geotechnical consultant for information relating to geoenvironmental issues.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid misinterpretations, retain your geotechnical engineer to work with other project design professionals who are affected by the geotechnical report. Have your geotechnical engineer explain report implications to design professionals affected by them, and then review those design professionals' plans and specifications to see how they have incorporated geotechnical factors. Although certain other design professionals may be familiar with geotechnical concerns, none knows as much about them as a competent geotechnical engineer.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE REPORT

Geotechnical engineers develop final boring logs based upon their interpretation of the field logs (assembled by site personnel) and laboratory evaluation of field samples. Geotechnical engineers customarily include only final boring logs in their reports. Final boring logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes, and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, give contractors ready access to the complete geotechnical engineering report prepared or authorized for their use. (If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared and that developing construction cost estimates was not one of the specific purposes for which it was prepared. In other words, while a contractor may gain important knowledge from a report prepared for another party, the contractor would be well-advised to discuss the report with your geotechnical engineer and to perform the additional or alternative work that the contractor believes may be needed to obtain the data specifically appropriate for construction cost estimating purposes.) Some clients believe that it is unwise or unnecessary to give contractors access to their geotechnical engineering reports because they hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems. It also helps reduce the adversarial attitudes that can aggravate problems to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical engineers. To help prevent this problem, geotechnical engineers have developed a number of clauses for use in their contracts, reports, and other documents. Responsibility clauses are not exculpatory clauses designed to transfer geotechnical engineers' liabilities to other parties. Instead, they are definitive clauses that identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report. Read them closely. Your geotechnical engineer will be pleased to give full and frank answers to any questions.

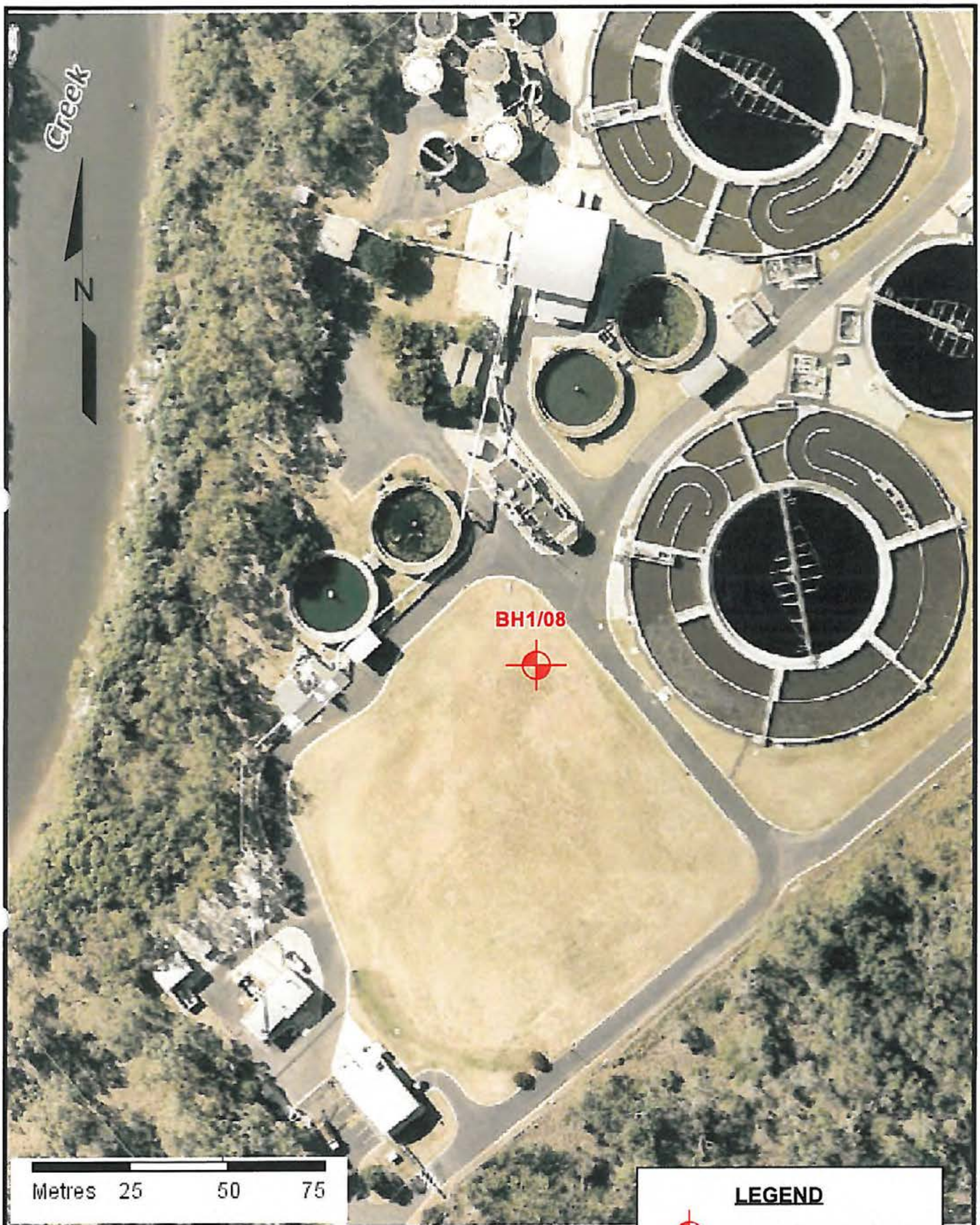
RELY ON THE GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Most ASFE-member consulting geotechnical engineering firms are familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a construction project, from design through construction. Speak with your geotechnical engineer not only about geotechnical issues, but others as well, to learn about approaches that may be of genuine benefit. You may also wish to obtain certain ASFE publications. Contact a member of ASFE of ASFE for a complimentary directory of ASFE publications.

ASFE PROFESSIONAL FIRMS PRACTICING IN THE GEOSCIENCES
8811 COLESVILLE ROAD/SUITE G106/SILVER SPRING, MD 20910
TELEPHONE: 301/565-2733 FACSIMILE: 301/589-2017

IIGER06943.5RP

Reprinted with permission by Geotechnical Services Section, Brisbane City Council, 1996



DIAGRAMMATIC ONLY

Design	G. Bruyeres	August 08	CITY DESIGN STRUCTURAL DESIGN GEOTECHNICAL REPORT SANDGATE WWTP BOREHOLE LOCATION	BRISBANE CITY COUNCIL City Design The Engineering Group - Ground Engineering
Drawn	P. Bowles	August 08		
Checked	G. Bruyeres	August 08		Report Reference No. CD/T3-G1/081056PR001A — Fig. 1
Scale	AS SHOWN	A4		

Dedicated to a better Brisbane

webmap

CITY DESIGN - GROUND ENGINEERING
DESCRIPTION AND CLASSIFICATION OF SOIL AND ROCK

GENERAL

Description and classification of soil and rock are based on definitions and systems outlined in Australian Standard AS1726-1993, Geotechnical Site Investigations. Description of rock fracturing is based on a system set out by the Sydney Group of the Australian Geomechanics Society, 1975.

DESCRIPTION AND CLASSIFICATION OF SOIL

Soils are classified on the basis of predominating grain size, modified by other significant grain size or sizes present (e.g. CLAYEY SAND).

Classification		Particle Size
CLAY		< 0.002mm
SILT		0.002 - 0.06mm
SAND	fine sand	0.06 - 0.2mm
	medium sand	0.2 - 0.6mm
	coarse sand	0.6 - 2.0mm
GRAVEL	fine gravel	2 - 6mm
	medium gravel	6 - 20mm
	coarse gravel	20 - 60mm
COBBLES		60 - 200mm
BOULDERS		> 200mm

COHESIVE SOILS

Cohesive soils are described in terms of consistency, colour and structure with comments on minor constituents or apparent special features. Consistency is based on the shear strength of the soil, and is generally estimated from experience, measured by hand penetrometer or determined by laboratory testing.

Term	Abbreviation	Undrained Shear Strength	Unconfined Compressive Strength
VERY SOFT	VS	< 12kPa	<25kPa
SOFT	S	12 - 25kPa	25-50kPa
FIRM	F	25 - 50kPa	50-100kPa
STIFF	St	50 - 100kPa	100-200kPa
VERY STIFF	VSt	100 - 200kPa	200-400kPa
HARD	H	> 200kPa	>400kPa

NON-COHESIVE SOILS

Non-Cohesive soils are described in terms of relative density, colour, with comments on minor constituents or apparent special features. Relative density or density index is generally based on standard penetration testing (AS1289 Test 6.3.1), or other forms of penetration testing.

Term	Relative Density	Abbreviation
VERY LOOSE	<15%	VL
LOOSE	15 - 35%	L
MEDIUM DENSE	35 - 65%	MD
DENSE	65 - 85%	D
VERY DENSE	>85%	VD

ENGINEERING CLASSIFICATION OF ROCK[1]

ROCK STRENGTH

GENERAL FIELD GUIDE	Is (50)[2] MPa	Code[3]	Abbr.	AS1726 Rock Strength	APPROX.[4] Q_U MPa
Easily remoulded by hand to a material with soil properties.	<0.03	<1	EL	Extremely Low	<0.7
May be crumbled and fragmented by hand	0.03 - 0.1	1 – 2	VL	Very Low	0.7 - 2.4
A piece of core 150mm x 50mm diameter may be broken by hand and easily scored with a knife. Sharp edges of the core may be friable and break during handling. Lumps of rock crumble with light hammer blow.	0.1 - 0.3	2 – 3	L	Low	2.4 - 7
A piece of core 150mm x 50mm diameter may be broken by hand with considerable difficulty but may be scored with a knife. Core may be broken with a light hammer blow.	0.3 - 1	3 – 4	M	Medium	7 - 24
A piece of core 150mm x 50mm diameter cannot be broken by hand, but can be slightly scratched or scored with a knife. Core may be broken with a blow from a hammer.	1 - 3	4 – 5	H	High	24 - 70
A piece of core 150mm x 50mm diameter may be broken with a heavy hammer blow, but cannot be scratched by a knife.	3 - 10	5 – 6	VH	Very High	70 - 240
A piece of core 150mm x 50mm diameter is difficult to break with a hammer and rings when struck.	>10	6 - 7	EH	Extremely High	>240

Notes:
1. Based on AS1726 - 1993 Geotechnical Site Investigations.
2. Point Load Strength Index: ISRM Committee on Laboratory Tests, Document No.1, October 1972.
3. Estimated strengths shown between the lines on the histogram indicate strengths are within the range assigned to the lines eg. the histogram plotted between lines 2 and 3 indicates strengths are within the low strength range (between 0.1 and 0.3Mpa)
4. The approximate unconfined compressive strength (q_u) is based on an assumed ratio to the point load index of 20:1. This ratio may vary widely.

ROCK MATERIAL WEATHERING CLASSIFICATION

DESCRIPTION TERM	ABBR	DEFINITION
Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely Weathered Rock	EW	Rock is weathered to such an extent that it has "soil" properties, ie. it either disintegrates or can be remoulded, in water.
Distinctly Weathered Rock	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by ironstaining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Slightly Weathered Rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh Rock	Fr	Rock shows no sign of decomposition or staining.
Note: Based on AS1726 - 1993 - Geotechnical Site Investigations		

DESCRIPTION OF DEFECTS IN ROCK OR SOIL

DEFECT TYPE	SURFACE SHAPE	SURFACE CHARACTERISTICS	COATINGS
PT - Parting along bedding or foliation JT - Joint IS - Infill Seam CS - Crushed Seam WS - Weathered Seam SS - Soil Seam SZ - Sheared Zone	Pl - Planar Cv - Curved Un - Undulose Ir - Irregular St - Stepped	Sm - Smooth Ro - Rough Sl - Slickensided Sr - Striated Po - Polished	lc - limonite coated cc - clay coated mc - manganese coated

CODE	DEFECT SPACING (mm)
1	30
2	100
3	300
4	1000
5	3000

Note: Defect spacings shown between the lines on the histogram indicate spacings are within the range assigned to the lines eg. the histogram plotted between lines 2 and 3 indicates defect spacings are within the range of 100mm to 300mm for the length of core indicated.

NOTES AND ABBREVIATIONS USED ON LOGS

DRILLING METHOD	
HA	Hand Auger
A	Continuous Flight Augering
HO	Hollow Auger
R	Rotary Drilling with flushing of cuttings from hole using water circulation.
RA	Rotary Drilling with flushing of cuttings from hole using air circulation.
NC	NMLC 52mm Triple Tube Core Drilling.
NQ	NQ 47mm Triple Tube Core Drilling.
V	V - Bit
TC	Tungsten Carbide Bit
DB	Drag Bit
RB	Roller Bit
MOISTURE CONDITION	
D	Dry : looks and feels dry
M	Moist: no free water on hands when remoulding
W	Wet : free water collects on hands when remoulding
FIELD SAMPLING AND TESTING	
Recovered	Recovered soil sample or length of recovered rock core.
Lost	Lost soil sample or length of lost rock core.
SPT	Standard Penetration Test to AS 1289 6.3.1 - 1993. N = penetration resistance (blows for 300mm penetration following 150mm seating drive). Result reported according to penetration (P) achieved: !P = 450mm blows : for each 150mm of penetration, and N Value !150<P<450 blows : for seating drive, plus subsequent blows and penetration. !P<150mm : total blows and penetration
RW	Rod weight only caused full penetration
HW	Hammer and rod weight only caused full penetration
HB	Hammer bouncing
U5O	Thin wall tube sample (50mm dia.) advanced by hydraulic pressure from drill rig. ! number indicates nominal sample diameter in mm. ! R indicates refusal to penetration
UP50	Piston sample (50mm dia. tube as above)
MV	Mini Pilcon vane shear test (approximate undrained shear strength in kPa)
FV	Field vane shear test (approximate undrained shear strength in kPa)
PP	Pocket penetrometer test (approximate unconfined compressive strength in kPa)
OTHER	
GROUNDWATER:	
GWO	Groundwater level first observed while drilling
GWL	Observed Groundwater level at time and date shown
GROUNDWATER NOT OBSERVED	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage, rain, etc, or caving of borehole or test pit
GROUNDWATER NOT ENCOUNTERED	Borehole or test pit dry after drilling, but groundwater could still be present in impermeable soil or where borehole or test pit was backfilled soon after completion.

(ii)

CITY DESIGN
Ground Engineering
505 St Paul's Tce, Fortitude Valley Qld 4006
Phone: (07) 30274774 Facsimile: (07) 3340220
Dedicated to a better Brisbane

BOREHOLE LOG Geotechnical BH01/08

PROJECT No: CD/T3-G1/081056PR001A

CLIENT: Structural Design **CONTRACTOR:** Schneider Drilling **LOGGED BY:** TW
PROJECT: Sandgate WWTP **EQUIPMENT:** Gemco HC10 **CHECKED BY:** GB
LOCATION: Sandgate Waset Water Treatment Plant **NOTES:**

DATE COMMENCED: 31/07/2008 **ELEVATION (m):** AHD **EASTING:** MGA **HOLE ANGLE:** 90°
COMPLETED: 31/07/2008 **TOTAL DEPTH (m):** 7.45 **NORTHING:** **BEARING:** ---

Method	Support	Groundwater	Depth (m)	Material Description	Moisture Content	Consistency	Relative Density	Samples / Test Results / Remarks	Additional Comments / Interpreted Geology
Solid Auger - TC Bit	No Support		0.0 – 1.6	FILL (CI) GRAVELLY CLAY, medium plasticity, mottled red-brown and grey, fine to cobble	M			U_{50} (approx. 1.1–1.3 m)	FILL
			1.6 – 7.0	(CI) SILTY CLAY, medium plasticity, mottled red-brown and pale grey, some gravelly bands				SPT 3, 4, 6 N=10 (1.6–2.0 m); SPT 4, 5, 6 N=11 (2.6–3.0 m); PP=440kPa U_{50} (4.1–4.5 m); SPT 4, 7, 10 N=17 (5.6–6.0 m)	RESIDUAL SOIL
			7.0 – 7.45	(CI) SANDY CLAY, medium plasticity, dark brown to dark grey, fine to medium grained sand				SPT 8, 13, 21 N=34	

Bottom of hole at 7.45 m.

NOTE: LOG TO BE READ IN CONJUNCTION WITH REPORT TEXT AND EXPLANATION SHEETS

Soil Description and Classification Symbols based on AS 1726

Water Symbols
- Water Level (date)
- Inflow
- Partial Loss
- Complete Loss

Moisture Content
- D - Dry
- M - Moist
- W - Wet
- W_p - Plastic Limit
- W_l - Liquid Limit

Consistancy (cohesive soils)
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

Relative Density (cohesionless soils)
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Sampling/Testing
- Bs - Bulk Sample
- Dist - Disturbed Sample
- SPT - Standard Penetration test
- SS - Split Spoon
- N - SPT 'N' Value
- PP - Pocket Penetrometer
- VS - Vane Shear
- U_{50} - Undisturbed Sample/Diameter

SOIL LOG - GEOTECHNICAL CD-T3-G1-080156PR001A.GPJ CITY DESIGN DATA TEMPLATE.GDT 26/8/08

5.2. Section 3 - Process Design Description

3 PROCESS DESIGN DESCRIPTION

Refer to Brisbane City Council Water Distribution Functional Specification included herein for the Process Design Description.

Dedicated to a better Brisbane

SANDGATE WATER RECLAMATION PLANT PHOSPHORUS REDUCTION PROJECT

FUNCTIONAL SPECIFICATION FOR ACETIC ACID DOSING FACILITY

Revision Control

Revision Number	Date	Amendment Details	Responsible Officer
V1	2008-05-12	Prepared from FD V4 (Originated by Cyril Tollari)	Rahim Janfada
V2	2008-05-26	Cyril Tollari and Graham Simpson's comments incorporated	Rahim Janfada
V3	2008-06-17	Cyril Tollari Updated to reflect latest changes	Cyril Tollari
V4	2008-06-26	Cyril Tollari Updated to reflect latest changes	Cyril Tollari
V5	2008-07-10	Bill's Comments Incorporated	Rahim Janfada
V6	2008-07-15	For Tender Issue	Rahim Janfada
V7	2008-08-01	Clarification of sump pump operation, dosing pump flow monitoring and operation.	Peter Tranter

Table of Contents

1. INTRODUCTION....4

2. ACETIC ACID DOSING PURPOSE AND CAPACITY REQUIREMENTS....4

3. DOSING SYSTEM EQUIPMENT AND CONTROL DESCRIPTIONS....5

3.1 Acetic Acid Storage Tank Level Controls and Monitoring....5
- 3.1.1 Hardwired Devices....5
- 3.1.2 Control Loop Details....6
- 3.1.3 Control Loop Parameters....6
- 3.1.4 Interlock Conditions....7
- 3.1.5 Data transfer to/from other control loops....7
- 3.1.6 Alarms....7
- 3.1.7 Reports....7

3.2 Acetic Acid Dosing System Controls....7
- 3.2.1 Hardwired Devices....7
- 3.2.2 Control Details....8
- 3.2.3 Interlock Conditions....8
- 3.2.4 Acetic Acid Dilution Water....8
- 3.2.5 Acetic Acid Feed Dosing Pumps, Flow Monitoring and Control....10
- 3.2.6 Dosing Pumps Control Modes....11

4 TRUCK UNLOADING AND STORAGE BUND DRAINAGE SYSTEM....14

4.1 Drainage System Alarms....14

5 DOSING SYSTEM CONTROL PANEL....14

5.2 Dosing Pump Duty and Rotation....15

6 SCADA REQUIREMENTS....15

6.1 Screens....15

6.2 Trends....15

6.3 Reports....17

7 QUALITY CONTROL OF PLC SOFTWARE DEVELOPMENT....17

APPENDIX A - DRAWINGS....18

1. Introduction

The purpose of this document is to specify the functional requirements of a Chemical Storage & Dosing System for Sandgate Water Reclamation Plant (WRP) Phosphorus Reduction. The chemical used for this process shall be Acetic Acid that will be supplied and installed as a package plant.

The package plant software design for this process shall operate as one of several slave control systems under the control of the Sandgate Water Reclamation Plant's master control system.

Sandgate WRP in currently controlled by a PLC/SCADA based control system that was installed by Brisbane Water Enviro Alliance (BWEA) in 2006. The Plant SCADA system servers and PLCs are connected to a Local Area Network (LAN) via an Ethernet TCP/IP Protocol.

The PLCs installed at the Plant are from Siemens S7-300 Series and the SCADA system is Citect. It is expected that the new Acetic Acid Dosing System will be supplied complete with its on-board PLC fully programmed to run the dosing system. The status of the Dosing system shall be monitored on the SCADA and some control commands shall also be issued from the SCADA as explained in the document.

Acetic Acid Dosing Package Plant shall be installed on the grassed area near the Inlet Works and will dose into each Feed Chamber of the Flowsplitter No. 2 to the Bioreactors 1&2.

An Acetic Acid Dosing Control Panel will be part of the package-dosing unit including a small PLC fully programmed to control the dosing system. Supply of a package unit for the dosing system needs to have provisions made for connection of the new control panel to the existing Siemens S7 PLCs via Ethernet
Associated Documents: the following documents should be read in conjunction with this Functional Specification:

- P&ID Drawing No. 486/5/5-0051-003 & 004
- Proposed Acetic Acid Dosing Lay Out Plans Drawing No. 486/5/5-0005-032 &33.
- Instrument and equipment list

2. Acetic Acid Dosing Purpose and Capacity Requirements

From 1st January 2009, the licence for the Sandgate WRP restricts the phosphorus discharge from Sandgate WRP to Moreton Bay to:

- 6 mg/L maximum Total Phosphorus (TP) concentration allowed in the effluent.
- 18 250 kg per year annual mass load calculated from a 50th percentile TP concentration of 2 mg/L and ultimate catchment average dry weather flow of 25 ML/d.

The current process at Sandgate WRP is able to achieve around 77% Phosphorus Removal, bringing influent TP of 13 mg/L down to 3 mg/L.

The new Acetic Acid Dosing System will be sized to remove an extra 2 mg/L on average and in the worst case an extra 5 mg/L.

Extra Effluent TP to Remove mg/L	Acetic Acid Dose Setpoint mg/L
5	46.86
4	37.49
3	28.12
2	18.74
1	9.37

The new Acetic Acid Dosing System shall incorporate the following components:

- Acetic Acid Storage Tank with a minimum required capacity of 25kL;
- Acetic Acid Feed Dosing System with two pumps with up to150L/h dosing capacity each in a duty/standby configuration;
- Acetic Acid Dilution Water System;
- Acetic Acid Dosing System Control Panel;
- Acetic Acid Fill Point Local Indicator Panel;
- Pipeworks, Instruments and valving as shown on the P&I Diagram Drawing No. 486/5/5-0051-004

The following sections describe the above listed components complete with their control loop descriptions, equipment, alarms and SCADA displays to enable the Dosing System supplier to program their PLC.

3. Dosing System Equipment and Control Descriptions

This section describes all controls associated with the Acetic Acid Storage & Dosing System.

3.1 Acetic Acid Storage Tank Level Controls and Monitoring

The Storage Tank TK-01 shall be a vertical cylindrical tank with a minimum required capacity of 25 m3 – Fibreglass max 4m diameter, 2.5m wall height. The chemical storage tank shall comply with the requirements specified in the Australian Dangerous Goods Code and relevant Australian Standards including AS3780:1994, Workplace Health and Safety Codes and Environmental Legislation.

3.1.1 Hardwired Devices

Equipment List

Not applicable.

Instrumentation List

Tag	Mnemonic	Description	EU	Min	Max
LIT01	*Acetic_Tank_Level*	Acetic Acid Storage Tank Level Transmitter	%	0.00	100
LSH01	*Acetic_Tank_LSH*	Acetic Acid Storage Tank Level High	Switch	-	-
LSH02	*Acetic_Tank_Bund _LSH*	Acetic Acid Storage Bund Level High	Switch	-	-

3.1.2 Control Loop Details

The Acetic Acid Storage Tank Level Transmitter LIT01 Profibus analog signal shall be used for the following Process Alarm/Trip conditions:

- If the Level is less than the Level Low Setpoint, Acetic Acid Storage Tank Level Low Acetic Acid Delivery Required Warning Alarm shall be generated.

- If the Level value is less than the Level Low Low Setpoint, Acetic Acid Storage Tank Level Low Low Acetic Acid Dosing System Shutdown Alarm shall be generated. <u>This is a latched alarm (Note: any latched alarm will require operator's reset to unlatch).</u>

The Acetic Acid Storage Tank Level Switch High LSH01 is monitored for the following Process Alarm condition:

- If the Level Switch High is activated, the Acetic Acid Storage Tank Level Switch High Acetic Acid Delivery Shutdown Alarm shall be generated. This alarm will activate an audible alarm and cut electricity to the local GPO powering the Acetic Acid Delivery Truck Transfer Pump on the Fill Point Local Indicator Panel. <u>This is a latched alarm.</u>

The Acetic Acid Storage Bund Level Switch High LSH02 is monitored for the following Process Alarm condition:

- If the Level Switch High is activated, the Acetic Acid Storage Bund Level Switch High Alarm shall be generated.

3.1.3 Control Loop Parameters

Operator Selection

Not applicable.

SCADA Adjustable Parameters

Tag	Mnemonic	Description	EU	Preset
XXXX	*Acetic_Tank_Level_L_SP*	Acetic Acid Tank Level Low Setpoint	%	25.00
XXXX	*Acetic_Tank_Level_LL_SP*	Acetic Acid Tank Level Low Low Setpoint	%	10.00
XXXX	*Acetic_Bulk_Conc*	Acetic Acid Bulk Concentration	%w/w	60.00
XXXX	*Acetic_Bulk_SG*	Acetic Acid Bulk Specific Gravity	-	1.049

3.1.4 Interlock Conditions

The following interlocks are applicable to the Storage Tank Levels:

- Acetic Acid Delivery Truck Transfer Pump on the Fill Point Local Indicator Panel is interlocked with the High Level Switch on the tank to stop filling the tank when it gets to a high level to prevent overflow.
- Acetic Acid Storage Tank Level Low Low signal is interlocked with Acetic Acid Dosing System to shutdown at low-low level for pumps protection.

3.1.5 Data transfer to/from other control loops

Not applicable.

3.1.6 Alarms

The following alarms shall be communicated from the Dosing System PLC to the SCADA:

Tag	Instrument	Name / Area	Description
XXXX	*LIT01*	ACETIC ACID TANK	LEVEL TRANS ACETIC ACID LOW - DELIVERY REQUIRED
XXXX	*LIT01*	ACETIC ACID TANK	LEVEL TRANS LOW LOW - ACETIC ACID DOSING SHUTDOWN
XXXX	*LIT01*	ACETIC ACID TANK	LEVEL TRANS SIGNAL INVALID
XXXX	*LSH01*	ACETIC ACID TANK	LEVEL SWITCH HIGH - ACETIC ACID DELIVERY SHUTDOWN
XXXX	*LSH02*	ACETIC ACID TANK	BUND LEVEL SWITCH HIGH

3.1.7 Reports

Not applicable.

3.2 Acetic Acid Dosing System Controls

3.2.1 Hardwired Devices

Equipment List

The Acetic Acid Dosing system consists of the following components:

- Acetic Acid Dilution Water System; and
- Acetic Acid Feed Dosing System including Duty/Standby Acetic Acid Feed Dosing Pumps PU-01 & PU-02

Instrumentation List

- Pneumatic Actuated Flow Control Valve FCV-02 on the Dilution Water Pipe;
- Flow Switch FSL-01 on the Dilution Water Pipe;
- Pneumatic Actuated Flow Control Valves FCV-04 & FCV-05 on dosing pumps delivery line;
- Pressure Gauge PI-01 mounted on the common pipe of dosing pumps discharge;

3.2.2 Control Details

Operation of the Acetic Acid Dosing System is enabled / disabled by the Operator at the SCADA and applies to all system components (IN AUTO MODE).

Any cause of a shutdown on the Acetic Acid Dilution Water or Acetic Acid Feed Dosing Systems will generate an Acetic Acid Dosing System Shutdown alarm. This alarm will be latched.

Operator Selection

Selection	Description	Enabled
ENABLE/DISABLE	Enable/Disable operation of the Acetic Acid Dosing System	Always

3.2.3 Interlock Conditions

Interlock between dilution water and dosing system will be installed to prevent dosing system without dilution water being available.

3.2.4 Acetic Acid Dilution Water

The function of the (Service) Dilution Water is to dilute the Acetic Acid to safe-carry the Acetic Acid solution for dosing at the Bioreactors No 1&2 (via the Feed Chambers No 1&2 of the Flowsplitter No 2).

The plant service water pressure is 670kPa, it is intended that the Flow Control Valve (FCV-103 25mm Maric valve on the P&ID) to throttle flow to a constant flow of 1000L/h at 200kPa (regardless of upstream water pressure) so that the Dosing Pump will only discharge into service pressure of less than 200kPa at all times.

The valve FCV103 is open for Dilution Water flowrates greater than 1000 L/h (0.3 L/s). This is the minimum dilution water flowrate required to ensure safe dilution of

Acetic Acid solution from maximum 75% to below 10% strength for the maximum dosing rate of 150 L/h deliverable by the Dosing Pump.

3.2.4.1 Hardwired Devices

Equipment List

Tag	Mnemonic	Description	Type
FCV 103	*Acetic_Dil_Valve*	Acetic Acid Dilution Water Valve	Valve
FCV02	*Acetic_Dil_Valve*	Acetic Acid Dilution Water Pneumatic Valve	Valve

Instrumentation List

Tag	Mnemonic	Description	EU	Min	Max
FSL01	*Acetic_Dil_FSL*	Acetic Acid Dilution Water Flow Switch	Switch	-	-
ZSO02	*Acetic_Dil_Valve_ZSO*	Acetic Acid Dilution Valve Open Limit Switch	Switch	-	-
ZSC02	*Acetic_Dil_Valve_ZSC*	Acetic Acid Dilution Valve Closed Limit Switch	Switch	-	-

3.2.4.2 Dilution Water Control Loop Details

The flow control valve FCV02 outlined in the above Equipment List Table shall operate as follows:

- The Valve will be energised to open on Acetic Acid dosing startup and will be de-energised to close on Acetic Acid dosing shutdown after a set period of delay time *(Acetic_Dilution_Stop_Delay_SP)*.
- On start up Dilution Water healthy and flow on will be detected for a set time before dosing is allowed to start.
- On shutdown the Dilution Water will run for a set period of time after dosing system shuts down.

The Low Flow Switch FSL01 is monitored for the following Process Alarm conditions:

- If the Acetic Acid Dilution Water Flow Switch Low FSL01 is activated for a set period of time (5 sec.) while FCV02 is in open position, Acetic Acid Dilution Water Flow Switch Low - Acetic Acid Shutdown Alarm will be generated. This alarm is latched.

SCADA Adjustable Parameters

Tag	Mnemonic	Description	EU	Preset
XXXX	*Acetic_Dil_Stop_Delay_SP*	Acetic Acid Dilution Water Stop Delay Set Point	Sec	180
XXXX	*Acetic_Dil_Water Low Flow Stop Timer SP*	Acetic Acid Dilution Water Low Flow Time Delay Set Point	Sec	5

Alarms

Tag	Instrument	Name / Area	Description
XXXX	*FSL01*	ACETIC ACID DILUTION WATER	DILUTION WATER FLOW SWITCH LOW - ACETIC ACID SHUTDOWN
XXXX	*FCV02*	ACETIC ACID DILUTION WATER	DILUTION WATER FLOW CONTROL VALVE FAILED TO OPEN
XXXX	*FCV02*	ACETIC ACID DILUTION WATER	DILUTION WATER FLOW CONTROL VALVE FAILED TO CLOSE
XXXX	*FCV02*	ACETIC ACID DILUTION WATER	DILUTION WATER FLOW CONTROL VALVE LIMIT SWITCHES DISCREPANCY

3.2.5 Acetic Acid Feed Dosing Pumps, Flow Monitoring and Control

There are two Acetic Acid dosing pumps capable of handling up to 150 L/h Acetic Acid at 400 kPa each to deliver Acetic Acid to the mixing point with the dilution water. The pumps are 110-240V AC 50Hz electrically powered pumps and will operate in duty/standby arrangement.

The function of the Acetic Acid Feed Dosing Pumps is to dose Acetic Acid into the Feed Chambers No 1&2 of the Flowsplitter No 2 (directly feeding the Anaerobic Zone of the Bioreactors 1&2).

A pressure indicator, a pulsation damper, pressure sustaining valve, a non-return valve and an isolation valve are located on the common discharge side of the dosing pumps.

3.2.5.1 Hardwired Devices

Equipment List

Tag	Mnemonic	Description	Type
PU01	*Acetic_Feed_PU1*	Acetic Acid Feed Dosing Pump No. 1	VSD or Stroke Control
PU02	*Acetic_Feed_PU2*	Acetic Acid Feed Dosing Pump No. 2	VSD or Stroke Control
FCV04	*Acetic_Feed_PU1_Valve*	Acetic Acid Feed Dosing Pump No. 1 Anti-syphon Valve	Valve
FCV05	*Acetic_Feed_PU2_Valve*	Acetic Acid Feed Dosing Pump No. 2 Anti-syphon Valve	Valve

Instrumentation List

Not applicable.

3.2.6 Dosing Pumps Control Modes

Each pump will be able to be operated in one (1) local manual mode and two (2) remote modes. The local and remote mode selection is selectable from one common three position (Local Manual/ Off/ Remote) switch mounted on the Dosing System Control Panel (CP). The operating modes are: **Local Manual and Remote Modes** as detailed below.
NOTE: IN ALL CONTROL MODES THE FOLLOWING INTERLOCKS SHALL APPLY:

- On initiation of the Acetic Acid Dosing System the Acetic Acid Dilution Water will start followed by the Acetic Acid Feed Dosing after a set time delay.

- The Anti-syphon Valve for the Acetic Acid Feed Dosing Pump is energised to open on pump run and de-energised to close on pump stop. This is to prevent syphoning and is active in all control modes.

- The Acetic Acid Feed Dosing Pump comes with an integral Low Flow Switch to fault the pump under low flow conditions and start the Standby Pump (In Remote Auto mode only).

Local Manual Mode
When a pump is selected to Local Manual, the pump will start via its hardwired start/stop push buttons mounted on the escutcheon plate of the Control Panel.

Remote Mode
This mode is the pumps normal operation mode. In Remote mode, the start/stop commands and dosing rate signal to the dosing pump are sent from the PLC initiated from the Citect system operator station.

In Remote mode, the dosing rate will be controlled by a Profibus analogue output signal from the PLC.

Normal operation in remote mode of the dosing plant via the SCADA system will have two modes of operations displayed on the operator station screen and selectable from the Citect SCADA screen as follows:

- Remote Manual
- Remote Auto (Flow Paced)

Remote Manual Mode
When the Dosing Pumps Rate Controller mode is in remote manual the operator can directly enter the pump dosing rate in L/hour and the PLC will run the pump at that rate. The pump is started and stopped by the operator from the SCADA screen.

Remote Auto (Flow Paced) Mode
In AUTO Feed Control mode the Acetic Acid Feed Dosing Pump Flow Setpoint shall be provided by the Flow Controller from the Acetic Acid Dose Rate Setpoint from either:

- A Scheduled Setpoint Mode (set points details to be provided during software design).
- A fixed Dose Entered Manually by the Operator (in mg/L).

Flow Setpoint

The algorithm for calculating the Acetic Acid Feed Dosing Flow Setpoint is as follows:

Acetic_Feed_Flow_SP [L/h]
= *Acetic_Feed_Dose_SP [mg/L] x FS2_Feed_Flow [L/s](existing flowmeter FIT85102 called the Plant Feed Flowmeter signal on raw screened sewage line)* / *Acetic_Bulk_SG [-]* / *Acetic_Bulk_Conc [%]* x 3.6 / 1000

Pump Speed Determination

Minimum flow / speed and Maximum flow / speed data points will be entered into the PLC to develop a linear relationship for determination of the pump speed. These data points will be adjustable at the SCADA.

3.2.6.1 Control Loop Parameters

Operator Selection

Not applicable.

SCADA Data

Tag	Mnemonic	Description	EU
XXXX	*Acetic_Feed_Flow_SP*	Calculated Acetic Acid Feed Dosing Flow Setpoint	L/h

SCADA Adjustable Parameters

Tag	Mnemonic	Description	EU	Preset
XXXX	*Acetic_Feed_Dose_SP*	Acetic Acid Feed Dose Rate Setpoint	mg/L	*37.49*
XXXX	*Acetic_Feed_PU_Start_Delay_SP*	Acetic Feed Pump Start Delay Setpoint	Sec	10
XXXX	*Acetic_Feed_Flow_Dev_SP*	Acetic Acid Feed Dosing Flow Deviation SP	%	10.00

3.2.6.2 Interlock Conditions

Device	Interlock Conditions
PU01 *PU02*	*LIT04* Acetic Acid Storage Tank Level Low Low Alarm Active
	XXXX Service Water Tank Level Switch Low Low Active
	XXXX Flowsplitter 2 Feed Flow – No flow signal
	FSL01 Acetic Acid Dilution Flow Switch Low Active
	ZSC02 Acetic Acid Dilution Valve Closed or not Open

3.2.6.3 Data transfer to/from other control loops

Tag	Mnemonic	Description	Type
XXXX	*FS2_Feed_Flow*	Flowsplitter 2 Feed Flow	Read
XXXX	*Acetic_Bulk_Conc*	Acetic Acid Bulk Concentration	Read
XXXX	*Acetic_Bulk_SG*	Acetic Acid Bulk Specific Gravity	Read

3.2.6.4 Alarms

Tag	Instrument	Name / Area	Description
XXXX	*PU01*	ACETIC ACID FEED PUMP NO. 1	FLOW SWITCH LOW SHUTDOWN
XXXX	*PU02*	ACETIC ACID FEED PUMP NO. 2	FLOW SWITCH LOW SHUTDOWN

3.2.6.5 Reports

Tag	Description	EU	Report
XXXX	Acetic Acid Feed Dosing Volume	L/d	Daily

3.2.6.6 Control Philosophy of Dosing Pumps

The control philosophy for dosing pumps is as described below:

- A Duty/Standby Selector Switch will control the duty/ standby function in Local mode. In Remote mode the duty/standby selection will be done by the PLC.
- In Remote mode failure of the duty pump would start the standby pump and an alarm would be raised.
- The duty-dosing pump will stop if a low-low level signal is received from the storage tank.
- The duty-dosing pump would stop if a low flow signal is received from the dilution water line flow switch and an alarm would be raised.

The dosing pumps will be either digital dosing pumps or positive displacement diaphragm-type pump driven by an electric stepper motor capable of controlling the stroke speed. Similar to the functionality of the Grudfos Alldos DDI222.

Each pump will be provided with:

(a) A flow monitor that is connected and monitored by the pump controller itself.
(b) Remote on/off input
(c) Speed/flow input
(d) Speed flow output
(e) Fault output on error detection of the pump and or power failure.
(f) Means of detection that the pump is not operating in remote.

4 Truck Unloading and Storage Bund Drainage System

Stormwater drain from Truck Unloading Bund and any wash down from the Acetic Acid Storage Bund will be collected to a Drainage Sump as shown on the P&ID Drawing No. 486/5/5-0051-004. The aim is to pump stormwater excess accumulating in these areas to the Inlet Works. This stormwater will possibly contain diluted small acetic acid and oil spills but not a harmful level to the Plant process.

The following arrangement will be made to prevent any issues associated with the spillage of chemicals:

- A manual valve will be installed between the Truck Unloading Bund and the Drainage Sump that will be left at Normal Open Position (NO) at all times except during chemical unloading, the truck driver will be required to shut this valve before starting to unload the Acetic Acid to ensure any major spillage does not flow into the Drainage Sump. If there is any major spillage it will be kept in the Unloading Bay and drained into a truck not into storm water drainage system.
- A manual valve will be installed between the Storage Bund and the Drainage Sump that will be kept at Normal Closed Position (NC) at all times except during storage area washdown. The Plant Operator will open this valve after a washdown or stormwater collection and drain the water into the Drainage Sump if there are not any major chemical contents. If there is a major chemical spillage in the Storage Bund it will be kept and drained into a truck not into the storm water drainage system.
- The Drainage Sump will be equipped with an automated submersible pump with an integrated float switch to pump the stormwater to the Plant Inlet Works. The sump pump shall be sized to pump approximately 10 L/s @ 10m head.
- A Truck Unloading Bund High level switch shall be installed and connected to the PLC to provide an alarm to the Plant SCADA system in the event of a failure of the submersible pump in the Drainage Sump.

4.1 Drainage System Alarms

Tag	Instrument	Name / Area	Description
XXXX	*HLS*	Truck Unloading Drainage Bund	Truck Unloading Bund High Level Alarm

5 Dosing System Control Panel

Power for the new dosing system will be provided from a new Control Panel (CP) supplied as part of the package plant. The three (3) phase power supply to the Control Panel will be provided from the existing Bioreactor No.2 Switchboard. .
The new control panel will house the power and control equipment, the pump and alarm local controls and the alarm indication as well as the cable marshalling. Equipment will include 415V main switch/power distribution, pump motors control relays, PLC Processor and I/O modules, I/O module interfacing terminals and 24V dc power supply.

The Dosing System PLC will be connected to the Bioreactor No 2 (see general specification) Siemens S7-300 PLC via Ethernet to communicate all control and monitoring data between the Plant SCADA System and the Dosing Package PLC. The preferred type of PLC for Dosing System shall be a Siemens S7-300 series PLC.

The dosing system control mode is selected from a Remote/Off/Local Manual selector switch mounted on the escutcheon panel behind the main door of the control panel.

The dosing system fault/shut down flashing indicator is mounted on the escutcheon panel.

5.2 Dosing Pump Duty and Rotation

The Pump Duty Selection function in the Dosing System PLC will monitor the availability of every pump and control the rotation of the duty pump. It is not intended to run both pumps in parallel. The Duty Pump rotation is rotated every time the current Duty Pump stops. It is also rotated whenever there is a request to start the Standby Pump by the operator via the SCADA Station.

The duty selection of the two (2) dosing pumps is to be changed each day to ensure that the pumps experience the same wear and tear. An hour run meter will be installed for each pump to allow such monitoring. In the event that the duty pump stops or goes into fault, the stand-by pump is to become the duty pump and start immediately. An alarm is to be raised to the SCADA system. Similarly, in the event of the stand-by pump stopping or going into fault a relevant alarm is to be raised. The duty pump on power up will default to Pump No. 1.

6 SCADA Requirements

The Existing Citect SCADA system will be programmed and configured by Brisbane Water to provide all control, alarms and monitoring functions via the plant operator room PC.

6.1 Screens

The Citect SCADA system will have a dedicated page displaying tank, pumps, valves and instrumentation as per the P&ID diagram. All devices shall be configured as per the current Citect standard include project, including all standard popup screens required for each equipment.

6.2 Trends

The following trends shall be made available for the operators as standard trend pages.

Tank Level Trend Screen

#	Trend	Sample Rate	Units
1	Storage Tank Level	5 sec	%

Acetic Acid Dosing Trend Screen

#	Trend	Sample Rate	Units
1	P1 Flow Paced Dosing Rate	5 sec	L/hr
2	P2 Flow Paced Dosing Rate	5 sec	L/hr
3	Flow Dosing Set Point	5 sec	L/hr
4	Raw Screened Sewage Flow used for flow pacing	5 sec	L/s
5	Acetic Acid Dose Set Point	5 sec	Mg/L
6	Dilution Water Flow Switch	5 sec	On/Off Time

6.3 Reports

Daily and Monthly reports will be developed in consultation with the Production Branch. These reports will be developed using the existing site Access Reports and will include the totalized flows (Bioreactors inlet, Acetic Acid dosing), pump hours run, Average/Min/Max Sensor Reading for the Total Phosphorus (TP) levels.

7 Quality Control of PLC Software Development

The Dosing Package Supplier shall obtain from Brisbane Water's Network Control Systems (NCS) examples of code and configuration and shall program the Dosing System PLC to the standards expected.

This shall include detailed commenting within the code.

All intellectual property contained within the code and software development shall remain the property of Brisbane Water.

The developed software, Factory Acceptance Test (FAT) and Site Acceptance Test (SAT) plans shall be provided to NCS for inspection and approval.

Factory testing shall be conducted at the contractor's premises prior to loading on site.

NCS shall supervise and approve the loading of all software on the Council's site. Complete backups and storage of existing projects must be taken prior to any site code change.

Appendix A - Drawings

Drawings:

Drawing No.	Description
486/5/5-0051-003	Acetic Acid Dosing General Notes and Symbol Legend
486/5/5-0051-004	Acetic Acid Dosing Piping and Instrumentation Diagram
486/5/5-0005-032	Acetic Acid Storage & Dosing General Arrangement
486/5/5-0005-033	Acetic Acid Storage & Dosing Storage and Unloading Facility Cross Sections
486/5/5-S3T010	Sandgate PLC/SCADA Network