

Oxley WRP Regional Sludge Processing

September 2011



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Principal Process Eng



Oxley WRP – A Brief Overview



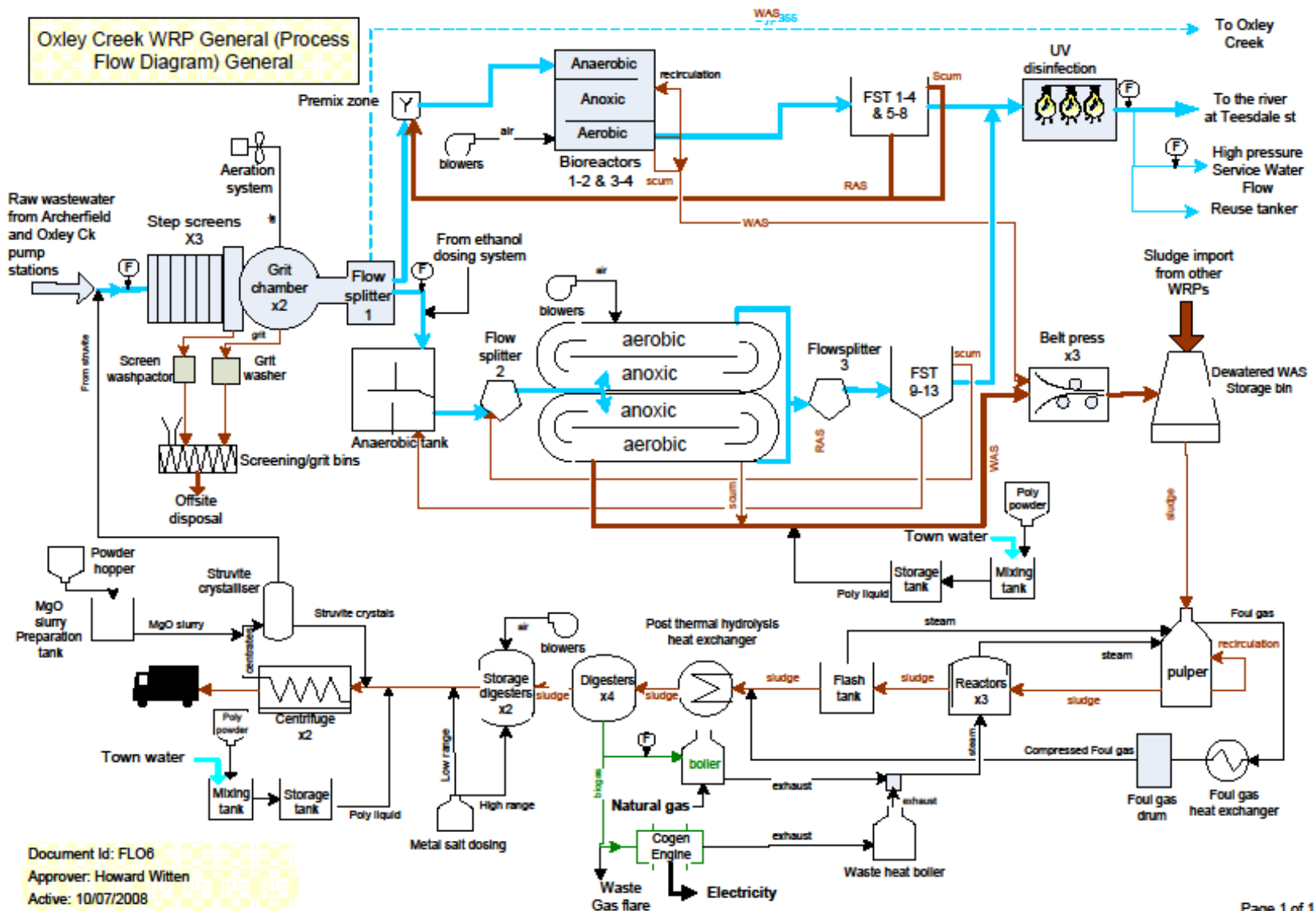
- Serves 280000EP
- 2005 Configuration
 - Main Train - RDS, PST, 4 bioreactors with an MLE configuration, 8 secondary clarifiers, chlorine disinfection
 - Sludge - DAF, anaerobic digestion, centrifuge dewatering
- Upgraded in 2006 to meet range of drivers including:
 - Growth
 - Licence - median effluent TN of 5 mg/l and TP of 6.5 mg/l (December 2008), 2 mg/l (from January 2009)
 - Odour

Oxley BWEA Upgrade



- Alliance – BW, John Holland, Aquatec Maxcon, MWH, JWP
- Upgrade included:
 - Main train - New inlet works, 2 new oxidation ditches 22 day sludge age (Stage 5), 5 new secondary clarifiers, UV disinfection
 - Sludge train - 3 new GDD/BFP, THP (Cambi) with ancillary equipment, 1 new centrifuge, struvite crystallisation reactor
 - Odour control
- Capacity
 - ADWF 65 ML/day
 - Stage 1 to 4 - 12 ML/day, Stage 5 – 53 ML/day
 - Inlet works- 5 ADWF
 - Biological process- 3 ADWF

Oxley Creek WRP General (Process Flow Diagram) General



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The Case for Anaerobic Digestion



- Existing infrastructure:
 - Existing digesters
 - Existing Cogeneration or Combined Heat & Power infrastructure
- Increase in Oxley sludge disposal costs
 - Oxley 14800t/year (2005)=> 38500t/year (2006)
 - \$820k/annum increase in sludge costs (2006)
- Truck movement increase on road network (2000/year along Ipswich Road)
- BCC Clean and Green Strategy– Class A stabilisation grade
- Odour performance critical to project success
 - Risk of waste activated sludge storage onsite

Option Analysis

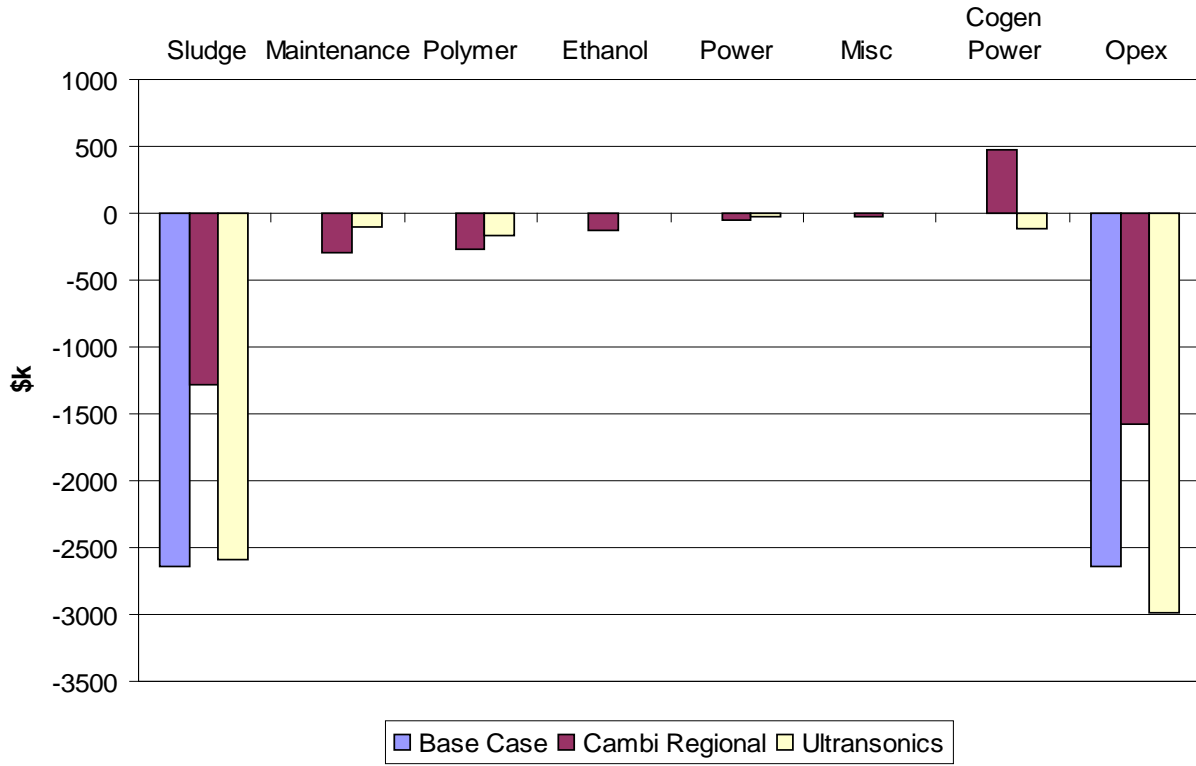
- Dewatered WAS to Swanbank
 - Base case
 - Did not meet stabilisation requirements
- No hydrolysis (100% WAS to existing digesters)
 - Process risk – digestibility, dewatering performance, odour
 - Insufficient biogas to maintain CHP
- Ultrasonic hydrolysis of Oxley Sludge
 - No world wide example on similar process train
 - Bench scale trials indicated 13% VS destruction UHP/AD
- Cambi Thermal Hydrolysis of Oxley sludge
 - Economies of scale favoured regional option
- Cambi Thermal Hydrolysis regional sludge facility



2006 Economic Analysis



Operating Expenditure 2006 Business Case

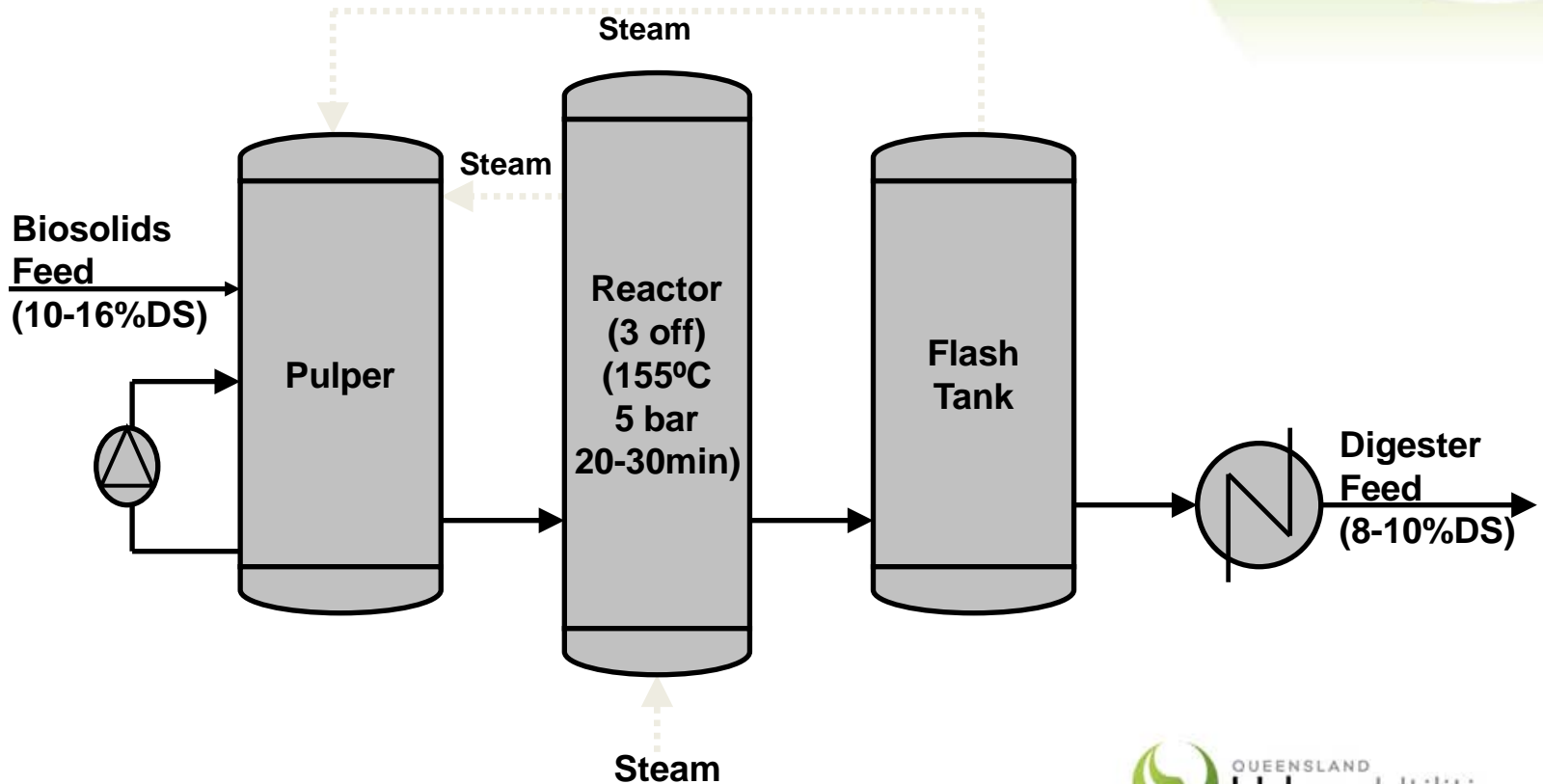


Oxley Sludge Train



- Sludge import hopper (50 tonne)
 - Imports from Gibson, Sandgate, Wynnum, Wacol and Fairfield
- Dewatered Waste Activated Sludge (DWAS) bin (320 tonne)
 - One days sludge storage
- CAMBI Feed Pumps
 - Positive displacement pumps feed CAMBI at 300tonne/day ~14%
- CAMBI Thermal Hydrolysis Process (280tonne/day)
- Mesophillic Anaerobic Digestion (4 primary, 2 secondary)
 - 15 day sludge age required to achieve 50% VSS destruction
 - 2 digesters currently operating at 16 day sludge age
 - Feed concentration 8-8.5%TS
- Centrifuge dewatering

Oxley Cambi Process



Oxley Cambi Process



Oxley Cambi operation



- Pulper Tank
 - Sludge balancing
 - Sludge pre-heating to 80oC with recovered steam from reactor
- Reactors (7 tonne/cycle)
 - Duty/duty/standby
 - Batch process (1hr 30min or ~16cycles/day)
 1. Sludge fill (18mins)
 2. Steam injection to 5bar (16mins)
 3. Retention (30mins, 5 bar, 155°C)
 4. Flashing steam to pulper from 5bar=>2bar (15min)
 5. Blowdown of sludge from reactor to flash tank (8mins)
- Flash Tank
 - Sludge balancing

Operational Performance



- VS Destruction
 - 45-50% VS Destruction (c/w 50% design)
- Centrifuge Performance
 - 26% total residue of dewatered cake (c/w 30% design)
 - 10kg/DT Poly usage

Operational Challenges



- Centrate Colour
 - Byproducts (melanoids) of the Cambi process taint effluent
 - Major problem for UV system - UVT decreases from 60% to 40%
 - Dwyer, Starenberg, et al (2008) detailed reduction in operating temperature from 165oC to 140oC resulted in 70% colour reduction
 - Digestibility not impacted by temp reduction
 - Viscosity problems below 150oC – mixing, pumping, heat exchanger
- Reliability
 - 2006-2010: 73% uptime (Tyr Group , 2011)
 - 50% of this downtime was ancillary equipment failure (boiler, DWAS bin)
- Sidestream Treatment
 - 2500mg/L N (500 kg/day), 500mg/L P (100 kg/day)
 - Struvite reactor reliability has been a major problem
 - Ferric dosing (\$10/kg P) vs Struvite (\$1/kg P) (Tyr Group , 2011)
- Boiler Failure
 - Natural gas currently used for heating

Acknowledgments

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