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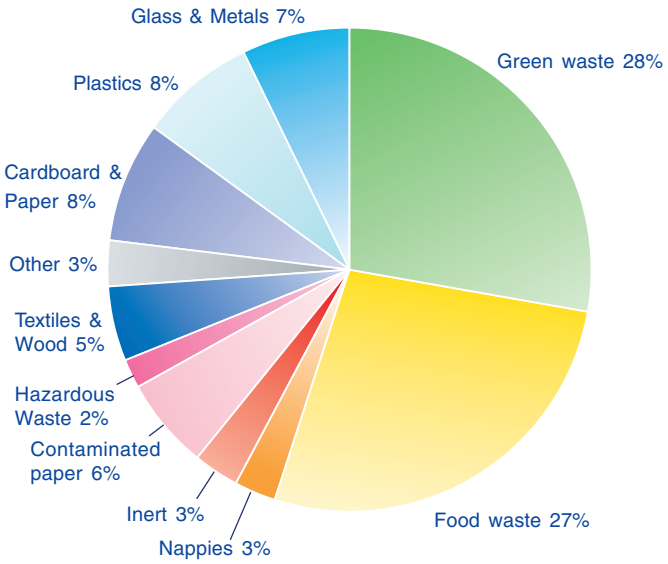
Douglas Partners Geotechnics • Environment • Groundwater

Waste Not...Want Not

Escalating land costs and a decline in availability of suitable landfill sites has forced many nations to find new ways to treat the steadily increasing volumes of municipal solid waste. In Australia segregation of residential wastes (glass, plastics, metal cans and paper) at the household level has been very successful but large volumes of materials are still directed to landfill. Therefore significant changes are required to the treatment of municipal solid waste to achieve an environmentally and economically sustainable outcome.

Typical waste categories of municipal solid waste at Eastern Creek, Sydney



Two of Douglas Partners waste management specialists, Michael Thom and Ronnie Tong have recently travelled overseas to evaluate two of the 'world's best practice' waste treatment processes now operating in Israel and Germany.

Both systems involve mechanical-biological treatment processes and accommodate intake of unsegregated municipal solid wastes with highly variable contents. In both systems, long established and well proven technologies have been integrated into an engineering process which provides reliability, efficiency and low technical and financial risk.

Michael Thom comments: "The Israeli process adopts well proven water based mechanical and biological waste treatment units. Mechanical pre-processing segregates heavy and light in-organics using a flotation tank. Light materials, such as plastics, float to the top and are then shredded for recycling. Heavy materials (such as metals and glass) settle at the bottom of the tank and are then mechanically screened and separated."

"Organics are sheared into smaller fragments in a high pressure hydro crusher, in readiness for anaerobic biological treatment. This produces a fluid stream which is treated using well established wastewater treatment technology and produces biogas (essentially methane), which can be used for power generation and compost. The system is an innovative adaption of existing technologies and requires hot energy input. The units can be easily duplicated to enable treatment of any volume of waste. It is also both simple and flexible, relying upon automatic mechanical screening and anaerobic digestion. The entire biological treatment process is closed, eliminating any odour problems with the final processing."

Ronnie Tong comments: "The German system is based upon water percolation and biological drying/stabilisation processes. Mechanical material separation and recovery facilities remove in-organics, then continuous percolation and hydrolysis remove various biodegradable fractions through leaching. Removal of these organic rich fractions from the wastewater can be optimised in stages according to their solubility and biodegradability. Using fully enclosed anaerobic digestion tanks, a high heat value Biogas is generated which can be sold or used for power generation. The bulk of the inert abrasive solids are also removed by the leaching action. Activated sludge is separated from the effluent water by ultra-filtration. Remaining percolated solid waste (percolate) are de-watered by screw press and after biological drying, under controlled conditions, a number of solid by-products are produced".

Both of these waterbased processes provide significant advantages over "dry" solid waste treatment plants currently operating in Australia. More discrete re-usable by-product fractions are achievable, together with a higher level of product consistency and process efficiency.

Finally Michael finished by stating that: "These systems result in a substantial reduction in 'end' materials requiring land filling". Ronnie concluded that: "As much as 70-80% is recycled or treated".

Given that both systems are based upon well proven technology with good operational records, technical and financial risks are low, and the processes are totally consistent with Australia's overall objective of significantly reducing volumes of waste requiring land filling.

For further information:
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Integrated practical solutions

Close integration of geotechnical and environmental services by engineers and scientists from DP's Newcastle office has produced significant cost and time benefits on a major new retail development in the Hunter Valley region of NSW.

Australia's largest hardware retailing group Bunnings, has successfully developed a new 17,000m^2 retail warehouse at Maitland, 30 km from Newcastle.

The development site had previously been utilised as a cattle holding yard and was bisected by a major gully which contained saturated weak soils. Additionally, "uncontrolled" fill materials were identified over a considerable portion of the site.

The warehouse required heavy duty flexible concrete pavements, and in order to facilitate construction and improve store amenities, site levels were raised by up to 7m, requiring large quantities of fill materials.

To achieve effective site drainage and foundation integrity, a pipe culvert

Investigations at Maitland site

(comprising 3 x 1350mm diameter pipes) was constructed within the central gully formation. This included a reinforced earth retaining wall up to 6m high with keystone facing blocks adjacent to the southern site boundary.

After conducting trials to establish the most cost effective combinations, poor subgrade areas were effectively 'bridged' during site fill, using sand (immediately beneath the culvert), overburden and geofabric materials.

DP Project Manager Chris Bozinovski comments: "DP provided a comprehensive package of investigation and testing services throughout the planning, design and construction phases of the project. By carefully integrating geotechnical and environmental material testing and placement, significant cost and time savings were achieved, including re-use of over 90 % of on-site fill materials which constituted about 25 percent of the required total of 100,000m^3 of fill. This reduced the need for costly imported fill material".

Bozinovski concludes: "A multi-disciplinary approach to investigation, design and construction proved to be invaluable during the development to minimise delays and associated costs for such a large scale earthworks program. Additionally, close teamwork with site manager and the earthworks contractor Keller Civil Engineering ensured the success of a challenging project."

The Bunnings Maitland store opened on schedule and within budget in August 2004.

Developer: Kilcor Property Development Pty Ltd
DP Client: Capicon Pty Ltd
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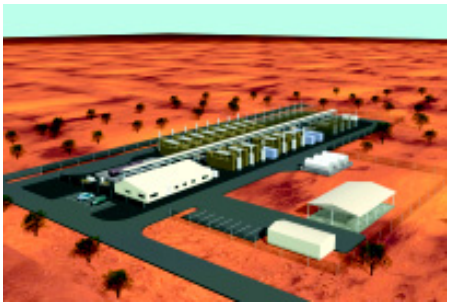
New power supply for remote WA towns



Artist's impression of new power station facilities in Broome, WA

A network of new environmentally friendly power stations will bring more efficient and reliable electricity supplies to towns in the remote West Kimberly region of Western Australia.

For the past 30 years Broome, Derby, Fitzroy Crossing, Halls Creek and Camballin have relied upon aging diesel generators which are unable to satisfactorily meet forecast future power needs of communities in the area.

The new power stations, which have involved extensive community consultation, will be fuelled by liquid natural gas (LNG) from a new mini LNG plant near Karratha and will bring significant environmental benefits.

DP's Perth office was engaged by Energy Developments Limited, the designer, constructor and operator for the new developments, to assist with the environmental approval process for the project. The key environmental issues involved in the proposal are potential air and noise impacts, and facility risk.

The power stations will incorporate lean burn natural gas internal combustion engines. Emissions will be controlled and managed using a combination best practice design, practicable technology and monitoring and management during plant operation.

Comprehensive modelling of air and noise impacts was undertaken by Pacific Air & Environment and Herring Storer Acoustics covering emission scenarios including maximum operational plant out up and plant design life.

DP's Project Manager Terry Waters comments "We have assisted Energy Developments Limited in obtaining a level of assessment of "*Informal Assessment – Advice Given*" from the Environmental Protection Authority for each main part of the project. This has resulted in very significant time savings in the environmental assessment process. Modelling has shown that the new plant will achieve a reduction of at least 70% in nitrogen oxide, particulates and sulphur dioxide emissions over the current diesel engines".

"Acoustics modules around the engines and installation of noise attenuation walls will ensure that the plants adequately achieve relevant noise criteria. Additionally there will be no adverse social, cultural, flora oblique, fauna or heritage impacts".

"Overall we believe that the new power plants will enhance community amenity without any detrimental environmental effects".

Construction of the new plants will commence early in 2005 and they are expected to be operating by late 2006.

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GEO-BITES

Faulty towers

A series of significant geological faults runs through the greater Sydney area, including the centre of the Sydney CBD. These have potentially significant cost and risk implications for both deep foundation developments, typically in the city's CBD, and for major infrastructure schemes.

The faulting is the result of the break up of the Tasman Sea which occurred nearly a hundred million years ago.

Geologists and engineers have known about individual fault locations within the Hawkesbury Sandstone for many years; however recent work by DP engineering geologists David Och and John Braybrooke, (amongst others) has indicated that there are at least four discrete fault zones running in a NNE/SSW direction across the Sydney CBD. This faulting is much more extensive than previously believed, potentially affecting sites previously considered to be unaffected by faulting.

Prior knowledge of the specific locations of these faults can significantly benefit government instrumentalities, developers and contractors. With such knowledge the design and construction of both shallow and deep surface excavations and underground excavations can take the faults into account and thus prevent potentially serious stability issues and costly and time-consuming changes later.

David Och comments; "We can now demonstrate that faults previously believed to be confined to the Sydney CBD area extend over distances of at least 20km to 30km and appear in suburbs such as Harbord, Ryde, Homebush, Watson's Bay and Heathcote. Similar faults have also been identified in Kangaroo Valley to the south and the Central Coast to the north.

The fault zones are relatively linear and subvertical extending from ground level to depths of many hundreds of metres or more and can be up to 40m to 50m wide. At the surface they are evidenced by 'weak' crumbly or fractured rock with limited load bearing capacity for building foundations."

David Och continues; "Over the years DP has provided advice to clients on a number of development sites affected by these geological faults. Their presence had not been identified until after excavation had started, which sometimes required costly and time consuming remediation to the boundary cut. On another site, this time for an underground railway station, the early identification of significant faulting allowed the repositioning of the station before design works had started. This high-lights the importance of an appropriate site investigation prior to both design and construction to avoid the risk of costly and time consuming remediation once site work has commenced."

Marked faults in Sydney CBD

For further information and/or a copy of DP's greater Sydney fault zone map, please contact David Och or John Braybrooke (02) 9453 5558.

CPT's save time & cost

DP CPT truck on site in SE Brisbane

Significant time and cost savings have recently been achieved by DP for a client's power line project in Queensland.

Powerlink Queensland is undertaking a 10km power transmission line duplication in SE Brisbane, between existing sub-stations at Murarrie and Belmont.

The original client brief called for a site investigation involving conventional test bores, however, with DP's extensive national computerised database, prior knowledge of sub-surface conditions revealed deep alluvial soil along a high proportion of the proposed alignment profiles. This enabled DP to substitute faster, lower cost cone penetration tests (CPTs) in place of most of the conventional test bores.

Using one of DP's purpose built 15 tonne truck-mounted CPT rigs, a 35mm diameter cone with a 130mm friction sleeve was pushed into the ground at a constant rate by hydraulic thrust. Loads on the cone and sleeve were measured continuously with depth and captured at 20mm intervals on a portable computer, for processing and plotting.

Conventional test bores were used at locations where shallow bedrock was anticipated and some supplementary bores were used to facilitate laboratory testing of soil and groundwater samples.

DP project manager David Qualischefski comments: "CPTs enable subtle changes in stratum to be detected which can sometimes be missed by conventional drilling. Additionally, we can link CPT test results directly to our in-house software for more efficient calculation of settlement and piled footing capacities."

"The end result is that our clients receive better quality information quicker and at a significantly lower cost".

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