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# TYPICAL WASTE MANAGEMENT PROJECTS UNDERTAKEN BY SMHB AND ASSOCIATED FIRMS

\* updated March 2023

Project	Description of Services	Type of Waste	Year of Completion
1. Bandar Indera Mahkota Sewage Treatment Plant Project and Sewer Network, Kuantan, Pahang	Preliminary and detailed design, tender documentation, head office direction and construction supervision of M&E works for a regional sewage treatment plant of 150,000 PE and associated sewerage network.	Wastewater	2023
2. Construction of a Regional Sewage Treatment Plant and Study of Sewerage Pipeline at Kota Setar, Kedah	Design and construction supervision of 25 km of sewer pipeline covering 7 zones and a Centralised Sewage Treatment Plant (CSTP) of 100,000 PE (ultimate 300,000 PE).	Wastewater	2022
3. Review of Influent Flow Rate and Peak Flow Rate for Sewerage Treatment Plant Design in Malaysia	Review of average daily flow per capita and peak factors in the Malaysian Sewerage Industry Guidelines (MSIG) that originated from MS1228:1991.	Wastewater	2022
4. Cadangan Pembinaan Centralised Sewage Treatment Plant (STP) dan Penyambungan Rangkaian Paip Pembedungan di Kawasan Tadahan Lembangan Sungai Langat Secara Reka dan Bina, Selangor	The project rationalized all multi-point or fragmented public STPs and private STPs located within the highly-urbanized catchment of the upper reaches Sungai Langat encompassing an area of approximately 77 sq. km from Taman Bukit Hartamas in the north extending southwards to Seksyen 5 Bandar Baru Bangi and Jalan Semenyih, Taman Kajang Utama to the East and Taman Putra Budiman to the West. All sewage generated will flow to the proposed centralised sewage treatment plant (CSTP). The proposed project takes into consideration the future growth within the catchment area, which is projected to be 920,000 ultimate PE in the year 2035. Functional specification, detailed engineering design, construction supervision, environmental impact assessment study, planning submission and approval.	Wastewater	2018
5. Package D43 - Design of Sewerage Network in Batu, Jinjang and Kepong (Design & Build), Kuala Lumpur	Tender design, detailed design and construction supervision of 42 km trunk sewer network and 5 nos pumping station.	Wastewater	2018
6. Proposed Construction of Sewer Pipeline for Si-Rusa Area, Port Dickson, Negeri Sembilan	Sewer extension and rationalisation of public sewage treatment plants within the Sunggala catchment (8.34 sq km). 8 km new trunk sewer. Rationalisation of 4 sewage treatment plants (285 PE - 3,600 PE); for conversion into pumping stations or decommissioned. 9,500 PE. Preliminary engineering design, detailed design, tender documentation and construction supervision.	Wastewater	2017



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7. Cadangan Kerja-kerja Menaiktaraf Loji Rawatan (PEG073) Batu Ferringhi (Design & Build), Pulau Pinang	Tender design, environmental services, detailed design and construction supervision to increase treatment capacity to 60,000 PE.	Wastewater	2016
8. Sewerage Catchment Review Study for Pencala-Pantai & River of Life Precinct 1 to 11, Kuala Lumpur	Sewerage and sludge catchment study for Precincts 1-11. Overall catchment study for whole of Pantai involving capacity assessment and recommendations for sewerage system improvements.	Wastewater	2015
9. Feasibility Study to Develop Water Recycling Plant in Peninsula Malaysia	A pilot water re-cycling plant in Peninsular Malaysia utilising effluent from sewage treatment plants located in industrialised and water-stressed states such as Pulau Pinang, Selangor and Johor.	Wastewater	2012
10. Co-Digestion to Optimise Bio-gas and Bio-fertilizer Yield for Anaerobic Digester Tank at Existing Bonus Sewage Treatment Plant at Titiwangsa, Kuala Lumpur	Co-digestion Project to optimise bio-gas and bio-fertilizer yield for anaerobic digester tank at the existing Bonus STP at Titiwangsa. The ultimate objective of the project is to construct facilities to generate 1 MW of electrical power on a commercial basis using co-digestion of sewage sludge and the organic fraction of municipal solid waste. Secondary objective is to assess the potential use of the dewatered sludge as fertiliser in view of the increased bio solids yield.	Wastewater	2011
11. Standard Method of Measurement for Water and Wastewater Project, Malaysia	Development of standards for procurement of water and wastewater projects in Malaysia	Wastewater	2010
12. Labuan Effluent Water Recycling Plant, Wilayah Persekutuan Labuan	Development of a Water Recycling Plant pilot project using affluent from the Ranche-Ranche Sewage Treatment Plant to supply water to Petronas Methanol Labuan.	Wastewater	2010
13. Pantai 2 Sewage Treatment Plant, Kuala Lumpur	Review of M&E, Process Design, construction supervision. Ultimately cater for 1.8 Million population until 2035. First STP built underground in Malaysia with a community centre above the STP complete with sports and recreational facilities. The project promotes sustainability living environment through low energy consumption, low pollution, low emission and utilised green technology measures such as rainwater harvesting, use of bio-gas and solar panels to generate electricity.	Wastewater	2015
14. Propose Use of Interceptor Sewer to Improve Water Quality in the Klang River, Kuala Lumpur	Technical review of a proposed installation of a network of "Interceptor Sewer" to divert sewage from more than 30 storm water drainage channels, discharging into six km stretch of the Klang River from Jalan Jelatek to Masjid Jamek and finally convey these flows to the Pantai Sewage Treatment Plant (STP).	Wastewater	2008



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15. Developing a Civil Specification for Indah Water Konsortium (IWK), Malaysia	The scope requires for developing and formulating a Civil Works Specification for IWK. The specification will be used as a standard specification to be complied by all developers and contractors engaged in the wastewater projects.	Wastewater	2008
16. Detailed Environmental Impact Assessment (DEIA) and Conceptual Design for the Proposed Kuala Langat Sanitary Landfill, Selangor	The landfill is to meet the urgent need in the state of Selangor for a proper sanitary landfill. The capacity of landfill is 1,000 tonnes of wastes per day. The facilities encompass a 15 km access road, weighbridge, administration building, waste disposal area, drainage system, leachate collection and treatment and landfill gas management. The design aspects includes selecting a suitable liner system to contain leachate as well as design of leachate and landfill gases collection systems, final capping during closure, designing the leachate treatment plant, estimating air space capacity and life span of the landfill and also identifying the closure and post closure programme.	Solid Waste	2007
17. Domestic, Medical and Hazardous Waste Management Services in Riau, Indonesia	Detailed feasibility study and Privatisation Master Plan which focused on major islands of the Riau Archipelago that include Batam, Bintan and Karimun. The study includes review of the existing practice, legislations and policies for domestic, medical and hazardous waste management in the study areas.	Medical/ Hazardous Waste	2006 – 2007
18. Beroga Solid Waste Treatment Plant, Selangor	Detailed design and authority approval, design review and construction supervision of Solid Waste Thermal Treatment Plant. Scope of work covers authority coordination, and all civil, structural and infrastructural engineering for the entire project. The proposed thermal treatment plant has a design capacity to treat approximately 1,500 tonnes/day of municipal solid waste. Apart from providing an alternative to landfilling methods of solid waste management, the system also supports waste recovery and recycling.	Solid Waste	2006
19. Medical/Hazardous Waste Management in West Java	Detailed feasibility study and Privatisation Master Plan for the Privatisation Proposal of the Integrated Medical and Hazardous Management Services. Scope of works for the consultancy services include: <ul style="list-style-type: none"> <li>• Study of existing waste disposal facilities.</li> <li>• Study on thermal treatment facility for medical waste and sludge generated from domestic industries and other scheduled wastes.</li> <li>• Integrated medical and hazardous waste management facility (IWMF).</li> <li>• Siting of the Integrated Waste Management Facility (IWMF).</li> <li>• Project cost, financial modelling, financing and economic evaluation</li> <li>• Risk management and environmental assessment</li> </ul>	Medical/ Hazardous Waste	2005



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20. Solid Waste Management in Greater Bandung, Indonesia	<p>Feasibility Study and Privatisation Master Plan for an integrated solid waste management services.</p> <p>Scope of works:</p> <ul style="list-style-type: none"> <li>Review Draft Interim Report prepared by associate firms.</li> <li>Prepare Privatisation Master Plan emphasising on Solid Waste Transfer Station and Sanitary Landfill.</li> </ul> <p>The goal of the Privatisation Master Plan is the promotion of a cleaner, healthier and safer living and working environment for the citizens of Greater Bandung through the provision of a proper and integrated system for the management of solid waste</p>	Solid Waste	2005
21. Study on the Establishment of the National Water Services Commission (SPAN)	<p>Technical advisory on the study to assess the institutional set up of water and sewerage services in Malaysia and identifying issues facing the industry.</p>	Wastewater	2004
22. Review and Design of Wastewater Treatment Plants in Syrian Arab Republic	<p>Study, design review and detailed engineering design.</p> <p>The scope of works:</p> <ul style="list-style-type: none"> <li>Develop concept for 24 wastewater treatment plants jointly with Syrian partner.</li> <li>Review of Syrian partner's detailed design for 9 nos. wastewater treatment plants.</li> <li>Detailed design of 2 wastewater treatment plants.</li> </ul> <p>The STPs will be located in major cities with population equivalent (P.E.) ranging from 2,000 to 250,000.</p> <p>The treatment process includes extended aeration and conventional activated sludge.</p>	Domestic Wastewater	2004 – 2006
23. Sewage Treatment Plant and Centralised Sludge Treatment Facility, Port Dickson, Negeri Sembilan	<p>Detailed design and construction supervision.</p> <p>The STP serves the town of Port Dickson and the associated tourist areas and caters for a population equivalent (P.E.) of 30,000. The Centralised Sludge Treatment Facility (CSTF) has a capacity of 98,000 PE and treats waste sludge arising from the STP as well as sludge collected from other STPs and arising from the desludging of septic tanks.</p> <p>The STP utilises an activated sludge type of treatment process modified to achieve biological removal of nitrogen and phosphorus using fine bubble diffused aeration and secondary clarification.</p> <p>Preliminary processes consist of flow equalisation, coarse and fine screening, and grit and grease removal. The effluent will be discharged and will comply with Standard "A" requirements i.e. BOD 10 mg/1 and SS 20 mg/1.</p> <p>Process units in the CSTF include mechanical sludge thickening, anaerobic sludge digestion and mechanical sludge dewatering using membrane plate pressure filtration.</p>	Domestic Wastewater	2002 – 2004



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24. Sludge Management Facilities at the Cheras and Langat Water Treatment Plants (WTP), Selangor	<p>Feasibility study, concept design and detailed engineering design of sludge management facilities.</p> <p>Several sludge treatment process options were studied and the recommended option involves mechanical dewatering utilising a centrifuge system for the Sungai Langat WTP and sludge lagoon method for the Cheras WTP.</p>	Industrial Wastewater	2002 – 2004
25. Melaka River Rehabilitation and Beautification Project, Melaka	<p>Environmental impact assessment, detailed engineering design and construction supervision.</p> <p>The main objective of the project is to improve the overall condition of Sungai Melaka and its riverine environment by creating a world class river front that recaptures the characteristics of old Melaka. The firm undertakes the study, design and construction supervision of the following:</p> <ul style="list-style-type: none"> <li>• Hydrologic and hydraulic modelling of Sungai Melaka to ascertain the impact of river embankment works</li> <li>• River embankment wall to stabilise and beautify the river banks, and board walk for nature conservation</li> <li>• Surface drainage improvement works and interfacing with river embankment works</li> <li>• Sewage interceptors system and sewage treatment plant</li> <li>• Minor dredging of Sungai Melaka</li> <li>• Storm water pump drainage to solve localised flooding</li> <li>• Replacement of an existing bridge</li> <li>• Tidal analysis and design of tidal barrage</li> </ul>	Domestic Wastewater	2002 - 2004
26. Sewerage Facilities for Cyberjaya Flagship Zone – Phase 2 Development, Cyberjaya	<p>Conceptual design, master plan review, and detailed design including head office administration during construction of sewers, pumping stations, pumping mains and associated works.</p> <p>The Cyberjaya Phase 2 development comprises the north-western, central-western and south-western catchments out of six catchments in the area. Recommendations were made to construct two sewage treatment plants with capacity of 309,119 P.E. and 123,071 P.E.</p> <p>Several designs criteria were adopted including topography and drainage elements, pumping station operation costs, staging of development, operation and maintenance considerations and size of sewage treatment plants.</p>	Domestic and Industrial Wastewater	2001 – 2005
27. Pintu Malim Sewerage Scheme – Jalan Kota Batu and Subok, Brunei	<p>Detailed design for the sewerage system along Jalan Subok-Kota Batu in Brunei which covers about 3 km of main trunk sewers and an inlet sewage pumping station into the existing Pintu Malim Sewage Treatment Work. The sewerage network serves an additional 39,000 PE within the Subok and Kota Batu districts.</p>	Domestic Wastewater	2001



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28. Western Transportation Terminal (WTT) Complex, Putrajaya	WTT forms part of the overall transportation development for Putrajaya. The sewerage system caters for flows from the various development components, which include commuter bus terminal, park and ride station, local bus interchange, street retails, concourse link, LRT concourse and main terminal. Sewage flows are directed into a temporary package plant and would later be diverted into the trunk sewer network.	Domestic and Industrial Wastewater	2000
29. Sewerage Works for Bandar Baru Sunggala, Port Dickson, Negeri Sembilan	The project involves the design of a sewerage system along the coastal area of Port Dickson, which had been identified by IWK as one of the priority area to be served due to its tourism attraction potential. It covers an area of approximately 8.5 sq. km serving about 110,000PE. The gravity sewers range from 225mm to 1050mm in diameter with a total length of 8 km. The pumping mains are of 250mm and 700mm diameter and equipped with surge vessels to cushion the water hammer effect due to very high heads and undulating profiles. The sewage flows are pumped from the Sunggala pumping station to the proposed centralized STP in Bandar Baru Sunggala.	Domestic Wastewater	1999
30. Term Consultancy for the Design and Construction of Minor Sewerage Works (Perak, Perlis, Pulau Pinang, Selangor, Negeri Sembilan and Pahang)	Detail engineering design and preparation of tender documents of several small sewerage works throughout the country. Package A included the construction of sludge drying beds at Bandar Baru Menglembu Sewage Treatment Plant in Ipoh, Perak. An aerated lagoon system was designed costing about RM1.5 million. Package B involved a sludge transfer station at Taman Sri Genting Sewage Treatment Plant at Balik Pulau, Pulau Pinang. Package C involved design and tender documentation for sludge lagoons at Mukim Wang Bintong in Kangar, Perlis. Package D comprised design of sewer network pumping station at Bukit Antarabangsa at Hulu Kelang, Selangor. Package E involved design and preparation of tender documentation for a sewage treatment plant and centralised sludge treatment facilities at Port Dickson, Negeri Sembilan. Package F involved certification of GSL Drawdown for the Proposed Maran Sewerage Scheme in Pahang.	Domestic Wastewater	1998 – 2000
31. Sludge Treatment Plant for Wangsa Maju Water Treatment Plant, Selangor	Detailed design and construction supervision of the associated civil works comprising the balancing tank and pumphouse, sludge thickener and supernatant tank. The Wangsa Maju Water Treatment Plant (WTP) in Kuala Lumpur has a treated water production capacity of 45,000 m <sup>3</sup> per day. Sludge is generated at the	Industrial Wastewater	1998 – 1999



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	<p>flocculation tanks, the dissolved air flotation plant and the filtration plant. It is discharged into a 900 mm diameter reinforced concrete pipe and released untreated directly into the monsoon drain adjacent to the WTP. The sludge treatment plant is constructed to avoid the practise of discharging sludge/washwater into the monsoon drain. It comprises a balancing tank, a gravity thickener, centrifuge decanters, dosing system and associated works. The sludge cake from the centrifuge decanters is expected to have between 20% and 25% dry solid contents. The sludge production rate is about 11,160 kg/day.</p>		
<p>32. Sewage Treatment Plant at Sungai Lukut Kechil, Port Dickson, Negeri Sembilan</p>	<p>Detailed design and construction supervision of a sewage treatment work which serves an ultimate 7,300 P.E. The main biological treatment process is rotating biological contractors (RBC). The plant is designed to consistently achieve an average Standard B final effluent quality (i.e. biological oxygen demand or BOD of 20 mg/l and suspended solids or SS of 40 mg/l). The Sewage Treatment Works comprise Raw Sewage Pumping Station, Vortex Grit Chamber and Classifier, Oil and Grease Tank, RBCs, Secondary Clarifiers, Raw and Thickened Sludge Storage Tank and Sludge Thickening Facility.</p>	<p>Domestic Wastewater</p>	<p>1997 – 1999</p>
<p>33. Environmental Monitoring for Malaysian Integrated Scheduled Waste Management Centre, Negeri Sembilan</p>	<p>Evaluation, interpretation and reporting of the monitoring results and annual audits. SMHB was involved in the preparation of the Environmental Impact Assessment report for the Malaysian Integrated Scheduled Waste Collection, Treatment and Disposal Project in 1992. In December 1995, Kualiti Alam was granted the approval to build, operate and maintain the Waste Management Centre and construction on the site began in January 1996. An environmental monitoring programme was carried out involving both the physical and biological components of the environment. This programme would also ensure compliance of site activities to the relevant regulations. The programme involves field sampling, observation and analysis. Kualiti Alam appointed SMHB to evaluate, interpret and report on the results of the programme. SMHB also carries out an annual audit of the programme to ensure its coverage and effectiveness.</p>	<p>Industrial Waste</p>	<p>1996 - 2005</p>
<p>34. Bukit Unggul Golf &amp; Country Resort</p>	<p>Conceptual design and cost evaluation for sewerage works for the resort development comprising golf course, residential, commercial, institutional, recreational and public facilities in Sepang, Selangor. The development is located within a very hilly area of approx. 550 hectares.</p>	<p>Domestic Wastewater</p>	<p>1993 – 2000</p>
<p>35. Malaysia – Singapore Second Crossing New Township (Phase I Development), Johor</p>	<p>The New Township covers an area of approximately 10,560 ha which will be developed into industrial, commercial, governmental, recreational and other</p>	<p>Domestic and Industrial Wastewater</p>	<p>1995 – 2000</p>



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	<p>purposes. The township is targeted to accommodate a population of 350,000 and will be developed in 5 phases within a 30 year period.</p> <p>The Phase I development covers an area of about 2,000 ha with an estimated population of 50,000. This phase will be developed over a period of 8 years (1995 to 2003).</p> <p>The sewerage works at Phase I development comprised 13.0 km of trunk sewers with pipe dia. ranging from 650 mm to 1,350 mm, 17 nos. of sewage pumping stations and 2 nos. of sewage treatment plants.</p>		
<p>36. Kuala Lumpur International Airport Wastewater Facilities, Selangor</p>	<p>Design, construction supervision and design review of the sewerage system to serve all of the airport facilities up to the year 2020 at 60 million passengers per annum (mppa).</p> <p>The design and construction supervision works comprise;</p> <ul style="list-style-type: none"> <li>• Two above ground and three below ground sewage pumping stations</li> <li>• Two aircraft waste discharge facilities</li> <li>• 14 km of sewers discharge facilities</li> <li>• 136 manholes some of which are more than 5 m in depth</li> </ul> <p>The sewerage works comprise 8.0 km of gravity sewers with pipe dia. ranging from 300 mm to 900 mm, 6.0 km of rising mains with pipe dia. ranging from 400 mm to 700 mm and 6 nos. of sewage pumping stations.</p> <p>The treatment plant was designed, constructed and equipped to treat 17 Mld of wastewater initially and it is expandable to treat up to 51 Mld. The treatment plant caters to approximately two equal streams originating from the Northern (A) and Southern (B) catchments of the airport. Stream A consists of purely domestic wastewater and Stream B contains mainly domestic but with some industrial wastewater discharges from aircraft cleaning and maintenance facilities.</p> <p>The plant utilises four main components:</p> <ul style="list-style-type: none"> <li>• Inlet Works – Preliminary Treatment</li> <li>• Sequential Batch Reactor (SBR) – Secondary Treatment</li> <li>• Tertiary Treatment for Reuse Water</li> <li>• Sludge Treatment</li> </ul>	<p>Domestic and Industrial Wastewater</p>	<p>1995 – 1997</p>
<p>37. Review of Sewage Proposals for George Town and Bayan Baru catchments, Pulau Pinang</p>	<p>Review study of options for providing sewage treatment facilities and sewer reticulation for George Town and Bayan Baru catchments. The study involves identifying the current and future landuse within the area, establishing the existing populations and forecasting future populations based on the population growth, mapping the sewered and unsewered developments and presenting alternatives to provide immediate and long term solution based on centralisation of the sewerage system.</p>	<p>Domestic and Industrial Wastewater</p>	<p>1995</p>



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38. Planning Evaluation Report (PER) for the Proposed Kangar Treatment Plant, Perlis	Study to evaluate and propose the sewage treatment works of Kangar town. The PER aims to assist IWK to identify the most appropriate treatment process for the centralized STP to serve the area taking into account land availability and achievable effluent parameters as well as capital and operating costs.	Domestic Wastewater	1995
39. Kuala Lumpur International Airport Solid Waste, Selangor	Detailed design of utilities including solid waste system for the new airport. A feasibility study was carried out to determine the various options of solid wastes collection, treatment and disposal. A waste arisings survey was carried out at Subang International Airport to determine basic design parameters such as waste volumes, densities and calorific values. The estimated solid waste generation at the new airport is approximately 150 tonne per day. SMHB has recommended the “cradle-to-grave” solutions, which involve waste separation at source, recycling, incineration and landfilling.	Solid Waste	1994 – 1995
40. Kangar Town Sewerage, Perlis	The Kangar sewerage works is one of the projects under the nationwide sewerage privatisation scheme. The works cover the residential, commercial and administrative centre of the state capital over an area of 18.22 km <sup>3</sup> with an estimated population projection of 43,610 by year 2000.	Domestic Wastewater	1994 – 1995
41. Pre-Tender Design for Pulau Pinang Solid Waste, Pulau Pinang	Full logistic design/analysis of refuse transfer systems. Detailed drawings of refuse transfer station building at Jelutong and Prai which were designed to cater for 1,020 tonnes per day during the final year of the concession period. The sanitary landfill which is located at Pulau Burong covers an area of 62.4 ha with 4.05 ha currently utilised as a solid waste disposal site. Barge transportation was also proposed as an alternative to collection vehicles and articulated container-trailer vehicles. Bill of quantity and materials for tender submission were also provided.	Solid Waste	1994 – 1997
42. Kranji Sewage Treatment Works – Odour Study, Singapore	Odour study including odour mapping using an air dispersion computer model. The study was aimed at providing information on the existing odour regime in the vicinity of the works, as well as to evaluate the performance of odour control systems to be implemented as part of the upgrading and extension works.	Domestic and Industrial Wastewater	1993 – 1994
43. Development of Criteria and Standards for Water Quality – Phase III	A study for the Department of Environment on the improvement, modification and strengthening of the existing industrial effluent standards which included the assessment of compliance and non-compliance of selected industries.	Industrial Wastewater	1993
44. Carlsberg Brewery Effluent Impact Study, Selangor	Environmental impact study.	Industrial Wastewater	1993



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	<p>Carlsberg Brewery Malaysia Bhd was requested by the Department of Environment Malaysia to conduct an impact study of their effluent discharge on the downstream receiving waters. SMHB was commissioned as an independent consultant to conduct the effluent impact study. The study involved:</p> <ul style="list-style-type: none"> <li>• Determination of the existing status of the receiving waters in terms of flow regime and water quality</li> <li>• Characterisation of the effluent</li> <li>• Estimation of pollutant loads from other sources</li> <li>• Water quality modelling</li> <li>• Assessment of potential impacts on river water quality</li> </ul>		
<p>45. Environmental Impact Assessment of Sanitary Landfill Sites at Pulau in Kedah and Teluk Chempedak on Pangkor Island in Perak</p>	<p>Environmental impact study. SMHB was commissioned by the Ministry of Housing and Local Government to carry out preliminary environmental impact assessment studies for these proposed landfill sites.</p> <p>The Pangkor landfill was an extension to an existing landfill and as such the impact study included an assessment of the methods of operation of the existing landfill as well as the impacts of the new construction. Impacts were considered in terms of construction, operation and abandonment.</p> <p>The site at Pulau was on sloping ground incised by a steep valley. The initial landfilling operation would involve the infilling of the valley and thereafter development of the remainder of the site.</p> <p>At both sites the main concern is surface and groundwater quality and the impacts of leachate generation and movement. The report included proposals for the most cost effective mitigating measures and raw and treated leachate, and surface and groundwater quality monitoring.</p>	<p>Solid Waste</p>	<p>1993</p>
<p>46. Environmental Improvements to Coastal Villages in Perlis</p>	<p>Study and design of sanitation facilities for the coastal villages in Kuala Perlis which part of the infrastructural works to improve the environmental conditions in the coastal area. Provision of individual septic tanks for 1,169 houses and communal latrines.</p>	<p>Domestic Wastewater</p>	<p>1993</p>
<p>47. Karambunai Golf and Beach Resort, Kota Kinabalu, Sabah</p>	<p>Preparation of the central sewerage master plan for the holiday resort and the design of the Phase I works consisting of 4.95 km of gravity sewers, 0.6 km of rising mains and 6 nos. of pumping station to serve 6,000 P.E.</p>	<p>Domestic Wastewater</p>	<p>1993</p>
<p>48. Bukit Tunggul Golf and Country Resort, Selangor</p>	<p>Preparation of sewerage master plan and preliminary design of the sewerage system which will be built in 10 phases. Sewerage works consist of 8 nos. of pumping station and 25 nos. of sewage treatment plants with approximately 36.2 km of main gravity sewers and 1.4 km of rising mains for 25 sewerage catchments.</p>	<p>Domestic Wastewater</p>	<p>1993</p>

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49. Berjaya Premier Beach Resort, Langkawi, Kedah	Design and construction supervision of sewerage system to serve a total of 2,000 E.P. which is divided into two sewerage catchments. Works comprised 4.9 km of gravity sewers, 4 nos. of pumping stations, 600 m rising main and 2 nos. of sewage treatment plants with 1,000 E.P. each.	Domestic Wastewater	1993
50. National Sewerage Scheme, Kedah	Asset database and preparation of conceptual sewerage design plan for Penang Island and Kangar town. Asset database and identification of sewerage catchment for Majlis Perbandaran Kota Setar, Majlis Daerah Kubang Pasu, Majlis Daerah Kulim, Majlis Daerah Kuala Muda and Majlis Daerah Baling.	Domestic Wastewater	1992 – 1993
51. Pintu Malim Sewage Treatment Works, Brunei: Secondary Treatment	Design of additional works to provide secondary treatment to the existing treatment works which treats 20.4 Mld of wastewater.	Domestic and Industrial Wastewater	1992
52. Pintu Malim Sewage Treatment Works, Brunei: Upgrading Phase I – Partial Secondary Treatment with Sludge Digestion	Design of secondary treatment with sludge digestion for 20.4 Mld (58,300 P.E.).	Domestic and Industrial Wastewater	1992
53. Corrosion protection to twin rising main in Jalan Subok/Kota Batu, Brunei	Study, investigation and design the rehabilitation works on the existing 2.26 km 600 mm dia. steel twin rising mains from sewage pumping station No. 6 to Pintu Malim Sewage Treatment Works.	Domestic and Industrial Wastewater	1992
54. Tunku Link Road Sewerage, Brunei	Design and construction supervision of main trunk sewers which will serve the developments along Tunku Link Road. Project comprises laying of 2.01 km of 300 mm and 600 mm gravity sewers, 1 no. of pumping mains and 1.62 km of 400 mm dia. rising mains to convey wastewater to Gadong Sewage Treatment Works.	Domestic Wastewater	1992
55. Malaysian Integrated Scheduled Wastes Collection, Treatment and Disposal Project, Negeri Sembilan	Environmental impact study. SMHB was appointed by the Consortium developing the concept to carry out an Environmental Impact Assessment (EIA) of the proposed facility in accordance with the EIA Regulations of the Environmental Quality Act. The EIA included in-depth studies on air quality, including the modelling of stack emissions, surface and ground water quality, aquatic and terrestrial flora and fauna, socio-economic aspects, health and safety issues and also involved a comprehensive hazard and risk analysis. Mitigating measures were recommended where appropriate.	Industrial Waste	1991
56. Alor Setar Town Sewerage Scheme (Phase I), Kedah	Design of a centralised sewerage system for the most commercialised part of Alor Setar town. The project area is of 187 ha and has a P.E. of about 55,000. The recommended scheme involves trunk sewers of dia. ranging from 225 mm to 1,350 mm, 8 nos. of sewage pumping stations and an aerated lagoon. The trunk sewers are designed to cater for an ultimate P.E. of 125,000.	Domestic Wastewater	1991 – 1992



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Project	Description of Services	Type of Waste	Year of Completion
57. Additional Sewerage Facilities to Bandar Tutong, Brunei	Design of sewerage facilities to serve the Bandar Tutong new developments. Works comprise 4.4 km of 150 mm to 250 mm dia. gravity sewers, 45 m of 100 mm dia. pumping mains and one sewage pumping station.	Domestic Wastewater	1991
58. Pharmaceutical Factory Wastewater Treatment, Selangor	Identification of wastewater sources and recommendation for improving the existing wastewater treatment plant. Major wastewater sources within the plant are the production facilities of the factory and domestic wastewater. About 38 individual sources of wastewater were identified in the production area including the intermittent discharge of waste from the de-ionising units. Housekeeping improvements were proposed and a variety of treatment processes were recommended. Designs for pipework improvements and detailed cost estimates were also provided.	Domestic and Industrial Wastewater	1990 – 1991
59. Jerudong Valley Sewerage, Brunei	Feasibility study and design of sewerage facilities and treatment plant for the Jerudong Valley Scheme consist of 61 km of gravity sewers, 18 nos. of pumping station and 14.8 km of rising main convey 162 l/s (40,000 P.E.) of wastewater into the central sewage treatment plant.	Domestic Wastewater	1990
60. Development of Centralised Pig Farms in the States of Penang and Melaka	Site studies, detailed engineering design and preparation of tender documents. The Department of Veterinary Services commissioned SMHB to provide consultancy services for the development of centralised pig farming areas in the two states in which comprehensive environmental control measures were required. The centralisation of pig farms aimed at a more systematic, progressive, environmentally acceptable and stable pig husbandry compared to the large number of small, scattered farms previously. Comprehensive studies were undertaken to identify suitable sites and to prepare preliminary designs and cost estimates. Management and operational strategies were also developed. Waste management was one of the major issues, and recommendations were made for the treatment of waste produced. A system was designed to provide on-farm liquid and solid separation with the liquid portion of the waste being transferred to a centralised activated sludge treatment facility. The separated solids are treated in a primary/secondary anaerobic digestion plant, prior to landfilling.	Agricultural Wastewater	1990
61. Design of Waste Treatment System for Pig Farms with Limited Land Availability, Negeri Sembilan	Study, preparation of information brochures for distribution to farmers and conceptual design for a demo treatment plant. Scope of work include: <ul style="list-style-type: none"> <li>Assessment of the most cost effective treatment options for solid waste and wastewater arising from pig farms with limited land availability for setting up a</li> </ul>	Agricultural Wastewater	1989 – 1990



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Project	Description of Services	Type of Waste	Year of Completion
	<p>treatment plant that should be able to treat standing pig population (SSP) of as follows:</p> <ul style="list-style-type: none"> <li>• 100 - 500 SSP</li> <li>• 500 - 1000 SSP</li> <li>• 1000 - 3000 SSP</li> <li>• 2000 - 5000 SSP</li> </ul> <ul style="list-style-type: none"> <li>• Detail design, specification and tender documentation for the handling, treatment and management of wastes and wastewater from pig farms.</li> <li>• Preparation of guidelines for pig farmers on the available options for on farm waste management.</li> <li>• Assessing capital and operating costs of the treatment options proposed in relation to recommended design guidelines for farms with available space requirement.</li> </ul>		
62. Bangar Town Sewerage, Brunei	Feasibility study for provision of sewerage and sewage treatment facilities for Bangar Town, Temburong.	Domestic Wastewater	1989
63. Gadong Sewage Treatment Works – Stage 1, Brunei	Detailed design and supervision of new ditch type treatment works for population equivalent to 55,000 near the airport, reticulation and pumping mains of 6 km and 2 pumping stations.	Domestic and Industrial Wastewater	1989 – 1992
64. Survey of Existing Sewerage System, Bandar Seri Begawan, Brunei	Survey of portion of an existing main sewerage system using closed circuit television techniques, inspection of corroded pipelines and design and supervision of renovation work.	Domestic and Industrial Wastewater	1988 – 1989
65. Rural Sanitation Study, Brunei	Study to assess methods for improving public health standards, indicating a realistic programme of implementation and comparing with International Water Supply and Sanitation Decade targets.	Domestic and Agricultural Wastewater	1988 – 1989
66. Gypsum Waste Treatment and Environmental Monitoring, Terengganu	<p>Detailed engineering design, environmental impact assessment and construction supervision of all waste management facilities.</p> <p>This project involved an assessment of the potential sites, including investigations to confirm safe containment of waste, design of a scheme for handling waste, preparation of contract documents, construction supervision and presentation of geotechnical and geological aspects at a public enquiry of the environmental impact assessment.</p> <p>Work carried out included sampling and testing of clays, sand and groundwater; hydrographic and geophysical survey for marine discharge pipeline; hydrological studies and drilling programmes; detailed design for the construction of containment</p>	Industrial Wastewater and Solid Waste	1988 - 1993



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Project	Description of Services	Type of Waste	Year of Completion
	embankments on soft clay, requiring the construction and monitoring of a trial embankment and construction supervision of all waste management facilities.		
67. Tawau Sewerage Project, Sabah	Detailed design, tender documentation for the construction of stabilisation lagoons to serve a population of 50,000 persons, 9 km of gravity/pumping sewers, 2 pumping stations, decommissioning of all package sewage treatment plants in existing housing estates and connection of sewer systems in these housing estates to the new system.	Domestic Wastewater	1987
68. Wilkinson Process Rubber Linatex Factory Effluent Disposal, Selangor	Feasibility study, detailed design and supervision of the effluent treatment plant comprising chemical precipitation tank, extended aeration tanks and secondary clarifiers.	Industrial Wastewater	1987
69. Subok/Kota Batu Sewerage, Brunei	Preliminary engineering design and phasing of a scheme to provide sewerage system for 30,000 persons.	Domestic and Industrial Wastewater	1987
70. Improvements to Jerudong Prison Sewerage System and Sewage Treatment Works, Brunei	Design and implementation of sewage treatment works (RBC system) for a population of 1,000 and extending sewer lines and pumping station.	Domestic Wastewater	1986 – 1989
71. Pintu Malim Sewage Treatment Works Extension, Brunei	Design and construction supervision of anaerobic digesters, sludge dewatering facilities and additional sedimentation tanks for existing treatment works at Pintu Malim.	Domestic and Industrial Wastewater	1986 – 1989
72. Gadong Police Complex Sewerage, Brunei	Design and construction supervision of sewerage and treatment works for the Gadong Police Headquarters and Police Training Complex to serve approximately 5,000 people. Included were 4 pumping stations, approximately 30 km of reticulation and main sewerage and an extended aeration treatment plant.	Domestic Wastewater	1985 – 1989
73. Gadong Future Sewerage Outline Plans, Brunei	Feasibility studies and outline plan for future sewerage in the Gadong area having an ultimate population of some 110,000 including conceptual designs of major sewers, pumping stations and two oxidation ditch sewage treatment works.	Domestic Wastewater	1985
74. Modification to Pumping Station, Brunei	Structural, electrical and mechanical modifications to an existing large wet/dry well pumping station. The pumping station had to remain operable during the modifications.	Domestic Wastewater	1985
75. Sungai Brunei Estuary Quality Study, Brunei	Studies on the pollution of Sungai Brunei, field monitoring, modelling studies and recommendations on methods of improvements of water quality.	Domestic, Industrial and Agricultural Wastewater	1985
76. Kluang Paper Mill for Scott Paper (M) Sdn Bhd, Johor	Study of the impact of the effluent discharge on downstream water resources. Investigation and detail design and wastewater treatment facilities.	Industrial Wastewater	1983 – 1990

Project	Description of Services	Type of Waste	Year of Completion
77. Mostek Malaysia Sdn Bhd, Pulau Pinang and Kota Bahru, Kelantan	Design and supervision of secure water, air, solid waste, miscellaneous hazardous waste discharge permits and arrangement of off-site hazardous waste landfill operations.	Industrial Wastewater	1981
78. Latex Factory for Kota Trading Co., Tampin Negeri Sembilan	Oxidation ditch system for latex effluent.	Industrial Wastewater	1979
79. Tutong, Brunei	Study, design, tender documents and construction supervision: 30 km of main sewers, pumping station, oxidation pond treatment works, submarine outfall pipeline and house connections. Construction in 3 stages.	Domestic Wastewater	1978 – 1989
80. Berakas, Brunei	Study, design, tender documents and construction supervision of 11 km of main sewers, 3 pumping stations, oxidation pond treatment works, submarine pipeline and house connections.	Domestic Wastewater	1978
81. Rubber Research Institute, Sungai Buloh, Selangor	Latex effluent treatment ponds at the Rubber Research Institute Experimental Station	Industrial Wastewater	1978
82. Malaysian Rubber Producers Council H & C Latex, Batu Anam, Johor	Latex effluent treatment pond: Pilot plant for Rubber Producers Council	Industrial Wastewater	1978
83. Kuantan Town, Pahang	Feasibility Study: Sewers, 11 pumping stations, 4 oxidation ponds, marine outfall, mathematical modelling of effluent discharge to tidal estuary to assess effect on water supply intake.	Domestic and Industrial Wastewater	1977
84. Kota Kinabalu, Sabah	Feasibility Study for the Tanjung Aru and Likas/ Tuaran Road Schemes: 24 km of main sewers and 4 pumping stations.	Domestic Wastewater	1969
85. Bandar Seri Begawan, Brunei	Study, design, tender documents and construction supervision: 21 km of main sewers, 5 pumping stations and sewage treatment works and house connection programme.	Domestic and Industrial Wastewater	1968 – 1972
86. Sandakan, Sabah	Feasibility Study: 5 km of main sewers and 4 pumping stations and submarine pipeline sea outfall.	Domestic Wastewater	1968
87. Melaka Town, Melaka	Master Plan: 93 km of main sewers, 17 pumping stations and submarine pipeline sea outfall, financial and organisation studies.	Domestic Wastewater	1968