



HENDRIK DURK AARTSMA

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Academic Qualifications:

- B Eng (Civil Engineering, University of Pretoria)

Membership of Professional Institutions:

- Engineering Council of South Africa : Professional Engineer (20040098)
- South African Institution of Civil Engineering : Corporate Member (91463)
- Water Institute of Southern Africa : Fellow Member (22474)
- Society of Construction Law for Africa : Individual Member (SCLA0659)
- South African Society for Trenchless Technology : Board Member (2009 – 2013)

Personal Charactaritics

- I enjoy sport and am a social outgoing person. I get on well with people, am disciplined, honest and am a hard worker. I view continued education as an important aspect of our profession and am keen to further develop my skills, and also to transfer my skills to the team(s) I'm working with to develop their careers. In five years' time I see myself in a technical director position in a Consulting Engineering Firm.

Personal Resume

- Henk Aartsma is a professional civil engineer with more than 23 years' experience and specialises in hydraulic flow in closed conduits. His key experience includes design of bulk water supply pipelines for both gravity and pumping systems, pump station design, design of outfall sewers, design and rehabilitation of sewer mains using trenchless technology, detail hydraulic analysis of water supply networks and schemes, design and evaluation of open channel flow conduits,

implementation of small membrane water treatment works, compilation of contract documentation, tender procurement, contract administration, project management and client liaison.

Summary of Employment history

- 2015 – Date Bigen Africa Services (Pty) Ltd, Bellville Principal Engineer
- 2013 – 2015 AECOM SA (Pty) Ltd, Bellville Executive
- 2012 – 2013 AECOM SA (Pty) Ltd, Bellville Principal Engineer
- 2008 – 2012 BKS (Pty) Ltd, Bellville Associate Engineer
- 2004 – 2008 BKS (Pty) Ltd, Bellville Chief Engineer
- 2002 – 2004 Arcus Gibb (Pty) Ltd, Cape Town Engineer
- 2002 – 2002 Goba Moahloli Keeve Steyn (Pty) Ltd, Johannesburg Engineer
- 2000 – 2001 Keeve Steyn (Pty) Ltd, Johannesburg Engineer
- 1998 – 2000 WBH Consulting Engineers (Pty) Ltd, Centurion Engineer
- 1996 – 1997 Department of Water Affairs and Forestry, Centurion Assistant Engineer

Professional Capacity

- Hydraulic analysis and design of bulk water pipelines
- Hydraulic analysis and design of outfall sewers
- Design of gravity and rising mains, including pump stations
- Hydraulic analysis and design of water supply systems and networks
- Applying trenchless construction methods (e.g. micro-tunnelling, pipe jacking, horizontal directional drilling (HDD), etc.) for bulk water pipelines and outfall sewers
- Design of rehabilitation of sewers using trenchless technology (e.g. slip-lining, cured-in-place pipe (CIPP), etc.)
- Small membrane filtration water treatment works (e.g. ultrafiltration, reverse osmosis, etc.)
- Hydrological investigations and flood analyses for various streams and river basins
- Design of urban and rural water supply schemes
- Contract documentation
- Tender procurement



- Contract administration
- Client liaison
- Project management
- Dispute resolution

Employment History

Water supply (bulk water supply pipelines, water networks and canals)

- **Desktop Feasibility Study - Water Supply to Yzerfontein and Darling from the Grootwater Aquifer (2019):** carry out a desktop feasibility study to develop the Grootwater Aquifer for the supply of water to the towns of Yzerfontein and Darling. (Client: Swartland Municipality, project value R0.173 million)
- **Diagrammatic Water Management Plan - Val de Vie and Pearl Valley Estates (2018 - 2019):** establish water zones within both Estates for effective water balance and reconciliation purposes, and act as project manager for the compilation of a diagrammatic water management plan for both Estates. (Client: Val de Vie Developments (Pty) Ltd, project value R0.625 million)
- **Smart metering and water balance & reconciliation - Val de Vie and Pearl Valley Estates (2018 - ongoing):** facilitate water meter audit and assess, including carrying out a monthly water balance and reconciliation of the bulk water supply system to the Estates, and investigate automatic meter reading (AMR) and advanced metering infrastructure (AMI) metering and technology. (Client: Val de Vie Developments (Pty) Ltd, project value R0.55 million)
- **Upgrading the Bulk Water Supply to Gansbaai - Phase 2 (2016 - 2017):** design second phase of upgrading the bulk water supply to Gansbaai comprising a 1.85km x 355mm diameter PVC-O bulk water main, including compilation of project specifications and tender documentation, tender process, compilation of construction drawings, and contract administration. (Client: Overstrand Municipality, project value R9.6 million)
- **Replacement of Hoekklip Siphon Pipeline (2016):** design review of a new 680m x 1 000mm diameter steel siphon close to Koekenaap. (Client: Department of Water and Sanitation, project value R18.5 million)
- **River Abstraction Works from the Berg River for the Val de Vie Phase 2 Development (2016):** Project Manager making use of a specialist sub-consultant for the design of a 120 m³/hr river abstraction works on the Berg River as part of the irrigation system for the Val de Vie Phase 2 Development. (Client: Val de Vie Estate)
- **Stellenbosch Arterial Bulk Water Pipeline (2016 - 2018):** design of a 2km x 800mm diameter and 1km x 500mm diameter bulk water pipeline based on imported PVC-O as pipeline material (originally designed based on ductile iron as pipeline material) for upgrading the bulk water supply to the Belhar and Delft area as part of Belhar CBD Development, including associated water meter, isolating, air and scour valve chambers. The project also includes a 70m pipeline bridge crossing with the Kuils River, as well as trenchless construction

for traversing the R300 Provincial Road (including the on and off-ramps) and Stellenbosch Arterial Road by means of pipe jacking as trenchless construction method (the latter was originally designed as Horizontal Direction Drilling (HDD) to connect the new bulk water pipeline to the existing bulk water main). Responsibilities include the design, compilation of tender documentation and construction drawings and technical input on contract administration during the construction phase of the Project. (Client: Calgro M3 Developments (Pty) Ltd, project value R100 million)

- **Table Mountain Fog Harvesting Feasibility Study (2016):** Project Manager leading a professional team to carry out a feasibility study for fog harvesting on Table Mountain. (Client: City of Cape Town)
- **Upgrading of the Elsenburg water supply system and sewer network (2015 - 2018):** design review, tender, contract administration and project management for extension of an existing bulk water main, construction of a new water pump station (83 m³/hr) and 200mm diameter rising main pipeline system, including Horizontal Directional Drilling (HDD) trenchless construction of the rising main road crossing with the Elsenburg/ Muldersvlei Road and upgrading of the sewer reticulation system as well as the construction of a small sewer pump station. (Client: Western Cape Government - Department of Transport and Public Works, project value R25 million)
- **Relocation of a section of the 1 200mm diameter pre-stressed concrete / 1 100mm diameter steel bulk water main (2015):** conceptual design for relocating and upgrading a section of approximately 800m of a 1 100mm diameter steel bulk water main using a 1 500mm diameter ductile iron / steel pipeline as part of construction of a new interchange on the R27 West Coast Road at Saldanha. (Client: Western Cape Government)
- **Marais Street relocation of a section of a bulk water main – Stellenbosch (2015):** design relocating a section of approximately 330m of a 350mm diameter fibre cement class 36 bulk water main using a 450mm diameter HDPE PE100 PN10 (SDR9) pipeline as part of a road rehabilitation project, including compilation of specifications and construction drawings. (Client: Stellenbosch Municipality)
- **Bonnievale potable water main bridge crossing (2014 – 2015):** design upgrading the potable water main bridge crossing with the Bonnievale Bridge (with a span of 210m) to 250mm diameter, including compilation of specifications, bills of quantities and construction drawings, and contract administration. (Client: ERO Engineers)
- **Upgrading of the Bulk Water Supply to Kleinbaai (2014 – 2015):** design 3.35km x 250mm diameter bulk water main, compilation of tender document, tender process, compilation of construction drawings, and contract administration. (Client: Danger Point Ecological Development Company, project value R5.6 million)
- **Upgrading of the Pearly Beach Water Reticulation Network – Phase 2 (2013 – 2014):** design second phase for upgrading 6.6km of the internal water reticulation for Pearly Beach, including compilation of tender document, tender process, compilation of construction drawings, and contract administration. (Client: Overstrand Municipality, project value R5.7 million)

- **Upgrading Baardskeerdersbos Water Supply (2012 – 2014):** design upgrading the water supply to Baardskeerdersbos including equipping of two boreholes, construction of a pipeline from the boreholes to a 185kl/day new water treatment works, construction of the new water treatment works, upgrading the telemetry system, and upgrading of some pipelines in the Baardskeerdersbos internal water reticulation. This project included compilation of tender document, tender process, compilation of construction drawings, and contract administration. (Client: Overstrand Municipality, project value R8.6 million)
- **Upgrading Murraysburg Water Supply (2012):** following the assessment of the water supply system, design upgrading the existing boreholes in terms of the pipework at the top, including upgrading of the telemetry system. In addition, tender documentation and tender drawings were compiled. (Client: Beaufort West Municipality)
- **Assessment of Murraysburg Water Supply (2011):** carry out an assessment of the water supply to Murraysburg in terms of future water requirements for the town of Murraysburg, sufficiency of existing boreholes in terms of capacity, capacity of the existing water storage facilities (reservoirs), and options for the upgrade of the existing telemetry communication system, including cost estimates and economic analyses. (Client: Beaufort West Municipality)
- **Upgrading of the Pearly Beach Water Reticulation Network (2011 – 2012):** design upgrading 3.6km of the internal water reticulation for Pearly Beach, including compilation of tender document, tender process, compilation of construction drawings, and contract administration. (Client: Overstrand Municipality, project value R2.25 million)
- **Central Karoo Comprehensive Bulk Infrastructure Master Plan (Water & Sanitation) (2010):** carry out on-site inspections of bulk water and sanitation infrastructure and compile a comprehensive bulk infrastructure master plan (water & sanitation) for the Beaufort West, Laingsburg and Prince Albert Municipalities as well as the Central Karoo District Management Area (Murraysburg). (Client: Central Karoo District Municipality, project value R1.3 million)
- **Vergeleë bulk water supply pipeline rehabilitation (2009):** design input and technical review to replace a section of the existing 1 000mm diameter bulk water main, including an off-take and scour valve chamber and associated hydraulic analysis of different scour scenarios. Furthermore, design input and technical review to change a bottleneck on the existing 600mm diameter supply pipeline from the Vergeleë Reservoir complex, including two bulk water main connections. (Client: West Coast District Municipality)
- **Upgrading of the Bulk Water Supply System to Pearly Beach (2008 – 2009):** design 3.3km bulk water main, compilation of tender document, tender process, compilation of construction drawings, and contract administration. (Client: Overstrand Municipality, project value R3.3 million)
- **Upgrading of the Bulk Water Supply System from Franskraal to Kleinbaai/Gansbaai (2007 – 2010):** design 2.2km x 350mm diameter ductile iron bulk water main, compilation of tender document, tender process, compilation of construction drawings and contract administration. (Client: Overstrand Municipality, project value R8.8 million)

- **Upgrading of the Bulk Seawater Supply to Velddrift Salt Company (2006 – 2011):** design the bulk seawater supply system to Velddrift Salt Company comprising of the installation of a 450mm diameter seawater abstraction manifold pipeline and 400mm diameter horizontal well on the beach, 400 m³/hr main seawater abstraction pump station and 1.7km x 350mm diameter rising main, including tender process, contract negotiation, and quality control and contract administration during construction. (Client: Velddrift Salt Company)
- **R300 Kalkfontein Pedestrian Bridge (2006):** design the replacement of a section of an existing fibre cement water main from the City of Cape Town using 450mm diameter ductile iron pipe. (Client: City of Cape Town)
- **Protea Heights Water Supply Scheme (2005 – 2006):** design, tender documentation and construction of the first phase (i.e. 2.1km) of a 400mm diameter ductile iron bulk main as part of the Protea Heights Water Supply Scheme. (Client: City of Cape Town)
- **Upgrading of the Bulk Water Supply Pipeline from Velddrif to Dwarskersbos (2005 – 2006):** assess the existing fibre cement bulk water supply pipeline between Velddrif and Dwarskersbos in terms of its condition and capacity and design the upgrading of the 12km bulk water supply system from Velddrif to Dwarskersbos, including Environmental Impact Assessment (EIA) input, tender documentation and tender process, contract administration and the registering of a servitude for the bulk water supply system. (Client: West Coast District Municipality)
- **Elandsbay Development (2005):** carry out a hydraulic analysis of the water supply network to evaluate the capacity of the network and existing reservoir for future developments. (Client: private developer)
- **Kersbosstrand Development (2005):** design of the water supply network and new trunk main supplying the Kersbosstrand Development at Dwarskersbos. (Client: Dolphin Whisper Trading 10 (Pty) Ltd)
- **St Helena Bay Erf 23 Development (2005):** carry out a hydraulic analysis and design the water supply network of the development of Erf 23 at St Helena Bay, including compiling the relevant project specifications. (Client: private developer)
- **Genadendal Water Supply Feasibility Study (2005):** carry out a feasibility study investigating bulk infrastructure required to supply Genadendal with water from the Overberg Water bulk system. (Client: Overberg Water)
- **Rehabilitation of the Hex River Canal (2004 – 2008):** following a status quo investigation of the canal, investigate various options for the rehabilitation of a portion of the earth canal section by lining the canal, including design, tender documentation and tender process, and contract administration during implementation. (Client: Breede Valley Municipality, project value R7.85 million)

- **Highlands Village Services (2005):** carry out a hydraulic analysis and design the water supply network as part of the design of the internal civil services for Highlands Village, Mitchells Plain, including compiling the relevant project specifications. (Client: Cape Town Community Housing Company)
- **Jacobsbay Erf 86 Development (2005):** carry out a hydraulic analysis and design the water supply network of the development of Erf 86 at Jacobsbay, including compiling the relevant project specifications. (Client: private developer)
- **Middelpos Emergency Services and Upgrading of Informal Settlement Programme (UISP) Project (2005):** carry out a hydraulic analysis and design the water supply network for a housing project at Middelpos, including compiling the relevant project specifications. (Client: Saldanha Municipality)
- **Cecilia Road Interchange (2005):** design the relocation of a section of an existing 375mm diameter fibre cement by the installation of a new 400mm diameter ductile iron pipeline and carry out quality management during construction.
- **Arabella Water Network Analysis (2004):** carry out a hydraulic analysis for the extension of the existing water supply network of the Arabella Country Estate close to Hermanus to determine preliminary pipe sizes for the proposed second phase of the development. (Client: Arabella (Pty) Ltd)
- **Mliba Network Analysis (2004):** carry out a hydraulic analysis for the Ministry of Public Works and Transport of Swaziland of the water supply network for the Mliba Police station and proposed blocks of flats that will serve as housing for the police station staff and their families, to determine upgrading required of the network. (Client: Ministry of Public Works and Transport of Swaziland)
- **Kunnenberg Water Quality Management Report (2003):** update Water Quality Management Report for the La Bella Vita agricultural small holdings development near Paarl to include the Kunnenberg agricultural small holdings development.
- **Lusoti Water Network Analysis (2003):** carry out a hydraulic analysis of the Lusoti water supply network in Swaziland. Compile a detailed report of the analysis with conclusions and recommendations. (Client: Royal Swaziland Sugar Corporation)
- **Bettys Bay Water Network Analysis (2003):** carry out a hydraulic analysis of the water supply network of Bettys Bay to determine upgrading required to some sections of the network. (Client: Overstrand Municipality)

- **Western Cape Olifants/Doring River Irrigation Study (WODRIS) (2002 – 2004):** identify and evaluate various scenarios and combinations of bulk irrigation infrastructure a dam or from wellfields or combinations thereof, based on a preliminary design of concrete canals, gravity mains, rising mains and pump stations including cost estimates as well as Unit Reference Value (URV) and Net Present Value (NPV) calculations. (Client: Provincial Government of the Western Cape)
- **Knysna Sparrebosch Pipeline (2002 – 2004):** compile method statement and carry out on-site supervision of the re-installation of a section of the 300mm diameter trunk main which failed numerous times. Site activities include accurate recordings of both the existing pipe and the newly installed pipe as part of an investigation to determine the cause of the failures. Compiled the method statement for the commissioning of the pipeline and carried out the commissioning. (Client: Knysna Municipality)
- **Nagle Dam Pipe Encasement (2002):** compile construction drawings and compile the schedule of quantities for the encasement of a 900mm diameter steel pipe at a stream crossing downstream of the Nagle Dam overflow. (Client: Umgeni Water)
- **La Motte Water Reservoir and Pipeline (2002):** tender drawings and documentation, including tender adjudication and report, of a rising main and 500 kℓ reinforced concrete reservoir. (Client: Boland District Municipality).
- **Germiston Water Demand Management (2001 – 2002):** contract implementation, contract administration and supervision of the installation of bulk flow meters in the central areas of Germiston to facilitate water loss control management. (Client: Ekurhuleni Metropolitan Council)
- **Installation of bulk flow meters in Germiston (2001 – 2002):** compilation of tender document, tender adjudication and recommendation and implementation including contract administration and supervision for the installation of bulk flow meters on various reservoir in- and outlet pipes with diameters up to 800mm in the Sandton area. (Client: Johannesburg Water (Pty) Ltd)
- **Installation of bulk flow meters in Sandton (2000 – 2001):** compilation of tender document, tender adjudication and recommendation and implementation including contract administration and supervision for the installation of bulk flow meters on various reservoir in- and outlet pipes with diameters up to 800mm in the Sandton area. (Client: Johannesburg Water (Pty) Ltd)
- **Wet services for Sapphire Secondary School (2000):** design of water supply, firewater and sewer including compilation of drawings for the Sapphire Secondary School in Bophelong. (Client: Gauteng Department of Education)
- **Water reticulations (1998 – 2000):** design investigation, design, compilation of tender document, tender adjudication and recommendations and implementation including contract

administration and supervision for the installation/upgrading of water networks in various townships. Included in some of the projects was the construction of elevated sectional steel water tanks, design of a booster pump and installation of a pressure reducing system. All the projects were carried out in the previous Kwa-Ndebele area. (Client: Highveld District Council)

- **Phiphidi Scour Pipeline (1997):** design of scour pipeline for Phiphidi water treatment works. (Client: Department of Water Affairs and Forestry)
- **Construction of Tshipise Balancing Dam (1996 – 1997):** resident engineer for the construction of the Tshipise balancing dam (earth dam). Responsibilities included surveying, taking of density tests, management of site staff, management of project budget and on-site design of the 750mm diameter inlet pipeline and the in- and outlet structure. (Client: Department of Water Affairs and Forestry)

Fire water systems

- **Refinery Fire Water System Phase 0.0 (2008 – 2012):** Project Leader on the design of the first phase of upgrading the fire water system for a refinery comprising of 400mm and 450mm diameter pipelines, including a study of the international and company specific standards and specifications, detail investigation of pipeline material, compilation of contract documentation and construction drawings, liaison with the Client and contract administration. (Project value R25.1 million)

Gas pipeline routing

- **West Coast Gas Pipeline (2006 – 2007):** investigation and assessment of potential pipeline routes for the proposed West Coast Gas Pipeline for PetroSA based on various considerations and constraints including topography, mining activities, environmental impact, geological conditions, etc. to assess the viability of providing natural gas from prospective off-shore gas fields along the Atlantic seaboard from Oranjemund in Namibia to potential users at Island Point, Doring Bay, Saldanha Bay, Atlantis, Cape Town, Mossel Bay and Port Elizabeth. (Client: Petronet)

Sewer reticulation and outfall sewers

- **Upgrading a portion of the Nooiensfontein Outfall Sewer (2017 – 2018):** investigate, hydraulic analysis, design and compilation of specifications and construction drawings for upgrading a portion of the Nooiensfontein Outfall Sewer to a 800mm nominal diameter sewer, including the associated manholes and road crossing with the Stellenbosch Arterial using micro-tunnelling (with a nominal diameter of 1 170mm) as trenchless construction method. (Client: Calgro M3 Developments (Pty) Ltd, End user: City of Cape Town, project value R10.5 million)
- **Construction of the Belhar CBD Internal Sewer Pump Station (2016 – 2018):** design and compilation of specifications and construction drawings of the new Belhar CBD Internal Sewer Pump Station with a design capacity of 70 m³/hr as part of the Belhar CBD Development, including the design of a 260m x 160mm diameter rising main and associated discharge chamber. (Client: Calgro M3 Developments (Pty) Ltd, End user: City of Cape Town, project value R2 million)
- **Construction of the Belhar CBD Main Sewer Pump Station (2016 – 2018):** design and compilation of specifications and construction drawings of the new Belhar CBD Main Sewer Pump Station with a design capacity of 240 m³/hr as part of the Belhar CBD Development, including the design of a 2.3km x 315mm diameter rising main and associated isolating, air and scour valve chambers as well as the discharge chamber / drop structure. The project includes crossing Symphony Way using Horizontal Directional Drilling (HDD) as trenchless construction method. (Client: Calgro M3 Developments (Pty) Ltd, End user: City of Cape Town, project value R12.5 million)
- **Upgrading of the Elsenburg water supply system and sewer network (2015 - 2018):** design review, tender, contract administration and project management for extension of an existing bulk water main, construction of a new water pump station (83 m³/hr) and 200mm diameter rising main pipeline system, including Horizontal Directional Drilling (HDD) trenchless construction of the rising main road crossing with the Elsenburg/ Muldersvlei Road and upgrading of the sewer reticulation system as well as the construction of a small sewer pump station. (Client: Western Cape Government - Department of Transport and Public Works, project value R25 million)
- **Construction of the Cape Flats 3 Bulk Sewer (2012 – 2015):** project manager and design engineer for the construction of a 5.1km x 1 000mm diameter sewer rising main, and a 0.3km x 1 200mm diameter sewer gravity main. A section of approximately 1 100m of the rising main was designed to be constructed using micro-tunnelling trenchless technology. The pipes to be used with the micro-tunnelling trenchless construction method were based on using imported ductile iron pressure jacking pipes. The project also includes upgrading the Bridgetown Sewage Pump Station from 330kW in total to 800kW with a duty flow of 1 300 l/s, including, upgrading the main incoming power supply and transformers, MCC, VSDs, and PLC. The design included a detailed pipeline route engineering investigation, as well as a flow

assessment of the total catchment areas for both the Athlone and Cape Flats Wastewater Treatment Works in terms of inter catchment transfers. Responsibilities included the design, compilation of tender documentation and construction drawings, and contract administration during the initial construction phase of the Project. (Client: City of Cape Town, project value R280 million)

- **Replacement of Northern Areas Sewer – Phase 2 (2009 – 2015):** carry out a review of a previous design, investigate the condition of the existing sewer and carry out the design for the replacement of the existing sewer, including the pipeline route for the new 5.2km long sewer varying in diameter from 1350mm to 1650mm nominal diameter. Following the design (including trenchless construction and rehabilitation methods, i.e. six number pipe jack road crossings with lengths up to 64m, two number pipe jack railway crossings with lengths up to 38m, one number horizontal directional drilling (HDD) road crossing, and 1.04km x 762mm diameter cured-in-place (CIPP)) compile tender documentation and drawings and carry out contract administration. (Client: City of Cape Town, project value R162 million)
- **Rehabilitation of Bulk Sewers in the Blaauwberg and Milnerton Area (2013 – 2014):** technical guidance and input for the investigations and assessments of the Pentz Drive, Sanddrift, Montague Drive, Bloubergrant, Bothasig and Edgemead bulk sewers, i.e. 13km in total with diameter varying from 300mm to 975mm, and reviewing the designs of rehabilitating these outfall sewers. (Client: City of Cape Town)
- **Langa Interceptor Sewer – Phase 2 (2012 – 2014):** rehabilitation of the balance (i.e. 390m) of the 1350mm high x 900mm wide egg-shaped Langa Interceptor Sewer using trenchless technology (GRP segmental slip lining). The project also entailed community liaison, compilation of project specifications and tender documentation, tender procedures, compilation of construction drawings, and contract administration. (Client: City of Cape Town, project value R10 million)
- **Maitland Outfall Sewer (2009 – 2010):** provide design input for relocating a section of the existing 750mm diameter sewer along the M5 provincial road with the upgrading thereof from Berkley Road interchange to Falkenberg overpass bridge, i.e. 1.35km, and upgrading this section of the sewer to 900mm diameter, and carry out completion inspection at the end of construction. (Client: Provincial Government Western Cape)
- **Langa Interceptor Sewer and Sandtrap (2007 – 2009):** investigation and assessment of the Langa Interceptor Sewer and design of the rehabilitation of the 1350mm high x 900mm wide egg-shaped using trenchless technology (GRP segmental slip lining), including an in-situ cast reinforced concrete sandtrap with overall dimensions 4.75m wide, 11.1m long and 7.15m high with an integrated bypass facility and stainless steel channel sluice gates for flow control. The project also entailed community liaison, compilation of project specifications and tender documentation, tender procedures, compilation of construction drawings, and contract administration. (Client: City of Cape Town, project value R16.3 million)



- **Gaborone Re-use Treated Effluent Analysis (2003):** carried out the hydraulic analysis and preliminary design of a treated effluent rising main supplying various storage tanks.

Trenchless construction and rehabilitation

- **Upgrading a portion of the Nooiensfontein Outfall Sewer (2017 – 2018):** investigate, hydraulic analysis, design and compilation of specifications and construction drawings for upgrading a portion of the Nooiensfontein Outfall Sewer to a 800mm nominal diameter sewer, including the associated manholes and road crossing with the Stellenbosch Arterial using micro-tunnelling (with a nominal diameter of 1 170mm) as trenchless construction method. (Client: Calgro M3 Developments (Pty) Ltd, End user: City of Cape Town, project value R10.5 million)
- **Stellenbosch Arterial Bulk Water Pipeline (2016 - 2018):** design of a 2km x 800mm diameter and 1km x 500mm diameter bulk water pipeline based on imported PVC-O as pipeline material (originally designed based on ductile iron as pipeline material) for upgrading the bulk water supply to the Belhar and Delft area as part of Belhar CBD Development, including associated water meter, isolating, air and scour valve chambers. The project also includes a 70m pipeline bridge crossing with the Kuils River, as well as trenchless construction for traversing the R300 Provincial Road (including the on and off-ramps) and Stellenbosch Arterial Road by means of pipe jacking as trenchless construction method (the latter was originally designed as Horizontal Direction Drilling (HDD) to connect the new bulk water pipeline to the existing bulk water main). Responsibilities include the design, compilation of tender documentation and construction drawings and technical input on contract administration during the construction phase of the Project. (Client: Calgro M3 Developments (Pty) Ltd, project value R100 million)
- **Construction of the Belhar CBD Main Sewer Pump Station (2016 – 2018):** design and compilation of specifications and construction drawings of the new Belhar CBD Main Sewer Pump Station with a design capacity of 240 m³/hr as part of the Belhar CBD Development, including the design of a 2.3km x 315mm diameter rising main and associated isolating, air and scour valve chambers as well as the discharge chamber / drop structure. The project includes crossing Symphony Way using Horizontal Directional Drilling (HDD) as trenchless construction method. (Client: Calgro M3 Developments (Pty) Ltd, project value R12.5 million)
- **Upgrading of the Elsenburg water supply system and sewer network (2015 - 2018):** design review, tender, contract administration and project management for extension of an existing bulk water main, construction of a new water pump station (83 m³/hr) and 200mm diameter rising main pipeline system, including Horizontal Directional Drilling (HDD) trenchless construction of the rising main road crossing with the Elsenburg/ Muldersvlei Road and upgrading of the sewer reticulation system as well as the construction of a small sewer pump station. (Client: Western Cape Government - Department of Transport and Public Works, project value R25 million)

- **Construction of the Cape Flats 3 Bulk Sewer (2012 – 2015):** project manager and design engineer for the construction of a 5.1km x 1 000mm diameter sewer rising main, and a 0.3km x 1 200mm diameter sewer gravity main. A section of approximately 1 100m of the rising main was designed to be constructed using micro-tunnelling trenchless technology. The pipes to be used with the micro-tunnelling trenchless construction method were based on using imported ductile iron pressure jacking pipes. The project also includes upgrading the Bridgetown Sewage Pump Station from 330kW in total to 800kW with a duty flow of 1 300 l/s, including, upgrading the main incoming power supply and transformers, MCC, VSDs, and PLC. The design included a detailed pipeline route engineering investigation, as well as a flow assessment of the total catchment areas for both the Athlone and Cape Flats Wastewater Treatment Works in terms of inter catchment transfers. Responsibilities included the design, compilation of tender documentation and construction drawings, and contract administration during the initial construction phase of the Project. (Client: City of Cape Town, project value R280 million)
- **Replacement of Northern Areas Sewer – Phase 2 (2009 – 2015):** carry out a review of a previous design, investigate the condition of the existing sewer and carry out the design for the replacement of the existing sewer, including the pipeline route for the new 5.2km long sewer varying in diameter from 1350mm to 1650mm nominal diameter. Following the design (including trenchless construction and rehabilitation methods, i.e. six number pipe jack road crossings with lengths up to 64m, two number pipe jack railway crossings with lengths up to 38m, one number horizontal directional drilling (HDD) road crossing, and 1.04km x 762mm diameter cured-in-place (CIPP)) compile tender documentation and drawings and carry out contract administration. (Client: City of Cape Town, project value R162 million)
- **N7 Leliefontein to Hopefield (2014):** design pressure pipeline road crossings with the N7 National Road using horizontal directional drilling (HDD), including compilation of specifications and bills of quantities. (Client: SANRAL)
- **Rehabilitation of Bulk Sewers in the Blaauwberg and Milnerton Area (2013 – 2014):** Design Reviewer and providing technical guidance for the investigations and assessments of 13km of bulk sewers with diameter varying from 300mm to 975mm, and reviewing the designs of rehabilitating these outfall sewers. (Client: City of Cape Town)
- **Langa Interceptor Sewer – Phase 2 (2012 – 2014):** rehabilitation of the balance (i.e. 390m) of the 1350mm high x 900mm wide egg-shaped Langa Interceptor Sewer using trenchless technology (GRP segmental slip lining). The project also entailed community liaison, compilation of project specifications and tender documentation, tender procedures, compilation of construction drawings, and contract administration. (Client: City of Cape Town, project value R10 million)
- **Langa Interceptor Sewer and Sandtrap (2007 – 2009):** investigation and assessment of the Langa Interceptor Sewer and design of the rehabilitation of the 1350mm high x 900mm wide egg-shaped using trenchless technology (GRP segmental slip lining), including an in-situ cast



reinforced concrete sandtrap with overall dimensions 4.75m wide, 11.1m long and 7.15m high with an integrated bypass facility and stainless steel channel sluice gates for flow control. The project also entailed community liaison, compilation of project specifications and tender documentation, tender procedures, compilation of construction drawings, and contract administration. (Client: City of Cape Town, project value R16.3 million)

Pump stations

- **Assessment of decreased yield from the horizontal well system and input on a trial pipeline to the sea for upgrading the Bulk Seawater Abstraction Pump Station (2018):** carry out an assessment of the decreased yield from the horizontal well system, and provide input on a trial pipeline to the sea for increasing the seawater abstraction capacity. (Client: Veldrift Salt Company, project value R0.5 million)
- **Construction of the Belhar CBD Internal Sewer Pump Station (2016 – 2018):** design and compilation of specifications and construction drawings of the new Belhar CBD Internal Sewer Pump Station with a design capacity of 70 m³/hr as part of the Belhar CBD Development, including the design of a 260m x 160mm diameter rising main and associated discharge chamber. (Client: Calgro M3 Developments (Pty) Ltd, project value R2 million)
- **Construction of the Belhar CBD Main Sewer Pump Station (2016 – 2018):** design and compilation of specifications and construction drawings of the new Belhar CBD Main Sewer Pump Station with a design capacity of 240 m³/hr as part of the Belhar CBD Development, including the design of a 2.3km x 315mm diameter rising main and associated isolating, air and scour valve chambers as well as the discharge chamber / drop structure. The project includes crossing Symphony Way using Horizontal Directional Drilling (HDD) as trenchless construction method. (Client: Calgro M3 Developments (Pty) Ltd, project value R12.5 million)
- **Upgrading of the Elsenburg water supply system and sewer network (2015 - 2018):** design review, tender, contract administration and project management for extension of an existing bulk water main, construction of a new water pump station (83 m³/hr) and 200mm diameter rising main pipeline system, including Horizontal Directional Drilling (HDD) trenchless construction of the rising main road crossing with the Elsenburg/ Muldersvlei Road and upgrading of the sewer reticulation system as well as the construction of a small sewer pump station. (Client: Western Cape Government - Department of Transport and Public Works, project value R25 million)
- **Construction of the Cape Flats 3 Bulk Sewer (2012 – 2015):** project manager and design engineer for the construction of a 5.1km x 1 000mm diameter sewer rising main, and a 0.3km x 1 200mm diameter sewer gravity main. A section of approximately 1 100m of the rising main was designed to be constructed using micro-tunnelling trenchless technology. The pipes to be used with the micro-tunnelling trenchless construction method were based on using imported ductile iron pressure jacking pipes. The project also includes upgrading the Bridgetown Sewage Pump Station from 330kW in total to 800kW with a duty flow of 1 300 l/s, including, upgrading the main incoming power supply and transformers, MCC, VSDs, and PLC. The

design included a detailed pipeline route engineering investigation, as well as a flow assessment of the total catchment areas for both the Athlone and Cape Flats Wastewater Treatment Works in terms of inter catchment transfers. Responsibilities included the design, compilation of tender documentation and construction drawings, and contract administration during the initial construction phase of the Project. (Client: City of Cape Town, project value R280 million)

- **Upgrading the Bulk Seawater Abstraction Pump Station (2015):** carry out the design and costing for installation of a separate pump to abstract seawater separately from the beachwell and horizontal well systems. (Client: Velddrift Salt Company)
- **Pearly Beach Booster Jockey Pump (2011):** design a jockey pump for the existing Pearly Beach Booster Pump Station, including detail design drawings, specifications, and contract administration during installation and commissioning. (Client: Overstrand Municipality)
- **Eersterivier Housing Development Sewage Pump Station and Rising Main (2011):** review design of a sewage pump station and rising main for the Eersterivier Housing Development, including drawings, bill of quantities and project specifications. (Client: Department of Human Settlement)
- **Pearly Beach Booster Pump Station (2008 – 2009):** carry out a hydraulic analysis of the water supply network to evaluate the capacity of the network, design a new 200 m³/hr booster pump station and upgrading of the pipework in the water tower, compilation of tender document, tender process, compilation of construction drawings, and contract administration. (Client: PSP Properties, project value R2.5 million)
- **Upgrading of the Bulk Seawater Supply to Velddrift Salt Company (2006 – 2011):** design the bulk seawater supply system to Velddrift Salt Company comprising of the installation of a 450mm diameter seawater abstraction manifold pipeline and 400mm diameter horizontal well on the beach, 400 m³/hr main seawater pump station and 1.7km x 350mm diameter rising main, including tender process, contract negotiation, and quality control and contract administration during construction. (Client: Velddrift Salt Company)
- **Kersbosstrand Development (2006):** design a new main booster pump station for the supply to the Dwarskersbos Town and Kersbosstrand Development. (Client: Dolphin Whisper Trading 10 (Pty) Ltd)
- **Thesen Island Sewage Pump Stations commissioning and Completion Inspection (2003 – 2004):** commission and carry out completion inspection on the mechanical and electrical work of four sewage pump stations on the Thesen Islands development in Knysna. Also carried out an inspection of the outstanding items of the final inspection of nine other sewage pump stations on Thesen Islands. In addition, design four sewage pump stations and compiled associated tender documentation and drawings. (Client: Thesen Island Development Company (Pty) Ltd)

- **Durbanville Business Park Sewage Pump Station and Rising Main (2004):** design sewage pump station and rising main for the Durbanville Business Park industrial development, including drawings and project specifications. (Client: Interactive Trading 377)
- **Eastford Pump Station Vibration Analysis (2003):** record flow rates as well as suction and delivery pressures and other measurements during a vibration analysis of the pump sets separately and combined to establish the cause of repeated pump bearing failures.
- **Novos Bairros Development in Luanda, Angola - Phase 2 (2002):** design of a booster pump station with a sump, including the rising main and an elevated sectional steel water tank for the development of 290 erven. (Client: Tilca Infrastructure Corporation (Pty) Ltd)
- **Upgrading of Crown Gardens Pump Station - Phase 2 (2002):** design upgrading of the existing pump station to increase the delivery capacity of the pump station. Compilation of quotation document, calling for quotations, quotation adjudication and recommendation and implementation. (Client: Johannesburg Water (Pty) Ltd)
- **Design of sump pump for Rom Bin (2002):** hydrology calculations and hydraulic design of the sump pumps and delivery pipeline configuration for the ROM Bin at Douglas Colliery. (Client: Ingwe Coal Corporation Ltd)
- **Investigation on supplementing Parktown and Berea reservoirs utilising Hector Norris booster pump station and G15 bulk water main (2001):** Develop a system operating philosophy to utilise the Hector Norris booster pump station and G15 bulk water main to supplement the Parktown and Berea reservoir complexes, comprising review of the pump performances and controls with the potential linkage to the supply pipe to the reservoir complexes at Parktown and Berea, identifying options for supplementation through the Hector Norris booster pump station and reporting on findings and recommendations for implementation. (Client: Johannesburg Water (Pty) Ltd)
- **Upgrading of Crown Gardens Pump Station - Phase 1 (2001):** design, compilation of quotation document, quotation adjudication and recommendation and implementation including contract administration and supervision of the upgrading of the delivery piping system in the water tower to facilitate the future upgrading of the capacity of the pump station for. (Client: Southern Metropolitan Local Council)
- **Refurbishment of Orange Farm Pump Station (2001):** compilation of quotation document, quotation adjudication and recommendation and implementation including contract administration and supervision of the refurbishment of the concrete plinths, motors and multi-stage pumps at Orange Farm pump station. (Client: Southern Metropolitan Local Council)
- **Status Quo of existing pump stations (2000):** status quo investigations into the condition of existing pump stations. (Client: Southern Metropolitan Local Council)

Water storage reservoirs

- **Vergeleë new 15 MI reservoir (2009):** Project Leader on the condition assessment of the existing eight no 1 MI reservoirs, and two 4.5 MI reservoirs at the Vergeleë Reservoir complex, and design input and technical review of the sizing, capacity, material selection (based on corrosion considerations) of the 600mm diameter inlet, 600mm diameter outlet, 500mm diameter overflow and 300mm diameter scour pipework for a new 15 MI reservoir, including connection detail to the existing 1000mm diameter bulk water main and the required controls for the operation of the reservoir. (Client: West Coast District Municipality)
- **Kersbosstrand Development (2005):** optimise the capacity of a new 0.5MI reservoir and design reservoir inlet control and outlet pipework. (Client: Dolphin Whisper Trading 10 (Pty) Ltd)
- **Upgrading Paternoster Reservoir (2005):** design the upgrading of the inlet and outlet pipework and control of the existing Paternoster Reservoir. (Client: Saldanha Municipality)
- **La Motte Water Reservoir and Pipeline (2002):** tender drawings and documentation, including tender adjudication and report, of a rising main and 500 kℓ reinforced concrete reservoir. (Client: Boland District Municipality).

Water treatment works

- **Val de Vie Water Treatment Works (2017 – 2018):** planning and design an emergency 1.5 MI/day ultrafiltration water treatment works to supply potable water to both Val de Vie and Pearl Valley Estates, including liaison with authorities, coordinating drilling and testing of boreholes, construction of the pipelines from the boreholes to the water treatment works, implementation of the transfer pumps, facilitating quotation and tender process and associated evaluation, compilation of construction drawings, coordinating electrical supply and SCADA, and overall project management. (Client: Val de Vie Developments (Pty) Ltd, project value R17 million)
- **Upgrading the Pre-treatment Process for the Pearly Beach Water Treatment Works (2015):** project management for the design and implementation of upgrading the pre-treatment process for the Pearly Beach Water Treatment Works. (Client: Overstrand Municipality)
- **Upgrading Baardskeerdersbos Water Supply (2012 – 2014):** design upgrading the water supply to Baardskeerdersbos including equipping of two boreholes, construction of a pipeline from the boreholes to a 185kl/day new water treatment works, construction of the new water treatment works, upgrading the telemetry system, and upgrading of some pipelines in the Baardskeerdersbos internal water reticulation. This project included compilation of tender

document, tender process, compilation of construction drawings, and contract administration. (Client: Overstrand Municipality, project value R8.6 million)

- **Assessment of Murraysburg Water Supply (2011):** carry out an assessment of the water supplied to Murraysburg from existing boreholes in terms of water quality, and evaluate different water treatment options for the treatment thereof, including cost estimates and economic analyses. (Client: Beaufort West Municipality)
- **De Kelders Reverse Osmosis Water Treatment Works (2010 – 2012):** design a new 1.6 Ml/day reverse osmosis water treatment works with ultrafiltration pre-treatment for De Kelders, including compilation of tender document and tender process, compilation of construction drawings and contract administration. (Client: Overstrand Municipality, project value R15.1 million)
- **Pearly Beach Water Ultrafiltration Treatment Works (2009 – 2010):** design a new 2.3 Ml/day ultrafiltration water treatment works for Pearly Beach, including compilation of tender document, tender process, compilation of construction drawings, and contract administration. (Client: Overstrand Municipality, project value R7.7 million)
- **Water Quality Assessment of De Kelders and Gansbaai Fountains (2008):** assessment of various fountains used for potable water in terms of fountain yields, water quality, water requirements, alternative water resources, water treatment options and carry out cost estimates and economic analyses for the treatment thereof. (Client: Overstrand Municipality)

Wastewater treatment works

- **Central Karoo Comprehensive Bulk Infrastructure Master Plan (Water & Sanitation) (2010):** carry out desktop assessment of oxidation pond wastewater treatment facility at Laingsburg, Leeu-Gamka, Prince Albert, Klaarstroom, Merweville, Nelspoort and Murraysburg. (Client: Central Karoo District Municipality, project value R1.3 million)
- **Sanitation Asset Register (2006):** carry out an asset assessment of the four wastewater treatment works at Worcester, Rawsonville, De Doorns and Touws River and compile a Sanitation Asset Register. (Client: Breede River Municipality)
- **Sonangol Clinic (2003):** Carried out the preliminary design for tender purposes of the water treatment as well as sewage package plants including compilation of drawings for the Sonangol Clinic in Luanda, Angola. (Client: Clinica Girassol)

Stormwater

- **Upgrading the stormwater system in Powrie Street in the Mossel Bay CBD (2018 – ongoing):** project manager and design input for upgrading the 150m long stormwater system in Powrie Street with a 600mmø pipeline, including compilation of project specifications and tender documentation, tender process, compilation of construction drawings, and contract administration. (Client: Mossel Bay Municipality, project value R3.43 million)
- **Upgrading the stormwater in the Mossel Bay CBD - Phase 2 (2018 – ongoing):** project manager for carrying out a detailed stormwater modelling of the eastern portion of the central business district (CBD) in Mossel Bay using PCSWMM for different storm events. (Client: Mossel Bay Municipality, project value R1.07 million)
- **Upgrading the stormwater in the Mossel Bay CBD - Phase 1 (2018):** project manager for carrying out a detailed stormwater modelling of the western portion of the central business district (CBD) in Mossel Bay using PCSWMM for different storm events, and provide a solution for a specific problem area at the intersection of Powrie and Marsh Streets. (Client: Mossel Bay Municipality, project value R0.86 million)
- **Plastic separating tank (2002):** design of a plastic separating tank to eliminate the plastic granules and powder from the discharged stormwater to comply with DWAF standards. (Client: DOW Plastics)
- **Design of a siphon (2001):** hydraulic calculations and design including compilation of drawings of a proposed syphon at Cookhouse.
- **Stormwater for Effingham – Avoca Interchange (2000):** hydrology calculations and hydraulic design of three major culverts including a backwater curve analysis of the Effingham Road – Avoca interchange in Durban. (Client: Durban Metropolitan Council)
- **Stormwater for Bakwena Platinum Corridor (2000):** hydrology calculations and check hydraulic capacity of existing 328 no culverts, six major culverts and 14 no bridges including backwater curve analyses where applicable on various sections of the Platinum Corridor from Pretoria to Skilpadhek (Botswana).
- **Stormwater for K101 in Midrand (2000):** hydrology calculations and hydraulic design of stormwater drainage system for the K101 in Midrand including a backwater curve analysis for the Midrand Town Council.

Involvement in contractual claims, adjudication, mediation and arbitration cases

- **Contractual claim and disputes (2018 - ongoing):** following assessment of contractual procedures followed on a construction contract, assist the contractor to compile a contractual claim, and subsequently provide further assistance to raise a contractual dispute and to proceed to Mediation on the matter.



- **Arbitration - Upgrading of the Elsenburg water supply system and sewer network (2017 - ongoing):** following Adjudication on disputes raised by the Contractor and subsequent issued Adjudicator's Decision, in eleven cases the Adjudicator's Decision were disputed by the Employer and referred to tribunal (i.e. arbitration). To this effect input and assistance are provided to the Employer during preparation for arbitration, including acting as factual witness during the arbitration hearing. (Client: Western Cape Government - Department of Transport and Public Works)
- **Adjudication - Upgrading of the Elsenburg water supply system and sewer network (2016 - 2018):** following assessment of a number of compensation events in terms of the NEC3 Engineering and Construction Short Contract, a number of these assessments were disputed by the Contractor and referred to Adjudication. To this effect input and assistance were provided to the Employer during adjudication of the various disputes, including compiling the Employer's Response. (Client: Western Cape Government - Department of Transport and Public Works)
- **Contractual claim and dispute (2014 – 2015):** following assessment of contractual procedures followed on a construction contract, assist the contractor to compile a contractual claim, and subsequently provide further assistance to raise a dispute following the ruling by the engineer, and to refer the matter to Adjudication.
- **Adjudication - Langa Interceptor Sewer – Phase 2 (2014 – 2015):** following the consultative process and Ruling issued on a contractual claim, the contractor raised a dispute with the Employer. Following initiation of the Adjudication process, compile the Employer's Response in reaction to the contractor's Statement of Case. The contractor's statement of Case was subsequently refuted by the Adjudicator. (Client: City of Cape Town)
- **Rulings on contractual claims (2006 – date):** assess contractor's claims on all projects where I acted contractually as the Engineer, and following consultative meetings with the contractor and Employer, issue rulings contractually.
- **Arbitration - Knysna Sparrebosch Pipeline (2006):** following an investigation into numerous pipeline failures of the newly constructed bulk water main provide expert witness on technical matters related to the uPVC pipeline material in an arbitration case between the Knysna Municipality and Contractor. (Client: Knysna Municipality)

Project awards

- **CESA AON Engineering Excellence Awards (2018):** the project Construction of the Cape Flats 3 Bulk Sewer won the 2018 AON Engineering Excellence Award for Projects with a value in excess of R250 million from the Consulting Engineers Southern African (CESA).

- **SASTT Joop van Wamelen Award of Excellence (2016):** the project Construction of the Cape Flats 3 Bulk Sewer won the 2016 Joop van Wamelen Award of Excellence from the Southern African Society for Trenchless Technology (SASTT).
- **SAICE Western Cape Regional Awards - Award for Technical Excellence (2016):** the project Replacement of Northern Areas Sewer – Phase 2 won the 2016 SAICE Western Cape Regional Technical Excellence Award.
- **Construction World Highly Commendable Award – Professional Services (2015):** the project Replacement of the Northern Areas Sewer – Phase 2 won the Construction World 2015 Highly Commendable Award in the Professional Services Category.
- **SASTT Award of Excellence (2014):** the project Langa Interceptor Sewer – Phase 2 won the 2014 Award of Excellence from the Southern African Society for Trenchless Technology (SASTT).

Continued Professional Development

- **Arbitration in the Construction Industry (2018):** completed three of the four modules of the one year diploma titled Advanced Alternative Dispute Resolution presented by the University of Pretoria and the Arbitration Foundation of Southern Africa. The last module to acquire the Advanced Alternative Dispute Resolution Diploma is scheduled to be completed in June 2019.
- **Sales and Negotiation Skills Training (2017):** completed a two day sales and negotiation course based on the CUSP Sales System presented by Markitects on 9 and 30 June 2017.
- **Pump Station Design (2017):** completed a three day Pump Station Design course which focused on all aspects of pump station design. The course was presented by the University of Pretoria during March 2017.
- **AECOM Project Management (2015):** attended a project management course based on “A Guide to the Project Management Body of Knowledge (PMBOK)” on 18 and 19 August 2015.
- **South African No-Dig Show (2014) – Pretoria:** attended the 2nd South African No-Dig Conference and exhibition on trenchless technology construction and rehabilitation methods held in Pretoria during July 2014.
- **Outfall Sewer Design (2013):** together with Mr Alaster Goyns compiled a two day course on the design of outfall sewers for the City of Cape Town on 18 and 19 February 2013.

- **Surge 2012 (2012):** completed a course focusing on the Surge 2012 water hammer analysis software presented by Dr S Lingireddy (developer of software) during November 2012.
- **South African No-Dig Show (2011) – Pretoria:** attended the 1st South African No-Dig Conference and exhibition on trenchless technology construction and rehabilitation methods held in Pretoria during August 2011.
- **Seminar on General Conditions of Contract (2nd Edition) 2010:** completed a course on the General Conditions of Contract (2nd Edition) 2010 presented by BCA Training in Bellville during July 2010.
- **Delay, Disruption and Extension of Time 2010:** completed a course on delay, disruption and extension of time on the context of construction contracts and disputes presented by BCA Training in Bellville during June 2010.
- **Mentoring:** completed a Mentoring course presented by Mentoring for Success in Bellville during May 2010.
- **Horizontal Directional Drilling:** completed a Horizontal Directional Drilling course presented by Vermeer in Midrand during March 2010.
- **South African Plastic Pipe Manufacturers Association (SAPPMA) 2009 National Conference:** attended the SAPPMA Annual National Conference in Midrand in September 2009.
- **Design of Concrete Outfall Sewers:** completed a Design of Concrete Outfall Sewers course presented by the Concrete Manufacturers Association in Bellville during May 2009.
- **Soliciting and Evaluating Tender Offers:** completed a Soliciting and Evaluating Tender Offers course presented by the South African Association of Consulting Engineers in Cape Town during October 2008.
- **Extending the Life of Pipelines – Design and Rehabilitation:** completed an Extending the Life of Pipelines – Design and Rehabilitation course presented by the Water Institute of South Africa in Durban during September 2008.
- **Technical Report Writing:** completed a Technical Report Writing course presented by Insite Training in Bellville during September 2008.
- **Practical Design of Concrete Sewer Pipes:** completed a Practical Design of Concrete Sewer Pipes course presented by the Concrete Manufacturers Association in Bellville during November 2007.

- **Pipeline and Pump Station Hydraulics and Design:** completed a Pipeline and Pump Station Hydraulics and Design course presented by the University of Stellenbosch during January 2007.
- **Water and Wastewater Treatment:** completed a Water and Wastewater Treatment course presented by the University of Stellenbosch during September 2006.
- **Pipeline Design:** completed a Pipeline Design course which focused on pipeline hydraulics, pipeline and pipe component design, pumping system design and pipeline installation, testing and operation. The course was presented by the University of Pretoria during November 2004.
- **Transient Flow in Pipe Systems:** completed a Transient Flow in Pipe Systems course which focused on the Surge 2000 water hammer analysis software and was presented by the University of Pretoria during July 2003.
- **Pipeline Engineering and Hydraulics:** completed a Pipeline Engineering and Hydraulics course presented by the South African Institution of Civil Engineering during September 2002.
- **Genetic Algorithms as an Optimization Technique for Water Supply Systems:** completed a Genetic Algorithms as an Optimization Technique for Water Supply Systems course presented by the University of Pretoria during November 2001.
- **Developments of Pressure Pipe Material:** completed a Developments of Pressure Pipe Material course presented by the Water Institute of South Africa in Johannesburg during November 2000.
- **ArcView GIS Geographical Information Systems:** completed an ArcView GIS course presented by ESRI during 2000.
- **AutoCAD 14 Computer Aided Design:** completed an AutoCAD 14 course during May 1998.
- **Caddie 6 Computer Aided Design:** completed a Caddie 6 course during November 1996.

International Courses and Factory Inspections

- **Molecor PVC-O Factory Inspection and Witness Testing 2016 – Madrid, Spain:** carried out a factory inspection and detailed independent witness quality control and assurance testing of the 800mm \varnothing and 500mm \varnothing PVC-O pipes fabricated for the Stellenbosch Arterial Bulk Water Pipeline during June 2016.



- **Valve Factory Tour 2009 – Denmark, Netherlands and Scotland:** did a factory tour and various valve factories in Denmark, the Netherlands and Scotland during October 2009.
- **Cured-in-Place Pipe (CIPP) Design Course – Toronto, Canada:** completed CIPP trenchless technology design course presented under the auspices of the North America Society for Trenchless Technology (NASTT) in Toronto, Canada during April 2009.

International Conferences

- **International No-Dig Show (2018) – Cape Town, South Africa:** attended the 36th international No-Dig Conference and exhibition on trenchless technology construction and rehabilitation methods held in Cape Town, South Africa during October 2018.
- **International No-Dig Show (2009) – Toronto, Canada:** attended the 27th international No-Dig Conference and exhibition on trenchless technology construction and rehabilitation methods held in Toronto, Canada during March 2009.
- **IFAT 2008 – Munich, Germany:** attended the three-yearly Air Fire Water and Earth international trade fair in Munich, Germany during May 2008.
- **International No-Dig Show (2007) – Rome, Italy:** attended the 25th international No-Dig Conference and exhibition on trenchless technology construction and rehabilitation methods held in Rome, Italy during September 2007.

Papers Presented

- **University of Stellenbosch – Water Network Analysis Course (2012):** present paper titled Design and Construction Considerations related to PVC and HDPE Pipelines and present it paper at the University of Stellenbosch in June 2012.
- **University of Stellenbosch – Sewer System Course (2011):** present the reviewed paper titled Local Application and Development of Trenchless Technology, and also prepared and presented a separate presentation on an introduction to the Cured-in-Place (CIPP) trenchless technology at the University of Stellenbosch in June 2011.
- **South African Plastic Pipe Manufacturers Association (SAPPMA) 2009 National Conference:** do a presentation on Design and Construction Considerations related to PVC



and HDPE Pipelines at the SAPPMA Annual National Conference in Midrand in September 2009.

University of Stellenbosch – Sewers Systems Planning and Design Course (2009): review and update a paper titled Local Application and Development of Trenchless Technology, and present this paper at the University of Stellenbosch in June 2009