Minerals & Metals
Capability & Experience
Corporate Overview

WorleyParsons is a leading global provider of professional services to the resources and energy sectors, and the complex process industries.

We cover the full asset spectrum, both in size and across the lifecycle, from the creation of new assets, to services that sustain and improve operating assets.

Our business has been built by working closely with our customers through long-term relationships, anticipating their needs, and delivering inventive solutions through streamlined, proprietary project delivery systems. We strive to provide tailored services wherever our customers need us.

EcoNomics™ provides our customers with the systems, technologies and expertise to optimize and balance financial, social, and environmental outcomes, improving sustainability performance while enhancing profit and long-term viability.

WorleyParsons’ vision is to be a leader in sustainability by helping our customers capture new markets and business opportunities created by the new energy economy.

Zero harm is our corporate vision for health, safety and the environment (HSE).

We are committed to our vision and apply it to all operations, at all times, in all locations, and at all levels of responsibility. We will actively work to align our expectations and behaviors to achieve zero harm in our dedication to continuous improvement. These expectations are reflected in our integrity management framework, OneWay™, and linked to our global systems and procedures.
WorleyParsons has over 50 years’ experience on some of the most complex and challenging minerals and metals projects globally. We help our customers to realize their business goals by providing a combination of extensive local experience and strong integrated solutions. We specialize in new project developments and existing facility upgrades or expansions, across many commodities as indicated below.

**Select, Deliver & Improve**

WorleyParsons’ experience covers all five phases of the asset lifecycle. In each one of these phases we understand the critical issues and tailor our services to enable customers to **Select** and **Deliver** their projects and **Improve** their assets for optimal long term performance. Our phased approach enables consistent project delivery worldwide. WorleyParsons’ project systems are fully aligned to this process.

**Select**
1 IDENTIFY  
2 EVALUATE
- Conceptual design  
- Business model development  
- Pre-feasibility studies  
- Cost estimating  
- Contract planning

**Deliver**
3 DEFINE  
4 EXECUTE
- Feasibility studies  
- Preliminary Engineering (FEED)  
- Cost estimating  
- Execution planning  
- Detailed Engineering  
- EPCM  
- PMC

**Improve**
5 OPERATE
- Brownfield projects  
- Portfolio delivery  
- Asset management  
- Business improvement  
- Operations and maintenance support
Global Presence ...

43 countries | 166 offices
37,500 people
Local Commitment

Since inception, WorleyParsons has committed to establishing operations close to our customers’ assets.

This decision is based on the understanding that every asset has a history, which needs to be understood. Invariably, each asset is a reflection of its leadership team and is supported by a community with expectations, and operations requiring world class on site services.

Today, WorleyParsons has arguably the largest global footprint amongst our peers with 165 offices in 43 countries. We are a stronger company because of our commitment to local operations. Using knowledge gained from each site we are able to refine design and project execution strategies to optimally meet our customers’ expectations in an efficient and cost effective manner.

Increasingly, owners in the resource and energy sectors are seeking providers to service their assets across a region and/or globally. WorleyParsons’ extensive network of offices and proven track record in customizing solutions for local environments has resulted in our recognition as a pre-eminent provider of global service contracts.
We’re with you every step

Providing innovative solutions for key customer challenges in each step of the mining value chain is achieved through our Select, Deliver, Improve and Advisory services. We understand the implications of decisions at every stage and are able to apply world-class capabilities to effectively achieve each customer’s business objectives. From studies to sustaining works, exploration to export, we’re with you every step.

The Mining Value Chain

**Exploration & Evaluation**
- Prospecting rights applications
- Exploration management inc. systematic core-logging and data processing
- Underground and in-pit mapping of geological features
- Ore block optimisation
- Ore-body modelling
- Geological and geostatistical modelling
- SAMREC, JORC & NI43-101 Code compliant resource and reserve estimates and audits
- Geometallurgy

**Mine Planning**
- Underground and in-pit mapping of geological features
- Ore block optimisation
- Ore-body modelling
- Geological and geostatistical modelling
- SAMREC, JORC & NI43-101 Code compliant resource and reserve estimates and audits
- Environmental & Social Impact Assessments
- Master Planning
- Construction camps
- Water, Power
- Non-process infrastructure

**Mining & Mine Development**
- Underground
- Open Pit
- Mine design and simulation
- Geotechnical and rock engineering
- Blastability assessments and blast designs
- Shaft sinking
- Stope and tunnel support design
- Mine economics and valuation
- Mine construction & establishment

**Materials Handling**
- Conveying systems
- Slurry pipelines
- Dynamic simulation
- Supply Chain Optimisation
- Crushing & Screening
- Stacking & Reclaiming
- Stockpiles and blending facilities
Mineral processing plants - Base and precious metal refinery - Concentrators - Acid Plants - Crushing & screening plants - Grinding circuits (ball, AG & SAG mills, HPGR) - Flotation - Classification - Pre-concentration circuits - Flotation of base and precious metals, oxide minerals, phosphates & RE's - Regrind & ultra-fine grinding circuits - Gravity & magnetic separation circuits - Solids/liquor separation & product dewatering - Concentrate handling - Reagent handling facilities

Hydrometallurgy - Atmospheric leaching - Pressure oxidation (POX) - High Pressure Acid Leaching (HPAL) - Heap and in-situ leaching - Bio leaching - Gold cyanidation - Bayer process - Solids/liquor separation and washing circuits - Precipitation & crystallisation - Solution purification - Solvent extraction - Electrowinning - Electro-refining

Pyrometallurgy - Calcining - Roasting - Smelting - Refining - Gas cleaning - Acid plants

Transport to Market
- Rail - Rolling stock - Track & Signals - Train loading
- Port - Car Dumpers - Stacking & Reclaiming - Ship loading
- Road

Environment & Approvals
- Remediation & Restoration - Permitting & Approvals - Environmental Social & Health Impact Assessments (ESHIA) - Social license to operate - Environmental management

Non-Process Infrastructure
Power - Generation, Transmission, Distribution
Water - Pipelines, Desalination, Water treatment
Camps - Communications

Tailings & Waste Management
- Tailings dam design - Waste water treatment & recycling

Minerals & Metals Capability & Experience
The Eureka gold mine is located at Guruve, approximately 150 km north of Harare, Zimbabwe. WorleyParsons TWP conducted the exploration programme to test mineralization and establish a large-scale open pit operation. The mine is based on a mineralised sheeted-vein system in a granodiorite delineated over an area on surface 150 m wide and 450 m long, dipping at 50 degrees.

Defined reserves contain 450,000 ounces of gold, and the total resource exceeds 1 million ounces. Stripping ratio is approximately 4.5/1.

Grade improves with depth and the deposit has been drilled to 370 m below the maximum pit depth with a view to assessing the viability of underground mining.
Minerals & Metals Capability & Experience

The De Beers Venetia Mine in Limpopo is the largest diamond mine in South Africa and the biggest source of rough diamonds in the country.

WorleyParsons, through TWP, completed a feasibility study for the proposed underground expansion of the mine. The new underground mine will be built beneath the current operating pit, which will extend the life of the Venetia Mine from 2021 to beyond 2040.

In early 2013 Anglo American-controlled De Beers announced an investment of $2bn to build the Venetia underground mine beneath the operating open pit. The Venetia underground project has received regulatory clearances and will be implemented from 2013 along with open pit operation.

Mine Planning

Determining the most appropriate mining method for the deposit is key to extracting maximum value. Our mining specialists are experienced in evaluating a range of mining methods, layouts and designs - from surface to underground.

Mine planning services include:

- Identifying and designing suitable mining methods and equipment
- Preparing basic grade, mining and financial equations
- Mine design scheduling, production profile reporting and optimization
- Three-dimensional mine layouts and designs
- Mine work plans

Venetia Underground Project

CUSTOMER: DE BEERS CONSOLIDATED MINES (DBCM)
COMMODITY: DIAMONDS
LOCATION: LIMPOPO, SOUTH AFRICA
OFFICE: JOHANNESBURG
PHASE: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

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The acquisition of TWP has strengthened our world-class capabilities in mining: from surface and shallow mining to deep and ultra-deep underground mining.

Mining and mine development services include:

- Shaft sinking - decline and vertical
- Underground cooling - ventilation design
- Safety systems, man and material logistics, rock removal
- High wall design, geological analysis, stability

WorleyParsons is providing full EPCM services for the design and development of Impala’s No.17 Shaft project, known as the ‘fourth generation’ shaft complex to reach depths of between 1600m and 2000m.

The project entails the sinking of three vertical shafts, the main, the vent, and the refrigeration shafts together with a 43m Bulk Air Cooler (BAC) Shaft, and all associated tunnels. The main shaft will have a final depth of 1920m at 10.0m in diameter; the ventilation shaft will be 1750m deep with a cross-sectional diameter of 9.0m; while the fridge shaft will be 1360m deep with a diameter of 6.0m. All three shafts are lined with concrete.

Once complete, the No.17 Shaft project will mine 225,000 tons per month of both Merensky and UG2 ore.

Key Achievements

- One million fatality-free shifts worked
- 8.5 million fatality-free hours worked
- SAISC - Mining & Industrial Award winner

Mining & Mine Development
Materials Handling

Materials handling is crucial to the mining process. We understand our customers need to achieve cost efficiencies and effective operations while minimizing degradation and contamination.

Materials Handling services:

- Conveying systems and slurry pipelines
- Stockyards and stockpile management
- Car dumpers, stackers and reclaimers, shiploaders and unloaders
- Train and truck loading and unloading
- Crushing, sizing and screening
- Supply Chain Optimization (dynamic simulation)

WorleyParsons is providing engineering, procurement and construction management (EPCM) services for Alderon's Kami Iron Ore project, which will produce 8 million tons of iron ore a year. The project includes: mine infrastructure, a concrete plant, power and utilities, railway, bridges and port facilities. The new mine will be located at Labrador and the ore transferred to the port at Pointe Noire. The Mississauga team is currently leading the project with support from Cegertec/WorleyParsons and multiple Canadian and global offices. This enables us to minimize project costs and meet the Newfoundland and Labrador Benefits Agreement requirements.

Key Achievements

- FEED design completed
- Control estimate approved
- Baseline schedule (level3) approved
Proven success in the delivery of all major components ensures the successful development of resource projects, particularly in the engineering of process plants. We excel at integrating multidiscipline engineering expertise and have experience with hands-on operational know-how to deliver innovative solutions to our customers.

Extensive experience in all facets of the mineral processing sector across many commodities benefits our customers. Our diverse industry knowledge encompasses base metals, precious metals, iron ore/magnetite, rare earths, alumina and mineral sands.

Our operational and technical expertise allows us to interact closely with our customers to deliver exceptional outcomes. We achieve these outcomes by seeding projects with high level resources.

Vale S11D Mine

CUSTOMER VALE
COMMODITY IRON ORE
LOCATION PARÁ, BRAZIL
OFFICE EDMONTON, BELO HORIZONTE
PHASE

Vale’s multi-billion dollar S11D project is a world-class iron ore processing facility located approximately 1,940 km north east of Sao Paulo in Para State, Brazil. One of the world’s richest iron ore bodies, upon completion the project will produce 90 million tons per annum of direct ship ore (DSO) iron ore.

To mitigate potential schedule impacts attributed to possible environmental permitting delays, Vale selected WorleyParsons to modularize the S11D beneficiation plant in 2010. The plant has been modularized using a total of 109 modules. The complete modular design and engineering is being carried out by our team in Edmonton, Canada with support from Belo Horizonte, Brazil.
Dominga is a greenfield iron ore prospect located 70 km north of La Serena in Chile. Andes Iron propose to develop an open pit mining operation feeding a 95 kilo tons per annum magnetite concentrator producing 11 million tons per annum magnetite, a tailings storage facility, a 25 km overland slurry pipeline to a new port development, a filter plant and concentrate storage facility at the port feeding ship loading facilities as well as a desalination plant for water supply.

WorleyParsons in Chile was awarded the feasibility study for the project. Our scope of work included: process plant; overland pipelines; tailings facility; desalination plant and port filter facilities; and the overall mine and port infrastructure.
Hydrometallurgy

Customers benefit from our expertise in hydrometallurgy, from the initial phases of conceptual flowsheet development, testing, design and construction, through to complex plant commissioning, operational support, optimization and troubleshooting.

WorleyParsons is committed to successful project execution. We have many years of experience executing projects ranging in size from single person studies to engineering, procurement and construction management (EPCM) of large greenfield’s projects.

Significant design, construction, commissioning and operations experience in alumina, nickel, cobalt, copper, lead, zinc, uranium, rare earths, minor metals and precious metals and extensive experience in hydrometallurgical plants and processing facilities including:

- Atmospheric leaching
- Pressure oxidation (POX)
- High Pressure Acid Leaching (HPAL)
- Heap and in-situ leaching
- Bio leaching
- CIP/CIL
- Bayer process
- Solids/liquor separation and washing circuits
- Precipitation and crystallization
- Solution purification
- Solvent extraction and ion exchange
- Electrowinning
- Electro-refining
- By-product treatment

Vale Growth Project

CUSTOMER: PT VALE INDONESIA
COMMODITY: BASE METALS
LOCATION: INDONESIA
OFFICE: JAKARTA

WorleyParsons is providing FEED services for PT Vale Indonesia’s Growth Project, which involves an expansion of the existing calcining and smelting facilities at Sorowako and a new greenfields refinery and port facility at Bahodopi, located 80 km east of Sorowako. The FEED services also include production of a capital cost estimate. WorleyParsons is also providing detail design and procurement services in the execution phase of the project, which is planned to commence in Q3-2014.

The project at Sorowako includes a new rotary dryer, two new reduction kilns, a new 90MW electric arc furnace and Pierce-Smith Converter and associated utilities and infrastructure. The project at Bahodopi includes a roaster/re-roaster, acid plant and effluent treatment plant, jetty and associated utilities and infrastructure.
WorleyParsons has extensive knowledge of refining and pyrometallurgy. Our specialists hold industry experience encompassing all major smelting and refining processes, having successfully delivered over 600 pyrometallurgy projects.

Smelting and refining services include:

- Smelter design
- Off-gas handling and gas cleaning
- Furnace and furnace containment system design
- World class Bayer process design
- Capacity creep projects

WorleyParsons, via joint venture provided the engineering, procurement and construction management services for this multi-billion dollar project, which also included a 2,000 MW gas-fired power plant and associated facilities on a 500 hectare site.

To deliver this challenging project, WorleyParsons drew on its global Minerals and Metals, Infrastructure, and Power groups to establish a multi-disciplined project management office at Al Taweelah, which is peaked at approximately 500 personnel.
Transport to Market

Providing our customers with complete solutions to get their product to market in the most efficient and cost effective manner is our focus. Through our integrated capabilities including road, rail, shipping, barging, intermodal transport and supply chain optimization we help our customers meet their business objectives.

Transport to market services include:

- Rail - route selection, track design, rolling stock engineering
- Roads and civil engineering
- Supply chain optimization - dynamic simulation
- Ports and marine - site selection, dredging and reclamation, vessel mooring analysis, jetties and wharves, port and harbor master planning

FMG Project

| CUSTOMER | CDN |
| COMMODITY | COAL |
| LOCATION | MOZAMBIQUE |
| OFFICE | MAPUTO, PRETORIA |
| PHASE | IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE |

WorleyParsons is currently providing Project Management Consultant (PMC) services for Corredor Do Desenvolvimento Do Norte's (CDN) Nacala Rail corridor project. Our scope of services involves project management of the rail construction including: contract administration, engineering, and detailed design of the rail facilities and maintenance complex at Nacala. The Nacala Rail corridor spans 584 km and links Vale’s Moatize coal mine in the north-east of Mozambique, with the export Port of Nacala. Once complete, the rail corridor will have capacity to transport 18 million tons per annum.
The development of sustainable environmental solutions to engineering challenges is critical to the overall success of a project. WorleyParsons have proven success in managing environmental and community impact assessments, including stakeholder engagement, permitting and approvals.

Environment and approvals services include:

- Environmental, Social and Health Impact Assessments (ESHIA)
- Environmental Management Plans
- Site remediation and rehabilitation
- Permitting and approvals
- Social license to operate

WorleyParsons has been involved in the industrial aspects of the Rondon Alumina project, a greenfield integrated bauxite-alumina mine and refinery, with a first phase production of 3 million tons per annum and estimated investment cost of USD3 billion.

Our involvement included Conceptual and Bankable Feasibility Studies (BFS), as well as preparation of the Environmental Impact Study (EIS).

The FEL 3 engineering study included overall beneficiation and refinery process design, identification of local and international vendors, development of the procurement plan and delivery of a Class 3 capital cost estimate.

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**Rondon Alumina - EIA**

**CUSTOMER** VOTORANTIM METALS  
**COMMODITY** ALUMINA  
**LOCATION** ARÁ, BRAZIL  
**OFFICE** BRISBANE, SÃO PAULO, BEIJING  
**PHASE**

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**Key Achievements**

Fast tracked BFS completed in 12 months, with some further CAPEX optimization studies being provided afterwards.
Non-Process Infrastructure

Diverse capabilities in non-process infrastructure allow us to provide totally integrated solutions for all aspects of mine development. The combination of our local knowledge and global procurement, provides customers with tailored solutions with the benefits of scale.

Non-process infrastructure services include:
- Power - generation, transmission, distribution
- Water and wastewater - desalination, pipelines, water treatment
- Accommodation villages and camps
- Communication and security
- Fuel storage, offices, workshops, roads, HVAC

Non-Process Infrastructure key Achievements

This fast-track project saw a schedule reduction of 7 months out of a 32-month schedule, a direct result of WorleyParsons’ workshare strategy.

Oyu Tolgoi Copper/Gold Mine

CUSTOMER RIO TINTO / IVANHOE MINES
COMMODITY COPPER/GOLD
LOCATION MONGOLIA
OFFICE CHINA, ULAANBAATAR, CALGARY, EDMONTON, SANTIAGO, ROME, DOHA, LONDON, SYDNEY, PERTH AND MELBOURNE

Oyu Tolgoi is one of the largest copper/gold mines currently under development with Phase 1 costing approximately USD6 billion, and the supporting mine infrastructure reaching over USD700 million.

WorleyParsons scope included detailed engineering, procurement support and site construction technical service for the mine infrastructure; power distribution and transmission (HV); site buildings and truck shops; central heating facility; water supply and distribution; roads and the ICT backbone of the entire mine site.
Safety First

Strong and continued focus on zero harm to people and assets and zero environment incidents has resulted in consistent improvements in both safety and operational performance for our customers.

This focus has seen WorleyParsons’ statistics fall to 0.21 Total Recordable Case Frequency Rate and 0.03 Lost Workday Case Frequency Rate. A performance that exceeds numerous industry benchmarks.

- **0.21** Total Recordable Case Frequency Rate
- **0.03** Lost Workday Case Frequency Rate

Industry Comparison of Total Recordable & Lost Workday Case Frequency Rates

- WorleyParsons, FY13, employees, contractors & sub-contractors and primary employees
- APPEA 2011 (adjusted from 1M hours worked)
- OGP 2012 (adjusted from 1M hours worked); includes company and contractor data
- OSHA 2011 (Heavy and Civil Engineering Construction)
- OSHA 2011 (Professional Services)
- OSHA 2011 (Mining Activities)