



Morupule Coal Mine
Seam to Value








SCOPE OF WORKS

ENGINEERING

**Predictive Analytics Platform Scope for
Morupule Coal Mine**

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APPROVAL

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REFERENCE DOCUMENTS

| Document Number | Document Name |
|------------------|---|
| Cap 44:02 | Mines Quarries, Works and Machinery Act |
| ISO 45001 | Occupational Health and Safety |
| ISO 14001 | Environmental Management System |
| FRCS | Fatal Risk Control Standards |
| ISO 31000: 2018 | Risk management System |
| ISO 55001: 2024 | Asset Management System |
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TABLE OF CONTENTS

| | | |
|------|--|---|
| 1. | BACKGROUND AND INTENT..... | 4 |
| 2. | OBJECTIVE | 4 |
| 3. | SCOPE OF SERVICES | 4 |
| 3.1. | INCEPTION AND DISCOVERY | 4 |
| 3.2. | SOLUTION ARCHITECTURE AND DESIGN | 4 |
| 3.3. | DATA INTEGRATION AND INTEROPERABILITY..... | 5 |
| 3.4. | PREDICTIVE ANALYTICS AND MACHINE LEARNING..... | 5 |
| 3.5. | ESG BASELINE AND IMPROVEMENT ANALYTICS | 5 |
| 3.6. | TRAINING, HANDOVER, AND SUPPORT..... | 6 |
| 4. | TECHNICAL AND FUNCTIONAL REQUIREMENTS..... | 6 |
| 4.1. | CORE FUNCTIONAL REQUIREMENTS | 6 |
| 4.2. | DATABASE AND DATA PLATFORM REQUIREMENTS..... | 6 |
| 4.3. | SCALABILITY REQUIREMENTS | 6 |
| 4.4. | COMMERCIAL MODEL CLARITY (MANDATORY)..... | 6 |
| 4.5. | CYBERSECURITY AND GOVERNANCE | 6 |
| 5. | RESPONSIBILITIES | 7 |
| 5.1. | CONSULTANT RESPONSIBILITIES | 7 |
| 5.2. | MCM RESPONSIBILITIES..... | 7 |
| 6. | DELIVERABLES..... | 7 |
| 7. | KEY PERFORMANCE INDICATORS (KPIS)..... | 7 |
| 8. | SHE AND COMPLIANCE REQUIREMENTS..... | 8 |
| 9. | APPLICABLE STANDARDS AND REFERENCES | 8 |
| 10. | BID SUBMISSION REQUIREMENTS (FOR CONSULTANTS)..... | 8 |

1. BACKGROUND AND INTENT

Morupule Coal Mine requires a scalable **Predictive Analytics Platform** to monitor both **fixed and mobile assets** across underground and surface operations. The platform shall ingest and process data from multiple sources (including plant equipment, underground machines, environmental monitoring systems, and energy meters) to establish operating baselines, correlate data points, predict failures, improve equipment reliability, optimize maintenance cost, and support ESG performance improvement initiatives.

2. OBJECTIVE

The Consultant shall design, deploy, configure, commission, and transfer to MCM a predictive analytics platform that:

1. Aggregates data from heterogeneous OT/IT sources in near real-time.
2. Uses rule-based analytics and machine learning to interpret & correlate data points to detect anomalies and predict failure risks based on previous scenarios or data points correlations.
3. Produces asset health data and improvement opportunities for reliability, energy, emissions, and environmental performance.
4. Scales from an initial asset population (selected underground, surface & services equipment) to full-mine deployment without platform re-design.
5. Capability to integrate with maintenance and operational systems for decision support and (where approved) automated work initiation.

3. SCOPE OF SERVICES

3.1. INCEPTION AND DISCOVERY

The Consultant shall:

- Conduct kick-off workshops with Engineering, Reliability, Maintenance, Operations, S&SD, and IT/OT teams to establish existing networks, sensors, data systems and establish robust connection and polling of data to a single predictive analytics platform.
- Review current architecture, network readiness (surface and underground), historians, Enterprise Resource Planning (ERP), Mining Information System (MIS), and available instrumentation and sensors.

3.2. SOLUTION ARCHITECTURE AND DESIGN

The Consultant shall provide a detailed architecture covering:

- Data ingestion layer for multi-source integration.
- The design and deployment strategy for the predictive analytics platform
- Time-series and relational data handling.
- Analytics and Machine Learning (ML) workbench.
- Visualization and reporting layer.
- Cybersecurity, user roles, audit trails, backup/recovery.
- Scalability design (horizontal expansion by assets, data points, and sites/sections).

3.3. DATA INTEGRATION AND INTEROPERABILITY

The platform shall support integration with, at minimum:

- PLC/SCADA/DCS and historians/gateways.
- Environmental monitoring systems.
- Power/energy metering systems.
- ERP system (for work order, status, and failure history synchronization).
- Existing and future sensors and IoT devices.

3.4. PREDICTIVE ANALYTICS AND MACHINE LEARNING

The Consultant shall:

- Configure automated data extraction from required sources.
- Develop baseline analytics by asset class (normal operating envelopes).
- Configure anomaly detection, trend deviation, and remaining useful life / failure likelihood models (as applicable per asset type).
- Implement hybrid logic (rules & ML models).
- Define model governance: retraining frequency, drift monitoring, explainability, and version control.
- Define threshold management and alarm rationalization to reduce false alerts.

3.5 DASHBOARDS, ALERTS, AND DECISION SUPPORT

The Consultant shall deliver role-based dashboards for:

- Reliability and Maintenance teams,
- Operations control,
- Engineering leadership,
- Equipment Efficiency Reporting to support ESG initiatives

Dashboards/reports shall include:

- Asset health index and criticality-risk score,
- Failure probability/risk ranking,
- Downtime and MTBF/MTTR trends,
- Energy and environmental baselines,
- Exception alerts and recommended actions,
- Improvement opportunity tracker (cost/risk/energy impact).

3.5. ENVIRONMENT, SOCIAL & GOVERNANCE (ESG) BASELINE AND IMPROVEMENT ANALYTICS

The platform shall support ESG programs by:

- Establishing operational baselines for energy intensity, emissions proxies (where direct emissions data exists), water/utilities usage, environmental compliance indicators, and related metrics.
- Trend analysis against baseline and target trajectories & predictions.
- Identification of avoidable loss patterns and improvement opportunities linked to asset condition and operating behaviour.

Commissioning shall include Site Acceptance Testing (SAT), User Acceptance Testing (UAT), user acceptance sign-off, and performance verification against defined KPIs.

3.6. TRAINING, HANDOVER, AND SUPPORT

The Consultant shall provide:

- Onsite/user training by role (IT personnel, Condition monitoring analysts, operators, reliability engineer, Maintenance engineers, administrators, S&SD personnel).
- Administrator training for model lifecycle and connector management.
- Full technical documentation & User Manuals.
- Warranty support period post-go-live.
- Gap recommendations report within one week after commissioning.

4. TECHNICAL AND FUNCTIONAL REQUIREMENTS

4.1. CORE FUNCTIONAL REQUIREMENTS

- Real-time/near-real-time condition monitoring.
- Predictive failure analytics
- Integration with ERP for maintenance decision support.
- Multi-asset, multi-source, multi-database support.
- Fixed and mobile asset monitoring platform.

4.2. DATABASE AND DATA PLATFORM REQUIREMENTS

The solution must support ingestion/query/interoperability across multiple database technologies

4.3. SCALABILITY REQUIREMENTS

The Consultant shall specify and demonstrate scale model for:

- Number of assets,
- Number of sensors/data points/tags,
- Data frequency/volume,
- Number of concurrent users/sites.

4.4. COMMERCIAL MODEL CLARITY (MANDATORY)

Bidder must clearly define software/commercial basis as one or more of:

- Usage-based (compute/storage/API/throughput),
- Data-point/tag based,
- Asset-count based,
- User-seat based,

and provide expansion pricing for each model.

4.5. CYBERSECURITY AND GOVERNANCE

Minimum requirements:

- Audit logs and change tracking,
- Backup/restore and disaster recovery provisions,
- Secure remote access controls,
- Compliance with MCM site IT/OT security policies.

5. RESPONSIBILITIES

5.1. CONSULTANT RESPONSIBILITIES

- Provide competent, certified personnel.
- Supply all tools, software components, and implementation consumables required for scope delivery.
- Prepare and communicate detailed execution schedule before site activities.
- Perform work safely and in compliance with MCM requirements.
- Deliver quality documentation, training, and handover materials.
- Ensure cyber resilient solution

5.2. MCM RESPONSIBILITIES

- Provide access approvals, inductions, and escort/competent person.
- Provide available infrastructure interfaces (power, network access points, existing systems access subject to policy).
- Provide transport to underground where required.
- Provide access to applicable databases
- Engage equipment OEMs in providing access to specific databases or data logging hardware.

6. DELIVERABLES

The Consultant's minimum deliverables shall include:

1. Predictive Analytics Platform.
2. Project Execution Plan.
3. Asset & Data Source Register (including quality and gap assessment).
4. Solution Architecture and Integration Design Documents.
5. Cybersecurity and Data Governance Plan.
6. Platform Configuration and Connector Setup Documentation.
7. Predictive Model Pack (methodology, training data, validation, retraining plan).
8. Dashboards, alerts, and report templates.
9. Commissioning Report with acceptance test results.
10. Training materials, attendance records, and competency transfer evidence.
11. Post-commissioning recommendations/gap closure plan (within one week).
12. BOQ and expansion roadmap (phase-wise scaling plan).
13. Licensing/commercial model declaration with cost curves (assets/data points/usage).

7. KEY PERFORMANCE INDICATORS (KPIs)

Minimum Key Performance Indicators (KPIs) to be measured during execution and at handover:

- SHE compliance: Zero incidents attributable to project execution.
- Schedule compliance against approved program.
- Data availability and pipeline reliability (target to be agreed at kick-off).
- Coverage: % of target assets onboarded in phase.
- Alert quality: precision/false-alert performance trend.
- Predictive lead time: usable early-warning window achieved.
- Maintenance impact: evidence of reduced unplanned downtime or improved planning quality.
- ESG baseline completeness for agreed metrics.
- End-user adoption and customer satisfaction.

8. SHE AND COMPLIANCE REQUIREMENTS

All activities shall comply with MCM SHE and FRCS requirements and applicable site procedures, including PPE, work permits, isolation/LOTO, incident reporting, emergency preparedness, and waste/spill management.

9. APPLICABLE STANDARDS AND REFERENCES

Work shall align with applicable national legislation and MCM standards/procedures, and the following frameworks as relevant:

- ISO 55001 (Asset Management),
- ISO 45001 (OH&S),
- ISO 14001 (Environmental Management),
- ISO 31000 (Risk Management)
- MCM FRCS and site rules/procedures,
- Mines, Quarries, Works and Machinery legal requirements.

10. BID SUBMISSION REQUIREMENTS (FOR CONSULTANTS)

Bidders shall submit:

- Method Statement showing full understanding of this scope.
- Company and team experience on similar predictive analytics deployments
- Team structure, CVs, and certifications.
- SHE plan/policy and baseline risk assessment.
- Program of works with milestones.
- BOQ and commercial proposal with explicit licensing basis.
- Legal/compliance documents (incorporation, VAT, shareholding, permits where applicable).