

XYLEM MINING SOLUTIONS

HOLISTIC MINE WATER MANAGEMENT

THE OPPORTUNITY YOU
CAN'T AFFORD TO MISS

At Xylem we know that optimal water management begins with a holistic view of how mining operations use water - from sourcing to dewatering to treatment and reuse. Whether water is scarce or plentiful, every step from intake to reuse is part of a process that can increase productivity, lower costs and ultimately, turn mining water management from an expense to a strategic advantage.

This guide will help you solve your toughest mine water challenges.

Optimal mine water management has never been more critical

As precious water resources become scarcer, investors and regulators are increasingly focused on how mining companies manage water. Holistic mine water management including smart technologies presents a powerful opportunity to unlock environmental and economic benefits for a mine operation.

The good news is many mine operators around the world are already making progress. A dramatic digital transformation with automation and Industrial Internet of Things (IIoT) connectivity is enhancing the productivity and safety of mining across the globe.

In EY's 2019-20 report on the top 10 business risks facing mining and metals, miners are making significant strides in applying digital solutions to single issues or bottlenecks.

But it is only when miners apply these solutions across the entire value chain to create a digital mine that they can truly transform and emerge as the dominant players in the market.

By 2025, two-thirds of the world's population could face water-stressed conditions.¹

180 million metric tons of mine waste flow into the world's waters annually.⁴

Water affordability represents another growing challenge and is among the top ten issues for miners.²

In the U.S., where some parts of the country are facing a historic drought, an estimated four billion gallons of water per day are withdrawn for mining purposes.³

We know water challenges can keep you awake at night

Findings from our recent poll of mining operators

What is your most pressing water-related issue on site?

63 %

Growing cost of water and sustainable water management

23 %

Water contamination

13 %

Access to water

What is your single most underlying constraint on site?

46 %

Capital expenditure

33 %

System uptime

20 %

Inventory quality and reliability

WATER QUALITY & SCARCITY

Remote monitoring and control with real-time continuous monitoring systems, give mine operators a better understanding of water use and ensure water can be extracted from multiple sources, transported and treated at the desired pressure and quantity.

REGULATORY COMPLIANCE

Real-time continuous monitoring systems and pipeline integrity management monitor water quantity and quality to ensure the extraction and transport of water, and management of tailings meets regulatory standards.

OPERATIONAL CONTINUITY & EFFICIENCY

Smart technologies like remote monitoring and control minimize costly, unplanned maintenance and unwanted downtime while reducing safety risks. Visibility and understanding the health of assets enables efficient scheduled maintenance, smart inventory management & reduced energy consumption.

PRODUCTIVITY
RELIABILITY
SUSTAINABILITY

Every mine has a distinct set of operating conditions, which is why there's no one-size-fits-all approach.

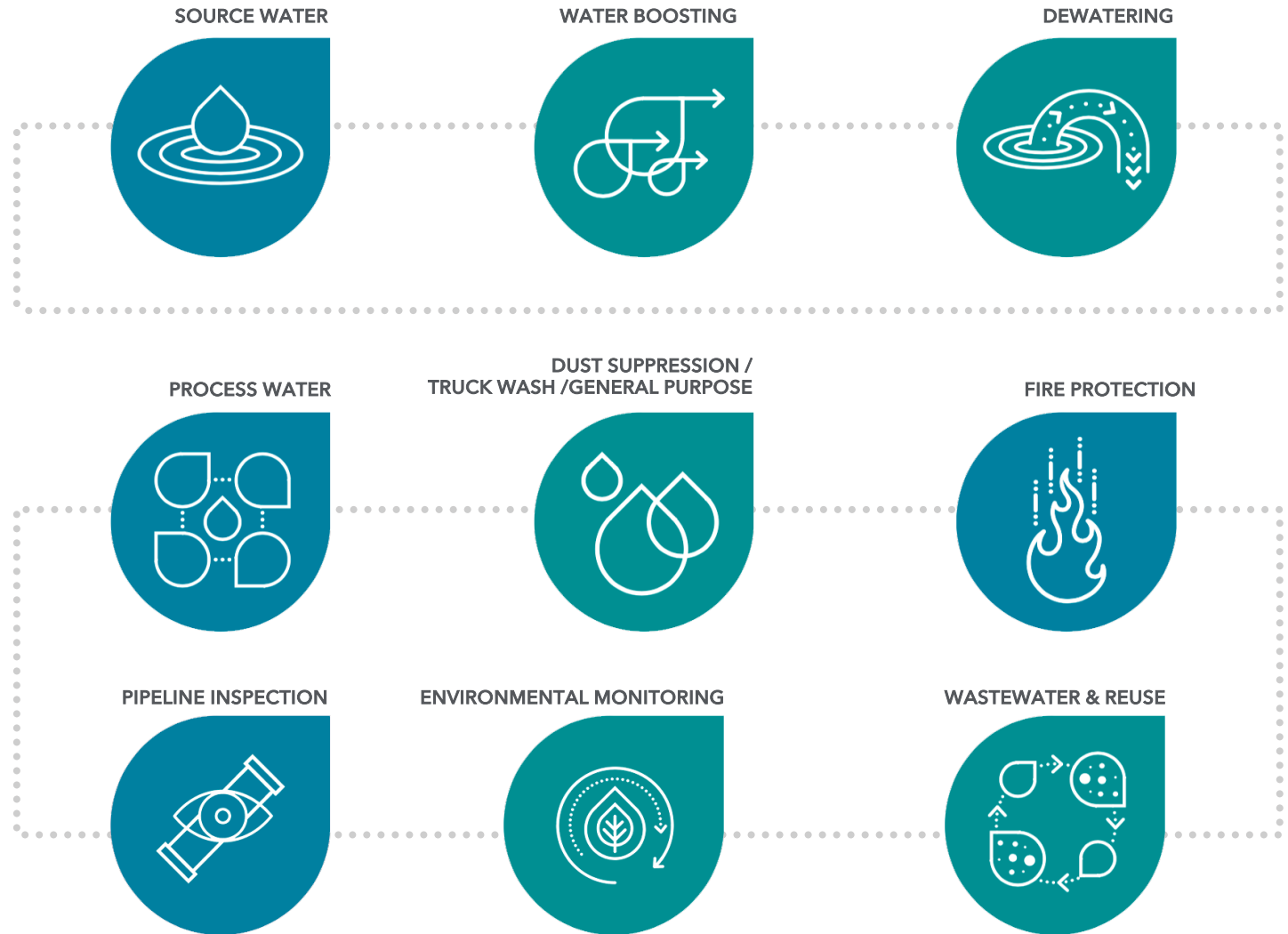
Customized water management solutions deliver better results by minimizing production downtime, lowering operating costs, enhancing performance and safety, and minimizing environmental impact - all supporting long-term prosperity.

By tapping into the power of digital and integrating your water management solutions, **you can get ahead of the issues that have been keeping you awake at night.**

MASTER WATER USAGE IN YOUR MINING OPERATIONS

Xylem's solutions portfolio for mining operations incorporates efficient and powerful pumping systems, monitoring, analytics and controls solutions and services, environmental water quality monitoring and quantity solutions, treatment systems, mixing equipment, heat transfer, fire protection and pipeline integrity management and monitoring solutions.

Whether you need fast-track temporary or emergency support, or reliable long-term solutions, we are standing by to assist you with **smart, safe and sustainable water management, for today - and tomorrow.**



MAPPING YOUR JOURNEY TO SMARTER SOLUTIONS

Let's look at how this approach works in practice.

SCENARIO

An open pit mining customer needs an efficient dewatering solution.

PHASE 1

Xylem develops a customized solution using the most efficient dewatering pump* to meet the head/flow requirements of the application. Pair the pump with a variable frequency drive (VFD) to ensure optimal performance.

PHASE 2

As the mine expands and dewatering requirements increase additional pumps may be needed. An intelligent controller such as Xylem's Flygt Multismart is incorporated into the system enabling the customer to easily control multiple pumps via programmable logic.

PHASE 3

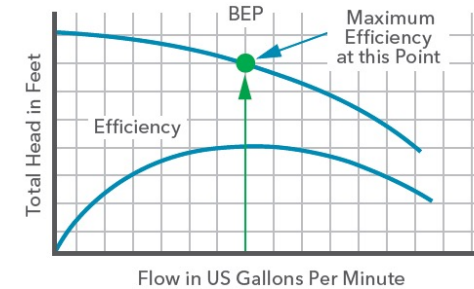
Enhance the dewatering system by adding a remote monitoring and control (M&C) solution. Xylem's Flygt Cloud-Based SCADA system connects to the Multismart control and allows the customer to monitor and control activity remotely. For isolated or inaccessible mine sites or operations where manpower is limited, remote M&C provides visibility of assets 24/7.

* Factors to consider when determining the most efficient pump to meet the specifications of the application include:

- Is aging equipment being replaced?
- Is there a scheduled maintenance program in place?
- How critical is the pump to the operation? Does the critical pump have a redundant system or a back-up pump in place?
- What are the head/flow requirements or pressure/quantity of water needed to be pumped?
- Where will the pump be located? A pit, sump, pond, river or well?
- What is the prevailing weather/climate in the area?
- What are the power limitations of the site?
- How will the pump be controlled?
- What is the solids content of the water?
- What is the physical size of the space available at the mine site?

BEST EFFICIENCY POINT - THE GOLDEN RULE OF PUMPING SYSTEMS

Straying too far from a pump's best efficiency point (BEP) leads to premature wear, higher energy consumption, increased maintenance requirements, a reduction of overall efficiency and as a result, more downtime. An audit of a mine's water management system is the first step in a process to **boost efficiency, reduce costs and enhance profit margins.**



10x
Unplanned downtime can cost up to ten times more than routine maintenance.

1

Perform a pumping system audit

Are pumps sized properly? Mine planners and engineers often oversize pumps as a way of anticipating greater capacity needs. However, significantly oversized pumps run inefficiently and wear out faster than they should.

How are pumps operating relative to their best efficiency point (BEP)? Would a different type of pump perform more effectively for the application?

How are piping, valves and controls performing on site?

2

Optimize pump energy consumption for enhanced BEP performance

Prime candidates are pumps that move large volumes of water over long distances or to much higher elevations. Ensure that air releases are installed to prevent the trapping of air at high points in the line. Such air pockets cause pumps to work harder and consume excess fuel.

Non-return valves ensure the same water is not pumped repeatedly while also preventing backflow which is catastrophic to a pump's resilience - based on the velocity of the backflow an impeller can be stripped from the pump shaft.

It is also important to ensure pumps are not snoring. PLC controls will allow pump performance to be controlled and optimized. Better again, incorporate a pump with integrated intelligence into the system.

3

Optimize total cost of ownership

For submersible pumps wear is the greatest contributor to cost. Sizing your pump to operate as close to the BEP in conjunction to optimizing the design of the hydraulic parts will tremendously reduce wear. Decreasing wear greatly reduces unplanned maintenance associated to the pump, which in turn saves the mine significantly on life cycle costs. Having the appropriate equipment in place with an effective maintenance schedule allows you to achieve long service life with a low cost of ownership resulting in overall peace of mind.

Use a computerized maintenance management system to capture service records and perform timely upkeep. Standardization with the aid of devices such as variable frequency drives (VFDs) can also help control costs. Reliance on a limited number of pump models from one or two manufacturers can help reduce and simplify parts inventories, maintenance requirements, and necessary training.

4

Optimize the system

Technology can be a major enabler to ensuring that the entire pumping system performs at the highest efficiency level, delivering the performance required, at low costs for energy and maintenance, and with the bare minimum of unplanned downtime. Variable frequency drives (VFDs) can enable pumps to respond smoothly and efficiently to fluctuations in demand.

Motors have also improved greatly in recent years; a change to the latest premium efficiency model may bring fast payback in energy savings.

SCADA systems enable remote monitoring and control, eliminating the cost of sending technicians on rounds to check equipment.

With improved visibility mine operators can better plan their day, be aware of pump failure quickly and eliminate flooded production areas, as necessary.

Enhanced visibility of pump operations also reduces safety risks as staff are not required to go on site to check on the pumps.

5

Contingency planning/emergency response

Finally, an optimized system includes built-in protection against downtime caused by equipment failure. The first line of defence is effective monitoring and maintenance. However, the most critical equipment requires contingency planning and emergency backup.

This can include:

Installing a redundant pump in parallel with the primary pump so that it can be automatically activated if needed.

Keeping a replacement pump in inventory—or at minimum, an adequate on-site inventory of replacement parts.

Developing a contingency plan and prearranging with a pump manufacturer or rental supplier to deliver a replacement immediately in case a critical unit fails.

CHALLENGE ROADMAP

1. PRODUCTIVITY

2. RELIABILITY

3. SUSTAINABILITY

1. PRODUCTIVITY

Pumps operating at their Best Efficiency Point, combined with smart technologies, support mine productivity by preventing unplanned downtime, reducing energy consumption, minimizing labor costs and enhancing infrastructure performance.

Xylem's smart tech solutions to minimize unplanned downtime & support productivity include:

- Intelligent Pumping Solutions
- Advanced Telemetry Systems
- Remote Monitoring & Controls
- Sensor Monitoring Ports

SMART SOLUTION SPOTLIGHT



A broad portfolio for mining needs

Every mine has a distinct set of operating conditions, which is why there's no one-size-fits-all approach. There are numerous factors to consider when determining the right pumps used in water management applications, that include:

- Vertical turbine pumps
- Automatic self-priming pumps
- Slurry pumps
- Submersible pumps
- End suction centrifugal pumps
- Single stage double suction centrifugal pumps
- Multistage pumps
- Booster packages
- Packaged pump stations

At Xylem, we design, engineer, manufacturer, install, and service our own equipment. And we rent it, too. To help with emergencies, outages, or to move equipment costs from capital budgets to operating expense, we can connect assets in ways to make your job easier - and your mine more efficient.

Xylem Field Smart Technology

Xylem Field Smart Technology (FST) is an advanced telemetry and cloud-based system that enables monitoring and control (M&C) of surface mounted centrifugal pumps from anywhere in the world. This is particularly useful when pumps are in remote locations or if intervention is needed in the middle of the night or during extreme weather conditions.



**+20
Uptime**

- Increases pump uptime by as much as 20 percent by preventing pump failures and unplanned downtime
- Eliminates unnecessary visits to a site to manually start/stop a pump
- Frees up employees to focus on profit generating tasks instead of 'pump watch'
- Unscheduled pump maintenance is minimized by understanding the condition of the equipment
- Alerts operators by phone/handheld smart device if a problem arises

CASE STUDY

Diesel-driven Dewatering Pumps with Remote Monitoring and Control Enhance Safety and Efficiency at Peru Copper Mine

Challenge

With the discovery of more copper and the forthcoming rainy season, a large open-pit mining operation in Peru sought a smart dewatering solution. The depth of the mine at 1,200 ft (365 m) below the surface made routing power for electric-driven dewatering pumps challenging as well as heightening safety risks; staff were required to travel down into the pit to physically handle the dewatering pumps' controls. Explosives used to excavate deeper into the mine added to safety concerns.

Solution

The Xylem team installed Godwin surface-mounted diesel-driven pumps operated by a remote monitoring and control (M&C) system. Connected to the mine's SCADA system the M&C solution can remotely start and stop the pumps, monitor capacity and fuel levels, and communicate operating parameter data to mine staff. **Mine operators can now monitor and control the pumps' flow and operation in just a matter of seconds when the pump is approaching maximum capacity for example, or in advance of anticipated heavy rain events.**

Previously, reconfiguring pumps required retrieving the power cable and disconnecting hoses. As well as **increased safety and efficiency, labor costs associated with switching pumps or running electrical power down into the mine were eliminated.**



CASE STUDY

Integrated Water Management System Supports 15% Increase in Production at Aggregates Processing Plant

Turnkey, efficient pumping solution facilitates plant's greater water needs

Challenge:

One of the largest U.S. producers of construction aggregates decided to relocate their processing plant to facilitate increased production capacity. However, the new location was further away from the plant's water supply. The customer needed a single-source provider who could design and install a comprehensive and integrated water management system to meet all applications - wash down, dust control, wheel wash, pugmill and slurry.

Solution:

Xylem designed and installed an efficient and reliable turnkey water management system incorporating a Goulds Water Technology lineshaft turbine pump with customized water tank, end suction pumps, multistage pumps and slurry pumps, that enables the plant to process 15 percent more aggregate than it could previously. Also, as the entire solution can be connected to the plant-wide SCADA system for remote, proactive monitoring and control, minimal downtime and maximum efficiency is ensured. **Just one person can monitor and control the entire system which provides operational cost savings.**



CHALLENGE ROADMAP

1. PRODUCTIVITY

2. RELIABILITY

3. SUSTAINABILITY

2. RELIABILITY

Smart technologies support efficient infrastructure that require minimum maintenance and deliver lower total life cycle cost.

Xylem's smart tech solutions to minimize unplanned downtime include:

- Intelligent Pumping Solutions
- Variable Frequency Drives
- Control Panels
- Adaptive Mixers

SMART SOLUTION SPOTLIGHT



VARIABLE FREQUENCY DRIVES

Xylem's Variable Frequency Drives (VFDs) are specifically designed to control pumps, offering greater efficiencies than standard VFDs.

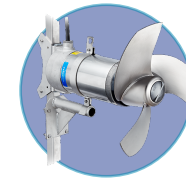
Optimize pump operations and reduce energy costs by as much as 70 percent, minimizing equipment wear and tear and unnecessary operating costs.



CONTROL PANELS

Xylem control panels can handle up to six pumps and are enabled with preconfigured functions.

Maximize efficiency, save time and reduce costs by preventing clogging and nuisance call outs. Ability to integrate into existing SCADA systems, enabling more efficient use of resources, and eliminating the need for in-person pump watch. Integrate and automate complex pumping systems and provide a real time view of performance, alarms and reporting.



ADAPTIVE MIXERS

Feature an integrated drive and advanced control capabilities, including full automation providing highly efficient, streamlined and optimized mixing in all conditions.

Reduce energy consumption by up to 50 percent, enhance process resiliency with continuous thrust regulation and increase mixer uptime thanks to the mixer's ability to warn of pending problems, sense overloading and adjust accordingly.

CASE STUDY

Holistic Solution of Mixers and Pumps Supports Efficient Mine Slime Transport - from Sump to Surface Disposal

Challenge

Operators of a hard rock nickel mine in Ontario, Canada needed an efficient and reliable solution to transport its mine slime from an underground sump up to the surface while ensuring continuity in production and minimizing downtime. The heavy, viscous nature of the slime, combined with the cramped location of the sump 4,000 feet underground, added to this challenge. The slurry needed to be continuously agitated to prevent heavier elements from settling at the bottom of the sump and clogging the dewatering pump. Due to the location deep underground, air agitation was not a feasible option.

Solution

The Xylem team developed a solution incorporating Flygt 4650 hard iron mixers installed on masts on diagonal corners of the sump and Flygt 2140 HT pumps to pump the slurry to the second sump at the surface. 12 months since being commissioned the solution has operated consistently and efficiently.

The mixers have kept the slime liquid moving and agitated, enabling the Flygt dewatering pump to operate continuously which helps reduce unnecessary maintenance from excessive wear and tear, saving manpower and allowing the mine team to focus on other tasks on site. This has also increased safety on site by reducing asset failures and associated maintenance requirements.



CASE STUDY

Dewatering Solution Going Strong at Alliance Coal Mine Six Years After Installation

Efficient water management system overcomes solid-laden mine water and low roof heights

Challenge

Alliance Resource Partners, L.P. faced a two-pronged water challenge at the company's Gibson County Coal, South Mine in Indiana. Solid-laden water needed to be pumped out of the mine, and a dewatering system installed in an area with limited space; a mine void less than eight feet high and a narrow 20-foot entry span.

Solution

Xylem designed and installed custom pump solutions throughout the construction of the South Mine. A series of Flygt submersible pumps, ideal for the extreme conditions of underground coal mining, moved mine water from small collection sumps to the main sump site. At this main sump two more Xylem pumps - seven stage Goulds Water Technology short set vertical turbine pumps - fit perfectly into the limited space. With these pumps in place, the mine was able to send 1,000 gallons of water per minute upwards with a vertical lift capability of 560 feet.



At the mixing chamber, the mine water was diluted by fresh water and then pumped by an additional vertical turbine pump to a fine refuse impoundment site for filtering impurities, to a settlement pond for storage and finally to the preparation plant for washing coal. At the settlement pond, Flygt submersible pumps floating on Xylem custom barges - designed to keep the pumps at the proper submerged level - ensured that the preparation plant would receive clean washing water.

Since the installation of the Goulds Water Technology vertical turbines six years ago, they have pumped water reliably and efficiently, minimizing manpower hours needed in pump supervision and maintenance, supporting production ranging from 3 million - 7 million tons of medium-sulfur coal a year.

CHALLENGE ROADMAP

1. PRODUCTIVITY

2. RELIABILITY

3. SUSTAINABILITY

3. SUSTAINABILITY

Complying with environmental regulations helps prevent costly shutdowns while reflecting an operation's respect for its community.

Xylem's smart tech solutions to support regulatory compliance relating to water use, emissions & waste management are made easier thanks to:

- Pipeline Integrity Management and Monitoring
- Water Quality & Quantity Monitoring Solutions

SMART SOLUTION SPOTLIGHT

PIPELINE INTEGRITY MANAGEMENT



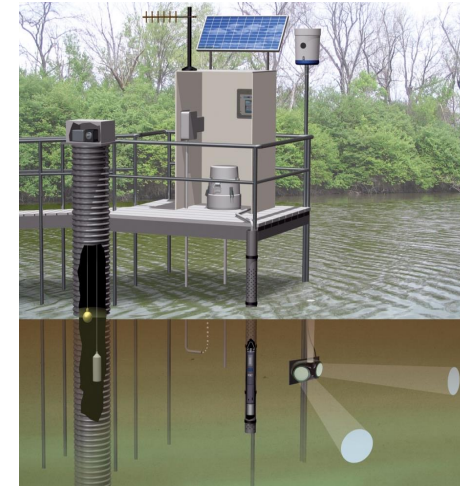
Degradation of protective measures or leaks on pressure pipe can be a precursor to larger failures for your mining operation. Failures that will result in costly downtime, reduced confidence levels, and environmental damage.

Pressurized pipelines degrade over time due to a number of factors:

- Soil or external conditions can corrode metallic pipelines
- High operating pressures or surges can add distress and cause cracking
- Impacts to the pipeline
- Failure of protective measures like cathodic protection or pipeline coating

Xylem offers a variety of solutions to help manage critical pressurized pipelines in mining operations such as free-swimming condition assessment, overline surveys and cathodic protection.

ENVIRONMENTAL MONITORING



It is a safe bet that in the long term, mines will be faced with more regulations, not fewer. So, it makes sense to meet today's social responsibility and environmental requirements with an eye towards those that are yet to come.

Xylem's premium laboratory, field, portable, and online instrumentation solutions, and real-time, continuous systems are built to answer your needs today - and easily incorporate tomorrow's. We can help you complete environmental baseline studies for new mines, monitor the environment throughout production, and track performance so you can address issues quickly, minimize costs and limit exposure to risk. We can also help you determine whether your water quality is suitable for a particular process.

CASE STUDY

Xylem Completes Inspection on a Critical Mine Discharge Pipeline in Environmentally Sensitive Area

To ensure environmental compliance while maximizing up-time

Challenge

Proactive, planned investigations for leaks in pipeline networks ensures that production can continue unimpeded and that the mine is operating in a sustainable manner and not harming the local environment. **Any contravention of environmental legislation can result in fines or having to shut down operations until repairs are fixed.**

In Colorado, Xylem was commissioned to inspect two parallel HDPE lines used to transport heavy metal-laden mine discharge water from deep underground to a settling pond almost three miles away. The pipelines travel through environmentally sensitive habitats and along a creek as they transport the hazardous water. This was the first inspection of the 12-inch and 14-inch diameter mine discharge pipes since they were installed 20 years ago.

Solution

Xylem's SmartBall platform is helpful for operators looking to identify leaks and confirm the alignment of buried pipelines. It is a free-swimming inline inspection tool that operates without any disruption to mining operations, travelling in the pipeline with the product flow. It identifies a leak using an acoustic sensor that listens for the sound of fluid leaving the pipeline, which makes a unique sound that is recognized by the ball. SmartBall enables targeted repairs of a pipeline and prevention of larger incidents which can lead to costly downtime, reduced confidence levels and environmental damage. A two-day inspection using the SmartBall Platform revealed a medium-size leak along one pipe in the vicinity of a nearby creek which could then be addressed through a targeted repairs program. **The client was so impressed with the technology that they accelerated their timeline developing a routine pipeline inspection program.**



CASE STUDY

Comprehensive Remote Bathymetric Surveying Requiring Minimal Manpower

Challenge

Operators of Norton Gold Fields in Kalgoorlie, Australia needed to survey impounded waters in the gold mine pit lakes. Volume surveys had previously been undertaken using Total Station positioning and soundings taken from a boat on the lake. However, this was a labor intensive process requiring up to four people that also posed safety concerns associated with working in a boat on the water.

Solution

Xylem was engaged to undertake bathymetric surveys at three of the pit lakes - a large and very shallow lake with a maximum depth of 5 feet (ft), a very deep, steep walled mining pit (maximum depth 180 ft) and a steep walled figure of eight shaped pit lake 20 ft deep. The total area surveyed was 1.9 million square ft. The Xylem team collected data using its UK rQPOD radio control vessel and SonTek HydroSurveyor-M9 over the course of two days. Due to the location of the lakes, the boat had to be controlled from up to 1180 ft away.

Speed of sound in water corrections, an integral part of any acoustic survey, were carried out using the SonTek CastAway-CTD. HYPACK software managed the preparation, survey, processing and outputs for the survey. **This resulting data enabled the customer to determine volume for environmental reporting while ensuring that the correct pumping capacities and suction placement were in situ.**



WHAT OUR CUSTOMERS SAY

"Personnel don't have to be on site monitoring operations 24/7 thanks to Xylem's smart technology."

Engineer,
State & Local Government

"Xylem's smart technology helped us know if we had a system failure with the pumps and ensure that we did not have a back-up in the system that could have been catastrophic."

Contractor,
Large enterprise engineering company

"Simplification. Xylem's smart technology automates the unit inventory process during times of deployment."

Operator,
Medium Enterprise Automotive & Transport Company

Source: TechValidate

Findings from our recent poll of mining operators

What types of operational challenges were solved by using Xylem's smart technology?

68 %

agreed that the ability to check on the system 24/7 provided peace of mind

47 %

agreed that the ability to monitor and control equipment remotely saved time

42 %

agreed that the ability to monitor and control equipment remotely saved money

LET'S EMBRACE THE SMART WATER MANAGEMENT OPPORTUNITY

The water-related challenges facing the mining industry remain complex while the drive for productivity continues at speed. The good news is that a holistic approach to water management combined with smart technologies can and is driving step-change and delivering major gains for mine operators - streamlining processes and making water management more efficient, sustainable and safe.

With exciting new developments on the horizon to add to the arsenal of powerful smart solutions already on the market, now is the time to harness the power of digital and turn mine water management from an expense to a strategic advantage.

Let's solve water.

Find out more at xylem.com/mining

xylem Industrial
Solutions



XYLEM MINING SOLUTIONS ENSURING WATER WORKS FOR YOU

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- 1: <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/wwdr4-2012/>
- 2: [https://www.ey.com/Publication/vwLUAssets/EY-Business-risks-facing-mining-and-metals-2014%E2%80%932015/\\$FILE/EY-Business-risks-facing-mining-and-metals-2014%E2%80%932015.pdf](https://www.ey.com/Publication/vwLUAssets/EY-Business-risks-facing-mining-and-metals-2014%E2%80%932015/$FILE/EY-Business-risks-facing-mining-and-metals-2014%E2%80%932015.pdf)
- 3: <https://www.conservation.org/priorities/responsible-mining-and-energy>
- 4: <http://12.000.scripts.mit.edu/mission2017/mining/>