

EnPhytoBox[®]

A smart water treatment system to support the decarbonisation of water

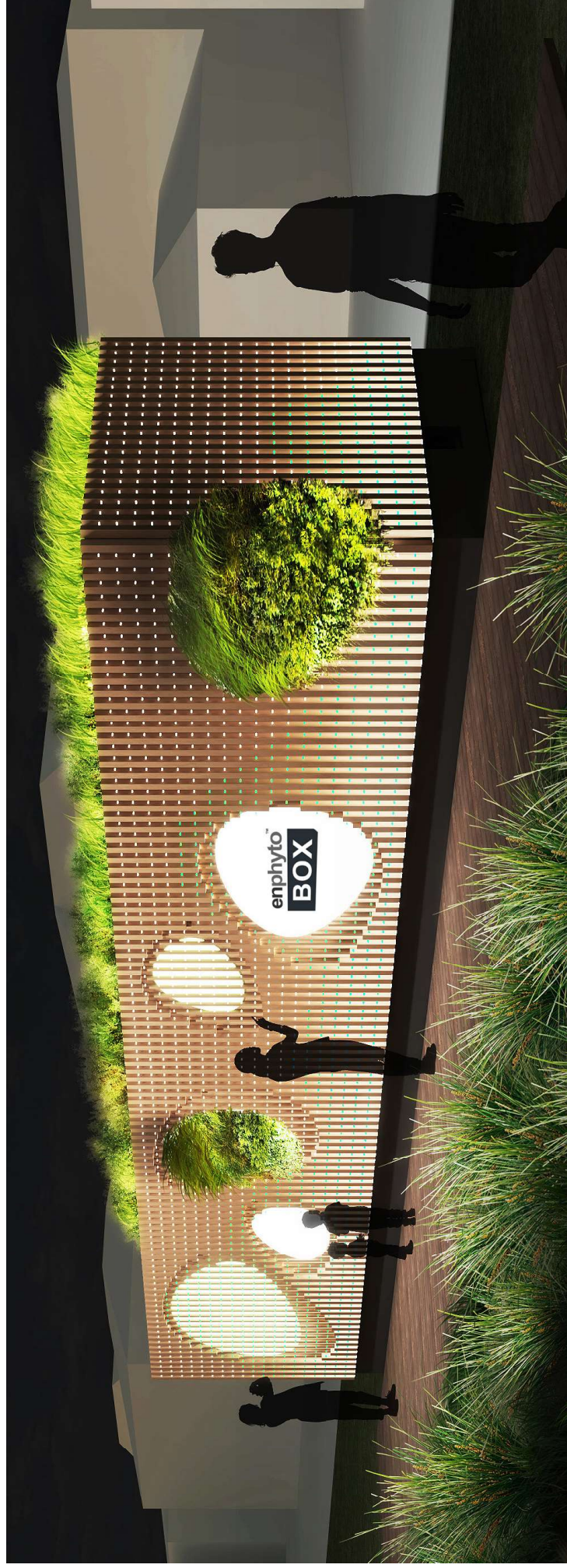


WHAT IS IT?

The EnPhytoBox[®] is a mobile, IoT enabled, nature-based water treatment technology. It is:

- **modular, versatile and adaptable** – remotely deployable across various locations and pollutant types.
- **scalable and sustainable** - zero waste, renewable energy powered, uses no hazardous chemicals.
- **resilient and robust** – facilitates climate resilience in remote communities, enables continuous remote control and monitoring.
- **impactful** – provides a source of reuse water to support irrigation for local economies.

This clean tech is a sustainable, impactful, natural, low carbon solution for mining. It can treat tailings water, drainage and other polluted mine water sources for local reuse.



WHY IS IT NEEDED?

Water insecurity and poor quality has enormous negative impacts, not only to industries such as mining but also to the environment, local economies, jobs and social resilience. Transformative approaches to address these water challenges are needed now. Additionally solutions must overcome barriers of remoteness, communication blind-spots, space constraints, climate challenges and high costs.

The EnPhytoBox® addresses current and predicted global water challenges across multiple sectors such as the mining industry and can operate in remote and hostile conditions. It assists to:

- Meet increasingly stringent water treatment discharge standards
- Meet increased water reuse demands and targets
- Provide of clean and reliable water supplies to all
- Provide sustainable management of water resources in every country



WATER SCARCITY

- **Billions of people** worldwide impacted by lack of water access.
- Water demand is projected to grow by **55% by 2050**.
- **Only 11%** of wastewater is recycled.

ENVIRONMENTAL & PUBLIC HEALTH DAMAGES

- **50% of Wastewater** flows back into the environment without being treated or reused.
- **1.8 billion people** are globally impacted by discharge of untreated sewage, industrial waste, and hazardous chemical into the ecosystem.
- Discharge of untreated sewage is the single biggest factor causing coastal pollution and degradation.

KEY FEATURES

Sustainable: small footprint, low energy use and renewable energy powered, zero waste (media and plants harvested for reuse), no hazardous chemicals.

Versatile: can treat different pollutant types and wastewater streams, including mining, industrial, agricultural, polluted groundwater and surface waters.

Adaptable: components and media types can be readily adjusted and changed to suit a change to wastewater type or composition.

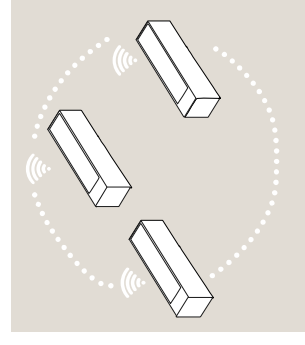
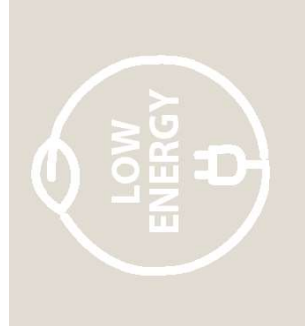
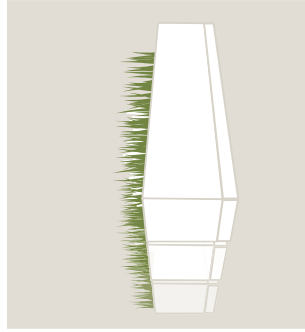
Circular: the whole unit and/or individual components can be removed and repurposed at 'end of need'.

Climate resilient: distributed units can help overcome risks associated with assuring water quality for reuse or environmental discharge and providing a clean water source during drought and floods.

- can be readily moved to where most needed and are readily repurposed by swapping out components e.g. from treatment for reuse in droughts to treatment of sewage overflows in natural disasters such as floods
- can be used as stand-alone or supplementary systems for larger centralised wastewater treatment plants
- in remote sites, units can be used to draw down high water levels in contaminated storage dams such as tailings, to prevent overflows and environmental contamination

Remote IoT control and operation: enables precise and continuous control, operation and monitoring via sensors, an integrated platform and a continuous wifi/satellite service. Overcomes the risks associated with decentralised water and wastewater treatment, particularly in remote settings.

Low operating and life cycle costs: ~40% lower OPEX compared with other small-scale mobile wastewater treatment technologies.



HOW DOES IT WORK?

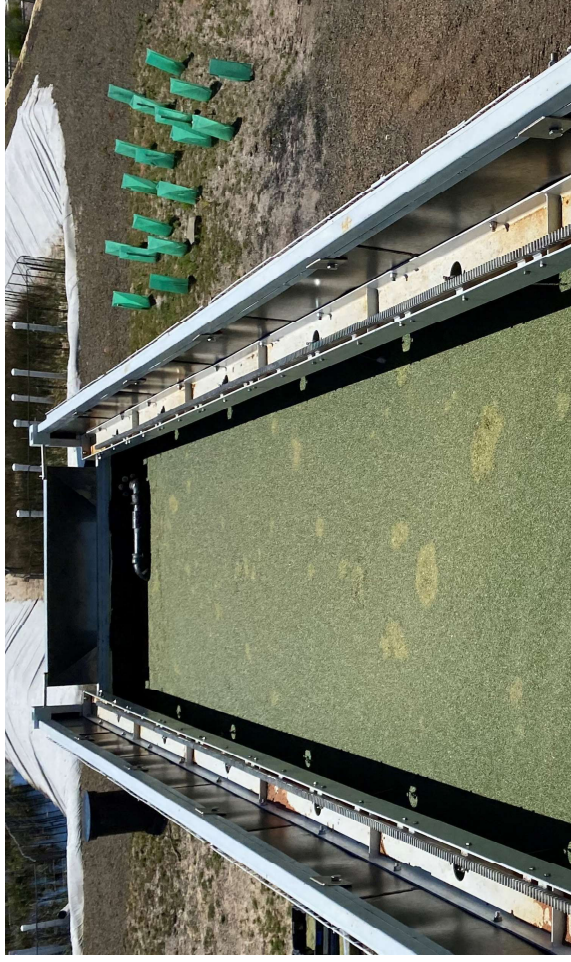
The EnPhytoBox[®] contains a vertical sequence of plants, water, biosorbents and natural filtration media, including zeolites.

It uses processes similar to natural wetlands and combines plant stabilisation, filtration and uptake (phytoremediation), biosorption, microbial transformation and ion exchange.

Our current model uses floating aquatics (duckweeds), which are automatically harvested periodically to maintain high uptake rates. Harvested material is deposited into a compost bin for reuse or value-add processing.

Biosorbent media is contained in removable cages, and these are changed over at intervals to avoid toxic levels of accumulation or enable resource recovery.

Natural filtration media is regenerated as required or reused and replaced where there is a productive demand (e.g. soil improvers).



Floating Aquatics within EnPhytoBox

Floating Aquatic Series



← floating aquatic plants →

← phyto-remediation →



Cassette Series



Removable Cage

Harvesting of duckweed

WHAT CAN IT TREAT?

The EnPhytoBox[®] can be used to treat a range of pollutants, including:

- Nutrients
- Metals and metalloids
- BOD
- TSS
- Organic compounds
- Microplastics
- Pathogens
- Emerging contaminants (pharmaceuticals, pesticides, personal care products)

Each unit can treat up to 100kL/day, depending on composition of leachate and target treatment standard. Multiple treatment units can be used to increase capacity.

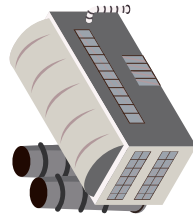
The EnPhytoBox[®] is suitable for freshwater and brackish wastewater.

Both reuse water and discharge quality water can be produced by customising the number of units, the biosorbents, plants and additional aeration, filtration and other components.



Floating Aquatic Series

Mine Operation



Mine Wastewater

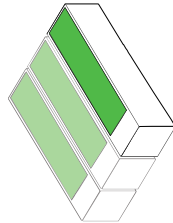
contaminated water



tailings storage
polluted groundwater / surface run-off
mine camp wastewater

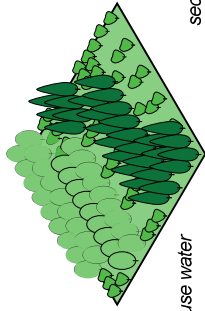
EnPhytoBox[®]

scalable, decentralised nature based water treatment technology



Seed Production / Native Nursery

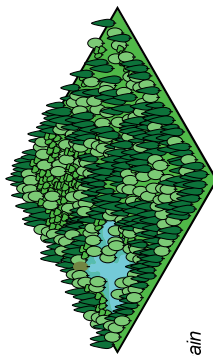
local, nature based economies



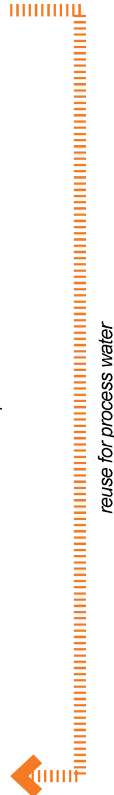
fit-for-purpose reuse water
reusable biomass

Mine Rehabilitation / Carbon Farming

net positive impact



security of seed supply chain



IOT CAPABILITY

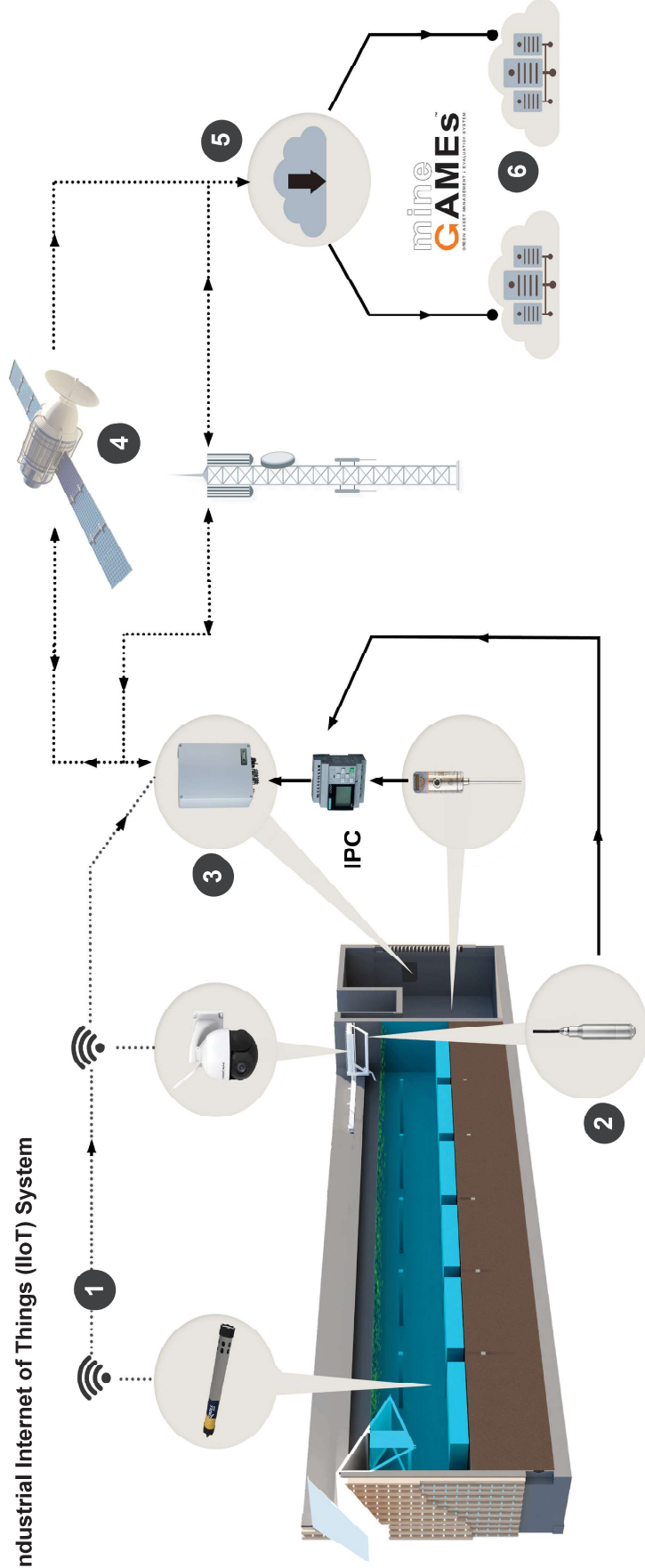
The **EnphytoBox[®] IoT system** comprises a series of advanced automation and monitoring sensors, controlled by an Industrial PC via a smart gateway and a LoRaWAN cellular Wi-Fi and satellite communication system.

This advanced system allows us to automate operational controls, seamlessly store and transmit data through the Cloud, analyse data using our data analytics platform (GreenGAMES™) and remotely adjust controls from anywhere in the world.

The IoT capability can also be used as a digital hub to support other sensors, such as soil weather stations, soil sensors to improve irrigation efficiency at the local scale.

The performance of each EnphytoBox[®] can be accessed by clients, regulators and users via a web-based dashboard, which can provide confidence in safe water supplies, and warnings if water is non-compliant or there is an issue.

Industrial Internet of Things (IIoT) System

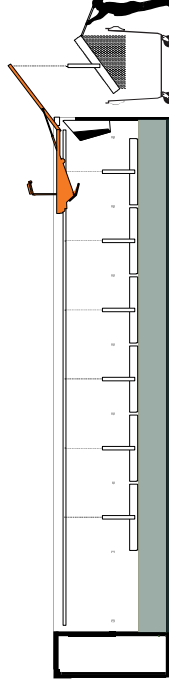
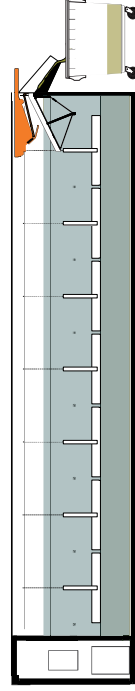
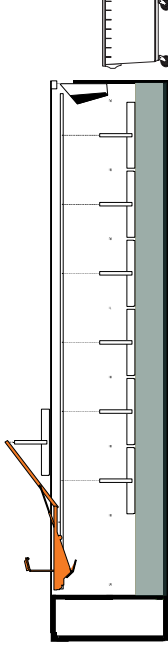
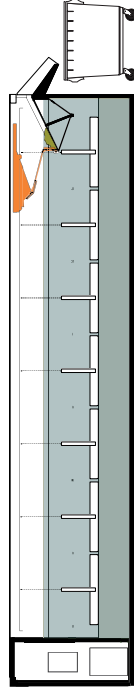
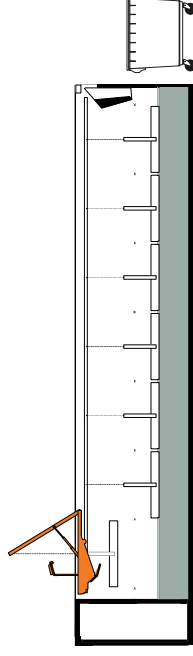
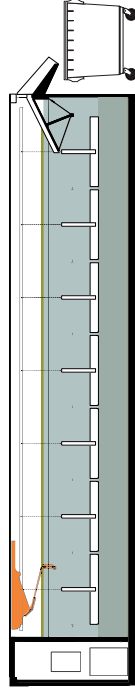


LEGEND

- 1** Monitoring devices connecting to the gateway wirelessly over LoRaWAN
- 2** Operational devices and IPC connecting to gateway
- 3** Smart gateway processes and transmits data to/from the cloud The connectivity can switch between satellite and dual cellular
- 4** Combined dual satellite and dual cellular enables resilience and reach
- 5** Cloud platform manages large-scale development securely, allocating different data streams to different applications, enabling layered services
- 6** Data integration and analysis enables remote control of each EnphytoBox multiple unit performance tracking

TECHNICAL SPECIFICATIONS

- Up to 100kL/day capacity per unit
- ISO structurally certified custom steel container, standard 40 ft dimensions for sea and land transport
- All galvanised stainless-steel container and parts certified for highly corrosive environments (ISO 12944:2018; C5 — very high, Im2 — immersion in sea or brackish water without cathodic protection)
- Integrated automated harvester for plant harvesting, with collector system
- Dosing tank and small pump allows continual or on-demand dosing of non-toxic chemicals for enhanced remediation and/or pH control
- Integrated renewable storage battery — needs connection to ~5kW solar or other renewable energy source
- Industrial PC (ethernet CAT) and multiple sensors and actuated controllers for automated operation and monitoring
- LoRaWAN gateway to cloud
- Pumps, IPC, spare parts, contained in fully lockable control room
- Retractable, locked ladder access to top of box to prevent unauthorised access
- Remote alarms and safety shutdowns
- Single variable speed pump for influent pumping, recirculation, and backflushing
- Built-in crane/hoist for periodic removal of biosorbent cages for media replacement
- Australian patented system; international patents pending
- A camera to monitor surface biomass coverage



Harvesting of duckweed for reuse

Periodic replacement of biosorbent material

STRESS TESTS

The EnPhytoBox[®] was designed as a compact version of the various wetlands/biofilters that Syrinx constructed over the past 20 years. It is highly versatile and can be directly applied to the mining sector. The technology was bench scale tested over many years and one full-scale commercial pilot operated at a landfill facility in Tasmania (supported by R&D grants from the Federal Government's Innovations Connection - Entrepreneurs' Programme and the Minerals Research Institute of Western Australia (MRIWA)).

The commercial pilot treated 20 to 30 m³/day (4399 to 6599 US gallons), of very high strength leachate, running for 5 months in saline conditions. The system demonstrated excellent removal of nutrients, organic carbons, pathogens, and heavy metals. It removed:

- 300g/m³ of total nitrogen (more than 40 times typical removal rates in various biofilters).
- High removal rates of various metals (e.g. 80% aluminium, 72% manganese) and hydrocarbons.

Plant uptake and removal (Phytoremediation) enhanced removal of nutrients and metals. This process remained below toxic levels to enable reuse of the plant biomass. Note: the system is not effective in super saline conditions (TDS >4500 mg/L), due to toxicity to plants.

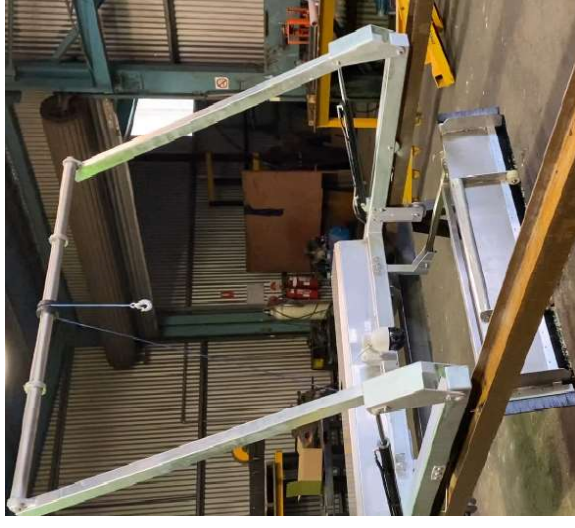
The IoT remote control capability is ideal for remote mining operations and includes IoT connectivity, data collection, transfer, analysis and remote control. These are a core part of the EnPhytoBox[®] capability and is developing as technology develops in this emerging field. Digital sensors, connectivity and a control system enable remote monitoring and operations. The system was advanced through a research project in collaboration with the University of Tasmania (UTAS) and the University of Western Australia (UWA). This work tested advanced sensors for real-time water quality monitoring, and developed the resilient communication system, delivering a hardware-software-comms system that can be standardized across multiple EnPhytoBox[®] units. Syrinx continues to research with UTAS, developing a real-time pathogen detection sensor (research funded by the Australian Research Council).



Transport of EnPhytoBox



EnPhytoBox plant room and remote operation system



Integrated harvester and crane

COMMERCIAL MODELS

SYRINX BIO.

With over 21 years' experience, Syrinx is an Australian privately owned service, product and research company working across many sectors, including mining. Headquartered in Perth Australia, Syrinx integrates cutting edge research with pragmatism and experience, to deliver impactful services and products. As pioneers in nature-based solutions, and with internationally certified sustainability practitioners, Syrinx provides specialist focus on innovation for nature-based biodiversity, water and climate solutions.

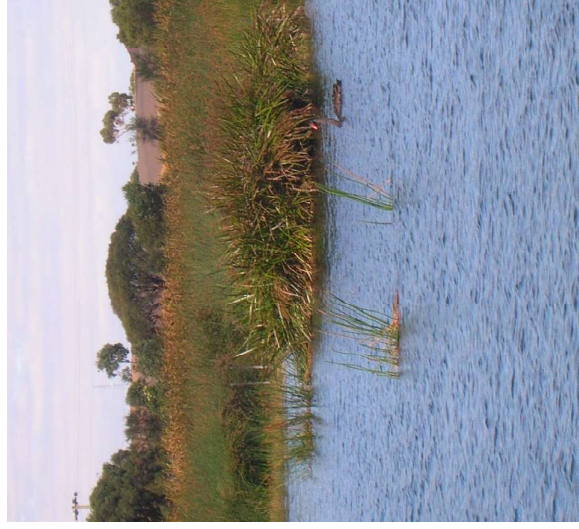
- Syrinx works extensively with the mining sector as well as agricultural, urban and industrial sectors to deliver nature positive, circular economy solutions.
- Syrinx specialises in sustainable water, infrastructure and nature-based remediation technologies and services.
- Syrinx provides end to end project delivery capability in research, design, construction, operations and maintenance.
- Syrinx has a subsidiary company in Serbia (NaturaTech d.o.o Beograd) that expands the international reach for our innovative products and services.

Our business model is an integrated product and service offering

We help customize your units, deploy them, commission them, maintain them and remotely operate them. We can also train and license your own operators if desired.

We offer a lease-to-purchase model, with an ongoing remote monitoring service (access-over- ownership digital share model).

Other models can be discussed if Clients prefer to purchase up-front.



Select nature-based solutions for - mining and industrial sectors

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