

Borumba Pumped Hydro Project Fibrous Minerals Management Plan

1. Purpose

Geotechnical investigations undertaken to date in the vicinity of Lake Borumba for the Borumba Pumped Hydro Project (“the Project”) have identified a potential for fibrous minerals, including naturally occurring asbestos (herein to be referred to as NOA), to be present. These fibrous minerals may be disturbed during site investigations, when undertaking surface civil activities such as building roads and other project infrastructure and in underground workings.

The purpose of the Fibrous Minerals Management Plan (“Plan”) is to outline how fibrous minerals including NOA will be identified, assessed and controlled on the Project.

The objectives of this Plan are to:

- Implement an ongoing risk assessment methodology for fibrous minerals, including testing associated soils and or rock for the presence of NOA.
- Outline work practices and control methods required to prevent or minimise the risk of exposure to fibrous minerals.
- Ensure workers receive adequate consultation, information and training about the risks and control measures for working with fibrous minerals.
- Outline procedures to manage incidents and emergencies involving NOA.

This Plan has been prepared to comply with the following relevant legislation:

- Work Health & Safety Act 2011 (QLD), specifically Chapter 8 Asbestos and Part 8.4 Management of NOA
- Work Health and Safety Regulations 2011 (QLD)
- How to Manage and Control Asbestos in the Workplace Code of Practice 2021 (QLD).

The following guideline can be used to derive risk-based decisions and implement reasonably practicable controls:

- WA Department of Mines and Petroleum, Resources Safety Guideline: Management of fibrous minerals in Western Australian mining operations, 2nd Edition 2015.

2. Scope

This Plan applies to the Exploratory Works phase of the Project for surface works under the management and control of Queensland Hydro. Queensland Hydro will not undertake any underground excavation work.

Where other entities have been appointed by Queensland Hydro to be the Principal Contractor for a package of works (e.g. interim civils, surface civils, underground tunnelling) that Principal Contractor is responsible for developing their own Fibrous Minerals Management Plan for their own scope of work. Where this occurs, the Principal Contractor is responsible for ensuring alignment with the requirements of this Plan. This Plan is to be read in conjunction with **BR-PLN-0001 Borumba Pumped Hydro Project Health and Safety Management Plan** and **BOR-QHY-PLN-ENV-00003 Borumba PHES Geotechnical Investigations Environmental Management Plan**.

Access to this Plan is to be provided and kept readily accessible for any person or their workers who has carried out, carries out, or intends to carry out work involving potential exposure to fibrous minerals.

3. Responsibilities

Role	Responsibility
<p>Senior Project Manager – Exploratory Works</p> <p>Project Manager</p>	<ul style="list-style-type: none"> ▪ Ensure this management plan is in place and reviewed on a regular basis ▪ Ensure Queensland Hydro has the resources in place to implement this Plan
<p>Site Person in Charge</p>	<ul style="list-style-type: none"> ▪ Ensure a risk assessment has been undertaken to determine the potential occurrence of fibrous minerals at the workplace and the nature and degree of worker exposure. ▪ Ensure controls have been developed and are implemented to mitigate such exposures. ▪ Ensure controls are in place for the identification, testing, verification requirements and control of fibrous minerals.
<p>Supervisors</p>	<p>Supervisors have a responsibility to follow the written instructions and guidelines to ensure when fibrous minerals are encountered, they are appropriately managed and:</p> <ul style="list-style-type: none"> ▪ Ensure workers are suitably trained and competent to identify and manage fibrous minerals. ▪ Ensure plant and equipment required to manage risks are available to workers and appropriately cleaned/repurposed or disposed of after use. ▪ Carry out inspections and ensure Queensland Hydro works are in compliance with this Plan.
<p>Workers</p>	<ul style="list-style-type: none"> ▪ Comply with work instructions related to fibrous minerals and follow instructions given to them for their own safety and health and that of others. ▪ Cooperate with their employer in the identification, assessment and control of fibrous minerals. ▪ Immediately report the presence of suspected fibrous minerals and implement additional controls to minimise exposure risk.
<p>Health and Safety Team</p> <p>Environmental Team</p>	<ul style="list-style-type: none"> ▪ Undertake assurance activities to ensure the agreed controls are implemented and are effective. ▪ Provide training in the requirements of this plan as needed

4. Fibrous Minerals Management Approach

The following summarises the approach to assess and manage fibrous mineral risks:

- As part of the pre-work risk assessment process, identify fibrous minerals risks for the work area via desktop assessment.
- Suitability qualified persons to carry out a visual inspection prior to works commencing.
- Implement standard controls to minimise exposure risk during works.
- Actively monitor during works and report and test any suspect fibrous materials.
- Implement additional controls if fibrous minerals are detected.
- Identify necessary hold points in the above activities where work is to cease for further investigation.

4.1 Potential Exposure Sources

Ground disturbing activities may present a potential risk if fibrous minerals are present in the rock/soil and the release of such fibres is not controlled. The following are examples of ground disturbing activities that may be undertaken by Queensland Hydro during the Exploratory Works phase of the Project:

- Site access road/track development.
- Clearing of vegetation and general earthworks associated with site establishment.
- Construction of site compounds and equipment laydown areas.
- Movement of vehicles and plant on access roads/tracks.
- Transferring dust from clothing and footwear to vehicles and then translocated to uncontaminated areas.
- Undertaking test pitting.
- Demobilisation of plant and clearance of site compound and equipment.

Fibrous minerals are more likely to be preserved in veins in fresh (unweathered) rocks than the surface weathered rock exposures. For near surface existing rock exposures, the weathering process is more likely to have taken effect and can change the mineralogy to more benign forms. New excavation of weathered surface rocks can still expose fibrous minerals and should be completed with due diligence and precaution, particularly as digging methods are more likely to promote high dispersal of dust and fibres. Most new exposure of unweathered rock will be via geotechnical investigations obtaining rock core samples, which are completed using water. The water helps to prevent dissemination of the fibres on exposure, allowing time for careful identification and cautionary action.

However, some fresh rock may be exposed by excavation and workers should be advised how to differentiate between unweathered and weathered rock. Where unweathered rock is exposed, there may need to engage a geologist for regular inspections as the excavation is progressed.

4.2 Potential Impacts on Exploratory Works

In addition to the risks to human health, the disturbance of asbestiform fibrous minerals could have the following impacts to the local environment:

- Mobilisation of surface and subsurface contaminants.
- Mobilisation of surface water contamination.
- Exposure of ecological receptors.

Considering the above, the potential receptors could include:

- Workers involved in the above Exploratory Works activities.
- Workers undertaking rehabilitation activities post investigation works being completed.
- Transient users of the access tracks within and adjacent to the Project site (e.g. SEQ Water).
- Flora and fauna in areas surrounding the site.
- Future users of the site.

4.3 Fibrous Minerals Register

Queensland Hydro have developed a register of areas (BR-FW-NON-ECT-REG-00001 - Borumba PHES - Naturally Occurring Fibrous Minerals Register) where asbestiform minerals have been identified and confirmed via laboratory analysis, as well as areas where suspected samples have been tested and found to be negative for asbestiform materials. This register is to be provided to Contractors undertaking ground disturbing works on the Project site.

This register and project geographic information system (GIS) mapping will be progressively updated as additional information becomes available. GIS mapping layers to be used as guidance on fibrous materials potential risk include:

- Hazard/Fibrous Material Potential Risk – Naturally Occurring Fibrous Minerals (NOFM).
- Hazard/Fibrous Material Potential Risk – Geology with potential for NOA.

5. Controls

5.1 Pre Work Assessment

Before the commencement of ground-disturbing work the following assessments will take place:

- A desktop review of the fibrous minerals register and current knowledge about the mineralogy and presence of fibrous minerals at the worksite location.
- An inspection of the work area by a suitably qualified person (e.g. geologist) prior to works commencing to visually check for the potential presence of fibrous minerals.

5.2 Control Measures

Given there is limited information about the location and extent of fibrous minerals on the Project area, work practices and controls must take a proactive approach to minimise potential exposure risk as far as is reasonably practicable.

The following control measures are to always be in place on the Project:

Type of Control	Detail
Substitution, Isolation and Engineering Controls	<ul style="list-style-type: none"> ▪ All vehicles and mobile plant must be fitted with enclosed, air-conditioned cabins to isolate workers from the outside environment. ▪ Dust suppression must be used to minimise and control dust at active digging areas and where workers-on-foot are located. ▪ When cutting core wet cutting methods are to be used. Special approval will be required for alternate air hammer or dry drilling methods, and will only be considered after a risk assessment. Appropriate guarding will be used to reduce or contain spray generated by the cutting tools. ▪ Where possible, workers-on-foot are to be isolated from dust generating activities, or, located outside an exclusion zone and upwind where practical.
Administrative Controls	<ul style="list-style-type: none"> ▪ The work area and ground conditions will be inspected and monitored for the presence of fibrous minerals during work. ▪ Where drilling activities are underway, geologists shall be employed to undertake fibrous mineral identification during core drilling and cutting. No core cutting or logging of cores is to be undertaken until the geologist has inspected the core in the drill splits and approved that the cored section appears to be free

	<p>of fibrous minerals.</p> <ul style="list-style-type: none"> ▪ Windows of vehicles and mobile plant are to be kept closed during use and when parked. ▪ Workers will have access to hygiene facilities to allow workers to wash hands and face. ▪ Active civil construction and drill sites will be sign posted with unauthorised access restricted signage. ▪ Regular housekeeping of work areas and plant and equipment will be carried out using wet methods (for example washing down equipment before leaving site). ▪ All waste rock core material, mud and water resulting from drilling processes will be captured and contained and kept wet where possible until permanently disposed of. Any waste generated from activities must be disposed of according to environmental protection regulations.
<p>PPE controls</p>	<p>Personal protective equipment (PPE) including respiratory protective equipment may be required in conjunction with higher order controls to minimise exposure risks, particularly for ground disturbing work carried out in a high-risk zone.</p> <p>The following PPE must be available for use at the work location and be in appropriate working order:</p> <ul style="list-style-type: none"> ▪ P2 rated respiratory protective equipment (RPE), fit tested to the individual. ▪ Disposable nitrile gloves. ▪ Disposable coveralls / shoe covers to prevent contamination of clothing and footwear. ▪ Razors and shaving consumables to allow the opportunity for closest respiratory mask fit. <p>As an alternative to disposable coveralls, work clothing may be worn provided there is a process to wash clothing at a facility with equipment to launder asbestos-contaminated clothing, or clothing is kept in a sealed container until it is reused for asbestos removal purposes.</p> <p><i>If used to minimise exposure to fibrous minerals, disposable PPE (e.g. masks, gloves, coveralls) must be disposed of as asbestos waste. Disposable PPE is not to be reused.</i></p>
<p>Education and Training</p>	<p>All workers that have the potential to be exposed to fibrous minerals must receive training (via the Project induction) that covers:</p> <ul style="list-style-type: none"> ▪ The type and likelihood of the occurrence of fibrous minerals at the site. ▪ The potential health effects of exposure to fibrous minerals. ▪ The control measures / safe work practices to be adopted. ▪ A process to follow if previously unidentified fibrous minerals are identified and a hold point is activated. ▪ The proper use and maintenance of respiratory protective equipment, where this has been identified as a required control. <p>Ongoing training and information about the potential for fibrous minerals must be provided regularly via pre-starts and toolbox talks.</p>

5.2 Use of Hold Points – Suspected Fibrous Minerals

Where fibrous minerals are suspected, a hold point is to be initiated and work should cease. The Queensland Hydro Person in Charge is to arrange for a geologist to inspect the area and where appropriate sample collection for testing.

If suspected fibrous minerals are identified, they should be treated as potentially asbestiform until laboratory confirmation has determined otherwise. While testing results are pending, the following work practices and controls are required for work to recommence:

- Consideration will be given to moving the work activity and/or substituting work practices or methods to a type that do not disturb the identified material. For drilling, this would entail removing the drill rods from the borehole and undertaking thorough wash down of the rig and associated equipment. It may result in casing being left in the ground.
- All workers engaged in the activity must be alerted to the presence of fibrous minerals and additional precautions necessary to minimise exposure.
- A designated work area is to be established which includes delineated or signposted 10 metre exclusion zone around the work area (where practicable), to warn workers and visitors of the potential presence of fibrous minerals within the workplace. This work area is to be secured to limit the potential for non-authorised personnel to enter.
- The work area is to be delineated into 'clean' and 'dirty' sections to allow for a decontamination process to occur as personnel leave site. The "dirty" area must have a decontamination area for washing hands and face as well as removing clothing; and a "clean area" for changing into fresh uncontaminated clothing. There may also be a need for a boot wash facility. Items which may be potentially contaminated are to remain on the 'dirty' side of the site until decontaminated or contained.
- Vehicles used to transport personnel to and from the work location should remain on the 'clean' side of the site.

5.2.1 Fibrous Minerals Encountered During Drilling

If fibrous minerals are identified during drilling and the geologist engages a hold point:

- The geologist and drilling crew (and any other staff present) must wash down their hands and put on the appropriate PPE and RPE for handling core with fibrous materials.
- The geologist photographs the core in the splits.
- The geologist packages the core for testing by the laboratory (refer to Section 5.3).
- All equipment associated with the drilling is decontaminated before leaving the site.
- The geologist reports the occurrence and extent of the intersection to Queensland Hydro Person in Charge.

The quantity of fibrous mineral intersection encountered shall be documented and considered before choosing to mobilise to a new borehole location. For narrow veins (up to 10mm each) of fibrous material encountered in core, the wet drilling method would minimise the risk of fibres becoming airborne by drilling. Due to the wet drilling method, drilling could likely recommence with additional PPE / RPE protocols in place for isolated occurrences.

Where fibrous mineral intersections are centimetre to decimetre in scale or comprise multiple narrow veins that cumulate to decimetre scale, drilling shall be halted until testing results are received. Regardless of the result, totally abandoning drilling is not ideal and consideration of the location is required. Drilling can and likely should progress with stricter controls in key areas where subsequent underground infrastructure is planned, as knowledge about potential intersection of fibrous minerals near to underground workings is critical.

Should fibrous minerals be laboratory confirmed, it is likely planned in-situ testing and downhole testing will need to be abandoned. The borehole logs should note the laboratory results as the reason for the further testing being cancelled.

5.3 Sampling and Laboratory Testing

Any samples of soil/loose rock should be sprayed damp (not too wet), collected in a plastic sample bag, and then double bagged and labelled with the location and stating as **containing possible fibrous material**.

Core samples should be bagged, sprayed wet, and double bagged and labelled with borehole ID, depth ranges and as **containing possible fibrous material**. If there are multiple core samples, the double bagged sticks of core should be placed in a core tray, with the tray and lid clearly labelled with borehole ID, depth ranges and as **containing possible fibrous material**. The tray should then be double wrapped in plastic film and further labelled with borehole ID, depth ranges and as **containing possible fibrous material**.

Loose bagged samples can be tied together (noting the number of bags tied together should be limited to ensure weight is easy to carry without needing to carry close to the chest and risk contamination).

Samples must not be transported in the cabin of a vehicle but should be placed in the tray of a utility vehicle.

The samples are to be sent to a NATA accredited laboratory equipped to analyse and classify asbestiform minerals, with appropriate chain of custody forms. Except in rare circumstances, the geologist who identified the fibrous materials should co-ordinate the sample transfer and advise the laboratory of the incoming samples and testing requirements.

5.3.1 Laboratory analysis to determine the presence of asbestiform minerals.

Analytical testing methods must follow the approach outlined within Australian Standard 5370:2024, with initial NOA 'screening' level analysis to be carried out via polarized light microscopy and dispersion staining techniques, and secondary confirmatory analysis (as required) via transmission electron microscopy (TEM).

On the completion of testing, if the samples prove negative for hazardous asbestiform minerals, core samples can be returned to site/core storage facility and included back into the boreholes preserved core.

If samples are positive for asbestiform minerals, the samples should be repackaged back into the core trays, double wrapped and re-labelled as **Containing Asbestiform Minerals**. The trays will need to be stored at the designated demarcated hazardous sample zone of the core storage facility.

5.4 Decontamination, waste removal and site clearance

5.4.1 Decontamination

Prior to leaving the 'dirty' side of the designated area, all equipment, exterior of vehicles, drill rigs and tools that have come into contact with potential or identified asbestiform fibrous minerals shall be:

- Washed down and decontaminated, with contaminated waste collected; or
- Placed in sealed containers (and used only for asbestos handling work); or
- Disposed of as asbestos waste if cleaning cannot be undertaken.
- All contaminated materials, including plastic sheeting and PPE etc, must be disposed of as asbestos waste.

Personal decontamination is to include a boot wash to clean footwear and washing hands and face. Regardless of whether gloves are used, workers handling core samples must clean their hands and fingernails thoroughly after work. RPE is to be worn during decontamination and removed and disposed of last. When not in use, safety footwear shall be stored upside down to minimise asbestos contamination inside the footwear.

5.4.2 Contaminated waste

For the disposal of small quantities of contaminated waste (for example PPE), the following guidelines should be followed:

- Solid fibrous waste should be collected in heavy duty polythene bags, about 0.2 mm thick, or in other approved containers and labelled as asbestos waste (i.e. '**Danger Asbestos – Do not open or damage bag. Do not inhale dust**').
- Bags must be taped shut once filled, before placing them into a second plastic disposable bag.
- The bags should be filled to no more than 50 per cent capacity. This minimises the potential for bag rupture and allows the bag to be adequately sealed.
- Fibrous material that is too large for the standard polythene bags should be placed in large double lined bins or drums.
- Bags that have held asbestos material should not be re-used for any purpose.
- Controlled wetting of waste should be employed, where practicable, to reduce fibrous dust emission during bag sealing or as a result of bag rupture during transportation. Over-wetting or waterlogging should be avoided because excess contaminated water leaking from the bags can create a future source of airborne fibrous dust.

Asbestos waste must be transported and disposed of in accordance with the Environmental Protection Act 1994 (administered by the Department of Environment, Science and Innovation (DESI)). Asbestos waste can only be disposed of at a site licensed by the DESI and it must never be disposed of in the general waste system.

Depending on the location, drilling muds and wastewater may be able to be encapsulated either in a buried sump or as backfill into the borehole. Such occurrences will need to be clearly identified on site and on the relevant GIS layer to advise future workers of possible fibrous waste contamination.

5.4.3 Site Clearance

At the completion of work and prior to the removal of warning signage all disturbed areas need to be appropriately decontaminated and/or made safe through covering and/or capping, taking into account the final land use and potential for future disturbance. All contaminated waste is to be disposed of in accordance with the Queensland Government DESI requirements. A competent person, such as an Occupational Hygienist in consultation with representatives from the Safety and Environmental Team, and geology personnel are to carry out a visual inspection of the work area to ensure the site is clear. Once this assessment is complete, a clearance certificate for the area is to be issued.

As part of the clearance process, validation soil samples may need to be collected and analysed by a NATA accredited laboratory to determine the presence of fibrous minerals and determine if they are asbestiform or non-asbestiform. If the soil analysis determines that asbestiform debris or fibres are still present as a result of the work activities, further treatment and/or future surface management may be required in the affected areas.

6 Incident / Emergency Management

Where uncontrolled exposure to fibrous minerals fibres has occurred, or the processes in this Plan not followed, an incident is to be raised in Bluestream.

If an emergency associated with the potential for exposure to airborne asbestos fibres necessitates the evacuation of a worksite, normal site evacuation procedures are to be applied, and arrangements then made to decontaminate the area.

7 Air Monitoring

The following types of airborne asbestos monitoring may be necessary:

- **Exposure Monitoring:** during work involving NOA, particularly if dust generation associated with NOA remains a potential risk.
- **Control Monitoring:** to ensure control measures implemented regarding the safe handling of NOA are effective.
- **Clearance Monitoring:** to ensure the work area is free of fibres following the completion of work (clearance monitoring) due to reoccupation or future land use considerations.

The type and approach of monitoring should be determined on a risk basis by a competent person, such as an Occupational Hygienist in consultation with the Safety and Environmental team.

Where required, air monitoring shall be performed in accordance with the *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres* [NOHSC: 3003 (2005)] and be analysed by a NATA accredited laboratory.

The results of all air monitoring shall be provided to all relevant parties as soon as possible.

'Control levels' are airborne asbestos fibre concentrations which, if exceeded, indicate there is a need to review current control measures or take other action. These control levels are occupational hygiene 'best practice' and are not health-based standards (i.e. they are below the concentration set in the National Workplace Exposure Standard for asbestos).

The control levels shown below shall be used if air monitoring is undertaken:

Control level (airborne asbestos fibres/mL)	Control / Action
<0.01	Continue with control measures (where work is ongoing) or is safe for reoccupation (if complete)
≥0.01	Review control measures and/or remediation or decontamination processes
≥0.02	Stop work and find the cause

8 Documentation

Records of all inductions, desktop and site assessment, material and waste movements, placement location and capping (type and thickness) and disposal are to be retained.

The coordinates and details of the presence of suspected or confirmed fibrous minerals will be recorded and added to the fibrous minerals register and the relevant GIS layer.

9 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of safety and environmental controls, compliance with the Plan, and other relevant approvals, licenses and guidelines. This would include random checks that the visual assessments of core are being completed; that the necessary additional supplies and PPE are on hand; that waste products are being appropriately disposed of, regardless of potential for contamination.

References







Document code	Document title
BR-PLN-0001	Borumba Pumped Hydro Project Safety Management Plan
BOR-QHY-PLN-ENV-00003	Borumba PHES Geotechnical Investigations Environmental Management Plan

Appendix A

Fibrous minerals are composed of parallel, radiating, or aggregates of fibres, from which fibres are sometimes separable.

Naturally Occurring Asbestos

The word asbestos is a commercial term used to generally refer to six types of naturally occurring fibrous minerals that can be found around the world in ultramafic and some mafic rock formations, as shown in the table below.

Minerals	Formula	Characteristics	Occurrences
 Actinolite	$\text{Ca}_2(\text{Mg}, \text{Fe}_{2+})_5\text{Si}_8\text{O}_{22}(\text{OH})_2$	Long-bladed crystals, fibrous or thin columnar aggregates	Contact and regional metamorphosed dolomite, magnesian limestone, low-grade ultrabasic rocks
 Amosite	$(\text{Mg}, \text{Fe}, \text{Mn})_7[\text{Si}_8\text{O}_{22}](\text{OH})_2$	Variable fibre length and a coarse texture	Contact and regional metamorphosed iron- rich rock
 Anthophyllite	$(\text{Mg}, \text{Fe}_{2+})_7\text{Si}_8\text{O}_{22}(\text{OH})_2$	Massive fibrous or lamellar; short harsh poorly flexible fibres	Metamorphosed schists and gneisses or metasomatic rock
 Chrysotile	$\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4$	Fibrous, commonly silky	Veins and veinlets and stockworks in serpentinite
 Crocidolite	$\text{Na}_{2+3}\text{Fe}_3\text{Fe}_2\text{Si}_8\text{O}_{22}(\text{OH})_2$	Short to long flexible fibres	In granite, syenite, rhyolite, trachyte, banded ironstone, regionally metamorphosed schists
 Tremolite	$\text{Ca}_2(\text{Mg}, \text{Fe}_{2+})_5\text{Si}_9\text{O}_{22}(\text{OH})_2$	Long-bladed crystals and short and stout crystals, fibrous or thin columnar aggregates	Contact and regional metamorphosed dolomite, magnesian limestone, low-grade ultrabasic rocks

These mineral fibres can be classified as either asbestiform or non-asbestiform. While similar in structure and shape, asbestiform mineral fibres differ in physical properties and importantly, potential health risks.

Asbestiform mineral fibres have high tensile strength, chemical resistance and thermal stability, with respirable fibres presenting as thin, needle-like fibres that can easily penetrate deep into the lungs. Asbestiform mineral fibres have been linked to lung cancer, mesothelioma and other respiratory diseases. Non-asbestiform mineral fibres may have the same crystal structure or shape, though they present a different morphology, being typically thicker and less durable. Because of this they are less likely to penetrate deep into the lungs, though can still be hazardous to health following prolonged exposure in high concentrations.

Below are examples of how fibrous minerals appear as veins in rock similar to the basic rock types found at the Borumba Project site.

<https://www.alexstrekeisen.it/english/meta/serpentinite.php>



https://www.flickr.com/photos/asbestos_pix/6071608621



https://www.flickr.com/photos/asbestos_pix/3654971437



<https://www.mindat.org/min-975.html>

