NEWGATE RESEARCH

COMMUNITY ATTITUDES TO THE USE AND MANAGEMENT OF BIOSOLIDS

2020 STAKEHOLDER RESEARCH REPORT

PREPARED FOR AUSTRALIAN AND NEW ZEALAND BIOSOLIDS PARTNERSHIP

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In preparing this report we have presented and interpreted information that we believe to be relevant for completing the agreed task in a professional manner. It is important to understand that we have sought to ensure the accuracy of all the information incorporated into this report.

Where we have made assumptions as a part of interpreting the data in this report, we have sought to make those assumptions clear. Similarly, we have sought to make clear where we are expressing our professional opinion rather than reporting findings. Please ensure that you take these assumptions into account when using this report as the basis for any decision-making.

The base (number and type of respondents asked each question) and the actual survey questions are shown at the bottom of each page. Results may not always total 100% due to rounding.

This project was conducted in accordance with AS: ISO20252:2012 guidelines, to which Newgate Research is accredited. Project reference number: NGR 1906009

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BESTPRACTICE CERTIFICATION AMSRO ISO20252 MARKET, OPINION & SOCIAL RESEARCH

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EXECUTIVE SUMMARY AND RECOMMENDATIONS

EXECUTIVE SUMMARY

This summarises the key findings from 37 stakeholder interviews conducted with a cross-section of groups in Australia and New Zealand who are responsible for processing, using, advising on, regulating and conducting research into biosolids. Four interviews were also conducted with 'neighbours' of producers and end-users.

The interviews were conducted between January and March 2020 and completed just prior to the advent of the coronavirus pandemic. Detailed findings are contained in this report.

OVERALL PERCEPTIONS OF BIOSOLIDS

- Among the stakeholders interviewed, perceptions of biosolids are positive.
- Initial conversation focuses very much on the benefits of biosolids, both in terms of specific product characteristics and as an excellent example of beneficial reuse of waste.
- However, concerns about emerging contaminants (in particular, PFAS and microplastics) quickly surface, with perceptions of regulators as slow to act in terms of providing clear guidance on safe levels and implications for handling and application.
- This appears to have compounded issues in an already risk-averse sector, leaving biosolids under-utilised as a soil improver for agriculture, leading to greater levels of stockpiling in certain regions.
- Discussion also focuses on use of biosolids in composting and energy generation. Opportunities for alternative use appear to be growing faster in NZ than in Australia. Australia appears hamstrung to some extent by regulatory frameworks in some states that prioritise land application over other applications.
- Specifically, land application of vermicomposted biosolids appears to be gaining acceptance from indigenous populations in NZ and is seen by some stakeholders as a way to drive biosolids use in a risk-averse market. However, there appears to be less of an impetus to scale up activities in NZ due to the relatively low cost of landfill, increased cost and time to dry biosolids and continuing public push-back.
- There is positive discussion about waste-to-energy and also biosolids as a source of biogas (particularly when co-digested with food waste). However, the scalability of these processes and the amount of investment required to make waste-to-energy a reality in either market appears to be limiting growth.
- There is a general sense that, particularly in Australian metropolitan areas, the decrease in land availability and increase in human waste production will drive more investment in, and focus on, biosolids as an energy source in the future.
- We do not know what, if any, impact the coronavirus pandemic may have had on stakeholder needs regarding biosolids or their future outlook.

CHANGES OBSERVED SINCE 2010

- The 2010 research elicited many of the same findings as those seen in 2020 and we also gained greater insight into the situation in NZ in 2020, conducting eight interviews instead of one.
- However, it appears that concerns raised in 2010 around the impact of emerging contaminants on use of biosolids are now starting to become a reality (in terms of a slight decrease in total beneficial reuse in Australia and anecdotal feedback from stakeholders about increased stockpiling and patchy availability).
- The level of discussion about new technology and research into energy production did not appear to be as high in 2010 as it is in 2020. In 2010 there was discussion about the exciting possibilities, which are now being trialed and further developed in 2020.

EXECUTIVE SUMMARY *(CONT'D)*

STRENGTHS AND WEAKNESSES

Key strengths of biosolids and the biosolids industry mentioned:

- Its role in minimising waste to landfill through beneficial reuse.
- Returning nutrients to the soil as part of the circular economy.
- Soil improvement characteristics, in particular, phosphate reclamation and improving the water-holding capacity of soil.
- Its role as a sequesterer of carbon.
- Its calorific value (similar to that of brown coal) and biogas output.
- The fact that regulations and guidelines underpin its processing and use and these are starting to be reviewed.
- End-users are starting to see good benefits.

Key weaknesses mentioned are:

- Its variable (and low) nutrient composition.
- Its variable contaminant profile and lack of evidence around safe levels and long-term health and environmental impacts. This has made end-users somewhat risk-averse.
- The cost to transport and apply biosolids in Australia and the cost to dry biosolids in NZ (relative to the cost of alternative options).
- Complex and increasingly outdated regulations and guidelines that are inconsistent between different jurisdictions and hard to operationalise. NZ bemoans the fact they do not have regulations and lack guidance around compost certification.
- A regulatory focus on land application over other options.
- Odour and pest issues when stored or being applied.
- Supply issues to end-users in Australia – potentially due to stockpiling due to lack of certainty over contaminant levels.
- Relatively low yield for energy generation, requiring more investment in trials (e.g. co-digestion with food waste).

OPPORTUNITIES AND THREATS

To a certain extent any changes to food and environmental regulations (both in ANZ and elsewhere) are outside the control of the industry.

Opportunities that industry can more readily leverage are:

- Provision of clear, streamlined, practical and up-to-date regulations across ANZ, ideally one set for all (although regulators mention a need to take into account local climate and soil factors).
- The current societal and government focus on reuse of waste, carbon reduction and renewable/alternative energy sources.
- The opportunity for the industry to secure more funding for research into biosolids quality, stability, transportability and usability improvements and alternative uses (e.g. energy generation).
- A stronger push to get phosphate reclamation on the political and social agenda as an important issue.
- A push by water companies and regulators to improve the quality of wastewater – targeting industrial producers and the community.
- Increasing acceptance of vermicomposted biosolids by NZ indigenous communities.

Threats that the industry must work to mitigate are:

- Directives that position biosolids as toxic, or a major public health or environmental scare caused by a known or emerging contaminant (either in ANZ or elsewhere).
- Lack of funding for further necessary product and use research.
- The continuing lack of legislative imperatives to drive biosolids use.
- A continuing government mindset that positions biosolids as a waste management issue rather than resource recovery. This is a particular issue in NZ where wastewater treatment, waste management and regulation is government controlled.
- Wastewater treatment may become decentralised and localised, meaning large-scale solutions are no longer required.

EXECUTIVE SUMMARY *(CONT'D)*

STAKEHOLDER NEEDS IN RELATION TO BIOSOLIDS

While a diversity of different stakeholder groups were interviewed, their needs covered similar areas:

1. Absolute clarity around the **contaminant profile and levels of contaminants in biosolids** (particularly emerging contaminants such as PFAS, microplastics, cancer treatment drugs and other pharmaceuticals) and to what extent these contaminants may end up in the food chain.
2. **Greater public awareness** of the key benefits of biosolids – particularly in terms of reducing waste, phosphate reclamation, soil improvement and carbon sequestration.
3. Greater awareness across industry and the broader stakeholder community of the **successes achieved in other countries**.
4. A product that is **more readily available and is more cost-effective to use than alternative products/disposal mechanisms,** in terms of supply, ease of transporting it, ease of applying it and the benefit that can be derived for land application and the permitted rate. This need was cited more by end-users, intermediaries, consultants and researchers and underscored by a need for greater research investment more generally.
5. A product that is of a **more consistent/predictable quality** particularly in regard to contaminant levels. This need was mainly cited by researchers, regulators, producers and end-users and focused on a need for greater research investment in processing technology, as well as greater control of wastewater inputs.
6. A greater impetus to **diversify use of biosolids beyond land application** to future-proof the industry in the face of any major public health or environmental scare. This was mainly cited by producers and researchers and focused on energy generation as well as use of biosolids in creating other products and materials.

ANZBP – AWARENESS, PERCEPTIONS AND EXPECTATIONS

- Awareness and knowledge of the ANZBP was highly variable across the stakeholder groups (and within groups) and was dependent on the focus they had on biosolids in their day-to-day role and/or those they represent.
  - **Those with the highest levels** of awareness and knowledge are Producers, Regulators and Researchers.
  - **Those with mixed levels of awareness** are Consultants, Intermediaries, Government, Peak Bodies and End-users. As the key recipient of biosolids, there appears to be an opportunity to drive end-user awareness further, particularly as those interviewed stated they are largely on a learning curve at the moment about biosolids and need more technical information.
  - **Those with the lowest levels of awareness** are Suppliers, the Energy sector and the general public (neighbours of producers and end-users)
- Those aware of the ANZBP value its role in sharing information, identifying issues and opportunities and acting as a conduit between (and voice for) the industry to government and between the private and public sector.
- However, there appear to be opportunities for the ANZBP to support the industry still further by broadcasting key messages about biosolids. These are outlined in more detail overleaf.

OVERALL RECOMMENDATIONS FOR ANZBP

1. Build industry and end-user confidence around levels and handling of emerging contaminants

- While research into emerging contaminants is currently underway, and regulations and guidelines are being reviewed by relevant bodies in each market, progress is slow, leaving a vacuum of information around safe levels, impact on application rates and practices and long-term impacts on health and the environment.
- Potentially the ANZBP has a role to play in ensuring that relevant research findings are circulated, and research gaps are being addressed through matching of funding sources with researchers.

2. Build stakeholder alignment around the key benefits of biosolids

- While producers, researchers and consultants are generally aware, and end-users are on a learning curve, other segments are far more varied in their knowledge of specific benefits, beyond a broad understanding. In particular, government stakeholders are still viewing biosolids as waste management, rather than resource reclamation.
- The broader industry needs to be fully aligned around biosolids as a way to help 'drought-proof' soil, as an important source of phosphate and carbon sequestration and other essential nutrients.

3. Invest in educational activities to improve biosolids inputs

- An emerging area of focus for regulators (and need cited by producers) in Australia is that of optimising the quality of wastewater. This would help to optimise biosolids quality and reduce the level of contaminants.
- Potentially a community education initiative as well as any activities that could help build buy-in from trade-waste producers would help.

4. Invest in community education

- While (particularly at this time) the perceptions of the public in relation to use of human waste is not fully known, societal shifts in thinking have never been more aligned with the beneficial reuse of biosolids. Exposure to the community of 'wins' from other countries and apprising them of the role of biosolids in 'drought-proofing' of soil, phosphate reclamation and carbon sequestration should help to generate support, or at least start to align thinking.
- These messages should be supplemented with those that aim to allay concerns about pathogenic and chemical contaminants.

5. Help support market development activities for land application

- Typically biosolids remain expensive to transport and apply (due to the need stated by some Australian stakeholders to use specialist contractors).
- There is a need for increased funding for new and scalable processes that can help improve the quality, stability and transportability of biosolids and better deliver to user needs. While trials and initiatives are underway for gasification, thermal hydrolysis and pyrolysis, and pelletisation, biochar and agri-ash production, there is a sense that more investment is needed to improve the quality and to refine the format (e.g. through extraction of nutrients and via composting).

6. Help support market development activities to broaden reuse

- Current regulations and guidelines appear to prioritise land application of biosolids over other potential uses. However, with the amount of biosolids only set to grow further, the potential for use of biosolids in other ways must be capitalised on, including:
  - Incineration for energy production
  - Co-digestion for biogas production
  - Composting (in particular, vermicompost)
  - Inclusion in building and construction materials
  - Plastics, glass and other raw materials

INTRODUCTION

BACKGROUND, OBJECTIVES & APPROACH

RESEARCH BACKGROUND AND OBJECTIVES

Biosolids are the major byproduct of the wastewater treatment process and are being increasingly used for a range of purposes including crop and pasture improvement, landscaping, land rehabilitation, road base, oil and fuel.

Production and use of biosolids is highly regulated in Australia, and guidelines around their treatment and use exist in NZ.

The Australian & New Zealand Biosolids Partnership (ANZBP), a member-based collaboration of utilities, consultants, academics and government bodies, is committed to the sustainable management of biosolids.

In 2010, the ANZBP commissioned a program of research to explore and establish stakeholder and community knowledge and attitudes towards biosolids and to develop a suite of benchmark metrics around community awareness and sentiment.

In 2020 a second community and stakeholder research project was conducted to update this understanding.

The overarching objective of this study is to obtain feedback from stakeholders and the wider community on the use and disposal of biosolids to help support ANZBP objectives and to inform communications development to address knowledge gaps and issues. Specifically to:

- Update key findings from the 2010 study.
- Identify the issues key stakeholders feel are most important in a debate about biosolids management, and their views with regard to these issues.
- Identify the factors that most influence stakeholder and general community views.

This report details the findings from the Stakeholder research phase.

RESEARCH APPROACH AND SAMPLE

OVERALL PROGRAM

SCOPING WORKSHOP

- A 2-hour kick off workshop (ANZBP and Newgate teams)
- Review of relevant reports and documents by Newgate Research to aid design and development of research materials

STAKEHOLDER RESEARCH

- Thirty-seven 30 to 45-minute interviews with biosolids stakeholders.
- Mix of phone and face-to-face interviews.
- Participants were not incentivised.
- Participants recruited from lists provided by ANZBP
- Fieldwork conducted between: 3rd February to 25th March 2020 (all conducted pre COVID-19)
- Interviewing team: Heather Jones, Cat Banks, Siobhan Twist, Lisa Vo and Oscar Dean.
- CanvasU conducted interviews with end-users, neighbours and community stakeholder groups.

COMMUNITY RESEARCH

- Survey with n=1,200 general public
- Mix of online and CATI surveying
- Mix of those living in close proximity to production and usage sites, and the general population
- TO COMMENCE IN LATE APRIL 2020

STAKEHOLDER SAMPLE OVERVIEW

	Category	Overall sample	Australian sample	NZ sample
Industry n=21	Regulators	3	3	**
	Producers	7	3	4*
	Consultants	3	3	
	Intermediaries (*Organic recyclers, sellers of derived products, contractors*)	3	2	1
	End Users	3	3	
Associates n=14	Suppliers	3	3	
	Energy industry	2	1	1
	Researchers	5	3	2
	Local Government	1	1	**
	Peak bodies	2	2	
Community n=5	Community groups	1	1	
	Neighbours to producers	2	2	
	Neighbours to end users	2	2	
TOTAL		37	29	8

*One producer was also an end-user

**Overlap between Local Government, Producer and Regulator in NZ

THE SEGMENTS IN MORE DETAIL

The stakeholders interviewed for this project comprised those at all stages of the biosolids industry and those that advise or oversee the industry

PRODUCERS

Water companies

SUPPLIERS

Waste management companies that supply facilities and equipment for the preparation and application of biosolids

INTERMEDIARIES

A variety of companies that handle biosolids e.g. transporting, undertaking further processing and/or using it in other products (e.g. compost). Including contractors, organic recyclers, sellers of derived product

END-USERS AND ENERGY COMPANIES

Organisations that utilise biosolids for land application or energy generation

NEIGHBOURS AND COMMUNITY GROUPS

Community members who live near to biosolids production or use sites, and community groups that represent members of the community on environmental topics

ORGANISATIONS AND BODIES THAT OVERSEE REGULATION OF THE INDUSTRY OR WORK WITHIN SECTORS ALLIED TO THE INDUSTRY

REGULATORS

Bodies that oversee biosolids industry regulation

LOCAL GOVERNMENT

NZ – producers and/or regulators
Aus – end-users (e.g. via land management)

PEAK BODIES

Represent those involved with biosolids, carbon reduction and/or waste reuse

CONSULTANTS

Organisations that advise the industry and/or end-users

RESEARCHERS

Universities and other institutions who conduct research into biosolids or related areas

SEGMENT CHARACTERISTICS

PRODUCERS (n=7)*

- Three stakeholders based in Australia, working at water companies.
- Four based in New Zealand, working at city, district and regional councils in wastewater, environment and technical management.

SUPPLIERS (n=3)

- Those we spoke with were from major waste management companies.
- They had backgrounds in energy from waste, manufacturing and land application of biosolids.

INTERMEDIARIES (n=3)

- Two of the stakeholders were based in Australia, working for composting companies; the other was based in New Zealand with a focus on vermicomposting.

END-USERS (n=3)

- All were key decision-makers at Australian agricultural businesses. They represented a mix of enterprises including broadacre farming and sugar cane.
- A further stakeholder (based in NZ) also had responsibility for waste-water, so was classed as a Producer.

ENERGY INDUSTRY (n=2)

- One stakeholder was based in Australia and the other in NZ.
- Both worked for energy companies and, while one was fairly new to biosolids the other had always worked in waste to energy and so was more familiar with biosolids.

COMMUNITY (n=5)

- Four members of the general public who lived next door to sewage treatment plants or areas where biosolids have been applied to land.
- A representative from a large environmental charity was also interviewed.

REGULATORS (n=6)*

- Relevant personnel from various EPA/ DoH jurisdictions in Australia.
- In NZ, some councils (who were Producers) had regulatory responsibilities

LOCAL GOVERNMENT (n=4)*

- Two personnel from a regional council in Australia were interviewed in a single interview.
- In NZ, four local councils were interviewed as Producers

CONSULTANTS (n=3)

- All were based in Australia with two from NSW and one from QLD.
- Roles spanned agronomy, water and waste management – including biosolids.

PEAK BODIES (n=2)

- Both stakeholders were based in Australia: one representing organisations that produce biosolids and the other representing organisations that utilise biosolids within other activities they undertake.

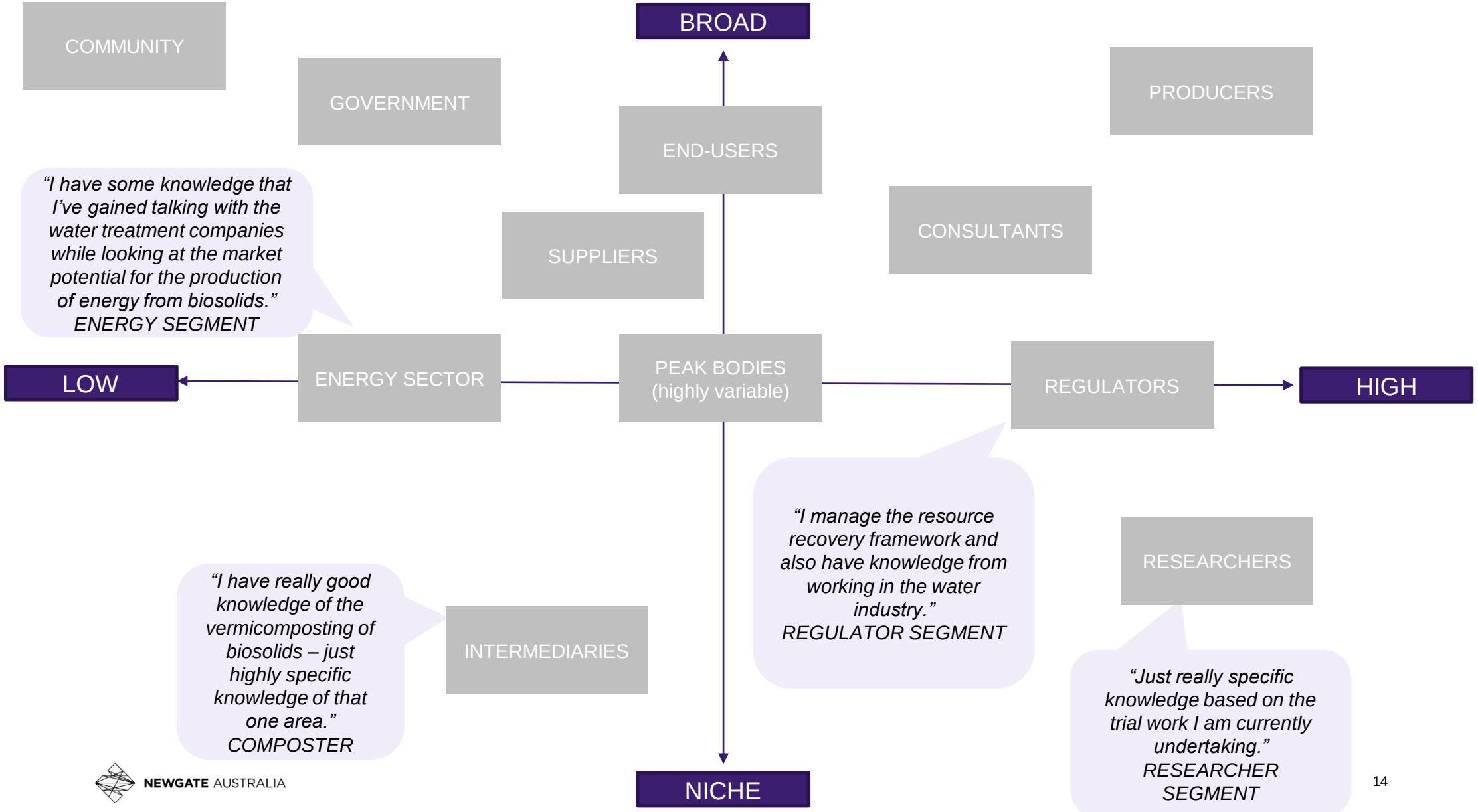
RESEARCHERS (n=5)

- Three stakeholders were based in Australia and two in NZ.
- They all had high knowledge levels about specific aspects of biosolids treatment and processing including energy production, waste and water treatment.

* Overlap between Producers, Regulators and Local Government in NZ means some fall into multiple categories

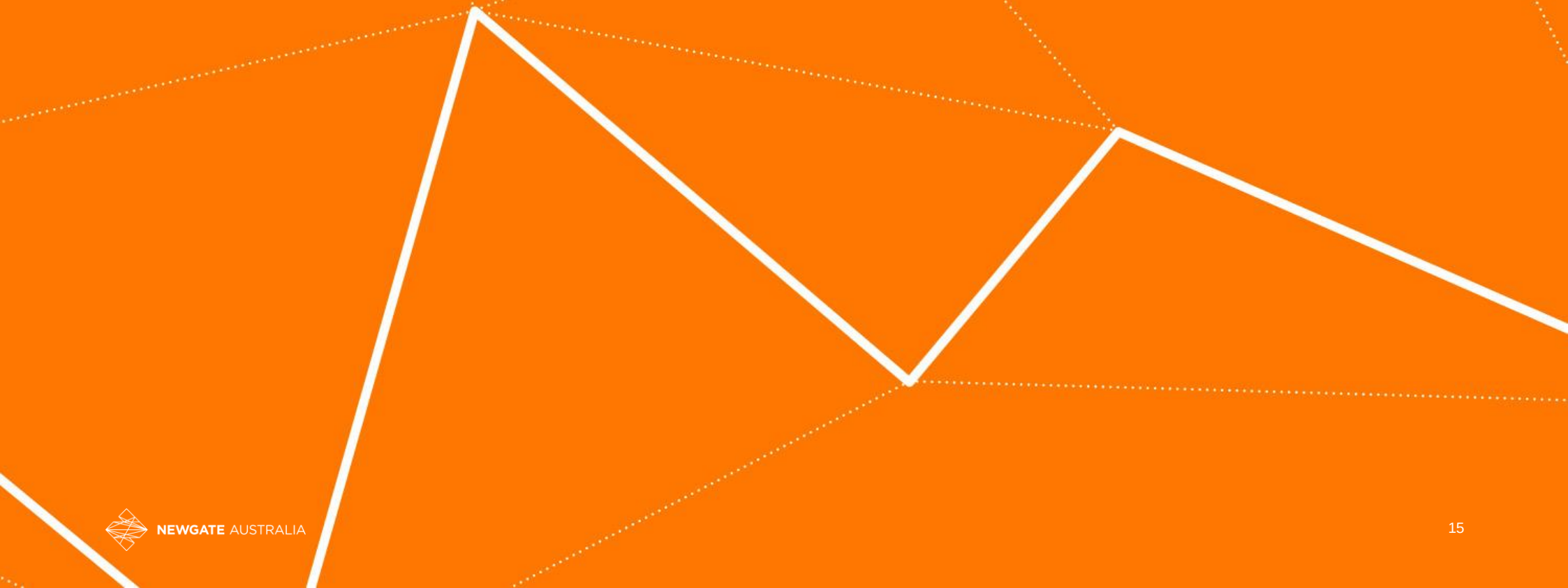
STAKEHOLDER BIOSOLIDS KNOWLEDGE

Knowledge about biosolids is largely accumulated 'on the job' and so is highly dependent on the role the stakeholders have. This means that knowledge levels vary greatly across the sample.



CURRENT CONTEXT

SNAPSHOT OF BIOSOLIDS USE IN AUSTRALIA & NZ – DESK RESEARCH



THE ANZ BIOSOLIDS INDUSTRY: SNAPSHOT IN SUM

The ANZBP's report 'Biosolids Production in Australia' (October 2019) shows major differences both between and within each market.

Production and reuse

- Beneficial reuse of biosolids is at 91% in Australia. In NZ, this is at 68%.
- In Australia, 67% of biosolids produced are used in agriculture. In NZ this figure is 14%.
- NZ produces around one-fifth of the biosolids Australia produces, with most going to land rehab or landfill.

Treatment

- Anaerobic digestion is the main primary treatment in both markets.
- Vermicasting accounts for 11% of secondary treatment in NZ. This is far lower in Australia.
- In both markets, there are regional differences in biosolids treatment and use.

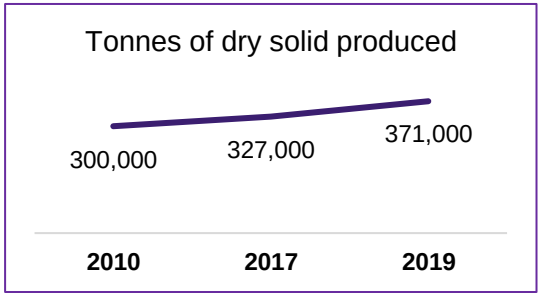
Regulation

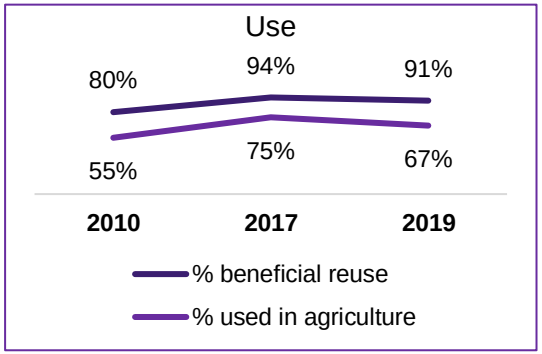
- In Australia regulations underpin biosolids treatment and use. NZ has guidelines.
- In NZ the treatment, governance and use of biosolids appears far more centralised within government than in Australia.

AUSTRALIAN INDUSTRY SNAPSHOT

Processing and use is different in each state/territory. Overall most are trending towards 100% beneficial reuse, though two (NT and WA) have begun increasing stockpiles in the past 2-3 years.

While production continues to grow, beneficial reuse has decreased in 2019 vs. 2017.





We will explore potential reasons for this in the detailed findings.

Overall utility

Agriculture	**67%**
Land rehabilitation	16%
Landscaping (composting)	8%

Overall stabilisation grade

A	**48%**
B	38%

Overall contamination grade

B	**58%**
C	34%

Overall preparation methods

Anaerobic digestion	**41%**
Lagoon storage	15%
Nothing	10%
Aerobic digestion	9%
Incineration	5%
Thermal hydrolysis	5%

Overall drying methods

Conventional centrifuge	**34%**
Drying beds	25%
Belt filter press	19%
High solids centrifuge	17%

Main uses, preparation methods, drying methods, stabilisation and contamination grades are very different in different states.

Main skews seen (where % is higher than the national average)…

Stockpiling, landfill & use of lime stabilisation are higher than national average.

% of stabilisation grade B is also higher.

Agricultural application focus, but starting to explore composting (Anecdotal)

Skews higher on B grade stabilisation and C contamination grade.

Highest rate of no preparation and of Thermal Hydrolysis.

Drying skews towards **belt filter press and high solids centrifuge.**

Agricultural focus and skews towards **higher stabilisation and contamination grades (A and B).**

Said to be 'risk-averse' (Anecdotal).

Land rehab application is higher than the nation average Agricultural focus and skews towards **higher stabilisation and contamination grades (A and B).**

Lagoon storage and beds/lagoon preparation skews higher in Vic.

Land rehab and **composting application** is higher than the nation average Agricultural focus.

Aerobic digestion and incineration, as well as high solids centrifuge skews higher in NSW/ACT.

SUMMARY OF ANZBP REPORT: BIOSOLIDS PRODUCTION IN AUSTRALIA, OCTOBER 2019. DATA IS IN THE APPENDIX

NEW ZEALAND INDUSTRY SNAPSHOT

NZ produces around one-fifth of the biosolids Australia produces, with most going to land rehab or landfill.

PRODUCTION

The industry produces more than 300,000 wet tonnes of biosolids per year, which equates to 54,000 tonnes of dry product.

GOVERNANCE

The current guidelines “Guidelines for the Safe Application of Biosolids to Land” (2003) are being updated. The update is currently in draft form “Guidelines for Beneficial Reuse of Organic Materials on Productive Land”.

GOVERNMENT

Central government and many councils have set targets for a zero waste future by 2050 or sooner.

Overall utility

Fate of wet tonnes of end product (2019)

Resource recovery	**68%**
Waste	32%
Quarry rehabilitation	**45%**
Landfill	27%
Agriculture	14%

Primary treatment

Fate of wet tonnes of end product (2019)

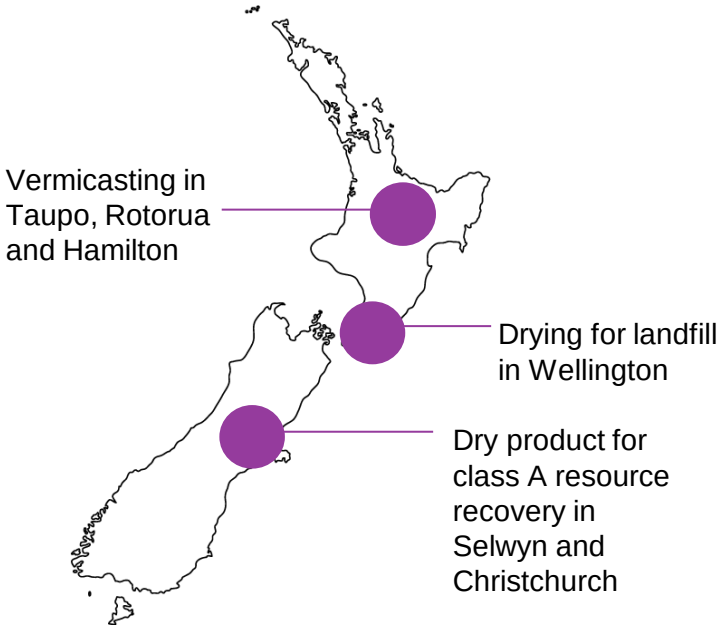
Anaerobic digestion	**66%**
Nothing	21%
Pond digestion	5%

Secondary treatment

Fate of wet tonnes of end product (2019)

Lime stabilisation	**45%**
Nothing	30%
Vermicasting	11%
Thermal dryer	6%

MAP OF USAGE



DATA FROM *THE VALUE OF BIOSOLIDS IN NEW ZEALAND* – AN INDUSTRY ASSESSMENT by Rob Tinholt (Watercare Services Ltd) - 2019

OVERALL ATTITUDES TOWARDS BIOSOLIDS, INDUSTRY STRENGTHS AND WEAKNESSES

CURRENT THINKING ABOUT BIOSOLIDS – THE 2020 STUDY

Quotable quotes from a cross-section of stakeholders show positivity towards biosolids, with growing numbers are seeing benefits from biosolids use. However, concern about emerging contaminants and a slow pace of uptake are mentioned.

*"I'm positive about biosolids moving towards being seen as a resourceful product – **mindsets are changing**."*

SELLER, AUS

*"There are two key arguments. **Economic rationalists want a least-cost solution to remove biosolids – which is often landfill – and environmentalists want more beneficial use from the product** – aiming for a circular economy, whatever the cost."*

CONSULTANT, AUS

*"I'm positive but I have **a lot more to learn** – more understanding of how they actually work to improve the soil and any impacts."*

END-USER, AUS

*"Regulations are there to protect public health and the environment, but these are changing and **there are different views on what these impacts are and how they should be best managed**."*

CONSULTANT, NZ

*"Australian thinking focuses on the agricultural use of biosolids and there are more uses for it – but it is **often influenced by hesitation to experiment with it, budget and technology**. **And people get very nervous about PFAS**."*

RESEARCHER, AUS

"NSW and WA is where focus on composting is. QLD also getting involved.

SA is risk-averse around contamination.

*Victoria is focusing on storing for buffering and stabilisation but is using it more and more. **Most use is aggregating towards land application on broadacre farms** (canola, pasture etc.)."*

RESEARCHER, AUS

*"Driving cultural change is hard and, at the moment there is **no legislative imperative to change**."*

GOVERNMENT, AUS

*"**Perceptions are changing slowly** as the industry becomes more aware of the cost and environmental impacts of coal."*

ENERGY SECTOR, AUS

*"There's growing interest from farmers who are looking to improve soil health and alternatives to current available mulch, but they are **conscious of the regulations they need to pass to get their products to supermarkets**."*

CONSULTANT, AUS

*"**Although the land is tired, biosolids helps to regenerate the healthy soils** and lands. I've seen the benefits. The soils have become more healthy from the added nutrients."*

END-USER, AUS

*"The quality is not there yet. It's **not ethical to use when we don't fully understand emerging contaminants**."*

SUPPLIER, AUS

SENTIMENT TOWARDS BIOSOLIDS BY STAKEHOLDER SEGMENT

General positivity, but cost, risk-averse mindsets and regulation mean it is undercapitalised as a resource

PRODUCERS (n=7)	SUPPLIERS (n=3)	INTERMEDIARIES (n=3)	END-USERS (n=3)	ENERGY INDUSTRY (n=2)
View biosolids use as a necessity as landfill becomes limited, but feel more investment is needed to 1) **broaden the diversity** of use from land application, 2) add value in processing to **lower costs and risks of using**, 3) **reposition biosolids** from waste disposal to beneficial reuse in the minds of government and the public and 4) generate market demand for biosolids as a valuable product.	**Very positive** about biosolids use and seeing positive feedback from end-users, but **want to see value-adding in processing to make it cheaper and easier** to transport and spread.	Most discussion focused on **composting** – it is seen as ideal for this purpose (pH, pathogens, nutrients and organic matter), but **needs more investment to drive it, establish quality assurance accreditation (particularly in NZ) and to reset government mindset** to view it as a safe enough example of beneficial reuse	**On a learning curve about biosolids,** but seeing good results and see it as an **important phosphate source**. However, **supply is limited and they need more certainty** around nutrient and contaminant levels. Some risk aversion among dairy farmers due to export market needs and pasture withhold.	Are on a **learning curve about biosolids, but see the benefits** for energy generation. However, the **cost** of setting up waste-to-energy and public sentiment are key challenges.

COMMUNITY (NEIGHBOURS) (n=5)	REGULATORS (n=6)	LOCAL GOVERNMENT (n=4)	CONSULTANTS (n=3)	PEAK BODIES (n=2)	RESEARCHERS (n=5)
Low awareness but generally positive after explanation (particularly around beneficial reuse of waste). However, they assume the public would be concerned about odour and health impacts. **Independent research organisation** needed to provide information and evidence on biosolids.	**Generally positive** about biosolids but **need more evidence around emerging contaminants** to update guidelines. Currently updating regulations across all jurisdictions with a focus on land application and aware the focus also needs to be on improving inputs (sewage quality).	**Positive but cautious** due to the limited evidence on emerging contaminants. Acknowledgement it is **slow to change mindset** from seeing biosolids as a waste issue to an opportunity for beneficial reuse.	**Very positive** about the opportunities for biosolids as **a nutrient source and carbon offset** but aware of the restrictions on use – e.g. **high transport costs, variable quality and stability**	**Positive** but acknowledge the **efforts of their members are often hampered by a risk-averse regulatory mindset a**nd the sheer cost of processing and using biosolids.	**Extremely positive** about the opportunities for biosolids but also **frustrated about the limited funding for research** into scaleable processing and energy generation, as well as value-add processing to increase ease of use and decrease costs.

KEY BIOSOLIDS AND BIOSOLIDS INDUSTRY STRENGTHS IDENTIFIED

Product strengths align with the 2010 study, but technological advancements appear to be driving conversation around biosolids as a potential energy generator and opening up opportunities for lower cost production, transport and utility more generally. End-users are also seeing the benefits.

PRODUCT

1. **Soil improver**:
   - **Nutrients** (Nitrates and **Phosphates** in particular);
   - Helps to increase the **moisture holding capacity** of the soil.
2. Natural product that is part of the nutrient cycle, benefiting the **circular economy**.
3. A **source of energy:**
   - Calorific content like low grade coal;
   - (Co)digestion to produce biogas to power plant / heat homes.
4. **Sequesters carbon**– utilising it will help reduce carbon emissions (biochar).
5. **Less run-off and leaching** than with chemical fertilisers on land and when stockpiling/in landfill.

ECONOMIC

1. Technological advancements in processing, such as faster digestion and dewatering are starting to make it **increasingly less costly to produce and transport**.
2. **Increasingly seen as a more viable option than landfill**, particularly in Australian metropolitan areas where landfill costs are expensive (relatively speaking).
3. Its role as a **source of phosphate** continues to drive value.
4. **Freely available** raw material – does not need to be mined or created.

INDUSTRY GOVERNANCE AND REGULATION

1. **Thorough, robust regulations and guidelines** govern product quality and application. Currently being updated across jurisdictions interviewed. A sense that 'everyone is trying to do the right thing' – regulator and user interests are aligned.
2. Regulations and guidelines are **starting to be updated** in some locations to take into account emerging contaminants and quality of inputs.

MARKET DEMAND

1. **End-users are seeing the benefits** of soil improvement and this is helping drive demand (mainly in Australia).

TECHNOLOGICAL

Lots of trials happening:

1. **Biogas production** via co-digestion with food waste.
2. **Vermicomposting,** which may help increase acceptance by Maori community and meet regulatory requirements (in NZ).
3. **Phosphate** reclamation and enrichment.
4. **NPD for product quality optimisation** – thermal hydrolysis.
5. **NPD for volume reduction and/or biogas production –** gasification and agri ash production.

KEY BIOSOLIDS AND BIOSOLIDS INDUSTRY WEAKNESSES IDENTIFIED

Limited information and guidance on the levels and impacts of contaminants, variable composition and stability, unclear regulation and costs associated with processing, transporting and using biosolids limit use. Investment in research is needed to answer questions and to value-add to overcome key issues.

PRODUCT

1. **Emerging contaminants with unknown health and environmental impacts – PFAS**, cancer drugs and pharmaceuticals, microplastics mentioned.
2. **Variable composition -** in terms of nutrient profile and contamination level. Application rate to minimise may be too low to achieve sufficient nutrient benefit.
3. **Variable stability** – leading to odour and issues with leaching in some cases.
4. **Low energy yield** compared to effort.

ECONOMIC

Cost relative to alternatives:

1. **Expensive to process –** particularly in NZ where drying takes longer, and landfill is cheaper.
2. **Expensive to transport to processing and application sites.** In Australia some end-users pay contractors to transport it, while in NZ producers appear to have to pay others to take it away.
3. **Expensive to apply** – specialist equipment/ contractors required in some states.
4. **Expensive to use in W2E** – the technology is expensive to buy and not particularly scaleable, and processes to prep biosolids are time-consuming.

INDUSTRY GOVERNANCE AND REGULATION

1. **Out of date regulations and guidelines impacting use:** Lack of clear directives around levels and management of emerging contaminants. It's happening but slowly, due to the need to build evidence. Some in NZ want regulations not just guidelines for clarity.
2. **Inconsistent regulatory frameworks and guidelines** between states, territories and countries. Multi-state organisations need to adjust their approach state by state (costly).
3. **Regulations focus on land application** rather than energy generation (mainly in Aus). Limiting focus on energy.
4. **Apparent misalignment** between government imperatives (waste reduction) and what is allowed by local councils in terms of biosolids application.
5. **Local government mindset.** Currently viewing biosolids as a waste disposal, rather than beneficial reuse issue.
6. **Highly centralised system management in NZ** (council driven) and lack of interest/passion limits use. In Australia, a mix of private and public entities are involved, which can lead to more opportunities to drive growth and innovation.

MARKET DEMAND

1. **Low public knowledge** and poor perception. Particular issues in NZ with biosolids at odds with indigenous cultural beliefs.
2. Councils and other end-users **remain risk-averse** due to lack of data on contaminant levels and impact.
3. **Product rather than needs-driven market.** Limited value-adding to meet needs of users and variable availability.

TECHNOLOGICAL

1. **Limited funding restricts research** into processing and product innovation and commercialisat-ion of technology. It also slows down necessary research into impacts of emerging contaminants.

STRENGTHS AND WEAKNESSES BY SEGMENT

Most segments are positive, however, some need more information and investment and others are being cautious

PRODUCERS (n=6)	SUPPLIERS (n=3)	INTERMEDIARIES (n=3)	END-USERS (n=3)	ENERGY INDUSTRY (n=2)
Strengths: A beneficial reuse of waste as landfill becomes limited. A good soil improver, and opportunities for energy generation. **Weaknesses:** Contaminant issues and little investment in public education on benefits and the need to improve wastewater, broader utility, value-adding and more contractors to facilitate use (NZ).	**Strengths:** Soil improvement benefits and positive feedback from end-users. **Weaknesses:** Concern about contaminants and want to see value-adding in processing to make it cheaper and easier to transport and spread.	**Strengths:** Seen as ideal for composting (pH, pathogens, nutrients and organic matter). **Weaknesses:** Concern about contaminants, lack of clear guidelines and lack of certification (in NZ) holding back market. Feel the government is risk-averse and viewing biosolids as waste disposal not reuse.	**Strengths:** Seeing soil improvement benefits and view it as an important phosphate source. **Weaknesses:** Limited supply and a need for more certainty around nutrient and contaminant levels. Some risk aversion among dairy farmers due to export market needs and pasture withhold.	**Strengths:** Can see the benefits of use for energy generation. **Weaknesses:** See biosolids as an issue of waste disposal currently. Also consider significant investment is needed in W2E infrastructure and improvement of biosolids to enable it to be used.

COMMUNITY (NEIGHBOURS) (n=5)	REGULATORS (n=6)	LOCAL GOVERNMENT (n=4)	CONSULTANTS (n=3)	PEAK BODIES (n=2)	RESEARCHERS (n=5)
Strengths: Low awareness but generally positive about it in terms of energy generation and reducing waste. **Weaknesses:** Can see the general public may have issues with its use on land for odour and safety reasons (health and environment).	**Strengths:** A soil improver and way of reducing waste. **Weaknesses:** Lack of research evidence around emerging contaminants, as well as issues with employing national regulations due to different conditions in each state.	**Strengths:** Are becoming aware of the benefits for soil improvement. **Weaknesses:** Risk-averse and slow to change mindset to see biosolids as nutrient reclamation rather than waste disposal issue.	**Strengths:** See a variety of strengths as soil improver, carbon offset and energy generator. **Weaknesses:** See it as expensive to transport and use with variable product quality and stability.	**Strengths:** See a number of positive benefits – particularly in soil improvement and composting. **Weaknesses:** Lack of evidence around emerging contaminants, poor public perception and regulation that hampers market growth.	**Strengths:** A wide range of benefits – for soil improvement, energy generation and in other products **Weaknesses:** Frustration about limited funding for research into scaleable processing, energy generation and product improvement.

OPPORTUNITIES, THREATS AND UNMET NEEDS

CONTEXTUAL THEMES EMERGING OVER LAST 10 YEARS – DESK RESEARCH

Prior to the Coronavirus pandemic, the market context in ANZ has never been so positively predisposed towards use of biosolids. The current situation is unclear, but there are significant risks that community opinion can change radically and quickly and other countries can influence use (due to our export focus).

POLITICAL/ REGULATORY

Situation is mixed:

- **There is an increased government focus on carbon emissions reduction, recycling and** reuse, including a shift towards renewable energy generation and away from fossil fuels. This bodes well for biosolids in terms of beneficial reuse and as an energy source (pending further investment in technology).
- **BUT, there is more stringent regulation** around food production (including agricultural inputs) and environmental protection (zero harm goals), which could set back use of biosolids.

ECONOMIC

Situation is mixed:

- **The ANZ economies are stable and resilient. The agriculture sector is still strong and there is growing investment in waste management.**
- **BUT agriculture is highly dependent on international trade (NZ in particular)**, which means other markets can influence what is produced and how.
- The current pandemic may tip both countries into recession.

SOCIAL

Situation is mixed:

- **We are in the midst of a pandemic,** raising concern about biosecurity, health and safety.
- **However, generally society has been moving in the right direction,** with greater awareness, interrogation and concern over inputs into food, water and impact on the environment.
- **The rise of activism.** Climate Change marches, Anonymous etc. Putting pressure on government to change position on specific issues impacting the environment.

TECHNOLOGICAL

Situation is mixed:

- **Fragmentation of media landscape** – it is more challenging to reach the community at large and people can end up in their own 'echo chamber' with media channels simply reinforcing their own (niche) views – issues can gain traction (a risk).
- **The rise of social media** – enabling the rapid spread of news and views. Individuals can now take on organisations and hold them to account. This presents both positive and negatives for biosolids.
- **Advances in technology** that have increased scalability of processes, the suite of diagnostic testing options possible and ways to release chemicals and energy from raw/waste material (a major positive for biosolids).

Red text relates to issues occurring after the fieldwork period – so not discussed with stakeholders but nevertheless important to note

OVERALL THOUGHTS ABOUT THE FUTURE FOR BIOSOLIDS IN ANZ

Both countries are generally aligned in their (favourable) view of the future for biosolids.

AUSTRALIA

- Continued population growth will drive the imperative for greater action on biosolids use as landfill becomes limited.
- New guidelines and research providing confidence and certainty for industry around management of emerging contaminants.
- Industry mindset shifts from mitigating risk to value-adding, through investment in technology to overcome cost, ease and perceptual barriers (i.e. lower volume and derived products).
- Technological advancements in processing and greater control of wastewater quality result in a more stable product of more consistent quality.
- Waste-to-energy regulation and new technology opens the opportunity for a greater diversity of biosolids use beyond land application (e.g. fuel, building materials and in plastics).
- People more aware of the role biosolids play in returning nutrients to the soil, sequestering carbon and reducing waste.
- Some discussion about the potential decentralisation of the sewage system meaning less need for investment in large-scale plant and processes to handle biosolids.

NEW ZEALAND

- Similar points raised to those in Australia. But a sense that Australia will lead the charge due to more negative public perception in NZ, alongside greater availability of landfill space and a wastewater system that is highly centralised and risk-averse.
- Expect use of vermicompost to go up significantly as it is acceptable to the Maori population.

WHAT THE BIOSOLIDS INDUSTRY CAN LEARN FROM ELSEWHERE

Feedback from stakeholders is patchy and some are not aware. Examples provided focus on diversification of use (e.g. energy generation) and building positive public perception through promotion and demonstration of positive effects.

"Generally Europe is more advanced. France has research facilities and they are more positive about W2E. It all comes down to willingness to take on new tech and support from regulators and the government"
SUPPLIER, AUS

"Seattle did a good job of addressing poor public perceptions of biosolids."
PRODUCER, NZ

"Hong Kong have a brilliant public demonstration of W2E, where the energy generated powers a swimming pool they can use."
PRODUCER, NZ

"Internationally biosolids are more widely used. Foreign countries see the benefits of the product and no harm caused."

SELLER, AUS

"The US – Obama talked about biosolids – we need more brand ambassadors who can positively promote the product."
RESEARCHER, AUS

"The UK has good examples of diversifying so you build operational resilience and don't put all your eggs in one basket (e.g. land application)."
CONSULTANT, AUS

"Extraction of phosphate from biosolids is happening in Ireland – they are using it to boost the potency of the biosolids applied to the land. They are also looking at co-digestion of biosolids with waste food"
REGULATOR, AUS

"Australia does biosolids reuse and NZ doesn't. We need to learn from them and how to improve the quality of the biosolids."
CONSULTANT, NZ

CASE STUDY: WHAT'S HAPPENING IN SEATTLE?

In King County, treated human waste, also known as biosolids, plays an important part in the county's efforts to combat global warming. "Every year we provide the ***equivalent of taking about 8,000 cars off the road****," said Cat Gowan, a biosolids project manager in the county's wastewater treatment division. The Seattle-area program, which began in the 1970s, is one of the nation's most ambitious. It includes* ***research partnerships with several universities, along with robust communications efforts: the county branded its biosolids as Loop and created a standalone website that provides in-depth information about the program.***

Each day, a dozen 31-ton Loop-branded trucks deliver biosolids to farmers throughout the region. According to Doug Poole, who uses it on his crop fields, Loop costs about one-half to one-third less than chemical fertilizer.

"Biosolids provide a broader range of plant-beneficial nutrients than farmers can typically provide through synthetic fertilizers alone. "When you're using biosolids, you're not just putting down nitrogen, which is pretty typical," he said. "You get a broad range of nutrients, the full meal deal – you're getting nitrogen, you get phosphorus, you get sulfur, you get a whole raft of micronutrients." Replicating this cocktail with chemical inputs is prohibitively expensive for most farmers, he said. Biosolids also help sequester carbon in the soil, something that's increasingly seen as a promising way to reduce atmospheric greenhouse gas levels.

According to Cat Gowan, a ***willingness to engage with people who are uneasy about biosolids has helped the Loop program flourish****. "Our agricultural project manager, if somebody has a concern about biosolids being applied near their home, he calls them and talks them through it, and they work out a solution," she said. But Gowan and her colleagues put* ***most of their outreach efforts into educating the general public****, most of whom have never heard of using treated sewage as fertilizer, let alone formed strong opinions on the subject.* ***Local gardeners who use the county's biosolids compost product, which receives an extra layer of treatment to make it safe for use in backyards and community gardens, have become particularly enthusiastic brand ambassadors****.*

ECOWATCH: Nov. 22, 2019 10:31AM EST

CASE STUDY: WHAT'S HAPPENING IN HONG KONG?

Veolia has built the world's largest sewage treatment plant in China's mega-city. Called ***T·PARK, the 100% water and energy autonomous facility*** *combines advanced technologies and an ecological approach.*

T·PARK embodies Hong Kong's commitment to recover its waste. It is a beautiful building overlooking Deep Bay in Hong Kong and with its curves it blends into the landscape between the waves and the hills. It's hard to imagine that it's a sludge treatment plant! It processes sludge from eleven sewage treatment plants in a region of over 7 million inhabitants and is ***the largest facility of its kind in the world.***

It is also one of the most technologically advanced. Known as ***"fluidized bed incineration", the heat treatment technology reduces waste by 90%,*** *thereby substantially reducing the volume of sewage sludge to be disposed of. The heat generated during the process is recovered to be transformed into electricity.*

With its 7-hectare site and remarkable architecture, this innovative facility combines the advanced technologies mentioned above with ***ecological leisure facilities and educational activities that highlight the benefits of a circular approach to waste management*** *based on energy recovery.*

70% green spaces and water, the site includes a ***recreational and educational center for the general public with a 2,800 m² interactive exhibition space focusing on sludge treatment; a 9,800 m² landscaped ecological garden, home to all the biodiversity Hong Kong Bay has to offer (grebes, kingfishers, water hens, dragonflies and amphibians); and a theater, food court, and spa with three pools heated thanks to the heat recovered during sludge incineration*** *– not to mention a terrace overlooking Deep Bay and Shenzhen...*
VEOLIA, LIVING CIRCULAR, 29 JUNE 2019

KEY OPPORTUNITIES IDENTIFIED THE INDUSTRY CAN LEVERAGE

Regulatory updates and education to improve industry and community confidence, a resetting of the cost-benefit ratio (through research investment), a continuing political and social environment and focus on phosphate reclamation all present opportunities to drive industry growth.

	POLITICAL/ REGULATORY	ECONOMIC	SOCIETAL	TECHNOLOGY
MORE ABLE TO BE INFLUENCED BY THE BIOSOLIDS INDUSTRY	1. **Clear directives from regulators / guidelines on safe levels of emerging contaminants and health/ environmental impacts** that build industry, government and public confidence. 2. **Increased focus on improvement of wastewater inputs** – community awareness of need to control what they put into the system and increased regulation of trade effluent production to improve the quality of biosolids.	1. **The need for phosphate enrichment of agricultural** land becomes more of a focus for government/ community. 2. **National regulations/ guidelines increase cost-efficiencies** driving uptake. 3. **Seen as a 'easier', cost-effective option compared to alternative use/disposal** (technology driven). 4. **Creation of more private-public partnerships** to boost investment in technological innovation and in socialising the benefits of use.	1. **The public becomes more educated** around benefits of biosolids (e.g. through school education, public demonstrations, 'brand' ambassadors). Some NZ stakeholders believe Australia is ahead on this.	1. **Investment in R&D to:** - Identify **contaminants,** establish safe levels and clarify long-term impacts. - **Develop scaleable, tailorable** processing, energy generation and application processes. - **Standardise quality, improve stability and remove contaminants**. - **Increase delivery of biosolids benefits** e.g. boosting biogas and/or heat production through co-digestion, nutrient enrichment. - Process improvements to **further allay indigenous concerns (in NZ).**
LESS ABLE TO BE INFLUENCED BY THE BIOSOLIDS INDUSTRY/ SITUATION UNCLEAR CURRENTLY	3. **Changes to food and environmental regulations** facilitate greater use of biosolids. 4. **Move towards more strongly enforced government policy that benefits biosolids use –** e.g. carbon and landfill reduction, reuse and recycling and/or renewable energy (including W2E).	5. **Cost of alternatives increases** i.e. chemical fertilisers, landfill disposal, other energy sources / other building materials become more expensive. 6. **The community becomes happier to pay** for beneficial reuse of biosolids (increased amount /bigger share of current bills).	2. Current 'wokeness' about **climate change and waste reduction** keeps gaining momentum.	

KEY THREATS IDENTIFIED THAT MAY IMPACT THE BIOSOLIDS INDUSTRY

At this time the government and societal response to Coronavirus represents the biggest threat in terms of acceptability of and regulation impacting biosolids use. Beyond that, development of a regulatory response for industry that does not address key issues or is too prescriptive is another likely threat.

	POLITICAL/ REGULATORY	ECONOMIC	SOCIETAL	TECHNOLOGY
MORE ABLE TO BE INFLUENCED BY THE BIOSOLIDS INDUSTRY	1. **Regulation becomes too restrictive – or not restrictive enough:** - **Biosolids classed as toxic,** limiting use or making it more expensive to use; - Regulation becomes too **prescriptive to implement**; and/or - **No clear directives around safe levels and impact of emerging contaminants.**	1. **Cost relative to alternative options increases:** - Biosolids product issues are not addressed, increasing risk & handling costs. - Transportability remains an issue. - Processing and application remains costly.	1. **Scare-stories about contaminants or long-term issues raise public concern** (either arising in ANZ or elsewhere). 2. **Too much education** raises public concerns.	1. **No funding** for necessary technological advancements to bring down costs and encourage uptake of processes and application.
LESS ABLE TO BE INFLUENCED BY THE BIOSOLIDS INDUSTRY/ SITUATION UNCLEAR CURRENTLY	➢ **GOVERNMENT RESPONSE TO CORONAVIRUS** – a major unknown that could impact regulation. 2. **Changes to food and environmental regulations that limit biosolids production and use**. This could include health regulations relating to Coronavirus. 3. **Energy policy shifts to focus on options other than W2E** – e.g. nuclear.	2. **The cost of alternative options decreases:** - Alternative **disposal mechanisms** e.g. landfill; - Alternative **products** e.g. fertiliser; - Also includes other options **being 'easier' and more 'tailored'** to the needs of users.	➢ **CORONAVIRUS IMPACT ON ATTITUDES TOWARDS USE OF HUMAN WASTE** – at this point a big unknown.	1. **Phosphorous** becomes able to be synthesised (unlikely). 2. **Decentralisation of sewage treatment** eliminating need for large-scale processing/ disposal solutions (would be some years in the future).

STAKEHOLDER KEY NEEDS BY SEGMENT

R&D to improve product quality and usability, clear directives around emerging contaminants, public education, sharing of international successes and wastewater quality improvements are key themes.

PRODUCERS (n=6)

- **Regulations to increase industry confidence** re emerging contaminants.
- Measures to improve **wastewater quality.**
- **Public education** around phosphate reclamation and beneficial reuse.
- **R&D to develop formats** that overcome existing issues with ease of use, odour, and transportability.

SUPPLIERS (n=3)

- **Regulations to increase industry confidence** re emerging contaminants.
- **R&D (high level processing) to develop new product formats** that overcome existing issues with ease of use and transportability.

INTERMEDIARIES (n=3)

- **Regulations to increase industry confidence** re emerging contaminants.
- **Support for NPD for derived products** – and certification to drive uptake.

END-USERS (n=3)

- **Greater availability**.
- **More investment in R&D** to make it easier to use and more stable.
- **Clear information on safe levels of application** and long-term effects of use.
- **Public education** on its importance as a soil improver and phosphate source.

ENERGY INDUSTRY (n=2)

- **Public education** on use of waste to generate energy.
- **More R&D investment** in biosolids energy generation – scalability and optimisation of product suitability (as it is not yielding enough energy for the effort required).

COMMUNITY (NEIGHBOURS) (n=5)

- **Evidence on the safety of biosolids for use on land** (human and environmental health) from a **leading, independent research institute** (e.g. CSIRO)

REGULATORS (n=6)

- **Research evidence on emerging contaminants** – safe levels and impacts to enable regulations and guidelines to be updated.
- **A more holistic approach to biosolids quality** e.g. control of wastewater inputs.

LOCAL GOVERNMENT (n=4)

- **Research evidence on emerging contaminants** and clear, updated regulations/ guidelines.
- **Investment in shifting government mindset** from viewing biosolids as a waste management issue to resource recovery.

CONSULTANTS (n=3)

- **Regulations to increase industry confidence**.
- **Greater investment in R&D** to overcome issues with stability, transportability and ease of application, and broaden utility.
- **Leveraging of technology** that has worked elsewhere.

PEAK BODIES (n=2)

- **Regulations to increase industry confidence** re emerging contaminants incl. **consistency of policy and regulation** from federal to local level.
- **Stronger regulatory imperative** to drive change.

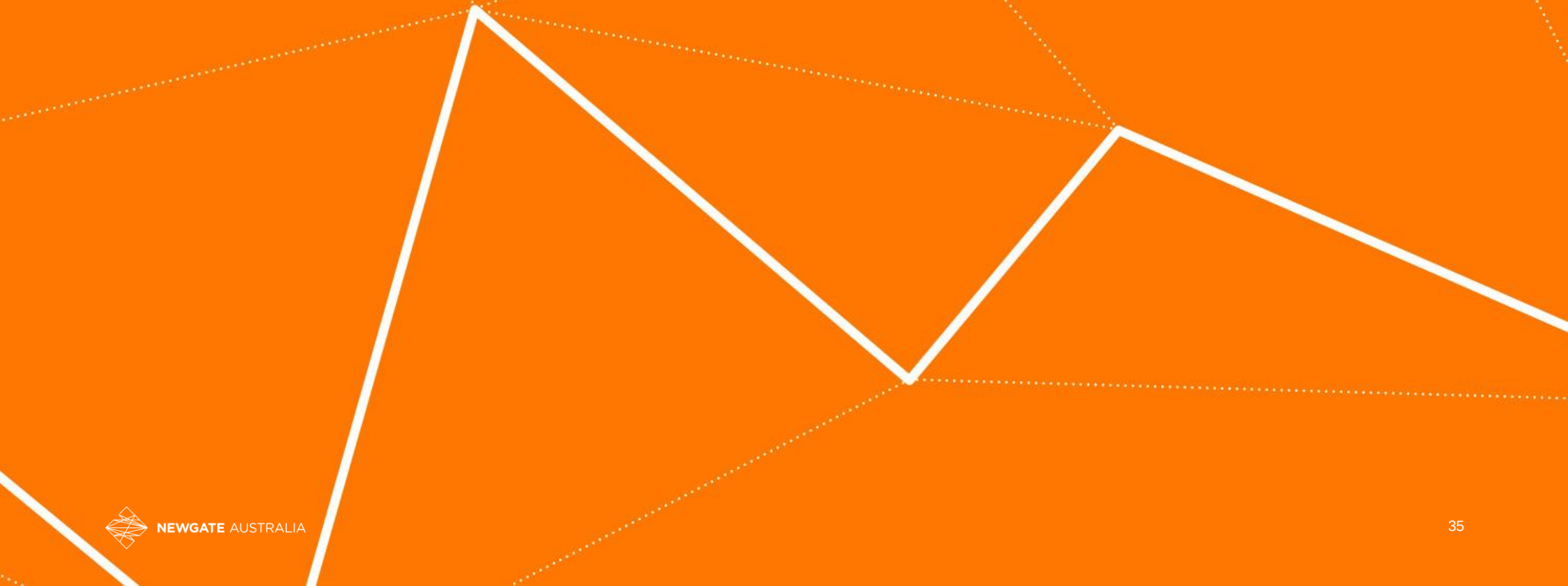
RESEARCHERS (n=5)

- **More funding for R&D** into utility, quality, stability, transportability, efficient processing.
- **Public education** on phosphate reclamation and waste recovery.
- **Leveraging of technology** that has worked elsewhere.

ACTIVITY IDENTIFICATION MATRIX – OPPORTUNITIES FOR THE INDUSTRY

KEY BIOSOLIDS STRENGTHS	BIOSOLIDS WEAKNESSES	OPPORTUNITIES TO LEVERAGE	THREATS TO MITIGATE	TACTICS TO CONSIDER
Source of phosphate **Source of nitrate** **Sequesters carbon** **Water holding capability**	• Variable nutrient levels. • Unknown contaminant levels (or unknown effects of contaminants).	• Phosphate reclamation is an important issue. • Land application is a focus for regulators. • Landfill is becoming less of an option (in Aus). • Growing government and public focus on climate change, carbon emissions reduction and waste reduction/recycling. • Parts of Australia have been (and still are) in drought.	• Phosphate reclamation is not on the public/political agenda as a high priority. • Low public awareness of benefits of biosolids. • Health/environmental issue caused by contaminants. • IMPACT OF CORONAVIRUS ON PUBLIC AND GOVERNMENT PERCEPTION OF USE OF HUMAN WASTE.	• Education of the public and relevant government stakeholders on benefits for phosphate reclamation, carbon sequestration and drought-proofing soil, as well as evidence around reduction of pathogenic burden through processing. • Improvement of wastewater quality through regulation of trade effluent producers and public education to minimise contaminant risks.
Regulations/guidelines govern the industry	• Out-of-date in relation to emerging contaminants – stalling use. • NZ only has guidelines not regulations. • No national regulations – presents challenges for national/multi-state organisations.	• Increased industry, government and public confidence in use of biosolids.	• Biosolids become classified as toxic / seen as too risky to use on land.	• Funding for research to determine contaminant profile, levels and long-term impacts to feed into regulation/ guideline development.
End-user demand growing	• Biosolids industry is product- rather than market-driven. The format is costly to transport and challenging to apply and supply varies.	• Further research to improve product quality, stability, transportability. • Aligning product improvements with market needs.	• Usage stalls due to lack of change on this front.	• Funding for research to improve product quality, stability and transportability, as well as increase processing scalability and efficiency.
Source of energy: • Calorific content of low-grade coal; • Biogas production.	• Needs more investment to increase energy yield (co-digestion etc.).	• Landfill is becoming less of an option (in Aus). • Growing government and public focus on climate change, carbon emissions reduction and waste reduction.	• W2E not supported by public. • Will require large investment to set up. • Not a focus for regulators.	• Funding for research into energy generation – scalability and yield improvement. • Greater sharing of information on ‘successes’ seen in overseas markets.

ANZBP: AWARENESS, KNOWLEDGE & EXPECTATIONS



PERCEPTIONS OF ANZBP

Only a minority of stakeholders were aware of the ANZBP, however, those that were considered it to have a valuable role and tended to view its work in a positive light.

AWARENESS AND KNOWLEDGE

- Only a minority of stakeholders interviewed report that that they have awareness and understanding of the ANZBP.

Highest awareness levels and interaction	Mixed awareness levels and interaction	Lowest awareness levels and interaction
Producers Regulators Researchers	Consultants Intermediaries Government Peak bodies End users	Suppliers Energy industry Public

- To a certain extent, level of awareness and knowledge of the ANZBP depends on how central biosolids are to the role of the stakeholder and/or those they represent. However, there appears to be an opportunity to build greater connection with end-users, some of whom stated a need for more education on health and safety benefits and technical information around contaminant levels and application rates.
- Those with most contact with the ANZBP mentioned delivery of informative email bulletins and industry participation at ANZBP events/conferences, as well as more informal engagement through relationships with specific ANZBP personnel.

PERCEPTIONS OF ANZBP'S PERFORMANCE AND ROLE

- Overall, among those aware **perceptions of the ANZBP are positive**, with stakeholders expressing general support for ANZBP's work and its key objectives as an organisation. In particular, stakeholders feel that ANZBP has a valuable role in:
  - Being a voice of the industry and researchers to government;
  - Identifying and managing interests between the public and private sectors;
  - Providing technical information and advice on biosolids; and
  - Advocating for beneficial reuse of biosolids.
- However one producer noted that it was hard to convince management to pay for membership as there was limited understanding of the value this might bring.

*"I look to ANZBP for **trusted advice on emerging technologies and uses** for biosolids."*
PEAK BODY, AUS

*"They are performing well as an **advocate for beneficial reuse of biosolids**."*
RESEARCHER, AUS

*"**Valuable role as voice of the industry and researchers** - generating open dialogue around industry needs."*
REGULATOR, AUS

*"I feel like they are **trying to do their bit** and I feel their conferences are interesting and is a niche area and industry."*
SUPPLIER, AUS

*"I receive **emails and the electronic advice they send out** – I disseminate this to my members."*
PEAK BODY, AUS

EXPECTATIONS OF THE ANZBP – QUOTABLE QUOTES FROM STAKEHOLDERS

Stakeholders would like to see the ANZBP continue to drive communication and collaboration between stakeholders. However, they also want more investment in public education, more clarity around the remit of the ANZBP and more visibility and activity to drive initiatives forward.

BUILDING NETWORKS, IDENTIFYING OPPORTUNITIES

*"I am broadly aware of ANZBP and think they should continue on with what they are doing in being a **conduit between private and public sector, identifying where community interests lie, where regulators may be headed and where opportunities lie**."*

CONSULTANT, AUS

GAINING CERTAINTY FROM REGULATORS

*"Would appreciate their assistance in **getting certainty from regulators** (in relation to emerging contaminants). I look to ANZBP for trusted advice on emerging technologies/uses for biosolids."*

PEAK BODY , AUS

ADVOCACY & ISSUES MANAGEMENT

*"To continue to be an **identifier of critical issues and acting as a voice for the industry."***

RESEARCHER, AUS

PROVISION OF INFORMATION ACROSS INDUSTRY

*"Having current and up-to-date information, continue the industry events and **keep everyone in the industry in the loop**."*

SUPPLIER, AUS

*"I think what you are doing is great and **when you have gone through the process and gone through the data and got some conclusions it would be useful to come and do roadshows in New Zealand**, especially with regional councils and key Government departments."*

RESEARCHER , NZ

*"It's good to know what is going on in the industry, but **I don't need a formal relationship with them at this stage**."*

GOVERNMENT, AUS

PUBLIC EDUCATION

*"I still need to **know what people in the city think about biosolids**, as at the moment it is more of an agricultural use product, so they should communicate the benefits of biosolids for helping solve how they manage the waste - **they are the one who are paying the water bills after all and could help boost investment.**"*

RESEARCHER, AUS

*"They need to expand their focus to do more on **community communication of the benefits** – social media etc."*

PRODUCER, AUS

MOMENTUM & CLARITY

*"I feel there needs to be a formalisation and a bit of command and control. I think **sometimes ad hoc informal committees are too slow and don't always have the mandate** and states are doing their own thing which can undermine the whole process, so formalisation is needed."*

CONSULTANT, AUS

*"I think they are doing good work overall but would like **clarity on who is driving the work, what work they are currently doing and the impact of this** – that would be great to hear and know about."*

RESEARCHER, AUS

EXPECTATIONS OF ANZBP – ALIGNED WITH ANZBP'S REMIT

Key needs are greater engagement of the public and government, more sharing of international success stories, greater research investment and driving clarity around emerging contaminant levels.

Creation of resources to identify opportunities and manage risks – including commissioning research and managing a repository of biosolids information	Support engagement with stakeholders and provide support services and information – including events (roadshows, conferences)	Support the industry on technical and regulatory policy	Support engagement with the public and other stakeholders, providing advocacy, support services and information	Build an international network of parties interested in the sustainable management of biosolids
While information provided is well-regarded, some stakeholders (particularly in the Research segment) would like the ANZBP to take on a more proactive role in sourcing funding or seeking funding opportunities to further research into biosolids processing, quality and usability.	An area where many feel ANZBP is performing well. Events are generally well received, and information bulletins are considered useful for keeping people in the loop. However, there is interest for more engagement from those sitting slightly outside the immediate industry group, e.g. energy and suppliers. One Regulator mentioned they felt ANZBP should engage more with Regulators regardless of whether they are members.	At this time many stakeholders (particularly those in Producer, Intermediary, Government and End-User segments) would like to see greater clarity of information around safe levels for emerging contaminants and how this translates to guidelines and regulations around application rates.	Public education was mentioned as a key need by most of those interviewed, including: • Showcasing of success stories and demonstration of benefits. • Addressing concerns related to health, safety and environment. • Greater presence on social media and in the media more generally. In addition, some within government would like to see more effort put in to helping convert mindsets from viewing biosolids as waste disposal to one of beneficial reuse (resource reclamation).	This work was mentioned by very few stakeholders and awareness of international efforts with biosolids is generally low. Greater promotion of successes from other countries would be well-received.

MATCHING ANZBP ROLE AND KEY STAKEHOLDER NEEDS TO MACRO OPPORTUNITIES IDENTIFIED

ANZBP ROLE / MACRO OPPORTUNTIIES	Creation of resources to identify opportunities and manage risks – including commissioning research and managing a repository of biosolids information	Support engagement with stakeholders and provide support services and information – including events (roadshows, conferences)	Support the industry on technical and regulatory policy	Support engagement with the public and other stakeholders, providing advocacy, support services and information	Build an international network of parties interested in the sustainable management of biosolids
Education of the public and other relevant stakeholders on the benefits of biosolids for phosphate reclamation, carbon sequestration and 'drought-proofing' of soil				A key need mentioned by stakeholders – a need to raise the profile of biosolids in the minds of the public and get it on the government agenda	
Improvement of wastewater quality to minimise contaminant risks (through regulation and public education)	A potential initiative that will help improve industry and end-user confidence			Public education on the circular economy in this respect is in line with societal norms	
Funding for research into contaminant levels and impacts, product quality and usability, and energy generation	Activities to identify opportunities to source funding and match investors with researchers		Robust regulations around emerging contaminants are needed to build industry and end-user confidence		
Greater sharing of information on successes seen in overseas markets		A useful activity to build industry understanding and buy-in			More sharing of this information is needed across the industry and with the public

APPENDIX

PRODUCTION AND USE ACROSS AUSTRALIAN STATES/TERRITORIES

SUMMARY OF ANZBP REPORT: BIOSOLIDS PRODUCTION IN AUSTRALIA, OCTOBER 2019

ANNUAL PRODUCTION	2010	2019
Tonnes of dry solid	300,000	371,000
% beneficial reuse	80% (94% in 2017)	91%

KEY USES	2010	2019
Agriculture	55% (75% in 2017)	67%
Land rehabilitation	11%	16%
Landscaping (composting)		8%

STABILISATION GRADE	2019
A	48%
B	38%

CONTAMINATION GRADE	2019
B	58%
C	34%

PREPARATION	2019
Anaerobic digestion	41%
Lagoon storage	15%
Nothing	10%
Aerobic digestion	9%
Incineration, thermal hydrol.	Both 5%

DRYING	2019
Conventional centrifuge	34%
Drying beds	25%
Belt filter press	19%
High solids centrifuge	17%

WA/NT
(11% of production)

Main uses:
- Agriculture = 59%
- Stockpiled = 17%
- Landfill = 12%

Main stabilisation grade:
- B = 59%

Main contamination grade:
- B = 71%

Main preparation:
- Aerobic digestion = 39%
- Lime stabilisation = 20%

Main drying:
- Conventional cent.. = 71%

SA
(13% of production)

Main uses:
- Agriculture = 98%

Main stabilisation grade:
- A = 87%

Main contamination grade:
- B = 91%

Main preparation:
- Anaerobic dig. = 87%

Main drying:
- Conventional cent.. = 88%

State differences

Vic
(29% of production)

Main uses:
- Agriculture = 61%
- Land rehab = 31%

Main stabilisation grade:
- A = 92%

Main contamination grade:
- B = 95%

Main preparation:
- Anaerobic dig. = 31%
- Lagoon storage = 43%

Main drying:
- Beds/lagoons = 74%

QLD
(19% of production)

Main uses:
- Agriculture = 92%
- Land rehab = 8%

Main stabilisation grade:
- B = 40%
- Unstabilised = 35%

Main contamination grade:
- C = 86%

Main preparation:
- Anaerobic dig. = 33%
- None = 29%
- Thermal hyd. = 25%

Main drying:
- Belt filter press = 47%
- High solids cent = 34%

NSW/ACT
(26% of production)

Main uses:
- Agriculture = 48%
- Land rehab = 22%
- Composting = 17%

Main stabilisation grade:
- B = 67%

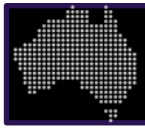
Main contamination grade:
- C = 64%

Main preparation:
- Anaerobic dig. = 38%
- Aerobic dig. = 21%
- Incineration = 19%

Main drying:
- Conventional cent = 39%
- High solids cent = 32%

KEY FINDINGS FROM THE 2010 STAKEHOLDER STUDY - SUMMARY

Key strengths were soil and reuse benefits, as well as benefits over chemical fertiliser, while key weaknesses were unknown levels of nutrients and contaminant impacts, poor public perception, cost relative to other options and issues with regulation.



AUSTRALIA

Key strengths:

- **Soil improvement** benefits:
  - Nutrient return to soil (**phosphate** in particular)
  - **Water** holding benefits.
- Its utility as the **beneficial reuse** of waste.
- **Potential cost and product benefits over chemical fertiliser** (particularly around its lower rate of leaching into groundwater) were also mentioned.

Key weaknesses:

- The variable (and unknown) **nutrient and contaminant** levels.
- Lack of data on **long-term health and environmental** impacts.
- The **high cost of processing, transporting and applying** biosolids (particularly as they are classified as toxic waste in handling and have limitations on where and how they can be applied to land).
- **Odour, pest issues when spreading**, **fire risk when drying** and **poor public perceptions**.
- **Complex regulations that were inconsistent** between states.

NEW ZEALAND

Similar strengths were mentioned in New Zealand, but there were some differences:

- The **decline in phosphate stocks** increasing interest in biosolids as a phosphate source appeared to be more of a focus in NZ.
- The Ministry of the Environment had **set targets** in 2002 for reducing sewage and leachate in landfill.

In terms of weaknesses, while the same issues were mentioned, there were some differences:

- Biosolids were mentioned as **more expensive to produce compared to Australia** (due to drying times).
- **Landfill** appeared to be a cheaper option for disposal.
- The high clay content soils meant that **water-holding benefits of biosolids** was less of an advantage in NZ. This difference in soil composition meant higher risk of run-off into water courses.
- There appeared to be a **greater public sensitivity** around biosolids land application than in Australia. This was compounded by cultural sensitivity among the Maori community.

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