Australian Wool Innovation Limited

FINAL REPORT

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Merino Lifetime Productivity Project

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EXECUTIVE SUMMARY

Commencing in 2015, the $13 million Merino Lifetime Productivity (MLP) Project is a collaborative industry partnership between Australian Wool Innovation (AWI), the Australian Merino Sire Evaluation Association (AMSEA), nominating stud breeders, site hosts, and research organisations. The project was established to address longstanding industry questions around lifetime productivity in Merino ewes, particularly focusing on how early-age selection methods-such as visual classing, breeding values, indexes, and new tools such as genomics-can more reliably predict whole-of-life performance.

Five geographically and environmentally diverse sites, Balmoral (VIC), Pingelly (WA), MerinoLink (NSW), Macquarie (NSW), and New England (NSW), formed the foundation of the project.

The primary objective of the AMSEA-led component of the MLP Project was to generate an unprecedented, robust dataset tracking the lifetime performance of over 5,700 F1 Merino ewes, the daughters of 134 industry sires. These ewes were retained in the project regardless of their visual or measured performance, with culling conducted solely for welfare reasons. Each ewe was tracked across four to five annual joinings and six to seven annual shearings, allowing for comprehensive, unbiased lifetime evaluation.

Throughout the study, MLP ewes underwent repeated assessments for a full suite of traits each year, including objective measurements of wool quantity and quality, growth and carcase attributes, disease resistance indicators, reproduction records, and detailed visual and classer gradings. The project collected 2 million data points, providing a unique opportunity to examine lifetime productivity in Merinos across a range of genotypes and conditions. The subsequent genetic and economic analyses, validation, and interpretation of this rich dataset are being delivered through separate ongoing AWI funded projects.

Key industry questions underpinning the project included:

- How accurately can lifetime productivity be predicted from young age measurements, breeding values, and visual classing?
- What are the relationships and trade-offs between wool, reproduction, carcase, welfare, disease resistance, and survival traits over a ewe's lifetime?
- Can new or improved tools be developed to better identify animals as young as possible that are high performing for life?

The MLP Project provided a robust platform for a wide range of "add-on" research projects that extended the value and impact of the core initiative. These add-on projects, conducted in partnership with site hosts and affiliated organisations, targeted specific research areas beyond the core objectives of the MLP, including feed efficiency, methane production, meat eating quality, neonatal survival, disease resistance (such as footrot), resilience, foetal age scanning, and udder conformation. Proposals for add-on projects were rigorously assessed by AMSEA, AWI, and the MLP Executive to ensure alignment with MLP objectives and to safeguard the integrity of the core dataset. All MLP sites hosted one or more add-on projects, which frequently utilised MLP ewes, wethers, and their progeny, contributing complementary data and insights that have further enhanced industry knowledge, supported new breeding values, and fostered ongoing innovation within the Australian Merino industry.

MLP Project Unique Contributions and Achievements

- All ewes were kept in the project for their entire lifetime, regardless of classing status, with the only exceptions being animals removed for welfare reasons. Any ewes culled for welfare were recorded to ensure they did not affect mortality analyses.
- The project encompassed diverse breeding philosophies and genotypes, ensuring findings are relevant across the full spectrum of Merino types.
- Industry played a key role in the project's design, conduct, oversight, and review through AMSEA, Site Committees, and the Industry Steering Committee.
- Rigorous protocols, routine data validation, and cross-institutional collaboration set a new benchmark for industry research.

Early Analysis Insights and Interim Results

While the comprehensive analysis of the full MLP dataset is still underway, the project has already delivered a range of valuable early insights and interim results to the wool industry through the core and “add on projects”. Preliminary findings have been communicated through project newsletters, "Beyond the Bale" articles, conference presentations, industry presentations, and field days.

General Insights from the core and add on projects:

- **Reproduction Strategies:** A "one-size-fits-all" culling approach for optimising reproduction in commercial flocks is unlikely to be effective. Although the very high weaning rates at all sites are likely to have impacted the outcomes to date. More nuanced selection based on repeat and lifetime records is warranted.
- **Lifetime Wool Production:** The importance of including at least one late hogget (18 months or older) or adult fleece record in a measurement program for predicting lifetime wool production has been reaffirmed.
    - One-year-old assessments are moderately correlated with lifetime productivity, making them valuable for rams as they are often the first progeny test results received.
    - Two-year-old assessments can be recorded on retained sires and ewes
- **Sire Variability:** Considerable variation exists in sire mating success rates among naturally mated ram teams. Instances where twins were sired by different sires (i.e., twins with different sires known as split paternity) ranged from 32% to 63% of twins were sired by two different sires.
- **Udder Traits:** Udder traits are heritable and are closely related to lamb survival and weaning weights. New udder and teat traits have been developed using New England MLP F1 ewe data, showing visually assessed udder depth, teat size, and teat placement are low to moderately heritable and highly correlated between lambing and weaning for ewes rearing lambs. These traits now appear in Version 4 of the Visual Sheep Scores guide published by AWI and MLA.
- **Eating Quality:** Selecting for eating quality (IMF and Shear Force) appears to have minimal impact on key Merino production traits.
- **Ewe Survival:** The heritability of ewe survival (to four-year-old) is low (0.06) but variable. There is a moderate, favourable genetic relationship (-0.4) between improved survival and lower wrinkle (i.e.,

genetically plainer ewes are more likely to have higher survival rates). This outcome will be updated to include ewe data out to six and seven years of age.

- **Skin Pigmentation:** Skin pigmentation recorded at marking is highly heritable and highly related to lifetime skin pigmentation/skin pigmentation recorded at later age stages.
- **Fleece Yield & Weight:**
    - Yields collected at the mid-side reliably predict differences in fleece weight, even under drought conditions, where dust penetration is high.
    - Comparison of yields taken from mid-side, pin-bone, or whole fleece core samples showed that all can be used to compare ewes and sires for clean fleece weight (CFW) without significant re-ranking.
    - Whole fleece testing at the MerinoLink site showed that longer staple length at any fleece weight results in slightly higher yield.
- **Foetal Age Prediction:** Trained pregnancy scan operators can reliably predict foetal age.
- **Foot Paring:** At the Macquarie site (2017 drop), foot paring did not significantly influence ewe performance and therefore did not bias sire Flock Breeding Values for production.
- **Sire Ranking Changes:** Early MLP results show that sire rankings for traits like greasy fleece weight (GFW) and classer grade are changing as their ewe progeny age, demonstrating the value of collecting repeat records at late hogget (18 months or older) or adult age stage.
- **Reproduction Breeding Value Accuracy:** The accuracy of Weaning Rate (WR) breeding values improves with the number of a sire's progeny evaluated and the number of repeat reproduction records. Genomics can enhance early-life reproduction genetic estimates, achieving high accuracy with fewer progeny evaluations and reproduction events.
- **Genomics for all other traits:** Genomic enhanced mid-parent values improve the accuracy of each individual trait prior to the first measurement, thus improving the correlations of early in life breeding values with lifetime productivity.
- **Resilience:** Immune competence is lowly unfavourably correlated with growth rate to yearling age and lowly favourably correlated with worm egg count and dags. There is no significant correlation between immune competence and fleece weight, fibre diameter, fat, or muscle.

Insights from Classing:

- **Value of Classing:** Data from sheep classing is re-confirming the value of classing as a selection tool. Visual classing is highly effective when breeding objectives focus on traits that can be assessed well visually. However, it has limitations when breeding objectives are more complicated and have a focus on non-visual traits such as reducing fibre diameter, worm resistance, eye muscle depth, staple strength, eating quality, and weaning rate.
- **Alignment with Indexes:** While there is generally good alignment between visual classing (tops, flocks, culls) and the Merino Production Plus index (when assessed at two years of age and again at seven years of age), outliers exist. Top indexing animals can have poor conformation, and top visually

assessed animals can have low indexes. A combination of approaches is often best. How to best combine visual and objective information will be a focus of the extension phase.

These early insights are paving the way for the comprehensive analysis phase of the MLP Project, which will further refine understanding and enhance breeding and selection strategies for the Merino industry.

Legacy and Future Directions

The project has now transitioned to its core analysis, peer review, and extension phase. The comprehensive dataset will support robust genetic and economic analyses, enabling evidence-based improvements in Merino breeding, selection, and management for years to come. The MLP Project leaves a legacy of improved industry capacity, collaborative frameworks, and a unique resource for ongoing research and innovation.

Key Messages

- **Data Quality and Depth:** The MLP Project's lifetime dataset is unparalleled within the Merino industry for its breadth, depth, and quality of a full suite of visual, objective, and classing assessments across diverse environments and genetics.
- **Add-On R&D projects:** The MLP Project provided a platform to investigate significant research areas such as feed efficiency, methane production, meat eating quality, neonatal survival, disease resistance (including footrot), resilience, foetal age scanning, and udder conformation.
- **Industry Impact:** The project has already enhanced national genetic evaluations, delivered new breeding values, and informed selection approaches for Merino producers.
    - High and low performers were observed across all breeding philosophies and Merino types, demonstrating that no breeding philosophy or Merino type inherently guarantees high or low lifetime productivity.
    - The data have contributed substantially to the Merino genomics reference population, supporting more accurate breeding value estimates.
    - Results are showing that classing is an effective method for selecting breeding objectives related to wool production and growth. Its effectiveness decreases when hard to visually assess traits like disease resistance and reproduction efficiency are included.
- **Collaboration and Engagement:** The MLP's inclusive approach made a significant impact. Over 2,100 participants attended field days in person, and at least 1,470 joined online. Regular newsletters, podcasts, and events strengthened trust in the project activities, with nearly 12,000 MLP reports downloaded by industry stakeholders.
- **Resilience and Adaptability:** The project overcame significant challenges, including droughts and COVID-19, through proactive risk management, protocol flexibility, and adaptive communication strategies.
- **Legacy and Future Use:** The MLP dataset will enable ongoing research, support the development of new genetic evaluation models, and provide a platform for future industry innovation.
- **Industry Initiative:** The MLP Project was initiated, designed, and overseen by woolgrowers, ensuring strong industry involvement at every stage. By building on the initial two-year AMSEA sire evaluation

phase, the MLP Project significantly increased woolgrower participation and reduced overall project costs, making it a truly collaborative and cost-effective industry initiative.

The success of the MLP Project reflects the dedication, expertise, and collaboration of many contributors. AMSEA gratefully acknowledges the site managers and hosts—Tuloona Pastoral, Moses & Son, Murdoch University/University of Western Australia, NSW Department of Primary Industries, and CSIRO—for their unwavering support, provision of land, resources, and management through diverse and challenging conditions. Our sincere thanks extend to the site committees for their strategic guidance and industry engagement, the sheep classers for their professional and consistent assessments, and all supporting organisations—including the analysis and reporting teams, and the Industry Steering Committee—whose collective commitment and collaboration ensured the delivery and impact of this important project.

INTRODUCTION

The Merino Lifetime Productivity (MLP) Project stands as one of the most comprehensive and inclusive genetic research initiatives undertaken in the Australian wool industry. Launched in 2015 and running for nearly a decade, the project was established in response to critical questions facing Merino breeders and woolgrowers: After several decades of selecting faster maturing animals at younger and younger ages, can we more accurately select for lifetime productivity in Merino sheep at these young ages? What genetic, environmental, and management factors contribute to superior assessments of whole-of-life performance in wool, meat, lamb, and relatively new welfare traits? And how can industry selection strategies be refined to ensure greater profitability and sustainability for woolgrowers into the future?

Australian Wool Innovation (AWI), in partnership with the Australian Merino Sire Evaluation Association (AMSEA), nominating stud Merino breeders, and site hosts, invested over $8 million (with an additional $5 million from partners) into this decade-long data collection collaboration.

The focus of the AMSEA investment has been the establishment and stewardship of this comprehensive project database-ensuring rigorous and standardised, high-quality data collection, management, and reporting across all sites. The subsequent genetic and economic analyses, validation, and interpretation of this rich dataset are being delivered through separate ongoing AWI funded projects.

Once analysed, the project aims to fill key data gaps and provide robust evidence to support breeding decisions that drive whole-of-life productivity in Merinos across a range of Merino types and breeding objectives.

Project Design and Scope

The MLP Project was structured around five geographically and environmentally diverse sire evaluation sites across Australia: Balmoral (VIC), MerinoLink (Temora, NSW), Pingelly (WA), Macquarie (Trangie, NSW), and New England (NSW). Each site was hosted in partnership with key industry collaborators (Balmoral Breeders, Moses and Son, MerinoLink, Murdoch University, the University of WA, NSW DPI, and CSIRO) and managed by dedicated site managers and committees.

The core of the project involved:

- Evaluating the lifetime performance of more than 5,700 first-generation (F1) Merino ewes, the daughters of 134 industry sires, across four to five annual joinings and six to seven shearings.
- Collecting a full suite of annual assessments, including visual trait scoring, professional classer gradings, objective measurements of wool, growth, carcase, disease resistance, welfare reproduction, and survival traits.
- Generating a comprehensive dataset of close to 2 million data points, capturing the relationships between genetics, environment, management, and lifetime productivity. The genetic and economic analysis, peer review, and communication of outcomes are part of independently funded future projects.
- Routine annual site and drop MLP Reports, detailing sire results. These reports ensured that sire outcomes were reported annually by site and drop throughout the project and were complemented by extensive communication outputs, including newsletters, annual field days, conference presentations, and updates in industry publications.

The project's scale and structure enabled numerous "Add-On" research projects, including work on resilience, feed efficiency, feed intake methane emissions, meat eating quality, footrot resistance, udder conformation, and more, leveraging the lifetime data and genetic diversity.

Objectives and Key Questions

The project sought to address several pivotal industry questions:

- **Selection at a young age:** How can breeders better reliably predict lifetime performance using early-age measurements, breeding values (including genomically enhanced values), and visual classing - or a combination of these methods?
- **Trait interactions:** How do selection pressures on traits such as wool quality, growth, reproduction, carcase, welfare, and indexes impact overall lifetime productivity?
- **Diversity of performance:** Why do some animals excel consistently across years while others decline, and how can this be predicted and managed? Does the current system allow sufficiently for different maturity patterns between weaning and two-year-old performance?
- **Tool development:** Are there new or improved tools and strategies that can better identify superior lifetime performers in the Merino flock at younger ages?

Unique Contribution to Industry

The MLP Project's scale and design make it unique:

- **Lifetime data:** Unlike traditional sire evaluation (which typically focuses on up to two-year-old data), or on farm data (which is increasingly being collected at post weaning ages (7-10 months)), the MLP Project followed ewes throughout their productive lives, capturing repeat records for reproduction, wool, carcase, welfare health, and survival traits. Uniquely, all ewes were retained in the project for their full productive life (except for welfare culls), regardless of being at any time classed as culls or tops. This allows the project to measure the real lifetime impact of early selection and culling decisions.
- **Diversity:** The involvement of industry sires from all breeding philosophies-including leaders in different wool, skin, and carcase traits-ensures that findings are relevant across the full spectrum of Merino types and breeding objectives.
- **Data Quality and Collaboration:** Rigorous protocols, multi-level data checking, and collaboration with genetic analysis teams (e.g., AGBU, CSIRO, Murdoch, NSW DPI) and industry groups (e.g., AASMB, NSW SMBA, MerinoLink, Moses and Son, Balmoral Breeders) have produced an unparalleled resource for both research purposes and practical breeding.

MLP Project Timeline

This project has been responsible for the creation of the MLP database, with detailed analysis and publication to be conducted under separate projects.

Site	F1 Ewe Drop at Each Site						Last Lambing at Each Site				
Balmoral	✔	✔		A2			✔			Analysis	Publication
Pingelly		✔	✔		A2			✔			
MerinoLink		✔	✔		A2			✔			
Macquarie			✔	✔		A2			✔		
New England			✔	✔		A2			✔		
Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025

Industry Impact and Legacy

Even before final analysis, the MLP Project has already delivered or contributed to:

- Improved reference populations for national genetic evaluations (e.g., MERINOSELECT), leading to more accurate Australian Sheep Breeding Values (ASBVs) for both existing and new traits, including lifetime reproduction, wool, and health and indexes.
- Generated evidence that incorporating at least one hogget or adult fleece weight record into measurement programs significantly improves the accuracy of predicting an animal's lifetime fleece production performance.
- Demonstrated that classing is aligned with indexes that focus on increasing wool production.
- The development of new breeding values for traits such as weaning rate, conception, litter size, ewe rearing ability, flystrike and methane production, enabling more targeted genetic improvement.
- Enhanced collaboration, knowledge sharing, and practice change within the Merino industry, with site field days and events reaching thousands of breeders, researchers, and advisors.

With the completion of data collection in July 2024, the MLP Project now transitions to its analysis and peer review phase. The resulting insights are set to enhance Merino breeding and selection, supporting the next generation of decisions for improved productivity, profitability, and sustainability.

Introduction to the Sites

Balmoral - March 2015 to February 2022

The Balmoral Sire Evaluation Group managed the MLP Project site at "Tuloona" in Harrow, hosted by the Craig family. Tuloona, a 42,000 DSE commercial farming business with cropping enterprises, that ceased mulesing in 2007. The area received approximately 470 mm of predominantly winter rainfall annually.

The annual management program involved February shearing, March joining and August lambing's. Foundation ewes were sourced from Tuloona's commercial flock, which were transitioning from a traditional ultra-fine wool focus to include improved reproduction, early growth, flystrike resistance, and increased wool production.

The site's classing objective prioritised:

- Strong productivity and growth.
- Sound conformation.
- Heavy fine wool fleeces with good character, colour, and nourishment, suitable for Western Victorian conditions.

The site had intended to evaluate 24 sires per year; however, owing to a semen mix-up at the collection centre, 25 sires were evaluated in each year. Three sires were used in both 2015 and 2016 to provide genetic linkage across the years, with one sire used in both years to address the semen mix-up issue.

Tom Silcock, a local stud breeder, was the initial site manager and chairman. Mark Bunge became the Balmoral chairman in October 2017.

MerinoLink - December 2015 to October 2022

The MerinoLink site was based at "The Vale," near Temora, NSW, and was operated by Moses and Son, Bluechip Livestock, and MerinoLink. "The Vale" is a commercial farming enterprise owned by Moses and Son, with sheep grazing on improved pastures receiving approximately 500 mm of winter-effective rainfall.

The annual management program involved December joinings with initially March (2017-2019) shearings that transitioned to October shearings in late 2019 with a June lambing.

The MerinoLink ewe base consisted of a mix of five ewe sources, evenly allocated to each sire. Specifically, the ewes are sourced from:

- Commercial Pooginook blood ewes
- Pooginook stud ewes
- Bundilla stud ewes
- Centre Plus stud ewes
- Ewes from a previous Bluechip sire evaluation program

The site's classing objective prioritised:

- Growth rates to achieve minimum joining weights at 18 months.
- Sound conformation.
- High-quality wool with long staple length, soft handling, and high fleece weight.

The site evaluated 13 sires in each drop, with one of those sires joined in each drop to provide linkage across years.

The site was initially managed by Sally Martin between 2015 and 2019 before Lexi Cesnik (Moses and Son) took on the role. Stud breeder Matthew Coddington was the initial chair of the MerinoLink site committee before commercial grower Rich Keniry took on the role in March 2016.

Pingelly - January 2016 to December 2022

The Pingelly site was part of the University of Western Australia's (UWA) mixed enterprise research facility, "Ridgefield," a 1,600-hectare farm situated south-east of Perth near Pingelly, WA. The farm receives an average of 425mm of winter-dominant rainfall annually. It was a non-mulesing site where sheep were managed at a stocking rate of 10 DSE/ha.

The annual management program included February joinings with March shearings that later moved to December with a June lambing. The ewe base consisted of large-framed, plain-bodied, highly fertile animals with moderate wool production. Ewes were selected from Ridgefield's commercial and Maternal Efficiency Flocks. Over five years, there had been an increased emphasis on genetic improvements in fat, growth, and muscling while maintaining wool cut and micron. The flock averaged 5 kg of 19µm wool and achieved weaning percentages of 100-115%.

The site's classing objective prioritised:

- Good conformation and constitution for ease of care.
- Medium to large frames.
- Bright, white, stylish wool free from colour and water faults.
- A balanced focus on wool production and body size for dual income streams.

The flock was managed through a partnership between Murdoch University, UWA, and the Federation of Performance Breeders Sire Evaluation Group.

The site evaluated 15 sires in each drop, with one of those sires joined in each drop to provide linkage across years.

The site was initially managed by Beth Panagoni from DAFWA before Dr Bronwyn Clark commenced in the role in late 2016. Stud breeder Brett Jones chaired the Pingelly site committee for the duration of the trial.

Macquarie - December 2016 to October 2023

The Macquarie site operated at the Trangie Agricultural Research Centre (TARC), 7 km north-west of Trangie in central western NSW. Pastures comprised native perennial grasses, herbage, and introduced species, receiving 500 mm of non-seasonal rainfall annually.

The annual management program included late December joinings and November shearing with a May/June lambing. The base ewes for the site were sourced from commercial clients of two bloodlines from the central west of New South Wales. One ewe base was sourced from large-framed, heavy-cutting Merino flocks that averaged between 20.5 and 21.5µm, whilst the other was sourced from all-purpose Merino flocks which averaged between 18.0 and 18.5µm. Ewes from these two bloodlines were equally allocated to each sire.

The site's classing objective prioritised:

- Commercially viable livestock under the western slopes and plains of NSW.
- Low maintenance with sound conformation.
- High fleece weight relative to medium wool type.
- Well-suited for dual purposes, including as first cross or prime lamb dams.

The site had intended to evaluate 16 sires in both drops; however, semen failure saw just 15 sires evaluated in the 2017 drop. One sire was joined in both the 2017 and 2018 drops to provide linkage across years.

The site was managed by NSW DPI staff with Dr Sue Hatcher managing from 2016 to mid-2017, followed by Dr Kathryn Egerton Warburton from mid-2017 to mid-2021, before Tracie Bird Gardiner took on the role from 2021 through to the end of 2023. Stud breeder Matthew Coddington was the initial site committee chair between 2016 and 2019, commercial breeder David Greig took on the role between 2019 and 2021, with Matthew Coddington then resuming the role.

New England - February 2017 to July 2024

The New England site operated at CSIRO's "Chiswick" property, located between Uralla and Armidale along the New England Highway. The property, a renowned agricultural research station, supported improved pastures with a carrying capacity of 9 DSE/ha, receiving approximately 800 mm of summer-dominant rainfall.

The flock, non-mulesed, followed an annual management program with April joinings and July shearings with August/September lambing. The ewe base comprised superfine/fine wool types sourced from the CSIRO station ewes (that were the genetics of local performance-recorded studs), with one third of the flock sourced from the AWI/CSIRO breech strike genetics flock.

The site's classing objective prioritised:

- Productive superfine fleeces (14-17.5 µm).
- Structurally sound and adaptable to New England's conditions.
- Excellent wool colour, character, and resistance to fleece rot.

The site was managed by CSIRO in collaboration with the New England Merino Sire Evaluation Association.

The site evaluated 15 sires in each drop with two of those sires joined in each drop to provide linkage across years.

Dr Jen Smith of CSIRO was the site manager for the duration of the project. The site committee was initially chaired by Duncan Lance between 2016 and 2021 before Todd Whillock took on the role in 2021.

Balmoral Site Overview – F1 Ewe – Annual Shearing, Joining and Lambing Date – Age and Wool Growth at Shearing Assessment – Average Drop Raw Clean Fleece Weight (CFW), Micron and Weaning Rate

Year	Stage (Reported)	Shearing Date	Age (month/ year)	Wool Growth (month)	Joining Date	Pre Joining CS	Lambing Date	Pre Lambing CS	CFW (kg)	Micron (µm)	Weaning Rate %
2015	P	2016-04-11	7.8m	8					1.2	15.2	
	A2	2017-03-31	19.4m	12	2017-03-31	2.9	2017-08-28	3.3	3.3	16.3	85
	A3	2018-02-23	2.6y	11	2018-03-19	3.1	2018-08-16	3.2	3.9	17.7	91
	A4	2019-02-14	3.6y	12	2019-03-17	3.0	2019-08-14	3.3	3.8	16.8	101
	A5	2020-02-24	4.6y	12	2020-03-13	3.4	2020-08-10	3.7	3.4	16.6	113
	A6	2021-02-22	5.6y	12	2021-03-12	3.4	2021-08-09	3.4	3.6	17.0	110
	A7	2022-02-21	6.6y	12					3.0	16.5	
2016	P	2017-05-08	8.4m	8					1.3	15.5	
	A2	2018-02-21	18.0m	10	2018-03-19	2.9	2018-08-16	3.0	2.8	17.1	73
	A3	2019-02-23	2.5y	11	2019-03-17	2.9	2019-08-14	3.2	3.6	16.9	95
	A4	2020-02-25	3.6y	12	2020-03-13	3.2	2020-08-10	3.5	3.5	16.7	113
	A5	2021-02-22	4.6y	12	2021-03-12	3.2	2021-08-09	3.4	3.6	17.2	111
	A6	2022-02-22	5.6y	12					3.1	16.8	

MerinoLink Site Overview – F1 Ewe – Annual Shearing, Joining and Lambing Date – Age and Wool Growth at Shearing Assessment – Average Drop Raw Clean Fleece Weight (CFW), Micron and Weaning Rate

Year	Stage (Reported)	Shearing Date	Age (month/ year)	Wool Growth (month)	Joining Date	Pre Joining CS	Lambing Date	Pre Lambing CS	CFW (kg)	Micron (µm)	Weaning Rate %
2016	Y	2017-03-28	10.0m	10					2.0	16.0	
	A2	2018-03-21	21.6m	12	21/12/2017	3.6	2018-05-20	3.9	5.2	18.9	101
	A3	2019-03-26	2.9y	12	20/12/2018	3.6	19/05/2019	3.5	5.4	18.7	99
	A3	2019-10-22	3.4y	7					2.3	17.9	
	A4	2020-10-21	4.5y	12	23/12/2019	3.4	2020-05-21	3.0	3.6	17.8	109
	A5	2021-10-27	5.5y	12	23/12/2020	3.4	2021-05-22	3.2	4.0	18.4	103
	A6	2022-10-18	6.5y	12	5/01/2022	3.3	2022-06-04	3.1	4.0	18.8	107
2017	Y	2018-03-23	9.5m	9.5					2.4	16.9	
	A2	2019-03-25	21.5m	12.5	20/12/2018	3.0	19/05/2019	3.1	5.2	17.9	71
	A2	2019-10-22	2.4y	7					3.2	19.0	
	A3	2020-10-21	3.4y	12	23/12/2019	3.4	2020-05-21	3.0	4.0	17.9	104
	A4	2021-10-27	4.5y	12	23/12/2020	3.5	2021-05-22	3.4	4.2	18.3	103
	A5	2022-10-18	5.4y	12	5/01/2022	3.4	2022-06-04	3.2	4.4	18.8	117

Pingelly Site Overview – F1 Ewe – Annual Shearing, Joining and Lambing Date – Age and Wool Growth at Shearing Assessment – Average Drop Raw Clean Fleece Weight (CFW), Micron and Weaning Rate

Year	Stage (Reported)	Shearing Date	Age (month/ year)	Wool Growth (month)	Joining Date	Pre Joining CS	Lambing Date	Pre Lambing CS	CFW (kg)	Micron (µm)	Weaning Rate %
2016	P	2017-04-12	9.6m	9.5					1.9	17.0	
	A2	2018-04-17	22.0m	12	3/01/2018	3.0	2/06/2018	3.1	3.8	18.3	96
	A2	2018-12-03	2.5y	7.5					2.9	20.0	
	A3	2019-12-05	3.5y	12	31/01/2019	3.3	2019-06-30	3.0	3.8	18.8	115
	A4	2020-12-08	4.5y	12	3/02/2020	3.0	2020-07-02	3.1	3.6	19.2	129
	A5	2021-12-02	5.5y	12	1/02/2021	3.1	2021-07-01	3.2	3.6	19.4	124
	A6	2022-12-12	6.5y	12	1/02/2022	2.9	2022-07-01	2.7	3.4	19.1	132
2017	P	2018-04-18	9.6m	9.6					2.1	16.8	
	H	2018-12-03	17.0m	7.5					2.7	19.0	
	A2	2019-12-05	2.5y	12	31/01/2019	3.2	2019-06-30	3.0	3.7	18.1	95
	A3	2020-12-09	3.5y	12	3/02/2020	2.7	2020-07-02	3.1	3.8	18.8	107
	A4	2021-12-03	4.5y	12	1/02/2021	2.9	2021-07-01	3.0	3.5	18.7	118
	A5	2022-12-12	5.5y	12	1/02/2022	2.7	2022-07-01	2.8	3.6	19.0	117

Macquarie Site Overview – F1 Ewe – Annual Shearing, Joining and Lambing Date – Age and Wool Growth at Shearing Assessment – Average Drop Raw Clean Fleece Weight (CFW), Micron and Weaning Rate

Year	Stage (Reported)	Shearing Date	Age (month/ year)	Wool Growth (month)	Joining Date	Pre Joining CS	Lambing Date	Pre Lambing CS	CFW (kg)	Micron (µm)	Weaning Rate %
2017	P	2018-02-19	8.8m	9					2.4	17.8	
	H	2018-10-17	16.7m	8					3.1	19.1	
	A2	2019-10-21	2.4y	12	3/12/2018	3.0	2019-05-02	3.4	4.5	18.7	87
	A3	2020-10-20	3.5y	12	2/12/2019	2.6	2020-04-30	3.0	4.9	19.4	115
	A4	2021-11-04	4.5y	12	21/12/2020	3.8	2021-05-20	3.6	5.2	20.3	126
	A5	2022-12-01	4.6y	13	21/12/2021	3.4	2022-05-20	3.4	5.2	20.5	115
	A6	2023-10-24	6.5y	11	21/12/2022	3.3	2023-05-20	3.0	3.8	20.3	112
2018	P	2019-02-28	9.9m	9					2.3	17.1	
	H	2019-10-22	17.6m	8					2.6	18.0	
	A2	2020-10-19	2.5y	12	2/12/2019	2.7	2020-04-30	3.1	4.8	19.0	93
	A3	2021-11-05	3.6y	12	21/12/2020	3.7	2021-05-20	3.5	5.1	19.9	129
	A4	2022-11-30	1.6y	13	21/12/2021	3.3	2022-05-20	3.4	5.1	20.3	119
	A5	2023-10-23	5.6y	11	21/12/2022	3.1	2023-05-20	3.0	4.1	19.9	116

New England Site Overview – F1 Ewe – Annual Shearing, Joining and Lambing Date – Age and Wool Growth at Shearing Assessment – Average Drop Raw Clean Fleece Weight (CFW), Micron and Weaning Rate

Year	Stage (Reported)	Shearing Date	Age (month/ year)	Wool Growth (month)	Joining Date	Pre Joining CS	Lambing Date	Pre Lambing CS	CFW (kg)	Micron (µm)	Weaning Rate %
2017	Y	2018-08-06	11.0m	11					1.8	15.2	
	A2	2019-07-15	22.0m	11.5	1/04/2019	3.1	2019-08-29	3.2	3.5	16.7	85
	A3	2020-06-29	2.9y	11.5	30/03/2020	3.6	2020-08-27	3.4	3.4	16.6	122
	A4	2021-06-28	3.9y	12	29/03/2021	3.3	2021-08-26	3.0	3.7	17.2	115
	A5	2022-06-28	4.9y	12	28/03/2022	2.9	2022-08-25	2.8	3.2	16.7	115
	A6	2023-06-22	5.9y	12	27/03/2023	3.1	2023-08-24	3.3	3.4	16.9	146
	A7	2024-06-24	6.9y	12					3.2	17.2	
2018	Y	2019-07-31	10.5m	10.5					2.1	15.4	
	A2	2020-07-01	21.8m	11	30/03/2020	3.1	2020-08-27	3.2	3.3	16.1	98
	A3	2021-06-29	2.9y	12	29/03/2021	3.2	2021-08-26	3.0	3.5	16.5	112
	A4	2022-06-29	3.9y	12	28/03/2022	2.9	2022-08-25	2.8	3.6	16.7	116
	A5	2023-06-21	4.9y	12	27/03/2023	3.4	2023-08-24	3.3	3.6	16.8	147
	A6	2024-06-25	5.9y	12					3.3	17.0	

Governance

The governance of the MLP Project was structured to ensure robust oversight, transparency, and effective collaboration among its diverse stakeholders. Consistency across the sites in data collection was critical to the future analysis, review, and reporting phase.

Central to its governance was the formation of the MLP Executive Committee, comprising representatives from AWI, AMSEA, with support from a project manager and an independent chair (Russell Pattinson of Miracle Dog). This committee provided strategic leadership, operational guidance, and administrative management, meeting regularly to monitor progress, manage budgets, oversee protocol compliance, and address emerging challenges.

The project also benefited from an Industry Steering Committee (ISC), which offered industry feedback and ensured the research remained relevant and responsive to the needs of woolgrowers and industry bodies. This multi-layered governance model emphasised inclusivity, proactive risk management, and disciplined yet flexible protocol development, underpinning the project's success and industry impact.

AMSEA's Role

A detailed overview of the roles of each party involved in the MLP Project can be found in the methodologies section of this report. In short, AMSEA (a breeder-led organisation made up of incorporated breeder Site Committees, with a 30-year history in data collection) played a key role in the MLP Project, serving as the coordinating body responsible for the development of the project dataset. Responsibilities spanned governance, technical oversight, and collaboration across various stakeholders. A high-level overview of AMSEA's role is provided below.

- **Project Coordination and Governance:** AMSEA developed contracted agreements with the sites that facilitated and coordinated data collection for the MLP Project, aligning goals with industry needs, funding, and overseeing progress and compliance with AWI. AMSEA also entered into agreements with the sire owners that set out the terms and conditions under which the rams' semen was supplied, progeny were evaluated, and results incorporated.
- **Standardisation and Oversight:** AMSEA established and monitored standardised protocols to ensure consistency and scientific rigor.
- **Data Management and Analysis:** AMSEA managed dataset collection, validation, and accessibility, facilitating analysis and results dissemination.
- **Facilitating Add-on Projects:** AMSEA handled applications for add-on projects, ensuring alignment with MLP objectives.
- **Communication and Industry Engagement:** AMSEA promoted the MLP Project to stakeholders through field days, updates, site results, and presentations, while managing team alignment and challenges.

Key AMSEA personnel included Ben Swain, AMSEA's Executive Officer, who was responsible for contract and data management and was a member of the project's Executive Committee. The AMSEA Chair was a core member of the project's Executive Committee. The role of chair was initially Tom Silcock from 2015 to late 2017, who was succeeded by Jock McLaren from 2017 to 2023, before Rich Keniry took on the role of AMSEA Chair. AMSEA contracted Anne Ramsay of Stenhouse Consulting as the MLP Project Manager for the duration of the project. Former AMSEA Project Officer Emma Grabham enhanced project communication from 2017 to 2022.

Animal Genetics Breeding Unit Role

AGBU (Animal Genetics and Breeding Unit) played a crucial role in the MLP Project through contracts with AWI for R&D and AMSEA for database management. Their primary responsibilities included:

- **Project Design:** AGBU provided project advice on a range of management protocols and link sire selections.
- **Data Analysis and Reporting**: AGBU analysed MLP data, performed genetic analyses, generated breeding values, and assisted in result interpretation.
- **Database Management**: AGBU managed and enhanced the AMSEA/MLP database, ensuring data validation, secure storage, and accessibility.
- **Quality Assurance and Validation**: AGBU screened data for anomalies and ensured data integrity before analysis.
- **Collaboration and Meetings**: AGBU regularly met with the MLP Operations Team and other stakeholders to discuss progress and technical issues.
- **Support for Add-on and Student Projects**: AGBU provided data and analysis support, collaborating on add-on projects and student research.

Professor Andrew Swan was the principal scientific lead for AGBU throughout the majority of the MLP Project. Professor Swan played a pivotal role in the design, analysis, and scientific direction of the MLP Project, contributing his expertise in genetic evaluation and genomic analysis.

Professor Daniel Brown was a principal scientific leader for genetic analysis and innovation in the MLP Project, providing expertise in genetic evaluation, supervising analysis teams, and supporting the project's communication and extension to industry.

From 2021, Dr Peter Wahinya joined the AGBU team in a position funded by AWI specifically to support the analysis phase of the MLP Project. Working closely under Professor Swan and Brown's mentorship, Dr Wahinya took on increasing responsibility for the MLP Project analysis and reporting.

The MLP Project wishes to formally acknowledge the outstanding contribution of Professor Andrew Swan, whose vision, technical expertise, and unwavering dedication were fundamental to the project's success. His scientific leadership not only ensured the highest standards of rigour and innovation within the MLP, but also strengthened collaborative partnerships across research, industry, and producer groups. Professor Swan's passing in December 2024 is a tremendous loss to the Australian sheep and wool research community. He is deeply missed, and his legacy will continue to benefit the industry for many years to come.

Australian Wool Innovation's Role

AWI was the principal funder and partner of the MLP Project, working in partnership with AMSEA. AWI's role was multifaceted and included governance, funding, contract management, project direction, communications, IP management, and support for analysis and extension. The following outlines AWI's role:

- **Initial collaboration with ram breeders and researchers:** Prior to contracting AMSEA, there was considerable liaison with ram breeders and researchers. AWI commissioned a 2013 report conducted by Dr Rob Woolaston, "Genetic aspects of lifetime productivity in Merinos" (**attachment 1**)
- **Strategic Oversight and Governance:** AWI was a key member of the MLP Executive Committee, which oversaw the project. AWI participated in all major decisions regarding project implementation,

protocols, and strategic direction. Further, AWI oversaw the Industry Steering Committee (ISC), which provided valued industry input, oversight, and feedback.

- **Funding and Contractual Management:** AWI provided significant financial support for the MLP Project, including the core project and various add-on projects. AWI managed contracts with AMSEA, AGBU (for core project analysis), and other partners involved in "add-on" activities. All major contractual matters were approved by AWI. AWI was also responsible for the coordination of drought funding applications and support.
- **Intellectual Property (IP) Management:** AWI was responsible for negotiating and managing IP arrangements, including data licences with sites and agreements with other industry bodies (e.g., MLA, AGBU, site hosts). AWI ensured MLP data was protected and used according to agreed protocols. AWI retains 100% of MLP IP.
- **Project Communications and Extension:** AWI was responsible for, or closely involved in, MLP Project communications, including newsletters, field days, media releases, and industry updates. AWI staff contributed to the development and approval of communication strategies and materials, ensuring recognition of AWI's investment and coordination of key messages.
- **Protocol and Policy Development:** AWI was involved in developing, updating, and approving project protocols, animal welfare policies, drought management, and disaster management plans for the MLP. AWI was responsible for maintaining and updating the project's risk management plan **(attachment 2).**
- **Add-on Project Approval and Management:** AWI managed the approval process for add-on projects, ensuring they did not compromise core MLP objectives or AWI's internal animal ethics requirements.
- **Monitoring, Evaluation, and Reporting:** AWI led or supported monitoring and evaluation (M&E) activities to track project progress against objectives, milestones, and industry impact. AWI contracted several consultants to develop M&E frameworks for the project (Lucy Richardson FSA Consulting, and Maria Thompson Agstar Projects – **attachment 3**). AWI also ensured robust financial and technical reporting.
- **Core Analysis Development and Management:** AWI led the development of the detailed project analysis plan through consultation with the projects ISC, site committees, and through requests for input via field days and industry communication channels. The plan was reviewed annually during the early stages of the project and was finalised in March 2020 with sign off by both the ISC and Executive committee. A copy of the latest plan is attached as **attachment 4.**

AWI's representatives were involved in the MLP Executive Committee and included senior staff such as the General Manager, Research, (initially Dr Paul Swan, followed by Dr Jane Littlejohn and finally Bridget Peachey) and the Program Manager, Genetics (initially Geoff Lindon, followed by Neil Judd before the return of Geoff Lindon). Neil provided effective leadership throughout the foundational phase of the project. Geoff delivered critical technical oversight and strategic direction, ensuring the highest standards of scientific rigor and the alignment of project objectives with broader industry priorities. Geoff played a pivotal role in shaping discussions on data analysis, protocol development, and communication strategies, underpinning the project's success and stakeholder engagement.

"Add-On Projects"

Add-on projects were research activities conducted in conjunction with the MLP Project, managed by site hosts and affiliated organisations. These projects focused on specific topics or emerging questions that extended beyond the scope of the core MLP Project.

These initiatives often involved a combination of MLP ewes, wethers, and the offspring of the ewes, making them complementary to the primary research. Proposals for add-on projects were assessed on a case-by-case basis through an application process overseen by **AMSEA**. Projects involving core MLP sheep underwent rigorous evaluation by **AWI**, the site's local committee, and the MLP Project Executive Team to ensure the integrity and objectives of the core MLP research were not compromised.

All sites hosted add-on projects, which played a crucial role in enhancing the overall value of the MLP initiative. A comprehensive list of these projects is available in **attachment 5**.

Industry Challenges and Complexity

The MLP Project operated in a complex industry environment, where divergent breeding philosophies, stakeholder interests, and evolving institutional relationships sometimes created challenges for project decision-making and delivery. Industry politics, including the dynamics between and within commercial and stud breeders, the roles of industry representative bodies, and the strategic interests of funding and research partners, influenced aspects of governance, communications, and even site engagement throughout the life of the project.

While an early commitment to the inclusion of diverse views throughout the planning and operational phases and proactive strategies helped, the project's history underscores the necessity for future industry research projects to anticipate and explicitly manage these dynamics to the advantage of the industry.

BACKGROUND/LITERATURE REVIEW

Initiated in 2015, the MLP Project was a decade-long partnership involving AWI, AMSEA, Merino ram breeders, research and development organisations, and the hosts of five sire evaluation sites. The project was conceived to address critical questions about lifetime productivity within Merino ewe enterprises.

Key industry concerns included the trend of selecting animals at younger ages, which potentially prioritised early performance at the expense of lifetime productivity. Furthermore, the increasing diversification of Merino enterprises to include carcase traits, disease resistance, early maturity, and reproduction alongside wool production highlighted gaps in existing selection methods. The MLP Project sought to ensure that breeding strategies accounted for the lifetime relationships between these production elements.

Prior to the establishment of the MLP Project, AWI commissioned a comprehensive literature review on Merino lifetime productivity. Conducted by Dr Rob Woolaston in 2013 and titled "Genetic aspects of lifetime productivity in Merinos", the review played a pivotal role in shaping the MLP Project by identifying critical challenges and research opportunities within the Merino industry.

Woolaston's findings highlighted key areas of concern, including the limitations of early selection practices, the complexity of genetic and phenotypic relationships between traits, and the need for comprehensive lifetime data. These insights informed the MLP Project's design and focus, ensuring it addressed the pressing questions faced by Merino breeders and producers. Some of the review's key findings that influenced the MLP Project included:

Concerns About Early Selection

Woolaston highlighted that selecting animals at younger ages, often based on limited data such as early fleece weight and fibre diameter, might favour animals that perform well early in life but not over their lifetime. The MLP Project addressed this by tracking lifetime performance to validate the reliability of early selection.

Importance of Comprehensive Data

The review emphasised the need for long-term, detailed data to understand the genetic relationships between trait groups, including wool production, reproduction, and carcase quality. This shaped the MLP Project's focus on lifetime trait tracking across diverse conditions.

Genetic and Phenotypic Trade-Offs

Woolaston noted the complex interactions between wool, reproduction, and other traits, particularly how energy resources compete between reproduction and fleece production. This insight reinforced the need for the MLP Project to evaluate lifetime trait relationships in breeding strategies.

Diverse Environments and Genetics

The review stressed the variability in trait expression across different environments and genetic lines. The MLP Project incorporated diverse sites and genotypes to ensure findings were broadly applicable to the Merino industry.

Role of Genomics

Woolaston highlighted the potential of genomics to enhance selection for hard-to-measure traits and lifetime productivity. The MLP Project integrated genomic data to refine breeding values and predictions.

Limited Reproduction Records

The review pointed out the lack of comprehensive reproduction records in existing databases, a gap that the MLP Project aimed to address by recording and analysing these traits. He predicted that 20,000 joinings were required to ensure scientific significance for reproduction traits.

The findings from Woolaston's review provided a foundation for the MLP Project's design, ensuring it addressed industry concerns about lifetime productivity and developed data-driven solutions for sustainable Merino breeding practices.

PROJECT OBJECTIVES

The primary objective of the AMSEA-led component of the MLP Project was to create an extensive dataset that captured the lifetime performance of 5,700 diverse F1 Merino ewes across five environments.

The completed dataset is expected to inform a range of research and development activities, providing valuable insights to guide future work. These will include the precise estimation of genetic parameters for lifetime production across traits and between ages that will help to address the range of industry questions that underpin the project.

More broadly, the AWI investment in the MLP Project has the following objectives.

Objectives of the MLP Project - Approved by AWI Board

The objectives of the MLP Project as approved by the AWI Board in January 2015, were as follows:

- To add significant amounts of adult data, thus increasing the accuracy of a large range of adult age traits leading to increased lifetime productivity.
- To create a prediction at yearling and hogget ages for sheep that will increase and decline in wool quality and productivity at older ages.
- To better define the correlations between key traits and thus advice to breeders.
- To compare on cost and accuracy, traditional classing and objective assessments at young ages only, with repeat annual lifetime assessments.
- To compare sires based on their Index results and GrassGro analysis.
- To increase data for genomic associations with lifetime productivity.
- To increase data to create ASBVs for the 3 component traits of fertility that will lead to increased gains.
- To increase data to assist in creating a Urine Stain ASBV.
- Provide a major stimulus to the collection of lifetime fertility data in Merino sheep and so contribute significantly to genetic improvement in Merino reproductive performance while defending against unintended fleece value loss.
- Make a substantial contribution to clarifying how visual classing and breeding value assessments at various ages reflect actual lifetime productivity, and how reproductive and other traits interact, such as breech strike-related traits.
- Increase recognition of the lifetime economic potential of the well-bred and managed Merino ewe.

It is assumed that the objectives outlined above relate to the enhancement of all selection approaches with a particular emphasis in addressing current limitations in the current Merino National Genetic Evaluation Service, MERINOSELECT.

Agreement between AWI and AMSEA - Contracted

Once approved by the AWI Board, the objectives and outcomes of the MLP Project were contracted to AMSEA through the Merino Lifetime Productivity Project Agreement.

The background outlined within the agreement mirrors the concerns of industry endorsed by the AWI Board - that classing and MERINOSELECT measurements is increasingly dominated by young age measurements and that selecting sheep too early will reduce selection accuracy and adversely affect a flock's lifetime productivity.

The agreement goes on to confirm that by evaluating ewes for a wide range of lifetime productivity traits over a period of six to seven years, the following questions will be addressed.

- Do some Merino types perform better for fleece value at younger ages and fade at older ages?
- Do Merino ewes that raise more lambs still produce high fleece values at five and six years of age?
- Do high indexing young sheep make more money over their lifetime?
- Can we increase the current rates of genetic gain?

Summary of Outputs

In summary, the outputs of the MLP Project, both approved by the AWI Board and contracted for delivery through AMSEA, can be stated as:

- Provide long-term data that will enable enhancement and validation of existing Merino breeding and selection approaches in delivering lifetime productivity across all genotypes and environments.
- Increase our understanding of the genetics of Merino sheep to produce wool, lambs, meat, and survive over its lifetime.
- Raise the profile and increase the collection of lifetime productivity data in the industry.
- To explore the cost-benefit relationship between objective measurement, performance recording, and traditional classing, as well as the combination of all three.
- To provide an independent and robust comparison of the lifetime productivity of Merinos of diverse types, managed in a range of environments.

SUCCESS IN ACHIEVING OBJECTIVES

The MLP Project has completed its data collection phase, created an unprecedented dataset, and has already delivered improvements via MERINOSELECT analysis updates in 2022 and 2024, valuable insights research benefits. It is now well-positioned to achieve its final objective of enhancing industry breeding and selection strategies through the ongoing robust analysis, peer review, and reporting phase.

Here is a summary of outcomes from the data collection phase of the project:

1. Creation of a Unique and Extensive Dataset

- The MLP Project has tracked the lifetime performance of approximately 5,700 ewes, resulting in a unique, high-quality and comprehensive dataset. This includes repeated measures of wool, carcase, reproduction, welfare, disease resistance, survival, visual scores, classer gradings, and DNA genotypes collected through four to five joinings and annual shearings at five diverse sites across Australia.

2. Enabling Additional Industry Research

- The MLP Project has served as a foundation for numerous "add-on" research projects, expanding knowledge in areas such as:
    - Feed efficiency and intake (GEPEP project)
    - Methane production and environmental impact
    - Meat eating quality and its association with production traits
    - Neonatal fitness and survival
    - Udder conformation
    - Footrot resistance breeding values
    - Resilience and immune competence in Merinos

3. Improved Genetic Evaluation and Breeding Tools

- Data from the MLP Project has already been incorporated into the MERINOSELECT genetic evaluation system, leading to
    - New and improved Breeding Values, especially for reproduction traits which are traditionally hard to measure and lowly heritable.
    - MLP has significantly contributed to the Merino genomics reference population for all traits, but particularly reproduction traits by providing lifetime reproduction data for more than 4,800 ewes (resulting in more than 20,000 weaning rate records). This contribution has enabled the industry to access more accurate reproduction estimates through genomic testing.
- Data from sheep classing is confirming the value of classing as a selection tool.
    - The project has shown that visual classing is highly effective when breeding objectives focus on traits that can be assessed well visually. However, it has limitations for non-visual traits such as worm resistance, eye muscle depth, staple strength, eating quality, and weaning rate.

- While there is generally good alignment between visual classing (tops, flocks, culls) and the MP+ index (when assessed at two years of age and again at seven years of age), outliers exist. Top indexing animals can have poor conformation, and top visually assessed animals can have low indexes. Consequently, a combined approach that integrates both objective measurements and visual assessments is often the most effective strategy when breeding objectives require the evaluation of both measurable traits and conformation qualities, as well as both visual and non-visual characteristics.

4. Early Industry Insights and Interim Results

- While the comprehensive analysis of the full MLP dataset is ongoing, the project has already delivered a range of valuable site reports, early insights, and interim results to the wool industry derived from both the core and add-on projects. These preliminary findings have been communicated through multiple channels, including MLP newsletters, field days at project sites, conference presentations, and articles in industry publications such as "Beyond the Bale."

Some of the key early insights and interim results provided to the industry include:

- **Genetic Parameters and Heritability of Traits:**
  The project has improved the accuracy of estimates of heritability and genetic correlations for important lifetime traits such as wool production, reproduction (including conception, litter size, and ewe rearing ability), and carcase traits used by MERINOSELECT. MLP data has also clarified that the heritability of ewe survival is low but variable and that less wrinkled (plainer) animals are genetically more likely to survive. The relationship is moderate and favourable, making this a useful trait for selection in Merino breeding. It has also clarified that reproduction traits-while challenging to measure-can be captured and genetically improved with robust genomic and phenotypic data collection.

- **Value of Repeat Records and Measurement Timing:**
  Early findings have highlighted the renewed importance of including at least one late hogget (18 months or older) or adult fleece record in measurement programs and classing for predicting lifetime wool production, rather than relying solely on early-age (up to10 month) data and early age classing.

- **Selection and Culling Strategies:**
  The data from the MLP Project, which is noted to have high weaning rates, has shown that a "one-size-fits-all" culling approach for optimising reproduction in commercial flocks is unlikely to be effective. Instead, more nuanced selection based on actual weaning rate and repeat records is warranted.

- **Ram Mating Success and Sire Variability:**
  There is considerable variation in sire mating success rates among naturally mated ram teams, and instances of twins born to different sires. This has implications for ram selection and evaluation.

- **Heritability and Importance of Visual Traits:**
  Traits like udder structure, neck wrinkle, and skin pigmentation have been shown to be heritable, and some are correlated with important outcomes such as lamb survival and flystrike resistance.

- **Genomics and Breeding Value Accuracy:**
  The contribution of MLP data to the development and refinement of genomically enhanced breeding values, particularly for reproduction and adult recorded traits, has been substantial. The data have underpinned the new MERINOSELECT reproduction model and improved the accuracy of breeding values for industry sires.

5. Economic Analysis and Decision Support

- AWI has initiated comprehensive economic analyses-including Value of Production, Gross Margin Analysis, and Profit per Hectare-to provide robust decision-support for future breeding and management strategies aimed at increasing profitability. These analyses are designed to quantify the cost-benefit of achieving genetic gain by considering not only production outputs but also input costs such as feed efficiency, management interventions, and resource allocation.

6. Fostering Social and Practice Change

- The MLP Project has played a pivotal role in bringing together diverse breeding philosophies and encouraging collaboration, information exchange, and networking within the Merino industry.
- Over 2,100 industry participants have attended field days, resulting in greater confidence in using objective data and breeding values for selection decisions.

7. Introduction of New Visual and Functional Scores

- The project has contributed to the development of new industry visual scores (e.g., teeth eruption, leg and feet scores, udder scores) and validated their usefulness as part of sheep assessment.

8. Enhanced Genetic Diversity and Sire Evaluation

- The MLP has introduced several ram breeding operations to sire evaluation for the first time, enriching the genetic pool and strengthening across-flock genetic evaluation and adding diversity to the Merino genomic resource population.

METHODOLOGY

High-Level Overview of Methodology

The MLP Project was established as a comprehensive, long-term research initiative designed to generate a unique database for evaluating and enhancing Merino ewe breeding and selection strategies.

The project was undertaken as a ten-year partnership between AWI, AMSEA, Merino ram breeders, RD&E organisations, and five geographically diverse sire evaluation sites across Australia. A total of 134 diverse industry sires were mated across these five sites to generate up to 5,700 F1 Merino ewe progeny. These ewe progenies were annually evaluated throughout their productive lives for a wide range of traits, including wool quality, growth, carcase, reproduction, and disease resistance.

The ewe base at each site was sourced from single or well-defined flocks and carefully managed to ensure evenness and genetic diversity. Artificial insemination was used to mate approximately 90 ewes per sire, with the aim of producing 30 live ewe progeny per sire for lifetime assessment.

Sites managed the F1 ewe progeny as one group wherever possible, with stratification, when necessary, due to management requirements such as pregnancy status.

Male F1 progeny were castrated and exited the core MLP Project after weaning, while F2 progeny from the F1 ewes left the project after DNA sampling and weaning weight recording. All F1 ewes were genotyped using a 50K SNP chip to contribute to the genomic reference population.

A comprehensive suite of visual and measured assessments was recorded annually on all F1 ewes, including wool measurements, growth and carcase data, health and welfare traits, visual conformation and wool traits, classing, and reproductive performance. Dam and sire pedigrees were determined via DNA testing, with additional pedigree recording and environmental effect tracking at some sites.

The project ensured genetic linkage across sites and years by repeat use of some sires and linking data to the national MERINOSELECT genetic evaluation service. Sire selection encompassed a broad representation of Merino strains, selection approaches, and performance levels, including industry-impacting and diverse rams.

During the sire evaluation phase, each site produced reports summarising sire results, and a dedicated analysis committee directed ongoing genetic and economic analyses relevant to both ram breeders and buyers.

This methodology enabled the MLP Project to serve as a foundation for future genetic improvement and industry innovation in Merino sheep breeding.

Detailed Methodology

Sites

Collaborating sites across Australia played a critical role in the project by enabling comparisons of Merino sires across a wide range of traits under varying environmental conditions and ewe bases. The five sites were chosen to represent diverse environmental and production settings, including contrasting climatic factors and pasture types. Ewe bases were selected to provide a variety of genetics and Merino types, ensuring that sire performance could be evaluated across differing genetic backgrounds.

The MLP Project site selection process was a structured, multi-stage approach designed to ensure that each site would provide robust, relevant, and high-quality data to meet the project's goals. An overview of the process is as follows:

1. Development of Site Selection Principles

The MLP Project, a partnership between AWI and AMSEA, developed a set of **12 Site Selection Principles (attachment 6**) to guide the identification and contracting of suitable sites. These principles were designed to ensure both the scientific rigour and practical industry relevance of the project.

Key Principles:

1. **Committed and active local site committee** (mandatory): A strong, engaged site committee (with succession plans) is essential for practical outcomes, engagement, and governance.
2. **Sound ewe base** (mandatory): Ewes must come from a high-quality, even, classed flock, appropriate for the region and ensuring minimal bias in analysis.
3. **Site business stability**
4. **Site facilities**
5. **Variation between sites:** Sites should represent a diversity of environments, ewe bases, and production systems.
6. **Site technical capacity**
7. **Site owner**
8. **Husbandry and sheep management skills**
9. **Lifetime ewe management skills**
10. **Biosecurity**
11. **Data management skills**
12. **Additional investment required**

2. Expression of Interest (EOI) Process

- EOIs were circulated to existing and potential new sire evaluation sites and widely advertised through industry channels.
- Interested sites were required to demonstrate how they met the selection principles, including details on the ewe base, committee structure, facilities, and management.

3. Evaluation and Shortlisting

- Applications were assessed by the MLP Project Executive (AWI, AMSEA, and independent chair), who reviewed them against the 12 principles.
- Only sites that could demonstrate committed committees and suitable ewe bases progressed.
- Diversity between sites (in environment, genetics, and management) was actively sought.

4. Site Visits and Committee Engagement

- Site committees and project representatives visited proposed sites to inspect ewe bases, facilities, and meet key personnel.
- Committees were expanded where needed to ensure broad representation (commercial and stud breeders, different breeding philosophies, service providers, etc).

5. Final Selection and Contracting

- The executive selected the most suitable sites. The initial plan was for four sites, but industry demand led to a fifth.
- Sites were contracted via **tripartite agreements**: between AMSEA, the site owner (e.g., research institution or commercial farm), and the local site committee.
- Legal review and budget negotiation followed, with flexibility for site-specific requirements.

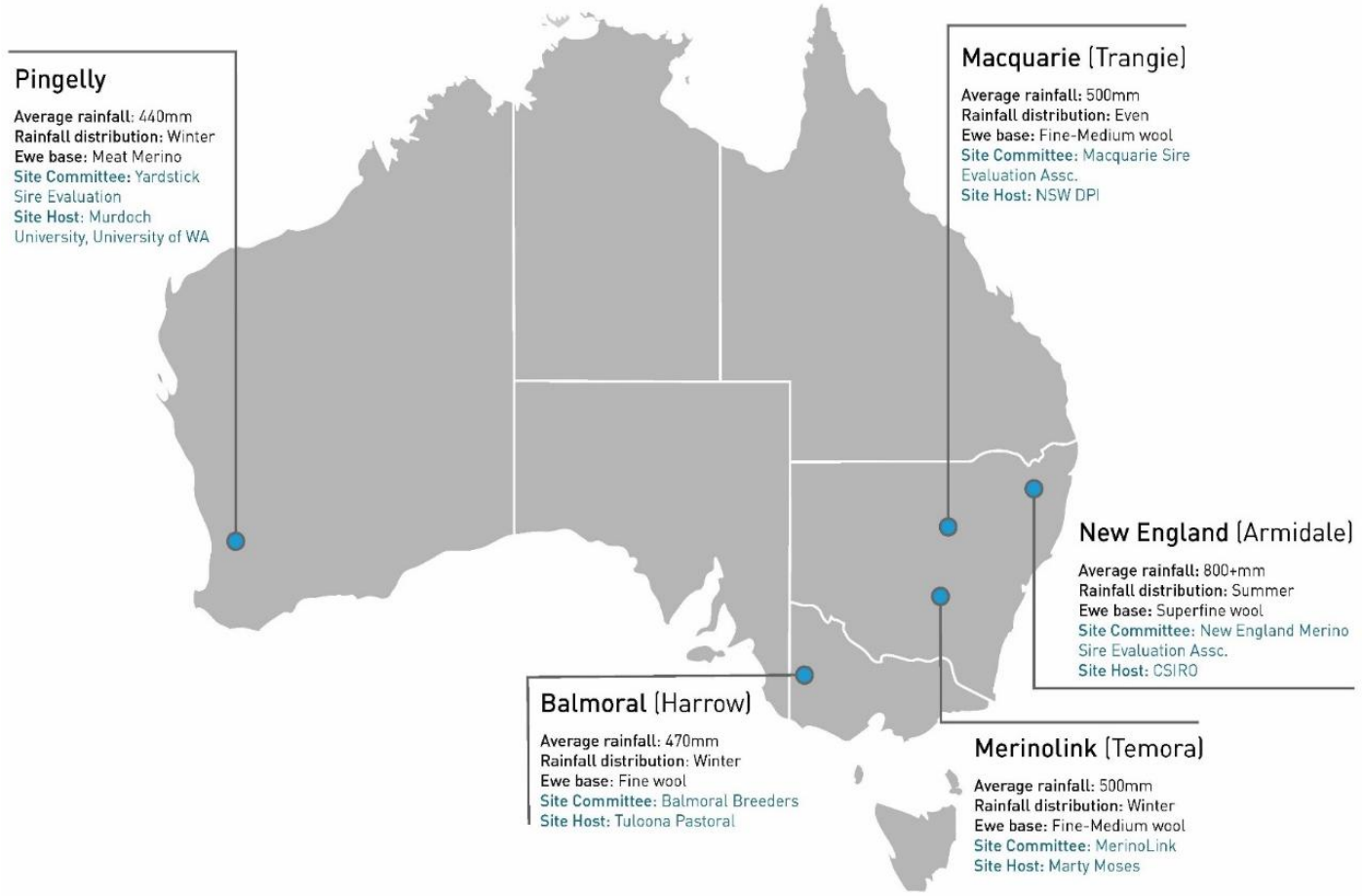
6. Site Characteristics

Ultimately, **five sites** were chosen to provide broad environmental and genetic representation:

- **Balmoral (VIC)** – Super fine wool, commercial site
- **Pingelly (WA)** - Meat/reproduction focus, research site
- **MerinoLink/Temora (NSW)** - Fine/medium wool, commercial site
- **Macquarie/Trangie (NSW)** - Fine/medium wool, two ewe bases for type-by-sire interaction, research site
- **New England/Armidale (NSW, CSIRO)** – Ultra fine wool, research site

Each site had a dedicated and active committee and a strong, even ewe base that was well linked to national genetics databases

The Five Sites



MLP site name, number of industry sires joined, ewe base details (microns and type), annual rainfall and rain fall distribution

Site	Number of Sires	Ewe Base	Rainfall
Balmoral, Harrow, Vic	50	17.2µm, super-fine wool base	470mm winter
MerinoLink, Temora, NSW	26	18µm, previous sire evaluation progeny, and studs with ASBVs	500mm winter
Pingelly, WA	30	19.5µm, meat focused Merino ewes	440mm winter
Macquarie, Trangie, NSW	31	19-21µm, two skin types	500mm even
New England, Armidale, NSW	30	17µm, ultra-fine flock	800mm summer

MLP Site Key Stakeholders

MLP Site	Host / Partner / Committee
Balmoral	**Host:** Tuloona Pastoral **Committee:** Balmoral Breeders Association
MerinoLink	**Host:** Moses & Son/Bluechip Livestock **Committee:** MerinoLink Limited
Pingelly	**Host:** Murdoch University / UWA **Committee:** Federation of Performance Sheep Breeders (WA Branch)
Macquarie	**Host:** NSW DPI **Committee:** Macquarie Sire Evaluation Association
New England	**Host:** CSIRO **Committee**: New England Merino Sire Evaluation Association

Ewe Base Detail

Balmoral

The ewe base at Balmoral was a traditional super fine wool flock that had concentrated over the past decade on enhancing growth rate, wool yield, and fertility while striving to maintain micron and quality standards. The mature ewe flock averaged 17.2µm and produced 38kg/ha of clean wool (4.7kg at 63% yield, 2.96kg CFW/head) with an average body weight of 52kg. It was classed and representative of Western Victoria flocks. No usable performance or pedigree information was available for these foundation ewes.

MerinoLink

The foundation ewes used to generate the 2016 and 2017 drops were sourced from five flocks and evenly distributed across all sire groups. The number of ewe bases was due to ensuring there were sufficient numbers of foundation ewes to AI rather than comparing the ewe bases. The foundation ewe base consisted of:

Bundilla: Approximately 150 ewes selected from a base of 800 stud ewes, all having reared a lamb and comprising 3 & 4-year-old ewes with an average MP+ of 140. Pedigree and performance data were available.

Centre Plus: Approximately 150 ewes selected from a base of 350 stud ewes with an average MP+ of 158. Pedigree and performance data were available.

Bluechip ewes: Approximately 550 ewes from two drops resulting from a previous sire evaluation program. All ewes had full pedigree and ASBVs.

Pooginook: Approximately 155 ewes aged 2, 3, and 4 years selected from a base of 1,050 stud ewes, consisting of single mated ewes (104) and syndicate mated ewes (51). Pedigree and performance data were available.

Commercial Pooginook: Approximately 200 commercial Pooginook blood ewes selected out of 750, measured for micron and greasy fleece weight, and having reared a lamb.

The combined ewe base was verified by the site committee as consistent and uniform.

Pingelly

The ewe base was characterised as large-framed, plain-bodied, highly fertile animals with moderate wool production. Over the previous five years, there had been a significant focus on genetic fat, growth, and muscling while maintaining wool yield and micron. The 'Ridgefield' flock was stocked at 10DSE/ha, averaging 5kg of 19µm wool and achieving weaning percentages between 100-115%. Ewes for the project were selected from four age groups from the 'Ridgefield' commercial and Maternal Efficiency Flocks. Maternal Efficiency Flock ewes had pedigree and performance data.

Macquarie

Ewes were sourced from commercial clients comprising "two bloodline types from the central west of NSW". One type originated from "large framed, heavy cutting Merino flocks" averaging 20.5-21.5µm, while the other was from "all-purpose Merino flocks" averaging 18.0-18.5µm. Ewes from these types were equally allocated to each sire joined at the site. No performance or pedigree information was available for these foundation ewes. AGBU advised that the number of ewes per bloodline was unlikely to be sufficient for a good comparison of sire by ewe bloodline breeding value interactions, although the industry was keen to test it.

New England

The foundation ewes were described as a typical New England fine wool sheep from a classed mob. Approximately two-thirds came from the "Chiswick resource flock," a typical commercial superfine/fine wool type based on local performance recorded studs. Approximately one-third came from the "Breech Strike Genetics flock," deeply pedigreed, performance recorded, linked to MERINOSELECT, and essentially a superfine/fine wool flock (adult ewe mean FD approximately 17µm). Foundation ewes did not require DNA pedigree testing as birth records (dam, birth type, etc.) were collected during lambing rounds funded by CSIRO and AWI in an Add On project.

Site Contracting

The MLP site contracting process involved several steps and agreements:

Contracting Process:

- **Tripartite Agreements:** The sites were contracted through tripartite agreements between AMSEA, the Site Host, and the Site Committee.
- **Legal Review:** Contracts were reviewed by legal teams from all parties throughout the contracting process.

Budget Development:

- **Initial Estimates:** Budgets were initially estimated based on normal sire evaluation activities and costings and estimates of the workloads of the site and data manager. As these workloads were added to, these estimates were found to be too low and were increased.
- **Consideration of Site Requirements:** The number of sires that each site joined, and the trial design of the site influenced the total budget allocation.
- **Flexibility and Adjustments:** Budgets were adjusted based on changing project requirements and cost structures. For example, condition scoring was added to the project protocols, requiring budget adjustments. Adjustments were also made in response to drought conditions, requiring drought

feeding. The funding for drought management was managed by AWI and did not form part of the site budget.

Animal Ethics Requirements

The MLP Project was established with strong attention to animal welfare and ethical requirements, particularly as it involved large-scale, multi-site, long-term sheep studies.

The requirements and processes for animal ethics approval evolved over the life of the project, influenced by the type of site (private/commercial vs. research institution), changes in legislation, and guidance from AWI and site hosts.

Research Institute Sites (e.g., Pingelly, Macquarie, and New England):

- Required animal ethics approval under the requirements of the organisations owning the sheep.
- These sites had their own internal animal ethics committees and approval processes.

Commercial/Private Sites (e.g., MerinoLink, Balmoral):

- As the activities were run under "normal husbandry" operations, formal animal ethics approval for the "privately owned professional woolgrower-run sites" was not required.
- AWI's internal welfare committee reviewed these sites' activities.

Site Protocols

The **MLP Project site protocols** served as the foundational framework to ensure consistency, scientific rigor, and reliable data collection across all trial sites to optimise the outcomes from the analysis and review phases. These protocols guided all aspects of trial conduct, from sheep management to data recording, ensuring that each site operated in alignment with the project's overarching objectives. A copy of the Macquarie site protocols is provided as an example set of protocols in **attachment 7**.

Key Elements of the Site Protocols

1. **Sheep Management**
    - Selection and Allocation:
        - Each site commenced with ewe cohorts balanced across sires to ensure unbiased results.
    - Joining and Breeding Plans:
        - Annual mating plans were implemented to track reproduction.
        - Joining involved mating to a syndicate of Merino sires.
    - Grazing and Nutrition:
        - Managed to provide consistent and appropriate conditions across sites.
        - Ewes were managed to Lifetime Ewe Management (LTEM) best practices, with condition score targets and nutrition protocols adjusted for drought and seasonal conditions.

2. **Data Collection and Traits Recorded**
    - Comprehensive data were collected across the lifespan of the ewes, including:
        - Wool traits (e.g., fibre diameter, fleece weight).
        - Reproduction (e.g., lambing success, litter size).
        - Carcase traits and growth rates (e.g., bodyweight).
        - Health and welfare indicators (e.g., worm egg count, dag).
    - The F2 progeny were recorded up to weaning to explore ewe rearing ability.
3. **Health and Welfare**
    - Protocols ensured animal health and welfare were prioritised to meet the Australian Animal Welfare Standards and Guidelines for Sheep.
    - Disease prevention measures, including vaccination and biosecurity practices, were uniformly applied.
4. **Data Security and Quality Control**
    - Data from each site was collated and audited by the site data manager and project data manager to maintain consistency and accuracy.
    - The MLP Data Manager and site data managers ensured secure storage and robust backup processes.
    - Regular reviews and across-site analyses were conducted to verify the integrity of collected data.

Updates to Site Protocols

The MLP Project protocols evolved to address operational realities, data quality, industry feedback, and new research opportunities. The modifications were made in stages, incorporating continual feedback from site managers, researchers, and industry stakeholders.

Overview of protocol changes made to the core protocol as the project progressed

Area/Topic	Change/Update	Details / Notes
Condition Scoring	Increased frequency, independent assessors	Condition scoring increased from 3 to 4 times/year; must be done by an independent scorer familiar with LTEM.
	Standardised repeatability exercises	Sites required to check scorer repeatability (e.g., Rsq > 0.6); address if below standard.
	Site can do own scoring	Protocol amended to allow sites to do their own scoring in some cases.
Mating/Weaning	Added need for mating plan	Must submit mating plan for approval. Syndicate sire scrotal circumference, post-weaning weights.
	Changes to mating percent and length	2% suggested mating percent for maidens, 35-day joining, rams checked by site committee.

Area/Topic	Change/Update	Details / Notes
	Mating and lambing management group flexibility	Sites can manage ewes based on pregnancy status post-scanning or in mixed mobs; must record management groups.
Extra Classing	Professional Grade plus Data added to protocols	Site protocols updated to include option for an additional Professional class that allowed the use of data.
Welfare Culls	Addition of a checklist for welfare culls	Sites required to record date of removal and reason for removal.
F2 Male Castration	Explicit requirement to castrate at marking	All F2 males must be castrated at marking unless prior site plans exist.
Animal Health Treatment	Process created	Introduced that sites could seek additional funds for animal health treatments for running off type sheep.
Visual Scores	Annual scoring of non-fibre pigmentation and neck wrinkle	Added to off-shears suite of traits, no extra cost to project.
	New feet/leg scores	New feet and leg scores added final year
Liveweight/Worm Egg Count (WEC)	Rapid liveweight, accredited WEC labs, faecal consistency scoring	Liveweights to be taken quickly; only ParaBoss-accredited labs for WEC; faecal consistency scoring added.
Data Management	Updated data submission requirements	Multiple layers of review introduced (site data managers, Project Manager, AMSEA Database manager).
Disaster/Drought Protocol	Drought protocol formalised, regular review	Drought protocol allows reduced condition scores and supplementary feeding during drought; reviewed annually.
	Drought payment and management plan required	Sites must submit disaster plan annually; details feeding and destocking priorities.
Animal Ethics/Welfare	Ethics approval process clarified	Research site owners required formal animal ethics approval; commercial/private sites reviewed by AWI Welfare Committee.
Communication	Protocol for publication approval clarified	All publications must be reviewed by project manager/AWI before release; template reports standardised; some relaxation for research partners.
	Updated communication protocols	Sites can have more flexibility in some communications, but AWI must be kept informed.
Functional Classing (Teeth/Udders)	Functional classing annualised; simplified scoring	Annual teeth and udder scoring at weaning; three-point scoring system (1,3,5); note mechanical injury vs genetic condition.
	Funded additional labour for functional classing	Budget increased to allow two-person teams for functional classing, not just one.
Add-on Projects	Formal approval process for add-on projects	Must be submitted using new template, reviewed by AWI, and approved by MLP Executive.

Area/Topic	Change/Update	Details / Notes
COVID-19 Protocol	Risk mitigation plan and site-specific response	All sites required a COVID-19 risk assessment and mitigation plan; social distancing and visitor restrictions; field days went virtual where needed.
End-of-Life Sample Collection	Collection of wool staple and TSU samples at end of project	All ewes to have wool staple and DNA (TSU) samples collected at project end for future research.
Shearing Timing	Changes to shearing timing at some sites	MerinoLink and Macquarie and others changed time of shearing, which affected assessment timing.

Balmoral was the first site to commence and was at times a place for fine-tuning the site protocols.

MerinoLink (from March to October) and **Pingelly** (from April to December) both changed their time of shearing during the MLP Project.

During the height of the COVID-19 pandemic, each site developed a risk management plan that was implemented to optimise staff safety and have minimal impact on the project protocol.

Monitoring and Compliance

Site managers and the MLP Project Manager played key roles in ensuring protocol compliance. Regular site visits, reporting, and communication among stakeholders helped maintain alignment with the project's objectives.

The adherence to site protocols was crucial in minimising complications in the analysis and review phase and maintaining wool grower support for the project, thus achieving the MLP Project's goals of advancing the understanding of Merino lifetime productivity and delivering actionable insights to the Australian wool industry.

With regular reporting requirements to the AWI Board and the project Industry Steering Committee, the initiative initially implemented bi-monthly **site milestone reporting**, later transitioning to a quarterly schedule. These reports tracked progress against contractual commitments, identified potential risks or challenges, documented communication outputs, and guided site planning for upcoming activities. Contractually compulsory milestone reporting proved invaluable in providing the project management team with routine updates, ensuring transparency, monitoring site activities, and maintaining budget oversight.

Project and Site Budget Management

MLP site budgets were managed by AMSEA through a system of initial allocation and tracking actual expenditure against the budget. This required sites to invoice based on actual costs incurred. Site budgets were overseen by the contract manager (Ben Swain) and the MLP Project Executive Committee, including formal reviews and reallocation of funds as needed throughout the project lifecycle.

The management of the MLP site budgets involved several key processes:

1. **Initial Budget Allocation:** Budgets were initially established for each site as part of the overall MLP Project budget managed by AMSEA under its agreement with AWI. These budgets covered specific line items required to operate each site, including site and data management.
2. **Invoicing Based on Actuals:** Sites were required to submit invoices to AMSEA for the costs incurred for MLP activities. The MLP Executive Committee decided to maintain payments against actuals to ensure accountability, although this sometimes created additional administrative challenges for some

research sites. A work around saw AMSEA paying some of the site invoices directly for services directly such as pregnancy scanners, carcase scanners, fleece testing, etc.

3. **Tracking Actual Expenditure:** AMSEA tracked actual site expenditures against the approved budgets. Detailed budget versus actuals reports were generated quarterly, showing variances for each line item.
4. **Budget Monitoring and Oversight:**
    - The AMSEA Contract Manager worked with sites to ensure claims were appropriate and related specifically to MLP activities.
    - The MLP Executive Committee actively reviewed and managed the budget, addressing areas of overspend or underspend.
    - Site management and data management costs often tracked over the initial budget due to higher-than-expected workloads related to project complexity, governance, and seasonal management needs. At some sites the site committee fatigue affected labour contribution to the sites, which saw the site hosts providing their own labour at often higher daily rates.
5. **Budget Reviews and Reallocations:**
    - Formal budget reviews were conducted, particularly when adding new sites or when significant variances emerged.
    - Later in the project (May 2022 and March 2024), the MLP Executive Committee formally reallocated identified savings from various project lines, including site cost lines to cover shortfalls in other areas or fund new priorities such as the end-of-site activities, analysis, and communications.

Annual disaster plans

Each site had an obligation to develop a risk management plan for their site using a proforma (**attachment 8**) that was annually reviewed and signed off by the site's committee.

Data collection protocols

To optimise the project's data integrity, a set of data collection guides was developed that were to be used in conjunction with the standard AMSEA Site Protocols. A copy of the guide can be found as **attachment 9**. This attachment includes the standard data collection process, Tagging Protocol, Weaning Protocol, AMSEA Visual Grade Protocol and Professional Classer Grade Protocol.

Drought protocol

The project had a drought protocol that was able to be enacted under drought circumstances that are outlined in the attached policy (**attachment 10)**. Four out of the five sites enacted drought funding during the life of the project, with the three NSW-based sites requiring the greatest support owing to the drought conditions experienced in 2018 to 2019. AWI has retained a record of the drought payments made to sites.

Communication protocol

A project communication protocol was developed to outline the process for publication approval and to ensure that contributing parties were acknowledged in project publications. A copy of the communication protocol can be found as **attachment 11**.

COVID protocol

Each site was required to undertake a detailed impact assessment of COVID-19 and to develop its own risk mitigation plan. For example, sites on commercial properties were considered to be at lower risk and continued many activities with practical on-site measures. In contrast, research station-based sites were required to operate under restricted access rules-with external visitors only being approved on a case-by-case basis.

The COVID protocols were periodically reviewed as the pandemic evolved.

Sires

The 167 sire spaces across the five Merino Lifetime Productivity (MLP) project sites were filled by 134 unique Merino sires supplied by 95 different studs or ram breeding flocks. Some sires, referred to as Link Sires, were used repeatedly across sites and years, enabling data to be collated across different sites and ewe genotypes. Each of the five sites joined ewes via artificial insemination for two years, using between 13 and 25 industry sires each year.

MLP sires were carefully selected from hundreds of sire nominations to allow for a comprehensive examination of factors influencing lifetime productivity and to generate results that were both industry representative and relevant.

Sire selection was carefully planned to balance site and drop-level representation and to ensure that the project's full sire list met the following criteria:

- Industry representative: A balance between horn and poll rams, different skin/wool types, and rams with and without Australian Sheep Breeding Values (ASBVs).
- Impact rams: Sires with significant show performance results or widespread use in the industry (with or without ASBVs).
- Sires were selected from four main genetic performance groups (referred to as "clusters"), which were identified through an analysis of the MERINOSELECT database, incorporating progeny records of sires used between 2006 and 2016. The selection of sires from each cluster was made in proportion to their frequency in the national flock. This approach ensured that the MLP Project's findings would be broadly applicable across the diverse range of genetic backgrounds and breeding philosophies.
- Performance range: Sires demonstrating high and low performance for key traits based on ASBV percentile band tables.
- Fleece value: Sires predicted to maintain, increase, or decrease fleece value over time.
- Diversity in age: A mix of young sires (with progeny yet to be evaluated) and older, proven sires.

Most owners of the 134 sires paid an entry fee that covered the first two years of the F1 daughters' evaluation (the standard sire evaluation component). Several sires' entry fees were funded by AWI to be included in the project to provide linkage across sites and/or fill specific performance gaps.

AWI commissioned a dedicated **Sire Advisory Group** tasked with identifying industry impact rams suitable for the sites that had performed well in shows and multivendor sales.

Sire linkage was required to allow a standalone analysis of the MLP dataset and to create genetic linkage to the national genetic evaluation program MERINOSELECT. The rule of thumb for linkage was to have one link sire per seven sires evaluated.

The project's ISC requested the use of two divergent sires across all sites to explore different genetic types and combinations of traits that may help examine the impact of sire type performance across diverse genotypes and environments. **One Oak R56 and Leahcim Poll 090918** were selected as across-site link rams for use in the 2016 drops at Balmoral, MerinoLink, and Pingelly sites. **West Plains Poll (Mercenary), 110004** and **Trigger Vale Poll, 140477** were both across-site link sires in the **2017 drops** used at Pingelly, MerinoLink, Macquarie, and New England sites.

The final sire lists at each site were generated in consultation with each sire evaluation site committee, plus the MLP Industry Steering Committee.

Sire listings by site and year of drop

BALMORAL 2015	BALMORAL 2016
Billandri Poll, 130087	Centre Plus Poll, 707115
Bogo, 111424	Glen Holme , 141077
Bundaleer Poll, 13V741	GRASS Merino, 142194 (R4)
Bundilla, 111265	Greendale, 120012*
Centre Plus Poll, 207316	Greenfields Poll, 140345
Darriwell, 130941	Greenland, 2.366
Glenpaen, 120042	Hannaton Poll, 120046
Greenfields Poll, 130599	Hazeldean, 11.3542
Hazeldean, 11.43	Kiandra Poll, 140757
Kurra-Wirra, SR5681	Kooringal, 130519
Leahcim Poll, 090918 L*	Kurra-Wirra, SB5585
Leahcim Poll, 123153	Leahcim Poll, 090918*
Merinotech WA Poll,	Melrose, 12UGB060
Mokanger, 120092	Mumblebone, 130389
Moojepin, 100248 L	Mumblebone, 140026
Mumblebone, 130389	Nerstane, 100919
Mumblebone, 130850	One Oak No.2, R56*
Nareeb Nareeb, 130380	Stockman Poll, 090853
Nerstane, 130467	Terrick West Poll, 122220
One Oak No.2, R56 L*	The Mountain Dam, 11/ESA004*
Roseville Park, 140019	Trefusis, 110482
The Mountain Dam, 11/ESA004	Tuckwood Poll, 131026
Tuckwood Poll, 121021	Wallaloo Park Poll, 120912
Yalgoo, 120043	Woodyarrup, 120175
Yiddinga, 130374	Yiddinga, 141989

L= Funded links to sire evaluation

* = between MLP site linkage

MERINOLINK 2016	MERINOLINK 2017
Bella Lana, 130296	Bundilla Poll, 140055
Boyanga, 145112	Centre Plus Poll, 407185
Glen Donald, 120014	Collinsville Poll, 130545 (Apollo)*
Greendale, 120012	DT Kenilworth, WH13017
Leahcim Poll, 090918*	Greendale, 140141
One Oak No.2, R56 *	Lachlan Merinos Poll,
Pastora Poll, 082893	Leahcim Poll, 132624
Poll Boonoke, 120020	Tallawong, 150280
Pooginook Poll, 140632	Toland Poll, 151058
Roseville Park, 140611	Trefusis, 150282
Trigger Vale Poll, 140477	Trigger Vale Poll, 140477*
Wattle Dale, 140754	Wallaloo Park Poll, 150422
Wurrook, 130149	West Plains Poll, 110004 (Mercenary)*

PINGELLY 2016	PINGELLY 2017
Billandri Poll, 130641	Anderson Rams, 140474
Boolading Blues Poll,	Barloo Poll, 140027
Claypans Poll, 130597	Billandri Poll, 151280
East Mundulla, 090137	Coromandel Poll, 130660
Ejanding Poll, 145096	Cranmore, 13.10
Haddon Rig, 2.715	Edale, 10Z266K
Hazeldean, 11.43*	Ingle Poll, 150087
Ingle Poll, 130387	Mianelup Poll, M00540
Leahcim Poll, 090918*	Moojepin, 120652
Merinotech WA Poll,	Moorundie Poll, NE73
Moojepin, 140377	Neearra Poll, 110264
One Oak No.2, R56*	Range View Poll, 5-680
Rhamily Poll, 110330 (Benny)	Trigger Vale Poll, 140477*
West Plains Poll, 110004 (Mercenary)	West Plains Poll, 110004 (Mercenary)*
Wyambeh Poll, 140141	Woodyarrup, 150329

Sire listings by site and year of drop continued

MACQUARIE 2017	MACQUARIE 2018
Centre Plus Poll, 707115 *	Anderson Rams, 150266
Collinsville Poll, 130545	Centre Plus Poll, 707115*
Darriwell, 130941 *	Charinga, 130240 (Doc)
GRASS Merino, 122190	Glen Donald, 120014*
Gullen Gamble Poll,	GRASS Merino, 141924
Hazeldean, 13.4936	Gullen Gamble Poll, 14189
Kerin Poll, 151911	Haddon Rig, 2.715*
Moojepin, 120652 *	Hazeldean, 11.3542
Mumblebone, 151367	Kerin Poll, 160137
Roseville Park, 132933	Langdene, 160950
Trigger Vale Poll, 140477 *	Lewisdale Poll, 150010
Wanganella, 130816	Orrie Cowie, 140050 (Trojan)
West Plains Poll, 110004 (Mercenary)*	Roseville Park (Poll), 150039
Wilgunya, 121224	Stockman Poll, 130707
Willandra Poll, 140030	Wanganella, 150610
	Willandra Poll, 160001

NEW ENGLAND 2017	NEW ENGLAND 2018
Connemara Poll, 140257	Alfoxton, 150430
Conrayn, MVB123	Avington Poll, 160047
Cressbrook, 140055	Bungulla, 160350
Egelabra, HEK 1.36	Clovernook Poll, 160095
Grindon, 150017	Cressbrook, 140055*
Karori, 140188	Eilan Donan, Harvey
Miramoona, 140012	Europambela, 120101
Mirani, 120021	Hillcreston Park Poll, 110143
Moorundie Poll, NE73*	Hilltop, HT Poll 156
Nerstane, 150073	Karori, 150222
Petali Poll, 150697	Nerstane, 150073*
Trefusis, 150282*	Petali Poll, 160849
Trigger Vale Poll, 140477*	Tallawong (Poll), 150280*
West Plains Poll, 110004 (Mercenary) L*	Wurrook, 130149*
Yalgoo, 150313	Yalgoo, 160070

Sire Agreements

Sire agreements were contracts between the project (AMSEA, on behalf of AWI) and the owners of the rams (sires) entered in the MLP trials. They set the terms and conditions under which rams' semen was supplied, progeny were evaluated, and results were reported. These agreements clarified ownership, rights, and obligations regarding:

- Use of semen and progeny data
- Payment of entry fees (in most cases)
- Permissions for use of data in publications and research (especially for "add-on" projects)
- Confidentiality or permission for the public release of sire results (especially for sensitive or add-on research)

The agreements provided the legal and ethical basis for using sire data in analysis, reporting, and publication, including in annual MLP Reports, MERINOSELECT, and scientific communications. They specified what could be shared publicly (e.g., raw data, adjusted means, breeding values) and what required special permission (e.g., identifying sires in add-on project results). The agreements were essential when negotiating IP, especially as new add-on projects emerged.

F1 Ewes

Each site joined nominated sires via AI to a base flock of classed commercial ewes, aiming for approximately 90 ewes per sire. The resulting F1 progeny (ewes and wethers) were the core animals evaluated.

The aim to breed 30 ewes per MLP sire was based on the need to generate sufficiently robust and accurate genetic estimates, especially for lowly heritable traits like reproduction. With 30 live ewe progeny per sire, this

would strike a balance, enough progeny to provide meaningful data, but not so many as to limit the number of sires evaluated. The project expected some loss of ewes due to mortality or welfare culling over several years and joinings. Modelling suggested that starting with 30 (or slightly more: up to 32) ewe lambs per sire group would leave about 20 ewes per sire still in the trial by six years of age, allowing for annual mortality of around 6%. This approach ensured the target of at least 20,000 joinings suggested by the Woolaston Review 2013.

Sire evaluation trials were conducted for the first two years of the MLP Project at all five sites. Following the sire evaluation phase, the sites continued to track the performance of the F1 ewe progeny as they proceeded through four to five joinings and annual shearings.

The F1 ewes were extensively assessed both visually and objectively for 6 to 7 years through an annual recording program. The first drop of ewes at each site were evaluated over seven shearings and five joinings, while the later drops were evaluated for six shearings and four joinings. A complete list of traits recorded in the project can be found below.

Culling was performed solely for welfare purposes. DNA was used to assign pedigree and conduct genomic testing.

Mortality was recorded when an animal failed to present for an assessment and then did not reappear.

Beginning at approximately 18 months of age, the F1 ewes were joined annually (following a site-developed natural mating plan) to a syndicate of Merino sires, and reproduction records were collected. The resulting F2 progeny exited the project after DNA collection and recording of their weaning weight.

Annually, approximately 60 data points were collected on each ewe, plus 7 data points on their lambs.

List of Trait Acronyms, Definitions, and Units

Trait	Definition and Units
BACK	Shoulder/back (score)
BCOV	Breech cover (score)
BDWR	Breech wrinkle (score)
BLK	Recessive black - agouti gene
BOPGRADE	Breed Objective Professional classer grade - five way class Top, Stud, Second, Sale, Cull
BPASTERN	Back pasterns (score)
BRWR	Breech wrinkle (score)
BTOES	Back Toes (score)
CCOV	Crutch cover (score)

Trait	Definition and Units
CFW	Clean fleece weight (kg/%)
CHAR	Wool character (score)
COL	Wool colour (score)
COMFORT	Wool comfort factor (%)
CONC	Conception
CS	Condition (score)
CURV	Fibre curvature (degrees/mm)
CURVSD	Fibre curvature standard deviation (degrees/mm)
DAG	Dag (score)
DUST	Dust penetration score
EMD	Eye muscle depth (mm) at the 'C' site
ERA	Ewe rearing ability
FACE	Face cover (score)
FMOIST	Faecal consistency (score)
FAT	Fat depth (mm) at the 'C' site
FD	Average fibre diameter (µm)
FDCV	Fibre diameter coefficient of variation (%)
FDSD	Fibre diameter standard deviation (µm)
FLEGS	Front legs (score)
FLROT	Fleece rot (score)
FPASTERN	Front pasterns (score)
FPIG	Fibre pigmentation (score)
FTOES	Front toes (score)

Trait	Definition and Units
GFW	Greasy fleece weight (kg/%)
HOCK	Hock (score)
HOCKS	Hocks – Researcher (score)
JAW	Jaw (score)
JAWR	Jaw – Researcher (score)
JOIN	Fit to join (score)
LEGS	Feet and legs (score)
LSIZE	Litter size
NKWR	Neck wrinkle (score)
NLB	Number of lambs born (%)
NLW	Number of lambs weaned (%)
OSPGRADE	Overall selection professional classer grade - five way class Top, Stud, Second, Sale, Cull
OSVGRADE	Overall selection grade - three way class Top, Flock, Cull
PASTERN	Pasterns (score)
PGRADE	Professional classer grade - five way class Top, Stud, Second, Sale, Cull
SL	Staple length (mm) at the mid-side
SPIG	Non fibre pigmentation (score)
SF	Spinning fineness (µm)
SPOT	Black spot
SS	Staple strength (NKtex) at the mid-side
SSTRC	Staple structure (score)
TEATS_F	Count of functional teats (score)

Trait	Definition and Units
TEATS_F_R	Count of functional teats (number)
TEATS_SH	Shape of functional teats (score)
TEETH_A_AL	Alignment of permanent incisors (score)
TEETH_A_LG	Length of permanent incisors compared to the average of the mob
TEETH_A_PI	Count of permanent incisors
TOES	Toes
TOESB	Back Toes
TOESF	Front Toes
UDDER_M	Mastitis severity (score)
URINE	Urine (score)
VGRADE	Classers visual grade - three way class Top, Flock, Cull
WEATH	Staple weathering (score)
WEC	Worm egg count (%)
WEC_Nematodirus	Worm egg count – Nematodirus (number)
WEC_Strongyle	Worm egg count – Strongyle (number)
WETDRY_M	Wet or dry (score) of the udder at marking
WETDRY_W	Wet or dry (score) of the udder at weaning
WR	Weaning rate lambs weaned per ewe joined
WT	Body weight (kg)
YLD	Wool yield (%)

F2 Progeny

Syndicate Sire Usage

The composition of ram sources for these syndicate joinings varied by site, year, and sometimes drop. In all sites, rams for syndicate joinings (natural matings) were selected according to project protocols:

- Physical exams (condition, feet, teeth, semen testing in some years).
- Preference for rams with Australian Sheep Breeding Values (ASBVs).
- Inspected and signed off by site committees.

Where possible, rams were sourced to match the genetic background of the F1 ewes.

At the Balmoral site, rams were bred by the property, which conducted annual AI programs. The MerinoLink site used sires sourced from Centre Plus, the Centre Plus Nucleus, and Kambah. Pingelly sires were obtained from the UWA Ridgefield Future Farm and local breeder Ingle. The Macquarie site acquired its rams from Centre Plus, Glenwood, Parkdale, and Mumblebone. The New England sites used syndicate sires sourced from local ram breeders Alfoxton, Mirani, and Karori.

F2 Progeny

The progeny of the F1 ewes (F2) played a pivotal role in accurately capturing reproduction outcomes. At marking, lambs were tagged and DNA sampled-except at the New England site, where tagging occurred at birth. While some sites also collected visual scores on the F2 lambs, this data collection was generally unfunded. Comprehensive weight records were obtained for all lambs at weaning, and a subsequent follow-up was conducted post-weaning to address any gaps resulting from missed initial weaning weights.

Once F2 animals had their post-weaning records collected, sites sought approval for their release from the project. Several sites leveraged their F2 progeny for additional research initiatives.

Data Flow, Management, and Reporting in the MLP

The MLP Project featured a multi-layered data flow and management system, with rigorous site-level collection and validation, centralised oversight and storage, quality assurance by genetic analysis experts, and integration with national genetic evaluation. There was a strong emphasis on data integrity, security, and regular reporting, ensuring the dataset's value for ongoing research, industry adoption, and genetic improvement.

1. Data Collection at Sites

- **Data Types:** Each MLP site annually collected a comprehensive suite of data on all F1 ewes, including wool measurements, growth and carcase data, health and welfare traits, visual conformation and wool traits, classing, and reproductive performance. Some sites also collected data on F2 progeny and F1 wethers.
- **Tools:** Data was collected using Electronic Identification (EID) technology and entered into Practical Systems (now Outcross) Stockbook software program.
- **Protocols:** Collection followed standardised protocols developed by AMSEA to ensure consistency and scientific rigor across sites. Protocols were updated as needed, and site managers were responsible for compliance.

2. Site Data Management and Submission

- **Initial Storage:** Data was initially stored and managed by local site data managers.
- **Transfer to AMSEA:** After collection, data was submitted from the site to AMSEA via Stockbook. Site data managers provided complete datasets to the MLP Data Manager within two weeks of collection.

- **Data Security:** Sites were responsible for securely storing their data and had redundancy processes in place to prevent data loss.

3. Central Data Validation and Storage

- **AMSEA Validation:** Upon receiving data, AMSEA undertook a validation process to check for anomalies, errors, and completeness. There are multiple layers of data review-by the site data managers, the project data manager, and the AMSEA database manager.
- **Main Database:** Validated data was then transferred to the central AMSEA database, which was hosted and managed by AGBU at UNE.
- **Data Security:** Databases were securely stored and backed up, with redundancy processes to safeguard intellectual property and prevent data loss.

4. Screening, Analysis, and Reporting

- **AGBU Screening:** AGBU screened the data for outliers and performed quality assurance before analysis.
- **Ongoing Analysis:** AGBU was responsible for running genetic analyses, producing breeding values, research breeding values, and supporting the interpretation of results for internal and external reporting.
- **Routine Reporting:** Data and results were published in annual MLP Site Reports and served as a routine validation and cross-checking process. These reports were reviewed and validated before release.

5. Integration with MERINOSELECT

- **Flow to MERINOSELECT:** Relevant MLP data (repeat adult data, F1 genotypes, phenotypes) were routinely submitted to the national MERINOSELECT genetic evaluation system. AGBU and AMSEA had developed processes to facilitate this ongoing data flow.
- **Genomic Data:** All F1 ewes were genotyped using high-density (50K) SNP chips, and this information was used to enhance the national genomic reference population.

6. Data Sharing and Licensing

- **External Access:** Complete MLP datasets are made available to research organisations operating a Site (e.g., NSW DPI, Murdoch University, CSIRO) under data licences for analysis and publication, subject to AWI approval.
- **IP Management:** AWI managed data licences and intellectual property arrangements to ensure data is protected and used appropriately.

7. Quality Control and Continuous Improvement

- **Regular Reviews:** Regular catch-ups and meetings between site managers and the MLP Data Managers facilitated the sharing of best practices and troubleshooting of data collection issues.
- **Routine Audits:** The production of annual MLP Site Reports and the flow of data into MERINOSELECT acted as routine audits and validation points.

- **Issue Resolution:** Any data anomalies or operational issues (e.g., DNA sample mix-ups, hardware failures, protocol deviations) were documented and addressed through updated protocols and management strategies.

Site Reporting

MLP site reporting refers to the structured process of collecting, analysing, and disseminating data from each of the five MLP Project trial sites. The reporting system was a critical component of the project, ensuring transparency, data quality, and communication with sire entrants and the wider industry.

Key Features of MLP Site Reporting

1. Annual (or Biannual) Site Reports

- **Frequency:** Each MLP site produced at least one major report per year, often timed to coincide with field days or major data collection milestones. In some years, two reports were generated (pre- and post-shearing/field day).
- **Purpose:** These reports serve both as a communication tool for entrants, breeders, and industry, as well as a quality assurance mechanism (routine data validation and cross-checking).

2. Report Content

MLP Site Reports are standardised according to a template developed by AMSEA and agreed on by AWI and the MLP Executive.

- **Raw Data:** Unadjusted averages for each sire's ewe progeny (not accounting for birth type, rear type, age of dam, or management group).
    - Included: Birth and rear type counts, number of progeny at each assessment, and results for wool traits, body weight, carcase traits, condition score, visual scores, professional classer grade, reproduction, etc.
- **Adjusted Sire Means:** Progeny averages adjusted for non-genetic factors (birth type, rearing method, age of dam, management group). These do **not** account for heritability or genetic correlations.
- **Flock Breeding Values (FBVs):** Calculated within site and drop, FBVs express a sire's performance relative to others in the evaluation, incorporating genetic and environmental effects. Accuracy increases with more data.
- **Indexes:** Industry-standard and project-specific indexes were included for context.

Governance, Project Roles and Responsibilities

Industry Steering Committee

The **Industry Steering Committee (ISC)** was established as an advisory body to the MLP Project Executive Committee and was managed by AWI. Its primary role was to provide guidance, ensure industry relevance, and act as a dispute resolution mechanism if required.

The ISC was essential to maintaining the project's alignment with its research, development, and extension objectives. Its responsibilities included:

- **Advising the Executive Committee:** Providing input on trial protocols and management to ensure they aligned with the project's goals.
- **Facilitating Industry Feedback:** Assisting AWI and AMSEA in communicating project progress and extending its outcomes to the broader industry.
- **Supporting Communication and Analysis Plans:** Helping the Executive Committee develop and maintain strategies for analysing and sharing project findings.
- **Providing General Recommendations:** Offering advice and recommendations on broader project matters as requested by the Executive Committee.

ISC Membership

The ISC comprised a diverse group of representatives from across the industry, including breeders, site representatives, classers, and AWI and AMSEA nominees. Membership reflected the collaborative nature of the project and ensured balanced input from all stakeholders.

Category	Name	Category	Name
AASMB Nominee	Matthew Coddington	**AMSEA Representative (Chair)**	Rich Keniry
AASMB Nominee	Graham Wells	**Executive Officer**	Ben Swain
AASMB Nominee	Georgie Wallace	**Site Rep Balmoral VIC**	Tom Silcock
Breeder	Craig Dewar	**Site Rep Pingelly WA**	Bill Sandilands
Breeder	Geoff Davidson	**Site Rep MerinoLink NSW**	Rich Keniry
Breeder	Brett Jones	**Site Rep Macquarie NSW**	Matthew Coddington
Breeder	Drew Chapman	**Site Rep New England NSW**	Jock McLaren
Classer	Chris Bowman	**AWI Representative**	Bridget Peachey
Classer	Bill Walker	**AWI Representative**	Geoff Lindon
Independent Chair	Russell Pattinson		

Observers

Category	Name
Classer (Proxy to Bill W./Chris B.)	Nathan King

The ISC's broad expertise and balanced representation ensured that the MLP Project remained both industry-relevant and scientifically robust while fostering transparent communication and collaboration across stakeholders.

MLP Executive

The **MLP Executive** played a pivotal role in overseeing the strategic, operational, and administrative aspects of the project to ensure its success. The Executive provided leadership, guidance, and governance to maintain the integrity of the project's objectives and deliverables.

During first two years of project establishment the MLP Executive met monthly or twice monthly, from 2020 onwards, meetings reduced in frequency but continued regularly with at least 3-4 per year and sometimes more during critical periods. By 2022 the group met on an as needed basis. A total of 53 MLP Executive meetings were held between 2015 and 2025.

Membership of the executive included

- Includes AWI GM Research (initially Paul Swan, later Jane LittleJohn followed by Bridget Peachey)
- AWI GM Genetics (initially Geoff Lindon, then Neil Judd before Geoff Lindon returned to the position)
- AMSEA Chairman (initially Tom Silcock followed by Jock McLaren and Richard Keniry)
- AMSEA Executive Officer (Ben Swain) with AMSEA Vice Chairman (Jock Mclaren then Richard Keniry) observing
- Secretariat (MLP Project Manager Anne Ramsay)
- Independent and non-voting Chairman (Russell Pattinson).

Key Responsibilities

- **Strategic Oversight**
    - Provided high-level guidance and decision-making to ensure the project remained aligned with its research, development, and extension goals.
    - Reviewed and approved protocols, budgets, and plans to maintain consistency across all trial sites.
- **Governance and Compliance**
    - Ensured the project adhered to contractual obligations, including the AMSEA/AWI Merino Lifetime Productivity Project Agreement.
    - Oversaw risk management processes and resolved issues to safeguard project outcomes.
- **Monitoring and Evaluation**
    - Evaluated site performance and provided feedback to improve operations and data collection.
- **Approval and Support for Add-On Projects**
    - Reviewed applications for add-on projects to ensure they complemented the core MLP objectives and did not compromise trial integrity.
- **Data and Reporting Oversight**
    - Monitored the management of data collection, storage, and analysis to maintain accuracy, security, and compliance with intellectual property requirements.

- **Resource Allocation and Budget Management**
    - Allocated resources efficiently across sites and monitored budget adherence.
    - Worked with AMSEA to resolve resourcing challenges.

AMSEA

AMSEA Executive - Ben Swain (AMSEA Executive Officer)

- Was responsible for delivering the AWI/AMSEA head agreement, including:
    - Contracting sites and maintaining contracts.
    - Managing data and intellectual property (IP) protection.
    - Overseeing service delivery (e.g., genotyping).
- Managed the project budget and site payments.
- Represented the sites' interests on the MLP Executive.
- Facilitated within-site analysis for site reporting.
- Oversaw base communication and reporting activities.
- Managed AMSEA-contracted add-on projects.

MLP Project Manager - Anne Ramsay (contracted to AMSEA)

- Worked with site managers and chairs to fulfill site contract requirements within budget, including:
    - Ensuring data collection aligned with protocols.
    - Preparing communication and annual disaster management plans.
    - Developing joining plans and addressing issues as they arose.
- Maintained site protocols and developed new ones when necessary.
- Recommended protocol changes to the MLP Executive.
- Managed quarterly milestone submissions.
- Organised regular Executive meetings, prepared materials, and ensured outcomes were actioned.
- Prepared quarterly updates for the Industry Steering Committee (ISC) and attended ISC meetings to implement decisions.
- Submitted monthly updates to the AWI Board.
- Contributed to reporting and communication materials, such as:
    - *Beyond the Bale* (BTB), newsletters, and MLP Reports.
- Organised site meetings and ensured follow-up actions were completed.
- Provided content for AMSEA milestone reporting to AWI.

- Handled ad hoc tasks, including communication approvals, management group development, and responding to industry requests.

MLP Data Manager - Ben Swain (AMSEA)

- Collated, stored, and managed project data.
- Provided project data to AGBU for inclusion in the AMSEA database.
- Audited project data and coordinated with site managers and the MLP Project Manager to address identified issues.
- Delivered data extraction services for third parties, AMSEA, and internal project purposes.
- Ensured databases were securely stored and backed up, with redundancy processes in place to prevent data loss and safeguard intellectual property rights, in line with the Project Agreement.

MLP Communication and Industry Reporting

Carried out by the AMSEA team, extensively by Emma Grabham between July 2017 to September 2022

- Organised and prepared MLP Reports.
- Coordinated and developed *Beyond the Bale* (BTB) articles.
- Developed and coordinated the MLP Newsletter.
- Supported field day promotion and site communication activities.
- Created presentations, including templates and standalone online content.
- Coordinated collateral such as brochures, signs, and promotional materials.

Site Hosts and Site Committees

- **Site Committees and Site Owners**
    - Responsible for undertaking all activities required to deliver the MLP Project as outlined in the Trial Protocols.
    - Ensure trial operations align with the project's research and extension objectives.
- **Site Hosts**
    - Provide the trial sheep, infrastructure, labour, and technology necessary to meet the Trial Protocol requirements.
- **Site Committees**
    - Function as an oversight group, an industry sounding board, and a source of labour (note that the level of labour contribution varied between sites).
    - Advocate for the project within the wider industry and ensure local engagement.

Site Managers

Site Managers: *Tom Silcock (Balmoral 2015-2022), Sally Martin (MerinoLink 2015 to 2019), Lexi Cesnik (MerinoLink 2019 to 2022), Beth Paganoni (Pingelly 2016), Bronwyn Clarke (Pingelly 2016 to 2022), Sue Hatcher*

(Macquarie 2016 to 2017), Kathryn Egerton Warburton (Macquarie 2017 to 2021), Tracie Bird Gardiner (Macquarie 2021 to 2023), Jen Smith (New England 2017-2024)

Key Responsibilities

- Ensure compliance with established protocols and budgets for their respective MLP sites.
- Guarantee that the site is adequately resourced with labour, materials, and infrastructure to fulfill project requirements.
- Work with the AMSEA Executive Officer to prepare invoices for measurements and activities undertaken at the site, which are then submitted to AMSEA.
- Attend all site meetings or workshops as needed to share knowledge and align site activities.
- Submit quarterly milestone reports to the MLP Project Manager, contributing to milestone tracking and project updates.

Site Data Managers

Site Data Managers: *Ben Swain (Balmoral), Lexi Cesnik (MerinoLink), Bronwyn Clarke (Pingelly), Tracie Bird Gardiner (Macquarie), Jen Smith (New England)*

Key Responsibilities

- Coordinate and ensure the timely and accurate collection of data for all traits recorded at their respective MLP sites.
- Provide complete datasets to the MLP Data Manager within two weeks of collection.
- Securely store all site data and implement redundancy processes to prevent data loss, ensuring compliance with intellectual property and data protection requirements as per the AMSEA/AWI MLP Project Agreement.
- Participate in inter-site meetings or workshops to support data management consistency across sites.
- Deliver relevant data and information to the MLP Project Manager for inclusion in milestone reports and overall project documentation.

Operations Team

The Operations Team held regular meetings for the Merino Lifetime Productivity project's coordination, typically via Zoom several times a quarter. They addressed operational issues such as data quality and site management while ensuring information flow to the Executive Committee and industry groups such as the ISC. Core members included Geoff Lindon, Ben Swain, and Anne Ramsay, with participation from Emma Grabham during her time with the project. Their discussions guided many aspects of the project.

Meeting Content and Purpose
During these sessions, the team discussed a wide range of operational topics, including:

- **Site Updates and Data Management**: Ensuring that data collection was on track and any issues at the various sites were addressed.
- **Contract and Financial Matters**: Reviewing site agreements, invoicing processes, and overall project budget implications.

- **Analysis and Add-On Projects**: Coordinating on analysis priorities and discussing proposals for smaller add-on projects that complement the core activities.
- **Communication and Coordination**: They also served as a forum for the project manager and other key staff to pass along updates from other committees or the executive and to plan next steps, such as preparing reports or scheduling site meetings.

They not only addressed immediate operational issues like data quality and site management but also facilitated the flow of information upward to the Executive Committee and later to industry-facing groups such as the ISC. In essence, they acted as a "control centre" that helps keep the project on track amid the many moving parts.

Site Manager and All Sites Meetings

The site manager meetings were held as a regular forum for those responsible for the day-to-day operations at each trial site to come together to:

- Review the progress of the project on-site (for example, updates on animal data collection, condition scoring, and other on-farm measurements)
- Discuss, troubleshoot, and resolve operational or administrative issues (such as invoicing, data management, and protocol adherence)
- Share best practices and ensure alignment in how protocols are implemented across sites
- Coordinate communication with site committees and project management so that any emerging issues (such as budget variances or unexpected field challenges) could be addressed promptly
- Provide feedback on new protocols, changes in management processes, and technical initiatives (for instance, training on new data collection or reporting methods)

These meetings were a key part of the project's governance and quality assurance process, ensuring that each site's challenges and experiences were discussed and that consistency in practices and reporting was optimised.

Initially, meetings were held quarterly, and at times more frequently before moving to an as-needed basis. A total of 23 meetings were convened, with most meetings held online combined with an annual face-to-face meeting.

In the early years, **all sites'** meetings were held annually face-to-face, involving site managers, site hosts, and site chairs. Meetings helped build relationships between site managers, data managers, and the broader project team, fostering a sense of project ownership and engagement.

AGBU

AGBU (Animal Genetics and Breeding Unit) has played a central and multifaceted role in the MLP Project. AGBU operated under contracts with AWI (for R&D and analysis) and with AMSEA (for database management and operational analyses). These contracts defined priorities, deliverables, and reporting obligations, including the following key responsibilities:

Data Analysis and Reporting

- **Core analysis provider**

    - AGBU was responsible for the analysis of MLP data, including running the genetic analyses that underpin MLP site reports, producing breeding values, and supporting the interpretation of results for both internal and external reporting.
    - R&D Activities: They performed research and development activities using MLP data, such as developing new analytical methods and reviewing genetic estimates for key traits like reproduction.
- **Advice and guidance**
    - AGBU provided annual consultations on managing F1 ewe groups, focusing on post-preg scanning groupings, lambing groups and their impact on analysis.
- **Database Management**
    - AGBU managed and developed the AMSEA/MLP database, ensuring that data from all sites was validated, stored securely, and is accessible for analysis.
- **Quality Assurance and Validation**
    - AGBU screened data for outliers and assisted in the thorough validation process to ensure data integrity prior to analysis.
- **Collaboration and Meetings**
    - AGBU participated in routine meetings with the MLP Operations Team, Executive Committee, and site representatives to discuss analysis progress, priorities, and technical issues.
- **Support for Add-on and Student Projects**
    - AGBU provided data and analysis support for add-on projects and student research, often requiring co-authorship or collaboration to ensure data is used appropriately.

AGBU Analysis Meetings

AWI contracted AGBU (ON-00775 Genetic Analysis – January 2022 to December 2026) to analyse MLP data, assist with general genetic benchmarking R&D (mostly Sire Evaluation and MERINOSELECT), and to create flystrike genomically enhanced breeding values.

AGBU analysis meetings were established in 2021 to guide the detailed MLP Project analysis, monitor progress on outputs, and facilitate cross-organisation communication for robust genetic analyses. Held mainly online via Zoom for an hour every fortnight, with two in-person meetings, a total of 56 meetings occurred between October 2021 and March 2025. Attendees included Geoff Lindon from AWI, Professors Andrew Swan and Daniel Brown from AGBU, Dr Peter Wahinya, Dr Elena Dehnavi, Ben Swain from AMSEA, and MLP Project Manager Anne Ramsay.

Communication

Internal Communication

Internal communication within the Merino Lifetime Productivity (MLP) Project was multi-faceted, structured, and evolved over time. Key features included:

Site Milestone Reports

Provided updates on project activities, site events, data collection, analysis progress, and features on project staff or site managers.

Project Updates

Project updates were circulated to the Industry Steering Committee (ISC) bimonthly.

Meetings

Executive Committee Meetings: Regular meetings (often monthly or quarterly) were held by the MLP Executive Committee to review progress, budget, protocols, and communications.

Operations Team Meetings: The operations team (including project managers and site representatives) met via Zoom or in-person to discuss operational issues, site management, and data collection.

Site Managers and Chairs Meetings: Periodic meetings for site managers and chairs were conducted to build relationships, discuss project ownership, data management, invoicing, and protocol adherence.

Analysis Meetings: Meetings with analysis partners (e.g., AGBU) commenced in 2021 and were held to review data collection and analysis plans.

External Communication

The evolution of external communication in the Merino Lifetime Productivity (MLP) project has been a process of increasing structure, sophistication, and strategic intent over time. Below is a summary highlighting key stages and developments.

Early Stages: Ad Hoc and Basic Communication (2015-2016)

- **Initial Activities**: The project began with basic external communications such as site field days, preparing brochures, and articles in industry newsletters.
- **Key Issues**: There was recognition early on that project communication was mostly reactive, with concerns about lack of coordination and transparency from some sites.

Introduction of Communication Protocols and Structured Planning (2016-2018)

- **Draft Communication Protocols**: By 2016, the project developed a draft "Site Communication Protocol" requiring all published material to be reviewed by the MLP Project manager before publication and acknowledging the need for standard funding acknowledgements.
- **Branding & Web Presence**: Discussions began about branding, web presence, and the need for a more active and strategic approach to communication.
- **Communication Planning**: The need for a proper communications program was acknowledged, and there was a move towards developing a plan and securing resources for its implementation.
- **Engagement of Communication Specialists**: A process was initiated to engage a communication company to develop a robust communication strategy.

Formalisation and Expansion (2018-2021)

- **Implementation of the Communications Plan**: With the appointment of communications professionals (e.g., Peter Schuster from Schuster Consulting), the project saw more coordinated and regular communications, including quarterly newsletters, online articles, and dedicated website content.
- **Field Days and Industry Events**: The project's presence at field days, conferences (e.g. AAABG, MerinoLink), and industry forums increased, with regular updates and presentations.
- **Use of Media and Digital Channels**: Communication expanded to include podcasts (AWI's The Yarn), webinars (SheepConnect NSW), and social media snippets. Project results and updates were shared in industry magazines and mainstream rural media. AWI was not supportive of the MLP Project having its own social media accounts (owing to branding concerns) and opted instead to promote MLP content on their own social media channels.
- **Newsletter & Reporting**: Regular, visually appealing newsletters were produced and distributed through multiple channels, including AWI networks, stud breeder lists, and regional networks.

Maturity and Strategic Coordination (2021-2024)

- **Communication as a Project Pillar**: External communication became one of the project's strategic pillars, with the plan regularly reviewed and updated. Key messages were tailored for awareness, engagement, and later, results adoption.
- **Multi-channel Outreach**: Outreach included internal (newsletters, reports, field days) and external (industry journals, podcasts, national print and radio media) channels. Notable is the structured use of press, podcast, and field day coverage for major milestones and achievements.
- **Evaluation and Feedback**: Surveys and feedback mechanisms at field days and via newsletters were increasingly used to gauge impact and improve communication.
- **Executive Oversight**: The Executive Committee regularly reviewed communication activities, with budget transparency and alignment to project milestones.

Recent and Final Stages (2023-2025)

- **Celebration of Outcomes:** As the project neared completion, external communication focused on celebrating achievements and disseminating final site results, with coordinated press coverage, conference presentations, and final field days.
- **Legacy and Extension**: AWI began planning for genetics-focused extension and sought to ensure project messages and insights would be sustained in industry practices.

MLP Communication and Awareness Plan 2020 - 2024

The following describes the communication and awareness plan that was followed between 2020 and 2024

Purpose and Objectives

The MLP Communication and Awareness Plan aimed to:

- **Create Awareness:** Introduce and explain the MLP Project to stakeholders.

- **Maintain Awareness:** Sustain stakeholder interest as the project progresses, especially leading up to data analysis and extension activities.
- **Build Confidence:** Foster trust in the project's methodology and anticipated outcomes.
- **Highlight Importance of Data:** Emphasise the value of accurately estimating Merino ewe lifetime performance at young ages.
- **Showcase Practical Improvements:** Illustrate how the MLP will inform better breeding and selection methods.
- **Demonstrate AWI Commitment:** Highlight AWI's long-term dedication to improving Merino ewe productivity and providing value for levy payers and the government.
- **Manage Expectations:** Communicate interim outcomes when appropriate, while clarifying that comprehensive results require full data collection, concluding in July 2024.
- **Balance Awareness and Expectations:** Increase interest while managing expectations for project outcomes during the data collection phase.

Target Audiences & Cognitive Stages

Audience Groups:

1. **Primary:** Project beneficiaries (Merino producers, ram breeders, buyers) and project influencers (boards, committees, staff, genetic/commercial influencers).
2. **Secondary:** Industry influencers (consultation groups, breed groups, service providers, supply chain influencers).
3. **Tertiary:** Educational influencers (colleges, universities, researchers, extension specialists, representative groups, related projects).

Cognitive Stages:

Audiences transition through these stages:

- **Unaware → Aware → Engaged → Using**
  Messages and tactics are tailored to move individuals along this continuum, acknowledging that progress is not strictly timeline-driven and individuals will proceed at their own pace.

Communication Tactics

Channels:

- MLP-specific email lists
- Site field days
- Scientific publications
- MLP webpage
- Rural media, social media (AWI, AMSEA)
- Newsletters (MLP, AWI)

- Industry events and breeder meetings
- YouTube, podcasts (The Yarn)
- AWI Extension Networks
- Training workshops

Content Elements:

- Detailed articles and editorials
- Slide decks for events
- Case studies (with potential video/podcast adaptations)
- Newsletters, posters, factsheets/brochures

Annual Priorities:

- Five site reports and field days
- Four main articles in "Beyond the Bale"
- Regularly updated MLP webpage and newsletters
- Bi-monthly project updates to committees
- Master PowerPoint and YouTube presentations
- Two podcasts and highlighted presentations at key industry events
- Ongoing social media and training activities

Communication Key Project Messages

WHY?

- **Rationale:**
  There are knowledge gaps in optimal ewe productivity assessment (wool, lamb, meat), cost-benefit analysis, and combining measurement methods.
- **Importance:**
  Understanding and optimising Merino ewe productivity increases woolgrower profitability.
- **Value:**
  Data collection and analysis enable better selection for profitable sheep.

WHAT?

- **Project Description:**
  The MLP is a research initiative to improve ewe lifetime productivity and economic performance in wool enterprises, collecting long-term data to enhance breeding and selection approaches.

WHO?

- **Stakeholders:**
  10-year, $13 million partnership among AWI, AMSEA, stud breeders, and five host sites.

WHERE?

- **Scope:**
  Up to 5,700 Merino ewe progeny across five sites, assessed through multiple joinings and shearings.
- **Access:**
  Further information at wool.com/mlp or merinosuperiorsires.com.au/mlp-project/

Evaluation

AMSEA monitored and evaluated the project by using a combination of frequent oversight meetings, rigorous financial/invoice reviews, technical data audits, and robust communication with all project stakeholders.

This integrated approach helped ensure that both the operational elements and the strategic outcomes of the project were continuously monitored.

In addition, a survey was developed that was designed to gather detailed feedback on the overall experience of the field day events, to track understanding of project results, and to obtain feedback about the best way to communicate with industry.

Specifically, the surveys focused on several aspects, including:

1. **Attendee Background and Communication:**
    - Identifying the type of attendee (e.g., wool grower, sire entrant, ram breeder, committee sponsor, etc.), and for wool growers, details like the number of Merino ewes joined to rams.
    - Determining how participants found out about the event (via email, social media, word of mouth, local media, etc.) and preferred formats for receiving further information.
2. **Event Experience:**
    - Requesting ratings on how enjoyable, valuable, informative, and relevant the field day was overall.
    - Collecting evaluations on specific components of the day, such as presentations, pen-side sire introductions, MLP site reports, and pen cards.
    - Including questions regarding the timing of individual events (for example, whether there was “just right” or “too short/too long” time for key elements like the keynote topics or time allocated to inspect the sheep).
3. **Understanding of Provided Information:**
    - Assessing attendees’ understanding of the distributed materials, such as the pen cards and results reports.
    - Gauging whether the additional information provided was comprehensive or needed more detail.
4. **Future Content and Improvements:**
    - Asking for suggestions on the most important questions the MLP Project could answer.

- Participants were even asked to rate the importance of various topics for the next year's field day.
- Collecting open-ended comments for further improvements regarding the event and the results presented.

5. **Staying in Touch:**
    - Requesting contact details to maintain ongoing communication with attendees as the project progresses and more data is collected.

Risk Management Summary

Risk management in the MLP Project was a well-structured, multi-layered process, embedded across all operational levels. The approach evolved over time, was reviewed regularly, and was tailored to both standard and site-specific risks, including biosecurity, animal welfare, operational disruptions (like COVID-19), drought, and data integrity. Below is a summary of how risk was managed:

Risk Type	**Management Approach**
Drought/Disaster	Annual plans, funding support, destocking priority, regular updates
Animal Welfare	Protocols, regular welfare reviews, ethics approvals, proactive treatment
COVID-19	Site-specific plans, online events, staff backup, protocol tweaks
Data Integrity	Data management protocols, regular audits, central oversight
Communication	Publication approval protocols, crisis communication planning
Budget/Resourcing	Contingency lines, reallocation, regular review

RESULTS - DATA

MLP Project Site Climatic and Health Data

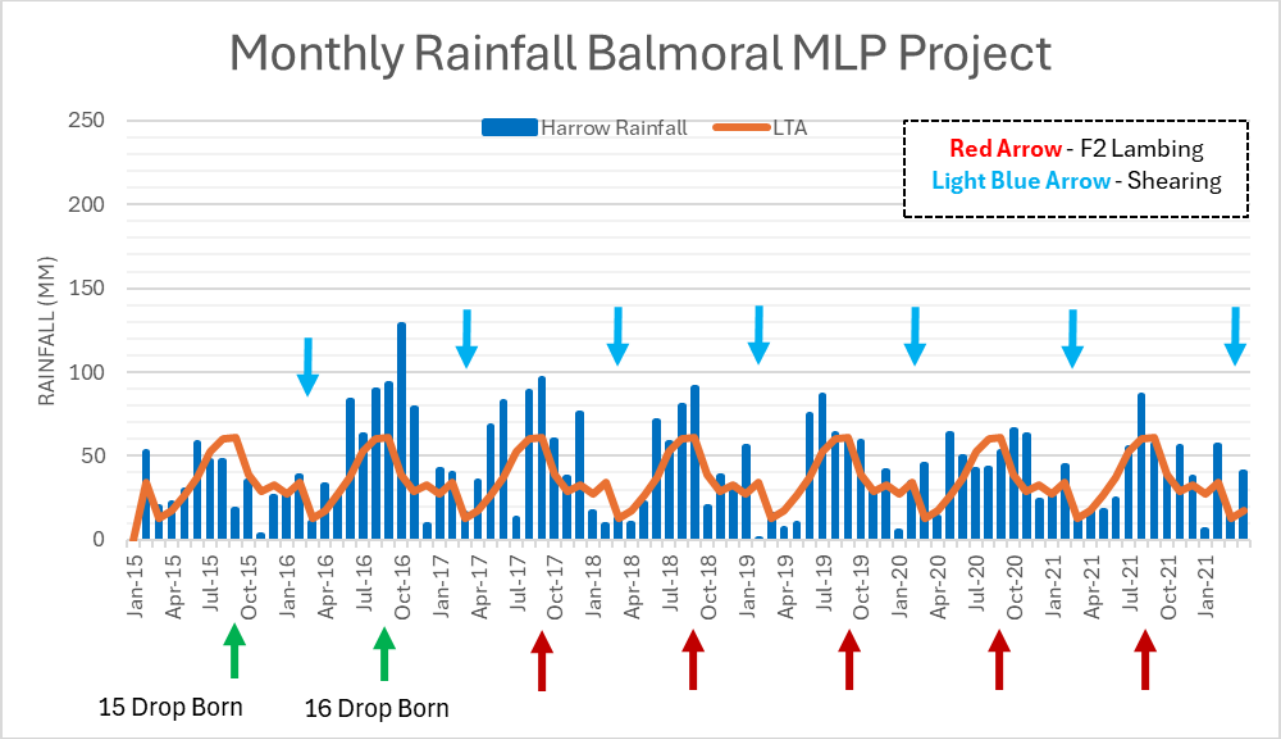
The climatic conditions across the MLP sites varied significantly throughout the project, ranging from severe drought to extremely wet periods. Seasonal conditions had significant impacts on site management, animal health, and feeding regimes.

Outlined below is a site-by-site breakdown of seasonal conditions and health events. The table below provides the average annual rainfall received for each site.

Annual Rainfall (mm) at MLP Project Sites

Year	Balmoral	MerinoLink	Pingelly	Macquarie	New England
2015	386				
2016	694	704	457		
2017	628	399	562	350	766
2018	498	301	409	263	552
2019	448	310	307	160	228
2020	521	687	321	631	1119
2021	507	776	552	784	1099
2022		1020	438	800	987
2023				424	693
2024					721
Long Term Median	**483**	**533**	**443**	**496**	**789**

Balmoral Site



For the duration of the project at the Balmoral site, rainfall was generally aligned with the long-term average. However, there were a few notable deviations:

- **2016-2017:** Excessive rainfall occurred during several months in 2016 and 2017.
- **2018-2019:** Dry periods were experienced in late summer and autumn during 2018 and 2019. These dry periods were not associated with drought and were within typical variability.

2015

Seasonal Conditions: The site experienced dry seasonal conditions during the second half of 2015. Supplementary feeding was required to maintain ewe condition. Despite this, lamb survival rates were above expectations for the season.

Health Issues: A high incidence of dermatitis (referred to as "dermo") was noted in the 2015 drop lambs at tagging. Lambs were treated and scored prior to their first assessment in May 2016. The fleece weight of animals with a score 4 or 5 were disregarded for the project analysis.

2016

Seasonal Conditions: The season improved significantly, with good conditions leading into lambing in August. Ewes showed high levels of nutrition and maintained good condition.

Health Issues: Lupinosis was diagnosed in the 2015 F1 ewes in March, causing losses and condition deterioration. It was noted that there was a higher incidence of flystrike in the F1 progeny compared to the commercial flock run on site.

2017

Seasonal Conditions: The autumn break was late, which brought reasonable rains but was followed by slow pasture growth due to frosts in June.

Health Issues: Ongoing issues with lameness (foot scald) was treated with foot bathing.

2018

Seasonal Conditions: There were reasonable seasonal conditions with some drier months.

Health Issues: Lice were detected in October 2018, successfully treated with long wool backline and full dipping program post-shearing in March 2019. Lameness was managed with foot bathing.

2019

Seasonal Conditions: A good autumn break was received, resulting in improved pasture growth.

Health Issues: Foot issues were managed with foot bathing, and there was speculation that OJD was having an impact on the 2016 drop.

2020

Seasonal Conditions: The site experienced favourable seasonal conditions, with abundant spring pasture growth.

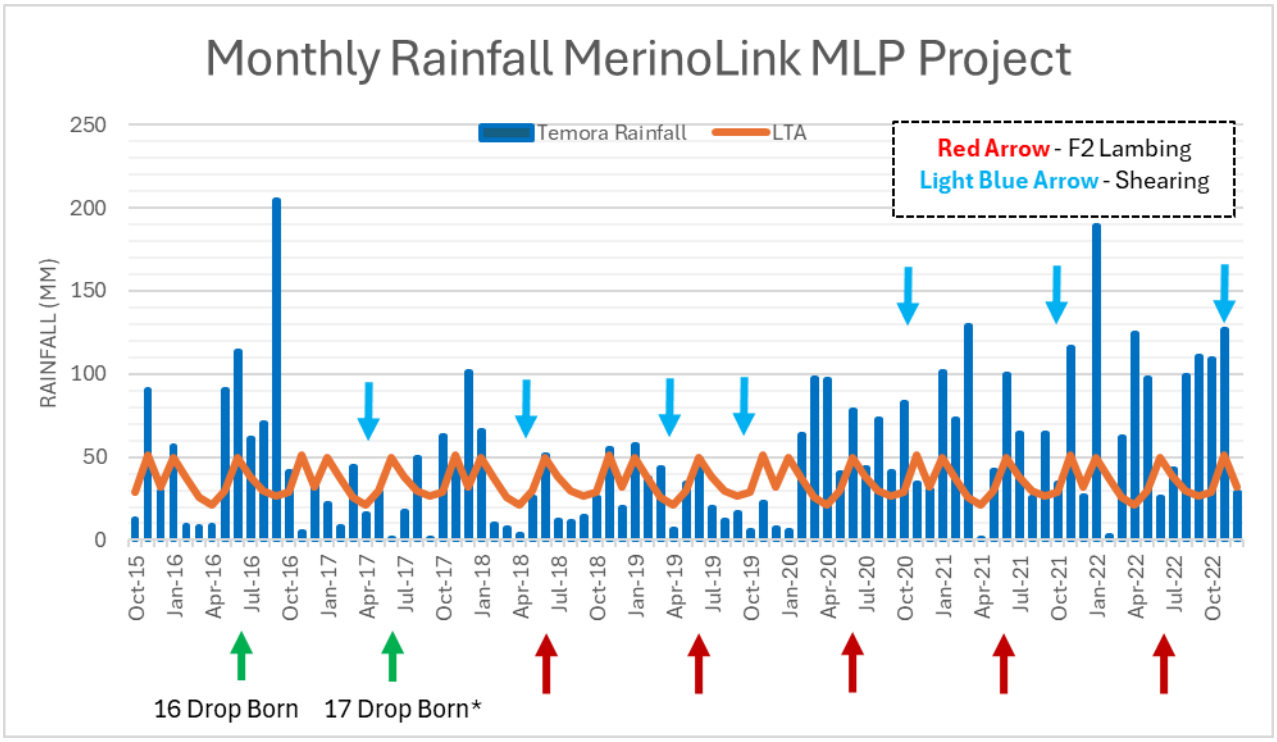
Health Issues: Persistent low-level losses were confirmed as OJD via autopsy in the 2016 drop F1 ewes (despite history of long-term vaccination). The average mortality rate of ewes was estimated to be 3-5% per annum in recent years, which was higher than the mortality in the site's commercial ewes, but comparable with industry commercial ewe mortality rates.

2021

Seasonal Conditions: Rainfall for the year was slightly below average. There was a reasonable autumn break and good rainfall in May and June.

The host property was sold during this period, and the final stages of the project were undertaken under pressure owing to the need to have the farm settled by March 2022.

MerinoLink Site



**The 2017 drop were born at a Cootamundra site 50km from Temora and returned in November. A total of 279mm fell at Cootamundra during the May to November 2017.*

The site was established in 2016 under favourable seasonal conditions; however, extreme climatic conditions were observed for the subsequent years.

- **2017:** Rainfall consistently fell below the long-term average.
- **2018-2020:** Drought conditions were officially declared from 2018 to early 2020.
- **2020 Onward:** Excessively wet conditions prevailed from early 2020 to the end of the project.

2016

Seasonal Conditions: The site experienced a reasonable season. It was an extremely wet winter, which may have impacted lamb survival owing to the availability of shelter. Access to paddocks saw a delay to weaning, and flooding resulted in fences being washed out.

2017

Seasonal Conditions: It was very dry with F1 ewes being supplemented with barley through lick feeders. Grazing crops failed. Availability of paddock water was an issue. Excellent lambing weather was noted.

Health Issues: The 2017 drop was affected by a blood infection, Mycoplasmosis Ovis, which saw losses of 6% of lambs between tagging and weaning. Advice from the Local Land Services vet was to leave the lambs alone and reduce any stress-inducing situations. As a result, weaning was slightly delayed.

2018

Seasonal Conditions: There were severe drought conditions, but the site committee chose to continue to maintain ewes at standard condition score targets. There was a total of 300mm of rainfall (well below the long-term average of 520mm).

2019

Seasonal Conditions: Drought continued throughout the year. Limited feed availability necessitated reliance on failed cereal crops and confinement feeding. Ewes were fed using self-feeders.

Health Issues: Lice were detected in one ewe prior to shearing. Ewes were dipped off shears to manage lice.

2020

Seasonal Conditions: The site received 145mm of rainfall early in the year, leading to the recovery of lucerne and pasture paddocks. The site moved out of drought conditions.

Health Issues: Foot abscesses impacted ewes owing to wet conditions. F1 ewes were regularly foot bathed, and penicillin administered to severe cases.

2021

Seasonal Conditions: Heavy rains in March caused flooding, washing out fences and affecting paddocks. Close to 600mm of rainfall was recorded through to the end of September. Cold and wet conditions persisted during lambing.

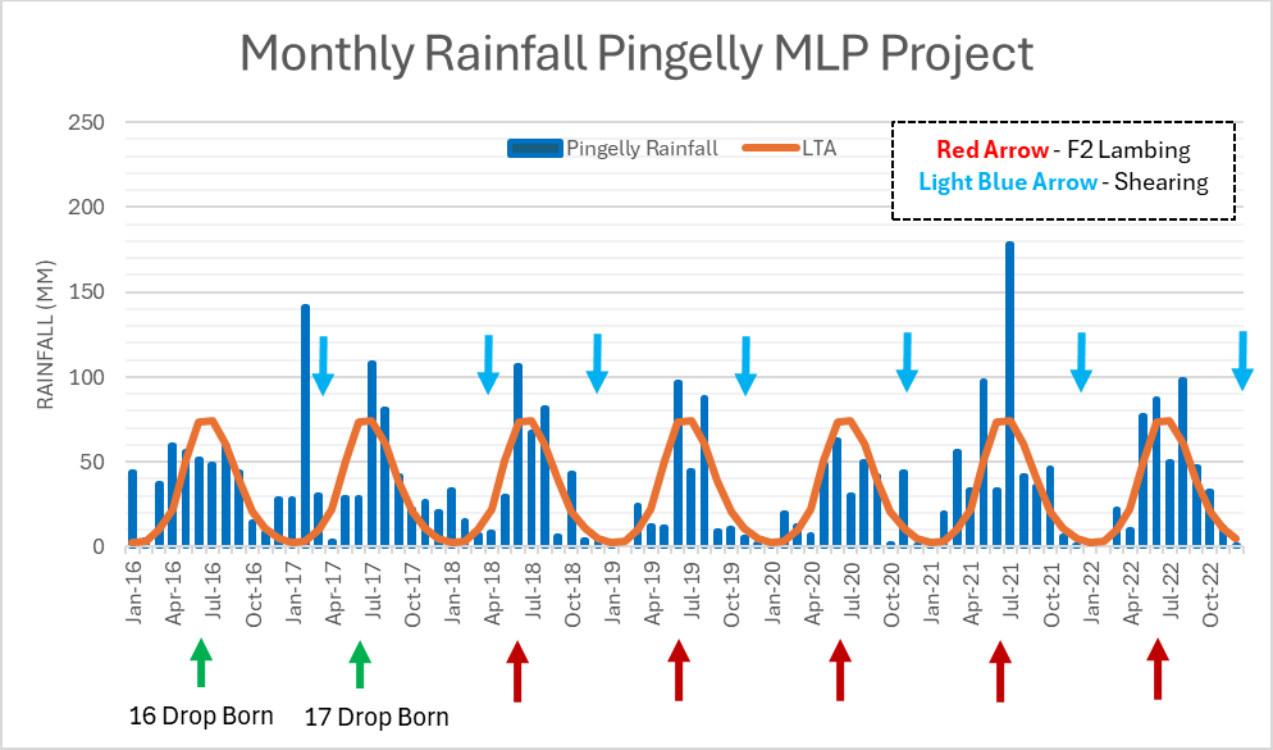
Health Issues: High worm burdens caused significant lamb mortality, especially in twins. Discussions revealed that ewes were not drenched prior to lambing as previously believed. Some foot soreness was reported, prompting foot bathing.

2022

Seasonal Conditions: It was an exceptionally wet spring with over 450mm recorded between August and November, leading to good pasture growth.

Health Issues: Some fly pressure noted prior to shearing. Mild foot soreness required repeated foot bathing.

Pingelly Site



The Pingelly site generally experienced average climatic conditions, with a few key exceptions:

- **Early 2017:** Dry conditions prompted funding for supplementary feed to ensure project condition score targets were maintained.
- **Late 2019-Early 2020:** A significant dry spell occurred during this period.
- **Mid-2020:** Another notable dry spell was observed.

2016

Seasonal Conditions: Pingelly experienced extremely dry conditions during 2016. Seasonal conditions markedly improved in July but remained challenging throughout the year.

2017

Seasonal Conditions: The site experienced a dry start but saw significant improvement in seasonal conditions after mid-year rains. Sheep were hand-fed through to June. A rainfall event of 40mm in June may have affected lambing.

Health Issues: Mortality among 2017 weaners was 4.9% due to flystrike and grass seed issues.

2018

Seasonal Conditions: Seasonal conditions were extremely dry at times, with supplementary feeding required throughout much of the year.

2019

Seasonal Conditions: The site had a very dry start to the year. Above-average rainfall in August led to good pasture growth for spring.

2020

Seasonal Conditions: A dry start to the year. Ewes were maintained in confinement paddocks and transitioned to green feed three weeks before lambing.

2021

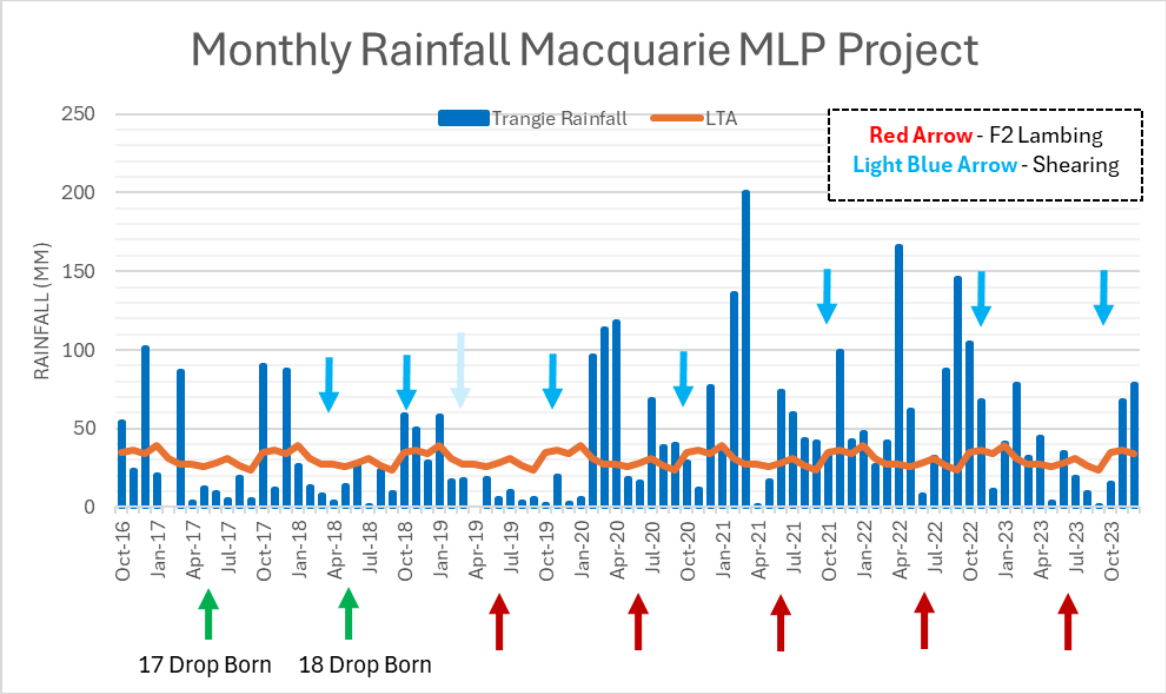
Seasonal Conditions: Above-average rainfall through autumn into winter, with 540mm recorded by May. Good pasture growth was reported.

2022

Seasonal Conditions: Reasonable growing conditions resulted in good feed availability. August received double the monthly average rainfall, supporting excellent spring pasture growth.

Health Issues: Foot abscesses were a significant problem, exacerbated by wet conditions. Several severely affected ewes were removed from the trial.

Macquarie Site



The Macquarie MLP Project site experienced prolonged dry conditions during the early years:

- **2017-2019:** Drought was officially declared from early 2017 and persisted through to the end of 2019. Supplementary feeding and drought-specific management measures were implemented during this period.
- **2020 Onward:** Seasonal conditions improved significantly, with excessively wet conditions reported from early 2020 onward.

2016

Seasonal Conditions: Dry conditions prevailed, with foundation ewes being supplementary fed in December and January.

Health Issues: Sponge retention issues occurred in 326 ewes during AI, requiring reprogramming and additional costs. No other major health issues were reported.

2017

Seasonal Conditions: Severe drought conditions characterised this year. Rainfall totalled 349.6mm, putting it among the lowest 25% of years recorded. Supplementary feeding began in January and continued throughout the year.

The Macquarie 2017 drop ewes were moved to the NSW DPI Condobolin Research Station in September 2017 due to severe drought conditions. These ewes returned to Trangie on November 21, 2017.

Health Issues: Lice were identified in foundation ewes and F1 ewes, and they were treated with a backline.

2018

Seasonal Conditions: Severe drought persisted with rainfall totalling 263mm, among the lowest 10% historically. Supplementary feeding continued throughout the year. October and November rains provided some Lucerne growth.

Health Issues: Scabby mouth vaccination was required for 2018 drop F1 ewes and lambs. Weaner mortality in the 2018 drop was higher than expected owing to misadventure. The reason for weaner mortality at the Macquarie site in 2018 was due to dehydration after their water tap had been turned off, resulting in the sheep not having access to water for several days. This incident occurred because of a failure for daily checks of water points at Trangie Agricultural Research Centre (TARC). A total of 43 ewes or 6% of the mob was recorded. The Department investigated and put controls in place to prevent recurrence.

2019

Seasonal Conditions: Intense drought conditions remained at the site, 160mm received in 2019, after 263mm in 2018 (LTA 500mm).

Health Issues: Concerns were raised about ewe foot health, with many ewes having overgrown toes. Foot paring was undertaken in the 2017 drop to manage foot health.

2020

Seasonal Conditions: Rainfall totalled 513mm with abundant feed available. Regular rains caused potential worm and fly issues.

2021

Seasonal Conditions: The site received 587mm of rainfall by September, leading to good pasture growth but wet conditions.

Health Issues: Foot abscess and scald became significant issues due to sodden paddocks. The site also indicated 3.5% ewe mortality due to pregnancy toxaemia associated with foot abscess.

2022

Seasonal Conditions: Rain totalled 861mm for the year, with persistent wet conditions causing challenges such as flooding and sodden paddocks.

Health Issues: Foot abscess issues persisted. Ewes were foot bathed twice in spring before foot paring was performed in November on both drops. Pregnancy toxaemia was directly linked to foot abscess issues during lambing. Approximately 3.5% of ewes died from pregnancy toxaemia. It was also noted that 13% of lamb losses were associated with foot abscess.

2023

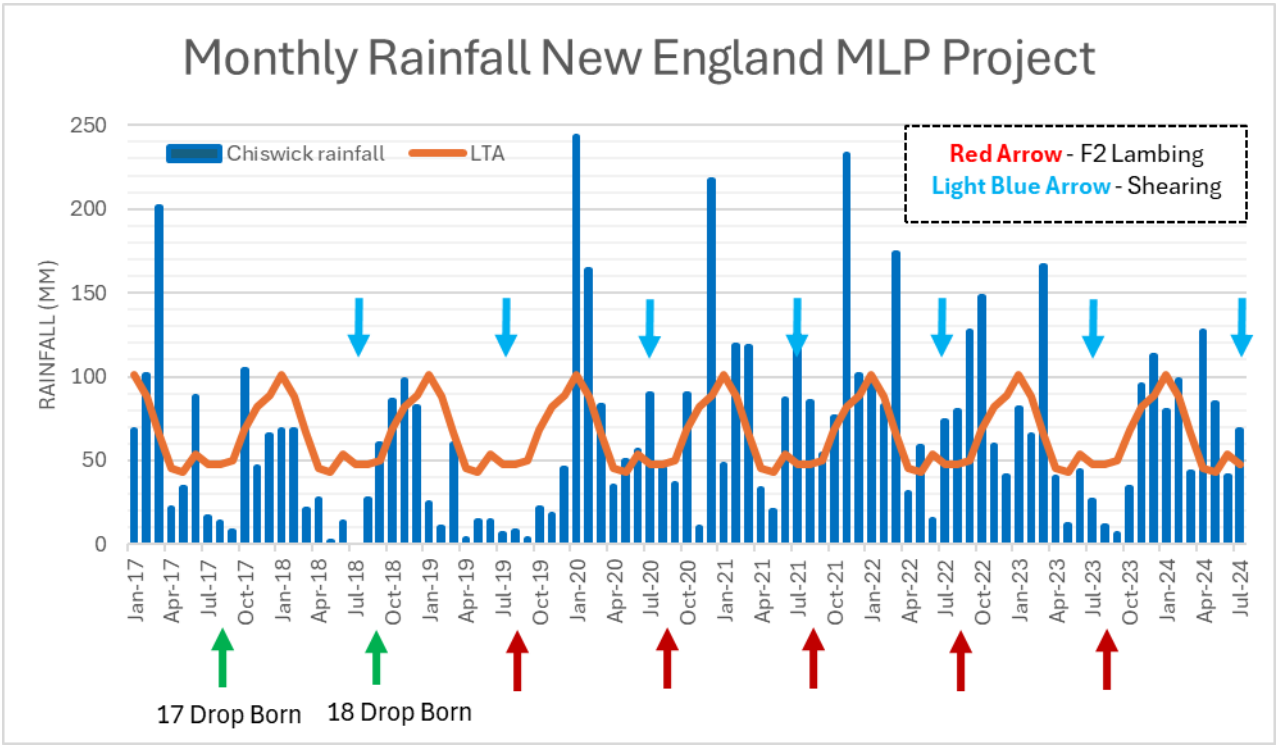
Seasonal Conditions: Dry conditions returned, with cooler weather in autumn and total rainfall of 262mm by September.

Health Issues: Foot issues were managed earlier in the year with foot paring.

New England Site

The New England site experienced extreme variability in rainfall:

- **2017-Early 2020:** Rainfall was very low, and drought was declared during this period. 2019 was the driest year on record.
- **2020 Onward:** A spike in rainfall occurred, with many months exceeding the long-term average. This led to excessively wet conditions including localised flooding and waterlogging of paddocks.



2017

Seasonal Conditions: It was a close to average season to begin, moving to dry conditions through spring.

Health issues: There was a long flystrike season, extending to late May, due to a mild autumn. Neonatal mortality to dystocia was relatively high.

2018

Seasonal Conditions: The site entered intense drought conditions, which worsened throughout the year. Feeding stopped briefly in late December but restarted in January 2019.

Health Issues: High breech flystrike rate in the summer prompted change to the flystrike prevention program for the flock (move to double crutching). There was incidence of Phalaris staggers and other metabolic disorders in the foundation ewes pre-lambing, and hypocalcaemia among foundation ewes at lamb marking. Neonatal mortality to dystocia was relatively high. Coccidia infection was noted in the 2018 drop lambs.

2019

Seasonal Conditions: Severe drought persisted. The summer was the third hottest on record, and rainfall was only 26% of long-term averages, stock water security became in an issue.

Health Issues: Prolapses (vaginal and uterine) were a problem at lambing, along with udder issues and abdominal hernias. The sheep were treated with Vit ADE (due to drought) at weaning which temporarily caused lameness, ill thrift and weight loss.

2020

Seasonal Conditions: A storm and flooding rain in January brought down trees (2 weaners died) and caused localised flooding. Seasonal conditions improved early in the year and recovery from drought began mid-year. Rainfall for the year was more than 1000mm.

Health Issues: Anthelmintic resistance was becoming an increasing issue, as was resistance to the main fly prevention actives. Breech strike and foot health issues (abscesses, interdigital dermatitis, shelly hoof) increased after the drought broke.

2021

Seasonal Conditions: This was another year of above-average rainfall (1099mm). Persistent waterlogging in the paddocks caused ongoing foot issues.

Health Issues: Ongoing foot issues prompted the first occasion of hoof paring and there was another long fly season.

2022

Seasonal Conditions: Another year of extreme wet conditions and rainfall (987mm, 25% above average). Persistent wet conditions caused lower ewe condition scores due to waterlogging and associated difficulty with supplementary (trail) feeding.

Health Issues: Foot issues persisted; there was another long fly season A *Listeria ivanovii* infection (diagnosed by EMAI) in the 2018 drop ewes (attributed to the waterlogged pasture conditions) caused an abortion storm whereby approx. 7% of lambs were lost to late term abortion.

2023

Seasonal Conditions: After a dry winter and spring, rainfall returned to normal (698mm, 10% below average). Grazing conditions improved.

Health Issues: Extremely high worm burdens were experienced, and anthelmintic resistance challenges were noted. Foot issues persisted. An extremely high rate of multiple births led to relatively high neonatal mortality.

2024

Seasonal Conditions: There was a mild summer with high worm challenges, and again, wet and mild winter affected feet health.

Site Foundation Ewes and F1 Ewe Management

The MLP dataset incorporates detailed management group information. The overall idea was to keep F1 ewes as a single, or as few, management groups as possible, which was essential to ensuring that differences seen in performance data really reflected genetic variation rather than differences in management or paddock conditions. Following Lifetime Ewe Management guidelines, most sites stratified ewes post pregnancy scanning into groups of single/dry ewes and ewes carrying multiple lambs. These management groups were

generally maintained through to lamb tagging or weaning, with ewes split into smaller mob sizes for the five-week lambing period. From weaning through to joining, ewes were run as one mob. In the genetic analysis, management group information will be used as a fixed effect to account for any significant differences that might otherwise mask true genetic performance.

Attachments 12 and 13 explain how these groups are defined and applied for both the foundation and F1 ewes.

Database

This section of the report provides an overview of the structure, content, and quality of the MLP data, setting the foundation for the detailed analyses and industry insights that follow.

Age of Assessment

MLP Site Reports use original age stages, while parameter analysis uses updated stages due to changes during the MLP Project.

MLP Site Reporting Age Ranges for Age Stages

M = Marking	14 to 42 days	A2 = Adult	1.5 to 2.5 years
W = Weaning	42 to 120 days	A3 = Adult	2.5 to 3.5 years
E = Early Post Weaning	120 to 210 days	A4 = Adult	3.5 to 4.5 years
P = Post Weaning	210 to 300 days	A5 = Adult	4.5 to 5.5 years
Y = Yearling	300 to 400 days	A6 = Adult	5.5 to 6.5 years
H = Hogget	400 to 540 days	A7 = Adult	6.5 to 7.5 years

MLP Analysis Age Ranges for Age Stages (Age ranges in analysis software OVIS)

M = Marking	14 to 39 days	A2 = Adult	1.8 to 2.8 years
W = Weaning	40 to 149 days	A3 = Adult	2.8 to 3.8 years
P = Post Weaning	150 to 299 days	A4 = Adult	3.8 to 4.8 years
Y = Yearling	300 to 449 days	A5 = Adult	4.8 to 5.8 years
H = Hogget	450 to 659 days	A6 = Adult	5.8 to 6.8 years
		A7 = Adult	6.8 to 7.8 years

MLP Site Assessment Age Stages

Balmoral - Shearing pre joining and crutching December/January

Year of Birth	Date of Shearing Assessment	MLP Report	Analysis Age Stage	Count	Age (Days)	Age (Years)
2015	2016-04-11	P	P	589	239	0.7
2015	2017-03-31	A2	H	549	593	1.6
2015	2018-02-23	A3	A2	567	922	2.6
2015	2019-02-14	A4	A3	550	1278	3.6
2015	2020-02-24	A5	A4	513	1653	4.6
2015	2021-02-22	A6	A5	476	2017	5.6
2015	2022-02-21	A7	A6	436	2381	6.6
2016	2017-05-08	P	P	798	257	0.7
2016	2018-02-21	A2	H	805	546	1.5
2016	2019-02-23	A3	A2	773	913	2.5
2016	2020-02-25	A4	A3	740	1280	3.6
2016	2021-02-22	A5	A4	678	1643	4.6
2016	2022-02-22	A6	A5	612	2008	5.6

MerinoLink - Shearing post weaning and crutching pre lambing

Year of Birth	Date of Shearing Assessment	MLP Report	Analysis Age Stage	Count	Age (Days)	Age (Years)
2016	2017-03-28	Y	Y	347	300	0.8
2016	2018-03-21	A2	H	346	658	1.8
2016	2019-03-26	A3	A2	338	1028	2.9
2016	2019-10-22	A32	A3	325	1238	3.4
2016	2020-10-21	A4	A4	305	1603	4.5
2016	2021-10-27	A5	A5	286	1974	5.5
2016	2022-10-18	A6	A6	262	2330	6.5
2017	2018-03-23	Y	P	418	290	0.8
2017	2019-03-25	A2	H	404	657	1.8
2017	2019-10-22	A22	A2	398	868	2.4
2017	2020-10-21	A3	A3	386	1233	3.4
2017	2021-10-27	A4	A4	362	1604	4.5
2017	2022-10-18	A5	A5	331	1960	5.4

Pingelly - Shearing pre joining and crutching generally pre shearing

Year of Birth	Date of Shearing Assessment	MLP Report	Analysis Age Stage	Count	Age (Days)	Age (Years)
2016	2017-04-12	P	P	380	292	0.8
2016	2018-04-17	A2	H	366	662	1.8
2016	2018-12-03	A22	A2	363	892	2.5
2016	2019-12-05	A3	A3	359	1259	3.5
2016	2020-12-08	A4	A4	342	1628	4.5
2016	2021-12-02	A5	A5	326	1987	5.5
2016	2022-12-12	A6	A6	291	2362	6.6
2017	2018-04-18	P	P	568	293	0.8
2017	2018-12-03	H	H	569	522	1.5
2017	2019-12-05	A2	A2	544	889	2.5
2017	2020-12-09	A3	A3	531	1259	3.5
2017	2021-12-03	A4	A4	515	1618	4.5
2017	2022-12-12	A5	A5	489	1992	5.5

Macquarie - Shearing pre joining, and crutching post joining and post lambing

Year of Birth	Date of Shearing Assessment	MLP Report	Analysis Age Stage	Count	Age (Days)	Age (Years)
2017	2018-02-19	P	P	436	269	0.7
2017	2018-10-17	H	H	433	509	1.4
2017	2019-10-21	A2	A2	425	878	2.4
2017	2020-10-20	A3	A3	421	1243	3.5
2017	2021-11-04	A4	A4	404	1623	4.5
2017	2022-12-01	A5	A5	369	2015	5.6
2017	2023-10-24	A6	A6	335	2342	6.5
2018	2019-02-28	P	Y	550	302	0.8
2018	2019-10-22	H	H	548	538	1.5
2018	2020-10-19	A2	A2	536	901	2.5
2018	2021-11-05	A3	A3	518	1283	3.6
2018	2022-11-30	A4	A4	487	1673	4.6
2018	2023-10-23	A5	A5	454	2000	5.6

New England – Shearing mid pregnancy, crutching pre-joining and post weaning

Year of Birth	Date of Shearing Assessment	MLP Report	Analysis Age Stage	Count	Age (Days)	Age (Years)
2017	2018-08-06	Y	Y	714	333	0.9
2017	2019-07-15	A2	A2	713	676	1.9
2017	2020-06-29	A3	A3	698	1026	2.9
2017	2021-06-28	A4	A4	674	1390	3.9
2017	2022-06-28	A5	A5	638	1755	4.9
2017	2023-06-22	A6	A6	608	2114	5.9
2017	2024-06-24	A7	A7	579	2482	6.9
2018	2019-07-31	Y	Y	639	329	0.9
2018	2020-07-01	A2	A2	638	665	1.8
2018	2021-06-29	A3	A3	633	1028	2.9
2018	2022-06-29	A4	A4	619	1393	3.9
2018	2023-06-21	A5	A5	609	1750	4.9
2018	2024-06-25	A6	A6	602	2120	5.9

MLP Site Progeny Numbers per Sire - Wether and Ewe

The project had a target of 30 F1 ewes per sire at weaning, allowing for losses, the project aimed to have 20 ewes by 6 years of age. Shortfalls below the 30 ewe lambs per sire target were mainly due to lower-than-expected conception and pregnancy rates (often linked to ewe condition, heat, and semen quality), low twin rates, lamb mortality, male-biased sex ratios, and occasional sire-specific failures. However, mortality was less than the budget for most drops. These factors often acted in combination, and some were unavoidable or only partially controllable within normal commercial management practices.

In total, 43 sires had less than 20 progeny at the last classing, the average per sire joined at the last classing was 26.8 progeny.

In the immediate tables below, the “missing numbers” from marking to last assessment include both natural mortality and the animals culled for welfare reasons.

Balmoral 2015 Drop

	Wethers	Ewes									
Breeders flock, Sire number	Marking 03/09/15	Marking 03/09/15	Weaning 09/11/15	Post Weaning Classing 11/04/16	Adult2 Classing 06/03/17	Adult3 Classing 02/02/18	Adult4 Classing 30/01/19	Adult5 Classing 31/01/20	Adult6 Classing 27/01/21	Adult7 Classing 07/02/22	Survival Rate from Marking %
Billandri Poll, 130087	31	19	18	16	15	15	14	14	13	12	63%
Bogo, 111424	25	29	28	26	24	23	22	21	19	19	66%
Bundaleer Poll, 13V741	26	32	29	29	29	29	29	29	28	28	88%
Bundilla, 111265	18	22	22	21	20	20	19	18	17	16	73%
Centre Plus Poll, 207316	21	25	24	24	22	21	20	20	20	18	72%
Darriwell, 130941	32	21	20	19	18	18	16	15	13	10	48%
Glenpaen, 120042	27	27	27	26	25	25	24	17	16	9	33%
Greenfields Poll, 130599	29	27	24	22	20	20	19	18	17	15	56%
Hazeldean, 11.43	31	31	29	27	27	27	26	24	24	21	68%
Kurra-Wirra, SR5681	25	31	31	25	21	21	21	19	18	15	48%
Leahcim Poll, 090918	36	29	29	28	27	26	26	22	21	21	72%
Leahcim Poll, 123153	21	23	23	22	22	22	22	22	21	21	91%
Merinotech WA Poll, 100081	33	28	26	26	26	25	25	23	23	19	68%
Mokanger, 120092	19	19	19	19	18	17	16	15	14	14	74%
Moojepin, 100248	27	23	22	21	21	20	20	20	20	19	83%
Mumblebone, 130389	17	15	14	13	13	13	13	13	11	10	67%
Mumblebone, 130850	12	15	15	15	15	14	14	14	14	12	80%
Nareeb Nareeb, 130380	23	26	25	25	25	22	20	19	15	11	42%
Nerstane, 130467	22	31	31	26	25	24	22	21	21	20	65%
One Oak No. 2, R56	24	39	39	36	36	33	33	32	26	25	64%
Roseville Park, 140019	16	20	19	18	18	18	18	18	17	16	80%
The Mountain Dam, 11/ESA004	29	32	32	32	32	31	30	28	25	22	69%
Tuckwood Poll, 121021	22	29	29	29	29	28	28	23	21	19	66%
Yalgoo, 120043	27	32	32	31	31	29	29	28	27	24	75%
Yiddinga, 130374	25	27	27	27	27	27	27	25	22	21	78%
Total	**25** ***618***	**26** ***652***	**25** ***634***	**24** ***603***	**23** ***586***	**23** ***568***	**22** ***553***	**21** ***518***	**19** ***483***	**17** ***437***	**67%**

Balmoral 2016 Drop

Breeders flock, Sire number	Wethers	Ewes								
	Marking 13/09/16	Marking 13/09/16	Weaning 05/12/16	Post Weaning Classing 03/05/17	Adult2 Classing 03/02/18	Adult3 Classing 02/02/19	Adult4 Classing 30/01/20	Adult5 Classing 28/01/21	Adult6 Classing 08/02/22	Survival Rate from Marking %
Centre Plus Poll, 707115	31	42	42	41	41	37	36	35	35	83%
GRASS, 142194 (R4)	52	30	29	29	29	29	29	29	28	93%
Glen Holme, 141077 (Dohne)	40	38	38	38	38	36	34	31	28	74%
Greendale, 120012	37	33	32	32	31	30	27	26	25	76%
Greenfields Poll, 140345	20	22	21	20	20	20	20	17	15	68%
Greenland, 2.366	45	37	36	35	34	34	32	31	29	78%
Hannaton Poll, 120046	37	43	41	40	40	39	38	34	32	74%
Hazeldean, 11.3542 (Hugh)	38	45	38	38	38	37	36	31	30	67%
Kiandra Poll, 140757	36	31	30	30	30	28	27	24	19	61%
Kooringal, 130519	54	42	38	37	36	36	32	28	28	67%
Kurra-Wirra, SB5585	31	27	27	27	27	27	27	27	24	89%
Leahcim Poll, 090918	54	35	35	35	35	35	34	32	32	91%
Melrose, 12UGB060	35	34	32	32	32	29	29	27	25	74%
Mumblebone, 130389	22	16	14	14	14	12	11	10	10	63%
Mumblebone, 140026	42	30	27	27	27	25	24	21	18	60%
Nerstane, 100919	50	41	41	41	41	40	38	36	33	80%
One Oak No. 2, R56	33	46	45	45	45	41	38	32	28	61%
Stockman Poll, 090853 (Stilts)	33	41	40	40	40	40	38	34	31	76%
Terrick West Poll, 122220	29	30	28	28	28	25	22	19	19	63%
The Mountain Dam, 11/ESA004	43	35	32	32	31	30	29	28	28	80%
Trefusis, 110482	36	37	37	37	37	37	35	34	34	92%
Tuckwood Poll, 131026	21	35	35	35	35	33	33	32	30	86%
Wallaloo Park Poll, 120912	50	35	34	33	33	33	31	26	25	71%
Woodyarrup, 120175	37	28	28	28	28	27	25	23	22	79%
Yiddinga, 141989	29	21	18	18	17	17	17	16	12	57%
Total	**37** ***935***	**34** ***854***	**33** ***818***	**32** ***812***	**32** ***807***	**31** ***777***	**30** ***742***	**27** ***683***	**26** ***640***	***75%***

MerinoLink 2016 Drop

Breeders flock, Sire number	Wethers	Ewes									
	Marking 29/06/16	Marking 29/06/16	Weaning 25/10/16	Yearling 24/03/17	Adult2 Classing 05/03/18	Adult3 Classing 08/03/19	Adult3* Classing 17/10/19	Adult4 Classing 02/10/20	Adult5 Classing 14/10/21	Adult6 Classing 12/10/22	Survival Rate from Marking %
Bella Lana, 130296	30	32	31	29	29	28	28	28	27	27	84%
Boyanga, 145112	26	43	41	40	37	36	35	32	32	30	70%
Glen Donald, 120014	15	20	19	19	19	19	18	18	17	15	75%
Greendale, 120012	19	23	20	20	20	19	18	15	14	13	57%
Leahcim Poll, 090918	32	30	28	28	27	25	23	20	20	18	60%
One Oak No. 2, R56	24	42	40	38	36	36	35	33	31	29	69%
Pastora Poll, 082893	29	28	28	28	28	28	28	28	27	26	93%
Poll Boonoke, 120020	21	31	29	29	29	29	29	29	27	25	81%
Pooginook Poll, 140632	38	26	26	26	26	26	26	25	25	23	88%
Roseville Park, 140611	29	16	16	16	16	15	15	13	13	8	50%
Trigger Vale Poll, 140477	34	36	35	35	35	34	33	32	30	27	75%
Wattle Dale, 140754	20	29	29	29	28	27	25	18	17	14	48%
Wurrook, 130149	25	19	19	18	16	16	14	14	12	12	63%
Total	**26** ***342***	**29** ***375***	**28** ***361***	**27** ***355***	**27** ***346***	**26** ***338***	**25** ***327***	**23** ***305***	**22** ***292***	**21** ***267***	***71%***

* Change to Shearing

MerinoLink 2017 Drop

Breeders flock, Sire number	Wethers	Ewes								
	Marking 12/07/17	Marking 12/07/17	Weaning 22/09/17	Yearling Classing 19/03/18	Adult2 Classing 08/03/19	Adult2* Classing 09/10/19	Adult3 Classing 02/10/20	Adult4 Classing 14/10/21	Adult5 Classing 12/10/22	Survival Rate from Marking %
Bundilla Poll, 140055	38	29	29	29	29	29	28	27	26	90%
Centre Plus Poll, 407185	40	28	28	28	26	26	25	24	24	86%
Collinsville Poll, 130545 (Apollo)	30	37	37	36	34	34	34	33	28	76%
DT Kenilworth, WH13017	42	37	37	36	35	33	31	28	27	73%
Greendale, 140141	32	20	18	18	18	18	18	17	17	85%
Lachlan Merinos Poll, 015305	42	37	35	34	34	33	33	31	28	76%
Leahcim Poll, 132624	35	36	35	35	33	33	33	30	27	75%
Tallawong Merinos, 150280	37	40	37	37	36	33	31	29	23	58%
Toland Poll, 151058	57	40	38	37	36	35	35	32	29	73%
Trefusis, 150282	40	43	41	40	40	40	39	36	34	79%
Trigger Vale Poll, 140477	35	42	42	42	39	39	38	36	35	83%
Wallaloo Park Poll, 150422	33	35	30	28	25	25	25	24	22	63%
West Plains Poll, 110004 (Mercenary)	37	25	24	24	23	21	20	20	16	64%
Total	**38** ***498***	**35** ***449***	**33** ***431***	**33** ***424***	**31** ***408***	**31** ***399***	**30** ***390***	**28** ***367***	**26** ***336***	***75%***

* Change to Shearing

Pingelly 2016 Drop

Breeders flock, Sire number	Wethers	Ewes									
	Marking 21/07/16	Marking 21/07/16	Weaning 26/09/16	Post Weaning Classing 15/03/17	Adult2 Classing 05/03/18	Adult2* Classing 27/11/18	Adult3 Classing 27/11/19	Adult4 Classing 18/11/20	Adult5 Classing 16/11/21	Adult6 Classing 14/11/22	Survival Rate from Marking %
Billandri Poll, 130641	24	35	35	35	35	34	32	30	29	26	74%
Boolading Blues Poll, 120708	20	23	22	21	21	20	19	18	18	17	74%
Claypans Poll, 130597	15	15	14	13	13	13	12	11	10	10	67%
East Mundulla, 090137 (Jonty)	26	29	29	28	28	25	22	20	18	14	48%
Ejanding Poll, 145096	35	34	34	34	33	33	33	32	30	26	76%
Haddon Rig, 2.715	20	21	21	20	18	18	18	18	18	18	86%
Hazeldean, 11.43	24	22	22	21	21	20	20	20	19	17	77%
Ingle Poll, 130387	27	29	27	26	25	25	25	24	21	19	66%
Leahcim Poll, 090918	35	35	35	34	34	33	32	30	30	28	80%
Merinotech WA Poll, 100081	22	36	36	36	34	33	29	25	22	22	61%
Moojepin, 140377	27	22	22	22	22	22	21	20	20	20	91%
One Oak No. 2, R56	32	36	35	30	30	30	28	27	27	24	67%
Rhamily Poll, 110330 (Benny)	29	23	22	22	21	21	21	19	18	17	74%
West Plains Poll, 110004 (Mercenary)	23	30	29	29	27	26	24	24	24	22	73%
Wyambeh Poll, 140141	31	24	24	24	23	22	22	22	21	19	79%
Total	**26** ***390***	**28** ***414***	**27** ***407***	**26** ***395***	**26** ***385***	**25** ***375***	**24** ***358***	**23** ***340***	**22** ***325***	**20** ***299***	***72%***

* Change to Shearing

Pingelly 2017 Drop

Breeders flock, Sire number	Wethers	Ewes								
	Marking 18/07/17	Marking 18/07/17	Weaning 28/09/17	Post Weaning Classing 06/03/18	Hogget Classing 27/11/18	Adult2 Classing 28/11/19	Adult3 Classing 18/11/20	Adult4 Classing 16/11/21	Adult5 Classing 14/11/22	Survival Rate from Marking %
Anderson Poll, 140474	38	41	40	39	39	37	35	34	32	78%
Barloo Poll, 140027 (Eureka)	48	43	43	41	41	41	41	39	38	88%
Billandri Poll, 151280	39	41	41	39	36	34	34	32	30	73%
Coromandel Poll, 130660	57	43	43	41	41	39	37	36	35	81%
Cranmore, 132051	43	35	35	33	33	31	30	29	27	77%
Edale, 10Z266K	50	51	51	45	45	41	40	36	34	67%
Ingle Poll, 150087	49	38	38	38	38	38	38	38	38	100%
Mianelup Poll, M00540 (Expo)	47	49	49	45	45	42	40	39	36	73%
Moojepin, 120652	47	42	42	42	42	42	42	41	39	93%
Moorundie Poll, NE73	35	28	27	26	26	24	23	23	23	82%
Neearra Poll, 110264	29	47	47	45	45	43	42	42	40	85%
Rangeview Poll, 5-680	39	27	26	24	24	24	23	23	23	85%
Trigger Vale Poll, 140477	36	55	55	52	51	49	49	47	44	80%
West Plains Poll, 110004 (Mercenary)	26	28	28	26	26	25	25	24	23	82%
Woodyarrup, 150329	36	40	40	37	37	35	34	34	32	80%
Total	**41** ***619***	**41** ***608***	**40** ***605***	**38** ***573***	**38** ***569***	**36** ***545***	**36** ***533***	**34** ***517***	**33** ***494***	***81%***

Macquarie 2017 Drop

Breeders flock, Sire number	Wethers	Ewes									
	Marking	Marking	Weaning	Post Weaning Classing	Hogget Classing	Adult2 Classing	Adult3 Classing	Adult4 Classing	Adult5 Classing	Adult6 Classing	Survival Rate from Marking
	26/06/17	26/06/17	06/09/17	01/02/18	26/09/18	18/10/19	15/10/20	13/10/21	11/10/22	11/10/23	%
Centre Plus Poll, 707115	38	34	34	34	34	33	32	32	27	20	59%
Collinsville Poll, 130545 (Apollo)	28	28	27	25	25	24	23	21	19	16	57%
Darriwell, 130941	33	23	21	20	20	19	19	18	17	12	52%
GRASS Merino, 122190 (P47)	35	45	43	42	42	41	41	38	34	33	73%
GullenGamble Poll, 120018	29	31	29	29	29	28	28	28	26	24	77%
Hazeldean, 13.4936	45	34	33	33	32	30	30	29	28	26	76%
Kerin Poll, 151911	25	26	24	24	24	23	23	23	21	19	73%
Moojepin, 120652	41	42	41	41	41	40	40	39	37	33	79%
Mumblebone, 151367	34	31	29	29	29	27	26	22	21	21	68%
Roseville Park, 132933	36	30	29	29	29	28	28	28	27	24	80%
Trigger Vale Poll, 140477	37	35	35	35	35	35	34	33	27	24	69%
Wanganella, 130816	24	21	21	21	21	20	20	18	16	15	71%
West Plains Poll, 110004 (Mercenary)	37	16	16	16	16	16	16	16	16	15	94%
Wilgunya, 121224	30	34	31	30	30	29	29	28	27	26	76%
Willandra Poll, 140030 (Des)	43	34	34	33	33	32	32	32	31	27	79%
Total	**34**	**31**	**30**	**29**	**29**	**28**	**28**	**27**	**25**	**22**	**72%**
	515	***464***	***447***	***441***	***440***	***425***	***421***	***405***	***374***	***335***	

Macquarie 2018 Drop

Breeders flock, Sire number	Wethers	Ewes								
	Marking	Marking	Weaning	Post Weaning Classing	Hogget Classing	Adult2 Classing	Adult3 Classing	Adult4 Classing	Adult5 Classing	Survival Rate from Marking
	16/05/18	16/05/18	15/08/18	22/02/19	17/10/19	14/10/20	12/10/21	12/10/22	10/10/23	%
Anderson Poll, 150266	36	42	42	40	40	40	40	38	34	81%
Centre Plus Poll, 707115	41	46	46	44	44	43	42	39	35	76%
Charinga, 130240 (Doc)	40	40	35	33	33	33	33	30	24	60%
GRASS, 141924 (R15)	43	45	39	34	34	33	33	32	30	67%
Glen Donald, 120014	34	38	37	37	36	36	35	33	31	82%
GullenGamble Poll, 014189	39	42	41	38	38	36	33	31	29	69%
Haddon Rig, 2.715	51	37	37	34	34	34	34	34	32	86%
Hazeldean, 11.3542 (Hugh)	41	56	52	40	40	40	38	35	31	55%
Kerin Poll, 160137	28	26	22	22	22	22	22	21	20	77%
Langdene, 160950	36	26	26	24	24	24	24	23	20	77%
Lewisdale Poll, 150010 (Monty)	55	42	39	34	34	32	30	29	28	67%
Orrie Cowie, 140050 (Trojan)	35	38	38	33	33	32	31	30	29	76%
Roseville Park, 150039	38	42	40	35	34	31	31	30	28	67%
Stockman Poll, 130707	45	41	37	33	33	33	32	31	29	71%
Wanganella, 150610	30	42	42	38	37	37	37	33	30	71%
Willandra Poll, 160001	59	36	36	32	32	31	30	27	24	67%
Average	**41**	**40**	**38**	**34**	**34**	**34**	**33**	**31**	**28**	**71%**
Total	***651***	***639***	***609***	***551***	***548***	***537***	***525***	***496***	***454***	

New England 2017 Drop

Breeders flock, Sire number	Wethers	Ewes								
	Marking	Marking	Weaning	Yearling Classing	Adult2 Classing	Adult3 Classing	Adult4 Classing	Adult5 Classing	Adult6 Classing	Survival Rate from Marking
	29/09/17	29/09/17	03/01/18	17/07/18	06/06/19	03/06/20	02/06/21	14/06/22	08/06/23	%
Connemara Poll, 140257	42	53	51	51	51	49	47	45	43	81%
Conrayn, MVB123	41	49	48	48	48	46	42	40	39	80%
Cressbrook, 140055	55	44	44	44	44	44	43	34	34	77%
Egelabra, HEK 1.36	42	51	51	49	49	49	49	47	44	86%
Grindon, 150017	44	47	47	47	47	43	41	38	36	77%
Karori, 140188	40	55	55	55	55	53	51	49	47	85%
Miramoona, 140012	33	41	41	40	40	39	38	35	35	85%
Mirani, 120021	30	60	59	59	59	59	59	57	54	90%
Moorundie Poll, NE73	41	30	30	30	29	29	27	27	23	77%
Nerstane, 150073	45	42	41	41	41	41	41	38	36	86%
Petali Poll, 150697	43	52	49	49	48	47	46	46	45	87%
Trefusis, 150282	43	60	60	60	58	57	53	51	45	75%
Trigger Vale Poll, 140477	38	45	44	42	42	41	38	38	37	82%
West Plains Poll, 110004 (Mercenary)	41	50	50	50	49	48	47	43	41	82%
Yalgoo, 150313	48	54	54	53	53	53	52	50	49	91%
Total	**42**	**49**	**48**	**48**	**48**	**47**	**45**	**43**	**41**	**83%**
	626	***733***	***724***	***718***	***713***	***698***	***674***	***638***	***608***	

New England 2018 Drop

Breeders flock, Sire number	Wethers	Ewes							
	Marking	Marking	Weaning	Yearling Classing	Adult2 Classing	Adult3 Classing	Adult4 Classing	Adult5 Classing	Survival Rate from Marking
	27/09/18	27/09/18	03/12/18	30/07/19	02/06/20	01/06/21	15/06/22	07/06/23	%
Alfoxton, 150430	45	48	48	48	48	48	47	46	96%
Avington Poll, 160047	37	47	47	47	46	44	42	42	89%
Bungulla, 160350	35	41	40	40	40	40	40	39	95%
Clovernook Poll, 160095	47	43	43	43	43	43	43	43	100%
Cressbrook, 140055	50	53	52	52	52	51	49	48	91%
Eilan Donan, ED5145 (Harvey)	48	43	42	42	42	42	42	41	95%
Europambela, 120101	51	40	39	39	39	39	38	38	95%
Hillcreston Park Poll, 110143	42	48	47	47	47	47	45	45	94%
Hilltop, 160156 (HT156)	50	44	44	42	42	42	41	40	91%
Karori, 150222	60	42	42	42	42	42	42	42	100%
Nerstane, 150073	41	43	43	41	41	40	39	38	88%
Petali Poll, 160849	49	42	42	42	42	42	40	40	95%
Tallawong Merinos, 150280	47	38	37	33	33	32	32	30	79%
Wurrook, 130149	46	41	41	41	41	41	41	39	95%
Yalgoo, 160070	42	40	40	40	40	40	38	38	95%
Average	**46**	**44**	**43**	**43**	**43**	**42**	**41**	**41**	**93%**
Total	***690***	***653***	***647***	***639***	***638***	***633***	***619***	***609***	

Original Budget v Actual Project Sheep Numbers

The number of progeny born per sire was 42% higher at the New England site and 5% higher at the other sites compared to budget. This amounts to 410 extra progeny at New England and 226 extra progeny in total at the other 4 sites. The extra progeny had budget implications in terms of extra recording and measurement costs and workload but also resulted in additional valued data.

Project Total

	Sires Joined		Foundation Ewes Joined		Foundation Ewes Pregnant		F1 Feotuses Scanned		F1 Ewe Progeny Tagged		F1 Wether Progeny Tagged		F1 Ewe Progeny Weaned		F1 Wether Progeny Weaned		F1 Ewes joined		F2 Progeny Tagged		F2 Progeny Weaned	
	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*
2015	24	*25*	2160	*2160*	1512	*1356*	1814	*1457*	816	*655*	816	*617*	771	*632*	771	*592*						
2016	52	*53*	4680	*4750*	3276	*2839*	3931	*4237*	1769	*1658*	1769	*1706*	1670	*1592*	1670	*1635*						
2017	59	*59*	5310	*5330*	3717	*3666*	4460	*5584*	2007	*2334*	2007	*2373*	1895	*2228*	1895	*2205*	694	*588*	624	*500*	562	*489*
2018	31	*31*	2790	*2795*	1953	*2241*	2344	*3488*	1055	*1372*	1055	*1491*	996	*1258*	996	*1362*	2155	*2106*	1940	*1839*	1746	*1816*
2019																	3732	*4160*	3359	*3924*	3023	*3860*
2020																	4404	*5183*	3964	*5730*	3567	*5675*
2021																	4140	*4978*	3726	*5840*	3353	*5726*
2022																	2841	*3673*	2557	*4322*	2301	*4280*
2023																	1444	*2052*	1299	*2749*	1169	*2730*
Total	**166**	***168***	**14,940**	***15,035***	**10,458**	***10,102***	**12,550**	***14,766***	**5,647**	***6,019***	**5,647**	***6,187***	**5,332**	***5,710***	**5,332**	***5,794***	**19,409**	***22,740***	**17,468**	***24,904***	**15,722**	***24,576***

Balmoral

	Sires Joined		Foundation Ewes Joined		Foundation Ewes Pregnant		F1 Feotuses Scanned		F1 Ewe Progeny Tagged		F1 Wether Progeny Tagged		F1 Ewe Progeny Weaned		F1 Wether Progeny Weaned		F1 Ewes joined		F1 Ewes per sire group		F2 Progeny Tagged		F2 Progeny Weaned	
	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*
2015	24	*25*	2160	*2160*	1512	*1356*	1814	*1457*	816	*655*	816	*617*	771	*632*	771	*592*								
2016	24	*25*	2160	*2209*	1512	*1632*	1814	*2451*	816	*856*	816	*947*	771	*818*	771	*900*								
2017																	694	*588*	29	*24*	624	*500*	562	*489*
2018																	1346	*1372*	28	*27*	1211	*1114*	1090	*1100*
2019																	1265	*1323*	26	*26*	1138	*1287*	1025	*1280*
2020																	1189	*1252*	25	*25*	1070	*1429*	963	*1398*
2021																	1118	*1152*	23	*23*	1006	*1274*	905	*1266*
Total	**48**	***50***	**4320**	***4369***	**3024**	***2988***	**3629**	***3908***	**1633**	***1511***	**1633**	***1564***	**1542**	***1450***	**1542**	***1492***	**5611**	***5687***			**5050**	***5604***	**4545**	***5533***

MerinoLink

	Sires Joined		Foundation Ewes Joined		Foundation Ewes Pregnant		F1 Feotuses Scanned		F1 Ewe Progeny Tagged		F1 Wether Progeny Tagged		F1 Ewe Progeny Weaned		F1 Wether Progeny Weaned		F1 Ewes joined		F1 Ewes per sire group		F2 Progeny Tagged		F2 Progeny Weaned	
	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*
2016	13	*13*	1170	*1171*	819	*754*	983	*1106*	442	*383*	442	*359*	418	*363*	418	*343*								
2017	13	*13*	1170	*1162*	819	*810*	983	*1213*	442	*459*	442	*503*	418	*436*	418	*468*								
2018																	376	*348*	29	*27*	339	*356*	305	*349*
2019																	730	*742*	28	*29*	657	*630*	591	*627*
2020																	686	*723*	26	*28*	617	*772*	556	*762*
2021																	645	*693*	25	*27*	580	*798*	522	*707*
2022																	606	*654*	23	*25*	546	*749*	491	*739*
Total	**26**	***26***	**2340**	***2333***	**1638**	***1564***	**1966**	***2319***	**885**	***842***	**885**	***862***	**836**	***799***	**836**	***811***	**3043**	***3160***			**2739**	***3305***	**2465**	***3184***

Pingelly

	Sires Joined		Foundation Ewes Joined		Foundation Ewes Pregnant		F1 Feotuses Scanned		F1 Ewe Progeny Tagged		F1 Wether Progeny Tagged		F1 Ewe Progeny Weaned		F1 Wether Progeny Weaned		F1 Ewes joined		F1 Ewes per sire group		F2 Progeny Tagged		F2 Progeny Weaned	
	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*
2016	15	*15*	1350	*1370*	945	*453*	1134	*680*	510	*419*	510	*400*	482	*411*	482	*392*								
2017	15	*15*	1350	*1376*	945	*1009*	1134	*1551*	510	*609*	510	*623*	482	*607*	482	*602*								
2018																	434	*386*	29	*26*	390	*369*	351	*367*
2019																	841	*942*	28	*31*	757	*991*	681	*968*
2020																	791	*903*	26	*30*	712	*1044*	640	*1043*
2021																	743	*873*	25	*29*	669	*1053*	602	*1050*
2022																	699	*841*	23	*34*	629	*1038*	566	*1027*
Total	**30**	***30***	**2700**	***2746***	**1890**	***1462***	**2268**	***2231***	**1021**	***1028***	**1021**	***1023***	**963**	***1018***	**963**	***994***	**3507**	***3945***			**3156**	***4495***	**2841**	***4455***

2016 drop pregnancy scanning and foetuses are incorrect due to significant scanning errors.

Macquarie

	Sires Joined		Foundation Ewes Joined		Foundation Ewes Pregnant		F1 Feotuses Scanned		F1 Ewe Progeny Tagged		F1 Wether Progeny Tagged		F1 Ewe Progeny Weaned		F1 Wether Progeny Weaned		F1 Ewes joined		F1 Ewes per sire group		F2 Progeny Tagged		F2 Progeny Weaned	
	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*
2017	16	*16*	1440	*1442*	1008	*797*	1210	*1308*	544	*478*	544	*539*	514	*462*	514	*516*								
2018	16	*16*	1440	*1445*	1008	*1137*	1210	*1905*	544	*639*	544	*657*	514	*608*	514	*629*								
2019																	462	*440*	29	*28*	416	*397*	375	*379*
2020																	897	*970*	28	*30*	807	*1009*	727	*998*
2021																	843	*957*	26	*30*	759	*1228*	683	*1222*
2022																	793	*921*	25	*29*	713	*1078*	642	*1064*
2023																	745	*826*	23	*26*	671	*958*	604	*945*
Total	**32**	***32***	**2880**	***2887***	**2016**	***1934***	**2419**	***3213***	**1089**	***1117***	**1089**	***1196***	**1028**	***1070***	**1028**	***1145***	**3741**	***4114***			**3367**	***4670***	**3030**	***4608***

2018 drop pregnancy scanning and foetuses are incorrect due to scanning errors where ewes pregnant to backups were included in AI results.

New England

	Sires Joined		Foundation Ewes Joined		Foundation Ewes Pregnant		F1 Feotuses Scanned		F1 Ewe Progeny Tagged		F1 Wether Progeny Tagged		F1 Ewe Progeny Weaned		F1 Wether Progeny Weaned		F1 Ewes joined		F1 Ewes per sire group		F2 Progeny Tagged		F2 Progeny Weaned	
	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*	Budget	*Actual*
2017	15	*15*	1350	*1350*	945	*1050*	1134	*1512*	510	*788*	510	*708*	482	*723*	482	*619*								
2018	15	*15*	1350	*1350*	945	*1104*	1134	*1583*	510	*733*	510	*834*	482	*650*	482	*733*								
2019																	434	*713*	29	*48*	390	*619*	351	*606*
2020																	841	*1335*	28	*45*	757	*1476*	681	*1474*
2021																	791	*1303*	26	*43*	712	*1487*	640	*1481*
2022																	743	*1257*	25	*42*	669	*1457*	602	*1450*
2023																	699	*1226*	23	*41*	629	*1791*	566	*1785*
Total	**30**	***30***	**2700**	***2700***	**1890**	***2154***	**2268**	***3095***	**1021**	***1521***	**1021**	***1542***	**963**	***1373***	**963**	***1352***	**3507**	***5834***			**3156**	***6830***	**2841**	***6796***

MLP Data

The data summaries presented here form the foundation for the subsequent genetic, phenotypic, and economic analyses that will address the key objectives of the MLP Project and inform future Merino breeding and selection strategies. **Attachment 14** provides a trait breakdown at a site level.

Data Summary Count - F1 Ewes, All Sites

TRAIT	B	M	W	P	Y	H	A2	A3	A4	A5	A6	A7	Total
Carcase	**1,517**		**6,317**	**16,742**	**26,128**	**40,719**	**63,461**	**59,344**	**55,291**	**47,765**	**15,059**	**692**	**333,035**
CS				1,522	5,973	12,396	23,550	21,718	20,142	17,906	5,438		108,645
EMD				489	4,246	6,134	5,281	5,134	4,851	3,352			29,487
FAT				489	4,246	6,135	5,281	5,131	4,851	3,352			29,485
WT	1,517		6,317	14,242	11,663	16,054	29,349	27,361	25,447	23,155	9,621	692	165,418
Fleece				**32,135**	**22,571**	**29,356**	**60,497**	**54,759**	**50,599**	**45,974**	**24,992**	**5,771**	**326,654**
CFW				3,181	2,249	2,900	6,070	5,498	5,002	4,524	2,487	577	32,488
COMFORT				3,221	2,259	2,944	6,094	5,511	5,028	4,579	2,502	577	32,715
CURV				3,221	2,259	2,944	6,094	5,511	5,028	4,579	2,502	577	32,715
CURVSD									367	292			659
FD				3,221	2,259	2,944	6,094	5,511	5,028	4,579	2,502	577	32,715
FDCV				3,221	2,259	2,944	6,094	5,511	5,028	4,579	2,502	577	32,715
FDSD				3,221	2,259	2,944	5,696	5,185	5,028	4,579	2,502	577	31,991
GFW				3,189	2,250	2,904	6,073	5,499	5,007	4,528	2,489	578	32,517
SL				3,221	2,259	2,944	6,094	5,511	5,028	4,579	2,502	577	32,715
SS				3,218	2,259	2,944	6,094	5,511	5,027	4,577	2,502	577	32,709
YLD				3,221	2,259	2,944	6,094	5,511	5,028	4,579	2,502	577	32,715
Reproduction						**4,109**	**24,052**	**23,966**	**26,160**	**22,635**	**8,793**		**109,715**
CONC						887	5,006	4,916	5,354	4,657	1,803		22,623
ERA						724	4,517	4,609	5,049	4,332	1,692		20,923
LSIZE						724	4,517	4,609	5,049	4,332	1,692		20,923
NLB						887	5,006	4,916	5,354	4,657	1,803		22,623
NLW						887	5,006	4,916	5,354	4,657	1,803		22,623
Visual		**32,772**	**3,144**	**54,924**	**36,003**	**87,469**	**142,090**	**134,291**	**140,493**	**136,614**	**66,389**	**7,527**	**841,716**
BACK				1,912	3,543	2,932	6,777	4,800	4,884	4,613	2,534	579	32,574
BCOV		5,622	210	1,962	2,304	2,718	5,312	4,810	4,005	3,174	1,935	579	32,631
BDWR				1,912	3,544	2,932	6,774	4,799	4,885	4,619	2,534	579	32,578
BLK		5,382	360										5,742
BOPGRADE				603									603
BPASTERN											602	579	1,181
BRWR		5,622	210	1,962	2,306	2,720	5,312	4,811	4,001	3,172	1,935	579	32,630
BTOES										1,269	1,486	579	3,334
CCOV				1,366	554	2,156	3,603	2,976	2,420	2,578	1,352		17,005
CHAR				3,837	1,633	5,363	5,346	4,893	4,908	4,783	1,916		32,679
COL				3,835	1,633	5,363	5,345	4,892	4,910	4,784	1,916		32,678
DAG			642	2,138	3,367	4,382	4,935	4,644	4,279	4,157	1,614		30,158
DUST				3,839	1,633	5,362	5,346	4,893	4,911	4,786	1,916		32,686
FACE				3,843	1,633	5,363	5,344	4,896	4,930	4,785	1,916		32,710
FLEGS										815	1,155	579	2,549
FLROT				3,839	1,633	5,363	5,346	4,893	4,912	4,785	1,916		32,687
FPASTERN											602	579	1,181
FPIG		5,382	360										5,742
FTOES										1,269	1,489	579	3,337
HOCK										813	1,154	579	2,546
JAW				3,839	1,631	4,783	3,415	2,371	1,870	1,269	299		19,477
JAWR				436		439	1,172	2,792	4,110	4,151	1,647		14,747
JOIN							1,166	2,769	3,442	2,877	1,245		11,499
LEGS				3,842	1,633	5,364	5,338	4,896	4,904	4,744	1,914		32,635
NKWR				97	894	987	962	1,576	3,728	4,130	2,534	579	15,487
OSPGRADE						753	2,473	2,955	2,761	2,570	1,029		12,541
OSVGRADE						4,843	4,682	4,564	4,410	3,972	1,612		24,083
PASTERN										1,630	2,310	1,158	5,098
PGRADE				3,490	1,635	5,672	5,317	5,138	4,874	4,600	1,911		32,637
SPIG		5,382	360				361	1,458	2,485	2,964	1,021		14,031
SPOT		5,382	360										5,742
SSTRC				3,839	1,633	5,362	5,346	4,892	4,909	4,786	1,914		32,681
TEATS_F							5,198	5,108	5,343	4,623	1,938		22,210
TEATS_F_R							1,211	2,228	2,240	2,696	1,338		9,713
TEATS_SH							5,199	5,109	5,880	4,656	1,953		22,797
TEETH_A_AL							5,289	5,153	5,346	4,658	1,951		22,397
TEETH_A_LG							5,288	5,153	5,881	4,658	1,951		22,931
TEETH_A_PI							5,289	5,152	5,881	4,657	1,955		22,934
TOES						544	425			454	335		1,758
TOESB										454	335		789
TOESF										454	335		789
UDDER_M							3,512	3,457	4,811	4,004	1,512		17,296
URINE			642	2,318	1,806	4,330	5,084	3,793	3,753	3,793	1,923		27,442
VGRADE				3,492	1,633	5,767	5,285	4,895	4,930	4,792	1,914		32,708
WEATH				2,523	1,355	3,971	4,046	3,949	4,011	3,964	1,584		25,403
WETDRY_M							1,304	424					1,728
WETDRY_W							5,288	5,152	5,879	4,656	1,957		22,932
WEC				**7,219**	**2,268**	**9,688**	**10,608**	**11,088**	**12,213**	**13,070**	**5,408**		**71,562**
FMOIST				2,145	567	2,422	2,652	2,772	3,054	3,288	1,352		18,252
WEC				2,145	567	2,422	2,652	2,772	3,054	3,289	1,352		18,253
WEC_Nematodirus				784	567	2,422	2,652	2,772	3,051	3,204	1,352		16,804
WEC_Strongyle				2,145	567	2,422	2,652	2,772	3,054	3,289	1,352		18,253
Total	**1,517**	**32,772**	**9,461**	**111,020**	**86,970**	**171,341**	**300,708**	**283,448**	**284,756**	**266,058**	**120,641**	**13,990**	**1,682,682**

Data Summary Count - F1 Wethers, All Sites

TRAIT	B	M	W	P	Y	H	A2	A3	Total
Carcase	**1,542**		**10,626**	**21,592**	**27,179**	**13,140**	**13,983**	**5,671**	**93,733**
CS				890	3,179	4,080	4,675	958	13,782
EMD				1,815	4,211	892	1,350	796	9,064
FAT				1,815	4,212	892	1,349	796	9,064
WT	1,542		10,626	17,072	15,577	7,276	6,609	3,121	61,823
Fleece				**30,499**	**21,941**	**12,316**	**28,010**	**8,323**	**101,089**
CFW				3,226	2,186	1,289	2,787	798	10,286
COMFORT				3,247	2,193	1,295	2,804	798	10,337
CURV				3,247	2,193	1,295	2,804	798	10,337
FD				3,247	2,193	1,295	2,804	798	10,337
FDCV				3,247	2,193	1,295	2,804	798	10,337
FDSD				3,247	2,193	1,295	2,804	798	10,337
GFW				3,230	2,211	1,291	2,791	1,141	10,664
SL				2,281	2,193	983	2,804	798	9,059
SS				2,280	2,193	983	2,804	798	9,058
YLD				3,247	2,193	1,295	2,804	798	10,337
Visual		**31,197**	**2,740**	**13,689**	**16,410**	**14,374**	**14,909**	**3,412**	**96,731**
BACK				515	1,365	548	1,476	454	4,358
BCOV		5,773	184	2,474	1,766	1,347	1,475	798	13,817
BDWR				1,152	1,749	548	1,476	454	5,379
BLK		4,913	411						5,324
BRWR		5,772	184	2,474	1,766	1,347	1,475	798	13,816
CHAR				528	816	1,013	992		3,349
COL				528	816	1,013	992		3,349
DAG			728	2,046	1,723	814	1,031		6,342
DUST				528	816	1,013	992		3,349
FACE				529	816	1,013	992		3,350
FLROT				528	816	1,012	992		3,348
FPIG		4,913	411						5,324
HOCKS					349				349
JAW				529	816	556	344		2,245
LEGS				529	466	1,012	688	454	3,149
NKWR								454	454
PASTERN					349				349
PGRADE				1		556			557
SPIG		4,913	411						5,324
SPOT		4,913	411						5,324
SSTRC				528	816	1,013	992		3,349
VGRADE				273	349	557			1,179
WEATH				527	816	1,012	992		3,347
WEC				**4,752**		**5,288**	**3,188**		**13,228**
FMOIST				1,340		1,322	797		3,459
WEC				1,340		1,322	797		3,459
WEC_Nematodirus				732		1,322	797		2,851
WEC_Strongyle				1,340		1,322	797		3,459
Total	**1,542**	**31,197**	**13,366**	**70,532**	**65,530**	**45,118**	**60,090**	**17,406**	**304,781**

Data Summary Count- F2 Ewes and Wethers

TRAIT	M	W	P	Total
Carcase	**772**	**39,041**	**4,393**	**44,206**
WT	772	39,041	4,393	44,206
Visual	**38,768**			**38,768**
BCOV	8,594			8,594
BLK	5,591			5,591
BRWR	7,822			7,822
FPIG	5,585			5,585
SPIG	5,585			5,585
SPOT	5,591			5,591
Total	**39,540**	**39,041**	**4,393**	**82,974**

Survival Rate by Site and Drop

The tables below show the starting count of F1 ewes at marking, and their subsequent count at each assessment. Reduction in counts is a result of mortality, misadventure, but also the removal of ewes for welfare purposes.

Mortality rates increased over time, with early losses ranging from 0% to 3% annually, and later losses ranging from 2% to 8%. A detailed analysis of the natural mortality and survival data will be included in the AGBU analysis deliverables and published separately.

Balmoral 2015

2015 Drop	N=652
2016	92%
2017	90%
2018	87%
2019	85%
2020	79%
2021	74%
2022	67%

Balmoral 2016

2016 Drop	N=854
2017	95%
2018	94%
2019	91%
2020	87%
2021	80%
2022	75%

Macquarie 2017

2017 Drop	N=464
2018	95%
2018	95%
2019	92%
2020	91%
2021	87%
2022	81%
2023	72%

Macquarie 2018

2018 Drop*	N=639
2019	86%
2019	86%
2020	84%
2021	82%
2022	78%
2023	71%

MerinoLink 2016

2016 Drop	N=375
2017	95%
2018	92%
2019	90%
2019	87%
2020	81%
2021	78%
2022	71%

MerinoLink 2017

2017 Drop	N=449
2018	94%
2019	91%
2019	89%
2020	87%
2021	82%
2022	75%

New England 2017

2017 Drop	N=733
2018	98%
2019	97%
2020	95%
2021	92%
2022	87%
2023	83%
2024	79%

New England 2018

2018 Drop	N=653
2019	98%
2020	98%
2021	97%
2022	95%
2023	94%
2024	92%

Pingelly 2016

2016 Drop	N=314
2017	95%
2018	93%
2018	91%
2019	86%
2020	82%
2021	79%
2022	75%

Pingelly 2017

2017 Drop	N=608
2018	94%
2018	94%
2019	90%
2020	88%
2021	85%
2022	81%

Raw F1 Ewe Reproduction Performance

Balmoral- Reproduction - Percentages (join March, lamb August, wean late November)

2015 Drop	Foetus Rate	Survival	Weaning Rate	2016 Drop	Foetus Rate	Survival	Weaning Rate
2017	115	74	85				
2018	119	77	91	2018	92	79	73
2019	131	77	101	2019	119	80	95
2020	163	69	113	2020	149	76	113
2021	157	70	110	2021	146	76	111
Ave	**137**	**73**	**100**	**Ave**	**127**	**78**	**98**

MerinoLink - Reproduction - Percentages (join end December, lamb May/June, wean September)

2016 Drop	Foetus Rate	Survival	Weaning Rate	2017 Drop	Foetus Rate	Survival	Weaning Rate
2018	124	82	101				
2019	136	73	99	2019	92	77	71
2020	148	74	109	2020	128	81	104
2021	157	66	103	2021	161	64	103
2022	163	66	107	2022	174	67	117
Ave	**146**	**72**	**104**	**Ave**	**139**	**72**	**99**

Pingelly - Reproduction - Percentages (join early February, lamb July, wean late September/early October)

2016 Drop	Foetus Rate	Survival	Weaning Rate	2017 Drop	Foetus Rate	Survival	Weaning Rate
2018	115	83	96				
2019	145	80	115	2019	120	79	95
2020	153	84	129	2020	122	88	107
2021	157	79	124	2021	143	82	118
2022	164	81	132	2022	140	83	117
Ave	**147**	**81**	**119**	**Ave**	**131**	**83**	**109**

Macquarie - Reproduction - Percentages (join December, lamb May, wean August)

2017 Drop	Foetus Rate	Survival	Weaning Rate	2018 Drop	Foetus Rate	Survival	Weaning Rate
2019	134	65	87				
2020	133	87	115	2020	111	84	93
2021	160	79	126	2021	154	84	129
2022	165	70	115	2022	163	73	119
2023	151	74	112	2023	151	77	116
Ave	**149**	**75**	**111**	**Ave**	**145**	**80**	**114**

New England - Reproduction - Percentages (join March, lamb Aug, Wean December)

2017 Drop	Foetus Rate	Survival	Weaning Rate	2018 Drop	Foetus Rate	Survival	Weaning Rate
2019	103	83	85				
2020	138	88	122	2020	106	93	98
2021	131	88	115	2021	125	90	112
2022	143	80	115	2022	133	87	116
2023	168	87	146	2023	177	83	147
Ave	**137**	**85**	**117**	**Ave**	**135**	**88**	**118**

F1 Ewe Condition Scores

The MLP Project managed its ewes according to **LTEM (Lifetime Ewe Management)** condition score targets, which are based on well-researched industry best practices to optimise reproductive performance, ewe and lamb survival, and overall flock productivity.

LTEM Condition Score Targets

LTEM is a program developed from the research of the AWI-funded Lifetime Wool project. It sets specific condition score (CS) targets for Merino ewes at key reproductive stages:

- **Joining:** CS 3.2
- **Scanning:** CS 2.8
- **Pre-lambing:** CS 3.2 (with CS 3.3 or higher for twin bearers)
- **Weaning:** CS 2.8

Across the five MLP sites, ewes were weighed and condition scored at key production times, including pre-joining, scanning, pre-lambing, and weaning, to ensure they were being managed to these LTEM targets.

- **Ewes below target CS** were drafted into separate mobs for preferential feeding to help them reach target CS before lambing
- **Twin-bearing ewes** were prioritised for better nutrition to reach higher CS targets critical for lamb survival

The attached document (**attachment 15**) contains a record of project weights and condition scores as reported by each site and provided as an update to the project's ISC. The yellow cell denotes an adjustment on the CS target owing to drought conditions. During drought conditions, the condition score targets for F1 project progeny were adjusted as follows:

- **Dry periods (3-6 months or more, ~2 in 7 years):**
    - Dry animals: greater than condition score 2.3
    - Pregnant or lactating animals: greater than condition score 2.8
- **Drought (6-9 months or more, ~1 in 7 years):**
    - Dry animals: greater than condition score 2
    - Pregnant or lactating animals: greater than condition score 2.5

Data Abnormalities

1. Sire/Progeny Data Abnormalities/ and how each was addressed

- **Sire Failures / Incorrect AI:**
    - In 2015, semen from two sires was sent for AI instead of the single nominated sire (Mumblebone 130389). This error was only discovered via DNA pedigreeing of the F1 progeny. The sire from the entered ram was also used in the 2016 drop. The result was that the progeny for this sire was spread over two years.
- **Backup (BU) Progeny Management:**
    - In 2016, Merinolink ran backup progeny with the MLP ewes, and these ewes were included in the classing. This confounded management groups and resulted in bias in AMSEA and Professional Classing results. As a result, the yearling classing results were ignored, and the classing was repeated at Hogget age.

2. DNA and Genotyping Issues

- **DNA Sample Mix-ups:**
    - Early in the project, there were mix-ups and duplications in DNA collection via TSUs (Tissue Sampling Units), especially for the F1 ewes. Where necessary, animals with ambiguous or missing DNA results were resampled to confirm pedigree assignment. New protocols were developed to avoid these issues in later years.
- **Missing or Delayed DNA Parentage Results:**
    - There were some delays and missing results due to DNA pedigree information being unavailable, especially for backup lambs and during the transition to new genotyping suppliers.

3. Data Collection and Transfer Problems

- **Hardware/Operator Failures:**
    - Although rare, there were some instances of hardware or operator failure that resulted in missed data points, especially for visual traits or when using EID technology.
- **Inconsistent Data Entry / Software Compatibility:**
    - Issues were reported with electronic equipment interfering with each other (e.g., body weigh/draft at the autodraft and Allflex greenstick used simultaneously), in minor instances, leading to the odd missing lamb weaning weights.

4. Management Group and Protocol Deviations

- **Unplanned/Unrecorded Management Groups:**
    - Creation of additional management groups at sites (often due to seasonal conditions) increased data management complexity and risked incorrect group assignments or tracking. These were picked up in milestones and oversight.

5. Trait-Specific Data Issues

- **Pregnancy Scanning Inaccuracy:**
    - Higher-than-expected errors in pregnancy scanning, especially triplet vs. twin classification, led to some ewes being run under unsuitable conditions and may confound lamb survival analysis. Scanning data was updated post-DNA testing of the F2 lambs.

6. Professional Classing

- **Not classing to instructions:**
    - The five-grade Professional Class, where ewes were classed as Top, Stud, Seconds, Sales, and Culls was impacted by several classers not adhering to the protocol, which may complicate the analysis of the professional classing grade. This was partly due to the wide variety in sires, resulting in significant variation among the progeny to be classed. The diversity in sire types within a drop, site, and entire project also adds complexity to the statistical analysis.
    - The three-way AMSEA classing was more familiar to the classers, and generally classers followed the protocol.
    - Feedback was provided to classers after classing to help them achieve better classing splits. Additionally, some classers received progress reports toward the splits during classing.

7. Other Notable Issues

- **Drought and Adverse Events:**
    - Drought conditions led to deviations in animal management, which may have affected consistency and completeness of data (e.g., drought feeding, missing WEC samples due to low worm challenge).

Sire Stocktake

At the conclusion of the sire selection phase, a stocktake (**Attachment 16**) showed that the project had achieved its aim of creating a sire list that was both industry relevant and representative. The selected sires offered a wide range of performance extremes and combinations, enabling the exploration of key drivers of lifetime productivity.

When sires were selected for use in the project, they had 9,000 progeny evaluated in MERINOSELECT. In early 2025, these sires had 70,000 progeny evaluated, of which 5,700 were in MLP.

DNA and Tissue Collection

In the Merino Lifetime Productivity (MLP) project, the following DNA and tissue materials are stored with Neogen:

Extracted High-Quality DNA from F1 Ewes: DNA is extracted from tissue samples (typically collected using Tissue Sampling Units, TSUs) from F1 ewe progeny involved in the project. This extracted DNA is stored by Neogen for use in genotyping and future use. The F1 wethers did not have their DNA stored.

Tissue Samples (TSUs): Tissue samples collected from the F1 progeny that have not had high-quality DNA extracted are stored by Neogen.

Sire DNA: DNA from sires entered in the MLP Project is stored by Neogen as either semen, TSU, or extracted DNA. In some cases, multiple samples are stored in various formats.

End of Life TSUs: A TSU was collected from each F1 ewe remaining at the end of the project and is stored by Neogen.

Sample Type	Number of Samples
Extracted High-Quality DNA from F1 Ewes	5,914
Tissue Samples (TSUs):	26,657
Sire DNA:	139
End of Life TSUs:	4,470

RESULTS - OPERATIONS

Site Milestone Reports

These reports tracked progress against contractual commitments, identified potential risks or challenges, documented communication outputs, and guided site planning for upcoming activities. Milestone reporting proved invaluable in providing the project management team with routine updates, ensuring transparency, monitoring site activities, and maintaining budget oversight.

A copy of all sites' submitted milestones is in **Folder 1**.

Communication

Effective communication has been a cornerstone of the MLP Project, ensuring that the substantial dataset, insights, and outcomes generated throughout the project have been shared with the Australian wool industry and key stakeholders.

MLP Project Sire Reports

A **standard sire evaluation report** was generated for the first two assessments at each site. Standard site reports followed a standard template developed by AMSEA that features sire performance packaged as adjusted sire means, flock breeding values, and industry standard indexes. The reports also include an overview of how the progeny of the sires were managed up to their assessments, details about the breeding of the sire and owner details, along with assessment dates and named the classers at the sites.

Once each site moved into the MLP phase, an **MLP Project** Report was developed with guidance from the project's Industry Steering Committee. Most of the elements of the site report evolved into the MLP report, as a result, the MLP Site Report included the following information:

Raw data: This represents ewe progeny results averaged by sire that have not been adjusted for birth type, rear type, age of dam, or management group. No consideration is given to trait heritability or genetic correlations between traits. The reported raw data includes:

- Birth and Rear Type counts.
- Counts of sires' ewe progeny at each assessment.
- Various traits such as wool, body weight, carcase traits, condition score, visual scores, professional classer grade, and reproduction.

Adjusted sire means: These values reflect the average performance of a sire's progeny, adjusted for factors such as birth type, rearing method, age of the dam, and management group. While these adjustments account for environmental and management effects, they do not include genetic factors like heritability. The reported data includes adjusted sire means for:

- Wool traits, body weight, carcase traits, condition score, and classer's visual grade.

Flock breeding values (FBVs): Calculated within site and drop, FBVs express the performance of a sire relative to other sires in the evaluation. These values incorporate genetics (such as heritability and trait correlations) as well as environmental influences, with accuracy increasing over time as more data is collected. FBVs were reported for the following trait groups:

- Wool traits, body weight, carcase traits, worm egg count.

Indexes: Standard industry indexes were reported, combining FBVs into a single value that reflects a particular emphasis on traits to achieve a breeding objective. Four standard indexes were reported throughout the project's life, including base indexes and plus indexes for the Dual Purpose, Merino Production, Fine Wool, and Wool Production categories.

Each report underwent extensive verification by multiple parties to adhere to the AWI standard of zero errors. A standardised report template was utilised across sites to ensure consistency. Reports were made available in print during field days and online for broader access. Typically, two reports were generated per site each year: a hard copy report in time for a field day and one available online post-shearing following the field day. For sites affected by COVID, one report per annum was produced.

Thirty-one MLP site reports were published on the Merino Superior Sires website, with a total of six reports from Balmoral, four from MerinoLink, six from Pingelly, seven from Macquarie, and eight from the New England site.

The inclusion of reproduction in the calculation of indexes was delayed for up to 18 months in the project, owing to the Number of Lambs Weaned estimate not reflecting the actual outcome. This was resolved with repeat reproduction records, and AGBU's creation of the three component traits of Weaning Rate: Conception, Litter Size, and Ewe Rearing Ability.

Project MLP Reports

Year	Month	Site
2018	February	Balmoral
2018	June	Balmoral
2018	July	Macquarie
2018	August	New England
2018	November	New England
2019	February	Pingelly
2019	February	Balmoral
2019	March	MerinoLink
2019	June	New England
2019	July	Macquarie
2019	October	Pingelly
2020	January	New England
2020	March	Balmoral
2020	March	Macquarie
2020	June	Pingelly
2020	August	New England
2020	November	MerinoLink

Year	Month	Site
2021	March	Macquarie
2021	July	Pingelly
2022	February	Balmoral
2022	March	Macquarie
2022	June	New England
2022	July	Balmoral (Final)
2022	August	MerinoLink
2022	October	Pingelly
2023	March	Macquarie
2023	May	MerinoLink (Final)
2023	July	Pingelly (Final)
2024	March	Macquarie (Final)
2024	May	New England
2024	November	New England (Final)

The reports were printed and available at field days with a total of **11,680 report downloads from the Merino Superior Sires Website** to March 2025.

A copy of all the site MLP Reports and standard sire evaluation reports can be found in **Folder 2**.

Newsletters

A total of 18 MLP Newsletters were published (**Folder 3**), each featuring a mix of project updates, site and event profiles, research developments, data milestones, Add-On projects, key personnel features, and analysis insights. The newsletters served as a primary communication tool to keep stakeholders and the industry informed and engaged throughout the life of the MLP Project. In total, 1760 newsletters were downloaded.

MLP Newsletters Published

Newsletter No.	Date	Content
1	December 2018	Introduction to the MLP Project, its objectives, and design. Details on trait assessments, site locations, and selection of sires. Explanation of data collection and its importance for improving Merino breeding. Upcoming field day information and contact details.
2	March 2019	Field day updates from Balmoral and MerinoLink, including attendance and highlights. Emphasis on increasing genetic and economic understanding.
3	June 2019	Field day updates: MerinoLink, Macquarie, New England, and Pingelly. Early insights into changes in sire rankings over time, highlighting the value of lifetime data.
4	December 2019	Discussion of tracking ewes' performance over their lifetime. Introduction to functionality classing (teeth and udder assessments) and the development of scoring systems. Announcement of upcoming field days.
5	March 2020	Mid-point data collection milestone: 54% of 2 million planned data points reached. Overview of the Macquarie MLP Field Day, workshops, and presentations. Explanation of the significance of a large dataset for genetic understanding. Announcement: MLP data to be included in MERINOSELECT from April 2020.
6	July 2020	Highlights the development of new reproduction Research Breeding Values using MLP data. Promotion of the New England Online Field Day. Site updates and feature on Balmoral Site Manager Tom Silcock.
7	October 2020	Focus on the New England Online Field Day (webinar and dedicated website). Project updates and site news. Feature article on the Pingelly site manager Dr Bronwyn Clarke (Murdoch).
8	January 2021	Review of Pingelly October Field Day and MerinoLink Inspection Day. Data collection updates and feature article on the MerinoLink site manager Lexi Cesnik (Moses and Son). Around the Sites update.
9	March 2021	Profile on Macquarie's online webinar, upcoming events, and data collection update. Around the Sites update and feature on New England site manager Dr Jen Smith (CSIRO, New England).
10	June 2021	Article on MerinoLink site's reproduction results. Site update and profile of Macquarie site managers Dr Kathryn Edgerton Warburton and Tracie Bird Gardiner (NSW DPI).
11	September 2021	Focused on reproduction across the project. Lambing updates, culling strategy discussion, site updates, and on-farm team profiles.

Newsletter No.	Date	Content
12	January 2022	Introduction to the AGBU team (now contracted for MLP analysis). Updates on data collection and upcoming events.
13	August 2022	Promotion of the MerinoLink and Pingelly field days. Thanked the Balmoral site and featured an article that explored the Balmoral lifetime dataset looking at associations between lambs weaned to clean fleece weight produced. Updates on site activities.
14	December 2022	Focus on MerinoLink and Pingelly final field days. Thanks to sites, overview of Add-On Project Yield analysis, and updates from all sites.
15	April 2023	Wrap-up of the final Macquarie MLP field day. Details on the celebration, presentations, and key features of the Macquarie site. Highlights from field day displays and data presented.
16	October 2023	Promotion of the final MLP Field Day at New England. Overview of the MLP data collection process and status. AGBU analysis insights and acknowledgment of industry awards.
17	March 2024	Promotion of the final New England MLP Field Day. Recap of the recent Analysis and Reporting Committee (ARC) meeting. Update on the New England site and feature on the December Beyond the Bale article. Early analysis insights and summary of project achievements to date.
18	September 2024	Wrap-up of the New England field day and the completion of the data collection phase. Article on predicting lifetime reproduction from early records. Acknowledgment and thanks to the New England site.

Beyond the Bale

A total of 33 articles based on the core MLP Project were published in AWI's Beyond the Bale Magazine between June 2016 and March 2025. A copy of these articles can be found in **Folder 4**.

Issue	Date	Pages	Content
67	June 2016	36-37	Merino Lifetime Productivity Update - Project Under Way
69	Dec 2016	48-49	Merino Lifetime Productivity Update
70	March 2017	3	Merino Lifetime Productivity Update in the CEO overview
71	June 2017	36-37	Merino Lifetime Productivity Update
73	Dec 2017	34-35	Merino Lifetime Productivity Update
74	March 2018	50-51	Merino Lifetime Productivity Update
75	June 2018	60-61	Merino Lifetime Productivity Update - stocktake of the project's ewe base, sires used, and diversity achieved
76	Sept 2018	58-59	Report on Field Days and Macquarie and New England
77	Dec 2018	57-58	Highlighting the new AMSEA website and access to MLP Website
78	Mar 2019	50-51	Featured a report on the success of naturally joined rams - "ram mating success"
79	June 2019	44	MLP Project classing approaches
80	Sept 2019	44-45	Featuring the Macquarie field day and insight into changes in classer grade
81	Dec 2019	46-47	Report on the Pingelly field day, overview of data to be collected
82	March 2020	46-47	Exploring link sire performance
83	June 2020	46-47	Updates from each MLP site
84	June 2020	41	Meeting the MLP Project Manager and Site Managers
85	Dec 2020	46	New England MLP Site Goes Online
86	March 2021	40-44	MLP Add-On Project: Ram Mating Success, Explanation of MLP reports (Video resource), ASBVs for MLP sires now searchable on MERINOSELECT
87	June 2021	44-45	Opportunities of a ewe's lifetime / MLP Add on Project Listing
88	Sept 2021	36-37	MLP data update and preliminary inspection of classing based on reproduction outcome
89	Dec 2021	48-49	Profiling the Pingelly MLP Site
90	March 2022	42-43	AWI and AGBU partnering for genomics and the MLP analysis
91	June 2022	26-27	Assessing the Assessment Tools
92	Sept 2022	24-26	Balmoral site wrap up
93	Dec 2022	20-21	Wrapping up at MerinoLink and Pingelly Sites
94	March 2023	20-21	Comparison of MLP FBV with ASBVs
95	June 2023	24-25	Final Macquarie Field Day coverage
96	Sept 2023	30-31	Overview of MLP related presentations at the AAABG conference, Preliminary evaluation of the impact of visual traits on lifetime ewe performance, Comparison of udder and teat traits in Merino ewes

Issue	Date	Pages	Content
			recorded at lambing and weaning, Relationships of sire breeding values for Merino production trait with eating quality of lamb
97	Dec 2023	24-25	MLP Proving its value
98	March 2024	18-19	Wrinkle Expression in the MLP Project - comparing breech wrinkle scores of link sires
99	June 2024	18-20	Article outlining how well early performance predict lifetime performance of MLP sires
100	Sept 2024	32-33	Report on the New England final MLP field day
101	Dec 2024	32-33	MLP Insights - Improving reproduction rates
102	March 2025	18-19	The importance of quality raw data in breeding and a tribute to the late Professor Andrew Swan

Six articles featuring MLP "Add on" projects were also published in AWI's Beyond the Bale.

Issue	Date	Pages	Content
77	Dec 2018	61	Improving Resilience in Merinos – CSIRO
82	March 2020	45	New Worm Egg Test - Mini FLOTAC – Dawbut
86	March 2021	40-41	Ram Mating Success - Livestock Logic, LLS, For Flocks Sake
86	March 2021	42-44	GEPEP - finding a better way to compare sheep performance - Murdoch
90	March 2022	44-45	GEPEP - finding a better way to compare sheep performance and profitability on a per hectare basis – Murdoch
103	June 2025	16-17	Methane Project Breeding Values of MLP sires entered at four MLP sites

AWI's The Yarn Podcast

In total, the MLP Project featured in AWI's The Yarn Podcast seven times. Copies of the podcasts can be found in **Folder 5:**

- **Episode 30 - March 5, 2018: Australia's Biggest Sheep Experiment: The Merino Lifetime Productivity Project**. This episode explores how big data is integrating into the sheep industry through the Merino Lifetime Productivity (MLP) project, and its implications for the field. Discover how this innovative project is opening new genetic possibilities.
- **Episode 86 - May 22, 2019: Merino Lifetime Productivity Project Update**. Four years into the ten-year MLP Project, industry experts from the MLP Industry Steering Committee discuss the achievements thus far and the future goals of the project.
- **Episode 129 - June 2, 2020: Gaining Genetic Ground with an MLP Milestone**. Ben Swain of AMSEA provides a project update as the data collection reaches its midpoint.
- **Episode 211 - February 4, 2022:** Features Tom Silcock and Bill Walker discussing the Balmoral MLP site in addition to the upcoming final Balmoral field day.
- **Episode 230 - October 4, 2022: Merino Lifetime Productivity**. Insights are emerging from the project that reveal significant aspects of Merino genetics. Contributions from Ben Swain (AMSEA), MerinoLink, and Pingelly site hosts Marty Moses and Dr Bronwyn Clarke present intriguing findings.

- **Episode 243 - March 15, 2023: MLP Macquarie's Final Field Day**. This episode promotes the final Macquarie field day and features discussions with Matthew Coddington, Chris Bowman, Graham Wells, and NSW DPI's Dr Sue Mortimer.
- **Episode 260 - May 7, 2024:** Features Todd Whillock, Jen Smith, and Geoff Lindon discussing the New England field day and Research Flystrike Breeding Values.

Field Days

There were 23 in-person field days with 2,155 attendees. These events were vital for communication, education, industry engagement, data demonstration, networking, feedback, and celebrating milestones. They allowed the MLP Project's research to reach the Australian wool industry directly.

The field days featured:

- **Sheep Displays**: Sheep were grouped by sire, making it easy to compare progeny with accompanying results.
- **Pen-Side Sire Introductions**: Presenters discussed each ram's reason for selection in the MLP Project, performance to date, and the breeding objectives of the flock that the sire was bred in.
- **Presentations and Workshops**: Talks covered MLP updates, AWI presentation, technical topics like reproduction and new trait assessments, and on-farm practices.
- **Trade and Technical Displays**: Included equipment presentations and provided networking opportunities.
- **Social and Networking Elements**: Events often ended with a dinner or informal session for participants to discuss findings and share experiences.

During the height of the COVID pandemic (2020 to 2021), the MLP Project's communication shifted from primarily in-person, event-based engagement to a multi-channel approach emphasising webinars, online resources, newsletters, and digital updates. This ensured continuity of industry engagement and even expanded the reach of project communications during the pandemic.

Western Australia's Pingelly site was an exception and held a standard field day due to fewer local restrictions. Balmoral and Macquarie cancelled their planned 2021 field days, and MerinoLink converted their day into an inspection-only day with no formal presentations. This was followed by a complementing webinar. The Macquarie site held a webinar that shared the latest sites.

Below is a detailed breakdown of the field days, both in person and online, including the sites, dates, and number of attendees:

Site	Date	Attendees
Balmoral	April 8, 2016	50
MerinoLink	March 15, 2017	70
Balmoral	March 24, 2017	130
Pingelly	April 4, 2017	60
MerinoLink	October 27, 2017	40
Balmoral	February 16, 2018	140
MerinoLink	March 16, 2018	120
Pingelly	March 28, 2018	80

Site	Date	Attendees
Macquarie	July 11, 2018	115
MerinoLink	March 15, 2019	100
Macquarie	July 10, 2019	109
New England	August 3, 2019	60
Pingelly	October 25, 2019	60
Macquarie	March 4, 2020	100
New England - online	August 2020	>1480 (web page visits)
New England - webinar	August 2020	158
MerinoLink (inspection only)	October 20, 2020	30
Pingelly	October 27, 2020	85
MerinoLink - webinar	November 19, 2020	75
Macquarie - webinar	May 13, 2021	53
Pingelly	October 22, 2021	60
Balmoral – FINAL	February 16, 2022	130
Macquarie	March 30, 2022	75
New England	June 2, 2022	70
MerinoLink - FINAL	October 14, 2022	50
Pingelly – FINAL	October 21, 2022	80
Macquarie - FINAL	March 29, 2023	120
New England - FINAL	May 29, 2024	150

Online Field Day (Due to Covid)

The New England online field day was designed as a complete conversion of the "traditional" in-person event into a digital experience that attendees could access at their convenience. Below is an overview of its format, development, and who attended, along with relevant references:

Format

- **Dual Components:**
  The event was delivered as both a live webinar and a dedicated website. The webinar (launched on August 13, 2020) featured live presentations by key personnel, while the website served as a repository for all the field day content.
- **Multimedia Content:**
  The online platform hosted many of the usual components of an in-person field day in digital format. For example:
    - A "Field Day Welcome" video presented by Duncan Lance (NEMSEA).
    - A "Site Overview" video featuring Jen Smith from CSIRO.

- Downloadable results report for the 2017 and 2018 drops, accompanied by an explanatory video.
- Sire progeny group inspection videos led by Ben Swain (AMSEA) and site classer Angus Carter.
- Downloadable sire results pen cards.
- Additional CSIRO research presentations and other associated information.

- **24/7 Access:**
  Once launched, the website's content was available "for the life of the project" so that interested parties could return to it repeatedly. The recorded webinar was linked on the website so that both live and subsequent viewers had full access to the presentations and discussions.

Development

- **Purpose and Inspiration:**
  The move from physical to online was primarily driven by COVID travel and social distancing restrictions. With limited site access granted to only a few personnel, the production team-comprising partners from CSIRO, AMSEA, and NEMSEA-rapidly adapted the classical field day format to an online medium. Former MLP team member Emma Grabham coordinated the development of the field day, with significant contributions from Dr Jen Smith, Ben Swain, Angus Carter, and the CSIRO technical team.
- **Content Creation:**
  Limited personnel with restricted site access were responsible for capturing videos and producing digital versions of traditional field day activities. This included everything from on-site overviews and live-style pen inspections to detailed presentations on research outcomes.
- **Hosting and Delivery:**
  The website was hosted by AMSEA, and the launch webinar was facilitated by SheepConnect NSW, ensuring that industry professionals nationwide (and even globally) would have the opportunity to view and interact with the content.

Attendees

- **Diverse and Wide-Reaching:**
  Although originally tailored for a local audience, the online format allowed industry stakeholders from across Australia-and even international participants attend. Feedback indicated that attendees came from multiple states and regions.
- **A total of 1480 website visits**
- **Positive Feedback:**
  Many attendees expressed enthusiasm for being able to access the high-quality video presentations and materials that traditionally would only be available on-site. The flexibility of accessing the content later on was also highly valued, as noted in the positive feedback responses.

Expense

- The online field day required significant investment in both financial resources and person hours to plan, film, edit, and display on the website. It was a necessary adaptation due to COVID restrictions across

the country; however, it did not fully substitute the experience of physically seeing the sheep and handling the wool.

External Publications

Sire Evaluation Site Newsletters:
Before the project newsletter was developed, several sites produced newsletters to keep site entrants, and the site committee updated. When the project newsletter was established, most sites stopped creating their own newsletters, except for the Balmoral site, which continues to publish a regular site newsletter.

Merino Superior Sires Annual Publication (October 2020, 2021, 2022, 2023, 2024): See Folder 6
A two-page MLP Project overview and update that also appeared in print.

ASWGA Newsletter Article (July 2020):
Included an article featuring the MLP Project.

Kondinin Group "Farming Ahead" Publication (May 2017, September 2020):
Publication ran a feature on the Pingelly site in 2017 and New England Online Field Day in

Australian Superfine Woolgrowers Annual Magazine (2020)
MLP Article supplied and included

NSW SMBA Top Sire Magazine (June 2017, 2021, 2024)
MLP Article supplied and included

AASMB Newsletter Update (July 2017, July 2018, July 2019, December 2020)
MLP Article supplied and included

Merino SA Annual (2019, 2022)
MLP Article supplied and included

Classings Classic (June 2016, June 2017)
Not supplied article, created by newsletter authors and collaborators

Industry Presentations

Many presentations are repeated or adapted for different field days and conferences. Several presentations were collaborative with multiple speakers per event.

The scope includes both formal presentations and informal talks/panel sessions at field days.

Dunkeld Wool Grower Group (February 2018)
Reproduction in the MLP Project - Andrew Swan

Australian Superfine Woolgrowers Association (May 2019)
MLP Overview - Rich Keniry

MerinoLink Conference (June 2019)
MLP Overview - Ben Swain

Victorian Farmers Federation Merino Gold Day - St Arnaud (March 2019)
Overview of the MLP Project - Ben Swain

South Australian Sire Evaluation (June 2019)
MLP Overview - Ben Swain

StockPro (2019)
MLP and Pingelly overview - Bronwyn Clarke

Sheep Meat Advisory Livestock Committee - Advisor Update (2019)
Realised & Future Outcomes of the Merino Lifetime Productivity Project - Geoff Lindon

NSW DPI Regional Research Roundup (2019)
Macquarie site MLP Overview - Kathryn Egerton Warburton

Best Wool Best Lamb Conference (2019)
MLP overview and update - Anne Ramsay

MerinoLink Conference (2021)
Results insights - Ben Swain
Project background and analysis - Lexi Cesnik and Geoff Lindon

Sheep Easy (August 2021)
MLP Update and Data - Bronwyn Clarke

Local Land Services (March 2022)
MLP Update and Macquarie Site - Tracie Bird Gardiner

Balmoral Field Day (February 2023)
MLP Update - FBV v ASBV and Snippets - Ben Swain

Yardstick Field Day (October 2023)
MLP Update - Bronwyn Clarke

Balmoral Field Day (2024)
MLP Sire Index Change over Time - Ben Swain

AWI Extension Networks Presentation (May 2024)
MLP Successes to Date - Geoff Lindon

Monaro Farming Systems (July 2024)
MLP and Add on Update - Geoff Lindon

Balmoral Field Day (March 2025)
MLP helping estimate lifetime reproduction - Ben Swain

Meat Up WA (**March 2025**)
MLP what have we learnt so far? - Bronwyn Clarke

Website

Merino Superior Sires Website - MLP Content

The MLP Project, hosted on the *Merino Superior Sires* website, includes the following features and content. https://merinosuperiorsires.com.au/mlp-project/

The development of the Merino Superior Sires (MSS) website to host MLP Project content was a deliberate part of the MLP Project's communication and extension strategy. The website was chosen as a central location for reporting, disseminating results, and providing ongoing updates to industry stakeholders, including ram breeders, commercial producers, researchers, and other interested parties.

Key points in the development and use of the MSS website for MLP:

Early Planning and Purpose

- In 2018, the MSS website was developed and became a central, easily accessible platform for hosting all MLP Project content, including reports, sire information, field day materials, and video/webinar content. This centralisation has supported industry transparency, communication, and engagement, and continues to be a key resource for MLP information.
- The MSS website hosts a range of MLP materials, including:
    - **Annual Site Reports**
    - **Sire Selection and Stocktake Documents**
    - **Field Day Updates**
    - **Webinar Recordings**
    - **Add-On Project Information**
- The MSS website is promoted regularly in internal and external communications, newsletters, and field day materials to drive industry engagement and ensure that the broader sheep and wool community can access MLP results.
- While the MSS website is the primary host for MLP data, updates are also shared on the wool.com MLP page, with cross-promotion between the two platforms.

Scientific Papers

As of June 2025, a total of 31 scientific papers have been published involving the MLP Project and/or its dataset. These papers are provided in **Folder 7**.

In addition, AMSEA, directed by the analysis team, has initiated the development of a Special Issue of Animal Production Science that has seen 29 papers approved to be included. Papers will be submitted by November 2025, and the Special Issue will be compiled once all papers are published. It is hoped that the special issue will be dedicated to the late Professor Andrew Swan.

Complete list of available published papers is found here:

AAABG - 2019

Clarke BE, Young JM, Hancock S, Thompson AN (2019) Merino Lifetime Productivity - Economic Value of Meat and Wool from Wethers at Yearling and Adult Age. *Proc. Assoc. Advmt. Anim. Breed. Genet. 23, 516-519*

Egerton-Warburton KL, Mortimer SI, Swan AA (2019) Accounting for Ewe Source Effects in Genetic Evaluation of Merino Fleece Traits. *Proc. Assoc. Advmt. Anim. Breed.*
Genet. 23, 520-523

Ramsay AMM, Swan AA, Swain BC (2019) Design and purpose of the Merino Lifetime Productivity project. *Proc. Assoc. Advmt. Anim. Breed.Genet. 23, 512-515*

AAABG - 2021

Clarke BE, Egerton-Warburton K, Smith J, Paganoni B, Martin G, Thompson A (2021) Split Paternity is High in Twins Born from Syndicate Mated Merino Ewes. *Proc. Assoc. Advmt. Anim. Breed. Genet: 24: 54-57*

Egerton-Warburton K, Smith J, Mortimer S, Swan A, Hine B (2021) The Importance of Early Environmental Effects on Merino Fleece Traits Across Two Shearings. *Proc. Assoc. Advmt. Anim. Breed. Genet: 24: 259-262*

Metcalfe B, Greeff J, Thompson A, Clarke B (2021) Visual Classing Grades are Heritable and Visually classed Merino Sheep Born and Reared as Twins are Graded Lower than Singles. *Proc. Assoc. Advmt. Anim. Breed. Genet: 24: 58-61*

Mortimer S, Smith J, Hine B, Fowler S, Holman B, Hopkins D, Edgerton-Warburton K, Swan A (2021) Variation between Merino Sires in Lamb Carcass Value. *Proc. Assoc. Advmt. Anim. Breed. Genet: 24: 255-258*

Mortimer S, Swan A, Bunter K (2021) Ewe Reproduction Status and its Impact on Greasy Fleece Weight Breeding Values. *Proc. Assoc. Advmt. Anim. Breed. Genet: 24: 251-254*

Wallace J, Egerton-Warburton K, Swan A (2021) Economic Analysis of Merino Ewe Performance from Diverse Industry Sires using GrassGro™. *Proc. Assoc. Advmt. Anim. Breed. Genet: 24: 337-340*

AAABG - 2023

Mortimer S, Holman B, Fowler S, Alvarenga T, Hopkins D, Egerton-Warburton K, Smith J, Hine B, Swan A (2023) Relationship of Sire Breeding Values for Merino Production Traits with Eating Quality of Lamb. *Proc. Assoc. Advmt. Anim. Breed. Genet. 25: 214 - 217*

Mortimer S, Egerton-Warburton K, Bird-Gardiner T, Swan A (2023) Ewe Genotype Effects in Genetic Evaluation of Merino Fleece Traits Across Ages. *Proc. Assoc. Advmt. Anim. Breed. Genet. 25: 214 - 217*

Smith E, Acton G, Bell A, Smith J (2023) Comparison of Udder and Teat Traits in Merino Ewes recorded at Lambing and Weaning. *Proc. Assoc. Advmt. Anim. Breed. Genet. 25: 51 -54*

Wahinya P, Brown D, Walkom S, Bird Gardiner T, Clarke B, Smith S, Swan A (2023) Preliminary Evaluation of the Impact of Visual Traits on Lifetime Ewe Performance. *Proc. Assoc. Advmt. Anim. Breed. Genet. 25: 47 – 50*

AAABG - 2025

Dehnavi E, Swan A, Swain B, Greeff J, Smith J, Burbidge G, Ramsay A, Bird Gardiner T, Brown D (2025) Assessing Genetic Variability in Flystrike Resistance Across Expression Levels in Australia Merino Sheep. *Proc. Assoc. Advmt. Anim. Breed. Genet. 26: 411-414*

Keshavarzi H, Dehnavi E, McNally J, Smith J, Schmoelzl S (2025) Genetic Analysis of Sensor Based Activity in Australian Merino Sheep. *Proc. Assoc. Advmt. Anim. Breed. Genet. 26: 50-53*

Mortimer S, Fowler S, Holman B, Alvarenga T, Hopkins D, Egerton Warburton K, Smith J, Hine B, Swan A (2025) Preliminary Genetic Correlations of Merion Meat colour Traits with Lean Meat Yield and Eating Quality. *Proc. Assoc. Advmt. Anim. Breed. Genet. 26: 335-338*

Wahinya P, Brown D, Clarke B, Smith J, Bird-Gardiner T, Swan A (2025) Genomic Models for Estimating Genetic Parameters for Lifetime Wool Traits in Merino Sheep. *Proc. Assoc. Advmt. Anim. Breed. Genet. 26: 86-89*

ASAP/AAAS-2018

Bunter, K.L. Smith, J. and Fowler, D. (2018) "How accurate is foetal aging at pregnancy scanning to predict lambing date?" *Animal Production Science* 58(8)

Ramsay A, Swain B, Swan A (2018) An Overview of the Merino Lifetime Productivity Project. Animal Production Science, 58(8)

Refshauge G, O'Keeffe P, Egerton-Warburton K, Morris S, Mortimer S (2018) Rectal temperature of Merino ewes and pregnancy outcome following artificial insemination. *Animal Production Science* 58(8)

Refshauge G, O'Keeffe P, Egerton-Warburton (2018) Rectal temperature of Merino ewes differs between two bloodlines. *Animal Production Science* 58(8)

AAAS - 2021

Clarke B, Thompson A (2021) Classers Successfully Combine Structural Traits with Assessments of Liveweight and Wool Quality When Visually Classing Sheep at Pingelly MLP Site but Should Account for Birth and Rear Type. *Animal Production Science* 61.

Hancock S, Clarke B, Kearney G, Thompson A (2021) Age of Hogget Classification Determined by Teeth Eruption Varies between Merino Sire Groups. *Animal Production Science* 61.

Mortimer SI, Egerton-Warburton, KL and Swan AA (2021a) Impact of ewe genotype on sire breeding values in genetic evaluation of Merino body composition and components of reproduction. *Animal Production Science* 61.

Mortimer SI, Egerton-Warburton, KL and Swan AA (2021b) Impact of ewe genotype on sire breeding values in genetic evaluation of Merino visual traits. *Animal Production Science* 61.

Special Issue

Bell A, Dominik S, Elks D, Acton G, Smith J (2021) Dentition Can Predict Maturity in Young Merino Sheep. *Animal Production Science 61*

Chapman J, Hebart M, Brien F (2021) Growth, body composition and body wrinkle are favourably correlated with reproductive performance in 2-8-year-old Merino sheep. *Animal Production Science* **61**, 1873-1883.

Small Ruminant Research

Hancock, S.N. et al. (2022) Age of Eruption of the First Permanent Incisors Varies between Merino Genotypes and Is Related to Liveweight. *Small Ruminant Research* 208

Smith E, Hine B, Acton G, Bell A, Doyle E, Smith J (2023) Ewe udder and teat traits as potential selection criteria for improvement of Merino lamb survival and growth. *Small Ruminant Research, v.225, p. 1-9*

Animal

Hine B, Acton G, Elks D, Niemeyer D, Bell A, Colditz I, Ingham A, Smith J (2022) Targeting Improved Resilience in Merino Sheep - Correlations between immune competence and health and fitness traits. *Animal 16 (7)*

Lockwood A, Hancock S, Paganoni B, Kearney G, Sohi, R, Thompson A (2018) Mob size of single-bearing or twin-bearing Merino ewes at lambing may not influence lamb survival when feed-on-offer is high. *Animal 13(6)*

Early Analysis Insights and Interim Results

While the comprehensive analysis of the full MLP dataset is still underway, the project has already delivered a range of valuable early insights and interim results to the wool industry. These preliminary findings have been communicated through project newsletters, "Beyond the Bale" articles, conference presentations, and field days.

General Insights from the core and add on projects:

- **Reproduction Strategies:** A "one-size-fits-all" culling approach for optimising reproduction in commercial flocks is unlikely to be effective. Although the very high weaning rates at all sites are likely to have impacted the outcomes to date. More nuanced selection based on repeat and lifetime records is warranted.
- **Lifetime Wool Production:** The importance of including at least one late hogget or adult fleece record in a measurement program for predicting lifetime wool production has been reaffirmed.
    - One-year-old assessments are moderately correlated with lifetime productivity, making them valuable for rams as they are often the first progeny test results received.
    - Two-year-old assessments can be recorded on sires and ewes.
- **Sire Variability:** Considerable variation exists in sire mating success rates among naturally mated ram teams. Instances of 50% of twins born from different sires have also been observed.
- **Udder Traits:** Udder traits are heritable and are closely related to lamb survival and weaning weights. New udder and teat traits have been developed using New England MLP F1 ewe data, showing visually scored udder depth, teat size, and teat placement are low to moderately heritable and highly correlated between lambing and weaning for ewes rearing lambs. These traits now appear in the AWI/MLA Sheep Visual Scores booklet.
- **Eating Quality:** Selecting for eating quality (IMF and Shear Force) appears to have minimal impact on key Merino production traits.
- **Ewe Survival:** The heritability of ewe survival (to four-year-old) is low (0.06) but variable. There is a moderate, favourable genetic relationship (-0.4) between improved survival and lower wrinkle (i.e., genetically plainer ewes are more likely to have higher survival rates). This outcome will be updated to include ewe data out to six and seven years of age.
- **Skin Pigmentation:** Skin pigmentation recorded at marking is highly heritable and highly related to lifetime skin pigmentation/skin pigmentation recorded at later age stages.
- **Fleece Yield & Weight:**
    - Yields collected at the mid-side reliably predict differences in fleece weight, even under drought conditions.
    - Comparison of yields taken from mid-side, pin-bone, or whole fleece core samples showed that all can be used to compare ewes and sires for clean fleece weight (CFW) without significant re-ranking.
    - Whole fleece testing at the MerinoLink site showed that longer staple length at any fleece weight results in slightly higher yield.

- **Foetal Age Prediction:** Trained pregnancy scan operators can reliably predict foetal age.
- **Foot Paring:** At the Macquarie site (2017 drop), foot paring did not significantly influence ewe performance and therefore did not bias sire Flock Breeding Values for production.
- **Sire Ranking Changes:** Early MLP results show that sire rankings for traits like greasy fleece weight (GFW) and classer grade are changing as their ewe progeny age, demonstrating the value of collecting repeat records at late hogget or adult age stage.
- **Reproduction Breeding Value Accuracy:** The accuracy of Weaning Rate (WR) breeding values improves with the number of a sire's progeny evaluated and the number of repeat reproduction records. Genomics can enhance early-life reproduction genetic estimates, achieving high accuracy with fewer progeny evaluations and reproduction events.
- **Genomics for all other traits:** Genomic enhanced mid-parent values improve the accuracy of each individual trait prior to the first measurement, thus improving the correlations of early in life breeding values with lifetime productivity.
- **Resilience:** Immune competence is lowly unfavourably correlated with growth rate to yearling age and lowly favourably correlated with worm egg count and dags. There is no significant correlation between immune competence and fleece weight, fibre diameter, fat, or muscle.

Insights from Classing Studies:

- **Value of Classing:** Data from sheep classing is re-confirming the value of classing as a selection tool.
- **Effectiveness of Visual Classing:** Visual classing is highly effective when breeding objectives focus on traits that can be assessed well visually. However, it has limitations when breeding objectives focus on non-visual traits such as reducing fibre diameter, worm resistance, eye muscle depth, staple strength, eating quality, and weaning rate.
- **Alignment with Indexes:** While there is generally good alignment between visual classing (tops, flocks, culls) and the MP+ index (when assessed at two years of age and again at seven years of age), outliers exist. Top-indexing animals can have poor conformation, and top visually assessed animals can have low indexes. A combination of approaches is often best. How to best combine visual and objective information will be a focus of the extension phase.

These early insights are paving the way for the comprehensive analysis phase of the MLP Project, which will further refine understanding and enhance breeding and selection strategies for the Merino industry.

Monitoring and Evaluation

Field day surveys across several MLP sites have consistently shown very positive feedback from industry participants. In summary, surveys indicate that:

- **Overall Satisfaction:**
  A very high proportion of attendees rate the events as highly enjoyable, informative, and relevant. For example, one survey reported that around 95% of respondents rated the day as highly enjoyable and informative, with approximately 89% describing it as valuable.
- **Content and Format:**
  Respondents appreciated the mix of activities offered, such as the display of sheep (especially with the preference for sheep being exhibited in sire groups), pen-side sire introductions, presentations on project results (including reproduction, wool, and other performance measures), and additional add-on project insights.
- **Communication Channels:**
  Attendees were accessing information about field days via multiple channels - including email, social media, and traditional outlets. Feedback on these communication activities shows that the outreach has been effective and contributes to high awareness and participation levels.
- **Minimal Criticism:**
  While a few comments or suggestions for improvement have been received, these have been few in number and mostly positive in tone. The overall sentiment is one of satisfaction with the value, engagement, and quality of the field day experience.

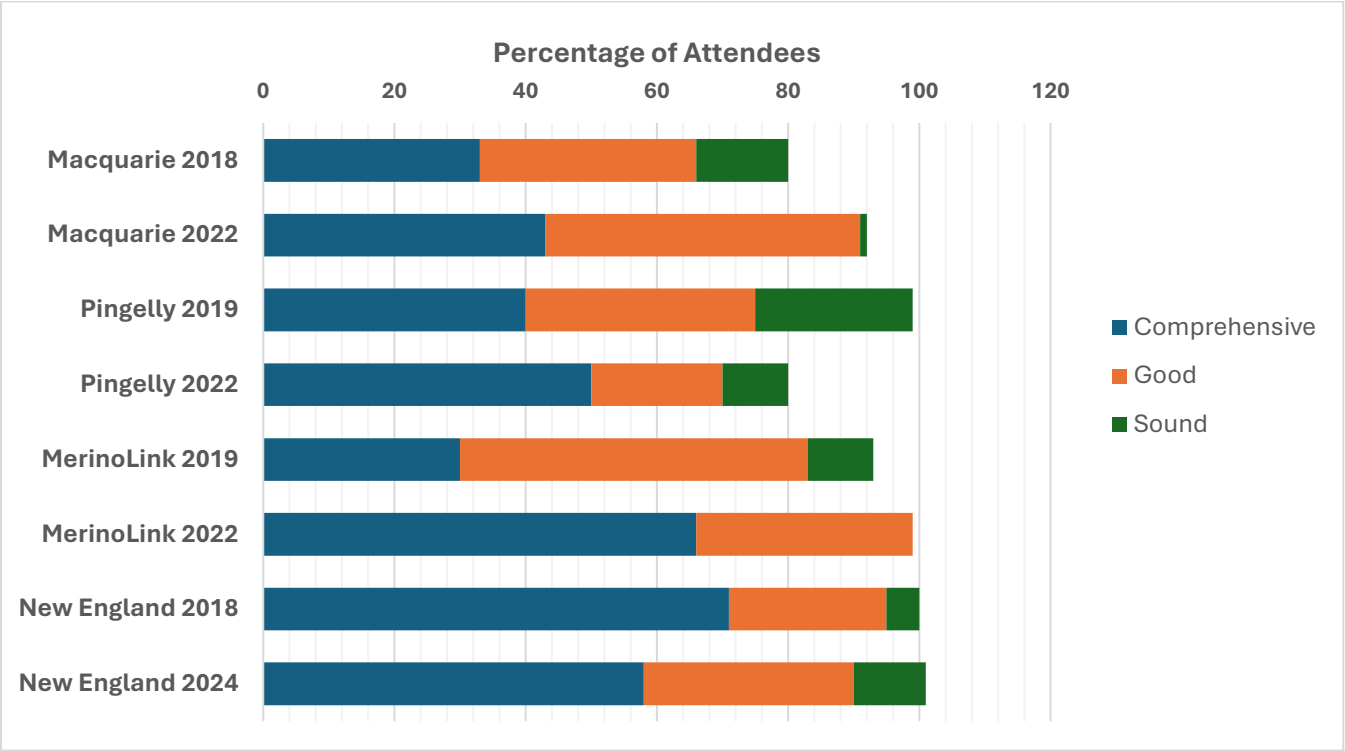
Surveys consistently show that field days were seen as a valuable and effective way of engaging with the industry. They provided clear, useful information delivered in an accessible format that is appreciated by a broad cross-section of commercial breeders, ram entrants, and service providers.

Early in the project, the understanding of results was low, and users needed more support and explanation. As the project progressed, targeted communications, field days, and explanatory materials increased awareness and understanding. By later stages, surveys and feedback indicated much greater confidence and ability to use the results, although some users still desired further clarity and support. The project deliberately tracked and fostered this progression as part of its communication and engagement strategy.

A comparison of survey results from the early and final field days, at sites where both sets of data were available, showed a significant increase in participants' understanding of project results at all locations except the New England site. It is likely that New England attendees already had a higher baseline understanding of concepts such as breeding values and indexes due to the site's proximity (15 minutes) to the MERINOSELECT team, and the presence of a long-running sire evaluation program in the region. The lower level of understanding recorded at the final New England field day suggests that a different cohort of attendees may have been present.

Survey response: "How well do you understand the MLP Project results"? Where audiences were asked to rank their understanding of project results from comprehensive (**highest**), good, sound, low (**lowest**)

Change in Participant Understanding of Project Results Over Time by Site and Field Day Year



AMSEA Contract and Budget Management

AMSEA provided regular, detailed financial, milestone, and operational reports to the MLP Executive Committee, Industry Steering Committee, and AWI, supporting robust oversight. AMSEA's finances were independently audited annually, and expenditure was subject to scrutiny by AWI and the project's executive governance structure.

The following lists challenges that affected contract management:

- *Genomic IP & Testing Delays:* A major recurring challenge was the protracted dispute over IP ownership related to genomic data involving AWI, Sheep CRC, and MLA. This significantly delayed the planned genotyping of F1 ewes, requiring DNA extraction and storage as an interim measure. While it was eventually resolved, allowing 50K testing via Neogen, it caused frustration and budget implications.
- *Contracts & Agreements:* Formalising agreements, particularly tripartite site agreements, proved complex and time-consuming, occasionally stalling progress.
- *Site Management & Resourcing:* Issues arose at specific sites regarding adherence to protocols, data submission timeliness, and communication. Project management and site management roles were consistently reported as being under-resourced compared to the actual workload, necessitating budget reviews and reallocations. Site financial management and invoicing processes varied significantly between sites, and project expectations caused frustration at some sites.
- *Analysis & Reporting Complexity:* Generating the detailed MLP site reports was resource-intensive, with the needs of all stakeholders having to be continually met. Analysing complex traits such as reproduction and indexes required significant development work by AGBU.
- *Communication Resources:* A consistent theme was the under-resourcing of project communications, hindering efforts to raise awareness and engage effectively with the broader industry despite the 18 MLP newsletters, 31 Site Reports, 33 Beyond the Bale articles, and 23 Field Days. Strategies were developed, but implementation capacity was limited beyond what was achieved.

Four major contract variations took place between 2015 and 2025.

- **First variation (2017):** Budget increase and project extension to accommodate an additional site and increased costs.
- **Second variation (2020):** Major budget review and contract variation approved by AWI Board in April 2020, effective 1 July 2020, increasing the project budget by $401,704, mostly due to higher than originally budgeted F1 ewe progeny numbers due to AI results being above expectations.
- **Third variation (2022):** Reallocation of project savings of $190,500 across line items and milestones, effective 1 July 2022, mostly due to COVID, additional oversight costs, and additional end-of-site costs.
- **Fourth variation (2024):** Additional reallocation of $123,250 in project savings, new milestones set, and contract reduced by $47,889.75. Final milestone shifted to 30 April 2025.

MLP Project Photo and Sample Library

MLP Project Photo Library

As part of its comprehensive data collection and industry engagement strategy, the MLP Project established an extensive photo library. Throughout the project, all participating sites were encouraged to capture high-quality photographs during data collection activities and at annual field days. These images are centrally stored and curated by AMSEA via Dropbox, ensuring secure and accessible archiving. Sites are likely to have additional photos available, and collating them could be a task undertaken prior to developing extension material for the project.

At the conclusion of each site's activities, AMSEA implemented a detailed photographic checklist to guarantee consistent documentation across all locations. This included capturing images of key personnel, as well as group photographs of each sire progeny group at the end of the project's lifespan. In addition, individual ewes-particularly those exhibiting notable or extreme trait values-were selected for focused photography. These end-of-site and end-of-project images were systematically catalogued to support a range of uses, including field day displays, project communications, educational resources, and as a robust visual reference for long-term research.

This meticulous approach to photo documentation played a vital role in the final wrap-up of each site, providing a valuable visual record to complement the extensive dataset collected throughout the project.

F1 Ewe Staple Storage

In parallel with the photo library, the MLP Project instituted a protocol for wool sample archiving. During the final midside sampling of each F1 ewe, a staple of wool was carefully removed and set aside for long-term storage. These staples were individually packed, collated by sire group, and are currently housed with AMSEA. This systematic collection ensures that high-quality wool samples are available for future research and industry extension activities, supporting ongoing genetic and phenotypic investigations well beyond the formal completion of the project.

Project Challenges and Lessons Learned

The MLP Project, by its nature as a decade-long, multi-site initiative, encountered a range of unique challenges inherent to large, long-term research investments. One of the most persistent challenges was the need to maintain protocol discipline and data consistency across five diverse sites and through numerous production cycles, floods, and droughts. While strict adherence to common protocols was essential for generating robust, comparable data, the project also needed to accommodate site-specific realities, seasonal variation, and unforeseen events such as drought and the COVID pandemic. This required a continual balancing act between scientific rigor and operational flexibility, with protocols periodically reviewed and updated in response to feedback, risk management, and evolving industry needs.

Staff continuity and resourcing were major challenges throughout the project's duration. Initially, the workload of site management, project coordination, and data management was underestimated. As the project progressed, it became evident that more resources were required for ongoing data collection, validation, and reporting. Key role turnover highlighted the need for succession planning and knowledge transfer to maintain project momentum and data integrity. Despite some turnovers, stable personnel in key positions at AWI, AMSEA, Project Management, and Sites contributed to the project's success.

Another significant challenge was navigating the evolving landscape of industry politics and institutional relationships. The MLP Project operated in an environment with divergent breeding philosophies, stakeholder interests, and shifting institutional alignments. Protracted negotiations around data ownership, intellectual property, and contractual arrangements (especially for genomic data and analysis) led to delays in key project deliverables and, at times, frustration among partners. The complexity of managing tripartite agreements, evolving site committee engagement, and ensuring consistent industry buy-in underscored the importance of transparent governance, frequent communication, and proactive risk management. Even with these in place, some issues proved difficult to fully resolve.

Over the life of the MLP Project, site committees played a vital role in governance, data integrity, and industry engagement. However, as the project entered later stages, the voluntary and ongoing nature of the committee members' roles led to fatigue. This was marked by reduced participation in data collection activities, turnover among committee chairs and members, and sometimes strained site operations. While various strategies were attempted to reinvigorate committee engagement-including shifting to advisory models or providing more administrative support, site committee fatigue remained a significant operational challenge and a lesson for future multi-year, multi-site research projects.

Finally, external shocks such as drought and the COVID pandemic tested the project's resilience. These events forced rapid adaptation, from developing site-specific disaster and risk management plans to shifting field days and extension events online. While the project successfully delivered high-quality data despite these disruptions, the reduction in face-to-face engagement and increased operational risk highlighted the vulnerability of long-term projects to factors beyond direct control.

In summary, the MLP Project's experience demonstrates that long-term, multi-site research requires flexible but disciplined protocols, realistic resourcing, proactive succession and risk management, and transparent, adaptive governance structures. These lessons are not only critical for the successful completion of the MLP Project but also provide a valuable blueprint for future industry research initiatives of similar scale and ambition.

IMPACT ON WOOL INDUSTRY - NOW & IN FIVE YEARS TIME

The MLP Project has significantly improved the industry's genetic evaluation and selection analysis methods and enhanced confidence in the resulting breeding values. This project has already enabled important research into new traits that were previously challenging to assess, including feed intake and efficiency, methane production, footrot, survival, resilience, and flystrike. Further, the project has reconfirmed the value of sheep classing. As the comprehensive dataset is fully analysed over the next five years, the focus will shift from methodological improvements to tangible practice changes on farm. These changes are expected to include:

Enhanced Early Assessments:
Increased reliance on both visual and objective assessments taken at 18 months to two years old (late Hogget 18 months or older - or Adult age stage) will provide earlier and more accurate predictions of lifetime productivity. Combining repeat records with early assessment at post-weaning and yearling measurements can better inform selection decisions.

Greater Genotypic Integration:
The MLP Project has demonstrated tangible benefits of genomics through improved accuracy and faster genetic progress for key traits, which creates a strong incentive for more growers to adopt genotyping. This expanded genotyping will improve the accuracy of genomically enhanced breeding values and support more "genotype-only" selection by non–MERINOSELECT ram breeders.

Expansion of Visual Trait Breeding Values:
Ongoing improvements in visual trait breeding values and the introduction of updated breeding values will result in a higher volume of visual score collection, covering areas such as:

- **Conformation:** Traits such as back and shoulders, legs, feet, and udder conformation.
- **Wool Characteristics:** Including fleece rot, wool character, wool colour, staple weathering, and dust penetration.
- **Breech Traits:** Covering aspects such as breech wrinkle, urine stain, dags, faecal consistency, crutch cover, breech cover, and direct flystrike indicators.

Integrated Measurement Approaches:
The MLP Project results will facilitate increased adoption of measurement and visual classing, and their combination, by providing the industry with robust, practical, and comparative evidence, best-practice protocols, training, and clear recommendations.

Better Husbandry and Management Protocols:
Increased awareness and adoption of standardised husbandry and management group protocols for visual classing at all ages-ensuring consistency and the highest-quality data collection-will further enable effective selection on farm.

Economic Index Development:
Ongoing economic analysis suggests the potential for developing more wool-oriented selection indexes. This means future breeding indexes could better capture the economic return from wool production combined with other productive traits, thus driving profitability improvements.

Impact Now

Unique, Comprehensive Dataset

- The MLP Project has created a robust, industry-representative dataset comprising over 5,700 ewes, tracked across five diverse sites, with approximately 2 million data points covering wool, reproduction, carcase, health, welfare, and visual traits, along with DNA genotypes.
- This dataset is already being used to enhance genetic evaluations, develop new breeding values, and inform breeding strategies.

Direct Improvements in Genetic Evaluation

- MLP data has been incorporated into the MERINOSELECT system, improving the accuracy of ASBVs, especially for challenging traits like reproduction and adult performance.
- The MLP Project incorporated significant lifetime visual and objective traits, as well as contemporary genetic data, into the Merino genomic population, plus established some linkage between the Dohne and Merino datasets.
- The project enabled the development of new breeding values for traits such as weaning rate, conception, litter size, and ewe rearing ability.

Catalyst for Add-on and Collaborative Research

- The MLP flock has provided a platform for numerous add-on projects in areas like feed efficiency, methane emissions, neonatal survival, disease resistance, eating quality, and resilience.

Industry Engagement and Upskilling

- Over 2,100 industry participants have attended MLP field days, and more than 11,600 MLP reports have been downloaded.
- Feedback from field days indicates increased understanding and confidence in using objective data and breeding values.

Social and Collaborative Impact

- The project has fostered collaboration and knowledge sharing among breeders, researchers, and service providers, breaking down philosophical divisions in Merino breeding.

Development of New Assessment Tools

- MLP has contributed to new visual sheep scores (e.g., udder, leg/feet, teeth) and validated their value for industry use.

Impact in Five Years Time

Transforming Merino Breeding and Selection

- As full analysis is completed (2024-2026), the industry will have validated, evidence-based selection tools that more reliably predict lifetime productivity from early-age assessments.
- New and improved indexes and breeding values will be available, supporting faster rates of genetic gain for productivity, reproduction, and resilience.
- Breeders who join ewe or ram lambs or hoggets early in life will have breeding values with higher accuracy, resulting in increased genetic gain.

Ongoing Research and Innovation Platform

- The MLP dataset will continue to support future research-including genetics of methane reduction, disease resistance, welfare, and new trait development.
- Industry and research partners will have access (under licence) to this dataset, ensuring legacy and continuous improvement.

Broader Adoption and Economic Benefit

- The tools and insights from MLP will be widely adopted by both ram breeders and commercial producers, increasing flock productivity, profitability, and sustainability across the industry.
- Economic analyses (e.g., gross margin, profit per hectare) will be used to support better decision-making at farm and industry level.

Training, Capacity, and Industry Confidence

- The project's collaborative model will have built ongoing capacity in genetics, extension, and data management, supporting the next generation of industry leaders.
- The legacy will include a best-practice framework for large-scale, multi-site research and industry collaboration.

CONCLUSION, KEY MESSAGES & RECOMMENDATIONS

Conclusions

The Merino Lifetime Productivity (MLP) Project has successfully achieved its core objectives, culminating in the establishment of a unique, robust, and long-term dataset that will have enduring value to the Australian wool industry. Over a decade, the project has tracked the lifetime performance of 5,700 ewes across five geographically and environmentally diverse sites, rigorously capturing over two million data points on wool, carcase, reproduction, health, welfare, and visual traits. This extensive dataset, together with comprehensive genotyping, provides an unparalleled resource for genetic evaluation and industry research, and extension.

The project has already delivered significant benefits, including direct contributions to the MERINOSELECT system, improved accuracy of ASBVs-notably for challenging traits like reproduction-and the development of new breeding values. The MLP Project established a best-practice, strongly grower-influenced framework for collaborative, multi-site research and has served as a catalyst for numerous add-on research initiatives, supporting advances in areas such as feed efficiency, methane emissions, neonatal survival, and disease resistance.

The successful completion and analysis of the MLP dataset will continue to transform and increase confidence in Merino breeding and selection approaches, underpinning future improvements in productivity, profitability, and sustainability. The project's legacy includes not only its data, but also the collaborative networks, communication strategies, and enhanced industry capacity it has fostered.

Key Messages

- **Data Quality and Depth:** The MLP Project's lifetime dataset is unparalleled in its breadth, depth, and quality of a full suite of visual, objective, and classing assessments across diverse environments and genetics.
- **Add-On R&D projects:** The MLP Project provided a platform to investigate significant research areas such as feed efficiency, methane production, meat eating quality, neonatal survival, disease resistance (including footrot), resilience, foetal age scanning, and udder conformation.
- **Industry Impact:** The project has already enhanced national genetic evaluations, delivered new breeding values, and informed selection approaches for Merino producers.
    - High and low performers were observed across all breeding philosophies and Merino types, demonstrating that no breeding philosophy or Merino type inherently guarantees high or low lifetime productivity.
    - The data have contributed substantially to the Merino genomics reference population, supporting more accurate breeding value estimates.
    - Results are showing that classing is an effective method for selecting breeding objectives related to wool production and growth. Its effectiveness decreases when hard to visually assess traits like disease resistance and reproduction efficiency are included.
- **Collaboration and Engagement:** The MLP Project's inclusive approach has made a significant impact. Over 2,100 participants attended field days in person, and at least 1,470 joined online. Regular

newsletters, podcasts, and events have built strong industry trust in the project, evidenced by nearly 12,000 downloads of MLP reports by stakeholders.

- **Resilience and Adaptability:** The project overcame significant challenges, including droughts and COVID, through proactive risk management, protocol flexibility, and adaptive communication strategies.
- **Legacy and Future Use:** The MLP dataset will enable ongoing research, support the development of new genetic evaluation models, and provide a platform for future industry innovation.
- **Industry Initiative:** The MLP Project was initiated, designed, and overseen by woolgrowers, ensuring strong industry involvement at every stage. By building on the initial two-year AMSEA sire evaluation phase, the MLP significantly increased woolgrower participation and reduced overall project costs, making it a truly collaborative and cost-effective industry initiative.

Recommendations

1. **Sustain Data Integrity and Accessibility**
    - Maintain rigorous data management, quality assurance, and secure storage protocols to ensure the MLP dataset's ongoing value and accessibility for research and industry applications.
2. **Prioritise Comprehensive Analysis and Reporting**
    - Allocate appropriate resources for the analysis, peer review, and extension phase, ensuring well-coordinated, timely, transparent, and informative reporting of results to all industry stakeholders. This should include tailored outputs for different user groups, from commercial producers to geneticists.
3. **Expand Industry Extension and Adoption Activities**
    - Build on the strong foundation of communication and engagement by developing targeted extension programs, practical decision-support tools, and training resources. This will accelerate the adoption of MLP insights and tools by Merino breeders and commercial producers.
4. **Foster Ongoing Collaboration**
    - Continue the collaborative model established by the MLP Project, involving breeders, researchers, industry bodies, and site hosts in future research and extension initiatives. This approach has proven critical to project success and industry impact.
5. **Enable and Resource Future Research**
    - Encourage and support further research leveraging the MLP dataset-e.g., studies on genetic correlations, lifetime economic modelling, new trait development, and validation of genomic tools. Ensure continued investment in add-on projects that address emerging industry priorities.
6. **Promote Best Practice in Large-Scale Research**
    - Document and share lessons learned from the MLP Project's woolgrower involvement, governance, protocol discipline, and adaptive management to inform future large-scale, multi-site industry research projects.

7. **Monitor and Evaluate Impact**
    - Establish ongoing mechanisms for monitoring the impact of MLP-derived selection tools and practices on industry productivity and profitability, and adjust extension strategies as needed.

The MLP Project demonstrates the value of long-term, collaborative investment in genetic and productivity research. Its successful implementation and extensive industry engagement provide a model for future initiatives. The ongoing analysis and communication of MLP results will be crucial to maximising its legacy for the Australian Merino industry.

Acknowledgements

AMSEA sincerely thanks the MLP site hosts for their key role in the project's success. The site hosts - Tuloona Pastoral (Balmoral, VIC), Murdoch University/University of Western Australia (Pingelly, WA), Moses & Son (MerinoLink, Temora, NSW), NSW Department of Primary Industries (Macquarie, Trangie, NSW), and CSIRO (New England, NSW) - have continually gone above and beyond to provide the land, infrastructure, resources, and day-to-day care required to deliver the MLP's demanding protocols. Their professionalism and dedication have maintained data integrity and ensured valuable results for the Australian wool industry, even in challenging conditions.

The success of our project was due in large part to the exceptional expertise and commitment of our site managers - including Tom Silcock, Sally Martin, Lexi Cesnik, Sue Hatcher, Kathryn Egerton Warburton, Tracie Bird Gardiner, Beth Paganoni, Dr Bronwyn Clarke, and Dr Jen Smith - and the dedicated efforts of the site committees from Balmoral Breeders, MerinoLink, the Federation of Performance Sheep Breeders, the Macquarie Sire Evaluation Association, and the New England Sire Evaluation Association. Their attention to detail was vital in overcoming the challenges posed by drought, floods, and the COVID-19 pandemic.

We extend our thanks to the chair of the ISC, Russell Pattinson, and members of the ISC for their invaluable guidance, advocacy, and industry insight over the course of the project. Your support ensured the project remained aligned with industry priorities and maintained the highest standards of governance.

We thank the nominating sire entrants and ram breeders for supporting the project and allowing their genetics to be publicly evaluated. Your involvement has created a valuable resource for the Australian wool industry.

We sincerely acknowledge the vital contributions made by the sheep classers across the project's sites. Their expert skills, dedication, and willingness to have their work open to public review each year have been essential in delivering rigorous visual assessments and consistent gradings that form the foundation of our extensive dataset. We extend our special thanks to David Whyte, Bill Walker, Craig Wilson, Ben Patrick, Jim Meckiff, Andrew Calvert, Angus Carter, Nathan King, Preston Clark, Mitchell Crosby, Chris Bowman, Allan Casey, and Greg Sawyer.

The MLP Project Executive Committee provided essential governance, strategic direction, and oversight for the MLP Project. We acknowledge the leadership of the MLP Executive and thank both current and former members for their significant contributions. Our appreciation also extends to Russell Pattinson for his valued service as chair.

Special thanks to Geoff Lindon (AWI) for his unwavering support, strategic oversight, and leadership throughout the journey of the MLP Project. His vision and commitment were pivotal in steering the project to completion.

We also acknowledge AGBU, Professor Andrew Swan, Dr Peter Wahinya, and Professor Daniel Brown for their scientific leadership and dedication to genetic analysis.

A special acknowledgement is made to AWTA for their generous sponsorship. AWTA's support has not only provided essential technical services in wool testing but has also enabled the project to achieve a higher standard of measurement and reporting.

We also thank AWI for principal funding and ongoing support and acknowledge the Australian Government for its support of research, development, and marketing of Australian wool.

Finally, we recognise the many woolgrowers who funded the project and who attended field days, provided feedback, or otherwise contributed to the success and impact of the MLP Project.

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LIST OF ABBREVIATIONS AND OR GLOSSARY

List of Acronyms

Acronym	Definition
AAABG	Association for the Advancement of Animal Breeding and Genetics
AGBU	Animal Genetics and Breeding Unit
AI	Artificial Insemination
AMSEA	Australian Merino Sire Evaluation Association
ARC	Analysis and Reporting Committee
ASAP	Australian Society of Animal Production (inferred, for scientific papers)
ASBVs	Australian Sheep Breeding Values
AWI	Australian Wool Innovation
BTB	Beyond the Bale (AWI Publication)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DNA	Deoxyribonucleic Acid
DPI	Department of Primary Industries (often referring to NSW DPI)
EID	Electronic Identification
EMD	Eye Muscle Depth
FBV	Flock Breeding Values
F1 Ewe	First generation Merino ewe progeny that were assessed through life.
F2 Progeny	Progeny of the F1 ewe that were assessed until weaning and then leave the project.
GEPEP	Genetic Evaluation and Prediction Enhancement Project (inferred)
IP	Intellectual Property
ISC	Industry Steering Committee
M&E	Monitoring and Evaluation

Acronym	Definition
MLA	Meat & Livestock Australia
MLP	Merino Lifetime Productivity (Project)
MS	MERINOSELECT (Sheep Genetics' genetic evaluation service)
MSS	Merino Superior Sires
MU	Murdoch University
NE	New England (MLP Site)
NLGC	National Livestock Genetics Consortium
OVIS	(Sheep Genetics' central database and genetic evaluation system)
QA	Quality Assurance
R&D	Research and Development
TSU	Tissue Sampling Unit (for DNA)
UNE	University of New England
UWA	University of Western Australia
WALRC	Western Australian Livestock Research Committee
WEC	Worm Egg Count

List of Trait Abbreviations, Description and Units

Trait	Definition and Units
BACK	Shoulder/back (score)
BCOV	Breech cover (score)
BDWR	Breech wrinkle (score)
BLK	Recessive black - agouti gene
BOPGRADE	Breed Objective Professional classer grade - five way class Top, Stud, Second, Sale, Cull
BPASTERN	Back pasterns (score)

Trait	Definition and Units
BRWR	Breech wrinkle (score)
BTOES	Back Toes (score)
CCOV	Crutch cover (score)
CFW	Clean fleece weight (kg/%)
CHAR	Wool character (score)
COL	Wool colour (score)
COMFORT	Wool comfort factor (%)
CONC	Conception
CS	Condition (score)
CURV	Fibre curvature (degrees/mm)
CURVSD	Fibre curvature standard deviation (degrees/mm)
DAG	Dag (score)
DUST	Dust penetration score
EMD	Eye muscle depth (mm) at the 'C' site
ERA	Ewe rearing ability
FACE	Face cover (score)
FMOIST	Faecal consistency (score)
FAT	Fat depth (mm) at the 'C' site
FD	Average fibre diameter (µm)
FDCV	Fibre diameter coefficient of variation (%)
FDSD	Fibre diameter standard deviation (µm)
FLEGS	Front legs (score)
FLROT	Fleece rot (score)
FPASTERN	Front pasterns (score)

Trait	Definition and Units
FPIG	Fibre pigmentation (score)
FTOES	Front toes (score)
GFW	Greasy fleece weight (kg/%)
HOCK	Hock (score)
HOCKS	Hocks – Researcher (score)
JAW	Jaw (score)
JAWR	Jaw – Researcher (score)
JOIN	Fit to join (score)
LEGS	Feet and legs (score)
LSIZE	Litter size
NKWR	Neck wrinkle (score)
NLB	Number of lambs born (%)
NLW	Number of lambs weaned (%)
OSPGRADE	Overall selection professional classer grade - five way class Top, Stud, Second, Sale, Cull
OSVGRADE	Overall selection grade - three way class Top, Flock, Cull
PASTERN	Pasterns (score)
PGRADE	Professional classer grade - five way class Top, Stud, Second, Sale, Cull
SL	Staple length (mm) at the mid-side
SPIG	Non fibre pigmentation (score)
SF	Spinning fineness (µm)
SPOT	Black spot
SS	Staple strength (NKtex) at the mid-side
SSTRC	Staple structure (score)

Trait	Definition and Units
TEATS_F	Count of functional teats (score)
TEATS_F_R	Count of functional teats (number)
TEATS_SH	Shape of functional teats (score)
TEETH_A_AL	Alignment of permanent incisors (score)
TEETH_A_LG	Length of permanent incisors compared to the average of the mob
TEETH_A_PI	Count of permanent incisors
TOES	Toes
TOESB	Back Toes
TOESF	Front Toes
UDDER_M	Mastitis severity (score)
URINE	Urine (score)
VGRADE	Classers visual grade - three way class Top, Flock, Cull
WEATH	Staple weathering (score)
WEC	Worm egg count (%)
WEC_Nematodirus	Worm egg count – Nematodirus (number)
WEC_Strongyle	Worm egg count – Strongyle (number)
WETDRY_M	Wet or dry (score) of the udder at marking
WETDRY_W	Wet or dry (score) of the udder at weaning
WR	Weaning rate lambs weaned per ewe joined
WT	Body weight (kg)
YLD	Wool yield (%)

APPENDICES

Appendix 1 - AWI Communication Report Template (see below)

Appendix 2 - Project Intellectual Property Register

Appendix 3 - Storage of Primary Research Data (Paper based and electronic)

Appendix 4 - Animal Ethics Approval (if any)

Appendix 5 - Research Capacity Building

Appendix 6 - Other Appendices (if any)

Appendix 1 - AWI Communication Report Template

Name of Project	Merino Lifetime Productivity Project
Name of Research Body	Australian Merino Sire Evaluation Association
Name(s) of any other project co-funding bodies	
Name(s) of any organisations involved (and specify how they are involved)	**The key organisations involved in the Merino Lifetime Productivity (MLP) project are:** 1. **Australian Wool Innovation (AWI) -** the principal funder and partner. 2. **Australian Merino Sire Evaluation Association (AMSEA) -** the main project partner overseeing sire evaluation and site coordination. 3. **Nominating stud Merino breeders -** who provided sires for evaluation**.** 4. **Site hosts/partners - organisations hosting the five trial sites:** o **Tuloona Pastoral (Balmoral, VIC), Committee: Balmoral Breeders Association** o **Murdoch University / University of Western Australia (Pingelly, WA), Committee: Federation of Performance Sheep Breeders (WA Branch)** o **Moses & Son (MerinoLink, Temora, NSW), Committee: MerinoLink Limited** o **NSW Department of Primary Industries (Macquarie, Trangie, NSW), Committee: Macquarie Sire Evaluation Association** o **CSIRO (New England, NSW), Committee: New England Merino Sire Evaluation Association** 5. **Animal Genetics and Breeding Unit -** responsible for MLP Genetic Analysis and Database Management Additional contributors include woolgrowers (through sire evaluation entry fees), site committees (in-kind contributions), sponsors of AMSEA, and the Australian Government (supporting R&D and marketing of Australian wool).
Project start date	30 June 2015
Project end date	30 April 2025
Other key dates (e.g. key milestone report(s), events, product launch)	
Main objectives of the project (approx. 150 words)	The AMSEA-led component of the Merino Lifetime Productivity (MLP) Project was designed to systematically capture a comprehensive lifetime dataset on a large cohort of genetically diverse Merino ewes, which were progeny of industry sires, as they progressed through four to five joinings and annual shearings at five geographically and environmentally distinct sites. The primary objectives included conducting a full suite of assessments encompassing visual trait scoring, independent classer gradings, and objective measurements of key wool, growth, carcase, reproduction, and welfare traits. By collecting and analysing this extensive and robust dataset, the project aims to significantly enhance existing Merino breeding and selection strategies, providing more accurate tools and insights for both ram sellers and buyers to improve lifetime productivity and profitability.

	Additionally, the AMSEA-led component sought to foster industry engagement and awareness through regular field days and communications, while also establishing a unique platform to support and enable further research projects that address emerging industry challenges.
Project summary (approx. 250 words)	The Merino Lifetime Productivity (MLP) project was a 10-year venture that was funded by AWI along with project partners, and it was coordinated by AWI and AMSEA with the support of industry breeders and host sites. The project tracked the lifetime performance of approximately 5,700 ewes as they underwent four to five joinings and annual shearings. A full suite of assessments was conducted, which included visual trait scorings, classer gradings, objective measurements of key traits, and index evaluations. Researchers and industry experts collected nearly two million data points, and the resulting dataset will be used to enhance existing breeding and selection strategies for both ram sellers and buyers. Throughout its duration, the MLP Project provided early analysis insights that led to further research, improved genetic evaluation systems, and supported the development of new industry indexes. Additional studies examined feed efficiency, methane production, carcase quality, neonatal survival, and genomic parameters. The project also served as an enabler of extensive collaboration through numerous field days where industry stakeholders attended presentations, inspected ewes, and exchanged knowledge. The project was carried out at five sites including Balmoral, Pingelly, MerinoLink, Macquarie, and New England, and they were designed to represent a range of Merino types and production systems. The project generated a comprehensive dataset that will undergo detailed analysis through separate contracts. The analysis output will aim to improve current breeding and selection methods to enhance lifetime productivity and profitability in the Merino industry.
Project (and key milestone) outcomes and outputs (approx. 250 words)	AMSEA along with key project partners such as the Balmoral Breeders, Moses and Son, MerinoLink, NSW DPI, CSIRO, Murdoch University and the Animal Breeding and Genetics Unit (AGBU) have successfully delivered the Merino Lifetime Productivity (MLP) Project dataset, have fostered industry awareness and created meaningful communication outputs. As the lead agent, AMSEA has overseen all operational aspects across the five national MLP sites, ensuring the rigorous collection, management, and validation of a unique, large-scale dataset on Merino ewes and their progeny. This includes comprehensive recording of lifetime reproductive performance, wool, carcase, and health traits, as well as visual and classing assessments, underpinned by extensive genotyping. Key outputs from the AMSEA-led component include the routine publication of detailed annual site MLP Reports, which provide raw data, adjusted sire means, breeding values, and indexes. AMSEA and collaborators have also facilitated regular communications to stakeholders through newsletters, field days, conference presentations, and updates in industry publications such as "Beyond the Bale". The project has enhanced industry understanding of Merino productivity and selection, built analytical and extension capacity, and fostered collaborative research via add-on projects. AMSEA's stewardship has ensured that project

	protocols, data integrity, and communication remain robust, delivering lasting value to the Merino industry.
Benefits for woolgrowers and wool industry (approx. 150 words)	The Merino Lifetime Productivity (MLP) project has generated a unique and extensive dataset that will underpin critical research to refine and enhance breeding and selection methods for Australian woolgrowers. By establishing a large Merino genomic reference population, the MLP Project has significantly improved the accuracy of genomic predictions for challenging traits such as reproduction, adult performance, worm egg count, and survival. This rich resource has enabled the development of the genomically enhanced MERINOSELECT reproduction model, delivering more reliable breeding values for industry sires. Additionally, the MLP Project has catalysed a wide array of add-on research initiatives, including projects focused on feed efficiency, methane emissions, meat quality, lamb survival, disease resistance, and resilience. These collaborations extend the project's impact across the industry. Beyond technical advancements, the MLP has fostered industry-wide collaboration and knowledge exchange, with field days and events attracting over 2,100 participants and increasing confidence in using MLP results for breeding decisions. Early analysis insights are already guiding industry practices and deepening understanding of the drivers of lifetime productivity.
Is the project related to other AWI-funded or other past/present research	The MLP Project actively integrates, extends, and supports AWI and industry research, sharing data and infrastructure, building on previous work, and enabling ongoing and future research. **Integration and Data Sharing:** MLP data feeds into national genetic evaluation systems like MERINOSELECT and is used to enhance ASBVs. The project also leverages and contributes to data and protocols from previous initiatives such as the Sheep CRC and Information Nucleus Flock (INF). **Support for Add-on Research:** MLP enables a range of add-on AWI and industry projects (e.g. resilience, methane emissions, feed efficiency, disease resistance), making its animals and data available for ongoing research. **Shared Infrastructure:** MLP uses shared resources such as the OVIS evaluation system and integrates with flocks from earlier AWI projects (Breech Flystrike Research Project). **Enabling Future Research:** The MLP dataset will be available for future research such as: • **Genetic Analysis:** Enhance ASBVs, develop new models, refine index emphases • **Research Supports:** Underpin feed efficiency, methane, survival, disease and resilience studies • **Selection and Management:** Compare/validate selection tools, optimise measurement timing/frequency • **Economic and Lifetime Analysis:** Analyse links between traits and profitability, conduct economic modelling. • **Industry Impact:** Improve data standards, foster collaboration, broaden genetic diversity

Potential/actual next steps in the research project	The MLP Project is now entering its core analysis, peer review and industry extension phase. Stakeholders can expect a focus on communicating results, supporting industry adoption, and ensuring the legacy of the project through genetic evaluation improvements and ongoing research applications.
Name(s)/role(s)/contact details of the potential spokesperson/people.	Geoff Lindon AWI Genetics Program Manager Ben Swain AMSEA Executive Officer
Name(s)/role(s)/contact details of the key personnel in the project that can be contacted for information for communication purposes (if different from above)	Geoff Lindon AWI Genetics Program Manager Ben Swain AMSEA Executive Officer
Current images/video assets and potential opportunities	AMSEA has an extensive photo collection accumulated during the life of the MLP Project that can be made available on request.

Appendix 2 - Project Intellectual Property Register

Background Intellectual Property (BIP) Register

	IP category and nature of protection	IP description	BIP owner	Freedom to operate	Intended purpose and relevance of the Project
	AMSEA Database	AMSEA database and analysis pipeline	90% AMSEA 10% AWI		Used to store all site data and generate within site analyses

Project Intellectual Property (PIP) Register

	IP category and nature of protection	IP description	PIP owner	Freedom to operate	Intended purpose and relevance of the Project
	Data and analysis results	All data obtained, derived and collected on MLP Project F1 and F2 MLP sheep whilst formally in the MLP Project	AWI 100%		

Appendix 3 - Storage of Primary Research Data

ALL MLP data is stored in the following locations:

- Each sites data is stored in Stockbook Database Software
- At central AMSEA location (Data Manager) in Stockbook database as well as export CSV files
- At AGBU in the AMSEA Database. The AMSEA Database is housed on Amazon Hosting Services
- At AWI

Appendix 4 - Animal Ethics Approval

Animal Ethics approvals were required for the Pingelly site run at UWA's Ridgefield, Macquarie site run at NSW DPI's Trangie Agricultural Research Station and at the New England site run at CSIRO's Chiswick property.

Appendix 5 - Research Capacity Building

Please include the total number of master and PhD students, and post-doctoral fellowships attached to this project.

Number of research personnel attached to the project	**Total**
Number of research master students	0
Number of PhD students	0
Number of post-doctoral fellowships	0