Group Assignment Cover Sheet

Never Stand Still | Faculty of Engineering | School of Mechanical and Manufacturing Engineering

- Please print clearly and complete all sections. All group members must sign the declaration below.
- Before submitting this assignment, students are strongly recommended to review the course outline, assessment requirements, UNSW's Plagarism and Academic Integrity website and Administrative Matters on the School's website.
- Please retain a copy of this assignment for your records.

Course code: GSOE 9820 **Course name: Project Management, Term 1 2025**

Date submitted: 4/4/2025

In preparing this assessment task we have followed the Student Code Policy. We certify that we have read and understand the University requirements in respect of student academic misconduct outlined in the StudentCode Policy and the Student Misconduct Procedure. We declare that this assessment item is our own work, except where acknowledged, and has not been submitted for academic credit previously in whole or in part.

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We have retained a copy of this, our assignment, which we can provide if necessary. By signing this declaration we are agreeing to the statements and conditions above.

Team Attribution Survey and Signature Table

FAMILY NAME	GIVEN NAME(S)	STUDENT ID	CONTRIBUTION (%)	SIGNATURE
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Grading procedure:

1. The report is marked according to the marking guide giving raw grade ***R***.
2. The team's demonstrator will check, modify if necessary, and approve the team attribution survey.
3. The approved contribution of a group member is ***C***.
4. Each group member receives a final grade ***F* = *R* x *C* x *N*** *(where **N** is number of group members).*
5. You will be individually notified of ***F*** and ***R***.

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1.Project Charter: UNSW Developmental Wind Farm Project

1.1 Purpose Statement

The purpose of the UNSW Developmental Wind Farm Project is to construct a **24MW wind farm**(expandable to 30MW) in rural NSW, providing:

- **Renewable energy** to UNSW via the grid (*Social Impact*).
- **Research infrastructure** for testing novel wind turbine designs (*Innovation & Engagement*).
- **Hands-on learning** for students through remote monitoring (*Academic Excellence*).

Aligns with UNSW's 2025 Strategic Goals.

1.2 Objectives and Success Criteria

Objective	Success Criteria
Deliver 8 x 3MW turbines	100% operational, grid-connected, meeting energy output targets.
Enable future expansion to 10 turbines	Civil/electrical works designed for 30MW capacity.
Establish campus control room	Remote monitoring system operational with training documentation.
Complete within $48M budget	Final costs ≤ $48M (see **1.7 Budget**).

1.3 Requirements.

1. Technical Requirements

Requirement	Strategic Alignment	Success Criteria
Proven 3MW Wind Turbines	Supports UNSW's renewable energy supply goal (*Social Impact*)	Turbines operate at ≥95% uptime post-commissioning; deliver 24MW total capacity.
Scalable Electrical Switchyard	Enables future research expansion (*Innovation & Engagement*)	Infrastructure supports 10 turbines (30MW); tested via load simulation.
Remote Monitoring System	Facilitates real-time research and teaching (*Academic Excellence*)	Control room operational on campus; data transmission reliability ≥99.9%.

Justification:
Technical specifications are prioritized to balance **reliability** (proven turbines), **scalability** (future research needs), and **academic utility** (remote monitoring).

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2. Regulatory Requirements

Requirement	Strategic Alignment	Success Criteria
NSW Environmental Permits	Ensures compliance with sustainability goals (*Social Impact*)	Permits approved before Phase 1 construction.
Noise Compliance (≤45 dB)	Minimizes community disruption (*Social Impact*)	Post-installation noise audit passes regulatory limits.
Grid Connection Agreement	Secures commercial energy supply (*Social Impact*)	Contract signed with Ausgrid prior to commissioning.

Risk Mitigation:
Permitting and compliance are critical path items; delays could impact the schedule (see *Risk Register, Section 8.3*).

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3. Stakeholder Requirements

Requirement	Strategic Alignment	Success Criteria
Training Manuals/Programs	Empowers students and staff (*Academic Excellence*)	100% of operational staff certified; modules integrated into 2025 curriculum.
Community Engagement	Addresses local concerns (*Social Impact*)	Quarterly stakeholder meetings held; no formal complaints.

Integration with Other Plans:

- Training programs are detailed in the *Human Resources Plan (Section 8)*.
- Community engagement is tracked in the *Stakeholder Management Plan (Section 5)*.

1.4 Project Boundaries

- **In Scope**:
  - Design → Procurement → Construction → Commissioning (see **WBS**).
  - Scalable infrastructure (roads, foundations, electrical).
- **Out of Scope**:
  - Long-term operation/maintenance (handed to UNSW post-project).
  - Research not tied to wind farm construction.

1.5 High-Level Risks

- The following risks are prioritized due to their external dependency and potential to halt project progress, exceeding the team's control:

1. **Indigenous Heritage Dispute Escalation (Risk C-01)**
   - Impact: 6-month legal freeze + $2M cost overrun.
   - Mitigation: 3D laser mapping and mediation fund.
   - Contingency: Judicial fast-track.
2. **Grid Access Permit Delays (Risk C-02**)
   - Impact: 4-month delay in commissioning.
   - Mitigation: Modular substation phased connection.
3. **Environmental Permit Additional Conditions (Risk A-01)**
   - Impact: Unplanned compliance costs + 3-month redesign.
   - Mitigation: Proactive audits and public communication.

1.6 Summary of Schedule and Milestones

Milestone	Type	Completion Criteria	Estimated Time
1. Project Kickoff	**Initiating**	- Project charter signed by sponsor - Initial scope, budget, and stakeholders defined - Wind resource assessment report approved (1.4.1) - Geotechnical report finalized (1.4.4) - Site layout drawings signed off (1.4.3)	Day 75
2. Project Management Office (PMO) Established	**Planning**	- Project office set up (8.1) - Site office operational (8.2) - Key team members recruited (8.3)	Day 142
3. Planning & Design Phase Completed	**Planning**	- complete budget(8.4) - Wind Turbine Design Documents(1.1.1) - Towers Design Documents(1.1.2) - Site Transportation Plan(3.1) - Drainage Systems Design Documents(1.3.2)	Day 179
4. Permits Secured & Procurement Closed	**Executing**	- All permits obtained - Turbines, towers, and electrical equipment contracts awarded - Procurement process formally closed	Day 246
5. Construction Phase Completed	**Executing**	- Turbine foundations built (4.3.1) - Turbines and towers installed (4.1.1, 4.1.2) - Switchyard and transformers operational (4.2.1, 4.2.2) - Roads and drainage systems finalized	Day 396

6. System Commissioning Finished	**Monitoring & Controlling**	- All turbines tested and operational (4.1.3) - Switchyard and cabling validated - SCADA monitoring system active	Day 426
7. Performance Testing & Client Acceptance	**Closing**	- Mechanical and electrical performance reports approved (7.1.1, 7.1.2) - Safety and load tests passed - Grid connection verified by utility provider	Day 441
8. Training & Documentation Delivered	**Closing**	- Operations and maintenance manuals handed over (6.1, 6.2) - End-user training completed (6.3) - System Design Documentation for training(6.4)	Day 477
9. Project Officially Closed	**Closing**	- Final design documents archived - Long-term maintenance plan implemented (8.6) - Formal sign-off from all stakeholders	Day 527

1.7 Summary of Preliminary Budget

Category	**Allocation (AUD)**	**% of Budget**	**Key Notes**
1. Wind Turbines	**21.6M**	45%	Core equipment cost (8×3MW)
2.Construction & Labor	**12.20M**	25.4%	Includes civil works, erection, and all workforce costs
3. Electrical Infrastructure	**4.8M**	10%	Switchyard, transformers, cabling

4.Risk Management	**2.83M**	6%	Contingency reserve
5.Control & Monitoring	**2.4M**	5%	SCADA system and UNSW control room setup
6. Project Management	**2.4M**	5%	Includes admin, safety, and reporting
7. Management Reserve	**1.77M**	3.6%	Unallocated buffer for unknown risks
Total	**48.0M**	**100%**	

1.8 Stakeholders List

Stakeholder	Project Role	Involvement	Strategic Alignment
Bernard Hayes (UNSW)	Project Sponsor	High	Funding & 2025 Strategy
Local Government Council	Permitting Authority	High	Regulatory Compliance
Engineering Consultant Team	Civil/Electrical Design	High	Technical Feasibility
UNSW Energy Research Faculty	Academic End-User	Medium	Research & Education Goals

1.9 PM Nomination

name	ziyao nie	xuting yang	Kirinn Zhang	qizhen zhu	Zheng LONG	LingXiao Jiang
zid	z5530728	z5559591	z5537877	z5547899	z5516222	z5562632
contributions	charter, communication	scope, stakeholder management	budget	schedule	risk, human resource management plan	risk, human resource management plan

1.10 Definition of Success

Success Dimension	Success Criteria	Measurement Method	Acceptance Threshold	Responsible Party
Scope Success	Delivery of 8×3MW turbines with 10-turbine expansion capability	WBS 100% completion audit	All WBS deliverables accepted by sponsor	Project Manager
Time Success	Project completion within 527 days	Schedule Performance Index (SPI)	SPI ≥ 0.95	Planning Team
Cost Success	Total project cost ≤ $48M	Cost Performance Index (CPI)	CPI ≥ 0.95	Finance Controller
Quality Success	Turbines operate at 95% capacity	Load test results	Meets IEC 61400 standards	Quality Assurance
Stakeholder Success	Formal acceptance by UNSW executives	Sign-off documentation	All approval documents signed	Sponsor

Strategic Success	• 15% UNSW energy supply • support for research papers • Educational integration	Energy production reports Research outputs Course materials	Verified by UNSW Energy Office	Academic Liaison
Risk Managemen t	Contingency reserve ≤ $3M	Risk register updates	≤ 80% contingency utilized	Risk Manager
Regulatory Compliance	All permits obtained Noise ≤45dB	Permit documentation Noise tests	Full regulatory approval	EHS Officer

1.11 PMBOK Referenced PM Methods

1. Integration Management (PMBOK 4.1)
- *Charter development*: Formalized project boundaries and success criteria aligned with UNSW's 2025 renewable energy strategy.

2. Stakeholder Management (PMBOK 13.1)
- *Power/Interest grid*: Prioritized engagement with UNSW executives and local community.

3. Cost Management (PMBOK 7.2)
- *Parametric estimating*: Validated 48M budget using industry−standard 2000/kW metric.

4. Risk Management (PMBOK 11.2)
- *Assumptions log*: Embedded critical assumptions requiring proactive monitoring.

5. Procurement Management (PMBOK 12.1)
- *Make-or-buy decision*: Mandated outsourcing of turbine procurement to approved vendors.

6. Strategic Alignment (PMBOK 1.2.6)
- *Business case*: Explicitly linked project deliverables to UNSW's academic research and energy goals.

1.12 Assumptions Log

Assumption	Impact if False	Owner	Mitigation Plan
Wind resource studies confirm site viability.	6-month delay; $2M redesign costs.	Site Engineer	Secure backup site options; allocate 10% design budget contingency.
No major supply chain disruptions occur.	$3M cost overrun; 3-month schedule delay.	Procurement Manager	Pre-negotiate backup suppliers; reserve 5% emergency procurement fund.
Local labor meets construction skill/demand requirements.	$1.5M additional costs (remote labor + accommodations).	HR Manager	Pre-train local workforce; sign labor reserve agreements.
All permits are approved within 6 months.	Legal penalties; project suspension.	Legal Advisor	Hire local compliance consultants to expedite approvals.
Grid connection capacity is sufficient for 24MW.	Unable to connect; requires $5M grid upgrades.	Electrical Engineer	Secure grid capacity reservation agreement in advance.

2. Scope Plan

To supply renewable power to UNSW while supporting research and education in wind energy technology, the UNSW Wind Farm project develops a commercial, grid-connected renewable energy facility. Furthermore, this project contributes to UNSW's 2025 strategy goals[2].

2.1 Deliverables

The UNSW Wind Farm Project shall deliver a fully operational 8 x 3MW wind energy facility with supporting infrastructure, grid integration, and a research monitoring system. The project deliverables are divided into six major categories, ensuring all components align with project objectives and stakeholder requirements.

2.1.1 Mechanical Plant

The mechanical plant will consist of wind turbines and towers, forming the core infrastructure of the wind farm. The project will include the design, procurement, transportation, site erection, commissioning, and performance testing of 8 x 3MW wind turbines with towers. Each turbine will be installed with precision to maximize energy efficiency and ensure structural stability. The commissioning phase will involve system calibration, operational testing, and safety verification to ensure compliance with industry standards. Once completed, the mechanical plant will provide a reliable and efficient renewable energy source for UNSW.

2.1.2 Electrical plant

The electrical plant will facilitate the efficient transmission and distribution of power generated by the wind turbines. It will include a switchyard, transformers, and cabling to connect the wind farm to the grid. The cabling system will link the turbines to the electrical network, ensuring stable power transmission. Transformers will convert the generated electricity to the appropriate voltage for grid compatibility, while the switchyard will serve as the central distribution hub, housing switchgear and circuit breakers for power regulation and protection. The entire system will be tested and commissioned to ensure safe and reliable operation in compliance with national grid standards.

2.1.3 Civil Works and Road Works

The civil works and road works will include the construction of turbine foundations, switchyard foundations, and cable trenches to ensure structural stability and efficient power distribution. Internal roads and access pathways will be developed to facilitate the transportation of turbine components and maintenance vehicles. Additionally, drainage systems will be installed to prevent erosion and water accumulation, while site buildings and infrastructure will be constructed to support operational and maintenance activities. All civil works will comply with Australian engineering and environmental standards, ensuring safety, durability, and minimal ecological impact.

2.1.4 Remote Control Room and Research Monitoring Station

The project will establish a remote control room and research monitoring station on the UNSW campus to facilitate real-time monitoring, data collection, and research on wind energy performance. The control room will be equipped with SCADA (Supervisory Control and Data Acquisition) systems to allow remote operation and performance tracking of the wind turbines. The research monitoring station will integrate with UNSW's academic and research programs, providing access to real-time turbine data for analysis, optimization studies, and educational purposes. The facility will be designed to meet industry standards for data security, operational efficiency, and renewable energy research.

2.1.5 Training Deliverables

The project will provide comprehensive training programs to ensure proper operation, maintenance, and safety procedures for all stakeholders involved. The training will include control room operation, focusing on the use of SCADA systems for remote monitoring and turbine performance analysis. Additionally, maintenance training will be conducted for on-site technicians, covering routine inspections, troubleshooting, and emergency response. Technical documentation, including user manuals and maintenance guides, will be provided to support long-term knowledge retention. Training sessions will align with industry best practices and safety regulations, ensuring personnel are well-equipped to manage the wind farm efficiently.

2.1.6 Project Management Deliverables

The project management component will ensure the effective planning, execution, monitoring, and control of the UNSW Wind Farm Project. A dedicated project office will oversee cost accounting, scheduling, and risk management, ensuring the project stays within budget and timeline constraints. Stakeholder coordination will be managed through regular meetings, reports, and engagement strategies, while regulatory approvals will be obtained to comply with Australian safety and environmental standards. Performance tracking, including project milestones, deliverable completion, and compliance audits, will be conducted to ensure all objectives are met efficiently.

2.2 Constraints

The project will operate under a fixed budget of AUD $48M, with funding provided by the project sponsor. To ensure financial accountability and compliance with institutional policies, all procurement activities must be conducted through UNSW's Strategic Procurement Team. Additionally, the project must adhere to strict regulatory, environmental, and safety standards, requiring approvals from relevant authorities before key phases can proceed. The construction timeline will be constrained by weather conditions, logistical challenges, and regulatory approvals, which may impact scheduling. Any modifications to scope, budget, or timeline will require formal change management approval from project stakeholders.

2.3 Exclusions

The project deliverables are strictly limited to the components specified in the scope. While the facility will be designed to accommodate future expansions up to 30MW, the development, procurement, and installation of additional turbines beyond the initial 24MW capacity will be outside the scope of this project. Similarly, any long-term maintenance beyond the initial two-month period will be considered a separate contractual arrangement and is not included in this project's scope.

During construction and renovation, the removal of unexpected structures or obstructions not listed in UNSW's official blueprints will be the responsibility of the project sponsor or a separately appointed contractor. Additionally, any modifications to grid infrastructure or power storage solutions beyond the wind farm's direct grid connection are not included in this project and must be handled by external entities.

2.4 Work Breakdown Structure (WBS)

The Work Breakdown Structure (WBS) provides a hierarchical decomposition of the project's deliverables into manageable work packages. This structured approach ensures that all critical tasks are identified, assigned, and tracked to facilitate the successful execution of the project (PMBOK Section 5.4).

Each major deliverable is outlined in Section 2.1. As the following figure 2.1, scope statement has been further broken down into sub-deliverables and specific work packages to clearly define the scope of work. The WBS ensures alignment with project objectives, stakeholder expectations, and compliance requirements.

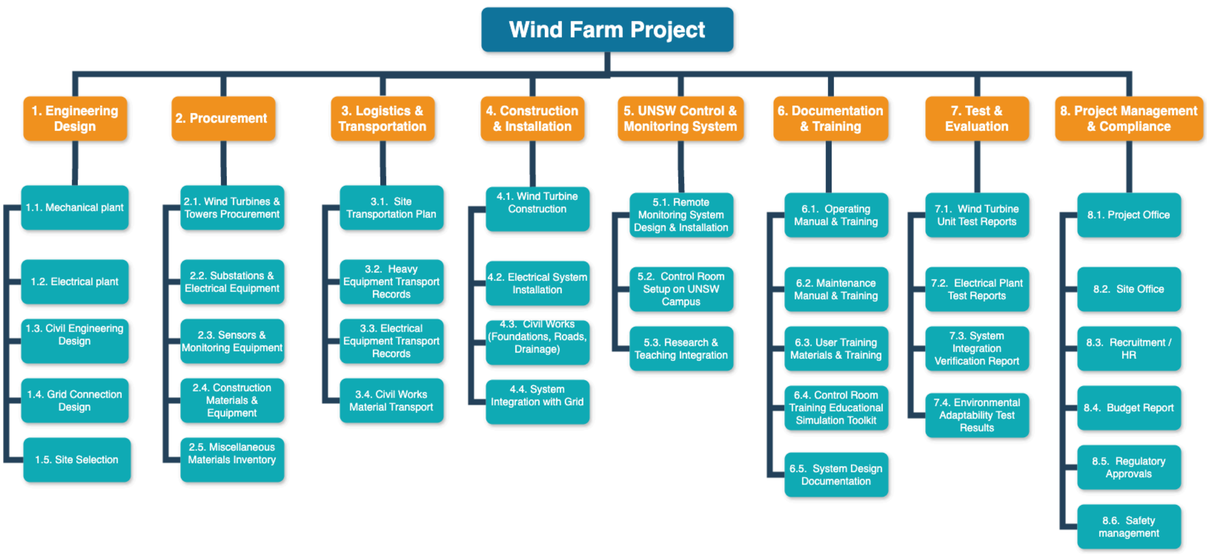


Figure 2.1: Work breakdown structure

The complete Work Breakdown Structure diagram can be found in Appendix 2.1, detailing the relationships between major deliverables, sub-components, and individual tasks required for project completion.

2.5 Scope Statement

The UNSW Wind Farm Project will deliver a grid-connected, 8 x 3MW wind energy facility in rural New South Wales. The facility will be designed to allow for future expansion to 30MW, though such extensions fall outside the current scope. The project will be executed under a fixed budget of AUD $48 million and will encompass engineering design, procurement of wind turbines, logistics, civil works, road and foundation construction, electrical reticulation, switchyard installation, system commissioning, and performance testing.

In support of UNSW's research and educational objectives, the project will also include the design and installation of a remote control room and monitoring station on the UNSW campus to enable real-time data access and operational oversight. The project must align with the UNSW 2025 Strategy, contributing to the university's goals in sustainability, innovation, and renewable energy leadership. The scope explicitly excludes any expansion beyond the initial 24MW capacity and any ongoing maintenance beyond the initial two-month period, both of which will be treated as separate future projects.

2.6 PMBOK Referenced PM Methods Used in Scope – Discussion

The scope planning process for the UNSW Wind Farm Project was developed in alignment with the PMBOK® Guide (6th Edition), particularly referencing Sections 5.1 to 5.4 from the Scope Management knowledge area. The process began with requirements collection (PMBOK Section 5.2), where project needs were identified through stakeholder consultation, document analysis, and expert judgment. These requirements formed the basis of a formal scope definition (PMBOK Section 5.3), which clearly outlined the project's inclusions, exclusions, constraints, and key deliverables, ensuring alignment with both strategic objectives and stakeholder expectations.

A hierarchical Work Breakdown Structure (WBS) was then created to decompose major deliverables into smaller, manageable work packages (PMBOK Section 5.4). This deliverable-oriented structure allows for more accurate scheduling, cost estimation, responsibility assignment, and progress monitoring. Together with the scope statement and WBS dictionary, the WBS forms the scope baseline (PMBOK Section 5.4), which acts as the foundation for scope control and performance measurement throughout the project lifecycle.

The scope planning process was supported by continuous stakeholder engagement (PMBOK Section 13.1), ensuring that the defined scope reflected the needs and constraints of all key parties, including UNSW leadership, regulatory authorities, and the project team. Furthermore, a formal Integrated Change Control mechanism (PMBOK Section 4.6) has been established to manage any changes to scope. Proposed changes will be evaluated for their impact on budget, schedule, and quality, and must receive approval from designated stakeholders before implementation.

By applying these PMBOK-guided methods, the project ensures that scope is clearly defined, effectively structured, and properly controlled, reducing the risk of scope creep and aligning all project efforts with UNSW's strategic and operational objectives.

3. Budget

3.1 Cost Estimation Strategy

The cost estimation strategy for the UNSW Wind Farm Project follows the *PMBOK® Guide (6th Edition)*, especially Section 7 – Project Cost Management. To make the estimates more reliable, both top-down and bottom-up methods were used.

In the beginning, we used a **top-down approach** to get a rough idea of the total cost. By comparing with similar wind farm projects, which usually cost between $1,750 and $2,000 per kW, we estimated that a 24MW wind farm would cost around $48 million. This also matches the fixed budget given in the *Project Brief: UNSW Wind Farm Project*.

After that, we used a **bottom-up method** to get more accurate estimates. We broke down the project into smaller work packages using the WBS, then estimated the cost for each activity separately *(Week05, Slide 10)*.

Here is how we estimated different types of costs:

- **Direct costs**: These include buying the wind turbines, transport, lifting (using cranes), construction, and electrical work. All these costs were based on current market prices or quotes from suppliers *(Week05, Slide 81)*.

- **Project overheads**: For example, crane hire was estimated at $300K/day for the main crane and $20K/day for assistant cranes. We also considered salaries, tools, and other site costs *(Week05, Slide 81)*.

- **Indirect costs**: These include things like admin fees and UNSW's internal project support. We used historical percentages from past projects to estimate them *(Week05, Slide 81)*.

To improve accuracy, we also used the following techniques:

- **Parametric Estimating**: We applied cost per unit values (e.g., $/MW or $/km for cables) using data from similar projects *(Week05, Slide 25)*.

- **Three-point Estimating (PERT)**: For tasks with more risk or uncertainty (like turbine installation), we used optimistic, most likely, and pessimistic values to find average expected costs *(Week05, Slide 27)*.

- **Vendor Quotes**: For key equipment like the turbines and logistics, we collected quotes from suppliers and contractors to check our estimates (Week05, Slide 32).

We also included **contingency reserves** to cover possible risks like delays, weather, or technical problems. These were calculated based on the risk register and expert judgment *(PMBOK Section 11.5; Week05, Slide 31)*.

Lastly, we used a **phase-based estimation** approach. The early phases (civil works, procurement) had more detailed cost breakdowns. Later phases (such as future expansion to 10 turbines) were estimated at a higher level and will be refined later *(Week05, Slide 30)*.

This estimation strategy helps us build a clear and realistic budget, which supports the project's success and aligns with UNSW's technical and financial goals.

3.2 Activity List - Cost & Time Estimation Table

Labour Table

	labour	Pay (AUD) /Hour
Grade1	General workers (Erection/Delivery/Commission)[2]	37.5
Grade2	Technical (Civil/M. & E.) & Officer[2],[3]	50
Grade3	Engineer (Design/research/report)[2],[3]	62.5
Grade4	Manager (Site[1]/Project)[3]	75

Suppose the Design team only works in optimization based on mature wind turbine models, with 6 members.

Suppose every Report researchers’ team is 4 members experts team.

[1]https://www.linkedin.com/jobs/construction-site-manager-jobs-greater-sydney-area/?currentJobId=4176914188&originalSubdomain=au

[2] https://www.seek.com.au

[3] https://www.bls.gov/green/wind_energy/

Cost & Time Estimation Table

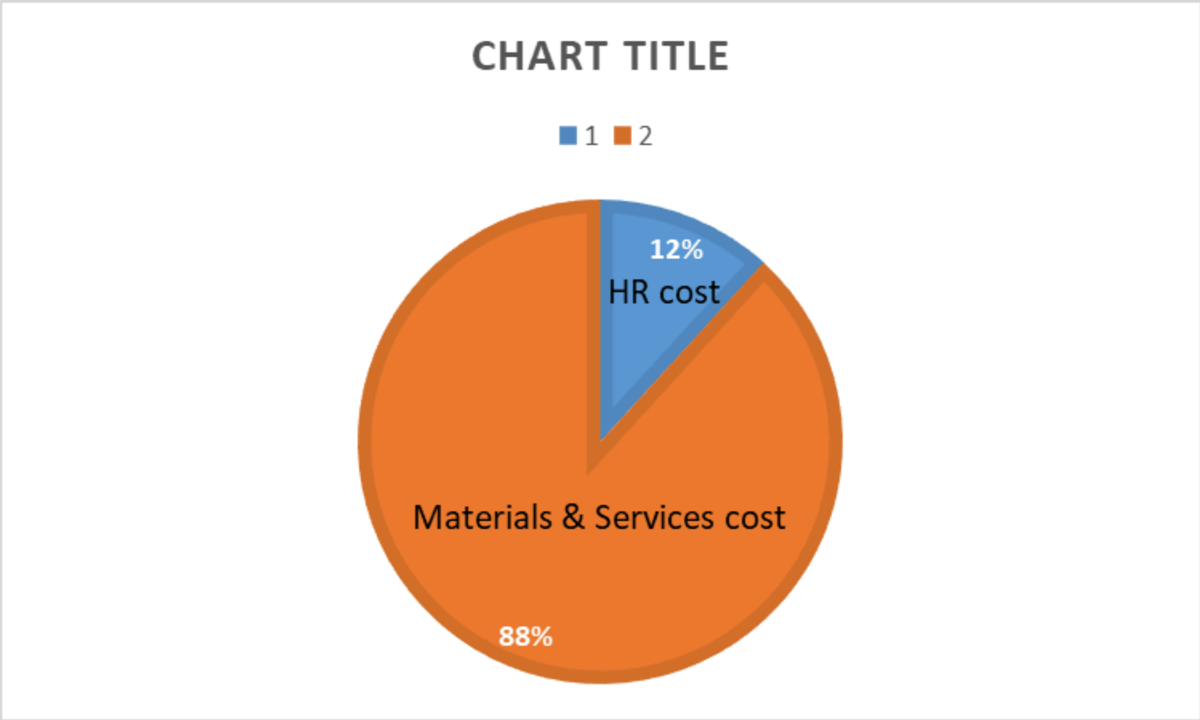
WBS Deliverables	Activities	Risk ID covered by contingency cover	Labour								Total Labour Cost (AUD)	Materials & Equipment		Estimated total cost (AUD)	consider contigency	
			Grade1		Grade2		Grade3		Grade4							
			Duration(Hrs)	Number	Duration(Hrs)	Number	Duration(Hrs)	Number	Duration(Hrs)	Number		items	Cost (AUD)		Contingency Budget (AUD)	Total Cost with contingency (AUD)
1. **Engineering Design**																$ 1,714,929
1.1. Mechanical plant																
1.1.1.Wind Turbine Design Documents	Wind Turbine Design	R1,R2,R4					257	12			$ 192,857		$ -	$ 192,857	$ 66,000	$ 258,857
1.1.2.Towers Design Documents	Towers Design	R4					257	6			$ 96,429		$ -	$ 96,429	$ 16,500	$ 112,929
1.1.3.Foundation Design Documents	Foundation Design	R4					257	6			$ 96,429		$ -	$ 96,429	$ 16,500	$ 112,929
1.1.4. Infrastructure Design Documents	Infrastructure Design	R4					171	12			$ 128,571		$ -	$ 128,571	$ 25,500	$ 154,071
1.2. Electrial plant																
1.2.1. Switchyard design Documents	Switchyard design	R1,R4					343	6			$ 128,571		$ -	$ 128,571	$ 22,000	$ 150,571
1.2.2. Transformers design Documents	Transformers design	R1,R4					257	6			$ 96,429		$ -	$ 96,429	$ 22,000	$ 118,429
1.2.3.Cabling and Reticulation Network Design Documents	Cabling and Reticulation Network Design	R1,R4					257	6			$ 96,429		$ -	$ 96,429	$ 22,000	$ 118,429
1.3. Civil Engineering Design																
1.3.1.Road Design Documents	Road Design	R1,R4					171	6			$ 64,286		$ -	$ 64,286	$ 22,000	$ 86,286
1.3.2. Drainage Systems Design	Drainage Systems Design	R1,R4					171	6			$ 64,286		$ -	$ 64,286	$ 22,000	$ 86,286
1.3.3. Foundation Design Documents	Foundation Design	R1,R4					171	6			$ 64,286		$ -	$ 64,286	$ 22,000	$ 86,286
1.4. Site selection																
1.4.1.Wind Resource Assessment Report	Assess Wind Resource	R3					86	4			$ 21,429		$ -	$ 21,429	$ 14,500	$ 35,929
1.4.2.Topographical and Boundary Survey Report	Topographical and Boundary Survey						86	4			$ 21,429		$ -	$ 21,429		$ 21,429
1.4.3.Site Layout Drawings	Draw Site Layout	R3,R5					171	4			$ 42,857		$ -	$ 42,857	$ 3,000	$ 45,857
1.4.4.Geotechnical Report	Report Geotechnical information						86	4			$ 21,429		$ -	$ 21,429		$ 21,429
1.5. Grid Connection Design																
1.5.1.Electrical Grid Integration	Integrate Electrical Grid						343	4			$ 85,714		$ -	$ 85,714		$ 85,714
1.5.2.Voltage Transformation and Regulation Design	Design Voltage Transformation and Regulation	R6					343	4			$ 85,714		$ -	$ 85,714	$ 45,500	$ 131,214
1.5.3.Grid Compliance Report	Report Grid Compliance	R6					257	4			$ 64,286		$ -	$ 64,286	$ 24,000	$ 88,286
2. **Procurement**																$ 34,897,143
2.1. Wind Turbines & Tower																
2.1.1.Wind Turbines	purchase Wind Turbines	R25	514	3	514	2					$ 109,286	Wind Turbines	$ 21,600,000	$ 21,709,286	$ 90,000	$ 21,799,286
2.1.2.Towers	purchase Towers	R25	514	3	514	1					$ 83,571	Towers	$ 2,400,000	$ 2,483,571	$ 10,000	$ 2,493,571
2.2. Substations & Electrical Equipment																
2.2.1.Transformers	purchase Transformers	R26		3	429	1					$ 21,429	Transformers	$ 800,000	$ 821,429	$ 50,000	$ 871,429
2.2.2.Cabling	purchase Cable	R26		3	343	1					$ 17,143	Cable	$ 200,000	$ 217,143	$ 20,000	$ 237,143
2.2.3.Switchyard	purchase Switchyard	R26		3	429	1					$ 21,429	Switchyard	$ 300,000	$ 321,429	$ 30,000	$ 351,429
2.2.4.Switchgear and Circuit Breakers	purchase Switchgear and Circuit Breakers	R26,R7		3	429	1					$ 21,429	Switchgear and Circuit Breakers	$ 200,000	$ 221,429	$ 20,000	$ 241,429
2.3.Sensors & Monitoring Equipment																
2.3.1.Remote Monitoring System Hardware	purchase Monitoring Equipment	R7		3	514	1					$ 25,714	Sensor & Adapter	$ 50,000	$ 75,714	$ 20,000	$ 95,714

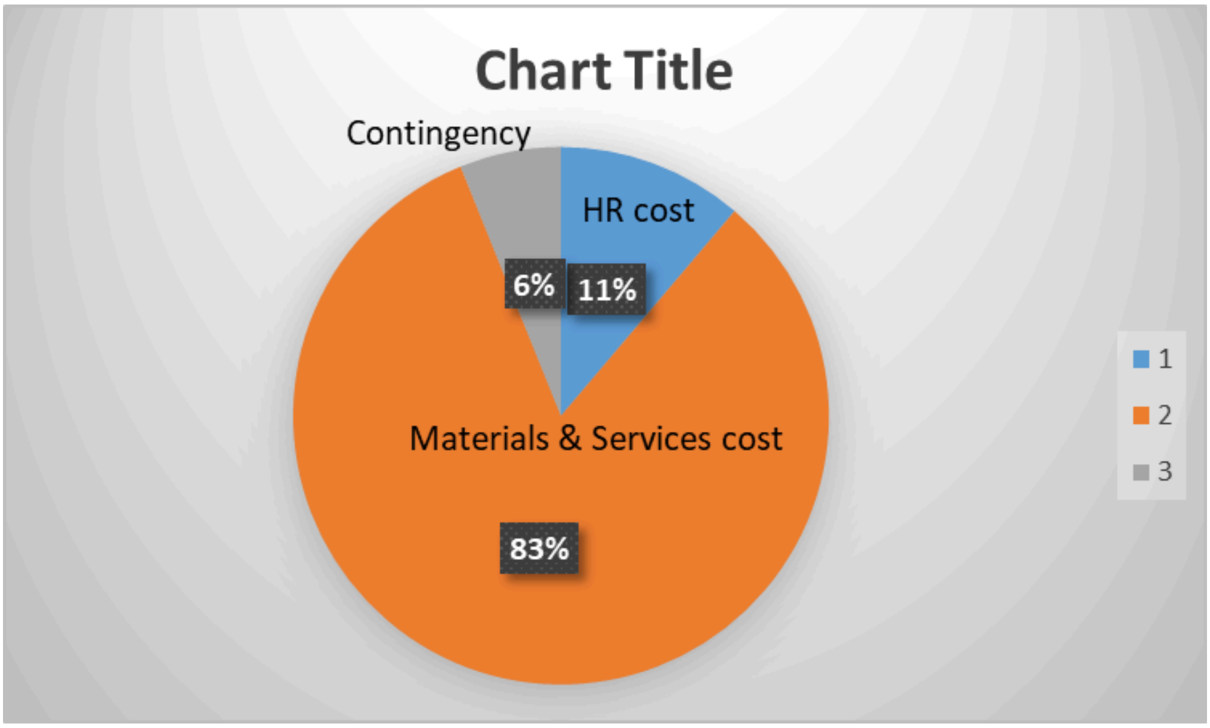
Monitoring System Hardware	purchase Monitoring Equipment	R7		3	514	1					$ 25,714	Sensor & Adapter	$ 50,000	$ 75,714	$ 20,000	$ 95,714
2.3.2.Field Data Acquisition Sensors	purchase Sensors	R7		3	514	1					$ 25,714	Sensors	$ 50,000	$ 75,714	$ 20,000	$ 95,714
2.4. Construction Materials & Equipment																
2.4.1.Heavy Machinery (leasing)	lease machineries	R8	86	3	86	1					$ 13,929	Building Machines & Transport servies	$ 1,000,000	$ 1,013,929	$ 150,000	$ 1,163,929
2.4.2. Building Materials	purchase steel	R8	40	3	40	1					$ 6,500	steel	$ 3,240,000	$ 3,246,500	$ 50,000	$ 3,296,500
	purchase concrete		40	3	40	1					$ 6,500	concrete	$ 2,160,000	$ 2,166,500	$ 50,000	$ 2,216,500
	purchase stone		40	3	40	1					$ 6,500	stone	$ 1,692,000	$ 1,698,500	$ 50,000	$ 1,748,500
	purchase glass		40	3	40	1					$ 6,500	glass	$ 108,000	$ 114,500	$ 50,000	$ 164,500
2.5. Miscellaneous Materials	purchase some consumables	R8	40	3	40	1					$ 6,500	Miscellaneous Materials	$ 100,000	$ 106,500	$ 15,000	$ 121,500
3. Logistics & Transportation																$ 920,857
3.1. Site Transportation	Plan Site Transportation								86	4	$ 25,714			$ 25,714		$ 25,714
3.2. Heavy Equipment Transport	Transport Heavy Equipment	R10	40	12							$ 18,000	Transport servies	$ 200,000	$ 218,000	$ 20,000	$ 238,000
3.3. Electrical Equipment Transport	Transport Electrical Equipment	R12	257	12							$ 115,714	Transport servies	$ 100,000	$ 215,714	$ 10,000	$ 225,714
3.4. Civil Works Material Transport	Transport Civil Works Material	R11	514	12							$ 231,429	Transport servies	$ 200,000	$ 431,429		$ 431,429
4. Construction & Installation																$ 7,238,200
4.1. Wind Turbine Installation																
4.1.2. Tower Erection	Unload	R32	12	6	12	6			12	1	$ 7,200	Crane leasing	$ 320,000	$ 327,200	$ 50,000	$ 377,200
	Erection		12	6	12	6			12	1	$ 7,200		$ 320,000	$ 327,200	$ 50,000	$ 377,200
4.1.1. Turbine Erection	Unload	R32	24	6	24	6			24	1	$ 14,400		$ 530,000	$ 544,400	$ 500,000	$ 1,044,400
	Erection		24	6	24	6			24	1	$ 14,400		$ 530,000	$ 544,400	$ 500,000	$ 1,044,400
4.1.3.Turbine Commission	Adjust Turbines	R32	40	8	40	6			40	1	$ 27,000	Crane leasing	$ 1,600,000	$ 1,627,000	$ 50,000	$ 1,677,000
4.2. Electrical System Installation																
4.2.1. Switchyard Construction	Construct Switchyard	R14	429	6	429	6			429	1	$ 257,14	Plot Area	$ -	$ 257,143	$ 26,000	$ 283,143
4.2.2.Transformer Installation	Install Transformer	R33	171	6	171	6			171	1	$ 102,857	Miscellaneous & Building Materials from Purchase Stage	$ -	$ 102,857	$ 50,000	$ 152,857
4.2.3.Power Cabling	Laying cables	R30	171	6	171	6			171	1	$ 102,857		$ -	$ 102,857	$ 1,000	$ 103,857
4.2.4.Switchyard & Cabling Commission	Adjust Switchyard & Cable	R30	86	6	86	6			86	1	$ 51,429		$ -	$ 51,429	$ 1,000	$ 52,429
4.3. Civil Works (Foundations, Roads, Drainage)																
4.3.1. Turbine Foundations	Construct Turbine Foundations	R13	343	6	343	6			343	1	$ 205,714	Building Materials from Purchase Stage	$ -	$ 205,714	$ 50,000	$ 255,714
4.3.2.Switchyard Foundations	Construct Switchyard Foundations	R16	343	6	343	6			343	1	$ 205,714		$ -	$ 205,714	$ 50,000	$ 255,714
4.3.3.Cabling Trenches and Conduits	Construct	R16	343	6	343	6			343	1	$ 205,714		$ -	$ 205,714	$ 50,000	$ 255,714
4.3.4. Internal Access Roads Construction	Bulid Road	R34	343	6	343	6			343	1	$ 205,714		$ -	$ 205,714	$ 100,000	$ 305,714
4.3.5. Drainage Systems and Stormwater	Manage Drainage Systems and Stormwater	R16	514	6	514	6			514	1	$ 308,571		$ -	$ 308,571	$ 150,000	$ 458,571
4.3.6. Site Buildings	construct Site	R16	343	6	343	6			343	1	$ 205,714		$ -	$ 205,714	$ 50,000	$ 255,714
4.4. System Integration with Grid	Integrate System	R15	514	6	514	6			514	1	$ 308,571		$ -	$ 308,571	$ 30,000	$ 338,571
5. UNSW Control & Monitoring System																$ 612,429
5.1. Remote Monitoring System Design&Installation																
5.1.1.System Architecture	Bulid System Architecture	R36					343	4			$ 85,714	System Architecture	$ 100,000	$ 185,714	$ 15,000	$ 200,714
5.1.2. Data Transmission Network	Laying Networks	R19					86	4			$ 21,429	Networks Parts' machines	$ 50,000	$ 71,429		$ 71,429
5.1.3. Performance Monitoring	Monitor Performance(System Setup)	R17,R19			86	1					$ 4,286	System Architecture	$ 50,000	$ 54,286	$ -	$ 54,286
5.2. Control Room Setup on UNSW Campus																
5.2.1. Display Systems	Set Display Systems	R36			40	1					$ 2,000		$ 50,000	$ 52,000	$ 5,000	$ 57,000
5.2.2. Control Consoles	Set Display Systems	R36			40	1					$ 2,000		$ 50,000	$ 52,000	$ 5,000	$ 57,000
5.2.3. Security and Backup Systems	Setup Security and Backup Systems	R36			40	1					$ 2,000		$ 50,000	$ 52,000		$ 52,000
5.3. Integration with Research & Teaching Labs																
5.3.1. Real-time Data Access for Research	Research(UNSW)	R18									$ -	Data System	$ 50,000	$ 50,000	$ -	$ 50,000
5.3.2. Educational Tools and Simulations	Do Simulations						40	4			$ 10,000	Educational Tools	$ 50,000	$ 60,000	$ -	$ 60,000
5.3.3. Collaboration with Industry	Collaborate with Industry	R18					40	4			$ 10,000		$ -	$ 10,000	$ -	$ 10,000
6. Documentation & Training																$ 225,714
6.1. Operating Manual & Training	Trian for Operating Manual	R21			343	4					$ 68,571	Production tools come from the results of the previous stage	$ -	$ 68,571	$ 5,000	$ 73,571
6.2. Maintenance Manual & Training	Trian for Maintenance				229	4					$ 45,714		$ -	$ 45,714		$ 45,714
6.3. User Training Materials & Training	Trian for User	R21			286	4					$ 57,143		$ -	$ 57,143	$ 5,000	$ 62,143
6.4. Control Room training	Trian for Control Room	R21			86	4					$ 17,143		$ -	$ 17,143	$ 5,000	$ 22,143
6.5. System Design Documentation	System Design	R22			86	4					$ 17,143		$ -	$ 17,143	$ 5,000	$ 22,143
7. Testing & Evaluation																$ 497,000
7.1. Wind Turbine Unit Testing																
7.1.1. Mechanical Performance	report Mechanical Performance	R27			86	1	86	4			$ 25,714	Production tools come from the results of the previous stage	$ -	$ 25,714	$ 5,000	$ 30,714
7.1.2. Electrical Performance	report Electrical Performance	R27			86	1	86	4			$ 25,714		$ -	$ 25,714	$ 5,000	$ 30,714
7.1.3. Safety Tests	Test for Safety	R27			114	1	114	4			$ 34,286		$ -	$ 34,286	$ 5,000	$ 39,286
7.1.4. Load Testing	Test for load	R27			86	1	86	4			$ 25,714		$ -	$ 25,714	$ 5,000	$ 30,714
7.2. Electrical Plant Testing																
7.2.1. Switchyard Testing	test Switchyard	R28			171	1	171	4			$ 51,429		$ -	$ 51,429	$ 5,000	$ 56,429
7.2.2.Transformer Load and Voltage	Test Transformer Load and Voltage	R28			171	1	171	4			$ 51,429		$ -	$ 51,429	$ 5,000	$ 56,429
7.2.3.Cabling Continuity and	Test Cabling Continuity and	R28			114	1	114	4			$ 34,286		$ -	$ 34,286	$ 5,000	$ 39,286
7.3. System Integration Testing																
7.3.1. Communication Between Turbines and Control System	Test Communication Between Turbines and Control System	R29			120	1	120	4			$ 36,000		$ -	$ 36,000	$ 5,000	$ 41,000
7.3.2. Grid Connection	Test Grid Connection	R29			120	1	120	4			$ 36,000		$ -	$ 36,000	$ 5,000	$ 41,000
7.3.3. Monitoring and Data Collection	Test Monitoring and Data Collection	R29			86	1	86	4			$ 25,714		$ -	$ 25,714	$ 5,000	$ 30,714
7.3.4. Redundancy and Failover Testing	Test Redundancy and Failover	R29			86	1	86	4			$ 25,714		$ -	$ 25,714	$ 5,000	$ 30,714
7.4. Environmental Adaptability Testing																
7.4.1. Temperature Extremes	Test Temperature Extremes	R30			114	1	114	4			$ 34,286		$ -	$ 34,286	$ 5,000	$ 39,286
7.4.2. Wind Speed Range	Test Wind Speed Range	R30			86	1	86	4			$ 25,714		$ -	$ 25,714	$ 5,000	$ 30,714
8. Project Management & Compliance																$ 158,286
8.1. Project Office	Setup Project Office				40	1			40	1	$ 5,000	Building Materials from Purchase Stage	$ 50,000	$ 55,000	$ -	$ 55,000
8.2. Site Office	Setup Site Office	R8			40	1			40	1	$ 5,000		$ 50,000	$ 55,000	$ 10,000	$ 65,000
8.3. Recruitment / HR	Ask for Recruitment				40	1			40	2	$ 8,000		$ -	$ 8,000	$ -	$ 8,000
8.4. Budgeting	Make Budget				40	1			40	1	$ 5,000		$ -	$ 5,000	$ -	$ 5,000
8.5. Regulatory Approvals																
8.5.1. Permit	Permit acquisition	R23,R24							86	1	$ 6,429	Production tools come from the results of	$ -	$ 6,429	$ -	
8.5.2. Environmental considerations	feedback Environmental considerations								171	1	$ 12,857		$ -	$ 12,857	$ -	$ 12,857

113	8.5. Regulatory Approvals																
114	8.5.1. Permit	Permit acquisition	R23,R24							86	1	$ 6,429	Production tools come from the results of the previous stage	$ -	$ 6,429	$ -	
115	8.5.2. Environmental considerations	feedback Environmental considerations								171	1	$ 12,857		$ -	$ 12,857	$ -	$ 12,857
116	8.5.3. Safety	regulate Safety								86	1	$ 6,429		$ -	$ 6,429	$ -	$ 6,429
117	8.6. Safety management	maintain Safety (Shortly)	R35			120	1					$ 6,000		$ -	$ 6,000	$ -	$ 6,000
118	total											$ 5,194,486		$ 38,250,000		$ 2,826,500	$ 46,270,986

Since screenshots can only show data results, we welcome teaching teams to open the Excel file in the following link to view the formula in each cell, to understand the ideas behind how to obtain each data: especially in the risk linkage part, different estimates of consequences corresponding to different risk levels and different risk handling methods are all stored in the cell formulas.

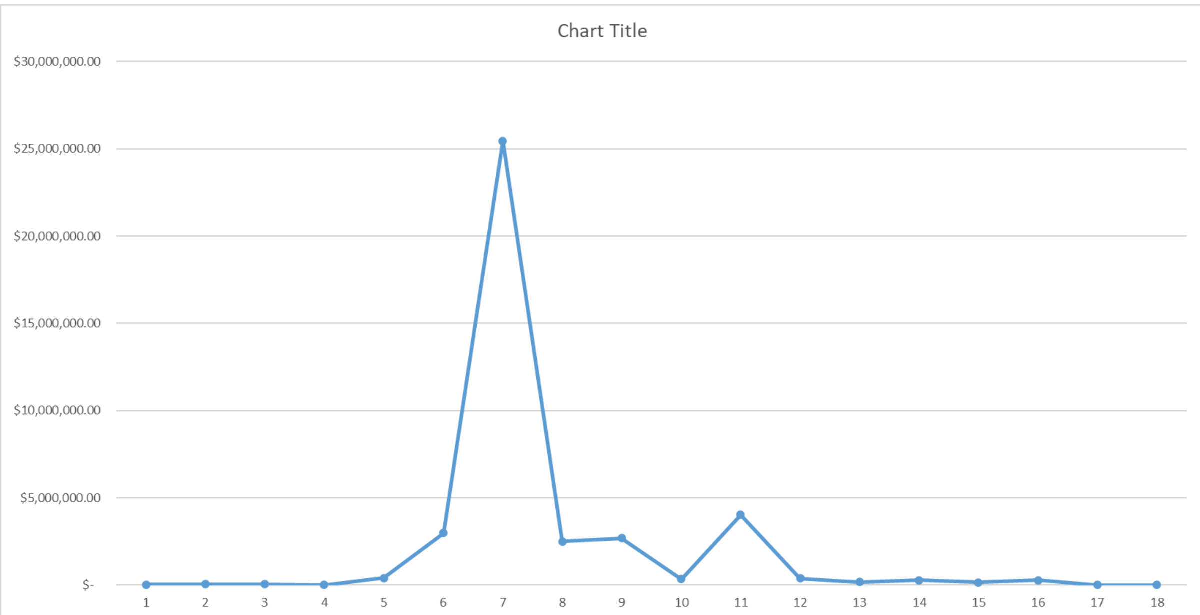
3.3 Project Budget





3.4 Time-based Budget

WBS	budget	Duration(Days)	2024						2025						2025					
			Q3			Q4			Q1			Q2			Q3			Q4		
			Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.4.1	$ 35,929	15	$ 17,964.50																	
1.4.2	$ 21,429	15	$ 10,714.50																	
1.4.4	$ 21,429	15		$ 10,714.50																
1.4.3	$ 45,857	30		$ 22,928.50	$ 22,928.50															
8.5.1	$ 6,249	60			$ 1,562.25	$ 3,124.50	$ 1,562.25													
8.5.2	$ 12,857	30			$ 6,428.50	$ 6,428.50														
8.5.3	$ 6,429	15			$ 3,214.50															
8.1	$ 55,000	7					$ 55,000.00													
8.2	$ 65,000	7					$ 65,000.00													
8.3	$ 8,000	7					$ 8,000.00													
8.4	$ 5,000	7					$ 5,000.00													
1.1.1	$ 258,857	45					$ 258,857.00	$ 172,571.33	$ 86,285.67											
1.1.2	$ 112,929	45						$ 75,286.00	$ 37,643.00											
1.1.3	$ 112,929	45						$ 75,286.00	$ 37,643.00											
1.1.4	$ 154,071	30						$ 154,071.00												
1.3.1	$ 86,286	30						$ 86,286.00												
1.3.2	$ 86,286	30						$ 86,286.00												
1.5.1	$ 85,714	30						$ 85,714.00												
2.3.1	$ 95,714	15						$ 95,714.00												
2.3.2	$ 95,714	15						$ 95,714.00												
2.4.1	$ 1,163,929	15						$ 1,163,929.00												
2.4.2	$ 742,600	7						$ 742,600.00												
3.1	$ 25,714	15						$ 25,714.00												
2.5	$ 121,500	7						$ 121,500.00												
1.5.2	$ 131,214	30							$ 131,214.00											
1.2.1	$ 150,571	30							$ 150,571.00											
1.2.2	$ 118,429	30							$ 118,429.00											
2.1.1	$ 21,799,286	15							$ 21,799,286.00											
2.1.2	$ 2,493,571	15							$ 2,493,571.00											
3.4	$ 431,429	15							$ 431,429.00											
5.1.1	$ 200,714	60							$ 50,178.50	$ 100,357.00	$ 50,178.50									
5.1.2	$ 71,429	15							$ 71,429.00											
5.1.3	$ 54,286	15							$ 54,286.00											
1.2.3	$ 118,429	30								$ 118,429.00										
1.5.3	$ 88,286	15								$ 88,286.00										
2.2.1	$ 871,429	15								$ 871,429.00										
2.2.3	$ 351,429	15								$ 351,429.00										
4.3.3	$ 255,714	30								$ 255,714.00										
4.3.5	$ 458,571	30								$ 458,571.00										
2.2.4	$ 241,429	7								$ 241,429.00										
2.2.2	$ 237,143	7									$ 237,143.00									
4.3.4	$ 805,714	30									$ 805,714.00									
4.3.6	$ 255,714	30									$ 255,714.00									
3.3	$ 225,714	15									$ 225,714.00									
4.1.2	$ 754,400	4									$ 754,400.00									
5.1.2	$ 71,429	7									$ 71,429.00									
5.1.3	$ 54,286	7									$ 54,286.00									
5.2.1	$ 57,000	7									$ 57,000.00									
4.3.1	$ 255,714	60									$ 63,928.50	$ 127,857.00	$ 63,928.50							
4.3.2	$ 255,714	60									$ 38,357.10	$ 142,063.33	$ 102,285.60							
5.3.1	$ 50,000	15									$ 30,000.00	$ 20,000.00								
5.3.2	$ 60,000	15									$ 36,000.00	$ 24,000.00								
5.3.3	$ 10,000	15									$ 6,000.00	$ 4,000.00								
6.4	$ 22,143	15										$ 22,143.00								
4.1.1	$ 2,088,800	5											$ 2,088,800.00							
4.1.3	$ 1,677,000	7											$ 1,677,000.00							
4.2.1	$ 283,143	30											$ 84,942.90	$ 198,200.10						
7.1.1	$ 30,714	15												$ 30,714.00						
7.1.3	$ 39,286	20												$ 23,571.60	$ 15,714.40					
7.1.4	$ 30,714	15												$ 24,571.20	$ 6,142.80					
4.2.2	$ 152,857	15												$ 91,714.20	$ 61,142.80					
4.2.3	$ 103,857	30													$ 83,085.60	$ 20,771.40				
4.2.4	$ 52,429	15														$ 52,429.00				
7.2.1	$ 56,429	10														$ 56,429.00				
7.2.2	$ 56,429	10														$ 56,429.00				
7.2.3	$ 39,286	10														$ 39,286.00				
7.1.2	$ 30,714	15														$ 18,428.40	$ 12,285.60			
7.3.1	$ 41,000	21														$ 24,600.00	$ 41,000.00			
7.3.2	$ 41,000	21															$ 41,000.00			
7.3.3	$ 30,714	15															$ 30,714.00			
7.4.1	$ 39,286	15															$ 7,857.20	$ 31,428.80		
7.4.2	$ 30,714	15															$ 6,142.80	$ 24,571.20		
6.1	$ 73,571	7																$ 73,571.00		
6.2	$ 45,714	7																$ 45,714.00		
6.3	$ 62,143	7																$ 62,143.00		
6.4	$ 22,143	15																$ 22,143.00		
8.6	$ 6,000	60																$ 6,000.00	$ 3,000.00	$ 3,000.00
			$ 28,679.00	$ 33,643.00	$ 34,133.75	$ 9,553.00	$ 393,419.25	$ 2,980,671.33	$ 25,461,965.17	$ 2,485,644.00	$ 2,685,864.10	$ 340,063.33	$ 4,016,957.00	$ 368,771.10	$ 166,085.60	$ 268,372.80	$ 138,999.60	$ 265,571.00	$ 3,000.00	$ 3,000.00



3.5 PMBOK Referenced PM Methods Used in Cost–Discussion

The cost planning for the UNSW Wind Farm Project was based on the *PMBOK® Guide (6th Edition)*, mainly using Sections 7.1 to 7.4 under the Cost Management area. These methods helped us plan, estimate, control, and monitor the project's cost in a structured way.

We started with **Cost Management Planning** *(Section 7.1)*. In this step, we decided how we would measure and report cost. This included setting the level of accuracy and precision for estimates, choosing the units (like AUD or cost per MW), and defining cost reporting formats. These helped us build a clear and shared understanding for the team.

Then we moved to **Cost Estimating** *(Section 7.2)*. We used several methods taught in class and mentioned in PMBOK:

- **Analogous estimating**: comparing to other wind farm projects to estimate a general budget range.
- **Parametric estimating**: applying unit cost (e.g., $/kW or $/meter of cable) to parts like turbines and cabling.
- **Bottom-up estimating**: breaking tasks into small parts (from WBS), then adding their costs up.
- **Three-point estimating**: using optimistic, likely, and pessimistic values for risky tasks (e.g., crane hire, transport). We also did a **reserve analysis**, adding contingency and management reserves to prepare for both known and unknown risks.

Next, we used the **Determine Budget** process *(Section 7.3)* to put all the estimated costs together. This included:

- Activity costs
- Work package totals
- Contingency reserves
- Management reserves
  We also checked that our planned spending didn't go over the $48M fixed budget using **funding limit reconciliation**. This step helped us create a **Cost Baseline**, which we will use to track financial performance.

Lastly, we used **Control Costs** *(Section 7.4)* methods to keep the project on budget. We plan to use:

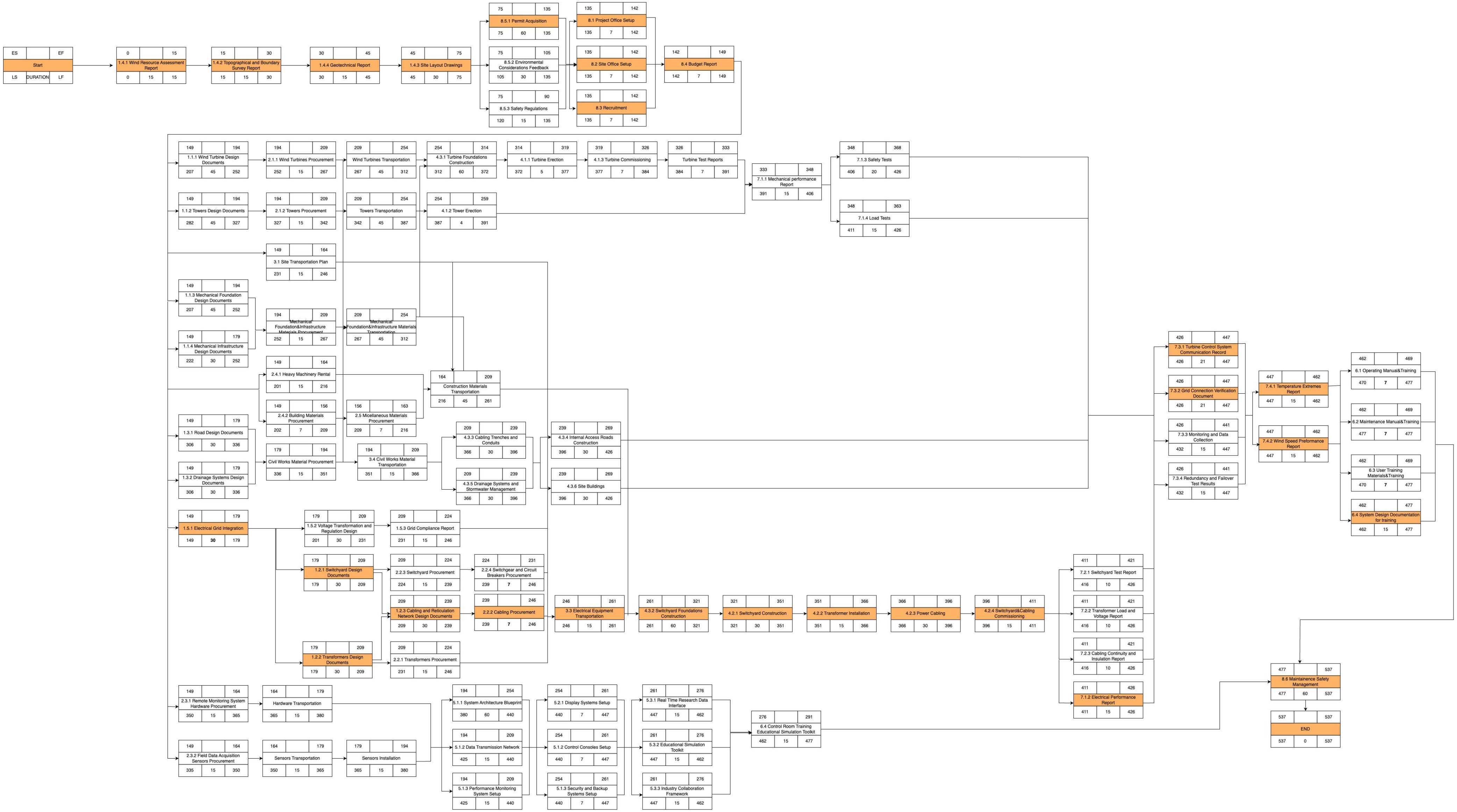
- **Earned Value Analysis (EVA)**: to check if cost and time performance are on track
- **Variance analysis**: to find differences between planned and actual costs
- **To-Complete Performance Index (TCPI)**: to predict if we can finish within budget.
- **Trend analysis**: to see if cost issues are improving or getting worse. These tools help us make decisions early and take action if things go off track.

We also followed **stakeholder engagement** methods *(PMBOK Section 13.1)* to make sure the budget met UNSW's expectations. If any changes affect the budget, we will handle them through the **Integrated Change Control** process *(PMBOK Section 4.6)*, making sure all changes are reviewed and approved before updating the budget.

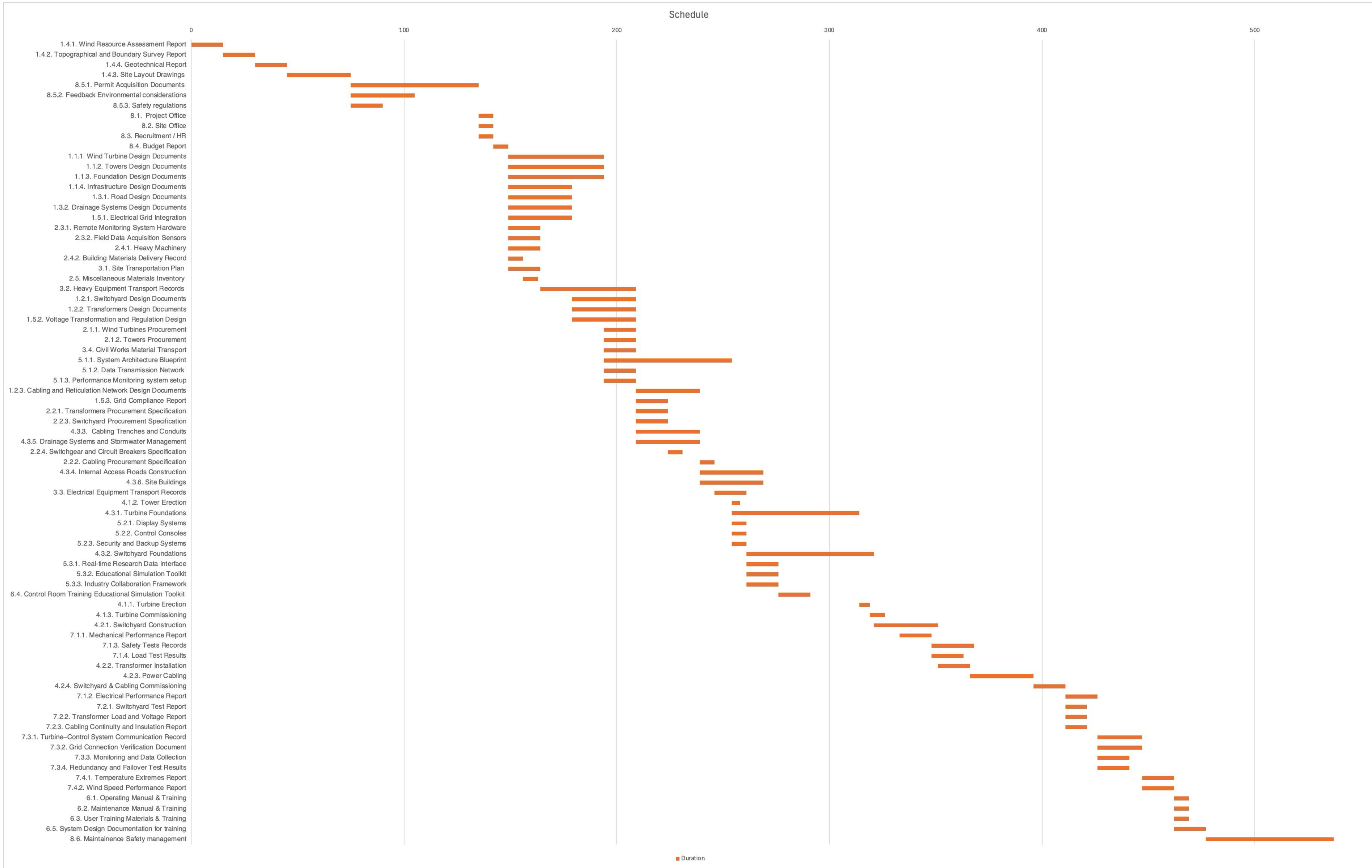
By applying these PMBOK methods, we created a solid cost plan that supports both project control and UNSW's goals.

4. Schedule

4.1 Network Diagram



4.2 Gantt Chart



4.3 PMBOK Referenced PM Methods Used in Schedule – Discussion

The development of network diagrams and Gantt charts in Project Schedule Management relies on a structured integration of methodologies outlined in the PMBOK Guide. Central to constructing network diagrams is the Precedence Diagramming Method (PDM) (PMBOK 6.3.2.1), which establishes logical dependencies between activities through four relationship types: Finish-to-Start (FS), Finish-to-Finish (FF), Start-to-Start (SS), and Start-to-Finish (SF). These relationships, visualized as nodes and links, form the backbone of activity sequencing, enabling the creation of project schedule network diagrams (Figure 6-9). To determine the project's critical path and minimum duration, the Critical Path Method (CPM) (PMBOK 6.5.2.2) is employed. CPM calculates early and late start/finish dates, identifies total float for non-critical activities, and highlights the longest path through the network, which dictates the project timeline (Figure 6-16). This analysis ensures alignment with schedule baselines while exposing risks associated with path convergence or divergence.

Subsequent refinement of the schedule model involves Resource Optimization Techniques (PMBOK 6.5.2.3), which adjusts activity timelines to balance resource allocation. Resource Leveling resolves over-allocations by delaying tasks, potentially altering the critical path, while Resource Smoothing adjusts activities within their float limits to avoid exceeding resource constraints. These techniques ensure realistic resource utilization, as depicted in Gantt charts (Figure 6-17). The overarching Schedule Network Analysis(PMBOK 6.5.2.1) integrates CPM, resource optimization, and risk evaluation to iteratively refine the network diagram. This process evaluates high-risk activity intersections and incorporates schedule reserves to mitigate uncertainties, ensuring a viable and resilient schedule model.

Gantt charts(PMBOK 6.5.3.2), translate the schedule model into a visual timeline, displaying activity start/finish dates, dependencies, and progress. They serve dual purposes: summary schedules provide high-level milestones for stakeholder communication, while detailed schedules incorporate resource assignments and logical relationships, often derived from time-scaled network diagrams (Figure 6-21). Adjustments to activity sequences are further refined using Leads and Lags (PMBOK 6.3.2.3), which modify successor activities without altering durations.

Collectively, these methodologies—rooted in Sections 6.3 and 6.5 of the PMBOK Guide—ensure that network diagrams and Gantt charts not only reflect theoretical dependencies and timelines but also adapt to practical constraints, resource availability, and project risks. By systematically applying PDM, CPM, resource optimization, and iterative analysis, project managers achieve a balance between rigorous planning and dynamic execution, ultimately delivering schedules that are both actionable and resilient.

5. Stakeholder Management Plan

5.1 Stakeholder Assessment

Stakeholder identification is one of the most critical early activities in project management, as emphasized in the PMBOK® Guide 6th Edition, Section 13.1. It involves recognizing individuals, groups, or organizations that can influence or be influenced by the project, either directly or indirectly. Understanding their interests, power, influence, and expectations allows the project team to design effective engagement strategies, reduce resistance, and align the project with broader organizational and community objectives.

To ensure that no critical stakeholders were overlooked, the team employed the techniques outlined in PMBOK 6th Ed. Section 13.1.2.1 (Expert Judgment) and Section 13.1.2.2 (Data Gathering). Based on these techniques, the project team compiled a complete list of internal and external stakeholders, including the project sponsor (Bernard Hayes), project management team members, engineering and electrical contractors, the procurement officer, university departments such as Finance and Sustainability, control room supervisors, local government authorities, the NSW Department of Planning, environmental agencies, students, faculty, and representatives of the local community. Each of these stakeholders has been recorded in the Stakeholder Register (see Appendix 5 Table 5.1), in accordance with PMBOK Section 13.1.3.1, which includes their project role, influence, communication preferences, level of interest, and classification as internal or external actors.

To analyze the engagement needs of these stakeholders and guide future communications, the team applied three stakeholder analysis tools.

5.1.1 Stakeholder Engagement Matrix

In alignment with PMBOK® 6th Edition, Section 13.1.2.3 (Data Representation), the project team developed a stakeholder engagement assessment matrix to evaluate and manage the engagement levels of all identified stakeholders. The matrix uses five standard engagement categories: unaware, resistant, neutral, supportive, and Leading. These classifications enable the team to map both the current and desired engagement levels for each stakeholder and to devise targeted strategies for closing any engagement gaps.

Stakeholder	Unware	Resistant	Neutral	Supportive	Leading
Bernard Hayes (Sponsor)				C →	D
Project Management Team					CD
Local Government Council			C →	D	
Engineering Consultant				CD	
Electrical Contractor				CD	
Procurement Officer			C →	D	
Control Room Supervisor			C →	D	
Local Community Rep	C →	→	D		
Research Faculty			C →	D	
Safety Manager			C →	D	
Environmental Agencies			C →	D	
Students	C →	→	D		
UNSW Finance Department			C →	D	
UNSW Sustainability Office			C →	D	
NSW Department of Planning			C →	D	

Table 5.1.1 Stakeholder Engagement Assessment Matrix

Current engagement levels (marked as “C”) and desired engagement levels (marked as “D”) were recorded for each stakeholder. For example, the project sponsor Bernard Hayes is currently supportive but is expected to take a leading role by being more involved in strategic decisions and milestone approvals. Similarly, internal roles such as the procurement officer and the control room supervisor are currently neutral, but their influence on procurement timelines and system commissioning makes it important to raise their engagement to a supportive level.

5.1.2 Power Influence Grid

The Power–Influence Grid is a strategic tool from stakeholder management practices that classifies stakeholders based on two dimensions: their power over the project and their influence. As recommended in PMBOK® Guide 6th Edition (Section 13.1.2.3), this grid allows project managers to visualise which stakeholders need to be involved in what way. Stakeholders with both high power and high influence must be closely managed and empowered throughout the project lifecycle.

To enhance the precision of the analysis, stakeholders in this project were scored on a 5-point scale for both power and influence. This expanded scale, inspired by best practices in stakeholder analysis frameworks, allows for greater granularity in classifying stakeholders. For instance, a rating of “5” in power indicates the ability to steer or block the project, while a “1” indicates limited or no direct influence. Definitions for each level are detailed in Appendix Table 5.2 & Table 5.3.

5.1.3 Power Interest Grid

The Power–Interest Grid, as outlined in the PMBOK® Guide (6th Edition, Section 13.1.2.3 – Data Representation), is a stakeholder analysis framework that enables project managers to classify stakeholders according to two key dimensions: their power (the ability to influence project decisions and outcomes) and their interest (the level of concern or involvement with the project’s results). This tool supports the development of tailored engagement strategies, ensuring that attention and communication efforts are aligned with each stakeholder’s potential impact on the project.

For the UNSW Wind Farm Project, the Power–Interest Grid was applied using a 5-point scale for both power and interest ratings. Definitions for each level are provided in Appendix Table 5.2 and Table 5.4, offering a granular view of stakeholder characteristics. This fine-grained classification was particularly useful in this context, given the wide-ranging stakeholder profile—spanning engineering consultants, electrical contractors, procurement officers, university researchers, community representatives, and sustainability leaders.

By combining these two dimensions, stakeholders were mapped into a stakeholder engagement decision matrix, which recommends appropriate engagement strategies based on their position within the grid. These strategies include empower, collaborate, involve, consult, inform, and monitor. Definitions for each strategy are provided in Appendix Table Table 5.5. The structured application of this grid allows the project team to prioritize stakeholder needs and adapt communication and participation plans accordingly, enhancing overall stakeholder alignment and support throughout the project lifecycle.

5.2 Detailed Stakeholder Management Strategy

Once stakeholder analysis is completed, it is essential to translate insights into actionable engagement strategies. According to the *PMBOK® Guide 6th Edition*, the development of stakeholder management strategies should be informed by tools such as the Power–Influence Grid and Power–Interest Grid, which are part of the data representation techniques described in Section 13.1.2.3. These tools provide the basis for identifying stakeholder priorities, but the management strategy itself must go further: it must determine how each stakeholder should be approached, involved, and supported throughout the project lifecycle.

For the UNSW Wind Farm Project, stakeholder management was designed to ensure targeted, responsive engagement aligned with each stakeholder's influence, power, and interest. Stakeholders were first placed within a Stakeholder Engagement Decision Matrix (SEDM), which integrates the results of power-interest mapping and translates those positions into specific engagement strategies. These strategies—Empower, Collaborate, Involve, Consult, Inform, and Monitor—represent different levels of involvement and decision authority, enabling the team to determine who should be briefed, who should be consulted, and who should have a leading role in decision-making processes. Definitions for each strategy are provided in Appendix Table Table 5.6.

To ensure strategic coherence, these engagement modes were further categorized into four organizational strategy types based on the PMBOK-aligned best practices: *Maintain*, *Meet*, *Manage*, and *Monitor*. "Maintain" strategies, which include Empower and Collaborate, are assigned to stakeholders with high power and influence who are critical to the project's strategic direction. "Meet" strategies, including Involve and Consult, apply to stakeholders who possess domain-specific knowledge or project execution responsibilities, and whose active feedback is required. "Manage" is typically associated with stakeholders who require updates at key intervals but do not influence major decisions. Finally, "Monitor" strategies are used for low-interest, low-power stakeholders who do not currently affect the project, but whose sentiment may evolve over time and thus require observation.

For example, the project sponsor Bernard Hayes, currently rated as supportive with maximum power and influence, is managed using an Empower strategy. He is involved in all key reviews and receives weekly strategic briefings to ensure consistent alignment and authority. On the other hand, the Local Government Council, which has high regulatory power but less day-to-day influence, is engaged through a Collaborate strategy—participating in regulatory planning discussions and environmental reviews. Stakeholders such as students and community representatives, who show lower levels of power and influence, are assigned Monitor or Inform strategies, ensuring transparency while minimizing unnecessary overhead.

As table 5.2, Each stakeholder's current and desired engagement levels were documented in the Stakeholder Engagement Matrix. The gap between the two was then bridged with targeted interventions. These actions, aligned with *PMBOK® 13.3 Manage Stakeholder Engagement* and *13.4 Monitor Stakeholder Engagement*, ensure proactive handling of expectations, foster cooperation, and reduce resistance. This dynamic and structured approach enables the project team to remain responsive to stakeholder needs while maintaining strategic control over communication flow and influence pathways.

Stakeholder	Power	Interest	Influence	Strategy	Classification	Actions
Bernard Hayes (Sponsor)	5	5	4	Empower	Maintain	Involve in all key reviews; ensure weekly strategic reports
Project Management Team	4	5	5	Empower	Maintain	Maintain regular coordination sessions and decision briefings
Local Government Council	4	3	3	Involve	Meet	Share planning updates and invite to environmental briefings
Engineering Consultant	3	5	3	Collaborate	Maintain	Continue weekly design meetings and milestone check-ins
Electrical Contractor	3	5	5	Collaborate	Maintain	Maintain daily site briefings and clear work instructions
Procurement Officer	2	3	5	Consult	Meet	Provide procurement schedule and supplier tracking updates
Control Room Supervisor	2	3	4	Consult	Meet	Engage early in system setup workshops
Local Community Rep	2	4	3	Consult	Meet	Community flyers, mailbox notifications, townhall sessions
Research Faculty	2	4	4	Consult	Meet	Grant access to live performance data, involve in reviews
Safety Manager	3	5	3	Collaborate	Maintain	Continue with site inspections and WHS audits
Environmental Agencies	4	3	3	Involve	Meet	Submit reports, offer site inspection invites
Students	1	2	2	Monitor	Monitor	Integrate into teaching materials and dashboard access
UNSW Finance Dept	3	4	3	Involve	Meet	Share periodic cost reports and variance summaries
UNSW Sustainability Office	3	5	3	Collaborate	Maintain	Align with UNSW 2025 goals, invite to environmental reviews
NSW Dept of Planning	5	3	3	Collaborate	Maintain	Ensure timely planning applications and compliance meetings

Table 5.2 Stakeholder Management Strategy

5.3 PMBOK Referenced PM Methods Used in Stakeholder Management –Discussion

The stakeholder management strategy adopted in the UNSW Wind Farm Project is firmly grounded in the *Project Stakeholder Management* processes outlined in the *PMBOK® Guide, 6th Edition, Chapter 13* (PMI, 2017). The team systematically followed all four core processes: 13.1 Identify Stakeholders, 13.2 Plan Stakeholder Engagement, 13.3 Manage Stakeholder Engagement, and 13.4 Monitor Stakeholder Engagement.

During the Identify Stakeholders phase (Section 13.1), the team applied tools such as *Expert Judgment* and *Data Gathering* (PMBOK 13.1.2.1 and 13.1.2.2), including document review, stakeholder interviews, and consultation with internal experts. This led to the development of a comprehensive Stakeholder Register (Section 13.1.3.1), which recorded each stakeholder's role, level of influence, engagement preferences, and classification (internal/external).

In the Plan Stakeholder Engagement phase (Section 13.2), the team utilized data representation techniques—specifically the Stakeholder Engagement Assessment Matrix, Power–Interest Grid, and Power–Influence Grid—as prescribed in Section 13.1.2.3. These tools enabled the classification of stakeholders based on engagement level (unaware to leading), and contextual attributes like power, interest, and influence. Stakeholders were then matched with appropriate engagement strategies using the Stakeholder Engagement Decision Matrix (SEDM), ensuring strategic alignment between their characteristics and the communication approach.

The Manage Stakeholder Engagement process (Section 13.3) was supported by customized strategies for each stakeholder, as reflected in the "Actions" column of the Stakeholder Matrix. These strategies included specific mechanisms such as regular review meetings, milestone briefings, live dashboard access, and participation in planning or compliance activities. These were tailored to stakeholder influence and interest levels, thereby enhancing responsiveness and reducing engagement friction.

Finally, to support Monitor Stakeholder Engagement (Section 13.4), periodic engagement reviews were scheduled at major project milestones. The Power Grids and Stakeholder Matrix served as dynamic monitoring tools to track shifts in stakeholder influence, interest, or expectations. This allowed the team to adjust communication efforts proactively, ensuring that stakeholder alignment was continuously maintained throughout the project lifecycle.

By integrating these PMBOK® methodologies holistically, the project team has established a structured, proactive, and adaptable stakeholder management framework. This approach not only aligns with best-practice project governance but also ensures that stakeholder expectations are met while maximizing their positive influence on project outcomes.

6.Risk Management Plan

6.1 Risk Breakdown Strategy

6.1.1 Risk identification

Our team employs a Risk Breakdown Structure (RBS) methodology to systematically identify, categorize, and assess potential risks. This structured approach involves:Evaluating project risks through expert analysis, historical data review, and stakeholder consultations.Developing contingency plans to mitigate high-priority risks, ensuring proactive response strategies.Documenting and prioritizing risks in a centralized risk register, utilizing a severity-impact matrix to rank risks based on likelihood and potential consequences.This method ensures comprehensive risk coverage across technical, external, organizational, and project management domains, enabling informed decision-making and resource allocation.

6.1.2 Project risk

Technical Risk:

- SCADA protocol conflict causes unexpected downtime
- Blade recycling technology defect
- Digital twin model deviation
- Grid connection harmonic

External Risk:

- Conflicts between industry, academia and research lead to low utilization of power generation
- Indigenous heritage dispute escalation which leads to delays in project development
- Optical pollution complaints
- Bat collision incident
- Heavy vehicle community complaints
- Soil contamination remediation dispute
- Extreme weather delay which is very common in Sydney

Organizational Risk:

- Scalability design flaws lead to insufficient subsequent development of the project
- Grid connection permit delay which delays the following work

Project Management Risk:

- Road construction cost overrun causes delays in costs and expected schedules
- Environmental permit additional conditions

6.1.3 Contingency Plan

To address potential risks, we have developed the following contingency measures:

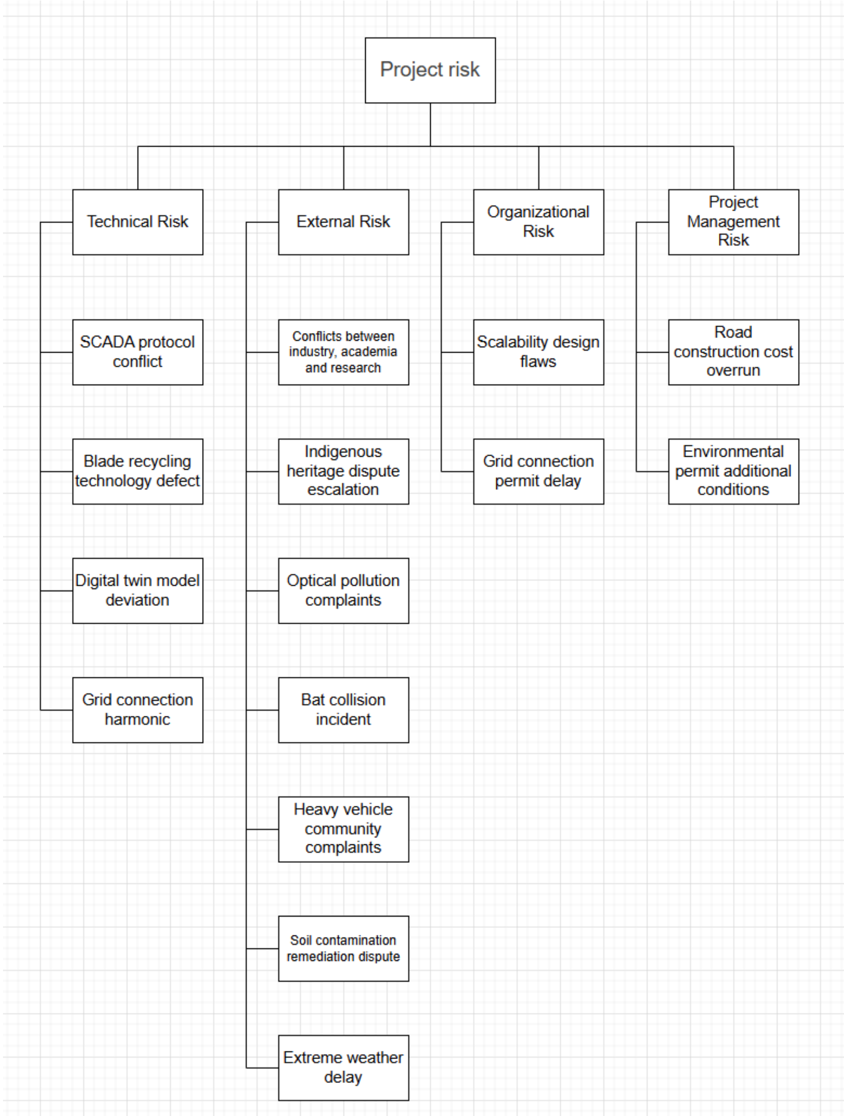
Technical Risks:
If a technical problem occurs, we will immediately reassign qualified internal team members to resolve the problem and use existing equipment for troubleshooting. If it cannot be eliminated, professionals will be hired. Although the short-term cost increases, the long-term stability and security of the project will be stronger.

Stakeholder Issues:
For community complaints or disputes, we will initiate established communication protocols and adjust working methods to resolve the problem while minimizing disruption.

Schedule/Budget:
We will maintain flexible task priorities and cross-trained staff to handle delays while optimizing existing resources to stay within the budget.

All emergency actions will be carefully documented and reviewed for effectiveness.

6.1.4 Risk Breakdown Strategy



RBS Level 0	RBS Level 1	RBS Level 2
All Project Risks	1. Technical Risk	1.1 Scope Definition
	1. Technical Risk	1.2 Requirements Clarity
	1. Technical Risk	1.3 Assumptions & Estimates
	1. Technical Risk	1.4 Design Process Complexity
	1. Technical Risk	1.5 Technical Feasibility
	1. Technical Risk	1.6 Integration with Existing Systems
	1. Technical Risk	1.7 Testing & Validation Risk
	2. External Risk	2.1 Project Scheduling Risk
	2. External Risk	2.2 Resource Allocation Risk
	2. External Risk	2.3 Communication Gaps
	2. External Risk	2.4 Stakeholder Misalignment
	2. External Risk	2.5 Documentation Delays
	2. External Risk	2.6 Change Management
	2. External Risk	2.7 Coordination of Multidisciplinary Teams
	3. Organizational Risk	3.1 Procurement Delays
	3. Organizational Risk	3.2 Budget Overruns
	3. Organizational Risk	3.3 Contractual Ambiguities
	3. Organizational Risk	3.4 Vendor Reliability
	3. Organizational Risk	3.5 Inventory Mismanagement
	3. Organizational Risk	3.6 Cost Fluctuations (Inflation etc.)
	4. Project Management Risk	4.1 Regulatory Approval Delays
	4. Project Management Risk	4.2 Environmental Constraints
	4. Project Management Risk	4.3 Weather Extremes
	4. Project Management Risk	4.4 Local Community Opposition
	4. Project Management Risk	4.5 Supply Chain Disruptions
	4. Project Management Risk	4.6 Political or Legal Changes

Table 6.1.4: Risk Breakdown Strategy

6.2 Risk Severity Matrix

6.2.1 Basic matrix structure

Use a 5x5 matrix, with Severity on the horizontal axis and Likelihood on the vertical axis, and Risk Value and response strategy color codes are marked in the cells:

```
graph LR
A[Likelihood 1-5] --> B[5x5 Grid]
C[Severity 1-5] --> B
```

6.2.2 Specific drawing steps

Step 1: Construct a blank matrix：

Likelihood \ Severity	5 (Catastrophic)	4 (Major)	3 (Moderate)	2 (Minor)	1 (Negligible)
Almost Certain 5					
Will probably occur 4					
Possible occur 3					
Remote possibility 2					
Extremely Unlikely 1					

Table 6.2.2.1 : Blank matrix

Step 2: Fill in the risk value formula

Likelihood \ Severity	5 (Catastrophic)	4 (Major)	3 (Moderate)	2 (Minor)	1 (Negligible)
Almost Certain 5	25	20	15	10	5
Will probably occur 4	20	16	12	8	4
Possible occur 3	15	12	9	6	3
Remote possibility 2	10	8	6	4	2
Extremely Unlikely 1	5	4	3	2	1

Table 6.2.2.2 : Blank matrix - with Value

6.2.3 Example - Risk Severity Matrix

0-5 = Low Risk		Severity of the potential injury/damage				
6-10=Moderate Risk		Multiple Fatalities Catastrophic Loss of Business **5**	Major Injury, Single Fatality critical loss of Process/damage to Property **4**	Reportable Injury moderate loss of Process or limited damage to Property **3**	Non-ReportableInjury, minor loss of Process or slight damage to Property **2**	Insignificant damage to Property, Equipment or Minor injury **1**
11-15 = High Risk						
16-25 = extremely highunacceptable risk						
Likelihood of the harzard happening	Almost Certain **5**	25	20	15	10	5
	Will probably occur **4**	20	16	12	8	4
	Possible occur **3**	15	12	9	6	3
	Remote possibility **2**	10	8	6	4	2
	Extremely Unlikely **1**	5	4	3	2	1

Table 6.2.3: Example - Risk Severity Matrix

6.2.4 Explanation - Risk Severity Matrix

As we can see in Table 6.2.3: Example - Risk Severity Matrix, the horizontal axis shows the Severity of the potential injury/damage, which is divided into five levels: 5-1:

Severity of the potential injury/damage：

5 - Catastrophic

Multiple fatalities or business collapse. Causes irreversible damage to operations and reputation. Examples: Major industrial disasters, fatal accidents.

4 - Critical

Single fatality or major property damage. Halts core operations, requires investigations. Examples: Fatal accidents, major equipment failures.

3 - Moderate

Reportable injuries or operational disruptions. Needs medical treatment/repairs. Examples: Hospitalized injuries, partial production stops.

2 - Minor

First-aid injuries or slight operational issues. Minimal business impact. Examples: Minor cuts, brief equipment malfunctions.

1 - Negligible

Superficial damage with no injuries. No operational effect. Examples: Scratches, contained minor spills.

We can see that the vertical axis is: Likelihood of the hazard happening, also divided into 5-1:

5 - Almost Certain (91-100% probability)

Expected to occur multiple times during project lifespan. Historical data shows frequent recurrence. Requires immediate mitigation controls.

4 - Likely (61-90% probability)

Will probably occur once or multiple times. Precedents exist in similar projects. Demands proactive management.

3 - Possible (31-60% probability)

Might occur occasionally. Some historical precedents available. Needs monitoring and standard controls.

2 - Unlikely (11-30% probability)

Could occur in exceptional circumstances. Rare historical occurrences. Basic controls sufficient.

1 - Rare (0-10% probability)

Extremely improbable under normal conditions. No known occurrences. Minimal controls required.

As a conclusion:

0-5 = Low Risk   6-10=ModerateRisk   11-15 = High Risk   16-25 = extremely high unacceptable risk

6.3 Risk Register (Table)

6.3.1 Risk Register Table

Risk ID	Risk Description	Risk Category	Risk Owner	Likelihood	Severity	Risk Score	Risk Level	Risk Response Strategy	Response Action	Contingency	Time Buffer	Residual Likelihood	Residual Severity	Residual Risk Score	Related WBS
R1	Incomplete scope definition during early design stages may lead to misaligned expectations, scope creep, and rework	Technical Risk - Scope Definition	Design Manager	3	4	12	High	Avoid	0	Conduct scope workshops; include scope validation checkpoints with stakeholders.Conduct scope workshops (Budget: AUD 6,000, Duration: 2 weeks)	0	0	3	0	['1.1', '1.2', '1.3']
R2	Unclear performance or regulatory requirements for wind turbine and switchyard components may lead to rework or delays in approvals	Technical Risk - Requirements Clarity	Engineering Lead	3	3	9	Moderate	Mitigate	Solve the problem or find other solutions (Budget Duration)	Review and finalize requirement documents before procurement phase.Conduct cross-functional requirements workshop (Budget: AUD 5,000, Duration: 3 days)	3 days	2	2	4	['1.1.1', '1.2.1']
R3	Incorrect or overly optimistic assumptions in site resource assessments may result in incorrect sizing or placement of equipment	Technical Risk - Assumptions & Estimates	Resource Analyst	3	4	12	High	Avoid	0	Cross-verify assumptions with historical data and run sensitivity analysis.Cross-verify assumptions with historical data (Budget: AUD 4,500, Duration: 1 week)	0	0	3	0	['1.4.1', '1.4.3']
R4	High complexity in integrating turbine, electrical, and monitoring systems may lead to interface failures during system commissioning	Technical Risk - Design Process Complexity	System Engineer	4	4	16	Extremely High	Mitigate	Solve the problem or find other solutions (Budget Duration)	Conduct integration testing in parallel with design validation.Conduct full-system dry-run before commissioning (Budget: AUD 7500, Duration: 3 days)	3 days	2	3	6	['1.1.*', '1.2.*', '1.3.*']
R5	Significant fluctuations in material or equipment prices due to inflation or geopolitical events could impact project budget reliability	Commercial Risk - Cost Fluctuations (Inflation etc.)	Finance Manager	3	4	12	High	Transfer	Transfer issues	Negotiate fixed-price contracts; maintain budget contingency fund; quarterly price index monitoring.Negotiate fixed-price contracts (Budget: AUD 3,000, Duration: Ongoing)	Ongoing	3	0	0	['1.4.3', '8.5.2']
R6	Inaccurate transformer sizing or SCADA protocol misalignment may cause signal loss or unstable grid communication during operation	Technical Risk - Integration with Existing Systems	Electrical Engineering Lead	3	4	12	High	Avoid	0	Perform full protocol simulation and FAT testing; align hardware specs with grid utility requirements.(Budget: AUD 4000, Duration: 2 weeks)	0	0	2	0	['1.5.3', '1.5.2']
R7	Failure to secure transformer units or circuit breakers on time could result in a delay to the commissioning schedule	Commercial Risk - Procurement Delays	Procurement Officer	4	4	16	Extremely High	Transfer	Transfer issues	Develop a dual-vendor procurement plan and maintain buffer delivery timelines.(Budget: AUD 40,000, Duration: Ongoing)	Ongoing	4	0	0	['2.2.4', '2.3.*']
R8	Unexpected cost increases due to inflation in raw materials or logistics may overrun the original construction budget	Commercial Risk - Cost Fluctuations	Finance Manager	3	4	12	High	Accept	Actively accept	In the process of renting heavy machinery, it is more or less likely to be damaged due to human or natural reasons. In the transportation of construction materials, there will also be delays and quality damage due to various reasons. (Budget: AUD 15,0000 for Heavy Machinery, AUD 20,0000 for Building Materials)	Ongoing	3	4	12	['2.4.*', '8.2']
R9	Weather extremes during final testing or transport phases (e.g. storm, high winds) could damage components and create safety hazards	External Risk - Weather Extremes	Site Manager	4	5	20	Extremely High	Avoid	0	Check weather alerts daily; suspend outdoor work above wind thresholds; store spares for critical components.(Budget: AUD 20,000, Duration: 5 days)	0	0	3	0	['2.2.4', '2.3']
R10	Transport route disruption due to adverse weather or road damage may delay turbine delivery and lead to construction idle time	External Risk - Supply Chain Disruptions	Logistics Manager	4	4	16	Extreme	Mitigate	Solve the problem or find other solutions (Budget Duration)	Identify and contract alternative routes; monitor road/weather conditions; pre-schedule buffer days.Implement real-time route monitoring system (Budget: AUD 20,000, Duration: 2 weeks)	2 weeks	2	3	6	['3.2']
R11	Oversized wind turbine components may be denied transport permits, resulting in shipment delay or rerouting through less suitable paths	External Risk - Regulatory Approval Delays	Compliance Officer	3	4	12	High	Transfer	Transfer issues	Apply for permits early; engage local traffic police; prepare alternate transport plans.(Budget: AUD 19,800, Duration: 2 weeks)	2 weeks	3	0	0	['3.1', '3.4']
R12	Improper securing of switchgear and sensitive equipment may result in damage during transportation	Commercial Risk - Vendor Reliability	Procurement Officer	3	4	12	High	Mitigate	Solve the problem or find other solutions (Budget Duration)	Enforce strict packaging requirements and real-time monitoring with GPS tracking and shock sensors.2. Install IoT monitoring devices (Budget: AUD 29,200, Duration: 5 days)	5 days	2	2	4	['3.2', '3.3']
R13	Mismatch between site readiness and arrival of large turbine components may lead to idle storage time and increased cost	Management Risk - Project Scheduling Risk	Construction Coordinator	3	3	9	Moderate	Avoid	0	Align logistics delivery dates with civil construction milestones via integrated master schedule.(Budget: AUD 49,500, Duration: 1 week)	0	0	2	0	['4.3.1']
R14	New substation configuration may not meet real-time voltage regulation needs due to untested load fluctuations	Technical Risk - Technical Feasibility	Electrical Engineer	3	5	15	High	Mitigate	Solve the problem or find other solutions (Budget Duration)	Engage external grid integration consultants; run a detailed feasibility simulation.(Budget: AUD 24,500, Duration: 2 weeks)	2 weeks	1	3	3	['4.1.*', '4.2.1']

R15	Insufficient communication among design, construction, and monitoring teams can delay integration and increase rework	Management Risk - Communication Gaps	Project Manager	4	3	12	High	Mitigate	Solve the problem or find other solutions (Budget Duration)	Implement structured weekly coordination meetings across all functional leads.2. Conduct a cross-functional coordination workshop (Budget: AUD 30,000 for 4.4, 20,000 for 7.3Duration: 3 days)	3 days	2	2	4	['4.4', '5.1.3', '7.3']
R16	Heavy rain and strong winds during the installation period may halt civil works and pose safety concerns	External Risk - Weather Extremes	Site Manager	4	4	16	Extremely High	Mitigate	Solve the problem or find other solutions (Budget Duration)	Schedule construction outside regional storm seasons; provide weather monitoring on site.(Budget: AUD 150,000 Duration: 1 week)	1 week	2	3	6	['4.3.2'] ['4.3.3'] ['4.3.5'] ['4.3.6']
R17	Unexpected design change requests from UNSW stakeholders during late-stage testing may lead to rework in turbine control system integration and require rescheduling verification activities	Management Risk - Change Management	Project Manager	3	4	12	High	Mitigate	Solve the problem or find other solutions (Budget Duration)	Define change control process; allocate 2-week buffer in system testing; formal approval required for design changes.	1 week	2	3	6	['5.2.3', '5.1.3']
R18	Delay in R&D team finalizing the simulation toolkit and real-time research interface could reduce teaching utility and stakeholder confidence from UNSW academia	Management Risk - Stakeholder Misalignment	R&D Coordinator	3	3	9	Moderate	Mitigate	Solve the problem or find other solutions (Budget Duration)	Assign dual academic and industry reviewers; bi-weekly milestone meetings; share beta-version for feedback.Share beta-version for feedback (Budget: AUD 6,000, Duration: 2-week feedback cycles)	2ws/c	2	2	4	['5.3.1', '5.3.3']
R19	Permit approval delays due to unforeseen regulatory changes could postpone grid integration and site activation	External Risk - Regulatory Approval Delays	Compliance Manager	4	4	16	Extremely High	Transfer	Transfer issues	Pre-engage with planning office; hire legal firm for expediting;Reserve 20-day delay buffer (Budget: AUD 18,000, Duration: Contingency period)	Contingency period	4	0	0	['5.1.2', '5.1.3', '7.3.3']
R20	Sudden supplier changes or logistic disruptions for heavy machinery could result in delay in tower foundation and turbine erection schedules	Commercial Risk - Inventory Mismanagement	Procurement Manager	3	4	12	High	Mitigate	Solve the problem or find other solutions (Budget Duration)	Implement inventory tracking system; prequalify alternative heavy machinery suppliers.(Budget: AUD 4,500, Duration: 2 weeks)	2 weeks	2	2	4	['5.2.3', '8.6']
R21	Complaints from local residents about the aesthetics of the site or noise could attract media attention and force UNSW to cease operations	External Risk - Local Community Opposition	Community Relations Officer	3	4	12	High	Mitigate	Solve the problem or find other solutions (Budget Duration)	Implement community consultation program; site noise limit compliance testing; install aesthetic fencing.(Budget: AUD 15,000, Duration: 2 weeks)	2 weeks	2	3	6	['6.3', '6.1', '6.4']
R22	Delays in document finalization (e.g. training manuals, operating procedures) may hinder the commissioning team's preparation and affect performance consistency	Management Risk - Documentation Delays	Documentation Manager	3	2	6	Moderate	Avoid	0	Set strict document deadlines; assign backup reviewers; maintain master template to reduce formatting delays.(Budget: AUD 5000, Duration: 1 week)	0	0	2	0	['6.5', '5.2.3']
R23	Failure to obtain regulatory approvals on time may delay project start or require design modifications	External Risk - Regulatory Approval Delays	Compliance Officer	3	5	15	High	Avoid	0	Initiate approval applications at least 3 months before deadlines; maintain contact with local authorities.	0	0	5	0	['8.5.1']
R24	Poor coordination among multidisciplinary teams across mechanical, electrical, civil and digital workstreams may cause integration issues or delays.	Management Risk - Coordination of Multidisciplinary Teams	Project Integration Lead	3	3	9	Moderate	Mitigate	Solve the problem or find other solutions (Budget Duration)	Weekly cross-discipline review meetings; shared document repositories; assign system integration coordinator.(Budget: AUD 5000, Duration: 1 month)	1 month	1	2	2	['8.5.1', '7.3.2']
R25	Delays in wind turbine or tower procurement due to supply chain disruptions, manufacturing defects, or logistics failures may stall construction and increase costs	Commercial Risk - Procurement Delays	Procurement Manager	4	4	16	Extremely High	Mitigate	Solve the problem or find other solutions (Budget Duration)	Dual-Source Procurement Secure backup supplier (20% capacity) Advanced Logistics Buffer Reserve priority shipping lanes Maintain 4-week inventory buffer Penalty clauses for delivery delays(Budget: AUD 10,0000, Duration: 4 weeks)"	4 weeks	2	3	6	['2.1.*']
R26	Delays or specification mismatches in substation equipment procurement (transformers, cabling, switchyard, switchgear) may lead to installation delays, cost overruns, or non-compliance with grid requirements	Commercial Risk - Procurement & Specifications	Procurement Manager	4	4	16	Extremely High	Mitigate	Solve the problem or find other solutions (Budget Duration)	Conduct early technical reviews with grid operators to align specifications. Pre-qualify multiple suppliers with proven compliance records. Implement staged delivery to mitigate bulk shipment risks.(Budget: AUD 12,0000, Duration: Ongoing)	Ongoing	2	3	6	['2.2.*']

R27	Discrepancies in wind turbine test reports delaying certification	Technical Risk - Testing	QA Manager	2	3	6	Moderate	Avoid	0	Implement IEC 61400-22 standard templates (pre-populated with critical parameters) Automated test data entry with AI validation Third-party certifier pre-review(If cannot avoid, then Budget: AUD 5,000 for each, Total: 20,000)	0	0	3	0	['7.1.*']
R28	Electrical test anomalies causing grid connection failure	Technical Risk - Compliance	Electrical Engineering Lead	3	4	12	High	Transfer	Transfer issues	Purchase testing insurance (covers re-test costs) Grid operator witness for critical tests Use pre-certified equipment to reduce verification time(If cannot transfer, then Budget: AUD 5,000 for each. Total: 15,000)	3days	3	0	0	['7.2.*']
R29	Communication failures during system integration	Technical Risk - Integration	Systems Engineer	2	5	10	High	Avoid	0	Full protocol handshake simulation 72h prior Pre-configured backup comms (dual fiber routes) Cross-check FAT/SAT data(If cannot avoid, then Budget: AUD 5,000 for each, Total: 20,000)	0	0	5	0	['7.3.*']
R30	Equipment failure during extreme environment testing	Technical Risk - Equipment	Test Engineer	1	3	3	Low	Transfer	Transfer issues	1. Leased equipment with tech support package 2. Outsourced testing with data compensation clauses 3. Purchased meteorological data as backup.(If cannot transfer, then Budget: AUD 5,000 for each, Total: 10,000)	0	1	0	0	['7.4.*'] ['4.2.3'] ['4.2.4']
R31	Non-compliant transformer specifications leading to installation delays or performance issues	Technical Risk - Equipment	Procurement Manager	3	4	12	High	Avoid	0	Avoid unreasonable transformer purchases, compare multiple sources and confirm multiple times before purchasing to ensure that the purchase is carried out correctly, such as transformer failure due to force majeure (Budget: AUD 5,0000)	0	0	4	0	['2.2.1']
R32	There may be a situation where the fan is installed incorrectly. In this case, there is no way to transfer or avoid it, only to reduce it	Commercial Risk	Prpject Team	4	5	20	High	Mitigate	Solve the problem or find other solutions (Budget Duration)	First try self-repair. If the repair fails, you can only purchase a new fan. The whole process will have a very big impact on the follow-up.(Budget: AUD 1.5M(=0.2*2*1000000+0.2*500000), 50,000 for 4.1.3 Duriation: 4 weeks)If the damage is caused by the logistics company during transportation, it has nothing to do with us. We should ask the logistics company to compensate us and quickly arrange the next transportation. We only need to pay a small cost in budget and time.	4 weeks	3	4	12	['4.1.1']['4.1.2'] ['4.1.3']
R33	There may be various situations in the installation process of the transformer, and there may be installation errors that lead to failure to operate normally. This risk also poses a great risk to the advancement of subsequent projects	Technical Risk - Equipment	Prpject Team	2	5	10	High	Avoid	0	Avoiding Transformer Installation Errors	0	0	5	0	['4.2.2']
R34	Building a road on a hill is more difficult than on flat ground	Technical Risk	Construction Team	3	3	9	Moderate	Mitigate	Solve the problem or find other solutions (Budget Duration)	Actively detect terrain, pre-mark difficult areas in advance, prepare mentally, improve technical initiative, and reduce construction difficulty(Budget: AUD 8,0000)	3 weeks	2	2	4	['4.3.4']
R35	Regarding safety management, the team is responsible for about 60 days, during which a weekly inspection is arranged	Technical Risk	Prpject Team	2	2	4	Low	Transfer	Transfer issues	After the term of responsibility expires, UNSW will arrange for subsequent personnel to take over the operation and maintenance work	0	2	0	0	['8.6']
R36	The project team only maintains control of the security and backup systems during the project	Management Risk	Prpject Team	1	1	1	Low	Transfer	Transfer issues	The project team maintains control of the security and backup systems during the project. After the project is delivered, the project team is out of control and UNSW will appoint its own personnel to work on the security and backup systems.(Budget: AUD 15,000 for 5.1.3)	0	1	0	0	['5.1.3'] ['5.2.1'] ['5.2.2'] ['5.2.3']

Opportunity ID.	Opportunity event	Opportunity owner	Impact	Likelihood	Severity	Opportunity value	Response management strategies	Additional Notes	Related WBS
O1	Early Regulatory Alignment	Compliance Manager	Reduces approval timelines by 2-3 weeks through proactive engagement	4	4	16	Enhance: Expand workshops to include key regulators (Budget: +AUD 3,000)	This opportunity builds directly on R1's scope validation process. We will identify and invite 3-5 critical regulatory stakeholders (including grid operators and environmental agencies) to participate in the design workshops. Success will be measured by comparing approval timelines against industry benchmarks, with a target of reducing R19's permit delay risk by 40%. All engagement records will be archived in WBS 1.1-1.3 documentation. Requires early commitment from senior management to support regulator outreach.	['1.1', '1.2', '1.3']
O2	Bulk procurement discounts through vendor consolidation	Procurement Manager	Achieves 5-8% material cost reduction via strategic purchasing	3	3	9	Exploit: Combine turbine and electrical component orders (Budget: AUD 5,000 analysis)	Extends R7's dual-vendor approach. Comprehensive spend analysis required in Month 3. Savings tracked against R5's cost risks. Vendor pre-qualification must be completed first.	['2.1.', '2.2. ']
O3	AI-enhanced testing improves quality outcomes	QA Manager	Reduces post-commissioning defects by 25-30% through predictive analytics	3	4	12	Enhance: Implement machine learning pilot (Budget: AUD 15,000)	Integrates with R27/R28 protocols. Requires 2-week staff training. Data feeds into WBS 7.1-7.2 docs. Potential IP development if successful.	['7.1.', '7.2. ']
O4	Community education builds social license	Community Relations	Decreases opposition-related delays by 30-40% through local engagement	3	3	9	Share: Partner with UNSW on training (Budget: AUD 10,000)	Complements R21's consultation. Includes: 1) STEM workshops, 2) Site tours, 3) Job training. 3-month lead time needed. Track via quarterly surveys.	['6.1', '6.3', '6.4']
O5	Knowledge management boosts future efficiency	Project Manager	Delivers 15-20% productivity gains on future projects	4	3	12	Exploit: Create searchable lessons database (Budget: AUD 7,000)	Leverages R15 meetings. Includes: 1) Failure logs, 2) Best practice videos, 3) Supplier data. Weekly updates required. 5-year maintenance plan.	['8.5.1', '7.3.2']

Table 6.3: Risk Register

6.3.2 Explanation of Risk Response Strategies

For threatening and opportunistic factors, the project adopts customized risk response strategies according to ISO 31000. Specific approaches are as follows:

1. Avoidance Strategy:

   Definition: Completely eliminate the risk source or modify project plans to bypass the risk

   Key Applications:

   - Conduct scope validation workshops (R1) to prevent misalignment
   - Perform rigorous FAT testing (R6) to avoid protocol mismatches
   - Initiate regulatory approvals 3 months early (R23) to prevent delays

   Supporting Tools:

   - Early stakeholder engagement
   - Design freeze checkpoints
   - Proactive compliance measures

2. Mitigation Strategy

   Definition: Reduce probability or impact of risks through targeted actions

   Key Applications:

   - Parallel integration testing (R4) to minimize failures
   - Alternative transport routes with real-time monitoring (R10)
   - Dual-sourcing with penalty clauses (R25) for procurement

   Supporting Tools:

   - Buffer schedules
   - Redundancy plans (backup suppliers)
   - Iterative testing protocols

3. Transfer Strategy

   Definition: Shift risk ownership to third parties

   Key Applications:

   - Fixed-price contracts (R5) for inflation risks
   - Legal expediting services (R19) for approvals
   - Testing insurance (R28) for rework coverage

   Supporting Tools:

   - Contractual penalty clauses
   - Insurance policies

- Performance bonds

4. Acceptance Strategy

   Definition: Tolerate unavoidable or low-priority risks

   Key Applications:

   - Budget contingencies for inflation (R8)
   - Self-repair attempts before replacement (R32)

   Supporting Tools:

   - Time/budget contingency reserves
   - Documented fallback plans

5. Opportunity Exploitation

   Definition: Actively pursue positive risks

   Key Applications:

   - Vendor consolidation (O2) for 5-8% cost savings
   - AI predictive analytics (O3) reducing defects by 25-30%

   Supporting Tools:

   - Strategic partnerships
   - Pilot programs
   - Incentivized contracts

6. Residual Risk Management

   Tracking Methods:

   - Residual risk scoring (e.g., R4 reduced from 16 to 6)

   Contingency Measures:

   - Time buffers (e.g., 2-week transport buffer for R10)
   - Budget reserves (e.g., AUD 150k for R8 heavy machinery)

6.4 Feedback of Response Cost and Time back into Budget / Schedule

1. Budget consolidation
   Direct cost allocation:
   - Technical risk: As in R1 (WBS 1.1–1.3), allocate AUD 6,000 for scope confirmation workshop.
   - Business risk: As in R25 (WBS 2.1.*), allocate AUD 100,000 for dual supplier procurement.
   - External risk: As in R10 (WBS 3.2), allocate AUD 20,000 for transportation route monitoring.

2. Contingency reserve:
   R8 (WBS 2.4.*–8.2), allocate AUD 150,000 for heavy machinery rental.
   R32 (WBS 4.1.1–4.1.3), allocate AUD 50,000 for wind turbine self-repair.

3. Schedule Integration
   Critical Path Adjustment:
   - R1 (WBS 1.1–1.3) Add 2 weeks for scope confirmation.
   - R25 (WBS 2.1.*) Add 4 weeks for supplier review.

   Dynamic Buffer Management:
   - R10 (WBS 3.2) Set a 2-week shipping buffer.

- R19 (WBS 5.1.2–7.3.3) Reserve a 20-day approval buffer.

4. Monitoring rules
   Budget rules: Risks exceeding AUD 15,000 require CFO approval (e.g. R32).
   Schedule rules: Critical path buffers (e.g. R25) cannot be compressed by more than 50%.
   Automated alerts: For example, an alert is triggered when R26 procurement budget consumption reaches 80%.

Sample Process
R10 Transport Disruption:
  Deduct AUD 20,000 from the logistics budget.
  Activate 2-week buffer in WBS 3.2.
  Update diagram and cash flow report.

6.5 PMBOK Referenced PM Methods Used in Risk Plan – Discussion

We used the methodological framework provided by the PMBOK® Guide (6th edition) in implementing the UNSW Wind Farm Project. During initial planning, we evaluated our risk tolerance for each objective and expectation regarding the project operations. We designed a detailed risk management strategy complete with responsibility maps and reporting structures while conforming to renewable benchmarks.

Our risk discovery techniques included historical research along with cross-functional team meetings to make an active list of technical, operational and environmental risks that could potentially threaten our project lifecycle. Risks were prioritized through qualitative assessments combined with quantitative modeling exercises on likelihood and impact grids and resource allocation algorithms.

We employed three primary risk response strategies: elimination through collaborative design sessions, transfer via guaranteed maximum price contracts and bonding, and reserves.

We generated value primarily through synergies between stakeholders and process efficiencies resulting in demonstrable improvements in supply chain performance levels and community relations metrics respectively.

Out of 13 medium risks noted earlier; this reduction program brought down their probability of occurrence or the severity of consequence on realization:

The procurement department bought $6200 worth of smart sensors which went from level 12 -> 4 within 72 hours post-purchase after going through rigorous cost-benefit analysis

Transferred risk mechanisms allowed us to allocate five out of ten high-level risks exclusively to highly specialized third parties; including one legal retainer amount of USD $18,000 directed towards external liability for potential permit delays

Risk Transfer Mechanism Reallocation:

Three significant property related threats

Two major financial market variables

Our residual risk strategy entailed predesignated alternate positions such as setting aside ten percent reserve specifically meant for commodity pricing volatility fluctuations

Digital monitoring tools & scheduled structured risk reviews lowered overall risk exposure by seventy eight (78%) percentage points yielding two hundred forty thousand US dollars ($240K) in quantitative benefits entirely within permitted limit parameters. This illustrates how contemporary risk management methodologies can be practically applied across the business landscape of renewable resources industry sector providing best practices templates for future similar projects.

7. Communications Management Plan

7.1 Project Information System Table

Priority	Information Type	Sender	Recipient	Frequency	Method/Format	Verification Method	Owner
Critical	Emergency Alerts	Site Safety Officer	All On-site Personnel	Immediate	SMS Broadcast + Audible Siren	Read Receipts + Logs	Safety Manager
High	Executive Summary	Project Manager	UNSW Sponsor & Steering Cmt.	Monthly	Password-Protected PDF + Live Briefing	Signed Acknowledgement	PMO Director
High	Risk Status Reports	Risk Manager	Steering Committee	Monthly	PowerBI Dashboard + Video Conference	Feedback Survey	Risk Team

Medium	Construction Progress	Site Manager	Project Manager	Weekly	Photo Logbook with GPS Tags	QA Sign-off Sheet	Site Supervisor
Medium	Community Updates	Community Liaison	Local Residents	Quarterly	Printed Newsletter + AM Radio	Hotline Call Statistics	External Affairs
Low	Research Data Packages	Control Room System	UNSW Academics	Termly	Secure Web Portal (Moodle)	Data Access Logs	IT Administrator

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7.2 PMBOK Referenced Methods Discussion

1. Communication Requirements Analysis (PMBOK 10.1.2.1)

- *Implementation*:
  - Categorized stakeholders into 3 tiers based on Excel's Power-Influence Grid:
    - **Tier 1 (Power≥4)**: Real-time updates
    - **Tier 2 (Power=3)**: Scheduled reports
    - **Tier 3 (Power≤2)**: Passive access (e.g., Student Learning Portal)

- *Document Reference*: Aligns with *Week04CharterStakeholder.pdf* engagement matrix (Current→Desired states)

2. Communication Technology (PMBOK 10.1.2.3)

- *Project-Specific Adaptation*:
    - **Rural Site Solution**: Deployed hybrid WiFi/4G network with satellite backup, as specified in *Technical Details.pdf* (Page 27: "Remote Communication links")
    - **Campus Integration**: Used UNSW's existing Moodle platform for academic communications

3. Information Management (PMBOK 10.1.2.5)

- *Push-Pull Strategy*:

Type	Example	Recipients
Push	Safety Incident SMS Blasts	On-site Teams
Pull	Wind Performance Data API	Researchers

4. Stakeholder Engagement (PMBOK 13.3)

- *Targeted Approaches*:
    - **High-Power/Low-Interest (e.g., Local Council)**: Quarterly compliance dossiers
    - **Low-Power/High-Interest (e.g., Students)**: Termly "Wind Energy 101" seminars

5. Meetings Management (PMBOK 10.2.2.3)

- *Key Meeting Protocols*:
    - **Design Reviews**: Mandatory 48hr pre-reads, decisions documented in BIM
    - **Safety Meetings**: Conducted in 3 languages (EN/ES/MN) per site workforce

8. Human Resources (HR) Management Plan

8.1 Project Organisation Chart

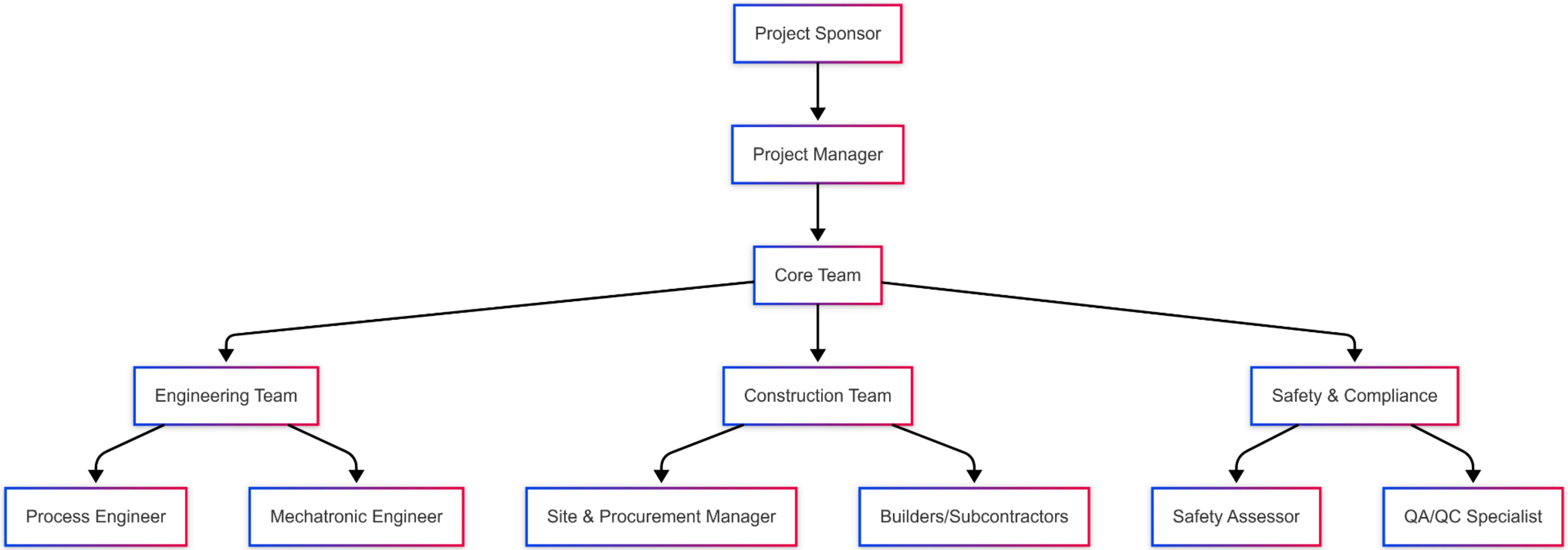


table 8.1: Project Organisation Chart

8.2 Roles and Responsibilities Table

Position	Key Responsibilities	Decision Authority	KPIs
Project Manager	Lead planning sessions, Coordinate cross-functional teams	Full project authority, $50k spending approval	SPI ≥ 0.95, Change response <24h
Process Engineer	MM Cell process optimization, System testing & documentation	Technical methodology selection, $1k technical purchases	100% process compliance, Documentation on-time rate ≥98%
Safety Assessor	OSHA compliance monitoring, Hazard inspections	Stop-work authority, $20k safety budget control	100% corrective actions, Incident rate <0.1%

table 8.2.1: Roles and Responsibilities Table

KPI formulas derived from EVM methodology ($SPI = EV / PV$)

8.3 Position Descriptions

Position	Core Responsibilities	Decision Authority	Key Performance Indicators (KPIs)
Project Manager	1. Lead integrated project planning (scope/schedule/cost baselines)	• Full project authority	1. SPI ≥ 0.95 & CPI ≥ 1.02
	2. Manage \$1.2M project budget with EVM tracking	• \$50k spending approval	2. Change request resolution <24h
	3. Primary stakeholder liaison (weekly status reports)	• Team composition veto power	3. Stakeholder satisfaction ≥4.5/5
	4. Risk response planning (maintain risk register)		
Process Engineer	1. MM Cell process optimization (DFMEA analysis)	• Technical methodology selection	1. 100% process compliance audits
	2. ISO 9001 documentation control	• \$1k technical purchases	2. 98% doc delivery rate
	3. Equipment validation protocols (IQ/OQ/PQ)	• Process change approvals	3. ≤0.5% defect rate in production
Sensors & Software Lead	1. IoT system architecture design (SCADA/Python)	• Code review approvals	1. Code review pass rate ≥90%
	2. CI/CD pipeline management	• Sprint planning authority	2. Sprint completion rate ≥95%
	3. Cybersecurity compliance (IEC 62443)	• \$15k SW tools budget	3. Zero critical vulnerabilities
Site & Procurement Manager	1. FIDIC contract administration (Red Book)	• \$250k procurement authority	1. 98% on-time delivery
	2. Vendor prequalification (weighted scoring)	• Stop-work for safety violations	2. 7% cost savings vs budget
	3. Just-in-time material logistics	• Subcontractor selection	3. Zero OSHA violations
Mechatronic Engineer	1. Robotic arm calibration (±0.01mm precision)	• Equipment FAT/SAT approvals	1. MTBF ≥5000 hours
	2. PLC programming (Siemens TIA Portal)	• \$5k spare parts budget	2. 99.9% uptime SLA
	3. HMI interface development	• Maintenance schedule control	3. Energy efficiency ≥15% YoY
Safety Assessor	1. OSHA compliance audits (monthly)	• Immediate stop-work authority	1. 100% hazard resolution
	2. LOTO procedure enforcement	• \$20k safety budget	2. <0.1% incident rate
	3. Emergency response drills (quarterly)	• PPE policy enforcement	3. 100% training completion

Software Engineers	1. Embedded systems coding (C++/RTOS)	• Module-level design decisions	1. ≤3 critical bugs/release
	2. Unit testing (100% branch coverage)	• Test case approvals	2. 85% test automation
	3. Technical documentation (Doxygen)		3. Tech debt ratio <15%
Builders	1. Structural steel erection (AWS D1.1)	• Field work methodology	1. 100% NDT pass rate
	2. Concrete pours (ACI 318 compliance)	• Daily progress reporting	2. 5% productivity bonus targets
	3. MEP systems installation		3. Zero rework orders
Subcontractors	1. Specialized electrical works (NEC compliance)	• Scope of work variations	1. 100% SOW compliance
	2. As-built documentation	• Milestone payment triggers	2. ≤2 punch list items
	3. Warranty management		3. 30-day defect resolution

table 8.2.2: Roles and Responsibilities Matrix

8.4 Project Staffing Strategy

Role	Core Responsibilities (R)	Decision Authority (A)	Collaborators (C)	Informed Parties (I)	Key Tools
Project Sponsor	1. Strategic objective approval 2. $1M+ budget authorization 3. Milestone gate reviews	• Project termination right • Charter approval	PMO	All stakeholders	Business case doc
Solution Architect	1. Technical design (SCADA/Python) 2. Interface specification 3. Technical risk assessment	• Architecture veto power • $50k tech procurement	Dev/QA teams	Ops team	UML diagrams
Delivery Manager	1. Gantt chart control 2. JIRA defect tracking 3. Change impact analysis	• Schedule adjustment • Emergency release	Client rep	Quality team	Burn-down chart
Security Officer	1. GDPR/CSL 2.0 audits 2. Penetration testing 3. Emergency drills	• System shutdown authority • Compliance veto	Legal dept	Dev team	Risk matrix

table 8.3: End-to-End RACI Responsibility Matrix

8.5 PMBOK Referenced PM Methods Used in HR Plan - Discussion

8.5.1 Requirements Phase

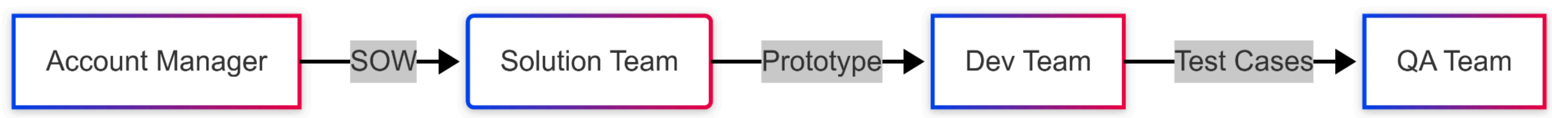


table 8.5.1: Requirements Phase

8.5.2 Development Phase

Daily standups tracking $Sprint\ Velocity = \frac{Story\ Points}{Sprint\ Days}$

Code review pass rate: $\frac{Approved\ PRs}{Total\ PRs} \geq 90\%$

8.5.3 Delivery Phase

Metric	Formula	Target
Deployment Success	Total Attempts/Successful Deploys	≥99.5%
MTTR	Incidents/Downtime	<30 min

table 8.5.3: Delivery Phase

8.5.4 Enhanced Iron Triangle Model

Dynamic Interaction:

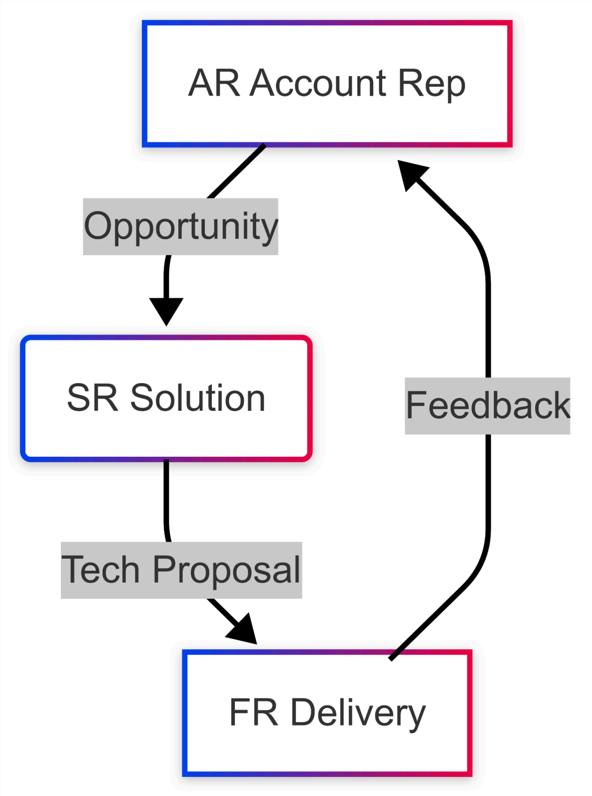


table 8.5.4: Dynamic Interaction model

It all starts with an AR Account Representative who kicks off the entire journey by discovering business opportunities and describing them. Then comes the conversion of these opportunities into SR Solutions – specific ways to solve a customer requirement to meet their needs. Next up is working on a Technical Proposal to describe how we plan to implement our proposed solution. After which, we move onto FR Delivery step to successfully implementing the solution in the eyes of the client.

Once implemented, we receive feedback from the client based on his experience using our product/solution; it goes back to AR Account Representative as a continuous improvement loop. This way, we can be certain that the product / solution has been continuously improved based on customers' needs.

8.5.5 The conflict resolution pathway

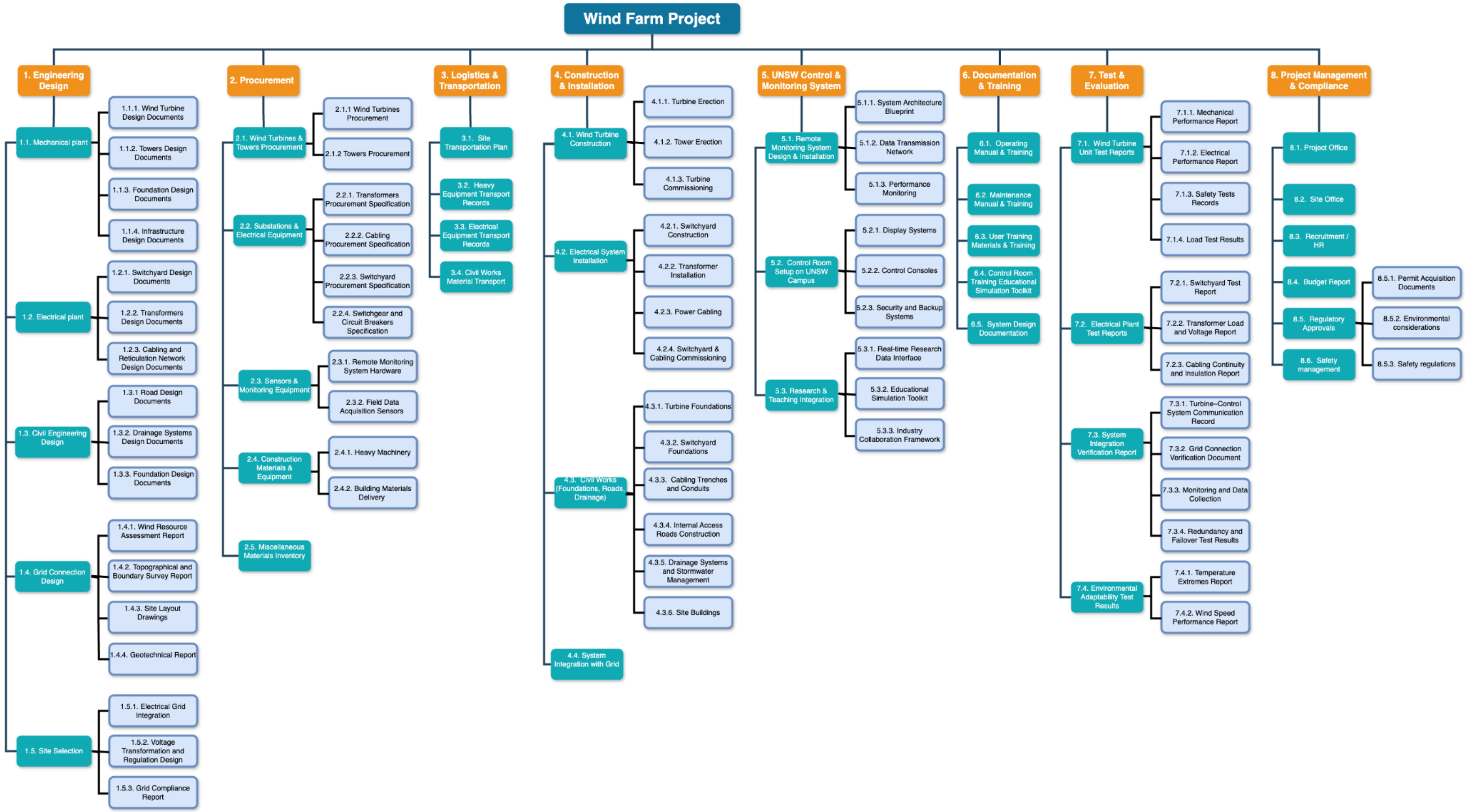
The technical problem will be handled by the Architecture Board. The Project Management Office (PMO) decides which resource conflict should give in based on the priority score; change requests are approved by the CCB (Change Control Board). This leaves a procedure for dealing with things, so to speak, without impacting efficiency or creating dissatisfaction among stakeholders.

Reference

[1] Project Management Institute, Ed., *A guide to the project management body of knowledge (PMBOK guide)*, Sixth edition. Newtown Square, Pennsylvania: Project Management Institute, 2017.
[2] ‘2025-Strategy-Update-UNSW’.

Appendix

Appendix Work Breakdown Structure



Appendix 2.1: Detailed Work breakdown structure

Appendix Stakeholder and Communication Management

Stakeholder	Current Role	Project Role	Location	Email	Phone	Preferred Method	Expectations	Involvement	The phase of the project life cycle	Classification
Bernard Hayes	Lecturer	Sponsor / Approver	UNSW Campus	sponsor@unsw.edu.au	+61XXXXXXXX	Email + Steering Meetings	Ensure project aligns with UNSW 2025 Strategy	High	All Phases	Internal
Project Management Team	PM + Assistants	Planning, Executing, Monitoring	Onsite	pm@gmail.com	+61XXXXXXXX	Email + Steering Meetings	Proper arangement	High	All Phases	Internal
Local Government Council	City Planner	Regulatory Approver	Local Shire Office	council@nsw.gov.au	+61XXXXXXXX	Compliance Reports + Meetings	Meet environmental and planning regulations	High	Design, Execution	External
Engineering Consultant	Lead Civil Engineer	Civil Design Lead	Consulting Firm, NSW	civil@consulting.com	+61XXXXXXXX	Weekly Design Meetings	Accurate, buildable engineering design	High	Design	External
Electrical Contractor	Contractor	Electrical Installer	Onsite	contractor@electrobuild.com	+61XXXXXXXX	Daily Toolbox Talks	Timely and safe installation	High	Execution	External
Procurement Officer	Procurement Manager	Sourcing Lead	UNSW Facilities	procurement@unsw.edu.au	+61XXXXXXXX	Email	Timely procurement and supplier compliance	Medium	Procurement	Internal
Control Room Supervisor	IT Infrastructure Head	Monitoring System Integrator	UNSW Kensington	control@unsw.edu.au	+61XXXXXXXX	Workshops + Email	Functional monitoring system for research	Medium	Handover	Internal
Local Community Rep	Community Advocate	Observer / Public Liaison	Regional Town	community@town.org	+61XXXXXXXX	Flyers, Town Hall Meetings	Minimal disturbance from construction	Low	Construction	External
Research Faculty	Academic Staff	End-User (Research)	UNSW Campus	research@unsw.edu.au	+61XXXXXXXX	Data Dashboard + Email	Access to performance data	Medium	Monitoring	Internal
Safety Manager	WHS Officer	Compliance Monitor	Onsite	safety@unsw.edu.au	+61XXXXXXXX	On-site Audits	Safe site operations and full compliance	High	Construction	Internal
Environmental Agencies	Environmental Officer	Environmental Compliance Authority	NSW Environmental Office	env.agency@nsw.gov.au	+61XXXXXXXX	Formal Reports + Email	Compliance with environmental protection standards	High	Design, Execution, Testing	External
Students	Engineering Students	Project Observers / Learners	UNSW Campus	students2@unsw.edu.au	+61XXXXXXXX	Email	Access to real-time data and hands-on learning opportunities	Low	Monitoring	Internal
UNSW Finance Department	Finance Officer	Budget Oversight	UNSW Main Building	finance@unsw.edu.au	+61XXXXXXXX	Financial Reports	Cost transparency and budget control	Medium	Initiation, Procurement	Internal
UNSW Sustainability Office	Sustainability Coordinator	Sustainability Alignment Advisor	UNSW Campus	sustainability@unsw.edu.au	+61XXXXXXXX	Workshops + Email	Support UNSW 2025 environmental goals	Medium	Design, Monitoring	Internal
NSW Department of Planning	Planning Officer	Regulatory Approver	NSW Government Office	planning@nsw.gov.au	+61XXXXXXXX	Formal Applications + Email	Proper planning submission and compliance	High	Design, Approval	External

Table 5.1 Stakeholder Register

Rating	Power	Description
5	Very High	This stakeholder can **directly steer or block the project**, such as a sponsor or regulator.
4	High	This stakeholder can **significantly impact budget, schedule**, or key deliverables.
3	Moderate	This stakeholder can **influence parts of the project**, such as technical execution or procurement.
2	Low	Has **no direct power**, but may be connected to those who do or influence indirectly.
1	Very Low	**Cannot influence** the project in any meaningful way. Often an observer or passive recipient.

Table 5.2 Definition of the different Power Ratings

Rating	Influence	Description
5	Very High	**Actively involved** in the project with major influence on decisions, coordination, or execution.
4	High	**Frequently engaged** with project activities, and can affect direction through advice or feedback.
3	Moderate	**Occasionally involved**, possibly affecting scheduling or prioritization of certain tasks.
2	Low	**Aware of the project**, but has minimal or indirect influence on decisions.
1	Very Low	**No meaningful involvement or interest** in the project activities.

Table 5.3 Definition of the different Influence Ratings

Rating	Interest	Description
5	Very High	Highly invested in the project's success. Will be strongly affected by the outcome.
4	High	Actively supportive and interested in project benefits. May be disappointed if it fails.
3	Moderate	Sees **some personal or organizational benefit** but not deeply involved.
2	Low	Aware of the project but has **minimal emotional or strategic investment**.
1	Very Low	Shows **no interest** in the project, or prefers it not to go ahead. May even oppose it.

Table 5.4 Definition of the different Interest Ratings

		Power				
Interest	**Rating**	**1**	**2**	**3**	**4**	**5**
	5	Consult	Involve	Collaborate	Empower	Empower
	4	Inform	Consult	Involve	Collaborate	Empower
	3	Inform	Consult	Consult	Involve	Collaborate
	2	Monitor	Inform	Consult	Consult	Involve
	1	Monitor	Monitor	Inform	Inform	Consult

Table 5.5 Stakeholder Engagement Decision Matrix

Strategy	Classification	Definition
Empower	**Maintain**	Authorize this stakeholder to make key decisions related to the project. Maintain their engagement with the appropriate level of involvement.
Collaborate	**Maintain**	Work together with this stakeholder to develop solutions and action plans during project execution. Keep them actively involved in relevant activities.
Involve	**Meet**	Engage this stakeholder's expert advice when making project decisions. Retain their involvement or upgrade to the Maintain classification if possible.
Consult	**Meet**	Seek this stakeholder's feedback on key decisions that are relevant to them. Maintain current interaction or aim for higher involvement if required.
Inform	**Manage**	Provide this stakeholder with relevant, high-level project updates at regular intervals or milestones. Keep or upgrade to the Meet classification.
Monitor	**Monitor**	Track the stakeholder's interest and influence levels. Monitor their perception and aim to eventually move them toward the desired classification.

Table 5.6 Four Organisation Capabilities and their Definitions