QUANTIL

Probabilistic risk & project management

MANAGEMENT REPORT

Schedule Risk Analysis

Hollin Sands Wind Phase 2: probabilistic finish-date analysis

Project	Hollin Sands Wind Phase 2
Client	Project Board
Project ID	HSW-PHASE2-2026
Analysis	Monte Carlo (10,000 iterations), 45 activities, 25 risks
Commitment level	P80
Prepared by	Generated with the Quantil Schedule Risk Analyzer Pro
Date	8 November 2026
Reference	QNT-SRA-20261108 | package 2.1
Classification	Public sample

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1. Executive summary

This analysis quantifies the schedule uncertainty of the project with a Monte Carlo simulation on the full CPM network: 45 activities, 57 logic relations and 25 mapped risks, simulated 10,000 times. Where a deterministic plan shows a single finish date, this analysis shows the full range of plausible finish dates with their probability.

10 May 2029	21 Jul 2029	29 Aug 2029
P50 finish (most likely)	P80 finish (recommended commitment)	P90 finish (conservative)

26 Oct 2028	+268 d	Stable
Deterministic finish (Dml only)	Schedule contingency to P80	Simulation convergence

What these dates mean: the P80 date (21 Jul 2029) is the date the project finishes on or before in 8 out of 10 simulated futures. Committing to it leaves a 2-in-10 chance of overrun, the level that AACE practice considers a defensible external commitment. The P50 date is a coin flip: half of the futures finish later. The deterministic date (26 Oct 2028) assumes every activity hits its most-likely duration and no risk occurs at all; the simulation shows that virtually no future is that kind.

The deterministic plan finishes on 26 Oct 2028. Sampling the duration uncertainty and the mapped risks moves the realistic commitment date to 21 Jul 2029 (P80): a gap of 268 calendar days that is invisible in the deterministic plan. The mean finish delay across all futures is 198 days, with a standard deviation of 83 days. Mean and median delay are close together, so the distribution is fairly symmetric: upside and downside around the expected outcome are of comparable size.

Decision point: the current target finish (30 Jun 2028) lies 386 days before the P80 date. Holding the target as an external commitment means accepting materially more than a 20% overrun probability. The realistic choices are: move the commitment to P80, buy the gap down with the mitigations in section 7, or change scope or logic, and that trade-off is exactly what this report puts on the table.

> **Recommendation:** commit externally at P80 (21 Jul 2029), hold the 268-day gap to the deterministic date as explicit schedule contingency, and focus mitigation on the top criticality and risk drivers in sections 4 and 5. Re-run the analysis at every phase gate.

2. Approach in brief

Each iteration samples every activity duration from its three-point estimate (Beta-PERT), samples which risks occur (Bernoulli) and how large their impact is (three-point), adds those impacts to the mapped activities, and recomputes the full CPM network, including FS/SS/FF/SF logic, lags and working-day calendars with holidays. The distribution of the resulting finish dates is the basis for every figure in this report. The method follows AACE 57R-09 and ISO 31000.

In plain terms: the project was played out 10,000 times. In some futures risks stayed away and work ran fast; in others estimates ran long and risks hit the critical path. No single future is a prediction, but together they show which finish dates are realistic, which are optimistic, and which activities and risks decide the difference.

Reproducible: the simulation ran with a fixed seed (20260421). Re-running with the same inputs reproduces these results exactly, so every figure in this report can be audited. An independent computational verification of the engine is included in the product documentation.

3. Results: the probabilistic finish date

How to read the S-curve: every point answers one question: 'what is the chance we finish on or before this date?'. Pick a confidence level on the vertical axis and read the matching commitment date on the horizontal axis. A steep curve means a predictable project (dates close together); a flat, stretched curve means high uncertainty. The distance between P50 and P90 is the practical width of your risk.

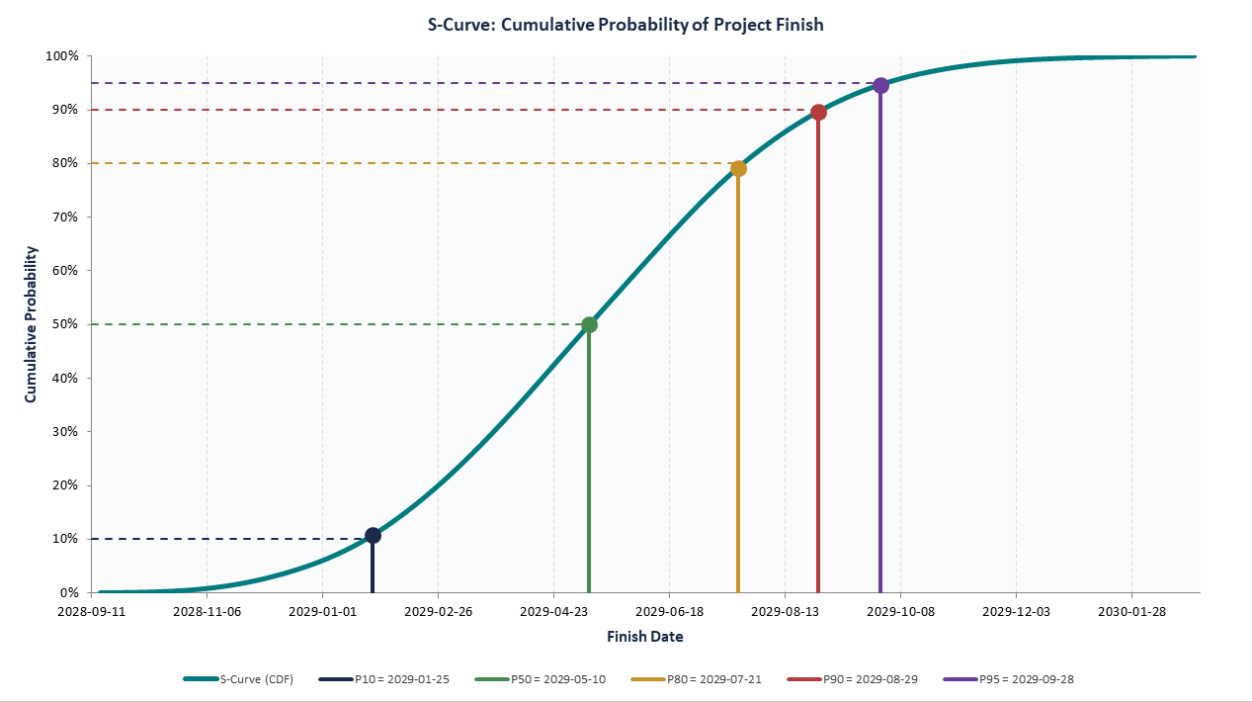


Figure 1. S-curve: cumulative probability of the project finish date.

For this project the curve spans 111 days between P50 and P90. That is a wide window: the schedule outcome is genuinely uncertain, and single-date promises deep in the project are not yet meaningful. Active de-risking (section 7) narrows this curve; re-planning alone does not. Every step to the right on this curve buys certainty with calendar time; the table below prices the three standard levels.

Level	Finish date	vs deterministic	Interpretation
Deterministic	26 Oct 2028	-	Dml only; no uncertainty, no risks, optimistic scenario
P50	10 May 2029	+196 d	Median: half of the futures finish later than this
P80	**21 Jul 2029**	**+268 d**	**Recommended commitment: 8 of 10 futures finish on or before**

Level	Finish date	vs deterministic	Interpretation
P90	29 Aug 2029	+307 d	Conservative; for hard external deadlines with penalties

The price of confidence in this project: moving a commitment from P50 to P80 costs 72 days; hardening it further to P90 costs another 39 days. That asymmetry is typical: the last 10% of certainty is bought in the tail, where the expensive scenarios live. Choose the level consciously, P80 for regular external commitments, P90 only where an overrun is truly not acceptable (contractual milestones with penalties, grid-connection windows, weather-critical hand-overs).

> **How to read the histogram:** the same simulation shown as frequencies: how often each finish window occurred. The peak is the most common outcome; the long right-hand tail contains the futures where risks hit the critical path and reinforce each other. Managing the project means cutting that tail, not sharpening the peak.

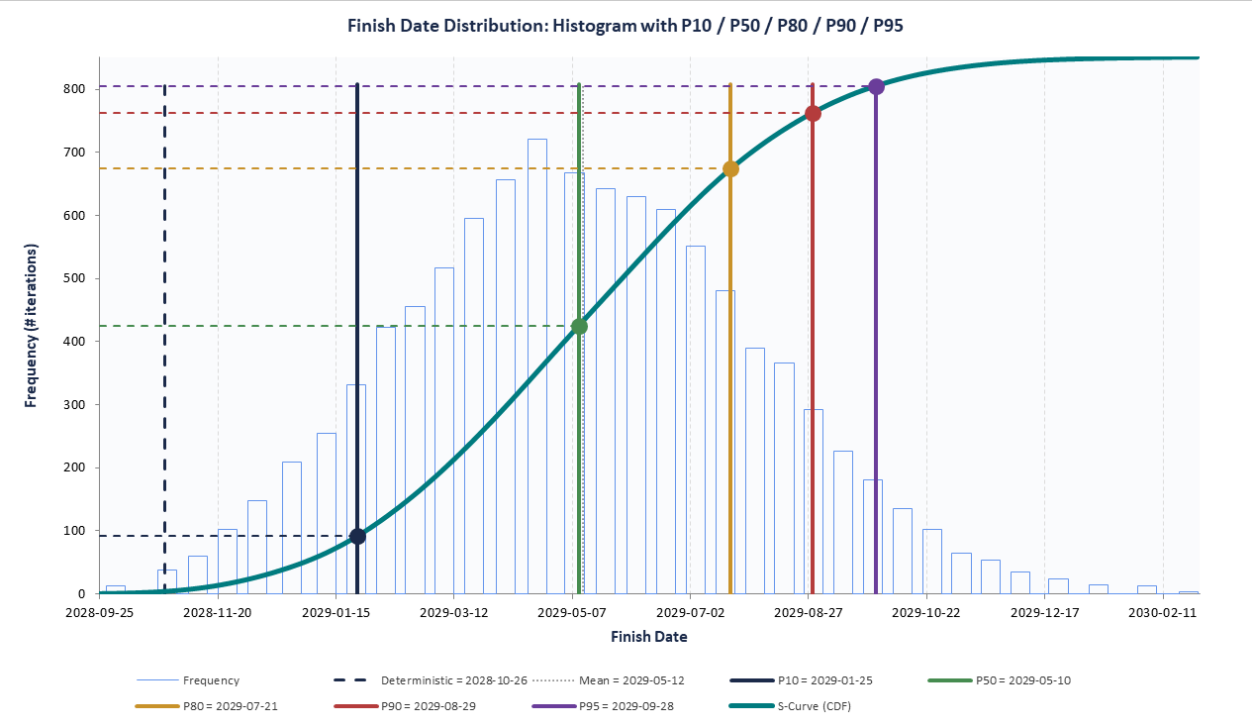


Figure 2. Distribution of simulated finish dates.

What the shape tells you here: the step from P50 to P80 spans 72 days, while the step from P80 to P90 spans another 39 days. The tail is modest relative to the core: the spread comes mainly from ordinary estimate uncertainty rather than from a few heavy risk scenarios. Tightening the biggest duration ranges (section 5.1) is then the most effective lever.

4. Criticality: which activities drive the finish

> **How to read the criticality map:** the criticality index is the percentage of simulated futures in which an activity sits on the critical path. 100% means the finish date always runs through this activity, a fixed bottleneck. Values in between mean the critical path shifts depending on how uncertainty plays out: those activities are the ones a deterministic plan quietly ignores.

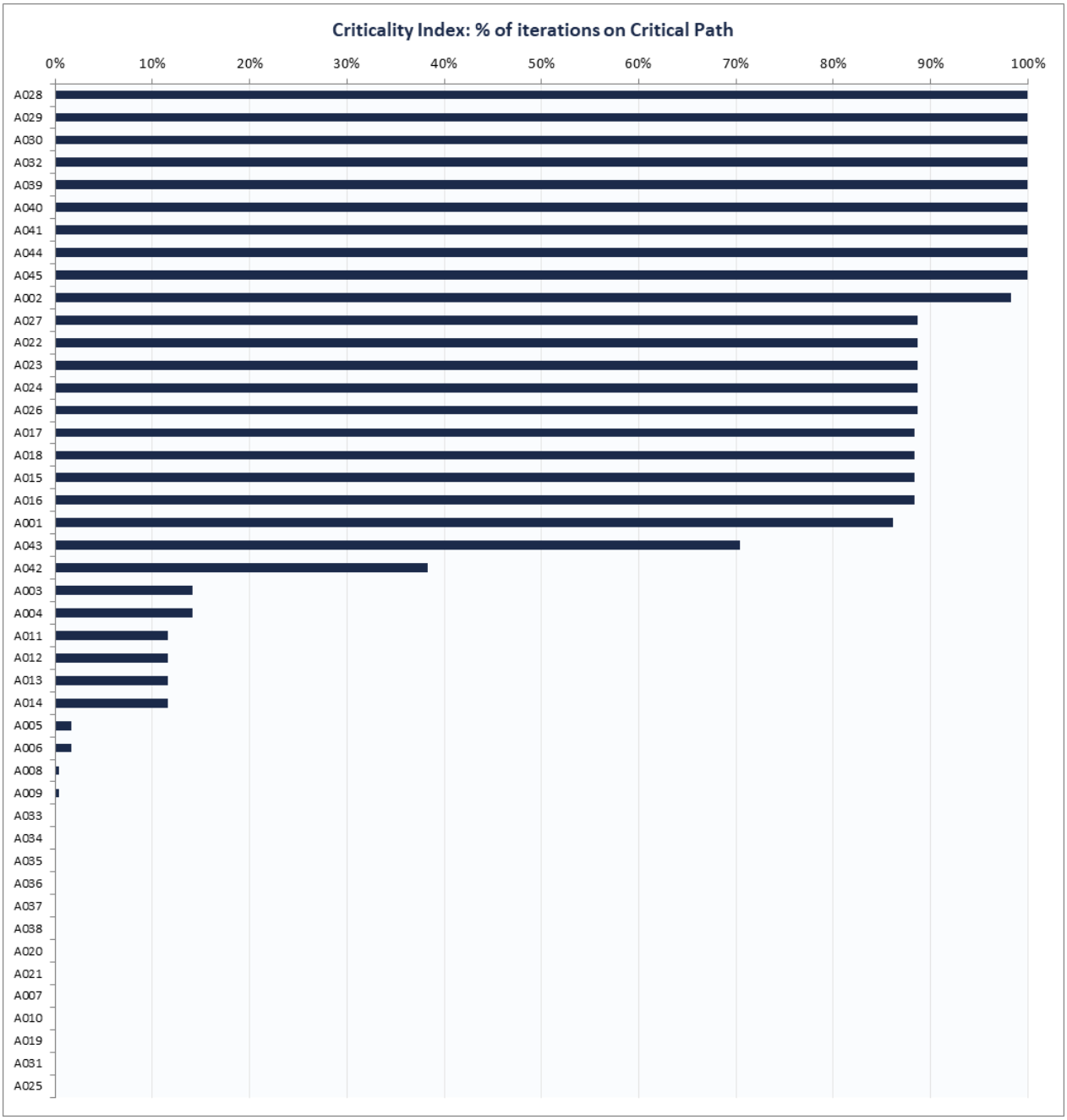


Figure 3. Criticality index per activity.

Activity	Name	Criticality
A028	Mobilization WTG installation vessel	100%
A029	WTG installation, cluster A	100%
A030	WTG installation, cluster B	100%
A032	WTG commissioning, cluster B	100%
A039	Pre-energization tests	100%
A040	Grid connection works onshore	100%
A041	Energization & first power	100%
A044	Reliability run & documentation	100%

Activity	Name	Criticality
A045	Final acceptance & handover to O&M	100%
A002	Detailed design foundations	98%

What this means for this project: 20 of the 45 activities are critical in more than 80% of the simulated futures, the backbone of the schedule runs through them (led by A028, A029 and A030), whatever the uncertainty does. Delay prevention on these activities translates almost one-for-one into finish-date protection. At the other end, 13 activities were never critical in any future: they carry real float and form the natural pool for resource and attention shifts. The activities in between are the ones to watch, they become critical only in adverse futures, which is precisely when management attention is scarce.

> **Management use:** an activity with high criticality but little duration uncertainty is a fixed bottleneck: manage the logic and the interfaces around it. An activity with high criticality and high sensitivity (section 5) is where compression, extra resources or de-risking buy the most schedule. Activities with 0% criticality carry float: they are the flexibility pool for resource shifts.

5. Drivers: sensitivity and risk contribution

> **How to read the tornado:** each bar is the correlation between one activity's sampled duration and the project finish date across all futures. A long bar means: when this activity runs long, the whole project runs long. Short bars mean the network absorbs the variation. This is estimate uncertainty; the discrete risks follow in section 5.2.

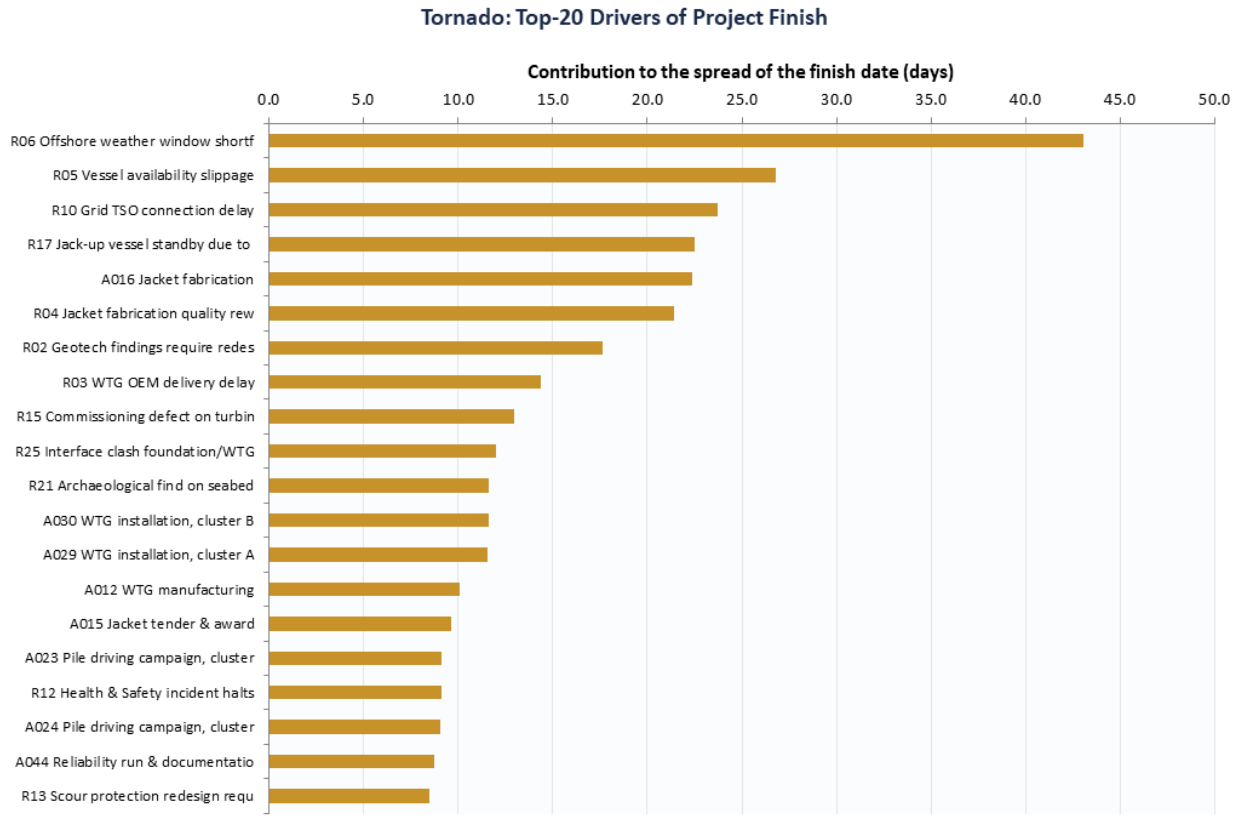


Figure 4. Tornado: duration sensitivity of the project finish.

5.1 Duration sensitivity (top 8)

Activity	Name	Correlation r
A016	Jacket fabrication	0.27
A030	WTG installation, cluster B	0.14
A029	WTG installation, cluster A	0.14
A012	WTG manufacturing	0.12
A015	Jacket tender & award	0.12
A023	Pile driving campaign, cluster A	0.11
A024	Pile driving campaign, cluster B	0.11
A044	Reliability run & documentation	0.10

What this means for this project: the strongest duration driver is A016 (Jacket fabrication, r = 0.27): in futures where this activity runs long, the project finish visibly moves with it. A better estimate here (reference data, an early trial, a firm supplier quotation) narrows the whole finish distribution, often the cheapest schedule protection available. Note that a top sensitivity ranking is not the same as a top criticality ranking: sensitivity flags the widest, most consequential duration ranges, criticality flags the structural bottlenecks. Activities that appear high on both lists are the priority.

5.2 Risk contribution to the expected delay (top 8)

Where section 5.1 looks at estimate uncertainty, this table ranks the discrete risks by the share of the finish delay attributed to them: in every iteration the delay is shared pro rata among the risks that occurred. 37_MITIGATION shows the effect of removing a risk.

Rank	Risk	Mean delay contribution
1	R06 Offshore weather window shortfall	21.1 d
2	R01 Permit delay due to ecological objection	20.2 d
3	R03 WTG OEM delivery delay	19.6 d
4	R05 Vessel availability slippage	14.3 d
5	R17 Jack-up vessel standby due to weather	12.5 d
6	R04 Jacket fabrication quality rework	10.7 d
7	R10 Grid TSO connection delay	10.5 d
8	R02 Geotech findings require redesign	10.5 d

What this means for this project: the largest single contributor is R06 Offshore weather window shortfall, accounting for 21.1 days of the 198-day mean delay (11%). Each contribution is a pro-rata share: in every iteration the delay is shared among the risks that occurred. Section 7 shows what removing a risk buys back on the P80 date.

6. Probabilistic Gantt

How to read this figure: each activity shows its P10-P90 window instead of a single bar: the earliest and latest realistic timing. Narrow bands are hard logic, little room, little risk of drift. Wide bands are where the schedule breathes; they typically widen towards the end of the network because upstream uncertainty accumulates through the logic. Use the bands, not the single-point dates, when promising dates to third parties downstream.

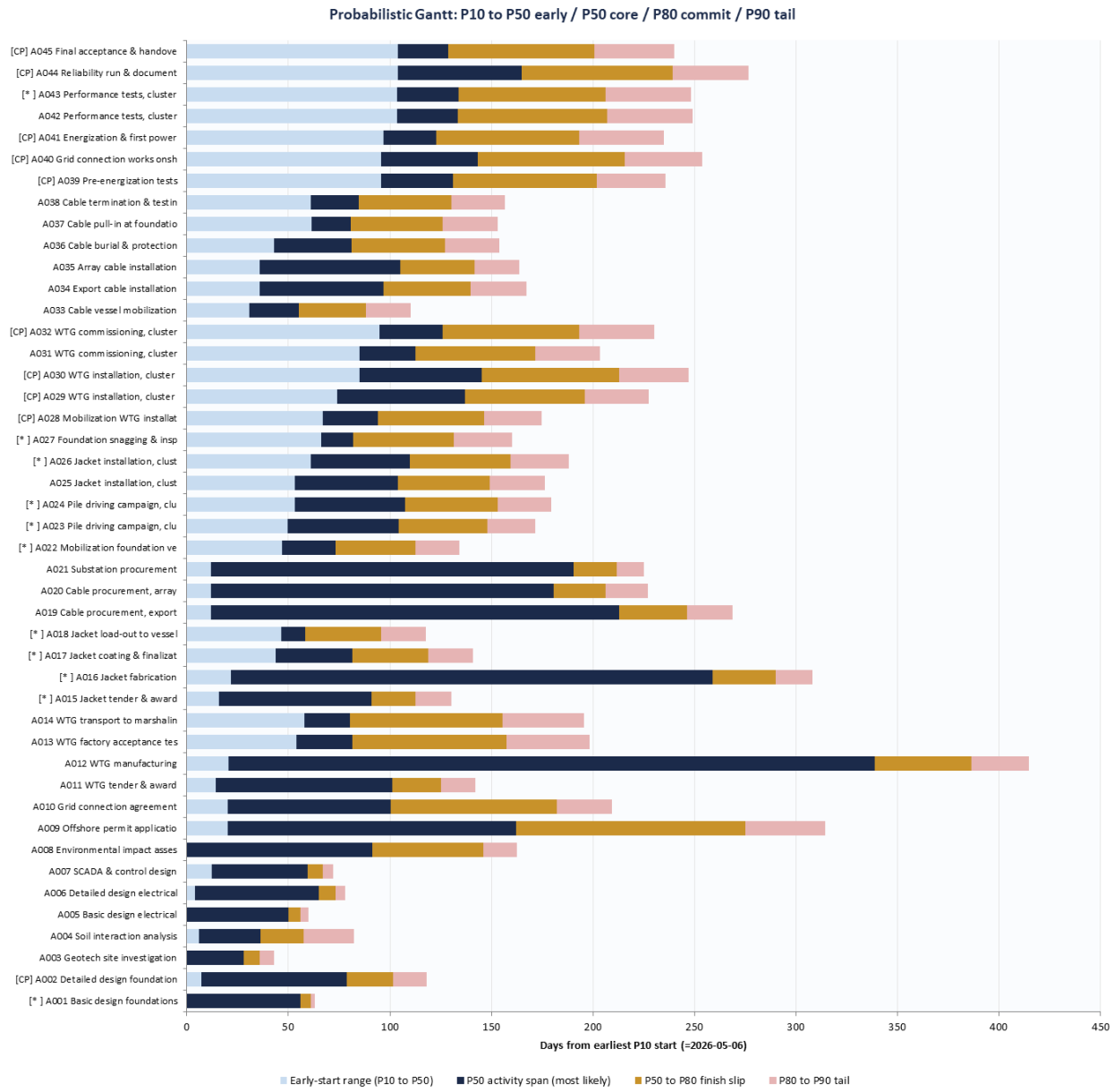


Figure 5. Probabilistic Gantt with P10-P90 bands per activity.

Practical reading for this project: activities early in the network still show narrow bands: commitments there are safe. The further right, the wider the windows become and the more any date promised to suppliers, authorities or interfacing contractors should be quoted as a window (or at P80) rather than a day.

7. Mitigation: what-if analysis

The table below shows, per risk, the new P80 finish if that risk were fully mitigated, and the days saved versus the baseline P80. It turns the risk register into a prioritized action list: mitigate where a day of schedule is cheapest.

Risk	Description	New P80 if mitigated	Days saved
R06	Offshore weather window shortfall	29 May 2029	53 d
R05	Vessel availability slippage	4 Jul 2029	17 d
R17	Jack-up vessel standby due to weather	5 Jul 2029	16 d
R10	Grid TSO connection delay	7 Jul 2029	14 d
R04	Jacket fabrication quality rework	7 Jul 2029	14 d
R02	Geotech findings require redesign	12 Jul 2029	9 d
R15	Commissioning defect on turbine batch	14 Jul 2029	7 d
R13	Scour protection redesign required	19 Jul 2029	2 d

What this means for this project: fully mitigating R06 alone moves the P80 finish forward by 53 days, the single most valuable intervention on the table. The top three mitigations together represent up to 86 P80-days (before overlap), which frames the realistic ambition level for a mitigation package. Risks with zero days saved are not harmless, they simply do not sit on paths that drive the P80 finish today, and they can start to matter once the top risks are treated.

Days saved are per-risk, single-mitigation deltas; combined mitigation packages should be re-simulated as a scenario because effects overlap on shared paths. The decision this table supports: compare the days saved against the cost of the mitigation, a measure that buys 10 P80-days for less than the cost of 10 days of standing organization is almost always worth it.

8. Assumptions and limitations

- Estimates originate from the project team and reflect knowledge at the date of this analysis; the simulation adds no assumptions of its own.
- Duration model: Beta-PERT on three-point estimates; risk impacts extend mapped activity durations. Re-sequencing, resource shifts and acceleration measures are not simulated.
- Correlation uses a Gaussian copula; extreme tail dependence is not modeled.
- Working-day calendars and holiday lists are applied as entered; verify them for your project.
- This analysis is a snapshot: re-run at every phase transition and after material scope, logic or market changes.

9. Conclusion and recommendations

The probabilistic analysis gives a defensible, auditable picture of the schedule uncertainty. The deterministic finish (26 Oct 2028) is best read as an optimistic scenario, not a plan of record; the realistic commitment level is P80 (21 Jul 2029). The uncertainty is not evenly spread: it concentrates in a small set of near-always-

critical activities and a small set of risks, which makes targeted control both possible and affordable. We recommend the steering committee to:

1. Commit externally at P80 (21 Jul 2029) and manage the 268-day window to the deterministic date as explicit, traceable schedule contingency.
2. Assign owners, actions and triggers to the top criticality activities (section 4) and the top risk contributors (section 5.2).
3. Quantify candidate mitigations with the what-if table (section 7) and re-simulate the chosen package as a scenario before deciding.
4. Re-run the analysis at every phase gate and report the P80 trend: a widening gap between plan and P80 is the earliest warning signal a schedule can give.

Finally: the value of this analysis is not the date itself but the explicit confidence level behind it. A P80 commitment with named drivers and a mitigation plan is defensible towards client, financier and auditor, a single-point date is not.

Appendix A. Simulation parameters

Iterations	10,000
Random seed	20260421
Convergence	OK
Engine runtime	7.2 s
Activities	45
Logic relations	57
Risks	25
Deterministic finish	26 Oct 2028
Target finish	30 Jun 2028

Disclaimer

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