June 2026

PRACTICE NOTE: NEC4 Secondary Option X29 Nature and Climate

NEC4 Engineering and Construction Contract

Context and purpose

The construction, operation, maintenance, renewal, and decommissioning of infrastructure play a significant role in greenhouse gas (GHG) emissions, resource consumption, biodiversity loss, flood risk and climate resilience, and long-term environmental, social and economic outcomes. Governments, Clients, investors, regulators and wider society are increasingly seeking measurable improvements in the environmental performance of infrastructure assets and programmes.

These expectations include reductions in whole-life carbon; improved climate resilience; biodiversity enhancement; more efficient use of materials and natural resources; and improved environmental reporting and transparency.

Option X29 provides a contractual mechanism through which environmental objectives relating to both climate change and nature may be incorporated into project delivery. Option X29 recognises the interdependence of nature recovery and climate resilience. This Practice Note promotes a nature-first decision pathway, with carbon optimisation given equal importance and embedded throughout the system.

This Practice Note[1] is intended to support Clients, Designers, Contractors, Project Managers, consultants, environmental specialists, commercial managers and procurement teams. The examples included throughout are illustrative only and should not be adopted without project-specific review.

The document is divided into two parts:

- Part 1: Practical guidance on implementing Option X29, covering the nature and carbon hierarchies, good-practice Scope drafting, the Performance Table, and related NEC mechanisms;
- Part 2: Technical supporting appendix, providing illustrative performance measures, definitions, PAS 2080 integration guidance, worked examples, flow charts, and references.

PART 1: PRACTICAL GUIDANCE

1. Purpose of this guidance

This guidance has been written for use with the NEC4 Engineering and Construction Contract (ECC) and uses terms from that contract. It is equally applicable to the other NEC4 main

[1] Note on use with NEC User Guides: This Practice Note should be read alongside the NEC4 User Guides Volume 2 (Preparing an ECC) and Volume 4 (Managing an ECC). Volumes 2 and 4 explain the X29 clause mechanics in reducing the impacts of climate change – defined terms, the Nature and Climate Plan, the Performance Table structure, compensation events, Contractor's proposals and performance measurement – and should be the first reference for contractual questions. This Practice Note provides the technical and practical depth that the User Guides do not: the nature and carbon hierarchies, good-practice guidance on what the Plan and the Scope should contain, the illustrative performance measures table, definitions, and PAS 2080 integration. The documents are designed to be complementary rather than self-contained.

VAT Number: 240877747
Registered in England and Wales Company Number: 2556636
Registered Office: One Great George Street, Westminster, London SW1P 3AA, United Kingdom

contracts that include X29, although the terminology and some of the content will vary across these.

The guidance has been developed primarily for use on UK-based projects. References to statutory biodiversity net gain, UK standards and professional accreditation requirements may not apply in other jurisdictions and should be reviewed accordingly. For projects outside the UK, equivalent local standards and frameworks should be identified and specified in the Scope.

For UK projects, PAS 2080:2023 is the recommended framework for whole-life carbon management. PAS 2080 describes what good carbon management looks like across the asset lifecycle; Option X29 is the contractual mechanism through which PAS 2080 principles are given effect in the contract. For projects outside the UK, an equivalent national or sector standard should be identified and specified in the Scope.

For Biodiversity and Nature, there are several standards that will support the identification and delivery of performance measures; for example, BS 8683:2021 details the process for designing and implementing Biodiversity Net Gain (BNG). It provides a robust, auditable specification for developers to ensure that BNG outcomes demonstrate genuine ecological uplift. BS 8632:2021 – the specification for Natural Capital Accounting for organisations – outlines principles, terminology, and the steps required to create a repeatable and transparent natural capital account, tracking impacts and dependencies on assets like soil, air, and water. Its international counterpart is BS ISO 14054:2025.

2. The Nature and Climate Plan

The Nature and Climate Plan (the 'Plan') is one of the four core defined terms in Option X29. It sets out the Contractor's strategy for achieving the Nature and Climate Requirements stated in the Scope. For clause-level explanation of the Plan – including submission, revision, acceptance – see NEC4 User Guide Volume 4, section X29.4.

This section focuses on the good-practice content for both carbon and nature, which goes beyond what the clause requires.

> NEC4 User Guide Volume 4, X29.4 explains the Plan mechanics, submission process and contractual status.
> NEC4 User Guide Volume 2, section 2.3 and S2605 explain what the Scope should require of the Plan.

Carbon content of the Plan

On the carbon side, the Plan should, as a minimum, document, where applicable:

- the whole-life carbon baseline and the methodology used to establish it;
- carbon reduction targets and the basis on which they have been set;
- carbon optioneering evidence demonstrating how the carbon hierarchy has been applied at each design stage – this is the primary evidential record for carbon performance;
- the GHG assessment methodology and reporting approach, identifying the lifecycle stages covered and the frequency of reporting;
- alignment with PAS 2080:2023 where adopted, including how responsibilities under PAS 2080 clause 6.2.1(b) have been allocated across the project team; and
- where nature-based solutions and nature-positive infrastructure are included, the methodology for quantifying and verifying any carbon sequestration they deliver.

The Plan is the primary document through which PAS 2080 carbon management activities are coordinated and evidenced under the contract. Where a Client has an existing Carbon Management Plan, the Nature and Climate Plan should reference it and explain how project-level activities align with it.

The Plan should show how nature, climate and carbon decisions have been considered together through a single optioneering process, rather than as separate or competing workstreams.

Nature content of the Plan

On the nature side, the Plan should document, where applicable:

- the biodiversity baseline survey methodology and BNG calculation approach, identifying the metric used and the baseline date;
- nature-positive and climate-resilient design measures selected and the basis for their selection within the nature hierarchy, with reasons documented where lower-order options were preferred;
- habitat management and monitoring procedures, including the frequency of ecological surveys, the standards to be used, and who is responsible;
- identification of the Nature and Climate Partners responsible for nature-related activities and how collaboration with them will be coordinated;
- seasonal activity planning where habitats, species or monitoring requirements create programme constraints;
- how nature-based solutions and nature-positive infrastructure have been considered during optioneering and the reasons for selecting engineered solutions where nature-based alternatives were not feasible;
- the anticipated ecosystem services and wider environmental benefits to be delivered, such as flood attenuation, water quality improvement, urban cooling, carbon sequestration, soil enhancement and habitat connectivity;
- the approach to maintaining and enhancing the long-term resilience and adaptability of natural assets throughout the lifecycle of the project;
- arrangements for post-completion stewardship, monitoring and adaptive management where ongoing ecological performance is required to achieve the intended outcomes.

The level of detail required in the Plan for both carbon and nature should be proportionate to the scale and environmental sensitivity of the project. For smaller projects a concise Plan covering the key points above will be sufficient; for larger or more complex projects the Plan may need to be a substantive document in its own right.

3. Drafting the Nature and Climate Requirements

An important aspect to consider is that Option X29 is only as effective as the Nature and Climate Requirements drafted into the Scope. The Requirements define the Contractor's obligations and the basis for performance assessment. For the contractual basis of the Scope – including what constitutes a Defect, the relationship to the Scope and other contract documents – see NEC User Guide Volume 2, section 2.3 and Chapter 3.

> NEC User Guide Volume 2, section 2.3 and S2605 provide detailed Scope drafting guidance for Option X29, including minimum content and the distinction between Scope and Performance Table. The guidance in this section focuses on the specific content good practice requires for carbon and nature.

Outcome-based requirements will often provide greater flexibility and encourage better solutions. Avoid prescribing materials or methods unless essential. For example:

> *Avoid: "reduce environmental impact where possible" – this is too vague to administer or evidence. Preferred: "undertake whole-life carbon assessment in accordance with [agreed methodology] and report reductions against the agreed baseline at each design gateway" – this is specific, measurable, and administrable.*
>
> *Avoid: "use sustainable drainage". Preferred: "manage a minimum of [X]% of surface water runoff through Sustainable Drainage Systems (SuDS) measures in accordance with [agreed design standard], measured by [agreed method] at Completion."*

Requirements should be proportionate to the project, capable of objective measurement, commercially realistic, capable of practical administration, and aligned with the allocation of risk under the contract.

Carbon requirements in the Scope

Where carbon reduction objectives are included, the Scope should establish:

- the whole-life carbon baseline methodology to be used, and the stage by which the baseline must be established (typically end of concept design);
- the carbon reduction target, expressed as a measurable percentage reduction against that baseline;
- the GHG assessment methodology and boundary, consistent with PAS 2080:2023 or an equivalent standard for international projects;
- carbon reporting requirements, including frequency, format, the lifecycle stages to be covered, and the data to be captured at each reporting stage;
- the approach to carbon optioneering: a requirement to produce and retain optioneering evidence at agreed design gateways, demonstrating how the carbon hierarchy has been applied;
- alignment with the Client's Carbon Management Plan where one exists.

Specifying outcomes – a stated percentage reduction against a verified baseline – rather than prescriptive materials is the recommended approach, consistent with PAS 2080:2023 clause 10.1.1(b).

Nature requirements in the Scope

Where nature enhancement objectives are included, the Scope should establish:

- the BNG target referenced to an agreed pre-construction baseline survey, and the metric to be used;
- a requirement for a habitat management and monitoring plan, with the monitoring frequency and standards specified;
- specification of the nature hierarchy approach to be followed (see section 5);
- any specific habitat, species or connectivity requirements relevant to the site;
- where statutory BNG applies, confirmation that the 10% minimum net gain is the floor and the project target is set above it.

The Scope should require the nature-first hierarchy to be applied before engineered solutions are selected. Where hybrid or engineered measures are necessary, the Scope requires carbon optimisation principles to be applied throughout, for example, with regards to land use change, design and supply chain.

The Scope and the Performance Table

The Scope establishes the minimum contractual requirements. The Performance Table provides incentives and disincentives for performance above or below that floor. These serve different functions and should not be confused: failure to meet a Performance Table target is not automatically a Defect unless the obligation is also in the Scope.

> NEC User Guide Volume 2, section 2.3 explains the Scope/Performance Table distinction in detail and includes guidance on structuring the Performance Table. NEC User Guide Volume 4 – X29.1(4) and X29.12 explain how the Performance Table operates during delivery.

4. The nature and climate hierarchy

This should be the primary decision-making framework for selecting project solutions under Option X29. It should consider nature and climate change together as single hierarchy rather than as separate competing decision pathways.

When identifying measures under Option X29, the Parties should apply the following hierarchy where appropriate to the project. The hierarchy supports a transition from sustainable infrastructure towards regenerative infrastructure, where projects seek not only to reduce harm but to restore ecological function, but to mitigate climate change, reduce carbon and create long-term environmental, social and economic value. It is not intended to prevent the use of engineered solutions where appropriate for project constraints, operational requirements or safety obligations.

The hierarchy is a design decision-making framework. Option X29 is the contractual mechanism through which the outcomes of applying it are given legal effect – translating design decisions into enforceable requirements in the Scope and measurable targets in the Performance Table.

Option A – Nature-based measures

Measures relying primarily on natural processes. Examples: swales, floodplain reconnection, vegetated drainage systems, riparian planting, and wetland treatment systems. May also contribute to reduced excavation, reduced embodied carbon and lower operational maintenance.

Option B – Nature-positive infrastructure

Designed interventions providing measurable environmental enhancement alongside engineering functionality. Examples: engineered wetlands, habitat bridges, integrated drainage and planting systems, green retaining structures, and green roofs. May support biodiversity enhancement, urban cooling, runoff attenuation and carbon reduction too.

Option C – Hybrid solutions

Combinations of natural and engineered systems, often the most realistic approach for infrastructure projects where land constraints, operational resilience requirements or engineering tolerances are strict. Examples: swales combined with piped drainage, reinforced flood storage, and hybrid SuDS arrangements. All elements should be optimised using carbon hierarchy principles, including avoiding unnecessary materials, reducing quantities and substituting lower-carbon alternatives.

Option D – Engineered solutions

Appropriate where nature-based or hybrid measures cannot meet operational requirements, or where site constraints, safety or performance requirements dictate their use. Examples: conventional drainage systems, structural flood defences, and reinforced retaining structures.

Where engineered solutions are adopted, opportunities to reduce environmental impact, reduce whole-life carbon and improve biodiversity outcomes should still be considered. Any decision not to pursue such opportunities should be documented and, where it affects the Nature and Climate Requirements or Performance Table, discussed through the early warning process under clause 15.

All solutions should apply carbon optimisation principles in the following order: avoid, reduce, substitute and, only as a last resort, offset residual emissions.

5. Carbon optimisation within all solutions

Option X29 addresses climate change mitigation, carbon reduction and nature and these are of equal importance. In applying the nature and climate hierarchy the multifunctional nature-based solutions should be considered first. The carbon management principles should be applied to all stages in the hierarchy to minimise whole-life carbon impacts. For example, measuring and tracking carbon through the design, land use change and the supply chain.

For UK projects, PAS 2080:2023 is the recommended framework for whole-life carbon management. Option X29 is the contractual mechanism through which PAS 2080 principles are implemented in the contract. For projects outside the UK, an equivalent national or sector standard should be identified and specified in the Scope.

Below are carbon management steps that should be used as part of the nature and climate hierarchy along with the PAS2028 framework.

Step A – Avoid

Avoid unnecessary carbon emissions at source through scope optimisation, reduction in material quantities and efficient asset utilisation. This should be the first consideration at all design stages. Examples: right-sizing structural elements, eliminating unnecessary excavation, and avoiding over-specification of materials.

Step B – Reduce

Reduce emissions through efficient design, lower-carbon construction methodologies, waste reduction and material efficiency. Carbon optioneering – the structured comparison of design options against the carbon baseline – is the primary tool at this stage and should be documented at agreed design gateways using an assessment methodology consistent with RICS Whole-life carbon Assessment or equivalent.

Step C – Substitute

Substitute higher-carbon materials or systems with lower-carbon alternatives where technically appropriate and commercially proportionate. Examples: lower-carbon concrete mixes, recycled aggregates, and lower-carbon structural systems.

Step D – Offset

Residual emissions may be offset where agreed. Offsetting should be a last resort and should not be used as a substitute for reasonably practicable reduction. Any offset

mechanism should be clearly specified in the Scope, including the standard against which offsets are verified.

Nature-based solutions and nature-positive infrastructure under section 5 may also contribute to carbon sequestration. Where this is the case, the methodology for quantifying and verifying sequestration should be agreed prior to construction and referenced in both the Plan and the Performance Table. The sequestration methodology, monitoring period and verification standard should be clearly stated in the Scope.

6. Early warnings

Early warnings should be notified for events that may affect achievement of the Nature and Climate Requirements or targets in the Performance Table. Carbon and nature risks should be managed through the early warning process on equal terms.

Examples of events that should be notified include:

- planting failure or habitat condition issues arising during or after construction;
- unforeseen ground conditions affecting drainage design or the feasibility of carbon-efficient construction;
- supply chain constraints affecting lower-carbon material availability or nature-positive design options;
- changes in legislation or environmental consents;
- design changes that reduce opportunities for nature recovery, habitat connectivity or the delivery of wider environmental, economic and social value;
- changes in land use, stakeholder requirements or site conditions that affect the viability of agreed nature-positive interventions;
- programme delays affecting seasonal ecological activities or monitoring periods;
- materials substitution constraints preventing agreed carbon reduction targets from being achieved;
- changes in carbon assessment methodology or PAS 2080 guidance affecting the agreed baseline.

Carbon optioneering evidence should be updated at each design gateway and form part of the Nature and Climate Plan. Where an early warning affects Performance Table targets, it should be addressed through the performance measurement process.

> NEC User Guide Volume 4, X29.3 explains the early warning obligation under Option X29. Core clause 15 explains the early warning process, Risk Reduction Meeting and Early Warning Register.

7. The Performance Table

The Performance Table provides a mechanism for performance measurement, incentives, disincentives and reporting. The Performance Table is not the Scope. Performance targets should be objectively measurable, proportionate and capable of practical administration.

Important: where secondary Option X18 (Limitation of Liability) is included in the contract, payments under the Performance Table are an excluded matter under clause X29.13. The Contractor's financial exposure under the Performance Table therefore sits outside any agreed liability cap. Where substantial negative incentives are contemplated, legal advice is recommended before the Performance Table is finalised.

NEC User Guide Volume 2, section 2.3 explains how to structure the Performance Table, what it must contain and how to set targets. NEC User Guide Volume 4, X29.12 explains how the Performance Table operates during delivery, including reporting intervals, corrective action and assessments.

The table below summarises the principal measures for inclusion in most Option X29 contracts. A fuller illustrative table with enforcement approaches is provided in Appendix A3 below.

Subject	Example target	Example measurement
Biodiversity	Net gain relative to agreed baseline	Biodiversity units (agreed metric)
Carbon – embodied	Reduction against agreed WLC baseline, evidenced at design gateways	tCO_2e reduction (agreed GHG methodology)
Carbon – sequestration and storage	Sequestration from nature-based solutions quantified and verified prior to Completion	tCO_2e sequestered and stored (agreed methodology)
Carbon reporting	Construction-phase carbon reported at agreed intervals	tCO_2e per period (agreed GHG methodology)
Drainage	Surface water managed through agreed SuDS measures	Percentage of runoff managed through SuDS
Nature recovery	Delivery of agreed habitat enhancement and restoration measures	Habitat units, area or agreed metric
Habitat connectivity	Improvement relative to agreed baseline	Type of species in the habitat to be connected or any other connectivity measure
Ecosystem services (flood attenuation, urban cooling, water improvement, etc)	Delivery of agreed ecosystem service benefits	Project-specific metric
Nature and climate hierarchy implementation	Application of hierarchy through optioneering and design	Evidence at agreed gateways
Reporting	Submission of agreed environmental reporting	Completion against agreed reporting dates
Collaboration	Participation in agreed Nature and Climate Partner activities	Attendance and submission records
Soil quality	Soil contaminants (specify types of contaminants) remediated (e.g. in nuclear or mining industry)	tCO_2e reduced. tCO_2e sequestered.
Thermal attenuation	Tree canopy cover relative to agreed baseline	Increase in percentage canopy cover (agreed method)
Soil reuse	Reuse of excavated soils on site	Agreed percentage of soil reuse on site

8. NEC administration mechanisms

Option X29 uses the standard NEC administration mechanisms – the early warning process, compensation events, the Accepted Programme, and Contractor's proposals – alongside its own specific provisions. The notes below identify the practice points most relevant to the nature and carbon objectives of X29; for full clause-level explanation see NEC User Guide Volume 4.

> NEC User Guide Volume 4, X29.2 (Nature and Climate Partners and Option X12), X29.6–X29.10 (acceleration, Defects, compensation events and Performance Table adjustments), X29.11 (Contractor's proposals), and X29.12 (performance measurement and reporting).

Compensation events and the Performance Table

Where a compensation event affects the Performance Table – including performance targets, assessment dates or payment adjustments – clause X29.9 provides the adjustment mechanism. This applies even where the compensation event affects only the Performance Table and would not otherwise be addressed through the core compensation event process.

Both carbon and nature targets may be affected: for example, unforeseen ground conditions preventing a nature-based drainage solution, or supply chain constraints affecting lower-carbon material availability. The period for responses may be extended by mutual agreement under clause 13.5.

Contractor's proposals (X29.11)

Clause X29.11 allows the Contractor to propose Scope changes to reduce the environmental impact of the works. The proposal requires the Project Manager's acceptance; the Contractor is not obliged to make proposals and the Scope cannot change unless the Contractor's quotation is accepted.

This clause should be actively used as a collaborative mechanism. It is particularly valuable where the Contractor identifies opportunities to reduce carbon impact or improve nature outcomes beyond what was originally specified. It should be referenced in the Nature and Climate Plan as a mechanism for continuous improvement during delivery.

Performance reporting

Reporting intervals should distinguish between carbon and nature requirements. Carbon reporting should align with design gateways and construction programme stages. Nature and ecological monitoring is often seasonal and may extend over one to three years post-completion; the Scope must clearly define post-completion reporting responsibilities.

Where the Contractor forecasts failure against a Performance Table target, it may propose corrective actions, revised methodologies or mitigation measures. Both carbon and nature performance issues should be raised through the early warning process in the first instance.

PART 2: TECHNICAL SUPPORTING APPENDIX

A1. Purpose of this appendix

This appendix provides illustrative technical examples that may support implementation of Option X29. The examples are non-mandatory and should be reviewed for project suitability, jurisdictional applicability, commercial proportionality, and technical feasibility. They are not intended to establish standard contractual wording, create mandatory obligations or replace project-specific drafting.

A2. Example hierarchy applications and decision-making process

The nature and climate hierarchy begins with nature-first approach when selecting project solutions. The carbon management principles will be applied to all solutions to optimise the selected solution and minimise whole-life carbon impacts.

Flow Chart 1 below shows the relationship between the nature hierarchy, the carbon hierarchy, the Nature and Climate Plan, the Performance Table and the NEC administration processes across the project lifecycle, including early warnings, Scope drafting, compensation events and Contractor's proposals. It illustrates a suggested decision-making process for applying Option X29 from project inception through to Completion. Flow Chart 1 and the worked example in Flow Chart 2 are illustrative only and should be adapted to reflect project-specific governance and programme requirements.

Option A - Nature-based measures

Examples: floodplain reconnection, swales, vegetated drainage systems, wetland creation, riparian planting, and sustainable drainage systems. Outcomes include flood attenuation, runoff reduction, biodiversity enhancement and water quality improvement. On suitable sites these measures may also reduce excavation quantities, reduce embodied carbon and lower long-term operational maintenance.

Option B - Nature-positive infrastructure

Examples: engineered wetlands, habitat bridges, green retaining structures, integrated tree pits, green roofs, and green walls. These approaches deliver measurable biodiversity enhancement alongside engineering functionality and may also contribute to urban cooling, runoff attenuation and reduced operational carbon.

Option C - Hybrid solutions

Examples: swales combined with piped drainage, reinforced flood storage, hybrid SuDS systems, and combined green-grey infrastructure. Hybrid approaches often allow projects to maintain operational performance while improving environmental outcomes and reducing carbon impacts.

Option D - Engineered solutions

Examples: conventional drainage systems, structural flood defences, reinforced retaining structures, and hard-engineered slope stabilisation. Where engineered solutions are required, the carbon hierarchy should still be applied to reduce embodied carbon and improve material efficiency. Carbon management principles should be applied at all stages in the process to reduce embodied carbon, improve material efficiency and avoid unnecessary residual emissions.

A3. Illustrative performance measures table

The following table provides illustrative performance measures across all principal themes relevant to Option X29. All targets, thresholds and enforcement approaches should be agreed on a project-specific basis. Targets should not be copied directly from this table without project-specific review.

The Performance Table should not become a long list of disconnected environmental measures. It should evidence the selected pathway through the hierarchy and focus on the few measures that are most material to the project.

This table is a pre-contract appraisal and drafting tool, not a template for the NEC Performance Table. The NEC Performance Table has a specific format defined in NEC contract documents (see NEC User Guide Volume 2, section 2.3 for the required column structure). Any measures selected from this table must be reformatted before inclusion in the contract. In practice, only a limited subset of measures will be appropriate for any individual project. Overly large Performance Tables may create disproportionate administration and commercial complexity.

Theme	Stage	Measure	Example target / threshold	Measurement method	Example enforcement approach (illustrative only)
BIODIVERSITY AND LANDSCAPE					
BNG	Design & Completion	Net biodiversity gain relative to agreed pre-construction baseline	Minimum 10% net gain (statutory UK minimum); project target to be agreed	Biodiversity units calculated using agreed metric (e.g. statutory biodiversity metric or equivalent)	Shortfall triggers corrective planting or enhancement at Contractor cost; gateway approval conditional on evidenced baseline
Habitat condition	Construction & Post-completion	Condition of created or enhanced habitats relative to agreed baseline	Target condition to be agreed with ecologist prior to construction	Condition assessment using UKHabs or equivalent methodology at agreed intervals	Failure to meet target triggers agreed corrective management plan; costs met by Contractor
Planting establishment	Post-completion	Establishment of agreed planting relative to design intent	Target establishment rate to be agreed (indicative: 90% establishment at 12 months)	Site survey at agreed intervals; percentage of planted units established	Failure triggers replacement planting at Contractor cost within agreed timescale
Habitat connectivity	Design & Completion	Delivery of agreed habitat connectivity measures	Connectivity measures specified in Nature and Climate Requirements	As-built survey against agreed design intent	Non-delivery reported to PM; corrective action agreed through early warning process
Invasive species management	Construction & Post-completion	Absence of agreed high-risk invasive species in works area	Zero high-risk outbreaks during construction and post-completion monitoring period	Site inspections at agreed intervals; third-party ecological survey at Completion	Outbreak triggers agreed management response; costs met by Contractor

Theme	Stage	Measure	Example target / threshold	Measurement method	Example enforcement approach (illustrative only)
Canopy cover	Post-completion	Increase in canopy cover relative to baseline	Target percentage increase to be agreed; 30% canopy cover indicative for urban projects	Remote sensing or site survey at agreed intervals post-completion	Failure triggers agreed management response
CARBON					
Whole-life carbon baseline	Concept design	Establishment of whole-life carbon baseline using agreed methodology	Baseline established and agreed before design proceeds beyond concept stage	Baseline report submitted using agreed GHG assessment methodology (e.g. RICS WLCA)	Design gateway approval conditional on agreed baseline; failure to submit triggers early warning
Embodied carbon reduction	Design gateways	Reduction in embodied carbon against agreed baseline, evidenced by carbon optioneering at each design gateway	Target percentage reduction to be agreed (indicative: ≥10% against baseline)	Carbon optioneering report at each gateway; tCO2e reduction against baseline using agreed methodology	Failure to evidence reduction at gateway triggers early warning; corrective optioneering required before proceeding
Construction-phase carbon reporting	Construction	Periodic reporting of construction-phase carbon against agreed baseline	Reporting at agreed intervals; material deviations from forecast to be notified	tCO2e per reporting period using agreed GHG assessment methodology; A4–A5 lifecycle stages	Failure to submit triggers early warning; persistent failure reported to PM
Carbon sequestration from nature-based solutions	Post-completion	Carbon sequestration delivered by nature-based solutions quantified and independently verified	Sequestration target and methodology to be agreed prior to construction	tCO2e sequestered; third-party verification using agreed methodology prior to Completion	Shortfall against agreed sequestration target triggers corrective action; unverified sequestration not credited
PAS 2080 alignment	Throughout	Alignment with PAS 2080:2023 carbon management principles throughout design and delivery	PAS 2080 alignment confirmed at each design gateway and at Completion	Carbon management plan submitted and updated; third-party certification where required by Scope	Non-alignment notified through early warning; corrective action agreed with PM

Theme	Stage	Measure	Example target / threshold	Measurement method	Example enforcement approach (illustrative only)
DRAINAGE AND SuDS					
SuDS coverage	Design & Completion	Percentage of surface water managed through agreed SuDS measures	Target percentage to be agreed; consistent with drainage hierarchy and local requirements	As-built drainage survey; percentage of runoff managed through SuDS relative to total runoff	Shortfall triggers review and corrective action
Runoff reduction	Design & Completion	Reduction in peak runoff rate relative to pre-intervention baseline	Target reduction to be agreed with drainage engineer; consistent with planning consents	Hydraulic modelling and post-construction flow monitoring at agreed intervals	Failure to achieve reduction triggers corrective drainage review
Water quality	Construction & Post-completion	No deterioration in receiving watercourse quality during or after construction	Compliance with agreed baseline water quality parameters throughout works	Water quality monitoring at agreed upstream and downstream locations	Deterioration triggers immediate investigation and agreed remediation
SOIL					
Soil reuse	Construction	Percentage of excavated soil reused on site	Target percentage to be agreed; minimise off-site disposal	Waste transfer notes and site records; tonnes or volume of soil reused vs disposed and imported.	Below-target reuse triggers review; excess disposal costs met by Contractor
Soil remediated (in mining and nuclear industry)	Construction	Percentage of onsite soil remediated to soil with agreed increased organic matter content. Results produced from a geotechnical laboratory	Target percentage to be agreed; maximise *in situ* remediation	Remediation and site records; tonnes or volume of soil remediated with the percentage *in situ*	Below-target remediation triggers review; excess disposal costs met by Contractor
Compaction prevention	Construction	Compliance with agreed soil protection measures during construction	Zero high-risk compaction events in designated sensitive areas	Site inspection records; agreed soil management plan compliance	Compaction event triggers soil remediation at Contractor cost
LIGHTING AND DARK SKIES					

Theme	Stage	Measure	Example target / threshold	Measurement method	Example enforcement approach (illustrative only)
Light spill	Design & Completion	Control of light spill into ecologically sensitive areas	Light spill targets to be agreed with ecologist; consistent with Institution of Lighting Professionals (ILP) guidance and local designations	Lux measurement at agreed boundary points at Completion	Exceedance of agreed lux levels triggers lighting review and corrective measures at Contractor cost
REPORTING, ENGAGEMENT AND SUPPLY CHAIN					
Environmental reporting	Throughout	Submission of agreed environmental and carbon reporting information at agreed intervals	100% submission against agreed reporting schedule	Completion against agreed reporting dates; content assessed against agreed reporting format	Late or incomplete submission triggers early warning; persistent failure reported to PM
Stakeholder and community engagement	Throughout	Participation in agreed Nature and Climate Partner coordination and community engagement activities	Attendance and submission records consistent with agreed engagement plan	Attendance records; meeting minutes; agreed deliverable submission dates	Failure to participate triggers early warning and review of engagement plan
Supply chain environmental requirements	Throughout	Compliance with agreed supply chain environmental and carbon requirements	Targets to be agreed; consistent with Nature and Climate Requirements and PAS 2080 where adopted	Supply chain pre-qualification records; carbon data submission from key suppliers	Non-compliance triggers early warning and supply chain corrective action plan
Nature and Climate Plan	Throughout	Submission and updating of Nature and Climate Plan in accordance with Scope requirements	Plan submitted at agreed stage and gateways; updated within agreed period following material change	Plan submission date; content assessed against agreed requirements	Late submission or failure to update triggers early warning

A4. Example sector applications

Highways

Potential applications: drainage improvement schemes; roadside biodiversity enhancement; integrated SuDS systems; lower-carbon pavement solutions; reduced excavation through

nature-based drainage integration; recycled aggregate specification; and whole-life carbon assessment from concept design.

Water sector

Potential applications: natural flood management; catchment management; wetland integration; operational carbon reduction; treatment process optimisation for carbon efficiency; and abstraction reduction through demand management.

Urban development

Potential applications: urban greening; integrated drainage systems; canopy enhancement; green roof systems; lower-carbon structural systems; whole-life carbon assessment from concept design; and BNG integrated with building design.

A5. PAS 2080:2023 integration

PAS 2080:2023 (Carbon Management in Buildings and Infrastructure) is the UK standard for managing whole-life carbon in infrastructure projects and programmes. Option X29 is the contractual mechanism through which PAS 2080 principles are implemented in the contract. PAS 2080:2023 should be understood as supporting whole-system value chain decision-making. Carbon accounting and management starts with site selection, targets and objectives; it includes land use change and supports collaboration, optioneering and better outcomes across the asset lifecycle.

Carbon baseline and target (PAS 2080 clause 8.2)

The Scope should specify that a whole-life carbon baseline is established using an agreed methodology before design proceeds beyond concept stage. The baseline should cover modules A1–A5 as a minimum. The carbon reduction target should be expressed as a measurable percentage reduction against this baseline.

Carbon optioneering (PAS 2080 clause 9)

Carbon optioneering is the structured comparison of design options against the carbon baseline. The Scope should require optioneering evidence at each agreed design gateway. This evidence forms part of the Nature and Climate Plan and supports both performance assessment and compensation event administration.

Responsibilities (PAS 2080 clause 6.2.1(b))

PAS 2080 requires clear responsibilities for carbon management to be allocated across the project team. The Nature and Climate Plan is the appropriate place to document this allocation.

Reporting (PAS 2080 clause 11)

Carbon reporting requirements should be specified in the Scope, including frequency, format and data to be captured. Post-construction reporting responsibilities should be clearly identified.

Nature-based solutions, nature-positive infrastructure and carbon sequestration

Where nature-based solutions and nature-positive infrastructure are included, the carbon sequestration they deliver may be quantified and credited against the project carbon account. The sequestration methodology and monitoring period must be agreed before construction and referenced in the Nature and Climate Plan. Independent verification is required before crediting.

Carbon certification

Where the Client requires PAS 2080 certification, this should be stated in the Scope. Certification requires third-party verification; its commercial and programme implications should be assessed at the outset. PAS 2080 Claims of Conformity also allows for Validation or Self-Verification.

A6. Example worked application

Project context

A highway drainage improvement project includes flood risk reduction, drainage improvements, biodiversity enhancement requirements and whole-life carbon reduction objectives. Option X29 is included in the contract, with Nature and Climate Requirements covering both nature and carbon outcomes.

Risks and opportunities identified

The Parties identify, through the early warning process and design review:

- flood risks and drainage constraints requiring assessment;
- biodiversity opportunities including riparian habitat and canopy enhancement;
- opportunity to improve habitat connectivity and deliver wider environmental, economic and social value through nature-positive interventions;
- high embodied carbon in existing drainage and highway materials;
- opportunity to establish a whole-life carbon baseline and identify carbon reduction opportunities through optioneering, consistent with PAS 2080:2023;
- opportunity to quantify carbon sequestration from nature-based drainage measures;
- opportunities for reduced excavation through swale integration.

Measures considered

The Parties apply both the nature and climate hierarchy (section 5) with the carbon hierarchy (section 6) being applied in parallel. The optioneering process demonstrates how nature-based and nature-positive measures were considered before engineered interventions were selected. Carbon optioneering at concept design compares conventional drainage reconstruction against lower-carbon alternatives including recycled aggregate specification, reduced excavation through swale integration and lower-carbon concrete mixes. The optioneering record is documented and retained as part of the Nature and Climate Plan.

Performance measures agreed

- BNG of at least 10% against the agreed pre-construction baseline
- Whole-life carbon assessment completed and baseline established by end of concept design
- Embodied carbon reduction of at least 10% against the agreed baseline, evidenced by carbon optioneering records at design gateways
- Carbon sequestration and storage from swale and wetland measures quantified and independently verified prior to Completion

- Flood attenuation capacity delivered through swale and wetland measures, quantified and independently verified prior to Completion
- Construction-phase carbon reported against the agreed baseline at each reporting period.

Programme and administration

The Accepted Programme includes environmental activities, reporting periods, seasonal activities and monitoring requirements for both nature and carbon. Carbon and nature risks are managed through the early warning process on equal terms. Contractor's proposals under X29.11 are used to identify opportunities to improve on agreed targets during delivery.

Key outcomes

- BNG delivered and independently verified against the agreed baseline
- Delivery of agreed habitat enhancement and connectivity measures identified within the Nature and Climate Change Plan
- Whole-life carbon reduction evidenced against the agreed baseline
- Carbon sequestration and storage from nature-based solutions independently verified and credited to the project carbon account
- PAS 2080:2023 alignment confirmed; carbon reporting certified where applicable
- Reduced flood risk delivered through a combination of nature-based and engineered drainage solutions
- Nature-positive interventions delivered measurable benefits including habitat enhancement, ecological connectivity and climate resilience
- Long-term environmental, economic and social value created through the integration of nature-based and lower-carbon solutions.

A7. Final observations

The most effective use of Option X29 will result from early collaboration between Clients, Contractors, environmental specialists and commercial managers translating environmental ambition into clear, measurable, administrable contractual requirements that both parties can price, deliver and evidence.

The examples in this appendix are illustrative only and are not intended to establish standard contractual wording, create mandatory obligations or replace project-specific drafting.

In practice, the greatest benefits are likely to be achieved where environmental objectives are supported by a clear hierarchy that prioritises nature-based solutions and nature-positive infrastructure while enabling carbon reduction opportunities to be considered throughout the project lifecycle.

The most effective use of Option X29 will come from a simple single hierarchy that users can understand, procure, price, deliver and evidence consistently.

A8. Definitions

The following definitions support interpretation of Option X29 guidance. They are explanatory in nature and are not intended to replace project-specific definitions or statutory meanings where these apply.

NEC contractual terms

Nature and Climate Requirements

The requirements stated within the Scope setting out the environmental obligations the Contractor must achieve under Option X29. These establish the contractual floor. Failure to achieve them may constitute a Defect under clause 11.2(6).

Nature and Climate Plan

The document prepared by the Contractor setting out the strategy for achieving the Nature and Climate Requirements. The Plan is not itself Scope; failure to comply with the Plan does not automatically constitute a Defect.

Nature and Climate Partners

The organisations identified within the Scope with whom the Contractor is required to collaborate under clause X29.2.

Performance Table

The table included within Option X29 setting out performance measures, targets, dates for assessment and adjustments to payments. Not Scope.

Carbon Management Plan

A document required under PAS 2080:2023 setting out how carbon will be managed across the asset lifecycle. Where a Client has an existing Carbon Management Plan, the Nature and Climate Requirements should reference it, and vice versa.

Nature and ecology terms

Nature-based solutions

Measures that work primarily by restoring, enhancing or working with natural processes to address project challenges such as flooding, heat, erosion, drought or water quality. Examples include floodplain reconnection, swales, sustainable drainage systems, tree planting and grassland buffers.

Nature-positive infrastructure

Intentionally designed interventions that meet the functional requirements of the works and provide measurable biodiversity or ecological enhancement relative to the agreed baseline. Examples include engineered wetlands, habitat bridges, green retaining structures, green roofs and integrated SuDS tree pits.

Regenerative design

An approach to planning, design, construction and operation that seeks to restore, renew and improve natural systems over time, rather than simply reducing harm

Biodiversity net gain (BNG)

A measurable improvement in biodiversity relative to a pre-development baseline, assessed using an agreed metric. Statutory BNG requires a minimum 10% net gain for most developments in England under the Environment Act 2021.

Ecosystem services

The benefits that people obtain from natural systems and processes, including flood regulation, water purification, climate regulation, soil formation, pollination and human wellbeing.

Natural capital

The stock of natural assets from which ecosystem services flow. Natural capital assessment provides a framework for valuing environmental assets and may support option appraisal for nature-based infrastructure measures.

Carbon and climate terms

Whole-life carbon

The sum of all GHG emissions and removals associated with an asset across its full lifecycle, expressed in CO2e. Covers embodied carbon (A1–A5), operational carbon (B1–B8) and end-of-life carbon (C1–C4), consistent with BS EN 17472 and PAS 2080:2023.

Embodied carbon

GHG emissions associated with materials and construction processes throughout the lifecycle of an asset, excluding operational energy use. Typically covers modules A1–A5 and C1–C4.

Operational carbon

GHG emissions arising from energy used in the operation of the asset over its operational life, covering modules B6 and B7 of the lifecycle assessment framework.

Carbon baseline

The reference level of whole-life carbon emissions against which reductions are measured, established using an agreed GHG assessment methodology before design proceeds beyond an agreed stage.

Carbon optioneering

The structured process of comparing design options against the carbon baseline to identify, quantify and evidence carbon reduction opportunities at each design stage. Consistent with PAS 2080:2023 clause 9.

Greenhouse gas (GHG) assessment

The quantification of GHG emissions and removals expressed in CO2e, carried out in accordance with an agreed methodology. For UK infrastructure projects, the RICS Whole-life carbon Assessment professional statement provides the recommended approach.

Carbon sequestration

The removal and long-term storage of atmospheric carbon dioxide by natural processes. Should be quantified using an agreed methodology, independently verified and credited only after verification.

Residual carbon

GHG emissions remaining after all reasonably practicable avoidance, reduction and substitution measures have been applied, which may then be addressed through verified offsetting.

A9. References and standards

- PAS 2080:2023 – Carbon Management in Buildings and Infrastructure (BSI)
- RICS Whole-life carbon Assessment for the Built Environment – Professional Standard (RICS)
- BS EN 17472:2022 Sustainability of construction works. Sustainability assessment of civil engineering works. Calculation methods
- BS 42020:2013 (Biodiversity – Code of practice for planning and development)
- BS 8683:2021 (Process for designing and implementing Biodiversity Net Gain – Specification)
- BS 8632 Natural Capital Accounting for Organizations – Specification
- BSI Flex 701 (Overarching Principles & Framework): The foundational standard defining transparency, measurement, governance, and environmental claims
- BSI Flex 702 (Supply of Biodiversity Benefits): Specifies requirements and processes for generating high-integrity biodiversity credits
- BSI Flex 703 (Supply of Nature-based Carbon Benefits): Dictates standards for greenhouse gas reductions and carbon removals delivered by natural projects
- BSI Flex 704 (Supply of Nature-based Nutrient Benefits): Specifies criteria for nutrient credits (e.g., water quality and mitigation)
- BSI Flex 705 (Community Engagement & Benefits): A code of practice for ensuring nature projects appropriately engage, involve, and benefit local communities
- Environment Act 2021 (UK) – statutory biodiversity net gain requirements
- CIEEM Biodiversity Net Gain – Good Practice Principles (CIEEM 2016)
- NEC4 Engineering and Construction Contract with Option X29 (NEC)
- NEC4 User Guide Volume 2 – Preparing an Engineering and Construction Contract (NEC)
- NEC4 User Guide Volume 4 – Managing an Engineering and Construction Contract (NEC)
- Chartered Institution of Water and Environmental Management (CIWEM) – SuDS guidance
- Institution of Lighting Professionals (ILP) – guidance on light pollution and dark skies

Flowchart 1. How to Apply the X29 Clause

Key Principle: Follow the Nature and Climate Hierarchy, use the highest viable option, apply carbon optimisation throughout and evidence decisions and outcomes.

NEC PROCESSES	X29 CLAUSE
NATURE AND CLIMATE PLAN Details how the supplier intends to achieve the Nature and Climate Requirements	**STEP 1** Identify risks and opportunities outline potential KPIs and targets
EARLY WARNINGS Matters which could adversely affect the Nature and Climate Requirements raised and recorded	**STEP 2** Apply the Nature and Climate Hierarchy Carbon Optimisation applies across Options A-D
EARLY WARNING MEETING Working together to reduce risk and improve outcomes	
PROGRAMME Include design, implementation, habitat establishment and monitoring activities	**STEP 3** Agree performance measures including Carbon Management
COMPENSATION EVENT Scope changes and other compensation events may impact targets Use the hierarchy and take proactive action collaboratively	**STEP 4** Implement and Deliver
PERFORMANCE TABLE Monitor performance against targets proactively address potential underperformance	**STEP 5** Monitor and Accept Outcomes

Early collaboration to understand the project context

RISKS
Climate (e.g. flooding, heat, drought) | Nature (e.g. habitat loss, low biodiversity) | Asset and service risks

OPPORTUNITIES
Use natural processes | Enhance and increase climate resilience | Carbon sequestration | Deliver social value benefits

Consider options in order and select the highest option that meets the performance requirements

A – Nature-based solutions
Work with or restore natural processes (e.g. wetlands, floodplain reconnection, tree planting, SuDS)

B – Nature-positive infrastructure
Design for measurable nature and climate benefits (e.g. green roofs, living walls, constructed wetlands, SuDS features)

C – Blended green & grey solutions
Mix of nature-based and traditional engineering (e.g. piped solutions where needed)

D – Engineered solutions
Use traditional engineering as a last resort, only where higher options cannot meet requirements

Starting with OPTION A, does this solution meet requirements? YES / NO, move to next option

Selected option becomes the design and delivery approach

Evidence is required to explain why higher options cannot be met

Agree KPIs and include them in the Performance Table, together with monitoring methods, reporting requirements and timescales

- Nature restoration delivered by BNG ≥10%
- Impermeable area to source control SuDS ≥80%
- Canopy cover ≥20%
- Surface water managed via SuDS ≥50%
- Carbon reduction (embodied) ≥10%
- Carbon sequestration (in-use) increase year-on-year

Deliver works in accordance with agreed approach and KPIs

DESIGN → Apply regenerative design principles and hierarchy

CONSTRUCTION → Implement nature-based solutions and safeguards

ESTABLISHMENT → Ensure habitats become established

MONITORING → Track performance against agreed KPIs

REPORTING → Provide data and evidence against KPIs

Verify outcomes and close out

- Independently verify benefits (biodiversity, SuDS, carbon outcomes)
- Assess against agreed KPIs and targets
- Implement corrective actions if required
- Accept outcomes once achieved and in accordance with contract

EXAMPLE OUTCOMES FROM APPLYING X29 CLAUSE

- Reduced flood risk
- Enhanced biodiversity
- Lower carbon emissions
- Improved health, wellbeing and community value
- Long-term resilience and asset value

Flowchart 2. Example Application of the X29 Clause using the Nature and Climate Hierarchy

Project Context: Highway drainage improvement in a semi-urban catchment. Frequent surface water flooding; Poor water quality in the nearby river; Surrounding habitat is intensively managed grassland in poor condition.

NEC PROCESSES	X29 CLAUSE
NATURE AND CLIMATE PLAN Details how the supplier intends to achieve the Nature and Climate Requirements	**STEP 1** Identify risks and opportunities outline potential KPIs and targets
EARLY WARNINGS Matters which could adversely affect the Nature and Climate Requirements raised and recorded	**STEP 2** Apply the Nature and Climate Hierarchy Carbon Optimisation applies across Options A-D
EARLY WARNING MEETING Working together to reduce risk and improve outcomes	
PROGRAMME Include design, implementation, habitat establishment and monitoring activities	**STEP 3** Agree performance measures including Carbon Management
COMPENSATION EVENT Scope changes and other compensation events may impact targets Use the hierarchy and take proactive action collaboratively	**STEP 4** Implement and Deliver
PERFORMANCE TABLE Monitor performance against targets proactively address potential underperformance	**STEP 5** Monitor, Address and Accept Outcomes

Early collaboration to understand the project context, potential KPIs and targets

RISKS
Climate (e.g. flooding, heat, drought) | Nature (e.g. habitat loss, pollution) | Asset and service risks

OPPORTUNITIES
Available land within highway verge and adjacent areas | Use natural processes | Enhance and increase climate resilience | Carbon sequestration | Deliver social value benefits

Consider options in order and select the highest option that meets the performance requirements

A – Nature-based solutions
- Swales and vegetated basins
- Floodplain reconnection
- Habitat creation

B – Nature-positive infrastructure
- Engineered wetlands
- Tree pits in SuDS
- Green retaining structures

C – Blended green & grey solutions
- Swales and piped overflow
- Reinforced floodplain storage
- Hybrid SuDS with flow control chambers and ecological features

D – Engineered solutions
- Conventional piped drainage system
- Higher embodied carbon
- No wider benefits

Starting with OPTION A, does this solution meet requirements? YES / NO, move to next option

Selected option becomes the design and delivery approach

Evidence is required to explain why higher options cannot be met

Agree KPIs and include them in the Performance Table, together with monitoring methods, reporting requirements and timescales

- Nature restoration delivered by BNG ≥10%
- Impermeable area to source control SuDS ≥80%
- Canopy cover ≥20%
- Surface water managed via SuDS ≥50%
- Carbon reduction (embodied) ≥10%
- Carbon sequestration (in-use) increase year-on-year

Deliver works in accordance with agreed approach and KPIs

DESIGN → Apply regenerative design principles and hierarchy

CONSTRUCTION → Implement nature-based solutions and safeguards

ESTABLISHMENT → Ensure habitats become established

MONITORING → Track performance against agreed KPIs

REPORTING → Provide data and evidence against KPIs

Verify outcomes and close out

- Independently verify benefits (biodiversity, SuDS, carbon outcomes)
- Assess against agreed KPIs and targets
- Implement corrective actions if required
- Accept outcomes once achieved and in accordance with contract

EXAMPLE OUTCOMES FROM APPLYING X29 CLAUSE

- Reduced flood risk
- Enhanced biodiversity
- Lower carbon emissions
- Improved health, wellbeing and community value
- Long-term resilience and asset value

Acknowledgements

X29 Nature and Climate Group:

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- Veronica Flint Williams, Contract and Risk Manager, Environment Agency
- Brandon Murray (Technical Director at Arcadis)
- Visual Communication: Mags Ashmore, Visual Literacy Lead at Arcadis

NEC4 Contract Board:

- Peter Higgins, BSc (Hons), CEng, FICE (Chair)
- Ian Heaphy, BSc (Hons), FRICS, FCIArb, FCInstCES, MACostE
- Matthew Garratt, BSc (Hons), MRICS, FCIArb
- Shy Jackson, LLB, LLM, MSc, FCIArb, FCInstCES
- Dale Evans, BSc, FICE, CEng, MBA
- Professor David Mosey, CBE, LLB (Hons), PhD, FICE
- Helen Sturdy, CEng, MSc, BEng (Hons), FIHEEM, CIWFM, MCIBSE, MAPM, MAfH