



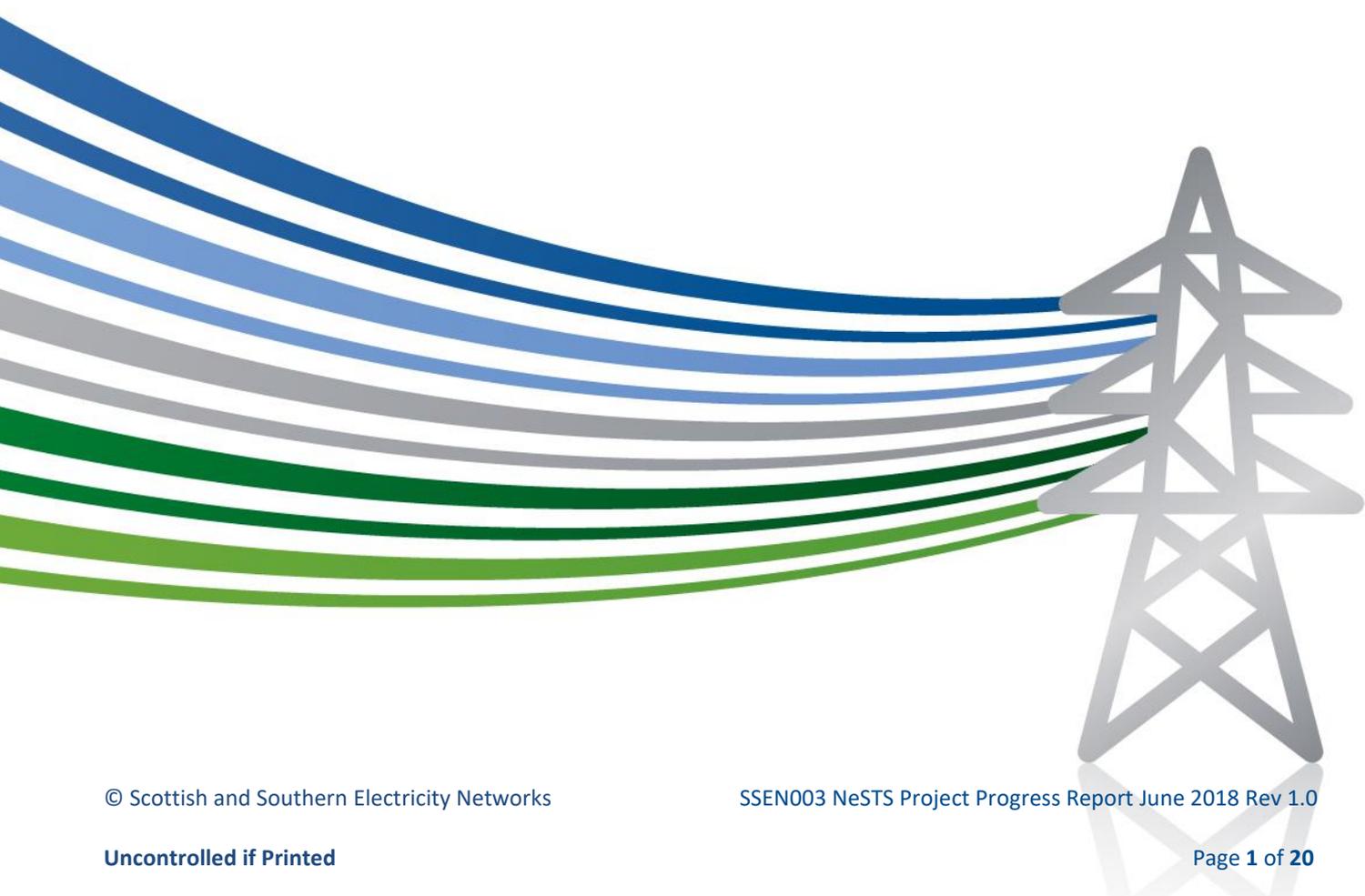
Scottish & Southern
Electricity Networks

SHE Transmission

New Suite of Transmission Structures: NeSTS (SSEN003)

Project Progress Report

June 2018



1) Executive Summary

Overview of NeSTS

Scottish Hydro Electric Transmission plc (SHE Transmission) is developing a New Suite of Transmission Structures (NeSTS), which are planned to be deployed on the Transmission Network.

Overhead lines (OHLs) built using transmission structures are the most visible element of the transmission network. The impact OHLs have on the environment can cause stakeholders concern.

The only available alternative to the steel lattice structures traditionally used in OHL construction is the T-Pylon. Developed by National Grid, the T-Pylon reduces the visual impact of OHLs but may be unsuited to areas with challenging terrain and propensity for severe weather events.

Establishing new infrastructure in these areas is essential to connect renewable generation, so there is a need for a new type of structure to address stakeholder concern.

The NeSTS project is developing innovative designs for OHL structures based on new technologies and techniques. The new suite of structures will then be deployed on the transmission network.

The NeSTS Project seeks to prove the following benefits:

- Improved OHL environmental performance by lowering visual and construction impacts; and
- Lower OHL whole life asset costs via reduced land, construction, maintenance and outage requirements.

Progress within this Reporting Period

During this reporting period, the Project has focused on:

- Designing a 132kV suite of supports in response to a business case review of OHL requirements;
- Working with the main contractor to develop the parallel OHL design;
- Preparing to engage with stakeholders to review an OHL design;
- Installing prototype assemblies to validate the construction and maintenance aspects of the design's performance;
- Preparing to test a cross arm and a cross arm:pole joint; and
- Developing full scale testing requirements.

Redesigning NeSTS for use at 132kV—instead of the previously designed 275kV—delayed the design process by 3 months.

This has delayed engaging with stakeholders to review OHL design, and the testing of a cross arm and cross arm:pole joint, although preparations for these activities are underway, and there will be no delay to the overall programme Successful Delivery Reward Criteria (SDRC).

Prototyping work has been successfully completed and has resulted in design refinements for construction, operation, and maintenance.

The supply chain has optimised the designs for manufacturing, has supplied prototype assemblies, and is currently manufacturing a cross arm test structure.

An OHL has been designed by a main contractor using the 132kV suite of supports and is being compared to a lattice steel solution designed in parallel.

1) Executive Summary

SDRC

The Project completed the delivery of its second SDRC, 11.2 Output of Stakeholder Engagement, with a report submitted on 28 September 2017.

The next SDRC is 11.3 Creation of Technical Specification; which is on schedule to be completed by 30 August 2018.

Risks

The main risks to the project are:

- That there is a change in the project identified for first deployment because of changing system requirements. Alternative options are being reviewed to mitigate this risk;
- That capacity for full scale testing of the NeSTS supports is not available to meet the programme. Procurement of testing capacity has started 6 months early to mitigate this risk; and
- That there is a delay in connection of the NeSTS project due to site selection challenges or planning application issues. Consultees are being engaged to mitigate this risk.

Events

A Prototyping Workshop event was held in February 2018, where full scale NeSTS prototypes were accessed by operatives and engineers from SHE Transmission, Energyline and construction contractor teams. The Project team explained the design choices made and discussed ideas for further improvements.

A video profile of the event is published on the Project website (www.NeSTSproject.com).

Communications

During this reporting period, Project information has been shared directly with stakeholders and published on the Project website.

Dissemination of Project learning has continued with the publication of the Outputs of Stakeholder Engagement Report on 30 September 2017.

This learning, and updates on design progress were presented at the Low Carbon Networks and Innovation (LCNI) conference on 7 December 2017.

2) Project Manager's Report

Project Summary

A New Suite of Transmission Structures has been designed following the design concept selection and prototype developments reported in previous periods.

This process has been driven by stakeholder requirements and their response to the results is positive.

The supply chain has optimised the designs for manufacturing, has supplied prototype assemblies, and is currently manufacturing a cross arm test assembly.

Prototyping work has optimised the designs for construction, operation, and maintenance. This has exposed the designs to operational teams from SHE Transmission, Energyline, and the main contractor.

The suite is insulated to 132kV and supports dual circuits of Araucaria conductors in the North of Scotland.

It has been used to design an OHL by a main contractor in parallel with a L7c lattice steel solution to enable comparison with the NeSTS solution.

SHE Transmission is currently reviewing the parallel design outputs.

The Project is managed via six work packages. An update on the progress made on each work package during this reporting period is provided below.

Project Management

The Project team and internal stakeholders are engaged and holding regular update meetings.

The Project Steering Group is engaged and holding bi-monthly meetings.

Consultee, supply chain, and transmission operator (TO) stakeholders are engaged and contributing to the Project. Engagements with landowners/managers and other interested members of the public are being planned.

During this period, contracts have been awarded for the supply of;

- Prototyping and Initial Testing;
- Full Scale Testing Preparation;
- OHL Support Design Optimisation;
- Cross Arm Test Assembly and Testing;
- OHL Design; and
- Stakeholder Engagement Materials.

The Project is currently in the 'Refinement' stage.

Prototyping and Initial Testing

The NeSTS prototype designs have been reviewed by Consultee, Supply Chain, and internal stakeholders.

Prototype structures based on these have been installed at SHE Transmission premises in Fanellan and at Energyline premises in Copgrove.

These have enabled physical assessment and validation of the construction and maintenance aspects of the designs. Operational teams and engineers from SHE Transmission, Energyline, and the main contractor have contributed to this work.

The conclusions have been documented in a design note, and have informed several design refinements.

Concurrently, manufacturers have been engaged to optimise the designs for manufacturing and cost efficacy.

2) Project Manager's Report

Parallel Design Process

Parallel designs of a proposed OHL have been completed by the main contractor. This allows the comparison of NeSTS based design outputs with those of a conventional L7c design.

A design adoption work package has also been completed, which details the main contractor's scrutiny and endorsement of the NeSTS designs.

SHE Transmission is currently reviewing these outputs.

3D visualisations allowing comparison of the NeSTS and L7c options are published on the Project website.

Full Scale Testing

Test specifications have been written and are being used to identify suitable test facilities.

Cross arm testing at full scale is planned in Summer 2018 and will inform the Decision Point / Review of Business Case stage gate.

Full scale testing of whole supports and foundations will follow the stage gate.

Planning, Construction and Monitoring Processes

This work package's main activities are scheduled to commence following the Decision Point / Review of Business case stage gate.

Knowledge Dissemination

The Project website is live and is disseminating design information and updates on progress, including publication of the Outputs of Stakeholder Engagement Report on 30 September 2017.

Design and Project information has been shared directly with OHL engineers at GB TOs and with the TO / System Operator (SO) Collaboration Group during this reporting period.

This learning, and updates on design progress were presented at the Low Carbon Networks and Innovation (LCNI) conference on 7 December 2017.

A Prototyping Workshop event was held in February 2018, where full scale NeSTS prototypes were accessed by operatives and engineers from the SSEN, Energyline and construction contractor teams. A video summary of this work is published on the Project website.

SDRCs

The Project completed the delivery of its second SDRC, 11.2 Output of Stakeholder Engagement, with a report submitted on 28 September 2017.

The next SDRC is 11.3 Creation of Technical Specification; which is on schedule to be completed by 30 August 2018.

SDRC 11.4 Decision Point / Review of Business Case is on schedule to be completed by 31 December 2018.

3) Business Case Update

No changes have been made to the Business Case for the NeSTS Project, described in the NIC full submission document.

4) Progress Against Plan

Summary of Progress

The Project has made good progress over the last 12 months and is progressing within budget. The design process is running 3 months behind programme due to OHL insulation level being re-specified to 132kV (from 275kV). Although this has delayed communication with stakeholders and cross arm testing, the Project will catch up on programme and deliver its two SDRC on schedule in 2018.

Concept proving, Prototyping and initial testing, and parallel OHL design have been completed, and the Project is approaching its Decision Point / Review of Business Case stage gate.

Learning has been published and shared directly with stakeholders and on the Project website.

Focus This Reporting Period

The focus over this reporting period has been on:

- Designing a 132kV suite of supports in response to a business case review of OHL requirements
- Working with the main contractor to develop the parallel OHL design;
- Preparing to engage with stakeholders to review the OHL design;
- Installing prototype assemblies and start work to validate the construction and maintenance aspects of the designs performance;
- Preparing to test a cross arm and cross arm:pole joint; and

- Developing full scale testing requirements.

Key Activities in Next Reporting Period

The Key Activities between 12 June 2018 and 10 June 2019 planned are:

- Publishing the NeSTS Technical Specification;
- Engaging with stakeholders to review a NeSTS OHL design;
- Testing a cross arm and cross arm:pole joint at full scale;
- Completing review of the parallel design outputs;
- Completing the Decision Point / Review of Business Case stage gate; and
- Developing a type testing programme.

5) Progress Against Budget

The table below details the spend to date against the Project budget for each cost category.

Cost Category	Total Budget	Spend to Date	Comment
Labour			
Project team resource costs	£1,645.49k	£384.72k	On plan
Equipment			
Prototyping, testing, and modelling	£258.56k	£0.57k	On plan
Contractors			
Project team resource costs	£5,344.34k	£1,684.31k	On plan
IT			
IT Infrastructure	£204.79k	£87.23k	On plan
Travel & Expenses			
Travel & Expenses	£47.44k	£17.52k	On plan
Total	£7,500.62k	£2,174.35k¹	

Notes:

- Up to 5 June 2017 the project spent £1,125,234; and from 6 June 2017 to 19 April 2018 the project spent £837,219 (which has been processed through the Project Bank Account, see Appendix 1 for details), totalling spend of £1,962,453. From 19 April 2018 to 30 April 2018 the project spent £211,901 which has yet to be processed through the Project Bank Account, so the total project spend to 30 April 2018 is £2,174,354 (as detailed in the table above).

6) Bank Account

A copy of the current project bank account statement is provided in Appendix 1.

7) SDRC

An update on the Project's SDRC is provided below.

The NeSTS Project identified eight Successful Delivery Reward Criteria (SDRC) which span both the objectives and the lifecycle of the project.

The following table lists each SDRC in chronological order and details the project's progress towards their achievement.

SDRC	Due	Description	Evidence	Status
11.1	30/9/2016	<p>NeSTS Design Selection</p> <p>The completion of the development of the Support Assessment Matrix. This will be offered to TOs to compare different types of overhead line supports in a technically balanced manner, incorporating the electrical, mechanical, environmental and construction and operational factors of overhead lines design.</p> <p>Selection of the final support designs.</p>	<p>Publish the initial outputs of the Support Assessment Matrix. An accompanying report will provide the technical details of the selected designs by 30 September 2016.</p>	<p>Completed (SDRC met)</p> <p>A report on NeSTS Design Selection and the completed Support Assessment Matrix were published on 30 September 2016.</p>
11.2	30/09/2017	<p>Output of Stakeholder Engagement</p> <p>Implement a programme of stakeholder engagement, supported by a suitable project supplier. This will include organised events and one to one interviews. Quantitative and qualitative analysis will be provided to understand key priorities. SHE Transmission will factor these viewpoints into the functional specification for NeSTS where practical.</p>	<p>Report to the Authority with an assessment on the need for a Customer Engagement Plan and/or data protection strategy by 30 June 2016.</p> <p>Publish a report describing the outputs from stakeholder engagement and demonstrate where these outputs have influenced the NeSTS designs by 30 September 2017.</p>	<p>Completed (SDRC met)</p> <p>An assessment that a Customer Engagement Plan was not required was submitted on 3 May 2016. The Authority agreed with this assessment on 5 July 2016.</p> <p>A report on Outputs of Stakeholder Engagement was published on 28 September 2017.</p>
11.3	30/8/2018	<p>Creation of Technical Specification</p> <p>The NeSTS overhead lines circuit will be designed in parallel with a traditional overhead lines support design - this is to create contingency in the event that NeSTS is not approved for demonstration at the stage gate process. The new technical specification for the supports will show how NeSTS design can be practically applied on a project, and is a key learning output for TOs and the supply chain. This will inform the procurement exercises for the initial deployment.</p>	<p>Publish a report on the outputs of the technical specifications of the NeSTS design stage by 30 August 2018.</p>	<p>On Target</p>

7) SDRC

SDRC	Due	Description	Evidence	Status
11.4	31/12/2018	<p>Decision Point / Review of business case</p> <p>Review the NeSTS business case to conclude whether or not the Project should continue to Phase 2.</p> <p>The learning gathered at this point will be assessed to ensure that NeSTS still has a positive business case - impacts of any energy policy developments regarding renewable generation and the results of stakeholder engagement will be considered as part of the decision process.</p> <p>It will involve SHE Transmission's Director of Transmission and the SHE Transmission Steering Board.</p>	<p>Submit an update to Section 3 and Appendix 6, the business case of the Full Submission, to the Authority evaluating the project and recommending whether or not to proceed to Phase 2 by 31 December 2018.</p>	On Target
11.5	30/09/2019	<p>Type Testing Agreement</p> <p>Within the first stage of Phase 2 (the demonstration part of the project), the detailed designs will enable the construction of a NeSTS overhead lines support structure, which will be tested at a dedicated testing facility.</p> <p>This is crucial in ensuring the design is supply chain ready and acceptable to other TOs.</p>	<p>A signed agreement with a dedicated testing facility by 30 September 2019.</p>	On Target
11.6	20/02/2020	<p>Completion of Type Testing</p> <p>The overhead lines support will be put through a series of tests in order to ensure that it complies with the relevant standards and specifications including BS EN 60652 and BS EN 61773.</p> <p>The completed test results will provide clear analysis regarding NeSTS's capabilities.</p>	<p>Publish a report on the outputs of the type testing conclusions by 20 February 2020.</p>	On Target
11.7	29/1/2021	<p>Energisation of NeSTS Overhead Lines</p> <p>The energisation of the NeSTS overhead lines circuit is the culmination of the construction and commissioning of a section of the project is a key milestone.</p>	<p>Publish a full report detailing outputs and knowledge capture including an evaluation comparing NeSTS construction, commissioning and energisation with that of a typical steel lattice tower project by 29 January 2021.</p>	On Target

7) SDRC

SDRC	Due	Description	Evidence	Status
11.8	31/03/2022	<p>Publication of e-learning and visualisation tools and project closedown report</p> <p>Knowledge capture and dissemination is of high importance to the project and the acceleration of NeSTS into TOs' business as usual activities. SHE Transmission will develop an e-learning module to assist with training and familiarisation activities amongst TOs and the supply chain.</p> <p>A visualisation tool will also be created to assist TOs with network planning, and to share learning with stakeholders.</p> <p>At the end of the project, full evaluation and key learning points will be considered for inclusion in a comprehensive project closedown process. This will include learning gathered from knowledge events and the progress of the MASC substation during operation.</p>	<p>Complete development of both tools and share with TOs and deliver detailed closedown report to Ofgem by 31 March 2022.</p>	On Target

 Completed (SDRC met)

 Emerging issue, remains on target

 SDRC completed late

 On target

 Unresolved issue, off target

 Not completed and late

8) Learning Outcomes

The following learning objectives have been set for the NeSTS project:

- **Develop a proven series of NeSTS design specifications:** The NeSTS project will further develop outputs from the NIA project and demonstrate these on the live transmission network. This will allow us to create the project's key output – a set of design specifications which can be shared with licensees and the supply chain. The specifications will take into account NeSTS's electrical, mechanical and civil engineering requirements.
- **Inform policy and procedure:** Each stage of the project will inform new policies and procedures for construction, operation, maintenance and safety. The development of these documents is fundamental to the successful adoption of NeSTS by other licensees.
- **Create future usage options:** NeSTS will be deployed and assessed against a range of terrain and climate scenarios that are representative of conditions found across GB. We will also implement a programme of prototype and component testing to measure NeSTS against severe weather events. This allows licensees and the supply chain to understand the conditions in which NeSTS is optimally suited, and creates confidence in the new designs.
- **Evaluate acceptance of alternative OHL supports by the consent and stakeholder processes:** During the project's first phase, a comprehensive stakeholder consultation will include discussion with licensees, landowners, statutory authorities and the supply chain. This allows us to understand and accommodate key priorities into the design where practical. Subsequent planning and consent for the planned OHL project will be evaluated to see the benefits of using NeSTS in comparison to conventional OHL methodology, and outputs from

this learning objective will be shared with all stakeholders.

- **Develop and validate Support Assessment Matrix:** The Support Assessment Matrix (SAM) was developed through the NIA NeSTS project to evaluate and compare a series of OHL support designs against a set of Main Design Aspects (MDAs). The SAM will be developed further and validated by NeSTS to produce a highly useful matrix available to the supply chain and to licensees. This creates a centralised vehicle to evaluate and facilitate future OHL support innovations.
- **Create a transmission infrastructure working group:** The NeSTS project will form a working group to create and share best working practices for OHL supports, similar to the Energy Storage Operators' Forum. The OHL working group will review and share best practice worldwide to facilitate further improvements in OHL methodology.

These learning objectives will be met as the NeSTS Project progresses into the design phase through to installation and final operation.

8) Learning Outcomes

Learning during this reporting period

Develop a proven series of NeSTS design specifications

The outputs of review by the main contractor and consultants to the Technical Authority have been embodied in a NeSTS Technical Specification.

Inform policy and procedure

A design note, capturing the outputs of prototyping activity has been written and will be disseminated among GB TOs.

Create future usage options

A medium duty 132kV suite of supports has been designed and used to design an OHL.

Refinements from the 132kV design process will be embodied in the 275kV design following the Decision Point / Review of Business Case stage gate.

Evaluate acceptance of alternative OHL supports by the consent and stakeholder processes

Materials to enable consultee assessment of the NeSTS designs in an OHL are being prepared for use in Summer 2018.

Develop and validate Support Assessment Matrix

The completed Support Assessment Matrix was delivered as part of the first SDRC and is published on the Project website.

Create a transmission infrastructure working group

Learning from the OHL design process and supply chain engagement activities is being shared with GB TOs, and the TO/SO Collaboration Group.

9) IPR

No relevant IPR has been generated or registered during this reporting period, and none is forecast to be generated or registered in the next reporting period.

10) Risk Management

Risk Management Plan

The Project has a Project Risk Management Plan that describes how Project risks are managed throughout the Project.

The Project risk register is regularly reviewed by the Project team and the key Project risks are highlighted and discussed at the bi-monthly steering group meetings, where mitigating actions are agreed.

Risk Register

The current Project Risk Register is provided in Appendix 2.

11) Accuracy Assurance Statement

PPR Preparation Steps

To ensure that the information contained in this report is accurate and completed, the following steps have been taken, the report has been:

- Prepared by the Project Manager;
- Reviewed by the Project Team;
- Reviewed by the Steering Group; and
- Approved by the Project Director and Regulation.

Sign-off

As the senior manager responsible for the NeSTS Project, I confirm that the processes in place and steps taken to prepare this PPR are sufficiently robust and that the information provided is accurate and complete.



Stewart A Reid

Head of DSO & Innovation

Scottish and Southern Electricity Networks

1-6-18.

Date

12) Appendices

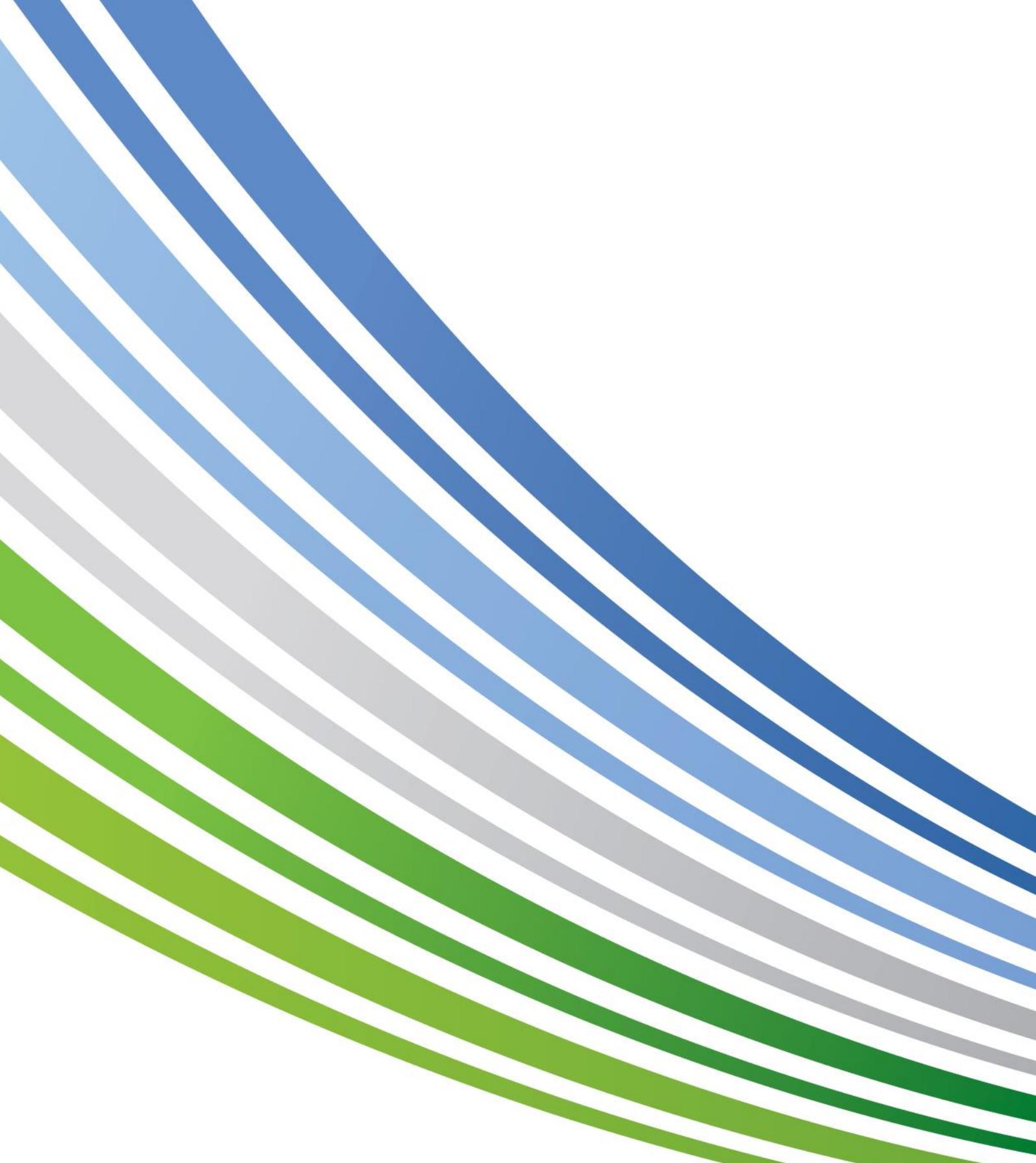
Appendix 1

Project Bank Account Statement

Appendix 2

Risk Register

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SSEN003 NeSTS Project Progress Report June 2018 Rev 1.0

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