ST FERGUS SUBSTATION (TRANSMISSION TOWER / CABLE SEALING END)

Flood Risk Assessment

Prepared for: **Scottish & Southern Electricity Networks**

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1.0 Introduction

1.1 Context

SLR Consulting Ltd (SLR) was appointed by Scottish & Southern Electricity Networks (SSE) to prepare a Flood Risk Assessment (FRA) in support of a planning application for a substation on land to the west of the A90, adjacent to St Fergus Gas Terminal, near St Fergus, Aberdeenshire.

This present report is an addendum to the FRA prepared for the substation in November 2019[1], and addresses the flood risks related to the transmission tower / cable sealing end associated with the substation.

It is noted that drainage aspects of the proposals are not reviewed in this report.

1.2 Policy and Guidance

This assessment has been completed in accordance with relevant guidance issued by Aberdeenshire Council (ABC), the Scottish Government, and the Scottish Environment Protection Agency (SEPA). It takes cognisance of *Scottish Planning Policy* (SSP)[2], the *National Planning Framework for Scotland 3* (NPF3)[3] and the *Flood Risk Management (Scotland) Act 2009*.

The assessment also references and takes due consideration (where appropriate) of the following principal guidance and policy documents:

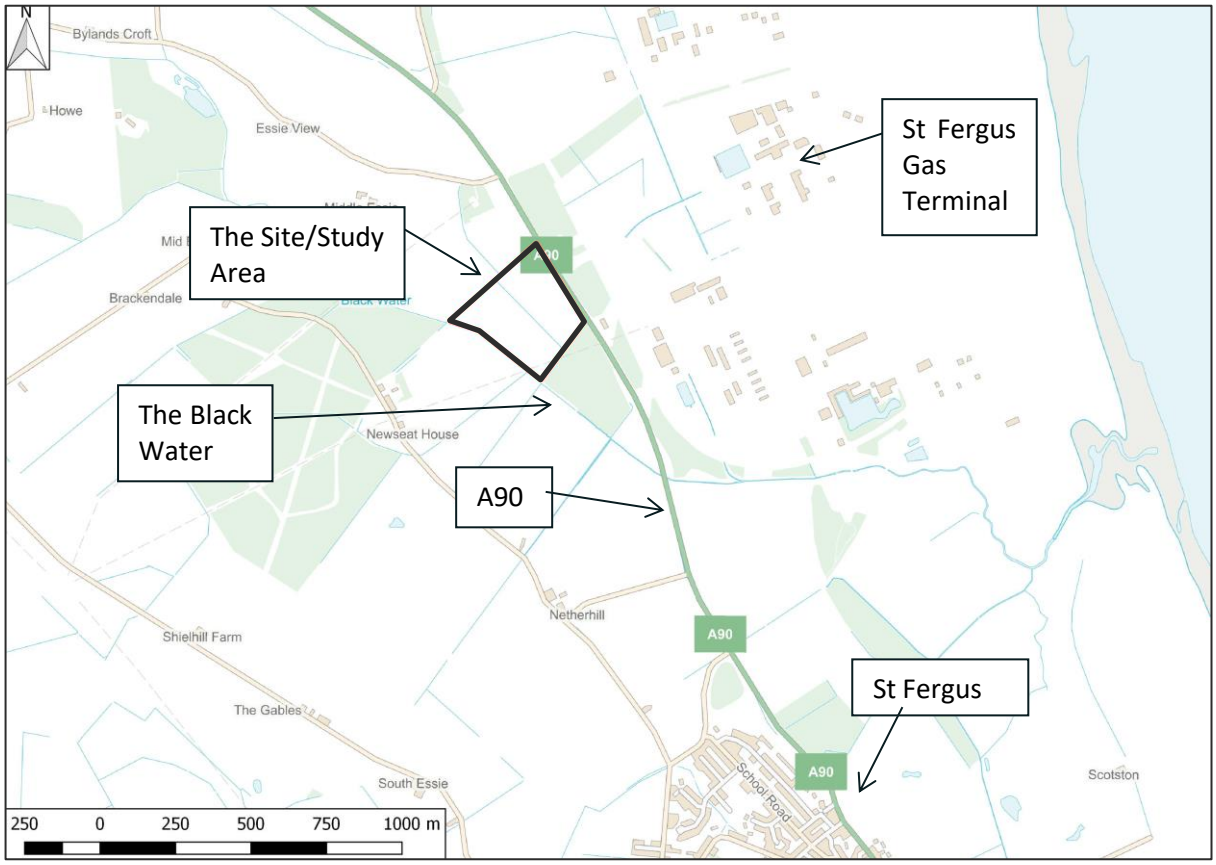
- British Standards Institution (2011) Assessing and Managing Flood Risk in Development – Code of Practice, Report BS-8533:2011, October 2011;
- CIRIA (2004) Development and Flood Risk – Guidance for the Construction Industry, Report C624; and
- SEPA (2015) Technical Flood Risk Guidance for Stakeholders (Reference: SS-NFR-P-002) June 2015.

1.3 Site Location

The Site is located approximately 2km to the north west of the village of St Fergus at National Grid Reference (NGR) NK 08853, and is shown in Figure 1-1 below. The Site is surrounded by pastureland and is bound to the east by the A90, opposite St Fergus Gas Terminal. A small watercourse, Black Water, runs through the Site, to the south west of the proposed substation. This watercourse flows in a south-easterly direction towards the coast. There is a small pond located within the Site to the south west of the proposed substation.

[1] St Fergus Substation, Flood Risk Assessment, SLR Consulting Ltd, November 2019 (version 1.4)
[2] The Scottish Government (2014) Scottish Planning Policy, June 2014
[3] The Scottish Government (2014) National Planning Framework 3, June 2014

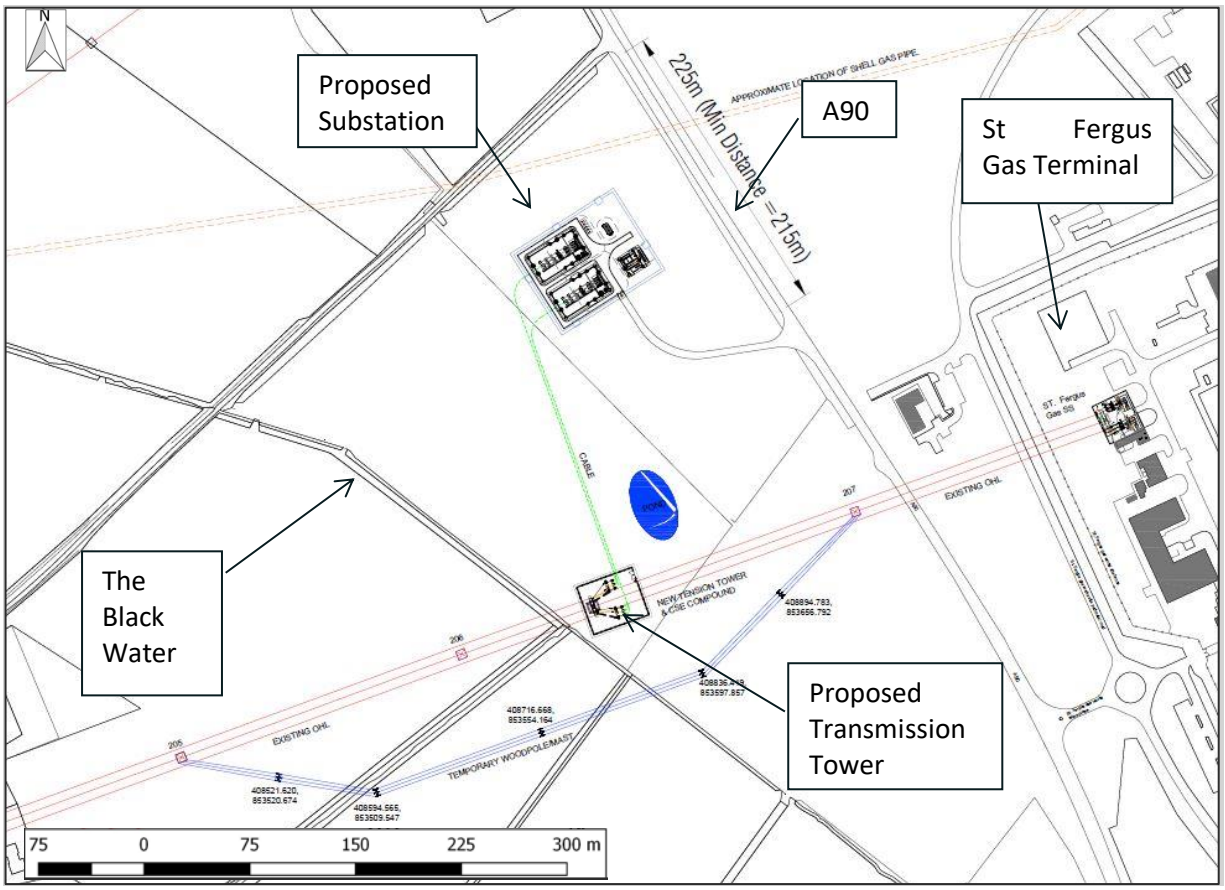
Figure 1-1 : Site Location



1.4 Proposed Development

The proposed development is shown below in Figure 1-2, which is an extract of the full plan provided in Appendix A. It consists of a substation in the northern part of the Site, as well as a separate steel transmission tower, and associated cabling. During construction, it is planned that a series of temporary timber transmission poles will be used to carry the aerial HV cables across the Black Water floodplain until the new steel tower is in place. This report relates to the transmission tower / cable sealing end, which will be located in the south-eastern part of the Site.

Figure 1-2: Proposed Development



2.0 Flood Risk Assessment

As discussed in the FRA , the key flood risk at the Site is from fluvial sources. This risk also relates to the transmission tower / cable sealing end, as it lies within the flood plain.

2.1 Design Flood Levels

2.1.1 Design Flood Event

Guidance on the application of the SPP framework is found in SEPA's "Flood Risk and Land Use Vulnerability Guidance"[4]. Using terminology from this document, development that includes "civil infrastructure" is considered to represent a "Most Vulnerable Use", for which SEPA advise that the design event would be the 1 in 1000 AEP event. This guidance does not specify that substations fall into this category. However, SSE design standards do specify that substations should be designed to remain flood-free in a 1:1000 AEP event.

The associated transmission tower would be considered in the SEPA vulnerability guidance to represent "Essential Infrastructure", as it requires to be sited in the floodplain for operational reasons.

The latest SEPA guidance on climate change allowances[5] states that climate change uplifts on peak river flow should be applied by River Basin Regions. For the NE of Scotland, the climate change uplift change to the year 2100 is 24%. Therefore, a design flood event of 1 in 1000 + 24% CC has been adopted.

2.1.2 SEPA Flood Modelling

SEPA's online Flood Maps provide indications of the likely flood patterns for a range of AEP. Whilst noting the limitations of this mapping, it can provide a guide to the likely scale of flooding in an area.

Given the limitations of the SEPA flood modelling and mapping, the mapping shown indicates that the 1 in 1000 AEP flood level at the site may be between 0.3 – 1m depth.

This flood mapping resource provides indications of the potential for flood risk at a local or "community" level and is intended to support community decisions. It is not considered by SEPA as suitable to assess flood risk at a site specific level.

2.1.3 Localised Hydraulic Modelling and Flood Level Prediction

In order to obtain a more refined estimate of flood levels at the Site, a numerical hydraulic model was established and used to determine the flood routing characteristics at the proposed St Fergus Substation.

Hydrology

It is understood that there is no publicly available flow gauging on the Black Water upstream of the Site.

In the absence of stream gauging, both ReFH[6] and FEH Pooling Group[7] methods have been used to develop the inflow in a 1 in 1000 + 24% CC event on the Black Water.

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[4] SEPA - Flood Risk and Land Use Vulnerability Guidance, Ver 3, Feb. 2018

[5] SEPA – Climate change allowances for flood risk assessment in land use planning, Ver 1, Apr. 2019

[6] Revitalised Flood Hydrograph Model 2.2 (ReFH), as defined in "The Revitalised Flood Hydrograph Model REFH2.2 Technical Guidance", CEH 2016

[7] As described in Volume 3 of the Flood Estimation Handbook (CEH, 1999) and implemented via WINFAP-FEH 3 software.

The key details of the rainfall and runoff parameters used in the ReFH method and details of the application and outcomes of the Pooling Ground Method are given in the Substation FRA[1].

It should be noted that a set of initial hydraulic model runs were carried out using a range of durations of rainfall event, in order to ensure that the critical event was captured for flood level response of Black Water. A range of events from 2.5 hours through to 24.5 hours were tested, and it was found that the 6.5 hour rainfall was critical for flood level. Longer and shorter durations resulted in lower flood levels.

The outcomes of the hydrological analyses, in terms of peak flowrates, were as follows:-

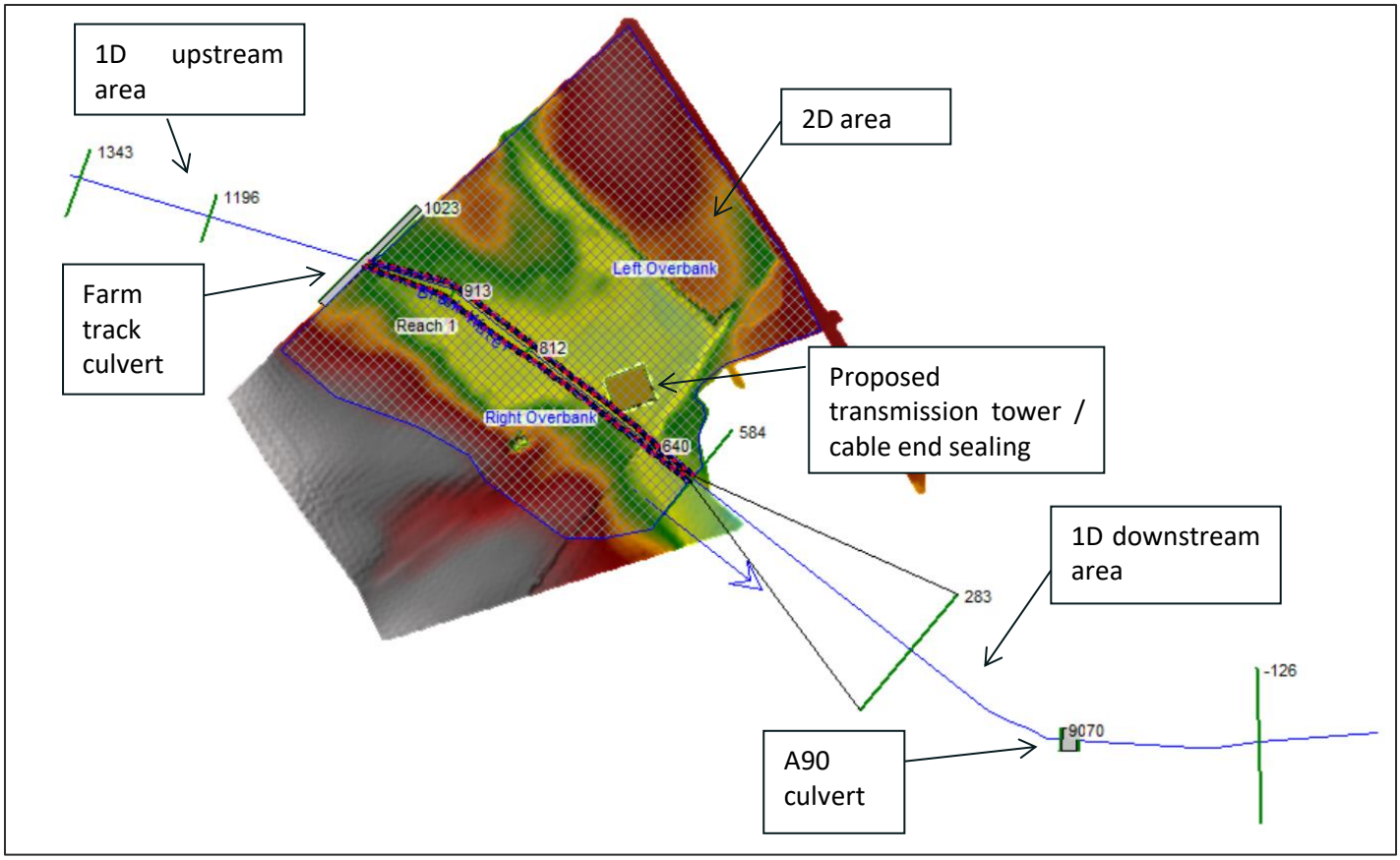
- ReFH Method: 1 in 1000 Peak Flowrate = 13.98 m^3/s;
- ReFH Method: 1 in 1000 + 24% Climate Change Peak Flowrate = 17.34 m^3/s;
- Target Pooling Group Method: 1 in 1000 Peak Flowrate = 12.07 m^3/s;
- Target Pooling Group Method: 1 in 1000 + 24% Climate Change Peak Flowrate = 16.89 m^3/s.

The ReFH method was chosen to be used in this model, as it presents a slightly more conservative estimate than the Target Pooling Group method, and is appropriate for smaller catchment, as in this case (catchment area is approximately 7.69km^2).

Hydraulic Model

A linked 1D/2D HEC-RAS model was established for the Black Water in the vicinity of the Site.

Figure 2-1: Model Setup



The upstream boundary condition was the ReFH hydrograph, and the downstream boundary condition was set as Normal Depth (based on assumed stream bed gradient).

The model included two structures, representing the two culverts in the study reach (farm track culvert upstream of the Site, and the A90 culvert downstream of the Site) – as described in the FRA.

The 1D sections were as used in the earlier FRA, supplemented with interpolated sections at maximum 40m spacing.

In the base modelling, reflecting observations on site, one of the barrels of the A90 culvert was set as blocked to a depth of 700mm by silt; the other is full diameter. In a blockage scenario (see below), the clean barrel is also set as blocked to 700mm depth.

The 2D area was modelled from ground survey carried out across this area in 2019 for the FRA and other purposes, using a 2m cell size and a Manning's 'n' value of 0.06, consistent with that adopted in the FRA in the 1D approach.

Modelling Results

The key outcomes of the post-development modelling for a 1:1000 + 24% CC event are:

- Peak Inflow = 17.34 m^3/s;
- Maximum Ponded Level adjacent to the cable sealing end platform and substation – approximately 7.83m aOD pre-development and 7.84maOD post-development (rounded to 7.8m aOD);
- Flow velocities around the proposed platform range from 0.1m/s to approximately 0.7 m/s.

Selected outputs from the modelling of the Pre- and Post-development scenarios are shown in Appendix B. This includes the overall water surface profile along the modelled reach, detailed comparisons of maximum water levels at the floodplain adjacent to the substation and at the A90 culvert, and the mapped flood extents with the proposed works in place.

Sensitivity Analysis

Since the inflows have been estimated, and the resulting flood levels cannot be verified against actual flood events, some sensitivity analyses were carried out in the FRA study to gauge the uncertainty and sensitivity of the resulting flood level given above to these input parameters. The outcomes (which inform the setting of freeboard amounts) were as follows:

- Varying slope at downstream boundary (+/- 20%): No change
- Varying Manning's n value (+/- 20%): +/- 50mm
- Varying the blockage (siltation, etc.) of the downstream culvert +/- 10mm

The mass balance error across the final pre and post-development runs was less than 0.3%.

Discussion

The hydraulic modelling including the cable sealing end platform indicates that (based on a conservative flow assessment) the maximum peak water level adjacent to the site would be at approximately 7.8m aOD, and the flood extents are shown below in Figure 2-2.

Figure 2-2 : Flood Extents

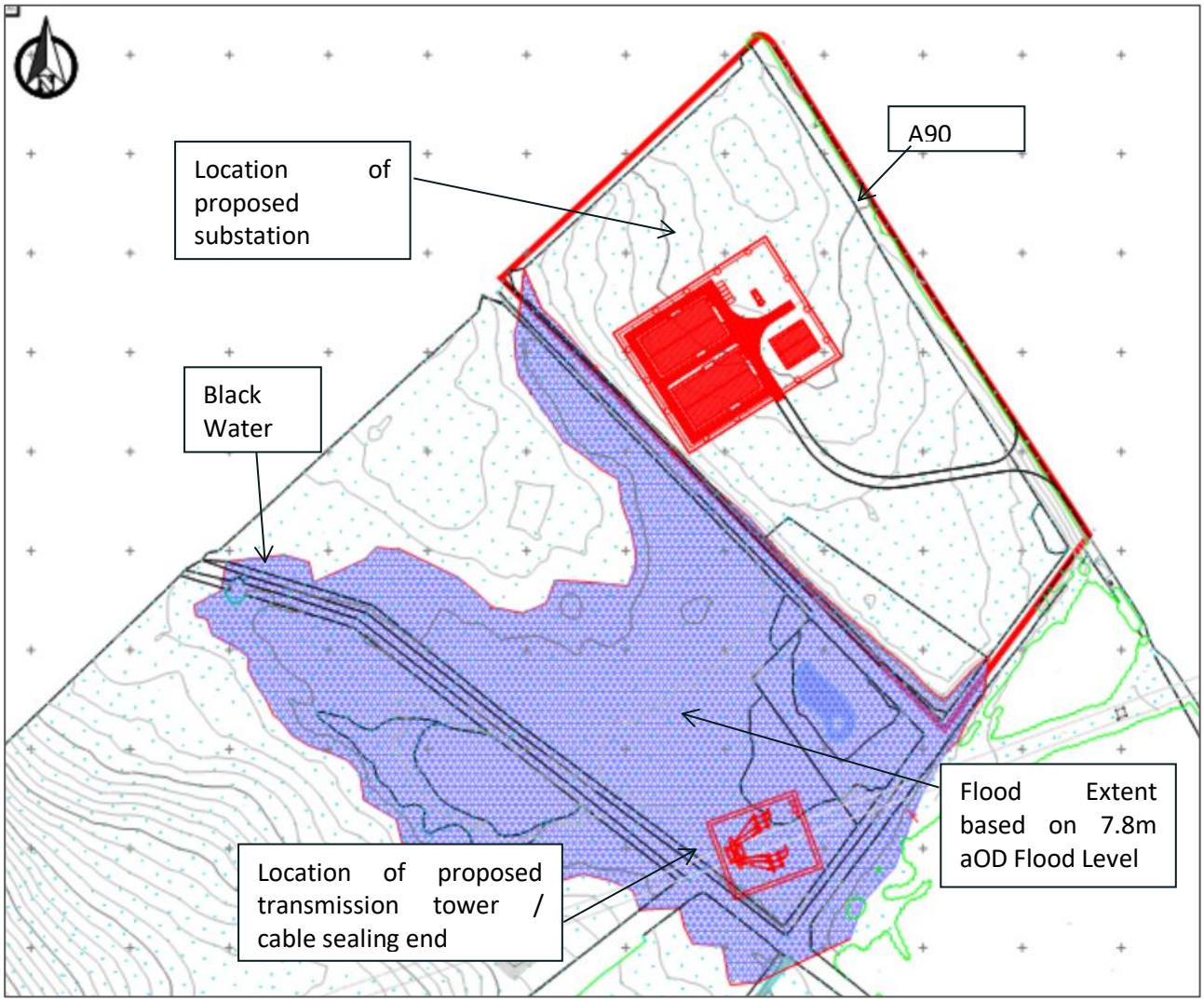


Figure 2-2 shows that in the 1 in 1000 +24% CC flood event, the flood extents would cover the majority of the south west part of the Site, including the location of the proposed transmission tower / cable sealing end. Since the land in the north east part of the Site is at higher elevations, the flooding only extends slightly onto this part of the Site. The flood extent is not predicted to inundate the area in which the proposed substation is located.

2.1.4 Freeboard Provisions in the Development

A freeboard should be applied to the adopted design flood level to arrive at suitable design floor levels.

Freeboard allows for both uncertainty in the hydrology and hydraulic modelling that is used to derive flood levels, and other physical processes not allowed for in the design flood estimation, such as minor wave or wind effects, super-elevation of water surfaces, and settlement of defence structures[8].

SEPA advises a minimum freeboard of 500mm to 600mm for fluvial flood risk and raised flood defence situations, where wave, surge, defence settlement and other such effects may be present.

[8] Environment Agency, Fluvial Freeboard Guidance Note, Report W187, C624, 2000.

Guidance such as *Improving the flood performance of new buildings – Flood resilient construction*[9] referenced by the Building Standards for Scotland suggest that freeboard related to uncertainties alone should be around 300mm.

In this instance, a freeboard of 600mm is recommended. The design platform level for the cable sealing end should therefore be a minimum of **8.4m aOD**.

2.2 Effect on Floodplain Hydrology

The differences in flood flows and peak flood heights at key locations was assessed in order to review the potential impact of the presence of the cable sealing end platform in the floodplain. This indicated the following:-

- At the farm access track culvert upstream of the site, the peak water level in a 1:1000 AEP+24% CC event under existing conditions is estimated to be 8.62m aOD, slightly above the level of the road surface at the crossing. With the development in place, the peak water level remains at 8.62m aOD.
- Across the floodplain area around the site (i.e. downstream of the farm access culvert) the modelled post-development levels are within 1cm of the pre-development levels.
- The flow velocities in the watercourse and across the floodplain in the vicinity of the platform do not materially vary above or below the pre-development velocities.
- At the A90 culvert, the culvert barrels would be part-full under the design 1:1000+24%CC peak flows, and the post-development peak water levels are the same as the pre-development levels.
- There is no discernible change in peak flowrate downstream of the development (e.g. at the A90) between the pre- and post-development scenarios.

These results indicate that the development is not likely to have any adverse effect on the flood regime of the Black Water.

2.3 Alignment with Flood Policy

The south-eastern part of the Site, where the proposed transmission tower / cable sealing end is to be located, is shown to be in a zone of Medium to High Flood Risk according to SPP criteria (i.e. it has an annual probability of flooding of more than 1:200). With reference to SEPA's guidance on vulnerability and alignment with SPP[10], the transmission tower requiring to be sited in the floodplain would be classed as Essential Infrastructure. SEPA's guidance indicates that this infrastructure is suitable to be sited within the floodplain, providing that it is designed and constructed to remain operational during at least a 1:200 AEP flood event and not impede the flow of water. As noted above, the platform for the tower and the cable sealing end facilities will be located an adequate freeboard amount above the 1:1000 AEP flood level, and therefore are suitable in this location.

The north-eastern part of the Site, where the proposed substation is to be located, is shown to be within a zone of Little to No Flood Risk (i.e. it has an annual probability of flooding of less than 1:1000). In accordance with SEPA's guidance, there would be no constraint to the siting of the substation in this area.

The proposed development is therefore considered to be in accordance with SPP and Aberdeenshire Council policy and SEPA guidance regarding appropriate land uses.

[9] Environment Agency, Improving the flood performance of new buildings – Flood resilient construction, 2007.
[10] SEPA, Flood Risk and Land Use Vulnerability Guidance, Ver 3, February 2018

3.0 Conclusions

SLR Consulting Ltd (SLR) was appointed by SSE to prepare a Flood Risk Assessment (FRA) in support of a planning application for a substation at St Fergus, Aberdeenshire. The FRA was reported in November 2019[1]. This present report assesses the flood risk at the transmission tower / cable sealing end and forms an addendum to the FRA.

This present flood study included detailed consideration of the response of Black Water to the passage of a 1 in 1000 + 24% CC flood event through the Site. Two forms of analysis of estimated flood flows have been carried out, and the most conservative method has been used to estimate potential flood levels.

A linked 1D/2D hydraulic model of the river system was established to assess the risk at the transmission tower / cable sealing end. This was used to model the effects of a 1 in 1000 + 24% CC storm event, in both existing conditions and with the cable sealing end platform in place.

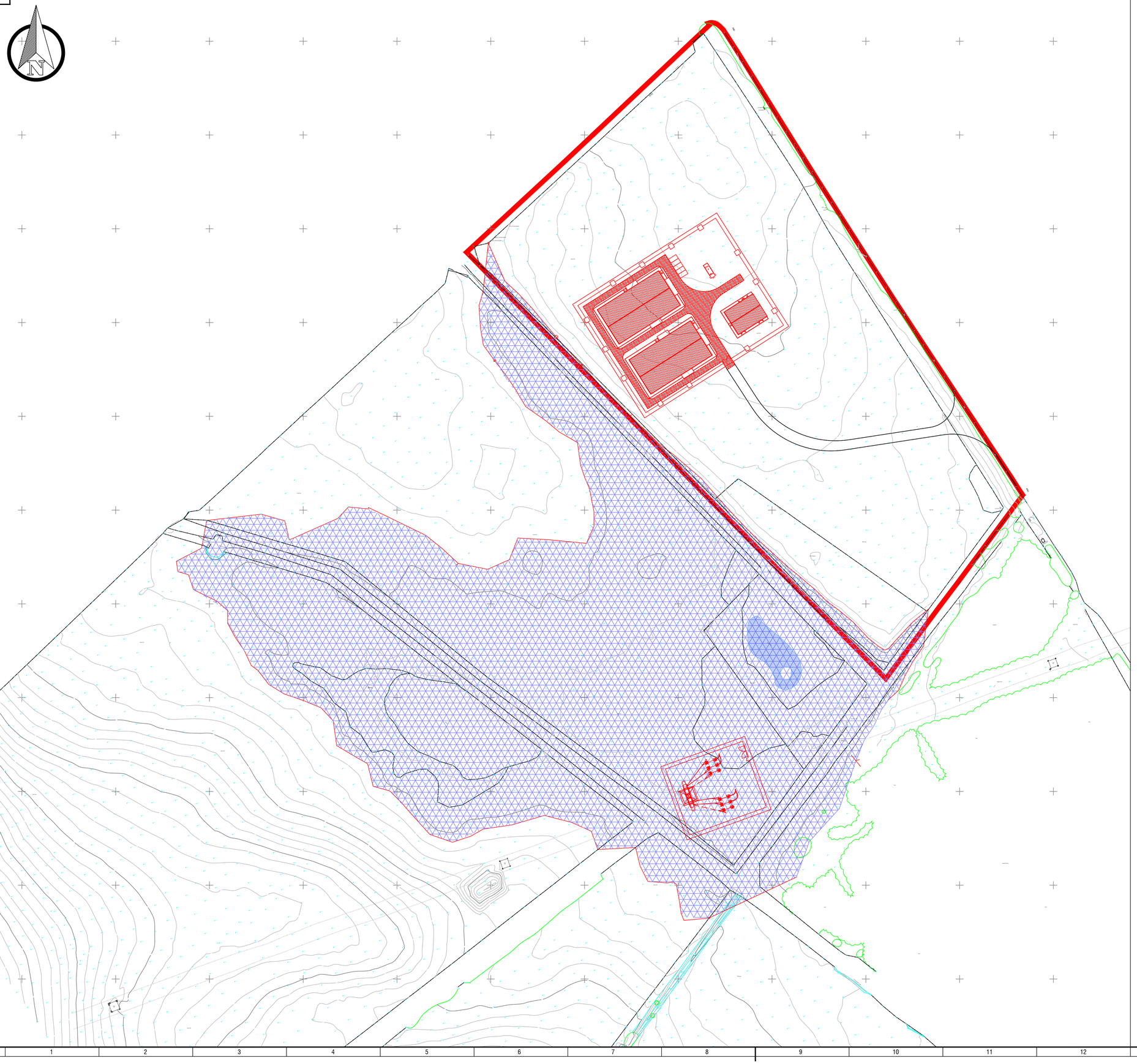
The maximum flood level in the Black Water floodplain adjacent to the substation and the transmission tower / cable sealing end platform is estimated to be 7.8m aOD, and with a suggested freeboard of 600mm, a design platform level is 8.4m aOD is recommended.

The analysis shows that the development of the cable sealing end platform in the floodplain adjacent to the Black Water would have a negligible effect on flood levels, flowrates or flow velocities upstream, adjacent to, and downstream of the proposed works.

APPENDIX A

Site Plans

A1



LIST OF ALL RELEVANT DRAWINGS OR DOCUMENTS THAT DIRECTLY RELATE TO THE CURRENT REVISION OF THE DRAWING

DOCUMENT REFERENCE:

NOTES:-

1. TOPOGRAPHICAL SURVEY TAKEN FROM UTEC DRAWING NUMBER ST-SSE0082_01_00.
2. PLATFORM EXTENTS TAKEN FROM SITE LAYOUT, PLEASE REFER TO SSEN DRAWING NUMBER LT197_SFEG_1104_0003_00_02.

LEGEND:-

- APPLICATION BOUNDARY
- PROPOSED INFRASTRUCTURE
- FLOOD PLAIN (1 IN A 1000 YEARS)

SCALE AT 1:1000

0m 25m 50m 75m 100m

PRELIMINARY DESIGN ONLY

FOR PLANNING

DRAFT

Rev:	Drawn:	Approved:	Description:
0A	PMR		FOR INTERNAL COMMENT ONLY.
	Checked:	Date: 16.01.20	

J:\05 Operations\10 Drawing Office\08 CAD customisation\SSE Drawing Borders\Logo_Primary_RGB.jpg

SSE Inveralmond House, 200 Dunkeld Road
Perth, PH1 3AQ, UK www.sse.com

Project:
ST. FERGUS GAS TRANSFORMER REPLACEMENT

Project Number: LT000197	**Location:** ST. FERGUS

Title:
PROPOSED ST FERGUS 132/11kV SUBSTATION
PROPOSED PLATFORM WITH FLOOD PLAIN (1 IN 1000 YEARS)

Drawing Status: FOR INFORMATION	**Drawn:** PMR
Scale: 1:1000 @ A1	**Checked:**
Date: 16.01.2020	**Approved:**

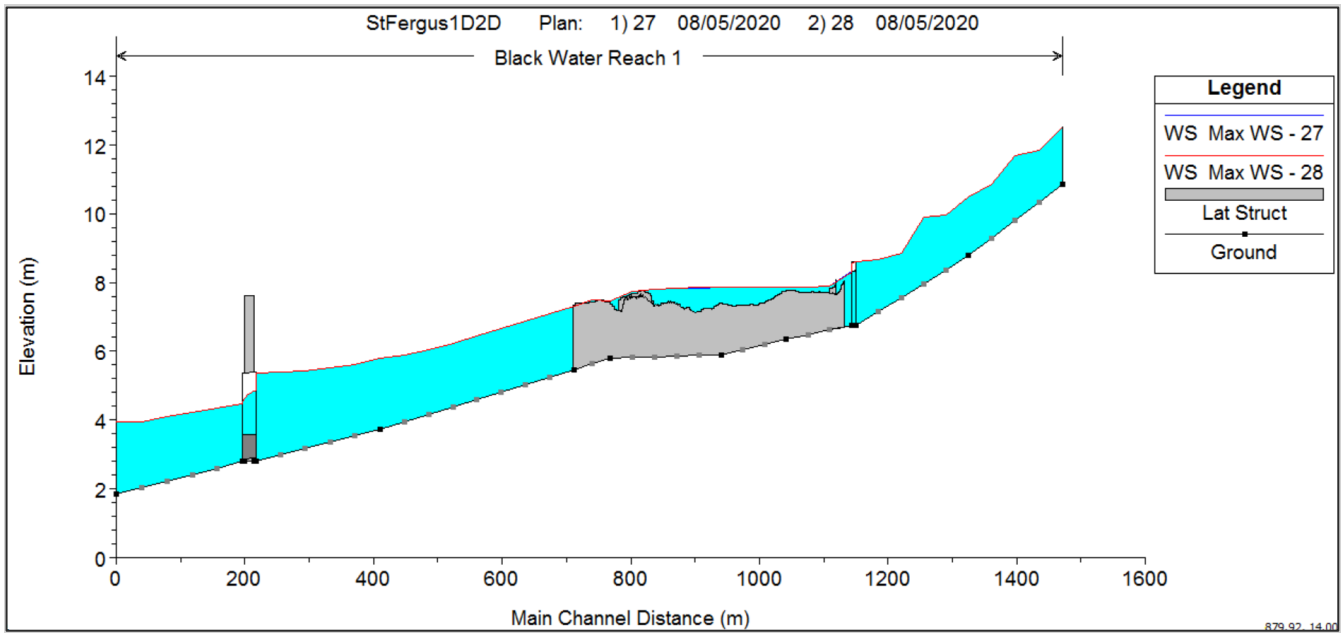
Drawing Number:	**Sheet No:**	**Revision No:**
LT197_SFEG_0802_0011	00	0A

Date Plotted: 06.04.2020
File Name: LT197_SFEG_0802_0011_00_0A_DRAFT - St Fergus Gas Tx Replacement Proposed PLATFORM & FLOOD PLAIN.dwg

APPENDIX B

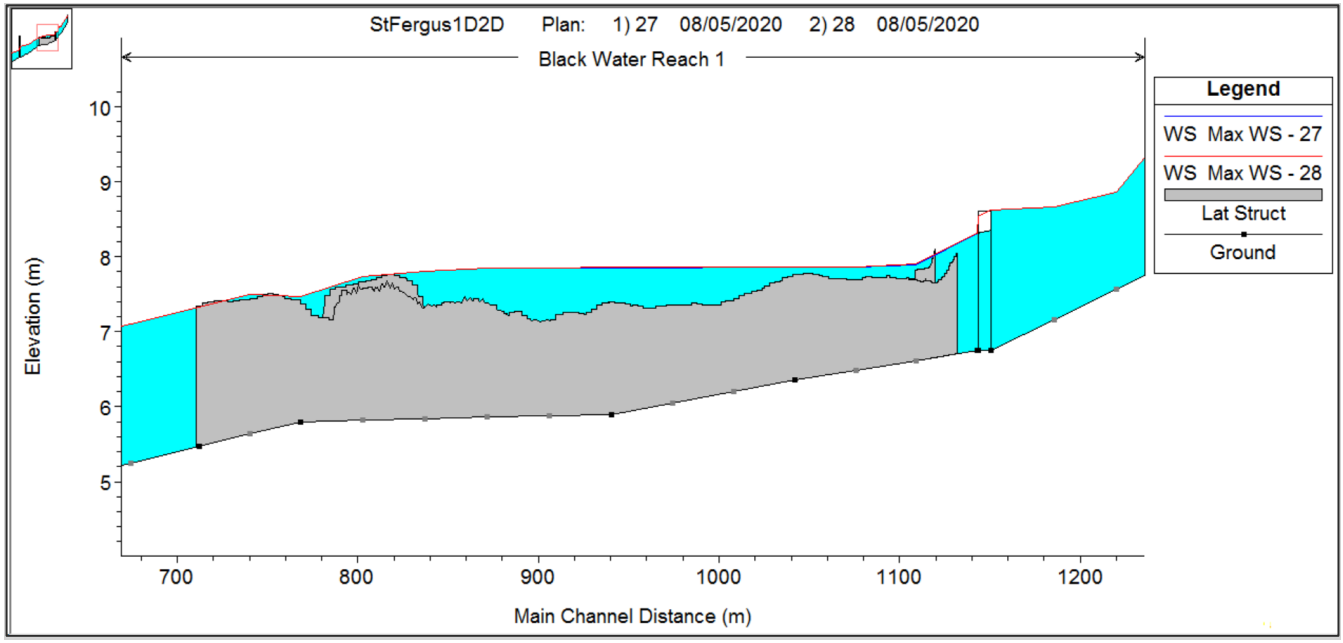
Selected Model Outputs

Peak Water Surface Levels – Overall Model Length



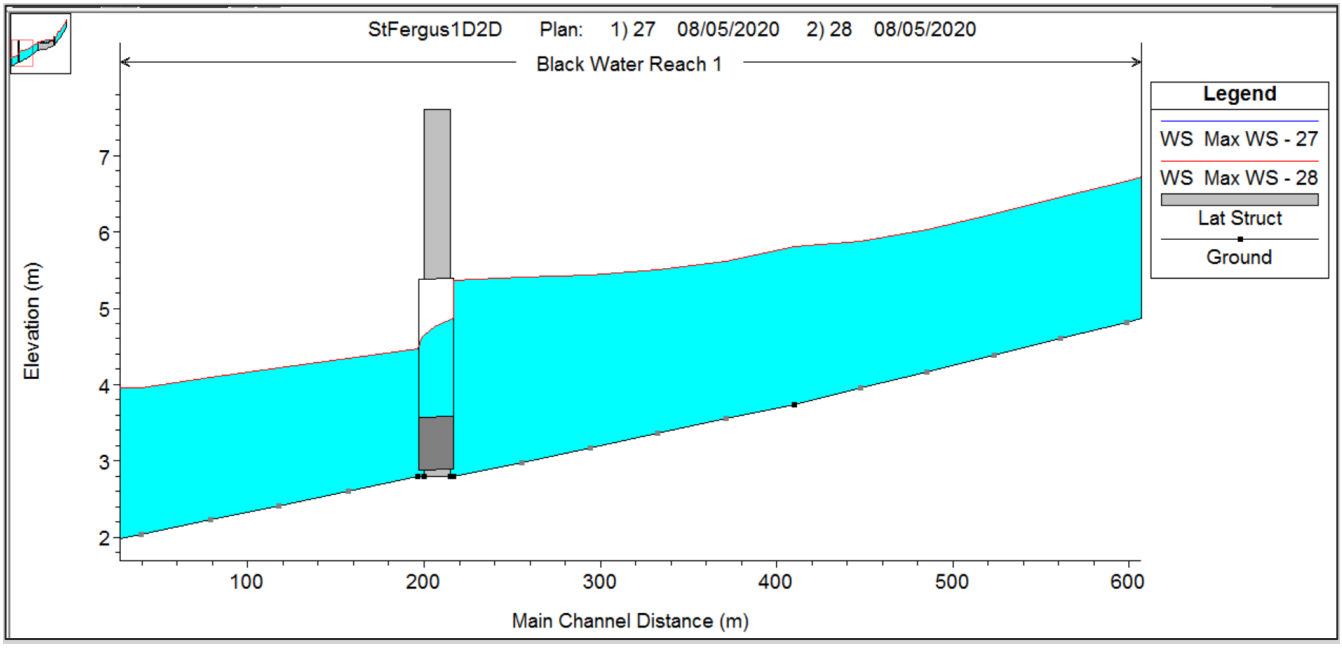
Note : Run 27 is Pre-development, Run 28 is Post-development

Peak Water Surface Levels – Detail Near Proposed Works



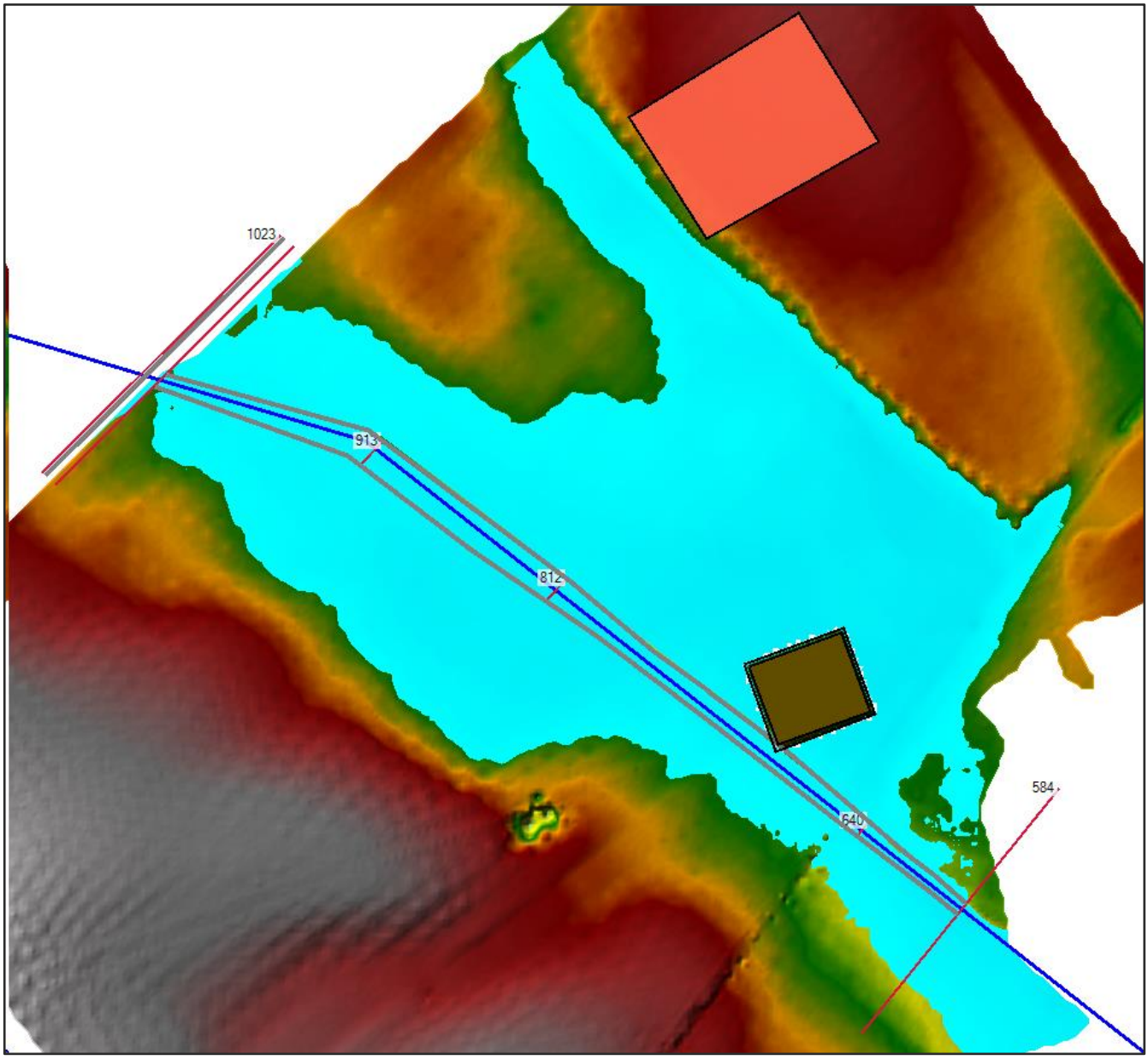
Note : Run 27 is Pre-development, Run 28 is Post-development

Peak Water Surface Levels – Detail At A90 Culvert



Note : Run 27 is Pre-development, Run 28 is Post-development

Maximum Flood Extents – Post Development Scenario



Tabulated Results – Pre and Post Development Scenarios

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach 1	1196	Max WS	27	14.00	8.78	10.48		10.56	0.003877	1.71	12.66	28.57	0.50
Reach 1	1196	Max WS	28	14.00	8.78	10.48		10.56	0.003890	1.72	12.64	28.57	0.50
Reach 1	1023	Max WS	27	17.38	6.75	8.62		8.64	0.000780	0.98	32.43	99.10	0.26
Reach 1	1023	Max WS	28	17.37	6.75	8.62		8.64	0.000780	0.98	32.43	99.10	0.26
Reach 1	1018			Culvert									
Reach 1	1014	Max WS	27	17.37	6.75	8.31	8.34	8.50	0.005312	2.19	12.22	42.46	0.65
Reach 1	1014	Max WS	28	17.12	6.75	8.31	8.33	8.49	0.005320	2.18	12.03	42.05	0.65
Reach 1	1013.5			Lat Struct									
Reach 1	1013			Lat Struct									
Reach 1	913	Max WS	27	13.41	6.35	7.86		7.90	0.000957	0.92	18.14	32.27	0.29
Reach 1	913	Max WS	28	13.40	6.35	7.87		7.90	0.000939	0.92	18.26	32.27	0.29
Reach 1	812	Max WS	27	7.74	5.90	7.85		7.86	0.000151	0.42	22.08	24.60	0.11
Reach 1	812	Max WS	28	7.74	5.90	7.86		7.86	0.000149	0.42	22.18	24.60	0.11
Reach 1	640	Max WS	27	12.25	5.80	7.47		7.67	0.004549	2.09	7.25	12.04	0.59
Reach 1	640	Max WS	28	12.29	5.80	7.47		7.67	0.004584	2.09	7.25	12.04	0.59
Reach 1	584	Max WS	27	16.28	5.47	7.32		7.43	0.005118	1.67	12.96	37.69	0.47
Reach 1	584	Max WS	28	16.31	5.47	7.32		7.43	0.005116	1.67	12.99	37.75	0.47
Reach 1	283	Max WS	27	16.90	3.74	5.81		5.84	0.001772	1.14	25.00	74.56	0.28
Reach 1	283	Max WS	28	16.91	3.74	5.81		5.84	0.001771	1.14	25.02	74.61	0.28
Reach 1	90	Max WS	27	16.84	2.79	5.37		5.40	0.000856	0.82	20.56	13.23	0.21
Reach 1	90	Max WS	28	16.84	2.79	5.37		5.40	0.000856	0.82	20.56	13.23	0.21
Reach 1	80			Culvert									
Reach 1	70	Max WS	27	17.49	2.79	4.47		4.63	0.003856	1.75	10.01	10.37	0.57
Reach 1	70	Max WS	28	17.49	2.79	4.47		4.63	0.003857	1.75	10.01	10.37	0.57
Reach 1	-126	Max WS	27	17.42	1.85	3.95	3.36	4.00	0.001063	1.12	27.78	80.67	0.30
Reach 1	-126	Max WS	28	17.42	1.85	3.95	3.36	4.00	0.001063	1.12	27.78	80.67	0.30

APPENDIX C

SEPA Checklist

Flood Risk Assessment (FRA) Checklist

(SS-NFR-F-001 - Version 16 - Last updated 27/08/2019

This document must be attached within the front cover of any Flood Risk Assessments issued to Local Planning Authorities (LPA) in support of a development proposal which may be at risk of flooding. The document will take only a few minutes to complete and will assist SEPA in reviewing FRAs, when consulted by LPAs. This document should not be a substitute for a FRA.

Development Proposal Summary							
Site Name:		St Fergus Substation					
Grid Reference:	Easting:	408741	Northing:	853823			
Local Authority:		Aberdeenshire Council					
Planning Reference number (if known):							
Nature of the development:		Utility Infrastructure	If residential, state type:				
Size of the development site:		6.5	Ha				
Identified Flood Risk:	Source:	Fluvial	Source name:				
Land Use Planning							
Is any of the site within the functional floodplain? (refer to SPP para 255)		Yes	If yes, what is the net loss of storage?		1617	m^3	
Is the site identified within the local development plan?		No	Local Development Plan Name:	Aberdeen Shire Wide		2017	
			Allocation Number / Reference:				
If yes, what is the proposed use for the site as identified in the local plan?		Select from List	If Other please specify:				
Does the local development plan and/or any pre-application advice, identify any flood risk issues with or requirements for the site.		Select from List	If so, please specify:				
What is the proposed land use vulnerability?		Essential Infrastructure	Do the proposals represent an increase in land use vulnerability?		Yes		
Supporting Information							
Have clear maps / plans been provided within the FRA (including topographic and flood inundation plans)?		Yes					
Has sufficient supporting information, in line with our Technical Guidance, been provided? For example: site plans, photos, topographic information, structure information and other site specific information.		Yes					
Has a historic flood search been undertaken?		Yes	If flood records in vicinity of the site please provide details:		No records identified		
Is a formal flood prevention scheme present?		No	If known, state the standard of protection offered:				
Current / historical site use:		Agricultural					
Is the site considered vacant or derelict?		Yes					
Development Requirements							
Freeboard on design water level:		0.6 Cable End / 1.7m Sstn	m				
Is safe / dry access and egress available?		Vehicular and Pedestrian	Min access/egress level:		10	m AOD	
Design levels:	Ground level:	8.4	m AOD	Min FFL:	10	mAOD	
Mitigation							
Can development be designed to avoid all areas at risk of flooding?		No					
Is mitigation proposed?		No					
If yes, is compenstory storage necessary?		No					
Demonstration of compensatory storage on a "like for like" basis?		No					
Should water resistant materials and forms of construction be used?		Yes					

Flood Risk Assessment (FRA) Checklist

(SS-NFR-F-001 - Version 16 - Last updated 27/08/2019

Hydrology

Is there a requirement to consider fluvial flooding?		Yes			
Area of catchment:		7.7	km^2	Is a map of catchment area included in FRA?	Select from List
Estimation method(s) used (please select all that apply):		Pooled Analysis ☑		If Pooled analysis have group details been included?	Select from List
		Single Site Analysis ☐			
		Enhanced Single Site ☐			
		ReFH2 ☑			
		FEH RRM ☐			
		Other ☐		If other (please specify methodology used):	
Estimate of 200 year design flood flow:		1:1000+CC = 17.34	m^3/s		
Qmed estimate:		2.91	m^3/s	Method:	Donor Transfer
Statistical Distribution Selected:		Generalised Extreme Value		Reasons for selection:	ReFH2 used (conservative)

Hydraulics

Hydraulic modelling method:		Linked 1D 2D		Software used:	HEC-RAS
				If other please specify:	
Number of cross sections:		12 surveyed + interp			
Source of data (i.e. topographic survey, LiDAR etc):		Topo survey		Date obtained / surveyed:	Feb-19
Modelled reach length:		1460	m		
Any changes to default simulation parameters?		No		If yes please provide details:	
Model timestep:		1.5 - 60s variable			
Model grid size:		2m			
Any structures within the modelled length?		Culvert		Specify, if combination:	1 no. Box culvert upstream, 1 no twin-barrel pipe culvert downstream
Maximum observed velocity:		2-4 chnnl, 0-0.5 fpln	m/s		
Brief summary of sensitivity tests, and range:					
variation on flow (%)		0% as is @ 1:1000	%	Please specify climate change scenario considered:	24%
variation on channel roughness (%)		20	%		
blockage of structure (range of % blocked)		28	%		
boundary conditions:		**Upstream**		**Downstream**	
(1) type		Flow		Normal depth	
	Specify if other			Specify if other:	
(2) does it influence water levels at the site?		Yes		No	
Has model been calibrated (gauge data / flood records)?		No			
Is the hydraulic model available to SEPA?		Yes			
Design flood levels:	1:1000+CC	7.8	m AOD		m AOD
Cross section results provided?		Yes			
Long section results provided?		Yes			
Cross section ratings provided?		No			
Tabular output provided (i.e. levels, velocities)?		Yes			
Mass balance error:		Less than 0.3%	%		

Coastal

Is there a requirement to consider coastal / tidal flooding?		No			
Estimate of 200 year design flood level:			m AOD		
Estimation method(s) used:		Select from List		If other please specify methodology used:	
Allowance for climate change (m):			m		
Allowance for wave action etc (m):			m		
Overall design flood level:			m AOD		

Comments

Any additional comments:	The initial FRA reported in Nov 2019 was 1D. This s/sheet relates to the additonal 1D-2D modelling carried out specifically for the Cable Sealing End platform which requires to be sited within the floodplain, and was carried out to review flood effects and set min platofrm height.

Approved by: D Wright
Organisation: SLR Consulting Limited
Date: 08/05/2020

Note: Further details and guidance is provided in 'Technical Flood Risk Guidance for Stakeholders' which can be accesssed here:- CLICK HERE

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