Flood risk assessment- Cross Keys Swing bridge M&E upgrades.

Flood Risk Assessment for Cross Keys Swing Bridge Upgrades

1.0 Introduction.

Development Type: Electrical and mechanical works to the swinging bridge, including new generator housing on the east bank adjacent to the site office.

This Flood Risk Assessment (FRA) has been prepared in support of maintenance, upgrade, and development works associated with the Cross Keys Swing Bridge located in Sutton Bridge, Lincolnshire. The bridge spans the River Nene and serves as a critical infrastructure link for road and marine traffic.

The purpose of this assessment is to evaluate the potential flood risks affecting the bridge structure and any proposed works, in compliance with the National Planning Policy Framework (NPPF) and guidance from the Environment Agency (EA).

2.0 Site Location and Description

- **Site Name**: Cross Keys Swing Bridge
- **Grid Reference**: TF 480 210.
- **Watercourse**: River Nene
- **Land Use**: Transport infrastructure (swing bridge – vehicular and marine passage permitted) Marine takes priority.

The bridge is a low-lying structure situated adjacent to tidal defences on the River Nene. The surrounding area is predominantly agricultural with some residential and commercial properties.

3.0 Flood Zone Classification

According to the Environment Agency's Flood Map for Planning:

- The site lies within Flood Zone 2 (Areas with medium probability of flooding from rivers or the sea).
- The site benefits from existing tidal flood defences along the River Nene. (Flood banks)
- The EA Long-Term Flood Risk map also indicates potential surface water and tidal flooding during extreme events.

4.0 Sources of Flood Risk

A. Tidal Flooding

- The River Nene is tidally influenced at Sutton Bridge.
- The primary flood risk to the site arises from overtopping or breach of tidal defences, particularly during North Sea storm surges.

B. Fluvial Flooding

- Risk from fluvial flooding is low due to the managed flow of the River Nene, though coincident high tides and river flows could exacerbate risks.

C. Surface Water Flooding

- Surface water accumulation during heavy rainfall could impact bridge approaches and machinery housing if not adequately drained.

D. Groundwater Flooding

- The risk of groundwater flooding is considered low, but prolonged wet periods may raise levels locally.

5.0 Climate Change Considerations

Climate change is expected to increase sea levels and the frequency of extreme weather events. As per EA climate change allowances:

- Tidal flood levels could rise by over 1 m by 2115.
- The swing bridge infrastructure must therefore account for increased hydraulic loading, greater overtopping potential, and resilience of electrical/mechanical components.

6.0 Flood Risk Mitigation Measures

To mitigate flood risks associated with the bridge:

- Elevate and seal control systems to prevent floodwater ingress.
- Continue to use flood warning systems and link to EA Floodline services.
- Designing for resilience: Electrical components to be flood-resistant or elevated above predicted flood levels.

- Emergency plan: Ensure contingency for bridge closure and evacuation in extreme events.

7.0 Residual Risk

Residual risks remain from:

- Failure or overtopping of tidal defences
- Extreme storm surge events exceeding design assumptions
- Mechanical/electrical failure due to flood damage

8.0 Planned works

- Concrete pad foundation which the new diesel generator will sit on, located on the West bank next to the existing site offices.
- Installation of four electrical drive motors to the existing carousel turntable.
- Installation of new electrical components, inside the pump room.
- Replacement of existing hydraulic fluid with environmentally safe oil. The existing hydraulic fluid will be drained and safely disposed of, while the hydraulic fluid tank will be retained in the structure and filled with sand for ballast. (Ensuring the existing balance of the bridge is not compromised).

9.0 Works flood risk consideration

- All debris will be removed from site and restricted from entering the watercourse by installing netting/ lining where necessary.
- Spill kits will be present for use with plant/ machinery on site.
- There is no heightened risk of damage to protected wildlife and a noted increased risk of flooding as a result of this activity. This has been taken into account and the temporary works design seeks to address this.
- There is a small risk of pollution to the waterway but the stringent measures imposed upon the contractor and implemented into the 24/7 bridge operator manuals, seek to addresses this issue.
- Method statements for the works operations will be provided by The Contractor nearer the start of the project.

9.0 Other hazards

9.1 The works are not deemed to be a potential hazard to wildlife. Whilst there is an increased pollution risk and a noted slight increased risk to flooding during the works the existing structure, mitigation will be put in place to reduce those risks.

9.2 The existing structure is not conducive to roosting so nesting birds and bats are discouraged from this location. A visual survey will be carried out in advance of the works. There will be no effect upon the local area and any evidence of protected species will be reported immediately and the works stopped in order to put mitigation in place for the recorded sighting.

9.3 Daily weather forecasts will be noted, recorded and acted upon if extreme events are predicted. In the event of extreme weather being forecast the Contractor will mobilise a flood safety plan and consider the removal of the scaffold if necessary. The nature of the predicted weather event and the operations that are planned will dictate the likelihood of the contractor's stand-down.

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10. Flood risk assessment-

Operation	Hazard	Receptor	Probability of exposure	Consequence	Severity	Risk management techniques	Overall risk
Construction of diesel generator compound.	Flood risk as a result of reduced area of flood banks	Local residents/ wildlife/ carriageway	Flood risk low in spring/summer months. LOW risk	Waterlogging, damage to wildlife habitat, private land, residences. Possible contamination.	LOW	The diesel generator concrete foundation/ compound is located next to the site offices, which is adjacent to the road side. The size of the compound has been set at 3m x 5m, non-invasive to the flood banks.	The overall risk is LOW/REMOVED, the river would have to completely overtop the banks and be at road level before the small concrete pad would take any affect on the flooding. No risk
Use of crane/ lifting machinery	Lifting machine failing and dropping parts/ materials into the watercourse.	Wildlife/ local residents	MEDIUM probability.	Possible damage to banks, harm to wildlife, waterlogging.	LOW	Operators to be trained and competent holding the correct tickets to safely operate the plant. Lifting plans and assessments before works begin.	LOW risk- amount of materials required will have negligible impact on flooding
Safety boat in river	Displacement of water causing restriction of flow/flooding.	Local residents/ wildlife/ carriageway	LOW probability.	Minor rise in water level causing possible flooding over bank top.	LOW	Monitor water levels using on bridge monitoring. Weather forecasts. Project to take place in summer when levels are expected to be lower.	LOW risk, safety boat size is much smaller than the 25000 Tonne cargo ships which regularly pass through which do not impact water levels significantly.
Scaffolding	Collapsing of scaffold materials into the river	Workforce on the bridge/scaffold, Local residents/wildlife/carriageway	Works in spring/ summer with inclement weather. MEDIUM probability of flooding as a result of works without mitigation.	Waterlogging of banks and possibly carriageway. Scaffold poles/materials falling into the water and blocking ships from passing through the bridge.	MEDIUM	Scaffold to be installed and inspected by competent personal.	LOW risk if scaffold is properly installed and inspected as per planned.
Operating new electrical systems during heavy rainfall/ flooding event.	Electrical systems being water damaged in a flood event.	Non- operation of swing bridge.	MEDIUM probability due to spring tides. Water levels can be higher in late summer to early Autumn.	Shipping cannot get through. If bridge stuck in a part swing, it is non operational to vehicular traffic	High	Electrical components located in the pump room are to be elevated off the ground to	LOW overall risk of damage caused to the electrical systems due to mitigations.

Commented [PP1]: No risk

Commented [PP2]: Water levels are generally high in late summer early Autumn when the spring tides arrive.

				and marine vessels. Significant delay costs.		prevent damage in the event of water ingress. Water tight door on pump room.	
Spring tides/tidal surges	Can result in flooding of pump room/ inside of the turntable.	Electrical equipment, people. Waterlogging of banks, harm to wildlife/ marine life.	LOW- This has occurred twice before in the last 15 years and is very uncommon.	Potential damage to equipment/ trapping people inside the pump room.	MEDIUM	Equipment room watertight doors and bilge pump available for excessive water ingress. Also high water protocols are implemented in advance of high tide/tidal surge if required. Consider whether Bridge operator protocols are sufficient for new equipment and review IP rating of electrical equipment	MEDIUM risk. Works to take place in lower water level months to reduce the impact of flooding on the works.
Diesel generator is relocated to west bank of river	Potential leakage of diesel fuel into river.	Contamination of water/ banks/ harm to wildlife.	MEDIUM risk, the fuel tank will be inspected regularly for leaks but is not monitored 24/7 and so someone could puncture the tank.	Diesel causing harm/ death to marine life if it spills into the watercourse. Damage to flora and fauna on banks.	MEDIUM	Diesel fuel stored in double bunded tank reducing the likelihood of spillage. Security fencing to be installed around the generator to keep unauthorised people out. CCTV is in place to monitor and discourage criminal behaviour.	LOW overall risk if mitigation methods followed. Generator should still be regularly inspected for damage or attempted access.

11.0 Climate Change Allowance

- For tidal flooding the upper end allowance means that there may be up to 1.24 m sea level rise by 2115. We will ensure that any permanent changes to the bridge, identified clearly in the supporting application documents, do not encroach lower than the existing lowest point of the bridge therefore leaving the risk of flooding/ trappings of debris unchanged.
- The generator is housed atop a concrete pad foundation which is set at the same height and location of the existing site offices. On flat ground above the river banks adjacent to the carriageway, this does not pose any additional flood risk than at present.

12.0 Mitigation Measures

- Resilient sitting of generator and housing (elevated with metal fencing allowing clear flow of water through for purpose of surface runoff/ rainfall build up etc.
- All new components are above the design flood level (including allowance for climate change)
- Access and egress for maintenance crews remains viable during flood conditions
- No net loss of floodplain storage
- No obstruction to flow or channel maintenance by EA

13.0 Surface Water & Drainage

- Minimal/no impact expected as generator housing is a very small footprint and set on hardstanding.
- Surface water runoff will be managed to avoid increasing flood risk (e.g. via soakaway or runoff control measures).

14.0 Residual Risk & Emergency Planning

- Confirm emergency access routes
- Flood warning systems (site is already covered by EA's Flood Warning Service)
- Emergency plan for generator maintenance and evacuation if needed

15.0 Conclusion

The proposed upgrades to the Cross Keys Swing Bridge, including the installation of a new diesel generator housing, have been assessed and found not to increase flood risk to third parties or the surrounding environment. The development is appropriately located on elevated ground adjacent to existing site infrastructure which does not have any known flood issues.

- The electrical and mechanical upgrades to the bridge are either like for like (Refurbishment of underslung lifting jacks) Or if they differ to the existing (Electrical PLC and control systems are housed inside the pump room or carousel).
- The pump room which is where the new electrical and hydraulic components will be housed, incorporates flood-resilient design measures, such as elevated and sealed electrical components and the room itself has a water tight sealed door.

Mitigation strategies have been integrated into the construction and operational plans to address potential risks from tidal surges, surface water runoff, and pollution. The small footprint and strategic placement of the generator housing ensure no obstruction to river flows or loss of floodplain storage. Emergency planning, climate change considerations, and compliance with national policy and Environment Agency guidance have been fully addressed, confirming that the proposed works are both sustainable and flood-resilient.

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16.0 Supporting Documents

- **Flood Zone Map** (from Flood Map for Planning)



- **Site map including location of Diesel generator housing lined in yellow pen**:



- **Design drawings** for generator housing (Attached separately).
    - **Front and side elevations.**
    - **Plan view.**