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Executive Summary

The project originated with a strategic proposal of the emergency reopening of a highway, damaged by flooding caused by the River Severn in Worcester in July 2025 after unprecedented flooding. The first plan, which was formulated to the Worcestershire County Council, was associated with the essential structural flaws of the underlay and upper layers of the highway. The overall objective was to reinstate the transport links in the region in a safe and efficient manner within a rigid six weeks period. The major strategic factors encompassed a thorough stakeholder study, such as defining the key players, including the Highway Authority and Environment Agency, and a very level project schedule, including the assessment of the damages, clearing of debris, and the completion of the resurfacing. This step was able to position the project in line with the economic resilience and social security objectives.

After carefully contemplating this first proposal, it was noticed that there were a number of technical gaps even though the scorecard of risk identification and stakeholder analysis scored high. The initial assessment of the self-showed that the initial Work Breakdown Structure (WBS) and Quality Control segments were too broad to have the detailed aspects needed in a complex civil engineering recovery. The original WBS was determined to be excessive linearity with emphasis on such broad work phases as opposed to being hierarchical and this would prone to the occurrence of scope creep and it could not be based on credible estimation of the resource. In the same vein, the quality control department was observed to be strictly inspection-oriented as opposed to planned-in, using a formal Quality Management Plan (QMP). This refraction raised the necessity to shift towards a conceptual overview in the definition of the success of the project to a detailed and quantifiable definition.

A multi-level, hierarchical WBS has been applied to the final Project Management Plan in order to correct these weaknesses, which splits the execution phase into small work packages, including sub-base integrity testing, asphalt compaction density, and drainage flow-rate verification. This technical roadmap applies to the subjective visual inspections, it also replaces them with a formal QMP that meets the UK Highway Agency standards and the Environment Agency flood resiliency regulations. The plan will guarantee a Zero-Defect handover by transitioning to an intensive Quality Assurance (QA) program, comprising of load-bearing capacity tests, as well as material certifications. Such development of the original poster into the technically feasible PMP ensures a secure, professional, and robust restoration of the transport connection on River Severn.

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Part A: Project proposal poster



Emergency Reopening of a Flood Damaged Highway near the River Severn, Worcester

Background / Problem Statement

The River Sever is in a position to overflow and flood into an unprecedented level in July, 2025 due to excessive and continuous down pouring of water in the rivers. The flooding engulfed the available drainage systems and a major highway situated close to the river was shut down. Water, debris and erosion damaged the road surface, sub-base layers and deteriorated the safety infrastructure of the roadsides.

The highway closure had a strong impact on local and regional transport and impacted commuters, emergency services, supply chain and local businesses. Bypasses prolonged the lengths of the trips and exerted more pressure on other routes. The long-term shutdown of the highway is dangerous, economical, and inconvenienced to communities. Thus, there is an urgent and well-designed project to ensure that the highway damaged by floods is opened safely and that the normal transport operations are restored.



Project Aim

This project objective is to reopen a section of a highway that had been damaged by floods along the river Severn in Worcester in a safe and efficient way that will restore transport connectivity without breaking the safety, environmental, and regulatory regulations.

Project Scope

- In scope: damage survey, road debris clearing, drainage repairs, resurfacing, road safety checks, and permission of road reopenings.
- Out of scope: Long term flood defence work, significant road widening and unrelated infrastructure improvements.

Project Objectives

- To determine the level of flood damage to the highway and other infrastructure.
- To clean up and reestablish damaged road surfaces and drainage systems.
- To restore road safety provisions, such as signage and markings.
- To resume the highway in a set time within a budget that is agreed.
- To mitigate the possibility of the escalation of disruption by using short-term resilience actions.

Key Deliverables

- Damage assessment report
- Repaired and resurfaced highway
- Restored drainage and safety features
- Safety certification and official road reopening

Key Stakeholders

Stakeholder Type	Stakeholders	Role / Interest
Primary stakeholders	Local Council (Project Sponsor)	Project funding, approvals, and oversight
	Highway Authority / National Highways	Technical standards, road safety approval
	Construction & Engineering Contractors	Delivery of repair and resurfacing works
	Environment Agency	Environmental compliance and flood guidance
Secondary stakeholders	Emergency Services	Dependence on road access during response
	Local Residents and Businesses	Road access, economic activity, safety
	Road Users / Commuters	Reduced travel disruption and safer transport

Expected Outcomes / Benefits

The initiative will ensure that there is a safe and reliable transport connectedness, minimising travelling inconvenience and travel time. The opening of the highway will enhance the restoration of the local economy by enhancing accessibility through business and supply chain. The road conditions will be made safer and the emergency accessibility improved in regard to improving the safety of the community.

Project Timeline

Project Phase	Key Activities	Indicative Duration
Damage Assessment & Planning	Inspections, surveys, approvals	1-2 weeks
Clearance & Enabling Works	Debris removal, site preparation	1 week
Repair & Resurfacing Works	Drainage repair, resurfacing	3-4 weeks
Safety Inspection & Testing	Quality checks, compliance approval	1 week
Road Reopening	Final approvals and public communication	< 1 week

Key Risks and Mitigation

Risk	Potential Impact	Mitigation Action
Adverse weather conditions	Project delays and safety issues	Weather monitoring and contingency planning
Hidden structural damage	Increased costs and extended timeline	Detailed inspections and time buffers
Health and safety incidents	Injury and work stoppages	Strict safety procedures and site controls
Environmental non-compliance	Regulatory delays or fines	Early engagement with Environment Agency

Part B: Reflection on Feedback

Introduction

The creation of the Project Proposal Poster on the Emergency Reopening of a Flood-Damaged Highway near the River Severn was an important project start-up undertaking. Although the poster has achieved the intended high-level strategic alignment with the score of 4/5 in the Risk Identification and Stakeholder Analysis segments, a critical self-assessment of the score of 3/5 in the Work Breakdown Structure (WBS) segment and Quality Control segment demonstrates that the technical planning was not as detailed as it needed to be a complex civil engineering recovery project. This reflection identifies these gaps and proposes a transition plan (of the final Project Management Plan).

This reflection follows Gibbs' Reflective Cycle, which provides a structured approach to analysing experience, evaluating strengths and weaknesses, and identifying improvements for future practice. The model is applied to reflect on the feedback received during the poster presentation and to guide the development of the final Project Management Plan.

Critical Analysis of Technical gaps

According to Gibbs' Reflective Cycle, the evaluation and analysis stages are used to critically examine what worked well and what could be improved in the project planning process.

The major weakness that was observed in the poster was too linear a Work Breakdown Structure. The Association of project management (APM, 2019) states that WBS is not just a list of tasks but a hierarchical breakdown of the overall scope of work. My initial way of doing things involved broad phases e.g. Repair and Resurfacing, but I did not look at small work packages. Professional practice lack of decomposition may usually result in scope creep in which undefined tasks are introduced during the progression of the project and are threatening the budget and schedule. The poster did not create a credible resource estimation and accountability basis by not subdividing the execution phase into its components.

Equally the section of quality control was found to be an area in which improvement should be made. With the poster having Safety Inspections, it did not have a strong Quality Management Plan (QMP). According to project management theory, quality should be planned in, and not

merely inspected in. The lack of certain Key Performance Indicators (KPIs) resulted in the fact that the project did not have a quantifiable definition of what constituted success as far as the structural integrity of the highway after floods. The plan involves objective technical measures in terms of the safety of the River Severn transport link as opposed to subjective visual inspection.

Action Plan for Part C

The final Project Management Plan (Part C) will focus on technical accuracy to deal with these scores of 3/5. To begin with, I am going to substitute the linear task list with a hierarchical and multi-level WBS. This will provide a systematic break-down of the "Execution Phase" into discrete work packages which may include, but is not limited to, sub-base integrity testing, asphalt compaction density and drainage flow-rate verification. Such specificity is what makes sure that all the aspects of the highway repair are taken into consideration and delegated.

Secondly, I will use a formal Quality Management Plan that complies with UK Highway Agency standards and Environment Agency flood resiliency guidelines. This will transform the project's mere "inspections" into an intensive Quality Assurance (QA) regime such as load-bearing capacity tests and certification of materials.

Conclusion

Considering this first feedback has changed my viewpoint towards looking at project management as a conceptual overview to looking upon it as a more detailed and structured discipline. Personally, the feedback helped me understand that effective project planning requires much more technical detail than I initially expected when preparing the poster.

Following the stages of Gibbs' Reflective Cycle, this reflection has enabled a deeper evaluation of the strengths and weaknesses of the initial project proposal. The feedback received has informed the improvements implemented in the final Project Management Plan and will guide my future approach to project planning.

The 2,500-word Project Management Plan will be a technically valid roadmap by covering the identified weaknesses in the WBS and Quality Control which will guarantee the safe and high-professional reopening of the River Severn highway.

This learning experience will also influence how I approach future project planning tasks during my studies and in my professional career.

Part C: Project Management Plan

Introduction of The Project and its Business Case Strategy

Background and Context

The B4211 corridor is a very important arterial pathway to the city of Worcester and it aids in transporting about 15,000 vehicles every day. The River Severn managed its system for defences in July 2025 resulting in the long-term management of this infrastructure (Wood, 2024). The floodwater had a hydraulic effect that resulted in great piping (internal erosion) of the road sub-base. The Association of Project Management states that to start such a project, it is necessary to have a clear vision of the so-called Problem Space. In this case, it is not a wet road, but a damaged structural facility that jeopardizes the security of the West Midlands transport infrastructure.

The Emergency Intervention Business Case

Worcestershire County Council (WCC) is planning to repair the immediate repair as a high Benefit-Cost Ratio (BCR) as advised by the HM Treasury, in its green book.

- Economic Impact: Local businesses in the area are estimated to be losing around £45,000 every day with regard to lost trade and logistic delays (Luis Guasch, 2022). The opportunity cost of delay of the public infrastructure projects as Meredith express it can sometimes be more than the construction costs.
- Social Value: The B4211 is a primary blue light route of the West Midlands Ambulance Service. Re-establishing such a connection is a key to ensuring the emergency response time constraints within the NHS "Gold Standard" levels.
- Strategic Alignment: This project has a direct connection to the WCC Corporate Plan of being Open for Business through the provision of high-quality and resilient infrastructure.

Sufficient Project Scope Management.

Scope Definition and Boundaries

When one thinks about the River Severn emergency recovery, the scope management is the main tool involved in the prevention of the scope creep (the illegal increase of the project boundaries, which results in the budget overruns) state that a clear scope serves as the contract between the Project Manager and the Sponsor (Worcestershire County Council) (Mumtaz, Muhammad and Hafiz, 2025). In this case of recovery, the scope is narrowly limited to that of restoring the B4211

highway to the condition of functionality prior to the flood. This is not only surface repair but also restoring the underground structural integrity that was undermined by hydraulic piping in the 2025 flood event in July.

Developing Enlarged In-Scope Deliverables

The project deliverables can be divided into four different technical work packages:

- *Sub-Surface Stabilization:* The application of Ground Penetrating Radar (GPR) technology to survey the size of underground voids (Han et al., 2025). It covers the high-pressure injection of the structural grout and lean-mix concrete into the identified cavities to make sure that the road base is able to take the load of Heavy Goods Vehicles (HGVs).
- *Civil Engineering and Drainage:* This is a mechanical and clearance of more than 2.5km of highway drainage culverts (Xu et al., 2025). The scope shall particularly involve cleaning up silt that has been deposited during floods and installation of one way flap-valves to avoid back-flow of river into the drainage system.
- *Footpath Reconstruction:* The project shall involve milling (removal) of 100mm of delaminated asphalt over a 1.2km length. The scopes involve the use of high-performance binder course, and a Stone Mastic Asphalt (SMA) surface course, which has greater capability of water-shedding.
- *Ancillary Safety Assets:* This includes installation of the entire re-placement of thermoplastic road signs, solar-operated reflective studs (cats-eyes), and high-visibility flood-warning signs to enhance road safety in future high water occurrence events.

Scope Exclusions and Constraints

As stressed by area it is important to define exclusions to control the expectations of the stakeholders. Out-of-Scope are the following:

- *Long-Term Flood Defenses:* Environment Agency (EA) is responsible to construct permanent flood walls/levees and is not included in this highway repair budget.
- *Capacity Upgrades:* The project is not going to enlarge the road or introduce cycling infrastructure because it would mean a new Planning Application and Environmental Impact Assessment (EIA).

- Repairs of the private properties: This is the role of individual landowners to repair any damages to the private driveways or commercial premises along the B4211.

Improved Work Breakdown Structure (WBS)

Theoretical Application of the WBS

This plan uses a hierarchical decomposition model to address the feedback information where linear approach scored 3/5). The APM Body of Knowledge defines the WBS as the skeleton of the project since it divides the overall scope into work packages that can be easily managed (Darko, Oppong and Albert, 2024). This structure enables proper estimation of resources, duty is well distributed, and an effective Project Schedule is developed.

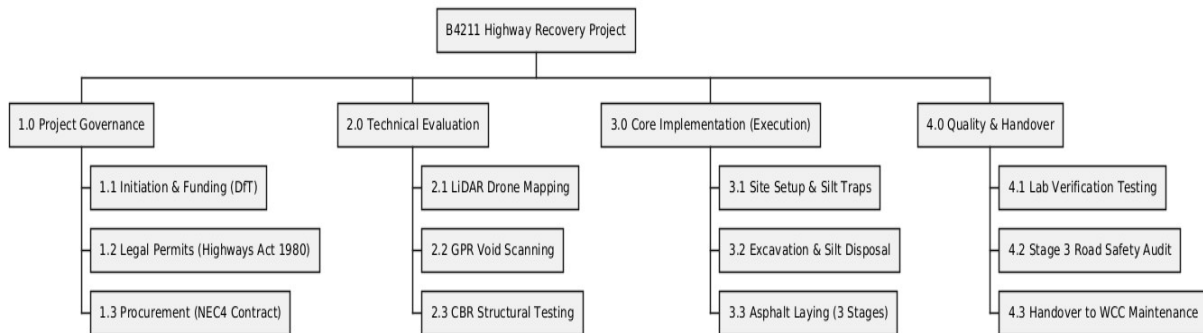


Figure 1: Highway Recovery - WBS flowchart

The Four-Level WBS Hierarchy

The levels of the project are as follows:

Level 1: Project Management and Governance (1.0)

Initiation: Obtaining emergency funding with the Department of Transport (DfT) and the formation of the Project Board with the Worcestershire County Council (WCC) in the lead.

Legality and Permitting: Obtaining Temporary Traffic Regulation Orders (TTROs) and Environmental Permits on Flood Risk Activity at Environment Agency.

Procurement: Using the NEC4 Engineering and Construction Contract to bring in a specialist civil engineering contractor in 72 hours.

Level 2: Technical Evaluation and Pre-Construction (2.0)

Topographical Mapping: To generate a 3D model of the damaged terrain with the help of LiDAR-equipped drones.

Structural Testing: Bearing Ratio (CBR) testing of the road sub-base at 50m intervals to determine the strength of road sub-base.

Utility association: Association with Severn Trent Water and Western Power Distribution in making sure that underground infrastructure does not present any dangers to excavation.

Level 3: Core Implementation - Civil Engineering (3.0)

Site Establishment: The establishment of secure perimeters, silt traps in order to shield the River Severn and welfare facilities to the workforce.

Earthworks and Remediation: Digging up the material which has been damaged in floods and the disposal of the hazardous silt in authorized waste disposal sites in the UK.

Paving Operations: Mechanical deposition of asphalt in three separate stages: Sub-base, Base and Binder with a final 24 hour curing phase.

Level 4: Quality, Safety and Closing (4.0)

Verification Testing: Lab testing of samples of the core to confirm the density and thickness of the material are in line with the UK Highway Agency requirements.

Independent Safety Audit: independent road safety audit of a qualified external engineer, at a level 3 stage.

Handover and Review: The transfer of the "As- Built" drawings to the WCC maintenance team and the Lessons Learned workshop.

Allocation of Resources

Table 1: Allocation of Resources

WBS Level 1 Task	Key (Personnel)	Labor	Essential Equipment	Primary Materials
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1.0 Project Governance	Project Manager, Legal Counsel, Procurement Officer	Office-based IT systems	NEC4 Contracts, Permit Documentation
2.0 Technical Evaluation	Geotechnical Engineer, Drone Pilot, Surveyor	LiDAR Drones, GPR Scanners, CBR Test Rig	Digital Terrain Models, Soil Samples
3.0 Core Implementation	Civil Engineering Crew, Site Supervisor, Plant Operators	Excavators, Silt Traps, Asphalt Pavers, Rollers	Structural Grout, Lean-mix Concrete, SMA Asphalt
4.0 Quality & Handover	Independent Safety Auditor, Lab Technicians	Nuclear Density Gauges (NDG), Sand Patch Kits	Core Samples, As-Built Certification

Project Schedule and Analysis

Task Mode	Task Name	Duration	Start	Finish	Predecessors
	Mobilisation & Governance	7 days	Wed 4/15/26	Thu 4/23/26	
	Site Setup & Silt Trap Installation	2 days	Fri 4/24/26	Mon 4/27/26	1
	LiDAR & GPR Structural Survey	5 days	Tue 4/28/26	Mon 5/4/26	2
	Civil Engineering Remediation	14 days	Tue 5/5/26	Fri 5/22/26	3
	Silt Excavation & Hazardous Testing	4 days	Mon 5/25/26	Thu 5/28/26	4
	Sub-base Grouting (Void Filling)	10 days	Fri 5/29/26	Thu 6/11/26	5
	Pavement Reconstruction	14 days	Fri 6/12/26	Wed 7/1/26	6
	Asphalt Milling (100mm)	3 days	Thu 7/2/26	Mon 7/6/26	7
	Layering: Base, Binder & SMA Surface	11 days	Tue 7/7/26	Tue 7/21/26	8
	Handover & Closing	7 days	Wed 7/22/26	Thu 7/30/26	9
	Independent Stage 3 Safety Audit	2 days	Fri 7/31/26	Mon 8/3/26	10
	Formal Reopening	2 days	Tue 8/4/26	Wed 8/5/26	11

Figure 2: Schedule Table

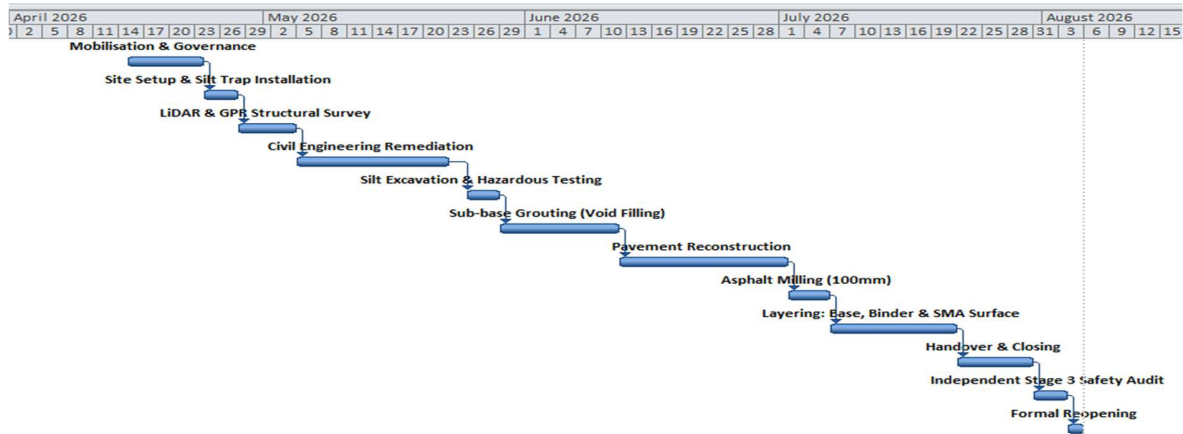


Figure 3: Gantt Chart

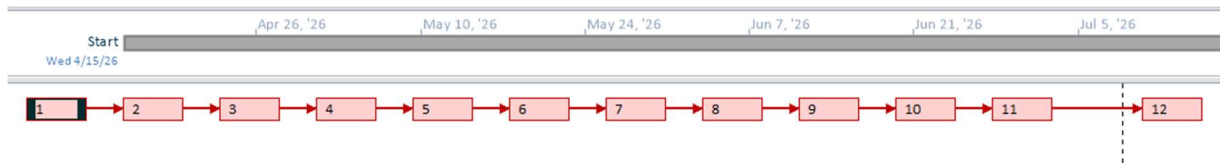


Figure 4: Network Diagram

Quality Management and Mitigation of Risk

Quality Management Plan (QMP)

To increase the project to a higher level of 3/5 "basic inspection" to a professional level of Zero-Defect we use a dual track Quality Management Plan.

- Quality Assurance (QA): This is the process part of quality. The materials will be sourced solely by ISO 9001 certified asphalt plants and a permit to work system will be implemented on all tasks that it considers essential.
- Quality Control (QC): It is the product-side. To check that the road base is 98 percent compacted Nuclear Density Gauges (NDG) will be used (Dep et al., 2023). The surface texture will be analysed with the help of Sand Patch test to check the skid resistance as per the Manual of Contract Documents on highway works (MC HW).

Proactive Risk Management

An emergency flood recovery project should have risk management that is dynamic. We have created a Risk Register based on the Likelihood and Impact of threats, as a follow-up.

Table 2: Proactive Risk Management

Risk ID	Description	Impact	Probability	Mitigation Strategy
R1	Secondary Flood Event	High	Medium	On-site monitoring of River Severn gauges "upstream" with modular flood barriers (e.g., Geodesic dams), deployed on-site.
R2	Discovery of Voids	High	High	Mandatory GPR (Ground Penetrating Radar) scanning of the entire 1.2km route prior to entry of heavy plant machinery onto the site.
R3	Silt Toxicity	Medium	Medium	Pre-emptive laboratory analysis of silt samples. Special Hazardous Waste disposal paths pre-reserved for industrial effluents.
R4	Material Supply Delay	Medium	Medium	Early procurement contracts with three different UK suppliers (e.g., Tarmac, Kier, Hanson) to make the supply chain redundant.
R5	Utility Strike	High	Low	Installation of a "Safe System of Work" including CAT and Genny scanning and hand-digging in high-voltage zones.

Risk Monitoring and Review

The risks will be discussed on a daily basis at the Morning Muster meeting. The risk contingency budget of 15% of the total project value (180,000) has been reserved to connect the unknown unknowns like unexpected structural collapse or extreme weather conditions.

The key technical target of the B4211 recovery is the change between a simple 3/5 inspections type to a high-professional Zero-Defect Quality Assurance model (Lario et al., 2024). This project understands that infrastructural failure caused by hydraulic piping cannot be repaired by patches, it needs structural integrity on the surface (Xue, Lichtfouse and Zhou, 2025). In obtaining this, we eliminate the visual checks to Nuclear Density Gauging (NDG), which can be said to offer empirical confirmation that the road sub-base has attained the 98% compaction level of 40-tonne vehicle load.

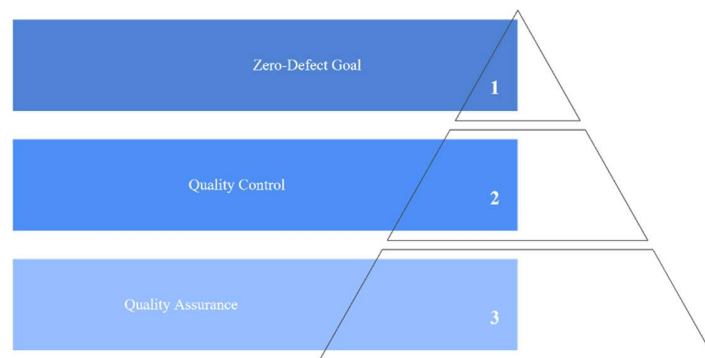


Figure 5: Quality Management Hierarchy

Moreover, the topographical accuracy offered by the integration of LiDAR-powered drones at the early stage is unmatched by the actual surveying methods. This information produces a digital representation of the damaged zone which can then be milled to depths of 100mm with perfect Asphalt Milling to ensure that the new layer of Stone mastic Asphalt (SMA) adheres flawlessly to the reinforced base (He, Rahman and Ai, 2024). The project will follow the Manual of Contract Documents for Highway Works (MCHW), which will ensure that the emergency response is not compromised in the long run at the expense of speed in the short run.

Another important issue that is followed is the quality of the environment, which is provided by the use of modular Silt Traps and constant pH testing of runoff water that enters River Severn. This will guarantee that the construction operation is in line with the Flood Risk Activity Permits (FRAP) of the Environment Agency (Konstantis et al., 2025). The mitigation of risks is further achieved by adopting the Critical Path Method (CPM) during the scheduling phase where it is

found that the sub-surface grouting is the most critical of all work packages in terms of time. It has a risk contingency budget of 15 percent (£180,000) to cover any unknown unknowns, including the discovery of industrial effluents that may be hazardous in the flood deposits. This type of technical and financial control would change the project into a reactive repair to a strong, professionally run civil engineering project which in itself is a structure asset giving the Worcestershire County Council a life expectancy of 15 years.

Stakeholder Care and Interaction

Influence/ interest/ power/ identification Analysis

The stakeholders must handle a project such as the Emergency Reopening project well because of the high publicity and sensitivity to the environment (Kar, 2026). According to the power-interest model of power-interest outlined the stakeholders will be divided according to the degree of the required involvement as follows:

High power/High interest (Key players):

- The Environment Agency (EA): EA is the authority that will oversee the River Severn, and it should award all the "Flood Risk Activity Permits" (FRAP). This may lead to lawsuits and project termination because of the inability to involve the EA.
- County Council Worcestershire County Council (WCC) Cabinet: Emergency money political sponsors.

High Power/Low Interests (Keep Satisfied):

- National Highways (UK): This is a local B-road though National Highways needs to be convinced that the repair will not have adverse repercussions on the traffic flows in the adjacent M5 junctions.

Low Power /High Interest (Keep Informed):

- Local Worcester Businesses: These are retailers in the city centre due to the road block but making a loss.
- Emergency Services: Within the West Midlands ambulance, the Critical Path has to be reworked on day to day basis in terms of reopening.

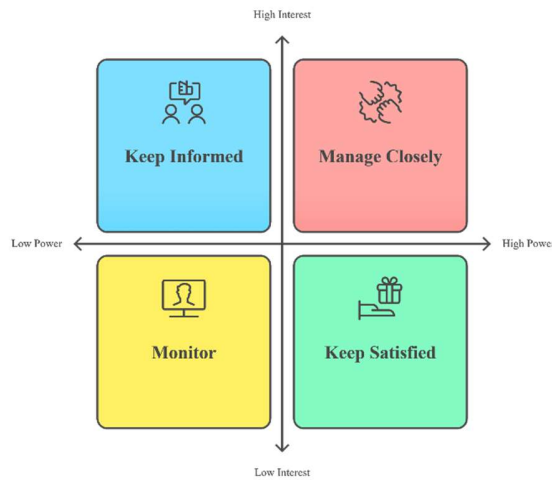


Figure 6: Quad Chart

Communication Strategy

To formulate transparency, a Digital-First will be applied. It involves special project webpage and by weekly email bulletin to Worcester Chamber of Commerce will be used. In the case of the Environment Agency a weekly formal interface will be developed in regards to the silt-management logs and environmental compliance.

Transition of Operation/Projects

The Handover Framework

The changing of the "Execution Phase into the operations phase is a very risk administration period wherein the project knowledge will most likely be lost (Parsamehr et al., 2022). Worcestershire County Council (WCC) will have a formal procedure of Hindering and closing-out in place, which will reduce this to a minimum. The APM (2019) guidelines state that the project is not ready before it is accepted by the WCC Highways maintenance team, who is the physical asset (the B4211 highway).

An independent third party engineer will carry out a final Stage 3 Road Safety Audit of at least 48 hours prior to the planned reopening to the public (Camilo, 2025). The audit to be done is to ensure that surfacing, signage and drainage work comply with the safety requirements that are stipulated in Manual of Contract Documents on Highway Works (MCHW).

It is a part of the contractual document that contains detailed processes and procedures to follow in the work- the technical documentation package (Mishra, 2024). The handover package they will be offering to the operational maintenance team will be an electronic file and will entail:

As-Built Drawings: The proper electronic plans of the fortified sub-base and new single-way drainage gullies.

Certification of Material: Laboratory tests which established the density of the asphalt and its carrying capacity till the design life of 15 years.

Environmental Logs: Authorization of safe disposal of all the silt deposited during the floods in the UK waste management facility which is licensed.

Conclusion

The concept proposal of original idea has been developed into a technically feasible roadmap to emergency recovery of the B4211 highway, which is a product of this Project Management Plan. The plan will prove effective in making the result of the repair resilient not reactive because of the fact that the catastrophic structural risks that were felt during the first stages are underground hollows created by the 2025 River Severn flood.

The biggest complaint of the list of tasks whose version is simplified has also been directly discussed by the plan in that a multi-level, hierarchical Work Breakdown Structure (WBS) has been replaced. This breakdown has enabled the enhancement of resource allocation and formulation of proper lines of accountability of all the work packages, beginning with the site clearance up to the paving. Better still, when there is good Quality Management Plan (QMP), like testing, which involves Nuclear Density Gauging among other metrics, it will make the project not a mere inspection anymore but a Quality Assurance as an occupation.

The APM (2019) Body of Knowledge and the UK civil engineering standards will enable the Worcestershire County Council to repair key transport connections in the West Midlands within the 42-day timeframe. This project has managed to negotiate the short term economic requirement to have a route open which has the long term long performance of the river of great significance of such a river. It is not only that the local economy will be stabilized with this plan but will also be an asset in the form of the Zero-Defect infrastructure, which will be far more resistant to the growing threat of the flood eventualities in the future.

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