Infrastructure Impact Analysis Report

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Executive Summary

Failure Source:	Hospital (Hospital)
Failure Type:	Supply Disruption
Severity Level:	HIGH
Overall Risk:	MEDIUM
Affected Nodes:	4
Critical Impacts:	0
High Severity:	0
Estimated Affected Population:	~300 people
Estimated Recovery Time:	1-2 hours

Detailed Cascading Impact Analysis

The GNN-based predictive model has analyzed the failure propagation through the infrastructure network. A total of 4 connected nodes are predicted to experience cascading effects, with 0 nodes reaching critical impact levels and 0 nodes experiencing high severity impacts.

Affected Infrastructure Nodes (Detailed Analysis)

Each node's risk is evaluated across multiple dimensions. The table below shows the critical dimension (highest risk factor) for each affected node, using MAX-based aggregation to ensure no critical risks are hidden.

Node Name	Type	Severity	Impact %	Critical Dimension	Expected Effects
School	School	MEDIUM	28%	Service Availability	Flow anomaly detected at School. Minor disruption to service with reduced pressure.
Main-Pipe	Water Pipe	MEDIUM	25%	Water Supply	Flow anomaly detected at Main-Pipe. Minor disruption to service with reduced pressure.
Pump-A	Water Pump	MEDIUM	24%	Water Supply	Flow anomaly detected at Pump-A. Minor disruption to service with reduced pressure.

Main-Tank	Water Tank	MEDIUM	20%	Water Supply	Flow anomaly detected at Main-Tank. Minor disruption to service with reduced pressure.

Node-by-Node Dimension Analysis

Below is the detailed risk breakdown for each affected node, showing all evaluated dimensions. The highlighted dimension represents the worst-case scenario (MAX risk) for that node.

1. School (School) - MEDIUM SEVERITY

Critical Dimension: Service Availability (28% impact probability)

Risk Dimension	Impact Level	Status
★ Service Availability	1.8%	■ LOW
Population Impact	1.7%	■ LOW
Water Supply	1.3%	■ LOW
Power	0.4%	■ LOW

Impact Analysis: Flow anomaly detected at School. Minor disruption to service with reduced pressure.

Supply Disruption	Pressure Drop	Quality Risk	Cascade Risk
1%	22%	16%	27%

2. Main-Pipe (Water Pipe) - MEDIUM SEVERITY

Critical Dimension: Water Supply (25% impact probability)

Risk Dimension	Impact Level	Status
★ Water Supply	1.5%	■ LOW
Flow Rate	1.4%	■ LOW
Pressure	1.3%	■ LOW
Water Quality	0.5%	■ LOW

Impact Analysis: Flow anomaly detected at Main-Pipe. Minor disruption to service with reduced pressure.

Supply Disruption	Pressure Drop	Quality Risk	Cascade Risk
1%	1%	0%	24%

3. Pump-A (Water Pump) - MEDIUM SEVERITY

Critical Dimension: Water Supply (24% impact probability)

Risk Dimension	Impact Level	Status
★ Water Supply	1.4%	■ LOW
Flow Rate	1.3%	■ LOW
Pressure	1.3%	■ LOW
Water Quality	0.5%	■ LOW

Impact Analysis: Flow anomaly detected at Pump-A. Minor disruption to service with reduced pressure.

Supply Disruption	Pressure Drop	Quality Risk	Cascade Risk
1%	1%	0%	24%

4. Main-Tank (Water Tank) - MEDIUM SEVERITY

Critical Dimension: Water Supply (20% impact probability)

Risk Dimension	Impact Level	Status
★ Water Supply	1.1%	■ LOW
Flow Rate	1.0%	■ LOW
Pressure	0.9%	■ LOW
Water Quality	0.4%	■ LOW

Impact Analysis: Flow anomaly detected at Main-Tank. Minor disruption to service with reduced pressure.

Supply Disruption	Pressure Drop	Quality Risk	Cascade Risk
1%	0%	0%	20%

Analysis Methodology

This analysis was generated using a Graph Neural Network (GNN) trained on infrastructure cascade patterns. The model analyzes network topology, node criticality, and historical failure propagation patterns to predict the cascading effects of infrastructure failures.

Network Configuration: 5 nodes connected by 4 bidirectional edges. The analysis accounts for node health status, infrastructure type, connectivity, and failure mode characteristics.

MAX-Based Risk Aggregation: Impact scores use MAX aggregation across 12 risk dimensions (water supply, power, service availability, quality, etc.) instead of averaging. This prevents critical risks in specific dimensions from being diluted by low risks in other dimensions. Each node's severity is determined by its worst-case dimension.

Semantic Interpretation: Negative deltas downstream of service nodes (hospitals, schools, markets) are semantically interpreted as service outages rather than 'reduced load.' This ensures that when a critical service facility fails, the system correctly flags it as a crisis rather than showing 'less stress' on upstream infrastructure.

This report is generated by the Village Infrastructure Impact Predictor using AI-powered cascade analysis. Predictions should be validated with domain experts and real-time monitoring data.