

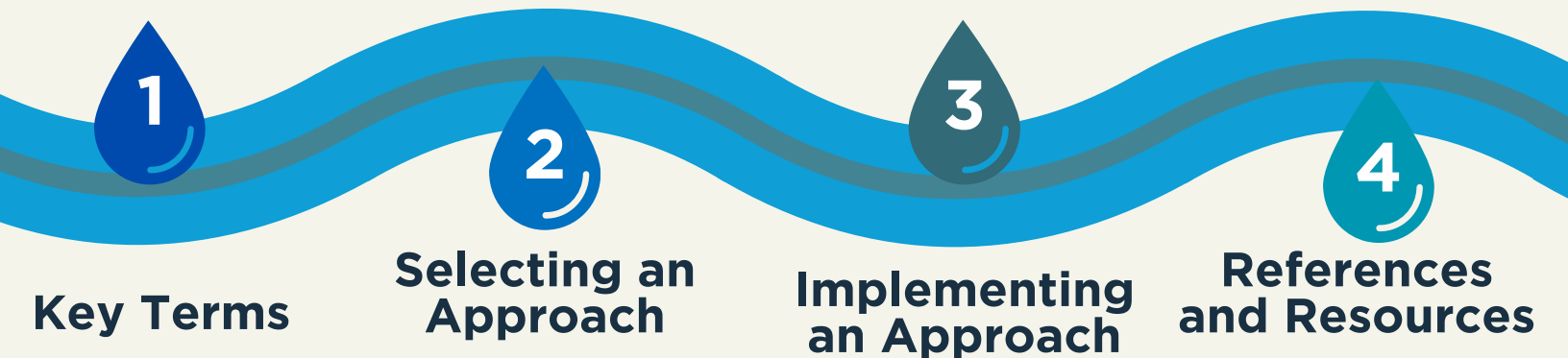
# Vulnerability Assessment Snapshot



## Purpose

The **Vulnerability Assessment Snapshot** provides a concise, easy-to-use overview of how to select an approach for conducting a vulnerability assessment. It is a companion to *A Practical Guide to Vulnerability Assessment for Stormwater Agencies: Approaches, Applications, and Best Practices* (the *Practical Guide*), which offers comprehensive guidance for stormwater practitioners. The full *Practical Guide* includes detailed descriptions of vulnerability assessment methods, step-by-step instructions for applying them, examples from stormwater agencies, and best practices for interpreting and using results to inform planning and investment decisions. This Snapshot distills those key elements into a streamlined reference to help users quickly identify suitable approaches and navigate the full guidebook for more in-depth information.

## Navigating the Vulnerability Assessment Snapshot



## Who is this for?

The Vulnerability Assessment Snapshot is designed for stormwater professionals who need help selecting an appropriate approach for evaluating how their systems may be affected by future conditions such as climate change, land-use shifts, or infrastructure aging. Choosing the right assessment method can be challenging given the range of available tools, data needs, and organizational capacities. This Snapshot — and the full *Practical Guide to Vulnerability Assessment* — supports decision-makers who must balance technical rigor with available resources and institutional priorities.

Potential users include stormwater managers, planners, engineers, and resource managers in local, state, and regional agencies, as well as consultants, contractors, and nonprofit partners who assist with vulnerability assessments.

# What is the *Practical Guide*?

The *Practical Guide* provides a practical, flexible framework for agencies and practitioners who need to understand and assess vulnerability in order to inform real-world decisions.

Rather than prescribing a single method, the guide helps users design assessments that are:

- **Right-sized to the intended use:** Assessments should be appropriately scoped to match their purpose, avoiding unnecessary complexity while still providing useful, relevant insight.
- **Meaningfully connected to planning and decision-making:** Vulnerability assessments are most effective when they are designed to inform specific actions, such as investment priorities, project design, operational changes, or long-term adaptation strategies.

A central message of the *Practical Guide* is that vulnerability assessments should be aligned with decision-making needs from the outset. When conducted alongside planning, rather than far in advance or after key decisions are already made, assessments are more likely to produce actionable findings that meaningfully shape solutions. The *Practical Guide* also recognizes that assessments will vary based on context, audience, and project scope, and encourages flexibility to reflect local conditions and goals.



## Vulnerability Assessment:

The assessment of how various elements of stormwater systems (including assets, functions or populations) are at risk when exposed to hazards. In practice, vulnerability assessments help agencies prioritize where to invest limited resources, which assets or communities need most protection, and what kinds of adaptation or resilience strategies will be most effective.



### Exposure

Whether, how, and how often system elements are exposed to hazards.

### Sensitivity

Understanding of how those assets, functions, or populations are affected if a hazard occurs.

### Adaptive capacity

The ability of the system or community to reduce potential impacts, or recover from them.

# Selecting an Approach



Page numbers throughout this Snapshot indicate corresponding locations in the *Practical Guide*

## 1. Clarify Your Purpose

The primary goal of a vulnerability assessment should drive the approach to carry it out. Is the assessment aiming to inform regulatory requirements, inform long-term adaptation planning, prioritize investments, or communicate with stakeholders? This will shape the level of detail and type of outputs you need. For some purposes, simpler approaches may be sufficient. (pg 10)

### Asset-specific

Focuses on individual, named assets; provides detailed, location-specific information; supports targeted interventions for assets most at risk.

ex: A utility-wide survey of specific, critical facilities (e.g., pump houses, control centers) produces a ranked list of individual assets by vulnerability.

(pg 13)

### Category-based

Focuses on broader categories of assets or geographic units rather than individual assets; provides generalized, system or area-wide insights.

ex: A summary report ranks all neighborhoods in the municipality by their average vulnerability score, helping prioritize stakeholder engagement and adaptation funding.

(pg 14)

(table 2, pg 12)

## 2. Assess Available Time and Resources

All organizations face some degree of resource and capacity constraints. Consider personnel, available datasets, technical expertise, funding sources, time, and whether external partners may be leveraged. (pg 15)

## 3. Select the Approach

Selecting an approach to a vulnerability assessment should be informed by its purpose and the time and resources an agency has available. The Practical Guide outlines six approaches to carrying out a vulnerability assessment (pg 23). See the following page for an overview of these approaches.

Additional considerations: data availability, technical capacity, stakeholder engagement, regulatory requirements, and intended use. See fig 4 and fig 5 (pg 20-21) for decision support trees. (pg 17)

## 4. Document and Communicate Your Choices

The Practical Guide provides a worksheet (Table 4, pg 26) to help make and record choices and share with stakeholders and decisionmakers to support transparency and facilitate feedback.

## Expert Judgment

(pg 36)

- **Definition:** Structured discussions with subject matter experts to identify and assess vulnerabilities.
- **Advantages:** Can be implemented on a flexible timeline; can capture rich experiential qualitative knowledge; builds multi-level ownership of findings; contextualizes results from other approaches; flexible— can be implemented rapidly or extensively depending on available time and stakeholder participation.
- **Limitations:** Dependent on participant expertise and diversity, potential bias; quantification is subjective unless combined with other data; limited transparency and repeatability without structured documentation.

## Scorecards

(pg 38)

- **Definition:** Scoring assets/functions based on exposure, sensitivity, and adaptive capacity.
- **Advantages:** Semi-quantitative structure, can be simple or complex; useful for prioritization with limited data; results easy to communicate.
- **Limitations:** Subjectivity can still be introduced; can oversimplify complex systems; requires careful facilitation to avoid “false precision” in the ratings.

## Indicators

(pg 39)

- **Definition:** Using indicators to rate vulnerability (e.g., % impervious area, age of infrastructure).
- **Advantages:** Creates consistency and comparability; semi-quantitative analysis balances data and local context; foundation for mapping and aggregation; can be simple or multi-dimensional.
- **Limitations:** Data quality may vary or not be fully representative, can lose nuance due to aggregation.

## Spatial Analysis

(pg 36)

- **Definition:** Overlaying spatial data on hazards and assets to quantify exposure.
- **Advantages:** Strong visual products useful for communication and decision-making; easy to identify “hot spots” and patterns; easily integrated with other approaches.
- **Limitations:** Requires significant capacity and analytical skill; data may be limited to exposure and partial sensitivity.

## Statistical Analysis

(pg 43)

- **Definition:** Using historical data to estimate probability and consequences of hazards.
- **Advantages:** Generates quantitative estimates of probability, severity, and potential losses, useful for calibration, validations, and grant eligibility documentation; reveals trends over time.
- **Limitations:** Dependent on historical data, often retrospective; requires technical capacity.

## Modeling

(pg 45)

- **Definition:** Simulating stormwater system response to various hazard scenarios.
- **Advantages:** Highest technical detail; integrates exposure and sensitivity quantitatively, can test adaptation measures; results suitable for regulatory and infrastructure investment.
- **Limitations:** Resource intensive (data and capacity), can be difficult for smaller agencies to sustain or replicate; may exclude social or institutional dimensions.

See Table 1 (pg 7) and Table 3 (pg 23)

# Implementing an Approach

**Table 5 (pg 47)** of the *Practical Guide* provides a high-level overview of the key steps an agency could take for the whole of the vulnerability assessment, summarizing each part of the process and breaking each step down into a What, Why, and How format. Below, we have broken Table 5 down one step further into a checklist tool.

Steps 1 and 2 are covered in the *Practical Guide* and page 3 of this Snapshot.

## 1. Determine Assessment Purpose and Define Scope

- Clearly state objectives (e.g., compliance, planning, investment)
- Define boundaries: geography, infrastructure, populations
- Identify hazards to address
- Consider decision context and audiences

## 2. Select and Implement Assessment Approach

- Review goals, resources, and timeline
- Align approach with output needed for regulatory and local priorities
- Using the decision guidance in this document, select an approach
- Match approach to data, capacity, and resources

## 3. Engage Stakeholders

- Identify key stakeholders (agencies, experts, community)
- Use input to validate data and findings
- Involve them early and often (workshops, interviews, surveys), not just in the beginning or end

## 4. Collect and Organize Data

- Gather relevant data (infrastructure, hazards, population)
- Organize data for analysis
- Review prior reports and plans
- Use proxies or expert judgement to fill gaps

## 5. Assess Vulnerability

- Exposure: Characterize where and how often elements are exposed
- Adaptive Capacity: Assess ability to reduce/recover from impacts
- Sensitivity: Evaluate how severely elements would be affected
- Integrate findings assess vulnerability

## 6. Implement and Communicate Findings

- Develop clear, actionable recommendations
- Prepare accessible communication products (maps, dashboards, reports)
- Share results and document lessons learned

# References and Resources

## Worksheet

The Vulnerability Assessment Worksheet (**table 4, pg 26-29**) provides practitioners the opportunity to note the thought process behind each step of the Practical Guide.

## Decision Trees

The decision trees (**figures 4 and 5, pg 20-21**) walk through the decision process of selecting an approach.

## Case Studies

Detailed case studies of vulnerability assessments done in Indiana (**pg 49**), Baltimore, MD (**pg 51**) and Washington, D.C. (**pg 54**) illustrate how different vulnerability assessment approaches have been used in real-world contexts.

## What comes next?

The *Practical Guide* is the first tool in a series intended to reduce barriers to more resilient stormwater infrastructure. Future tools will include:

- Decision support framework to inform the use of projected IDF curves in stormwater management.
- Guidebook for resilient stormwater BMP design
- Analysis of changes in BMP performance under future hydrology
- Training program to support resilient stormwater management



Scan for the **Vulnerability Assessment project webpage** and link to the full **Practical Guide**

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