

The standards and best practices contained in this document are required elements for new projects seeking State funding under the New Jersey Environmental Infrastructure Finance Program (NJEIFP). Further information on the NJEIFP can be found at the following link(s): <https://www.njeit.org/> and <http://www.nj.gov/dep/dwq/mface.htm>

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# **Infrastructure Flood Protection Guidance and Best Practices**

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It is widely accepted that critical infrastructure must be designed, located, and/or sufficiently protected to remain operational during an emergency, including floods, storm surges and power outages, and for long-term viability (i.e. designed to remain functional despite potentially increasing base flood elevations). For example, recent FEMA and ASCE publications recommend elevating critical infrastructure above the 500-year flood (i.e. 0.2% annual flood event) elevation, if feasible, or flood-proofing.<sup>1,2</sup>

The Department considers all infrastructure that is necessary to maintain system operations and ensure compliance with the applicable service standard (see discussion of Service Standard included in the NJDEP's Best Practices for Auxiliary Power). Such components already may have been identified and prioritized as part of asset management or emergency response planning or vulnerability analyses.

To assist and guide system managers with their rebuild and resiliency efforts, this section:

1. Identifies design requirements governing recovery or mitigation activities for which Federal and/or State funding assistance is provided.
2. Clarifies existing State regulations governing recovery or mitigation activities located in floodplains. DEP is currently promulgating new rules that will incorporate best practices for flood protection to the extent that current rules do not directly address them.
3. Encourages measures to enhance flood resiliency for both existing and new facilities where the above requirements do not apply or where systems opt to exceed minimum standards to maximize resiliency. System managers must consider the cost-benefits of integrating the enhanced levels of protection to ensure service standard compliance.

Finally, in addition to the NJDEP's regulatory authority governing wastewater and drinking water systems, infrastructure projects may also be regulated under the following, and compliance with these requirements is required, as applicable:

- FHACA rules (N.J.A.C. 7:13)
- Uniform Construction Code (UCC) (N.J.A.C. 5:23), which reference the most recent version of the American Society of Civil Engineers - Flood Resistant Design and Construction standards (ASCE 24)

## **1. Publicly Funded Infrastructure Mitigation/Resiliency Standards**

Generally, the NJDEP's existing rules reference the 100-year floodplain, or the "flood hazard area design flood elevation" as defined by N.J.A.C. 7:13, as the minimum design threshold for specified structures. In many cases, this elevation has proven inadequate based on the flooding and storm surge experienced during Sandy and other recent storms. The need for enhanced flood protection for critical infrastructure has been recognized by FEMA, which requires a higher minimum design threshold for activities involving the repair, rehabilitation, or

construction of facilities for which Federal financial assistance is provided. State-funded projects will equally require this more stringent standard. An explanation of these standards follows:

### Executive Order 11988 (Floodplain Management)

Federal Executive Order 11988 (EO 11988) addresses the potential loss of the natural and beneficial functions of the nation's floodplains as well as the increased cost to Federal, state and local governments from flooding disasters caused or exacerbated by development in vulnerable areas. When funding actions, Federal agencies are required to avoid, to the extent possible, adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.<sup>3</sup>

1. Any critical action<sup>4</sup> for which Federal funding assistance is provided is required to avoid or be elevated above the 500-year flood elevation. There is a rebuttable presumption that this standard must be met unless impacts cannot be avoided, whereby minimization of impacts to, restoration, and preservation of the floodplain must be considered.<sup>5</sup>
  - This includes, but is not limited to, for example, projects or activities that are eligible for Federal Emergency Management Agency (FEMA) Public Assistance (PA) or other disaster relief or mitigation assistance from the Housing and Urban Development, USEPA, and the Army Corps of Engineers.

### USEPA/State of New Jersey Funding Requirements

The USEPA has indicated that any projects for which funding assistance is administered through that agency will be required to meet the minimum flood elevation thresholds stipulated by FEMA, as directed by EO 11988. Similarly, the State of New Jersey expects to condition all State-sourced (e.g. New Jersey Environmental Infrastructure Trust (NJEIT) and State Revolving Fund (SRF), etc.) financial assistance agreements to mirror the minimum Federal flood elevation threshold requirements as above.

## 2. Non-Publicly Funded Infrastructure Mitigation/Resiliency Standards

Projects for which no Federal or State funding assistance is provided (and to which the EO 11988 requirements or State funding assistance conditions do not apply), must comply with the existing NJDEP rule provisions summarized below, which represent the minimum standards.

Nevertheless, serious consideration should be given to maximizing protection of critical system components beyond these minimum requirements, as the siting, design, construction, operation, and maintenance of the system (and therefore its integral components) requires adequate protections to ensure effective operation and attainment of the service standard. Accordingly, additional resilience options based on an "avoidance, elevation, and flood-proofing" hierarchy are outlined in subsection 3 below.

### WASTEWATER SYSTEMS

The New Jersey Pollutant Discharge Eliminations System (NJPDES) rules (N.J.A.C. 7:14A-6.12 and 23 – Treatment Works Approval) govern the elevation and flood-proofing of wastewater treatment and conveyance infrastructure to address concerns associated with flooding. The following rules currently provide for resiliency through elevation and flood-proofing requirements for new construction and reconstruction of certain elements of a wastewater system.

Wastewater Treatment Plants (N.J.A.C. 7:14A-23.13(c)3)

Pumping Stations (N.J.A.C. 7:14A-23.10(a)5)

Collection System (N.J.A.C. 7:14A-23.8(f))

## DRINKING WATER SYSTEMS

The NJDEP requires the elevation and flood-proofing of certain drinking water infrastructure components, including buildings, wells/wellheads/wet wells, pump stations, mechanical equipment, and water main crossings, under the New Jersey Safe Drinking Water Act rules (N.J.A.C. 7:10) and the Well Construction rules (N.J.A.C. 7:9D).

The existing rules, which were adopted and/or amended at various points in time and reference differing flood elevation regulatory thresholds, reflect the concepts, terms, and standards associated with floodplain regulation that were in place when the rules were periodically revised. The Department recognizes the need to amend these rules for consistency and expects to accomplish this in future rulemaking.

Treatment Plants/Building (N.J.A.C. 7:10-11.6(g))

Well Heads (Public Community Water Systems) (N.J.A.C. 7:10-11.7(i))

Pump Stations (N.J.A.C. 7:10-11.9(b))

Mechanical Equipment (N.J.A.C. 7:10-11.8(c)7)

Wet Wells (N.J.A.C. 7:10-11.9(c))

Water Mains Crossing Surface Waters (N.J.A.C. 7:10-11.10(f))

Wells (N.J.A.C. 7:9D-2.3(b))

## 3. Alternative Flood Resiliency Measures

### A. Infrastructure Repair and Construction

Notwithstanding the above-referenced regulatory requirements applicable to wastewater and drinking water system infrastructure, the following hierarchy of flood resiliency measures is strongly recommended as a means to ensure service standard compliance.

**Floodplain Avoidance** – *This recommendation is the most protective and is therefore preferred above the other options below.*

- Where feasible, all critical infrastructure should be constructed outside the 500-year floodplain, as delineated by FEMA.
- Where avoidance of the 500-year floodplain is not feasible, or for non-critical infrastructure, construction should occur outside the Flood Hazard Area, as defined and determined pursuant to the FHACA rules at N.J.A.C. 7:13.

**Elevation** – *Where avoidance of the floodplain is not feasible (e.g. the intended purpose requires proximity to a waterway or location at a low point in the landscape), the next preferred option is to elevate the infrastructure as described below:*

- Critical infrastructure should be located above the 500-year flood elevation, or elevated as required in the UCC (N.J.A.C. 5:23), whichever is higher; or
- Where it is not feasible to elevate as described above or for non-critical infrastructure, it should be elevated in accordance with UCC, or one foot above the flood hazard area design flood elevation as determined by the FHACA rules, whichever is higher.

**Flood Proofing** – *This option may offer some protection but is the least desirable of all the recommendations.*

Flood-proofing involves the use of structural components capable of resisting hydrostatic and hydrodynamic loads and the effects of buoyancy. The walls of flood-proofed buildings are substantially impermeable to the passage of water.<sup>6</sup> Examples of flood-proofing include:

- Use of waterproof membranes and other sealants to prevent the entrance of water into a structure through the walls
  - The installation of watertight shields over doors, windows and man-hole covers, or
  - Other measures to restrict water egress, prevent sewer backups, or damage caused by immersion.<sup>7</sup>
- Where it is not feasible to avoid the floodplain or to elevate infrastructure as described above, flood-proofing of appropriate infrastructure components shall be conducted in accordance with National Flood Insurance Program (NFIP) requirements, FHACA rules and/or the UCC, unless otherwise prohibited.<sup>8</sup>
  - Where flood-proofing of critical system infrastructure is not currently possible, system operators must consider prioritization of system components and ensure that they be flood-proofed over time. For example, motor control centers/equipment, emergency generators, and chemical feed equipment could be conducted first, with other components being addressed at a later date.

## B. Surface Water Crossings – Drinking Water and Sewer Mains

Drinking water and sewer main crossings are vulnerable to flooding and flood-associated damage, and special consideration to protect them is warranted. In addition to any applicable requirements under the NJPDES, SDWA, and FHACA rules, or the UCC, the following are recommended actions to meet the service standard<sup>9</sup>:

For underground crossings of water courses greater than 15 feet in width, the following should be provided:

- The pipe should be of special construction, having flexible, restrained or welded water-tight joints.

For above-ground crossings:

- The pipe should be adequately supported and anchored, protected from vandalism, damage, freezing, and accessible for repair or replacement.
- Where the pipe is installed on a private bridge or dedicated pipe bridge, the bridge structure should be capable of withstanding loads imposed by flood waters including impact and scour up to the flood hazard area design flood elevation.

### Drinking Water Systems Only --

- Valves should be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible, and located above or outside the flood hazard area.
- Permanent taps or other provisions to allow insertion or installation of testing equipment to determine leakage and obtain water samples should be installed on each side of the valve closest to the supply source.

## C. Access to Facilities

The ability to access facilities during an event is important in order to ensure proper and effective operation, maintenance and inspection. The following actions are recommended to ensure service standard compliance (in addition to the applicable road crossing standards found in the FHACA rules), and are based on the Ten States Standards, which recommends that access roads shall be protected to at least the 100-year flood elevation or maximum flood of record, whichever is higher.

### Access to new or reconstructed facilities:

Where access is required to a new or reconstructed facility, whether on a permanent, temporary or maintenance basis, access should be provided to at least the same flood protection elevation as the facility. However, the full length of access ways may need to be constructed at higher elevations since flooding of specific areas at any given point during an event could exceed the 100-year flood elevation.

### Access to an existing facility, should be either:

- Maintained, to the extent practicable, during a flooding event; or
- Where access is likely to be compromised during a flood, a system's EP or ERP should address the access (and egress for occupied facilities), to ensure a safe working environment and to facilitate the operation, maintenance, refueling and repair of the facility.

***DISCLAIMER:*** THIS GUIDE IS INTENDED TO PROVIDE INFORMATION ABOUT HAZARD MITIGATION AND RESOURCES THAT MAY APPLY TO YOUR SITUATION. IT IS NOT INTENDED TO BE ALL-INCLUSIVE OR REPLACE OR IMPOSE NEW REQUIREMENTS BEYOND THOSE ESTABLISHED UNDER EXISTING STATUTES AND REGULATIONS, APPLICABLE BUILDING CODES AND STANDARDS, OR FUNDING CONDITIONS ASSOCIATED WITH FEDERAL AND/OR STATE DISASTER RELIEF AND MITIGATION ASSISTANCE. ALSO, IT WILL NOT BE USED BY THE NJDEP AS A SUBSTITUTE FOR AN EXISTING STATE OR FEDERAL LAW OR RULE FOR ENFORCEMENT PURPOSES.

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<sup>1</sup>Elevation of critical infrastructure above the 500-year flood elevation is recommended in the following publications: “Reducing Flood Effects in Critical Facilities,” FEMA RA2, and “Designing for Flood Levels Above the BFE After Hurricane Sandy, RA5, et al., FEMA, April 2013, The American Society of Civil Engineers (ASCE) code referred to as “ASCE 24-05: Flood Resistant Design and Construction” (ASCE 24-05); FEMA’s Hurricane Katrina Recovery Advisory: “Designing for Flood Levels Above the BFE”; and The Association of State Floodplain Managers, Inc. position paper “Critical Facilities and Flood Risk”

<sup>2</sup>FEMA 543: Design Guide for Improving Critical Facility Safety from Flooding at <http://www.fema.gov/library/viewRecord.do?id=2441>.

<sup>3</sup>FEMA’s procedures for implementing EO 11988 are found at Title 44 Part 9 of the Code of Federal Regulations (44 CFR 9), which include an eight-step process that decision-makers must follow when considering projects that have potential impacts to or within a floodplain or wetland.

<sup>4</sup>In accordance with regulations implementing EO 11988 (see 44 CFR 9), *Critical Action* means an action for which even a slight chance of flooding is too great. The minimum floodplain of concern for critical actions is the 500-year floodplain. Critical actions include, but are not limited to, those which create or extend the useful life of structures or facilities such as the following:

- (a) Those which produce, use or store highly volatile, flammable, explosive, toxic or water-reactive materials;
- (b) Hospitals and nursing homes, and housing for the elderly, which are likely to contain occupants who may not be sufficiently mobile to avoid the loss of life or injury during flood and storm events;
- (c) Emergency operation centers, or data storage centers which contain records or services that may become lost or inoperative during flood and storm events; and
- (d) Such as generating plants, and other principal points of utility lines.

<sup>5</sup>The NJDEP currently understands that this requirement will apply to facilities or components thereof deemed as “critical” according to FEMA. Based on our initial consultations with FEMA, it is possible that individual determinations concerning alternatives to the strict application of the EO provisions and the accompanying regulatory flood elevation thresholds may be made on a case-specific basis.

<sup>6</sup>A structural evaluation is necessary to determine whether a structure can withstand anticipated flood loads, especially hydrostatic pressure and buoyancy. Currently, only non-residential structures and residences that are listed as historic structures may be dry flood-proofed (FEMA -758/May 2010).

<sup>7</sup>*Selecting Appropriate Mitigation Measures for Floodprone Structures*, FEMA 551 (2007), Chapter 7-2, (available at <http://www.fema.gov/library/viewRecord.do?id=2737>).

<sup>8</sup>For example, dry flood-proofing may not be permitted in certain areas or under certain circumstances. Also, compliance with the NFIP requirements cannot be achieved by using wet flood-proofing measures in which floodwater is allowed to enter a building.

<sup>9</sup>“Recommended Standards for Water Works – 2012 Edition” – a report of the Water Supply Committee of the Great Lakes–Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, (a.k.a. Ten States Standards).