Appendix F
Floodplain Considerations

Hartford - Brainard Airport Reuse Study
Floodplain Considerations

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Introduction

Hartford – Brainard Airport (KHFD) is a public-use, publicly owned airport situated on 201 acres in the City of Hartford, just 3 miles from the downtown business district. Maxim Road generally bounds the airport to the north, Lindbergh Drive to the west, the Metropolitan District Commission (MDC) wastewater treatment plant to the south, and the Connecticut River to the east. The State is undertaking a study for the potential decommissioning of the airport and redevelopment of the airport site.

Floodplain Context

The entirety of the site is protected from flooding of the site by the Hartford Levee, which was constructed in response to the 1936 floods that devastated the City. As a result, Flood Insurance Rate Map panels 09003C0506G and 09003C0507G, effective September 16, 2011, show the subject site in Zone X, Area with Reduced Flood Risk Due to Levee.

The Federal Emergency Management Agency (FEMA) defines a levee as a "man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding."

Levees reduce risk during certain flood events. They do not provide complete protection from flooding. In addition, they can and do deteriorate over time and must be maintained to retain their effectiveness. When levees fail or are overtopped, the results can be catastrophic. In fact, the flood damage can be greater than if the levee had not been built.

A levee is a barrier between the river and the Airport. However, as a barrier, the levee also prevents the natural drainage of the land toward the river. Therefore, runoff from behind the levee must be collected and pumped over or through the levee into the river. Without the pumping, runoff from behind the levee could collect and flood the very assets it was intended to protect.

Levee Accreditation

FEMA regulates development within Special Flood Hazard Areas (SFHA), which have a 1-percent chance of flooding to a certain level in any given year, such as requiring construction with a minimum freeboard over the base flood elevation or floodproofing for non-residential

buildings. Flood insurance is required within an SFHA as a condition of any federally backed, regulated, or insured mortgage.

The area protected by the Hartford Levee is currently not within a Special Flood Hazard Area. Therefore, no provisions under the National Flood Insurance Program would require new structures to be floodproofed or built to a certain elevation.

FEMA analyzes and maps the flood hazards associated with levee systems based on the information provided by other Federal agencies, levee owners, and/or communities. Accredited levee systems are depicted as reducing the base flood hazard on a Flood Insurance Rate Maps (FIRM) if FEMA has been provided with documentation and certified data that meets the requirements of 44 CFR 65.10, including an adopted operation, maintenance, and emergency preparedness plan provided by the community or other qualified entity seeking accreditation.

The accreditation criteria include:

1. **Freeboard**: 3 feet above the base flood elevation, plus an additional foot within 100 feet on either side of structures (such as bridges) riverward of the levee or where flow is constricted.

2. **Closures**: A closure shall be considered for any opening within the levee system elevated at or below the minimum freeboard elevation that pertains to a hydraulic connection between the riverside and the landside of the levee system. Closures can include road openings and utility penetrations. All considered closures must have a documented and properly designed closure device and procedure in the levee system operation and maintenance manual that meets the requirements laid out for Operation Plans and Criteria under 44 CFR 65.10(c). Closures requiring manual intervention, such as road openings, gate structures, and manual operation for closures on pipe penetrations, must have a warning system that allows adequate time to respond.

3. **Embankment Protection**. The embankment protection of 44 CFR 65.10(b)(3) which states the following: Engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through the reduction of the seepage path and subsequent instability. The factors to be addressed in such analyses include but are not limited to expected flow velocities (especially in constricted areas); expected wind and wave action, ice loading, impact of debris; slope protection techniques; duration of flooding at various stages and velocities; embankment and foundation materials; levee alignment, bends, and transitions; and levee side slopes.

4. **Embankment and Foundation Stability**: The embankment and foundation stability requirements are stated in 44 CFR 65.10(b)(4), which states that Engineering analyses that evaluate levee embankment stability must be submitted. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment and foundation stability. An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined by the US Army Corps of Engineers (COE) manual, "Design and Construction of Levees" (EM 1110-2-1913, Chapter 6, Section II) may be used. The factors that shall be addressed in the analyses include Depth of flooding, duration of flooding, embankment geometry and length of seepage path at

critical locations, embankment and foundation materials, embankment compaction, penetrations, other design factors affecting seepage (such as drainage layers), and other design factors affecting embankment and foundation stability (such as berms).

5. **Settlement**. An analysis or calculation utilizing the composition of the levee to determine current and future settlement is required for areas subject to coastal and riverine flooding to demonstrate the current and future impacts of settlement on the freeboard. This analysis may leverage existing data regarding calculations and composition of the levee if still applicable. The analysis must address any future loss of freeboard associated with settlement over time, including subsidence impacts.

6. **Interior Drainage**. The interior drainage requirements are stated in 44 CFR 65.10(b)(6), which requires the following: An analysis must be submitted that identifies the source(s) of such flooding, the extent of the flooded area, and if the average depth is greater than one foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters.

7. **Operations and Maintenance Plans**. An operations and maintenance plan is required as detailed in 44 CFR 65.10(c)

Hartford Flood Protection System

The levee protecting the Airport is part of a larger flood protection system serving the City.

The Flood Protection System (System) protects approximately 3,000 acres of urban area in the vicinity of the Connecticut and Park Rivers. The United States Army Corps of Engineers (USACE) estimates that the population at risk resulting from a failure of the System/system component ranges from 26,200 (day) to 5,500 (night), with direct economic losses in the range of $300 million to $1 billion. The Federal Government constructed the System in various phases, with some of the segments of the Park River Conduit being constructed by the Connecticut Department of Transportation (DOT) between 1938 and 1981. Ownership of the System was transferred from the Federal Government to the City of Hartford, with the City agreeing to operate and maintain the System in accordance with Federal standards.

The System consists of the following:

1. Four levee sections

    a. **North Meadows Dike** (16,400 LF of earthen dike with an average height of 27')

    b. **Hartford Dike,** also known as the Riverfront Dike (5,300 LF of earthen dike & 4,400 LF of concrete floodwall)

    c. **Clark Dike,** also known as the South Meadows Dike (11,400 LF of earthen dike with an average height of 24') This is the structure at the subject property.

    d. **Folly Brook Dike** (650 LF of earth fill dike with a minimum height of 10')

2. System Components

    a. 6.4 mile of embankment (34,000 LF)

    b. 0.8 miles of concrete floodwall (4,400 LF)

    c. 4 Stop Log Closure Structures (one of the former closure structures has been properly abandoned)

    d. 1 Sandbag Closure Structure (Wethersfield Ave.)

    e. Six Stormwater pump stations

    f. Four Conduits

        1) Park River Conduit (16,800 LF of twin-rectangular reinforced concrete conduit)

        2) Park River Auxiliary Conduit (9,100 LF of 22’ diameter concrete-lined tunnel)

        3) Folly Brook Conduit (2,200 LF of reinforced concrete box culvert)

        4) Gully Brook (3,100 LF of rectangular section pressure conduit – Drainage area = +/- 120 acres)

3. The System is designed to provide protection for a maximum water surface elevation of 37.5’ (1929 NGVD) with a top elevation of 42.5’ (1929 NGVD)

Various engineering analyses and studies of the System have been completed as part of the FEMA Accreditation Process and as a result of USACE’s Inspection Program. The studies have identified a number of deficiencies which need to be addressed. The Department of Public Works (DPW) has been working with the USACE and the Connecticut Department of Energy and Environmental Protection (CT DEEP) to make the necessary improvements to ensure the System provides the intended level of protection based on current engineering standards.

Several improvements have been made to the System in the past few years. Unfortunately, the System is comprised of various elements, and the strength of the overall System is dependent on its weakest link. DPW is moving forward to address structural deficiencies that could adversely affect the system's integrity and result in catastrophic failure. Operational elements and other components that are obsolete and past their operating life but are currently functioning have received lower priority but still must be addressed.

The USACE’s interim inspection/rating policy utilizes the traditional inspection criteria but places additional emphasis on a subset of 18 elements. An unacceptable rating in any of the subset of 18 elements will result in a system being moved to “inactive status” as it relates to PL 84-99. Previous inspections of the System identified deficiencies that resulted in an unacceptable rating. The City has maintained conditional active status by participating in the USACE System-wide Improvement Framework Program (SWIF). The City’s draft SWIF program, which obligates the City to undertake specific corrective actions per an approved timeline, is currently being reviewed by the USACE. It is our understanding that the SWIF should be finalized later in 2023 when a Semi-Quantitative Risk Analysis (SQRA) of the System is completed. The SQRA consists of a review of the System’s known deficiencies and existing field conditions, which were compared to current engineering standards. The SQRA

process identified the five most likely potential failure modes out of the 20 potential failure modes reviewed for the System. The most likely potential modes identified include:

1. Seepage through the System foundation
2. Seepage through the levee embankment
3. Floodwall instability
4. Collapse of an abandoned structure/levee penetration
5. Overtopping of the levee

Development Considerations

The area protected by the Hartford Levee is currently not within a Special Flood Hazard Area. Therefore, no provisions under the National Flood Insurance Program would require new structures to be floodproofed or built to a certain elevation. In other words, there is no restriction on development behind the levee from a floodplain management perspective.

The base flood elevation at the levee in the project area is approximately elevation 29.5 NGVD29, which is below the levee protection elevation of 37.5.

Risk of Flooding

However, the risk of flooding is not zero. The following identifies some of the potential risks.

Loss of Accreditation. In the event that the levee loses accreditation, the flood protection offered by the levee will be discounted, and the area protected from the 1% annual chance of flood will be mapped as a floodplain. If a building is constructed behind the levee, which subsequently loses its accreditation, the building owners would be required to purchase flood insurance, with the premium varying based upon the depth of flooding. Furthermore, the owner of a structure in a newly mapped SFHA area will be required to bring the entire structure into conformance with existing floodplain regulations should the value of the improvements exceed 50 percent of the fair market value of the structure. Therefore, the flood insurance requirement is subject to the maintenance of the levee and the levee maintaining its accreditation status.

Failure of Pumping Stations. The levee is a barrier to natural runoff and relies on a series of toe drains and pumping stations to evacuate runoff collected behind the levee. In the event that one or more of the pumping stations fail, runoff will accumulate behind the levee, potentially flooding the development area.

Levee Breach. It is possible that a structural issue in the levee may develop, causing the levee to fail allowing floodwaters to flood the levee protected area.

Levee Overtopping. Flood Insurance Studies are based on historical risk and do not represent future risk. There is a possibility that a storm, a combination of storms and/or saturated ground conditions, or an upstream failure of a large dam could produce enough runoff in the river that the water surface elevation is raised above the top of the levee.

Modifications to Existing Levee

Any modifications to the levee itself for public access will require review by the U.S. Army Corps of Engineers under 33 USC 408. USACE may grant permission for the alteration of a public work so long as that alteration is not injurious to the public interest and will not impair the usefulness of the work. The review area includes the levee itself and the easement area associated with the levee on either side.

The typical 408 review process is as follows and is lengthy, taking approximately 24 to 36 months:

Step 1: Pre-Coordination

- Pre-application meetings to help identify USACE procedures and potential issues

Step 2: Written Request

- Officially initiates USACE involvement and review
- Determines documentation and approval level requirements

Step 3: Required Documentation

- Technical Analysis (i.e. Basis of Design)
- Hydrologic and Hydraulics System Performance Analysis
- Geotechnical Analysis
- Environmental Compliance (NEPA)
- Real Estate Requirements
- Requester's Review Plan (district determination)

Step 4: District-Led Agency Technical Review

- Impair of the Usefulness of the Project Determination
- Injurious to the Public Interest Determination
- Legal and Policy Compliance Determination

Step 5: Summary of Findings

- District makes their recommendation

Step 6: Division Review (if required)

- Minimum 30-day review period

Step 7: USACE Headquarters Review (if required)

- Minimum 30-day review period

Step 8: Notification

- District provides written notification of 408 request decision

Step 9: Post-Permission Oversight

- Construction Oversight
- As-Builts
- O&M Manual Update
- Post Construction Closeout
- Administrative Record

Document2