

# District-Scale Flood Protection Systems

A CITYWIDE PERSPECTIVE

Based on the citywide vulnerability assessment and the focus-area analyses, Climate Ready Boston proposes nine locations for flood-protection interventions. As sea level rises over the century, the number of interventions needed increases, and their cumulative effectiveness becomes more important.

## KEY FINDINGS

### The Progression of Flood Protection

In the near term, with nine inches of sea level rise, four flood protection systems, independent of one another, could protect against widespread one percent annual chance flooding: **East Boston**; the **New Charles River Dam**; the **Downtown Waterfront**; and the **South Boston Waterfront**.

As sea level rise progresses to 36 inches (2070s or later), preventing one percent annual chance flooding would require additional interventions:

- An expansion of the **East Boston** flood protection system;
- A **Charlestown** system near **Sullivan Square**;
- A **Downtown Waterfront** system; and
- A **combined flood protection system** for the **New Charles River Dam, the South Boston Waterfront, and Dorchester Bay**. This combined system will become necessary because low-lying inland areas and below-grade roads can bring floodwaters from the waterfront across the city.

<sup>1</sup> Important factors, including existing drainage systems, underground transportation and utility structures, soil conditions, zoning, as well as any potential external impacts as a result of the project have not been studied in detail.

<sup>2</sup> See Appendix for more detailed information on expected effectiveness of flood protection systems, including analysis of additional flood protection locations and flood frequencies.

<sup>3</sup> Annualized benefits can be used to determine project cost effectiveness by applying a discount rate to benefits, capital costs, and maintenance costs over the expected project useful life and evaluating the ratio of the net present value of benefits over costs. A ratio of one or greater typically indicates that a project is cost effective. A ratio less than one, for an evaluation that is based entirely on avoided damage costs, does not necessarily mean that a project is not worthwhile. Cost effectiveness is one lens through which to evaluate the merits of a project. These estimates consider current resident and structures in the study area, not future growth. For methodology see Appendix.

### The Locations of Flood Protection

- A flood protection system that addresses the overtopping or flanking of the **New Charles River Dam** can reduce flood risk Downtown, in Charlestown, and along both sides of the Charles River.
- In **East Boston** and in **Charlestown**, targeted flood protection systems can address relatively narrow flood pathways.
- The low-lying portion of the **Downtown Waterfront** is very broad and densely built, which makes it challenging to identify a specific location for a flood protection system.
- Nearly the entire **South Boston Waterfront** is low-lying and exposed to flooding from three edges, presenting significant challenges to a flood protection system. A system that prevents flooding from Fort Point Channel can also benefit areas as far inland as the South End, **Roxbury, Newmarket, and Widett Circle**.
- Along **Dorchester Bay**, The broad, low-lying waterfront areas from **Joseph Moakley Park to Savin Hill Cove** also expose inland areas to flooding but do not present obvious, targeted solutions for flood protection systems.

## Methodology

Based on existing topography, rights-of-way, and urban and environmental conditions, Climate Ready Boston identified locations where green or gray flood protection systems could protect populations and reduce damage to buildings, infrastructure, and the economy from the projected one percent annual flooding. This analysis is preliminary. As described in Initiatives 5-2 and 5-3, detailed feasibility studies and public and stakeholder engagement are required to better understand the costs and benefits of flood protection in each location.<sup>1</sup>

The three maps and accompanying tables on the following pages correspond to the three levels of sea level rise—9, 21, and 36 inches—assessed in this report. There are 9 potential intervention areas, described in more detail in the various focus area sections.<sup>2</sup> The accompanying tables provide preliminary, order-of-magnitude estimates of certain benefits<sup>3</sup> that could result from the implementation of the flood protection systems. They do not estimate potential costs.

*This set of potential locations for district-scale flood protection is not comprehensive, and additional infrastructure may be necessary to protect specific sites. Additionally, district-scale flood protection is only one piece of a multi-layered solution that includes prepared and connected communities, resilient infrastructure, and adapted buildings.*

# 9 INCHES SLR (2030–2050S)

## DISTRICT-SCALE FLOOD PROTECTION FOR 1% ANNUAL CHANCE FLOOD



### Jeffries Point to Central Square

(See East Boston Focus Area for more information)

#### Estimated Benefits

Benefiting Area <sup>4</sup>	
People	10,700
Structures	1,580
Land Area	260 acres

#### Avoided Economic Losses

From a single 1% annual chance flood	\$186 million
Annualized across multiple flood probabilities <sup>5</sup>	\$6 million

### New Charles River Dam

(See Downtown and Charlestown Focus Areas for more information)

#### Estimated Benefits

Benefiting Area <sup>8</sup>	
People	1,500
Structures	110
Land Area	90 acres

#### Avoided Economic Losses

From a single 1% annual chance flood	\$314 million
Annualized across multiple flood probabilities <sup>9</sup>	\$13 million

<sup>4</sup>Area protected through the 1% annual chance flood event. Additional flood protection would be necessary to protect against the 0.1% annual chance flood event.

<sup>5</sup>Probability-adjusted economic losses for the 1%, 2%, and 10% annual chance flood events. Additional flood protection locations would be necessary to protect against the 0.1% annual chance flood event.

<sup>6</sup>Area protected through the 0.1% annual chance flood event.

<sup>7</sup>Probability-adjusted economic losses for the 0.1%, 1%, 2%, and 10% annual chance flood events.

### Downtown Waterfront

(See Downtown Focus Area for more information)

#### Estimated Benefits

Benefiting Area <sup>6</sup>	
People	1,100
Structures	170
Land Area	40 acres

#### Avoided Economic Losses

From a single 1% annual chance flood	\$219 million
Annualized across multiple flood probabilities <sup>7</sup>	\$21 million

### South Boston Waterfront

(See South Boston Focus Area for more information)

#### Estimated Benefits

Benefiting Area <sup>10</sup>	
People	2,300
Structures	290
Land Area	320 acres

#### Avoided Economic Losses

From a single 1% annual chance flood	\$978 billion
Annualized across multiple flood probabilities <sup>11</sup>	\$62 million

<sup>8</sup>Area protected through the 1% annual chance flood event. Additional flood protection would be necessary to protect against the 0.1% annual chance flood event.

<sup>9</sup>Probability-adjusted economic losses for the 1%, 2%, and 10% annual chance flood events. Additional flood protection would be necessary to protect against the 0.1% annual chance flood event.

<sup>10</sup>Area protected through the 1% annual chance flood event. Additional flood protection would be necessary to protect against the 0.1% annual chance flood event.

<sup>11</sup>Probability-adjusted economic losses for the 1%, 2%, and 10% annual chance flood events. Additional flood protection locations would be necessary to protect against the 0.1% annual chance flood event.

## DISTRICT-SCALE FLOOD PROTECTION FOR 1% ANNUAL CHANCE FLOOD

(See East Boston Focus Area for more information)

Benefiting Area<sup>12</sup>

### Avoided Economic Losses

### North Charlestown and New Charles River Dam Locations Combined<sup>16</sup>

Benefiting Area<sup>17</sup>

### Avoided Economic Losses

<sup>12</sup>Area protected through the 1% annual chance flood event. Additional flood protection would be necessary to protect against the 0.1% annual chance flood event.

<sup>13</sup>Probability-adjusted economic losses for the 1%, 2%, and 10% annual chance flood events. Additional flood protection locations would be necessary to protect against the 0.1% annual chance flood event.

<sup>14</sup>Area protected through the 0.1% annual chance flood event.

<sup>15</sup>Probability-adjusted economic losses for the 0.1%, 1%, 2%, and 10% annual chance flood events.

(See East Boston Focus Area for more information)

Benefiting Area<sup>14</sup>

### Avoided Economic Losses

## Downtown Waterfront

Benefiting Area<sup>19</sup>

### Avoided Economic Losses

<sup>16</sup> Only includes benefits in Charlestown. See table for New Charles River Dam for additional benefits citywide.

<sup>17</sup> Area protected through the 0.1% annual chance flood event.

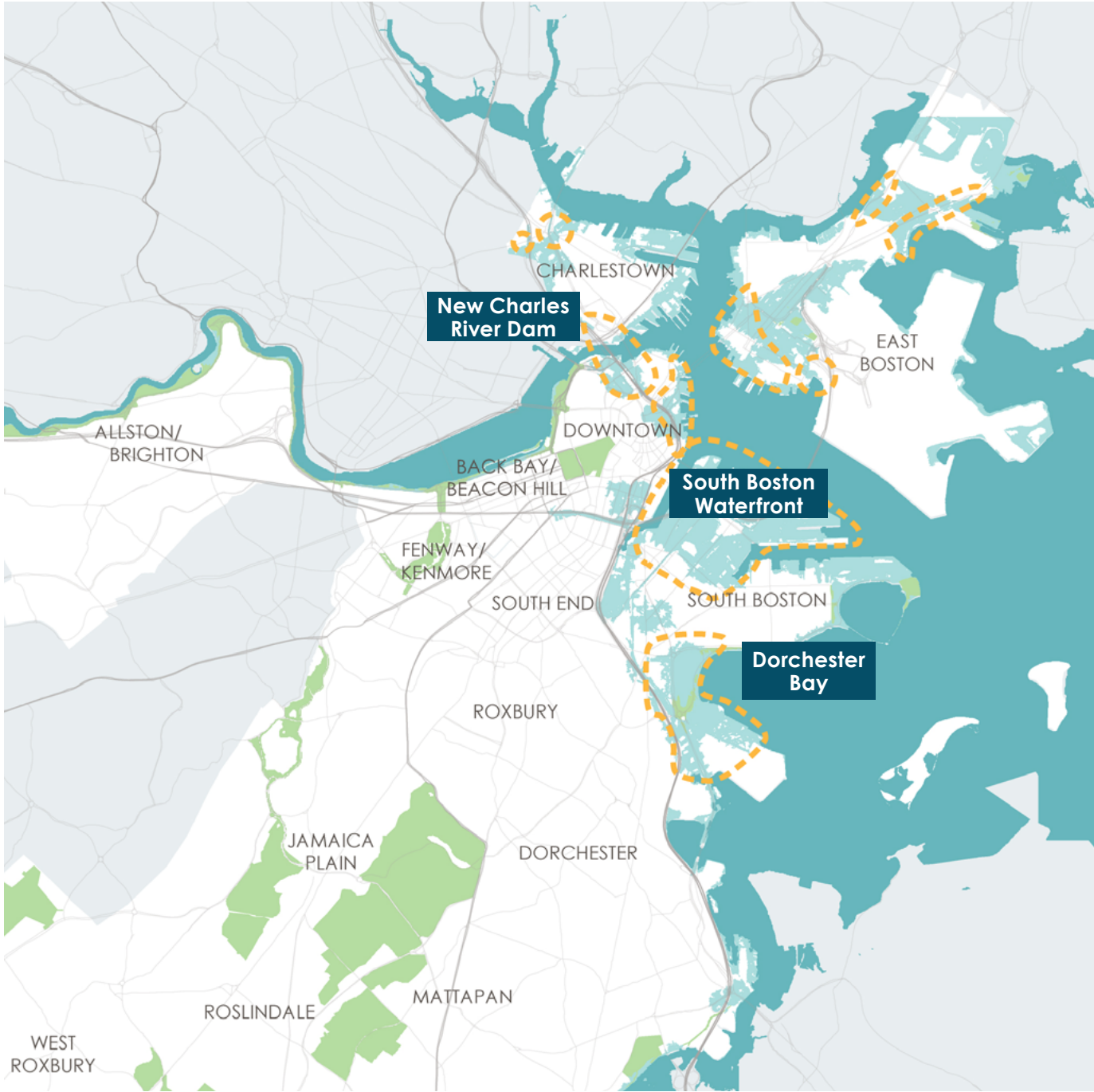
<sup>18</sup> Probability-adjusted economic losses for the 0.1%, 1%, 2%, and 10% annual chance flood events.

<sup>19</sup> Area protected through the 0.1% annual chance flood event.

<sup>20</sup> Probability-adjusted economic losses for the 0.1%, 1%, 2%, and 10% annual chance flood events.



21 INCHES SLR (2050S–2100S)  
DISTRICT-SCALE FLOOD PROTECTION FOR 1% ANNUAL CHANCE FLOOD



New Charles River Dam<sup>21</sup>  
(See Downtown and Charlestown  
Focus Areas for more information)

Estimated Benefits

Benefiting Area<sup>22</sup>

People	23,600
Structures	4,360
Land Area	290 acres

Avoided Economic Losses

From a single 1% annual chance flood	\$543 million
Annualized across multiple flood probabilities <sup>23</sup>	\$24 million

South Boston Waterfront and  
Dorchester Bay Locations Combined  
(See South Boston and Dorchester Bay  
Focus Areas for more information)

Estimated Benefits

Benefiting Area<sup>24</sup>

People	41,700
Structures	4,990
Land Area	1,580 acres

Avoided Economic Losses

From a single 1% annual chance flood	\$3 billion
Annualized across multiple flood probabilities <sup>25</sup>	\$218 million

<sup>21</sup>Does not include benefits in Charlestown, which are dependent on flood protection in North Charlestown. See table for North Charlestown and New Charles River Dam Locations Combined.

<sup>22</sup>Area protected through the 0.1% annual chance flood event.

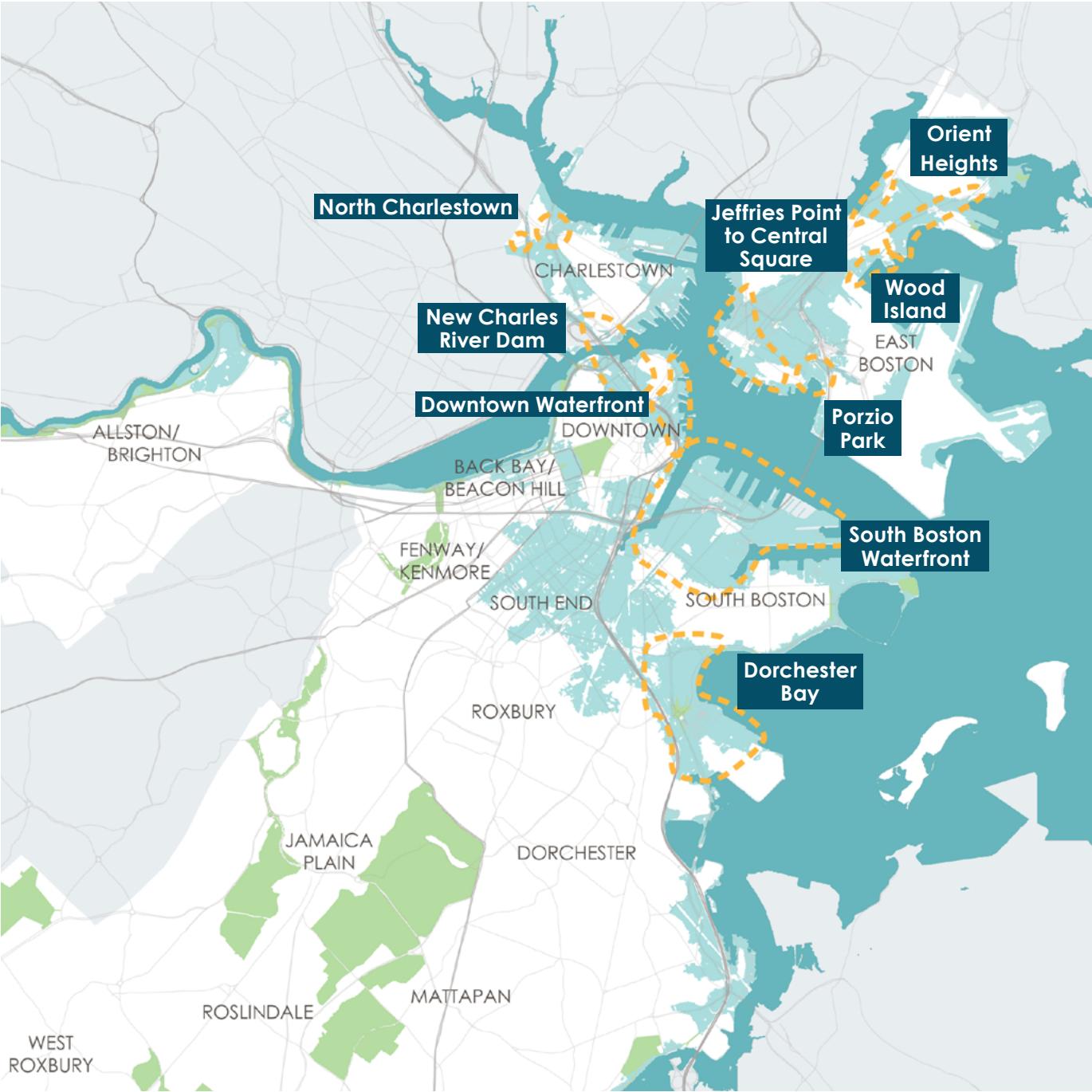
<sup>23</sup>Probability-adjusted economic losses for the 0.1%, 1%, 2%, and 10% annual chance flood events.

<sup>24</sup>Area protected through the 0.1% annual chance flood event.

<sup>25</sup>Probability-adjusted economic losses for the 0.1%, 1%, 2%, and 10% annual chance flood events.

# 36 INCHES SLR (2070S OR LATER)

## DISTRICT-SCALE FLOOD PROTECTION FOR 1% ANNUAL CHANCE FLOOD



### All Four East Boston Locations Combined

(See East Boston Focus Area for more information)

Estimated Benefits

Benefiting Area <sup>26</sup>	
People	14,800
Structures	2,430
Land Area	650 acres

Avoided Economic Losses

From a single 1% annual chance flood	\$1.2 billion
Annualized across multiple flood probabilities <sup>27</sup>	\$122 million

### Downtown Waterfront

(See Downtown Focus Area for more information)

Estimated Benefits

Benefiting Area <sup>31</sup>	
People	1,100
Structures	230
Land Area	60 acres

Avoided Economic Losses

From a single 1% annual chance flood	\$680 million
Annualized across multiple flood probabilities <sup>32</sup>	\$71 million

<sup>26</sup> Area protected through the 0.1 percent annual chance flood event.

<sup>27</sup> Probability-adjusted economic losses for the 0.1 percent, 1 percent, 2 percent, and 10 percent annual chance flood events.

<sup>28</sup> Only includes benefits in Charlestown. See table for Locations 7, 8 and 9 Combined for additional benefits citywide.

<sup>29</sup> Area protected through the 0.1% annual chance flood event.

<sup>30</sup> Probability-adjusted economic losses for the 0.1%, 1%, 2%, and 10% annual chance flood events.

### North Charlestown and New Charles River Dam Locations Combined<sup>28</sup>

(See Charlestown Focus Area for more information)

Estimated Benefits

Benefiting Area <sup>29</sup>	
People	1,300
Structures	370
Land Area	170 acres

Avoided Economic Losses

From a single 1% annual chance flood	\$238 million
Annualized across multiple flood probabilities <sup>30</sup>	\$20 million

### New Charles River Dam, South Boston Waterfront, and Dorchester Bay Locations Combined<sup>33</sup>

(See Downtown, Charlestown, South Boston and Dorchester Focus Areas for more information)

Estimated Benefits

Benefiting Area <sup>34</sup>	
People	114,100
Structures	10,620
Land Area	3,370 acres

Avoided Economic Losses

From a single 1% annual chance flood	\$9.4 billion
Annualized across multiple flood probabilities <sup>35</sup>	\$912 million

<sup>31</sup>Area protected through the 0.1% annual chance flood event.

<sup>32</sup> Probability-adjusted economic losses for the 0.1%, 1%, 2%, and 10% annual chance flood events.

<sup>33</sup> Does not include benefits in Charlestown, which are dependent on flood protection in North Charlestown. See table for North Charlestown and New Charles River Dam Locations Combined.

<sup>34</sup> Area protected through the 0.1% annual chance flood event.

<sup>35</sup> Probability-adjusted economic losses for the 0.1%, 1%, 2%, and 10% annual chance flood events.