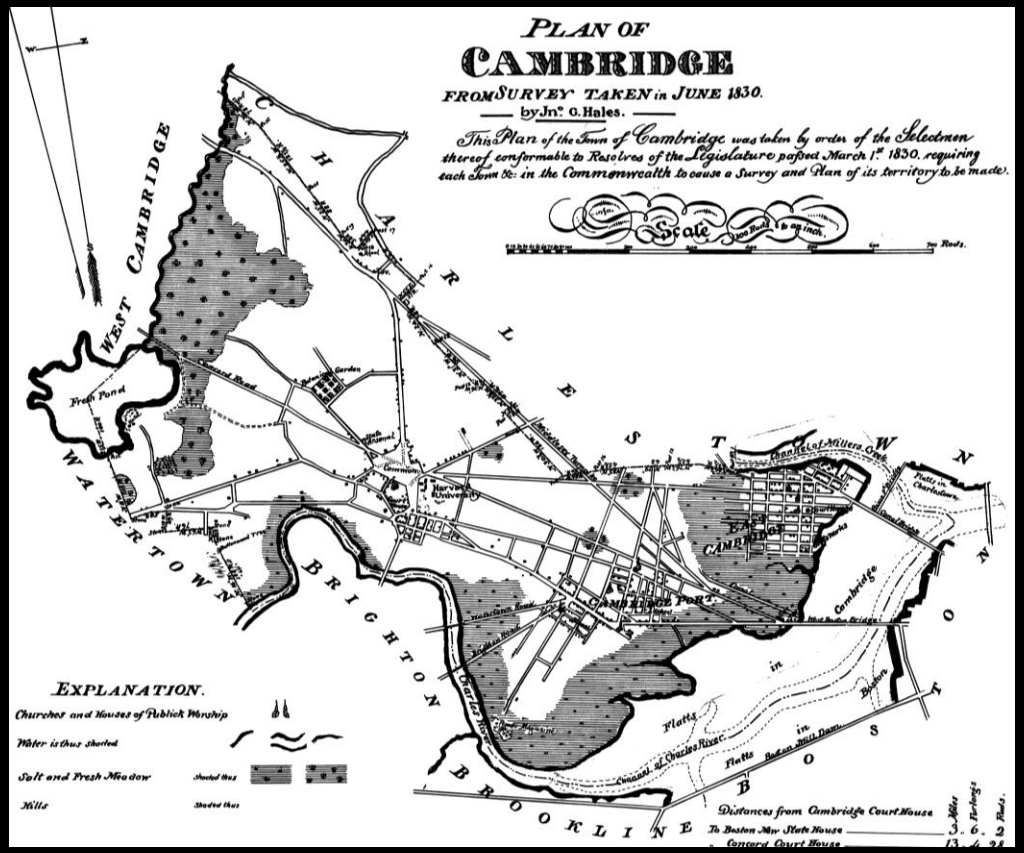


Green St & Sidney Place, July 10, 2010

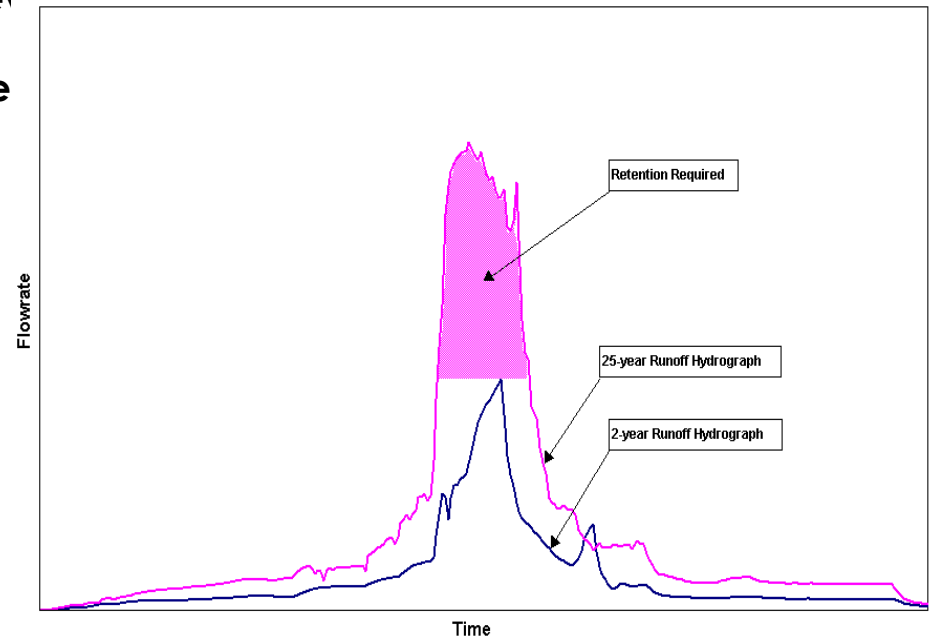
Cambridge in 1830 / Flooding in 2010
Walking Tour March 21, 2019 – Thoughts for Discussion

What is currently required for stormwater management?
How is project benefitting the City's system?
What steps are being taken to protect the property?
What's missing? Additional requirements?

Is the project in the FEMA 100-Year Flood Plain, per June 4, 2010 Map?

- ConCom Review – MA Wetlands Protections Act.
- Compensatory Storage
- Flood Plain Overlay District 20.70 of Zoning – Review by ConCom and City Engineer
  - Compensatory storage and documentations of no increase in flood levels during 100-year flood.

- **Requirements for All Projects to ensure protecting city system**
  - Performance based criteria. Met through combination of green and grey infrastructure.
  - 25:2 Requirement. Post-development discharge hydrograph for the 25-year event <= to the 2-year rainfall event pre-development. Stored or recharge difference on site.
  - Post-development peak discharge rates cannot exceed pre-development pe
  - Water quality improvements – TSS and phosphorus.
  - Sewer flows over 15,000 gallons per day must be offset 4:1.
  - Sewer Holding tanks in Kendall Sq and Alewife areas; 8-hour volume.

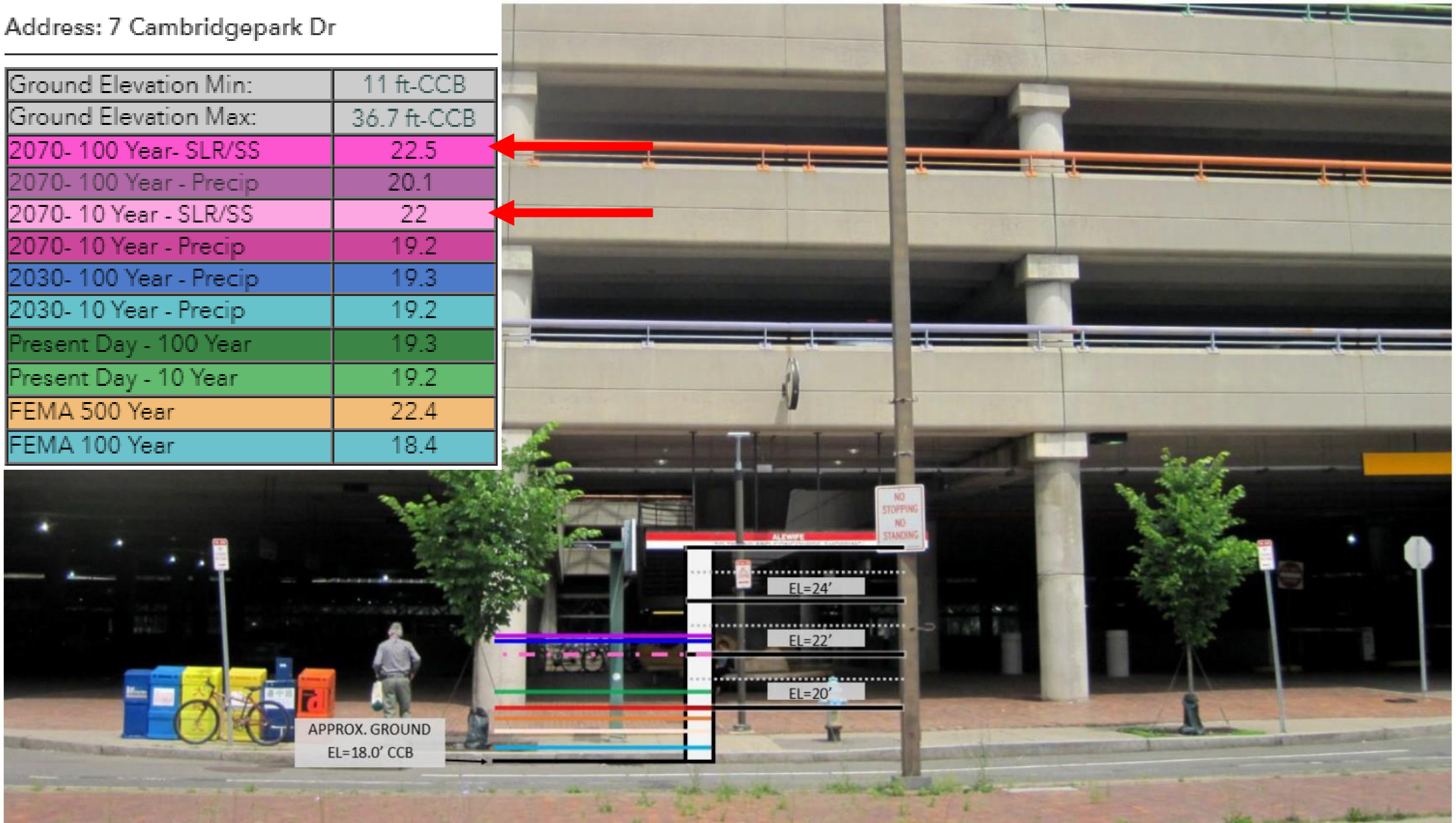


- **Building Vulnerability - Advise**
  - Build/Protect to 2070 10-Year Event
  - Recover from 2070 100-Year Event
  - 50 Cambridgepark Drive Site Action Plan – Future building adaptation

D. ALEWIFE GARAGE FLOOD ELEVATIONS

Address: 7 Cambridgepark Dr

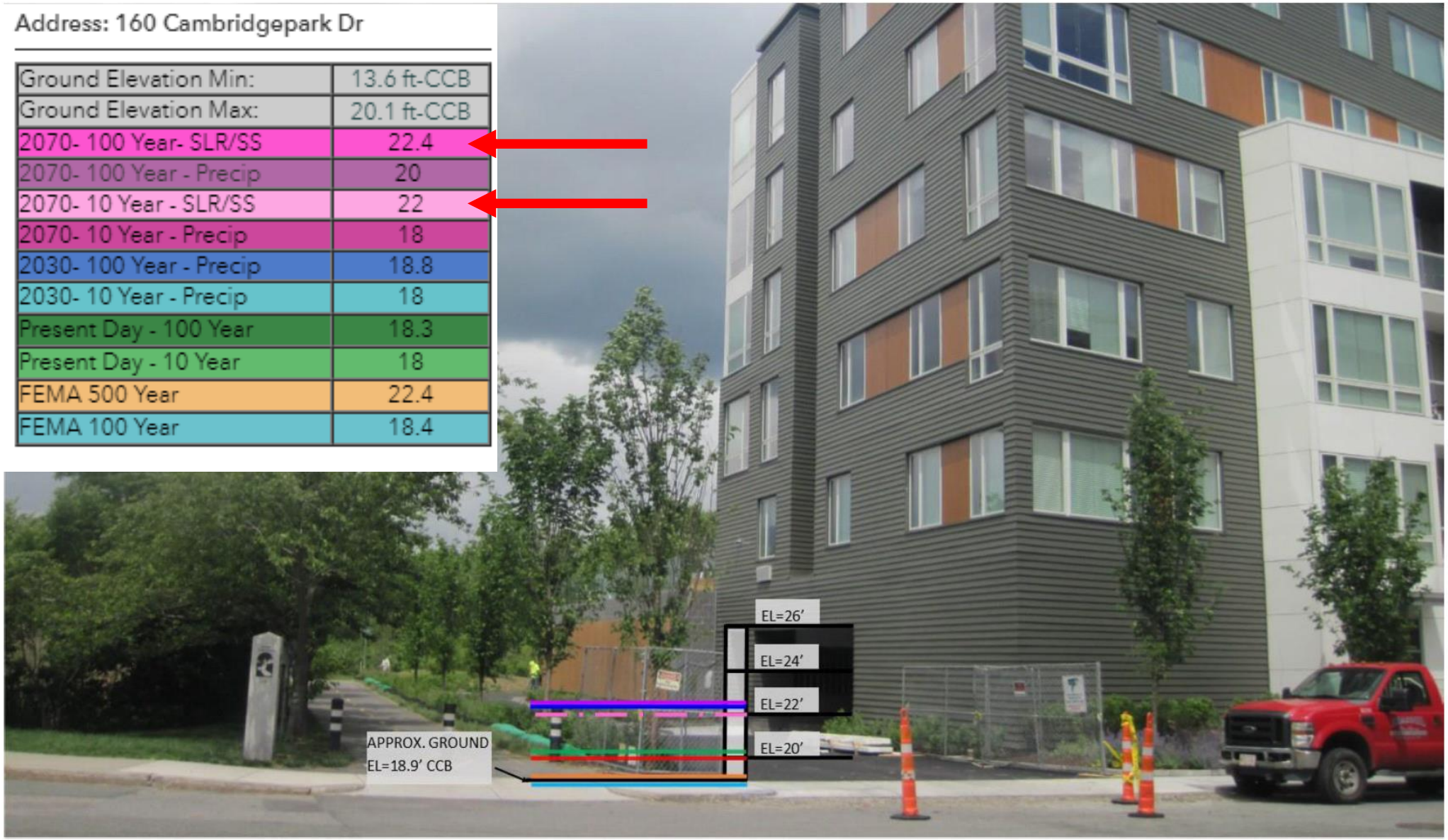
Ground Elevation Min:	11 ft-CCB
Ground Elevation Max:	36.7 ft-CCB
2070- 100 Year- SLR/SS	22.5
2070- 100 Year - Precip	20.1
2070- 10 Year - SLR/SS	22
2070- 10 Year - Precip	19.2
2030- 100 Year - Precip	19.3
2030- 10 Year - Precip	19.2
Present Day - 100 Year	19.3
Present Day - 10 Year	19.2
FEMA 500 Year	22.4
FEMA 100 Year	18.4

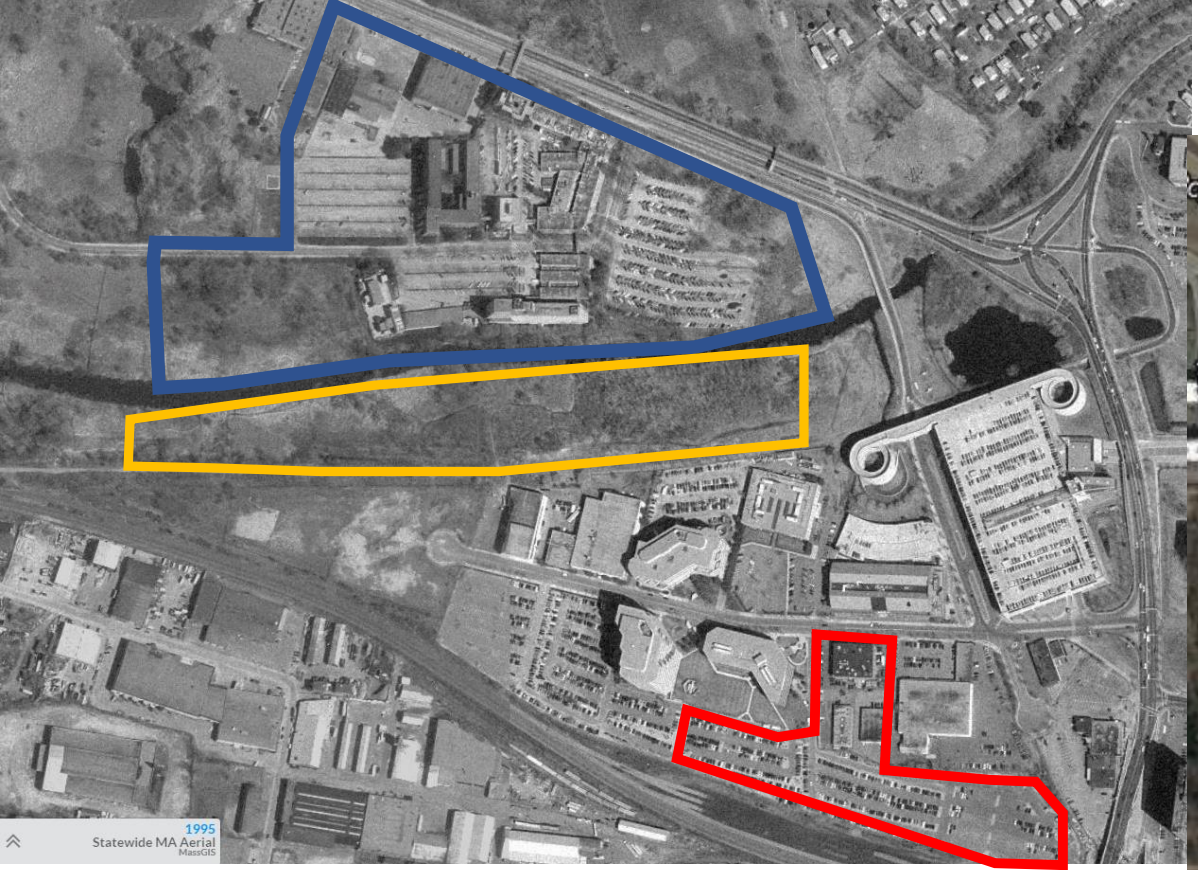


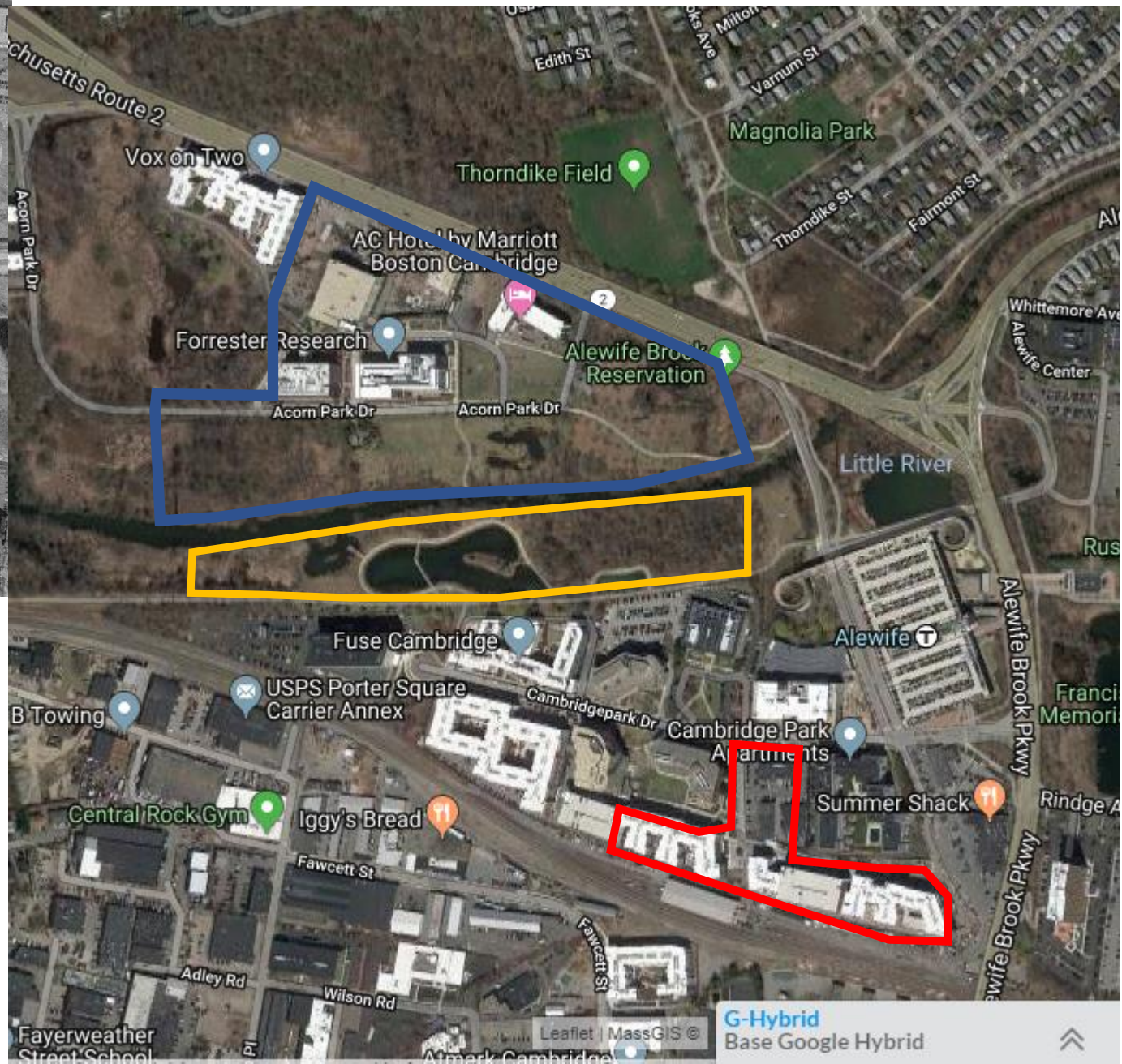
B. CAMBRIDGE PARK DR. WETLAND ENTRANCE

Address: 160 Cambridgepark Dr

Ground Elevation Min:	13.6 ft-CCB
Ground Elevation Max:	20.1 ft-CCB
2070- 100 Year- SLR/SS	22.4
2070- 100 Year - Precip	20
2070- 10 Year - SLR/SS	22
2070- 10 Year - Precip	18
2030- 100 Year - Precip	18.8
2030- 10 Year - Precip	18
Present Day - 100 Year	18.3
Present Day - 10 Year	18
FEMA 500 Year	22.4
FEMA 100 Year	18.4







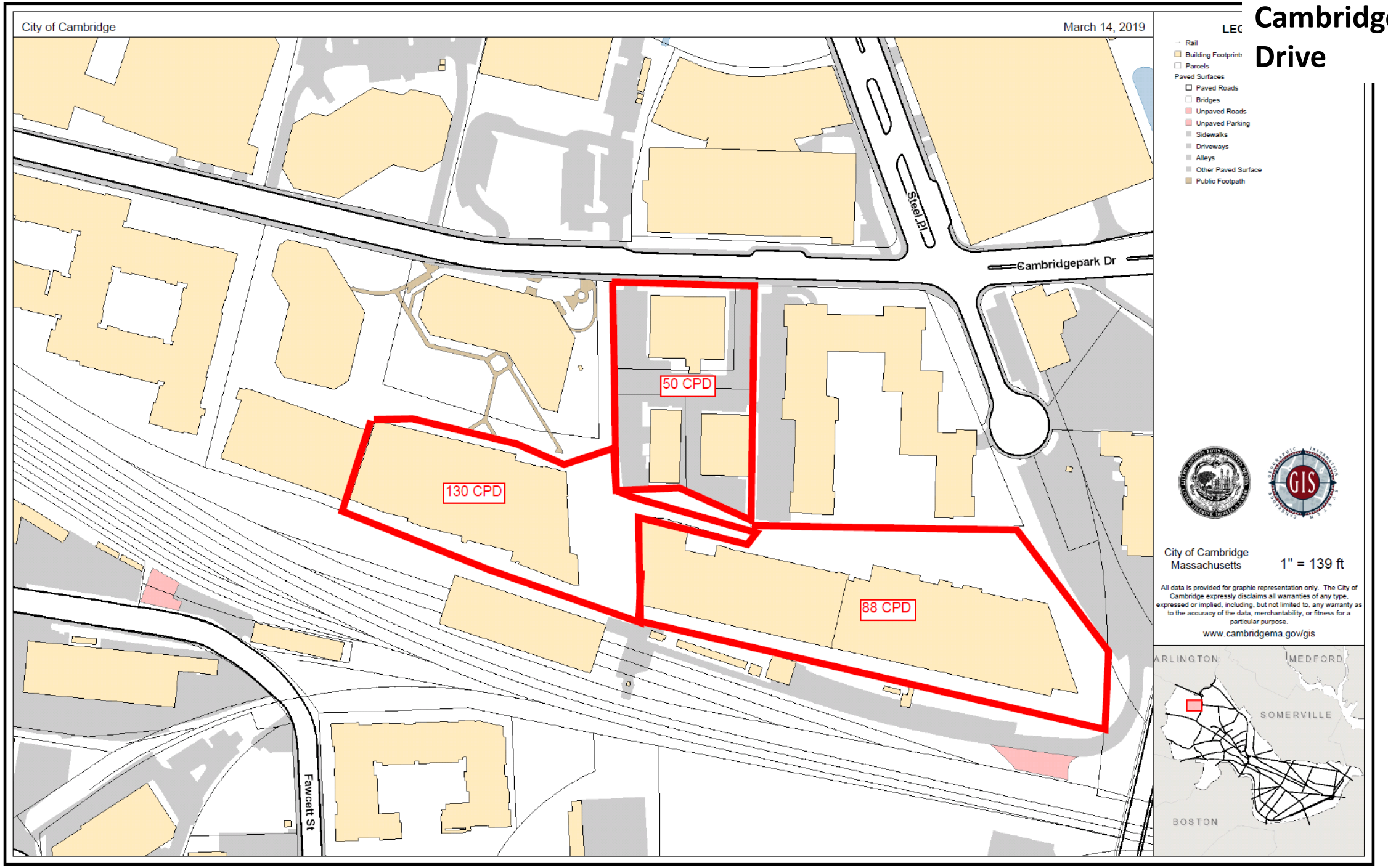
Aerial 1995 vs 2017 +/-

Discovery Park

Alewife Wetland

50, 88 and 130 Cambridgepark Drive

Cambridgepark Drive

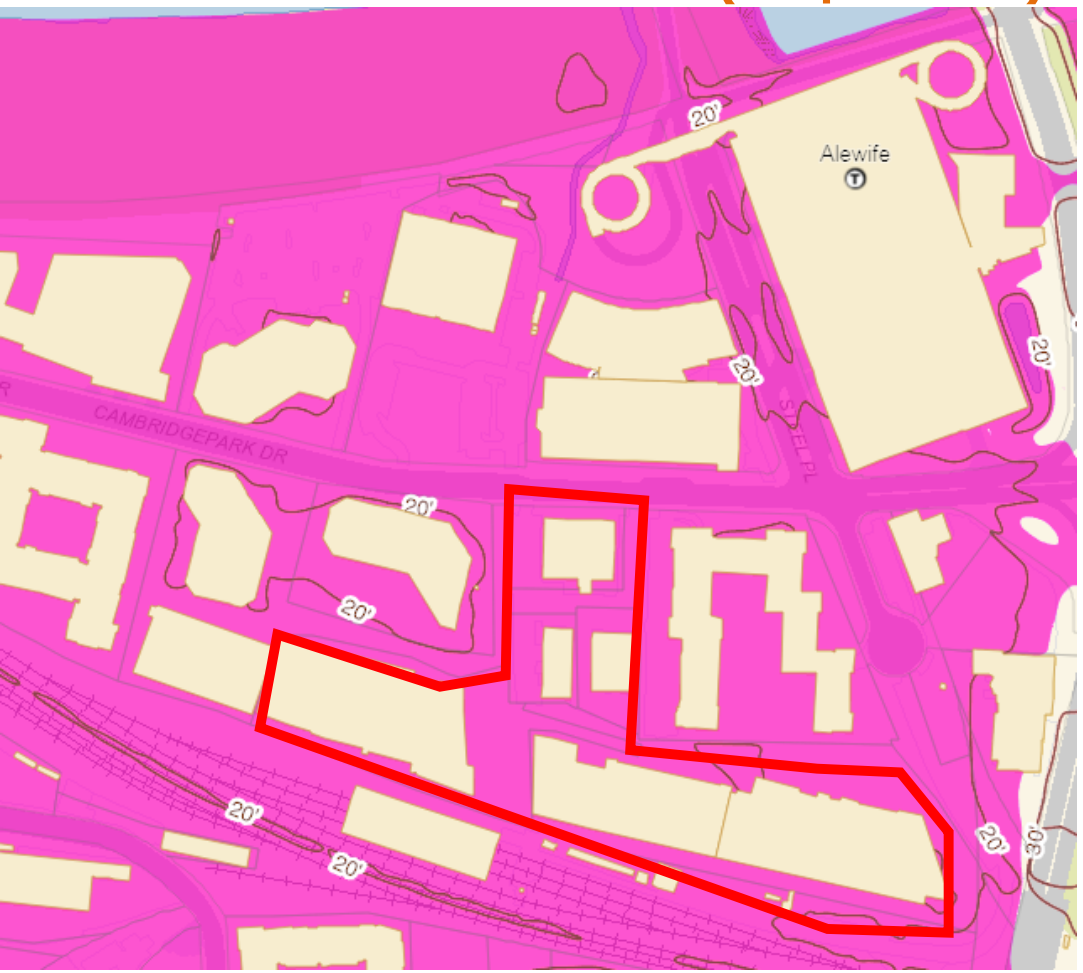


Cambridgepark Drive

Existing Elevation 15.7 to 21.2

2070 10-Year SLR/SS 22.0

2070 100-Year SLR/SS 22.4 (Map Below)



Cambridgepark Drive

Address: 88 Cambridgepark Dr

Ground Elevation Min:	15.7 ft-CCB
Ground Elevation Max:	21.2 ft-CCB
2070- 100 Year- SLR/SS	22.4
2070- 100 Year - Precip	20
2070- 10 Year - SLR/SS	22
2070- 10 Year - Precip	18.7
2030- 100 Year - Precip	19
2030- 10 Year - Precip	18.6
Present Day - 100 Year	18.9
Present Day - 10 Year	18.4
FEMA 500 Year	22.4
FEMA 100 Year	18.4

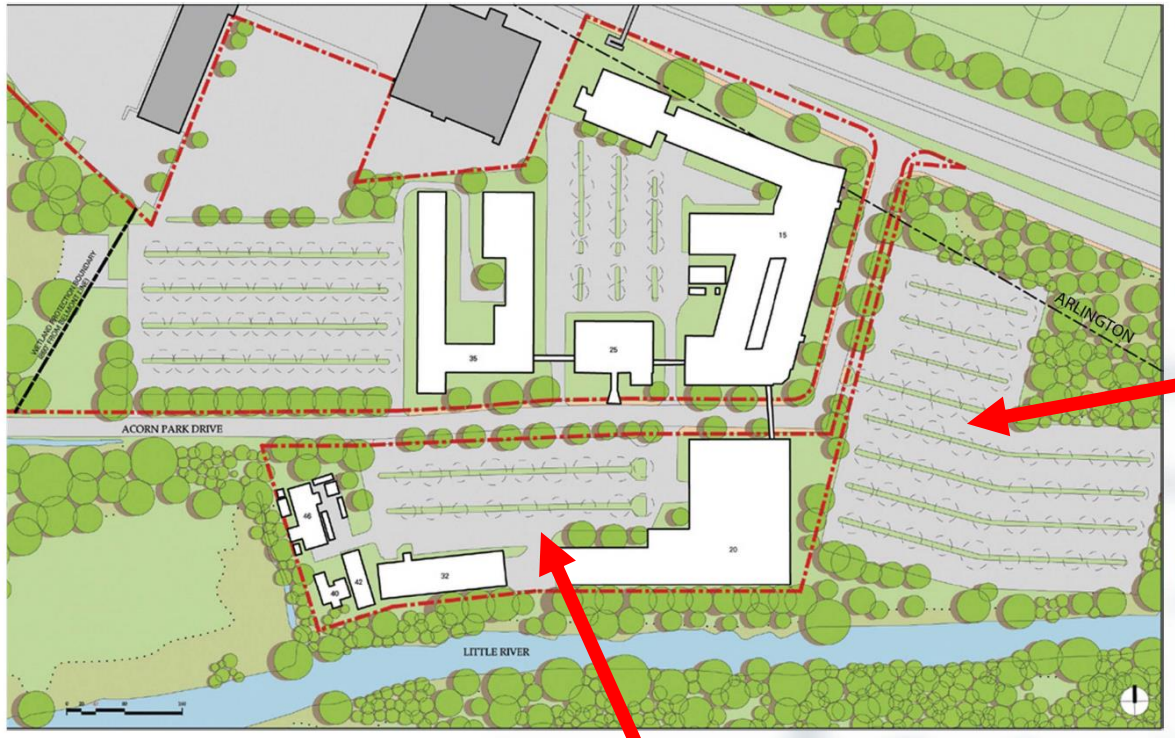
A lot of detail –

Short Version: Projects are improving stormwater conditions & requirements are evolving.

Question: What's Missing? What additional requirements should be included?

130 Cambridge Park Drive	88 Cambridge Park Drive	50 Cambridge Park Drive
6/27/2013	11/20/2014	10/3/2018
215 Units on 2.34 acres	254 units and Parking Garage on 4.52 acres	300 units on 2.32 acres
Existing 87,877 SF Proposed: 82,540 SF Net Decrease of 5,377 SF	Existing: 147,694 SF Proposed: 127,339 SF New Decrease of 20,355 SF	Existing: 94,961 SF Proposed: 87,120 SF Net Decrease of: 7,841 SF
Met DEP and City of Cambridge Regulations for Quantity and Quality Utilized TP-40 Design Storms 5,653 CF of Detention below Slab	Met DEP and City of Cambridge Regulations for Quantity and Quality Utilized TP-40 Storms 9 ,100 CF of detention provided in two tanks and small Infiltration system	Met DEP and City of Cambridge Regulations for Quantity and Quality Utilized NOAA Atlas 14 Rain Events and CCVA projects 2030 events 22,121 CF of Storage/Infiltration
15,000 Gallon Tank	19,000 Gallon Tank	Tank to be designed
Provided 3,161 CY of Storage at surface and below slab 934 CY net increase from pre-redevelopment	Provided 2,919 CY of Storage at surface and below slab 916 CY net increase from pre-redevelopment	Provide 6,494 CY of Storage on surface and below slab 1869 CY net increase from pre-redevelopment
	First Floor is above 100-year flood elevation First Floor is amenity/common space only All residential units are on second story or above; above 100 and 500 year flood elevations Key mechanicals are set above the 100-year flood elevation	Built to 2070-10 year event Recovery plans for 2070-100 year event Site Action plan to be prepared Will establish Triangle Preparedness and Resiliency Initiative to consider regional solutions / plans for preparedness
I/I mitigation requirement of 125,000 gallons Provided Stormwater infiltration on Clay Street	I/I mitigation Requirement of 158,000 Gallons Provided stormwater Infiltration on Clay and Montgomery	I/I Mitigation Requirement of 161,500 gallons

Discovery Park



CAMBRIDGE Discovery Park *Where Companies and Ideas Grow*

Arthur D. Little Campus 2001

CAMBRIDGE Discovery Park *Where Companies and Ideas Grow*

Proposed Master Plan

Discovery Park

CAMBRIDGE Discovery Park *Where Companies and Ideas Grow*

Existing Conditions of Site: 2009 Aerial

CAMBRIDGE Discovery Park *Where Companies and Ideas Grow*

Site Aerial Photo

Discovery Park

Existing Elevation 13.1 to 19.4

2070 10-Year SLR/SS 21.9 (Map Below)

2070 100-Year SLR/SS 22.5

Discovery Park

Address:

Ground Elevation Min:	13.1 ft-CCB
Ground Elevation Max:	19.4 ft-CCB
2070- 100 Year- SLR/SS	22.5
2070- 100 Year - Precip	20.1
2070- 10 Year - SLR/SS	21.9
2070- 10 Year - Precip	16.3
2030- 100 Year - Precip	18.6
2030- 10 Year - Precip	N/A
Present Day - 100 Year	17.5
Present Day - 10 Year	N/A
FEMA 500 Year	22.4
FEMA 100 Year	18.4

Selected Map-Lot: 267.1-232

Selected Address:

Zoom to

Discovery Park:

Discovery Park

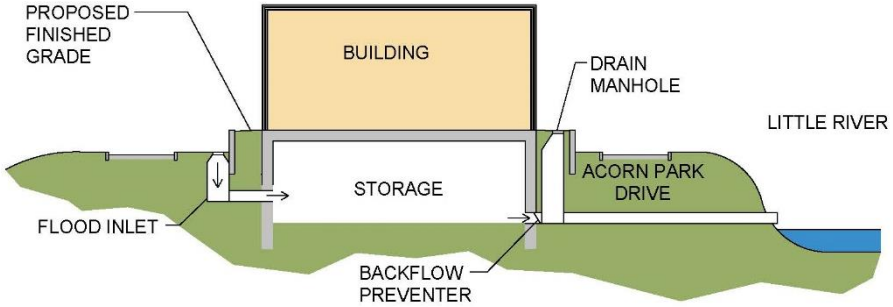
From September 2, 2014 Presentation to Planning Board:

- Full Build-out provides a 2.7 acre reduction in impervious area from the 2004 Existing Conditions, a 26% reduction.
- Full Build-out provides a 11,572 cubic yards of additional flood storage over the 2004 Existing Conditions, a 33% increase.
- See also interesting graphics in presentation about how flood storage below structures functions in river flooding events.

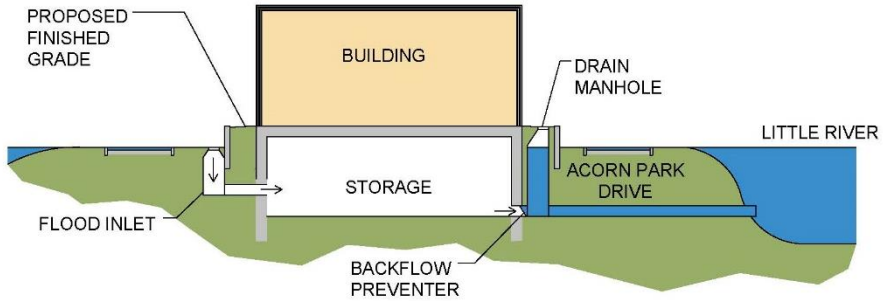
Utilities:

- See utility plan attached.

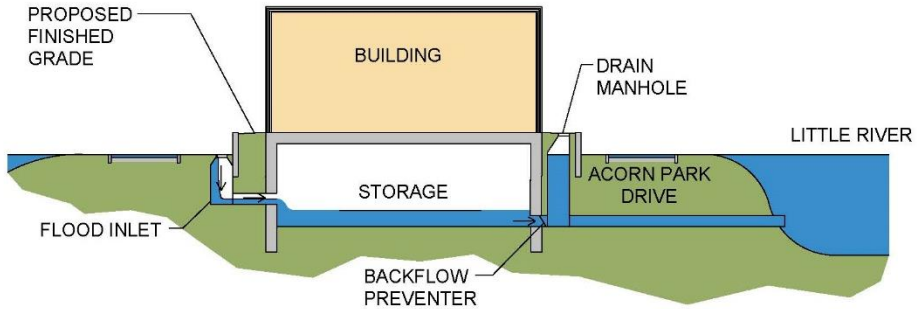
Discovery Park



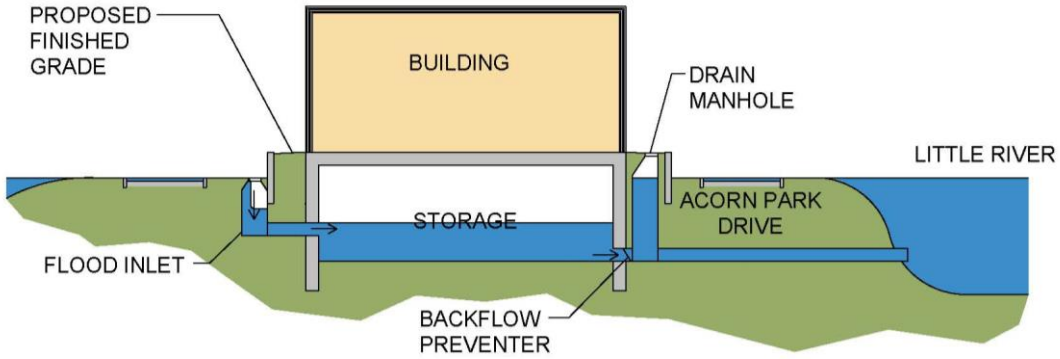
NORMAL RIVER ELEVATION



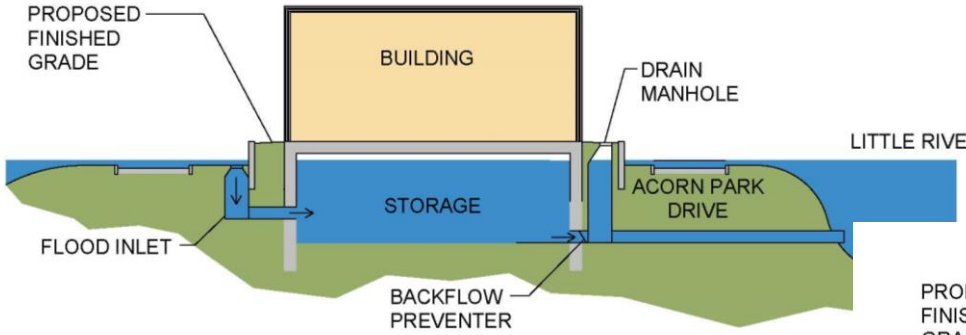
WATER LEVEL AT
FLOOD INLET RIM



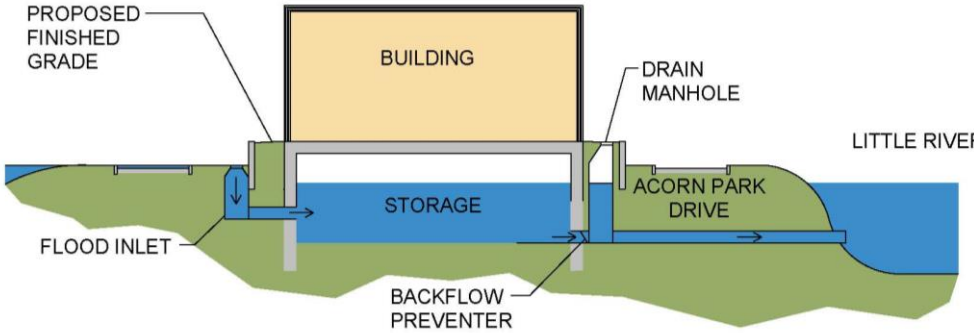
WATER ENTERS FLOOD INLET



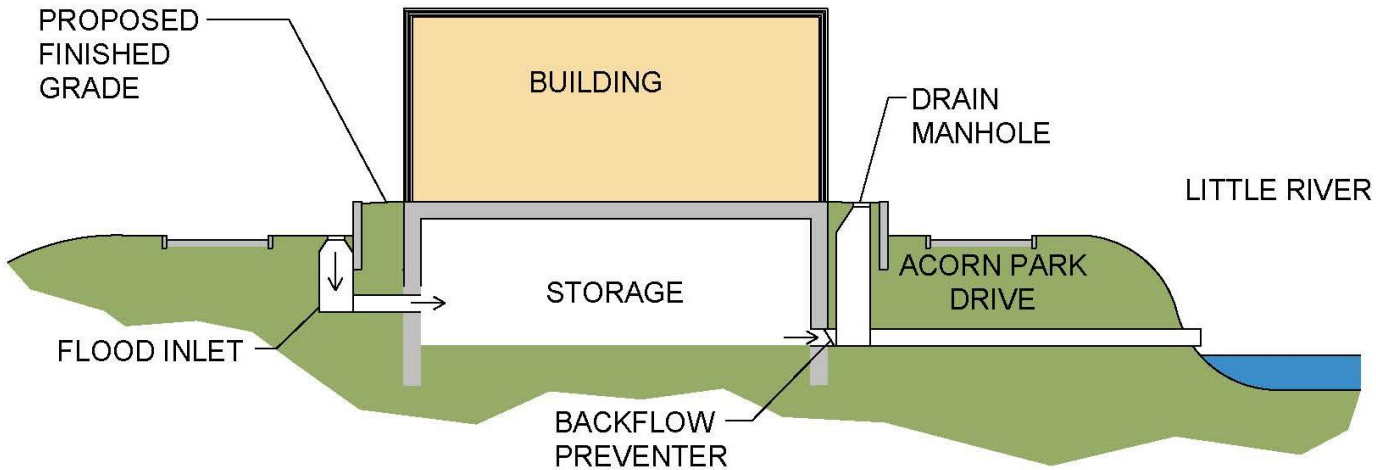
STORAGE IS FILLING UP



WATER IS AT 100 YEAR FLOOD LEVEL,
ELEVATION 7.6



FLOOD WATER BEGINS TO RECEDE



NORMAL RIVER ELEVATION

300 Putnam Avenue

Existing Elevation 19.5 to 20.8

No Flooding in 2070 10-Year Event

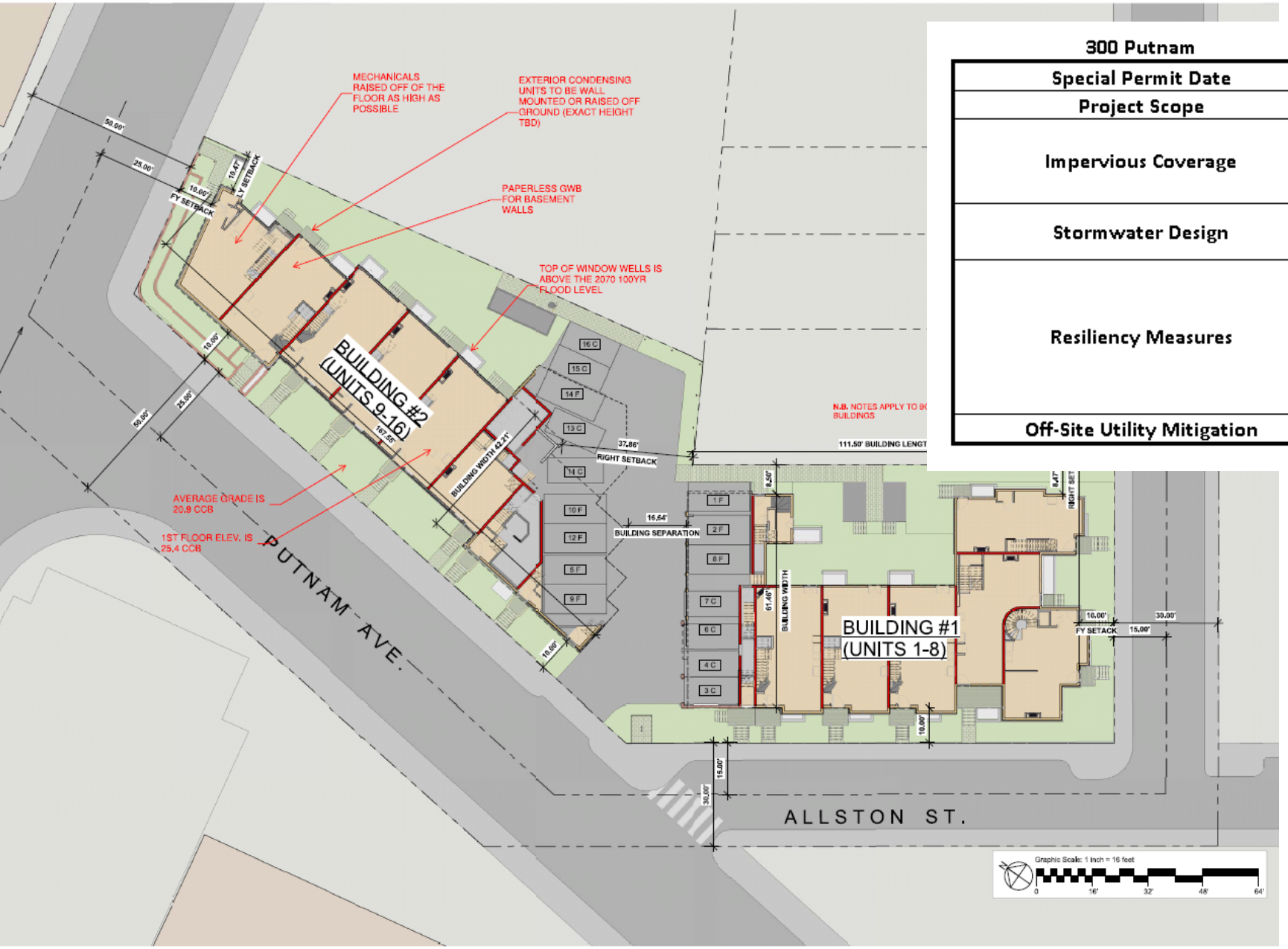
Elev for 2070 100-Year Event 20.3 (Map Below)

300 Putnam Ave

Address: 320 Putnam Ave

Ground Elevation Min:	19.5 ft-CCB
Ground Elevation Max:	22.4 ft-CCB
2070- 100 Year- SLR/SS	19.9
2070- 100 Year - Precip	20.3
2070- 10 Year - SLR/SS	N/A
2070- 10 Year - Precip	N/A
2030- 100 Year - Precip	20.1
2030- 10 Year - Precip	N/A
Present Day - 100 Year	20.1
Present Day - 10 Year	N/A
FEMA 500 Year	N/A
FEMA 100 Year	N/A

300 Putnam Ave



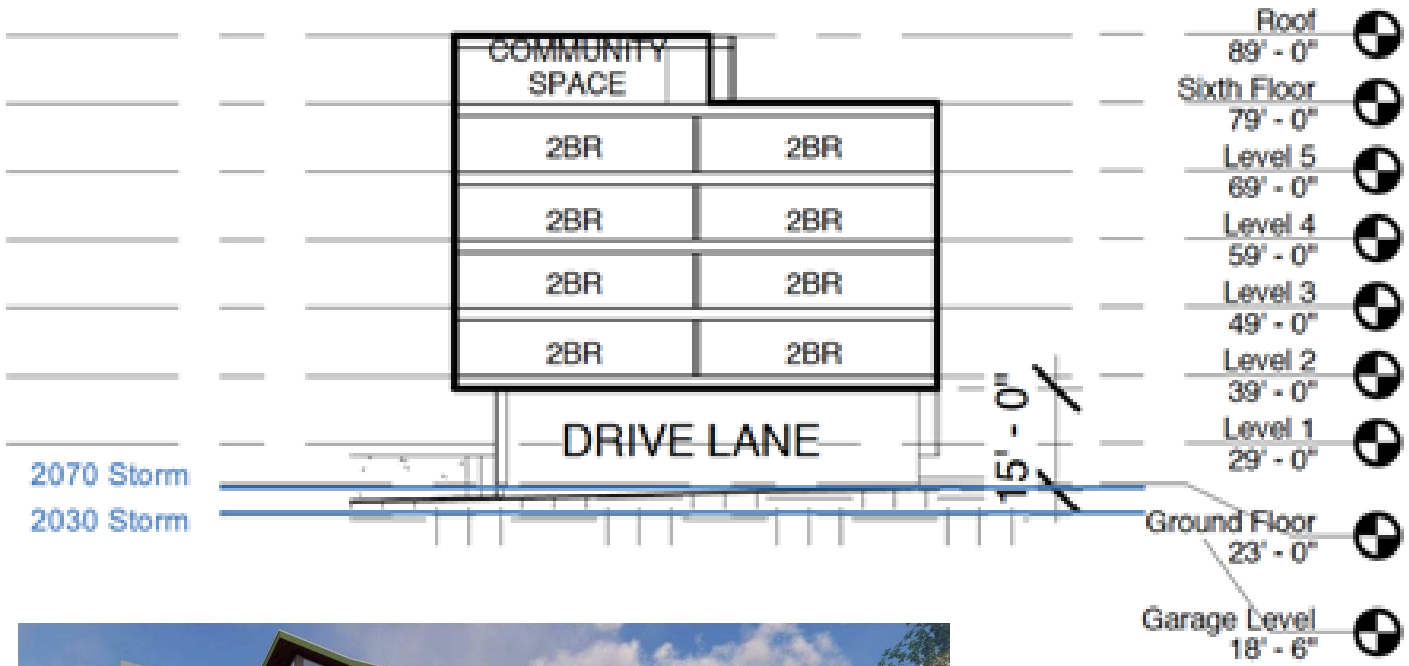
① PROPOSED SITE - ZONING
1/16" = 1'-0"

300 Putnam

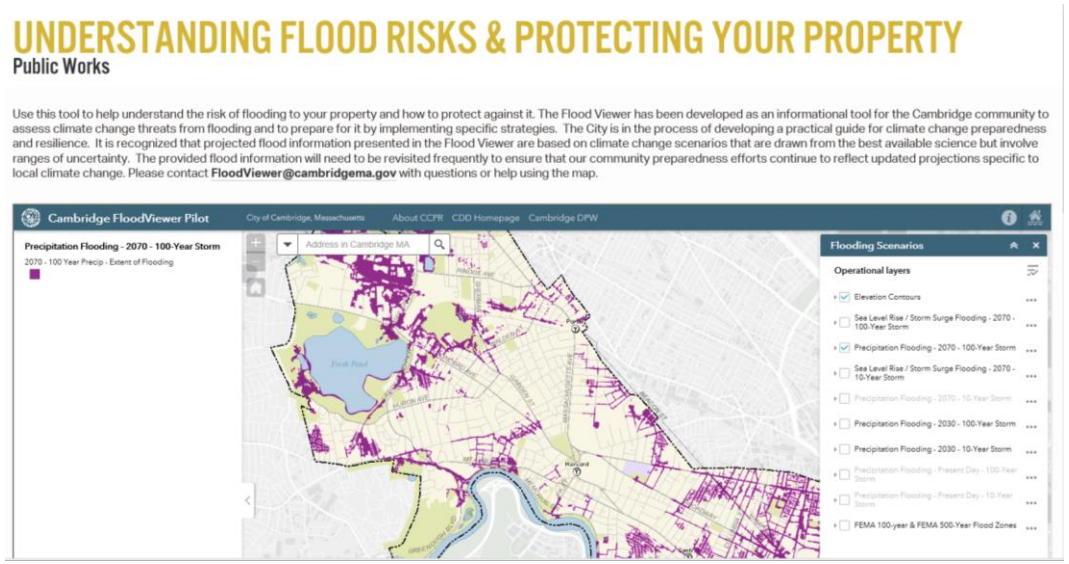
Special Permit Date	11/30/2016
Project Scope	16 units in two structures on 0.54 acres
Impervious Coverage	Existing: 22,392 SF Proposed: 19,356 SF Net Decrease of 2,733 SF
Stormwater Design	Met City of Cambridge Regulations for Quantity and Quality 600 CF of Detention on-site
Resiliency Measures	Vulnerable entrances (Window Wells and doors) elevated above 2070-100 year elevation Basement construction maerials chosen to improve recovery conditions Mechaincal elevated for flood protection
Off-Site Utility Mitigation	None required

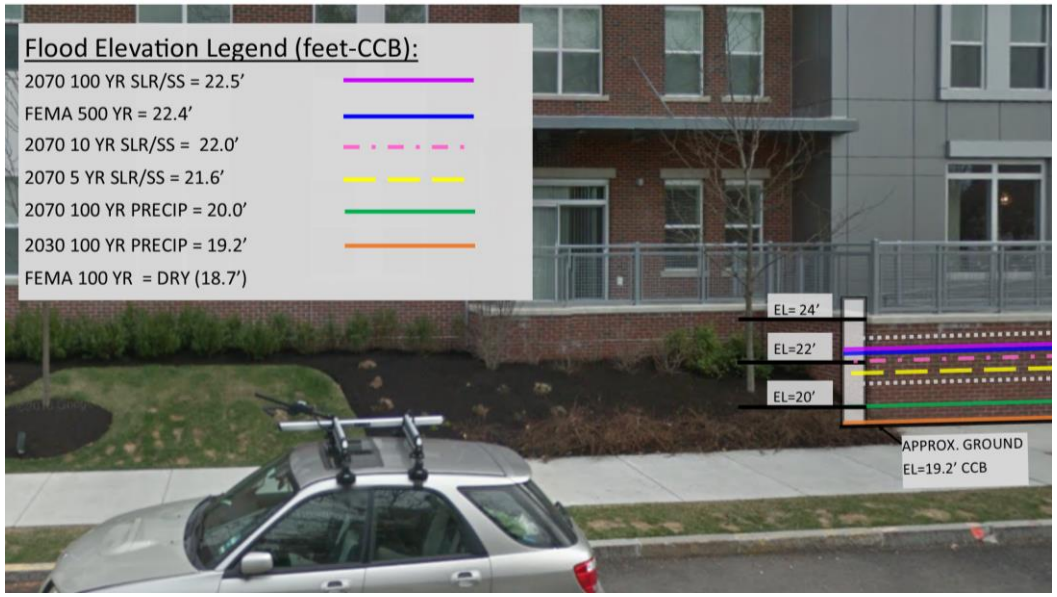
Adapted Buildings: HRI Cambridge Highlands Affordable Housing

1. High performance building envelope and cool roof (**project will be Passive House certified** under the PHIUS+ 2015 system); **can stay in 55-85˚ F range for 4 days passively**.
2. Heat recovery ventilation system
3. VRF heat pump and efficient central hot water system
4. **83 kW Solar PV on roof Sub-metered utilities and separate sub-panel for life safety loads** (above flood elevation)
5. Sub-metered utilities and **separate sub-panel for life safety loads (above flood elevation)**
6. Building energy management
7. **Top floor community room and residential units elevated above flood elevation**



Flood Viewer Tool





Address: 197 Vassal Ln
Map-Lot: 260-80

FloodViewer
City of Cambridge, MA

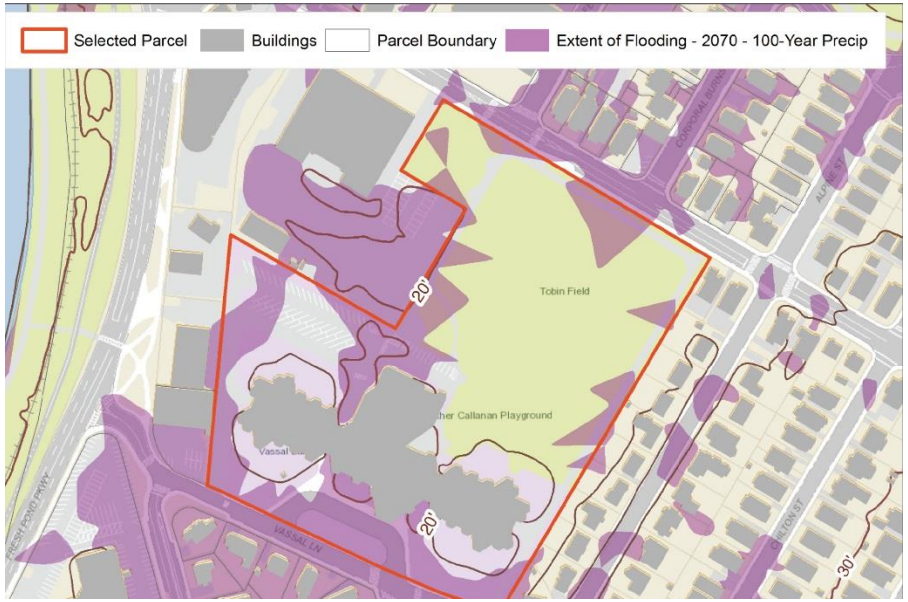
(Elevations in ft-CCB[1]) **Flood Elevation Data**

Minimum Ground Elevation:	16.9
Maximum Ground Elevation:	28.6
2070 100-Year SLR/SS Flooding:	22.5
2070 100-Year Precipitation Flooding:	24.1
2070 10-Year SLR/SS Flooding:	22.1
2070 10-Year Precipitation Flooding:	22.6
2030 100-Year Precipitation Flooding:	23.9
2030 10-Year Precipitation Flooding:	22.2
Present Day 100-Year Precipitation Flooding:	23.5
Present Day 10-Year Precipitation Flooding:	21.9
FEMA 100-year Flood Elevation:	N/A
FEMA 500-year Flood Elevation:	22.4

The Flood Viewer has been developed as an informational tool for the Cambridge community to assess climate change threats from flooding and to prepare for it by implementing specific strategies.

Use this tool to help understand the risk of flooding to your property and how to protect against it.

Learn more at:
CambridgeMA.gov/FloodViewer



IMPERVIOUS AREA SUMMARY

Building 600

	Impervious			Pervious	Total Area
	Buildings	Pavements	TOTAL	TOTAL	
Original Condition[1]	152,979 sf	293,404 sf	446,383 sf	708,037 sf	1,154,420 sf
(09-13-04)	3.51 Ac	6.74 Ac	10.25 Ac	16.25 Ac	26.50 Ac
	13.3 %	25.4 %	38.7 %	61.3 %	100.0 %
Proposed Conditions	133,178 sf	127,193 sf	260,371 sf	894,049 sf	1,154,420 sf
	3.06 Ac	2.92 Ac	5.98 Ac	20.52 Ac	26.50 Ac
	11.5 %	11.0 %	22.6 %	77.4 %	100.0 %

1. Original Condition as September 13, 2004 prior to any CDP development.

- Building 600 provides a 4.2 acre reduction in impervious area from the 2004 Existing Conditions, a 41% reduction.

IMPERVIOUS AREA SUMMARY

Full Build-out

	Impervious			Pervious	Total Area
	Buildings	Pavements	TOTAL	TOTAL	
Original Condition[1]	152,979 sf	293,404 sf	446,383 sf	708,037 sf	1,154,420 sf
(09-13-04)	3.51 Ac	6.74 Ac	10.25 Ac	16.25 Ac	26.50 Ac
	13.3 %	25.4 %	38.7 %	61.3 %	100.0 %
Proposed Conditions	195,363 sf	133,033 sf	328,396 sf	826,024 sf	1,154,420 sf
	4.48 Ac	3.05 Ac	7.54 Ac	18.96 Ac	26.50 Ac
	16.9 %	11.5 %	28.4 %	71.6 %	100.0 %

1. Original Condition as September 13, 2004 prior to any CDP development.

- Full Build-out provides a 2.7 acre reduction in impervious area from the 2004 Existing Conditions, a 26% reduction.

SUMMARY OF NET AVAILABLE FLOOD STORAGE VOLUMES
VOLUME CALCULATIONS - PROPOSED BUILDING 600
COMPARED WITH EXISTING 2004 STORAGE VOLUMES

Elevation	Existing (2004) Incremental Available Flood Storage (CY)	PROPOSED BUILDING 600 Incremental Available Flood Storage (CY)	PROPOSED BUILDING 600 Net Change from 2004 (CY)
up to 4	25	4,632	**4,607**
4 to 5	1,817	3,389	**1,572**
5 to 6	7,235	11,505	**4,270**
6 to 7	14,718	16,562	**1,844**
7 to 7.6	10,573	11,801	**1,228**
Total Storage	**34,368**	**47,889**	**13,521**

Note: Flood storage table reflects the current FEMA 100 flood elevation of 7.6' NGVD 29. All calculations have been based on this current best available data.

- Building 600 provides a 13,521 cubic yards of additional flood storage over the 2004 Existing Conditions, a 39% increase.

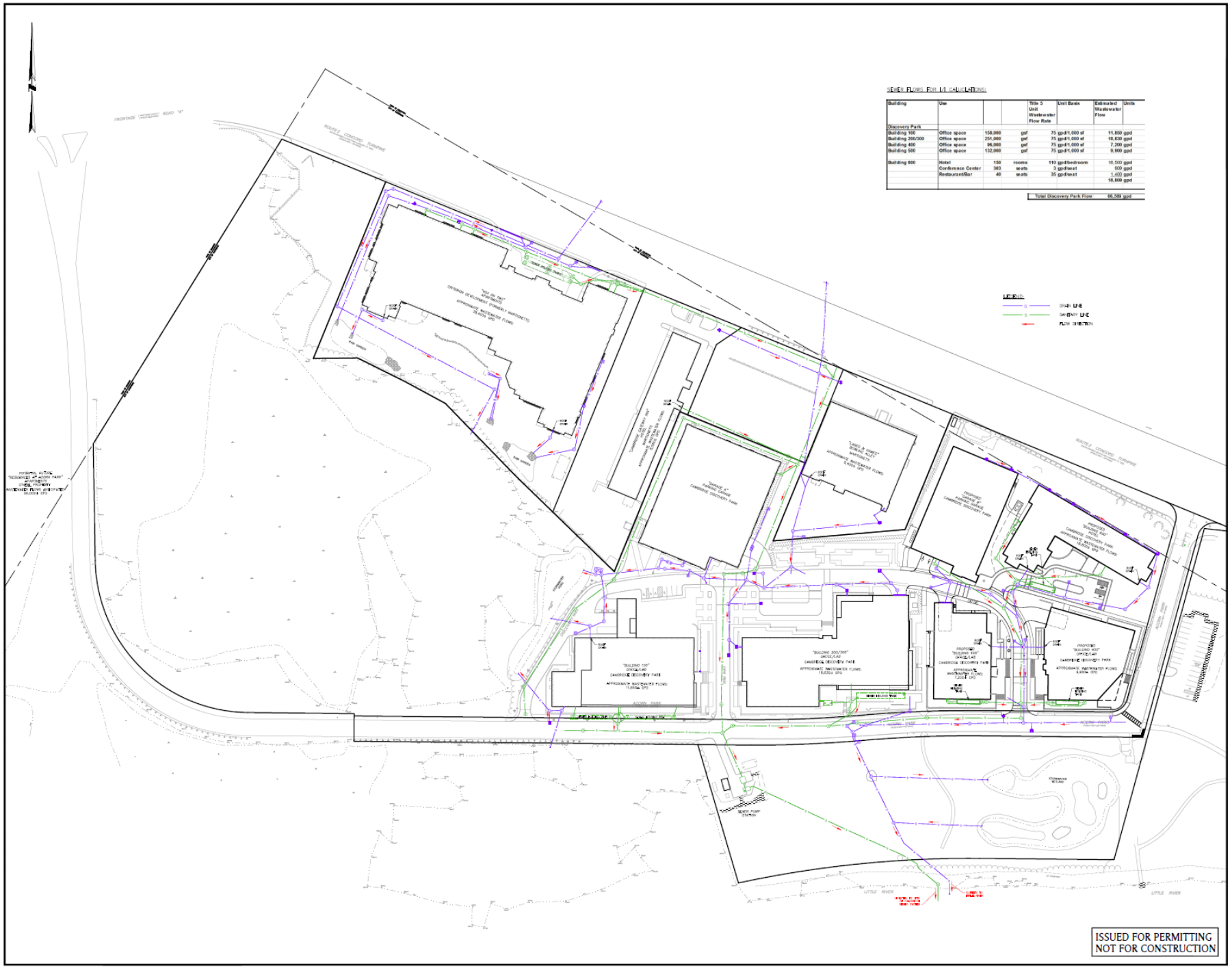
SUMMARY OF NET AVAILABLE FLOOD STORAGE VOLUMES PROPOSED BUILDING 400 & 500, AND GARAGE B COMPARED WITH EXISTING 2004 STORAGE VOLUMES

Elevation	Existing (2004) Incremental Flood Storage Available (CY)	Proposed Building 400 & 600 and Garage B Incremental Flood Storage Available (CY)	Incremental Flood Storage Available (CY)
up to 4	25	4,736	4,711
4 to 5	1,817	3,269	1,452
5 to 6	7,235	10,854	3,619
6 to 7	14,718	15,698	980
7 to 7.6	10,573	11,383	810
Total Storage	**34,368**	**45,940**	**11,572**

Note:
1.) Flood storage table reflects the current FEMA 100 flood elevation of 7.6' NGVD 29.
2.) All calculations have been based on this current best available data.

- Full Build-out provides a 11,572 cubic yards of additional flood storage over the 2004 Existing Conditions, a 33% increase.

Discovery Park



THE BULFINCH COMPANIES, INC. – SINCE 1936

CAMBRIDGE DISCOVERY PARK

ACORN PARK DRIVE
IN
CAMRBIDGE
MASSACHUSETTS
(MIDDLESEX COUNTY)

INFLOW/INFILTRATION GRAPHIC

FEBRUARY 6, 2015

REVISIONS:
NO. | DATE | DESC.

PREPARED FOR:
BHK, LLC, Trustee of Acorn Park Holdings Realty Trust
c/o Bulfinch Companies
250 First Street
Needham, Ma. 02494-2805

BSC GROUP
15 Elkins Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 60'

FILE: 112787\Civil\Drawings\Calculations
DWG. NO:
JOB. NO: 11278.73
SHEET 1 OF 1

Discovery Park