

# Flood Mitigation Study

Bowman Avenue Dam Site

City of Rye and the Village of Rye Brook

Westchester County

Presentation

October 30 , 2007



**CHAS. H. SELLS, INC.**

Consulting Engineers, Surveyors & Photogrammetrists

# Presentation Outline

- Project Overview
- Existing Conditions
- Alternatives Analysis
- Preferred Alternatives
- Conclusions and Recommendations
- Next Steps
- Questions and Answers

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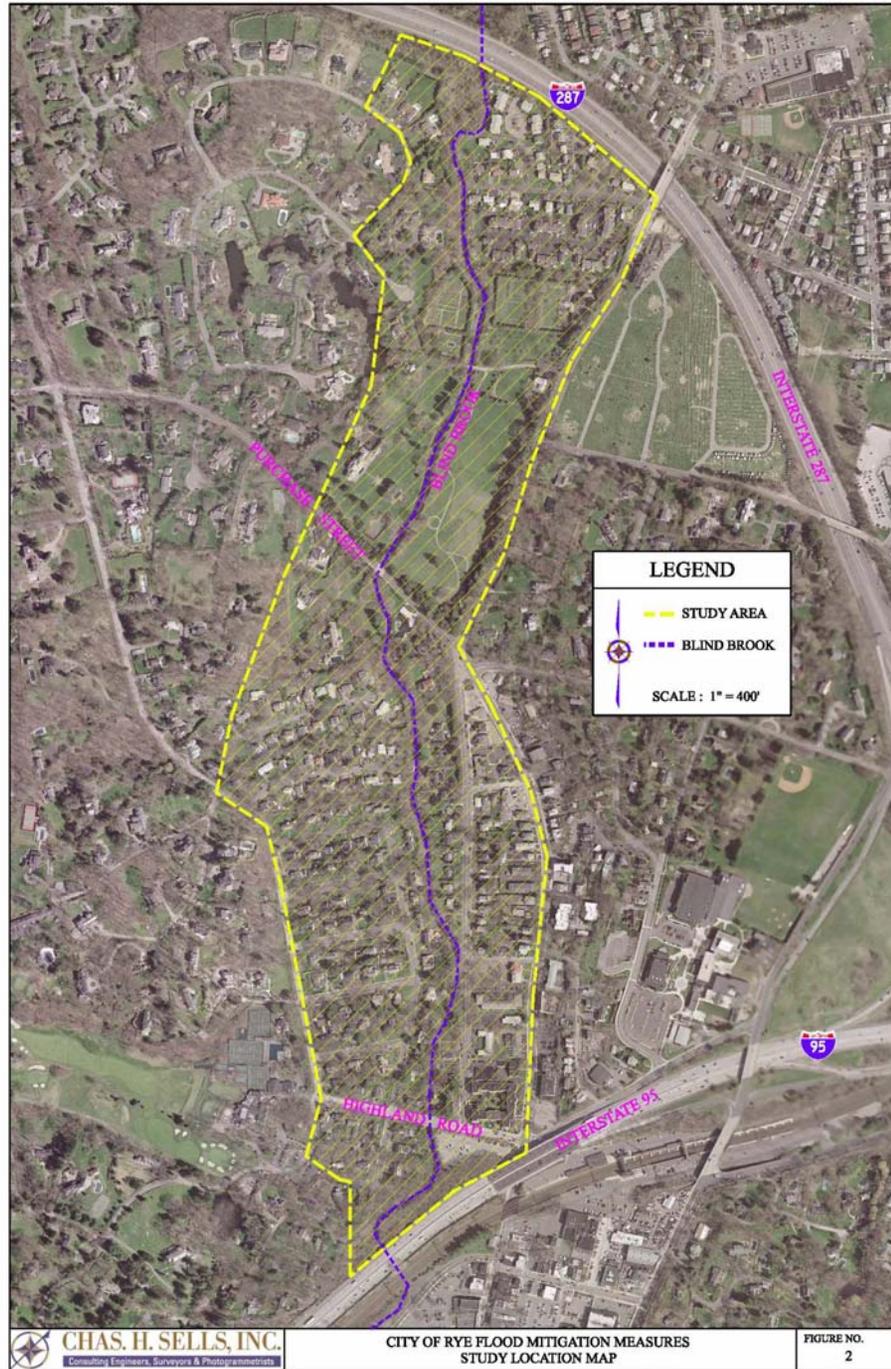
# PROJECT OVERVIEW



# Project Overview

## Project Objective:

1. To compare existing water surface elevations with proposed water surface elevations resulting from flood reduction measures at the Bowman Avenue Dam Site
2. Determine impact/benefit on reach between I-287 and I-95.



# Project Overview (cont'd)

## Our Scope: 2-phases

- Phase 1: Preliminary Investigation and Analysis
- Phase 2: Alternatives Analysis and Recommendations

# Project Overview (cont'd)

## Phase 1:

- Data Collection
- Field Survey and Mapping
- Determine Existing Conditions
- Hydrologic and Hydraulic Analysis

# Project Overview (cont'd)

## Phase 2:

- Mitigation Alternatives Analysis
- Report and Recommendations

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# EXISTING CONDITIONS



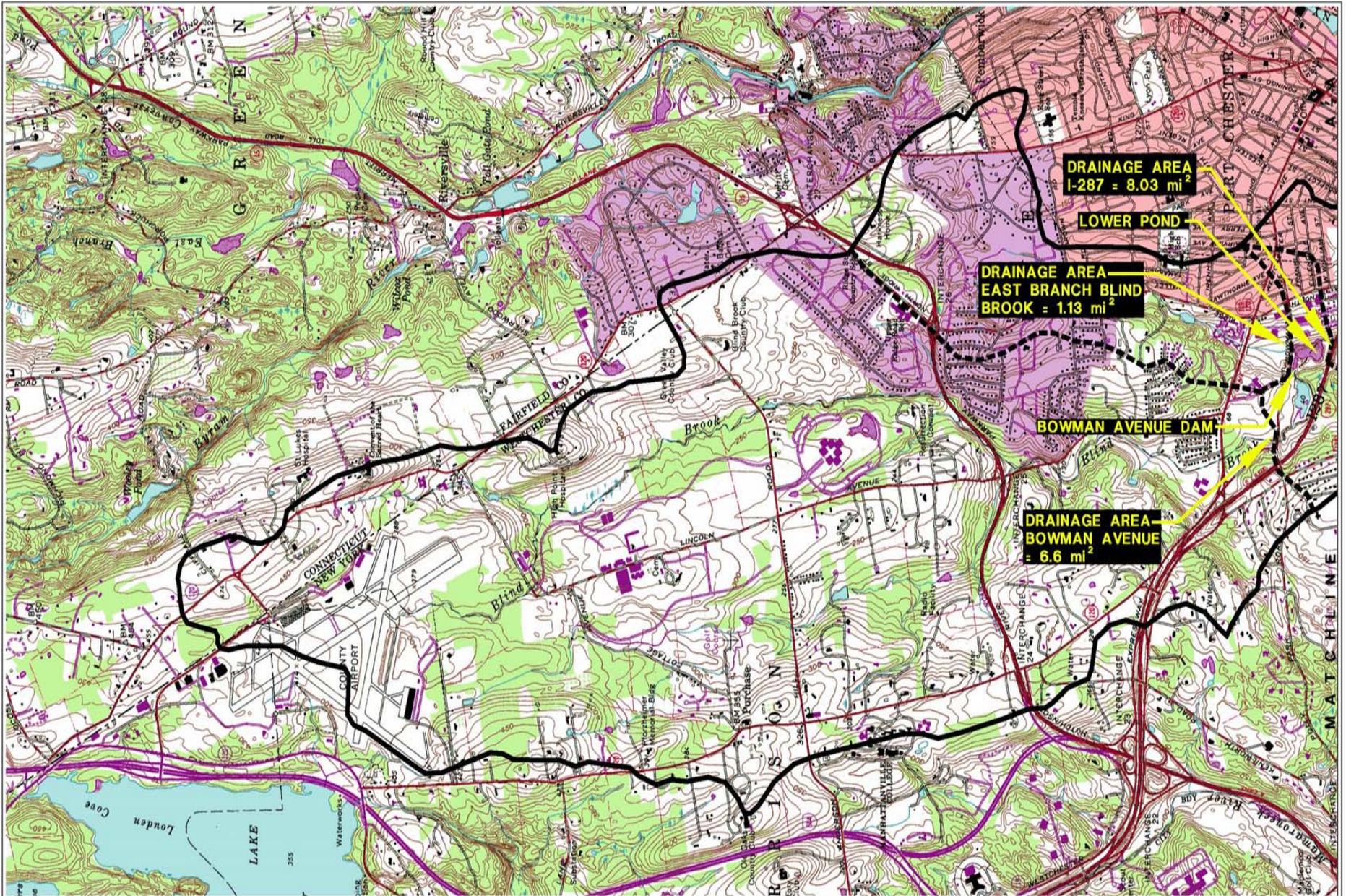
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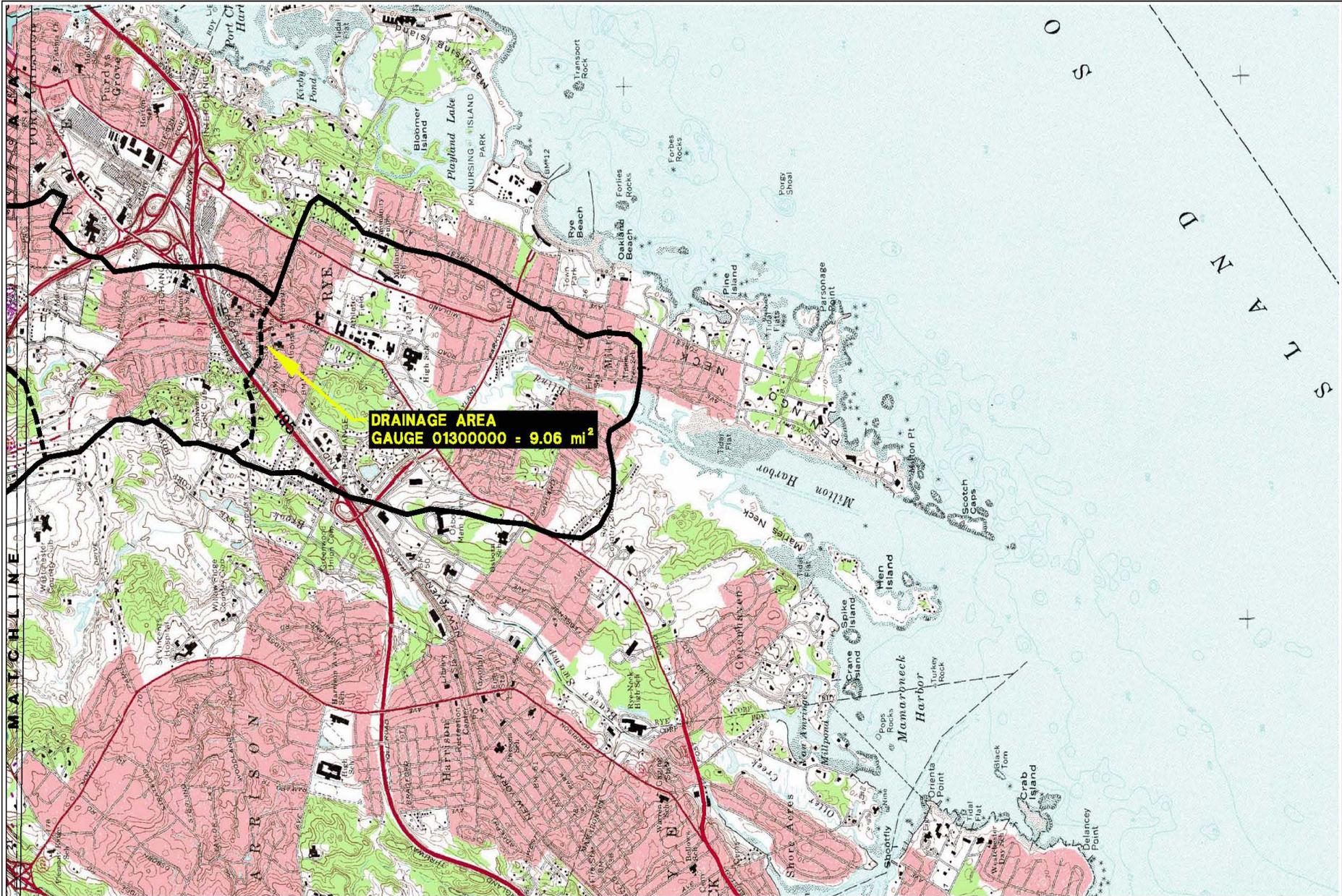


# Existing Conditions

## Blind Brook Watershed

- City of Rye, Villages of Harrison, Rye Brook and Port Chester, Town of Greenwich
- Suburban in upper and middle third, urbanized in lower third
- Low-medium density residential/commercial
- Watershed area is 9.6 sq.m. delineated at I-95
- Floodplain is wide compared to the channel





**DRAINAGE AREA  
GAUGE 01300000 = 9.06 mi<sup>2</sup>**



# Existing Conditions (cont'd)

- Based on ACOE, 20% of Rye properties located within FEMA flood zone
- Based on ACOE, 1,500 structures located within Blind Brook watershed
- 140 structures in 100-year floodplain between I-287 and I-95

# Existing Conditions (cont'd)

## Explanation Flood Frequency

- 100-year event (lower frequency storm) = 1% chance in any given year
- 10-year event (higher frequency storm) = 10% chance in any given year

# Existing Conditions (cont'd)

## Historical Storm Events

- Hurricane Agnes – June 1972 - 2,320 cfs (20-year)
- Hurricane Eloise – Sept. 1975 -2,280 cfs (20-year)

## Other notable events:

- November 1978 - 1,440 cfs (5-year)
- January 1979 - 2,120 cfs (15-year)
- April 1984 - 1,380 cfs (7-year)
- December 1992
- April 2007 Nor'easter (approx. 100-year storm)

# Existing Conditions (cont'd)

April 17, 2007 Nor'easter:

TABLE 1 April 15, 2007 Nor'easter City of Rye Summary of Damages	
Damage Description	Total Cost
<b>Private Property<sup>1</sup></b>	
Minor Damage	\$4,691,670
Moderate Damage	\$20,863,350
Major Damage	\$57,675,620
<b>Total Private Property Damage</b>	<b>\$83,230,640</b>
<b>Public Property<sup>2</sup></b>	
Debris Removal	\$24,560
Elm Place Retaining Wall	\$1,032,000
Emergency Services	\$128,160
Theodore Fremd Retaining Wall	\$880,000
Locust Avenue Firehouse	\$153,840
Parking Paystation	\$12,490
<b>Total Public Property Damages</b>	<b>\$2,231,050</b>
<b>Grand Total</b>	<b>\$85,461,690</b>

<sup>1</sup> Damage report for Westchester County. Damage amounts are based on building assessed values (minor-15%, moderate-40%, major – 63%)

<sup>2</sup> According to FEMA PA FA forms prepared by the City of Rye

# Existing Conditions (cont'd)

Based on 2007 ACOE report, flooding problems due to:

- Narrow channel
- Obstructed flows
- Overgrowth within stream banks
- Constricted bridge openings
- Low banks
- Sedimentation in tidal reaches
- Wetland filling
- Floodplain encroachment

# Existing Conditions (cont'd)

## Bowman Avenue Dam Upstream Face



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# Existing Conditions (cont'd)

## Bowman Avenue Dam Downstream Face



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# Existing Conditions (cont'd)

## Lower Pond

- Confluence of Blind Brook and East Branch Blind Brook
- Abandoned quarry operation, flooded in 1976
- Pond approximately 30-feet deep
- Filling on north side formed 1-acre peninsula
- Lower Pond was not originally designed for flood control purposes

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# ALTERNATIVES ANALYSIS



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# Alternatives Analysis

## Use of FEMA Data

- Use of baseline data
- Sells performed more detailed routing analysis at flood control structures to better account for storage capacity
- Flood routing through structures is time-dependent

# Alternatives Analysis (cont'd)

Comparison Between the FIS and Sells Analysis						
	Existing Conditions					
	FIS		Sells			
	Discharge (cfs)	WS Elev. (ft.)	Discharge (cfs)	difference (%)	WS Elev. (ft.)	difference (inches)
<b>10-Year Storm</b>						
I-95 (U/S)	1,521	22.93	1,982	30%	24.59	19.92
Highland Rd. (U/S)	1,521	24.15	1,982	30%	25.88	20.76
Purchase St. (U/S)	1,434	27.35	1,663	16%	28.33	11.76
<b>Wyman Street</b>	<b>1,374</b>	<b>32.32</b>	<b>1,663</b>	<b>21%</b>	<b>32.73</b>	<b>4.92</b>
<b>50-Year Storm</b>						
I-95 (U/S)	2,497	26.55	3,078	23%	30.56	48.12
Highland Rd. (U/S)	2,497	27.49	3,078	23%	31.01	42.24
Purchase St. (U/S)	2,353	30.12	2,767	18%	31.91	21.48
<b>Wyman Street</b>	<b>2,255</b>	<b>33.45</b>	<b>2,767</b>	<b>23%</b>	<b>34.11</b>	<b>7.92</b>
<b>100-Year Storm</b>						
I-95 (U/S)	2,984	30.33	3,583	20%	32.17	22.08
Highland Rd. (U/S)	2,984	30.78	3,583	20%	32.60	21.84
Purchase St. (U/S)	2,812	31.71	3,346	19%	33.44	20.76
<b>Wyman Street</b>	<b>2,694</b>	<b>34.01</b>	<b>3,346</b>	<b>24%</b>	<b>34.97</b>	<b>11.52</b>

# Alternatives Analysis

Initial Alternatives – 5 categories

1. No-build
2. Resizing the Upper Pond
3. Optimizing the outlet of the dam
4. Raising the crest of the dam
5. Resizing the Upper Pond and optimizing the outlet of the dam

# Alternatives Analysis (cont'd)

## Initial Alternatives – 5 categories

1. No-build
  - a. Description of existing condition
  - b. Used as basis of comparison for alternatives

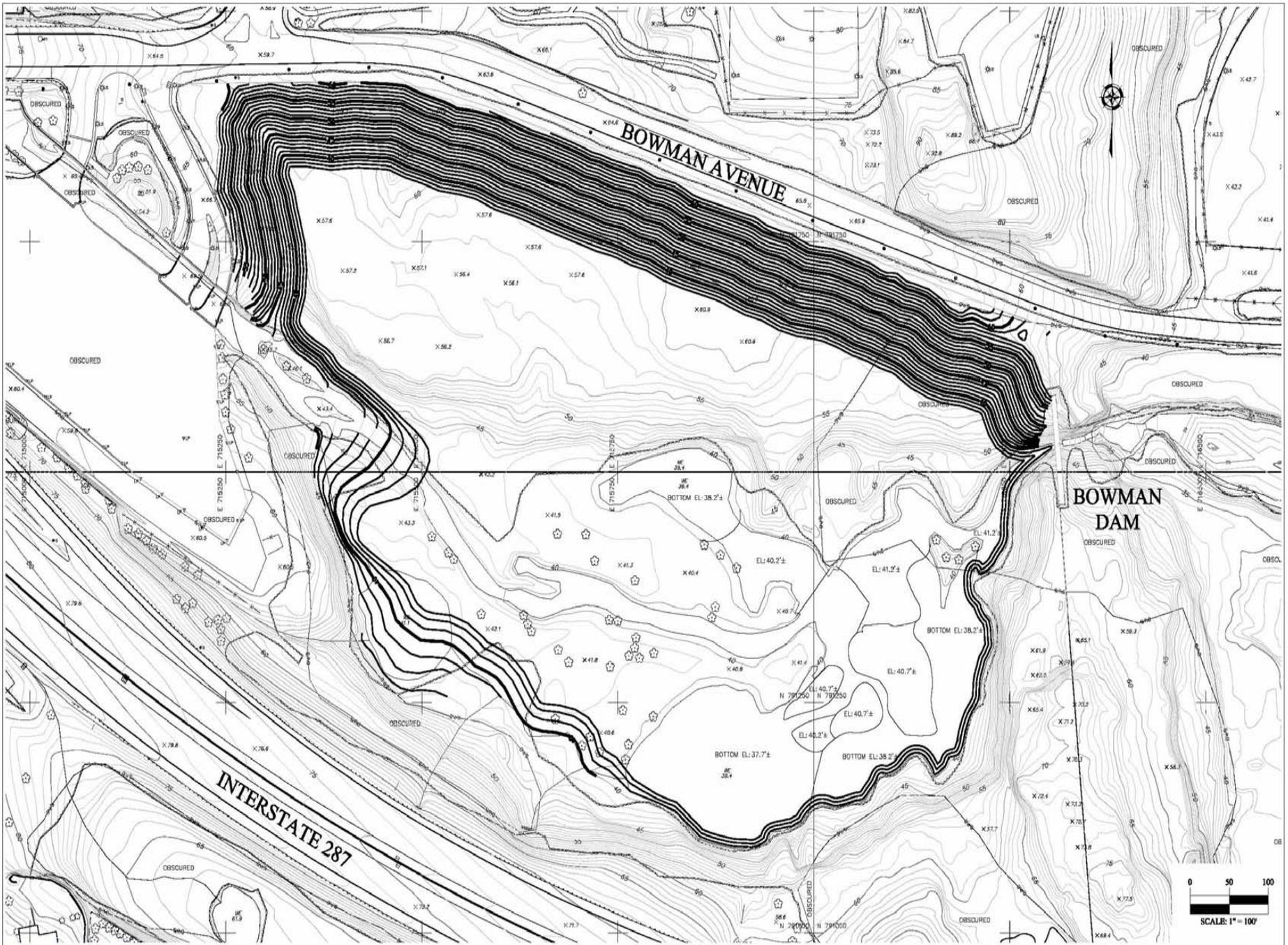
# Alternatives Analysis (cont'd)

## 2. Resizing the Upper Pond

- a. Provide increased storage capacity
  - Enlargement through excavation
  - Silt removal through dredging
- b. Analyzed various limits of excavation with and without dredging
  - Alt. 1: Excavate pond to 1925 size w/o dredging (36,000 c.y.)
  - Alt. 2: Excavate pond to 1925 size with 2 feet of dredging (53,000 c.y.)
  - Alt. 3: Maximize size of pond w/o dredging (160,000 c.y.)
  - Alt. 4: Maximize size of pond with dredging (190,000 c.y.)
- c. Preliminarily estimated impact due to rock and contaminated soils

### *Results:*

- Meaningful flow reductions were achieved
- Increase storage from 145 to 245 acre-feet



# Alternatives Analysis (cont'd)

Reduction in Discharges - Alternatives 1 - 4				
Storm Event/Location	Alt. 1 % Red.	Alt. 2 % Red.	Alt. 3 % Red.	Alt. 4 % Red.
<b>2-Year Storm</b>				
D/S I-287	3.7%	5.3%	6.9%	11.0%
D/S I-95	3.4%	6.5%	3.8%	13.1%
<b>5-Year Storm</b>				
D/S I-287	11.5%	13.8%	45.5%	50.5%
D/S I-95	10.0%	12.0%	22.2%	26.6%
<b>10-Year Storm</b>				
D/S I-287	6.2%	7.4%	27.8%	31.0%
D/S I-95	6.7%	8.0%	27.7%	30.7%
<b>25-Year Storm</b>				
D/S I-287	2.3%	2.7%	12.6%	14.1%
D/S I-95	2.4%	2.9%	12.3%	13.6%
<b>50-Year Storm</b>				
D/S I-287	0.4%	0.5%	4.7%	5.4%
D/S I-95	0.9%	1.0%	7.2%	8.3%
<b>100-Year Storm</b>				
D/S I-287	0.4%	0.5%	3.3%	3.8%
D/S I-95	0.6%	0.8%	4.5%	5.0%

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# Alternatives Analysis (cont'd)

## 3. Optimizing the outlet of the dam

- a. Examined effects of variable size openings  
20.2 s.f. (15%), 45.6 s.f. (30%), 72.1 s.f. (50%),  
105.6 s.f. (75%), 139.1 s.f. (100%)

### *Results:*

- Smaller opening reduced flow for higher frequency events
- Larger opening reduced flow for lower frequency events
- More significant reductions in flow for 25-, 50-, and 100-year as compared to upper pond resizing
- Retrofit dam with automated sluice gate to achieve optimum opening during given storm event

# Alternatives Analysis (cont'd)

Reduction in Discharges - Alternatives 5 - 8	
Storm Event/Location	Optimized Reductions
<b>5-Year Storm</b>	
Orifice Opening (sf)	<b>45.6</b>
D/S Bowman Dam	22.7%
<b>Wyman Street</b>	<b>21.7%</b>
D/S I-95	12.4%
<b>10-Year Storm</b>	
Orifice Opening (sf)	<b>72.1</b>
D/S Bowman Dam	30.9%
<b>Wyman Street</b>	<b>15.9%</b>
D/S I-95	9.5%
<b>25-Year Storm</b>	
Orifice Opening (sf)	<b>105.6</b>
D/S Bowman Dam	19.1%
<b>Wyman Street</b>	<b>21.2%</b>
D/S I-95	7.4%
<b>50-Year Storm</b>	
Orifice Opening (sf)	<b>139.1</b>
D/S Bowman Dam	10.0%
<b>Wyman Street</b>	<b>11.2%</b>
D/S I-95	20.0%
<b>100-Year Storm</b>	
Orifice Opening (sf)	<b>139.1</b>
D/S Bowman Dam	5.6%
<b>Wyman Street</b>	<b>6.8%</b>
D/S I-95	8.6%

# Alternatives Analysis (cont'd)

4. Raising the elevation of the dam crest
  - a. Increase storage capacity behind dam
  - b. 2-foot increase in height with berms along Bowman Ave.

## *Results:*

- Dam fails based on stability analysis, would require major reconstruction
- Results in further flooding of upstream properties due to backwater effect from Bowman Dam Reservoir

# Alternatives Analysis (cont'd)

5. Resizing upper pond with outlet optimization
  - a. Combination of Alternatives 2 and 3

***Results:***

- Maximum flow reduction during various frequency storms

# Alternatives Analysis (cont'd)

Reduction in Discharges - Alternates 13 - 20		
	Optimized reductions, max. size no dredging	Optimized reductions, max. size with dredging
<b>5-Year Storm</b>		
Orifice Opening (sf)	<b>45.6</b>	<b>45.6</b>
D/S Bowman Dam	37.9%	38.7%
<b>Wyman Street</b>	<b>32.1%</b>	<b>33.4%</b>
D/S I-95	20.2%	21.7%
<b>10-Year Storm</b>		
Orifice Opening (sf)	<b>45.6</b>	<b>45.6</b>
D/S Bowman Dam	44.4%	45.9%
<b>Wyman Street</b>	<b>43.9%</b>	<b>45.4%</b>
D/S I-95	34.9%	43.9%
<b>25-Year Storm</b>		
Orifice Opening (sf)	<b>72.1</b>	<b>72.1</b>
D/S Bowman Dam	31.3%	32.4%
<b>Wyman Street</b>	<b>33.4%</b>	<b>34.5%</b>
D/S I-95	22.1%	23.2%
<b>50-Year Storm</b>		
Orifice Opening (sf)	<b>139.1</b>	<b>139.1</b>
D/S Bowman Dam	24.8%	25.0%
<b>Wyman Street</b>	<b>25.9%</b>	<b>26.2%</b>
D/S I-95	29.3%	29.6%
<b>100-Year Storm</b>		
Orifice Opening (sf)	<b>139.1</b>	<b>139.1</b>
D/S Bowman Dam	15.3%	15.6%
<b>Wyman Street</b>	<b>16.4%</b>	<b>16.7%</b>
D/S I-95	19.7%	20.1%

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# PREFERRED ALTERNATIVES



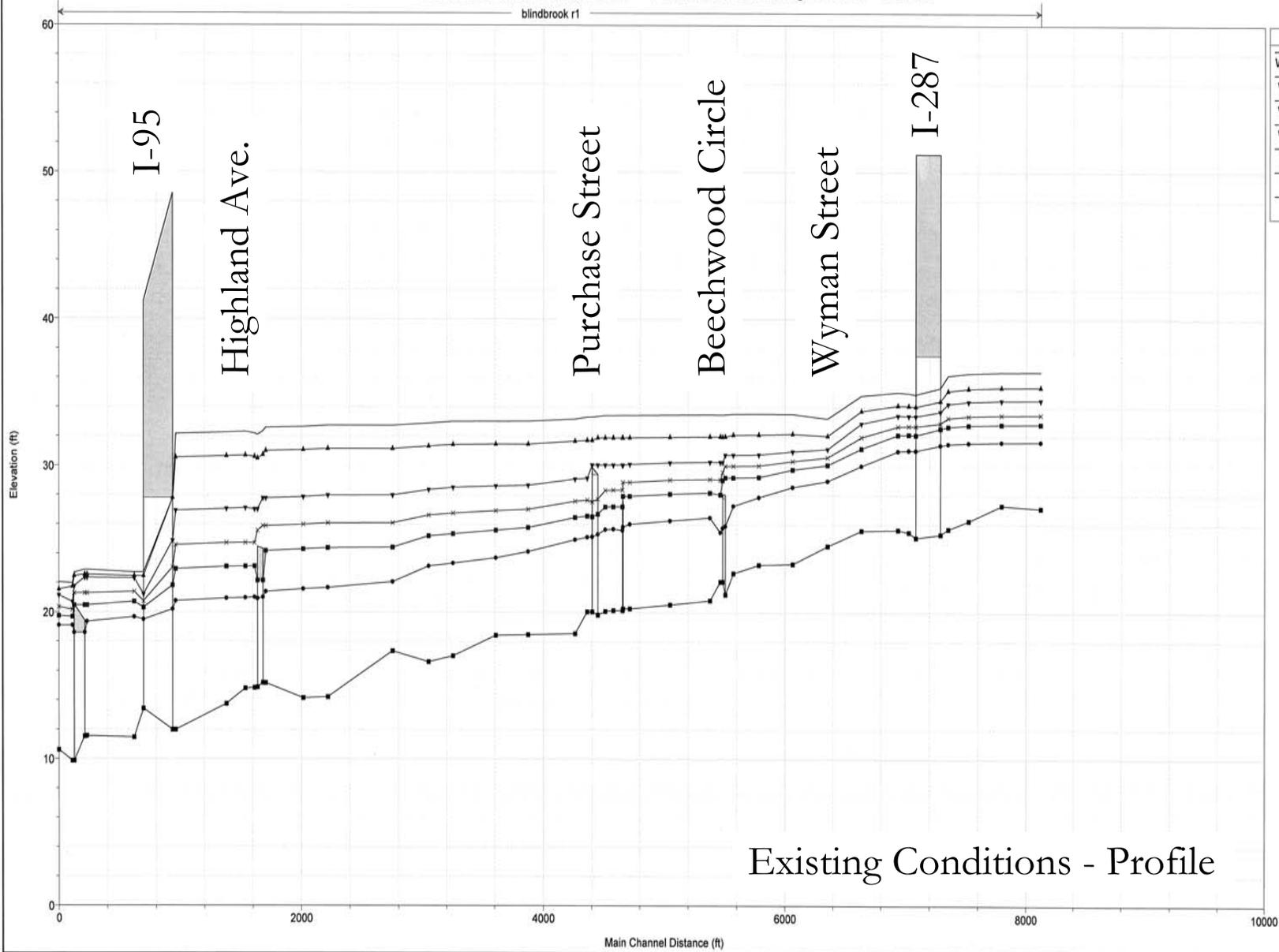
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# Preferred Alternatives

- Three alternatives further studied to develop water surface elevations
  - Alternative A: Optimizing Outlet
  - Alternative B: Optimize Outlet with maximizing Upper Pond Area
  - Alternative C: Optimizing Outlet, maximizing Upper Pond Area and 2-feet of dredging

blindbrook r1



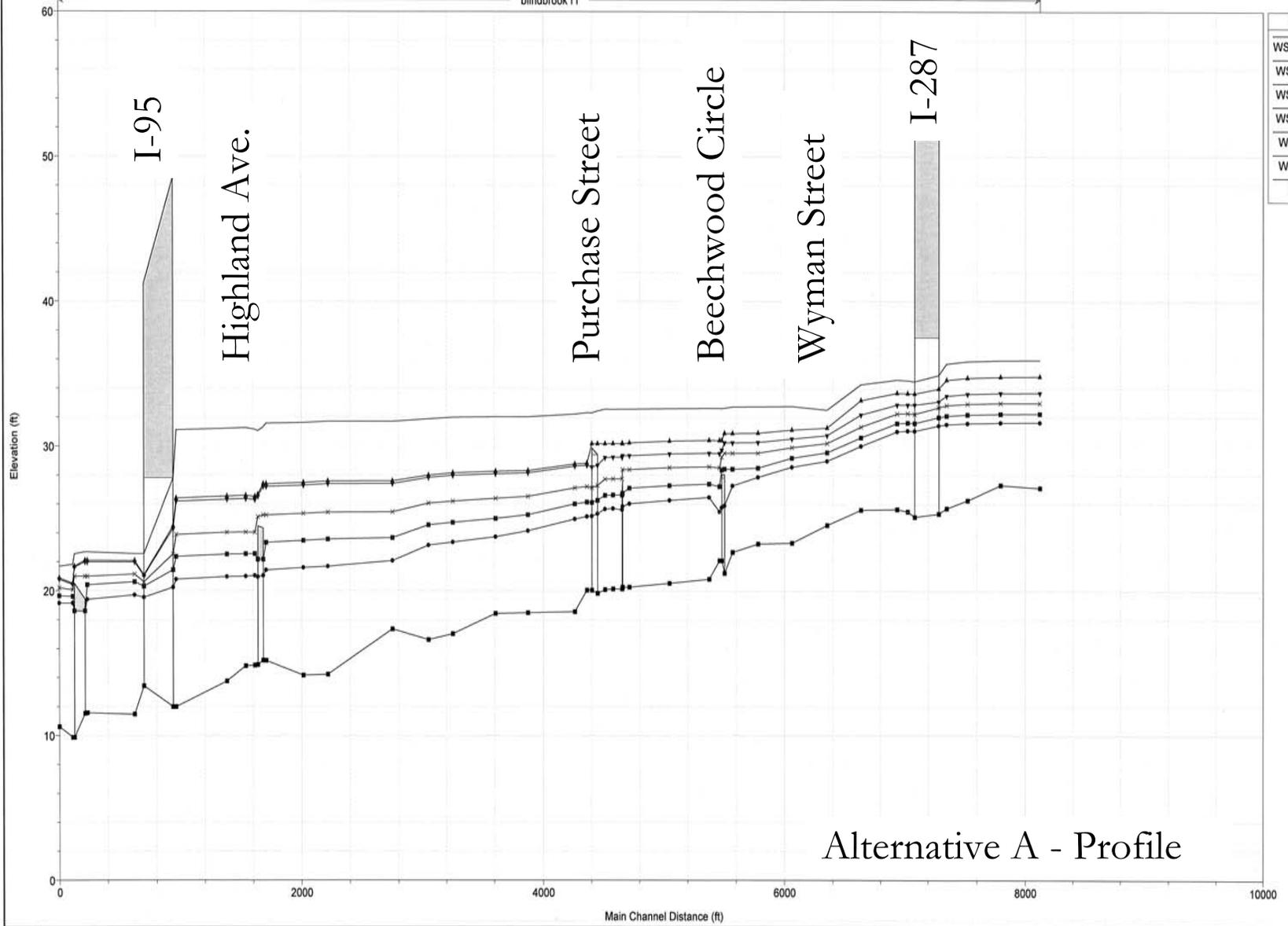
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WS 100 - year	▲
WS 50 - year	▲
WS 25 - year	▲
WS 10 - year	▲
WS 5 - year	▲
WS 2 - year	▲
Ground	■

Existing Conditions - Profile

ALTERNATIVE A	Orifice Size	Water Surface Elevation (ft-NAVD)		
		Existing Cond.	Proposed Cond.	Difference
<b>2-Year Storm</b>	<b>20.2</b>			
D/S I-287		31.07	31.07	0.00
Wyman Street		28.98	28.98	0.00
Beechwood Circle		26.47	26.47	0.00
Purchase Street		25.65	25.65	0.00
Highland Road		21.41	21.43	0.02
U/S I-95		20.77	20.80	0.03
<b>5-Year Storm</b>	<b>45.6</b>			
D/S I-287		32.15	31.62	-0.53
Wyman Street		30.07	29.56	-0.51
Beechwood Circle		28.16	27.39	-0.77
Purchase Street		27.20	26.61	-0.59
Highland Road		24.19	23.35	-0.84
U/S I-95		22.95	22.36	-0.59
<b>10-Year Storm</b>	<b>72.1</b>			
D/S I-287		32.73	32.27	-0.46
Wyman Street		30.59	30.20	-0.39
Beechwood Circle		29.10	28.58	-0.52
Purchase Street		28.33	27.73	-0.60
Highland Road		25.88	25.24	-0.64
U/S I-95		24.59	23.89	-0.70
<b>25-Year Storm</b>	<b>105.6</b>			
D/S I-287		33.44	32.87	-0.57
Wyman Street		31.16	30.75	-0.41
Beechwood Circle		30.27	29.52	-0.75
Purchase Street		30.06	29.21	-0.85
Highland Road		27.78	27.20	-0.58
U/S I-95		26.93	26.19	-0.74
<b>50-Year Storm</b>	<b>139.1</b>			
D/S I-287		34.11	33.66	-0.45
Wyman Street		32.06	31.27	-0.79
Beechwood Circle		31.99	30.41	-1.58
Purchase Street		31.91	30.18	-1.73
Highland Road		31.01	27.39	-3.62
U/S I-95		30.56	26.41	-4.15
<b>100-Year Storm</b>	<b>139.1</b>			
D/S I-287		34.97	34.54	-0.43
Wyman Street		33.24	32.52	-0.72
Beechwood Circle		33.49	32.62	-0.87
Purchase Street		33.44	32.55	-0.89
Highland Road		32.60	31.57	-1.03
U/S I-95		32.17	31.12	-1.05

## Alternative A - Optimizing Outlet Opening

blindbrook r1



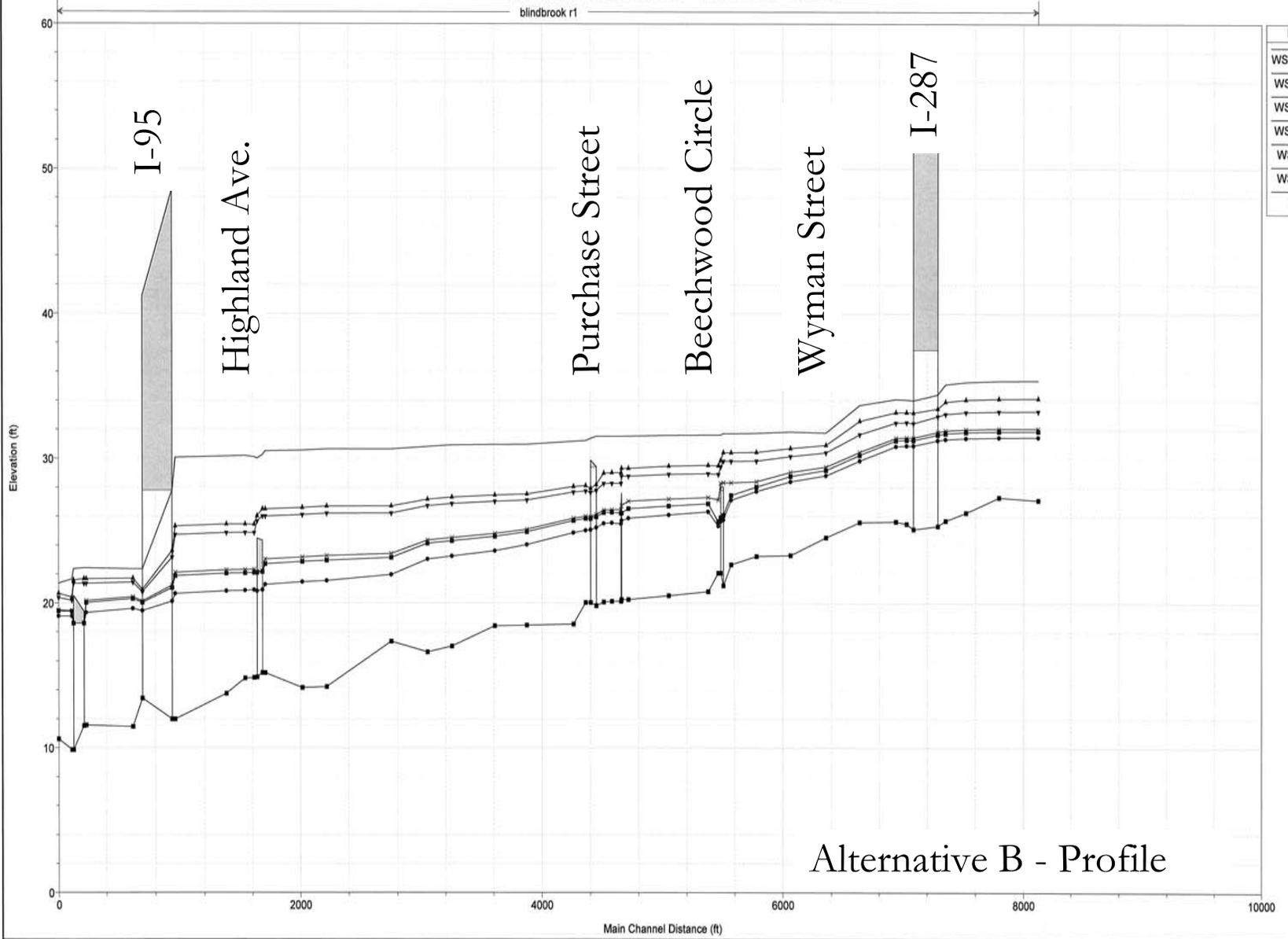
Legend	
WS 100 - year	▲
WS 50 - year	▲
WS 25 - year	▲
WS 10 - year	▲
WS 5 - year	▲
WS 2 - year	▲
Ground	—

Alternative A - Profile

ALTERNATIVE B	Orifice Size	Water Surface Elevation (ft-NAVD)		
		Existing Cond.	Proposed Cond.	Difference
<b>2-Year Storm</b>	<b>20.2</b>			
D/S I-287		31.07	30.90	-0.17
Wyman Street		29.98	28.83	-1.15
Beechwood Circle		26.47	26.33	-0.14
Purchase Street		25.65	25.52	-0.13
Highland Road		21.41	21.29	-0.12
U/S I-95		20.77	20.66	-0.11
<b>5-Year Storm</b>	<b>45.6</b>			
D/S I-287		32.15	31.29	-0.86
Wyman Street		30.07	29.20	-0.87
Beechwood Circle		28.16	26.89	-1.27
Purchase Street		27.20	26.27	-0.93
Highland Road		24.19	22.72	-1.47
U/S I-95		22.95	21.89	-1.06
<b>10-Year Storm</b>	<b>45.6</b>			
D/S I-287		32.73	31.47	-1.26
Wyman Street		30.59	29.44	-1.15
Beechwood Circle		29.10	27.32	-1.78
Purchase Street		28.33	26.45	-1.88
Highland Road		25.88	23.04	-2.84
U/S I-95		24.59	22.12	-2.47
<b>25-Year Storm</b>	<b>72.1</b>			
D/S I-287		33.44	32.51	-0.93
Wyman Street		31.16	30.42	-0.74
Beechwood Circle		30.27	28.97	-1.30
Purchase Street		30.06	28.28	-1.78
Highland Road		27.78	26.01	-1.77
U/S I-95		26.93	24.73	-2.20
<b>50-Year Storm</b>	<b>139.1</b>			
D/S I-287		34.11	33.20	-0.91
Wyman Street		32.06	30.94	-1.12
Beechwood Circle		31.99	29.55	-2.44
Purchase Street		31.91	29.00	-2.91
Highland Road		31.01	26.51	-4.50
U/S I-95		30.56	25.32	-5.24
<b>100-Year Storm</b>	<b>139.1</b>			
D/S I-287		34.97	34.08	-0.89
Wyman Street		33.24	31.79	-1.45
Beechwood Circle		33.49	31.64	-1.85
Purchase Street		33.44	31.54	-1.90
Highland Road		32.60	30.52	-2.08
U/S I-95		32.17	30.07	-2.10

**Alternative B –  
Optimize Outlet  
with maximizing  
Upper Pond Area**

blindbrook r1



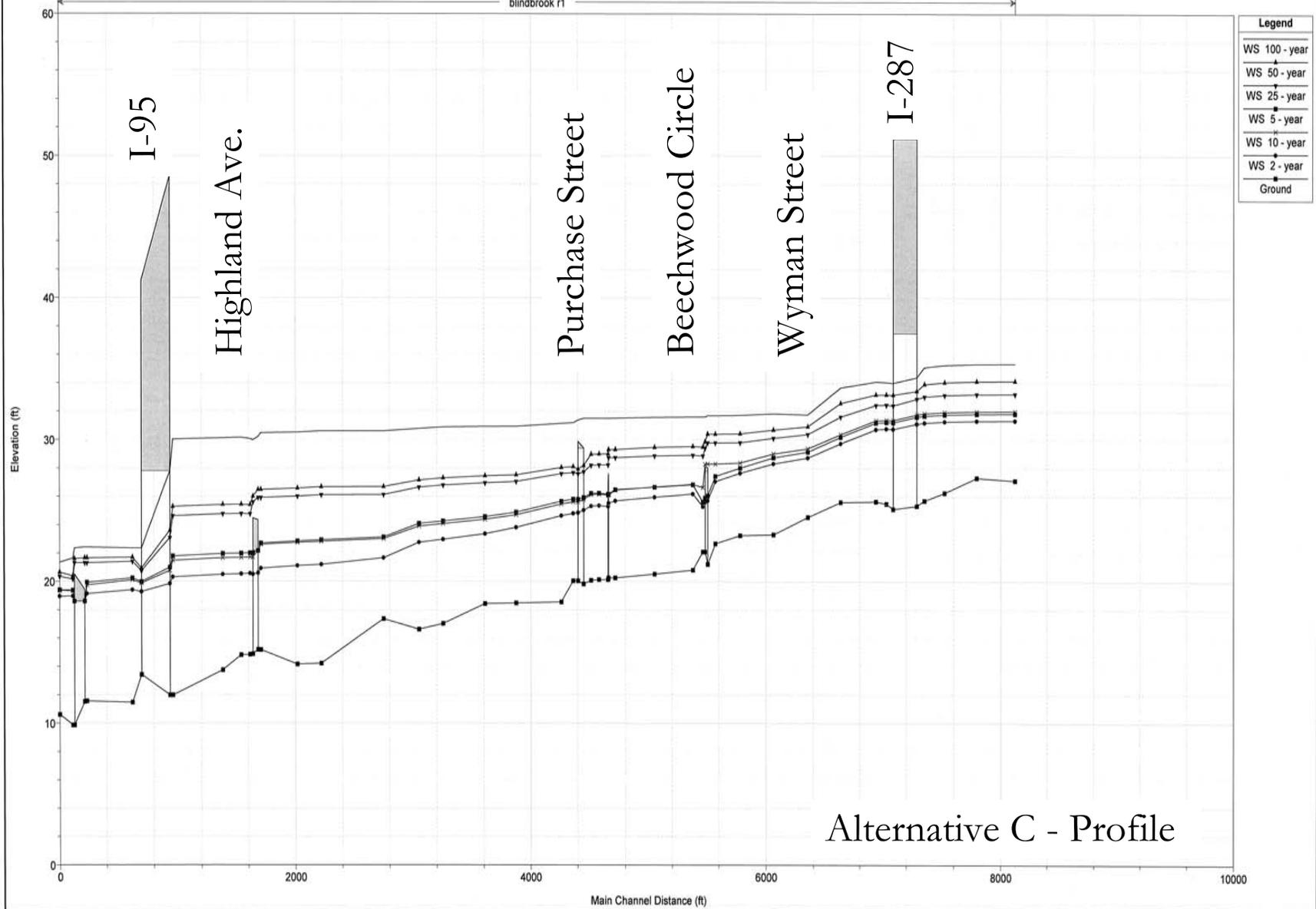
Legend	
WS 100 - year	▲
WS 50 - year	◆
WS 25 - year	■
WS 10 - year	●
WS 5 - year	×
WS 2 - year	*
Ground	—

Alternative B - Profile

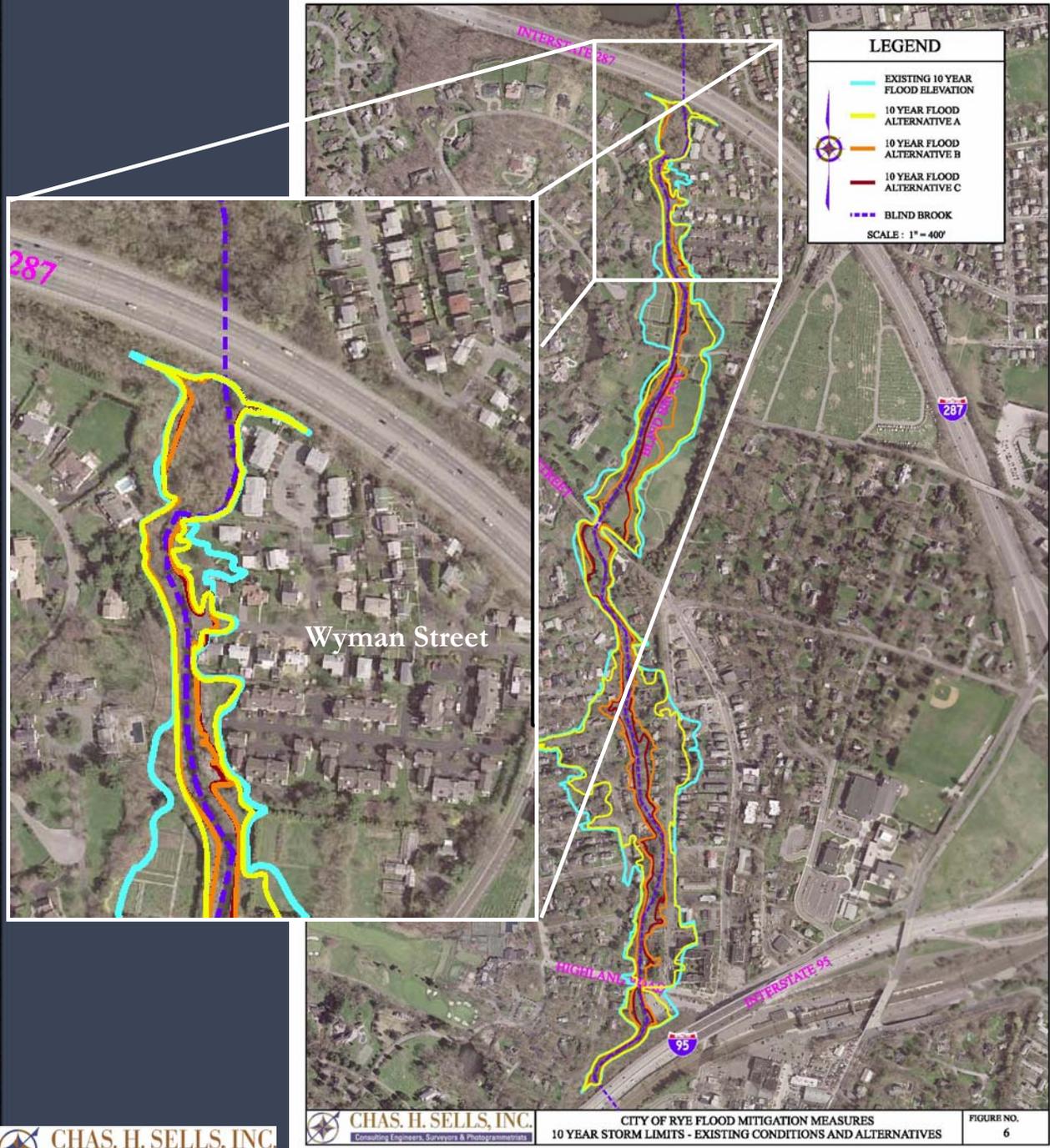
ALTERNATIVE C	Orifice Size	Water Surface Elevation (ft-NAVD)		
		Existing Cond.	Proposed Cond.	Difference
<b>2-Year Storm</b>	<b>20.2</b>			
D/S I-287		31.07	30.79	-0.28
Wyman Street		29.98	28.73	-1.25
Beechwood Circle		26.47	26.18	-0.29
Purchase Street		25.65	25.32	-0.33
Highland Road		21.41	20.93	-0.48
U/S I-95		20.77	20.32	-0.45
<b>5-Year Storm</b>	<b>45.6</b>			
D/S I-287		32.15	31.25	-0.90
Wyman Street		30.07	29.16	-0.91
Beechwood Circle		28.16	26.83	-1.33
Purchase Street		27.20	26.22	-0.98
Highland Road		24.19	22.70	-1.49
U/S I-95		22.95	21.79	-1.16
<b>10-Year Storm</b>	<b>45.6</b>			
D/S I-287		32.73	31.41	-1.32
Wyman Street		30.59	29.39	-1.20
Beechwood Circle		29.10	26.86	-2.24
Purchase Street		28.33	26.14	-2.19
Highland Road		25.88	22.62	-3.26
U/S I-95		24.59	21.48	-3.11
<b>25-Year Storm</b>	<b>72.1</b>			
D/S I-287		33.44	32.47	-0.97
Wyman Street		31.16	30.39	-0.77
Beechwood Circle		30.27	28.92	-1.35
Purchase Street		30.06	28.20	-1.86
Highland Road		27.78	25.92	-1.86
U/S I-95		26.93	24.62	-2.31
<b>50-Year Storm</b>	<b>139.1</b>			
D/S I-287		34.11	33.19	-0.92
Wyman Street		32.06	30.93	-1.13
Beechwood Circle		31.99	29.54	-2.45
Purchase Street		31.91	28.98	-2.93
Highland Road		31.01	26.48	-4.53
U/S I-95		30.56	25.29	-5.27
<b>100-Year Storm</b>	<b>139.1</b>			
D/S I-287		34.97	34.06	-0.91
Wyman Street		33.24	31.77	-1.47
Beechwood Circle		33.49	31.62	-1.87
Purchase Street		33.44	31.51	-1.93

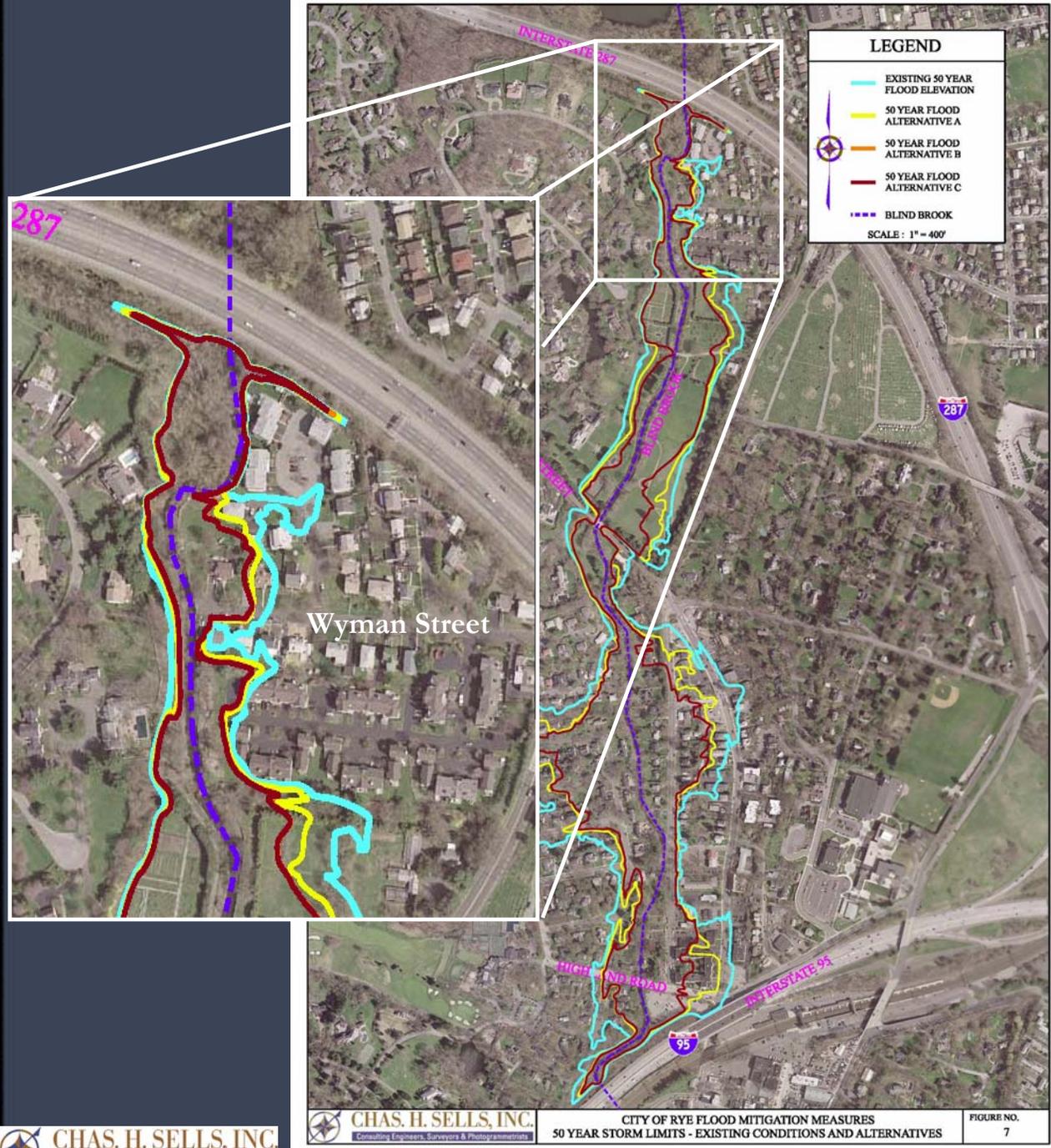
**Alternative C –**  
Optimize Outlet with  
maximizing Upper  
Pond Area and  
dredging

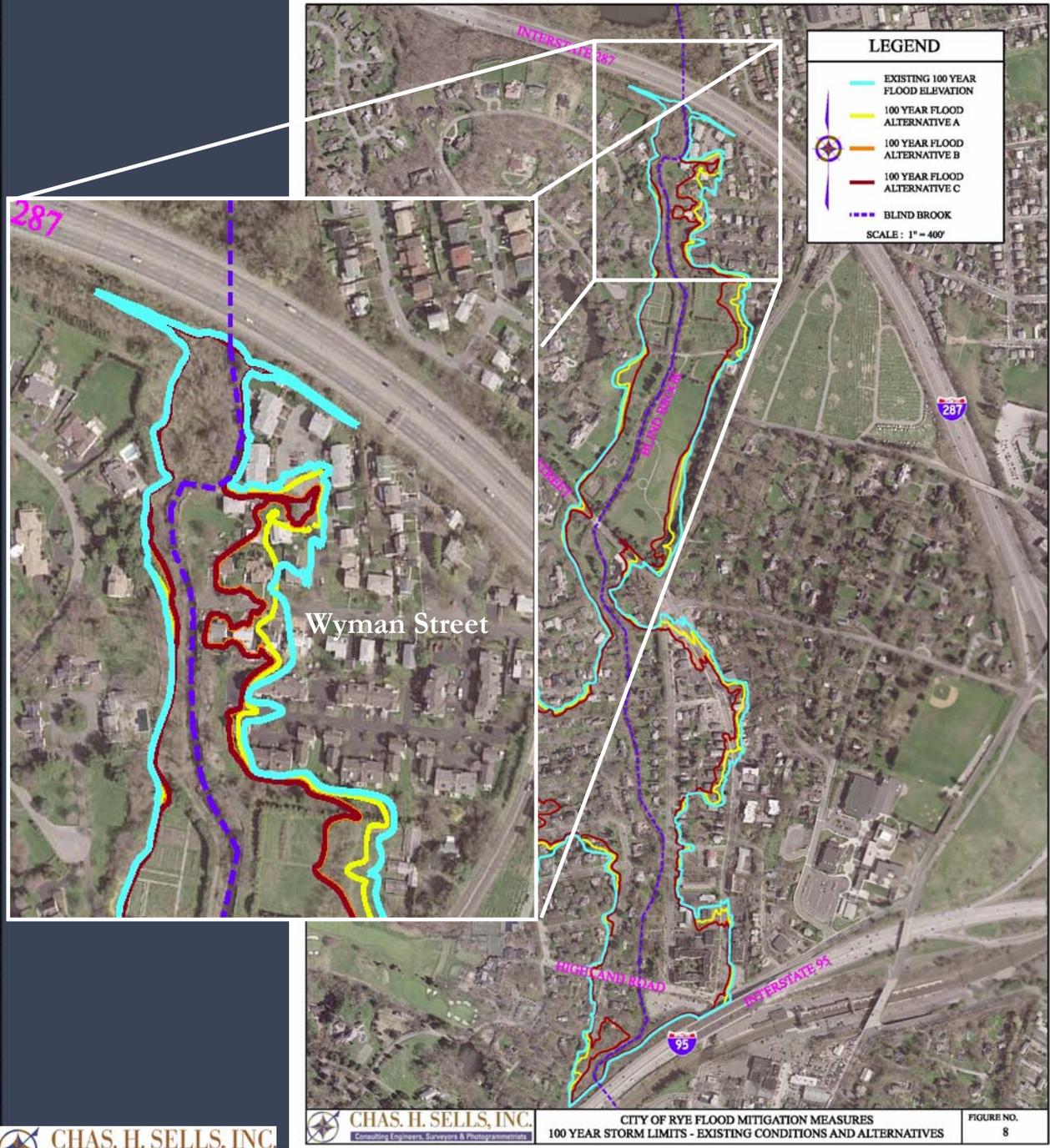
blindbrook r1



Alternative C - Profile







# Preferred Alternatives (cont'd)

Upstream Impacts - East Branch Blind Brook										
	Orifice Size	Alternate A			Alternate B			Alternate C		
		Optimize Orifice Opening			Opt. Orifice Opening, Maz. Vol. with Bottom Elevation of 39.0			Opt. Orifice Opening, Maz. Vol. with Bottom Elevation of 37.0		
		Existing Cond.	Proposed Cond.	Difference	Existing Cond.	Proposed Cond.	Difference	Existing Cond.	Proposed Cond.	Difference
<b>2-Year Storm</b>	<b>20.2</b>									
I-287		31.35	31.15	-0.20	31.35	31.30	-0.05	31.35	31.25	-0.10
Bowman Avenue (U/S)		33.68	33.68	0.00	33.68	33.68	0.00	33.68	33.68	0.00
Westchester Ave. Culvert (D/S)		39.94	39.94	0.00	39.94	39.94	0.00	39.94	39.94	0.00
Longledge Court (D/S)		62.07	62.07	0.00	62.07	62.07	0.00	62.07	62.07	0.00
<b>5-Year Storm</b>	<b>45.6</b>									
I-287		31.90	31.72	-0.18	31.90	31.42	-0.48	31.90	31.40	-0.50
Bowman Avenue (U/S)		34.54	34.54	0.00	34.54	34.54	0.00	34.54	34.54	0.00
Westchester Ave. Culvert (D/S)		40.49	40.49	0.00	40.49	40.49	0.00	40.49	40.49	0.00
Longledge Court (D/S)		62.88	62.88	0.00	62.88	62.88	0.00	62.88	62.88	0.00
<b>10-Year Storm</b>	<b>72.1</b>									
I-287		32.35	32.05	-0.30	32.35	31.60	-0.75	32.35	31.50	-0.85
Bowman Avenue (U/S)		36.09	36.09	0.00	36.09	36.09	0.00	36.09	36.09	0.00
Westchester Ave. Culvert (D/S)		40.67	40.67	0.00	40.67	40.67	0.00	40.67	40.67	0.00
Longledge Court (D/S)		63.25	63.25	0.00	63.25	63.25	0.00	63.25	63.25	0.00
<b>25-Year Storm</b>	<b>105.6</b>									
I-287		32.35	32.05	-0.30	32.35	31.60	-0.75	32.35	31.50	-0.85
Bowman Avenue (U/S)		37.35	37.35	0.00	37.35	37.35	0.00	37.35	37.35	0.00
Westchester Ave. Culvert (D/S)		40.90	40.90	0.00	40.90	40.90	0.00	40.90	40.90	0.00
Longledge Court (D/S)		63.65	63.65	0.00	63.65	63.65	0.00	63.65	63.65	0.00
<b>50-Year Storm</b>	<b>139.1</b>									
I-287		32.75	32.35	-0.40	32.75	32.20	-0.55	32.75	32.13	-0.62
Bowman Avenue (U/S)		38.47	38.47	0.00	38.47	38.47	0.00	38.47	38.47	0.00
Westchester Ave. Culvert (D/S)		42.09	42.09	0.00	42.09	42.09	0.00	42.09	42.09	0.00
Longledge Court (D/S)		64.90	64.90	0.00	64.90	64.90	0.00	64.90	64.90	0.00
<b>100-Year Storm</b>	<b>139.1</b>									
I-287		33.10	32.90	-0.20	33.10	32.65	-0.45	33.10	32.64	-0.46
Bowman Avenue (U/S)		40.06	40.06	0.00	40.06	40.06	0.00	40.06	40.06	0.00
Westchester Ave. Culvert (D/S)		41.31	41.31	0.00	41.31	41.31	0.00	41.31	41.31	0.00
Longledge Court (D/S)		64.27	64.27	0.00	64.27	64.27	0.00	64.27	64.27	0.00

No Upstream Impacts

# Preferred Alternatives (cont'd)

Upstream Impacts - Blind Brook										
	Orifice Size	Alternate A			Alternate B			Alternate C		
		Optimize Orifice Opening			Opt. Orifice Opening, Maz. Vol. with Bottom Elevation of 39.0			Opt. Orifice Opening, Maz. Vol. with Bottom Elevation of 37.0		
		Existing Cond.	Proposed Cond.	Difference	Existing Cond.	Proposed Cond.	Difference	Existing Cond.	Proposed Cond.	Difference
<b>2-Year Storm</b>	<b>20.2</b>									
Bowman Avenue Dam		51.75	51.75	0.00	51.75	48.00	-3.75	51.75	47.20	-4.55
Bowman Avenue (U/S)		55.91	55.91	0.00	55.91	55.91	0.00	55.91	55.91	0.00
Westchester Ave. Culvert (U/S)		67.11	67.11	0.00	67.11	67.11	0.00	67.11	67.11	0.00
Deer Run Area		84.25	84.25	0.00	84.25	84.25	0.00	84.25	84.25	0.00
<b>5-Year Storm</b>	<b>45.6</b>									
Bowman Avenue Dam		53.90	53.85	-0.05	53.90	49.80	-4.10	53.90	49.20	-4.70
Bowman Avenue (U/S)		58.06	58.06	0.00	58.06	58.06	0.00	58.06	58.06	0.00
Westchester Ave. Culvert (U/S)		68.30	68.30	0.00	68.30	68.29	-0.01	68.30	68.29	-0.01
Deer Run Area		85.05	85.05	0.00	85.05	85.05	0.00	85.05	85.05	0.00
<b>10-Year Storm</b>	<b>72.1</b>									
Bowman Avenue Dam		56.40	55.30	-1.10	56.40	51.40	-5.00	56.40	51.00	-5.40
Bowman Avenue (U/S)		59.37	59.18	-0.19	59.37	59.23	-0.14	59.37	59.23	-0.14
Westchester Ave. Culvert (U/S)		68.83	68.83	0.00	68.83	68.83	0.00	68.83	68.83	0.00
Deer Run Area		85.49	85.49	0.00	85.49	85.49	0.00	85.49	85.49	0.00
<b>25-Year Storm</b>	<b>105.6</b>									
Bowman Avenue Dam		58.95	57.80	-1.15	58.95	55.20	-3.75	58.95	54.95	-4.00
Bowman Avenue (U/S)		62.03	61.24	-0.79	62.03	60.89	-1.14	62.03	60.89	-1.14
Westchester Ave. Culvert (U/S)		70.45	70.45	0.00	70.45	70.45	0.00	70.45	70.45	0.00
Deer Run Area		86.01	86.01	0.00	86.01	86.01	0.00	86.01	86.01	0.00
<b>50-Year Storm</b>	<b>139.1</b>									
Bowman Avenue Dam		59.20	58.45	-0.75	59.20	57.45	-1.75	59.20	57.25	-1.95
Bowman Avenue (U/S)		62.92	62.50	-0.42	62.92	62.14	-0.78	62.92	62.11	-0.81
Westchester Ave. Culvert (U/S)		70.90	70.90	0.00	70.90	70.90	0.00	70.90	70.90	0.00
Deer Run Area		86.41	86.41	0.00	86.41	86.41	0.00	86.41	86.41	0.00
<b>100-Year Storm</b>	<b>139.1</b>									
Bowman Avenue Dam		59.60	58.55	-1.05	59.60	57.90	-1.70	59.60	57.79	-1.81
Bowman Avenue (U/S)		63.54	63.66	0.12	63.54	63.53	-0.01	63.54	63.53	-0.01
Westchester Ave. Culvert (U/S)		71.84	71.84	0.00	71.84	71.84	0.00	71.84	71.84	0.00
Deer Run Area		86.82	86.82	0.00	86.82	86.82	0.00	86.82	86.82	0.00

No Upstream Impacts

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# CONCLUSIONS & RECOMMENDATIONS



# Conclusions and Recommendations

## Outlet Optimization

### ▪ *Results*

- Provides the greatest cost-benefit ratio
- At Highland Road: Over 3-ft reduction in w.s.e. for 50-year storm

### ▪ *Recommendation*

- Install automated sluice gate system at Bowman Avenue Dam
- Cost-effective solution: \$1 - \$2 million (budgetary construction cost)
- Dynamic solution: system may be adjusted based on future needs
- Secure funding for sluice gate design and construction (HMGP application)

# Conclusions and Recommendations



Typical sluice gate

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# Conclusions and Recommendations

## Maximize Storage Capacity at Upper Pond

### ▪ *Results*

- provides largest overall reduction in w.s.e. in conjunction with sluice gate
- At Highland Road: over 1-ft for 5-year storm, over 4.5-ft for 50-year storm

### *Recommendations*

- Further study required: subsurface investigation and soil testing
- Re-evaluate cost effectiveness \$10 - \$22 million (budgetary construction cost)
- Evaluate maintenance access methods and develop long-term maintenance plan

# Conclusions and Recommendations

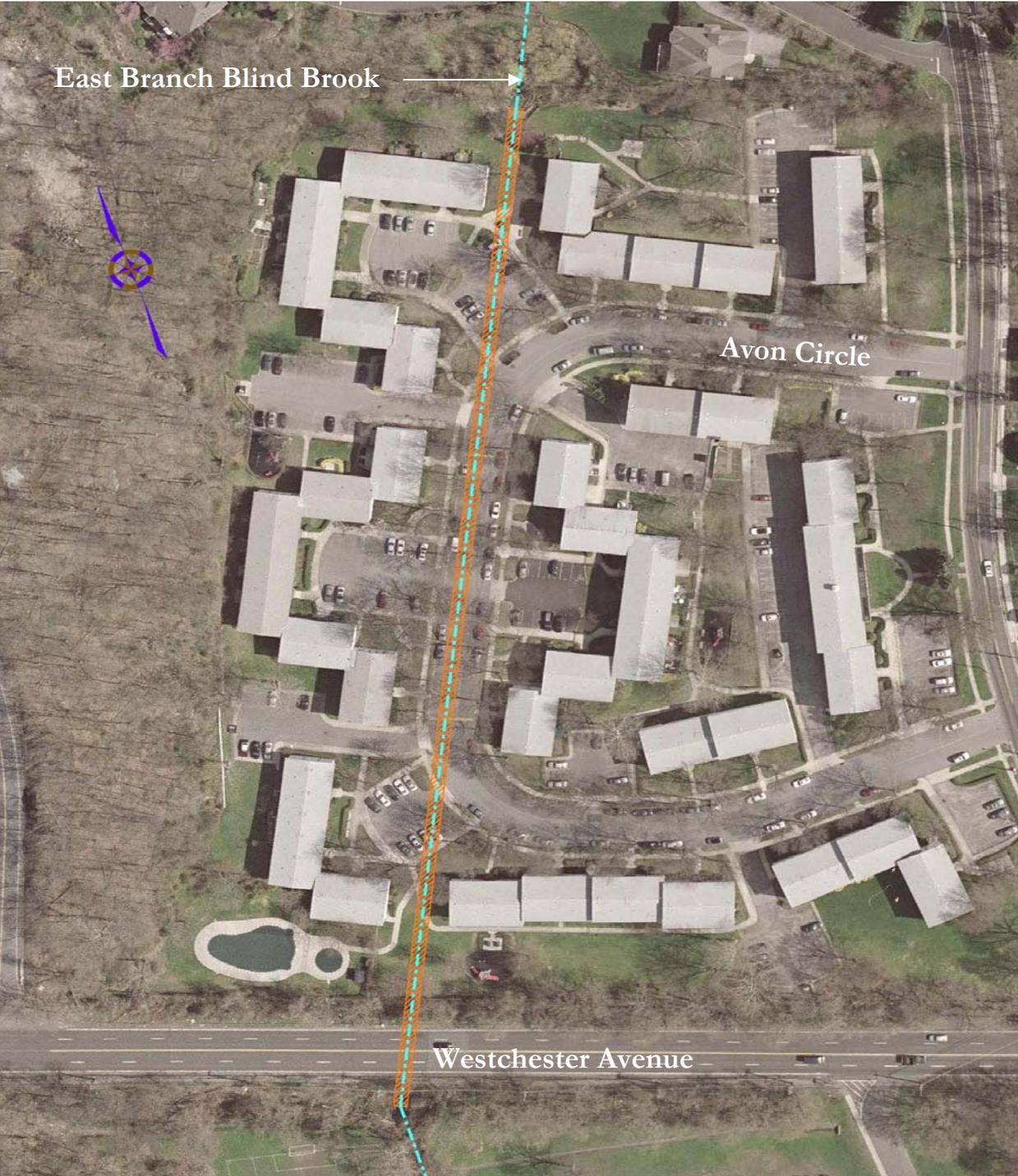
- Revise FIS and FIRM Mapping
  - Based on this study's discharges
  - Accurately reflect constructed mitigated measures in compliance with regulatory requirements
  - Engage the State and FEMA with proactive approach to Map Modernization to maximize benefits
  - Better defined floodplain

# Conclusions and Recommendations

- Complete alternatives analysis at the Lower Pond
  - Maximize storage potential
  - Improve outlet control
  - Evaluate pre-draining options

# Conclusions and Recommendations

- Provide improvements at other upstream locations in the Village of Rye Brook
  - Avon Circle
  - Brook Lane

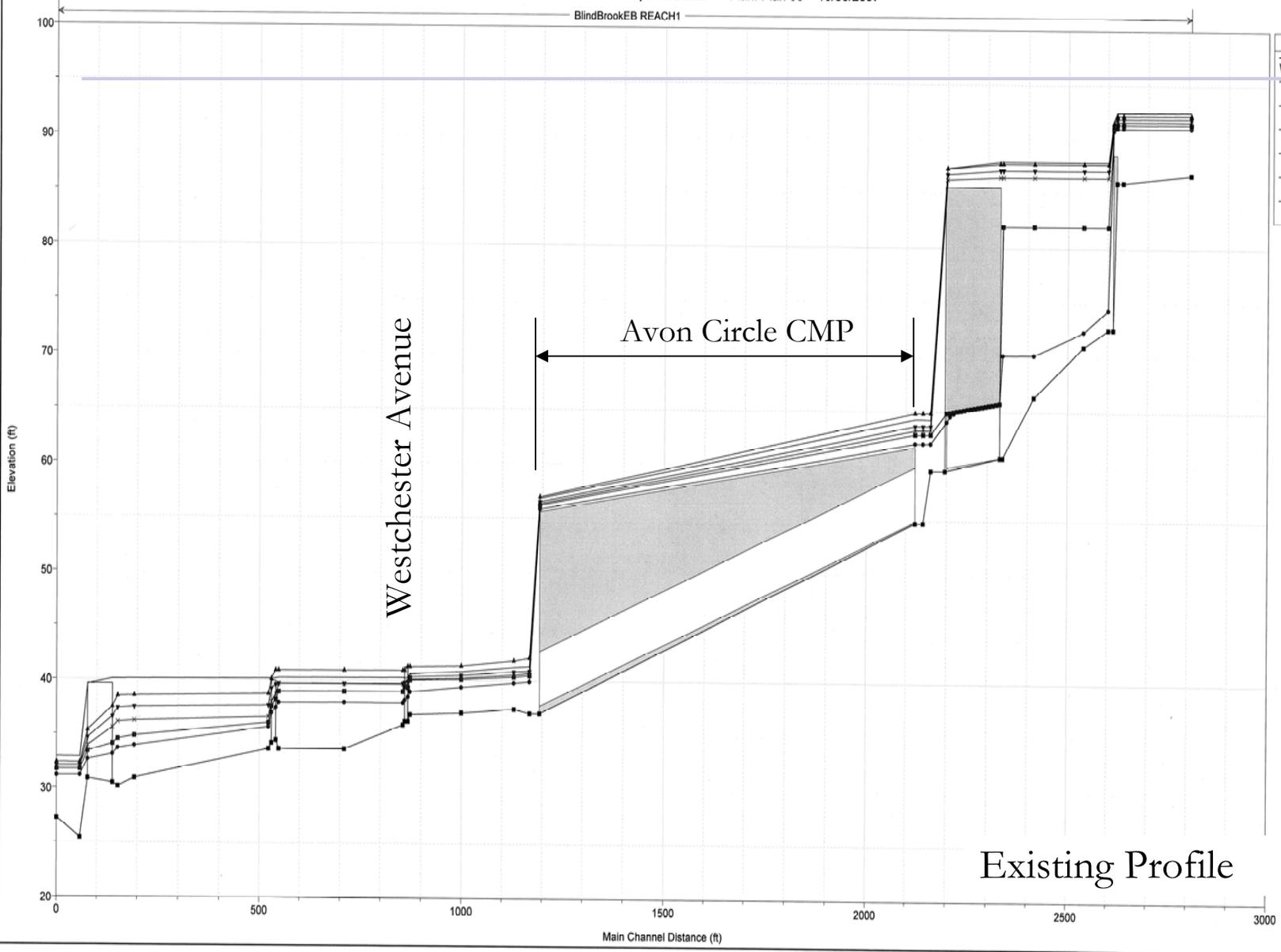


**Avon Circle:**

- Existing CMP is hydraulically inadequate
- Replace with 12'x6' culvert (940ft)
- Impact to residential community
- Cost = \$4.0 - \$4.5 million



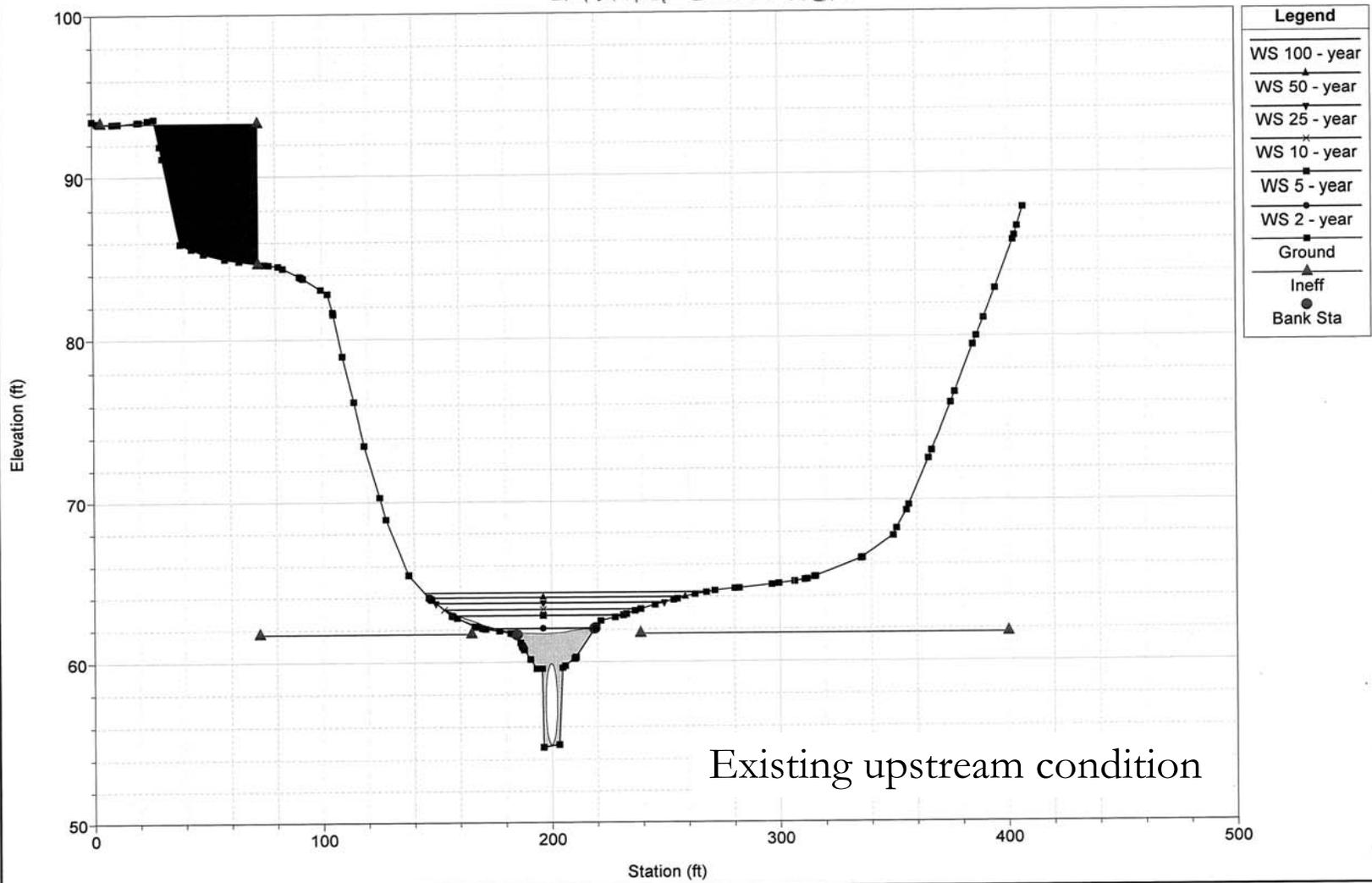
BlindBrookEB REACH1



Legend	
WS 100 - year	—■—
WS 50 - year	—■—
WS 25 - year	—■—
WS 10 - year	—■—
WS 5 - year	—■—
WS 2 - year	—■—
Ground	—■—

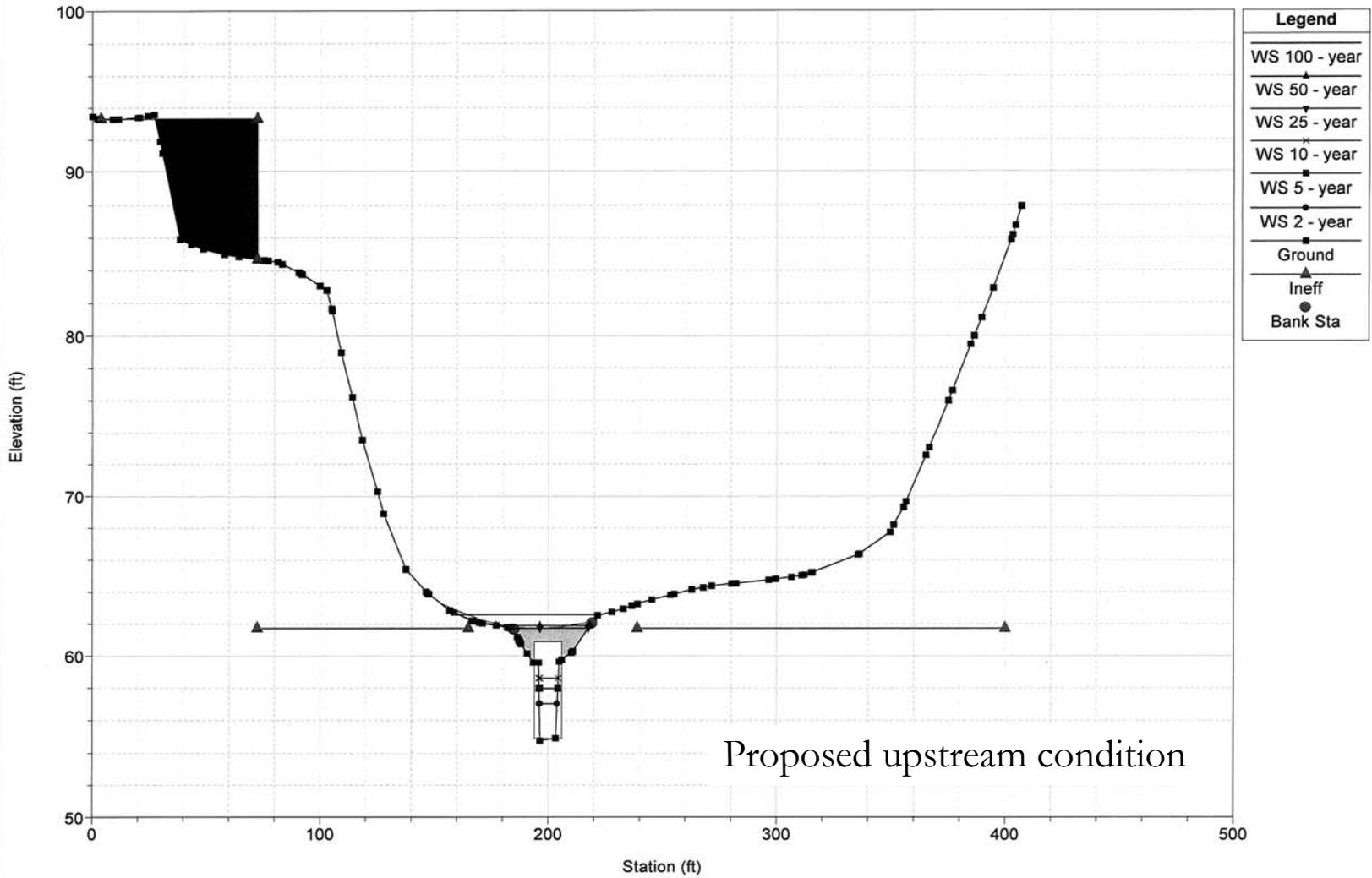
Existing Profile

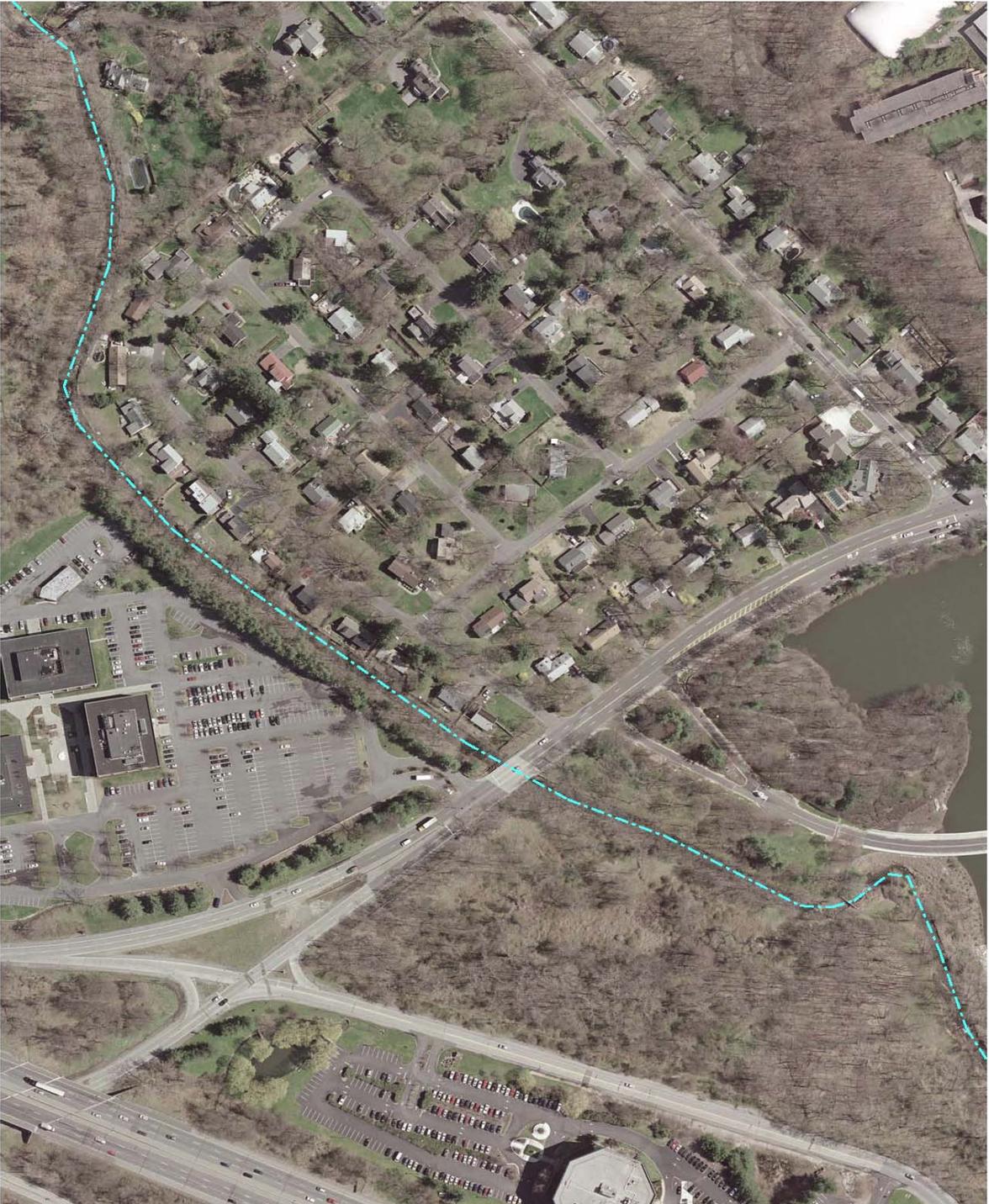
EstBrBlindExistBReservoirOptimizOutlet Plan: Plan 10 10/30/2007  
WESTCHESTER AVENUE BRIDGE U/S FACE  
EXISTING CONDITION





EstBrBlindOptOutlet 12x6 culv. at WestcA Plan: 12x6 Box Culv Replacement at WestchAve 10/18/2007  
 WESTCHESTER AVENUE BRIDGE



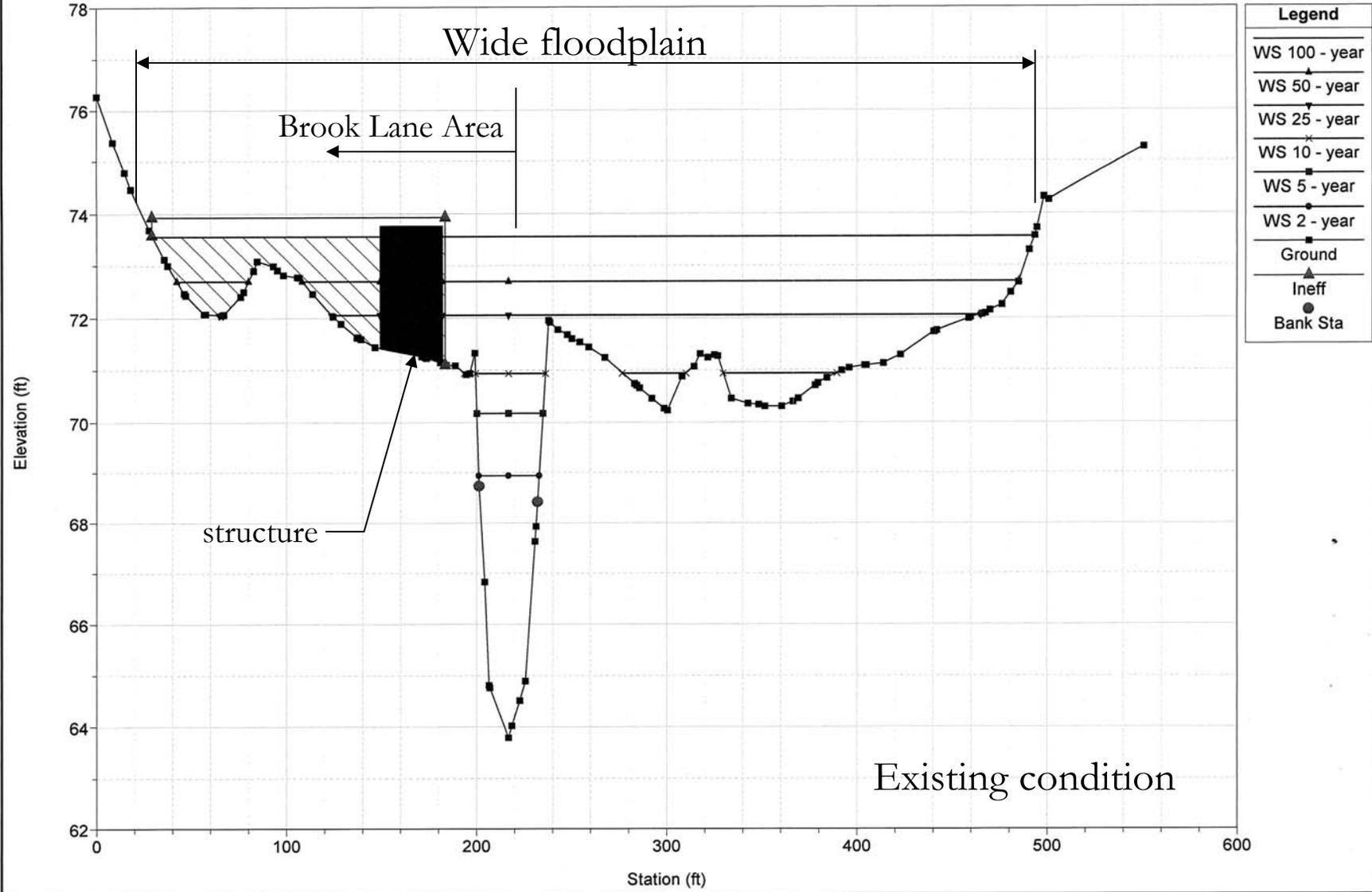


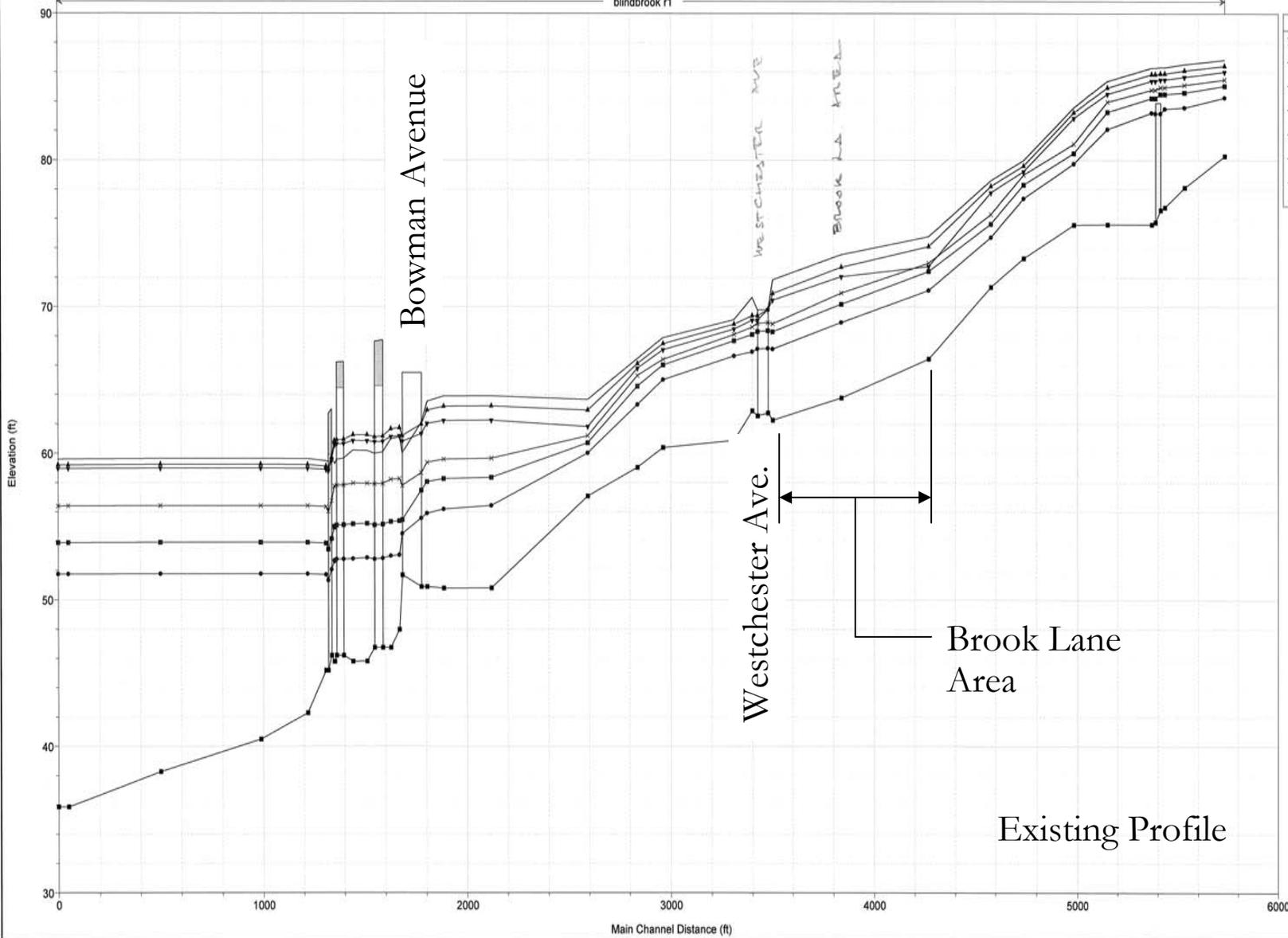
## Brook Lane:

- Existing floodplain is wide, low banks
- Westchester Ave. Bridge limited backwater effect
- Upgrade existing stormwater drainage



STA 24582 - Brook LA. AREA





Legend	
WS 100 - year	▲
WS 50 - year	▼
WS 25 - year	×
WS 10 - year	*
WS 5 - year	■
WS 2 - year	◆
Ground	—

Bowman Avenue

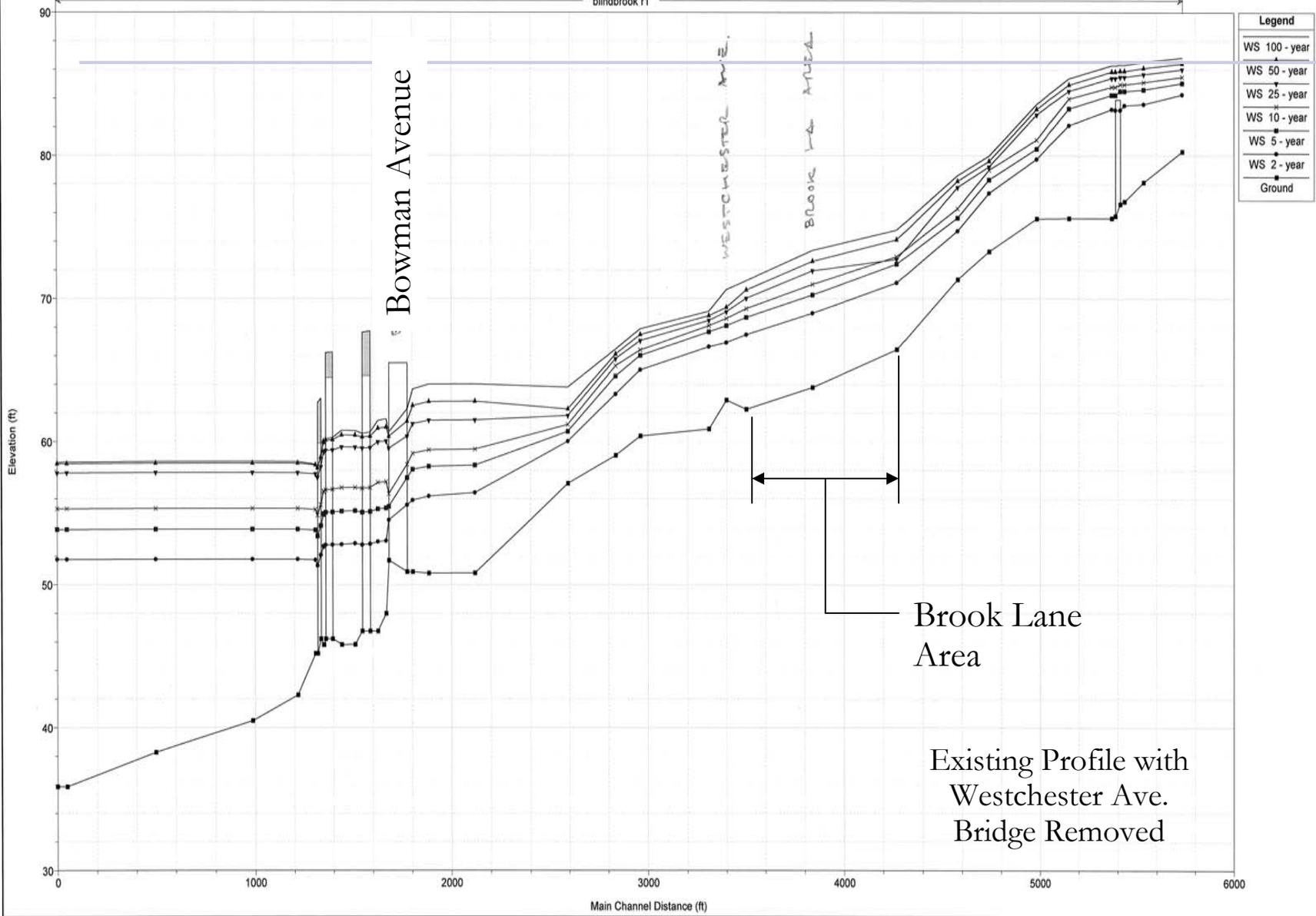
Westchester Ave.

WESTCHESTER AVE

BROOK LANE AREA

Brook Lane Area

Existing Profile



Legend

WS 100 - year	▲
WS 50 - year	▼
WS 25 - year	×
WS 10 - year	+
WS 5 - year	●
WS 2 - year	■
Ground	■

Bowman Avenue

WESTCHESTER AVE.

BROOK LANE AREA

Brook Lane Area

Existing Profile with Westchester Ave. Bridge Removed

# Next Steps

- Submit Hazard Mitigation Grant Application (HMGP) for sluice gate alternative – due November 9, 2007
  - Statewide competitive
  - \$10 million available in this round
  - 25% local share split b/w Rye Brook & City of Rye
- Complete feasibility analysis of Lower Pond alternatives
- Continue investigation of upper pond resizing
  - Conduct subsurface investigation
  - Refine model and costs
- Investigate cost-benefit of Avon Circle improvements

**Flood Mitigation Study  
Bowman Avenue Dam Site  
Blind Brook**

**QUESTION AND ANSWER SESSION**

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