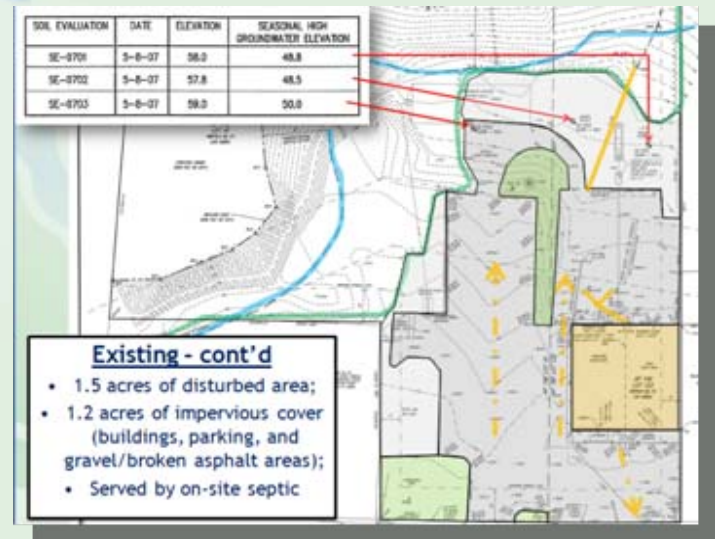


# Rhode Island Stormwater Design and Installations Standards Manual

Public Workshop  
Design Exercises to Learn  
How to Use the Revised  
Manual

January 13, 2011



# Introduction

- Two design exercises to help you become more familiar with the manual and how it might be applied to real projects
  - Subdivision
  - Commercial Redevelopment
- Real project examples
- Thanks to designers for allowing us to use their plans!

# Subdivision Exercise

Barrington Workforce Housing is an affordable subdivision project proposed in the Town of Barrington, RI.

Existing:

- 1 lot, total of 1.8 acres;
- 6,500 sf of impervious cover (buildings and driveway).

Proposed:

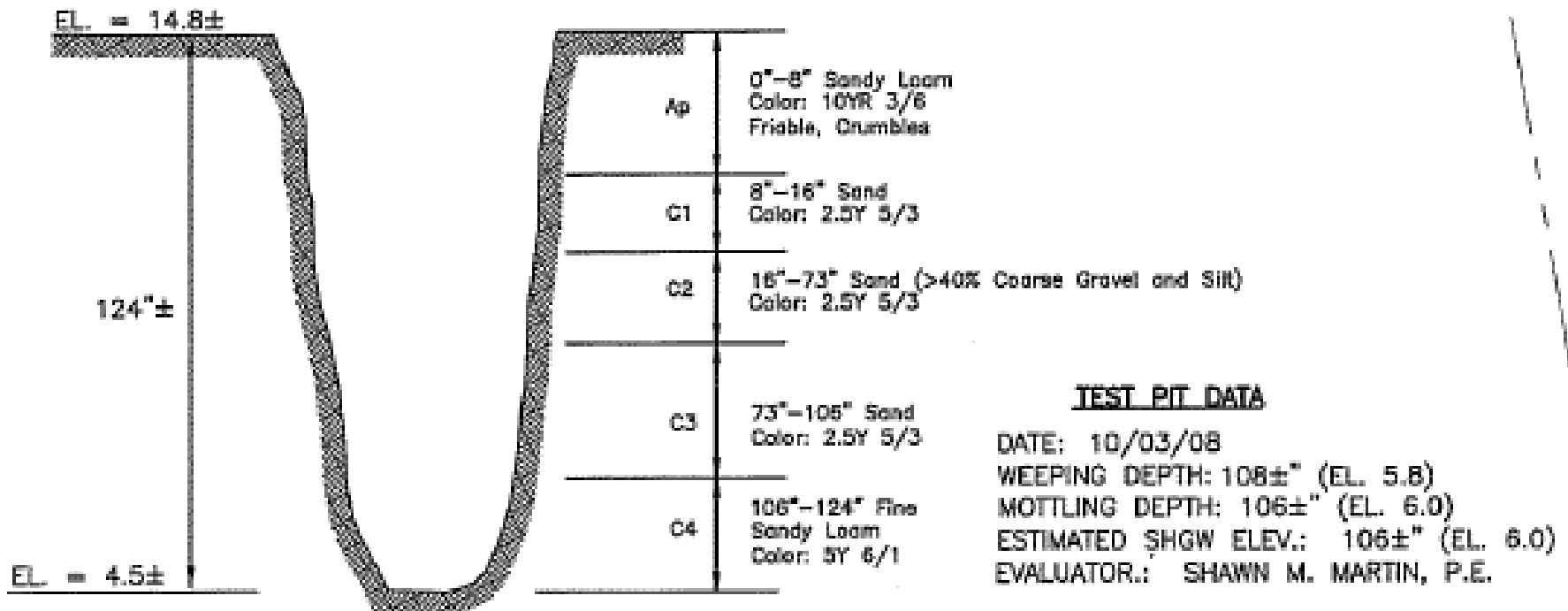
- 1 lot, total of 1.8 acres;
- 27,000 sf of impervious cover (road = 7,800 sf; porous asphalt driveways/parking = 6,200 sf; rooftops = 13,000 sf).





# Soil Characteristics

## TEST PIT 4



## PARKING TABLE

REQUIREMENT: TWO CAR SPACES PER DWELLING

NO. OF SPACES	REQUIRED 24 (FOR 12 UNITS)	PROPOSED 24 OFF-STREET 4 ON-STREET
---------------	----------------------------------	------------------------------------------

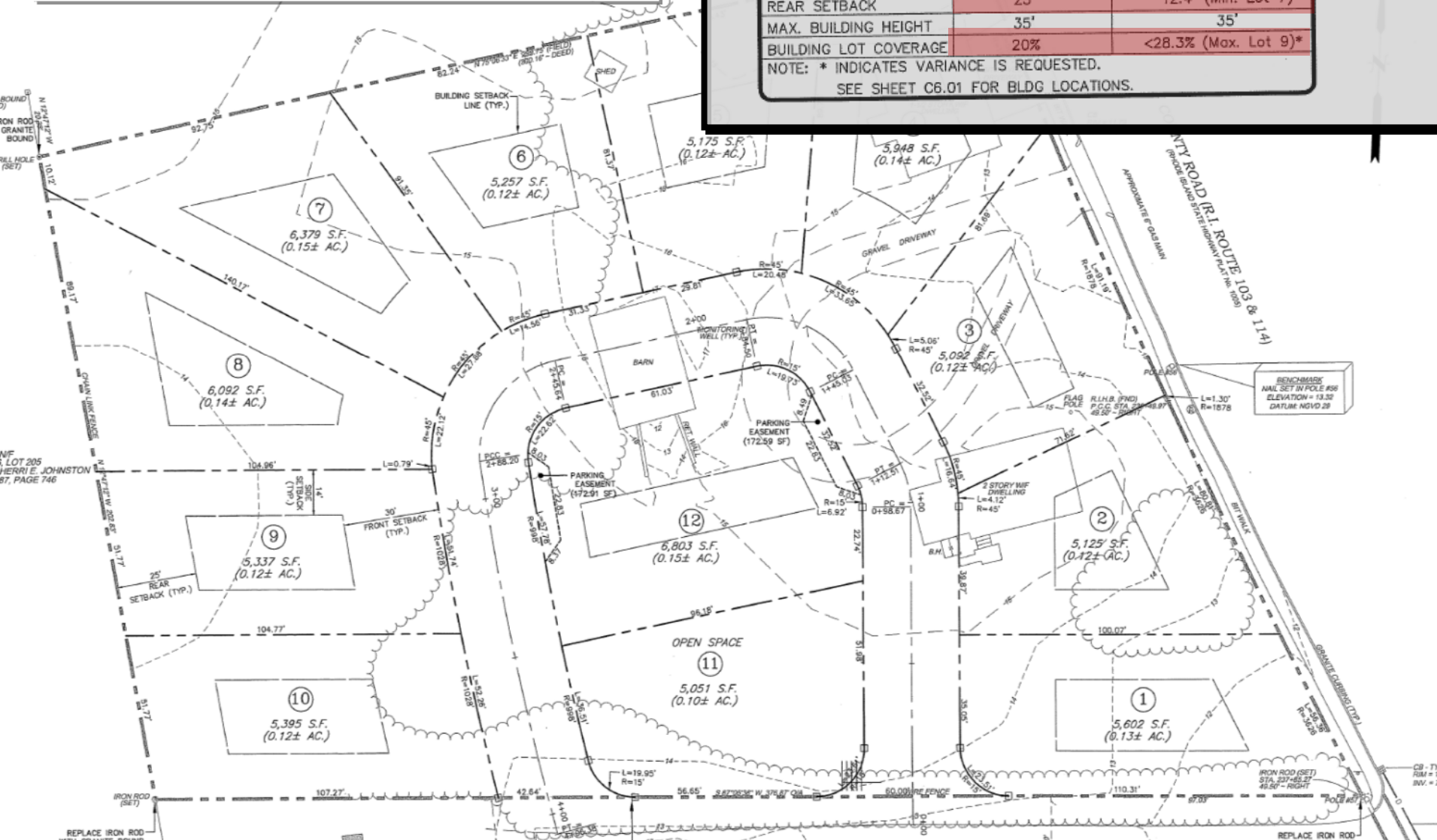
## ZONING TABLE

ZONE: RESIDENTIAL R-25  
USE: SINGLE FAMILY RESIDENTIAL

	REQUIRED	PROPOSED
MINIMUM LOT AREA	25,000 S.F.	5,092±S.F. (Min. Lot 3)*
MINIMUM LOT FRONTAGE	140'	22.9' (Min. Lot 8)*
FRONT SETBACK	30'	18.5' (Min. Lot 4)*
SIDE SETBACK	14'	3.6' (Min. Lot 8)*
REAR SETBACK	25'	12.4' (Min. Lot 7)*
MAX. BUILDING HEIGHT	35'	35'
BUILDING LOT COVERAGE	20%	<28.3% (Max. Lot 9)*

NOTE: \* INDICATES VARIANCE IS REQUESTED.

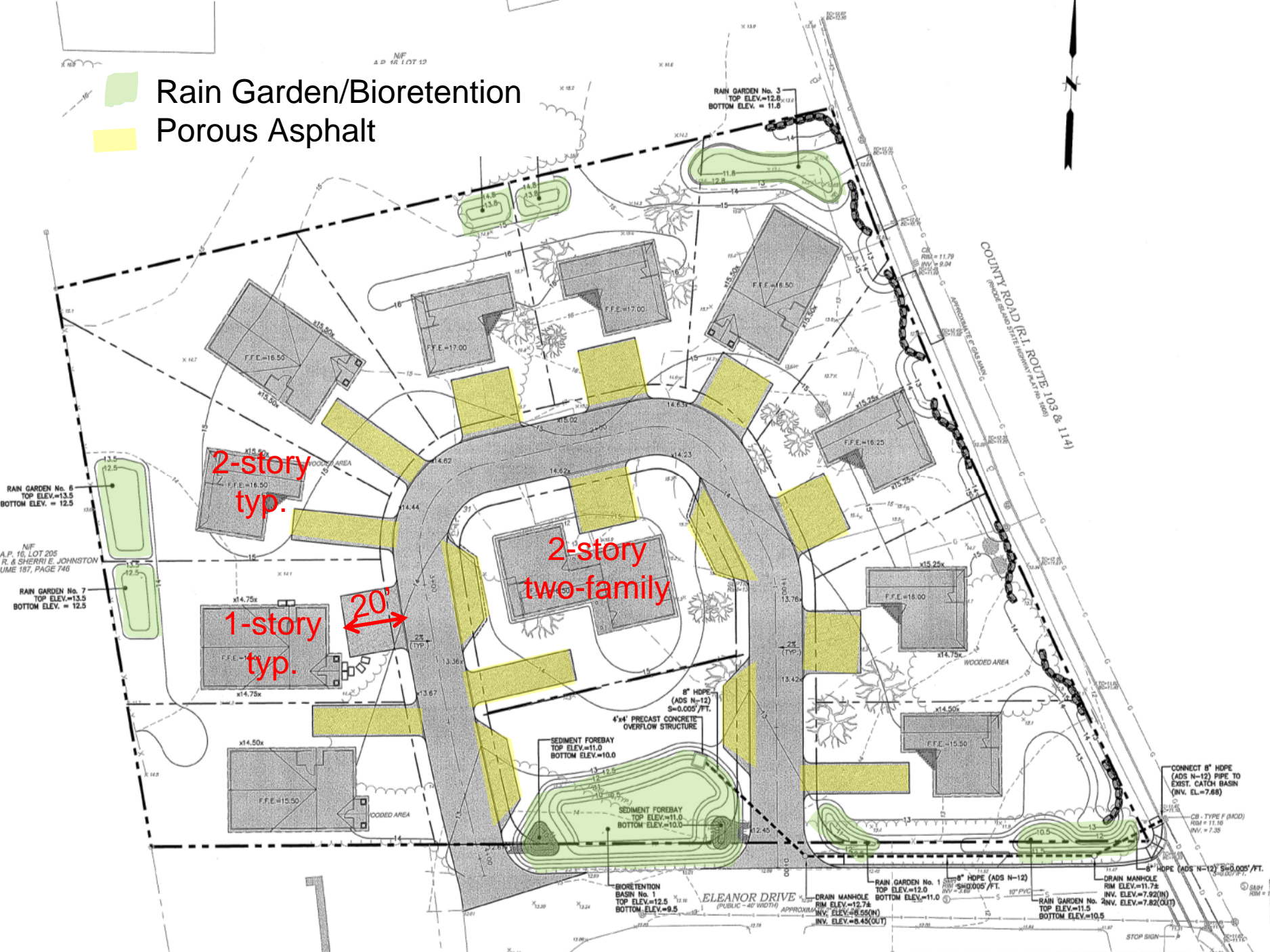
SEE SHEET C6.01 FOR BLDG LOCATIONS.





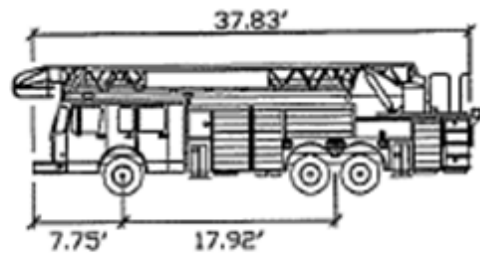


 Rain Garden/Bioretenction  
 Porous Asphalt





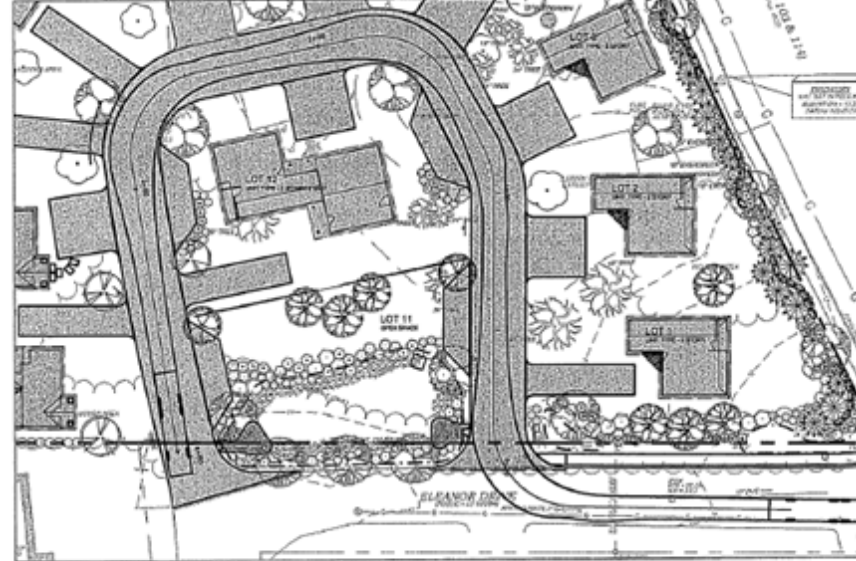
# Proposed Road



## BARRINGTON FIRE TRUCK

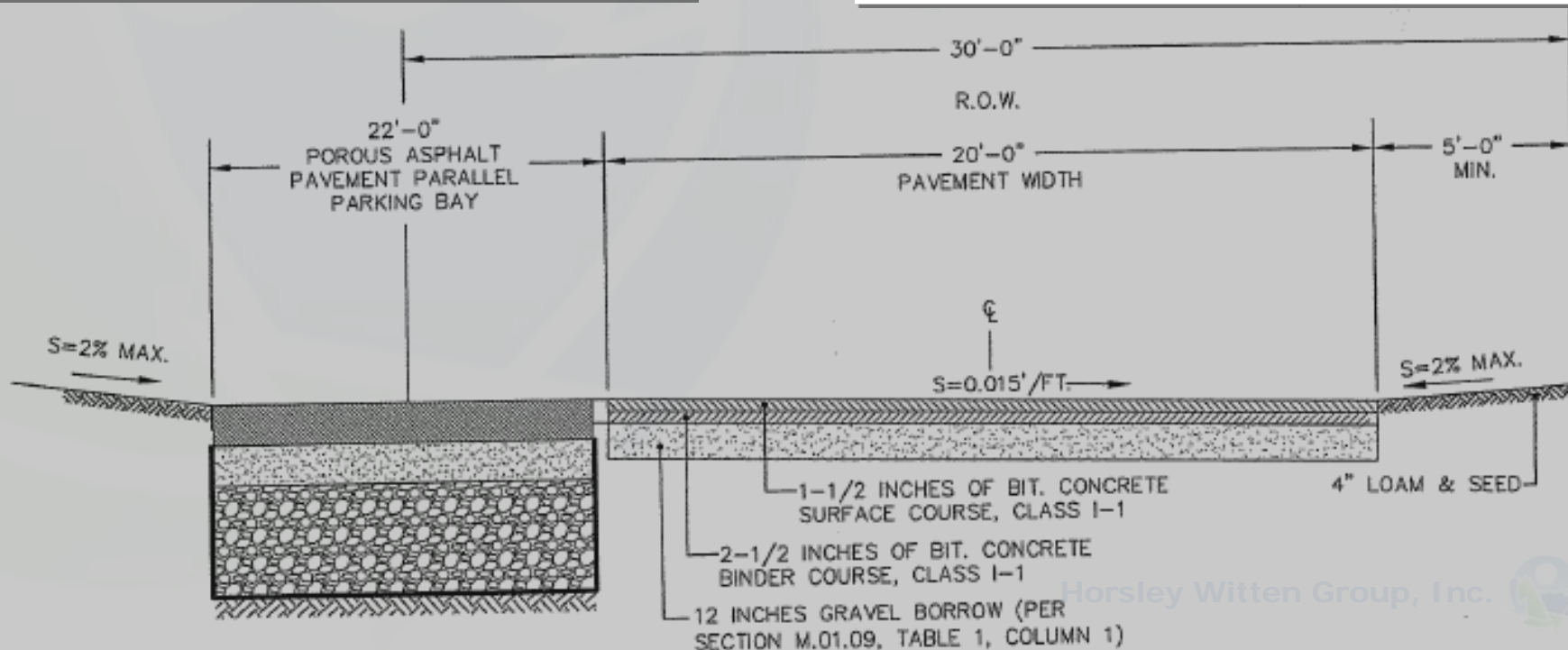
WIDTH : 8.17'  
 TRACK : 8.42'  
 STEERING ANGLE : 34.70°

\*FIRE TRUCK DIMENSIONS ARE FROM MEASUREMENTS TAKEN AT BARRINGTON FIRE DEPARTMENT



## FIRE TRUCK TURNING DETAIL

SCALE 1"=40'



# Stormwater Management

- How is stormwater being managed for recharge and water quality for the proposed project? Are these appropriate BMPs? How is runoff conveyed to each practice and what is the proposed pretreatment?
- *Rain gardens/bioretention, porous asphalt.*
- *Sheet flow from rooftops; cross-sloped roadway to sediment forebays*



# Other Criteria

- Does the project need to provide  $Cp_v$ ?  
What information would we need to determine if the project must provide  $Q_p$ ?
- *No, less than 1 acre of impervious cover.*
- *Receiving water characteristics*
- Does this project fall under the redevelopment standard? Why?
- *No. Existing impervious cover is only 6,500 sf (less than 10,000sf) - detached single-family residential?*



# Porous Asphalt Detail

- What curve number would the designer be allowed to use for the proposed porous asphalt surfaces based on Table 5-5?

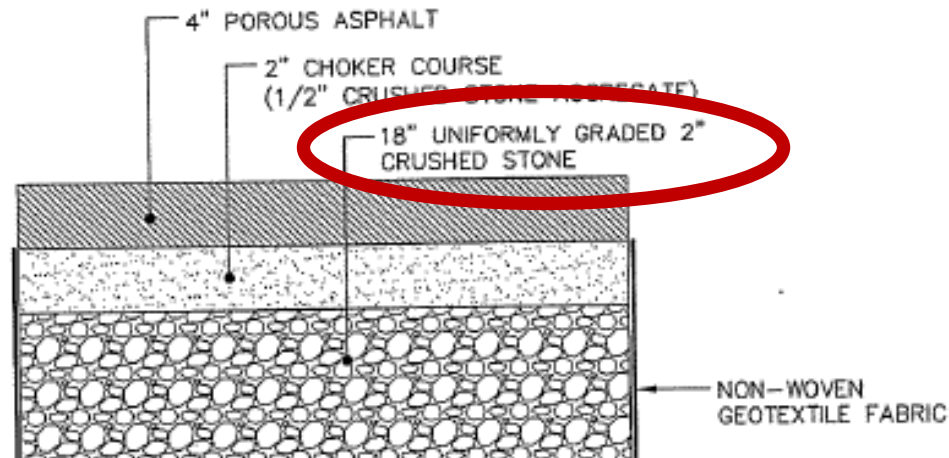


Table 5-5 Curve Numbers for Infiltrating Permeable Pavements (MDE, 2009)

Subbase (inches)	Hydrologic Soil Group			
	A	B	C	D
6	76	84	93	-
9	62	65	77	-
≥12	40	55	70	-



- Based on the proposed porous asphalt locations shown on the plan, does this project meet the required setbacks listed in Table 5-4?

- Not enough information provided*

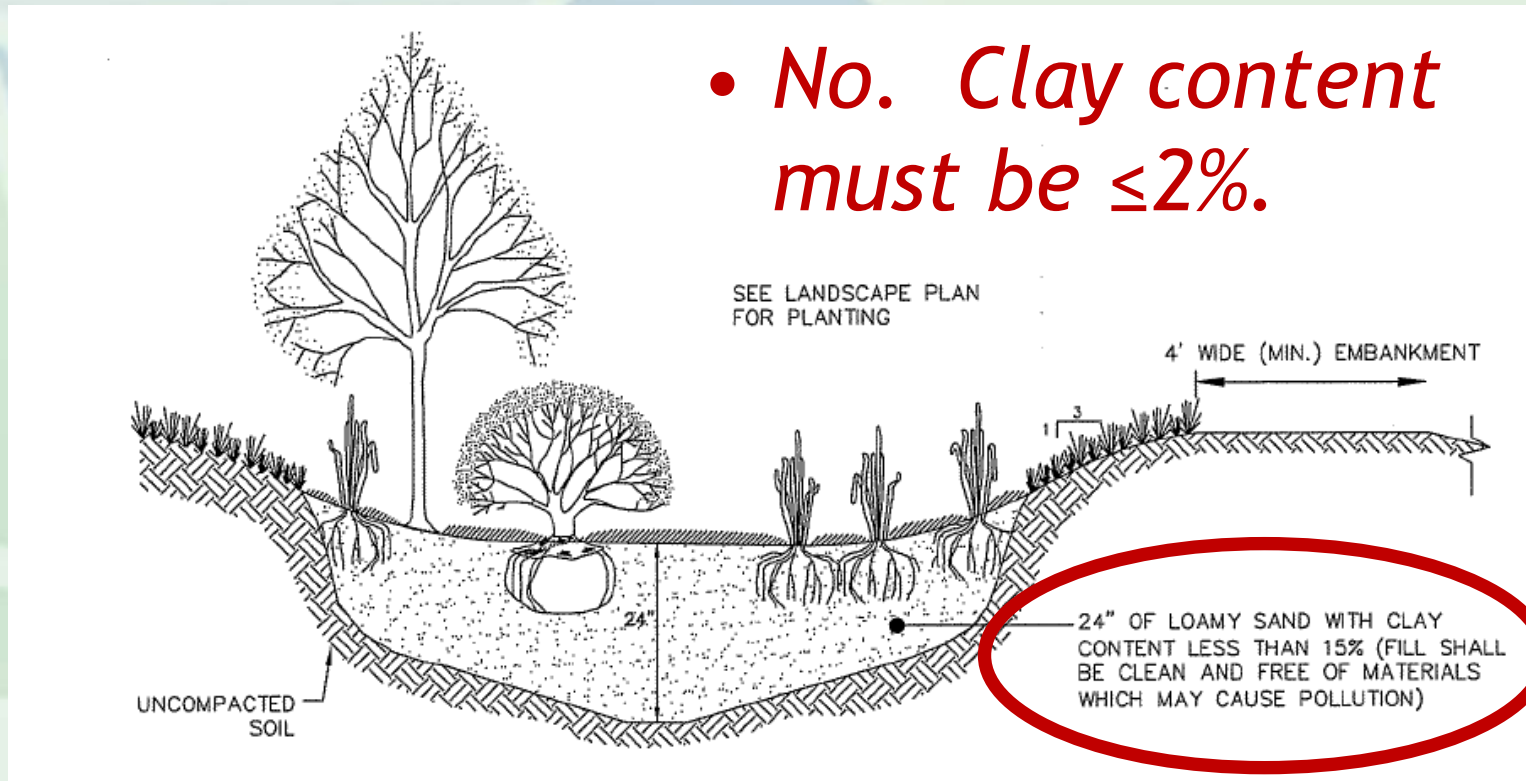
	Minimum Horizontal Setbacks	
	From small-scale facilities serving residential properties OR non-vehicle surface applications (ft)	For all other applications (ft)
Public Drinking Water Supply Well – Gravel Packed, Gravel Developed	400	400
Private Drinking Water Wells	25	100
Surface Water Drinking Water Supply Impoundment* with Supply Intake	100	200
Tributaries that Discharge to the Surface Drinking Water Supply Impoundment*	50	100
Coastal Features	50	50
All Other Surface Waters	50	50
Up-gradient from Natural slopes $\geq 15\%$	25	50
Down-gradient from Building Structures**	10	25
Up-gradient from Building Structures**	10	50
Onsite Wastewater Treatment Systems (OWTS)	15	25

\*Refer to DEM Onsite Wastewater Treatment System Rules Figure 14-16 for maps of the drinking water impoundments.

\*\*Setback does not apply where basement or slab is at or above the surface elevation of the permeable pavement.

# Bioretention/Rain Garden Detail

- Would the proposed soil mix be allowed under the revised manual? If not, how should it be revised based on Section 5.5.4.



- *No. Clay content must be  $\leq 2\%$ .*



# 1. Strategies to Avoid the Impacts

## A. Preservation of Undisturbed Areas

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Limits of disturbance clearly marked on all construction plans.
- Mapped soils by Hydrologic Soil Group (HSG).
- Building envelopes avoid steep slopes, forest stands, riparian corridors, HSG D soils, and floodplains.
- New lots, to the extent practicable, have been kept out of freshwater and coastal wetland jurisdictional areas.
- Important natural areas (i.e., undisturbed forest, riparian corridors, and wetlands) identified and protected with permanent conservation easement.
- Percent of natural open space calculation is provided.
- Other (describe):

Explain constraints when a strategy is applied and/or proposed alternatives in space below:

4 trees preserved with dripline protection

Soils mapped

But wooded areas not preserved, space limitations (0% natural open space preserved)

## B. Preservation of Buffers and Floodplains

Not Applied or N/A. Use space below to explain why:

Select from the following:

- Applicable vegetated buffers of coastal and freshwater wetlands and perennial and intermittent streams have been preserved, where possible.
- Limits of disturbance included on all construction plans that protect applicable buffers
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

No jurisdictional resources on lot

**C. Minimized Clearing and Grading**

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Site fingerprinting to extent needed for building footprints, construction access and safety (i.e., clearing and grading limited to 15 feet beyond building pad or 5 feet beyond road bed/shoulder).
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

Whole site to be cleared except for 4 large trees

**D. Locating Sites in Less Sensitive Areas**

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- A site design process, such as conservation development, used to avoid or minimize impacts to sensitive resources such as floodplains, steep slopes, erodible soils, wetlands, hydric soils, surface waters, and their riparian buffers.
- Development located in areas with least hydrologic value (e.g., soil groups A and B)
- Development on steep slopes, grading and flattening of ridges has been avoided to the maximum extent practicable.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

No steep slopes, Type A soils throughout

**E. Compact Development**

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- A site design technique (e.g., conservation development) used to concentrate development to preserve as much undisturbed open space as practicable and reduce impervious cover.
- Reduced setbacks, frontages, and right-of-way widths have been used where practicable.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

Waivers were requested for reduced setbacks, frontages, and ROWs



**F. Work with the Natural Landscape Conditions, Hydrology, and Soils**

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Stormwater management system mimics pre-development hydrology to retain and attenuate runoff in upland areas (e.g., cuts and fills limited and BMPs distributed throughout site; trees used for interception and uptake).
- The post-development time of concentration ( $t_c$ ) should approximate pre-development  $t_c$ .
- Flow velocity in graded areas as low as practicable to avoid soil erosion (i.e., slope grade minimized). Velocities shall not exceed velocities in Appendix B, Table B-2.
- Plans show measures to prevent soil compaction in areas designated as Qualified Pervious Areas (QPAs) for better infiltration.
- Site designed to locate buildings, roadways and parking to minimize grading (cut and fill quantities)
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

Rain gardens throughout for roof runoff, some trees retained, low slopes

**2. Strategies to Reduce the Impacts**

**Reduce Impervious Cover**

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Reduced roadway widths
- Reduced sidewalk area
- Other (describe):
- Reduce driveway areas
- Reduced cul-de-sacs
- Reduced building footprint
- Reduced parking lot area

Explain constraints and/or proposed alternatives in space below:

Waivers requested for road widths, sidewalks. Porous asphalt used. Some bldgs 2-story. But some driveways could be shared, more parking than req'd.

**3. Strategies to Manage the Impacts**

**A. Disconnecting Impervious Area**

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Impervious surfaces have been disconnected to QPAs to the extent possible.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

Roofs directed overland to rain gardens, driveways pervious.

## LID Site Planning and Design Checklist

### B. Mitigation of Runoff at the point of generation

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- Roof runoff has been directed to a QPA, such as a yard or vegetated area.
- Roof runoff has been directed to a lower impact practice such as a rain barrel or cistern.
- A green roof has been designed to reduce runoff.
- Small-scale BMPs applied at source.
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

Rain gardens

### C. Stream/Wetland Restoration

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- Historic drainage patterns have been restored by removing closed drainage systems and/or restoring degraded stream channels and/or wetlands.
- Removal of invasive species.
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

No streams or wetlands on site



#### D. Reforestation

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- Low maintenance, native vegetation has been proposed.
- Trees are proposed to be planted or conserved to reduce runoff volume, increase nutrient uptake, and provide shading and habitat.
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

Plantings throughout site in rain gardens/bioretentions \_\_\_\_\_

Trees proposed on site \_\_\_\_\_

#### E. Source Control

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- Source control techniques such as street sweeping or pet waste management have been proposed.
- Other (describe):

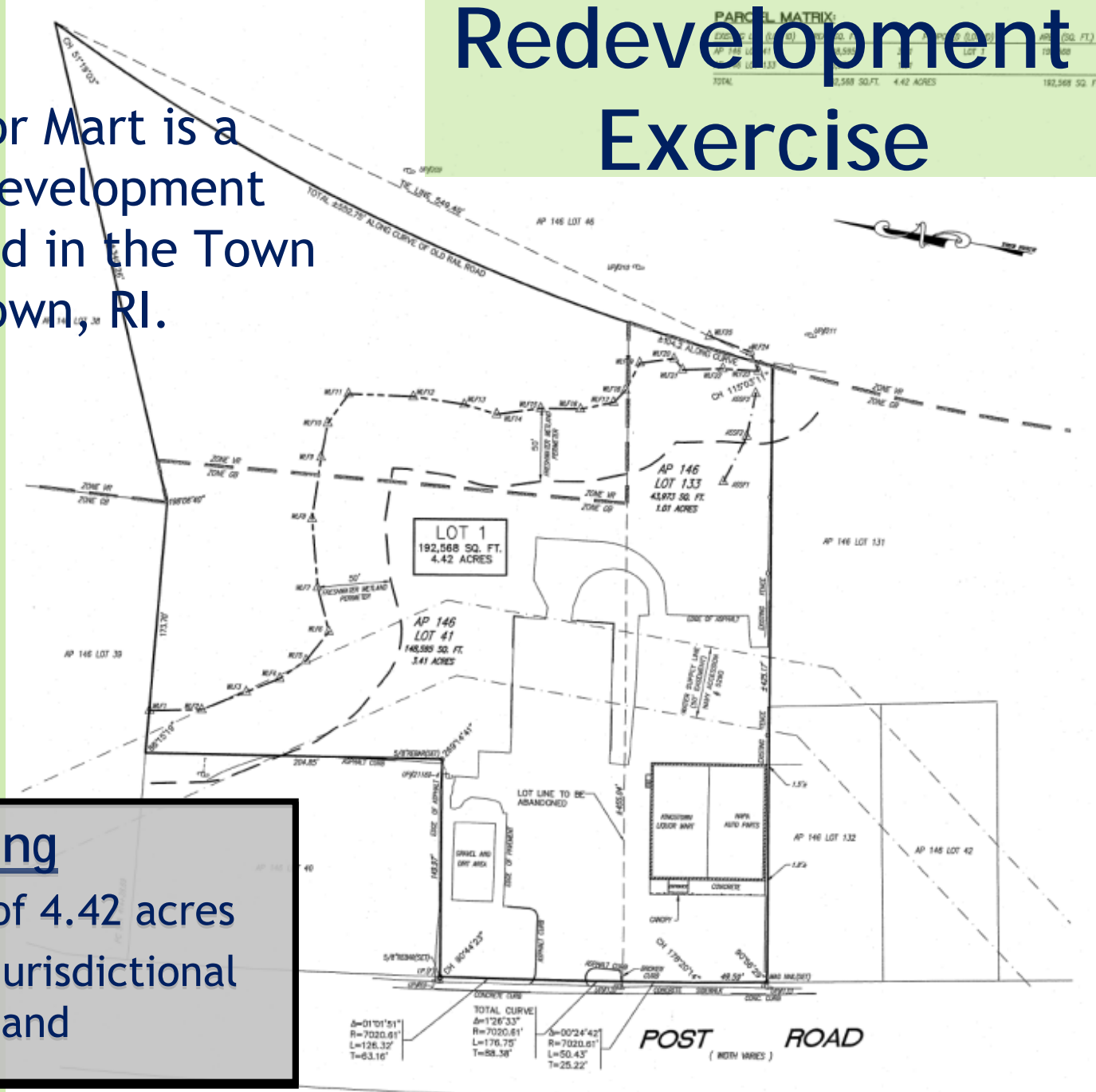
*Explain constraints and/or proposed alternatives in space below:*

Unknown. \_\_\_\_\_

Ideas? Street sweeping, lawn maintenance education, pet waste education, car washing/maint education (porous driveways) \_\_\_\_\_

# Redevelopment Exercise

Kingstown Liquor Mart is a commercial redevelopment project proposed in the Town of North Kingstown, RI.

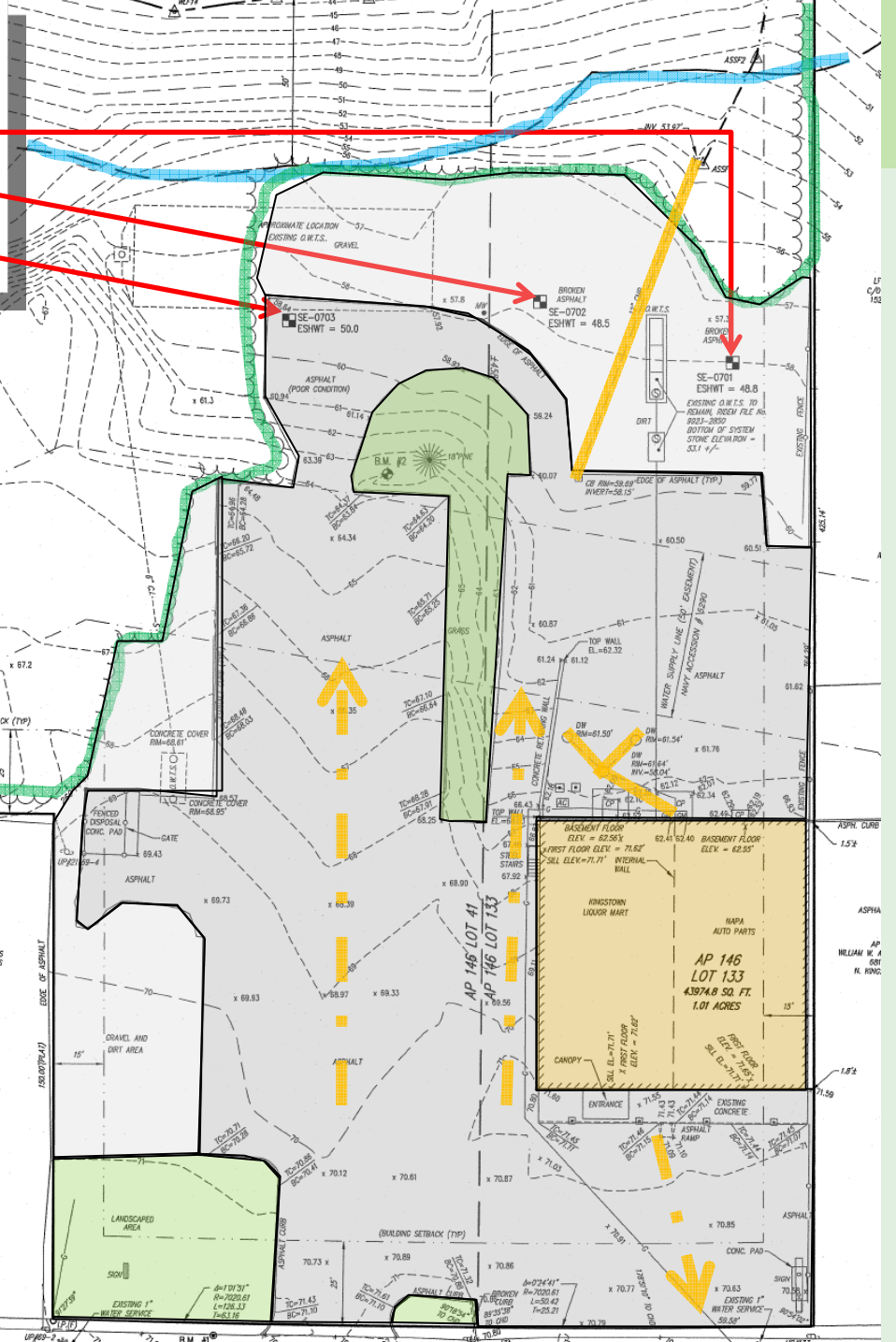
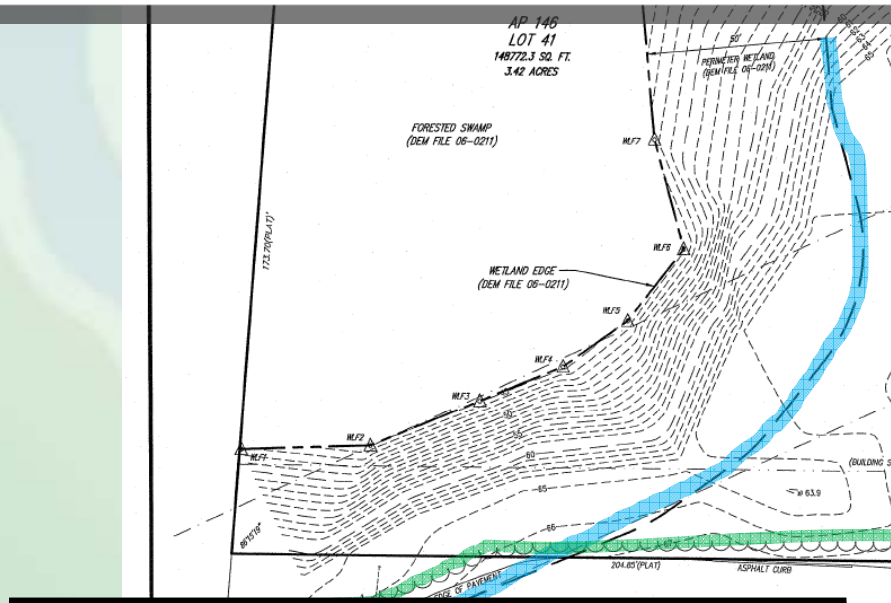


## Existing

- 2 lots, total of 4.42 acres
- 2.4 acres of jurisdictional wetland



SOIL EVALUATION	DATE	ELEVATION	SEASONAL HIGH GROUNDWATER ELEVATION
SE-0701	5-8-07	58.0	48.8
SE-0702	5-8-07	57.8	48.5
SE-0703	5-8-07	59.0	50.0



## Existing - cont'd

- 1.5 acres of disturbed area;
- 1.2 acres of impervious cover (buildings, parking, and gravel/broken asphalt areas);
- Served by on-site septic



## OFF STREET PARKING AND LOADING REQUIREMENTS

	REQUIRED	PROPOSED
PARKING (CODE: SECTION 21-272) LOADING (CODE: SECTION 21-273)		
RETAIL: OVER 1,500 SF OF GROSS FLOOR AREA (GFA), ONE FOR EACH 225 SF OF GFA: $11,300 \text{ SF} / 225 \text{ SF} = 50.22$	51 SPACES	56 SPACES
OFFICE: OFFICE BUILDINGS, INCLUDING MEDICAL AND DENTAL ONE FOR EACH 250 SF OF OFFICE FLOOR AREA: $3,200 \text{ SF} / 250 \text{ SF} = 12.80$	13 SPACES	13 SPACES
REGULAR PARKING SPACES	61 SPACES	66 SPACES
ACCESSIBLE: 3 PER 51-75 SPACES PROVIDED	3 SPACES	3 SPACES
TOTAL PARKING SPACES	64 SPACES	69 SPACES
OFF STREET LOADING SPACES: 8,000-25,000 SF OF BUILDING FLOOR AREA	2 SPACES	2 SPACES

NOTE: SEE ARCHITECTURAL PLANS FOR THE ACTUAL BUILDING DIMENSIONS.



# Question 1

Which category of redevelopment does this project fall under?

< 40% impervious area or  $\geq$  40% impervious area

- $\geq$  40% impervious area.  $1.2 \text{ ac} / (4.42 \text{ ac} - 2.4 \text{ ac}) = 59.4\%$
- *“When calculating site size, jurisdictional wetland areas and undeveloped lands protected by conservation easements should be subtracted from the total site area.”* Page 3-5



# Question 2

- What are the redevelopment requirements based on the category?
- *For redevelopment sites with 40% or more existing impervious surface coverage, only Standards 2, 3, and 7-11 must be addressed.  
Page 3-5*
- For meeting Standards 2 and 3, must manage 50% (reduction in imp. area, BMPs, LID, combo)



# Question 2 cont'd

- Based on the type of stormwater BMPs proposed, would this project meet Standards 2 and 3? If not, how would you change the design to meet them at this site?
- No. Detention basins are not an approved WQ BMPs, and do not provide recharge.
- Infiltration for roof runoff, bios integrated in front/parking lots, other LID techniques

# Question 3

- Based only on the type of project (redevelopment vs. new development), does this project need to meet Standard 5 (Overbank Flood Protection)? Why?
- Yes.  $1.4 - 1.2 \text{ acres} = 0.2 \text{ acres}$  of new impervious cover. Must meet all standards for the 0.2 acres.

# Question 4

- What other information not included in the project summary do we need to know?
- History of past flooding or contamination problems
- Receiving water characteristics
- Soil information
- Other restrictions at site?



# 1. Strategies to Avoid the Impacts

## A. Preservation of Undisturbed Areas

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Limits of disturbance clearly marked on all construction plans.
- Mapped soils by Hydrologic Soil Group (HSG).
- Building envelopes avoid steep slopes, forest stands, riparian corridors, HSG D soils, and floodplains.
- New lots, to the extent practicable, have been kept out of freshwater and coastal wetland jurisdictional areas.
- Important natural areas (i.e., undisturbed forest, riparian corridors, and wetlands) identified and protected with permanent conservation easement.
- Percent of natural open space calculation is provided.
- Other (describe):

Explain constraints when a strategy is applied and/or proposed alternatives in space below:

**LOD is clearly marked. However, the site should have been designed to protect more of the trees in the buffer area. HSG should also be mapped.**

## B. Preservation of Buffers and Floodplains

Not Applied or N/A. Use space below to explain why:

Select from the following:

- Applicable vegetated buffers of coastal and freshwater wetlands and perennial and intermittent streams have been preserved, where possible.
- Limits of disturbance included on all construction plans that protect applicable buffers
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

**While the proposed site is shown to stay completely out of the regulated buffer, is this feasible as shown?**

**C. Minimized Clearing and Grading**

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Site fingerprinting to extent needed for building footprints, construction access and safety (i.e., clearing and grading limited to 15 feet beyond building pad or 5 feet beyond road bed/shoulder).
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

Proposed site utilizes all available upland for development and stormwater basin.

**D. Locating Sites in Less Sensitive Areas**

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- A site design process, such as conservation development, used to avoid or minimize impacts to sensitive resources such as floodplains, steep slopes, erodible soils, wetlands, hydric soils, surface waters, and their riparian buffers.
- Development located in areas with least hydrologic value (e.g., soil groups A and B)
- Development on steep slopes, grading and flattening of ridges has been avoided to the maximum extent practicable.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

Proposed construction directly abuts wetland buffer

**E. Compact Development**

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- A site design technique (e.g., conservation development) used to concentrate development to preserve as much undisturbed open space as practicable and reduce impervious cover.
- Reduced setbacks, frontages, and right-of-way widths have been used where practicable.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

Not applied



**F. Work with the Natural Landscape Conditions, Hydrology, and Soils**

**X** Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Stormwater management system mimics pre-development hydrology to retain and attenuate runoff in upland areas (e.g., cuts and fills limited and BMPs distributed throughout site; trees used for interception and uptake).
- The post-development time of concentration ( $t_c$ ) should approximate pre-development  $t_c$ .
- Flow velocity in graded areas as low as practicable to avoid soil erosion (i.e., slope grade minimized). Velocities shall not exceed velocities in Appendix B, Table B-2.
- Plans show measures to prevent soil compaction in areas designated as Qualified Pervious Areas (QPAs) for better infiltration.
- Site designed to locate buildings, roadways and parking to minimize grading (cut and fill quantities)
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

Site plan does not utilize natural stormwater management techniques.

**2. Strategies to Reduce the Impacts**

**Reduce Impervious Cover**

**X** Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Reduced roadway widths
- Reduced driveway areas
- Reduced building footprint
- Reduced sidewalk area
- Reduced cul-de-sacs
- Reduced parking lot area
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

No impervious reductions obvious. Could consider reducing parking spaces, widths of drive aisles.

**3. Strategies to Manage the Impacts**

**A. Disconnecting Impervious Area**

**X** Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Impervious surfaces have been disconnected to QPAs to the extent possible.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

All imp cover on site directly connected to basin. Should consider breaking up drainage areas to small-scale practices throughout.

## LID Site Planning and Design Checklist

### B. Mitigation of Runoff at the point of generation

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- Roof runoff has been directed to a QPA, such as a yard or vegetated area.
- Roof runoff has been directed to a lower impact practice such as a rain barrel or cistern.
- A green roof has been designed to reduce runoff.
- Small-scale BMPs applied at source.
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

Roof runoff used to be directed to drywells – now straight to detention basin

### C. Stream/Wetland Restoration

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- Historic drainage patterns have been restored by removing closed drainage systems and/or restoring degraded stream channels and/or wetlands.
- Removal of invasive species.
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

Unknown



**D. Reforestation**

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- Low maintenance, native vegetation has been proposed.
- Trees are proposed to be planted or conserved to reduce runoff volume, increase nutrient uptake, and provide shading and habitat.
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

Very little vegetation proposed.

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**E. Source Control**

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- Source control techniques such as street sweeping or pet waste management have been proposed.
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

Unknown.

Ideas? Street sweeping, snow management plan

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