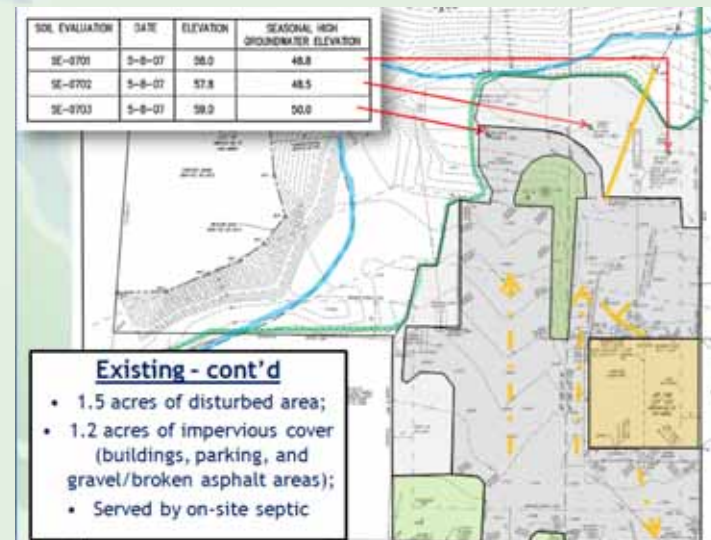# Rhode Island Stormwater Design and Installations Standards Manual

Public Workshop
Case Study:
Redevelopment/Infill –
Compliance with the new
Standards
March 22, 2011

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

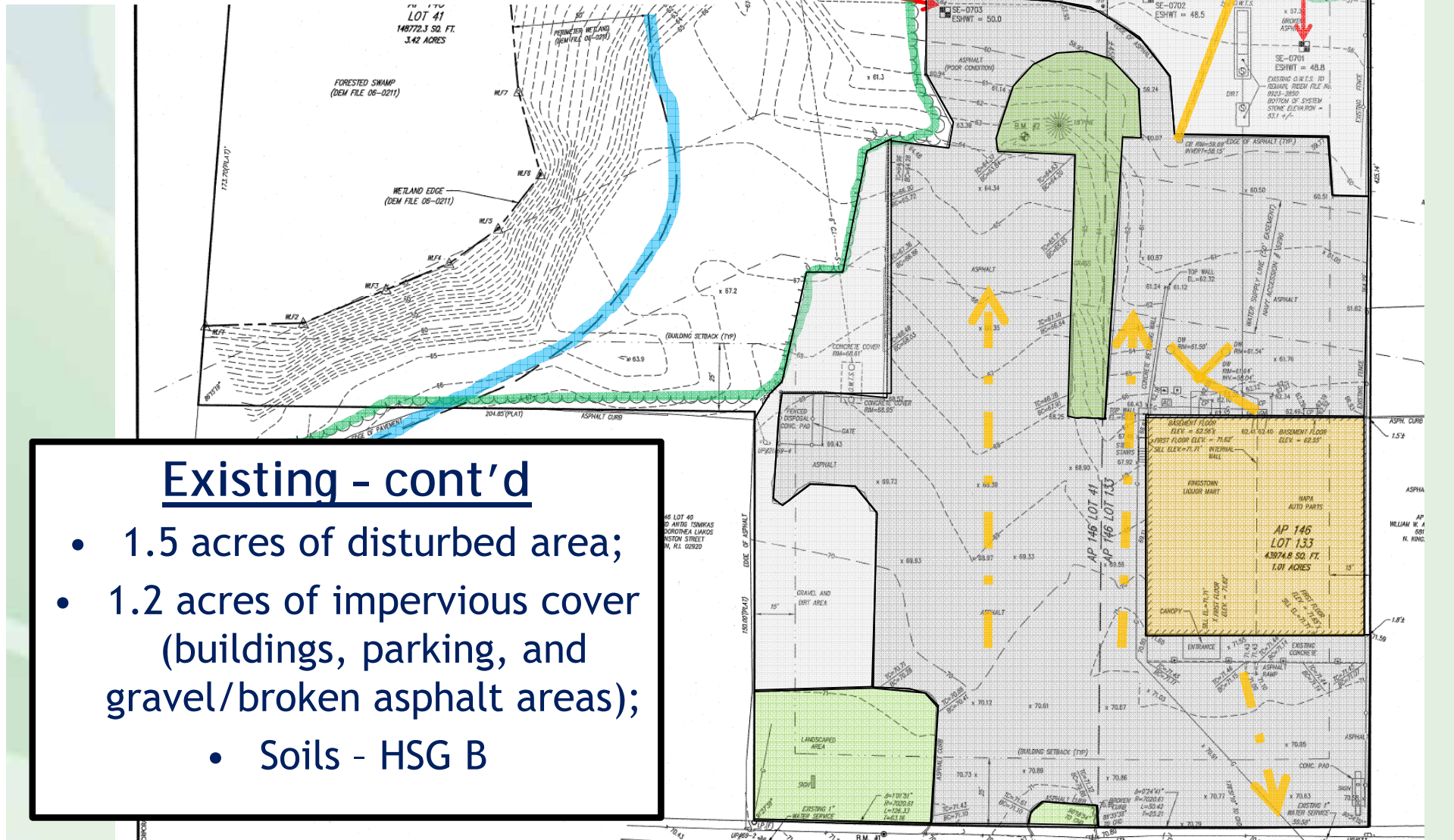Horsley Witten Group, Inc.

Redevelopment Project

Kingstown Liquor Mart is a commercial redevelopment project proposed in the Town of North Kingstown, RI.
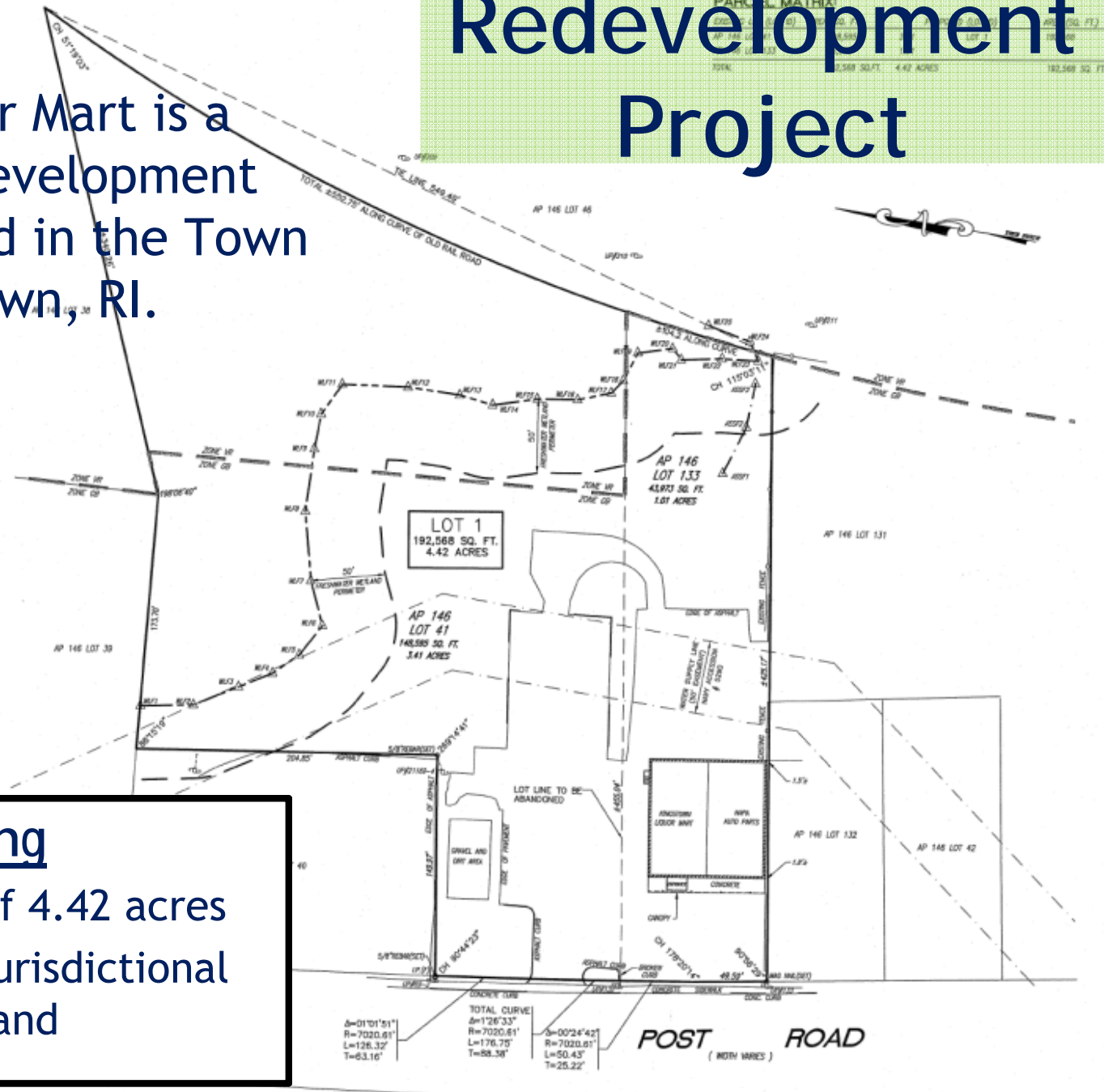
Existing
- 2 lots, total of 4.42 acres
- 2.4 acres of jurisdictional wetland

| 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);
  - Soils – HSG B

Proposed

- 1 lot, total of 4.42 acres;
- 2.4 acres of jurisd. wetland;
- 1.9 acres of disturbed area;
- 1.4 acres of impervious cover (buildings, parking);
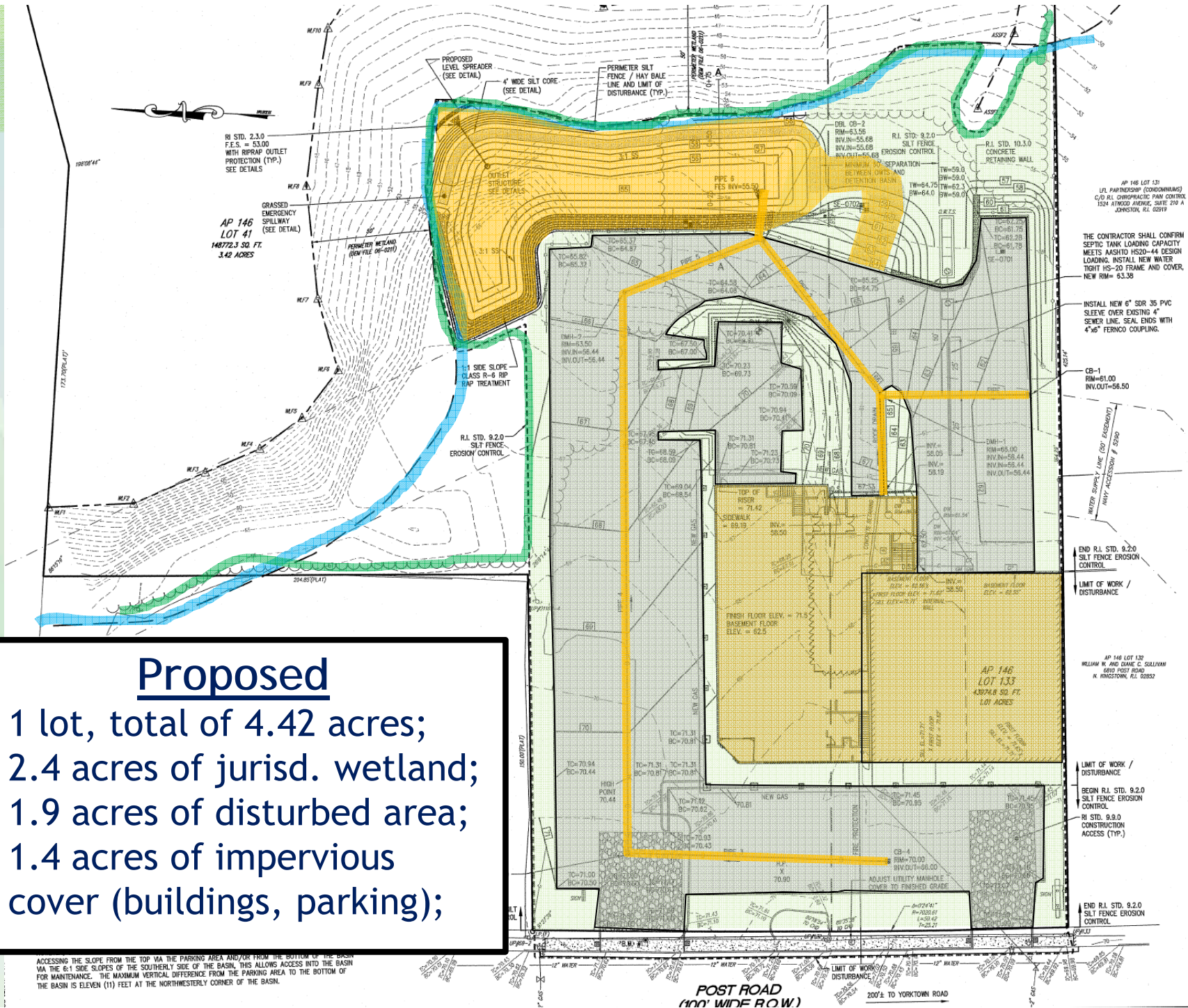
OFF STREET PARKING AND LOADING REQUIREMENTS

	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 SF/225 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 SF/250 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.

Other Options?

- How can it be redesigned to meet the requirements in the revised manual?

RHODE ISLAND STORMWATER DESIGN AND INSTALLATION STANDARDS MANUAL

DECEMBER 2010

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT AND

C R M C COASTAL RESOURCES MANAGEMENT COUNCIL

Horsley Witten Group, Inc.
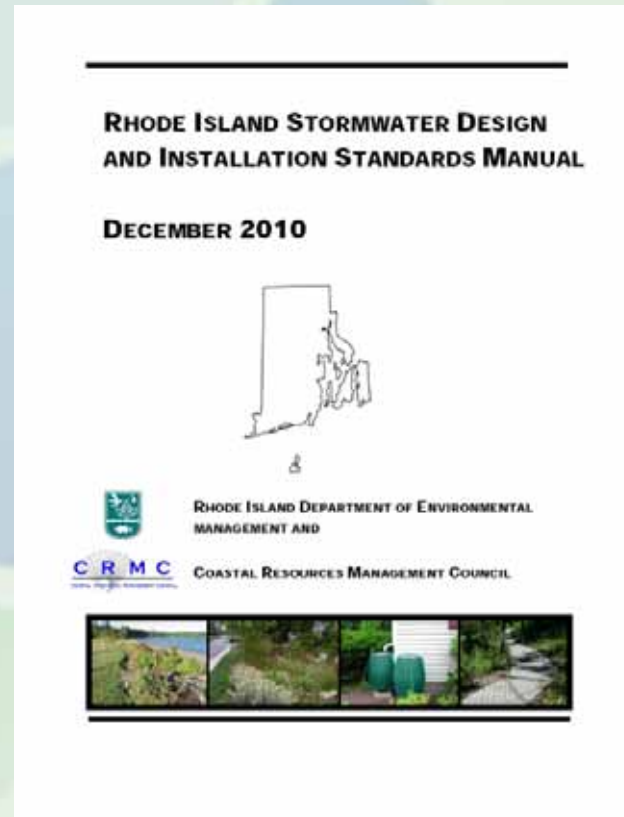
Determine Required Sizing Criteria

1. Which category of redevelopment does this project fall under?

 < 40% impervious area or ≥ 40% impervious area

- ≥ 40% impervious area. 1.2ac / (4.42 ac - 2.4 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

Horsley Witten Group, Inc.

Redevelopment Criteria

- 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

Redevelopment Options

- Reduce existing impervious area by at least 50%; or

- Use LID techniques for at least 50% of area; or

- Use BMPs (Chapt. 3) to provide recharge and water quality management for at least 50% of area; or

- Any combination of impervious area reduction, other LID techniques, or BMPs for at least 50% of area.

*If none of the above are feasible, alternatives may be proposed that achieve an equiv. pollutant reduction (e.g., treating more of redev. area by BMPs with lesser pollutant removal efficiency than stipulated in Standard 3).

Determine Required Sizing Criteria

- Based on the type of stormwater BMPs proposed, would this project meet Standards 2 and 3?

- No and Maybe. Detention basins do not provide recharge, but may be used to meet WQv in redevelopment cases if:
  - Manage >50% of existing runoff
  - Designed to meet extra criteria on pg.7.4.

Horsley Witten Group, Inc.

- Standard 3 requires 85% TSS, 30% TP/TN, 60% Bacteria.

- Under Redev., only treating 50% of total load. Thus, 43% TSS, 15% TP/TN, 30% Bacteria.

- Dry Basin for 100% of site – 50% TSS, 20% TP/TN, 35% Bacteria.

Using Basins for Additional Pollutant Loading Reduction

In order to use the removal rates for basins as listed in Appendix H.3 (Pollutant Loading Analyses) Table H-4, the following design criteria must be met.

Pretreatment
Required Elements
- Each basin shall have a sediment forebay or equivalent upstream pretreatment. The forebay shall be sized to contain 10% of the water quality volume (WQ_v) sized per Chapter 6. The forebay storage volume counts toward the total WQ_v requirement.

Treatment
Required Elements
- The minimum detention time for the WQ_v shall be 24 hours.
- Storage for the channel protection volume (CP_v) and the WQ_v shall be computed and routed separately (i.e., the WQ_v cannot be met simply by providing CP_v storage for the one-year storm).
- Provide water quality treatment storage to capture the computed WQ_v from the contributing drainage area through a combination of permanent pool and extended detention, as outlined in Table 7-1.

Table 7-1. Minimum Required Storage Volumes for Basins Used for Enhanced Pollutant Removal

Design Variation	%WQ_v	
	Permanent Pool	Extended Detention
Dry Extended Detention Basin	20% min.	80% max.
Wet Extended Detention Basin	50% min.	50% max.

Design Guidance
- Water quality storage can be provided in multiple cells. Performance is enhanced when multiple treatment pathways are provided by using multiple cells, longer flowpaths, high surface area to volume ratios, complex microtopography, and/or redundant treatment methods (combinations of pool, extended detention, and shallow water).

Minimum Basin Geometry
Required Elements
- The minimum length to width ratio for a basin shall be 1.5:1 (i.e., length relative to width).
- Provide a minimum Drainage Area: Surface Area Ratio of 75:1.
- Incorporate an aquatic bench that extends up to 15 feet inward from the normal edge of water, has an irregular configuration, and a maximum depth of 18 inches below the normal pool water surface elevation (see Figure 5-5).

Design Guidance
- To the greatest extent possible, maximize flow path through the system, and design basins with irregular shapes.

Standards 4 and 5?

- Does this project need to meet Standards 4 (Channel Protection) and 5 (Overbank Flood Protection)?

- 1.4 – 1.2 acres = 0.2 acres of new impervious cover. Must meet all standards for the 0.2 acres.

- 0.2 acres < 1 acre. Cp_v is waived.

- For Q_p, provide peak flow attenuation, comparing proposed to existing

Horsley Witten Group, Inc.

Required Volume Calcs

- Compute required Re_v, Redev.

$$50\% \ Re_v = [(1") \ (F) \ (I)] \ / \ 12 * 50\%$$
$$= [(1") \ (0.35) \ (1.2 \ ac)] \ (1ft/12in) * 50\%$$
$$= \underline{0.0175 \ ac\text{-}ft = \mathord{\sim}760 \ cf}$$

- Compute required Re_v, New dev.

$$Re_v = [(1") \ (F) \ (I)] \ / \ 12$$
$$= [(1") \ (0.35) \ (0.2 \ ac)] \ (1ft/12in)$$
$$= \underline{0.006 \ ac\text{-}ft = \mathord{\sim}260 \ cf}$$

- **Total required recharge volume = 1,020 cf**

Required Volume Calcs

- Compute WQ_v, Redev.

  50% WQ_v = [(1") (I)] / 12 * 50%

            = [(1")(1.2 ac)] (1ft/12in) * 50%

            = <u>0.05 ac-ft = ~2,200 cf</u>

- Compute WQ_v, New dev.

  WQ_v = [(1") (I)] / 12

        = [(1")(0.2 ac)] (1ft/12in)

        = <u>0.017 ac-ft = ~740 cf</u>

- Total required water quality volume = 2,940 cf

What BMPs Could be Used?

- For Re_v: Infiltration for roof runoff, bios integrated in front/parking lots, other LID techniques

- For WQ_v: Could use properly design detention basin for the redevelopment portion. Must use an acceptable BMP for area equiv. to new impervious cover. Could count the roof runoff infil., bios integrated in front/parking lots, other LID techniques.

- For Q_p: detention basin or match peaks by site design techniques (e.g., longer t_c).

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

, Inc.

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:

Site plan does not utilize natural stormwater management techniques.

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   ☐ Reduce 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

☒ 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.

oup, Inc.

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.

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

Horsley Witten Group, Inc.