

CHAPTER SIX

ARCHITECTURAL DESIGN

The purpose of the architecture portion of these design guidelines is to provide direction for development of the vertical elements on PAC owned land in order to achieve a built environment based on sustainable design. The building design guidelines contained in this section are designed to create a sense of place on PAC owned land without being overly prescriptive. It is the desire of the PAC to not have a “cookie cutter” environment but also to not have an environment in which the buildings do not articulate to each other.

6.1 ENVIRONMENTAL INTEGRATION

Environmental integration into building design is not only focused on the sustainability initiatives presented in **Chapter 4** but also in understanding how humans and buildings interact with each other. The following design guidelines are designed to bring buildings down to the pedestrian scale through the effective use of building materials.

6.1.1 LEED Design

Use of the Leadership in Energy and Environmental Design (LEED™) standard will be supported and encouraged in the development of sustainable buildings. While Developers are *not required* to submit designs for LEED certification or meet a certain LEED certification level, the PAC does desire to see sustainable initiatives implemented in the design (See **Chapter 4**). Additional sustainable resources for Developers include the Sustainable Aviation Guidance Alliance (SAGA) at www.airportsustainability.org.

6.1.2 Harmony with Natural Setting

Buildings should be in harmony with the natural setting and provide a smooth transition from the natural to the built environment.

Design Strategies

- Keep buildings low and oriented to the contours of the topography.

- Nestle buildings into the landforms with creative land forming to provide earth sheltering.
- Landscaping materials and choices should articulate towards wetlands to provide a smooth transition between wetland areas and landscape.
- Minimize heavy bases and built-up platforms.

6.1.3 Building Clusters

Break down the mass of a larger building into a group of buildings clustered into traditional building compounds or campus to create a sense of community and shelter. Building compounds should be used to create protective enclosure and human scale.

Design Strategies

- Wherever possible, position building entrances to relate to those of other buildings.
- Use buildings to screen and protect major pedestrian areas from winds and noise.
- Position entrances and courtyards to relate to adjacent buildings

6.1.4 Relationships Between Buildings

All buildings should relate visually to one another and be compatible with adjacent buildings.

Design Strategies

- Orient buildings to not obscure views from nearby proposed buildings.
- Assist compatibility by use of similar architectural elements such as window shapes and roof forms, and by similar materials, colors, and textures.
- Plazas, courtyards, and terraces incorporated as public amenities in, or between, new buildings should be designed to be easily accessible and reasonably comfortable for a substantial part of the year.

6.1.5 Visual Interest of Façade

Facades with a high level of visual interest from both auto and pedestrian viewpoints are encouraged. The exterior character of all buildings should enhance pedestrian activity in their immediate vicinities.

Design Strategies

- Design walkways that encourage pedestrian use.
- Avoid locating walkways where users will be subjected to excessive glare from building materials or excessive environmental conditions.

- Design ground floor exteriors of buildings to be “pedestrian-friendly.” Specific design considerations include the following:
 - Use of decorative wall surfaces and landscape materials.
 - Use of muted, modular materials, such as brick and stone.
 - Use of windows that reveal indoor amenities and activities while also providing sufficient security.
 - Avoid use of large expanses of blank walls or mirror glass.

6.2 BUILDING ARCHITECTURE

6.2.1 Building Mass

Buildings should relate to the terrain and each other in their massing and forms. Larger masses should be located at the centers of building compositions, with smaller forms stepping outwards and down.

Integrating this design principal will reduce the “wind tunnel” effect and “canyons” between structures as well as provide sunlight to landscape elements between buildings.

Design Strategies

- Consider breaking very large buildings into modules or sub-parts to reduce perceived scale.
- The building should be low in profile and layered horizontally upon the landscape.
- Avoid tall stand-alone buildings.
- Use landscape materials to reinforce tiered building forms. “Stepped-down approaches” are especially appropriate for breaking up larger structures in excess of 100,000 square feet or those over two stories in height.
- Exterior wall designs should help pedestrians establish a suitable sense of scale when relating to buildings.
- Express the position of each floor in the external skin design, using the following techniques:
 - Terracing, articulated structural elements, or changing building materials.
 - Belt courses, or other horizontal trim bands, of contrasting colors and/ or materials.

6.2.2 Roof Forms

Rooftops should contribute to the visual continuity of PAC owned land and should be considered as design elements from various viewpoints: at ground level, from other buildings, and from adjacent

perimeter roadways. Mixing roof forms on buildings creates variety in the “roofscape.”

Design Strategies

- Roof elements should be simple in form; continuous, horizontal lines should dominate.
- Roof design should facilitate and express the daylighting of the building.
- The roof should appear solidly connected to the building.
- Roofs should reflect heat without creating glare to assure air traffic safety.
- Roofs must be shaped to withstand high winds.
- Clerestories are desirable.
- Consider sloping roof forms, such as gables, hipped roofs, or shed roofs, for all or portions of roof designs. Sloping roof forms at entrances are especially encouraged.
- Consider a combination of roof types. The following techniques are encouraged:
 - Use a mix of roof forms to create variety in the “roofscape.”
 - Portions of roofs may be flat, especially on larger building segments, but some sloping forms should be visible from major viewpoints.
 - Allowable materials for sloping roofs include metal, flat concrete tile, slate or slate-look.
- Roof Equipment:
 - Group and screen equipment from view from the ground.
 - Group exhaust flues and provide architecturally integrated solutions for the screening of process equipment.
 - Equipment should be painted in a color complementary to adjacent roof/ building materials.
 - Consider developing a “green” roof using native grasses.

6.2.3 Walls and Windows

Use walls and windows to emphasize a horizontal view-scape from within the building. This also helps the design to remain sensitive to the low, open setting of the airport environment.

Design Strategies

- Building Base and Wall:
 - Anchor the wall directly to the natural ground form.
 - Avoid creating a heavy building base or platform.
 - The majority of walls should be straight.
 - Emphasize the horizontal through mullion patterns and window alignment.

- Windows/ Openings:
 - Incorporate more extensive windows on the north side to reduce exposure to summer sun
 - Align windows to make a horizontal pattern.
 - Clearly define entries to make them inviting, providing articulation and color for identity and interest.
 - Windows articulated to the southern horizon should incorporate high efficiency glazing and fritting patterns to reduce solar heat gain.
 - Allow natural light to illuminate interior spaces through the use of clerestory windows.

6.2.4 Entrances

Primary entrances should be easily identifiable and relate to human scale. Wherever possible, entrances should contrast strongly with their lighter backgrounds.

Design Strategies:

- Design main entrances to be clearly identifiable as seen from primary driveways and drop-offs.
- Entrances should be designed to read as “contrasting” areas on a building’s façade.
- Use building entranceways as transitions from buildings to the ground. Specific criteria include:
 - Walls, terraces, grading, and plant materials should be incorporated.
 - Terraces or porticos can be used to define and extend entrances.
- Design secondary entrances to connect to pedestrian circulation systems. These entrances should be visible from parking areas. They may also be more subdued than primary entrances, and need not demonstrate the same characteristics.

6.2.5 Interior Spaces

The buildings should reflect the use of their public interior spaces. The functional use of the buildings should be reflected in the architectural design of the buildings.

6.2.6 Service Areas

Service areas should be visually unobtrusive and integrated with each building’s architecture and site design.

Design Strategies:

- Orient service entrances, loading docks, waste disposal areas, and other similar uses toward service roads and away from primary building entrances.

- Screen service entrances with walls or landscaping. Use materials similar to others employed on the site.
- Wherever possible, coordinate the locations of service areas between adjacent developments so that service drives can be shared.
- Avoid locating service areas where they are visible from adjacent buildings or where they may affect designated view corridors.

6.3 COLOR AND MATERIALS

6.3.1 Continuity

Visual continuity in major building materials is desired throughout PAC owned land. Building materials, finishes, and design elements should respect the character and intent of adjacent buildings constructed in earlier phases and should help to provide a sense of cohesive design.

For air traffic safety, glass with reflective, metallic coatings that increase glare is not allowed. Additionally, cast in place concrete and synthetic insulation/ stucco systems, referred to commonly as Exterior Insulation and Finishing Systems (EIFS) are not allowed unless the Developer can show that the general contractor will use skilled labor in the installation process.

Design Strategies

- Use wall materials that are muted in color and have texture. Specific criteria include the following:
 - Natural matte textures and earth tone colors are encouraged. Textured colored concrete may also be considered.
 - The use of fine textured materials, such as brick, cast stone, tile, and textured block are encouraged. Horizontally textured concrete, stucco and dark metal panels or glass spandrel panels may be suitable if used at a scale visually related to pedestrians.
 - Wood is not appropriate as a primary building material.
- Reserve the use of strongly contrasting materials and colors for accents, such as building entrances, railings, stairs, etc. Avoid an excessive variety of façade materials.
- Use clear or lightly tinted low-e glass (glazing), particularly at pedestrian levels where transparency between indoor and outdoor spaces is desirable.
- Select building materials that will age without reducing aesthetic properties.

- Effectively use light color with a high SRI on areas that are not visible to the public and use materials that will not streak, fade, stain or detract from the natural setting.
- Create a routine maintenance program to maintain high SRI values.

6.3.2 Human Scale Materials

Building materials manufactured in units measurable in human proportions (such as brick, tile, concrete masonry units, and modular stone) should be used whenever possible. Avoid over scaling materials.

Design Strategies

- Use building materials that are familiar in their dimensions and can be repeated in understandable modules.
- Combine building materials in modules that can be visually measured.
- Cast or scored concrete that gives a sense of proportion may be appropriate, as well as conventional modular materials, such as brick or stone.
- Large, uninterrupted surface areas should have a change in articulation through the use of pattern, texture, material, openings, or change in plane.
- Express facade components in ways that help establish building scale.
- Encourage compositions that emphasize floor lines or express rhythms and patterns of windows, columns, and other architectural features.

6.3.3 Colors

Building colors should blend in with the natural surroundings.

Design Strategies

- Color pallet should be compatible with other built structures for visual continuity.
- Use darker colors at the base of walls and lighter colors for the tops of walls.
- Use darker colors or earth tones for expanses of walls, with brighter accents for trim.
- Use neutral roof colors between light and dark, avoiding white or reflective materials.

CHAPTER SEVEN

LANDSCAPING DESIGN

The purpose of the landscape portion of the Design Guidelines is to provide strategies for site development as site landscape is a critical visual element that will define the overall character of PAC owned land. The predominant landscape character is comprised of uplands abutting areas of wetlands. The intent of the landscape guidelines is to minimize adverse effects on the natural environment by using regionally appropriate landscape treatments. Using the landscaping design guidelines will create a continuous landscape character that extends throughout PAC owned land. Developers will be required to depict the landscaping plan at the 30% Design Development review meeting.

7.1 VISUAL BUFFERS

Where utility, service, garbage and/or loading areas face adjacent public streets, and/or open space these facilities are to be thoroughly screened through the use of earth berms integrated with plant material or masonry walls screened by vegetation. The plant material should be a combination of trees and large deciduous shrubs planted in an informal wind row configuration.

7.1.1 Preservation of Existing Vegetation

Retain as much of the existing vegetation as possible in order to maintain the visual image. Preservation measures shall be used to preserve subareas of native wetlands. The Developer shall maintain within proposed the landscaping and green areas any healthy single-stemmed existing deciduous trees of a minimum of six-inch diameter at breast height (DBH) when measured at least 4-feet 6-inches above grade. Additionally, the Developer shall maintain within the proposed landscaping and green areas any healthy multi-stemmed evergreen trees that measure at a minimum eight (8) feet in height.

7.1.1.1 Identification on Plan Sheets

The preserved trees shall be identified by size and variety, clearly marked in the field and shown on the landscaping

plan, erosion and sediment control plan, demolition plan and grading plan.

7.1.1.2 Grouping of Trees

In naturally vegetated areas of one thousand (1,000) square feet or greater, groups of trees rather than single trees may be identified on the plan. Existing tree canopy limits shall be clearly shown on all plans identified in **Section 7.1.1.1**. Within the tree canopy limits shown on the plan(s), an accounting shall be provided stating the minimum quantities, sizes and varieties of trees to remain in each group.

7.1.1.3 Credit for Meeting Landscaping Requirements

Credit will be given towards the landscaping requirement outlined in **Section 7.2.2.2** for preserving any healthy single-stemmed existing deciduous trees of a minimum of six-inch diameter at breast height (DBH) when measured at least 4-feet 6-inches above grade. Credit will also be extended towards the landscaping requirement outlined in **Section 7.2.2.2** for preserving healthy multi-stemmed evergreen trees that measure at a minimum eight (8) feet in height.

7.1.1.4 Deficient Coverage Due to Tree Death

When construction activities result in the death of a preserved tree, or the loss of 50% of the tree canopy; then the Developer is required to replace the tree with a tree of the same size and type as that being lost at the time of the loss with a maximum installation size of three and one-half inches (3.5") DBH for single-stemmed deciduous trees and twelve (12) feet in height for evergreen or multi-stemmed trees.

7.1.1.5 Protection of Trees During Construction

Individual trees and groups of trees that are preserved shall be enclosed by a temporary fence or barrier to be located and maintained five (5) feet outside the dripline of the tree(s) during construction. Such a fence or barrier shall be installed prior to clearing, construction or issuance of a land disturbing permit. The tree protection fencing shall be a minimum of 40-inches in height and sufficient to prevent intrusion in to the area during construction by vehicles. In no case shall vehicles, materials or equipment be stored or stockpiled within the enclosure.

7.1.1.6 Variances

The DRC may allow trees to be removed in the case of hardship in developing the site, or when prohibited by FAA regulations.

7.1.2 Wetland Buffer

A wetland buffer shall be maintained free of the storage of materials and equipment. The wetland buffer is defined as a line that extends 10-feet from the edge of the USCOE jurisdictional determination line towards the interior portion of the parcel.

7.1.3 Grading and Erosion Control

Grading throughout PAC owned land shall reflect the generally flat character of the area. Smooth transitions between parcels and within each individual site will help to create the overall visual character that is desired. Slopes shall be less than 1 foot of rise for every 4 feet of run and shall transition gradually to provide undulations and mimic the natural landscape. Earth berms shall have a maximum slope of 1 foot of rise for every 2 feet of run.

Where necessary, retaining walls shall be integrated into the rolling slopes and hidden below the horizon. High water use turf areas shall be limited to slopes of no more than 1 foot of rise for every 5 feet of run.

Drainage should be left in as natural a condition as possible. Where improvements must be made, they should be accomplished with minimal disturbance. Low flow channels should be natural in configuration and alignment, in order to allow the natural regeneration of wetland plants. Edges shall be treated with plant material indigenous to drainage ways.

7.2 PLANTING ZONES

The regional landscaping context shall be incorporated in each building site. The landscaping plans should provide for a concentric intensity of landscape for each development that provides for the greatest intensity of an introduced horticultural landscape occurring in the immediate vicinity of the building and transitioning back to the natural landscape as the landscape progresses towards the perimeter of the site. It is the PAC's intent that visual continuity with the natural landscape is achieved by utilizing minimal horticultural landscapes.

7.2.1 Planting Zones

Three planting zones have been defined for the building sites where the intensity of landscape treatment reflects the significance of the applicable areas. These zones are:

- Intensive Zone: Areas with the greatest variety of plant materials and the highest irrigation requirements. This zone

is used in areas where a site element is featured or significant design detail is warranted. This includes primary street intersections, primary vehicular entrances, primary building entrances, and high pedestrian use areas.

- **Wetland Zone:** For portions of PAC owned land that abut jurisdictionally determined wetland areas, the landscaping plan should include a transitional zone from the upland landscaping areas to the natural wetland areas. The designer should use the natural attributes of the wetland as a basis upon which to build the design. The colors, textures, variety, and scale of the plant material found in the wetland should be replicated to the extent practicable. No introduced plant species should be located within the wetland buffer defined in **Section 7.1.1**.
- **Transitional Zone:** Areas that provide subtle connections between the Intensive zone and either the wetland buffer zone or upland areas. The design character within this zone needs to provide a gradual transition from the interior landscaping found in the intensive zone to a regionally unique palette on the exterior of each developed area. Areas of special attention include onsite detention, bio swales, low water use turf, parking lot areas, and interior landscape areas. Plant materials within this zone are a unique combination that reflects each adjacent zone. For Transitional Zone areas, 50 percent of the plant material must be from the Transitional Plant Palette List, 25 percent from the Wetlands Plant Palette and 25 percent from either list.

Plant materials that are appropriate for these zones have been listed in **Section 7.3**. Plants from the Wetland Zone may be used in the Intensive Zone and the Transitional Zone but plants from the Intensive Zone may not be used in the Wetland Zone. The contrast and juxtaposition of different design solutions is encouraged, with the intent of coordinating design solutions and integration between adjoining property owners. The objective is to create an overall cohesive appearance on PAC owned land.

7.2.2 Site Coverage

7.2.2.1 Minimum Landscaping Area

Each parcel of PAC owned land shall provide, to the extent practicable, the following minimum landscape areas. For 1-acre parcels, the minimum landscape area shall be equal to 20% of leased space (8,700 square feet). For 2-acre parcels, the minimum landscape area shall be equal to 15% of leased space (13,000 square feet). For 3-acre parcels, the minimum landscape area shall be equal to 15% of leased space (19,600 square feet).

7.2.2.2 Required Tree Coverage

One tree is required per 1,500 square feet of gross building area, including open bay hangar portion of buildings. Should the calculation result in a fraction of a tree, the number of trees provided shall be rounded up to the next nearest whole number. All trees within the landscaping plan shall be planted with a minimum caliper diameter of 2” at breast height. Additional requirements are outlined for parking lots in **Section 7.5**. Trees shall be selected from the approved plant material list located in **Section 7.3**. At least one tree is required along every 30-feet of linear roadway frontage.

7.2.2.3 Substitution of Trees

Each tree up to a maximum of 50 percent of the required number of trees can be substituted with:

- 15 – 5 gallon shrubs OR
- 25 – 1 gallon shrubs OR
- 25 – 1 gallon perennials or ornamental grasses

7.2.2.4 Maximum Intensive Zone Landscaping Area

Intensive zone shall be, at a maximum, 10-percent of the leased parcel size with 50-percent of the required square footage to be located in the immediate vicinity of the building entrance and other pedestrian areas. Parking islands and medians with a minimum dimension of 10 feet can also be counted towards the intensive landscape area requirement. The landscaping plan should place emphasis on the elevations from which the public view of the building is perceived. The landscape treatment of these areas should use Xeriscape and water conservation measures while providing the necessary amenities.

On the ground plane, avoid straight lines between the Intensive, Transitional and Wetland planting zones. This guideline is particularly applicable to open space areas and any setback areas and/or property lines. When parcels adjoin a parcel that is slated for future development, the landscaping plan should provide for the future connection so that there is integration across property lines.

7.2.3 Seasonal Interest

Provide a variety of plant material that is representative of seasonal interest within the intensive planting zone. The plant palette, seasonal interest, and textural qualities of the plant palette within the Transitional Zone should be less intensive and reflect the characteristics of uplands or the wetland buffer zone.

7.3 REGIONALLY APPROPRIATE LANDSCAPE PALLET

7.3.1 Intensive Zone

The Developer is free to choose from any plant species for use within the intensive zone providing that the plant species is conducive to the USDA Hardiness Zone 7 and is a non-invasive species.

7.3.2 Wetland Zone

The Developer shall draw landscaping elements from the following plant pallet. Plant species indicated below are appropriate for use in the wetland or transitional zones for development within PAC owned Land.

Canopy Trees

Red Maple	<i>Acer rubrum</i>
Bald Cypress	<i>Taxodium distichum</i>
White Ash	<i>Fraxinus pensylvanica</i>
Sycamore	<i>Platanus occidentalis</i>
Swamp Chestnut	<i>Quercus michauxii</i>
Pin Oak	<i>Quercus palustris</i>

Small/ Medium Trees

Sweetbay Magnolia	<i>Magnolia virginiana</i>
Canada Serviceberry	<i>Amelanchier arborea</i>
River Birch	<i>Betula nigra</i>

Shrubs

Common Alder	<i>Alnus serrulata</i>
Buttonbush	<i>Cephalanthus occidentalis</i>
Red Osier Dogwood	<i>Cornus sericea</i>
Sweetpire	<i>Itea virginica</i>
Northern Bayberry	<i>Myrica pensylvanica</i>
High Tide Bush	<i>Baccharis halimifolia</i>
Star Anise	<i>Illicium floridana</i>
Winterberry	<i>Ilex verticilla</i>

Small Shrubs/ Grasses

Muhly Grass	<i>Muhlenbergia capillaries</i>
Broomsedge	<i>Andropogon virginicus</i>
Soft Rush	<i>Juncus effuses</i>
Switchgrass	<i>Panicum virgatum</i>

Groundcovers

Cinnamon Fern	<i>Osmunda cinnamonmea</i>
Virginia Chain Fern	<i>Woodwardia virginica</i>
Carolina Jessamine	<i>Gelsemium sempervirens</i>
Virginia Blueflag	<i>Iris virginica</i>

7.3.3 Transitional Zone

The Developer shall draw landscaping elements from the following plant pallet. Plant species indicated below are appropriate for use in the transitional zone for development within PAC owned land.

Canopy Trees

White Oak	<i>Quercus alba</i>
Scarlet Oak	<i>Quercus bicolor</i>
Chestnut Oak	<i>Quercus montana</i>
Tulip Poplar	<i>Liriodendron tulipifera</i>
Sugar Hackberry	<i>Celtis laevigata</i>
Winged Elm	<i>Ulmus alata</i>
Eastern Cedar	<i>Juniperus virginiana</i>

Small/ Medium Trees

Flowering Dogwood	<i>Cornus florida</i>
Cockspur Hawthorne	<i>Crataegus crusgalli</i>
Chinese Fringe	<i>Chionanthus virginicus</i>
American Holly	<i>Ilex opaca</i>
Chinese Redbud	<i>Cercis Canadensis</i>
Yaupon Holly	<i>Ilex vomitoria</i>
Downy Serviceberry	<i>Amelanchier arborea</i>

Shrubs

Witch Hazel	<i>Hamamelis virginiana</i>
Flameleaf Sumac	<i>Rhus copallinum</i>
Southern Arrowwood Viburnum	<i>Viburnum dentatum</i>
Mapleleaf Viburnum	<i>Viburnum acerifolium</i>
Black Haw Viburnum	<i>Viburnum prunifolium</i>
Southern Bayberry	<i>Myrica heterophylla</i>
Summersweet	<i>Clethra ainifolia</i>
Red Chokeberry	<i>Aronia arbutifolia</i>
New Jersey Tea	<i>Ceanothus americanus</i>

Small Shrubs/ Grasses

St. Johns Wort	<i>Hypericum frondosum</i>
American Strawberry Bush	<i>Euonymus Americana</i>
Dwarf Southern Bayberry	<i>Myrica cerifera 'Dwarf'</i>
Bluestem	<i>Andropogon gerardii</i>
Little Bluestem	<i>Schizachyrium scoparium</i>

Groundcovers

Garden Phlox	<i>Phlox divaricata</i>
Gallardia	<i>Gallardia puchella var. puchella</i>
Coastal Plain Joe-pye	<i>Eupatorium dubium</i>
Purple Coneflower	<i>Echinacea purpurea</i>
Swamp Sunflower	<i>Helianthus angustifolius</i>

7.4 LANDSCAPE SETBACKS

Uses permitted within landscape setbacks are berms, driveways crossings, landscaping, public and private utilities, drainage and slopes, sidewalks, trails, irrigation, and permitted signs. The following landscape setbacks shall be incorporated into the landscaping plan submitted to the DRC at the 30% Design Review Meeting:

7.4.1 Major Arterial

Forty (40) feet from edge of pavement with first 11-feet and 6-inches, as measured from edge of pavement, reserved as open space. The remainder of the setback shall be landscaped using plants from the Transitional Zone pallet. At least one tree is required along every 30-feet of linear roadway frontage.

7.4.2 Minor Arterial

Thirty (30) feet from edge of pavement with first 11-feet and 6-inches, as measured from edge of pavement, reserved as open space. The remainder of the setback shall be landscaped using plants from the Transitional Zone pallet. At least one tree is required along every 30-feet of linear roadway frontage.

7.4.3 Private Street

Twenty-five (25) feet from edge of pavement with first 11-feet and 6-inches, as measured from edge of pavement, reserved as open space. The remainder of the setback shall be landscaped using plants from the Transitional Zone pallet. At least one tree is required along every 30-feet of linear roadway frontage.

7.4.4 Intersections

Landscape at intersections is based on a hierarchy of road type. The greatest emphasis will be at major arterial intersections or interchanges, with the least emphasis on internal intersections within PAC owned land.

Primary intersections within PAC owned land will receive the greatest traffic volumes and should have larger plant material masses in order to provide visual interest. Secondary intersections are smaller in scale and are the character of the Transitional Zone.

7.4.5 Parcel Entry Drive

The landscape emphasis at the entry drives is to be based on intended use. Visitor and primary entrances are to receive the greatest emphasis with respect to landscape treatment. The landscaping setback shall extend 15-feet from the edge of pavement for the entire length of the parcel entry drive. The landscape treatment within the setback should be of an intensive nature, but the use of high water use turf is discouraged. The plant material selection should provide a variety of seasonal interest, texture and color and selected from the Intensive Plant Palette.

7.4.6 Parcel Boundaries

Adjacent to open space or any non-irrigated area there shall be a Transitional Zone between parcels so that a uniform appearance is created. The Transition Zone shall have undulations with maximum slopes of 4 feet of run for every 1 foot of rise and be coordinated across property lines. The open space shall encompass the required side yard setbacks to meet the requirements for the zoning district applied to the parcel. The plant palette and the other landscape treatments shall be similar to the materials used in the adjoining parcels.

7.4.7 Median Plantings

Landscape themes for medians will be specific to roadway corridors, creating a distinct yet cohesive theme for the different corridors. Median plantings shall use plant material from the Transitional Plant Pallet.

Major arterials have a 10-foot-wide median comprised of the Transitional Plant Palette. Minor arterials have an 8-foot-wide median and are located in closer proximity to the intensive landscape zones and the interior portions of PAC owned land.

7.4.8 Open Space, Uplands and Wetlands

For parcels abutting open space or upland space, the landscaping setback shall be 30-feet from edge of property line. The landscaping setback should be used as Transitional Buffer Zone and use appropriate material from the plant pallet identified in **Section 7.3.3**. It is not the intent of this section to be applied to parcels that are abutting a parcel of land that is slated for future development.

For parcels abutting wetland areas, or containing wetland areas, the landscape setback shall be 20-feet from edge of the wetland buffer defined in **Section 7.1.1**. The landscaping setback should be used as Wetland Buffer Zone and use appropriate material from the plant pallet identified in **Section 7.3.2**

7.5 PARKING LOTS

Landscape islands are to be provided internal to parking areas and as terminus to all parking bays. A maximum of 15 contiguous parking stalls are permitted before providing a landscape island. Parking lot landscape islands are to be a minimum of 150 square feet and 10-feet in width.

In addition to the number of trees provided in accordance with **Section 7.2.2**, parking lot trees shall be provided at a ratio of 1 tree for every 7 spaces. Should the calculation result in a fraction of a tree, the number of trees provided shall be rounded up to the next nearest whole number. All trees within the landscaping plan shall be planted with a minimum caliper diameter of 2” at breast height. Within the larger parking lots shade trees shall be used closer to the intensive landscape zones, transitioning to Transitional Zone plant material nearer to the rear of the parking lot.

Irrigated high water use turf that is less than 6 feet in width shall not be permitted in medians or parking lot islands. Bio swales shall be integrated into the median design wherever possible to accommodate parking lot runoff.

7.6 WATER CONSERVATION MEASURES

Whenever possible, landscape development is to occur with the intent of meeting the standards of the LEED™ practices. This would include the following:

- Reduced site disturbance
- Stormwater management
- Heat island effect (non-roof)
- Water efficient landscaping
- Innovative design

7.6.1 Xeriscaping

Principles of Xeriscape shall be integrated throughout the entire landscape.

- Planning and design.
- Efficient irrigation systems,
- Properly designed and maintained
- Use of mulch
- Soil preparation
- Appropriate turf
- Water-efficient plant material

7.6.2 Planning and Design

As each new parcel is planned, it is important to consider the traditional aspects of site design, topography, slope orientation, user needs, program elements, soils, vehicular and pedestrian circulation, access, and existing vegetation. The integration of Xeriscape principles with traditional site planning enables the designer to introduce water conservation methods throughout the design process. The integration of intensive zone plant material near building entrances will result in the creation of an area that receives more water and, as a result, is cooler.

7.6.3 Minimize Turf Coverage

Turfgrasses have a place in a xerigraphic landscape and is an important element in cooling the local environment, reducing erosion, and preventing glare from the sun. Throughout the site design process, it is important to limit areas of high water use turf to areas of intensive use by people, such as areas that are highly visible by pedestrians. Turf grasses should be used as a ground plan amenity and not just as infill material. High water use turf should

not be used on slopes greater than 4:1, or in medians and narrow strips of planting that are less than 6 feet wide, whether in a parking lot application, roadway median or setback area.

7.6.4 Irrigation

Irrigation is necessary in a xeric landscape, at least during the first few years while the plants' root systems are developing. Following establishment, irrigation may still be necessary depending on the landscape design and plants' needs. The intensive and transitional planting zones have the greatest need for irrigation, but it is wise to plan irrigation even in a low-water-use zone to allow for new planting and protection from drought.

Irrigation systems should be zoned so those plant materials with similar water demands are on the same irrigation zone, for example, high water use turf should be separated from shrubs and ornamental grasses. With in-ground irrigation systems, each zone should be under a separate valve. The water should be applied as efficiently as possible. Sprinkler systems are appropriate in areas of turf, but drip, bubbler, and micro-spray systems or soaker hoses are more appropriate for shrubs, trees, and annual and perennial plantings.

Professionally designed and drawn irrigation plans should be an integral part of each new building or landscape plan. The plans should specifically address application methods, natural precipitation, and application rates for the individual zones. Plans also need to indicate tap locations, controller type, type and size of heads, drip methods, type and size of mainline, laterals, water pressure, and meter locations. Irrigation systems shall be designed to conform to the highest level of industry standards and equipment..

7.6.5 Plant Material

Plant selection and location are critical components of Xeriscape landscaping plans. Plants should be placed together in groupings of plants that require similar amounts of water. Low water use plants tend to have a more informal appearance and arrangement than higher water use plants. For maximum visual effect plant material should be placed in masses rather than as isolated individual plantings.

7.6.6 Mulches

Organic mulches keep the soil moist and reflect less heat. They work well with plants adapted to cooler microclimates. Organic mulches act to cool the soil during hot weather, thereby reducing evaporation and subsequent water use. Mulches also reduce the growth of weeds and buffer soil temperature fluctuations throughout the year. Bark mulch should not be used on steep slopes or in drainage ways because it washes away in heavy rains. Inorganic mulches are very beneficial and have excellent applications for specific purposes as well.

Trees and shrubs should be placed in mulched areas rather than in turf areas so that irrigation can be zoned separately. This arrangement also facilitates easier maintenance. Transitions from the intensive landscape to these remote areas can be created by shrub and tree masses and mowing patterns.

7.6.7 Soil Evaluation and Improvements

Soil testing can help determine which plants are best adapted to the site and which amendments are appropriate for improving the soil for the selected plants. The Developer should provide a copy of the soil analysis to the DRC with the landscape plan submittal at the 30% Design Review Meeting. The soil analysis provides soil recommendations for individual type of soil improvements and soil amendments. Organic soil additives that decay quickly should be used to correct soil chemical properties. Slow decaying materials should be used sparingly as these materials will compete with plants for the available nitrogen.

7.6.8 Maintenance Practices

Sound maintenance practices should include regular watering, fertilizer applications, pesticide management, and other sound horticultural principles. With the integration of Xeriscape principles, it will become more important to ensure that properly scheduled maintenance occurs. The mowing height and the mowing schedule will affect the growth, health, and appearance of the different types of grasses.

Regular aeration and mulching of clippings reduces soil compaction, improves aeration, controls excess thatch, increases water infiltration, encourages root growth, and further improves drought resistance of turf areas. Soil improvements, annual applications of organic matter, and using organic mulches in the shrub beds will increase the water-holding capacity of the soil in those areas.

7.7 STORM WATER QUALITY

A well planned, constructed and maintained landscape can be an effective method for meeting storm water quality requirements. As appropriate, innovative techniques in storm water management are to be implemented within the site design. Conveyance of storm water should, whenever possible, be accomplished through open grasslined channels. The islands within the parking lots should be used as bioretention facilities. Where possible, the setback areas are also to be used as site bioretention facilities.

7.7.1 Planting Schedule

Submit proposed planting schedule with landscape plan submittal, indicating dates for each type of landscape work during normal seasons. Once accepted, revise dates only as approved in writing

after documenting the reason for delay. The contractor should proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required. Contract specifications shall indicate that 1) no planting operations shall take place when site is excessively wet or during freezing temperatures and 2) delivery and storage of plants onsite should not be allowed when ambient temperatures may rise above 90 degrees Fahrenheit or when wind velocity exceeds 30 miles per hour. Plants shall be planted only when weather and soil conditions permit.

7.7.2 Landscape and Irrigation Maintenance

Practice maintenance principles that promote plant health, water conservation, safety of the public, and control costs. All landscape maintenance services shall be performed by an adequate number of trained personnel using current, acceptable horticultural practices.

7.7.3 Enhanced Natural Drainage Areas

The drainages should be left in as natural a condition as possible. Where improvements must be made they should be accomplished with as minimal a disturbance as possible. Low flow channels should be natural in configuration and alignment allowing the natural regeneration of wetland plants. The edges shall be treated with plant material indigenous to drainage ways.

7.7.4 Decorative Landscaping

Any decorative landscaping shall be compatible with the natural environment and any architectural material used on the individual building. Samples and/ or color samples shall be submitted to the DRC for approval prior to installation. Boulders shall be installed so that they are integrated into the ground plane, burying half of the boulder with groups to mimic natural placement.

7.7.5 Retaining Walls

Retaining walls, low landscape walls, and/ or boulder walls shall be integrated into the improved landscape or used as a transition treatment between the improved and the native areas. The walls should be curvilinear in alignment as much as possible and flow with the natural terrain of the site. The color, texture and material of the retaining walls should be consistent with the building exterior colors, textures, and materials. Submit samples of the materials to the DRC for approval prior to installation.

CHAPTER EIGHT

SIGNAGE DESIGN GUIDELINES

Signage is a key element on PAC owned land and should be considered an integral part of the landscaping plan. All permanent and temporary signs within the proposed development are to be designed so they are compatible with the desired character of PAC owned land. Signage required along the AOA fence line is provided in **Section 3.1** of these Design Guidelines.

Signage will be reviewed for appropriateness, including location and proportionality. Sign requests shall include details of design, materials, location, size, height, color, and lighting and shall be approved by the DRC prior to construction or installation of the sign. Overhead signs and/or blade signs should be avoided throughout PAC owned land. All signage must meet the general “spirit and intent” of these Design Guidelines.

8.1 MATERIALS

All exterior permanent signage must be constructed with a palette of material that is consistent with the predominant material and architectural character on the attendant buildings. All project identification signs shall be integrated into the surrounding landscaping.

8.2 FREESTANDING BUILDING IDENTIFICATION SIGN

One (1) freestanding sign is permitted for each developed site with frontage on one (1) or more public streets.

8.2.1 Sign Size

No freestanding sign shall exceed an area of one hundred (100) square feet. The total permitted sign area for all free-standing signs shall be computed in the following manner:

<u>Linear Street Frontage</u>	<u>Sign Size Factor</u>	<u>Maximum Sign Size</u>
< 300 linear feet	0.20 sf/ lf	60 sf
301-500 linear feet	0.15 sf/ lf	75 sf
500+ linear feet	0.10 sf/ lf	100 sf

8.2.2 Sign Separation

There shall be a minimum separation between all such signs measured along the frontage of the public street in accordance with the following conditions:

- Every sign having an area between seventy-five (75) square feet and one hundred (100) square feet shall be separated from every adjacent freestanding sign (and structure) by not less than one hundred seventy-five (175) feet; and
- Every sign having an area between fifty (50) and seventy-five (75) square feet shall be separated from every adjacent freestanding sign (and structure) of equal or lesser area by not less than one hundred fifty (150) feet; and
- Every sign less than fifty (50) square feet in area, shall be separated from every adjacent freestanding sign (and structure) of equal or lesser area by at least one hundred twenty-five (125) feet.

The distances identified above not only applies to multiple signs located on individual parcels, but also to the distance between the proposed sign and signs located on adjacent parcels.

8.2.3 Sign Setback

No freestanding or ground sign shall be erected closer than twenty-five (25) feet from the side and rear boundary defined for that developed site. Signs shall not be located closer than fifteen (15) feet from the paved portion of the adjacent street, provided that in all cases signs shall be set back to at least the front property line. Maximum sign height, including base, shall be 6 feet. No signs shall be permitted that may obstruct the view in any direction at the intersection of a street.

8.3 BUILDING-MOUNTED BUILDING IDENTIFICATION SIGN

Building sign area on each building frontage shall be limited to one square foot of sign area per linear foot of that building frontage up to a maximum of 100 square feet and may not extend above building parapet or more than 18 inches from building face. Building-mounted signs shall be proportional to building in scale. A building with more than one building frontage shall not

combine or transfer the sign area permitted any such "front"; each such "front" shall be limited to one square foot of sign area per its separate linear frontage.

8.4 CAMPUS IDENTIFICATION SIGN

Any sign giving identity to three or more buildings shall be considered a Campus Identification Sign. The information provided on a Campus Identification Sign shall be limited to the complex name, complex logo (if applicable), and address. The signs may be single- or double-faced, ground-mounted monuments only. The maximum sign face shall be a maximum of 50 square feet and a maximum height, including base, of 6 feet.

Only one Campus Identification Sign at the main entry drive along the street frontage is allowed for any given building. Exceptions will be considered in those cases where a site has more than one vehicular entrance, or more than one major structure with each structure housing a different use or major tenant. Campus Identification Signs shall not be located in proximity to Freestanding Building Identification Signs.

8.5 DISTRIBUTION/WAREHOUSE SIGNS

Distribution/ Warehouse Signs may be ground-mounted (single or double-faced) or building mounted. Only one Distribution/ Warehouse Sign at the main entry drive along the street frontage is allowed for any given building. Ground-mounted signs shall be a maximum of 60 square feet per face and shall be a maximum of 6 feet in height. Building-mounted signs shall be 1 square foot per linear foot of building frontage up to a maximum of 100 square feet and may not extend above building parapet or more than 18 inches from building face. Building-mounted signs shall be proportional to building in scale.

Distribution/ Warehouse Signs may only contain the business name, logo, and principal service or product only if necessary to clarify the nature of the business. Address may be allowed only on the ground-mounted sign.

8.6 DIRECTORY SIGNS

Directory signage, as approved by the DRC, may be permitted subject to the following criteria:

- Such signage may be located at major street entry points to the Business Park.
- The scale and quality of such signage should be proportionate to the overall scale of the development; not to exceed 100 square feet per face or 15 feet in overall height; setbacks must be a

minimum of 35 feet from the property line unless otherwise agreed to by the DRC as appropriate to the location.

- Identity signage language may only contain the primary development's name and logo.
- Directory signage may also contain a map and listing of property names and uses.

8.7 TEMPORARY SIGNS

Temporary Signs can be used for construction and design team information or future tenant identification. Temporary Signs shall be approved by the DRC prior to construction and installation. Only one Temporary Sign may be installed and directed towards street frontage. Temporary Signs may not exceed 3 feet in height from grade.

8.8 PROHIBITED SIGNS

The following signs are prohibited on PAC owned land:

- Signs which advertise general products or services (such as, gas, cigarettes, liquors)
- Animated, moving, rotating, or sound-emitting signs.
- Billboards.
- Benches used for signs.
- Window signage.
- Portable signs which are not permanently affixed to any structure on the site, or permanently mounted to the ground (except for "Temporary Signage").
- Signs mounted, attached, or painted on motor vehicles, trailers, or boats when used as additional advertising signs on or near the premises and not used in conducting a business or service.
- Roof-mounted signs or signs which project above the highest point of the roof line of the fascia of the building.
- Signs which project from the buildings for a distance of more than 18 inches from the building.
- Signs attached parallel to the wall of a building but mounted more than 18 inches from the wall.
- "Going out of Business" or similar signage indicating a distressed property.
- Median signage.
- Internally illuminated awnings; awnings, if allowed, shall be opaque and shall not be back-lit.
- Reader boards and changeable message signs.

8.9 VIOLATIONS AND REMOVAL OF SIGNS

Whenever the PAC has cause to issue a written notice under the provisions outlined in these Design Standards, and upon refusal or neglect of the owner to comply with the requirements of the order to abate the unsafe condition, the PAC is authorized and empowered to cause such sign that has been declared unsafe to be taken down and removed.

8.9.1 Violations

Any owner who erects a sign found in violation of these Design Guidelines shall be fined two fifty hundred dollars (\$250.00) for each offense. Shall the owner neglect to pay the fine and/or does not remove the violating sign within two weeks of receiving notice from the PAC of the violation, then the PAC shall have the right to remove the sign pursuant to **Section 8.9.2**.

8.9.2 Removal of Sign

When, in the opinion of the PAC, there is immediate danger of collapse or failure of a sign, or any part thereof, which would endanger persons or premises; or when a violation of these Design Standards results in a fire hazard that creates an immediate, serious and imminent threat to life and safety, the PAC shall order the affected area barricaded or otherwise segregated and marked off to the extent necessary to warn others of such danger.

Upon notice of such dangerous condition, the PAC shall make a reasonable attempt to notify the owner. If the owner is unable to be contacted within forty-eight (48) hours, or if the owner is contacted and takes no action within forty-eight (48) hours after notification, the PAC shall cause the sign, or so much thereof as is deemed unsafe, if it can be safely removed from the remainder, to be demolished and removed from the site.

Additionally, the PAC reserves the right to remove any sign that is in violation of these Design Guidelines or sign that has not been approved by the DRC.

The PAC shall determine the costs and expenses of the demolition and removal of unsafe signs or signs in violation of these Design Guidelines. Such costs and expenses shall include an administrative charge of one hundred dollars (\$100.00), and such costs and expenses shall be chargeable to and paid by the owner of the premises upon which such sign was located.

8.10 SIGNAGE APPROVAL CRITERIA

A Site Signage Plan shall be submitted for DRC approval prior to the installation of any signs.

CHAPTER NINE

CBPA COMPLIANCE

Many of the storm water design guidelines contained in Section Nine of these Design Guidelines are adapted from the city of Newport News Design Criteria Manual (DCM). Whereas the DCM is tailored to different types of development (e.g. residential, commercial, industrial etc), these Design Guidelines focus only on the applicable sections of the DCM to the types of development envisioned on PAC owned land. However, the developer is strongly encouraged to consult the DCM.

Overall site grading will largely determine the degree to how effectively the site sheds storm water. For these reasons, site grading and drainage are key concerns of these Design Guidelines. Changes to existing topography should be minimized on all development sites. Where grading does occur, it should be done in a manner that respects the existing landscape, eliminates abrupt or unnatural landforms and promotes positive surface drainage. Special attention should be given to providing smooth grading transitions between neighboring development sites.

9.1 VIRGINIA STORM WATER REGULATIONS

The State Storm Water Management Regulations are administered by the Virginia Department of Conservation and Recreation (VDNR). The State regulations specify both runoff quantity and quality criteria which must be provided to control storm water pollution discharges from all development.

Chesapeake Bay regulations require the control of storm water pollution discharges from new development and redevelopment within designated Chesapeake Bay management areas. These regulations require that new development provide Best Management Practices (BMPs) to reduce the post-development storm water discharges of total phosphorus (total P) to the pre-development loading based upon “average land cover conditions.” Total P has been designated by the Virginia Chesapeake Bay Local Assistance Department (CBLAD) as the “keystone” pollutant for the Chesapeake Bay management program. The Chesapeake Bay regulations also require redevelopment projects to achieve a 10 percent reduction in the total P loading compared to the existing storm water load from the site.

The City Reservoir Protection Ordinance requires new development in the City of Newport News water supply watersheds to provide BMPs to control storm water pollution discharges. Following approval of a runoff control

plan for the development project, the City of Newport News will issue a runoff control permit. Wet detention BMPs have been identified by the City of Newport News as the preferred BMP for development in water supply watersheds.

This chapter is restricted to BMP requirements for post-development conditions. It does not address management practices to be implemented at new development sites during the construction phase. Construction site BMPs are required by the State Erosion and Sediment Control Regulations (VR 625-02-00). Criteria for construction site BMPs and other management practices to control soil erosion and sediment deposition from construction sites are presented in the Virginia Erosion and Sediment Control Handbook published by the VDCR.

9.1.1 Design Principles

The design of drainage systems shall conform to the following:

1. Designs shall meet or exceed all current Federal, State and City regulatory requirements;
2. Designs shall conform to approved BMPs;
3. To avoid piecemeal designs, drainage systems shall be designed to complement one another, and;
4. Designs shall not adversely affect existing off-site systems.

Satisfactory solutions to known drainage problems shall be proposed, rather than transferring problems to another location along the system.

9.1.2 Storm Water Criteria Applicability

Storm water management criteria shall apply to all development and land-disturbing projects at Newport News/ Williamsburg International Airport.

9.1.3 Storm Water Objectives

The objectives of storm water management can be achieved by maintaining runoff after development at a rate equivalent to that occurring prior to development or to the existing capacity of the off-site receiving system, whichever is more stringent. For these purposes, both the two-year (erosion control) and the 10-year (flood control) design storm frequencies shall be used to evaluate a development's runoff contribution to the off-site receiving system.

Concentrated storm water runoff from a development site must be discharged directly into an adequate natural or man-made receiving channel or pipe. Each receiving channel or pipe shall be tested for adequacy. The receiving system may be considered adequate for storm water management purposes if the following conditions can be satisfied:

1. For natural or man-made channels, the post-development flow from a 10-year (minimum) frequency storm will not overtop the banks and the post-development flow from a

two-year storm will not exceed the permissible non-erodible velocity of the channel lining.

2. For pipes and storm sewer systems, the post-development flow from a 10-year (minimum) frequency storm will be contained within the pipe or system.

If an existing off-site receiving system is not an adequate system as determined, then the Developer shall:

1. Obtain easements from downstream property owners, where applicable, to improve the receiving channel or pipe to an adequate condition for the two- and 10-year storm. Such improvements shall extend downstream until an adequate system is reached.
2. Develop a site design that will not cause the pre-development peak rate of runoff from the two-year and/ or the 10-year storm to increase or exceed the capacity of the existing off-site receiving system, whichever is the more stringent. Such a design may be accomplished by providing on-site storm water detention measures. If storm water detention is chosen, a plan for the continued maintenance of the detention facility shall be provided.

9.1.4 Drainage System Elements

Systems shall be designed to protect property of all classes against flooding and to maintain the required level of service for public facilities as specified below. The design shall be based on criteria established in this chapter and subject to the final determination and approval of the DRC. The system shall be designed as a coordinated unit and may include any or all of the following elements:

1. **Enclosed System** which consists of one or more pipes connecting two or more structures (for example, drop inlets and manholes) and shall be used to collect/ convey storm water runoff. Design storm should be a 10-year storm.
2. **Open System** which consists of roadside ditches, swales and open channels, which shall be either triangular or trapezoidal in shape. Design storm should be a 10-year storm.
3. **Culverts** which consists of one or more pipes or structures and shall be provided where an open system crosses the public right-of-way. Design storm should be a 10-year storm.
4. **Retention/ Detention Facilities** which consist of a number of practices and techniques (for example, impoundments and parking lot storage) used to manage both the quantity and quality of urban storm water runoff. Design storm should be either a 2-, 10- or 25-year storm depending on the adequacy of the receiving system.

9.1.5 Design Storm Frequency

Recognizing that floods cannot be precisely predicted and it is seldom economically feasible to design for the very rare flood, all

designs shall be reviewed for the extent of probable damage should the design storm be exceeded. Minimum design frequency values that shall be used are listed in **Section 9.1.4**. In addition, a frequency determination shall be based upon but not be limited to the following considerations:

1. Potential damage to adjacent property.
2. Potential damage to hydraulic structures.
3. Potential hazards to human life.
4. Potential damage to stream and flood plain environments

9.1.6 Flood Magnitude Estimates

There are several methods to determine design runoff available and the designer must be familiar with the general sources of the various methods and their applications and limitations. It shall be the responsibility of the designer to examine all methods that apply to a particular site and to make the decision as to which discharge is the most appropriate. The application of sound engineering judgment and the provision of complete documentation is emphasized. Additionally, several different values for both time of concentration and storm duration shall be tried in order to determine which is most critical to the particular site.

9.2 DESIGN PROCEDURES

9.2.1 Maps and Surveys

All plans and surveys shall be based on the datum established at the airport by the National Geodetic Survey and conform to survey specifications outlined in Federal Aviation Administration Advisory 150/ 5300-18b. The final plan shall be based on actual, detailed field survey information showing spot elevations and contours for both existing and proposed conditions.

9.2.2 Existing Utilities and Information

In the area of the existing or proposed drainage system, all utilities shall be located in the field and noted on the site plan to avoid conflicts between the existing utilities and the future drainage system.

9.2.3 Runoff Determination

The designer shall compute both pre- and post-development runoff using one of the applicable methods outlined in **Section 9.1.4**. Determine and show the ridge lines for the runoff area(s) and indicate cubic feet per second by increment at each point of interception and access to the system or at points of discharge from the site.

9.2.4 Preliminary Layout

The designer shall prepare a preliminary layout for discussion with the DRC at the 30% Design Development Review Meeting. The preliminary drainage layout shall indicate the following:

1. Two-foot contours (existing and proposed) in which the proposed drainage pattern must be compatible with the existing pattern, and;
2. Verified location and size of connecting storm sewer lines, appurtenances, street grades and all other information pertaining to the proposed drainage system.

9.2.5 Erosion and Sediment Control

An erosion and sedimentation control plan for all land-disturbing activities shall be prepared and submitted for approval by the DRC. Plans shall be developed in accordance with the latest edition of the Virginia Erosion and Sediment Control Handbook. Additionally, contract specifications and Engineer's Reports shall specify construction procedures in accordance with the Virginia Erosion and Sediment Control Handbook.

9.2.6 Floodplain Development

No PAC owned is included in a FEMA designated floodplain. At any point in the future, should FEMA indicate any portion of the site is in a 100-year floodplain, then the Developer shall provide a hydrologic and hydraulic study of proposed developments which shall contain but not be limited to the following:

1. Documentation of the elevation and location of the 100-year flood contours for pre- and post-development conditions.
2. Evaluation of the total effects that the proposed development will have on existing developments, drainage facilities and properties upstream and downstream from the proposed development.

The studies must show that the proposed development will not create or worsen drainage problems upstream or downstream from the proposed development and that the 100-year water surface elevation will not increase by more than one foot at any point in the floodway due to encroachments within the floodway fringe.

9.2.7 Environmentally Sensitive Areas

Certain PAC owned land is located within the designated Reservoir Protection District for Harwood Mills Reservoir. All land-disturbing activities proposed within environmentally sensitive areas, shall comply with provisions of Chapter 42, Article V "Reservoir Protection" of the City of Newport News Code of Ordinances and Section 24.1.376, Article III of Division 7 of the York County Code of Ordinances which can be found in **Appendix B** and **Appendix C** accordingly.

9.3 ENCLOSED SYSTEMS

9.3.1 Access Points

The distance between points of access in a storm sewer system shall be limited to 150 feet where the pipe diameter is 15 inches, 300 feet where the pipe diameter is 18 to 42 inches, and 800 feet where the pipe diameter is 48 inches or larger. It is mandatory that access be provided at all pipe junctions and bends.

9.3.2 Depth of Cover

A minimum cover of two feet should be maintained wherever possible. Design consisting of multiple or low head pipes or special bedding shall be provided where cover is decreased below two feet.

9.3.3 Hydraulic Grade Line

A hydraulic grade line shall be determined for the entire system and shown on the plan. The grade line shall not rise above the top of junction facilities (for example, manholes and yard drains) or the flowline in curb and gutter sections.

9.3.4 Material

Concrete pipe is the standard design. The use of metal and plastic pipes shall be subject to approval by the DRC on a case-by-case basis for drainage systems. Metal and plastic pipes shall not be permitted in areas subject to traffic loadings and each shall be evaluated for possible floatation. Metal pipe shall not be permitted in salty or brackish water environments. Sufficient tests to determine the soil pH level throughout the project area shall also be provided when metal pipe is proposed.

9.3.5 Pipe Bedding

Material bedding shall be selected in accordance with Method A of VDOT Road and Bridge Standards. Soil borings shall be taken at the project site, and the designer shall determine from them the need for special pipe bedding and backfill. For foundations of soft, yielding or otherwise unsuitable materials, coarse aggregate #57 or #68 shall be used.

9.3.6 Inverts

Invert elevations shall be determined on all pipes entering or leaving drop inlets, catch basins, manholes, etc. The inverts of all manholes and inlets shall be constructed according to Virginia Department of Transportation (VDOT) IS-1 (Inlet Shaping), and this shall be clearly indicated on all plans.

9.3.7 Pipe

Minimum pipe diameter shall be 15 inches. Pipes shall be sized in an analysis independent from that which locates inlets and shall be designed in accordance with Manning's Formula.

Drainage systems shall be designed to maintain self-cleaning velocities. A minimum velocity of three feet per second, where practical; and a maximum velocity of 15 feet per second, when flowing full; should be used in the design. The design procedure shall include a check to ensure that self-cleaning velocities will be achieved.

9.3.8 Inlets

The Rational Equation, applied with judgment, is satisfactory for estimating flows in the design spacing of inlets. A rainfall intensity of 3.5 inches per hour shall be used to determine spread and curb-opening length.

Inlets shall be spaced so as to limit the spread of water on the pavement to a pre-determined amount that will not interfere with traffic or pedestrians at designated crosswalks as follows:

1. For curb or curb and gutter sections, the inlet spacing shall be sufficient to limit the spread of water to one-half the width of the travel way in each direction or eight to 10 feet from the face of curb, whichever is less;
2. For pedestrian crosswalks, a spread of two feet shall be the maximum allowed.

Where an inlet is located on a continuous grade, the flow bypassing that inlet shall be included in the total gutter flow contributing to the next inlet downstream unless the flow is diverted or intercepted.

To properly drain a sump or low point, a check of the width spread approaching the low point from each direction where the gutter grade is one-tenth of a percent is required.

Curb opening inlets shall be designed and spaced to pick up 85 to 90 percent of the gutter flow. After having located the inlets for the suggested design storm, the designer shall check for excessive flooding and adjust the spacing accordingly.

9.4 OPEN SYSTEMS

9.4.1 Design Factors

Open systems will be considered for approval on a case-by-case basis but only where the required concrete pipe diameter exceeds 60 inches or the following conditions are deemed to exist by the DRC:

1. Shallow ground cover or flat outfall slopes preclude installation of an efficient enclosed system, or;
2. A potential flooding hazard to the public is not created, or
3. A 100-year storm can be confined within the proposed channel limits.

In the design of an open system, three prime concerns shall govern as follows:

1. The system shall carry its design storm flows without overtopping, and;
2. The system shall carry its design storm flows without excessive erosion, and;
3. The system shall be economically constructed and maintained.

The minimum design storm frequencies shall be as previously mentioned. Documentation of existing conditions, the design of a proposed facility and analyses of the effects a proposed change will exert on existing conditions shall be provided. A determination of water surface profile, velocity and flow distribution in individual reaches of the channel shall also be provided by the designer. Modified or relocated channels shall duplicate the existing stream and flood plain characteristics as nearly as possible and this shall be done in accordance with the current edition of Best Management Practices for Hydrologic Modifications.

9.4.2 Swale

Concrete swales shall be the standard of design. Earth swales shall be considered on a case-by-case basis. The depth of a concrete swale shall be between a minimum of six inches and a maximum of 18 inches below adjacent ground at its centerline. All other open drainage ways are considered to be ditches or channels.

9.4.3 Connection

Structures, such as pipes, box culverts, etc., that enter a channel shall not project into the normal waterway area.

9.4.4 Velocity

The computed velocity of the proposed channel shall be compared to the maximum allowable velocity associated with the selected channel lining so as to ensure an erosion-resistant design. Open drainage systems shall be required to incorporate low maintenance liners if channel velocities exceed maximum permissible velocities as shown in **Table 9.1**. Liner designs shall include provisions to prevent undermining. All rip rap linings (grouted or un-grouted) shall be placed on filter fabric. The Developer shall use the Manning Roughness Coefficients found in the Design and Construction of Urban Stormwater Management Systems American Society of Civil Engineers, Manuals and Reports of Engineering Practice Number 77 and Water Environment Federation Manual of Practice FD-20 for use in the design of open systems. The designer shall furnish information pertaining to soil types and design flow velocities.

Table 9.1

Permissible Velocities for Channels Lined with Uniform Stands of Various Grass Covers, Well Maintained (1) (2)

<u>Cover</u>	<u>Slope Range (%)</u>	<u>Erosion Resistant Soils (fps)</u>	<u>Easily Eroded Soils (fps)</u>
Bermudagrass	0-5	8.0	6.0
	5-10	7.0	5.0
	10+	6.0	4.0
Buffalo grass, Kentucky bluegrass, Smooth brome, Blue gama	0-5	7.0	5.0
	5-10	6.0	4.0
	10+	5.0	3.0
Grass Mixture	0-5	5.0	4.0
	5-10	4.0	3.0
Lespedeza seriosa, Weeping lovegrass, Yellow bluestem, Kudzu, Alfalfa, Crabgrass	0-5	3.5	2.5
Common Lespedeza (3) (4), Sudangrass	0-5	3.5	2.5

- (1) From “Handbook on Channel Design for Soil and Water Conservation”
- (2) Use velocities over 5 fps only where good covers and proper maintenance can be obtained
- (3) Annuals, used on mild slopes or as temporary protection until permanent covers are established
- (4) Use on slopes steeper than 5% is not recommended

Source: Table 1-2-3 of the City of Newport News Design Criteria Manual, 1997.

9.4.5 Capacity

Open channels shall be sized to carry design flow rates with a minimum freeboard of one and one-half feet.

9.4.6 Cross-Sections

Channel cross-sections shall be compatible with the type of lining and maintenance practice to be used. The Developer shall submit documentation to support the design. In general, channel side slopes stabilized with vegetative ground cover shall not be steeper than 2:1 (horizontal to vertical); however, a final determination by the DRC of

acceptable side slopes will be based upon channel size, soil type and proposed lining.

9.5 CULVERTS

9.5.1 Minimum Culvert Size

The minimum sizes of main line culverts shall be 15 inches for primary, secondary, commercial, and industrial roadways. In no case shall a culvert be smaller than required to convey the anticipated runoff.

9.5.2 Freeboard

A minimum freeboard of one and one-half feet will be provided to safeguard existing or proposed structures.

9.6 DETENTION FACILITIES

9.6.1 Hydrographic Analysis

Should the Developer determine that a detention facility is required to meet storm water quantity and quality criteria, then the specific approval of the DRC shall be required as part of the 30% Design Development Review.

There are many methods available for hydrographic analysis. Any established method will be acceptable within the limitations of the method used. Examples of acceptable methods include:

1. Modified Rational Method;
2. CS Tabular Method;
3. SCS Unit Hydrograph Method, and;
4. SCS Peak Discharge Method.

Approximate flood routing techniques may be used to determine storage volumes during preliminary stages of design. However, the Storage Indication Routing Method shall be used to verify adequacy of the final design.

9.6.2 Design Criteria

Design storm frequencies as previously mentioned are further explained in this section. Additional guidelines based on flood control experiences are also explained.

1. When required, detention ponds shall be designed to limit post-development runoff to pre-development levels, depending on the adequacy of the off-site receiving system as determined in this chapter, for one or more of the following frequencies: two-, 10- or 25-year Storm

2. No flow from the above design storms shall be allowed to pass through the emergency spillway. That is, each storm must be completely routed through the principal spillway and the resulting headwater shall remain below the emergency spillway crest.
3. The facility and its outlet works shall be checked for possible damage resulting in the passage of the 100-year storm.

For Soil Conservation Service (SCS) methods, a 24-hour storm duration shall be used with an incremental computational time of 30 minutes or less. When using the Modified Rational or similar methods, several storm durations shall be evaluated in order to determine the critical storm duration.

The U.S. Department of Commerce Rainfall Frequency Atlas of the United States (TP-40) may be used to determine point rainfall amounts.

One foot of freeboard with the emergency spillway flowing at design depth shall be provided from the maximum routed design storm (100-year) water elevation to the minimum elevation on top of the pond embankment.

The outlet works shall not include any mechanical components and shall function without requiring attendance or control during operation.

The detention facility shall be designed to accept storm water runoff from the entire tributary area, regardless of land ownership.

9.6.3 Detention Facilities: Impoundment Types

Storm water detention impoundments can vary greatly in size and design. For a relatively small area, such as a parking lot, a “dry pond” is often used. A “wet pond” can also be used for storm water detention and is the preferred BMP for water quality control. The outlet works can be designed as dual-purpose devices to obtain both runoff quantity and water quality control.