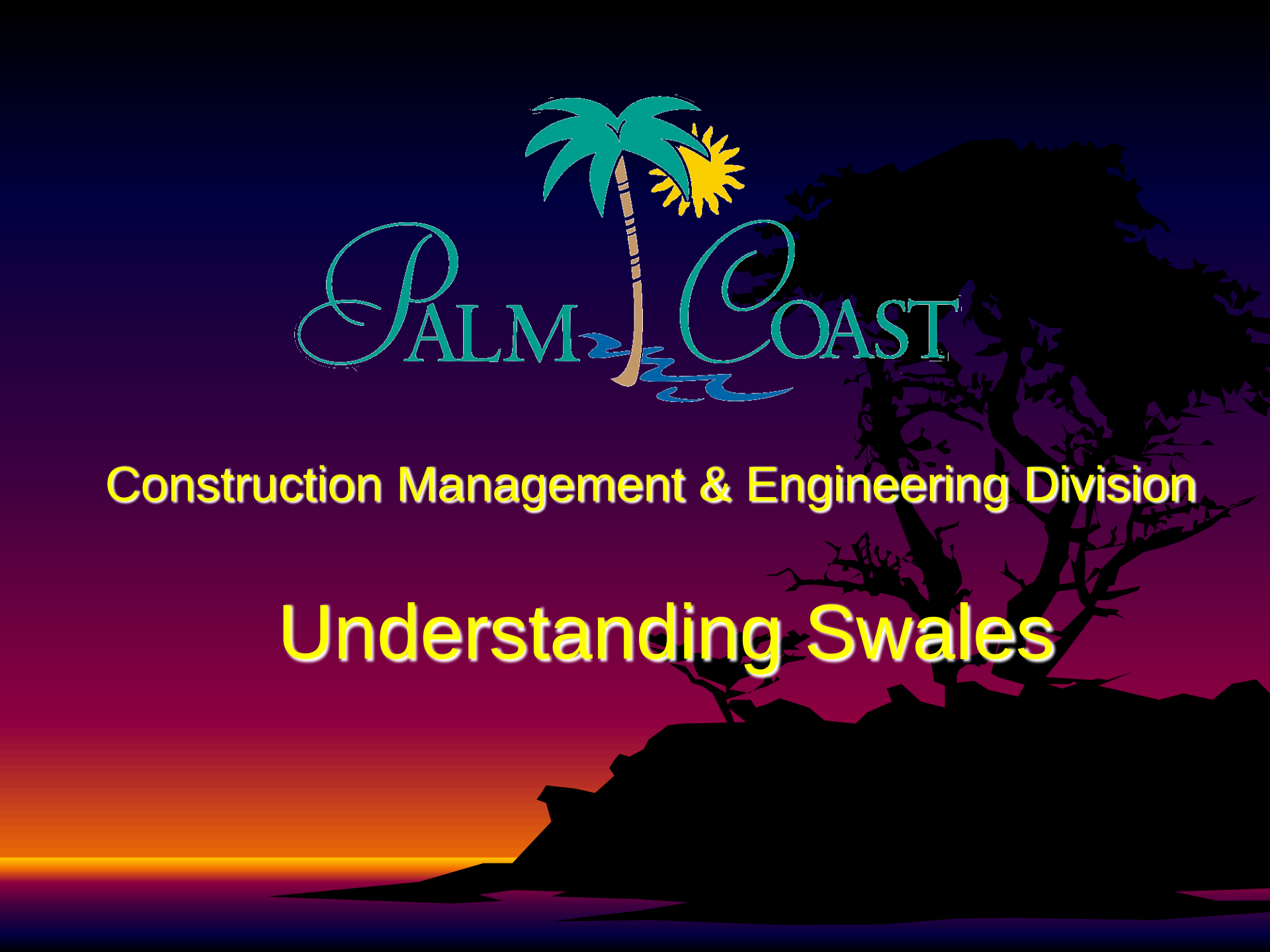
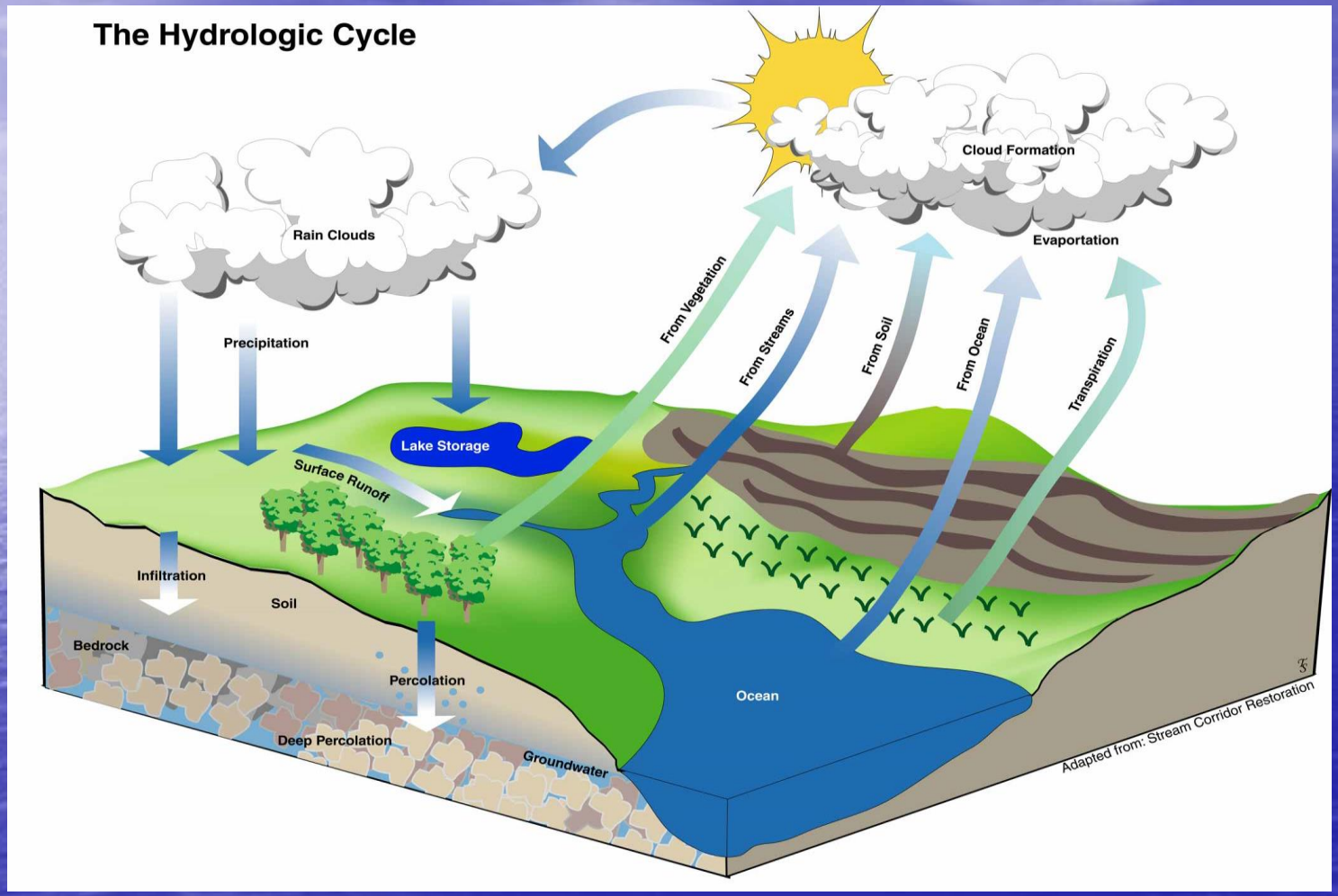


Construction Management & Engineering Division

Understanding Swales

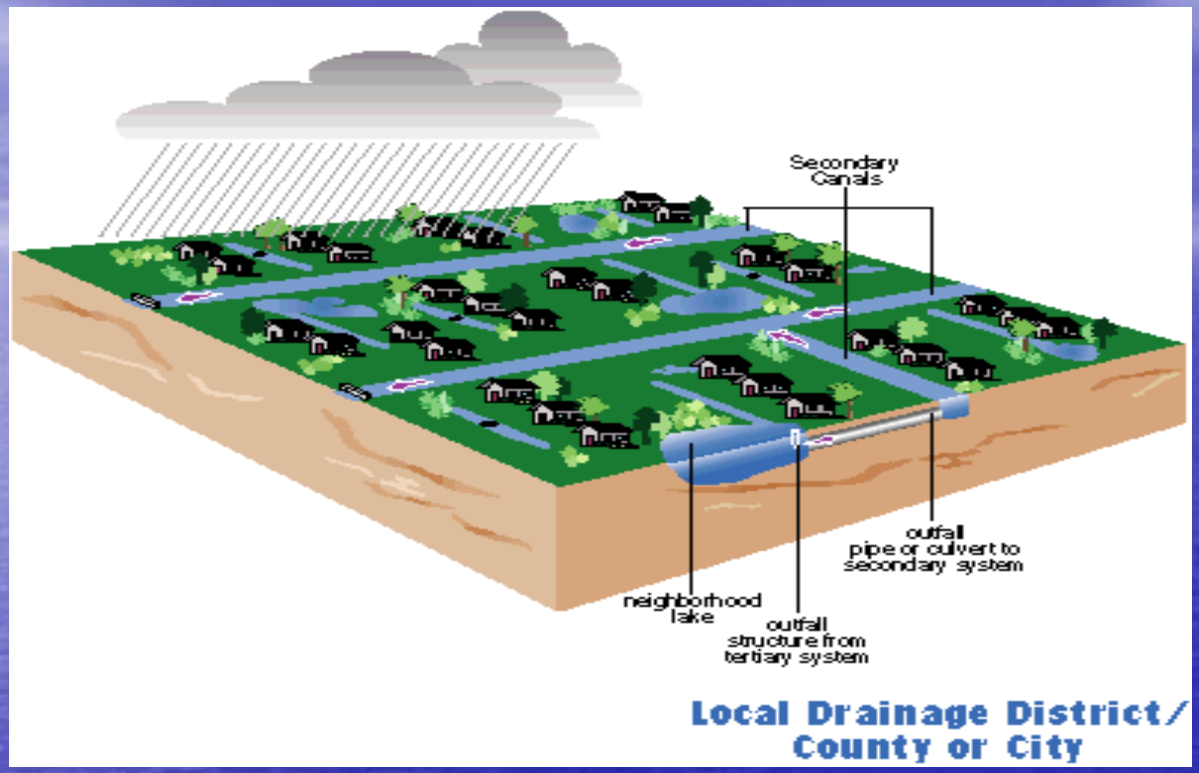
The Florida hydrological cycle …



… it all starts … and ends … here.

Rainfall becomes stormwater when it can no longer soak into the ground and "runs off" the surfaces.

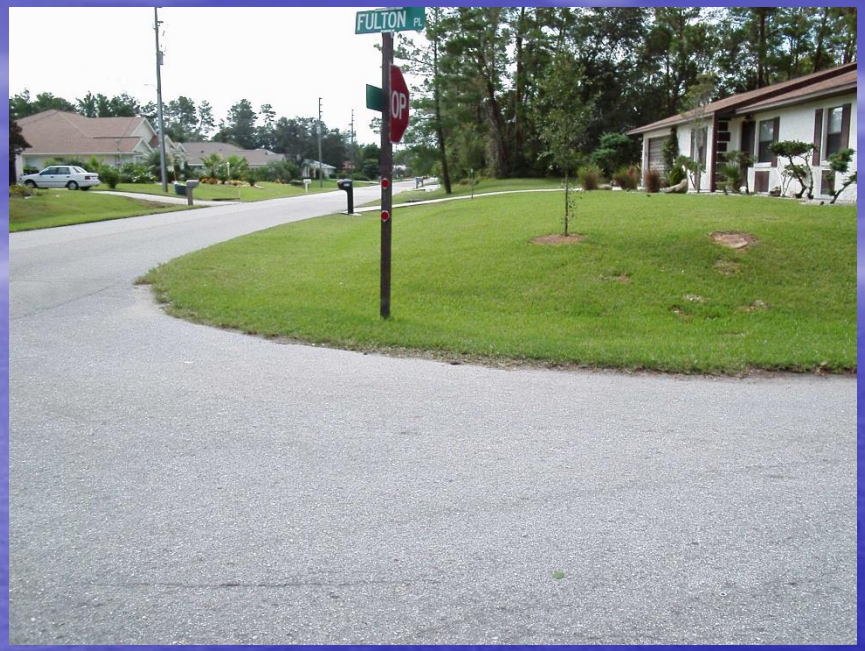
Swales are one of the most commonly used stormwater practices.



For many years, swales have been used to direct runoff from rural highways and residential streets.

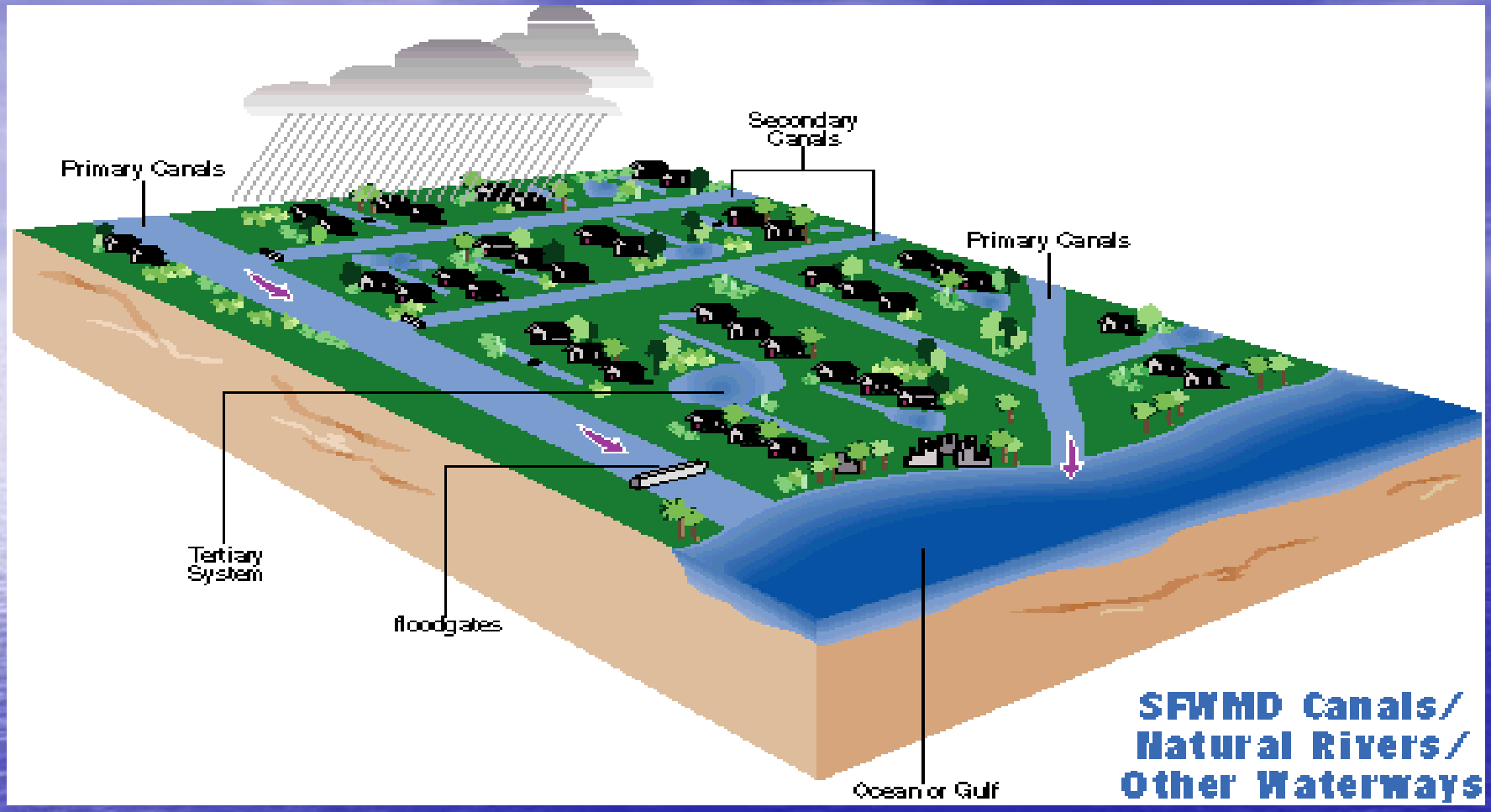
When land is converted from its natural state to other uses, such as roads, homes, and shopping centers, many impervious or paved surfaces are created.

The volume, speed, and pollutants of stormwater runoff increase with land development.



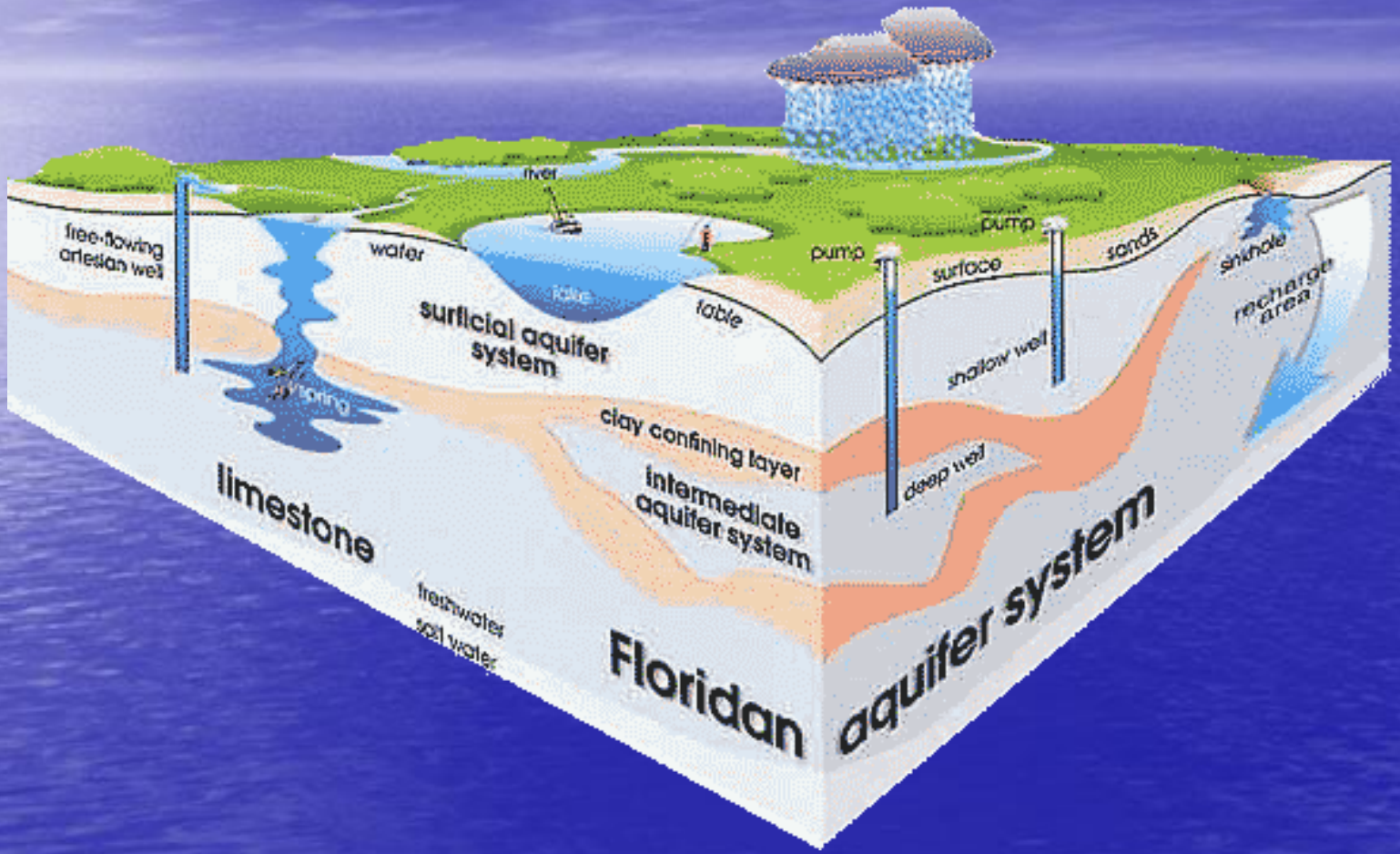
One of the swale's major functions is to maintain a dry roadbed. The bottom of the swale is generally a foot or so below the road and helps keep the road above the water table, thus maintaining the structural integrity of the road helping it to last longer.

Swales also store run-off to mitigate the effect of impervious surfaces.



Swales not only direct stormwater to an outfall structure, ditch or canal they also help filter the runoff and reduce pollutants.

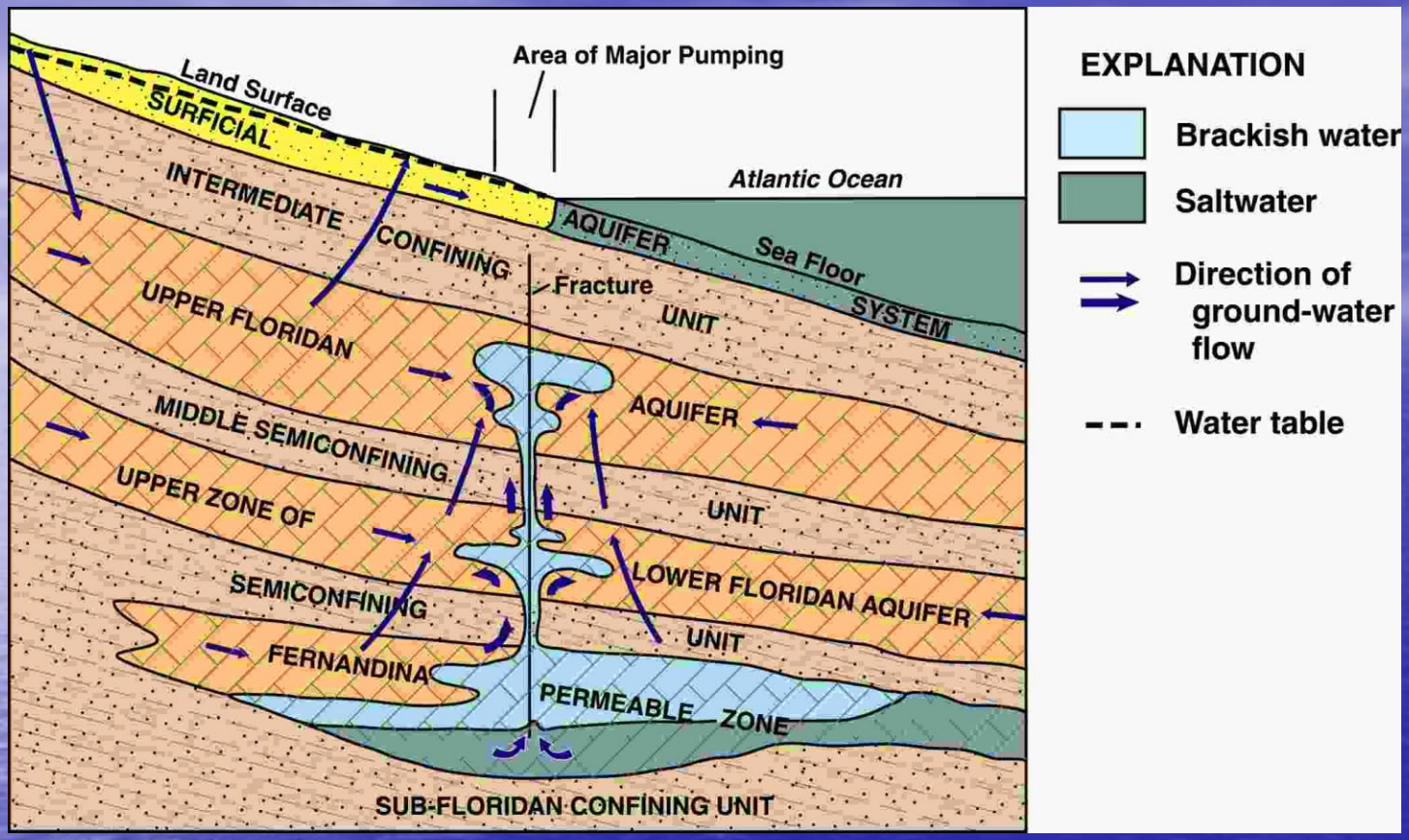
Swales also replenish the Florida aquifer



Florida surficial aquifer system

Florida is essentially a flat state with a soil that readily absorbs stormwater into the freshwater aquifer.

The surficial aquifer in Palm Coast is only 60 to 80 feet thick.



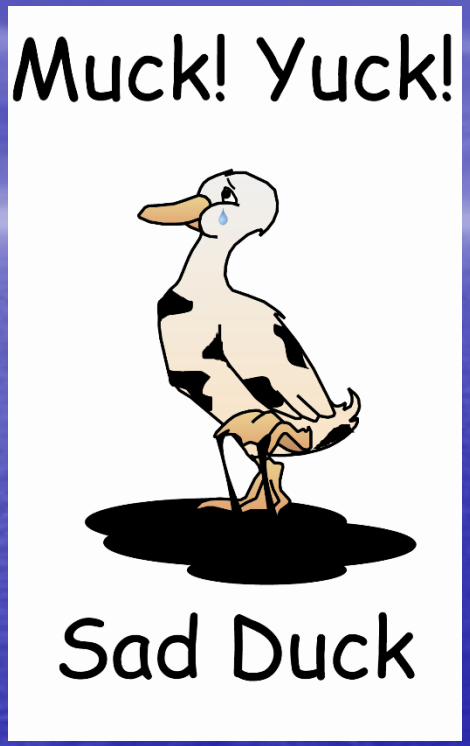
Palm Coast residents typically use 7 million gallons of water a day, which is climbing. Without returning this gift of freshwater, the shallow surficial aquifer would be depleted or become saline.

A swale has four functional states:

1. **Dry** – The swale is dormant and is not functioning.
2. **Puddling** – Which is the normal state, where there is some residual water left in the swale.
3. **Low flow** – Which is typical for the first three days after a rainfall event.
4. **High flow** – Demonstrates the swale systems ability to remove stormwater at its design capacity, but the road itself may be submerged after particularly heavy rainfall events.

Simplified, a swale serves 3 functions:

- Drains
- Retains
- Treats

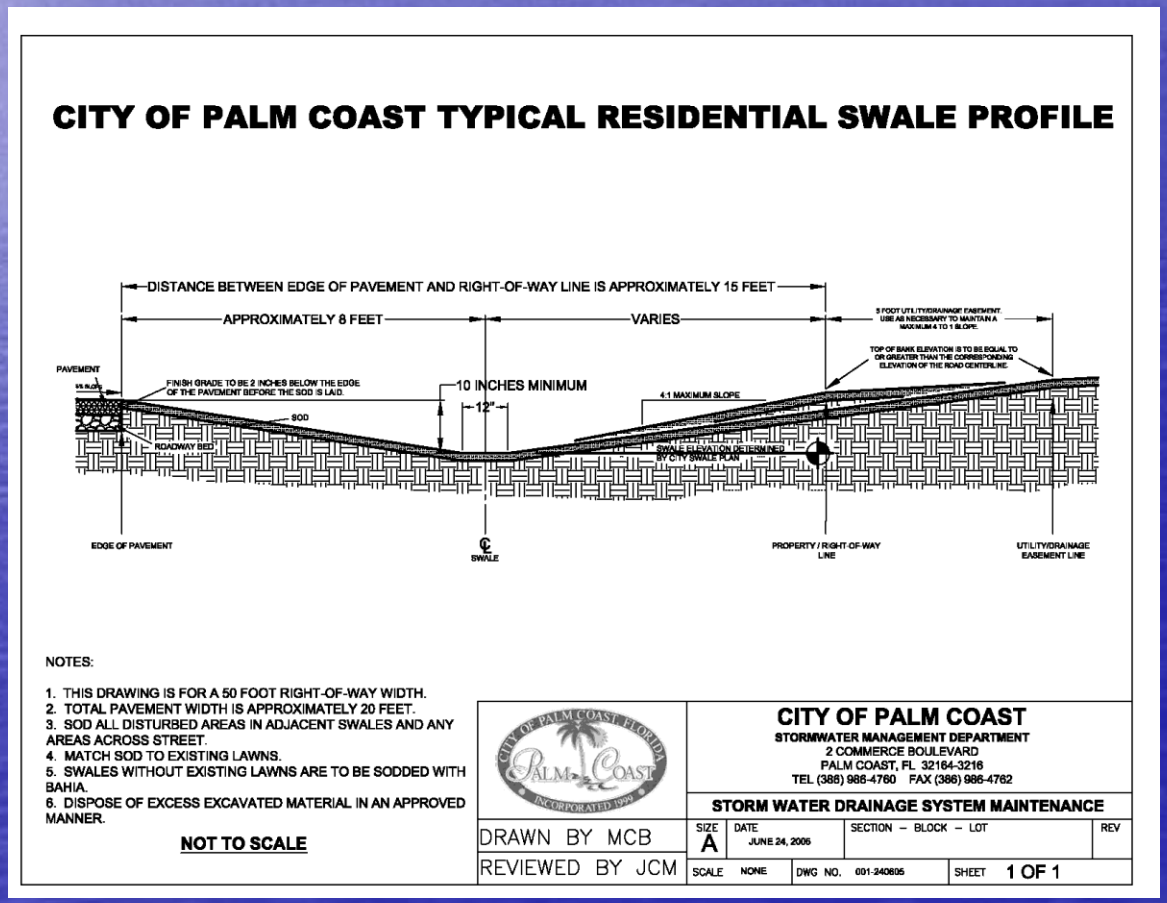


Stormwater management practices are used to retain or detain runoff to filter out the pollutants.

Before Swales

These practices also minimize flooding, protect property, and reduce the pollution of water bodies.

A swale slows down the rapid flow of stormwater runoff by ponding water between its sloping sides.



CITY OF PALM COAST TYPICAL RESIDENTIAL SWALE PROFILE

NOTES:

1. THIS DRAWING IS FOR A 50 FOOT RIGHT-OF-WAY WIDTH.
2. TOTAL PAVEMENT WIDTH IS APPROXIMATELY 20 FEET.
3. SOD ALL DISTURBED AREAS IN ADJACENT SWALES AND ANY AREAS ACROSS STREET.
4. MATCH SOD TO EXISTING LAWNS.
5. SWALES WITHOUT EXISTING LAWNS ARE TO BE SODDED WITH BAHIA.
6. DISPOSE OF EXCESS EXCAVATED MATERIAL IN AN APPROVED MANNER.

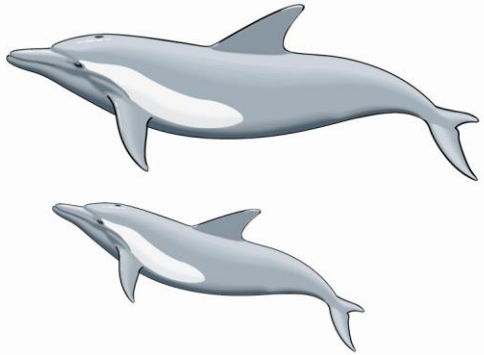
NOT TO SCALE

CITY OF PALM COAST
STORMWATER MANAGEMENT DEPARTMENT
2 COMMERCE BOULEVARD
PALM COAST, FL 32164-3216
TEL (386) 986-4760 FAX (386) 986-4762

STORM WATER DRAINAGE SYSTEM MAINTENANCE

DRAWN BY MCB	SIZE A	DATE JUNE 24, 2005	SECTION – BLOCK – LOT / REV
REVIEWED BY JCM	SCALE NONE	DWG NO. 001-240605	SHEET 1 OF 1

Please Don't Pour



That's Our Front Door

This ponding not only slows down the rate of flow it also allows pollutants to settle out of the water.

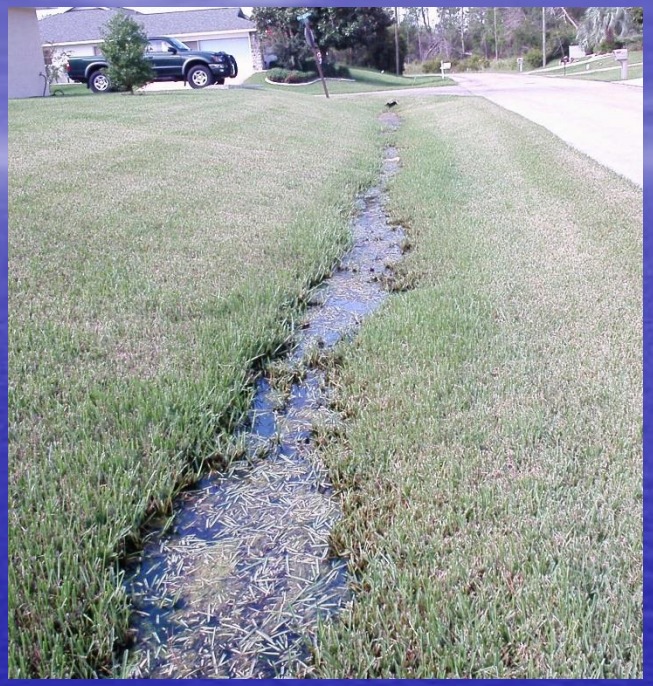
When the swale becomes full, the cleaner surface water will slowly run into a local water body.

Eventually, the remaining ponded water will either evaporate or infiltrate into the soil.

In a case where there has been no rain for a considerable period of time and there is a significant amount of standing water in the swale, there may be a blockage downstream. This warrants an investigation by an inspector who will determine if there is a blockage and what the likely cause may be.

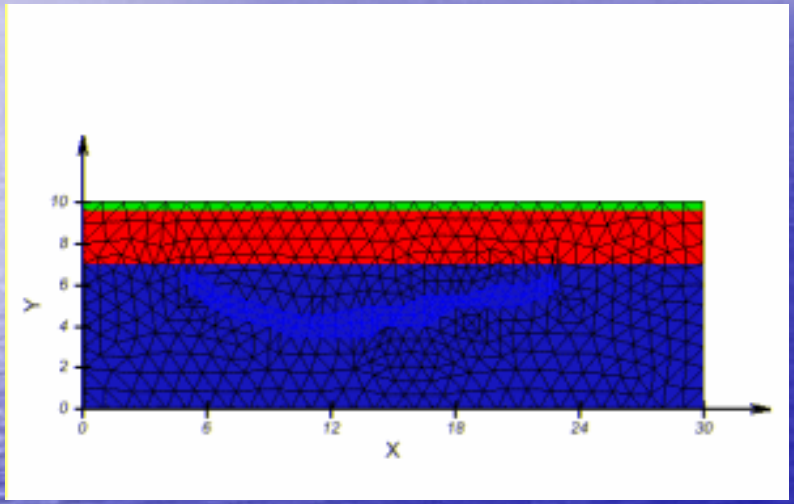
In other cases the water has not had enough time to be absorbed before another rain has occurred or the ground is saturated due to a high water table and it cannot absorb any more water. This is an acceptable condition and does not place the resident in any danger of flooding just because the swale has not emptied. The high flow capacity is so much greater than these conditions that there is little reason to worry.

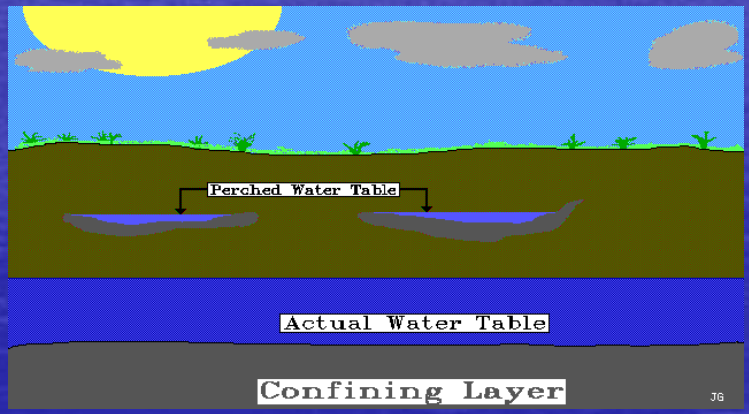
Some swales may never reach the dry state …



… this is because in some cases the bottom of the swale is below the water table and it is continuously being filled.

Even when neighboring swales are dry, the swale may retain water due to a perched water table.





A **perched water table** is an aquifer that is located above the normal water table. This occurs when there is an impermeable layer of soil or rock perched above the main aquifer but below the surface. Water on the way down to the main aquifer gets trapped above this second impermeable soil or rock layer.

Swale Design

The minimum design slope is 0.1% (a tenth of a percent) which is equivalent to a fall of 1 foot in a run of 1000 feet.

Or

Almost 1 inch of fall across the front of a typical 80 foot lot.

Builders are provided with a Swale Plan in order to grade the swale to the proper elevations on a property.

Permit # 2005120672

FAX # 986-1664

COMPLETED - 6/29/2006

ENGINEERING & STORMWATER DEPARTMENT

SWALE PLAN

[SECTION 25 BLOCK 57 LOT 06]

81 Panorama Drive

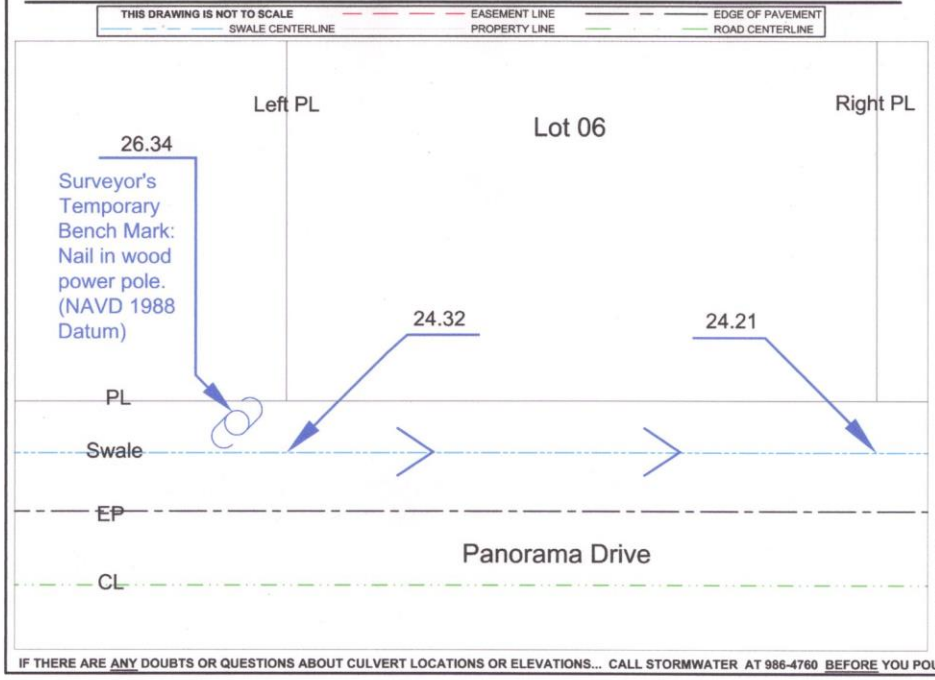
KB Home

GENERAL NOTES

1. The driveway culvert inverts are to be located 1 to 3 inches below the roadside swale's finished grade. The finished swale elevation is with sod in place and is expressed in engineering terms (tenths and hundreths of a foot) rather than in carpenter terms (inches and feet).
2. The swale centerline is located 8 feet from the edge of pavement unless otherwise noted.
3. The design swale elevations may vary from the existing swale conditions in the field.
4. The finished grade of the swale along the edge of pavement is to be 2 inches (before sodding) below the upper edge of the pavement.
5. The swale must have a minimum slope of 0.1% (1 inch across an 80 foot lot) in the direction of flow shown on the Swale Plan.
6. Match the existing swales on adjacent lots by no greater than a 4:1 slope, while maintaining the swale elevations given in front of your property lines. This can be done by extending your grading into the city's swale in front of the adjacent lots as needed. Match existing downstream swales with a level to descending slope and upstream swales with a level to ascending slope. Maintain flow in the indicated direction.
7. All work in the City right-of-way, including swale maintenance (temporary pipe may be required) during construction, litter control, road/swale damage and final cleanup must comply with the current City of Palm Coast Code of Ordinances.
8. Swales at the construction site and on adjacent lots **MUST NOT** be **OBSTRUCTED** at any time. Any obstruction **MUST** be cleared **IMMEDIATELY**.
9. If the builder is unable to locate the temporary benchmark referenced in this Swale Plan, they must contact the surveyor who set the benchmark and notify Stormwater changes are made. **The City assumes no responsibility for data used to prepare this Swale Plan that was provided by third parties including builders owners and surveyors.**
10. It is the **BUILDER'S/OWNER'S RESPONSILITY** to confirm elevations/locations for culvert placement and to ensure that obstructions do not exist upstream and/or downstream. Should there be any questions, or if an obstruction exists, contact **Stormwater at (386) 986-4760**.

SPECIFIC DETAILS

1. The driveway culvert is to be a helical corrugated metal pipe with mitered ends. The size of the culvert is to be 17 X 13 inches in diameter or a 15 inch equivalent, installed in accordance with The City of Palm Coast Residential Culvert Detail (DWG NO. 002-270605). Substitutes require prior City approval.
2. A 2 foot minimum opening between culverts or outfall inlets is required.
3. Driveway replacements and additions are required to meet current City Codes and specifications.
4. Erosion control (silt fence) is **required** across the swale on the downstream property line **before** any construction begins on the site.
5. The swale is to be graded from property line to property line using the elevations in this Swale Plan and the specifications and details provided in the City of Palm Coast Typical Residential Swale Profile (DWG NO. 001-240605) or Residential Cul-De-Sac Swale Profile (DWG NO. 001-270605) unless otherwise specified or directed. All drawings specified in this Swale Plan are available at www.ci.palm-coast.fl.us or can be obtained at the Stormwater Office.



IF THERE ARE **ANY** DOUBTS OR QUESTIONS ABOUT CULVERT LOCATIONS OR ELEVATIONS... CALL STORMWATER AT 986-4760 **BEFORE** YOU POUR.

The builders are allowed swale grading tolerances … which are checked when their final survey is submitted …

- The tolerance for the swale elevations at the property lines is +/- 0.1 feet (a little over an inch.
- The tolerance for the culvert invert (bottom of the pipe) elevations are 1 to 3 inches below the swale finished grade.

The ideal swale grade …

The normal swale grade … within tolerances …

The City does everything possible to ensure that swales match the design grades and are constructed within the prescribed tolerances.

What you can do as a resident ...

Let water pond. In most instances, runoff should temporarily pond in the swale.

Mow and maintain the swale at an acceptable grass height. Tall grass slows the swale even further.

Blow grass clippings back onto grass or landscape areas. Using a mulching mower returns nutrients to the soil and helps save landfill space.

Keep your driveway culvert cleaned out.

Prevent accumulation by removing and composting leaves and grass clippings from the swale.

Keep stormwater swales and stormdrains trash and debris free. Debris in our waterways increases the likelihood of algae blooms and low oxygen water, which cannot support aquatic or marine life.

Minimize the use of fertilizers, pesticides, and herbicides on your lawn.

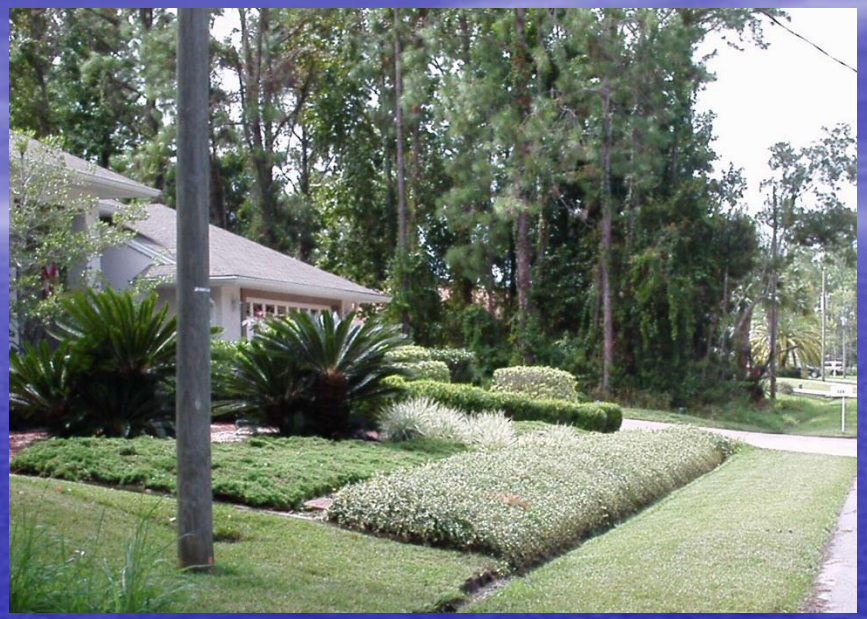
Water and fertilize sparingly. Refrain from applying fertilizers, pesticides and herbicides within 50 feet of a waterway and within 10 feet of a paved surface.

Understand that sometimes swales must be dug out or regraded in order to reestablish their shape – this allows swales to continue doing their job by collecting soil and harmful pollutants so it does not reach the downstream water bodies.

Keep your swale free of leaves, limbs, and other vegetation.

Properly dispose of all debris and oil rather than placing them in your swale.

Avoid continual parking of vehicles on your swale to allow healthy grass to develop and keep the soil loose so water can percolate into the ground.

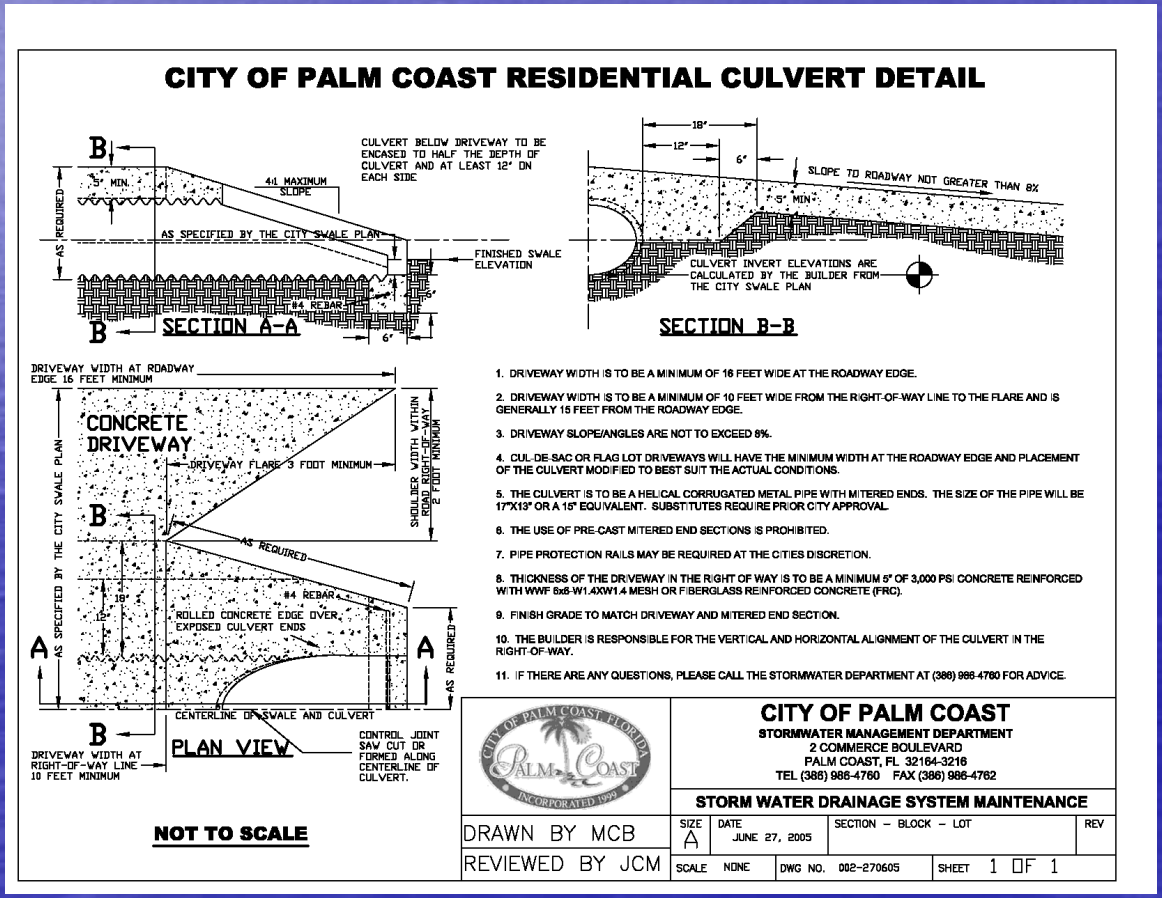


Landscaping your front swale may be pleasing to the eye, but it can disrupt the natural drainage features of your neighborhood. Installing your plantings behind your property line, away from the road (At least 15 – 20 feet), adds beauty to your home and leaves the swale intact.

Do not pave or fill in the swale – this reduces the filtration and infiltration of runoff and reduces the carrying capacity of the swale and it's ability to dewater the roadbed.

Driving across the swale creates ruts which block the flow of water.

Make sure your driveway's design allows water to drain toward your swale. If you want to replace, repair or add to your driveway you must apply for the appropriate permits and abide by the current City Codes.



Additional steps you can take to keep our waterways clean.

- Direct pressure washers to pervious surfaces or grassy surfaces to minimize surface runoff.
- Wash vehicles and equipment on grassy or pervious areas where soapy water will seep into and replenish our shallow aquifer. Keep equipment well maintained to minimize oil and fuel leaks.
- Never dispose or pour solvents or cleaning solutions onto driveways, parking lots, sidewalks or streets.
- Responsibly dispose of construction wastes and hazardous materials – never in swales or stormdrains.
- Use native plants and slow-release fertilizers and herbicides.
- Keep sediment piles at least 10 feet away from waterways and 6 feet from paved surfaces to minimize stormwater runoff. Cover or contain sediment piles when possible.
- Never drain pools to a waterway, stormdrain or street – chlorine and pool chemicals are toxic to our waterways. Allow small amounts of pool water to slowly percolate into grassy or pervious areas.

Please remember…

The way you treat your swale may be repeated in your neighborhood by neighbors following your lead. If changes are done improperly, or if maintenance is neglected, drainage problems are further compounded which make things more difficult for everyone.

You may contact us at:

Construction Management & Engineering Division

160 Lake Avenue
Palm Coast, FL 32164

(386) 986-3794