Land Development Regulations (LDR) Updates – Section 604.01 Stormwater Management and Drainage

January 6, 2025

Land Development Regulations (LDR) Updates

Time Line:

- Purchase Order # 220215-000 was issued on May 17, 2022 to Parker Mynchenberg & Associates (consultant).
- Consultant submitted 1st DRAFT of the LDR update in April 2023 for staff review and comments.
- Consultant re-submitted a FINAL Draft in January 2024.
- City staff provided additional engineering design standards and tables in February 2024.
- FINAL Draft version #1 present to City Commission at Workshop on June 20, 2024.
- Follow-up edits from City Commissioners Workshop Q & A session.
- Present FINAL Draft version #2 to Planning & Zoning Commission on January 6, 2025.

Land Development Regulations (LDR) Updates

LDR Update (Definitions and Rainfall Amounts):

- Added stormwater definitions to explain technical jargon and engineering concepts.
- Current LDR does NOT provide rainfall amounts for development projects. It just states use the 25yr-24hr storm event.
- This resulted in some cases developments using less rainfall than SJRWMD and NOAA recorded data. For example, Venetian Bay Master Development used slightly less rainfall for the 25yr-24hr storm when it was permitted by SJRWMD in 2007.
- Update LDR to provide rainfall amounts for the 10yr-24, 25yr-24hr, 100yr-24hr, and 100yr-72hr (closed basin) design storms.
- Using a higher rainfall intensity for design increases the stormwater system Level of Service (LOS).

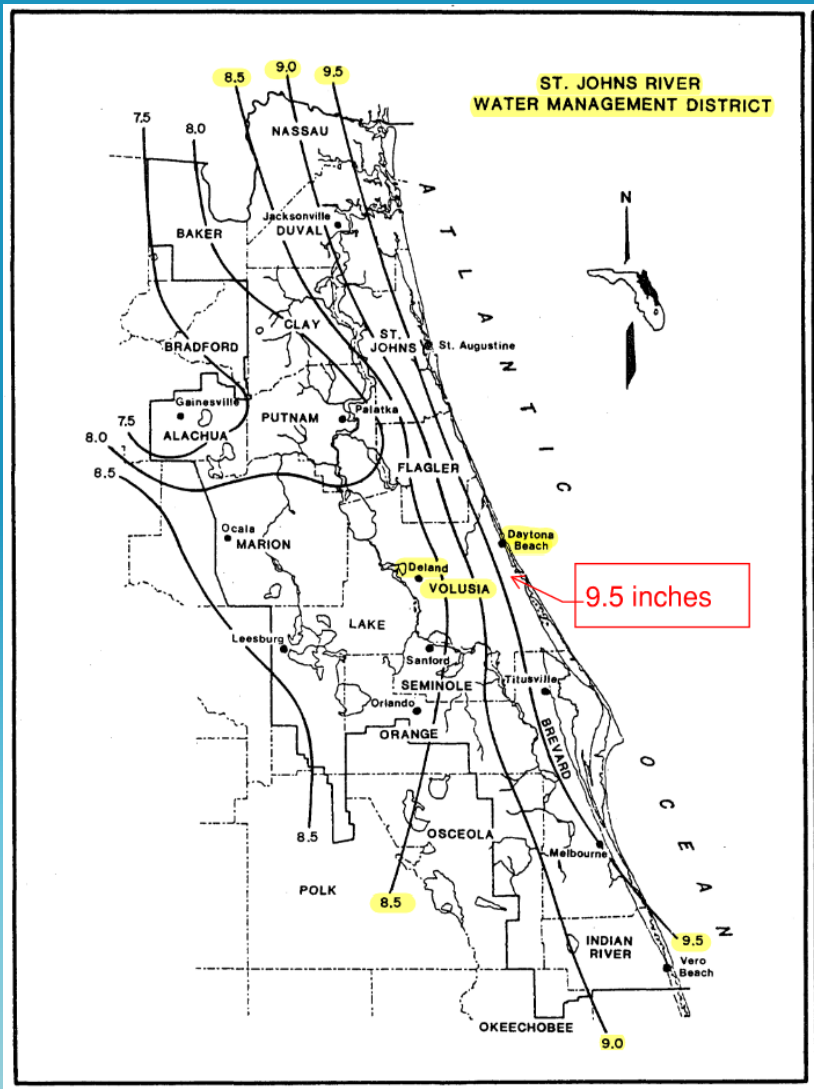


Figure 7. 25-Year 24-Hour Maximum Rainfall for Northeast Florida, Inches.

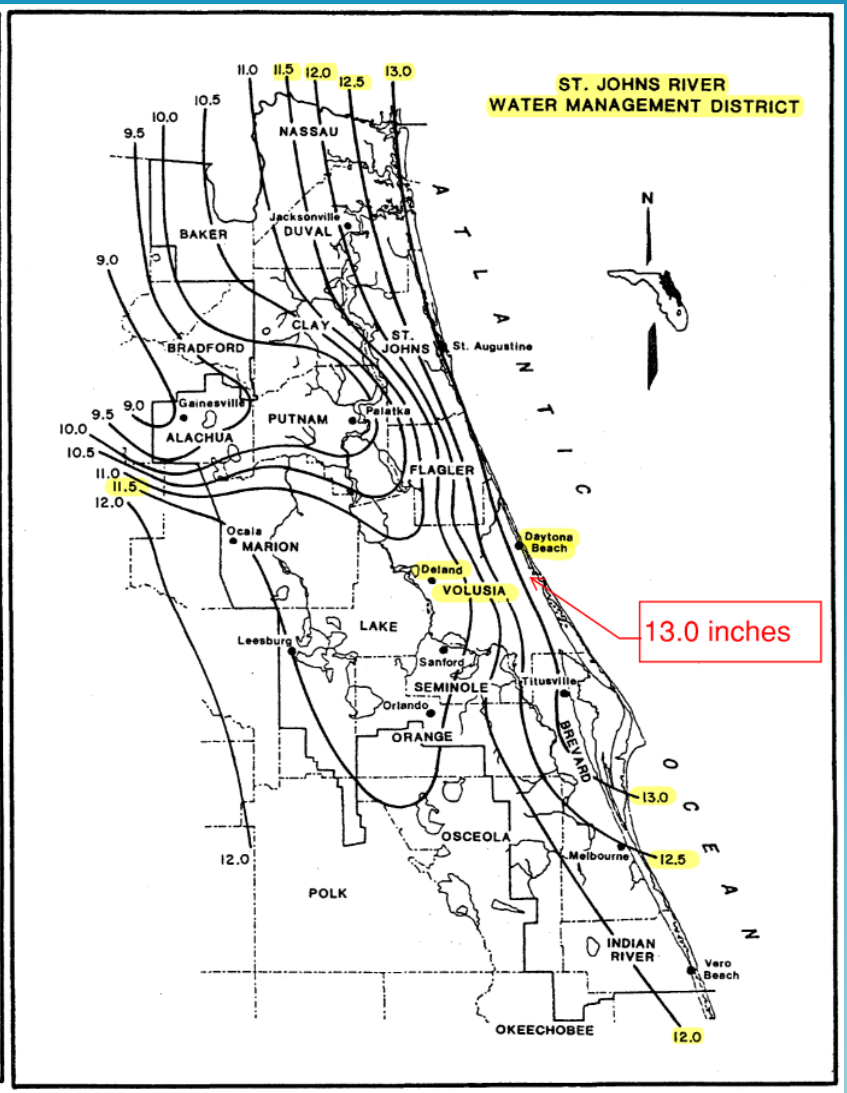
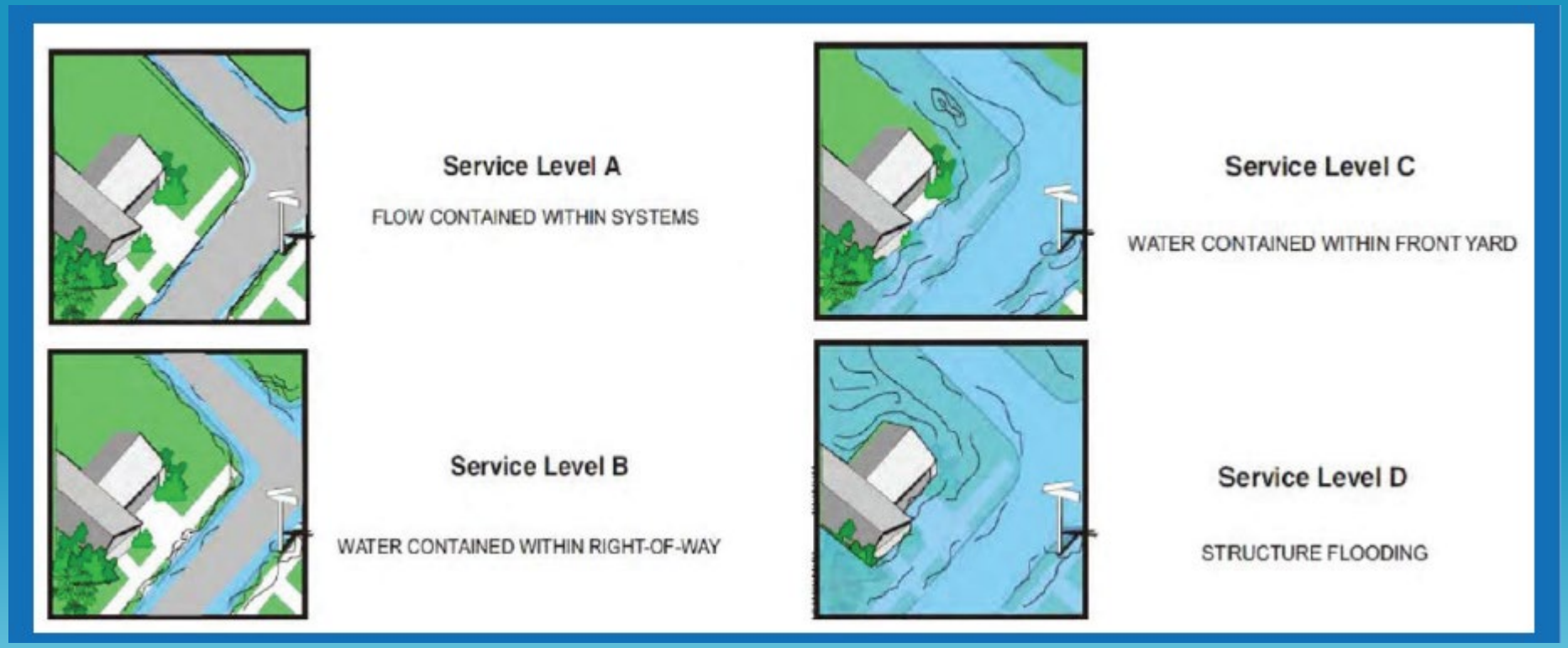


Figure 8. 100-Year 24-Hour Maximum Rainfall for Northeast Florida, Inches.

Land Development Regulations (LDR) Updates



Level of Service (LOS) Category:

Service Level A: Runoff contained within the stormwater system.

Service Level B: Runoff contained within the right-of-way.

Service Level C: Runoff contained within the front yards and around the property.

Service Level D: Structure and house flooding.

Land Development Regulations (LDR) Updates

LDR Update (Closed Basin Criteria):

- Current LDR does not have Closed Basin (land-locked) criteria. However, some developments have used the SJRWMD 25yr-96hr storm (12.5 inches in 4 days) closed basin criteria.

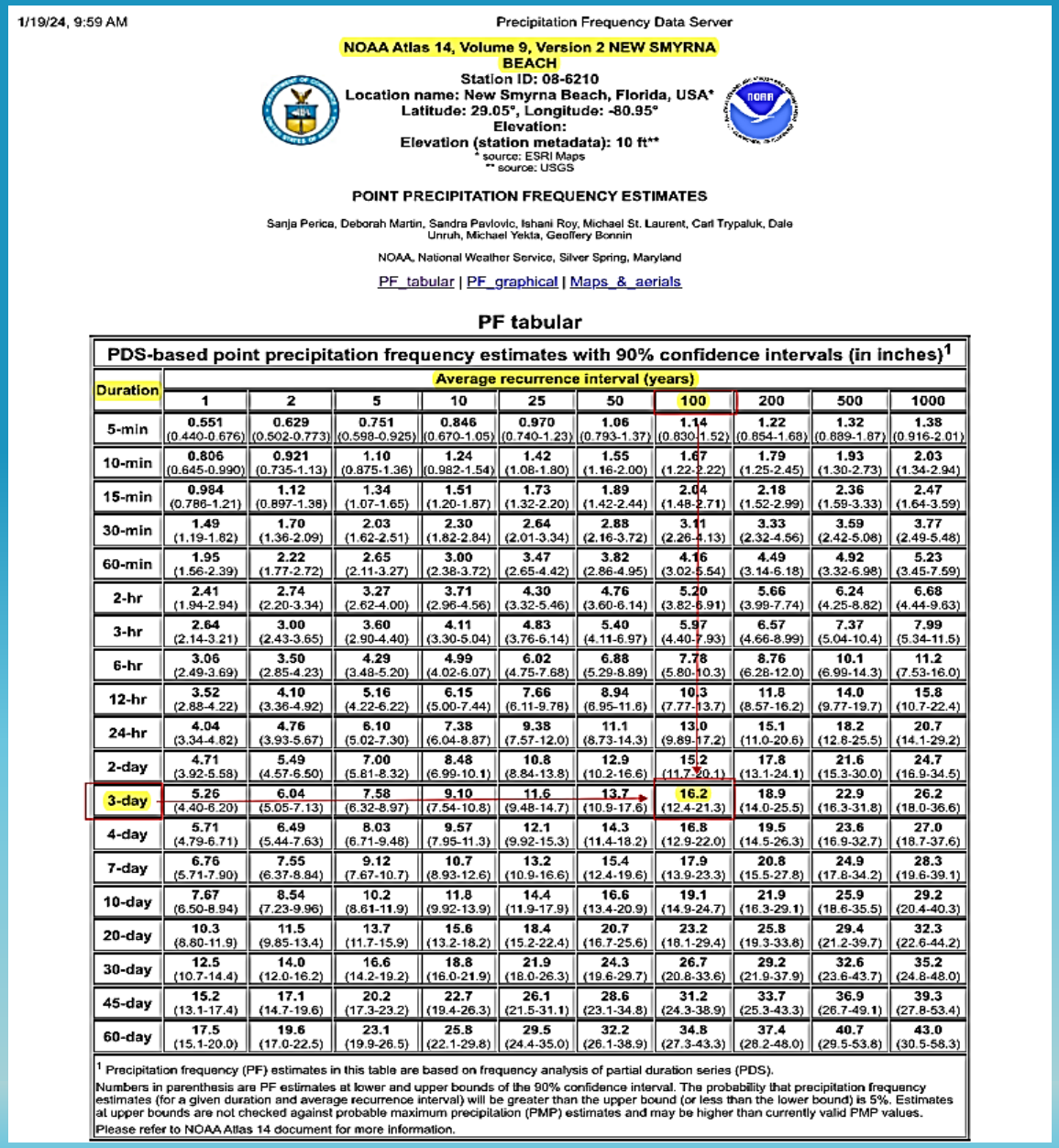
Closed Basin – A land-locked basin that drains to a depression or receiving water body in which water can only leave (discharge) by percolation or evaporation. Or the downstream receiving water body is "volume sensitive" and restricted in capacity.

- Update LDR:

"All development within a closed basin shall provide flood protection for the 100yr-72hr storm event".

- Use NOAA rainfall data for the 100yr-72hr storm event with 16.2 inches. SJRWMD does not provide 72-hour (3-day) duration rainfall data.

- Proposed 16.2 inches will provide a higher level of service (LOS) than SJRWMD 25yr-96hr storm with 12.5 inches for closed basin (landlocked).



1/19/24, 9:59 AM Precipitation Frequency Data Server

NOAA Atlas 14, Volume 9, Version 2 NEW SMYRNA BEACH
Station ID: 08-6210
Location name: New Smyrna Beach, Florida, USA*
Latitude: 29.05°, Longitude: -80.95°
Elevation:
Elevation (station metadata): 10 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.551 (0.440-0.676)	0.629 (0.502-0.773)	0.751 (0.598-0.925)	0.846 (0.670-1.05)	0.970 (0.740-1.23)	1.06 (0.793-1.37)	1.14 (0.830-1.52)	1.22 (0.854-1.68)	1.32 (0.889-1.87)	1.38 (0.916-2.01)
10-min	0.806 (0.645-0.990)	0.921 (0.735-1.13)	1.10 (0.875-1.36)	1.24 (0.982-1.54)	1.42 (1.08-1.80)	1.55 (1.16-2.00)	1.67 (1.22-2.22)	1.79 (1.25-2.45)	1.93 (1.30-2.73)	2.03 (1.34-2.94)
15-min	0.984 (0.786-1.21)	1.12 (0.897-1.38)	1.34 (1.07-1.65)	1.51 (1.20-1.87)	1.73 (1.32-2.20)	1.89 (1.42-2.44)	2.04 (1.48-2.71)	2.18 (1.52-2.99)	2.36 (1.59-3.33)	2.47 (1.64-3.59)
30-min	1.49 (1.19-1.82)	1.70 (1.36-2.09)	2.03 (1.62-2.51)	2.30 (1.82-2.84)	2.64 (2.01-3.34)	2.88 (2.16-3.72)	3.11 (2.26-4.13)	3.33 (2.32-4.56)	3.59 (2.42-5.08)	3.77 (2.49-5.48)
60-min	1.95 (1.56-2.39)	2.22 (1.77-2.72)	2.65 (2.11-3.27)	3.00 (2.38-3.72)	3.47 (2.65-4.42)	3.82 (2.86-4.95)	4.16 (3.02-5.54)	4.49 (3.14-6.18)	4.92 (3.32-6.98)	5.23 (3.45-7.59)
2-hr	2.41 (1.94-2.94)	2.74 (2.20-3.34)	3.27 (2.62-4.00)	3.71 (2.96-4.56)	4.30 (3.32-5.46)	4.76 (3.60-6.14)	5.20 (3.82-6.91)	5.66 (3.99-7.74)	6.24 (4.25-8.82)	6.68 (4.44-9.63)
3-hr	2.64 (2.14-3.21)	3.00 (2.43-3.65)	3.60 (2.90-4.40)	4.11 (3.30-5.04)	4.83 (3.76-6.14)	5.40 (4.11-6.97)	5.97 (4.40-7.93)	6.57 (4.66-8.99)	7.37 (5.04-10.4)	7.99 (5.34-11.5)
6-hr	3.06 (2.49-3.69)	3.50 (2.85-4.23)	4.29 (3.48-5.20)	4.99 (4.02-6.07)	6.02 (4.75-7.68)	6.88 (5.29-8.89)	7.78 (5.80-10.3)	8.76 (6.28-12.0)	10.1 (6.99-14.3)	11.2 (7.53-16.0)
12-hr	3.52 (2.88-4.22)	4.10 (3.36-4.92)	5.16 (4.22-6.22)	6.15 (5.00-7.44)	7.66 (6.11-9.78)	8.94 (6.95-11.6)	10.3 (7.77-13.7)	11.8 (8.57-16.2)	14.0 (9.77-19.7)	15.8 (10.7-22.4)
24-hr	4.04 (3.34-4.82)	4.76 (3.93-5.67)	6.10 (5.02-7.30)	7.38 (6.04-8.87)	9.38 (7.57-12.0)	11.1 (8.73-14.3)	13.0 (9.89-17.2)	15.1 (11.0-20.6)	18.2 (12.8-25.5)	20.7 (14.1-29.2)
2-day	4.71 (3.92-5.58)	5.49 (4.57-6.50)	7.00 (5.81-8.32)	8.48 (6.99-10.1)	10.8 (8.84-13.8)	12.9 (10.2-16.6)	15.2 (11.7-20.1)	17.8 (13.1-24.1)	21.6 (15.3-30.0)	24.7 (16.9-34.5)
3-day	5.26 (4.40-6.20)	6.04 (5.05-7.13)	7.58 (6.32-8.97)	9.10 (7.54-10.8)	11.6 (9.48-14.7)	13.7 (10.9-17.6)	16.2 (12.4-21.3)	18.9 (14.0-25.5)	22.9 (16.3-31.8)	26.2 (18.0-36.6)
4-day	5.71 (4.79-6.71)	6.49 (5.44-7.63)	8.03 (6.71-9.48)	9.57 (7.95-11.3)	12.1 (9.92-15.3)	14.3 (11.4-18.2)	16.8 (12.9-22.0)	19.5 (14.5-26.3)	23.6 (16.9-32.7)	27.0 (18.7-37.6)
7-day	6.76 (5.71-7.90)	7.55 (6.37-8.84)	9.12 (7.67-10.7)	10.7 (8.93-12.6)	13.2 (10.9-16.6)	15.4 (12.4-19.6)	17.9 (13.9-23.3)	20.8 (15.5-27.8)	24.9 (17.8-34.2)	28.3 (19.6-39.1)
10-day	7.67 (6.50-8.94)	8.54 (7.23-9.96)	10.2 (8.61-11.9)	11.8 (9.92-13.9)	14.4 (11.9-17.9)	16.6 (13.4-20.9)	19.1 (14.9-24.7)	21.9 (16.3-29.1)	25.9 (18.6-35.5)	29.2 (20.4-40.3)
20-day	10.3 (8.80-11.9)	11.5 (9.85-13.4)	13.7 (11.7-15.9)	15.6 (13.2-18.2)	18.4 (15.2-22.4)	20.7 (16.7-25.6)	23.2 (18.1-29.4)	25.8 (19.3-33.8)	29.4 (21.2-39.7)	32.3 (22.6-44.2)
30-day	12.5 (10.7-14.4)	14.0 (12.0-16.2)	16.6 (14.2-19.2)	18.8 (16.0-21.9)	21.9 (18.0-26.3)	24.3 (19.6-29.7)	26.7 (20.8-33.6)	29.2 (21.9-37.9)	32.6 (23.6-43.7)	35.2 (24.8-48.0)
45-day	15.2 (13.1-17.4)	17.1 (14.7-19.6)	20.2 (17.3-23.2)	22.7 (19.4-26.3)	26.1 (21.5-31.1)	28.6 (23.1-34.8)	31.2 (24.3-38.9)	33.7 (25.3-43.3)	36.9 (26.7-49.1)	39.3 (27.8-53.4)
60-day	17.5 (15.1-20.0)	19.6 (17.0-22.5)	23.1 (19.9-26.5)	25.8 (22.1-29.8)	29.5 (24.4-35.0)	32.2 (26.1-38.9)	34.8 (27.3-43.3)	37.4 (28.2-48.0)	40.7 (29.5-53.8)	43.0 (30.5-58.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Land Development Regulations (LDR) Updates

LDR Update (Pre versus Post Discharge Criteria):

● Current LDR Section 604.01, Part B, (3) - Pre versus Post development discharge Rate and Volume criteria:

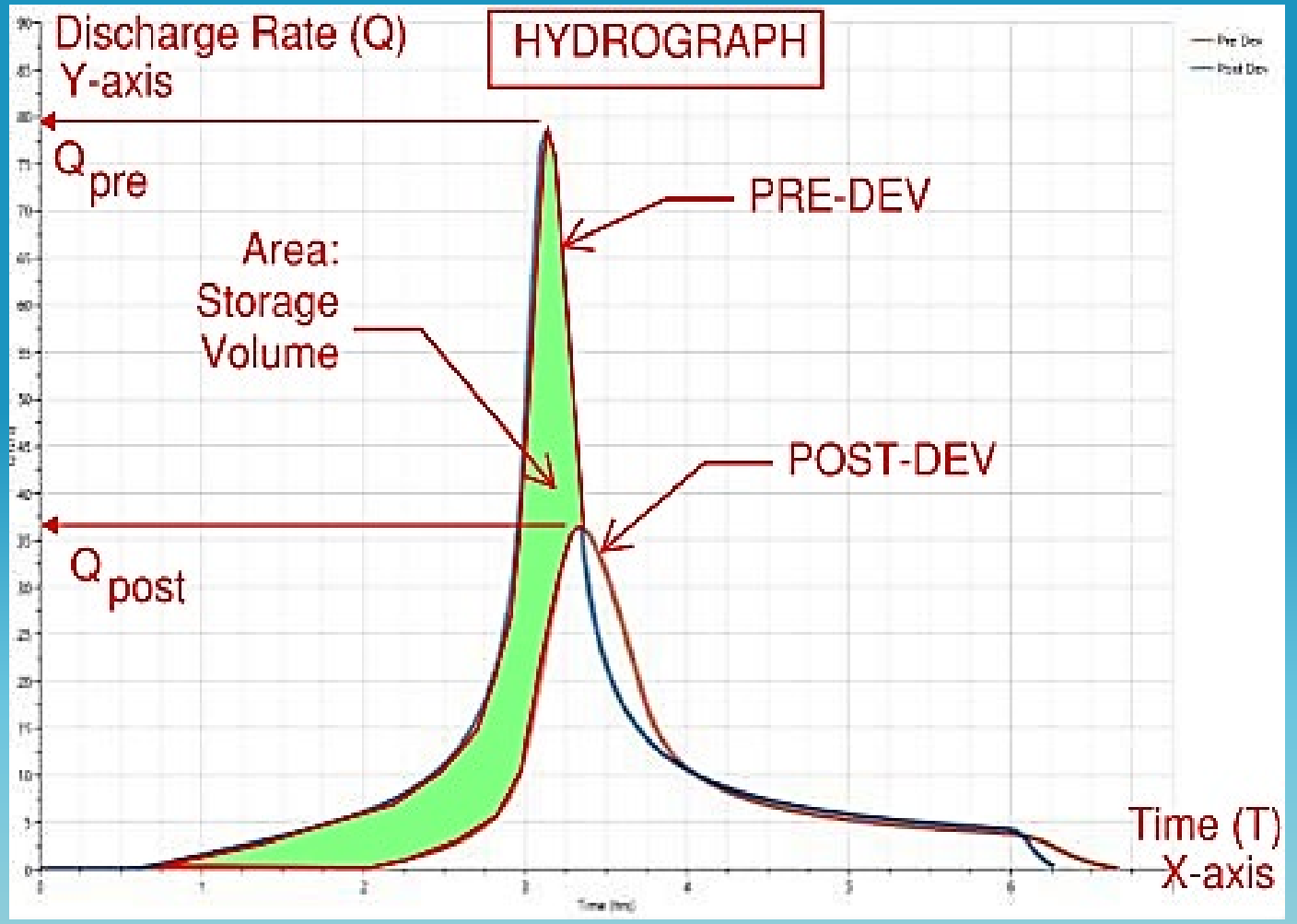
"For a 25-year storm of 24 hours duration, the peak discharge rate and the total runoff volume leaving the developed or redeveloped site shall be limited to the 110 percent of the peak discharge rate and the total runoff volume prior to development or redevelopment".

** This allow projects Post-development to discharge 10% MORE than Pre-development Rate (CFS) and volume (CF) leaving the site.

● Update LDR:

"For a 25-year storm of 24 hours duration, the peak discharge rate and the total runoff volume leaving the developed or redeveloped site shall be limited to the 100 percent of the peak discharge rate and the total runoff volume prior to development or redevelopment".

** This will ensure Post-development discharge is Equal or Less than Pre-development Rate (CFS) and Volume (CF).



Land Development Regulations (LDR) Updates

LDR Update:

- Add Design Table # 1 – To summarize Design Storms, Rainfall Amounts, and Pre versus Post discharge requirements.
- Engineers can reference this table during design of the stormwater system.

Table 1: ***Design Storm Events and Peak Discharges***

Stormwater Facility	Design Storms and Discharge Requirements	Rainfall Amount
Retention or Detention Ponds		**Per IDF Curves**
Ponds with Positive Outfall	Post-Development less than Pre-Development Discharge of Peak Rate and Volume for 25-year, 24-hour Storm (SCS Type II or Florida Modified Rainfall Distribution)	9.5 inches
Discharge to Closed Basin (Land-locked) without Positive Outfall*	Post-Development less than Pre-Development Discharge of Peak Rate and Volume for 100-year, 72-hour (3 Days) Storm (SCS Type II or Florida Modified Rainfall Distribution)	16.2 inches
Sites with known flooding issues or with restricted downstream outfall system**	Post-Development less than Pre-Development Discharge of Peak Rate for 100-year, 24-hour Storm (SCS Type II or Florida Modified Rainfall Distribution)	13.0 inches
Conveyance Systems		
Storm Sewers	10-year, 24-hour Storm (Peak Discharge from Rational Equation)	7.5 inches
Roadside Swales	10-year, 24-hour Storm	7.5 inches
Major Conveyance Canal or Ditch	25-Year, 24-hour Storm	9.5 inches
Major Bridge or Box Culvert	100-year, 24-hour Storm	13.0 inches

Note: Above storm design frequency or duration may be increased if deemed necessary by the city engineer to prevent flooding and protect properties.

*In addition to SJRWMD closed basin (land-locked) criteria.

** As determined by the city engineer.

Land Development Regulations (LDR) Updates

LDR Update:

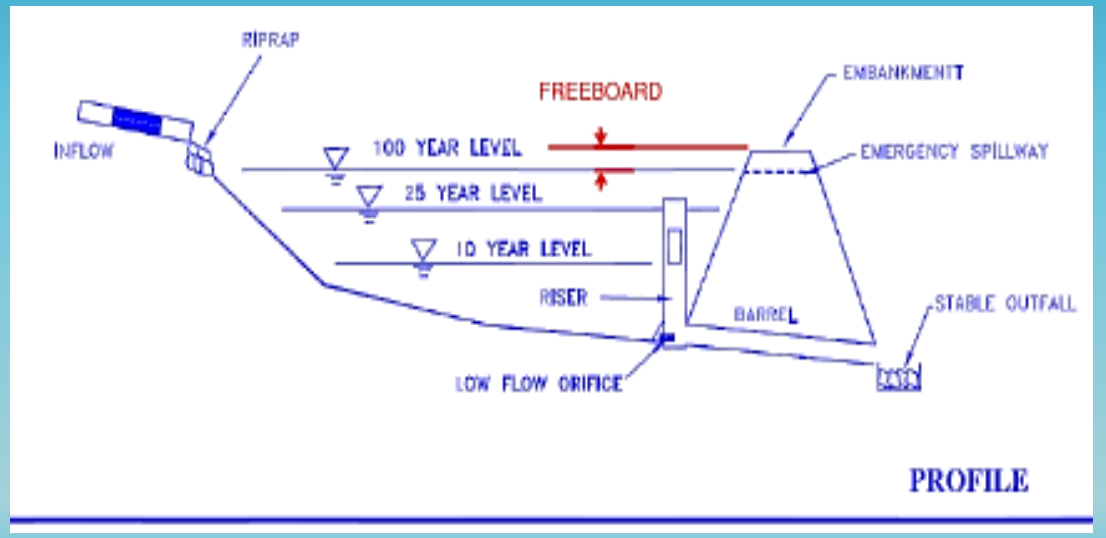
- Freeboard – Provides safety of factor and increase level of service (LOS) for the stormwater system design. Current LDR does not have freeboard requirements.

Freeboard – the vertical distance between (clearance) the Design High Water (DHW) and pond top of berm for the design storm event (i.e. 25yr-24hr storm). Or within storm sewers the vertical distance between the Hydraulic Grade Line (HGL) and inlet grate or throat elevation for the design storm event (i.e. 10yr-24hr storm).

- Design Table # 2 - Provide minimum freeboard requirements for retention ponds, swales, storm sewers, canals, and ditches.

Table 2: Minimum Freeboard Protection and Hydraulic Grade Line (HGL)

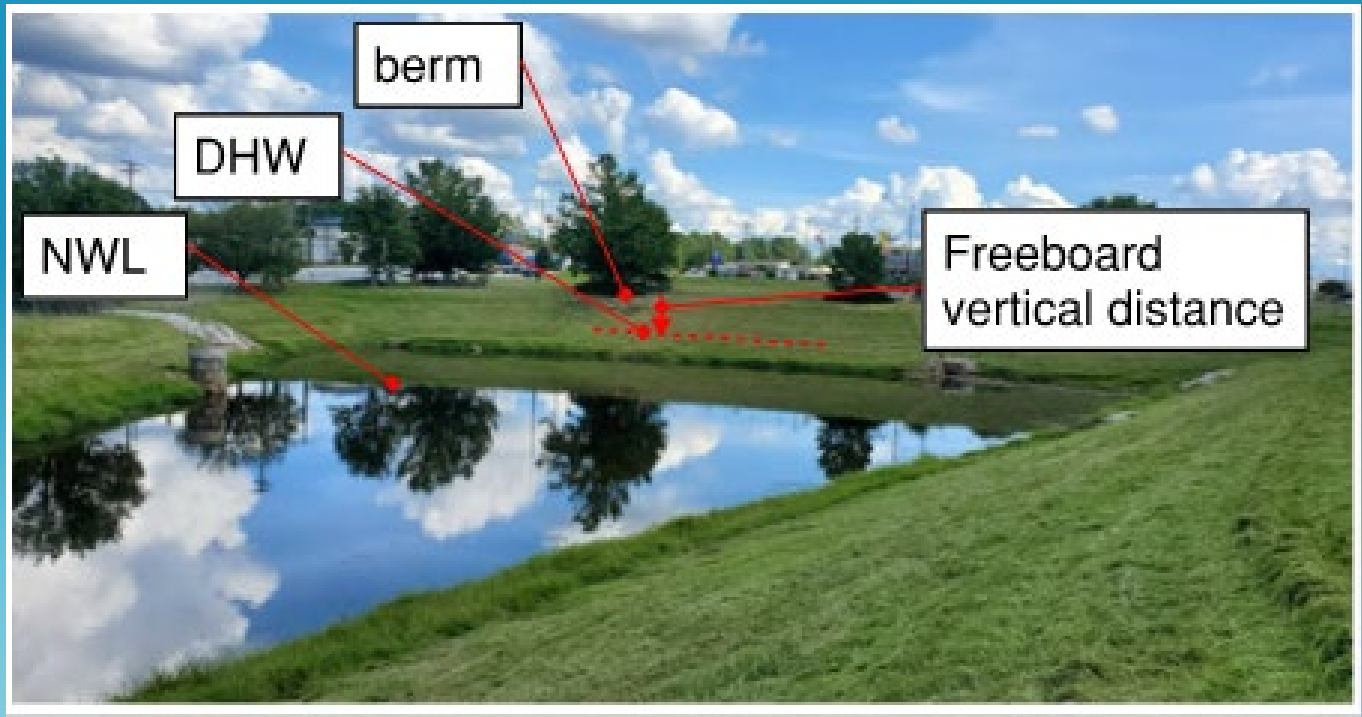
Stormwater Conveyance System	Minimum Freeboard
Retention & Detention Ponds	12 inches above Design High Water (DHW)
Roadside Swales	6 inches above Design High Water (DHW)
Canal & Ditches (Major Conveyance System)	12 inches above Design High Water (DHW)
Storm Sewers	6 inches above Hydraulic Grade Line (HGL)

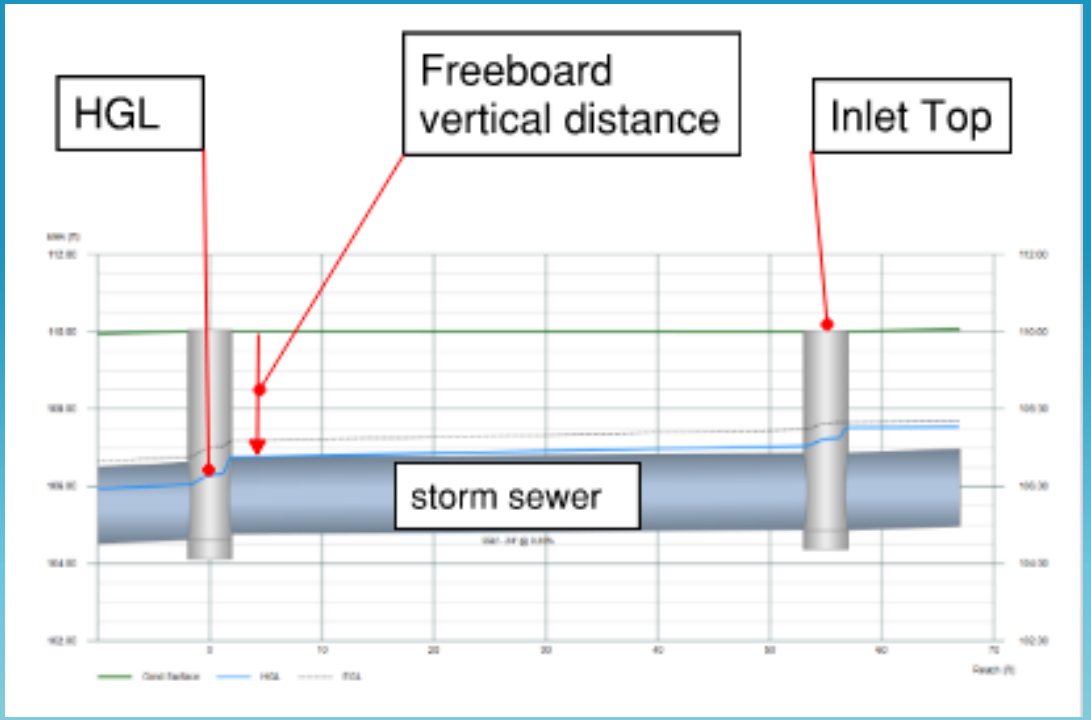


Land Development Regulations (LDR) Updates

LDR Update:

- Freeboard – Examples:





Land Development Regulations (LDR) Updates

LDR Update:

● Tailwater Conditions (Boundary Conditions) – Tailwater is the downstream water depths. Important engineering design concept and assumption, which can impact the drainage system discharge Rate and Volume leaving the site.

● Tailwater assumption – if error or under-estimate can cause backwater effect, reverse flow back into the ponds. Or it can restrict the pond outfall discharge. This can lower the level of service (LOS).

● Table #5 – Provide Tailwater Conditions guidance for engineers and designers.

Table 5: Tailwater for Design

Conveyance Type	Design Tailwater
Storm Sewers	Crown of Pipe or HGL Elevation
Stormwater Ponds	Design High Water (DHW)
Lakes and Rivers	Normal High-Water Line
Ditches and Canals	Normal Depth for Design Storm
Wetlands and Depressions	Seasonal High-Water Table (SHWT)

Note: Above tailwater requirements may be increased if deemed necessary by the city engineer to prevent flooding and protect properties.

Land Development Regulations (LDR) Updates

Other LDR Updates (currently not in our LDR):

● Provide min. easements and maintenance berms requirements. For example, larger easement widths required between lots based on pipe depths.

● Max. side slopes for ponds, swales, and ditches. This is needed to provide safety for mowing equipment, help prevent erosion and reduce maintenance.

● Roadway and streets design standards:

- Proper roadway drainage extend the life of the pavement and reduce maintenance.

- Design for 10yr-24hr storm level of service (7.5 inches in 24 hour).

- Max. allowable stormwater spread onto the travel lane is one-half lane during the 4.0 inches in one-hour storm event. This is the maximum rainfall intensity for driver visibility on the roads.

- Hydraulic Grade Line (HGL) at least 6 inches below the inlet throat grate or roadside swale berm. HGL is the water surface levels of the drainage system for a design storm event (i.e. 10yr-24hr storm).

- Seasonal High-Water Table (SHWT) must be at least one-foot below the road base to protect the pavement. Otherwise, under-drain are required.

Land Development Regulations (LDR) Updates

Other LDR Updates (currently not in our LDR):

- Inlets and storm sewer design and tables:

Table 7: Maximum Inlet Interception Rates

Inlet Types	Maximum Intake Capacity (CFS)
Curb Inlet Type 1	4.1
Curb Inlet Type 2	9.0
Curb Inlet Type 3	1.9
Curb Inlet Type 4	6.5
Curb Inlet Type 5	3.1
Curb Inlet Type 6	7.5
Ditch Bottom Inlet Type C	4.0
Ditch Bottom Inlet Type D and E	6.0
Ditch Bottom Inlet Type H	7.0
Gutter Inlet Type S	4.0
Gutter Inlet Type V	5.0

Table 8: Maximum Pipe Lengths without Structure for Maintenance and Access

Pipe Size (inside diameter)	Maximum Pipe Length
15-inch	200 feet
18-inch	300 feet
24-inch to 36-inch	400 feet
42-inch and Larger Pipes	500 feet

Table 9: Minimum and Maximum Pipe Velocities

Conveyance Type	Allowable Velocities
Storm Sewers (Flowing full)	Min. 2.5 feet per sec
	Max. 12 feet per sec
Max. Outlet Velocity without Energy Dissipator	4.0 feet per sec

Land Development Regulations (LDR) Updates

Other LDR Updates (currently not in our LDR):

- Open drainage conveyance system design:

Table 10: Maximum Allowable Velocities for Open Conveyance Systems

Open Drainage System	Allowable Velocities
Bare soil with seed & mulch	Max. 1.5 feet per sec
Sod	Max. 4 feet per sec
Rip-rap rubble (Ditch Lining)	Max. 6 feet per sec
Rigid Concrete Lining	Max. 10 feet per sec
Outlet Point Requiring Energy Dissipation Device	Greater than 4 feet per sec

- Best Management Practices (BMP) and Stormwater Pollution Prevention Plan (SWPPP)

  - Required an erosion control plan on developments to protect adjacent ROW, properties, and wetlands.

  - Criteria for stockpiling of material during construction.

  - Temporary seeding during construction to prevent sediment runoff.

  - De-watering requirements per the SJRWMD and FDEP permit conditions.

Land Development Regulations (LDR) Updates

Other LDR Updates (currently not in our LDR):

- Residential Lot Grading and Infill Lots requirements
- Stormwater Management Plan requirements for developments
- Low Impact Development (LID) standards and criteria

Summary conclusion:

- Updating the LDR, Section 604.01, Stormwater Management and Drainage will provide higher level of service (LOS) and factor of safety for developments and protect properties. This will also strengthen the infrastructure resiliency and adapt to today's extreme storm events. These events have occurred more frequent and with higher intensity in the last few years.