



Climatological Impact on Wet Weather Management and a Resiliency Plan for Wastewater Operations

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Agenda

City of Garland WWTP Facilities

Project Background and Objectives

Historical Rainfall Data Analysis

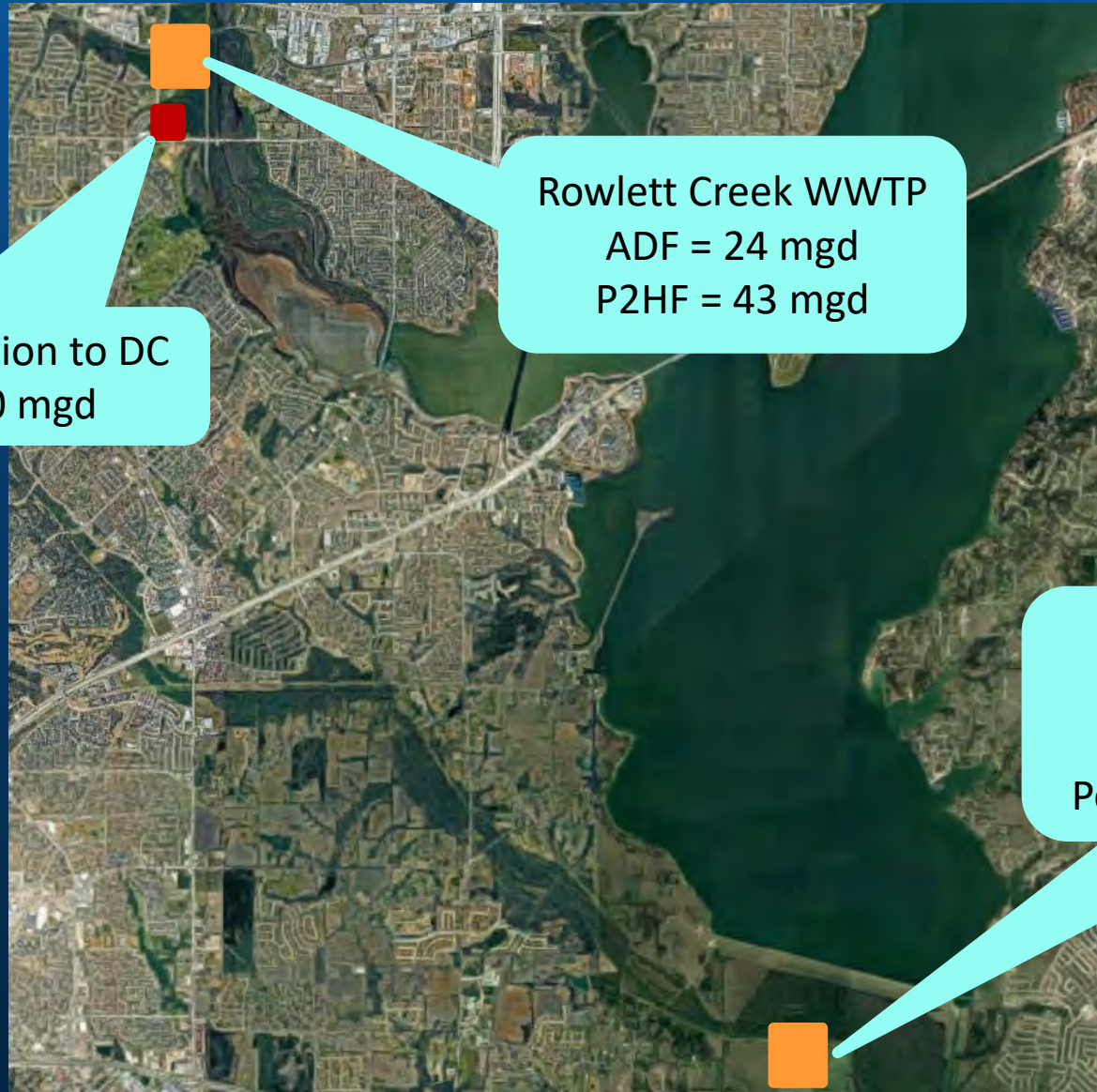
Collection System Hydraulic Model

Collection System Rain Gauge Data Analysis

Major Wet Weather Events and Peak Flows

Peak Flow Alternatives

City of Garland, WWTP Facilities



RC Transfer Pump Station to DC
Firm Capacity = 60 mgd

Rowlett Creek WWTP
ADF = 24 mgd
P2HF = 43 mgd

Duck Creek WWTP
ADF = 40 mgd
P2HF = 72 mgd
Peak Flow Basin = 50 MG

Project Background and Objectives

> Collection System Hydraulic Model

- Design Storm “5-year 6-hour” event (High intensity Short duration)
- Appropriate for collection system capacity assessment and planning

> Facilities Master Plan

- Based on collection system peak hydraulic event
- 50 MG existing Peak Flow Basin at DC-WWTP adequate for short term wet weather events.

> Treatment Plant Major Wet Weather Events

- Extended wet weather event
- Multiple peaks during major wet weather events
- Risk of compromising the treatment processes
- Past Flooding events at RC – WWTP

> Project Objectives

- Analyze historical data
- Determine major wet weather event (Design Storm) for treatment plant peak flows
- Peak flow storage volumes and alternatives

Project Background and Objectives

RCP Basin West
7:49:51.633 AM
10/24/2015



RCP Basin East
12:21:07.395 PM
10/24/2015



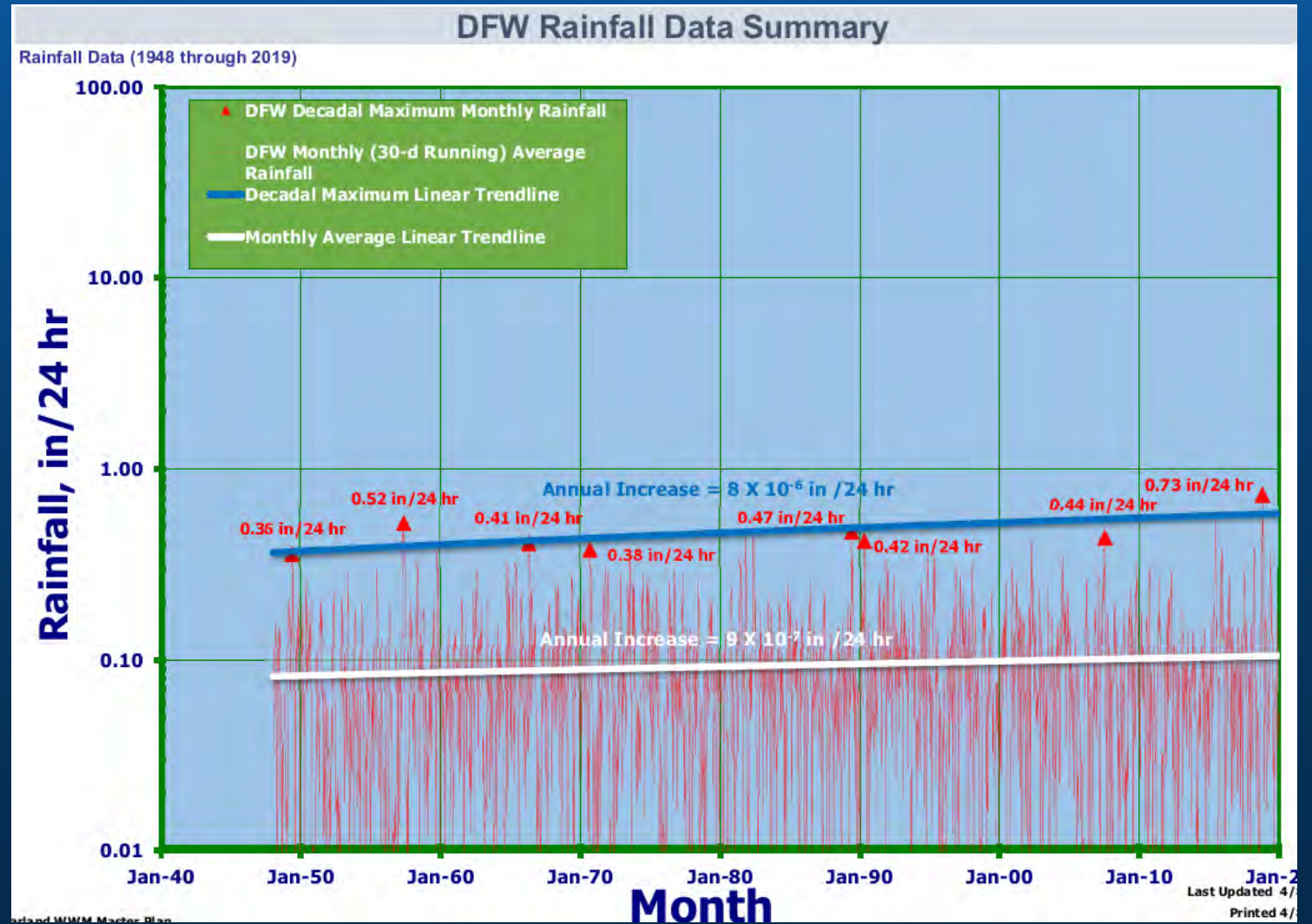
Historical Rainfall Data

> Climatological Data from NOAA.GOV

- Station Name – DAL FTW WSCMO AIRPORT, TX, US. # USW00003927

> Rainfall data Analysis

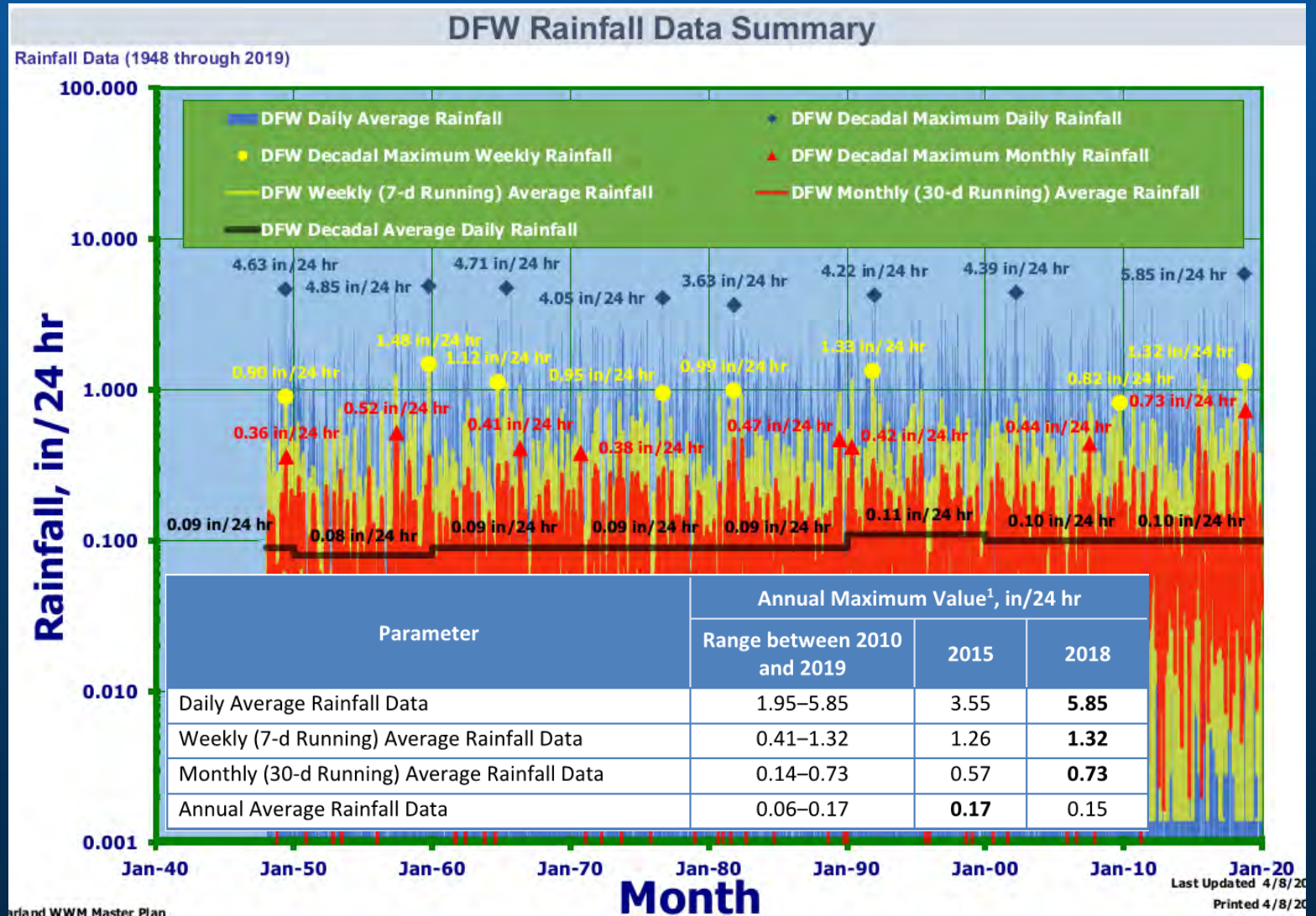
- DFW data from 1949 to 2019 (70-year data)
- Minor Increasing Trend (Monthly Averages)



Historical Rainfall Data

> Rainfall data Analysis

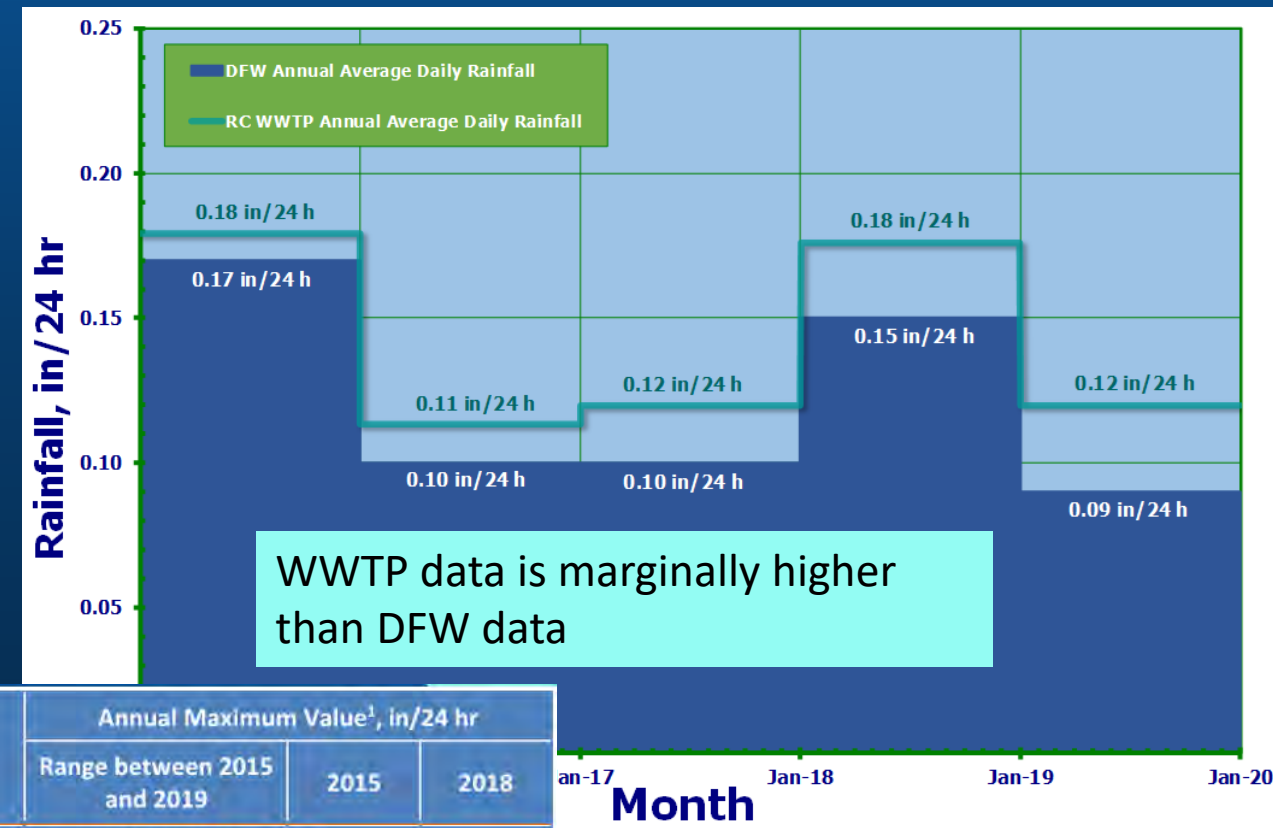
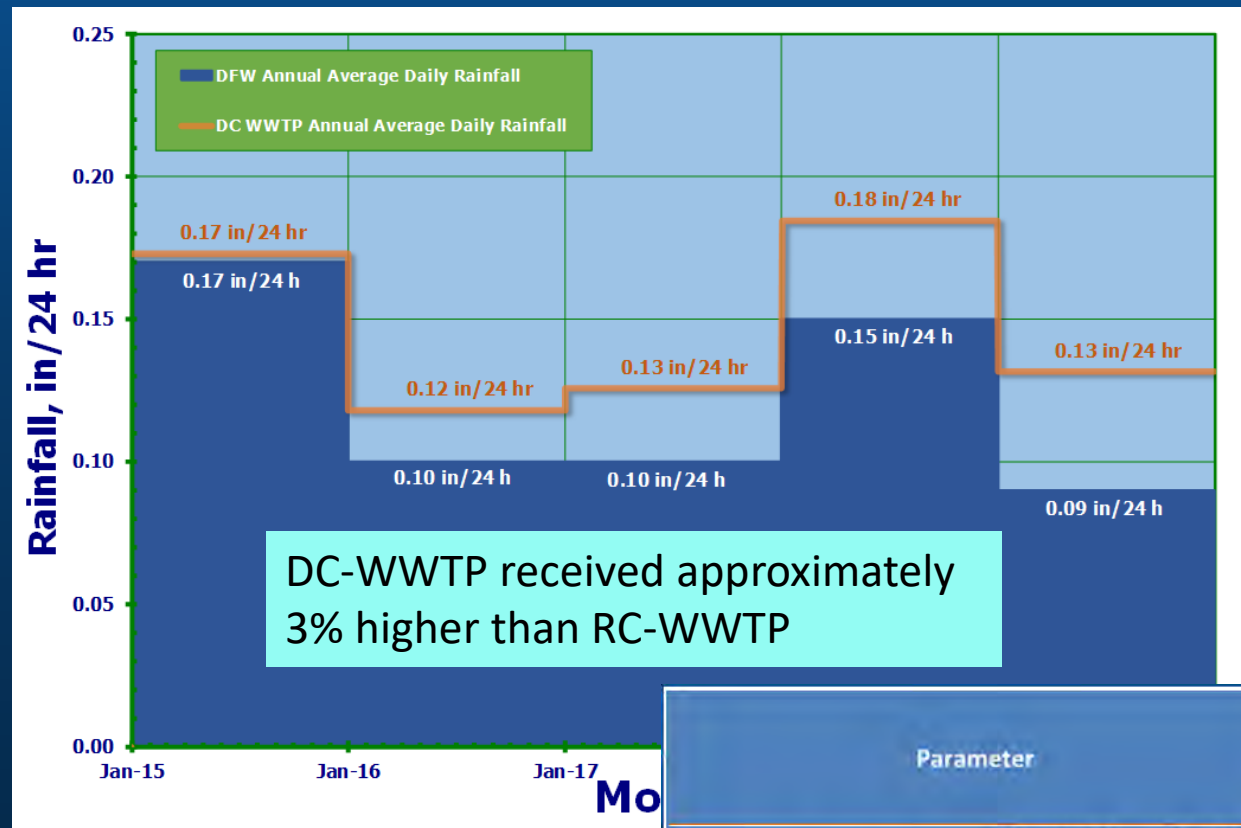
- 2010's showed severe wet weather conditions in 2018 and 2015 (for maximum daily, weekly, monthly and annual rainfalls)



Historical Rainfall Data

> WWTPs Rain Gauge Data

- Obtained 5-year rainfall data (2015 to 2019) from RC and DC WWTPs.
- High rainfalls observed in 2015 and 2018 (Similar to DFW Data)



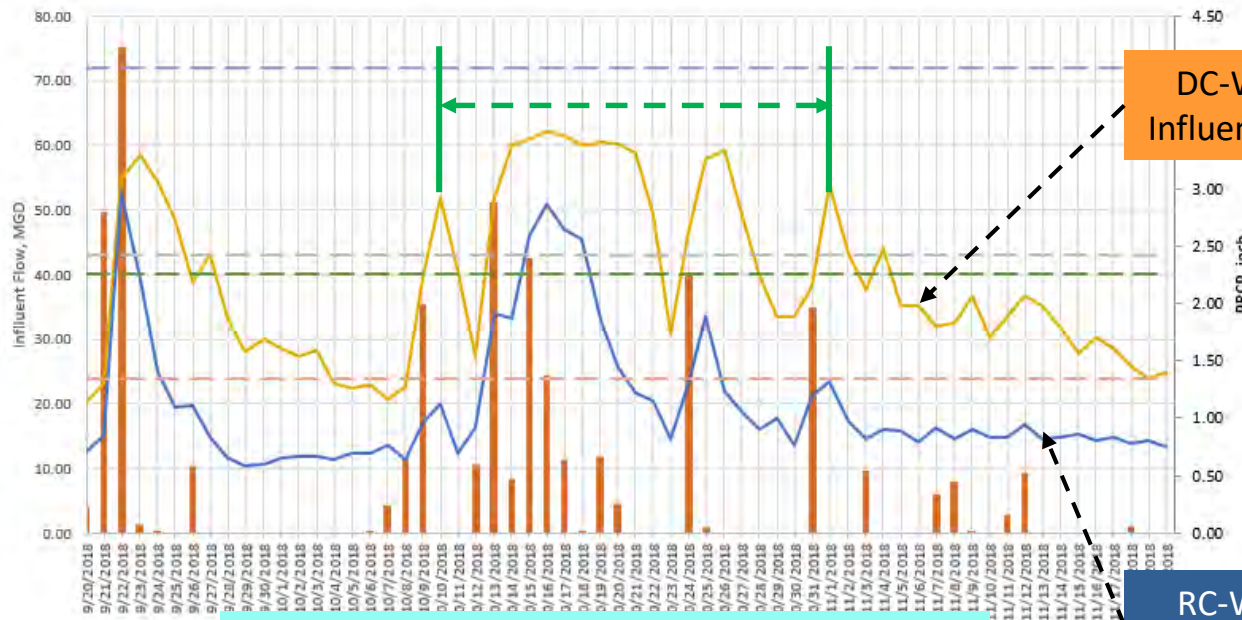
| Parameter | Annual Maximum Value ¹ , in/24 hr | | |
|---|--|------|------|
| | Range between 2015 and 2019 | 2015 | 2018 |
| Estimated Overall Rainfall Values at the Plants | | | |
| Daily Average Rainfall Data | 2.77-5.88 | 5.88 | 4.24 |
| Weekly (7-d Running) Average Rainfall Data | 0.78-1.44 | 1.34 | 1.44 |
| Monthly (30-d Running) Average Rainfall Data | 0.29-0.66 | 0.52 | 0.66 |
| Annual Average Rainfall Data | 0.12-0.18 | 0.18 | 0.18 |

Historical Rainfall Data and Analysis

> Wet Weather Event Analysis

- o First and Second maximum DFW rainfall events (2018 and 2015, respectively)

2018 - Duck Creek WWTP and Rowlett Creek WWTP Influent Flow with Max 30-Day Running Summation

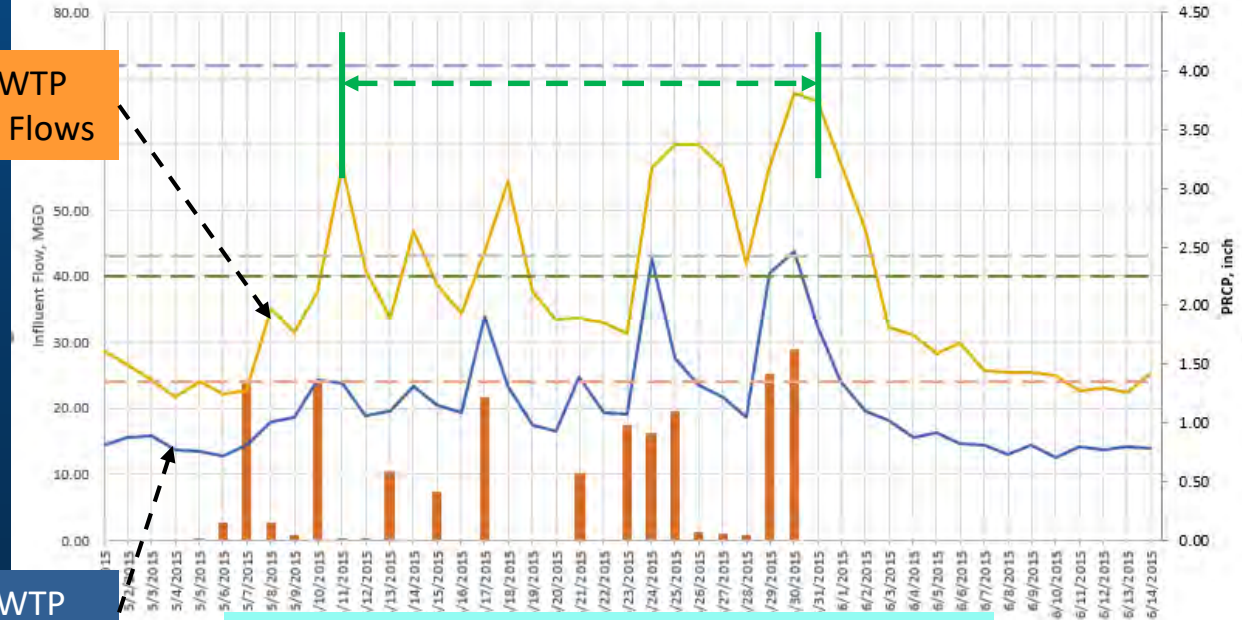


10/10/2018 to 11/1/2018
A 20-Day Major Wet Weather Event

DC-WWTP
Influent Flows

RC-WWTP
Influent Flows

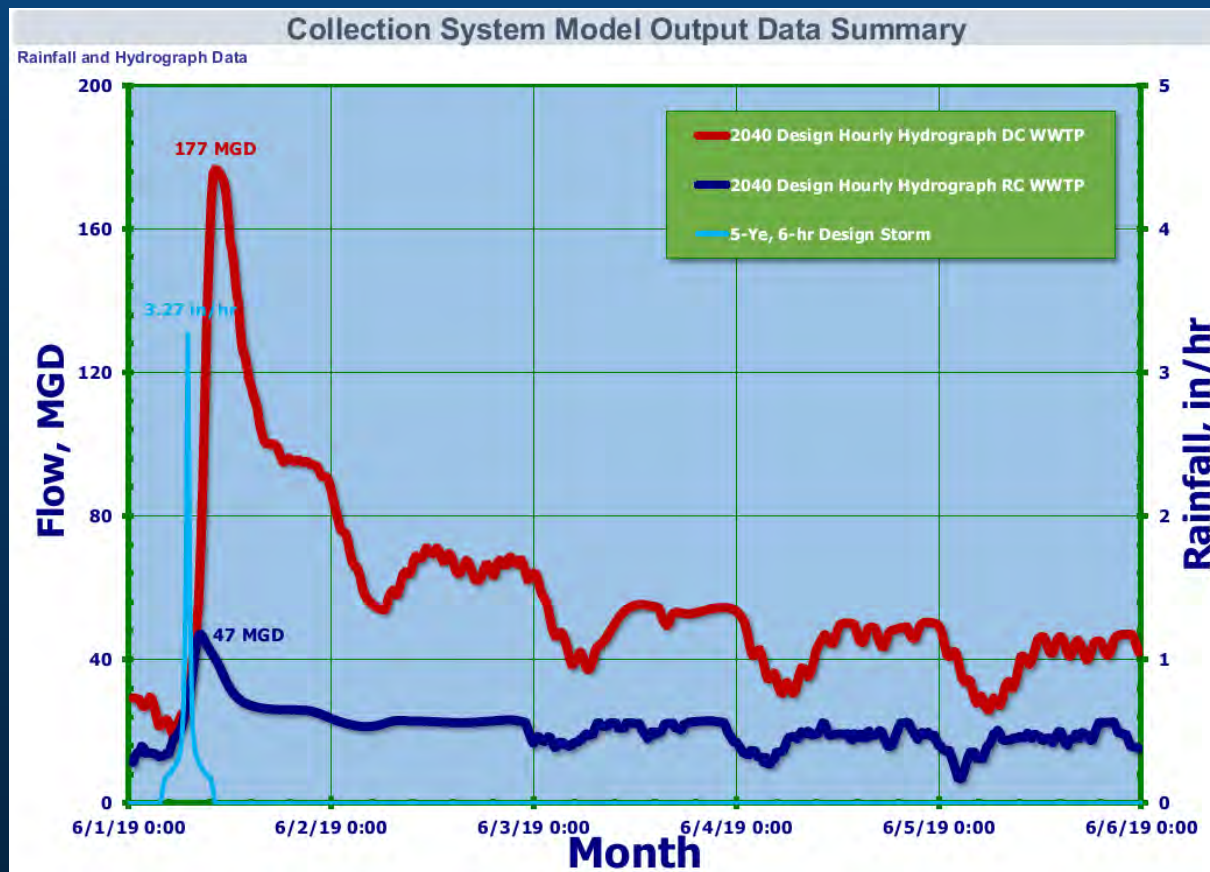
2015 - Duck Creek WWTP and Rowlett Creek WWTP Influent Flow with 2nd Largest 30-Day Running Summation



5/11/2015 to 5/31/2015
A 20-Day Major Wet Weather Event

Collection System Hydraulic Model

- > Collection System Hydraulic Model (Provided by the City)
 - 5-year 6-hour design storm
 - High Intensity short duration storm
 - Appropriate for collection system assessment and planning
 - Volumes at Treatment Plants are much higher

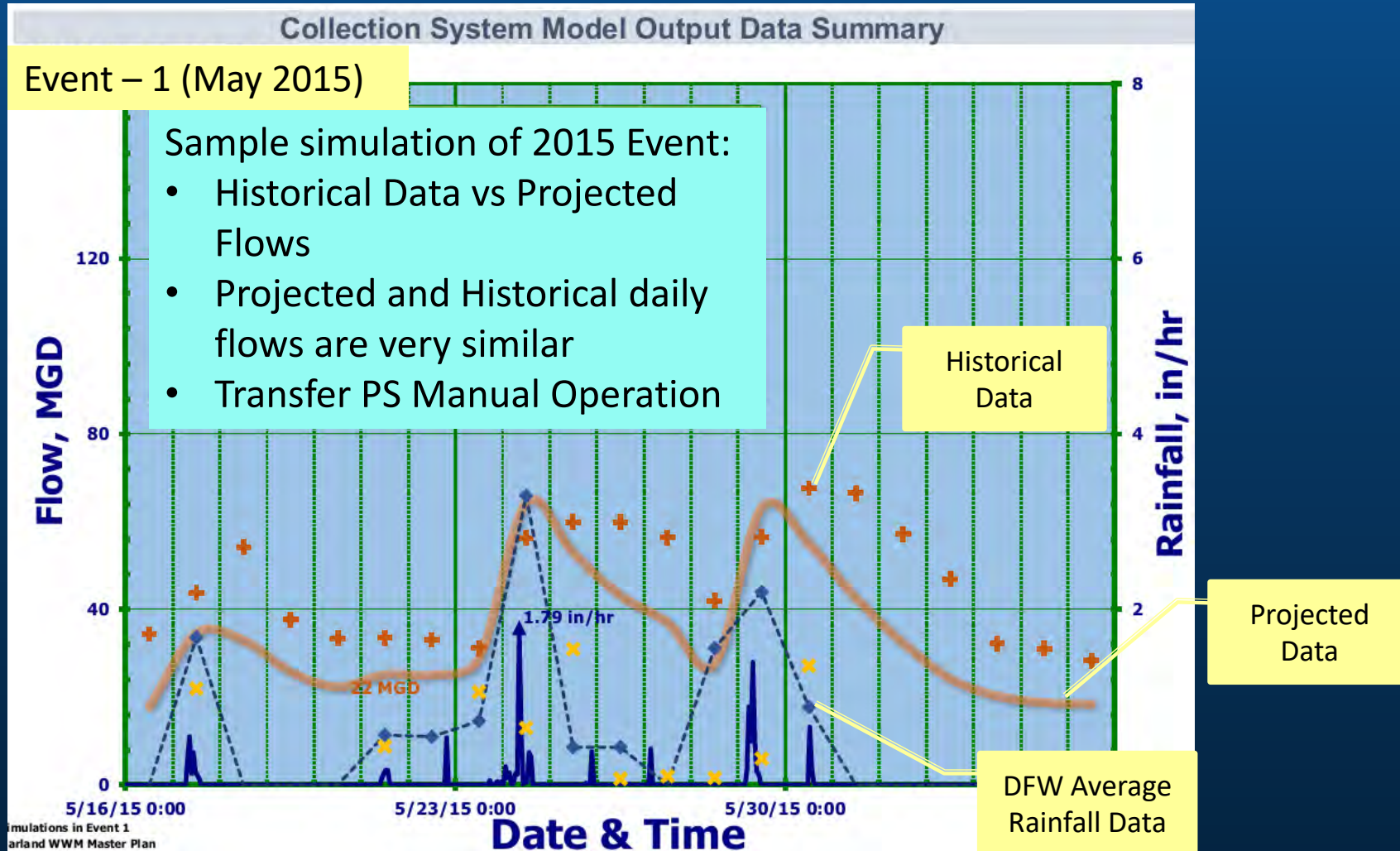


- > Model Simulation for Transfer PS from RC to DC
 - Dry weather condition: 3 – 4 mgd
 - Wet weather condition: 10 – 20 mgd
 - Peak flow: 36 mgd (3-pumps in service)

Collection System Hydraulic Model

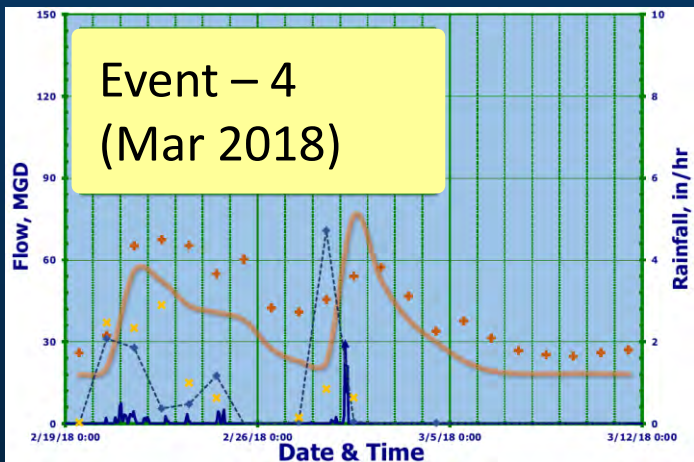
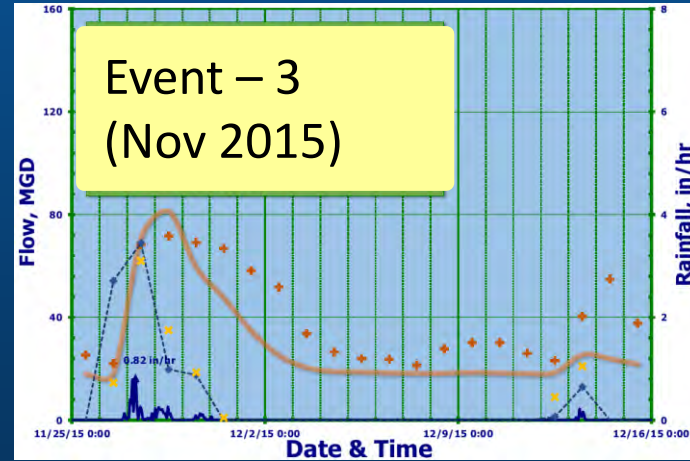
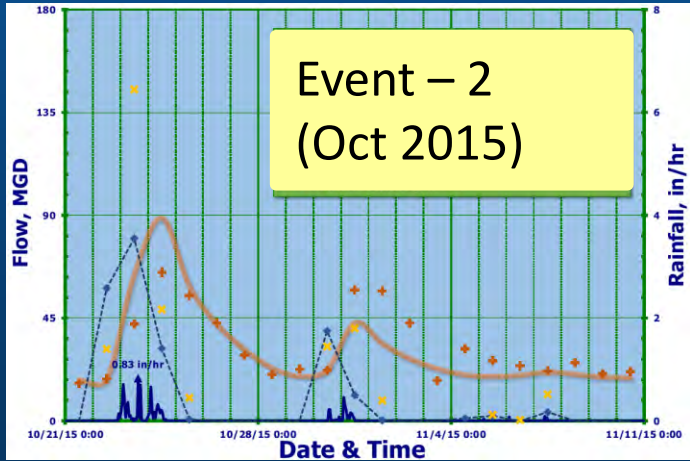
> DC-WWTP (DFW Rainfall Data)

- Projected daily flows comparable to historical data
- Flows differ due to model's RC transfer pump station assumptions



Collection System Hydraulic Model

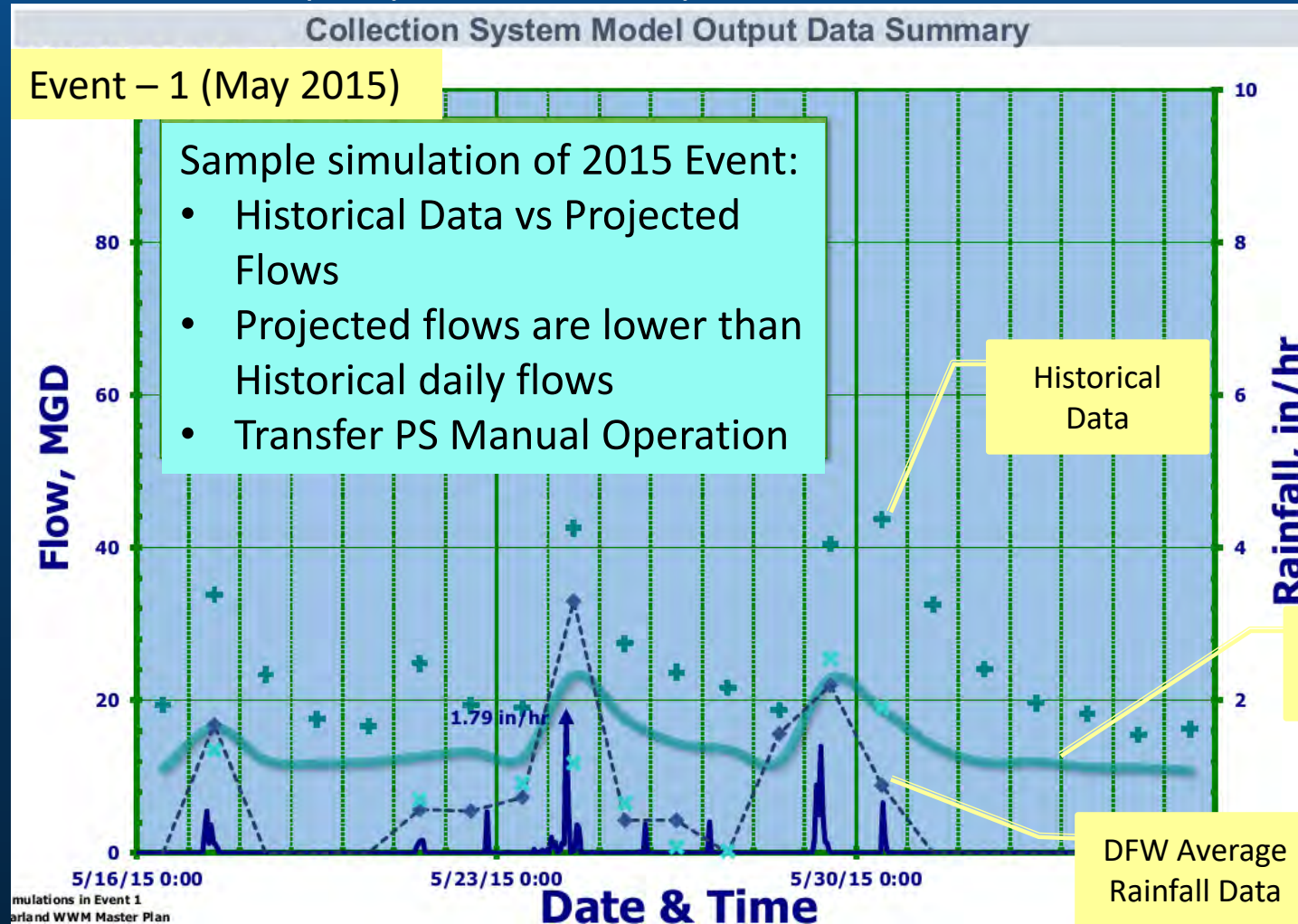
- > Selected Events Simulation Results
 - o 2015 & 2018 DC-WWTP



Collection System Hydraulic Model

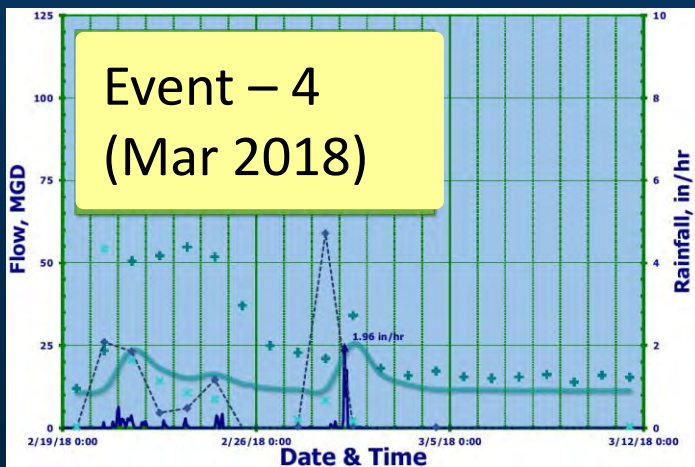
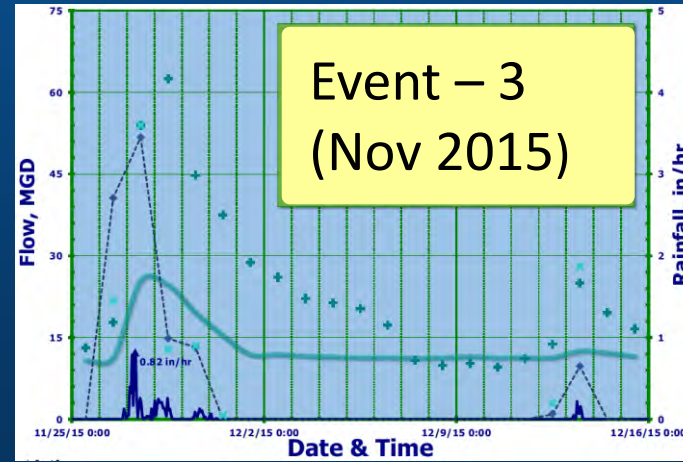
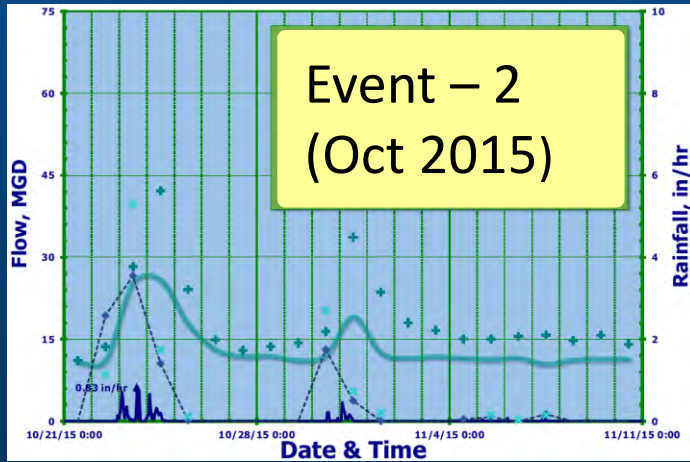
> RC-WWTP (DFW Rainfall Data)

- Projected daily flows are much lower than historical data
- Due to model's RC transfer pump station assumptions



Collection System Hydraulic Model

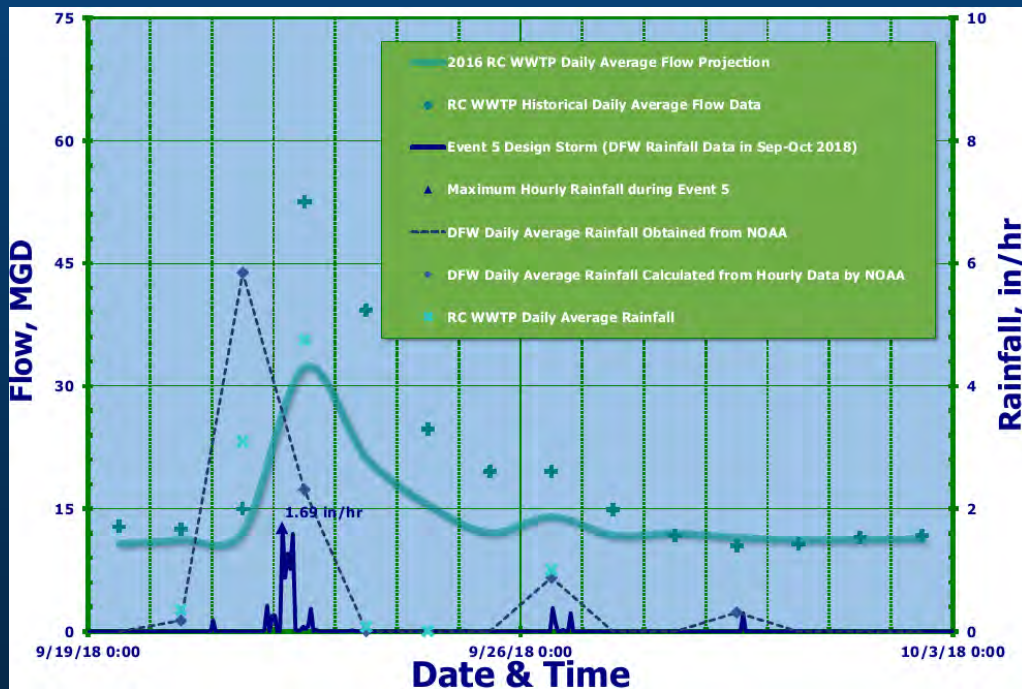
- > Selected Events Simulation Results
 - o 2015 & 2018 RC-WWTP



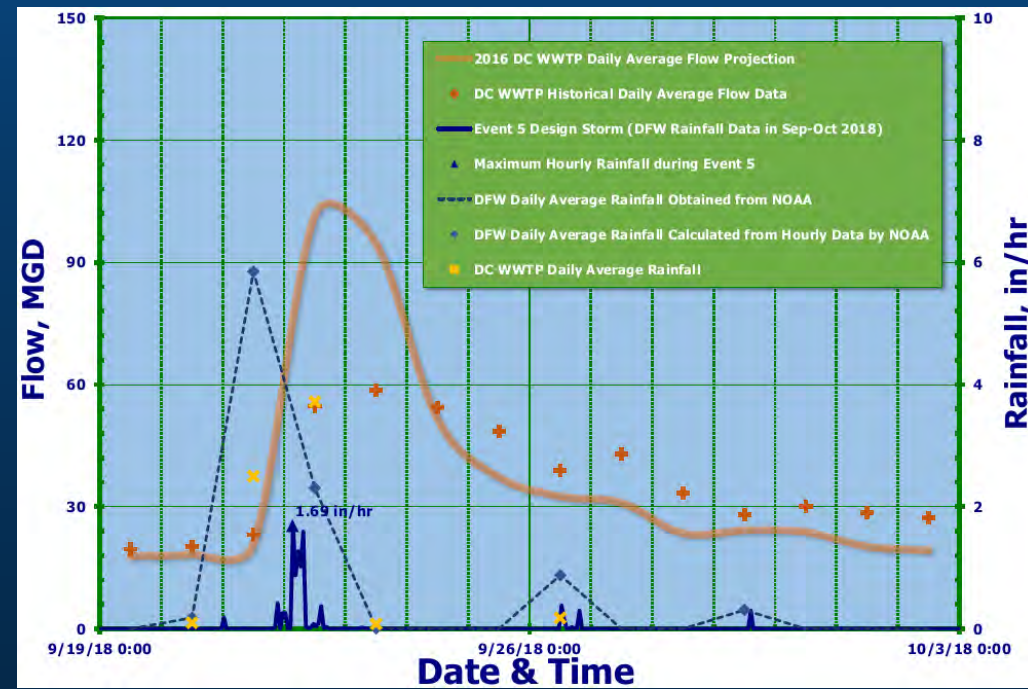
Collection System Hydraulic Model

> Simulation Analysis Summary

- Historical DFW Rainfall data 2018 and 2015 Years were worst case 1 and 2 respectively.
- 6 – Events were Chosen to Analyze (3 – events from each year 2015 and 2018)
- Event – 5 (9/19/18 to 10/3/18) was worst case
 - Projected Hydrographs did not match Plant’s SCADA Data
 - However, Plant flow volumes were comparable to the projected flow volumes



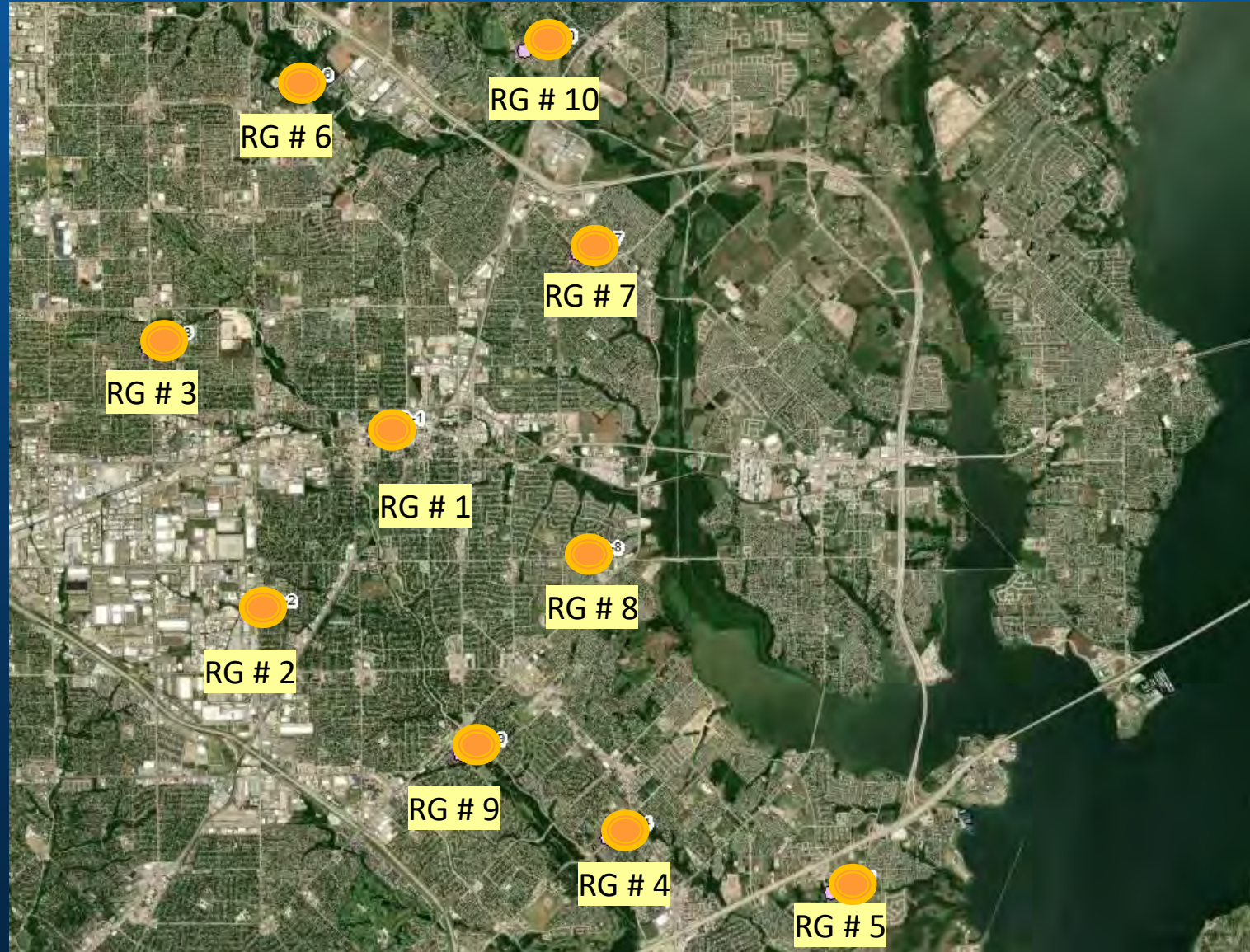
RC-WWTP: Event – 5 (DFW Rainfall Data)



DC-WWTP: Event – 5 (DFW Rainfall Data)

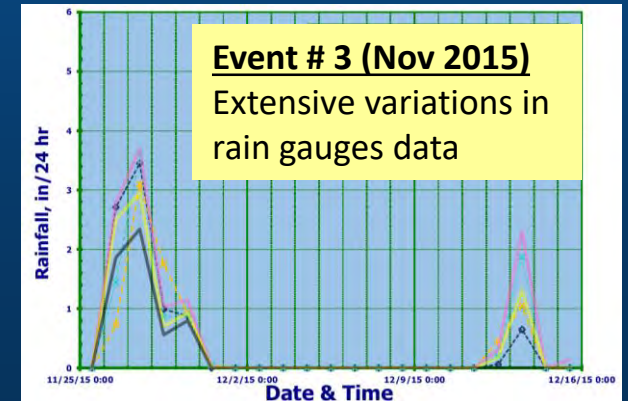
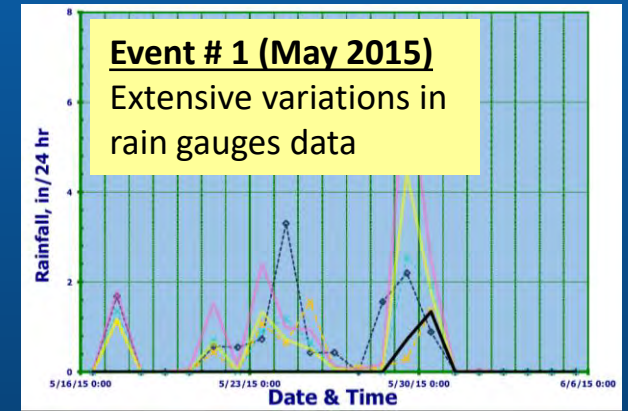
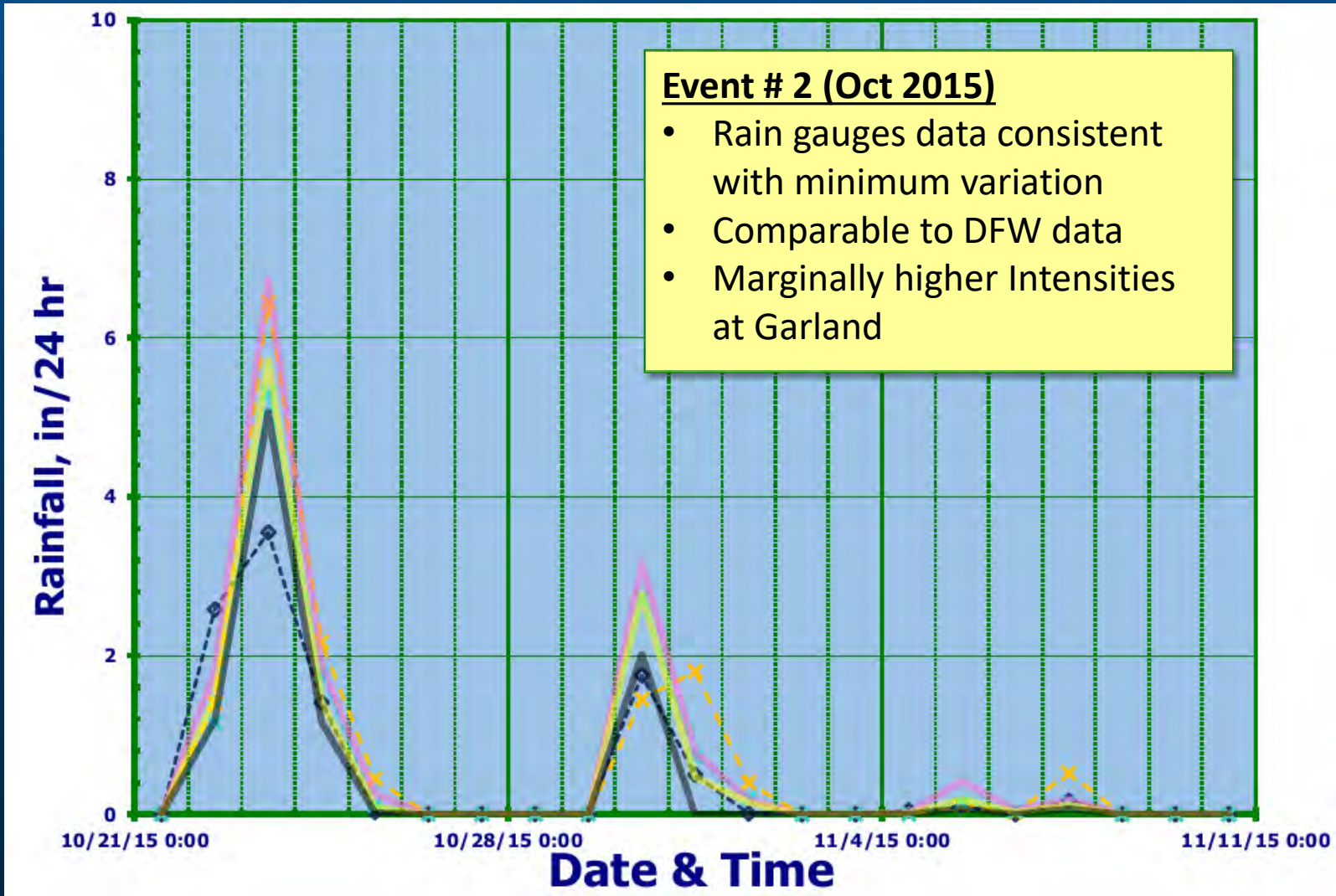
Collection System Rain Gauge Data

- > Garland Rain Gauge Data
 - o City provided 10 rain gauges data used during collection system modeling (2015 and 2016)



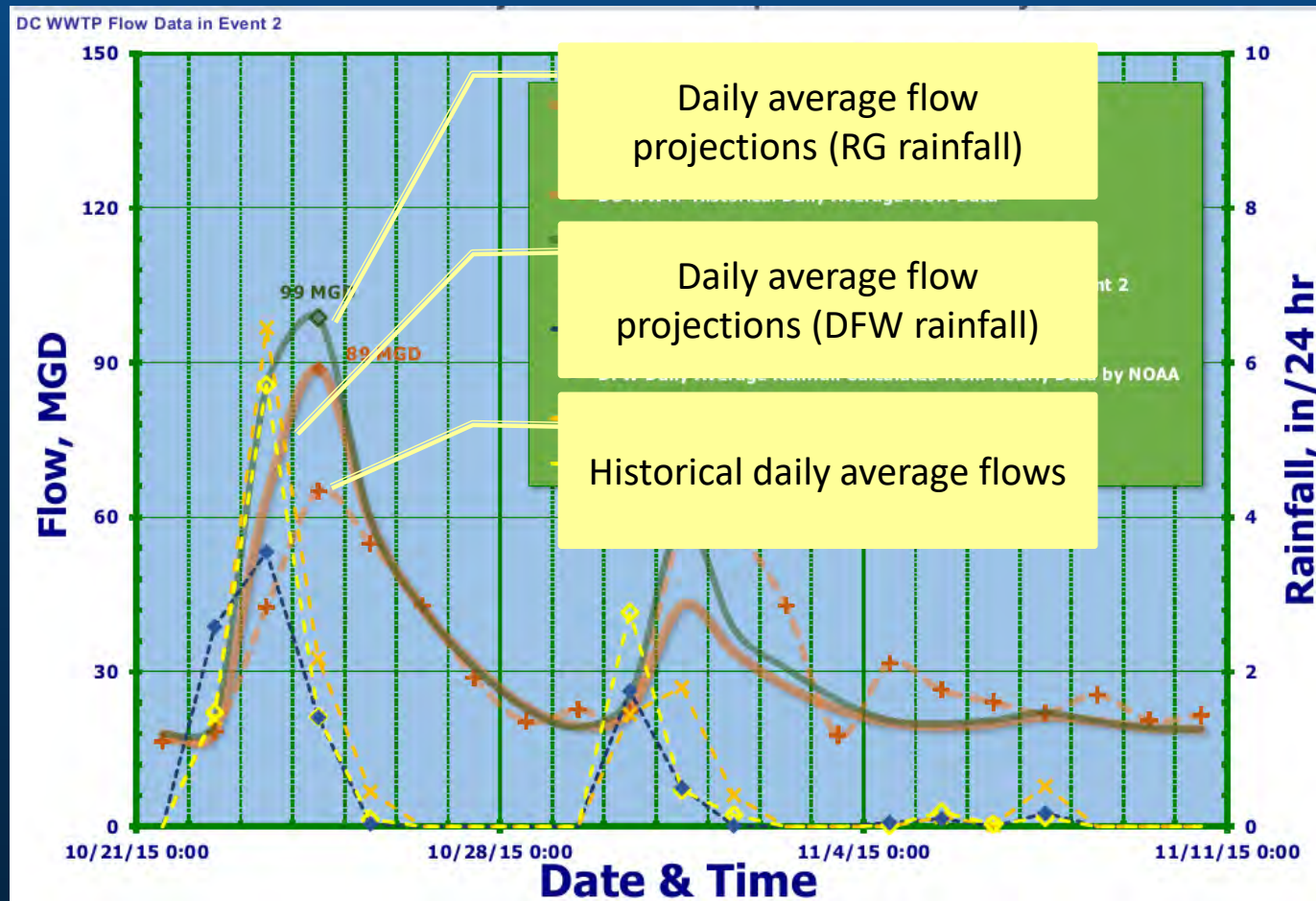
Collection System Rain Gauge Data

> 2015 – Three Events Analyzed



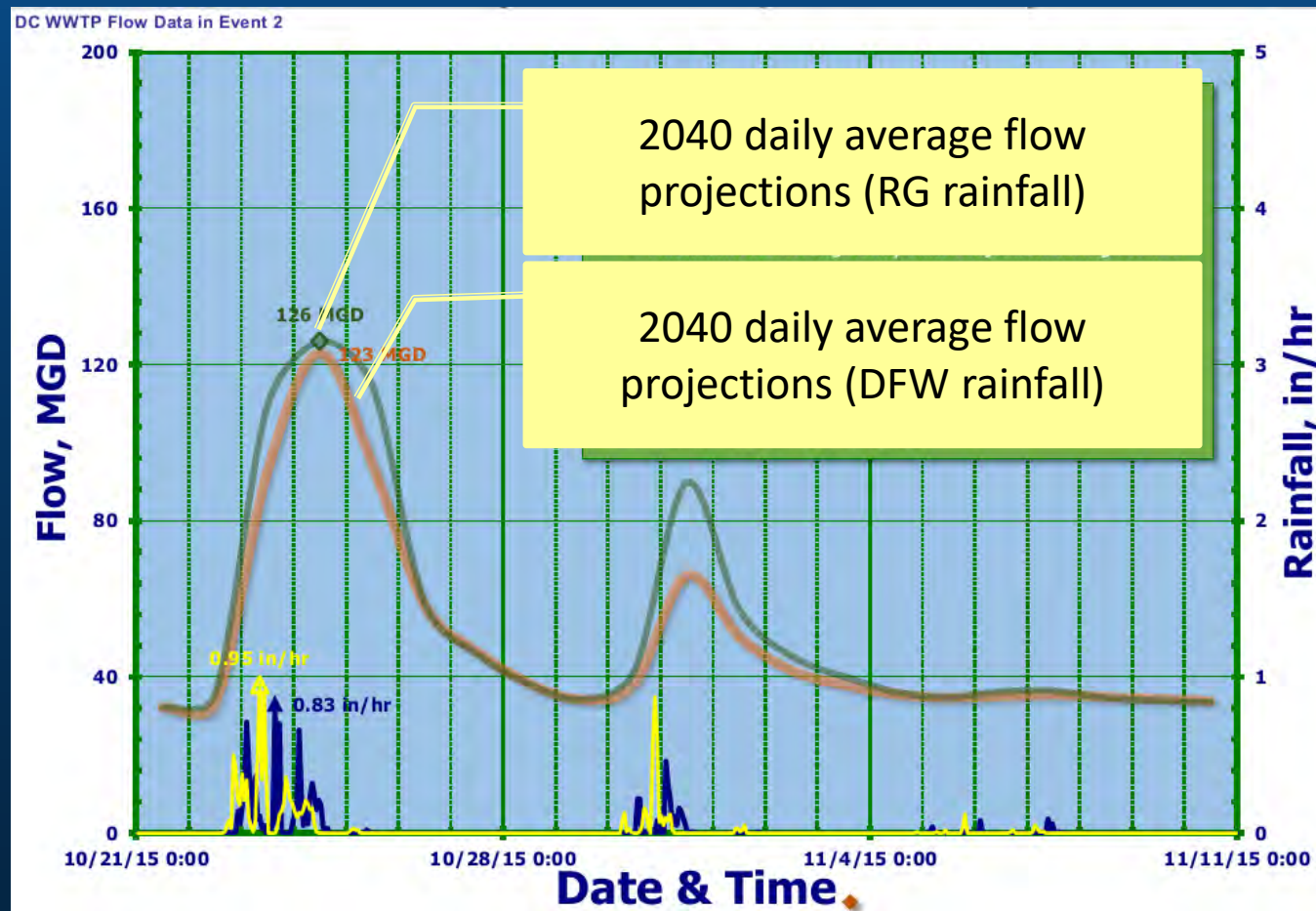
Collection System Rain Gauge Data

- > DC-WWTP : Event # 2, Simulation Results
 - Using average of the 10 gauges
 - Flow increase by 10 mgd



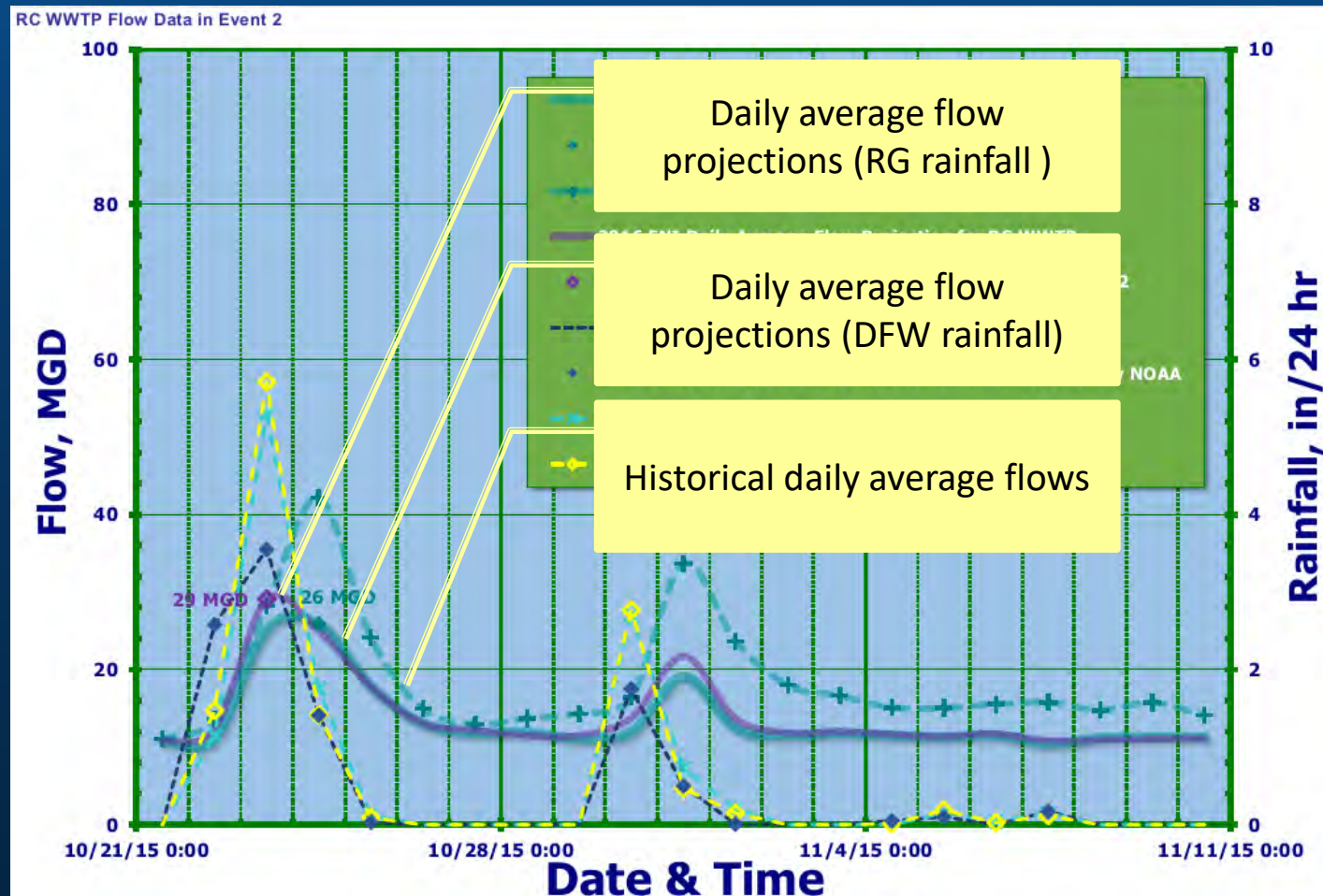
Collection System Rain Gauge Analysis

- > Event # 2, Simulation Results (DC – WWTP)
 - High flows of 126 mgd for 3 days
 - A second peak also predicted compared to DFW data



Collection System Rain Gauge Data Analysis

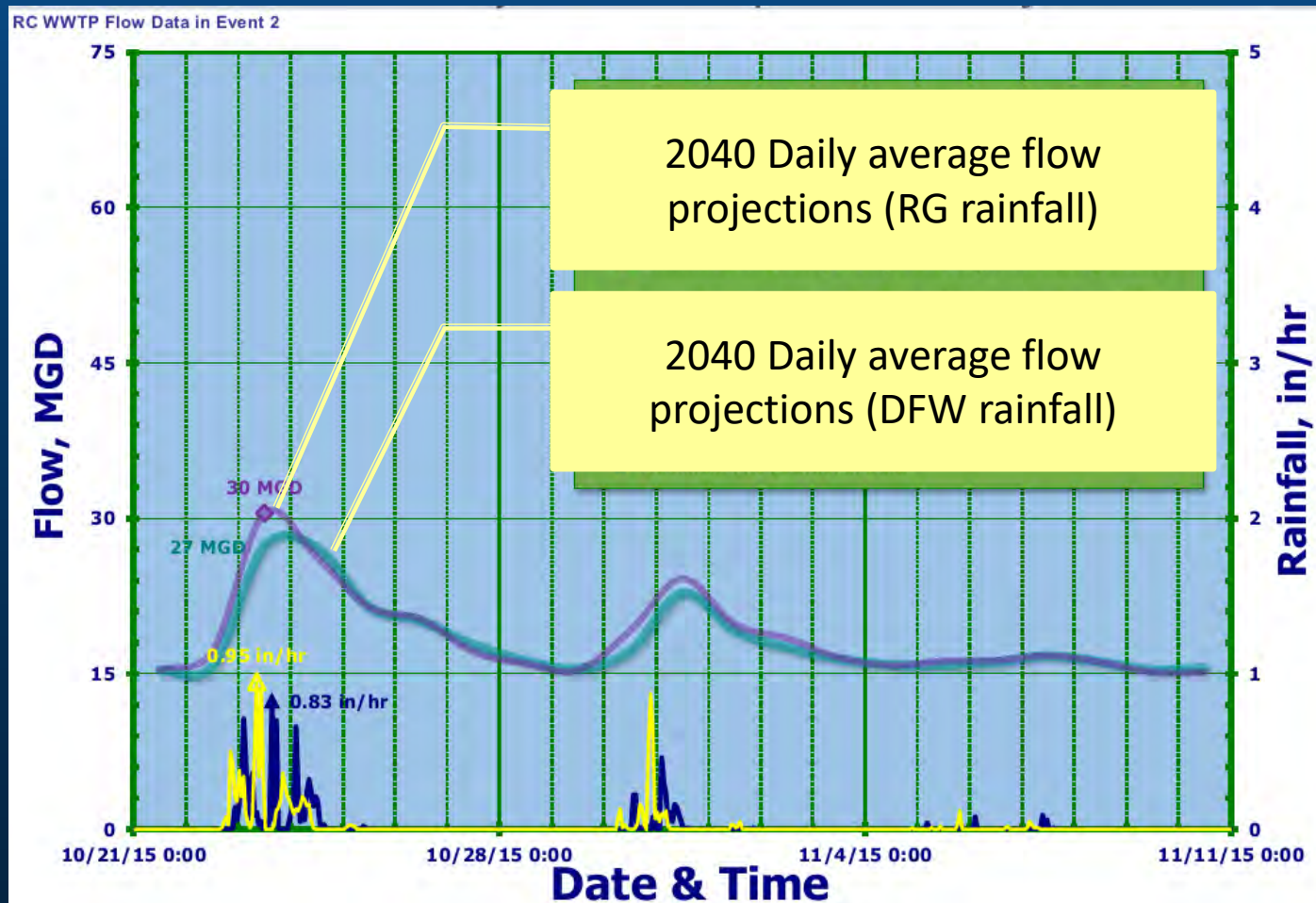
- > RC-WWTP : Event # 2, Simulation Results
 - Using average of the 10 gauges
 - Flow increase by 3 mgd



Collection System Rain Gauge Data Analysis

> Event # 2, Simulation Results (RC – WWTP)

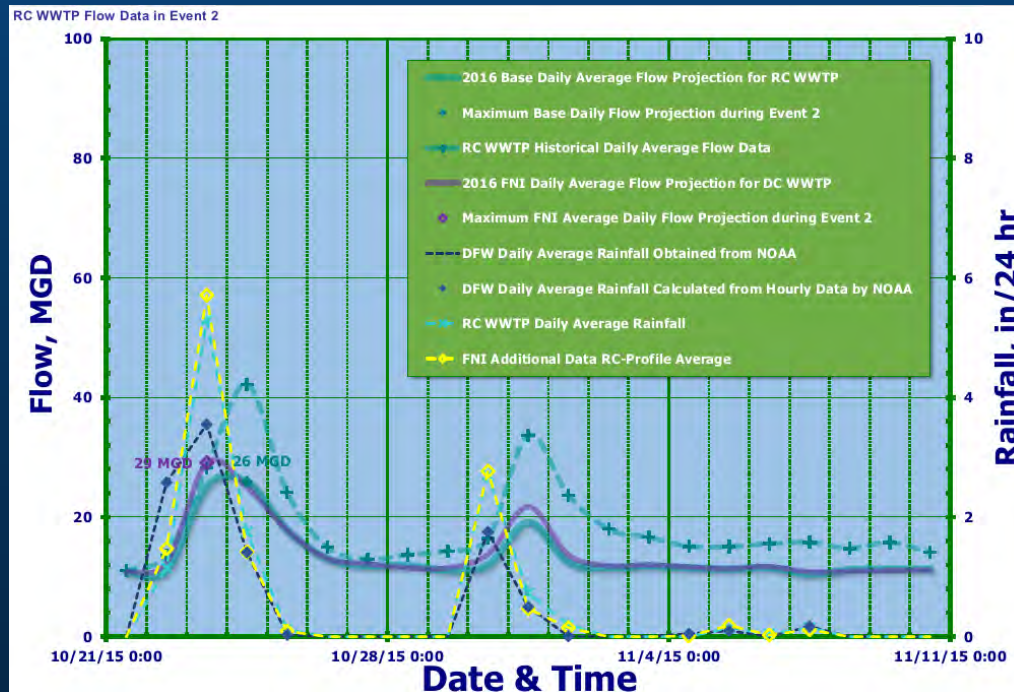
- High flows of 30 mgd
- A second peak also predicted compared to DFW data



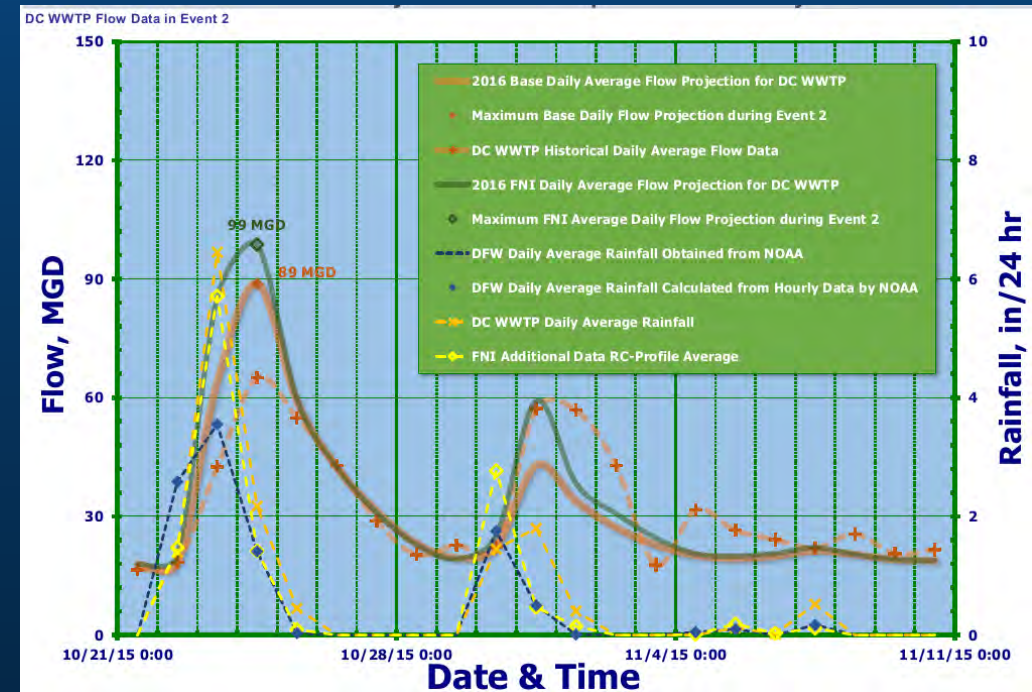
Collection System Rain Gauge Data Analysis

> Simulation Analysis Summary

- Received Rain Gauge Data for Years 2015 and 2016.
- 2015 Year Event – 2 (10/21/15 to 11/11/15) data was selected for analysis.
 - Projected flows were higher than DFW rainfall data and matched marginally closer to Plant SCADA data in terms of overall volume



RC-WWTP: Event – 2 (Garland Rain Gauge Data)



DC-WWTP: Event – 2 (Garland Rain Gauge Data)

Major Wet Weather Events

| Sustained Rainfall Condition | Rainfall Major Wet Weather Event (in/24hr) | | | | | | |
|------------------------------|--|----------|---------|----------|---------|----------|----------|
| | 2015 | | | | | | 2018 |
| | 1 | | 2 | | 3 | | 5 |
| | RG Data | DWF Data | RG Data | DWF Data | RG Data | DWF Data | DWF Data |
| Peak Daily Average | 4.43 | 2.2 | 5.71 | 3.55 | 2.95 | 3.45 | 5.85 |
| Peak 2-d Average | 3.11 | 1.88 | 3.59 | 3.07 | 2.73 | 3.08 | 4.08 |
| Peak 3-d Average | 2.08 | 1.55 | 2.87 | 2.51 | 2.05 | 2.38 | 2.78 |
| Peak 7-d Average | 1.08 | 1.26 | 1.24 | 1.08 | 1.02 | 1.15 | 1.32 |

| Duration | SCADA Data | DFW Rainfall Data | RG Average Rainfall Data |
|----------------------------------|------------|-------------------|--------------------------|
| 2015 Total Influent Volumes (MG) | | | |
| Event - 2 (Oct 21 to Nov 10) | 1,070 | 936 | 1,011 |
| 2040 Total Influent Volumes (MG) | | | |
| Event - 2 (Oct 21 to Nov 10) | N/A | 1,413 | 1,503 |

> Summary of Analysis

- The selected major wet weather event:
 - Event - 2: 10/21/15 to 11/11/15 (Approximately a 20-day event)
 - Design Storm Frequency 10 to 25 years (Based on NOAA's point precipitation frequency estimates)

Peak Flow Storage Volumes

- > Peak Flow Basin Storage Volume Requirements for Planning
- > Sustained Treatment Capacity:
 - o RC-WWTP = 43 mgd,
 - o DC-WWTP = 72 mgd

| Rainfall Data | Wet Weather Event | DC-WWTP Peak Flow Storage (MG) |
|-----------------|-------------------|--------------------------------|
| DFW Data | | |
| | Event - 2 (2015) | 106 |
| | Event - 5 (2018) | 116 |
| RG Average | | |
| | Event - 2 (2015) | 99 |
| RG # 4, Maximum | | |
| | Event - 2 (2015) | 141 |

Peak Flows Alternatives

| Alternatives | STC, RC WWTP (MGD) | STC, DC WWTP (MGD) | DC - WWTP | |
|--------------|-----------------------|--------------------------|--|--|
| | | | Total Storage Volume Required (MG) | Additional Storage Volume Provided (MG)* |
| 1 | 43 | 72 | 100 | 50 |
| 2 | 57 | 72 | 86 | 40 |
| 3 | 68 | 72 | 83 | 35 |
| 4 | 43 | 85 | 69 | 20 |
| 5 | 57 | 85 | 52 | 0 |
| 6 | 68 | 85 | 45 | 0 |

*Existing 50 MG Storage Basin at DC-WWTP

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Thank you!

Any questions?



an STV Company

