City of Frontenac
Dear Creek Flood Protection Study
2022

City of Frontenac –
Jeff Wappelhorst
Public Works Director
(314) 393-6550

EDM Incorporated
Primary Consultant
Len Madalon, MS, PE
ljm@edm-inc.com
(314) 335-6945

Agenda

- Introduction/Study Driver
- Focus Area/Issues
- Modeling
- Floodproofing
- New Development
- Alternative Evaluation

Villa Duchesne and Oak Hill School Tennis Courts

Cloudburst
on
August 9, 2020

12:45 AM to 1:45 AM

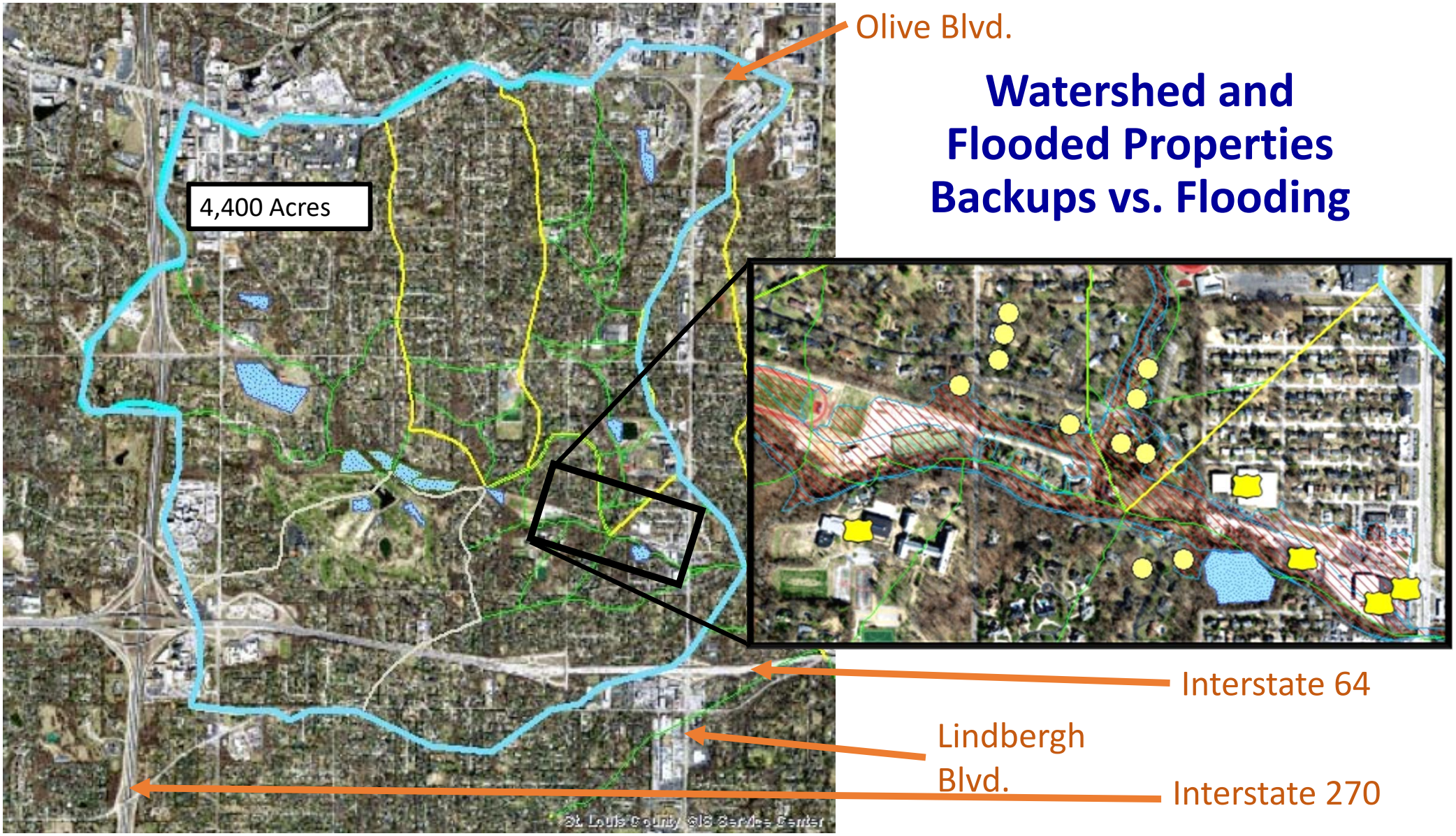
0.56 to 5.3 Inches

Grassi Video Footage

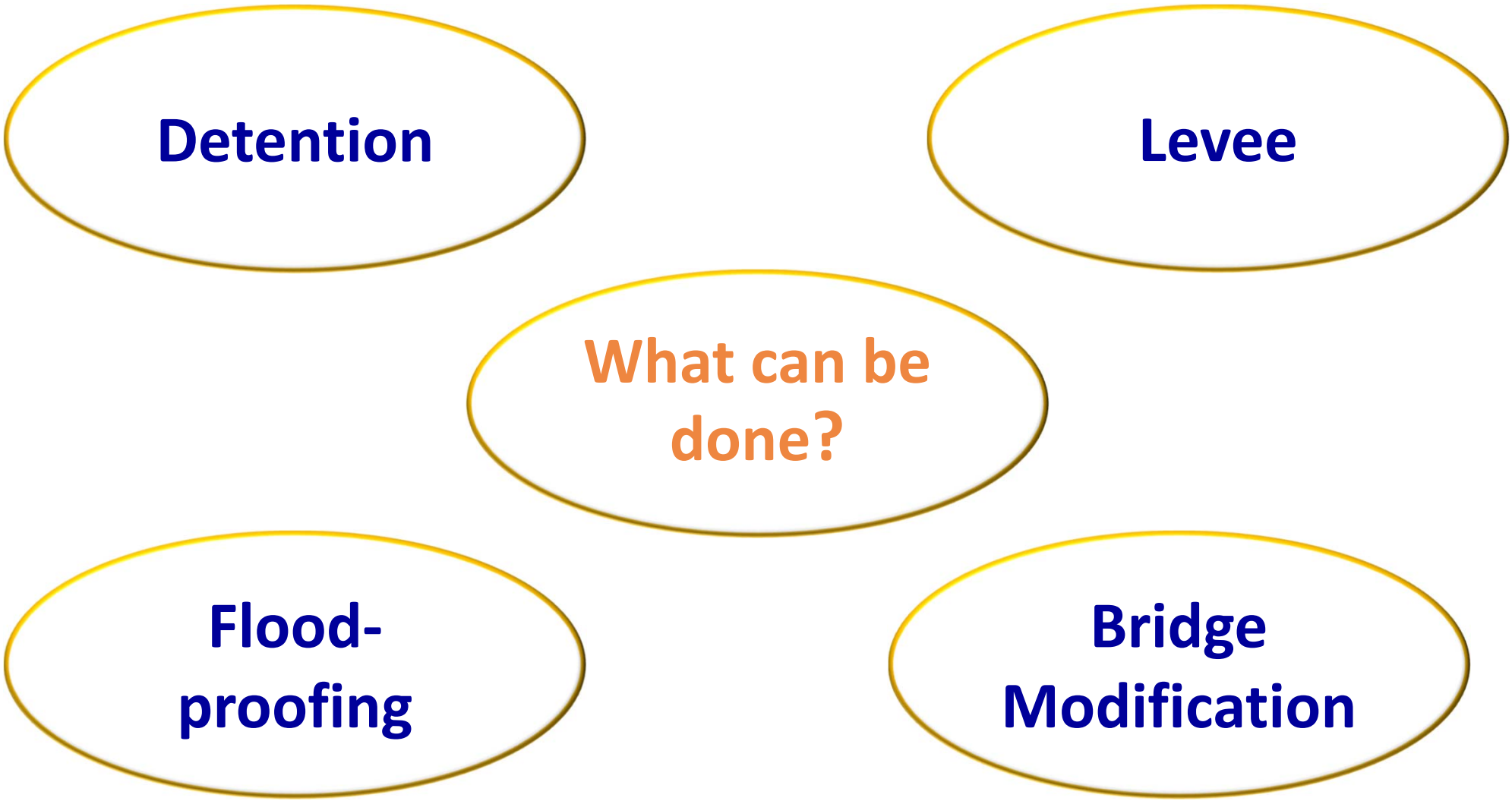
Floating Dumpster

Damage and Debris

Watershed and Flooded Properties Backups vs. Flooding



Published Floodplain and Floodway


Detention
Levee
What can be done?
Flood-proofing
Bridge Modification

Study Approach

- Literature Review
- **Modeling**
- **Floodproofing Alternatives**
- Stakeholder Meetings
- Conclusions

Modeling

- Choosing the Right Storm
- Model Verification
- Detention
- Bridge Modification
- Levee

Design Storm Considerations

- Water Volume
- Account for Variable Intensity
- Account for Storm Movement

24-Hour Synthetic Storm
vs.
Cloudburst Storm

❖24-Hour Synthetic Storm

- Contains Cloudburst and Longer Synoptic Storm
- Produces Flow Volume of 8.5 x 10^7
- Peak Rainfall Intensity is at Noon with High Water at 1PM

❖Cloudburst Storm

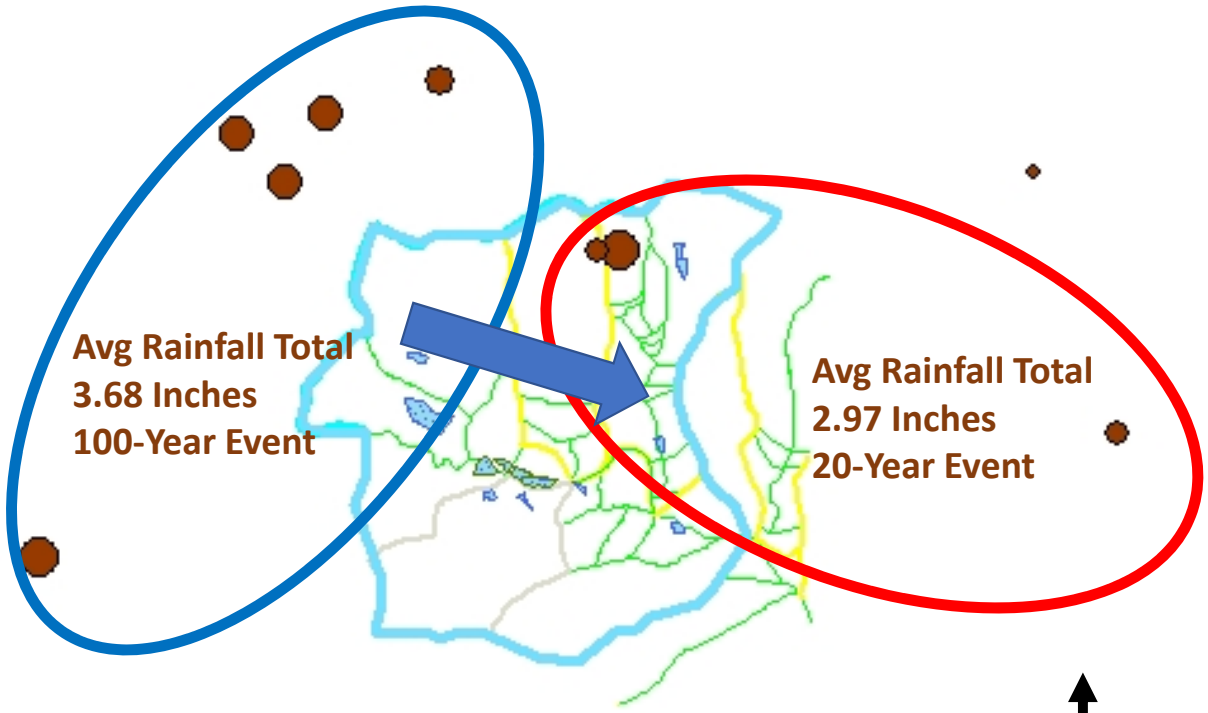
- Produces Flow Volume of 5.06 x 10^7, 40% Less
- Peak Rainfall Intensity 12:05 & 12:20/High Water at 12:53
- Can Account for Variable Intensity and Storm Movement

Legend

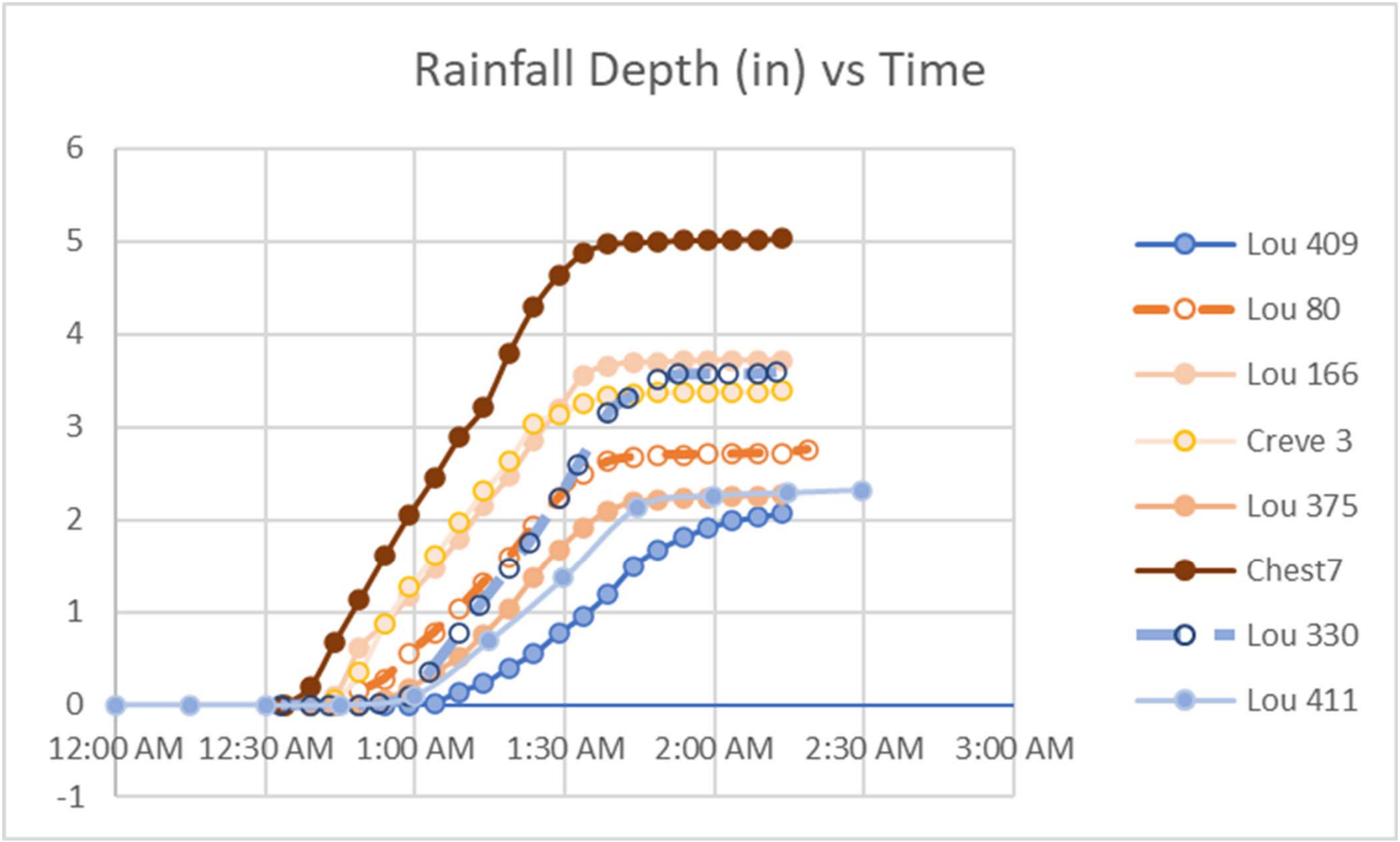
GageLoc

Score

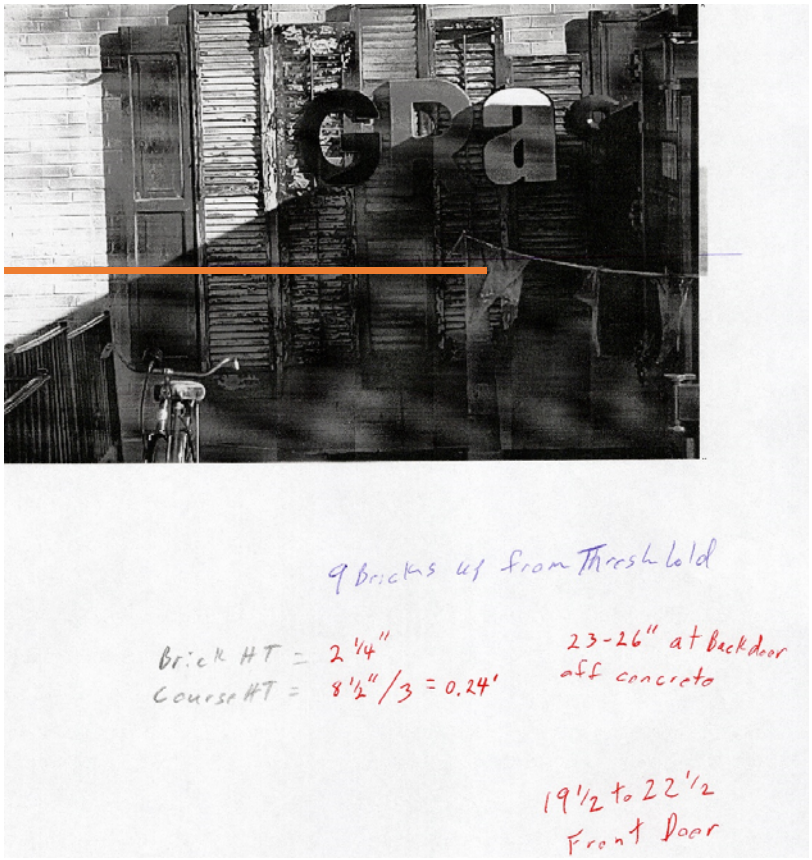
- 0.56
- 0.57 - 1.04
- 1.05 - 1.73
- 1.74 - 1.98
- 1.99 - 2.10
- 2.11 - 2.32
- 2.33 - 2.47
- 2.48 - 2.56
- 2.57 - 2.62
- 2.63 - 2.68
- 2.69 - 2.96
- 2.97 - 3.58
- 3.59 - 4.00
- 4.01 - 4.12
- 4.13 - 5.30

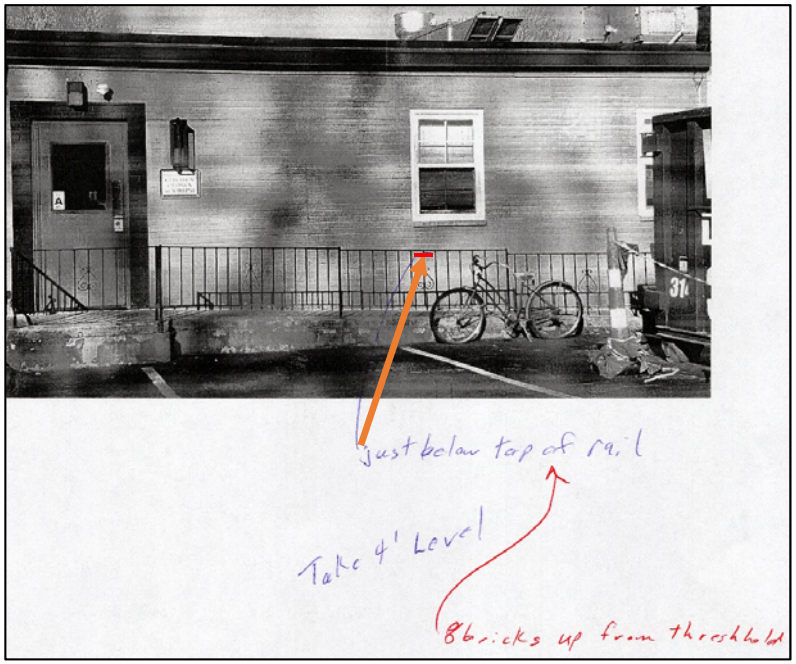


Rain Gage Data


Rainfall Depth (in) vs Time
6
5
4
3
2
1
0
-1
12:00 AM
12:30 AM
1:00 AM
1:30 AM
2:00 AM
2:30 AM
3:00 AM
Lou 409
Lou 80
Lou 166
Creve 3
Lou 375
Chest7
Lou 330
Lou 411

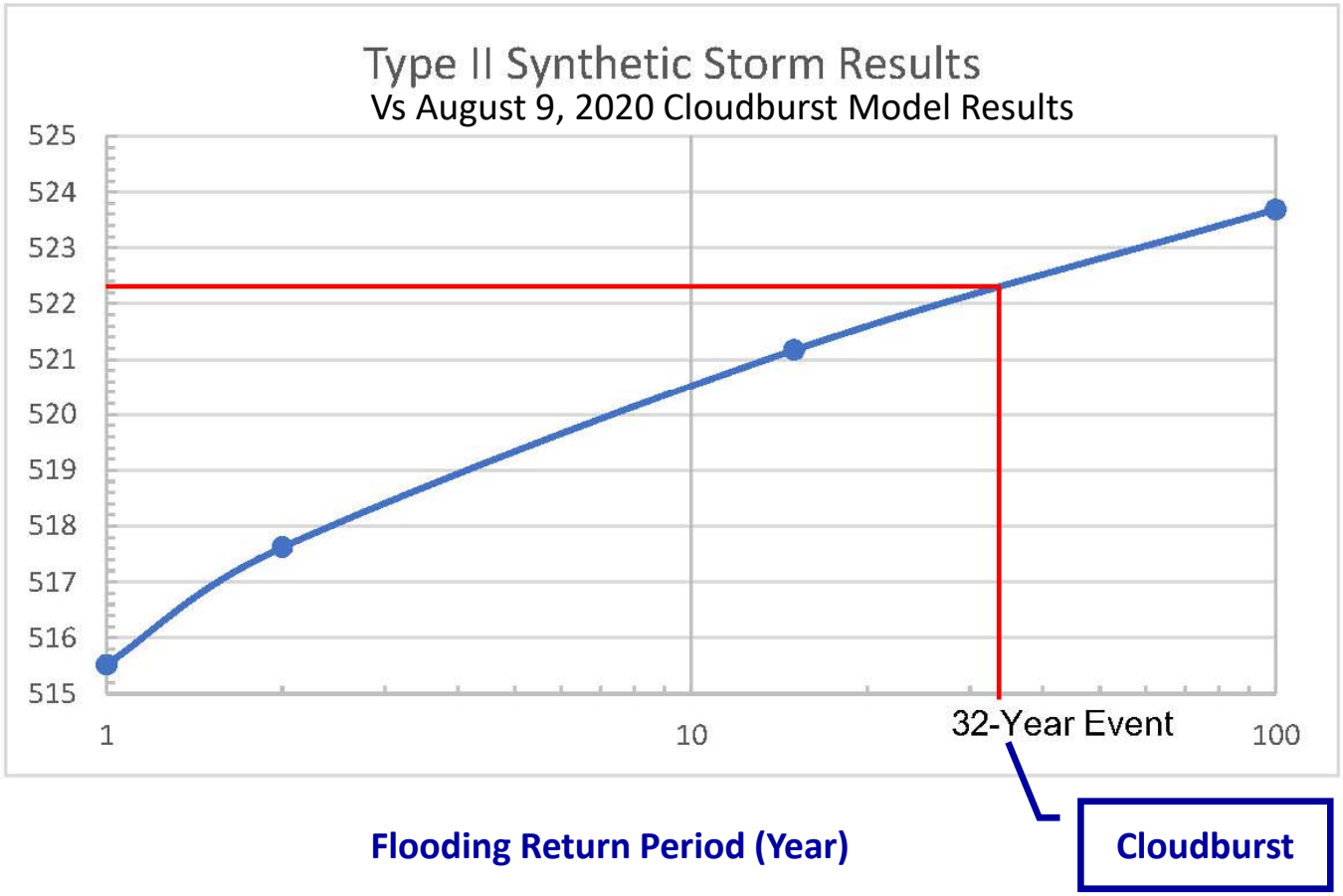
Model Verification





Measured Flood Elevations Between 522.10 and 522.36

Model Flood Elevation with 2 Storm Analysis 522.31


Type II Synthetic Storm Results
Vs August 9, 2020 Cloudburst Model Results
525
524
523
522
521
520
519
518
517
516
515
1
10
100
32-Year Event
Water Surface Elevations (Feet)
Flooding Return Period (Year)
Cloudburst

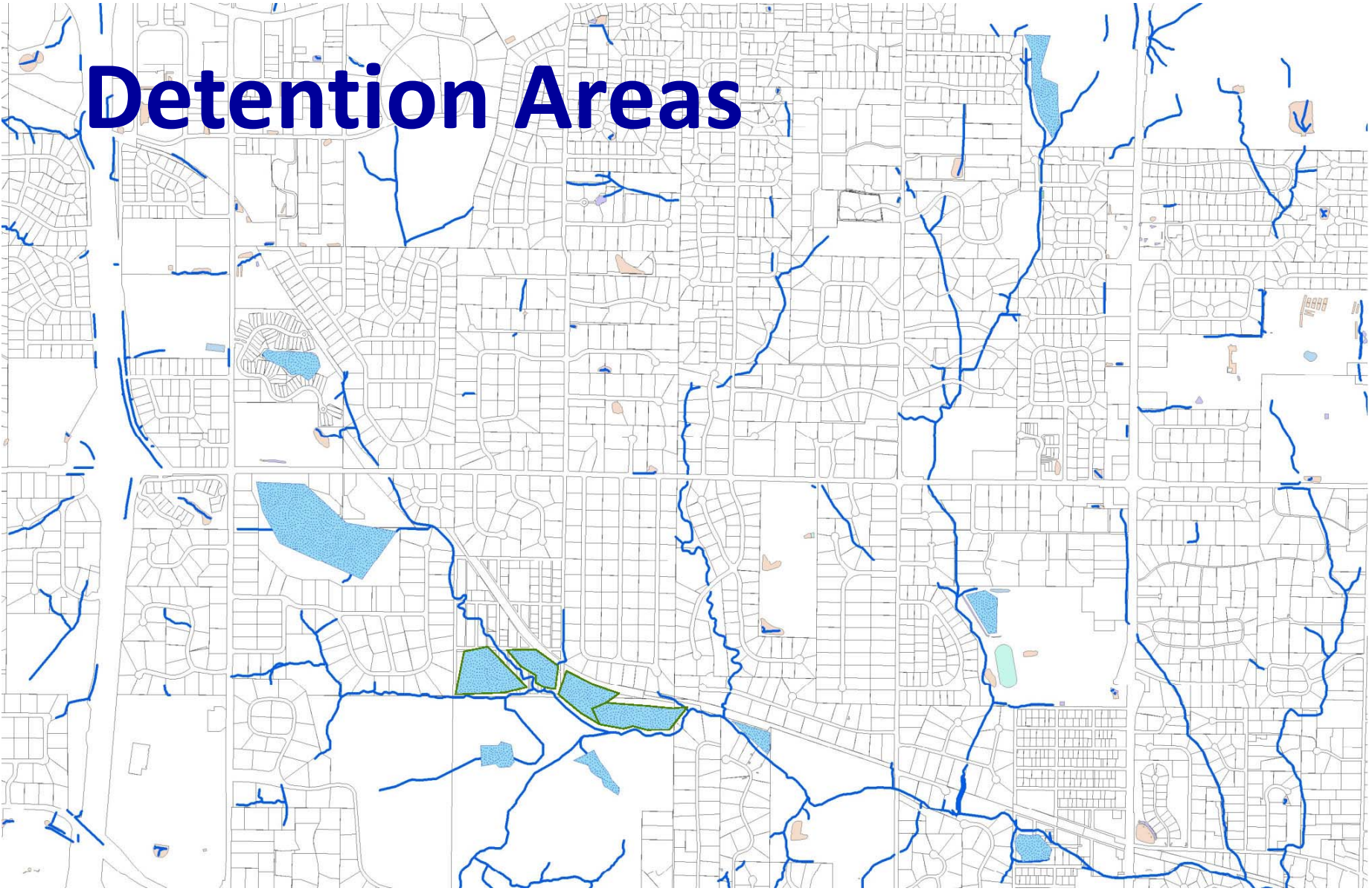
Detention Goal for August 9, 2020 Storm

- Lowest Finished Floor Elevation of 520.17
- Set Goal Elevation at 520.00
- Flood Reduction of 2.31 feet

Areas Considered for Detention

- Westchester Estates Lake, 22 Acres (Local)
- Chaminade, 3 Acres
- Old Quarry, 2.7 Acres
- Bluespring Ln., 1.5 Acres
- Carlyle Lake, 2.75 Acres (Local)
- Bayer Property, 6 Acres
- Westwood Country Club South, 3 and 4.5 Acres (Local)
- Westwood Country Club North, 4.6 and 6.2 Acres
- Malcolm Terrace Park , 7.1 and 3.5 Acres

Detention Areas



Flood Reduction Provided

7 Simultaneous Locations Total 2.33 Feet

Site	Estimated Water Surface Elevation Reduction at Grassi's (ft)
Bayer	0.52
Chaminade	0.20
Quarry	0.53
Bluespring	0.13
Carlyle Lake	0.01
Westwood CC South	0.08
Malcom Terrace Park	0.59
Westwood CC North	0.90

Bridge Modification

- Lindbergh Bridge
  - Widening the bridge by 10 feet
  - Widening the bridge by 10 feet and raising it 5 feet
    - Lowering WSE 0.06 feet at bridge, 0.00 feet at Grassi's
- Limited Protection (30 + Year Storm)
  - No change in WSE

Levee
Lindbergh to 400 Feet Upstream of the Private Bridge

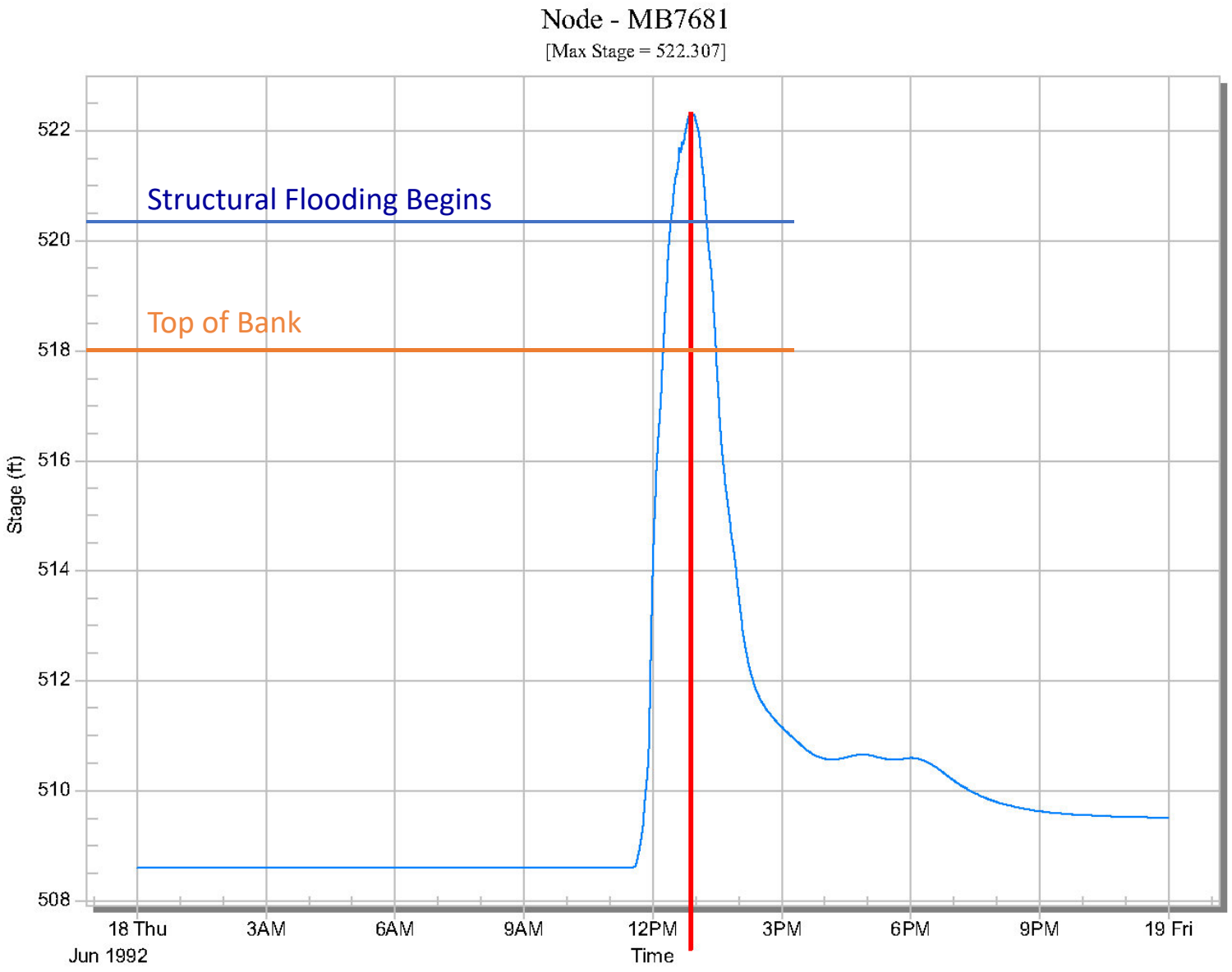
- Placed along top of Bank
- 1.51 Foot Rise at Grassi's
- 3.73 Foot Rise at the Private Bridge
- Rise further upstream to near Monsanto-Sunswept Creek

Floodproofing Alternatives

Floodproofing Alternatives

- Considerations
  - Floodway Regulations: No Rise
  - Cloud Bursts and Flash Flooding Response Time
    - Storm 1 Peak Intensity at 12:05 PM
    - Storm 2 Peak Intensity at 12:20 PM
    - Grassi's Peak Flow at 12:53 PM (30 to 50 minutes)

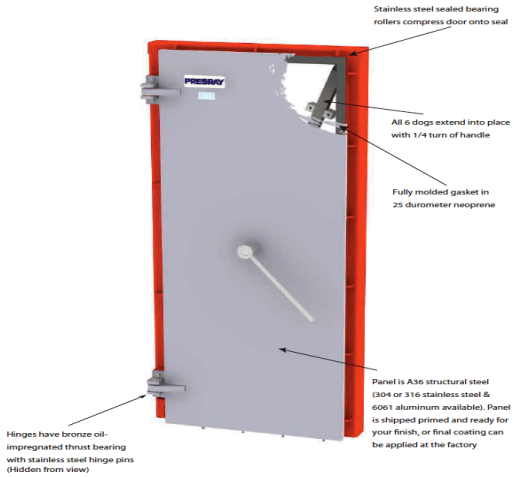
Timing of Peak

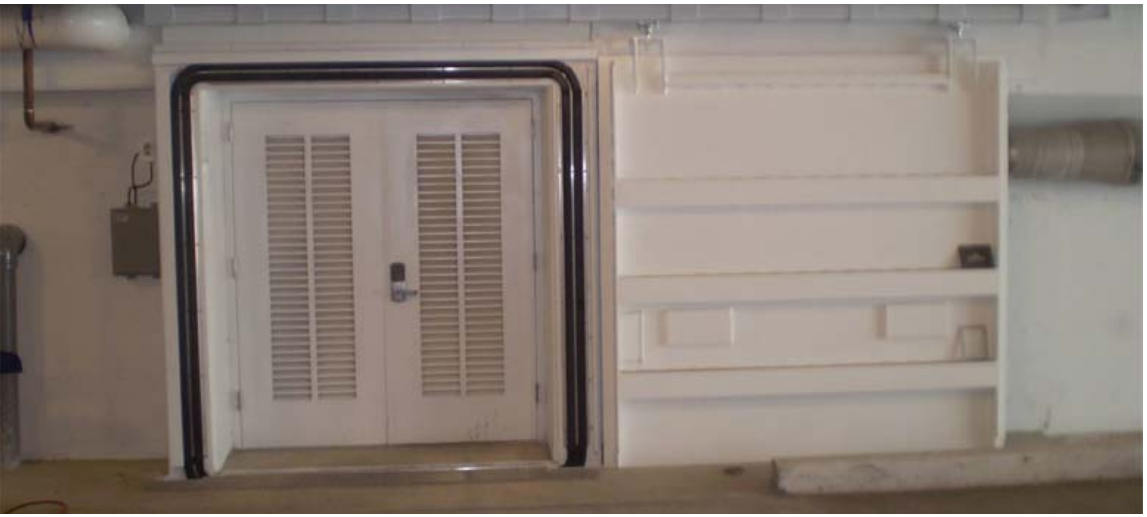


Floodproofing Alternatives

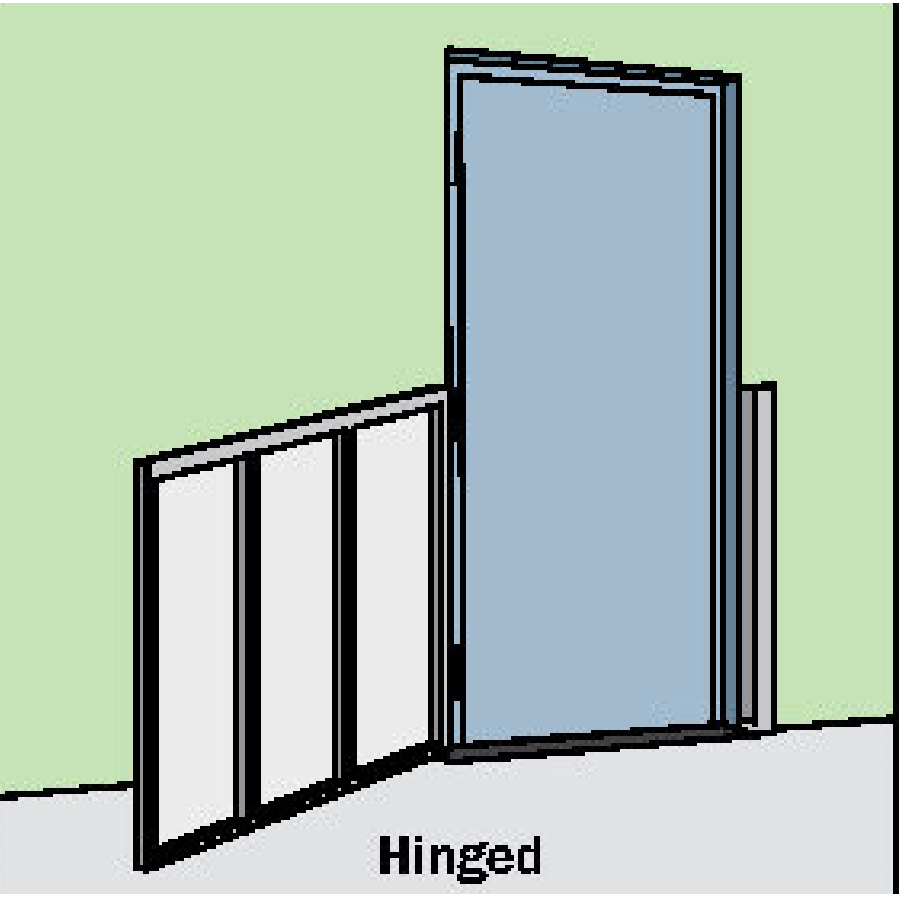
- Permanent Solutions
  - Commercial
    - Waterproof paint to exterior masonry type walls
    - Water tight doors
    - Hinged or Sliding
    - Glass block/Window systems

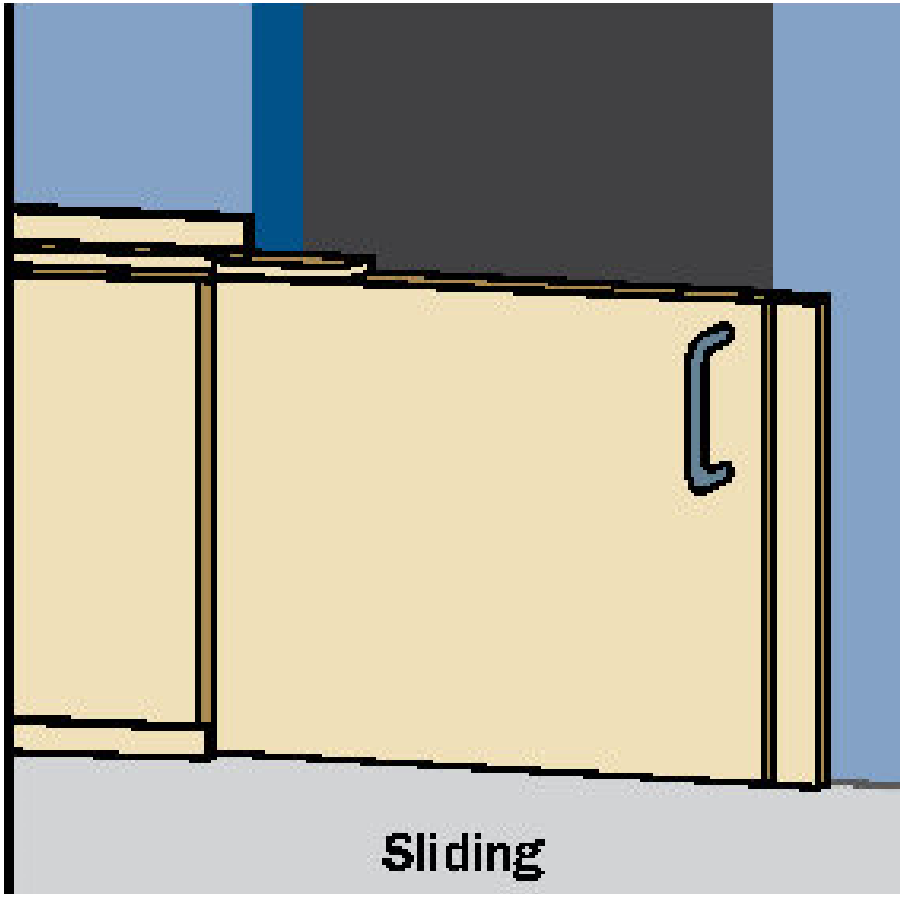
Water Tight Doors





Hinged or Sliding System



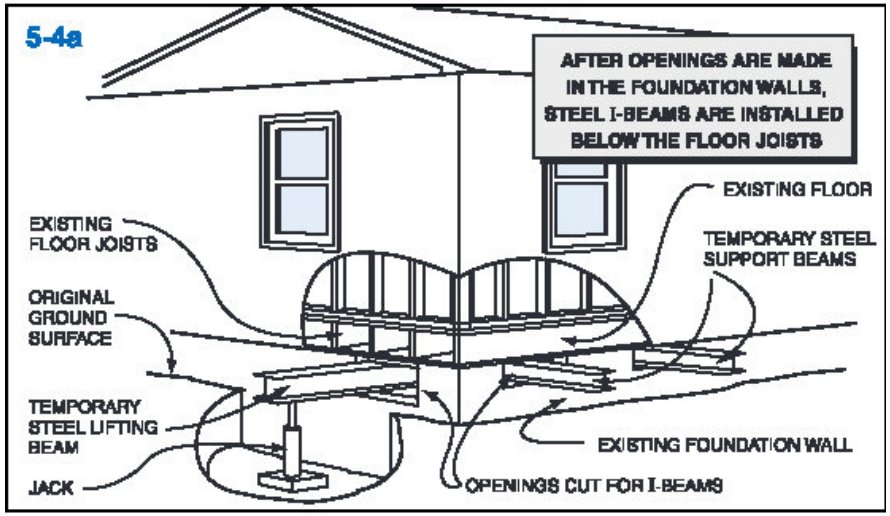


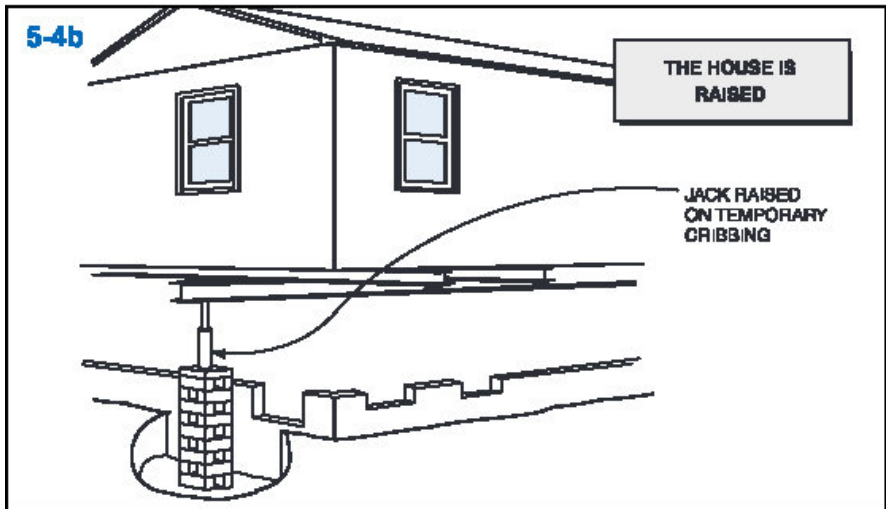
Window Systems

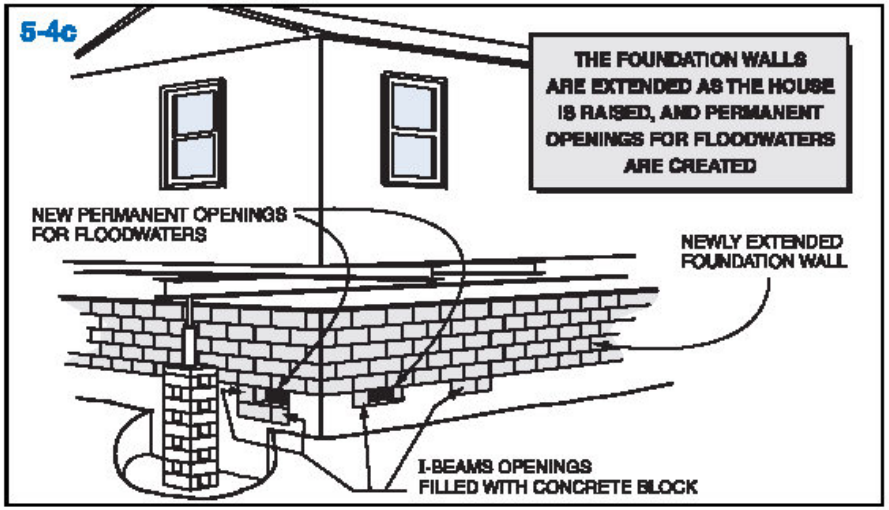
Floodproofing Alternatives

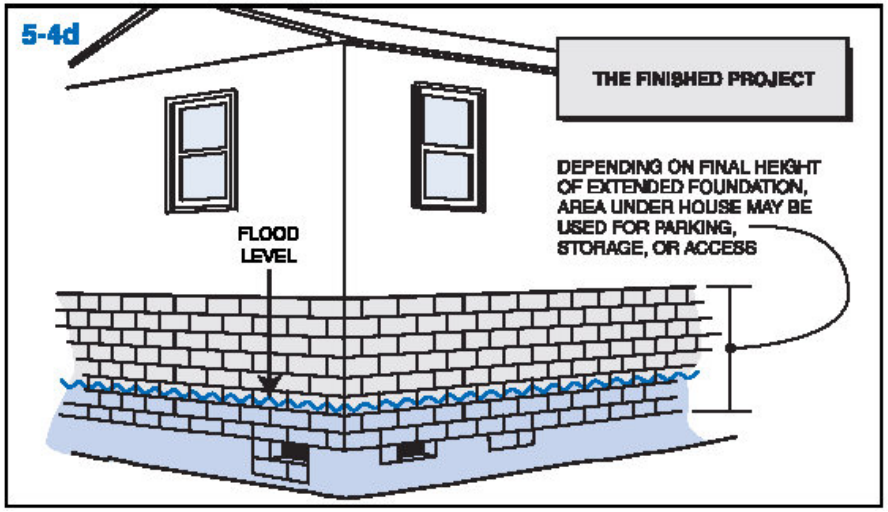
- Permanent Solutions
  - Residential
    - Fill in Basements
    - Raise Buildings
    - Glass Block Windows

Elevate Home





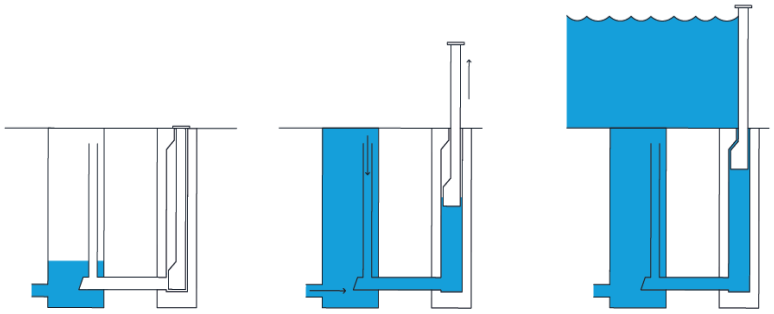




Floodproofing Alternatives

- Passive Solutions
  - Commercial
    - Horizontal
    - Vertical

Passive Solutions Vertical

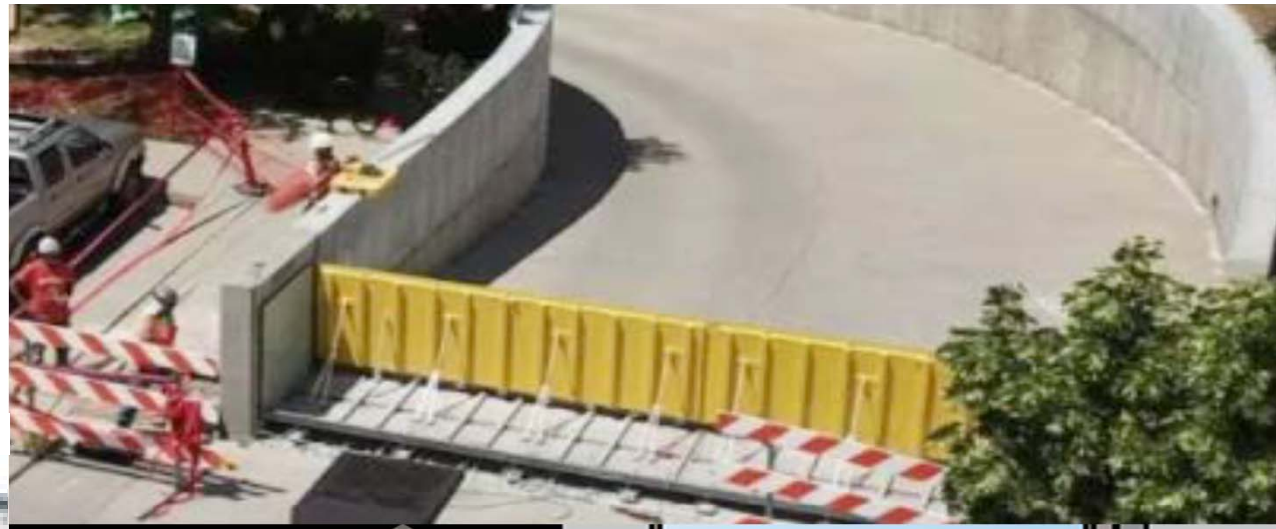


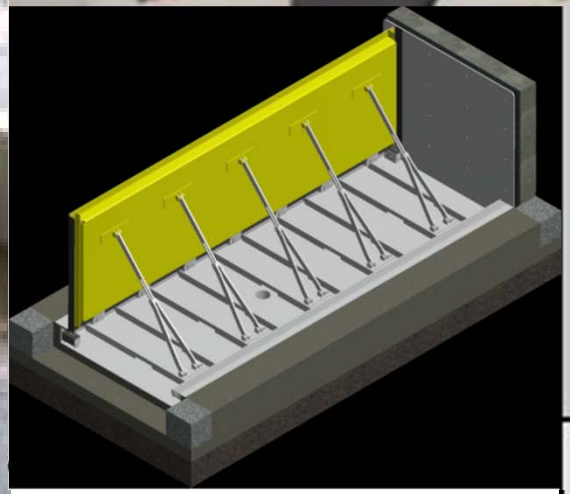
Resting Position
In non-flood conditions, all operational parts are concealed in an underground basin.

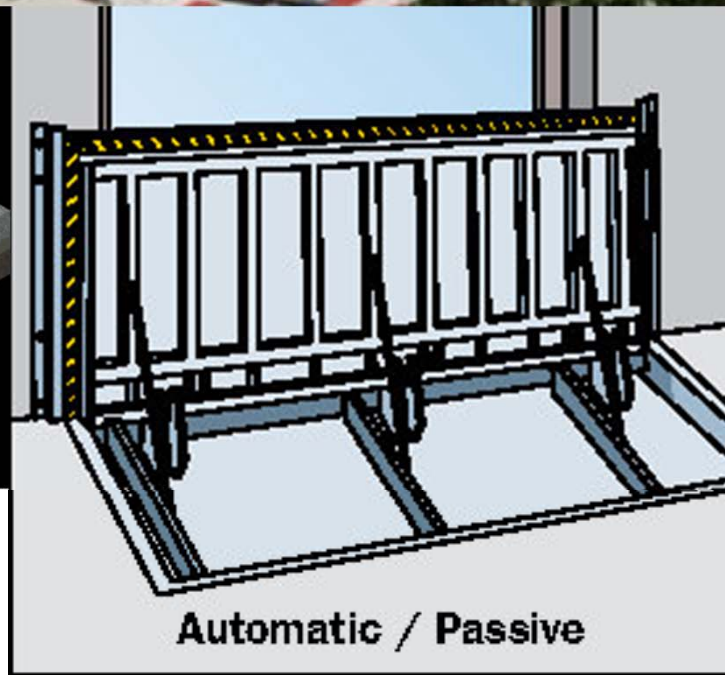
Deployed Position
As floodwater rises to a predetermined level, an inlet pipe fills the basin, making the flood wall float up.

Fully Deployed
When the basin is full, an angled support block locks the flood wall into position making it watertight.

Passive Solutions
Horizontal







Evaluating Alternatives

Detention

- Effective But Not Feasible
  - Very Expensive
  - 8 Different Areas to Negotiate Property Use
    - Only 2 in Frontenac
- Limited Protection (30 + Year Storm)

Bridge Modification

- Ineffective
  - Did not lower water surface at Grassi's
- Expensive

Levee

- Modeled Option is Not Permittable
- Expensive

Floodproofing

- Option Has Potential
- Depends on Property Owner Preferences/Needs
- Need to Evaluate Specific Solution/s For Each Building

New Development

- Difficult in Floodplain/Floodway
  - No-Rise Needed
    - Ordinance 506.300.P and 415.040.D
  - Construction Requirements
    - Ordinance 415.040.A and 415.040.B
- Local Opposition

Thanks for your attention.
Let’s discuss.