

# North Logsdon Storm Water Master Plan



**Toby Spalding, PE**  
City Engineer  
City of Radcliff

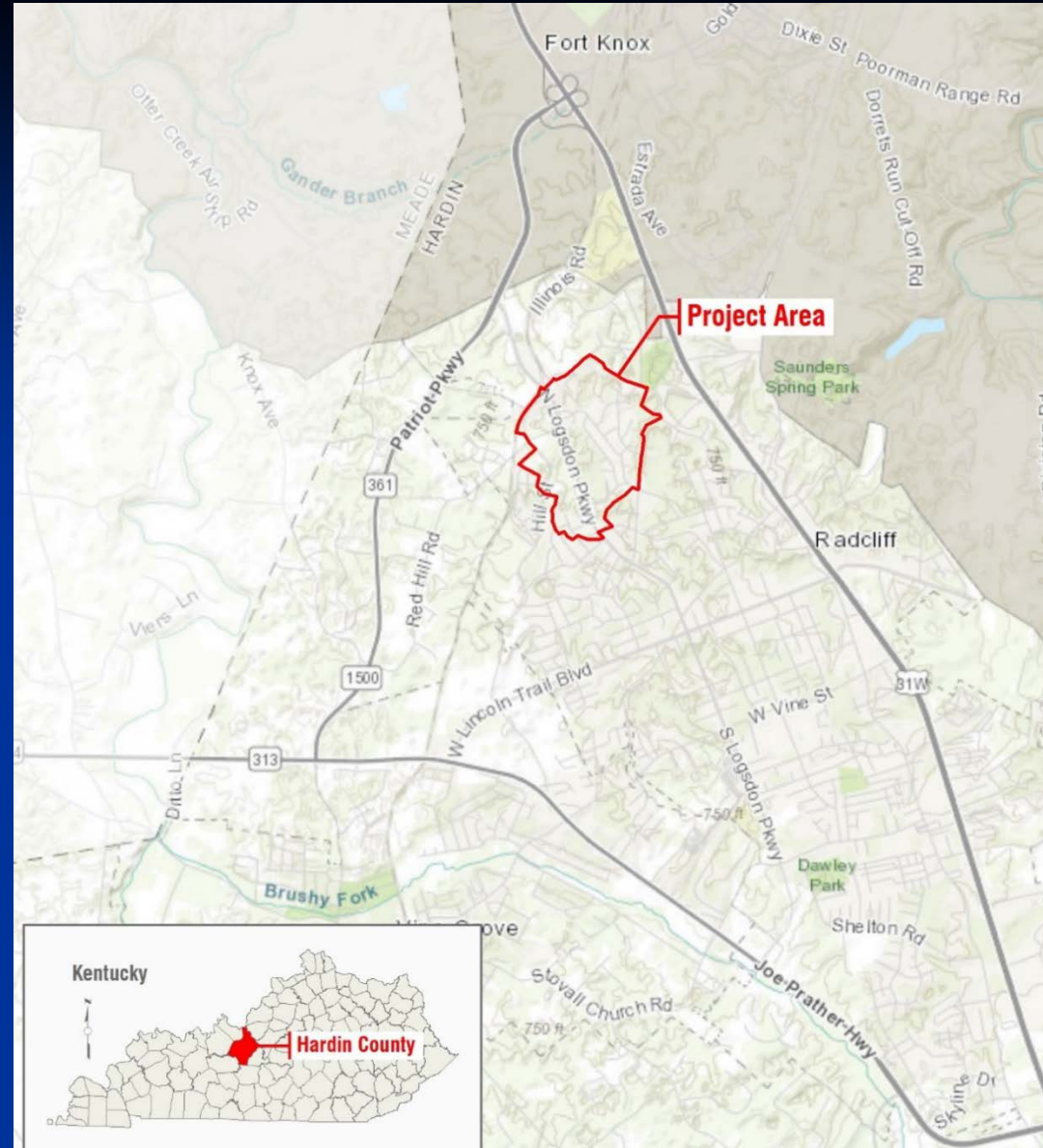


**Neal Crawford, PE, Rebecca Hammond, EIT**  
Project Manager, Project Engineer  
Qk4, Inc.



# Project Details

- Radcliff, Kentucky
- Along Logsdon Parkway
- 2 Major Watersheds
- 10 Sub-watersheds
- 13 Basins
- Major flooding problems

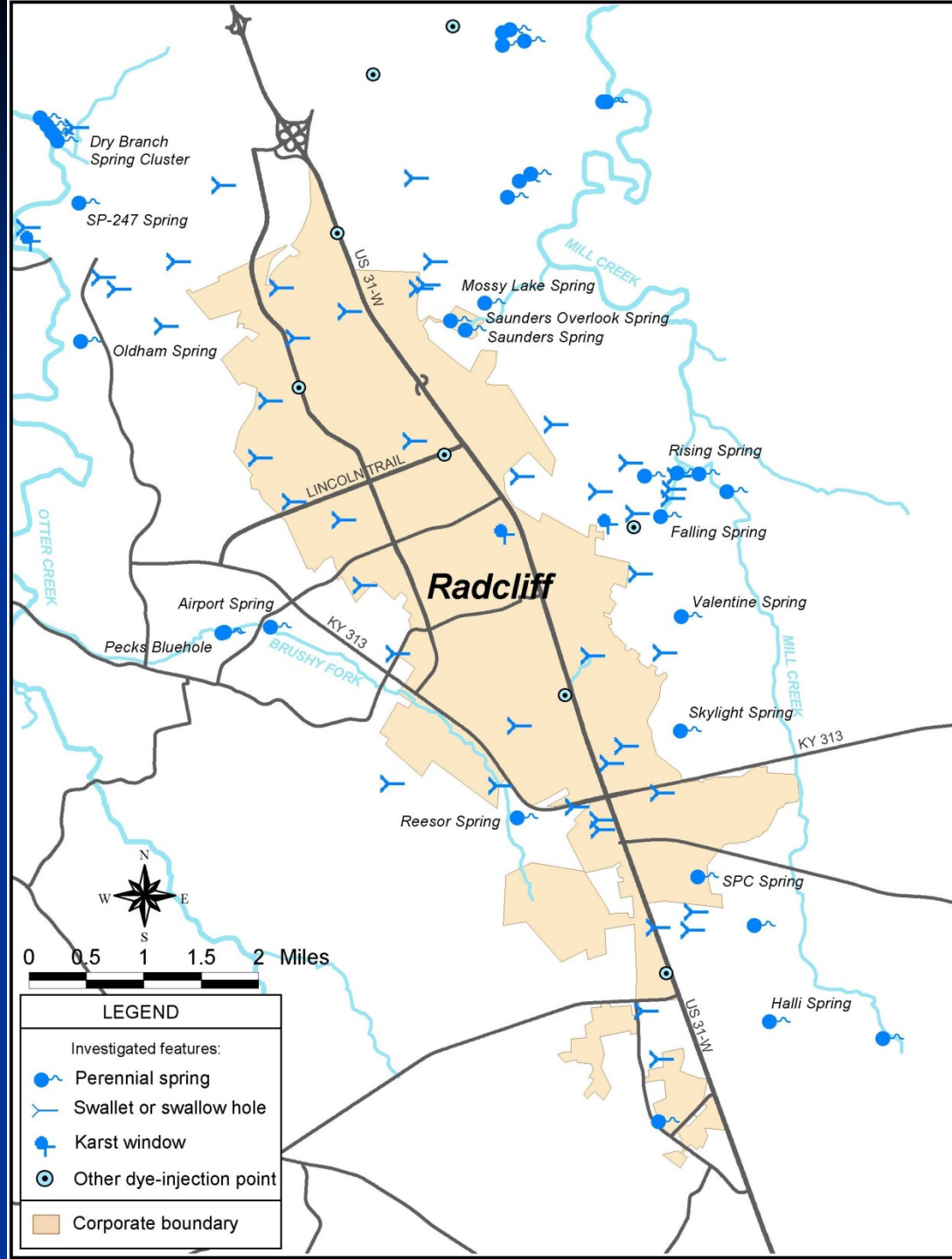


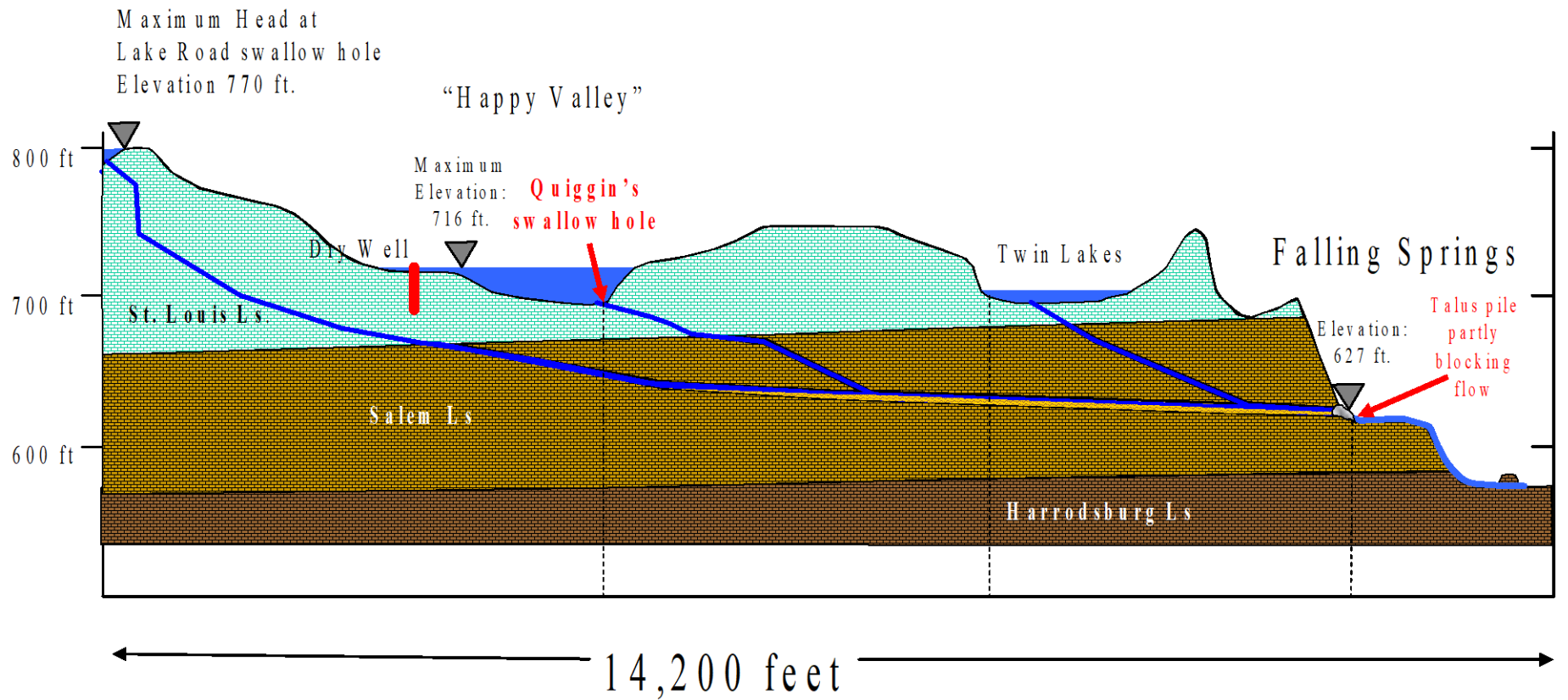
# North Logsdon Storm Water Master Plan Project Scope

- Provide more detailed investigation and analysis of the existing conditions of the North Logsdon Project Area.
- Provide accurate approximations of the potential 100 year flood impacts for the sinkhole watersheds within the North Logsdon Project Area.
- Validate the analysis and potential flood impacts using historical flood information (2008, 1997).
- Provide potential solutions for improvements to protect the homes and residents from flooding for the North Logsdon Project Area.

# Kentucky Geological Survey (KGS)

- Oct. 2006-Sep. 2007
- Delineated groundwater basins and mapped watersheds.
- Field verified sinkhole connectivity.

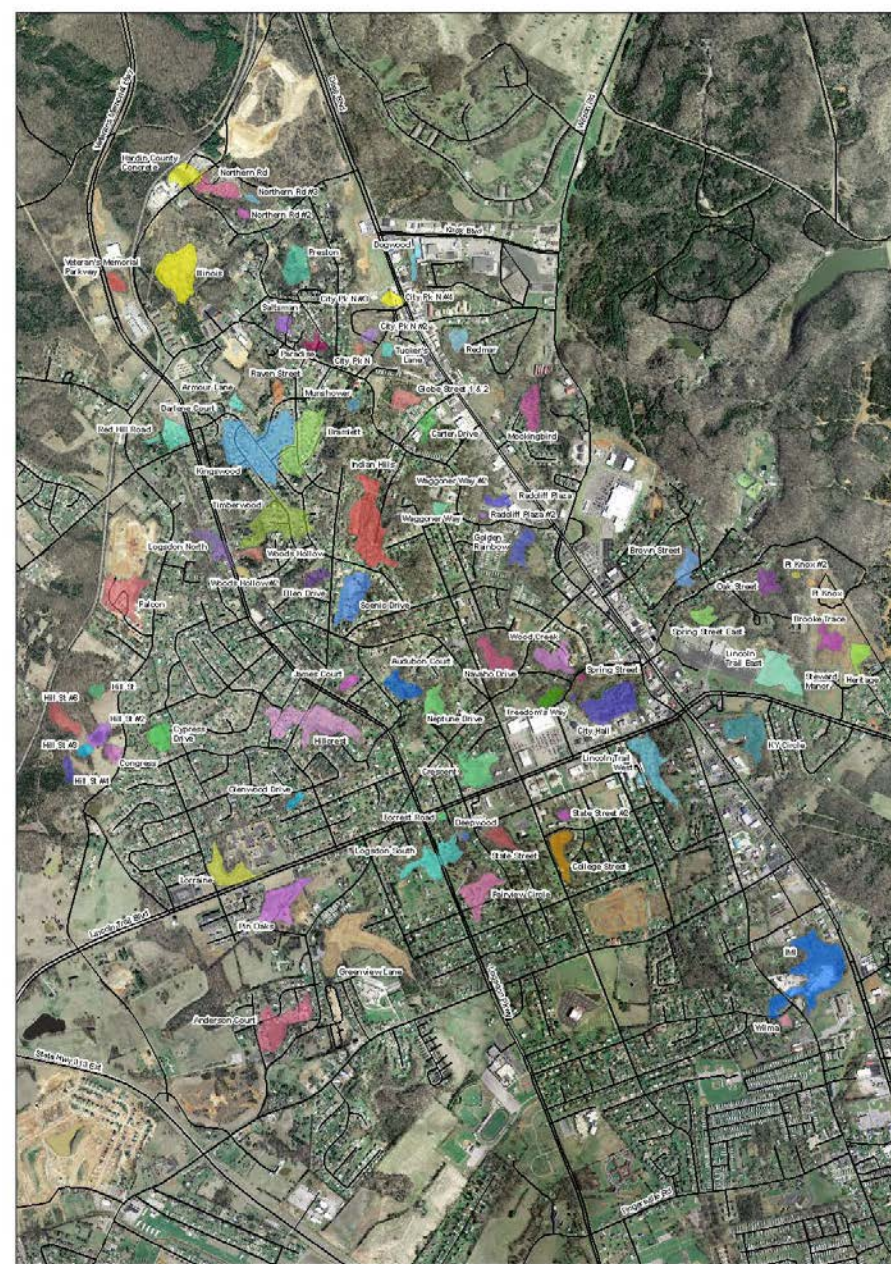




# Sink Hole/ Swallow Hole

# U.S. Army Corps of Engineers (USACE)

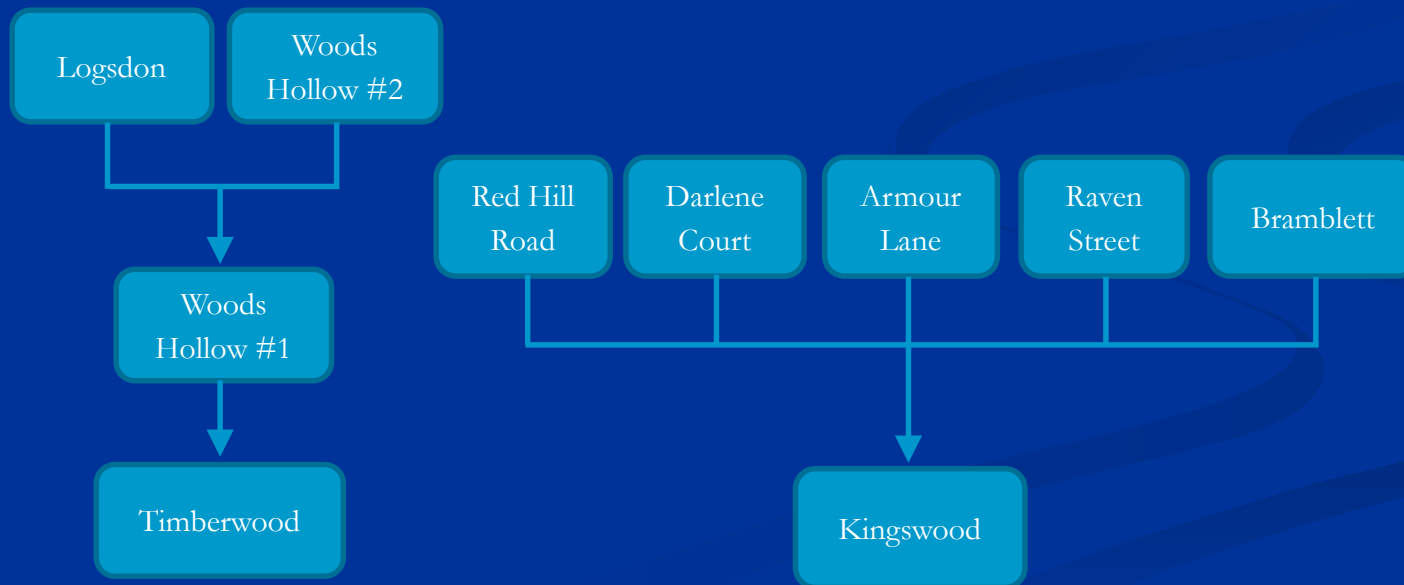
- April 2010
- Evaluated all sinkhole watersheds
- Approximated 100 yr. floodplain for all sinkholes.
- Provided higher level hydrologic analysis of existing conditions of each sinkhole watershed.



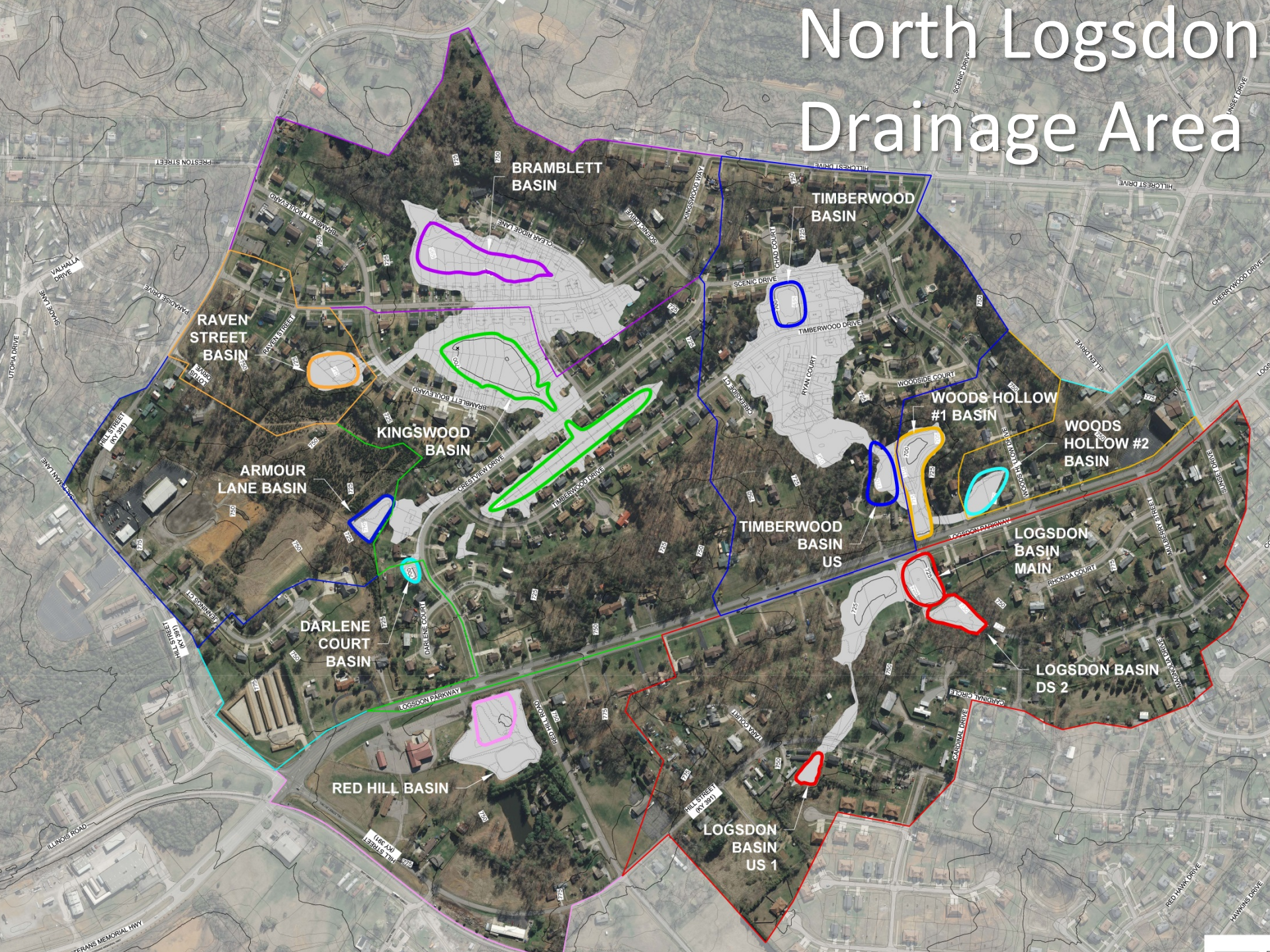
Radcliff, KY  
Mapping of Conservancy Areas Around Sinkholes  
Appendix B - Sheet 1 of 4

# Project Parameters

- Project area includes ~ 316 acres of watershed area contributing to 13 basins with 10 sinkholes.
- Basins overflow into each other creating 2 main watersheds: Kingswood and Timberwood.



# North Logsdon Drainage Area





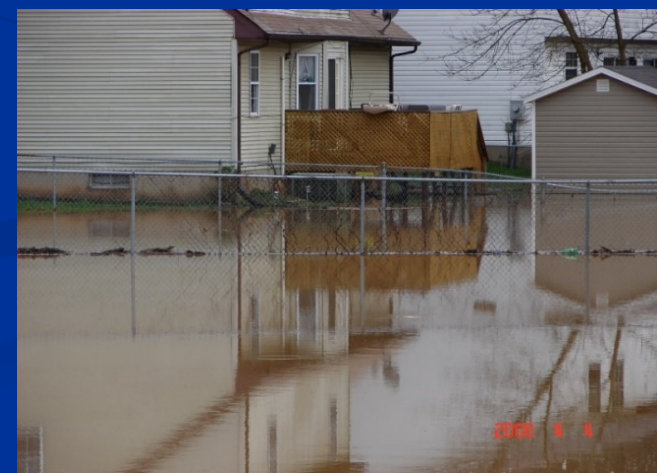
# The Problem

- Existing network of interconnected sinkholes with limited flow capacity. (Approx. 5 cfs)
- Residential development of the watershed and around the sinkholes
- Insufficient available storage of runoff.
- All this results in structural and roadway flooding.



# Timberwood Basin

## Existing Conditions: Flooded



# Timberwood Basin Existing Conditions: Flooded









Kingswood Basin  
Existing Conditions: Flooded

2008 4 4



# Bramblett Basin

## Existing Conditions: Flooded



# The Hurdles

- Limited undeveloped available property around the sinkholes. (Limiting expansion or new construction)
- Open public access to basins at nearly all the sinkholes (public safety issue)
- Sinkhole capacity is limited (requires storage)



Kingswood Basin  
Existing Conditions: Dry



Woods Hollow #1 Basin  
Existing Conditions



Timberwood Basin  
Existing Conditions: Dry



# Logsdon Basin Existing Conditions



# Woods Hollow #2 Basin Existing Conditions

# Hydraulic Study

Watershed	Basin	Top of Basin Elevation (ft.)	Maximum Elevation - 100-Year Event (ft.)	Number of Homes Impacted
Logsdon	Logsdon US	745	745.64	0
Logsdon	Logsdon DS 2	732	732.82	0
Logsdon	Logsdon DS Main	726	727.76	0
Woods Hollow #2	Woods Hollow #2	732	729.58	0
Woods Hollow #1	Woods Hollow #1	718	718.09	1
Timberwood	Timberwood US	712	712.63	0
Timberwood	Timberwood DS	706	711.61	25
Red Hill Road	Red Hill Road	736	735.90	0
Darlene Court	Darlene Court	714	714.75	0
Armour Lane	Armour Lane	714	714.52	3
Raven Street	Raven Street	716	717.58	2
Bramblett	Bramblett	700	702.06	31
Kingswood	Kingswood	705	707.65	35

Calibrated hydrologic model based on 1997 and 2008 known flood elevations and rainfall amounts.

**TIMBERWOOD SUB-WATERSHED  
EXISTING CONDITIONS**

Homes Impacted By 100-Year Floodplain:

The Timberwood US Basins overflows into Timberwood DS Basin—the final downstream basin reached in the Timberwood Watershed

**TIMBERWOOD HYDRAULIC SUMMARY**



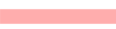



Storm Year	50-Year	100-Year
Rainfall Depth (in)	4.71	7.07
Watershed Runoff Volume (ac-ft)	US: 14.97 DS: 11.30	US: 20.04 DS: 11.36
Storage Provided (ac-ft)	US: 0.76 DS: 5.27	US: 0.87 DS: 5.27
Maximum Elevation (ft)	US: 712.61 DS: 710.66	US: 712.63 DS: 711.61
Basin Outflow (cfs)	US: 31.80 DS: 1.60	US: 90.99 DS: 1.60
Basin Outflow Volume (ac-ft)	US: 14.32 DS: 11.30	US: 19.38 DS: 11.36

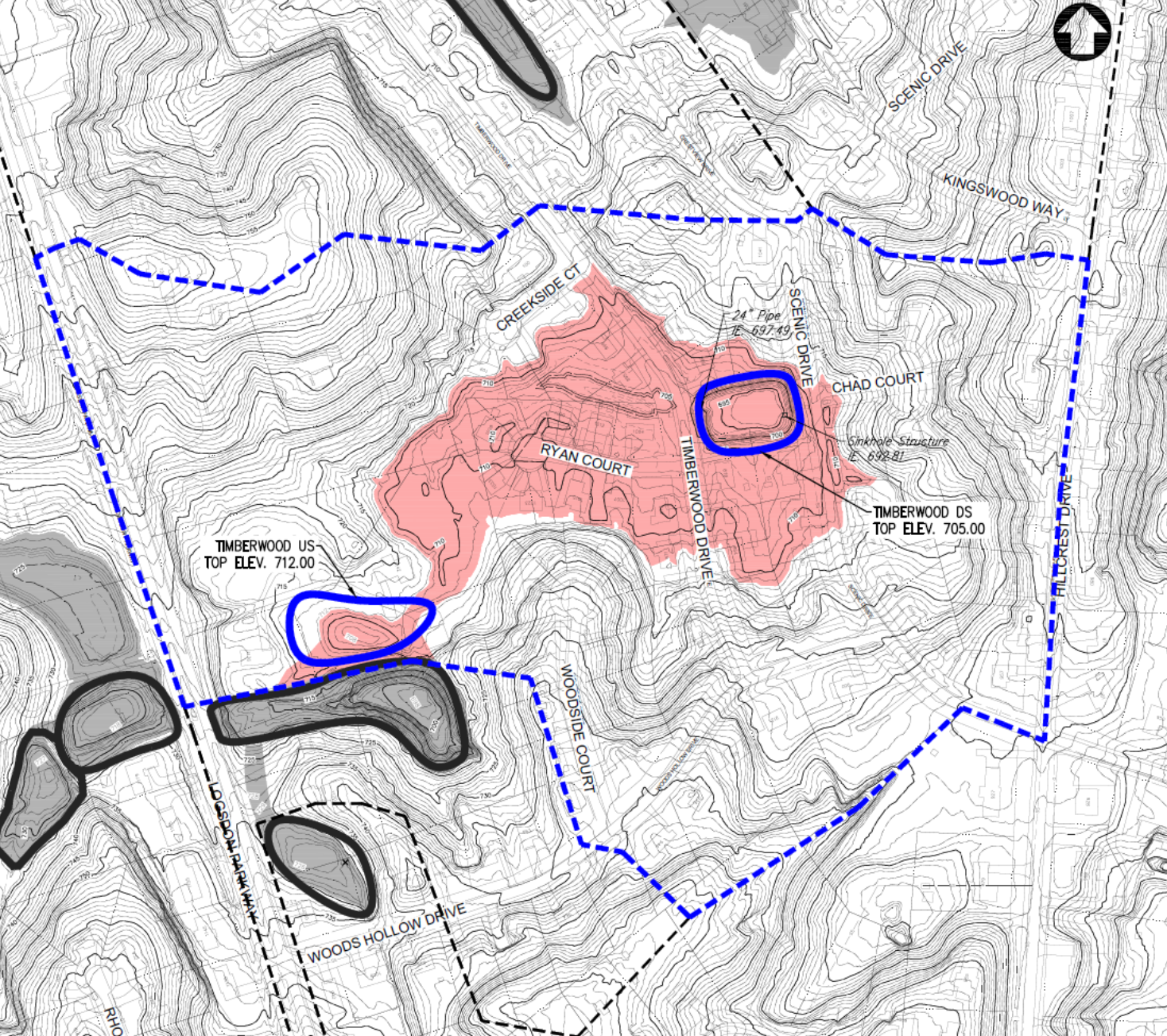
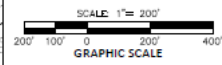
Note: Rainfall Depth is based on SCS 24-Hour Precipitation Data.

Hydraulic analysis assumed outflow 1.6 cfs though the existing sinkhole

Basin outflow was calibrated using historical flood data from 4/4/200

**LEGEND**

-  Timberwood Drainage Area
-  Timberwood Basin Areas
-  Timberwood 100-Year Flood Area (711.61)
-  Nearby Watershed 100-Year Flood Area
-  Existing Major Contour
-  Existing Minor Contour



# Timberwood Sub-Watershed



**KINGSWOOD SUB-WATERSHED  
EXISTING CONDITIONS**

Homes Impacted By 100-Year Floodplain: 35

The Kingswood Basin is the final downstream basin reached in the Kingswood Watershed.

**KINGSWOOD HYDRAULIC SUMMARY**

Storm Year	50-Year	100-Year
Rainfall Depth (in)	6.27	7.07
Watershed Runoff Volume (ac-ft)	31.00	38.83
Storage Provided (ac-ft)	14.74	14.74
Maximum Elevation (ft)	706.89	707.65
Basin Outflow (cfs)	2.60	2.60
Basin Outflow Volume (ac-ft)	18.22	18.29

Note: Rainfall Depth is based on SCS 24-Hour Precipitation Data.

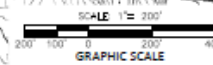
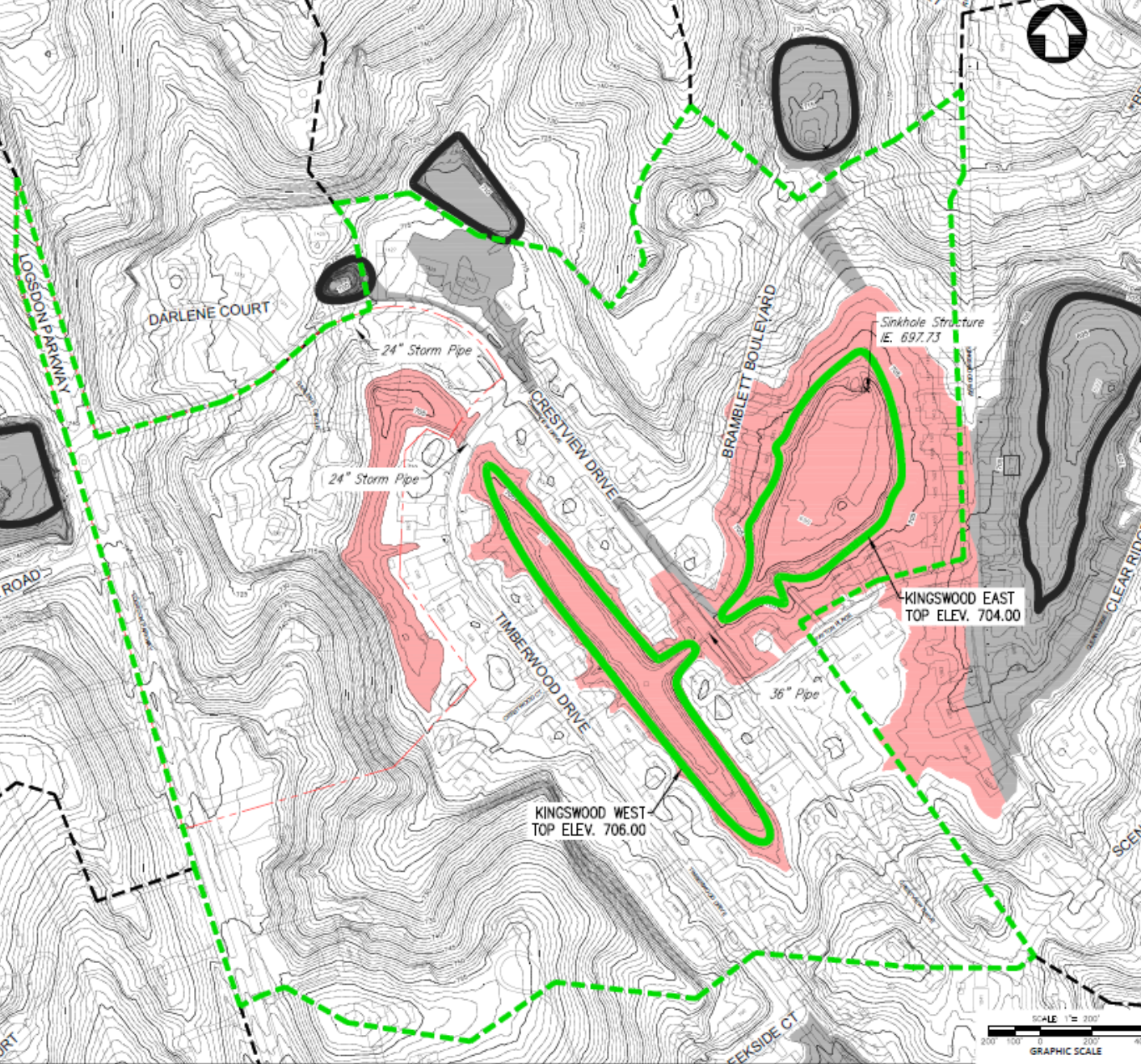
Hydraulic analysis assumed outflow of 2.6 cfs through the existing sinkhole.

Basin outflow was calibrated using historical flood data from 4/4/2008.

**LEGEND**

- - - - - Kingswood Drainage Area
- Kingswood Basin Areas
- - - - - Shared Drainage Area\*
- Kingswood 100-Year Flood Area (Elev. 707.65)
- Nearby Watershed 100-Year Flood Elevation
- Existing Major Contour
- - - - - Existing Minor Contour

\* Area contributes to Darlene Court Basin in < 5-year rain events and to the Kingswood Basin in ≥ 5-year rain events.



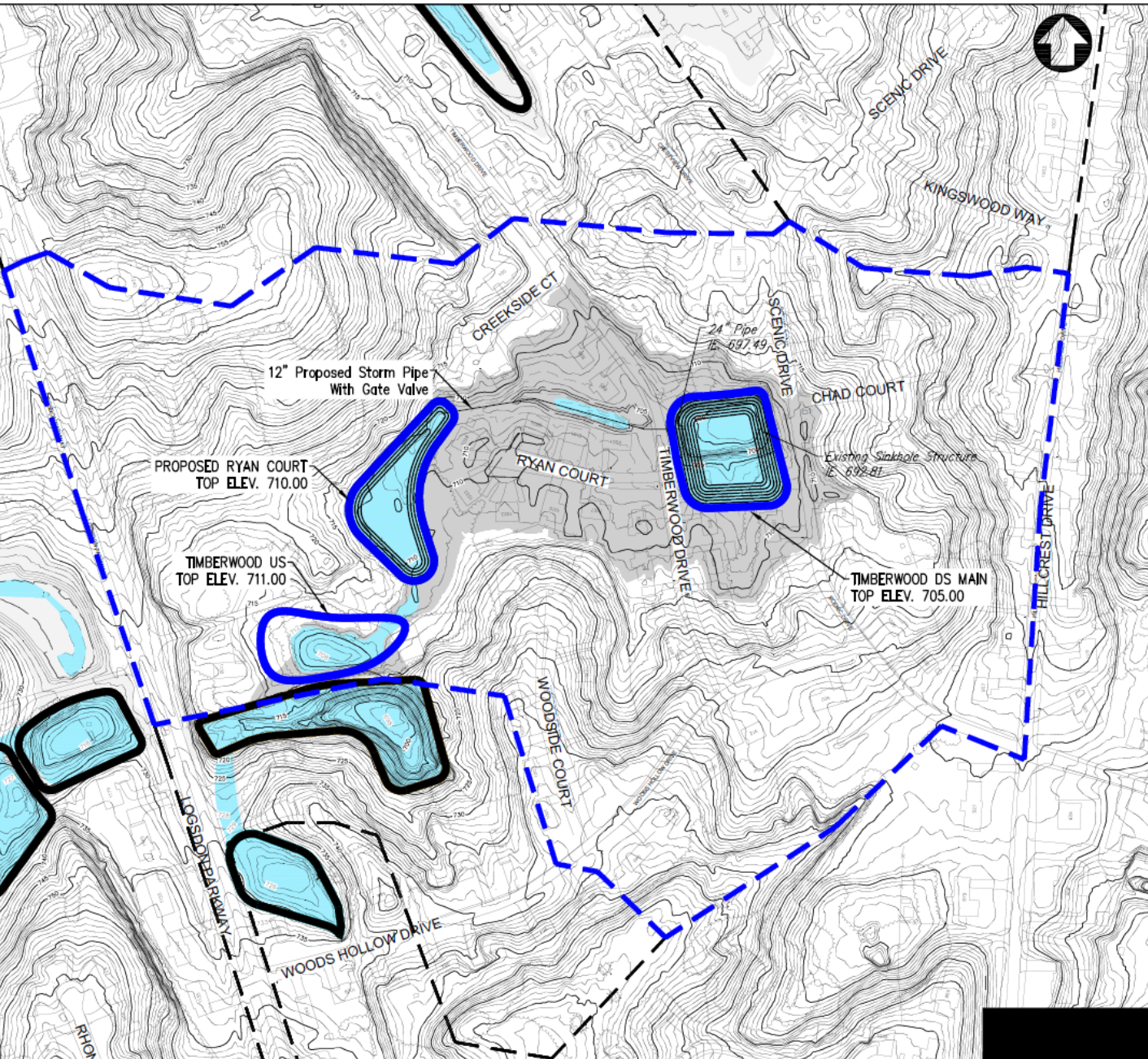
**Kingswood Sub-Watershed**



Alternatives	Description	Total Estimated Cost	Results
<b>Baseline</b>	Excavating and altering outlets of 8 basins within current boundary.	\$1,624,150	Remove 82 homes from theoretical 100-year flooding area, and lower max. elev. to 709.90' in the Timberwood watershed and to 703.15' in the Kingswood watershed.
<b>Alternative 1</b>	Baseline Solution plus the construction of Ryan Court Basin.	\$1,850,557	Remove 83 homes from theoretical 100-year flooding area and lower max. elev. to 709.24' in the Timberwood watershed and to 703.15' in the Kingswood watershed.
<b>Alternative 2</b>	Baseline Solution plus the construction of Tara Court Basin.	\$1,816,289	Remove 88 homes from theoretical 100-year flooding area, and lower max. elev. to 708.66' in the Timberwood watershed and to 703.15' in the Kingswood watershed.
<b>Alternative 3</b>	Baseline Solution plus piping overflow from the Timberwood DS Basin to The Kingswood Basin.	\$2,521,202	Remove 73 homes from theoretical 100-year flooding area, lower max. elev. to 707.66' in the Timberwood watershed, and raise max. elev. to 706.40' in the Kingswood watershed. Not successful. Not recommended
<b>Alternative 4</b>	Baseline Solution plus underground storage near Timberwood DS Basin.	\$3,624,150	Not practical to implement. Not recommended
<b>Alternative 5</b>	Baseline Solution plus expansion of the Timberwood DS Basin into an adjacent property.	\$2,050,283	Remove 83 homes from theoretical 100-year flooding area and lower max. elev. to 709.24' in the Timberwood watershed and to 703.15' in the Kingswood watershed.
<b>Alternatives 1,2, &amp; 5</b>	Baseline Solution plus the construction of Ryan Court Basin, Tara Court Basin and expansion of the Timberwood DS Basin.	\$2,468,829	Remove all 97 homes from theoretical 100-year flooding area and lower max. elev. to 704.28' in the Timberwood watershed and to 703.15' in the Kingswood watershed.

# The Recommended Solutions

- Provide additional storage within 8 of the 13 existing basins by excavating the bottom/sides. (32.5 Ac.-Ft.)
- Expand the Timberwood DS Basin. (9.8 Ac.-Ft.)
- Construct 2 additional basins upstream of existing sinkholes
  - Tara Ct – 6.9 Ac.-Ft.; Ryan Ct – 4.7 Ac.-Ft.
- Add control valving on 2 existing basin outlets and 2 new outlets.



**TIMBERWOOD SUB-WATERSHED  
PROPOSED CONDITIONS**

Homes Within 100-Year Floodplain-Proposed: 0

Homes Within 100-Year Floodplain-Existing: 25

The Timberwood DS Basin is the final downstream basin reached in the Timberwood Watershed and receives flow from the Logsdon, Woods Hollow #1, & Woods Hollow #2 basins.

**TIMBERWOOD HYDRAULIC SUMMARY**

Storm Year	50-Year	100-Year
Storage Provided (ac-ft)	US: 0.56 Ryan Ct: 3.61 DS: 6.60	US: 0.58 Ryan Ct: 4.67 DS: 8.14
Storage Volume Increased (ac-ft)	US: -0.20* Ryan Ct: 3.61 DS: -1.27*	US 1: -0.29* Ryan Ct: 4.67 DS: -2.79*
Basin Outflow (cfs)	US: 35.25 Ryan Ct: 0.00 DS: 1.60	US: 43.08 Ryan Ct: 0.00 DS: 1.60
Basin Outflow Volume (ac-ft)	US: 1.82 Ryan Ct: 0.00 DS: 8.32	US: 2.54 Ryan Ct: 0.00 DS: 9.86
Maximum Elevation (ft)	US: 711.60 Ryan Ct: 708.63 DS: 701.45	US 1: 711.68 Ryan Ct: 710.02 DS: 703.20








Note: Rainfall Depth is based on SCS 24-Hour Precipitation Data.

Hydraulic analysis assumed outflow of 1.6 cfs through the existing sinkhole.

Basin outflow was calibrated using historical flood data from 4/4/2008.

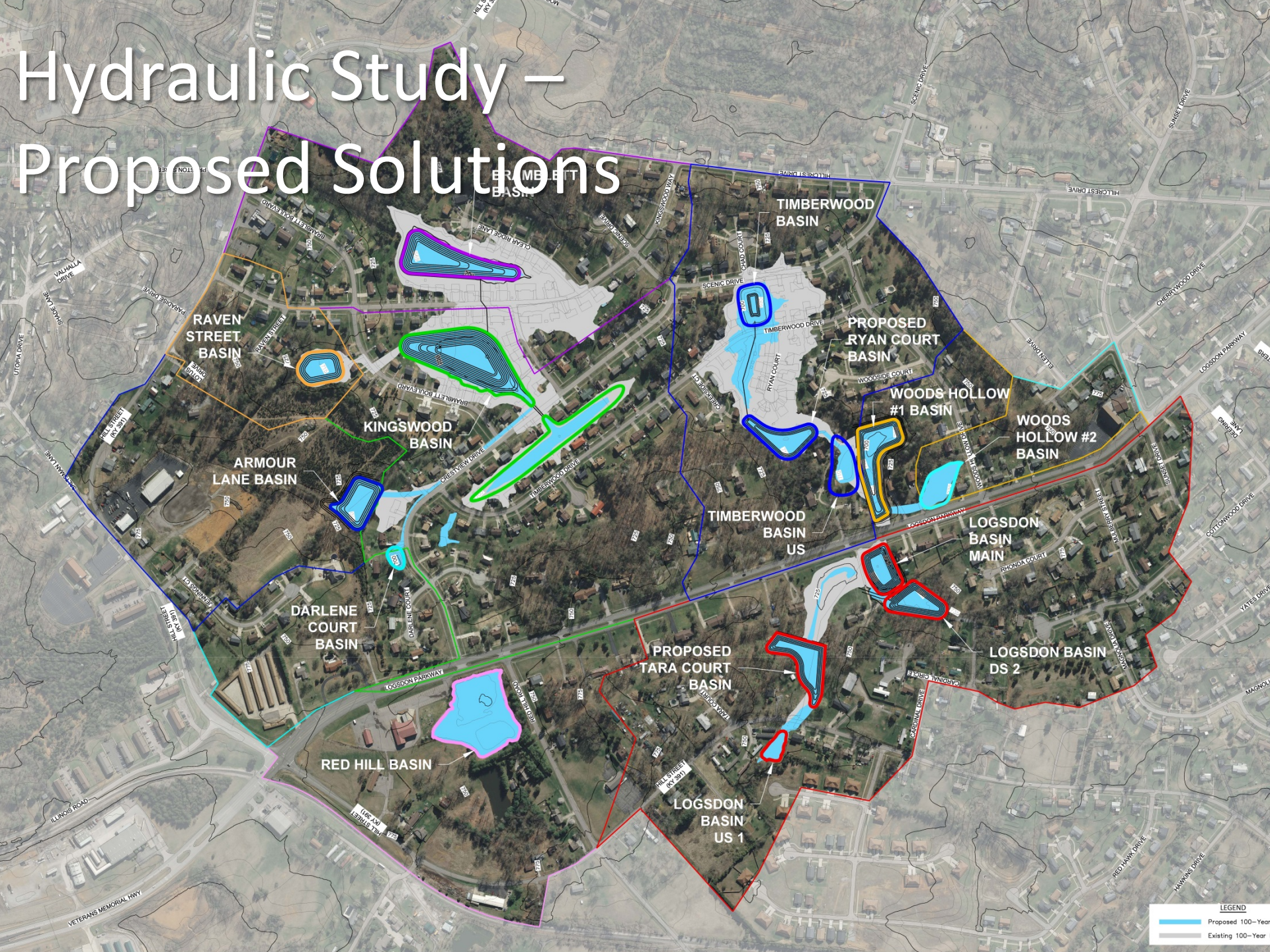
\*Note: Decreased storage reported in this event due to mitigation of upstream volumes.

**LEGEND**

-  Timberwood Drainage Area
-  Timberwood Basin Areas
-  Proposed 100-Year Flood Area (Elev. 704.28)
-  Existing Watershed 100-Year Flood Area (Elev. 711.61)
-  Existing Major Contour
-  Existing Minor Contour
-  Proposed Contour

# Timberwood Sub-Watershed

# Hydraulic Study – Proposed Solutions



# Summary

Watershed	Existing Storage (AC-FT)	Proposed Storage (AC-FT)	Floodplain Lowered (FT)	Homes Removed From Floodplain
Kingswood	37.4	61.6	4.5	71
Timberwood	22.3	43.3	8.4	26
<b>Total</b>	<b>59.7</b>	<b>104.9</b>	-	<b>97</b>

\*table reflects predicted values for a 100-yr, hr storm event

# The Next Steps

- Detailed Construction Design
- Refined Project Costs
- Potential Funding Assistance Application
- Acquisitions
- Construction



# Questions?



North Logsdon Storm Water Master Plan

Toby Spalding, PE  
City Engineer  
City of Radcliff



Neal Crawford, PE  
Project Manager  
Qk4, Inc.

