City of Raleigh
Engineering
Services
Department

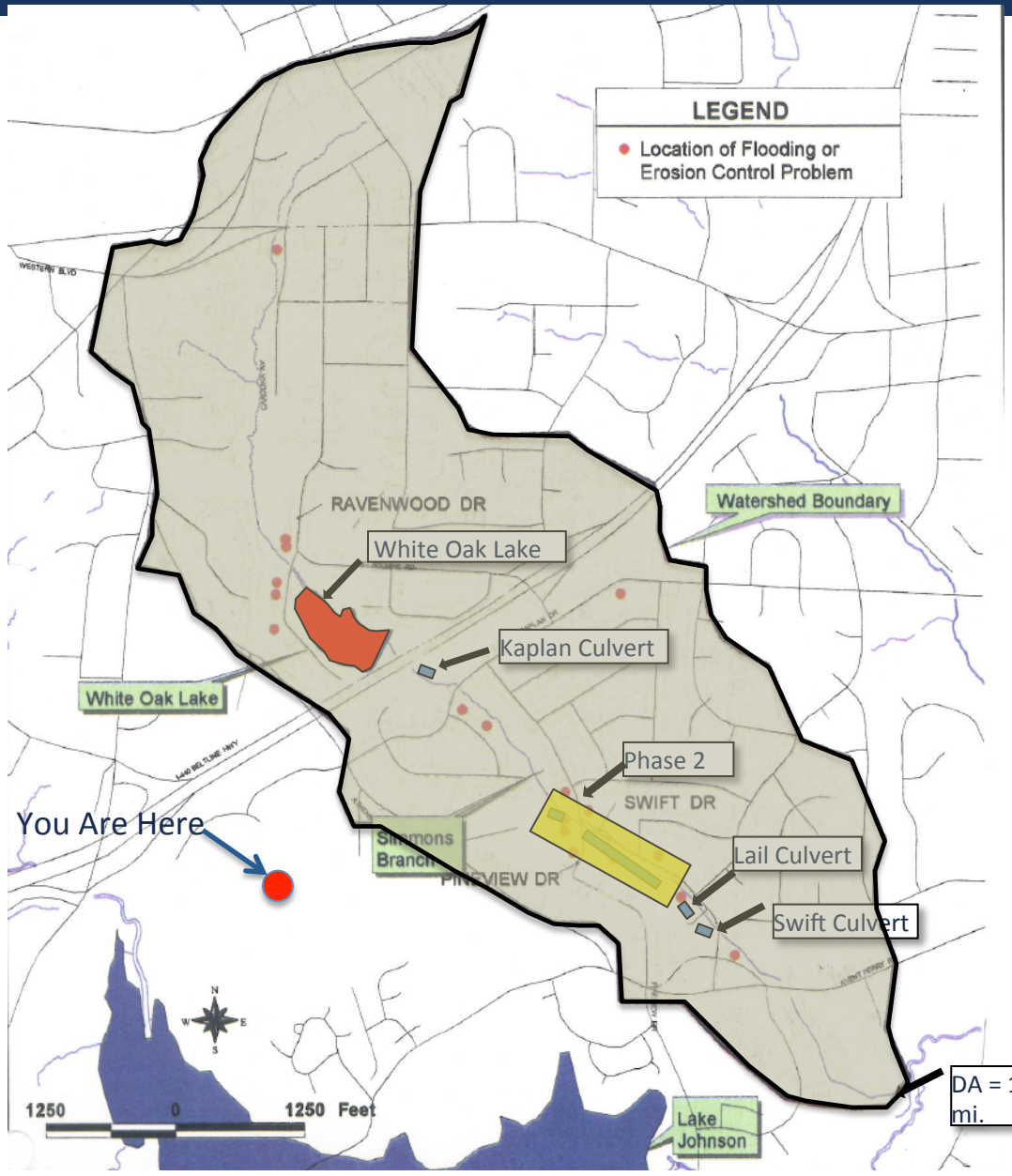
Stormwater Management

Simmons Branch Drainage Improvement Project - Phase 2 w/ White Oak Lake

May 16, 2017

Dewberry®

Phasing and Project Orientation



Phase 1

- Lail, Kaplan, and Swift Culverts

Phase 2

- Pineview Culvert
- Swift Drive Culvert
- Driveway Bridge
- Bank Stabilization

Phase 3

- White Oak Lake

Project Objectives

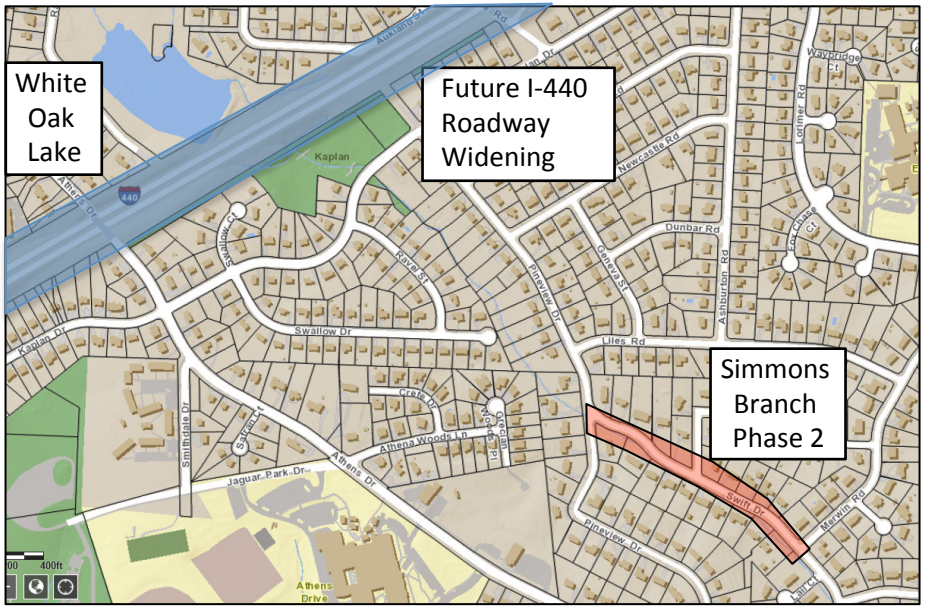
1. Reduce flooding
    - Eliminate roadway flooding for a 10-year flood
    - Minimize flooding of homes and yards
2. Improve public safety
3. Address maintenance challenges with failing infrastructure
4. Stabilize stream banks of Swift Creek

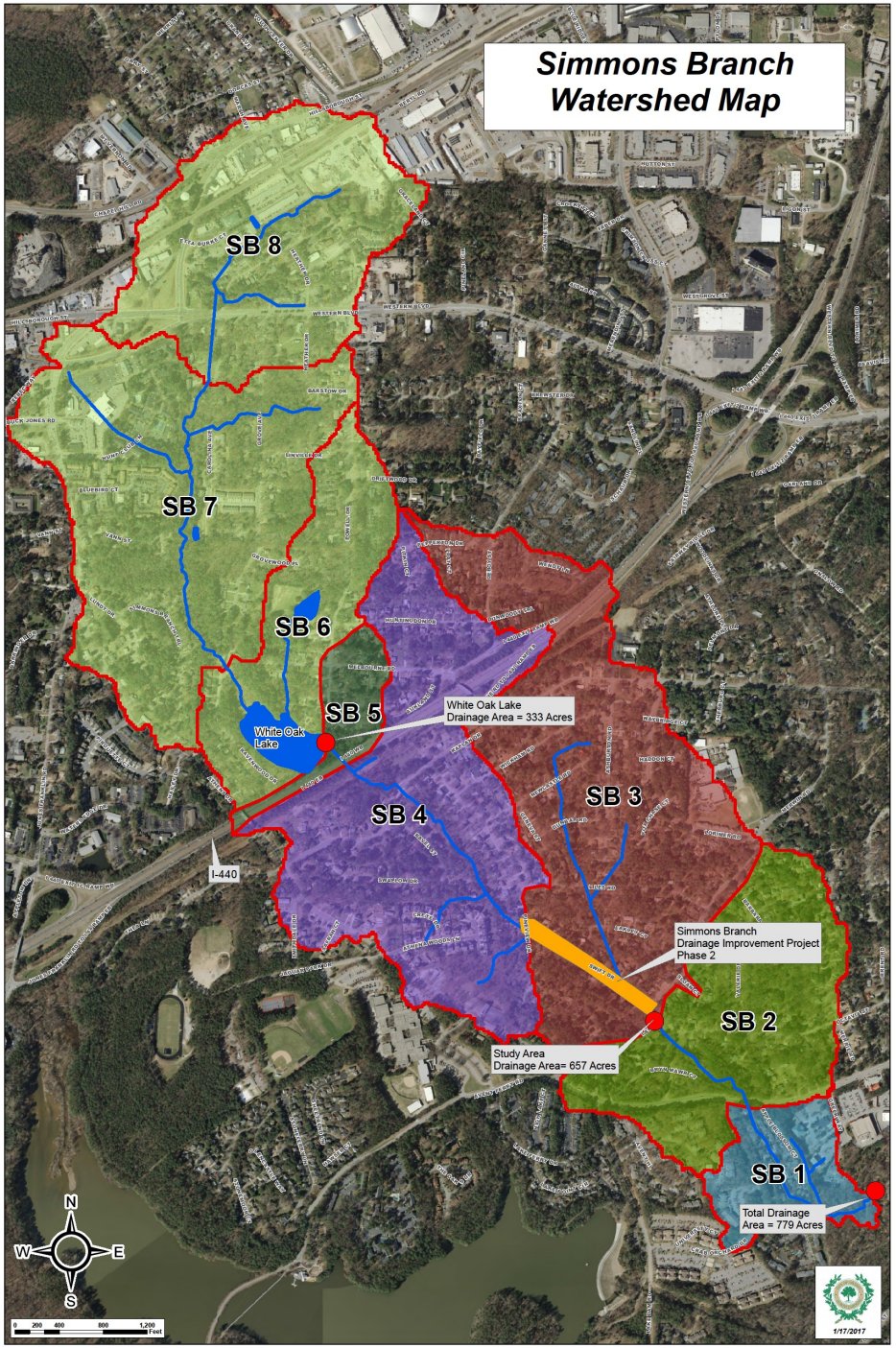
Example of bank erosion
(near Merwin Road)

10-year floodplain

Taking a Second Look

- Optimize White Oak Lake to lower downstream runoff volume
- Consider timing of NCDOT's I-440 Roadway widening project
- Efficiently spend funding to reduce flooding
  - Reduce rock blasting
  - Reduce utility relocations
  - Increase performance of the original design

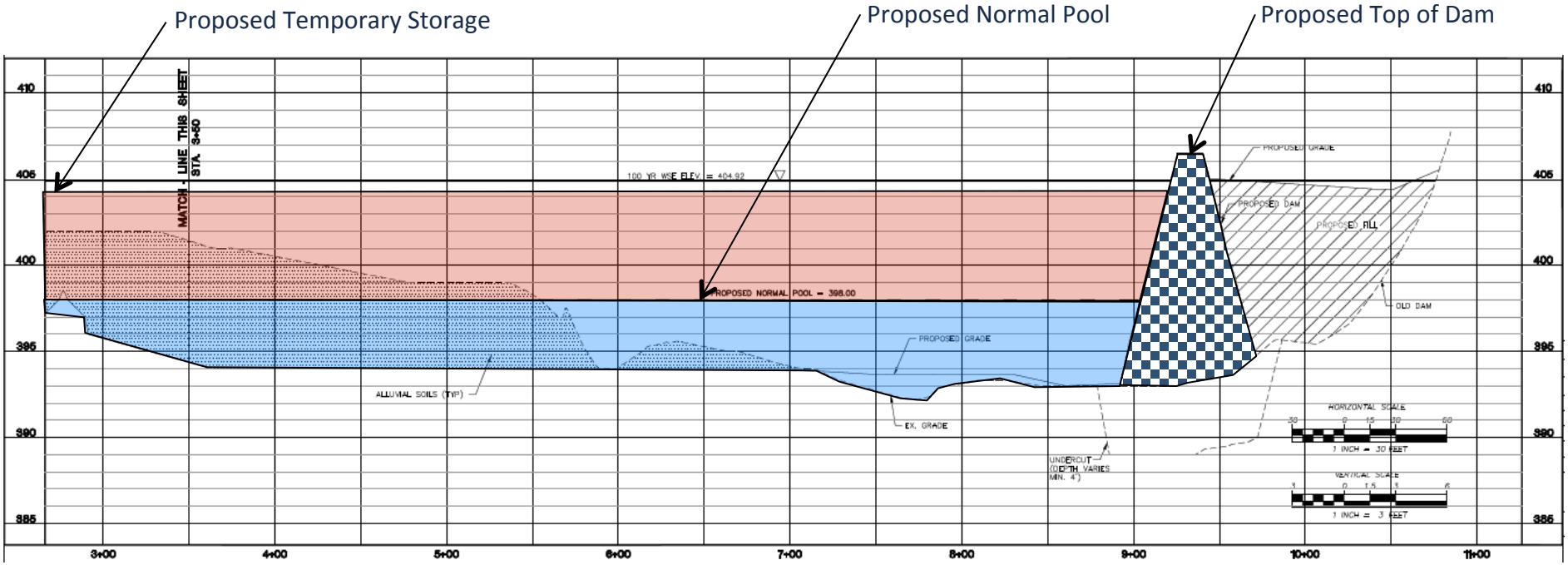



Simmons Branch
Watershed Map
SB 8
SB 7
SB 6
SB 5
White Oak Lake
White Oak Lake
Drainage Area = 333 Acres
SB 4
SB 3
I-440
Simmons Branch
Drainage Improvement Project
Phase 2
SB 2
Study Area
Drainage Area= 657 Acres
SB 1
Total Drainage
Area = 779 Acres
N
W
E
S
1/17/2017

White Oak Lake Flood Reduction

Flood Reduction Benefits

- Lower normal pool from 402.5’ to 396.0’
- Raise emergency spillway from 402.5’ to 404.5’
- Install new riser with 90” dia. Barrel
- Take temporary storage from 0 cf. to more than 1,500,000 cf.
- Peak flow is delayed by almost one hour



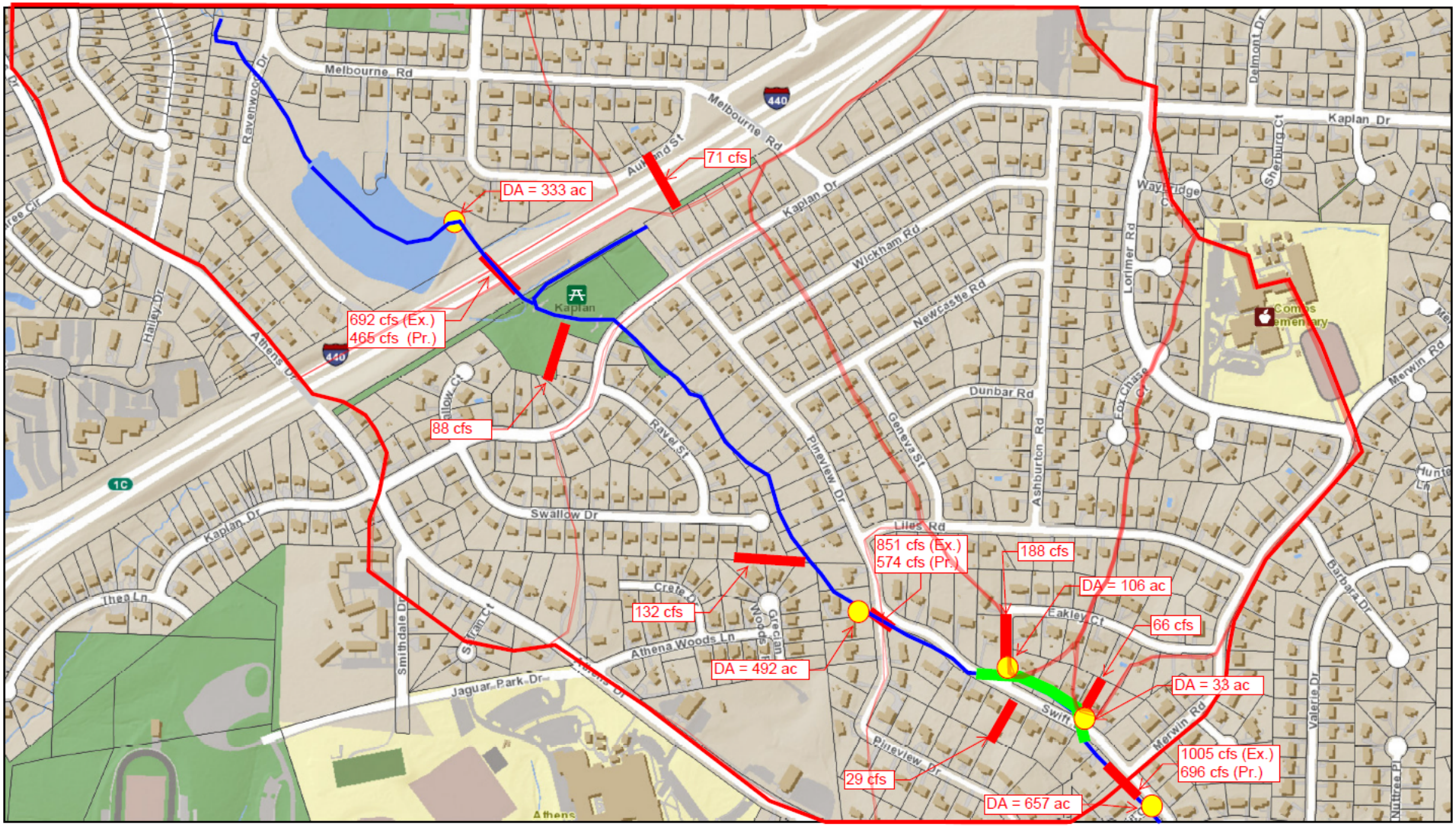
Temporary Storage

Current Lake

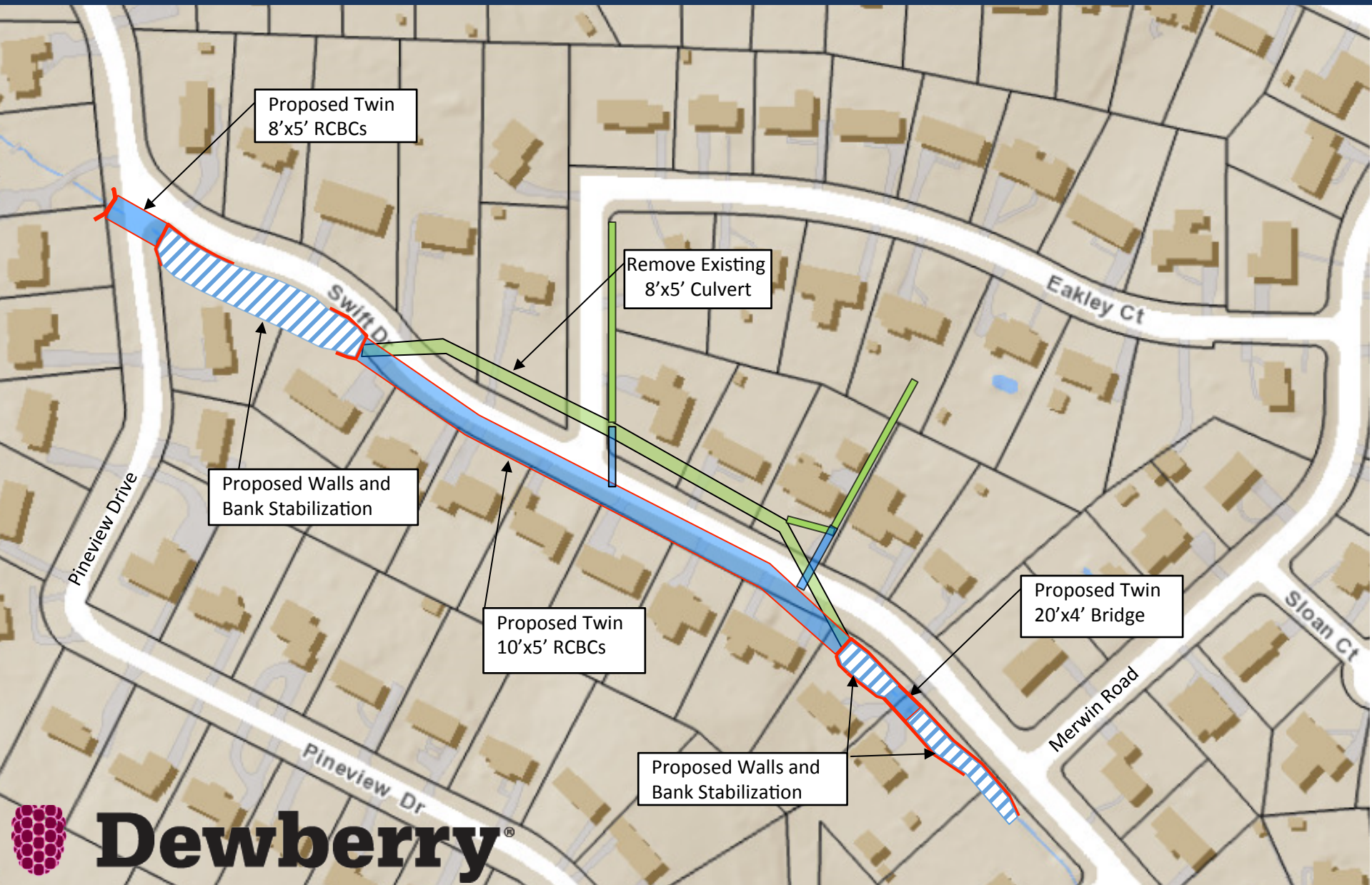
Failed Emergency Spillway

Failed Primary Spillway

Contributing Flows in Lower Watershed

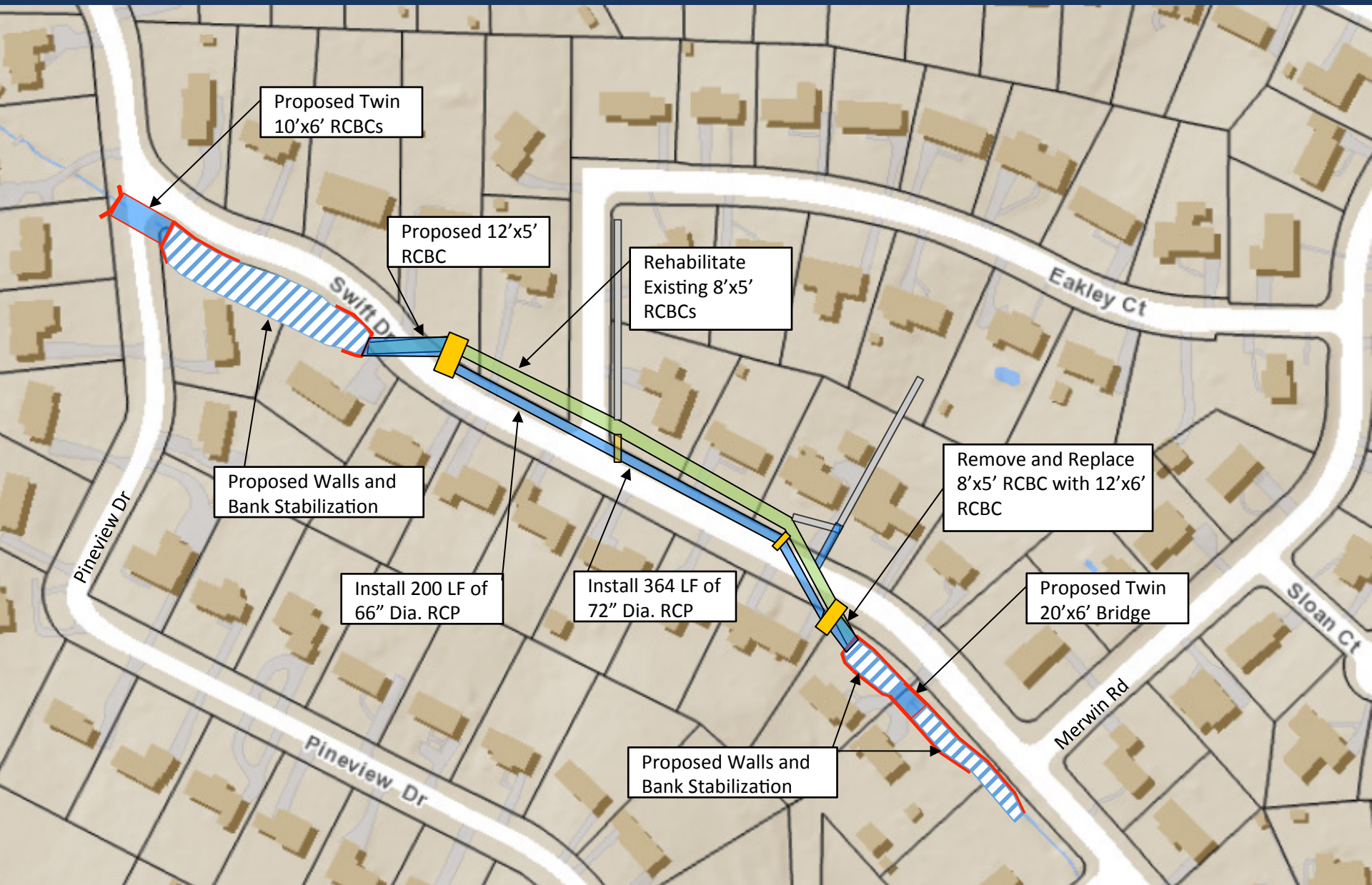


Previous Design

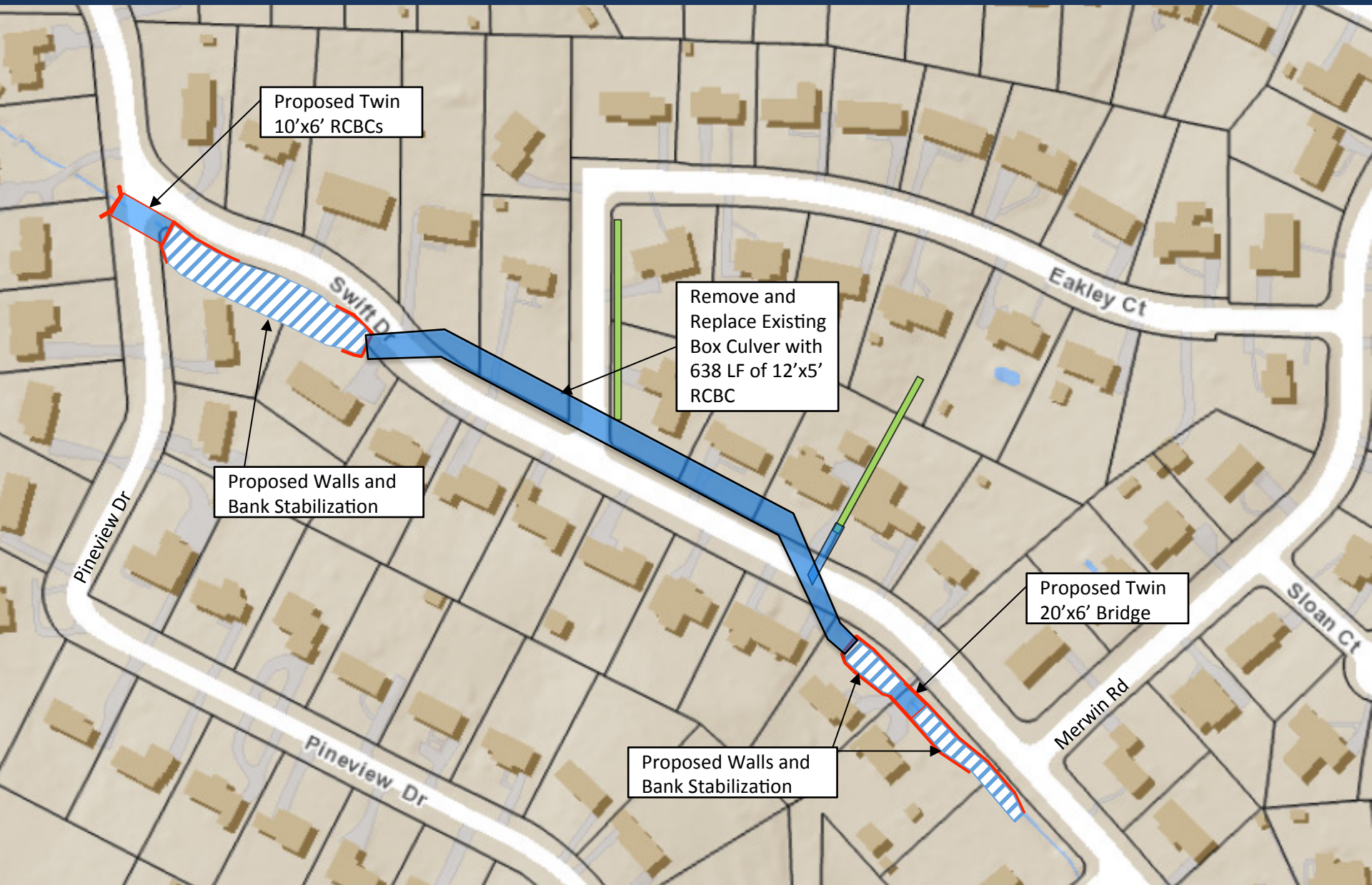


Dewberry®

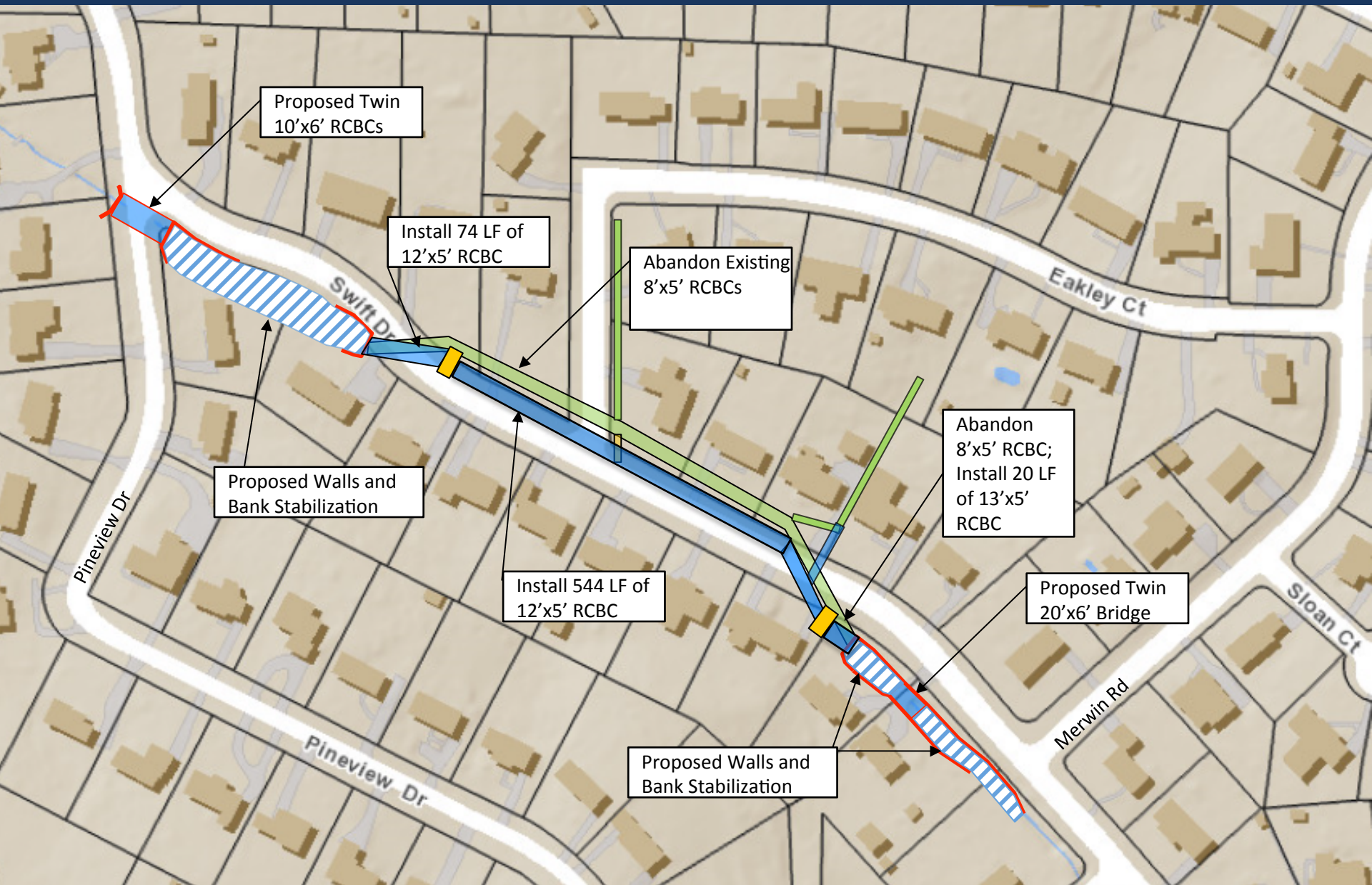
Alt#1: Rehabilitation Alternative



Alt#2: New RCBC (Same Location)

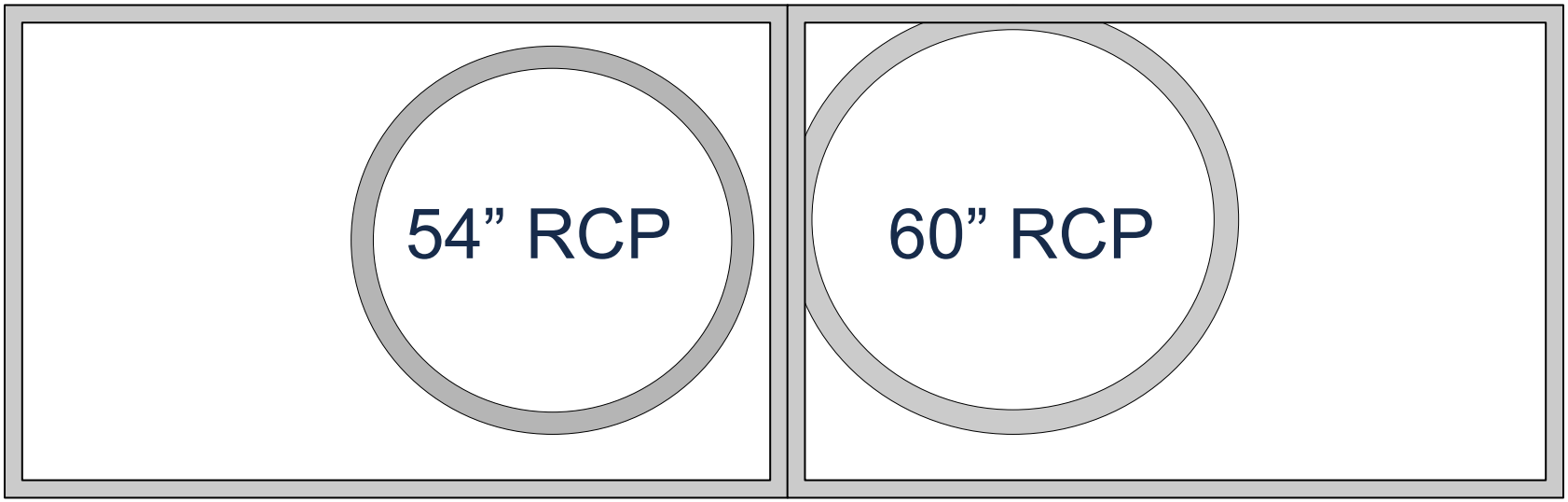


Alt#3: New RCBC (Work in Dry)



Culvert Change: Pineview Drive

Conditions	Culvert Size/ Material	Opening Area (sq. ft.)	Culvert Capacity (cfs.)	Upstream Invert (ft. NAVD '88)
Existing	54" and 60' RCPs	35.5	350	344.62
Proposed	Twin 10' x6' RCBCs	120	1155	343.62



Culvert capacity is designed to keep water underground and off the road

Flood Reduction Benefits: Pineview Drive

Table 1: Performance Comparison at Overtopping

Conditions	Culvert Size/Material	Culvert Capacity (cfs.)	Level of Service
Existing	54" and 60' RCPs	350	< 2-year
Prev. Design	Twin 8'x5'	740	10-year
Proposed	Twin 10'x6' RCBCs	**1155**	100-year

Table 2: WSEL Reductions

Storm Event	Ex. Conditions WSEL & Freeboard	**Prev. Design WSEL & Freeboard**	Proposed Design WSEL & Freeboard
10-year	353.78/**-1.78**	**350.49/1.51**	349.23/2.77
25-year	354.07/**-2.07**	352.09/**-0.09**	350.38/1.62
50-year	354.22/**-2.22**	353.17/**-1.17**	351.11/0.89
100-year	354.42/-**2.42**	**353.57**/**-1.57**	**351.65**/0.35

(FFE @ 1422 Pineview Dr. = 352.0'; Road Overtops 353.03)

Flood Reduction Benefits: 3609 Swift

Table 1: Performance Comparison at Overtopping

Conditions	Bridge Size/Material	Bridge Capacity (cfs.)	Level of Service
Existing	8.7'x4' Concrete	260	< 2-year
Prev. Design	20'x4' Concrete	657	10-year
Proposed	20'x6' Concrete	**1075**	25-year

Reduced Construction Footprint

Project Schedule – White Oak Lake

July: 60% design complete

July – August: Public meeting scheduled

July - October: Private utility relocation, permit application, easement acquisition; finalized construction plan

November – January 2018: Project bid

February – March 2018: Project award

April 2018: Project construction begins

November 2018: Project completed

Project Schedule – Simmons Branch

Previous Design Timeline

- January 24: Public meeting
- February – March: Revise current plan
- March -May: permit applications; finalize construction plans
- June – October: Project bid and award
- November 2017: Begin project construction
- April 2019: Project completed

18 month project

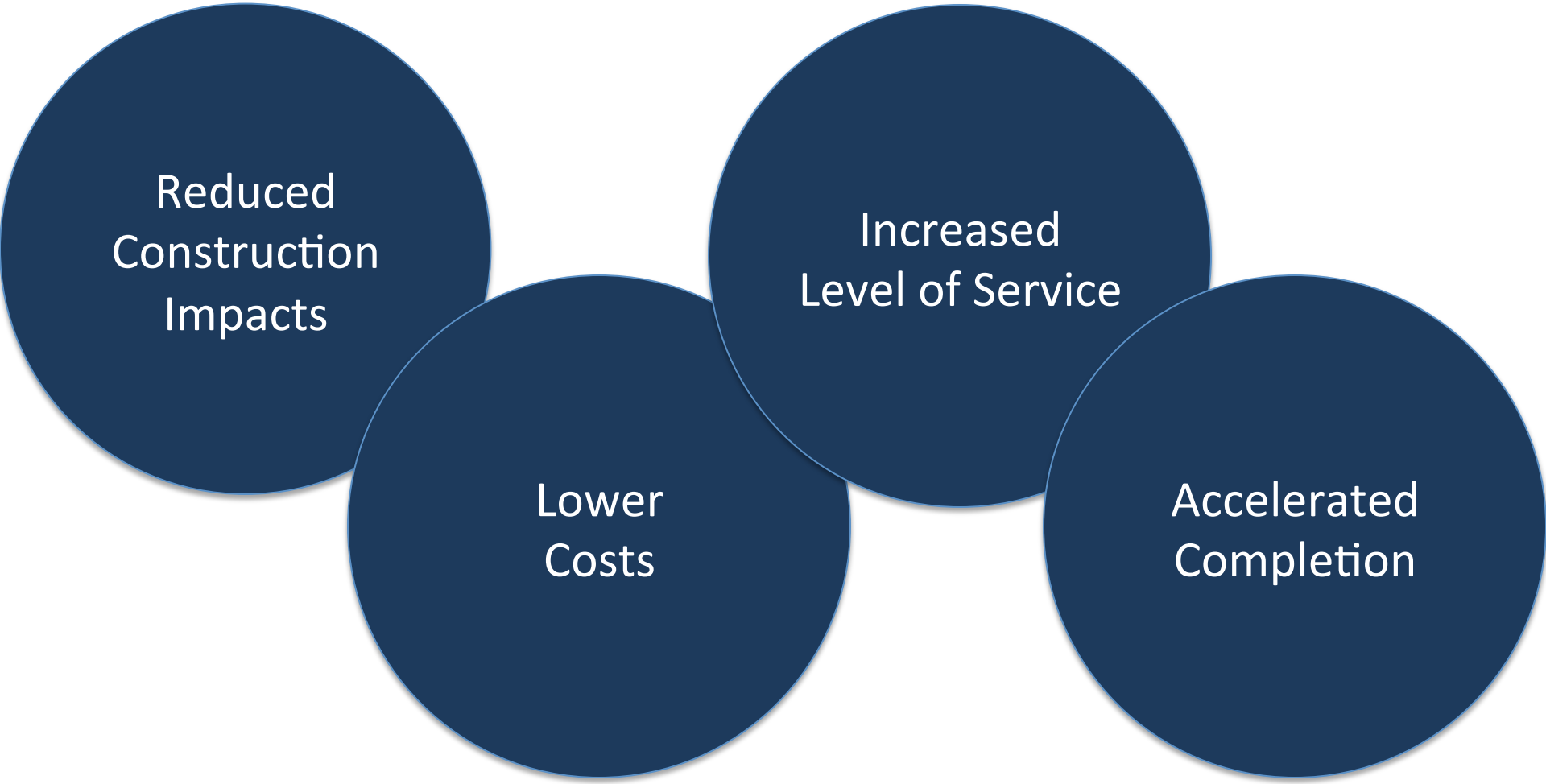
Revised Design Timeline

- January 24: Public meeting
- February – March: 30% design plan developed
- April – August: private utility relocation, permit applications & easement acquisition; finalize construction plans
- October – January: Project bid and award
- February 2018: Begin project construction
- February 2019: Project completed

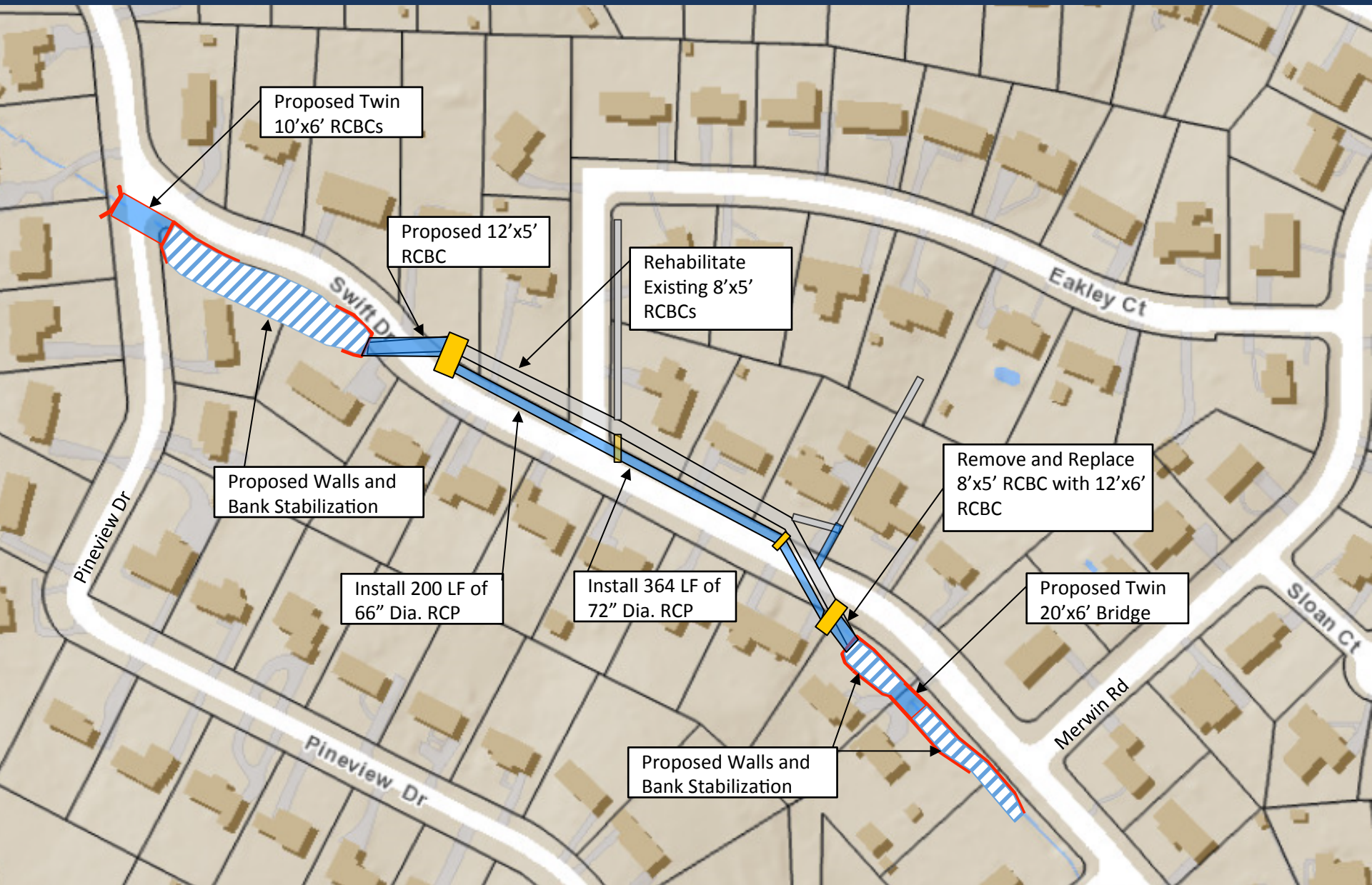
12 month project

Project Recap

A Revised Simmons Branch Drainage Improvement Project - Phase 2 offers…



Questions?


Proposed Twin 10’x6’ RCBCs
Proposed 12’x5’ RCBC
Rehabilitate Existing 8’x5’ RCBCs
Proposed Walls and Bank Stabilization
Install 200 LF of 66” Dia. RCP
Install 364 LF of 72” Dia. RCP
Remove and Replace 8’x5’ RCBC with 12’x6’ RCBC
Proposed Twin 20’x6’ Bridge
Proposed Walls and Bank Stabilization
Swift Dr
Eakley Ct
Pineview Dr
Pineview Dr
Merwin Rd
Sloan Ct

City Website and Project Updates

City of Raleigh
Stormwater Management Division

Raleighnc.gov (Search “Simmons Branch”)
RaleighStormwater@raleighnc.gov
919-996-3940

Private Utility Relocation

Completed utility relocation will reduce future relocation needs

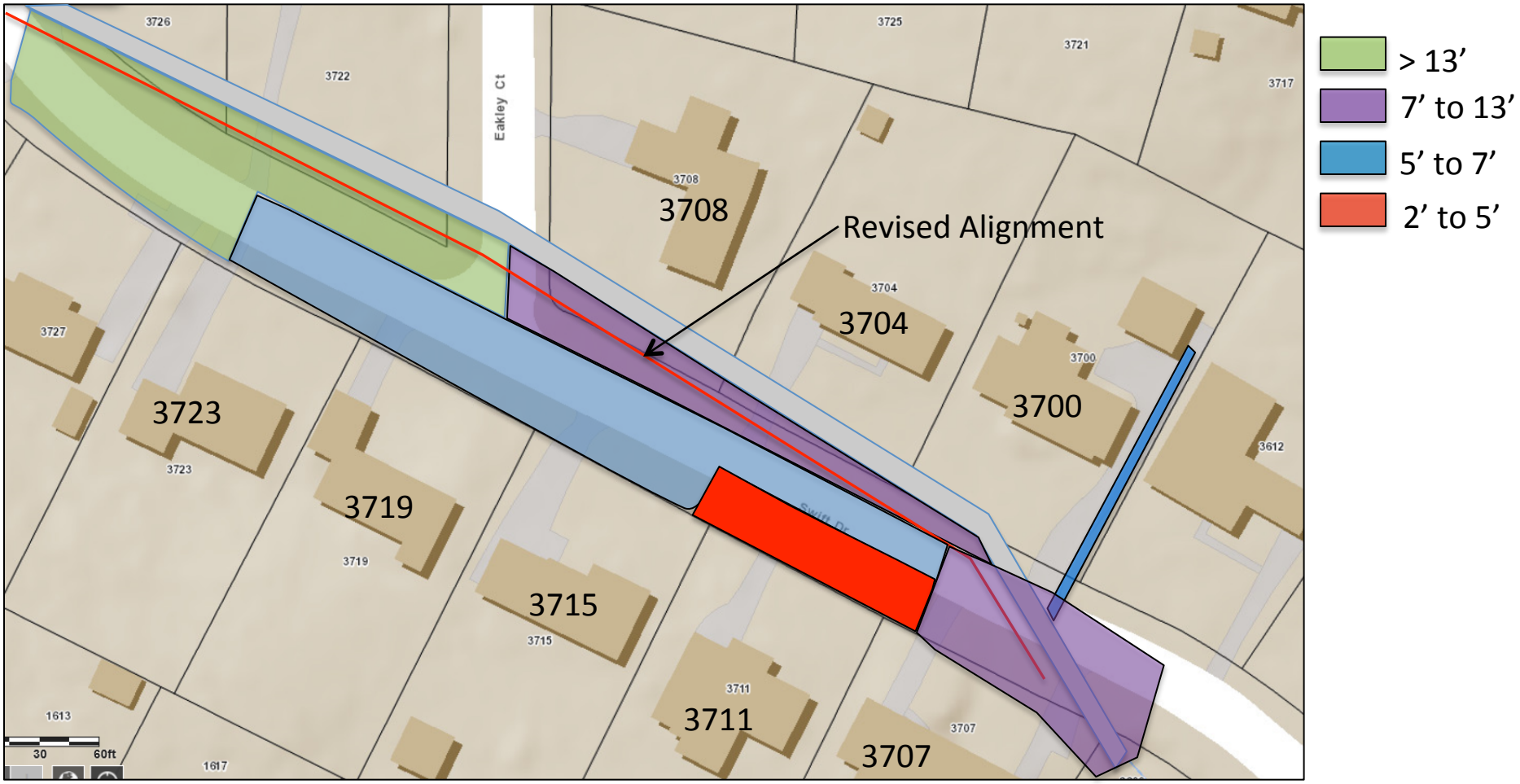
Relocation coordination is underway

Residents may be impacted by additional and temporary relocation

Our intent is to avoid as much relocation as possible and to make the process seamless

Carbon Fiber Wrap Installation

Rock Depth with Proposed Revised Alignment

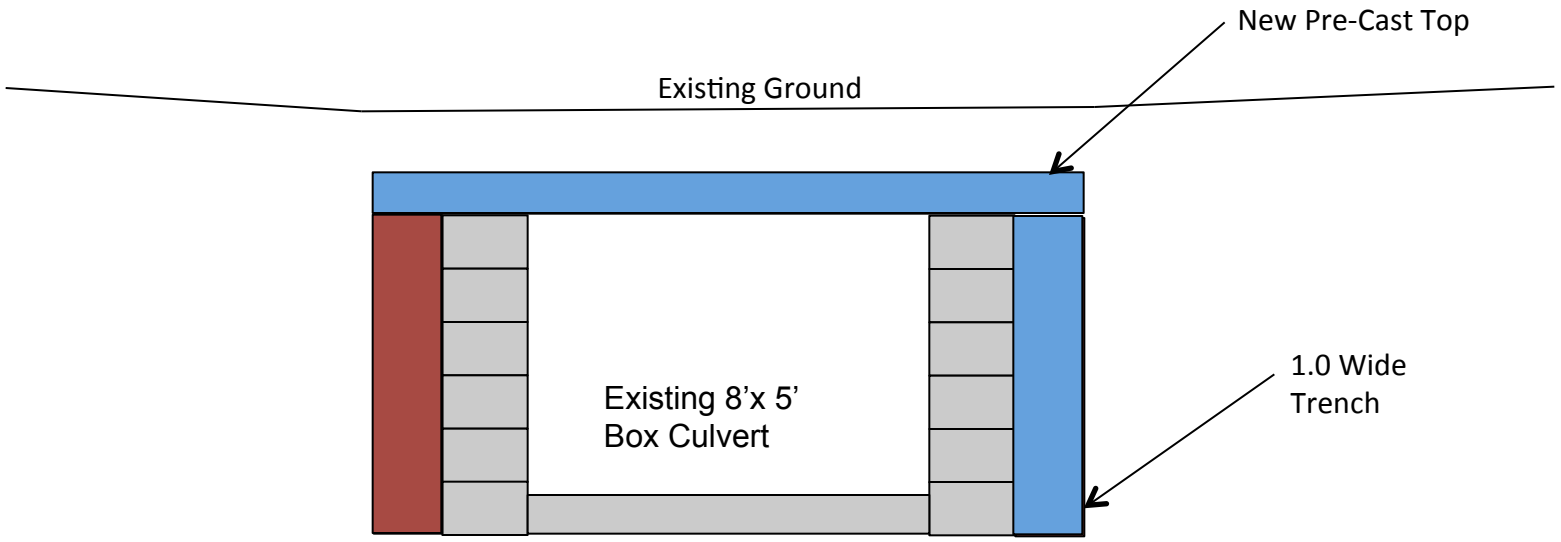


Why Rehabilitate?

- Technological advancements
- Expertise from structural engineers who specialize in sustainable culvert rehabilitation
- Reduced construction impacts
- Additional City experience gained over the last 5 years

Culvert Rehabilitation: Top

- Repair cracks that have formed on the outside of culvert by:
  - Replacing concrete top slab at driveways and Eakley Court
  - Installing sustainable epoxy resin joint sealant and carbon fiber wraps in cracks



Culvert Rehabilitation: Bottoms

- Repair the bottom part of the culvert that is failing to eliminate potential for sink holes:

Remove failed bottom	Install cutoff wall to prevent piping	Inject polymer resin to fill voids
Install rebar and wire mesh	Add in additional rebar	Pour new concrete bottom

Culvert Rehabilitation: Walls

- Repair walls that are failing or bulging by:
  - Removing and replacing cinderblock wall
  - Installing carbon fiber wrap for structural support
  - Installing temporary vertical bracing to support top slab
  - Repairing bottom slab as needed
  - **Areas that are failing structurally will be replaced**

Culvert at 3708 Swift Drive

Flood Reduction