

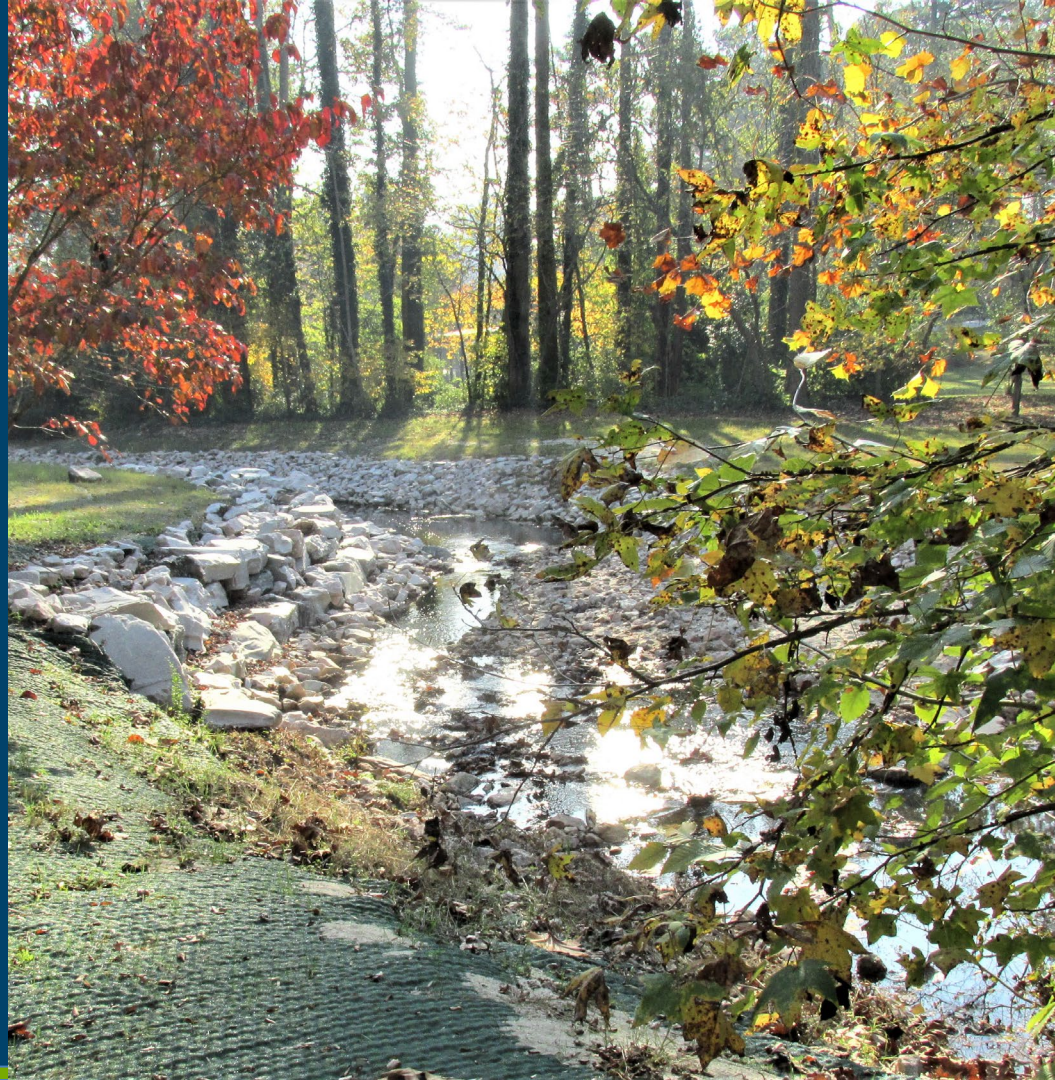
City of Raleigh

Drainage Assistance and Stream Stabilization Programs

American Society of Civil Engineers
NC Eastern Branch



Raleigh



Before We Start



CRABTREE BOATMEN — Three men on a raft at Crabtree Valley Shopping Center paddle an improvised raft in the parking lot during Friday's flooding. The theater marquee in background offers an appropriate movie — "The Poseidon Adventure," a story of an ocean liner overturned by a tidal wave.

Staff photo by Ken Strickland





Agenda

1. About the Raleigh Stormwater Program
2. Drainage Assistance Program
3. Stream Stabilization Program
4. Working with our Consultants
5. Goals for our Program



Raleigh

Raleigh City Government





Stormwater Management Advisory Commission





Our People

Wayne Miles – Program Manager
Mani Kumar – Division Manager
Dominick Smalls – Project Manager
Sonya Debnam – Eng. Support Supervisor
Jeleesa White – Sr. Engineering Specialist
Danny Hinnant – Engineering Specialist
David Kiker – Engineering Supervisor
Chas Webb – Engineering Supervisor





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Program Objective

Stormwater Management Core Mission

To preserve and protect life, support healthy natural resources, and complement sustainable growth within the Raleigh community.





We are applying the
“Be Stormwater
Smart!”
philosophy to all
programs supporting
our mission.

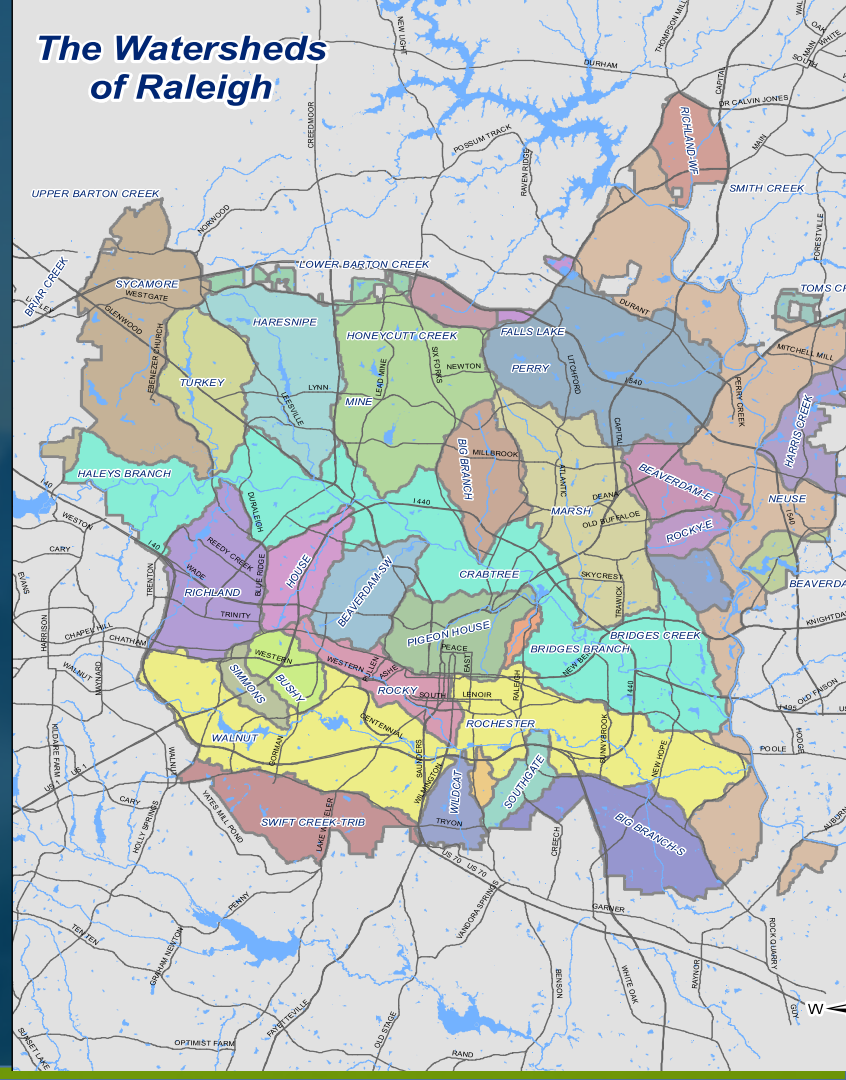




About Raleigh Stormwater

- 36 watersheds across the city
- 1,200 miles of streams, 1,700 miles of pipes
- Funded by the Stormwater Utility Fee

The Watersheds of Raleigh





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Drainage Assistance Program



- Assist residents with flooding and severe erosion.
- Fully funded City Program.
- Eligibility Requirements:
 - Own property in City limits.
 - Receive public stormwater runoff.
 - Be willing to donate an easement.



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Drainage Assistance Program

- Provides \$1.25M in annual funding.
- Supports 8 projects (+/-) per year.
- Projects selected by ranking in the prioritization model.





Program Timeline



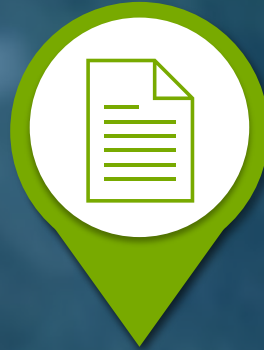
1989

City cost-share
program



2016

Drainage
Assistance
Program



2021

Proposal of Stream
Stabilization Program



Nov 2022

Council adopts
SS Program



Drainage Assistance Process



Citizen calls or emails about flooding and/or erosion.



Staff promptly responds and often conducts a site visit.



If project qualifies for DA program, the project is scored and ranked.

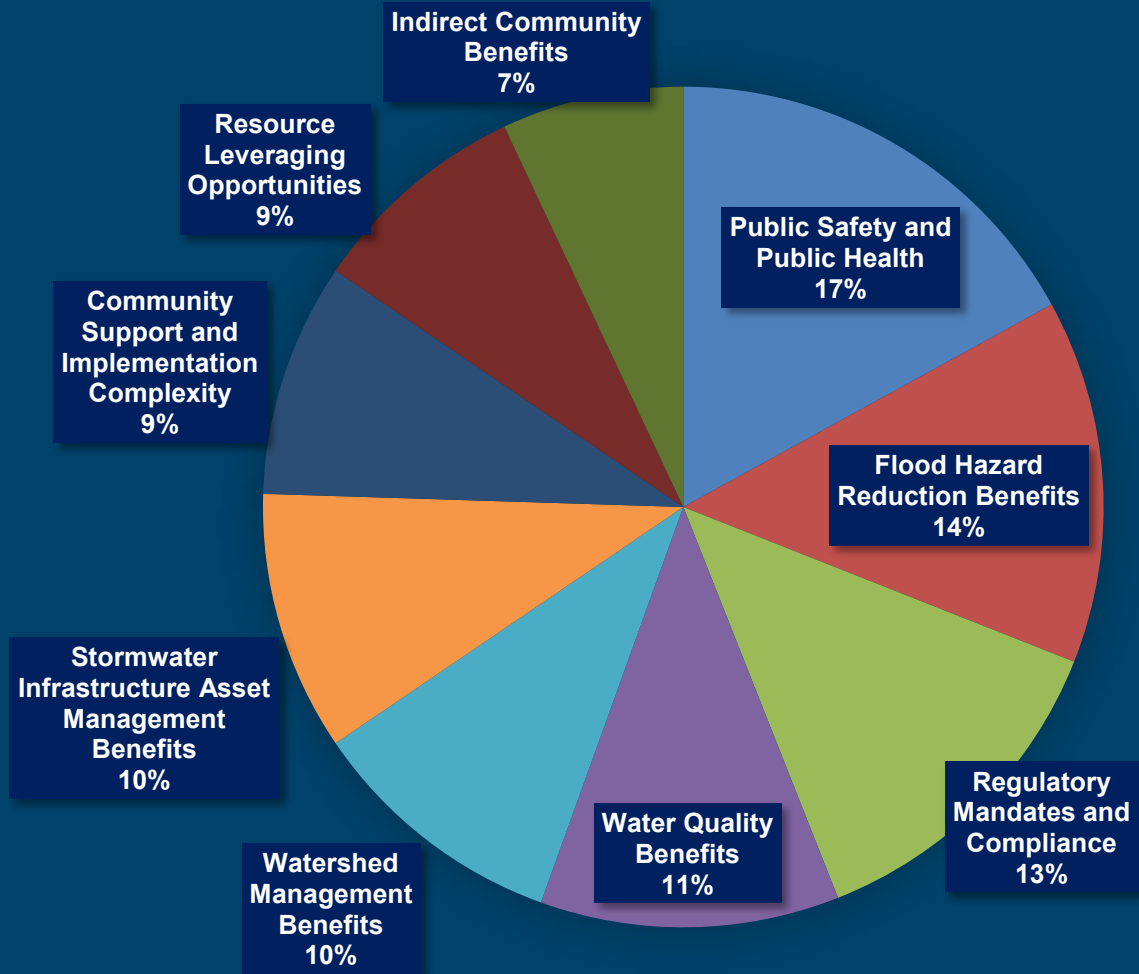


Projects are rescored as conditions change or after a certain time has elapsed.



Prioritization Model

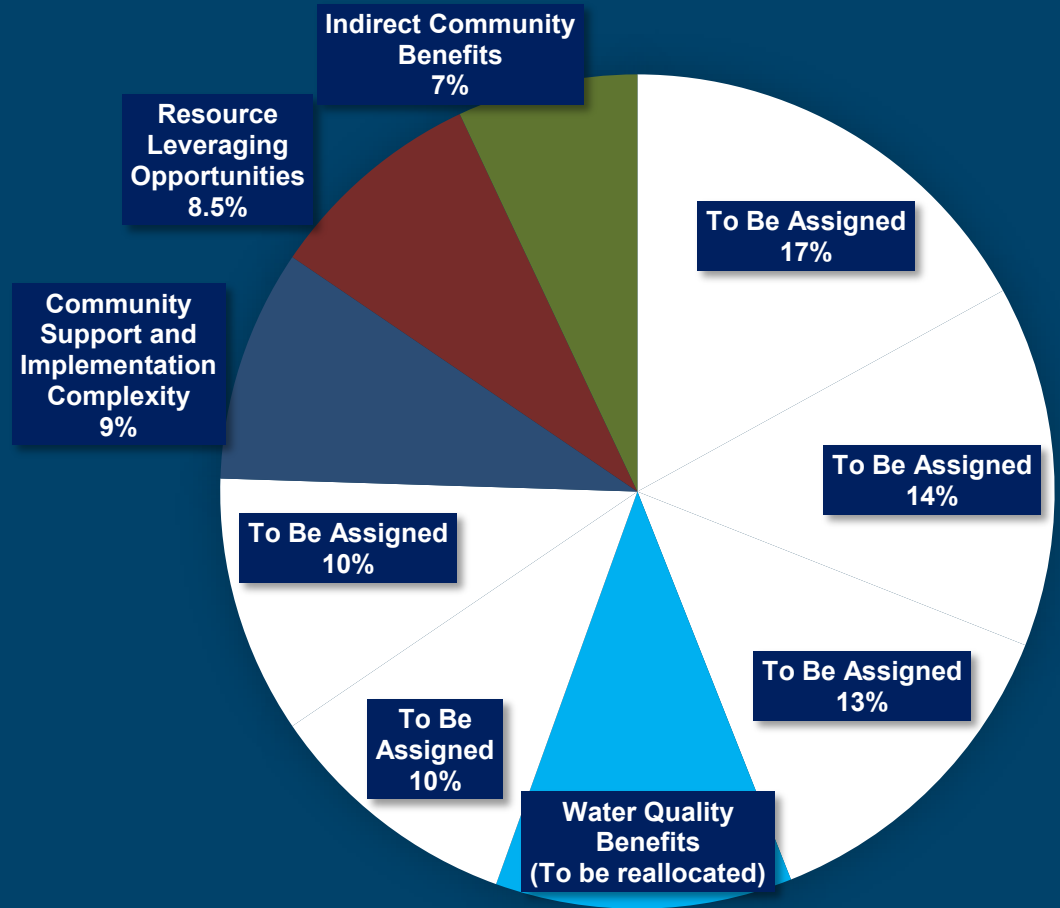
Integrated Prioritization Criteria





Total Project Score (TPS)

To Be Assigned = 75%





Pending Projects

Rank	Project ID	Project Name	Evaluation Date (most recent)	Primary Type of Project	Sub-Watershed	Council District	Total Project Score (TPS)	Safety Criticality Score (SCS)	Mission Criticality Score (MCS)	Study and/or Engineering Design Cost	Construction Cost	Total Project Cost
							(0 - 100)	(0 - 100)	(0 - 100)	(\$)	(\$)	(\$)
1	216-2019-0147	Foxtrot Rd	3/24/2020	Integrated	Southgate	C	31.13	70.00	34.83	\$18,000	\$105,000	\$123,000
2	216-2023-0272	Guard Hill Drive	1/0/1900	Infrastructure	Neuse	C	28.20	80.00	26.85	\$16,000	\$94,000	\$110,000
3	216-2020-0175	Glenbrook Dr.	3/3/2020	Infrastructure	Walnut Creek	D	27.07	60.00	26.25	\$9,000	\$81,000	\$90,000
4	216-2021-0217	Port Royal Rd 2109	2/18/2021	Infrastructure	Marsh Creek	A	26.92	60.00	30.48	\$12,000	\$115,000	\$127,000
5	216-2023-0273	Long and Winding Drive	1/0/1900	Infrastructure	Neuse	D	26.79	60.00	29.93	\$10,000	\$115,000	\$125,000
6	216-2020-0210	Grist Mill 7201	12/31/2020	Infrastructure	Perry Creek	A	26.75	70.00	23.78	\$13,000	\$135,000	\$148,000
7	216-2021-0239	Midlands Townhomes HOA	3/24/2023	Stream/Erosion	Mine Creek	A	26.74	60.00	34.53	\$16,000	\$97,000	\$113,000
8	216-2021-0211	Meredith Street	1/11/2021	Integrated	Walnut Creek	D	26.73	50.00	28.71	\$12,000	\$10,000	\$112,000
9	216-2022-0261	Bells Valley Drive	9/21/2022	Stream/Erosion	Sycamore	E	26.73	60.00	33.15	\$14,000	\$85,000	\$99,000
10	216-2018-0125	Runnymede Rd. 906	11/12/2019	Infrastructure	Beaverdam-SW	E	26.63	70.00	34.55	\$26,000	\$135,000	\$161,000
11	216-2020-0197	Averell Court 8505	10/28/2020	Stream/Erosion	Perry	A	26.49	20.00	26.78	\$52,500	\$122,500	\$175,000
12	216-2019-0140	Oak Pard Rd 4436	2/19/2019	Stream/Erosion	Crabtree Creek	E	26.46	40.00	30.24	\$28,000	\$158,000	\$186,000
13	216-2021-0232	Angel Falls Rd	9/13/2022	Infrastructure	Richland-WF	B	26.45	80.00	26.85	\$13,000	\$108,000	\$123,000
14	216-2018-0127	Lakehaven Dr	12/6/2018	Infrastructure	Mine Creek	A	26.44	50.00	28.17	\$18,000	\$125,000	\$143,000
15	216-2019-0149	Neptune Dr.	2/22/2022	Stream/Erosion	Marsh Creek	B	26.40	70.00	35.09	\$32,000	\$210,000	\$0
16	216-2021-0222	Watkins St	3/29/2021	Stream/Erosion	Pigeon House	C	26.39	50.00	31.47	N/A	N/A	\$0
17	216-2017-0041	Gramercy Ct. 4609	7/21/2017	Infrastructure	Mine Creek	A	26.26	70.00	27.49	\$28,000	\$172,000	\$200,000
18	216-2022-0263	Hershey Court	1/0/1900	Infrastructure	Haresnipe	A	26.22	10.00	26.43	\$0	\$0	\$0
19	216-2019-0151	Charleston Oak Drive 2932	1/10/2018	Stream/Erosion	Richland-WF	B	26.21	50.00	33.93	\$11,000	\$35,000	\$46,000
20	216-2020-0202	Keswick Drive	3/10/2023	Infrastructure	Mine Creek	A	26.17	70.00	27.24	\$28,000	\$100,000	\$0
21	216-2020-0174	Glenwood Ave 1909/1911	2/21/2020	Infrastructure	Crabtree Creek	E	26.12	60.00	26.25	\$35,000	\$100,000	\$135,000
22	216-2018-0158	Port Royal Rd 2109	12/31/2020	Infrastructure	Marsh Creek	A	26.08	70.00	23.78	\$12,000	\$115,000	\$127,000



The Model

Excel formula bar: `=IFERROR(INDEX('PROJECTS Summary Portfolio'!B10:B500,MATCH(SMALL(A9:A500,ROWS('PROJECTS Summary Sorted'!A9:'PROJECTS Summary Sorted'!A10)), 'PROJECTS Summary Sorted'!A9:'PROJECTS Summary Sorted'!A500,0)), "")`

Master Developing Drainage Assistance Projects Portfolio

LAST UPDATED		
Project ID	Project Name	Evaluat (most
216-2023-0288	Hunting Ridge	1/0
216-2020-0173	Genford Court	2/6
216-2023-0282	Wood Spring Court	5/2
216-2023-0289	Levister Ct	1/0
216-2020-0175	Glenbrook Dr.	3/3
216-2021-0217	Port Royal Rd 2109	2/18
216-2020-0210	Grist Mill 7201	12/3
216-2021-0211	Meredith Street	1/11
216-2018-0125	Runnymede Rd. 906	11/1
216-2020-0197	Averell Court 8505	10/2
216-2019-0140	Oak Park Rd 4436	2/19
216-2021-0232	Angel Falls Rd	9/13
216-2019-0149	Neptune Dr.	2/22
216-2021-0222	Watkins St	3/29
216-2023-0284	New Bern Ave 2337	7/18

`=IFERROR(INDEX('PROJECTS Summary Portfolio'!
B10:B500,MATCH(SMALL(A9:A500,
ROWS('PROJECTS Summary Sorted'!A9:
'PROJECTS Summary Sorted'!A10)), 'PROJECTS
Summary Sorted'!A9:'PROJECTS Summary
Sorted'!A500,0)), "")`



The Model

Advantages

- Can handle lots of data.
- Level of familiarity.
- Relies on user inputs.
- Reliable
- Consistent

Disadvantages

- Criteria weights cannot be easily adjusted.
- The spreadsheet does not talk to other programs.
- Relies on user inputs.



Completed Project – Spring Drive

Before



After





Drainage Assistance vs Stream Stabilization



Major Erosion
Drainage Assistance



Minor-Moderate Erosion
Stream Stabilization



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Stream Stabilization Program



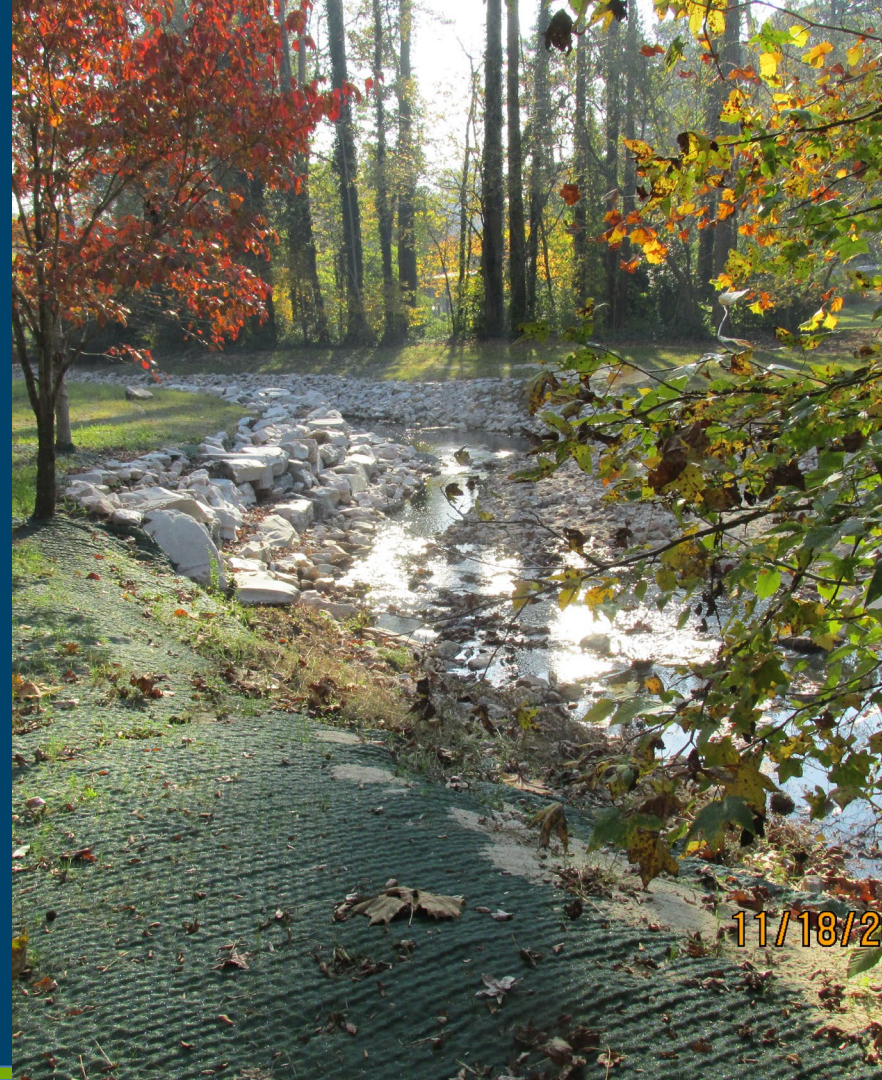
- Addresses streambank erosion that would not score high under the Drainage Assistance Program.
- Driven by the public safety criteria within the scoring system.
- Purpose: to improve the water quality by protecting and stabilizing the eroding stream banks.



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Stream Stabilization Program

- Provides \$500k in annual funding.
- Supports 6 projects (+/-) per year.
- Projects selected by ranking in the prioritization model.
- Three options provided:
 - Stream Stabilization projects
 - Stream Repair Workshops
 - Buffer Builder Bags





Stream Stabilization Process



Citizen calls or emails about stream and/or channel erosion.



Staff promptly responds and often conducts a site visit.



Staff determine proper option: Stream Stabilization, Stream Repair Workshop, or Buffer Builder Bag.



If the site qualifies, the project is scored and ranked.



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Option 1: Stream Stabilization

- Moderate stream erosion.
- Erosion not threatening foundation of home or structure.
- Permitting/Design/Construction type project.
- Requires Permanent Drainage Easement from citizen.
- Usually involves 4-6 properties.





Option 2: Stream Repair Workshops

Partnership



- Held between late fall and early spring.
- 3-5 workshops per year.
- Teach cost-effective and natural methods for repairing streams.



Stream Repair Workshops

Typical materials

- Coir matting
- Coir logs
- Straw
- Riparian buffer seed mix
- Live stakes





Stream Repair Workshops

Hadley Road

- 90 feet of erosion
- Installed coir matting, straw, and riparian buffer seed mix.
- 200 live stakes and 10 trees were planted.
- Cost: \$450 Stream Repair vs \$220k involving 13 properties with Stream Stabilization





Hadley Road Stream Repair

Before



After





Stream Repair Workshops

Sylvester Street

- 110 feet of erosion
- Installed coir matting, coir logs, straw, and riparian buffer seed mix
- 200 live stakes and 5 trees were planted
- Cost: \$350 Stream Repair cost vs \$85k SS cost





Sylvester Street Stream Repair

Before



After





Stream Repair Workshops

Watkins Street

- 100 feet of erosion
- Installed coir matting and straw.
- 200 live stakes were planted
- Cost: \$532 Stream Repair vs \$105k Stream Stabilization



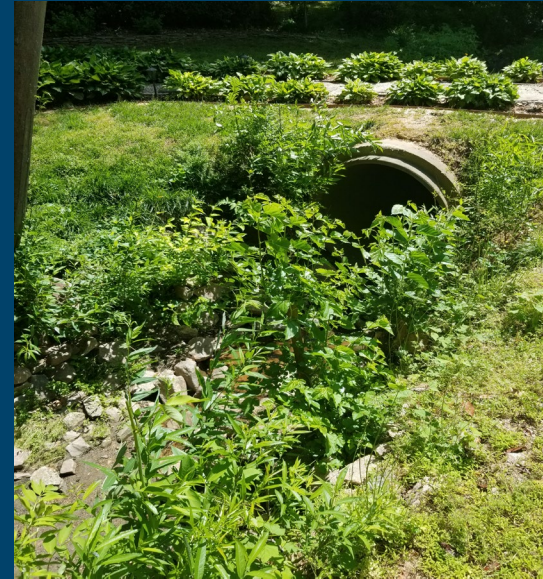


Watkins Street Stream Repair

Before



After





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Buffer Builder Bag (B3)

- Free native shrub and tree seedlings provided.
- Helps prevent erosion and create a streamside buffer.
- First-come, first-served basis.





Buffer Builder Bag Installation

Before



After





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Working With Consulting Engineers

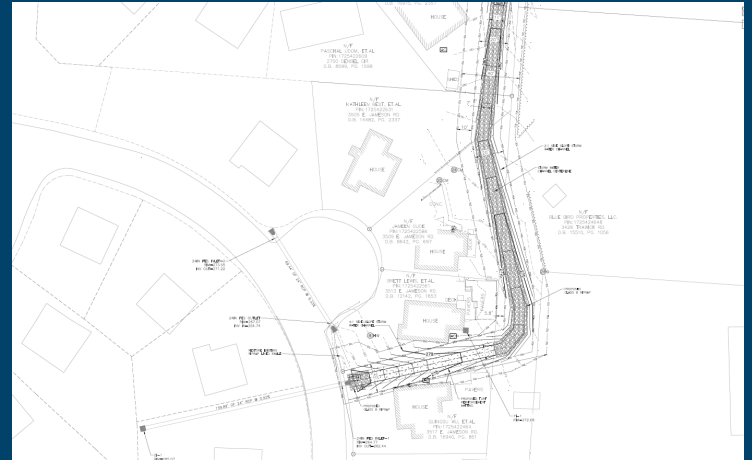


- Stormwater Division on-calls.
- 16 for general stormwater services and 2 for stormwater surveying.
- Work together on a variety of stormwater needs.
- Work together in plan review.



Working with our Consultants

- Currently there are 25 projects in design.
- 7 of those will go to bid by June 2024.
- 8 more will be in design by mid-2024.
- Work being done by 7 firms.
- 0 in-house designs currently.





Working with our Consultants

- A process of checks and balances occurs within Stormwater.
- Plans and calculations are checked for consistency and accuracy.
- Plans are also set to the citizens for review and explanation.

PROJECT:	Wilmot			
SUB-BASIN ID:	2 Acres			
CB 1 PEAK DISCHARGE (Q=CIA)				
	%	Acres	C	
Total Area (A)		2.5		
Parks/Farm	0	0	0.1	
Commercial/Business	0.2	0.5	0.8	
Residential (1/4-2 acre)	0.8	2	0.5	
Other	0	0	0.65	
C	1	2.5	0.56	
Tc = ((L^3/H)^.385)/128				
Flow Length L (Ft)	630			
Elev Up (Ft)	472			
Elev Down (Ft)	458			
H	14			
Tc	4.8			
Assume Tc	5.0			
yr	g	h	I=g/(h+Tc)	Q=CIA
2	132	18	5.74	8.03
5	169	21	6.50	9.10
10	195	22	7.22	10.11
25	232	23	8.29	11.60
50	261	24	9.00	12.60
100	290	25	9.67	13.53

Working with our Consultants

Rational Flow Calc

$Q = CIA$
 C = Rational C-Factor
 I = Rainfall Intensity in in/hr
 A = Area in acres

C = 0.65 Existing
 A = 2.60 ac
 Tc = 15 min

To 18" Dia HDPE

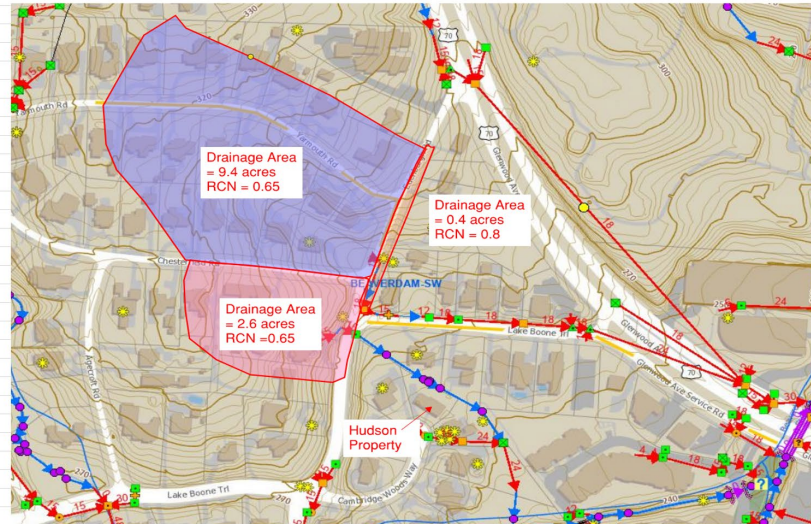
Frequency	Intensity (in/hr)	C-Factor	Area (acres)	Peak Flow, Q (cfs)
2-yr	4.04	0.65	2.6	7
10-yr	5.25	0.65	2.6	9
25-yr	6.03	0.65	2.6	11
50-yr	6.64	0.65	2.6	13
100-yr	7.24	0.65	2.6	15

C = 0.65 Existing
 A = 2.60 ac
 Tc = 20 min

To 18" Dia HDPE

Frequency	Intensity (in/hr)	C-Factor	Area (acres)	Peak Flow, Q (cfs)
2-yr	3.47	0.65	2.60	6
10-yr	4.64	0.65	2.60	8
25-yr	5.42	0.65	2.60	10
50-yr	5.93	0.65	2.60	12
100-yr	6.47	0.65	2.60	14

Rainfall intensities taken from Hydro 35 (Raleigh Stormwater Design Manual)





Drainage Assistance Program Goals

- ✓ Complete 10 projects by mid 2025.
- ✓ Complete several in-house design projects in 2026.
- ✓ Model overhaul.



Stream Stabilization Program Goals

- ✓ Complete **5 stream stabilization projects** by the end of 2024.
- ✓ Increase projected approval projects to **10 projects per year**.
- ✓ Add additional staff to the program.



Stream Repair and B3 Goals

- ✓ Increase community awareness and outreach through social media and community meetings.
- ✓ Incorporate summer Stream Repair Workshops.
- ✓ Pursue more local partnerships.
- ✓ Stabilize **2,000 feet of stream** on public and private properties this year (currently 1,200 feet stabilized).
- ✓ Install **2,500 live stakes** this year (currently 1,850 live stakes installed).



Thank you!

Questions?

Visit raleighnc.gov and search “**Drainage Assistance Program**” for info about the Drainage Assistance and Stream Stabilization Programs.

Chas Webb – Charles.webb@raleighnc.gov

919-996-3519