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Stormwater and Erosion
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Conference

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Balancing Act – Watercourse Restoration Beside a
Closed Landfill

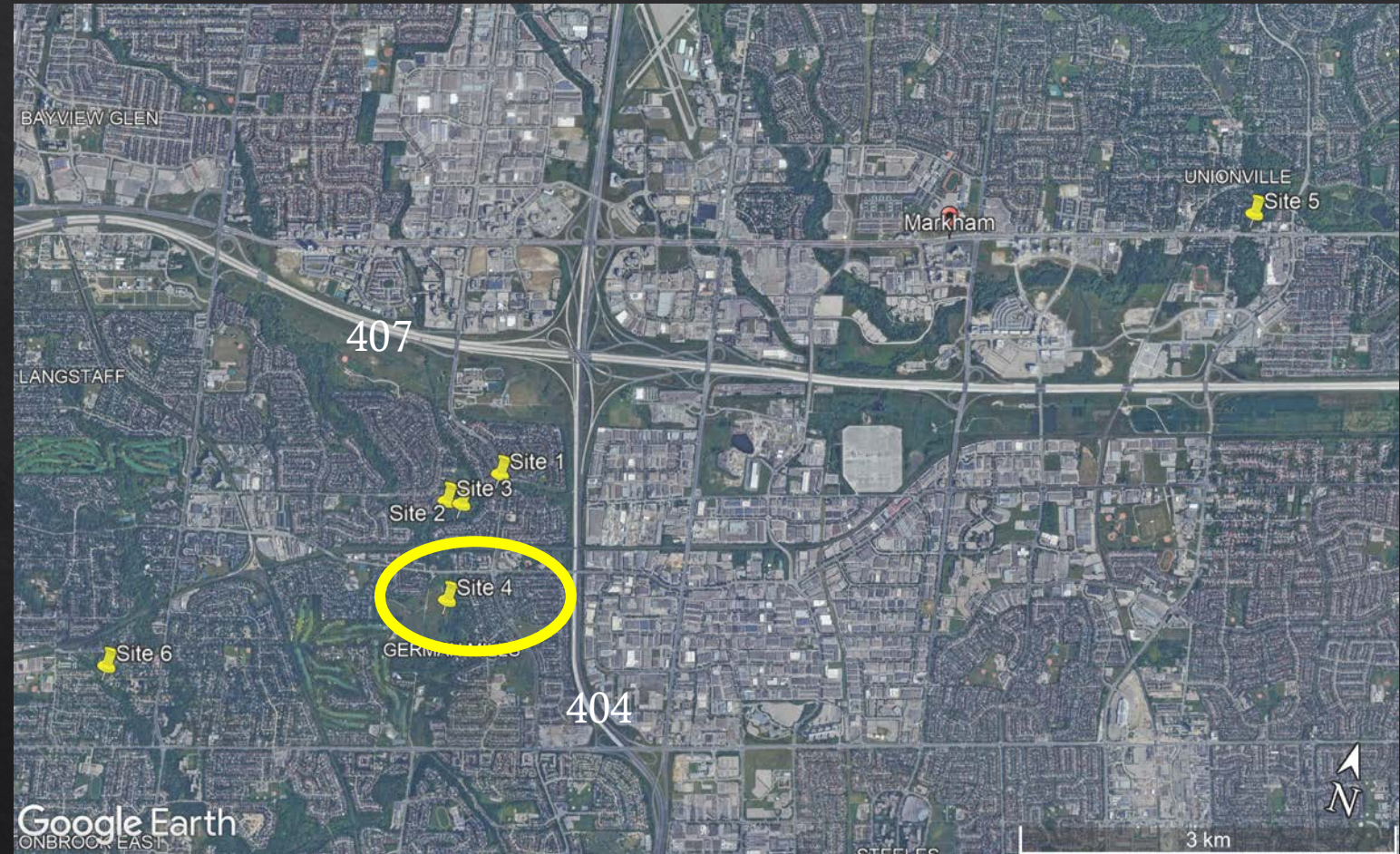
German Mills Creek – City of Markham

Presentation Overview

- ◆ Project overview
- ◆ Site specific considerations
- ◆ Design optimization – the balancing act!
- ◆ Implementation
- ◆ Lessons learned

Project Overview

- ◆ In 2019, Resilient Consulting was retained by the City of Markham to complete the detailed design, permitting, contract administration for six (6) watercourse erosion sites around the City
- ◆ Based on limited capital budget, implementation was phased over three (3) years, based on priority of each erosion site



The Problem

- ◆ The site was located on German Mills Creek within German Mills Park which is highly utilized for passive recreation
- ◆ Watercourse erosion and slope failure +/- 5m high, 1:1 or steeper
- ◆ Located adjacent to closed Sabiston landfill
- ◆ Concern that erosion would encroach into waste, resulting in exposure to the watercourse
- ◆ Due to this concern, site was identified as higher priority and advanced for construction in 2020



The Site

- ◇ Surrounded by residential areas in the City of Markham, German Mills Park is a naturalized area which is open to the public for passive park uses such as bird watching, dog walking and hiking
- ◇ The Park is watched over and cared for by a German Mills Meadow and Natural Habitat Liaison Committee with an active Facebook group featuring regular contributions of wildlife photos
- ◇ Local wildlife includes mink, muskrats, ducks and birds of prey
- ◇ Surface of former landfill has been naturalized with native grass plantings, resulting in nesting habitat for Eastern Meadowlark, listed as an endangered species



Site Specific Considerations

- ◆ German Mills Creek is a high energy, flashy system in a highly developed watershed
- ◆ Slopes at the site were quite steep (1:1 H:V), high (5 m) and actively eroding
- ◆ Site investigations showed that waste was being exposed. Testing indicated that soils adjacent to the slope were impacted
- ◆ Species at risk were identified in the project area

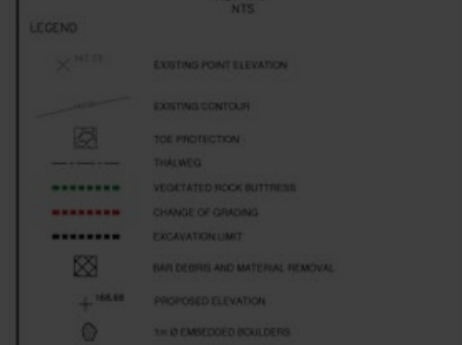
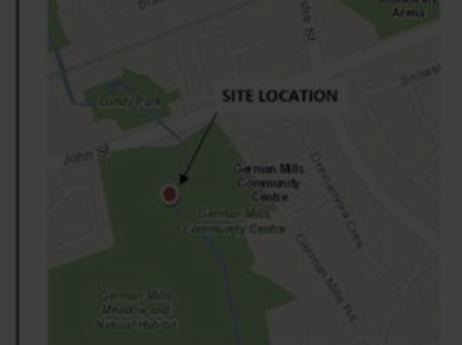
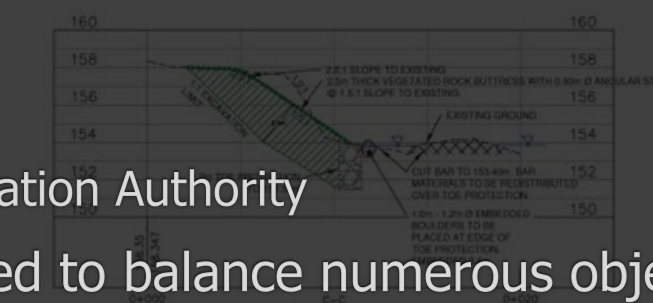


Eroding Slope

Debris falling
into Creek

Design Optimization

- ◆ A multi-disciplinary team worked together to develop the design:
 - ◆ Water resources engineers and PM – Resilient Consulting
 - ◆ Geotechnical engineers – Soil Engineers
 - ◆ Fluvial Geomorphologists – GEO Morphix Ltd.
 - ◆ Ecologists – North-South Environmental
 - ◆ Client – City of Markham
 - ◆ Regulator – Toronto and Region Conservation Authority
- ◆ An iterative design process was completed to balance numerous objectives:
 - ◆ Ensure watercourse and slope stability to mitigate risk to the landfill
 - ◆ Minimize environmental disturbance during construction
 - ◆ Enhance terrestrial and aquatic ecological functions
 - ◆ Provide cost effective solution – reducing excavation volumes









GENERAL NOTES

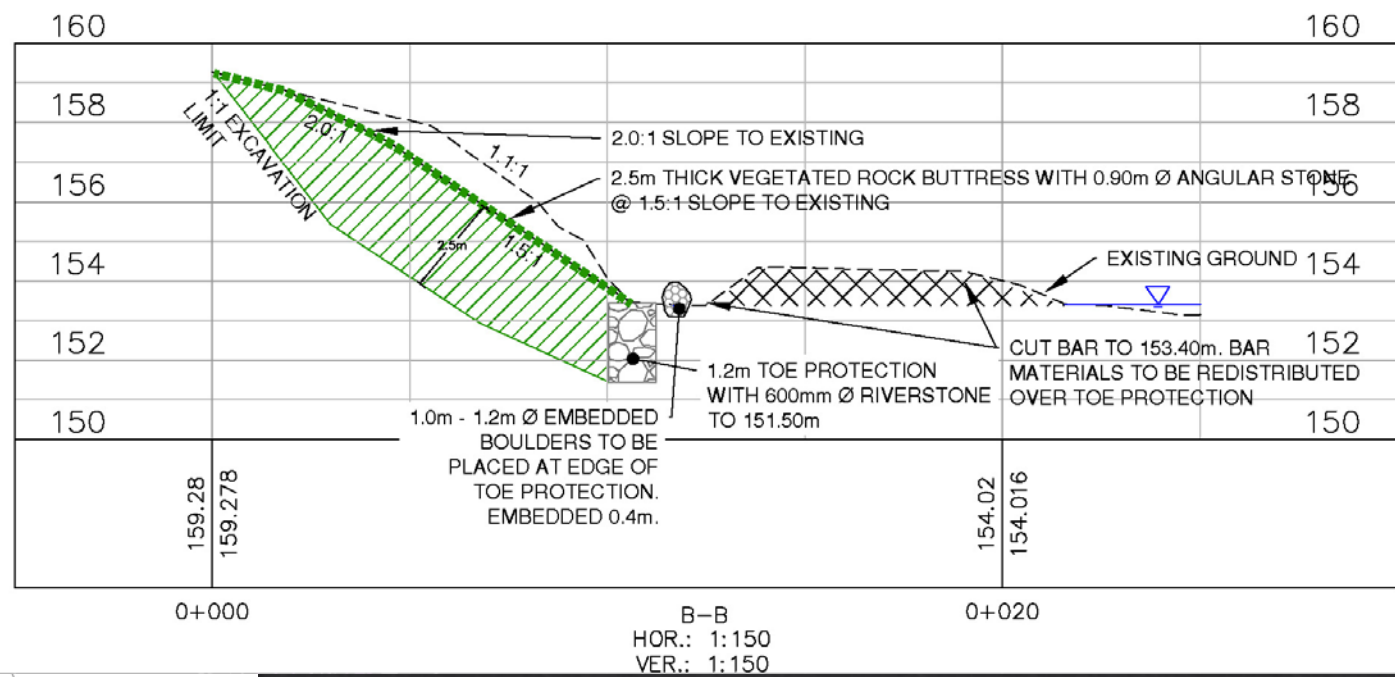
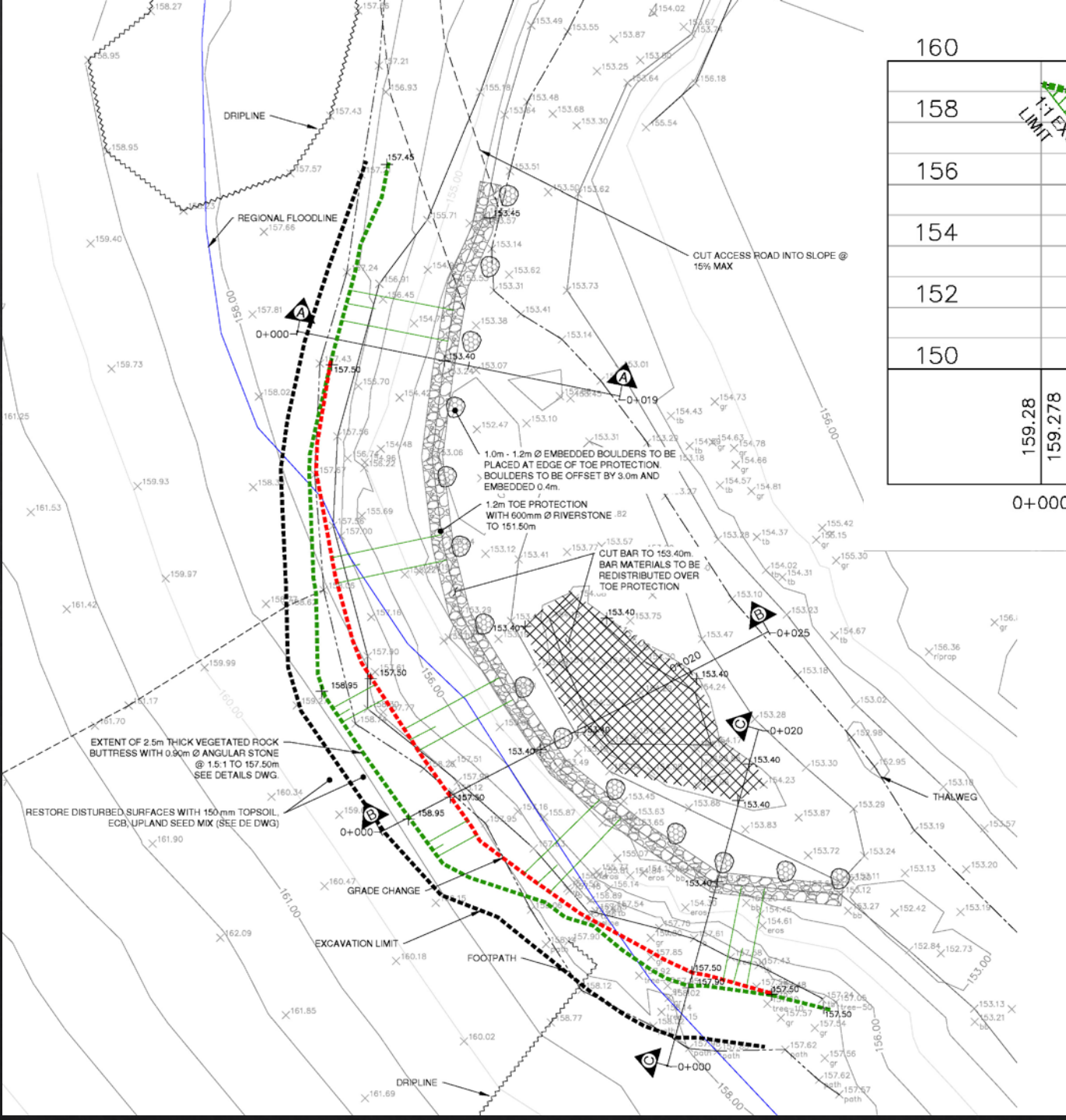
- DO NOT SCALE THE DRAWINGS. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
- THE CONTRACTOR SHALL VERIFY ALL EXISTING AND PROPOSED GRADING AND CONDITIONS ON THE PROJECT AND REPORT ANY DISCREPANCIES TO THE CONSULTANT BEFORE PROCEEDING WITH ANY WORK.
- THE CONTRACTOR IS TO BE AWARE OF ALL EXISTING AND PROPOSED SERVICES AND UTILITIES. THE CONTRACTOR IS RESPONSIBLE FOR IDENTIFYING ALL UNDERGROUND SERVICES AND UTILITY LINES STAKED BY EACH AGENCY HAVING JURISDICTION OVER THE PROJECT.
- KEEP AREA OUTSIDE CONSTRUCTION ZONE CLEAN AND USEABLE BY OTHERS AT ALL TIMES. CONTRACTOR SHALL THOROUGHLY CLEAN AREAS SURROUNDING THE CONSTRUCTION ZONE AT THE END OF EACH WORK DAY.
- CONTRACTOR TO MAKE SURE TO MARK AND ALL DIMENSIONS OUTSIDE OF THE DEVELOPMENT AREA THAT MAY OCCUR AS A RESULT OF THE CONSTRUCTION WORK.
- TOE PROTECTION CONSTRUCTION FENCING MUST BE INSTALLED AROUND ALL TREES IN THE VICINITY OF THE WORK AND THE ACCESS ROUTE.
- TREE REMOVALS ARE TO OCCUR OUTSIDE OF THE ACTIVE PERIOD FOR BATS (APRIL 1ST TO AUGUST 31ST) TO AVOID IMPACTS TO SPECIES AT RISK BATS AND ENSURE COMPLIANCE WITH THE ENDANGERED SPECIES ACT.
- CONSTRUCTION TO OCCUR DURING THE WARM WATER CONSTRUCTION TIMING WINDOW OF JULY 1 - MARCH 31.

NO.	DATE	NAME	REVISIONS
6	09/2020	AN	ISSUED FOR CONSTRUCTION
5	05/2020	AN	RE-ISSUED FOR TENDER
4	05/2020	AN	RE-ISSUED TO TRCA
3	02/2020	AN	ISSUED FOR TENDER
2	01/2020	AN	DETAILED DESIGN ISSUED FOR TRCA REVIEW
1	09/19	MFB	PRELIMINARY DESIGN ISSUED FOR CLIENT REVIEW

SURVEY COMPLETED BY RESILIENT CONSULTING AND GEOMORPHIX STAFF THE WEEK OF JULY 8th - 12th 2019

		SURVEY DATA DATE 2019 07 08
		SCALE 1:150
DRAWN: AN	DATE: 2019 07 25	
DESIGN: AN	DATE: 2019 07 25	
CHECKED: MFB	DATE: 2019 07 25	
APPROVED: MFB	DATE: 2019 07 25	

Alternative	Advantages	Disadvantages	Rating
Do nothing	Cost	Continued erosion Waste in landfill ends up in German Mills Creek	
Armourstone Wall	Reduced excavation into impacted soil or waste	High cost No habitat enhancement – approvals issues Potential floodplain impacts	
Cut Back Slope with Toe Protection	Potential for habitat enhancement No floodplain impacts	Significant excavation w/impacted soil/waste requiring offsite disposal High cost	
Mechanically Stabilized Earth Wall	Potential for habitat enhancement No floodplain impacts	Tie backs would require significant excavation w/impacted soil/waste requiring offsite disposal High cost	
Soil Nailing	No floodplain impacts Potentially low cost	May not be feasible due to waste behind slope	
Vegetated Rock Buttress with Toe Protection	Potential for habitat enhancement No floodplain impacts	Moderate excavation into impacted soil Moderate (optimal?) cost	



The Solution

- ◊ Cut back slope and replace with a 2.5m thick Vegetated Rock Buttress at 1.5:1
- ◊ Top of slope transition at 2:1 to existing
- ◊ Toe protection trench and embedded boulders

Benefits

- ◆ Excavation and removal of 1,700 tonnes of contaminated soil and waste material
- ◆ Naturalized solution avoiding engineered products
- ◆ Stabilized slope, protected from future erosion
- ◆ Habitat enhancement through installation of over 200 shrubs
- ◆ Construction with bank isolation measures, limiting the time of in water works
- ◆ Limit the amount of soil going to landfill to reduce construction costs



Implementation

- ◆ Design was refined in early 2020
- ◆ Project required permits and approvals from:
 - ◆ Toronto and Region Conservation Authority
 - ◆ Ministry of Environment, Conservation and Parks (registration)
 - ◆ Department of Fisheries and Oceans (LOA)
- ◆ Project was tendered in Spring 2020 and awarded to R&M Construction

Pre-construction
March 2020

Continued
erosion and
waste becoming
exposed



Looking
Downstream



Looking
Upstream

Construction
September 2020



Construction
September 2020



Construction
September 2020



Construction
October 2020



Construction Cost - \$500,000

Construction Completed October 2020 by R&M Construction



August 2021



October 2021



Innovation and Environmental Sustainability

- ◆ Numerous environmental enhancements, with contributions from local residents:
 - ◆ Site restored with a meadow seed mix that is beneficial to the endangered Meadowlark found in the project area to provide an increase in habitat
 - ◆ Limited the time of in water works by isolating the work area with metal plates without a full blockage of the creek as the project was constructed near the time of year salmon were known to be moving up German Mills Creek
 - ◆ Provided turtle sun bathing rocks for habitat enhancement
 - ◆ Removal of invasive species
- ◆ Limit the amount of soil going to landfill to reduce construction costs



Lessons Learned

- ◆ As projects become more complex due to site constraints, close coordination between specialists is increasingly important. The team on this project included:
 - ◆ Water Resources Engineers
 - ◆ Fluvial Geomorphologists
 - ◆ Geotechnical Engineers
 - ◆ Ecologists
- ◆ Involve the regulators in design evaluation and optimization exercises
- ◆ In addition to optimization in design phase, work closely with Contractors to optimize during construction phase

Thank You



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<https://www.linkedin.com/company/resilient-consulting-corporation>



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Email

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