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Rapid Response for Resilience: Rebuilding Stormwater Infrastructure and Ecological Integrity at Burke Brook

Date: March 27th , 2025

Author: Anna Paris, MSc. Business Development Manager – Maccaferri North America
Nicholas Bellissimo, P.Eng., Manager, Project Delivery – Accardi Engineering

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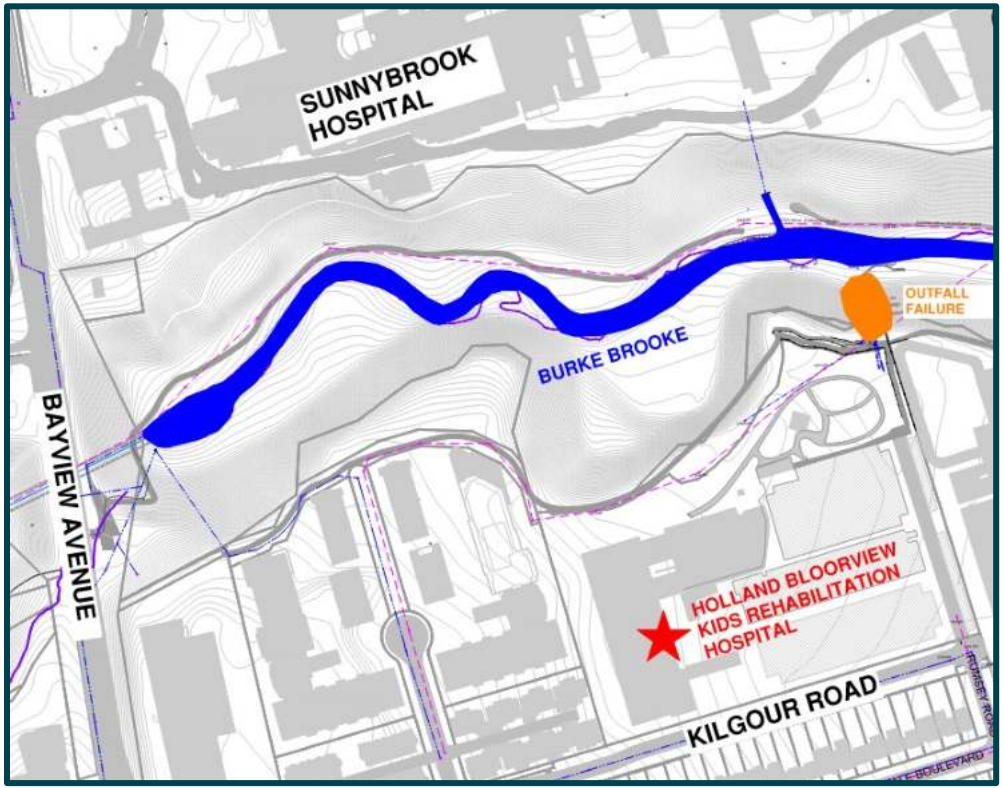
AGENDA

- Project Background
- Project Scope and Key Components
- Project Constraints
- Design and Construction Innovations
- Summary and Lessons Learned

Project Background

- Over a 10-year timeline the failing stormwater outfall located behind the Bloorview Kids Rehabilitation Hospital led to a massive erosion gully approximately 27m high, 25m wide and 45m long
- Loss of table land, storm sewer failure, mature vegetation, degraded aquatic habitat
- Design-Build RFP was released in 2023

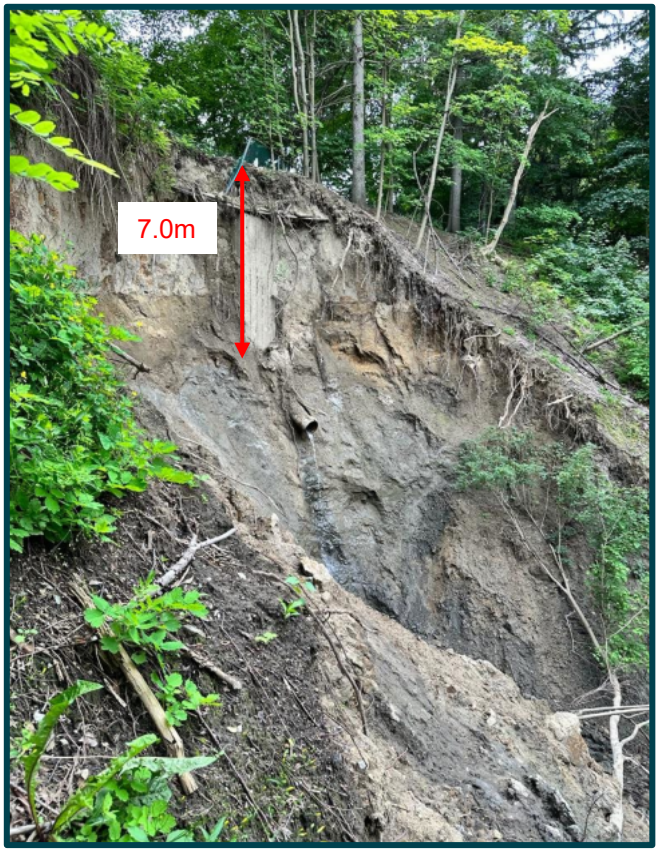


Project Location

Project Background

Existing Conditions

Site Clean-Up



Maintenance Hole at Risk of Failure

Project Scope and Key Components

Design-Build Team

1. Re-build the storm sewer and outfall
2. Reconstruct and stabilize the slope/ erosion scar
3. Restore Burke Brooke and prevent further erosion

Design Team

Project Constraints and Challenges

1. Site Access
2. Site Safety
3. Stormwater Surcharging/ Energy Dissipation
4. Secure Permits Under Emergency Framework

Bloorview Kids Rehabilitation Hospital – Spiral Garden

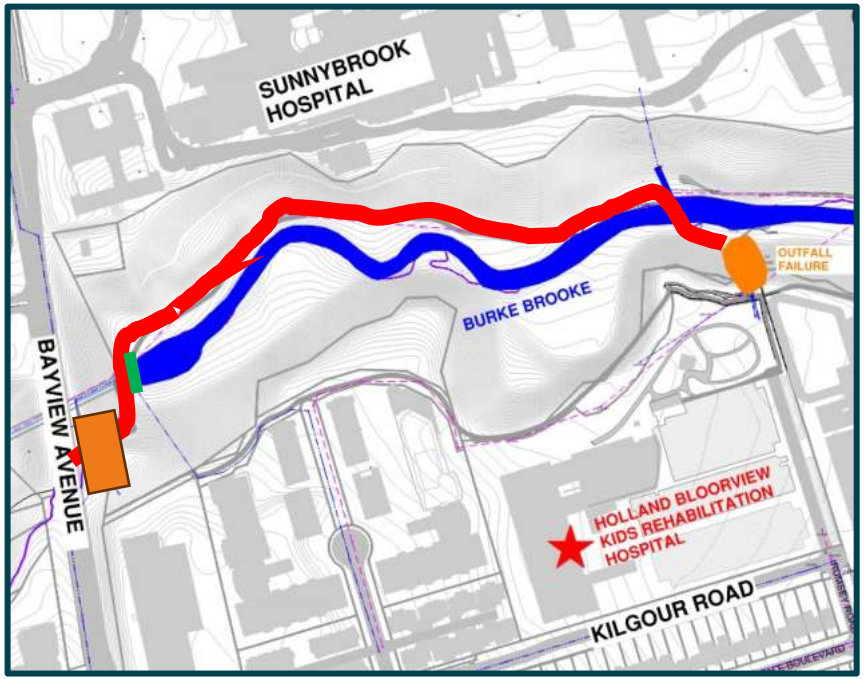
Design and Construction Innovations

Overview

- Alternative access road and creek diversion
- A robust storm sewer with easily constructable maintenance holes
- Slope stabilization in lifts
- Armour stone wall outlet with scour protection provided by a grouted armour stone scour pad
- Vegetated buttress bank protection within the watercourse

Access Considerations

- Mitigate Impacts to the Bloorview Kids Rehabilitation Hospital
- 550m Access Road
- Site Compound
- Armour Stone Wall



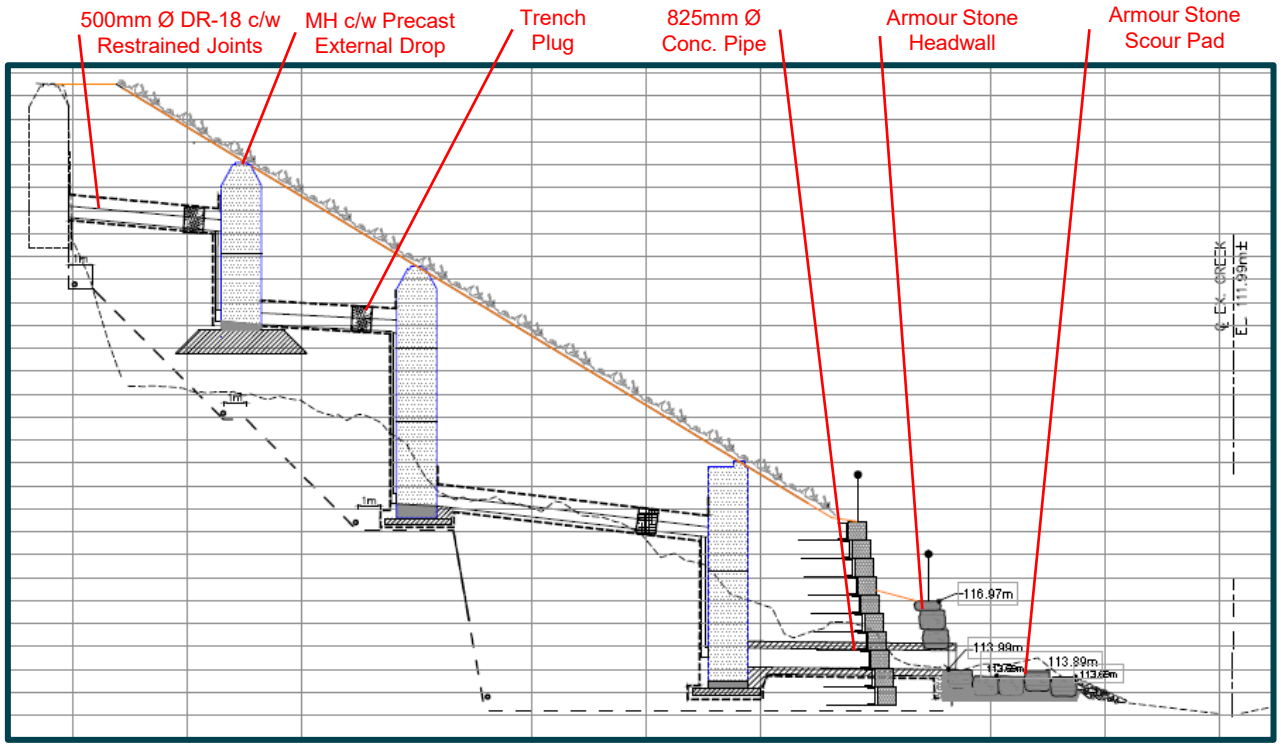
Access Road

Access Road Construction

Access Road

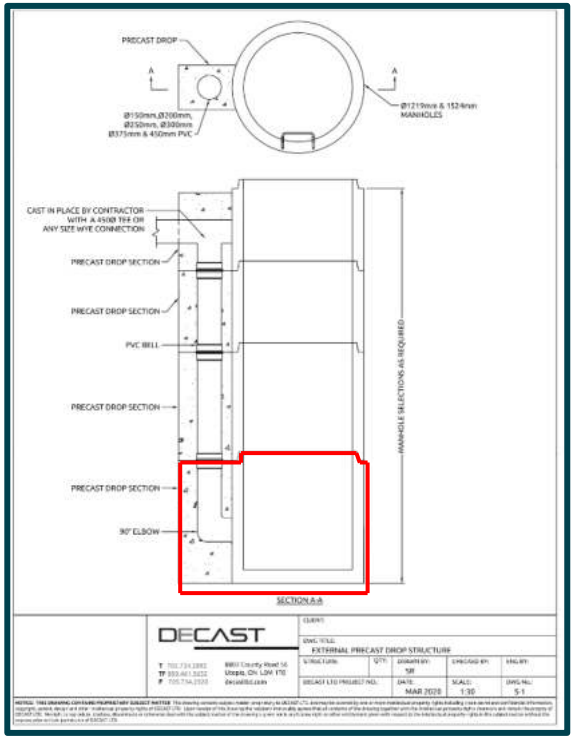
Storm Sewer and Armourstone Outfall

1. Surcharging Conditions
2. Mitigate Compaction
3. Maintenance Holes c/w Precast External Drop Structures
4. Groundwater Migration
5. Armour Stone Outlet

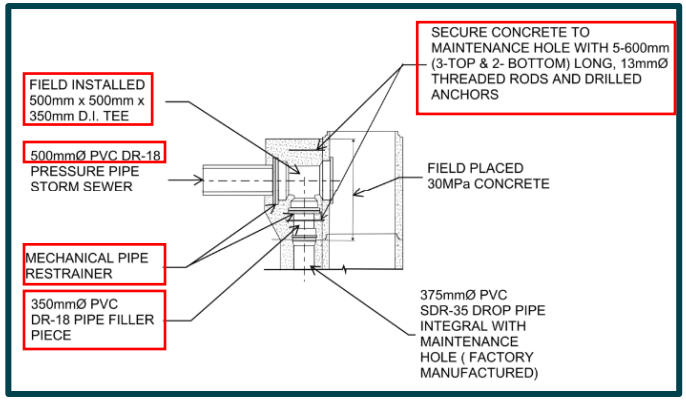


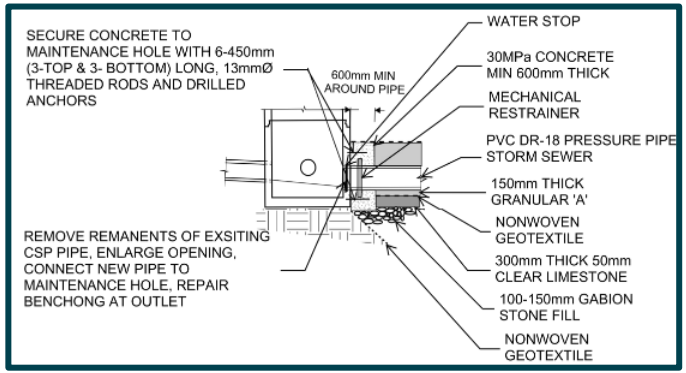
Storm Sewer Design

Maintenance Hole Design



Precast MH c/w External Drop





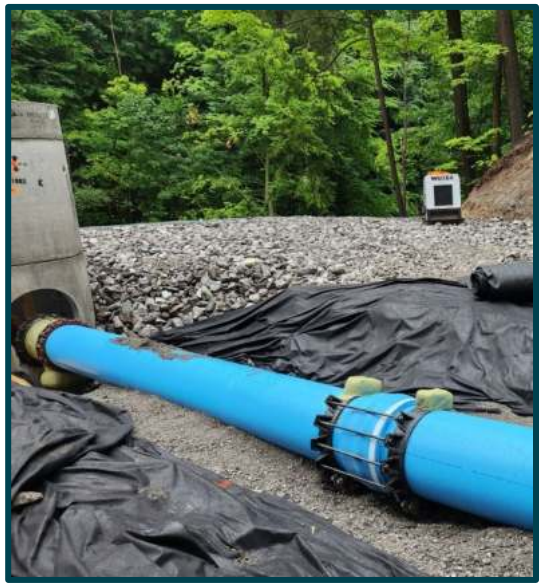
Connection Details

Design and Construction Innovations

Storm Sewer and Maintenance Hole Construction

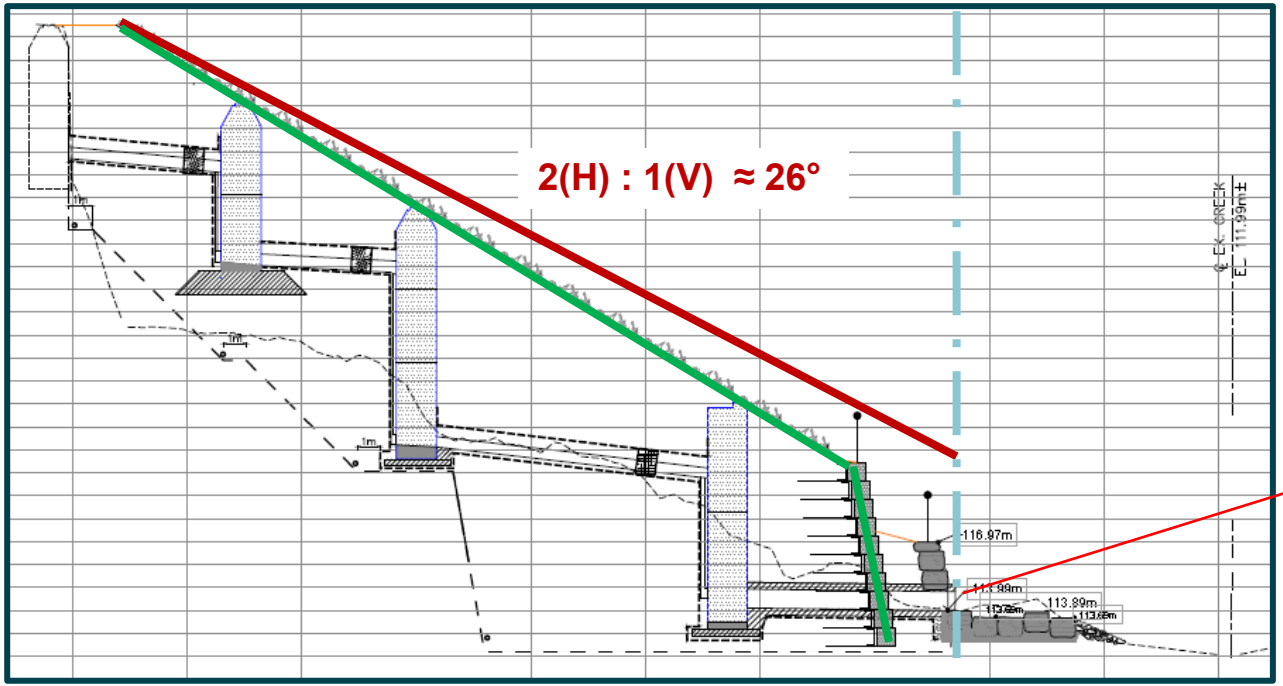
Precast MH c/w External Drop

MH Connection

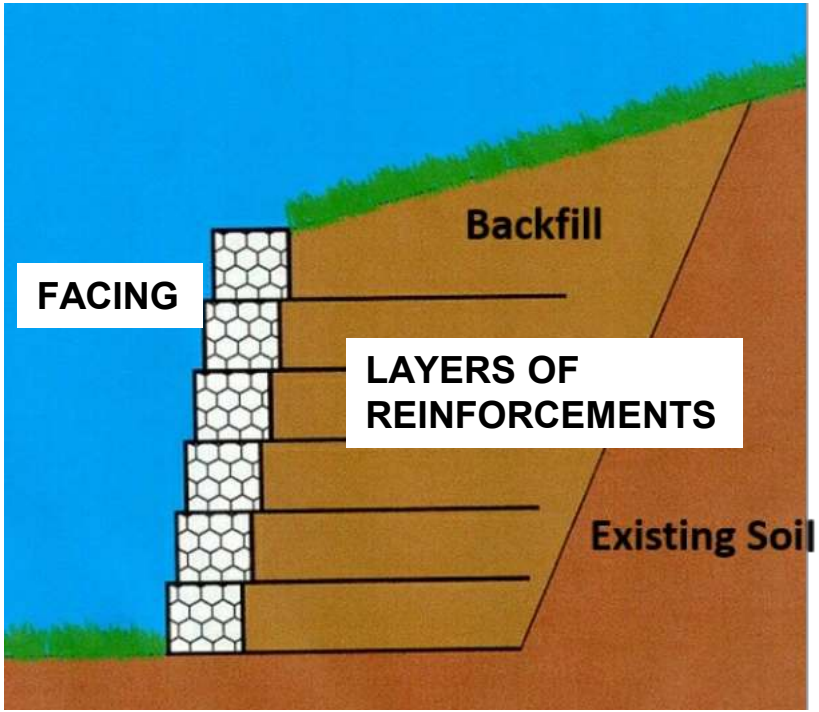


Restrained Joints

Slope Stabilization in lifts



Slope Stabilization in lifts



Slope angle > 70°

MECHANICALLY STABILIZED EARTH (MSE) WALLS

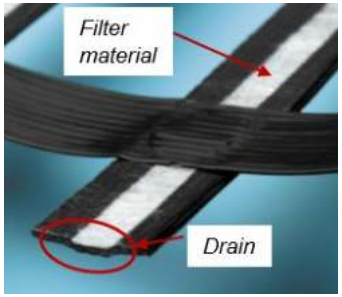
Slope angle ≤ 70°

REINFORCED SOIL SLOPES (RSS)

Slope Stabilization in lifts

Geogrids:

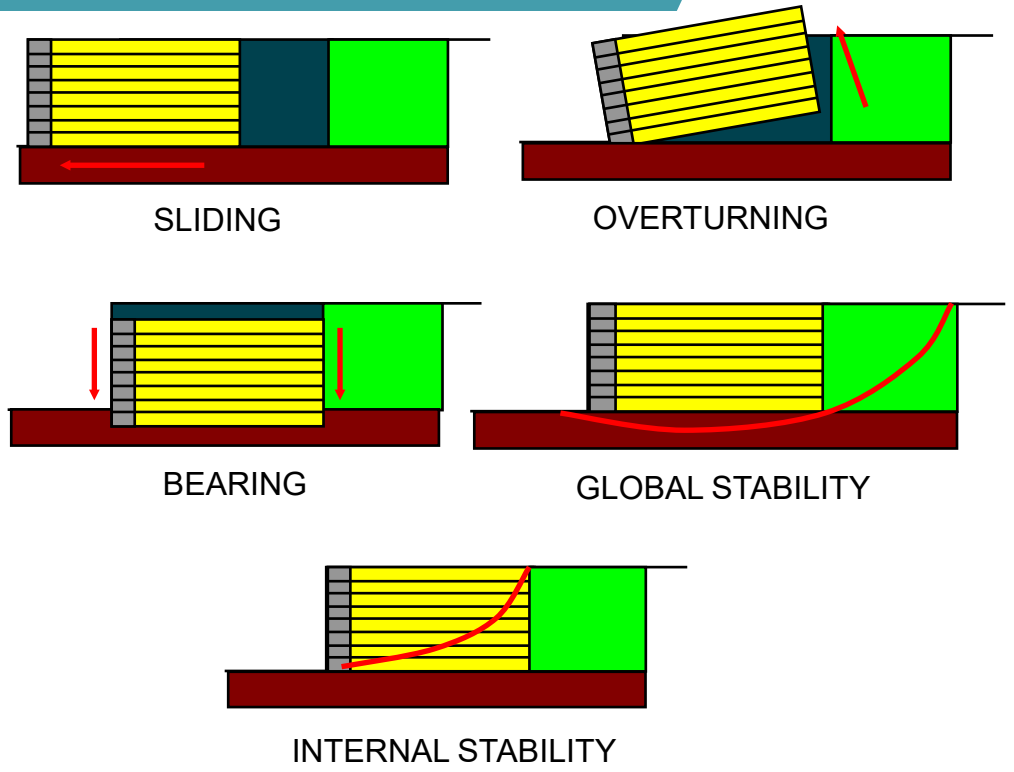
- A gridlike polymeric material formed by intersecting ribs joined at the junctions
- Function is soil reinforcement
- Typ. uniaxial geogrids
- Can be woven, bonded or extruded
- Length, tensile strength (kN/m) and spacing is part of the design
- Reduction Factors such as installation damage and creep must be considered
- Typ. Backfill needs to be compacted free draining granular material
- Some geogrids can be used with excess soil for RSS



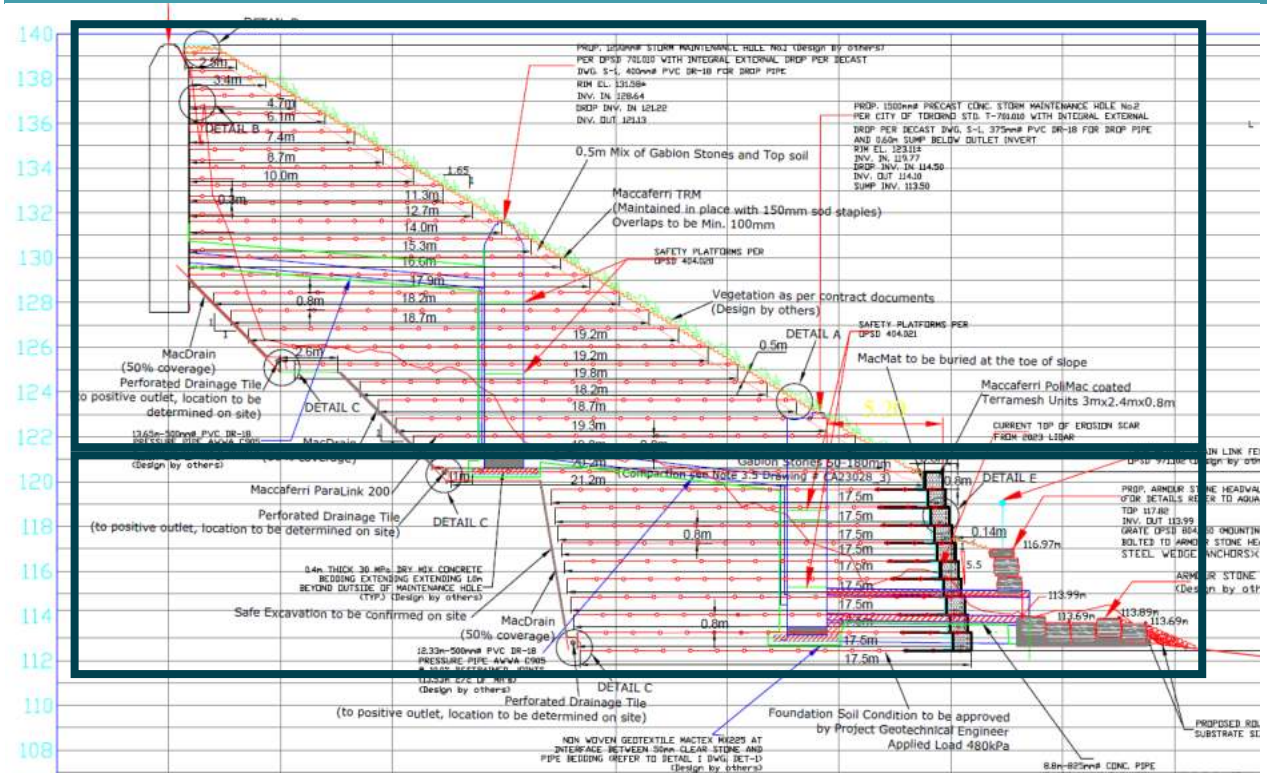
Slope Stabilization in lifts

Design, Structural & Geotechnical Stability Analysis

- Existing site topography - natural slopes, excavation limits
- Design configuration – slope height and extension
- External surcharge – e.g. road
- Seismic factors
- Soil types and properties – retained and foundation soil
- Water table
- Stability analysis with software
- Factors of Safety



Slope Stabilization in lifts



20 m high RSS

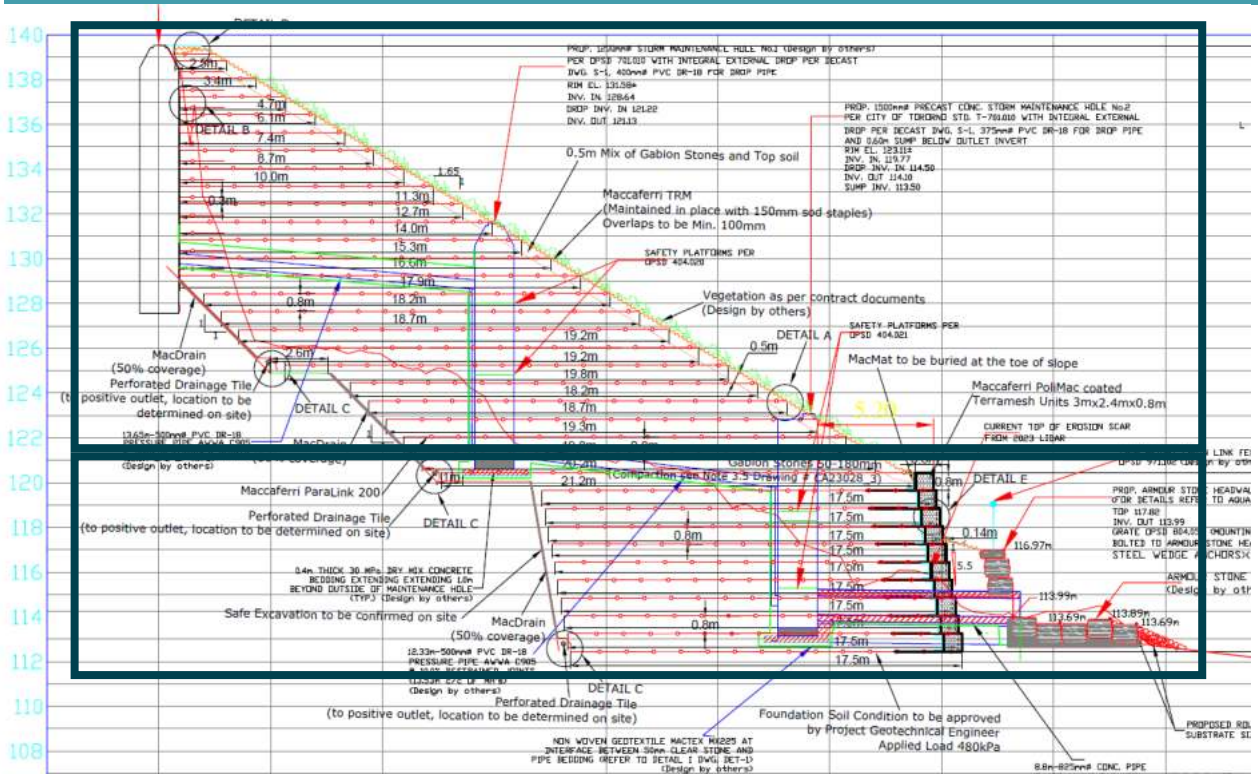
(Reinforced Soil Slope)

8 m high MSE

(Mechanically Stabilized Earth) Wall

Design and Construction Innovations

Slope Stabilization in lifts



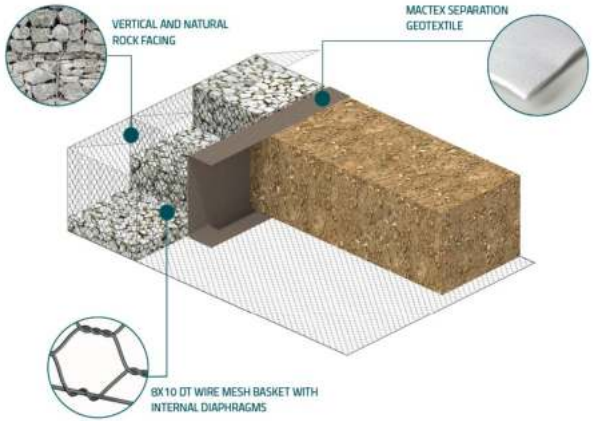
- RSS slope at 35°
- Lined with TRM and anchors
- Geogrid spacing is fixed = 0.8m
- Geogrid length varies

- MSE wall facing at 80°
- Basket pre-assembled facing units
- Geogrid spacing is fixed = 0.8m
- Geogrid length = 17.5 m

Slope Stabilization in lifts

MSE Wall Pre-Assembled Facing Unit

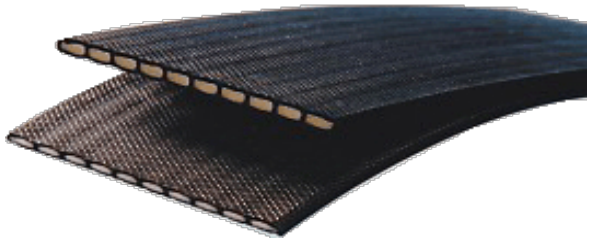
- Double-twist wire mesh baskets with tail
- Green TRM internal lining for erosion control
- Rock fill mixed with topsoil & seeds



Slope Stabilization in lifts

Geogrid layers and backfill

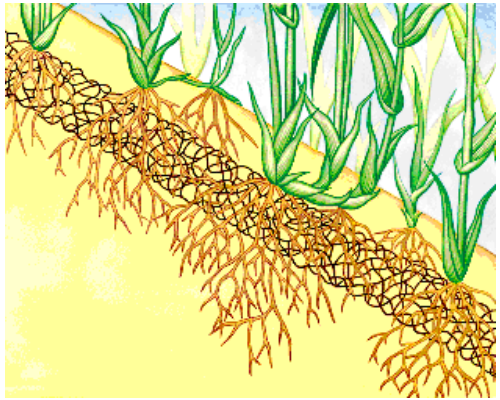
- Vibratory compaction to be avoided
- Gabion stone 50-180 mm backfill
- Compaction achieved by placing, spreading and driving on top of the stone several times
- Need of high-strength & high-performance uniaxial geogrids to minimize installation damage
- High tenacity polyester geogrids with a thick polymeric coating, 200 kN/m

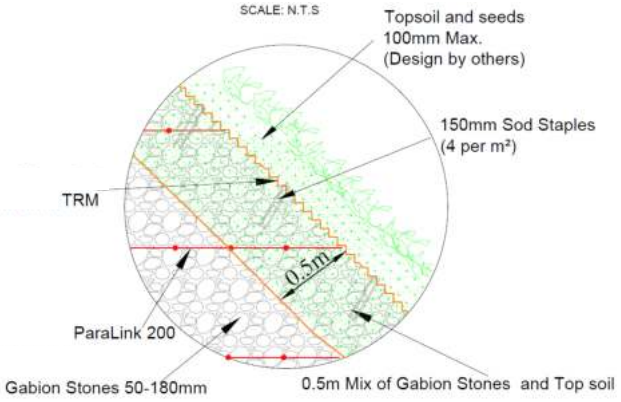


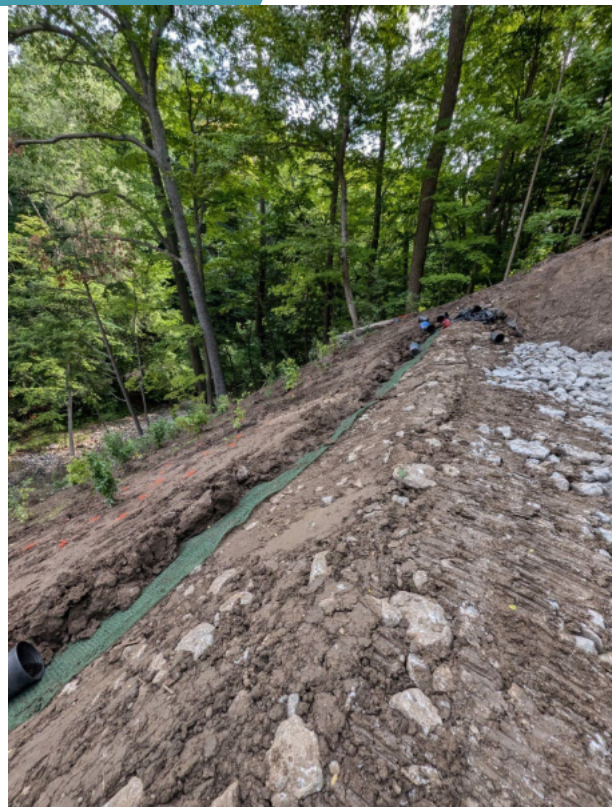
Slope Stabilization in lifts

RSS Facing

- 0.5 m mix of gabion stone and topsoil below TRM
- TRM with 150 mm sod staples to reinforce roots & surficial soil
- 100 mm topsoil and seeds
- Potted plants

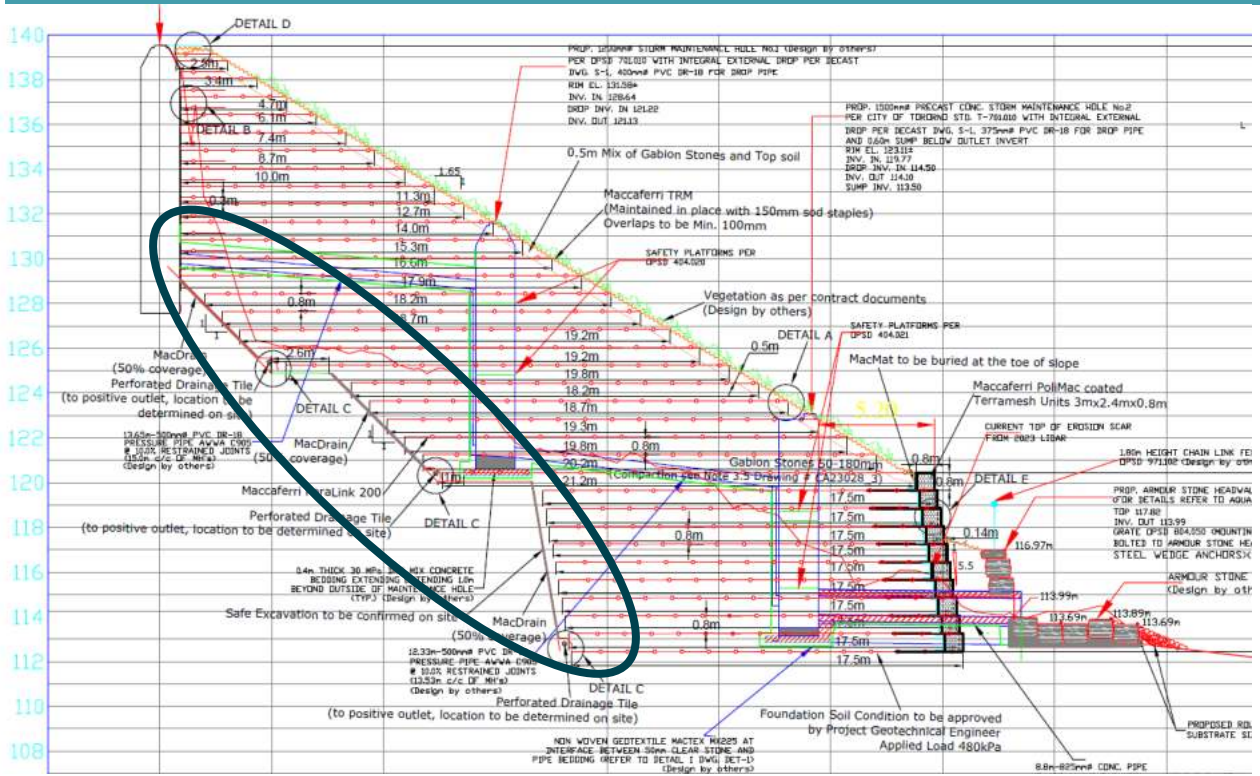






Design and Construction Innovations

Slope Stabilization in lifts

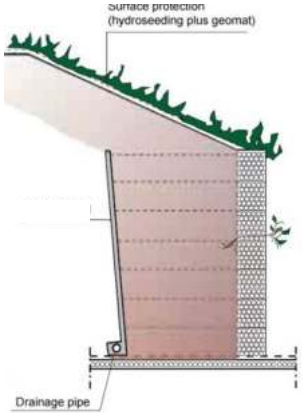


- Need to intercept possible water infiltration and convey it to an outlet
- Combination of drainage geocomposite + perforated drainage tiles

Slope Stabilization in lifts

Drainage geocomposite

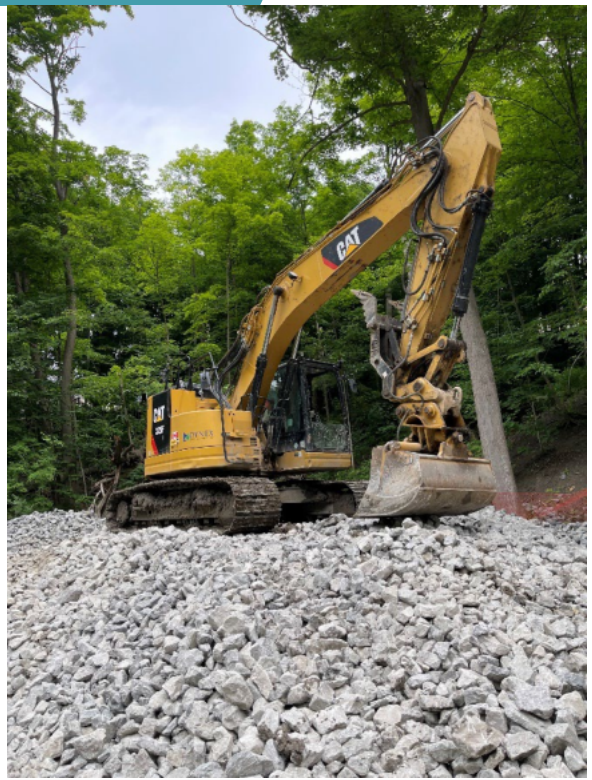
- Allows in-plane flow and conveyance to a suitable outlet
- Filtering geotextile + draining core
- Very high void ratio
- Flexible, cost-effective alternative to traditional mineral draining fills



Slope Stabilization in lifts

Construction challenges

- Heavy equipment required for storm sewer system and slope construction (12,000 tons of gabion stone)



Slope Stabilization in lifts

Construction challenges

- Access to the backfilling area only from the front of the reinforced slope

Slope Stabilization in lifts

Construction challenges

- Create an access ramp that “grows” with the new slope elevation

July 3, 2024

August 7, 2024

September 3, 2024

Armour stone headwall and scour pad

August 1, 2024

August 21, 2024

Design and Construction Innovations

Vegetated buttress for bank protection

September 4, 2024

September 13, 2024

Slope ecological restoration

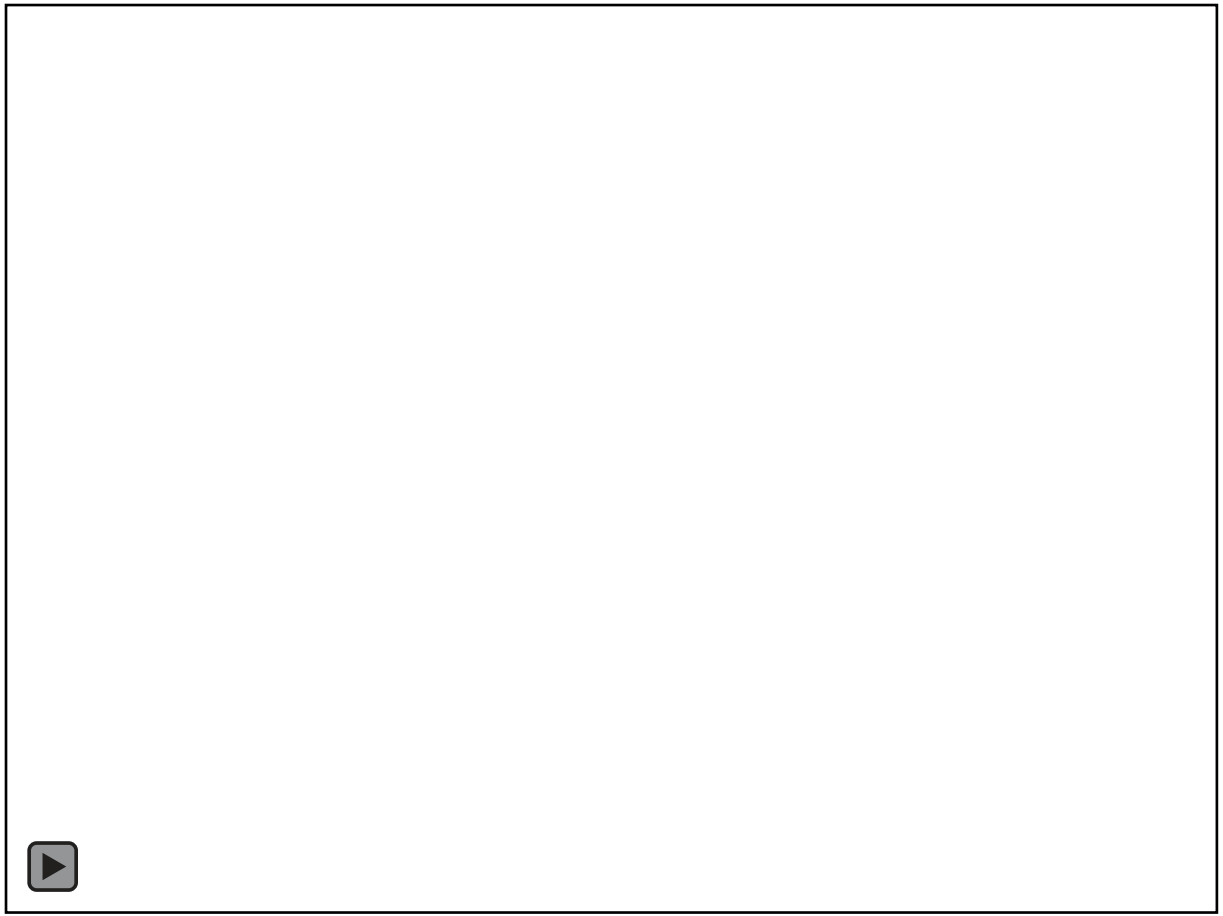
September 18, 2024

Design and Construction Innovations

Burke Brook rehabilitation completed

October 8, 2024

Video Presentation – Timelapse During Construction



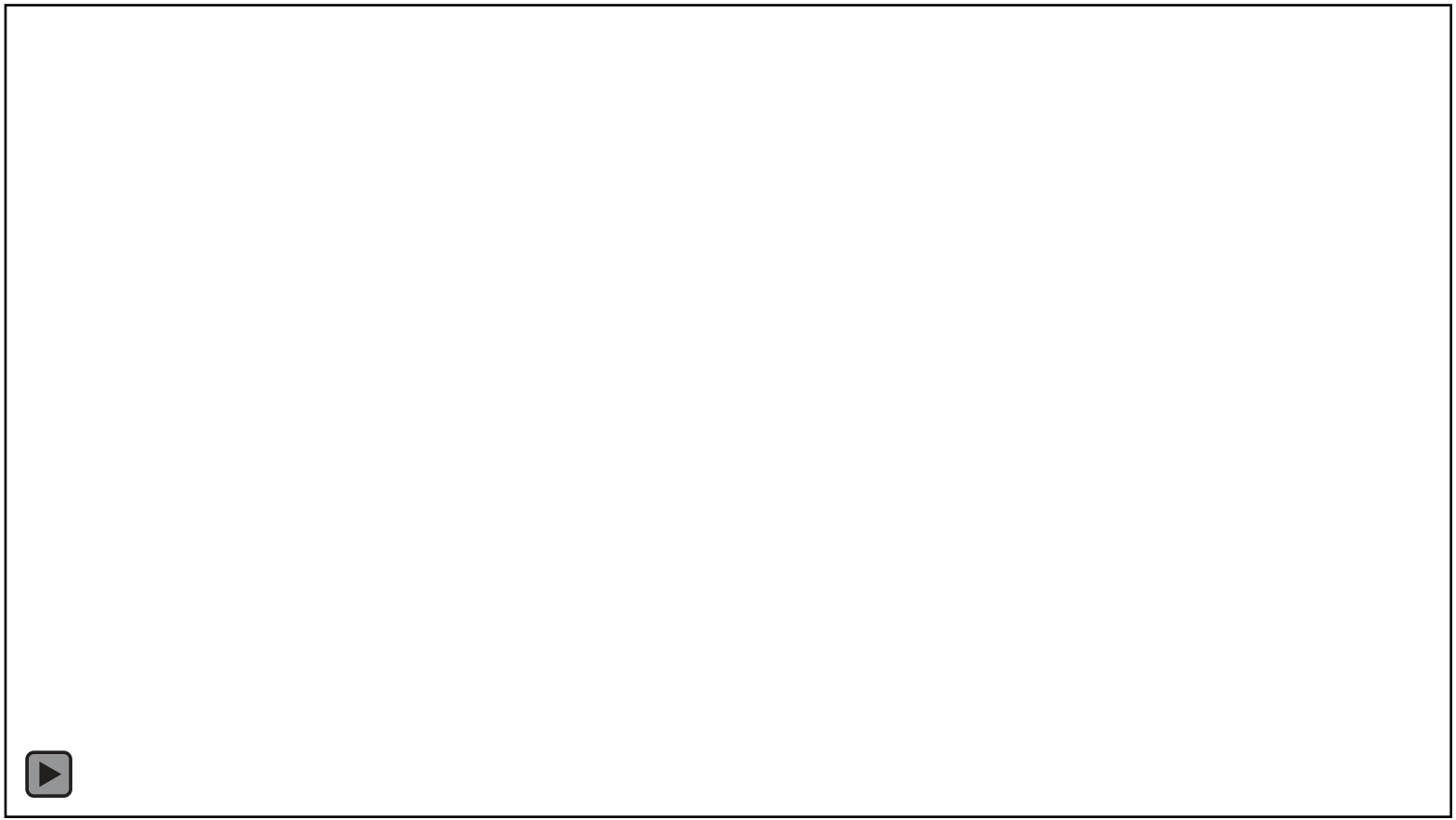
Design and Construction Innovations

Rapid response for resilience

February 13, 2024

October 30, 2024

Video Presentation – Highlight Reel



Benefits of Design-Build Delivery Model

- Streamlined the design and construction timelines
  - Design and Construction was completed in less than 9 months
  - A minimum of 15 months quicker than traditional Design-Bid-Build method – approximately 24 months)

- Including the contractor's perspective in the design phase ultimately created a more constructable design, with less unexpected delays throughout the construction project

- Multi-disciplinary effort to achieve excellence

THANK YOU! Any questions?

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