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ESC Implementation Tottenham Airfield

March 2018

Lessons Learned from ESC Implementation at the Tottenham Airfield

Going Beyond Silt Fence

Overview

Purpose

- Break down over-reliance on use of perimeter silt fences and old techniques
- Identify strategies for overcoming resistance to BMPs

Case Study:

- 52 ha site in Southern Ontario
- Release of sediment
- Steps taken to avoid shut-down

Take-Aways:

- Three factors that contribute to an ESC compliant site
- Adaptability from an ESC perspective
- A "system of tools approach"
- The importance of proper ESC planning for longer term construction projects

Case Study – Site Location

Case Study – Background

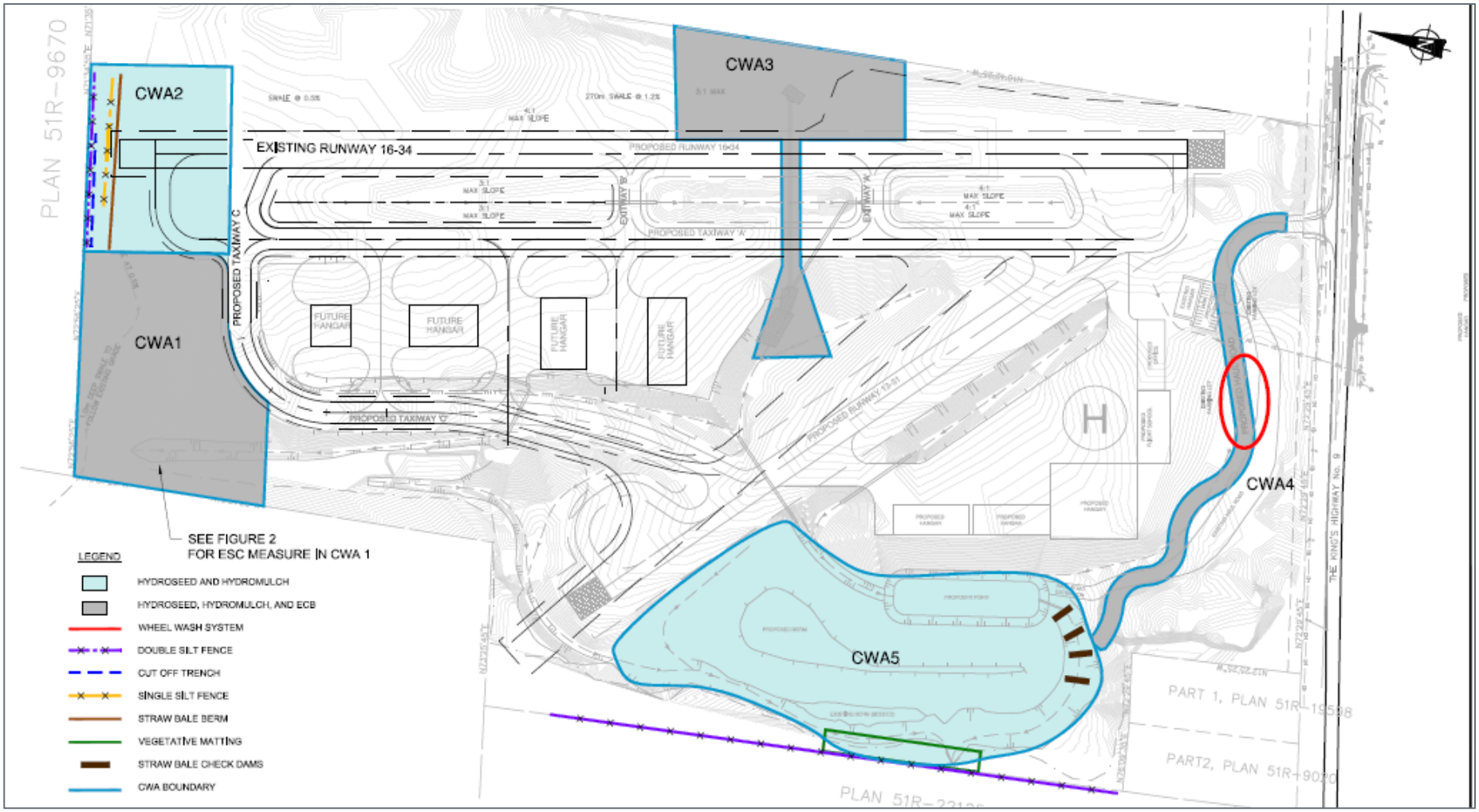
- Redevelopment of a municipal airfield
- Federal jurisdiction - exempt from municipal regulations
- Multi-year fill and grading program
- No comprehensive ESC plan in place during initial construction phase

Case Study – Initial ESC Measures

SWOT Analysis

- Designed and installed by owner's personnel
- Silt fence at boundary of site
- No additional measures at ditches, culverts, or overland flow paths; no slope stabilization
- Disturbed soils left unstabilized

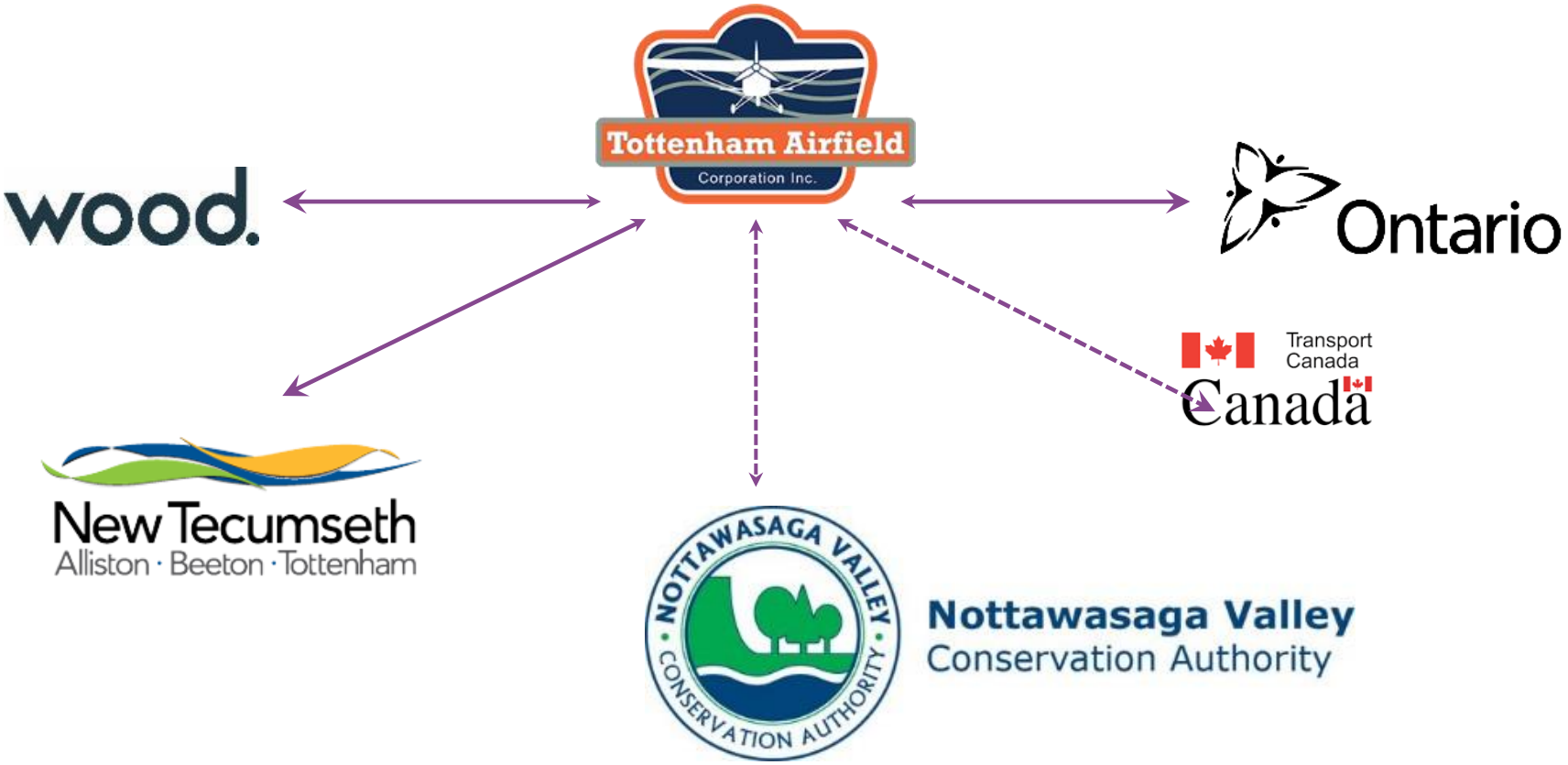
Case Study – Site



Case Study – The Incident

- Extreme rain on snow event resulted in surface runoff significantly greater than average conditions
- Uninterrupted flows caused erosion
- Sediment laden runoff overwhelmed silt fence and resulted in sediment deposition … Municipality became involved

Case Study – Stakeholders



Case Study – Root Causes

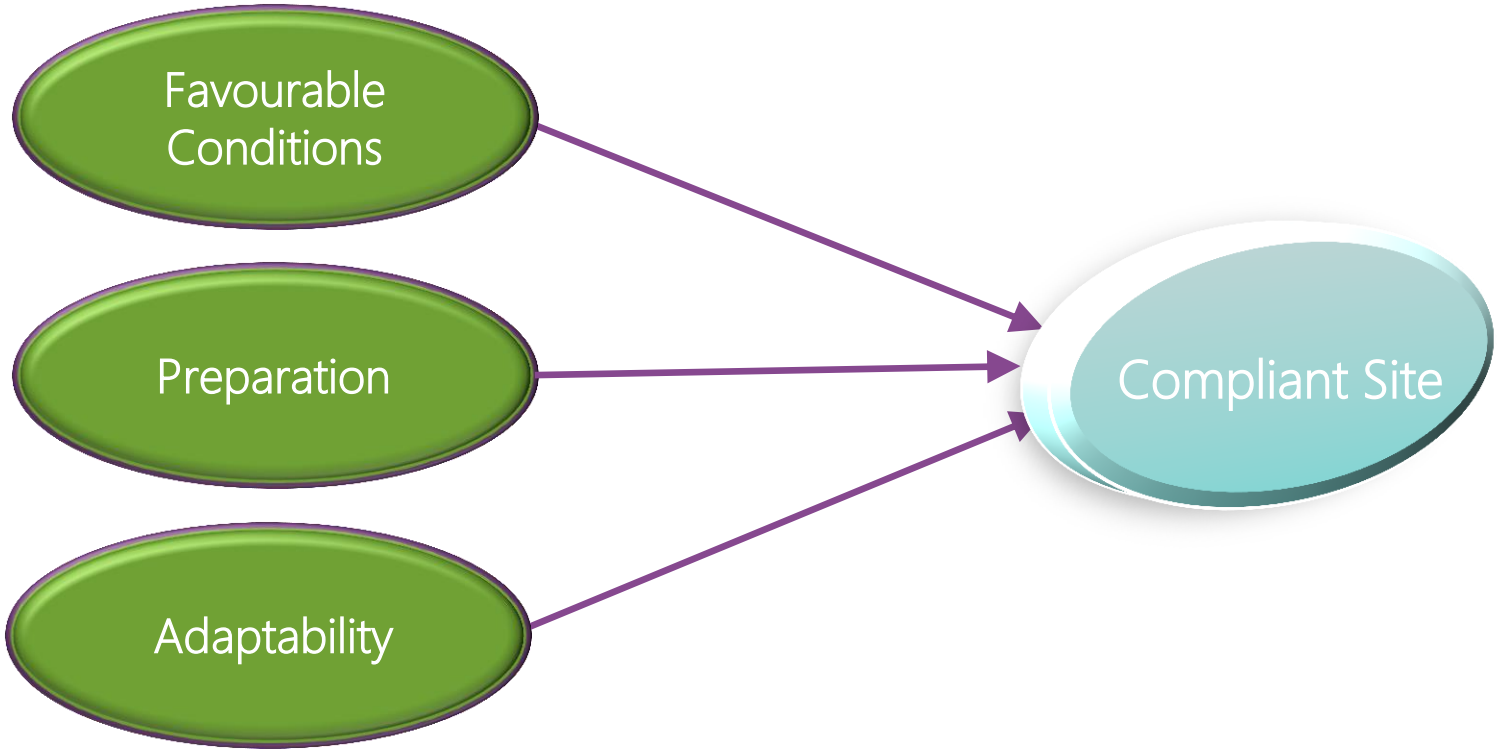
- Undercutting
- Overtopping
- Flow bypass
- Lack of maintenance

- Limited involvement from QP-ESC
- Lack of understanding of ESC risk factors as they apply to a large, multi-year development site
- Contractor led ESC installation using some outdated BMPs
- Reliance on “tried and true” technique

Case Study – Root Causes

- ❑ Sediment retention
- ❑ Flow through rate
- ❑ Structural integrity
- ❑ Natural vs. synthetic
- ❑ Degradation (life span)

Key Factors Affecting ESC Management



Case Study – Key ESC Factors

Conditions:

- Large site
- Extreme flow conditions
- High visibility
- Erodible soils (loamy to fine sand)

Preparation:

- Handling ESC themselves
- No initial plan or monitoring practices

Adaptability:

- Engaged an ESC practitioner
- Implemented recommended ESC measures
- Proactive monitoring, repair and maintenance

Favourable Conditions

Likelihood of ESC issues versus the size of the site is not a linear relationship:

- Small site – short construction window, short flow paths, smaller volume of erodible soils
- Medium site – soils exposed for 1-2 years, longer flow paths with potential for rill formation, more erodible soils
- Full scale neighbourhood sized development – soils exposed for 3-5 years, channelized flow, more scrutiny

Silt Fence

Silt fence is:

- Last line of defense on most sites
- Only line of defense on some sites
- Easy to design and spec
- Properly installed silt fence can withstand up to 12 l/s/m^2 (sediment laden) and 400 l/s/m^2 (clear)
- Labour intensive
- Requires significant effort to monitor and maintain
- Good for “day-to-day” protection

Unstuck Thinking

- Experienced contractor, owners, engineers who haven't experienced, or dealt with consequences, of a serious sediment release
- Narrow insight into factors surrounding ESC
- False sense of confidence
- Correlation is not causation

$$Silt\ Fence \neq Compliant\ Site$$

$$Silt\ Fence + Favourable\ Conditions = Compliant\ Site$$

- Installation of silt fence, while beneficial, is not the primary reason for soils staying on the site

Design Considerations

- Drainage area
- Slope and gradient
- Peak flow rate
- Volume
- Soil type

Adaptability & Preparation

For an ESC practitioner adaptability involves:

- Resourcefulness – know which BMPs to apply
- Forethought – anticipate how changes at the site will impact ESC
- Focus – exclude external considerations
- Crisis management – review, prioritize, manage expectations
- Decisiveness – devise a solution and execute

Erosion Controls

- Surficial erosion is caused by water flowing across soils and is dependent on slope and flow depth

$$\tau = \gamma ds$$

  - τ = Shear Stress (N/m^2)
  - γ = Weight of Water (9,810 N/m^3)
  - d = Flow depth (m)
  - s = Slope (m/m)

- Slopes dictated by Civil and Geotechnical designs
- Flow interruption devices to create pools and disperse flow
- Swales and ditches to limit overland flow lengths
- Increase shear resistance

Case Study - Aftermath

Following the initial sediment discharge, municipality:

- More involvement from the Town
- Became vocal
- Insisted on a site from which **NO** sediment could be discharged
- Remediation planning and implementation

Meanwhile, the owner:

- Added delivery controls at a critical location
- Engaged Wood to develop a comprehensive ESC plan

Obstacles

- Municipality resistant to a dynamic ESC Plan that could evolve as measures were applied and site conditions changed
- Concurrent to changes to grading design
- Retroactive assessment of ESC measures designed in the field
- Engagement late in the construction season
- Evolving site design
- Wet summer
- Lack of context

Measure - Rock Check Dams

Rock Check Dam Benefits

- Arrest the flow to form upstream pool and reduce hydraulic grade line
- Disperse flow to decrease depth

Rock Check Dam Considerations

- Materials – spec is important to ensure gradation
- Geometry – regular intervals to form pool
- Moderate to high cost – procure rock, use equipment

Measure - Fibre Roll Logs

Fibre Roll Log Benefits

- Disperse flows and prevent flow from concentrating across long slope
- Low cost
- Easy to install
- Can vegetate

Fibre Roll Log Considerations

- Require maintenance
- Can be overwhelmed by heavy flows

Measure – Hydroseed / Hydromulch

Hydroseed consisted of

- Selected seed
- Biotic earth
- Bonded fibre matrix mulch

Hydroseed Benefits

- Efficient to cover large area
- Low maintenance
- Simple to procure
- Mulch protects soil while seed establishes

Hydroseed Considerations

- Moderate cost
- Soil preparation

Measure – Erosion Control Blanket (ECB)

ECB Benefits

- High resistance to erosion
- Immediate protection

ECB Considerations

- High cost
- Difficult installation, soil prep

Outcomes

Preparation:

- Applied source controls to critical areas throughout the site
- Analyzed shear stress and effectiveness of ESC measures already in place at critical northwest corner
- Installed truck wheel wash
- Installed cut-off trenches and established sediment accumulation zones

Adaptability:

- Made recommendations for additional measures that could be installed if current measures do not perform as anticipated
- Formal monitoring and reporting plan
- Follow up inspections by QP-ESC specialist

Outcomes

Adaptability:

- Utilized a **system of tools approach** to implement a range of control measures, these included:
  - Effective soil cover
  - Effective slope stabilization
  - Effective perimeter control
  - Selected the combination of methods that are expected to perform best under the known site conditions

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Thank you ...

Questions?

matthew.graham@woodplc.com
peter.nimmrichter@woodplc.com

woodplc.com

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