



National
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CANADIAN
ARMED FORCES

DESIGN AND CONSTRUCTION OF A DE-ICING FACILITY FOR A SMALL AIRPORT ENVIRONMENT

Myron Thiessen, P.Eng., M.Sc.

Royal Canadian Air Force

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Canada



Outline

- Background
- Design Objectives
- Design Details
 - Drainage Systems
 - Pavement Structure
 - Concrete Joints
 - Geomembrane Liner
- Paving Issues
- Lessons Learned





Project Location



8 WING
TRENTON

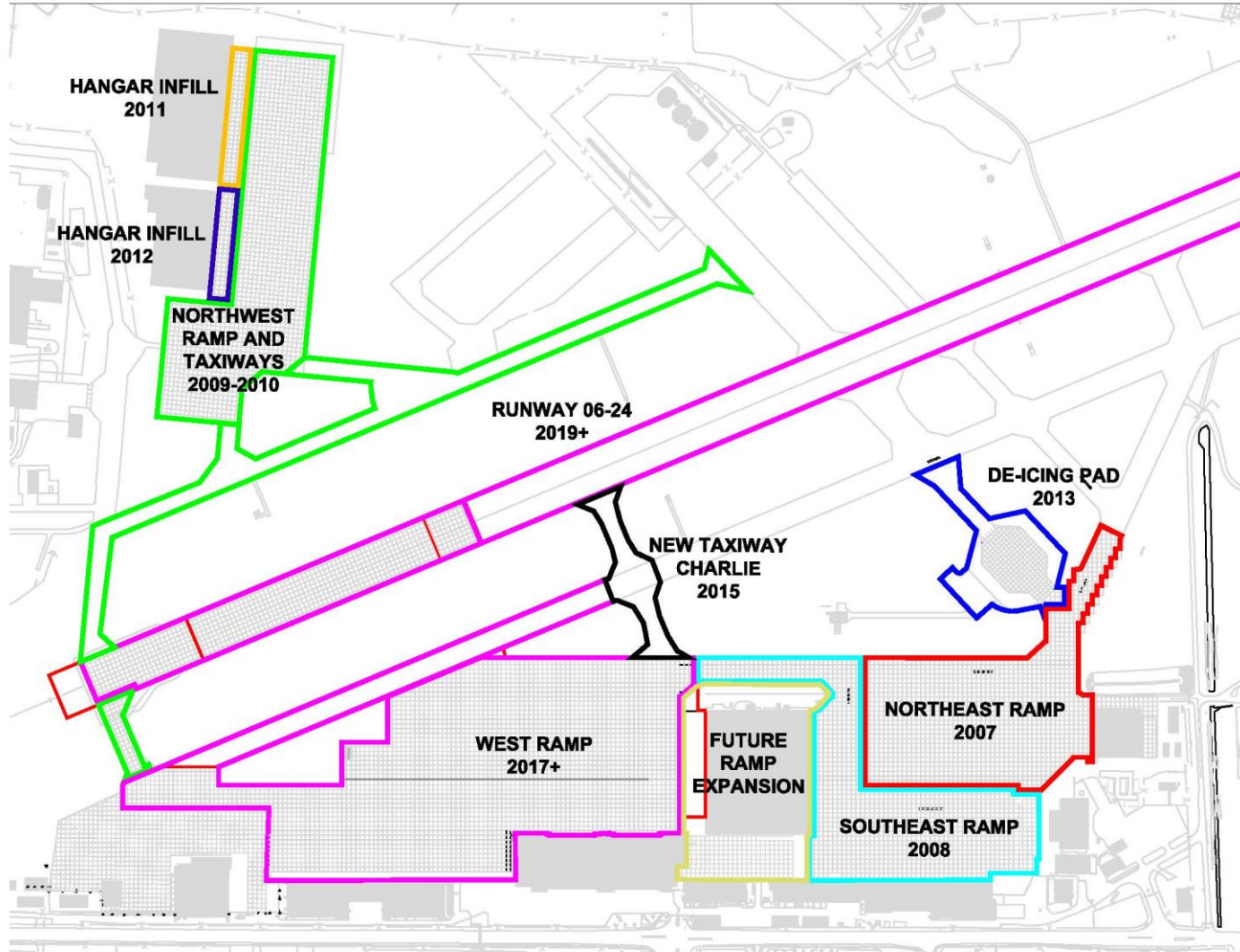


8 Wing Trenton - 2006





Paving Projects - 2007 to 2015 (and beyond)



Traffic Mix – RCAF Aircraft



CC - 177



CC-150 (A310-300)



CC - 130J



Traffic Mix – Foreign Aircraft



AN - 124



IL - 76



AN - 225





Background

- Prior to 2007, aircraft de-icing was completed at individual parking spots
 - Done by DND staff
 - All surface runoff handled by trench drains
- For environmental reasons a decision was made to plug all trench drain outlets
 - Plugs only removed after confirmation of environmental compliance
 - **Major Problems**



Apron Flooding





Underground Contamination





RCAF purchased four C-17 aircraft (2006)

→ Significant increase in de-icing activity





Temporary Solutions

- 2007 → NE Ramp
 - Reconstructed/expanded existing ramp
 - Installed isolated drainage system
 - Still flooding problems and environmental concerns
- 2008 to 2011 → Taxiway Juliet
 - Former runway (45 m wide)
 - Constructed temporary de-icing fluid collection “bowl” adjacent to the taxiway



Location of Temporary De-Icing Pad



Taxiway
Juliet

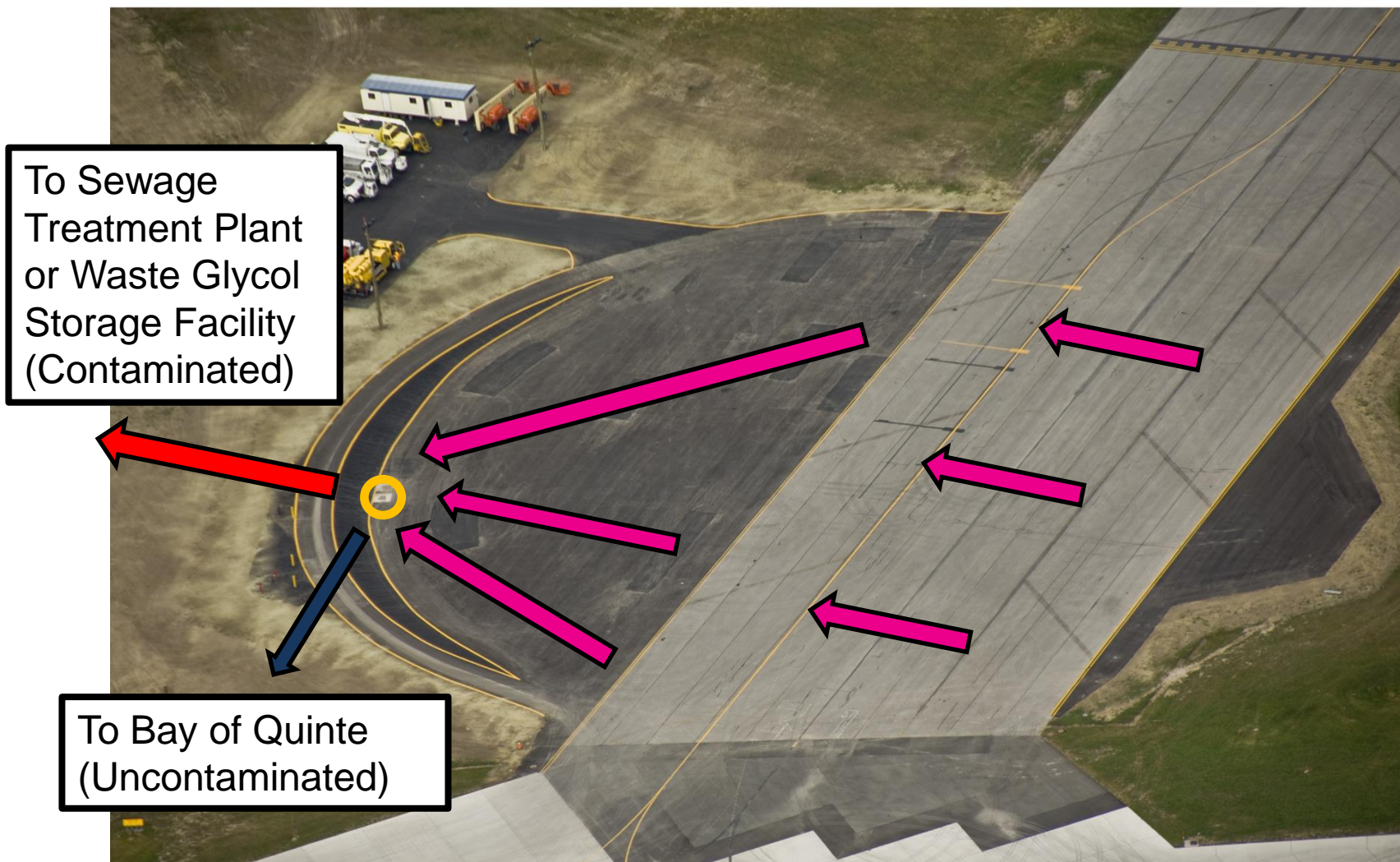


Temporary De-Icing Pad - Layout





Temporary De-Icing Pad - Surface Drainage





Waste Glycol Storage Facility

- Built in 2010
- 8 – 50,000L holding tanks
- Connected to Wing sewage treatment plant





Temporary De-Icing Pad - Pavement Damage (2009)





Temporary De-Icing Pad - Pavement Damage (2009)





New Pad - Design Objectives

- Permanently address deteriorating asphalt surface and increase structural capacity
- Reduce long-term maintenance
 - Concrete vs. asphalt
- Expand size of pad
 - Design aircraft = C-17 (but large enough to handle the AN-225)
 - Allow for manoeuvring of de-icing vehicles and overspray



New Pad - Design Objectives

- Expand parking area for de-icing fluid application vehicles (contracted)
- Expand “pink” snow storage area
- Provide enhanced environmental protection
 - Geomembrane liner
 - Redesigned drainage system
- Keep it simple
 - Utilize existing glycol storage facility → gravity feed
 - Maintain existing operational concept → surface collection



New Pad – Roles and Responsibilities

- Operation of de-icing pad → DND (Air Traffic Control)
- Application of de-icing fluid → Contractor
- Collection/recycling of waste de-icing fluid → Contractor
- Control of drainage release points and discharge → DND (Wing Environmental)

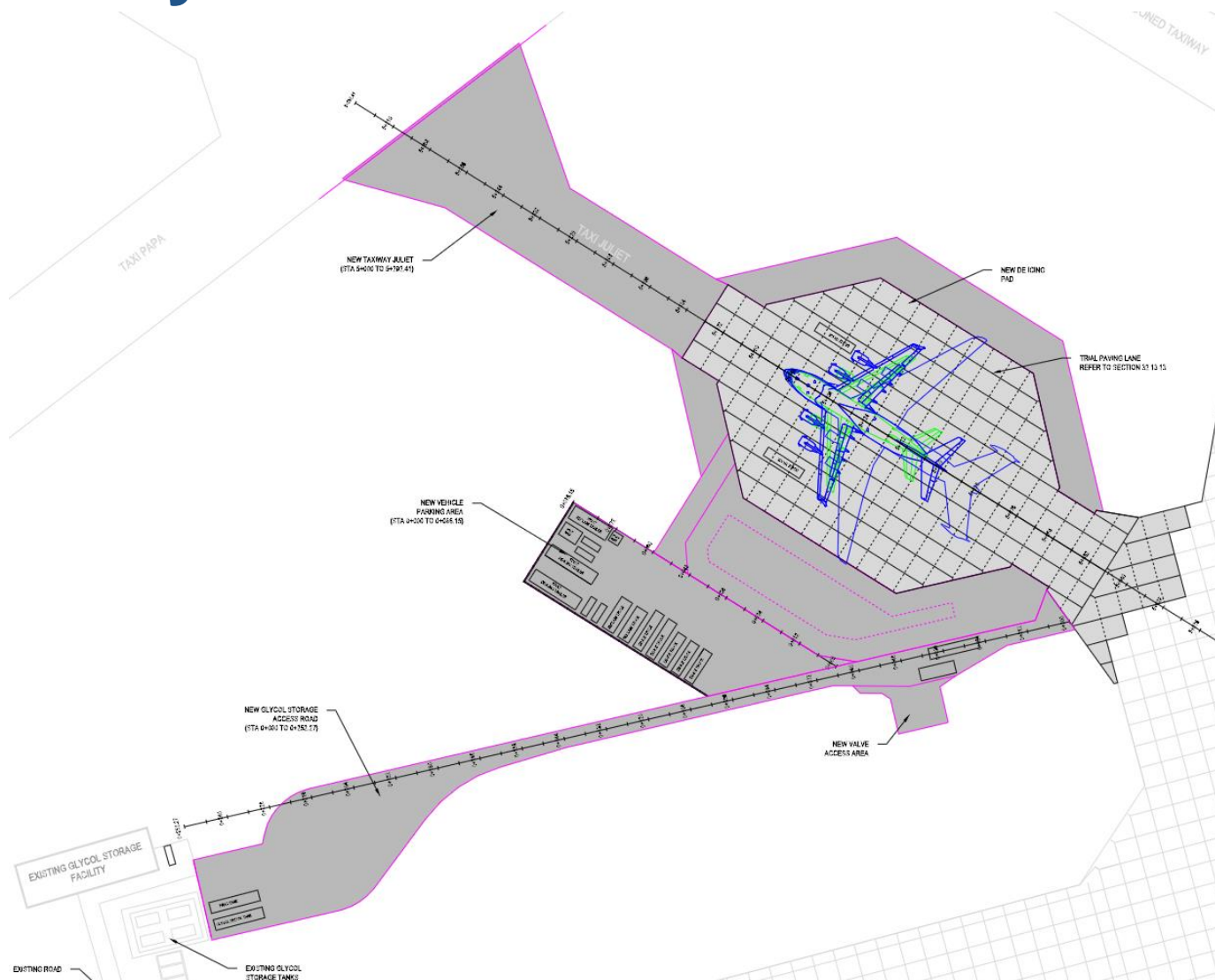


Project Details

- Tendered / Awarded: Early 2013
- Contractor: Mulrooney Trucking Ltd.
- Timeline: May to August → “No Fail”
- Scope:
 - Removal of existing asphalt = 17,000 m²
 - Granular Base and Subbase = 18,300 m³
 - PCC = 7,400 m²
 - HMA = 3,300 t
 - Sub-drainage piping = 1,000 m
 - Storm sewer piping = 550 m
 - New edge lighting (re-use existing flood lighting)



Pad Layout







Primary Containment Area

- Storage capacity – approx. 400,000 L





Drainage Collection Systems

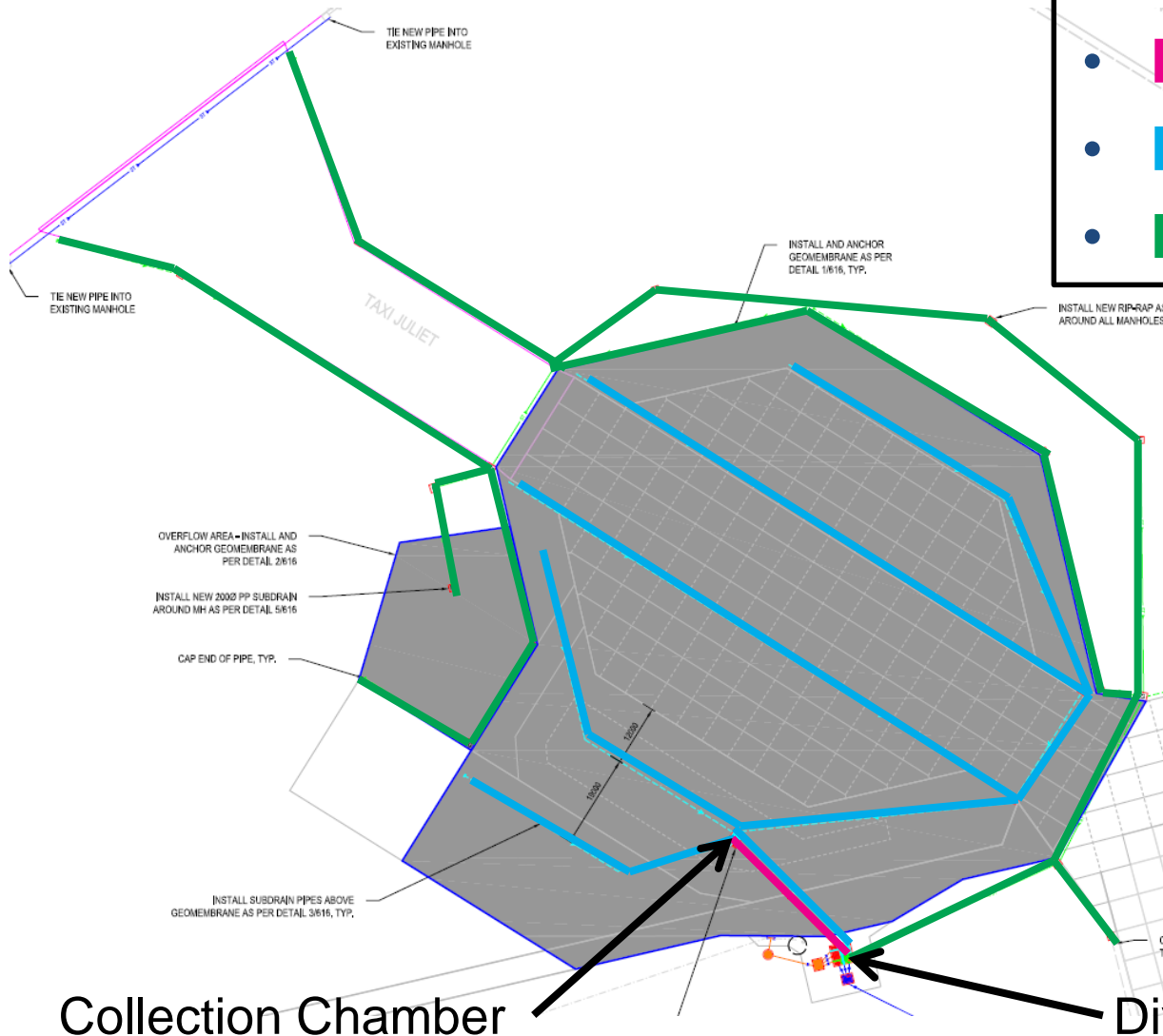
- 3 isolated systems
 - Pad Storm → surface water from pad
 - Pad Subdrain → subsurface water trapped above geomembrane
 - Pad Perimeter → storm (including overflow) and subdrains
- Custom diversion chamber
 - Separate compartments for each drainage system
 - Ability to sample and direct flow independently of each other



Drainage Collection Systems

Underground Piping

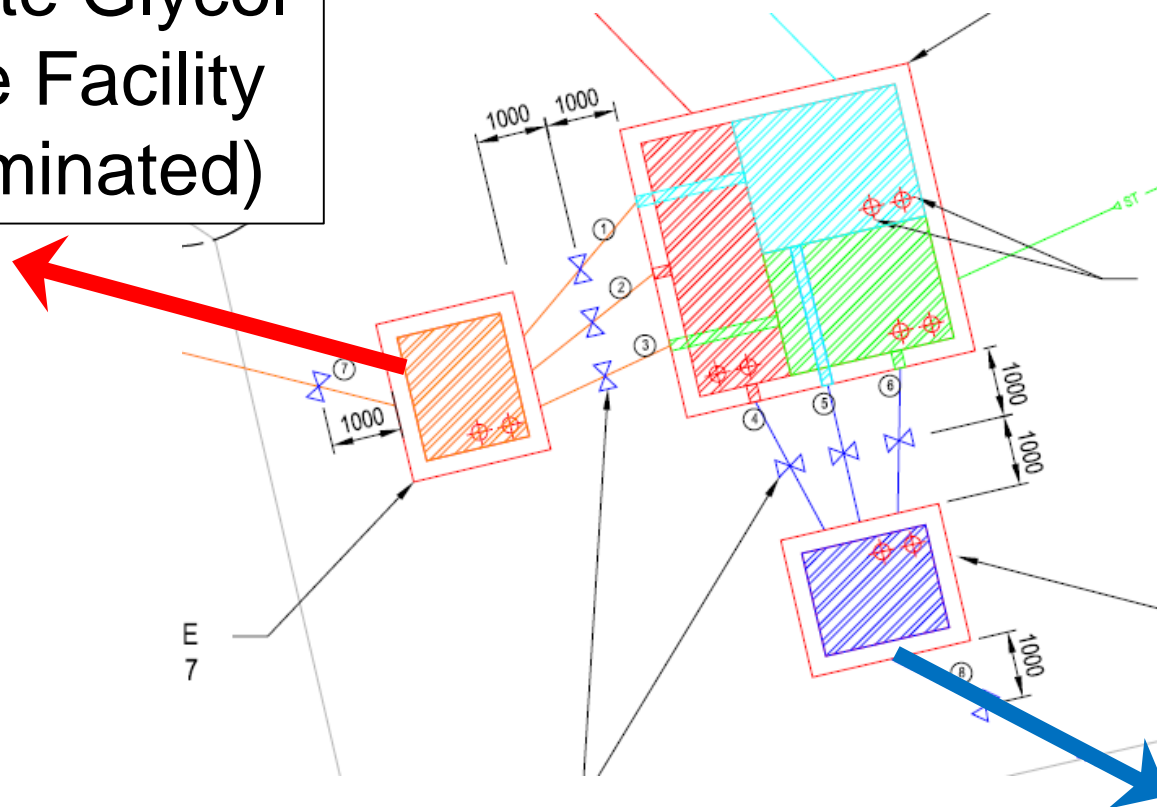
- **Pad Storm**
- **Pad Subdrain**
- **Pad Perimeter**





Drainage Collection Systems

To Waste Glycol
Storage Facility
(Contaminated)



To Bay of Quinte
(Uncontaminated)

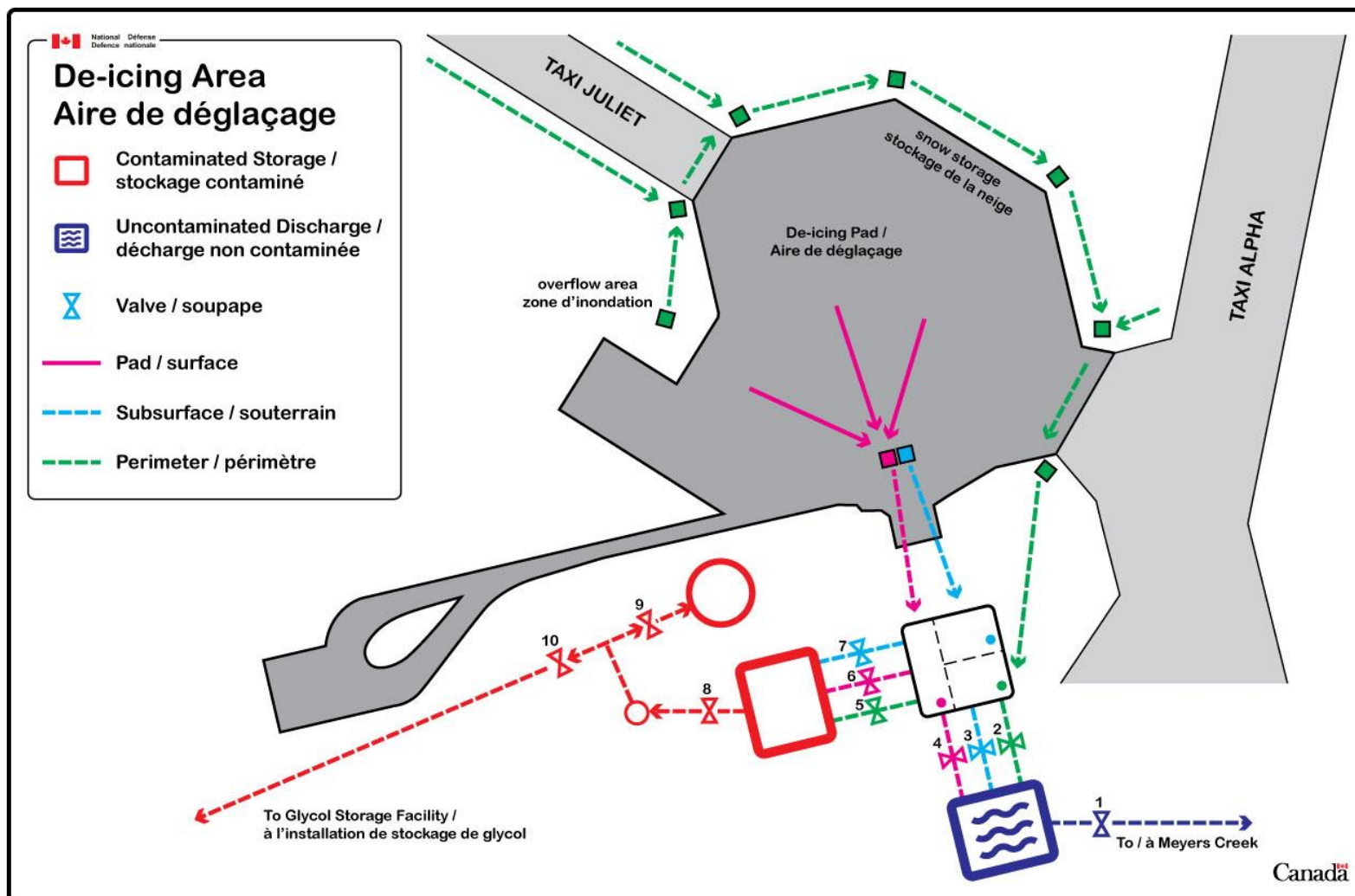


Diversion Chamber





De-Icing Pad Operations





De-Icing Pad Operations

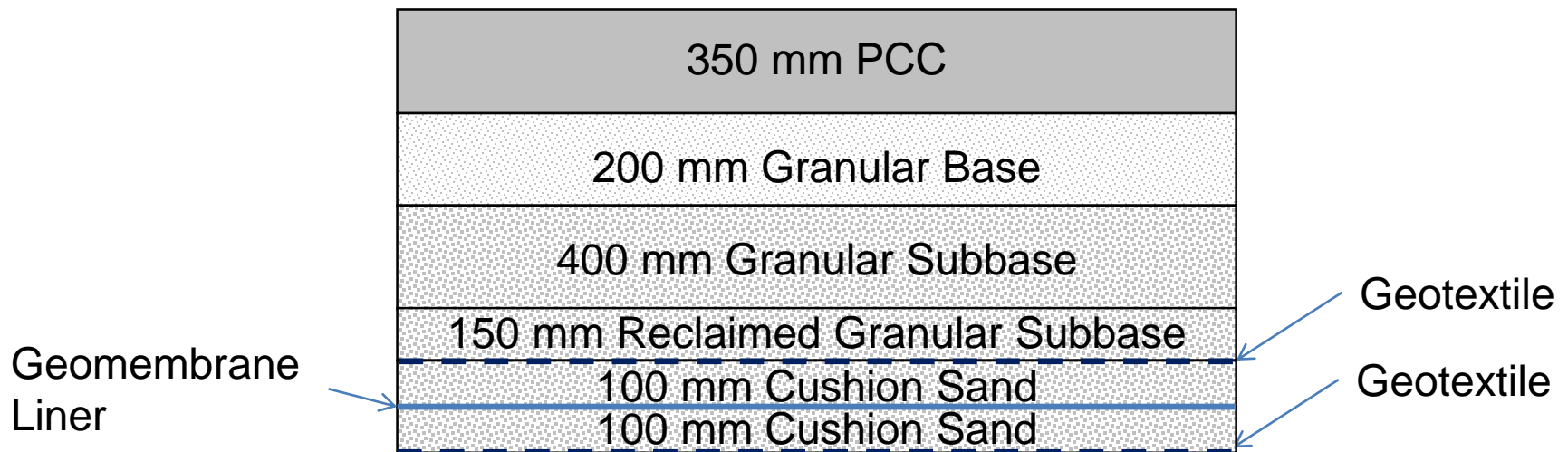
- Simplify operations → color-coded post indicator valves





Pavement Design

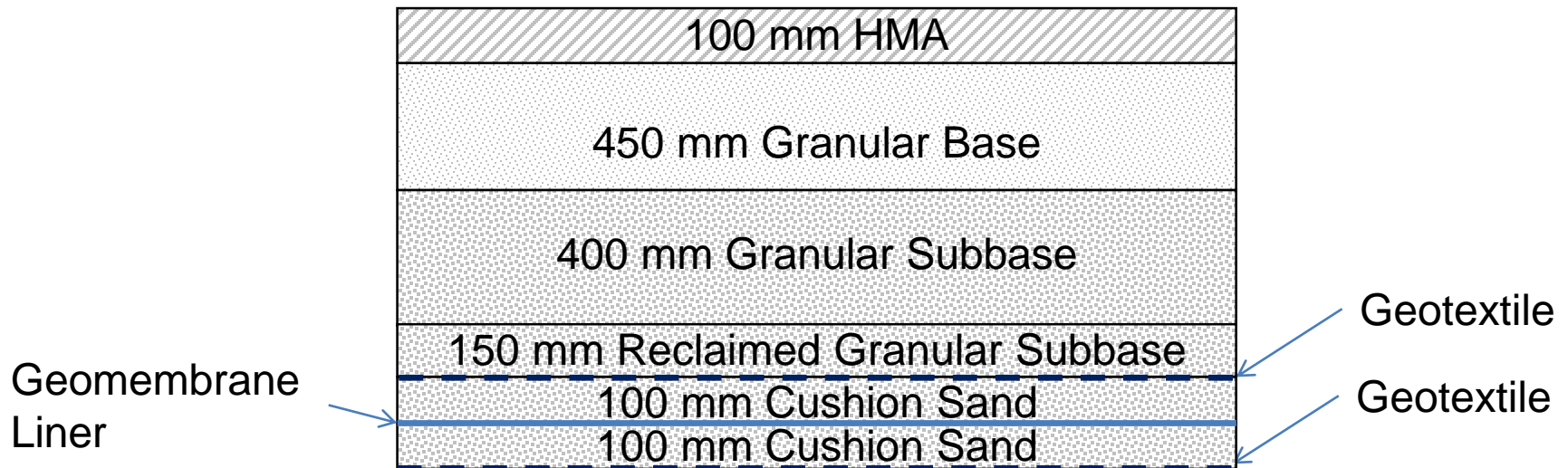
- PCC Pavement Structure – De-Icing Pad





Pavement Design

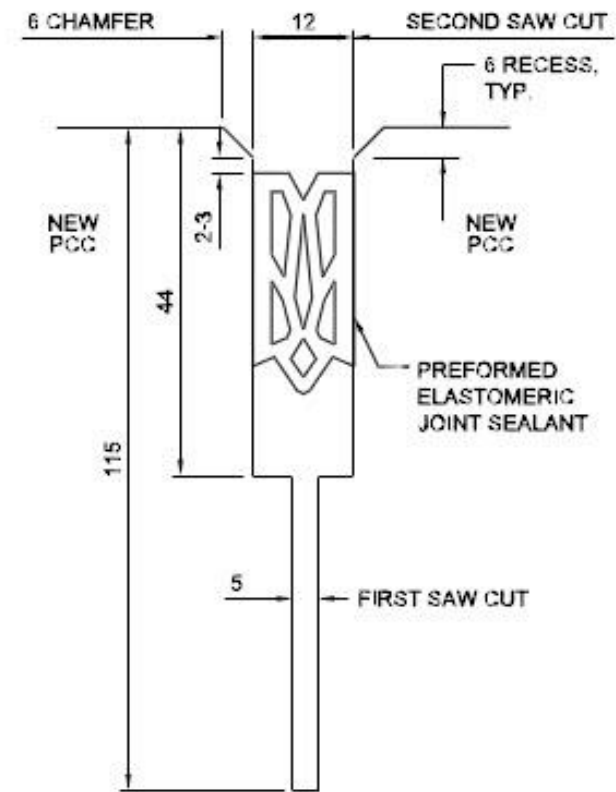
- HMA Pavement Structure – Perimeter Area





PCC Joint Design

- 6 x 6 m joint spacing
- Chamfered joints
- Pre-formed neoprene joint sealant
 - First widespread use on a DND facility



DETAIL 2
N.T.S.

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613	613



Geomembrane Liner

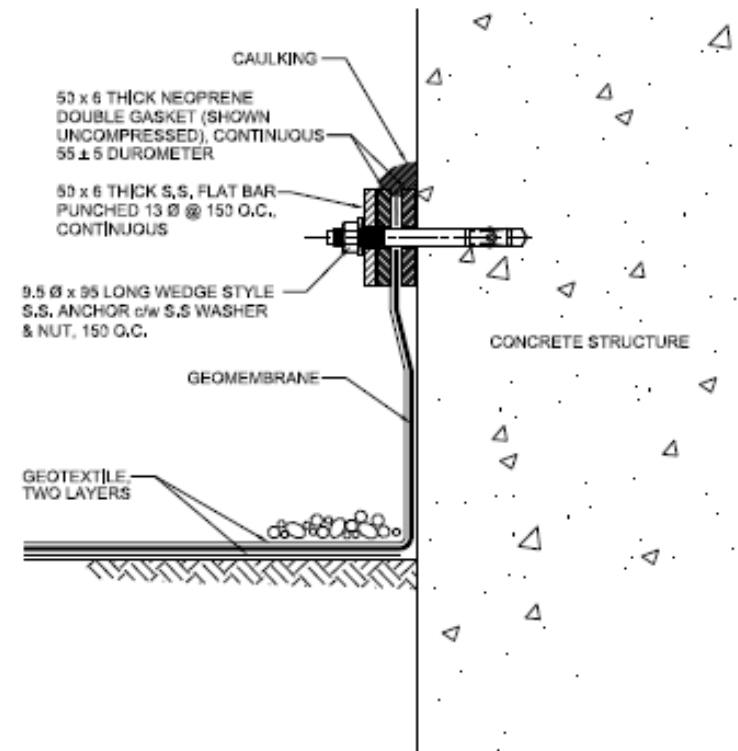
- Membrane → glycol resistant polyolefin
 - Supplied in extruded sheets bonded in the factory
 - Anchored around perimeter
- Cushion sand → only small equipment allowed





Geomembrane Liner

- Installation around penetrations





Proofrolling





Asphalt Paving

- Asphalt cement – PGAC 64-28
- Echelon paving used where possible





Asphalt Paving

- Only significant issue → ponding water on Juliet





Concrete Paving

- Concrete Mix Requirements
 - 40-5 or 28-5 mm aggregate allowed
 - 310 kg/m³ total cementitious material (min.)
 - 4.2 MPa flex strength (28-day min.)
 - 0.45 w/c (max.)
- No room for on-site batch plant
- Slip form OR fixed form paving allowed



Concrete Paving

- Concrete supply → off-site ready mix plant
- Fixed form paving → roller screed





Concrete Paving

- Initial trial lane looked good at first but surface defects became evident as it cured
 - Multiple trials, mix designs, material suppliers
- Urgency of project left us in a tight spot



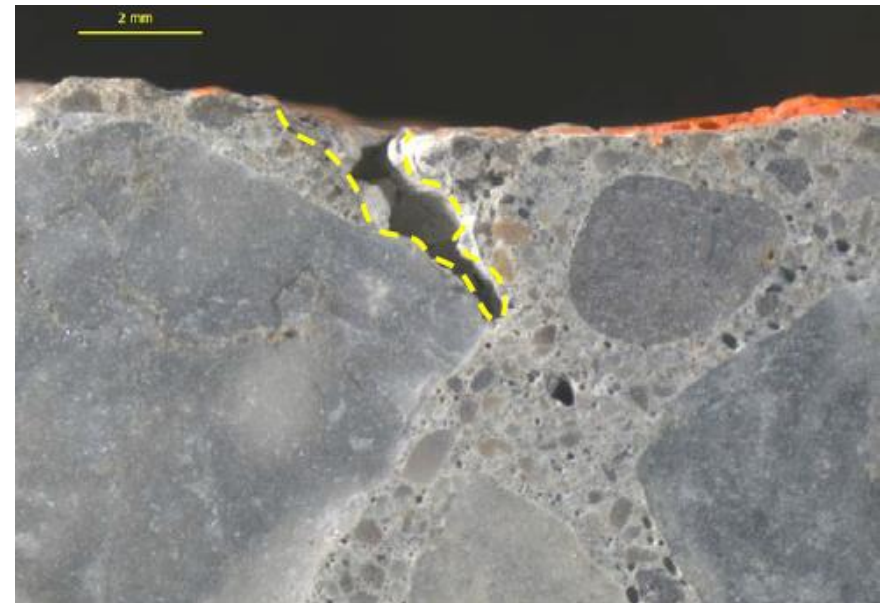
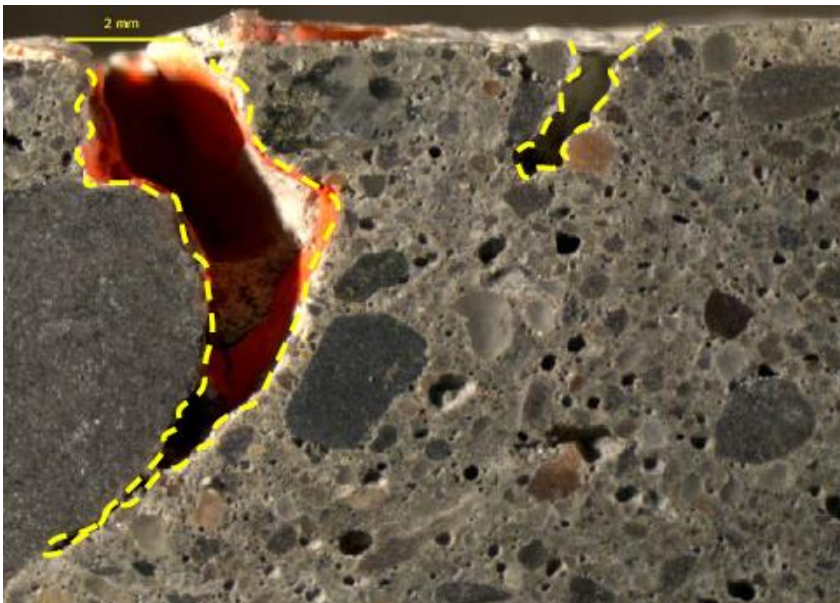


Concrete Paving - Surface Defects



Concrete Paving - Surface Defects

- Petrographic testing confirmed microcracking around aggregates
 - Generally 5 mm, but sometimes deeper
 - Long-term durability concerns





Solution

- Considered various sealants → unacceptable
- Diamond grinding (2014)
 - Depth - approx. 5 mm
 - Replaced all neoprene joint seals





Lessons Learned

- De-icing pad operation → education and on-going maintenance is key
- On-site batch plant → better mix consistency
- Slipform paver → improved finishing





Questions?

