

# Highway 14 Grade Raise at Range Road 30

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# Agenda

1. Project Background
2. Design Challenges and Considerations
3. Construction Issues, Solutions & Lessons Learned
4. Conclusion/Q&A



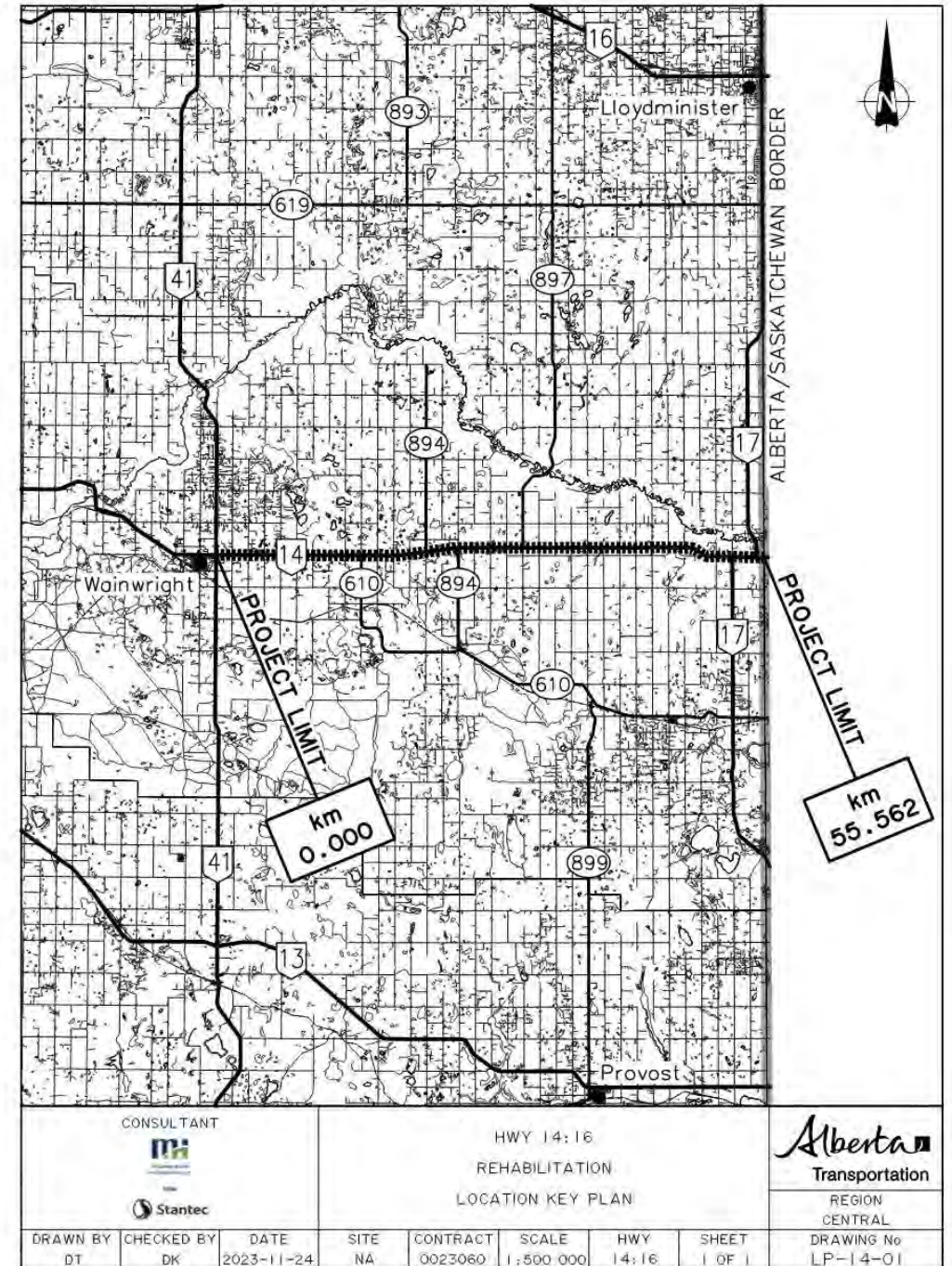
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# **Project Background**



# Project Background

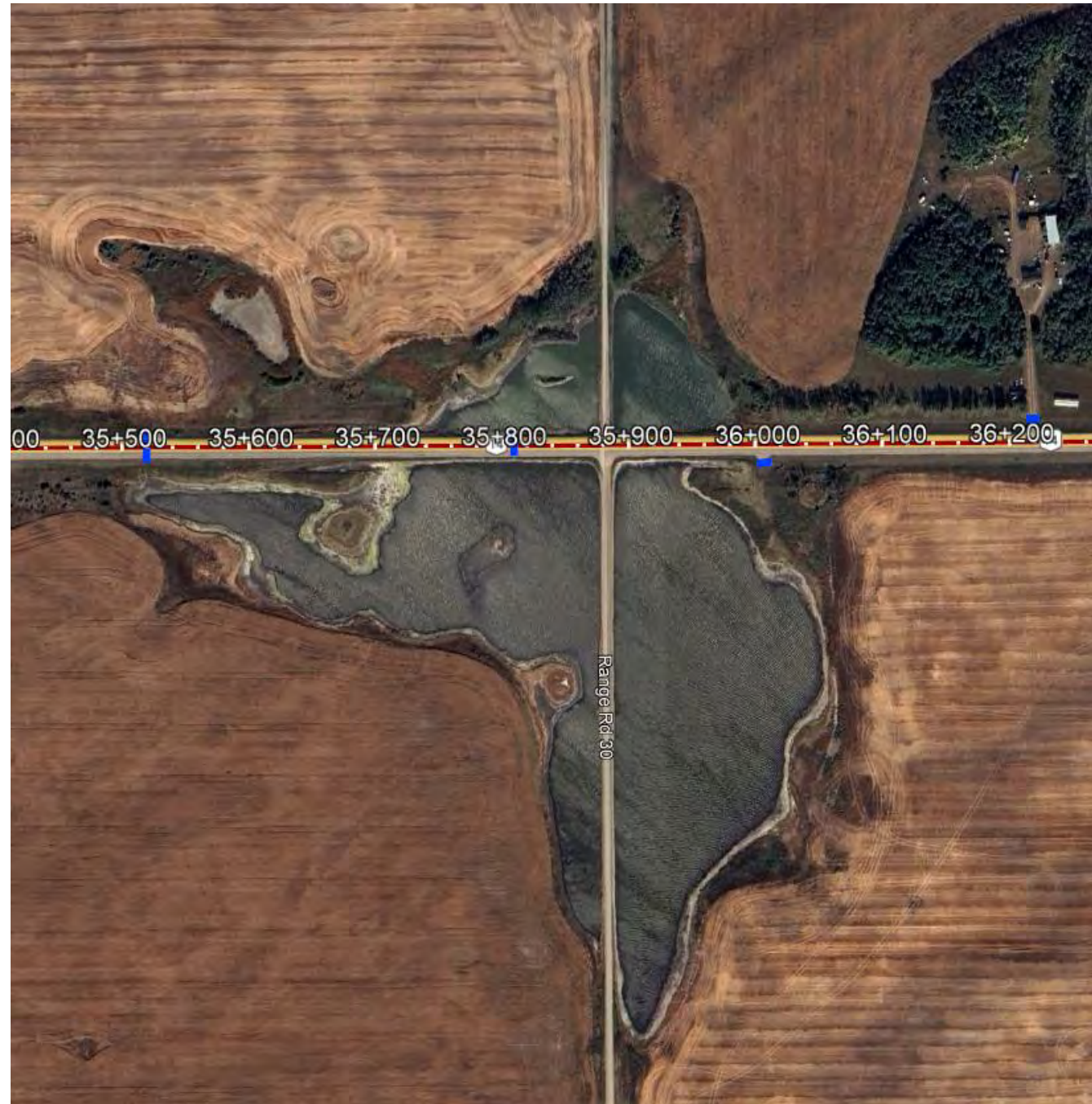
- Highway 14:16 rehabilitation from Highway 41 (Wainwright) to Saskatchewan Border (55.562 km);
- Grading work included:
  - Grade raise at Range Road 30;
  - Two intersection upgrades;
  - Approach removals, construction and sideslope improvements.
- Total surfacing quantities included approximately:
  - 168,000 tonnes of ACP;
  - 28,000 tonnes of Granular Fill;
  - 15,000 tonnes of GBC.





# Project Background (cont.)

- Grade Raise at Range Road 30:
  - Intersection in a low-lying area and has experienced historical flooding and overtopping of the range road;
  - TEC maintenance forces often had to pump water away in the spring to mitigate risk of overtopping the highway;
  - TEC wished to permanently solve the issue by raising the grade of Highway 14 and physically removing portions of Range Road 30.





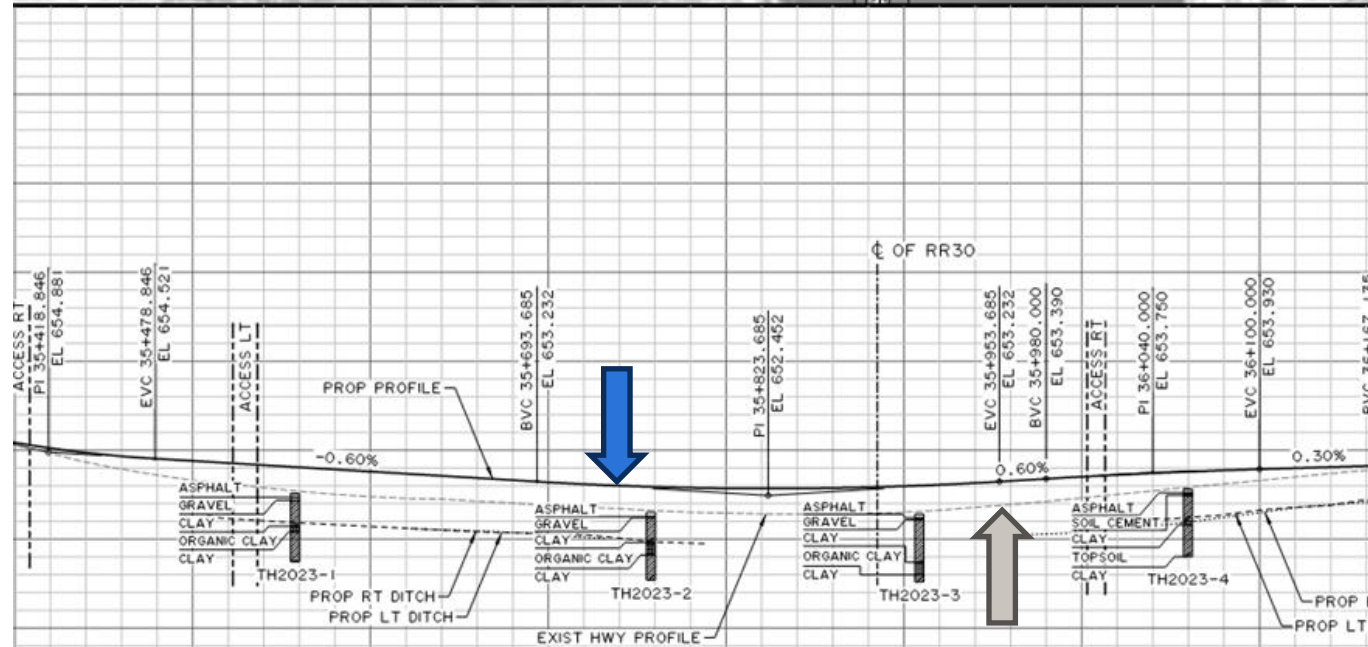
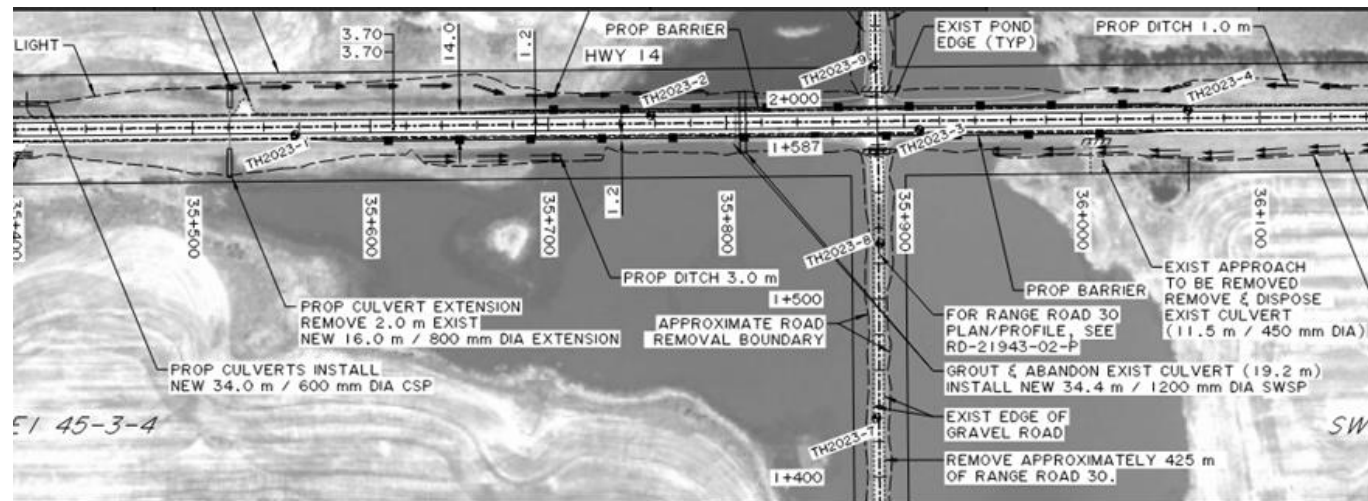
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# Design Challenges & Considerations

# Design Challenges & Considerations

## Geometric Design Considerations:

- Elevation of grade raise
  - Determined based on hydrology and including a factor of safety to be 1.5 m max above existing highway;
- Cross Section
  - 5:1 away from wetland area with ditches ranging from 1-3 m;
  - 3:1 with HTCB in wetland area to minimize footprint of ground disturbance;
  - 14 m finished width to ensure grade widening isn't required for a long time.

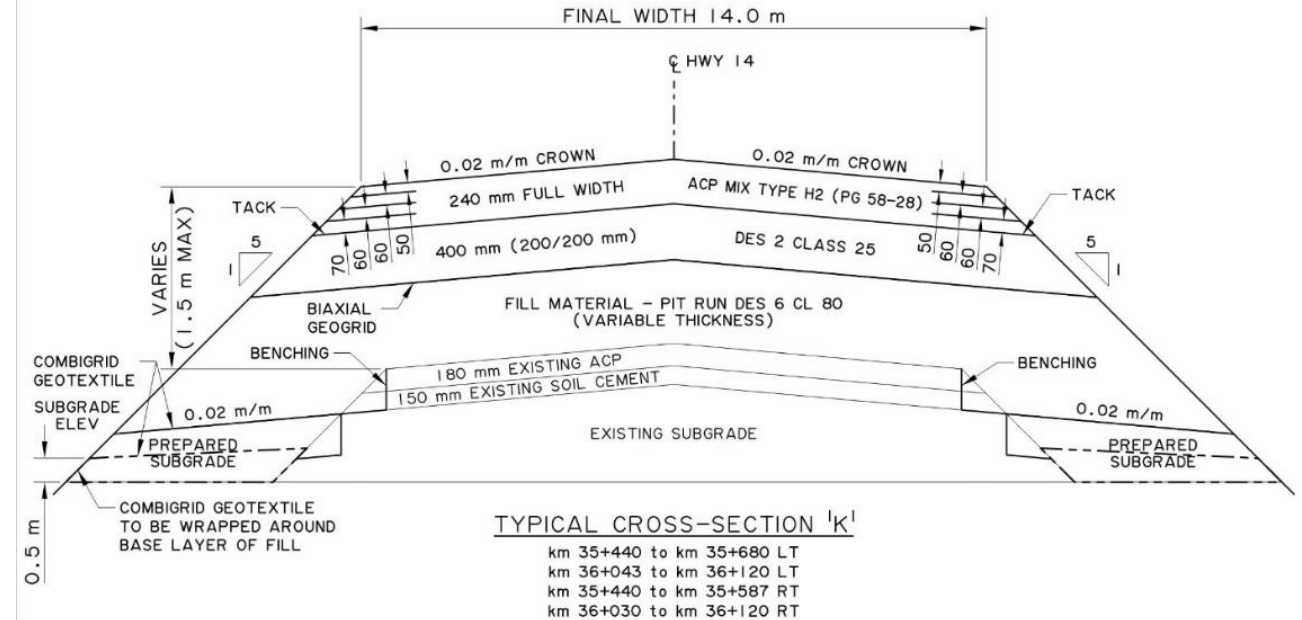




# Design Challenges & Considerations (cont.)

## Geotechnical/Surfacing Design Considerations:

- Surfacing design by Tetra Tech
  - 240 mm ACP/400 mm GBC/variable thickness Pit Run to elevation of Hwy 14 existing subgrade;
  - Biaxial geogrid on top of pit run, non-woven geotextile on top of subgrade;
  - Stantec replaced non-woven geotextile with combi-grid product and added layers in subgrade.
- Geotechnical site investigation by Hoggan Engineering
  - Drilled along Hwy 14 to confirm existing conditions;
  - Drilled existing Range Road 30 to determine suitability of existing material for use in grade raise;
    - Decent material for top ~1 m below existing elevation of Range Road 30.
  - Hand auger investigation for existing organic depths along Highway 14.
    - Found up to 1 m of organics.

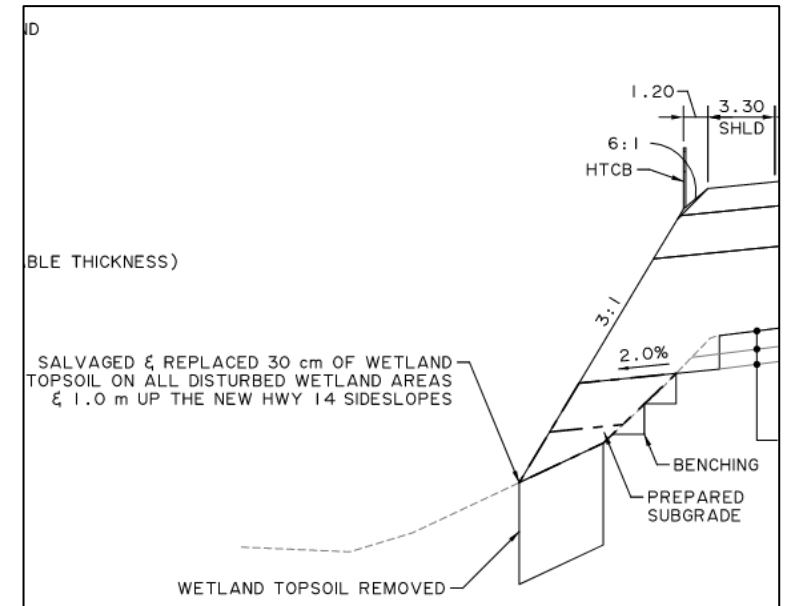
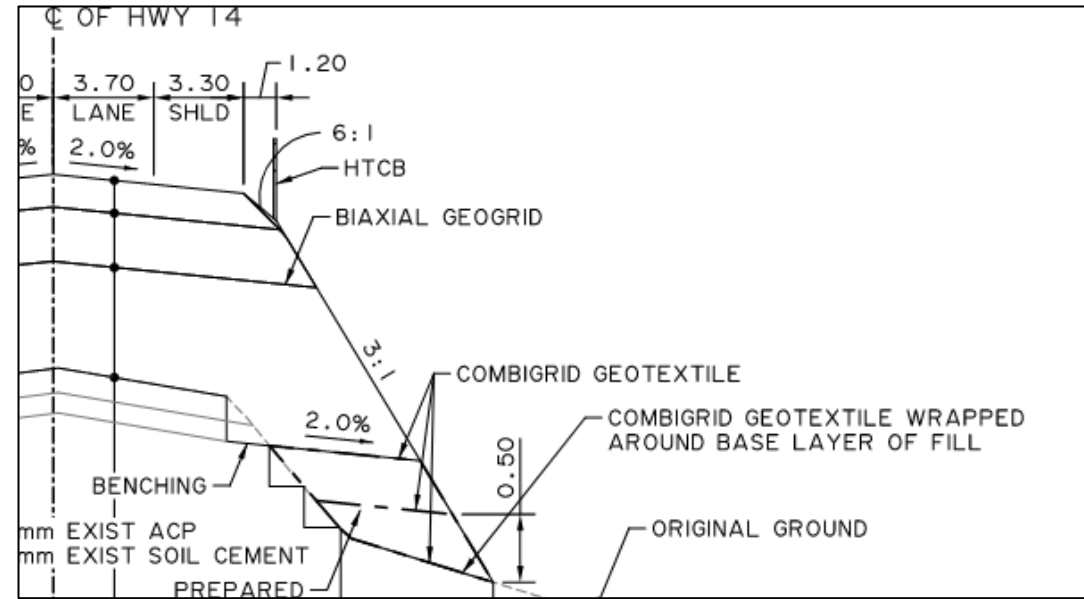




# Design Challenges & Considerations (cont.)

## Constructability Considerations:

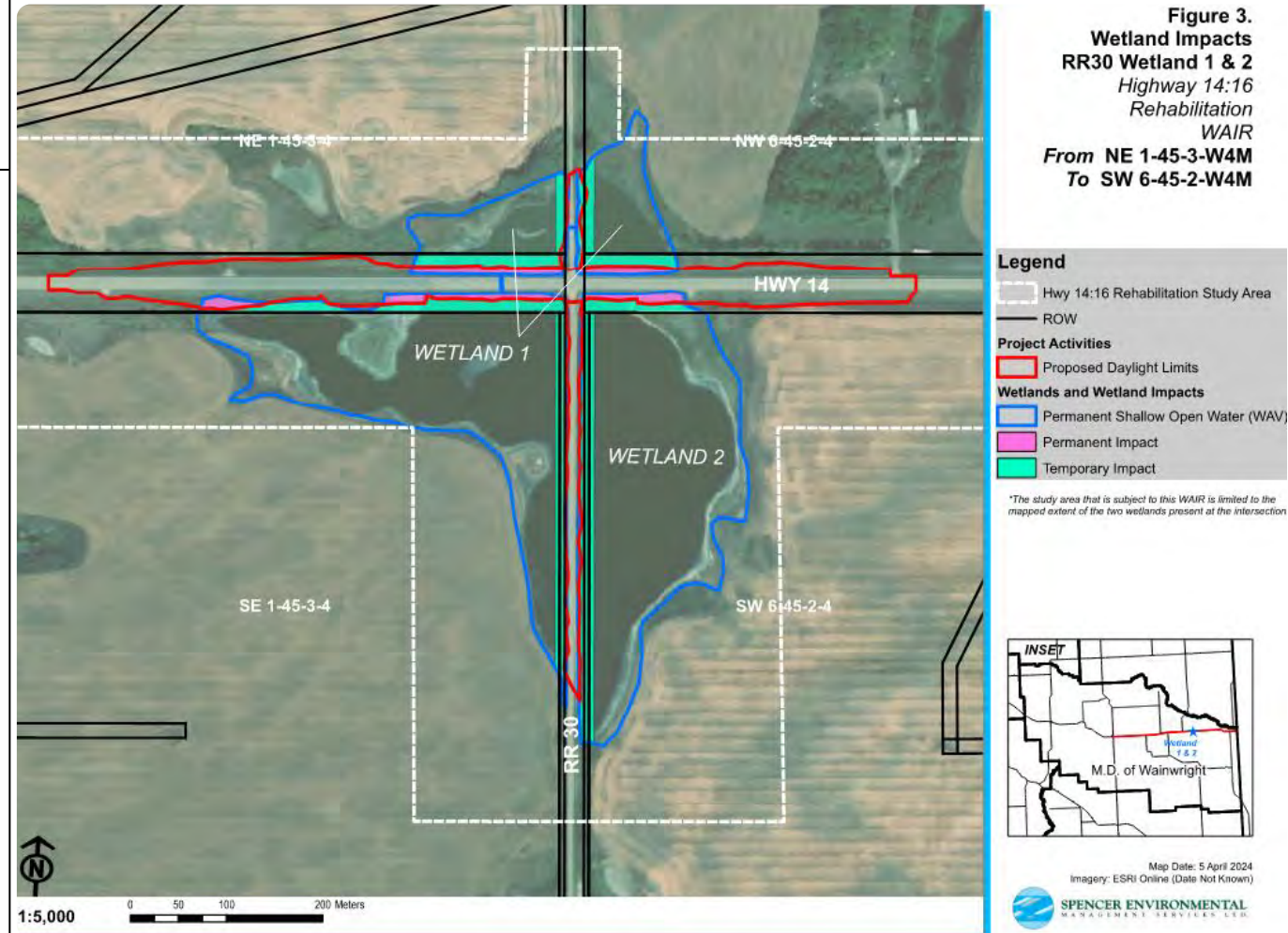
- Traffic Accommodation
  - No closure of Highway 14 or detours on local roads;
  - Highway 14 on OSOW (High Load) corridor.
- Base layer of subgrade
  - 0.5 m base layer with as much compaction as possible to support construction equipment;
  - Base layer to be wrapped with combigrid for strength and containment of layer;
  - Naue 60/60 combigrid selected.
- Isolation/Dewatering
  - Specified that water had to be managed along Highway 14 – construction could not occur in the wet;
  - Range Road 30 removal could occur in wet.
- Wetland organics
  - Needed to be salvaged and spread up toe of new slope per environmental requirements.



# Design Challenges & Considerations (cont.)

## Other Considerations:

- Environmental
  - Water Act and Temporary Field Authorization (TFA) required for wetland impacts;
  - Range Road 30 removal area becomes wetland and used to offset permanent impacts from roadwork;
  - Amphibian salvage/translocation required;
  - Full time biologist for work in wetland;
  - Wetland reclamation report required at end of construction.
- Public Consultation
  - Worked with MD of Wainwright;
  - Public notices on social media/MD website and letters sent to nearby landowners;
  - Presentations to council to justify physical removal of Range Road 30.





**3**

# **Construction Issues, Solutions & Lessons Learned**



# Construction Issues, Solutions & Lessons Learned

## Benching/Existing Unsuitable Material

- Organic layer discovered in undercuts along Highway 14;
- Discussions in early stages about benching vs removal of organic layer;
- TEC Grade Widening spec – Sideslopes shall be benched; vertical cuts for full depth of embankment not permitted;
- **Solutions**
  - Hoggan recommended benching depth of 1 m.
  - Top layer of cut (above organics) suitable for embankment construction.
  - Unsuitable material can be used at toes of fill.
- **Lessons Learned**
  - Address benching expectations in tender. Specify benching depth in tender and/or on drawings (Specs say Consultant specifies depth of benches).





# Construction Issues, Solutions & Lessons Learned (cont.)

## Combi-grid Product

- Naue 60/60 (ie 60 KN strength) specified in design
  - Specialized product, not readily available in Canada
- CG 3131 (ie 31 KN strength) brought to site and installed in base layers west of wetland area
- Issue identified by Stantec prior to work commencing in wetland area
- **Solutions**
  - Product performing well in dry areas away from water. Keep monitoring site conditions and increase layers of combi-grid as required.
- **Lessons Learned**
  - When specifying non-typical products, check on availability prior to tendering.
  - Confirm with Contractors prior to work commencing that they are ordering correct product.





# Construction Issues, Solutions & Lessons Learned (cont.)

## Base Layer

- 0.5 m base layer with combi-grid on bottom and wrapped around sides to support weight of construction equipment;
- Constructability concerns raised with wrapping of grid;
- Single layer seemed sufficient in dry areas;
- **Solutions**
  - Hoggan recommended not to wrap grid around outside of base layer. Grid can be extended up inside of bench.
  - Containment of base layer on outside achieved by not excavating all the way to design toe (leaving existing materials).
  - Number of layers of combi-grid to be determined on site. Expectation was that more layers would be needed once work began in wetland area.





# Construction Issues, Solutions & Lessons Learned (cont.)

## Embankment Construction Through Wetland

- Method of isolation proposed was to use earth material to hold water back;
- Wetland organics required to buffer clays (environmental requirement);
- Water levels lower during construction than observed in prior years;
- Base layer construction required 3-4 layers of combigrid, which ultimately worked in bridging soft/wet underlying materials.









# Construction Issues, Solutions & Lessons Learned (cont.)

## Amphibian Translocation

- Isolation of areas required for each quadrant/work zone;
- Capture and translocation of amphibians required until certain thresholds hit (<10% of max catch or several days of 0);
- Paid for in bid item per day that translocation occurred;
- Some ambiguity on Special Provision requirements and protected status of only species found (Barred Tiger Salamander);
- Much higher level of effort incurred than anticipated during tendering.
- **Lessons Learned**
  - Tender SP wording should not be ambiguous and should clearly state expectations around amphibian salvage;
  - Protected status of species found and criteria for stopping amphibian capture/translocation should be more explicitly stated by the Contractor's biologist and agreed to by all parties.





# Construction Issues, Solutions & Lessons Learned (cont.)

## Granular Fill and Granular Base Course Construction

- Material substitution proposed by Contractor to utilize Des 2 CI 25 material for granular fill (rather than Des 6 CI 80);
- Layers kept separate and paid separate even though material was the same;
- Substitution aided in traffic accommodation once gravel was placed on existing Highway 14 surface.













# Construction Issues, Solutions & Lessons Learned (cont.)

## Range Road 30 Removal

- Removal of Range Road 30 final step in construction;
- Existing Range Road 30 similar to Highway 14 – layer of non-organic material on top of layer of organics. Mixing of layers observed.
- Design assumed existing road material would be used in grade raise construction;
- Contractor offered a reduction in borrow quantity based on percentage of usable Range Road 30 material (site agreement).
- **Lessons Learned**
  - Tough to separate layers of good material from organics. Design quantities should have been more conservative in assuming how much material could be salvaged for embankment construction.











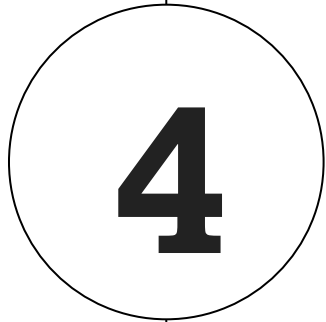












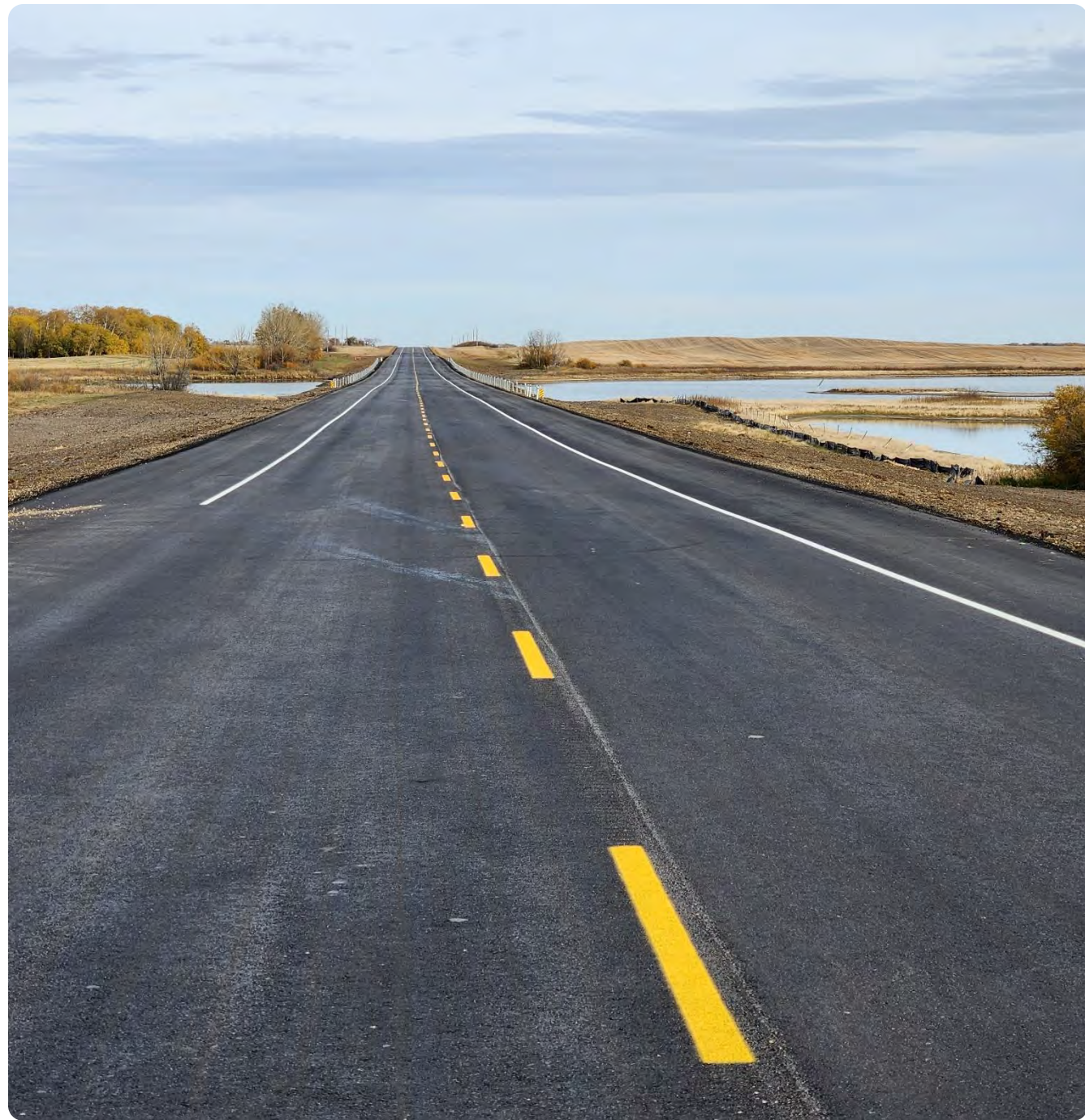
# Conclusion/ Q&A



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## Conclusion

- Highway 14 rehabilitation project included raising the grade of the highway at Range Road 30 to address flooding issues;
- Design needed to address the geometry of the grade raise (vertical profile and cross section), geotechnical and surfacing design, constructability, environmental and public consultation;
- Construction challenges related to combi-grid, benching, and base layer construction were managed through site discussions and directives from Stantec and Hoggan;
- Work through the wetland and the removal and reclamation of Range Road 30 went smoothly;
- Overall – A successful project!







# Thank you

## Any questions?

