

Erosion Ditch Repair
H614:02 and H894:04
Using ArmorMax System (an anchored reinforced vegetation system)
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Background

Severe ditch erosion was noted at two sites: H614:02 north ditch and H894:04 east ditch. The two sites are about 500m apart. The erosion has resulted in gullies almost 2m deep in some areas at both sites creating an unsafe slope at H614 and side slope erosion at H894.

The site conditions of both sites are similar in nature and soil materials are sandy and silty. The site was inspected in detail in 2009 at which time it was determined that repairs to these ditches were badly needed. If left unattended to further erosion would occur that might increase risks to the environment and to public safety.

H614:02 north ditch – the eroded ditch was 91m long with a 7.2% grade. In 2006, ditch scour was in the order of 1m to 1.5m; in 2009 erosion had doubled the scour size to more than 2m in some areas. The existence of sand intrusions within a mainly silty soil profile produces a highly erodible soil profile. Furthermore, this ditch borders the south edge of a farmer's canola field and would be a liability to the department should farm equipment roll into the erosion gully. Public safety would also be jeopardized should a vehicle or snowmobile drive along the ditch. With the steep 7% slope and the large ditch void there is potential danger of losing the roadway during large storm events. Added to the risk is the existence of a gas pipe line running across the ditch at the east end of the site.

H894:04 east ditch – the eroded ditch is 114m in length with a 5.4% grade. In 2006 the ditch displayed widespread erosion gulying and by 2009 the scoured area had doubled in size.

Mitigation Scheme

ArmorMax System

The steep grades and nature of the substrate soil dictated that a robust permanent repair was required. A review of several ESC Best Management Practices was undertaken, and a new product to Alberta Transportation, namely, ArmorMax Anchored Reinforced Vegetation System was chosen. ArmorMax provides robust protection of soil surfaces from two failure mechanisms: surface erosion and shallow plane instability due to both steel pins and duck-bill anchoring. This project also serves as a pilot project for a new materials as well as a demonstration to contractors and department staff the proper installation of an erosion control matting. The material manufacturer was on site full time supervising the installation to ensure the material was installed correctly.

The ArmorMax system comprises of a high performance Turf Reinforcement Mat (TRM) and percussion driven anchors. The matting is a 3-dimensional woven polypropylene geosynthetic and it exhibits high interlocking and reinforcement capacity with both soil and root systems. Percussion duck-billed anchors, connected by stainless steel cable and an end-lock device, are driven up to 700mm into the soil by using a Hilti percussion hammer which makes the installation easy and fast.

Construction

Organic material was removed before back filling and compaction with imported competent material. This was native non-organic soil extracted from a local farmer's property adjacent to the job site. The ditches were graded to a trapezoidal cross-section with 4:1 side slopes. A 300mm x 300mm trench was dug at all 4 sides of the ditch to allow for edge embedding and anchoring of the matting. Properly burying the edge in the trench will prevent unraveling of the matting due to runoff. Seed and fertilizer was applied after grading was complete. Starter rolls were keyed in at the bottom of the ditch and worked uphill in order to minimize runoff erosion to the lower ditch due to flash storms. Roll overlap was 300mm. The matting was anchored with 2 types of pins: deep duck-bill anchors at overlap and edge locations and 500mm x 5mm steel rods also at manufacturer prescribed grid locations. A backhoe was used to "knuckle" the trenched keys to compaction. At the H894 site, riprap was placed at the culvert to form a stilling basin.

Georidge, a synthetic ditch check, was installed at 3.5m intervals in the ditches above the ArmorMax material. Finally, Flexterra, a hydromulch that has synthetic fibers embedded to improve adhesion, in addition to natural fibers and tackifier, was sprayed on the matting and all disturbed surfaces. Zone 5 seed was included in the hydromulch. Flexterra hydromulch was applied in 4 stages to ensure that all openings of the 3-dimensional matting were filled and covered. The site will be monitored closely in spring melt and intense rainfall for performance in erosion control and for grass growth.

	Ditch length	Matting row widths	Installation time	Labour
H614:02	90 m	3	10 hr.	8 men
H894:04	123 m	2	14 hr.	8 men

Table: ArmorMax installation - time and labour

Conclusion

The total cost of the project, including hydromulching was \$136,000.

The work was done through the maintenance contractor, Carillion for CMA16. They mastered the installation procedure quickly and the application of the ArmorMax product was done expeditiously. Site preparation took up the majority of the project time. In all, the project took 4 days. The application of the product is labour intensive as the pin and anchor pattern is tight. The ground conditions in September made hammering the pins slow due to dry, hard packed material.

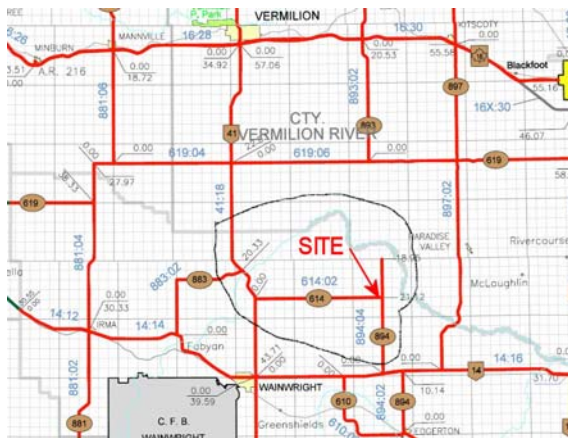
All in all, the project went without a hitch. The sites have been monitored regularly by Carillion and district staff since installation. ArmorMax was found to perform very well on this 7% ditch. No ditch erosion has been noticed and grass catch is full. GeoRidge barriers will be removed in coming months.

If there are questions regarding this article please contact:

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Photos



Project location



H894:04 - 2006



H614:02 – 2006



H 614:02 - prior to Construction



H614:02 – 2009 During construction



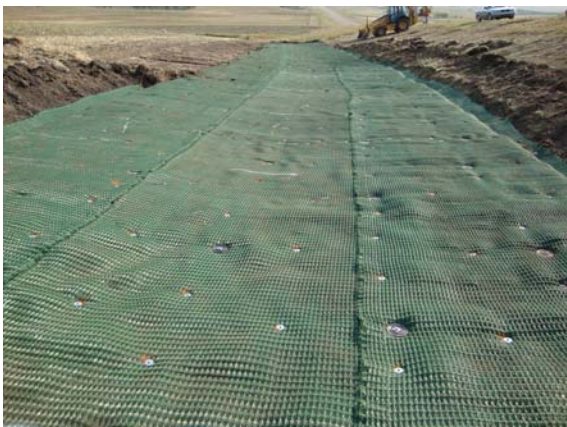
H894:04 – 2009 During construction



H614:02 - Placement of anchor pins



Hilti hammering the duckbill anchors



H614:02



H894 - May 2012



H894 - May 2012



H894 - May 2012



H614 - May 2012



H614 - May 2012



H614 - May 2012



H614 - May 2012