



Appendix D

Fluvial Geomorphology

APPENDIX D-1
Meander Belt Mapping
Updated August 2017



FIGURE D-1-1 Meander belt delineation for Hornby Tributary reaches



FIGURE D-1-2 Meander belt delineation for Middle Sixteen Mile Creek Tributary reaches

APPENDIX D-2
Headwater Drainage Feature Assessment Memo
June 3, 2016



A Division of Matrix Solutions Inc.

June 3, 2016

Matrix 21510-522

Mr. Ron Scheckenberger
AMEC FOSTER WHEELER
3215 North Service Rd
Burlington, ON L7N 3G2

Subject: Results of Headwater Drainage Feature Assessment for Premier Gateway Scoped Subwatershed Study

Dear Mr. Scheckenberger

A headwater drainage feature (HDF) assessment was undertaken as part of the Premier Gateway Scoped Subwatershed Study. The assessment was initiated in 2015, however due to timing of project initiation and permission to enter information, only the 'second visit' as outlined in the TRCA/CVC (2014) protocol was completed. To establish complete characterization of the HDFs, the 'first visit' was completed during the appropriate timing window in March 2016. Due to the delay in completion of the assessment, from 2015 to 2016, results were not included in the Phase 1: Study Area Characterization which was issued February 2016. The results and documentation from the assessment are presented in the following memorandum and appendices.

Following the guidance of the TRCA/CVC protocol, the HDFs were visited on two separate occasions (no feature required three visits). As outlined in the Phase 1 report, the timing of the visits was based on the three visit recommendation set out in the TRCA/CVC protocol. The visits were completed as outlined below.

1. May 28, 2015 - initial visits were conducted during the Site Visit #2 timing window in 2015. All features were visited during this visit with the exception of HDF-1, HT-2b-4 (a and b), and W-T1-2b.
2. July 3, 2015 - visit conducted during the Site Visit #3 timing window in 2015. Only HDF-1 and W-T1-2b were visited on this date, based on conditions during the assessment it was determined that a Site Visit #2 would be superfluous for these features and was not needed in 2016.
3. March 8, 2016 - all features were visited on this date to serve as Site Visit #1. Due to unseasonably warm winter conditions, this is somewhat earlier than the normal freshet visit (late March-April). A melt event occurred on this date as a result of snowfall accumulation occurred over the previous week followed by warming temperatures (high of 11.6° Celsius on March 8, 2016). Typically, Site Visit #1 is conducted a few days after the freshet to allow for melt of the snow pack

and runoff. To compensate for a smaller snowpack in 2016, the Site Visit #1 was conducted closer to the melt event. However, this may have resulted in somewhat higher flows than would normally be anticipated for a typical Site Visit #1.

4. May 25, 2016 - this served as the Site Visit #2 for HT-2b-4 (a and b) because access was not available in 2015 during the proper timing window.

The goal of the TRCA/CVC protocol is to objectively classify those features on the landscape which are not considered permanent watercourses but appear to serve some hydrologic, terrestrial, riparian, or aquatic function. Due to the subjective, ill-defined nature of these features, the protocol at times does not appear to adequately capture their function and importance. It is understood that a protocol can never address or anticipate all possible scenarios that may arise in the field. Therefore, to address this two management recommendations have been provided for the features: one based on strict adherence to the TRCA/CVC protocol (protocol management recommendation), and a second based on the protocol results and interpretation of overall function and importance of the feature to the system (final management recommendation). This helps to address features that are particularly complex or difficult to interpret. Both recommendations have been shown in the summary table (Appendix A), along with specific notes and rationale, and in separate mapping (Appendix B).

There were a few features which were particularly complex that warrant additional discussion within this section. Original mapping for HT-2b-4 (shown as a dashed blue line in Appendix B) is located in a low-lying area adjacent to an active agricultural field. During Site Visit #1, drainage that would be directed to the original drainage line was pooling along the edge of the agricultural fields as a result of furrowing and altered drainage. An additional line therefore was added to indicate where the water is primarily draining due to modification of the landscape (this is labelled HT-2b-4 in Appendix B). Additionally, at Steeles Avenue there is a culvert which appears to outlet drainage from the roadway (Photo 42 and 49, Appendix C). Based on Site Visit #1, this outlet does not appear to connect to the drainage along the agricultural fields and was primarily ponded within 100 m of the outlet.

Drainage mapping for W-T1-2b indicates that it should flow straight in a north-south direction. During Site Visit #1 it was noted that within Segment 1 (S1), the feature made a 90 degree turn at the property line and then drained toward Sixth Line as opposed to continuing southward (Photo 136, Appendix C). The drainage line has been modified to show this in the mapping (Appendix B). The connection between S1 and Segment 3 (S3) is unclear due to a lack of access to the properties on which Segment 2 is located. At the upstream end of S3, minimal surface flow was noted during Site Visit #1 (Photo 139, Appendix C). Modified drainage made it difficult to determine connectivity and drainage within this feature. Based on upstream (S1) and downstream (S3) conditions and review of aerial photography, the majority of S2 can be given a preliminary management recommendation of 'Mitigation' (Appendix A). Currently, the break between S2 and S3 coincides with the property boundary to indicate where the segment of W-T1-2b which could not be accessed (shown in Figure 3, Appendix B). The downstream end of S2 should be considered part of S3 due to consistent riparian vegetation (scrubland) and would therefore receive the recommendation of 'Conservation' (shown in Figure 4, Appendix B).

The management recommendations from the protocol listed in order of importance (high to low) are Protection, Conservation, Mitigation, Recharge, Protection, Maintain or Replicate Terrestrial Linkage, and No Management Required. A brief description, taken directly from the protocol, of each recommendation is provided below to aid in interpretation.

Protection - Important Functions: e.g. swamps with amphibian breeding habitat; perennial HDFs; seeps and springs; Species at Risk habitat; permanent fish habitat with woody riparian cover

- Protect and/or enhance the existing feature and its riparian zone corridor, and groundwater discharge or wetland in-situ.
- Maintain hydroperiod.
- Incorporate shallow groundwater and baseflow protection techniques such as infiltration treatment.
- Use natural channel design techniques or wetland design to restore and enhance existing habitat features, if necessary; realignment not generally permitted.
- Design and locate the stormwater management system (e.g. Extended detention outfalls) are to be designed and located to avoid impacts (i.e. Sediment, temperature) to the feature.

Conservation - Valued Functions: e.g. seasonal fish habitat with woody riparian cover; marshes with amphibian breeding habitat; or general amphibian habitat with woody riparian cover.

- Maintain, relocate, and/or enhance drainage feature and its riparian zone corridor.
- If catchment drainage has been previously removed or will be removed due to diversion of stormwater flows, restore lost functions through enhanced lot level controls (i.e. Restore original catchment using clean roof drainage), as feasible.
- Maintain or replace on-site flows using mitigation measures and/or wetland creation, if necessary.
- Maintain or replace external flows.
- Use natural channel design techniques to maintain or enhance overall productivity of the reach.
- Drainage feature must connect to downstream.

Mitigation - Contributing Functions: e.g. contributing fish habitat with meadow vegetation or limited cover

- Replicate or enhance functions through enhanced lot level conveyance measures, such as well-vegetated swales (herbaceous, shrub and tree material) to mimic online wet vegetation pockets, or replicate through constructed wetland features connected to downstream.
- Replicate on-site flow and outlet flows at the top end of system to maintain feature functions with vegetated swales, bioswales, etc. If catchment drainage has been previously removed due to diversion of stormwater flows, restore lost functions through enhanced lot level controls (i.e. restore original catchment using clean roof drainage).
- Replicate functions by lot level conveyance measures (e.g. vegetated swales) connected to the natural heritage system, as feasible and/or Low Impact Development stormwater options (refer to Conservation Authority Water Management Guidelines for details).

Recharge Protection - Recharge Functions: e.g. features with no flow with sandy or gravelly soils

- Maintain overall water balance by providing mitigation measures to infiltrate clean stormwater, unless the area qualifies as an Area of High Aquifer Vulnerability under the Oak Ridges Moraine Conservation Plan or Significant Recharge Areas under the Source Water Protection Act. These areas will be subject to specific policies under their respective legislation.
- Terrestrial features may need to be assessed separately through an Environmental Impact Study to determine whether there are other terrestrial functions associated with them.

Maintain or Replicate Terrestrial Linkage - Terrestrial Functions: e.g. features with no flow with woody riparian vegetation and connects two other natural features identified for protection

- Maintain the corridor between the other features through in-situ protection or if the other features require protection, replicate and enhance the corridor elsewhere
- If the feature is wider than 20 m, it may need to be assessed separately through an Environmental Impact Study to determine whether there are other terrestrial functions associated with it.

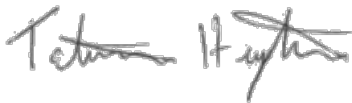
No Management Required - Limited Functions: e.g. features with no or minimal flow; cropped land or no riparian vegetation; no fish or fish habitat; and no amphibian habitat.

- The feature that was identified during desktop pre-screening has been field verified to confirm that no feature and/or functions associated with HDFs are present on the ground and/or there is no connection downstream. These features are generally characterized by lack of flow, evidence of cultivation, furrowing, presence of a seasonal crop, and lack of natural vegetation. No management recommendations required.

We trust that this memorandum suits your present requirements. If you have any questions or comments, please feel free to contact us.

Yours truly,

PARISH AQUATIC SERVICES



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TH/ap

REFERENCES

Toronto and Region Conservation Authority and Credit Valley Conservation. 2014. Evaluation, Classification, and management of headwater drainage features guideline. TRCA Approval July 2013 (Finalized January 2014).

DISCLAIMER

We certify that this letter report is accurate and complete and accords with the information available during the site investigation. Information obtained during the site investigation or provided by third parties is believed to be accurate but is not guaranteed. We have exercised reasonable skill, care and diligence in assessing the information obtained during the preparation of this letter report.

This letter report was prepared for AMEC Foster Wheeler. The letter report may not be relied upon by any other person or entity without our written consent and that of AMEC Foster Wheeler. Any uses of this letter report by a third party, or any reliance on decisions made based on it, are the responsibility of that party. We are not responsible for damages or injuries incurred by any third party, as a result of decisions made or actions taken based on this letter report.

APPENDIX A
Headwater Drainage Feature
Summary Table

Drainage Feature Segment	Segment Code	Step 1 Hydrology	Modifiers	Step 2 Riparian	Step 3 Fish Habitat	Step 4 Terrestrial Habitat	Protocol Management Recommendation	Final Management Recommendation	Notes/ Rationale
HT-2b-3b	S1	Contributing	Ag	Limited (code 3)	Contributing	Limited	Mitigation	No Management	Higher flow than normally anticipated due to timing of first visit. Modified through agricultural usage. Feature could not be located on second visit.
HT-2b-3a	S1	Limited or recharge	Ag	Limited (code 3)	Contributing	Limited	No Management	No Management	Higher flow than normally anticipated due to timing of first visit. Modified through agricultural usage. Feature could not be located on second visit.
HT-2b-3	S1	Contributing	Ag	Valued (code 4)	Contributing	Limited	Mitigation	Mitigation	Larger feature. Presence of healthy vegetation on second visit indicative of wetter conditions later into the dry season.
HT-2b-2	S1	Contributing		Important (code 7)	Contributing	Limited	Conservation	Conservation	Management recommendation is "Conservation" due to "important" riparian vegetation consisting of wetland and scrubland.
	S2	Contributing		Valued (code 4)	Contributing	Limited	Mitigation	Conservation	Mitigation recommendation based on hydrology. Recommendation is increased to "Conservation" as a result of higher classification in upstream segment.
	S3	Contributing		Valued (code 4)	Contributing	Limited	Mitigation	No HDF recommendation, segment has been upgraded to 'watercourse'	Receives a "Mitigation" classification based on hydrology. Standing water at downstream end of segment (Site Visit #2), defined bed/banks through length of segment, and gravel substrates on the bed suggest that this is a permanent feature of higher importance. Segment is classified as a 'watercourse' consistent with segment downstream of Trafalgar Road.
HT-2b-4	S1	Limited or recharge	Ag	Limited (code 3)	Contributing	Limited	No Management	No Management	No management based on standing water at the first visit as a result of water pooling at the downstream end of the agricultural field.
	S2	Limited or recharge	Ag	Limited (code 3)	Contributing	Limited	No Management	Conservation	No management based on hydrology. This segment had defined bed/banks approaching the Trafalgar Road culvert and gravel substrate suggesting higher importance. Management recommendation was increased to "Conservation".
HT-2b-4b	S1	Limited or recharge	Ag	Limited (code 3)	Contributing	Limited	No Management	No Management	Based on hydrology, standing water at the first visit. Feature appears to be cut through furrowing to help drain the fields in the spring.
HT-2b-4a	S1	Limited or recharge	Ag	Limited (code 3)	Contributing	Limited	No Management	No Management	Based on hydrology, standing water at the first visit. Feature appears to be cut through furrowing to help drain the fields in the spring.

Drainage Feature Segment	Segment Code	Step 1 Hydrology	Modifiers	Step 2 Riparian	Step 3 Fish Habitat	Step 4 Terrestrial Habitat	Protocol Management Recommendation	Final Management Recommendation	Notes/ Rationale
E-T1-4	S1	Contributing		Limited (code 3)	Contributing	Limited	Mitigation	Conservation	Management recommendation is "Mitigation" based on hydrology. Based on the amount of flow noted at Site Visit #1, historic aerial photos, and conditions upstream of the study area, the management recommendation has been increased to "Conservation". It is noted that upstream of the golf course the feature appears to be a defined watercourse based on a review of aerial photography. Modification by the golf course has made this feature difficult to assess fully. It is thought that with removal of the golf course this could potentially be a more significant feature than it currently appears to be, based on upstream conditions.
	S2	Valued		Important (code 5)	Contributing	Limited	Conservation	Protection	Management recommendation is "Conservation" due to surrounding riparian vegetation dominated by scrubland. Management recommendation is increased to "Protection" as a result of both defined bed and banks and standing water at Site Visit #2, suggesting more permanence and importance hydrologically.
HDF-1	S1	Important	Golf course ponds outlet at upstream end	Valued (code 4)	Contributing	Valued	Protection	Conservation	Management recommendation is "Protection" based on "important" hydrology classification as a result of water during Site Visit #3. Terrestrial habitat is "valued" due to presence of tadpoles in isolated pool during Site Visit #3. Management recommendation is reduced to "Conservation" as the golf course ponds outlet to the feature and it is unclear how this impacts the natural hydrology of the feature.
	S2	Important		Valued (code 4)	Contributing	Valued	Protection	Conservation	Management recommendation is "Protection" based on "important" hydrology classification as a result of water during Site Visit #3. Terrestrial habitat is "valued" due to presence of tadpoles in isolated pool during Site Visit #3. Management recommendation is reduced to "Conservation" as the golf course ponds outlet to the feature and it is unclear how this impacts the natural hydrology of the feature.
HDF-2	S1	Contributing	Outlet from west to east pond	Limited (code 3)	Contributing	Limited	Mitigation	No Management	Management recommendation is based on hydrology. This feature is a small swale that connects the west golf course pond to the east golf course pond; therefore, hydrology is a result of the pond water levels. Suggest reducing recommendation to "No Management".

Drainage Feature Segment	Segment Code	Step 1 Hydrology	Modifiers	Step 2 Riparian	Step 3 Fish Habitat	Step 4 Terrestrial Habitat	Protocol Management Recommendation	Final Management Recommendation	Notes/ Rationale
HDF-3	S1	Limited or recharge		Limited (code 3)	Contributing	Limited	No Management	No Management	Standing water at Site Visit #1, no management required.
HDF-4	S1	Contributing		Limited (code 3)	Contributing	Limited	Mitigation	No Management	Management recommendation of "Mitigation" is based on hydrology. Difficult to determine management due to potentially altered drainage on golf course, suggested that "No Management" recommendation.
HDF-4a	S1	Limited or recharge		Limited (code 3)	Contributing	Limited	No Management	No Management	Standing water at site visit 1, no management required.
W-T1-2b	S1	Contributing	Ag	Limited (code 3)	Contributing	Limited	Mitigation	Mitigation	Management recommendation of "Mitigation" based on hydrology.
	S2	Contributing*		Contributing* (code 2)	Contributing*	Limited*		Mitigation*	Management recommendation of "Mitigation" based on hydrology.
	S3	Contributing		Important (code 5)	Contributing	Contributing	Conservation	Conservation	Management recommendation of "Conservation" based on "important" riparian vegetation classification due to scrubland.

*Hydrology and fish habitat for W-T1-2b (S2) were based on the up- and down- stream classification, while riparian and terrestrial were based on a review of aerial photographs. Final management recommendation is preliminary based on a lack of field confirmation.

APPENDIX B
Headwater Drainage Feature
Management Recommendation Maps

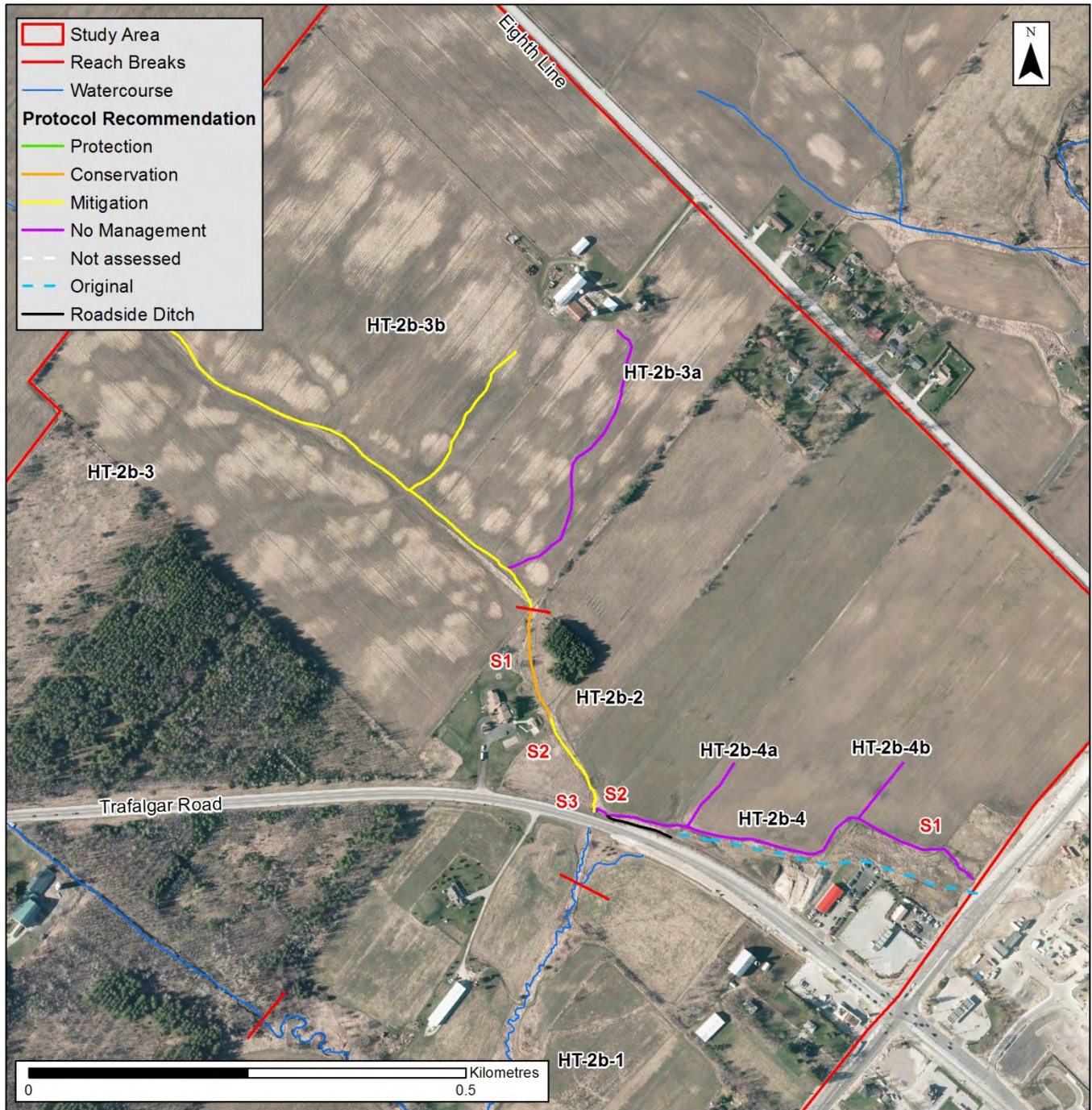


Figure 1 – Protocol Management Recommendations for HDFs in Eastern Portion of Study Area.

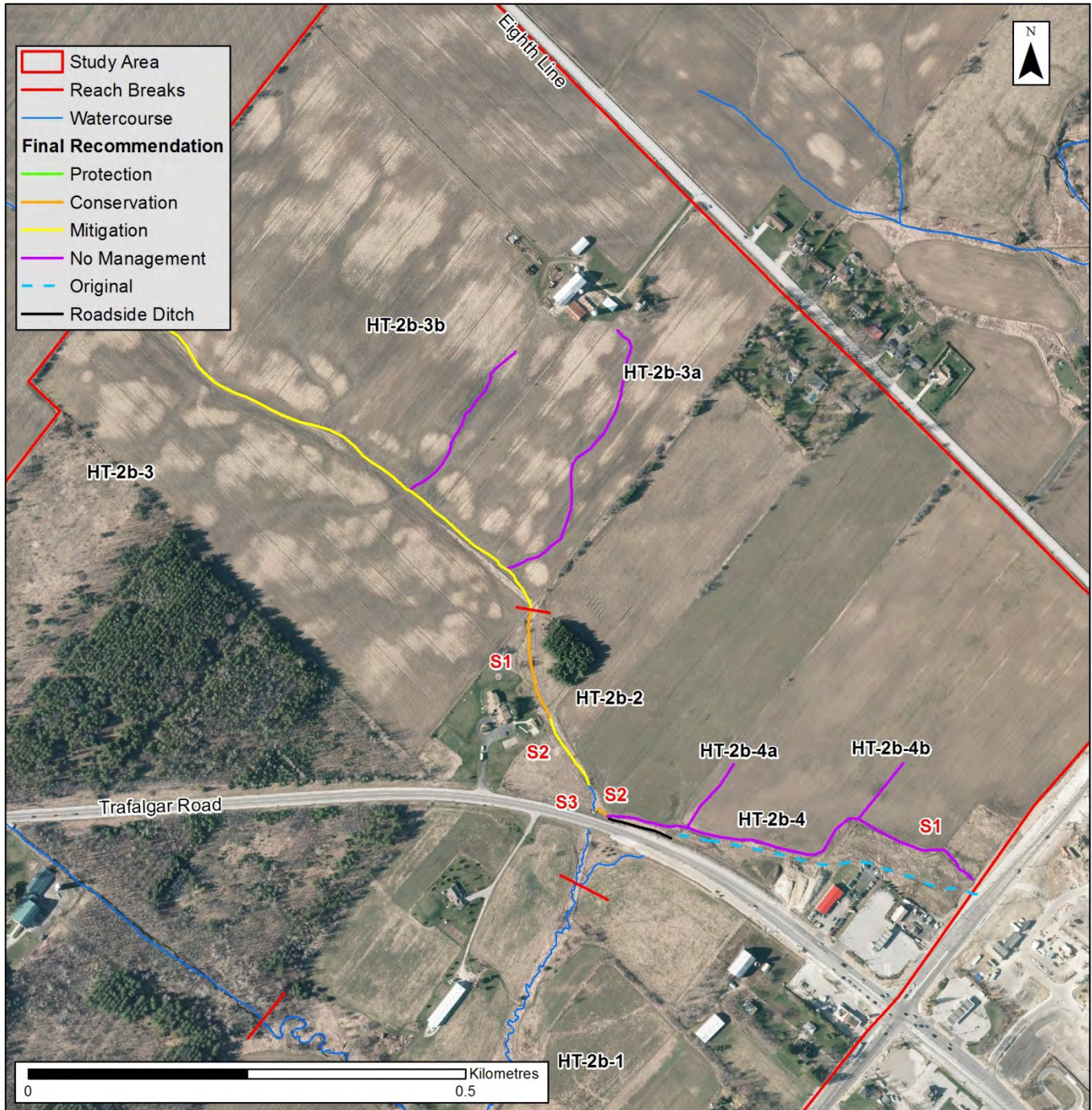


Figure 2 – Final Management Recommendations for HDFs in Eastern Portion of Study Area

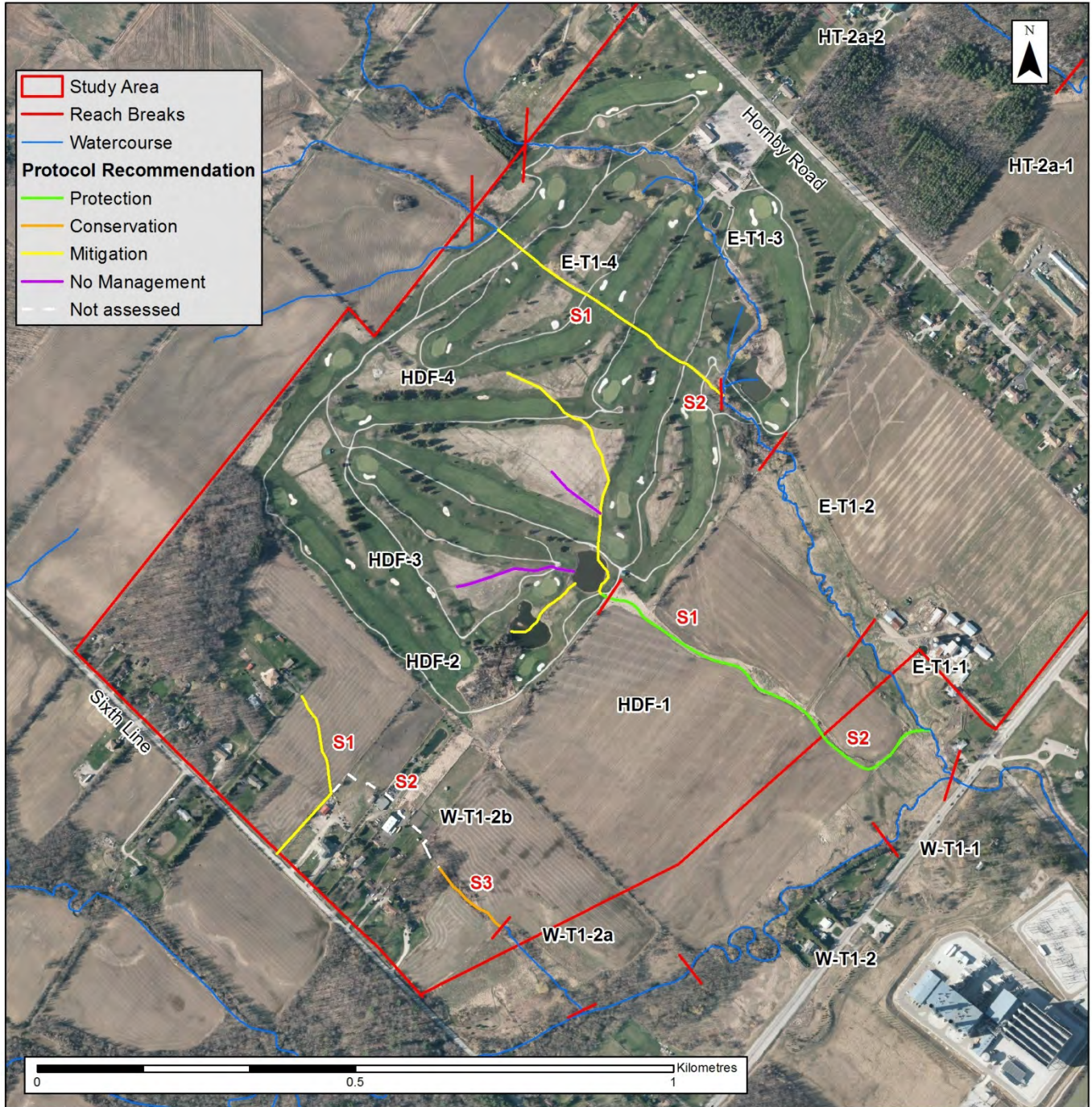


Figure 3 - Protocol Management Recommendations for HDFs in Western Portion of Study Area

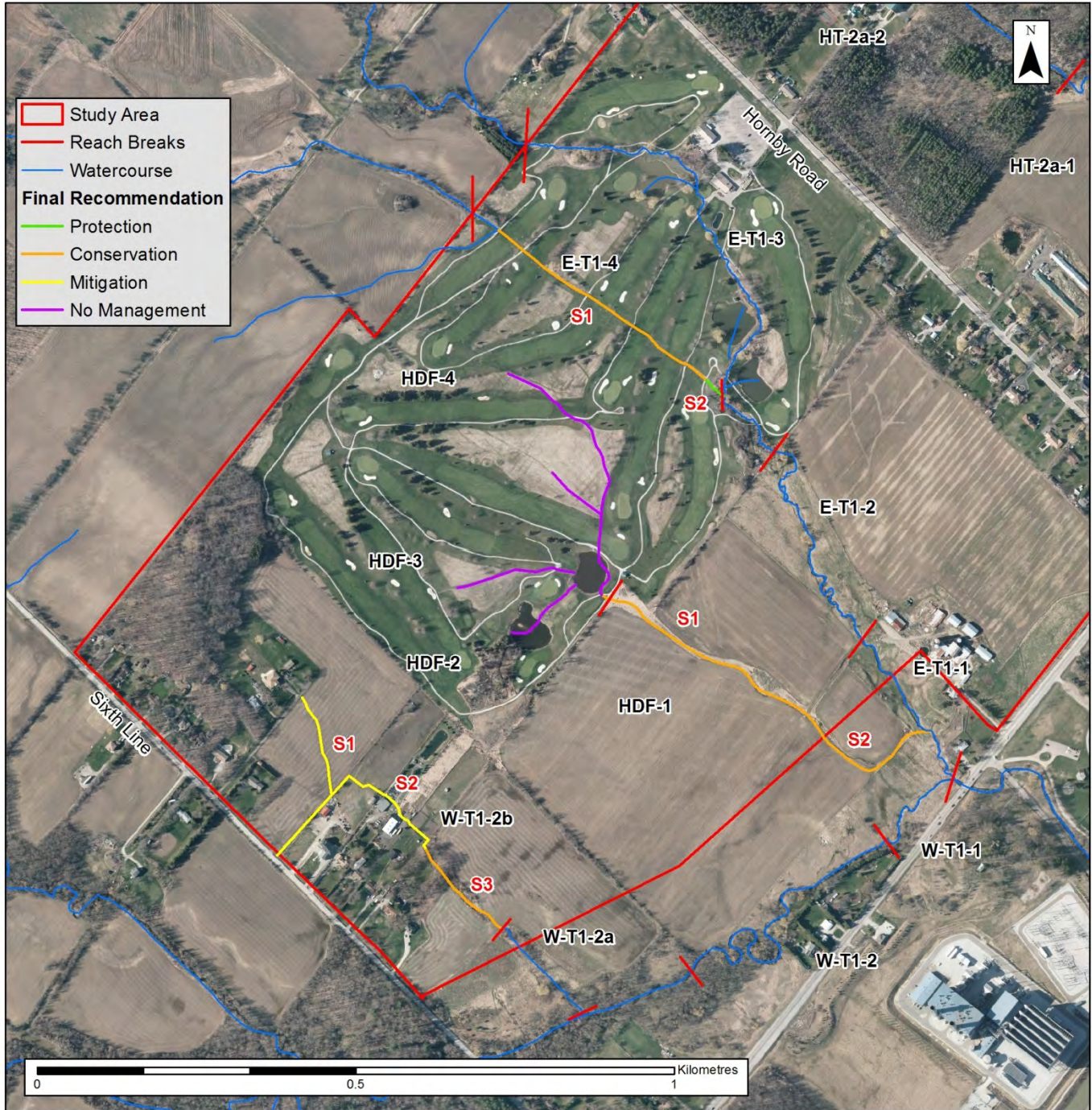


Figure 4 - Final Management Recommendations for HDFs in Western Portion of Study Area

APPENDIX C
Headwater Drainage Feature
Assessment Photographs



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

1. **HT -2b -3b.** At upstream end of feature where flow begins to follow defined flow path. Facing upstream. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

2. **HT -2b -3b.** Mid -feature, facing upstream. Note defined flow path and some development of sinuosity. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

3. **HT -2b -3b.** Near downstream end of feature, facing upstream. Feature type is swale and flow condition is surface flow minimal. Feature had sinuosity development and transport of fine sediments.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

4. **HT -2b -3b.** Downstream end of feature where it meets HT -2b -3, flow disperses. Feature type is swale and flow condition is surface flow minimal. Yellow arrow indicates direction of flow.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

5. **HT -2b -3b.** Area where feature would be located facing upstream. Feature type is swale, flow condition is dry. **Management recommendation: No Management**



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

6. **HT -2b -3a.** Upstream end of feature, facing upstream. Feature type is swale and flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

7. **HT -2b -3a.** Mid -feature, facing upstream. Water is primarily standing and does not have a well-defined flow path. Feature type is swale and flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

8. **HT -2b -3a.** Approaching downstream end, facing upstream. Flow becomes more defined as it approaches confluence with HT -2b -3. Feature type is swale and flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

9. **HT -2b -3a.** Downstream end where feature meets HT -2b -3. Feature type is swale and flow condition is standing water. Yellow arrow indicates direction of flow.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

10. **HT -2b -3a.** Facing upstream in vicinity of feature. No depression was visible. Flow condition was no surface water and feature type was swale. **Management Recommendation: No management required.**



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March 8, 2016 (Site Visit 1)*

11. HT -2b -3. Standing water adjacent to vegetation and cropland at upstream end of feature.
Feature type is no defined feature (overland flow only) and flow condition is surface flow minimal.



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March 8, 2016 (Site Visit 1)*

12. HT -2b -3. Standing water adjacent to vegetated area and cropland, near upstream end. Feature type is no defined feature (overland flow only) and flow condition is surface flow minimal.



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March 8, 2016 (Site Visit 1)*

13. HT -2b -3. Water on either side of vegetated area between two crop fields. Facing upstream. Feature type is no defined feature (overland flow only) and flow condition is surface flow minimal.



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March 8, 2016 (Site Visit 1)*

14. HT -2b -3. Near downstream end of feature, facing upstream. Flow is more spread out over flatter area. Feature type is no defined feature (overland flow only) and flow condition is surface flow minimal.



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15. HT -2b -3. Downstream end of feature, ponded water on either side of vegetation area, facing upstream. Feature type is no defined feature (overland flow only) and flow condition is surface flow minimal.



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May 28, 2015 (Site Visit 2)*

16. HT -2b -3. Near upstream end of feature, facing upstream. Vegetated buffer area between two crop fields. Feature type is no defined feature (overland flow only) and flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

17. HT -2b -3. Facing upstream, within vegetated area. Note narrow depression in center of photo. Feature type is no defined feature (overland flow only) and flow condition is no surface water.



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May 28, 2015 (Site Visit 2)*

18. HT -2b -3. Facing upstream, near downstream end of feature. Feature type is no defined feature (overland flow only) and flow condition is no surface water.



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19. **HT -2b -3.** Facing upstream and downstream extent of feature. Feature type is no defined feature (overland flow only) and flow condition is no surface water. **Management Recommendation:**
Mitigation



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20. **HT -2b -2 (Segment 1).** At upstream end of feature where water flows off agricultural fields upstream. Maximum water depth was at upstream end where water was pooling in several locations (max depth approx. 20cm). Feature type is multi -thread and flow condition is surface flow substantial.



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March 8, 2016 (Site Visit 1)*

21. HT -2b -2 (Segment 1). Facing downstream, multiple poorly defined flow paths. Feature type is multi -thread and flow condition is surface flow substantial.



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March 8, 2016 (Site Visit 1)*

22. HT -2b -2 (Segment 1). Facing upstream at downstream end of Segment. Multiple poorly defined flow paths upstream of small pedestrian boardwalk on property. Feature type is multi -thread and flow condition is surface flow substantial.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

23. HT -2b -2 (Segment 1). Upstream end of feature, facing downstream from property boundary. No defined depression or flow path, no water present. Feature type is multi -thread and flow condition is no surface water.



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May 28, 2015 (Site Visit 2)*

24. HT -2b -2 (Segment 1). Facing upstream within feature. Note dead grass patches indicating previous flow paths. Feature type is multi -thread and flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

- 25. HT -2b -2 (Segment 1).** Facing upstream from downstream end of Segment towards area of wetland vegetation (cattails). Numerous depressions indicative of multi -thread flow during spring freshet. Feature type is multi -thread and flow condition is no surface water. **Management Recommendation: Conservation (based on riparian vegetation)**



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

- 26. HT -2b -2 (Segment 2).** Upstream end of Segment, facing downstream. Downstream of boardwalk crossing flow is more focused into single channel. Feature type is swale and flow condition is surface flow substantial.



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27. HT -2b -2 (Segment 2). Facing upstream, mid -Segment. Feature type is swale and flow condition is surface flow substantial.



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March 8, 2016 (Site Visit 1)*

28. HT -2b -2 (Segment 2). Facing downstream at end of Segment. Feature type is swale and flow condition is surface flow substantial.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

29. HT -2b -2 (Segment 2). Upstream end of Segment located at small boardwalk. Visible depression through this Segment. Feature type is swale and flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

30. HT -2b -2 (Segment 2). Within Segment, facing upstream. Note dead grass indicative of swale depression. Feature type is swale and flow condition is no surface water.



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May 28, 2015 (Site Visit 2)*

31. HT -2b -2 (Segment 2). Downstream end of Segment, facing downstream. Tree indicates transition to Segment 3. Feature type is swale and flow condition is no surface water. **Management Recommendation: Conservation**



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

32. HT -2b -2 (Segment 3). Upstream end of Segment where feature transitions into feature type defined natural channel (visible banks). Flow condition is surface flow substantial.



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March 8, 2016 (Site Visit 1)*

33. HT -2b -2 (Segment 3). Facing downstream to culvert at Trafalgar Road, note overhanging grasses. Feature type is defined natural channel (visible banks); flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

34. HT -2b -2 (Segment 3). Facing downstream to culvert at Trafalgar Road, note well -defined channel banks. Feature type is defined natural channel (visible banks); flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

35. HT -2b -2 (Segment 3). Downstream end of Segment where feature enters Trafalgar Road culvert. Feature type is defined natural channel (visible banks); flow condition is surface flow substantial.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

36. HT -2b -2 (Segment 3). Upstream end of feature at tree where channel bed becomes defined. The feature is primarily dry through the length of the Segment with some very isolated standing water. Feature type is defined natural channel (visible banks); flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

37. HT -2b -2 (Segment 3). Facing downstream towards culvert at Trafalgar Road. Feature type is defined natural channel (visible banks); flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

38. HT -2b -2 (Segment 3). Gravel bed substrates within Segment 3. Feature type is defined natural channel (visible banks); flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

39. HT -2b -2 (Segment 3). Facing upstream at downstream end of Segment. Note channel is dry within this section. Feature type is defined natural channel (visible banks); flow condition is no surface water



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

40. HT -2b -2 (Segment 3). Standing water was only noted at downstream end of Segment immediately upstream of culvert. Feature type is defined natural channel (visible banks); flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

41. HT -2b -2 (Segment 3). Standing water in culvert, downstream end of Segment. Feature type is defined natural channel (visible banks); flow condition is no surface. **Management Recommendation: None. Feature is classified as a Watercourse**



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

42. HT -2b -4 (Segment 1). Culvert at Steeles Avenue upstream end of feature. Feature type is no defined feature (overland flow only); flow condition was standing water.



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March 8, 2016 (Site Visit 1)*

43. HT -2b -4 (Segment 1). Facing upstream towards Steeles Avenue. Lack of flow or well -defined single flow path. Feature type is no defined feature (overland flow only) and flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

44. HT -2b -4 (Segment 1). Standing at base of agricultural field where water had ponded facing Steeles Avenue. Feature type is no defined feature (overland flow only) and flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

45. HT -2b -4 (Segment 1). Facing upstream towards Steeles Avenue. Water is more concentrated into modified channel. Feature type is no defined feature (overland flow only); flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

46. HT -2b -4 (Segment 1). Facing downstream to large ponded area where water runs off the fields. Feature type is no defined feature (overland flow only); flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

47. HT -2b -4 (Segment 1). Facing upstream, ponded water draining off the fields toward roadside ditch. Feature type is no defined feature (overland flow only); flow condition standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

48. Roadside ditch along Trafalgar adjacent HT -2b -4 (Segment 1). Standing water.



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

49. HT -2b -4 (Segment 1). Upstream end of feature at Steeles Avenue culvert. Standing water was noted at the culvert only, and not within feature. Feature type is no defined feature (overland flow only); flow condition is no surface water.



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

50. HT -2b -4 (Segment 1). Facing downstream towards agricultural fields. Several depressions no singular flow path. Feature type is no defined feature (overland flow only); flow condition is no surface water.



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

51. HT -2b -4 (Segment 1). Facing upstream towards Steeles Avenue from agricultural field. Feature type is no defined feature (overland flow only); flow condition is no surface water.



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

52. HT -2b -4 (Segment 1). Facing upstream towards Steeles Avenue in agricultural field. Feature type is no defined feature (overland flow only); flow condition is no surface water.



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

53. HT -2b -4 (Segment 1). Facing downstream towards Trafalgar Road where water was ponded during first visit. Feature type is no defined feature (overland flow only), flow condition is no surface water.



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

54. HT -2b -4 (Segment 1). Facing downstream towards Trafalgar Road where water drains off agricultural field towards roadside ditch. Feature type is no defined feature (overland flow only), flow condition is no surface water.



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

55. HT -2b -4 (Segment 1). Facing downstream towards Trafalgar Road, feature drains toward roadside ditch. During this visit no defined depression noted through this area. Feature type is no defined feature (overland flow only) and flow type is no surface water.



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

56. Roadside ditch adjacent to **HT -2b -4**, facing downstream towards Trafalgar Road culvert. Feature was dry.



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

57. Area where **HT -2b -4 (Segment 1)** and roadside ditch converge upstream of Trafalgar Road culvert. **HT -2b -4 (Segment 1)** is on the left, roadside ditch is on the right. **Management recommendation:**
No Management



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

58. **HT -2b -4 (Segment 2)**. Downstream of confluence with roadside ditch, features combine to establish defined bed and banks approaching culvert.



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

59. HT -2b -4 (Segment 2). Defined bed and banks directly upstream of Trafalgar road culvert, flow condition is dry. **Management Recommendation: Conservation**



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

60. HT -2b -4a. Feature added after observation in field on first visit. Facing upstream from downstream end. Feature looks to be cut as a furrow by farmer. Feature type is channelized (modified agricultural) and flow condition is standing water.



*Matrix Solutions Inc.
May 25, 2016 (Site Visit 2)*

61. HT -2b -4a. Looking eastward across field where feature was previously located. Feature is no longer visible as field appears to have been reworked. Flow condition is dry, feature type is channelization (modified agricultural). **Management Recommendation: No management required.**



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

62. HT -2b -4b. Feature added after identification in the field at time of first visit. Facing upstream from downstream end. Feature appears to be cut as a furrow by farmer. Feature type is channelization (modified agricultural) and flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

63. HT -2b -4b. Feature drains to large ponded area of HT -2b -4, photo facing upstream. Feature appears to be cut as a furrow by farmer. Feature type is channelization (modified agricultural) and flow condition is standing water.



*Matrix Solutions Inc.
May 25, 2016*

64. HT -2b -4b. Facing east across field where feature was located at Site Visit #1. Feature is no longer visible as field appears to have been reworked. Flow condition is dry, feature type is channelization (modified agricultural). **Management Recommendation: No management required.**



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

65. E -T1 -4 (Segment 1). At upstream end of golf course facing upstream. Water is standing and pooled, approximately depth of 20 cm. Feature type is classified as tiled drainage (buried stream/pipe) because the feature is primarily piped through the extent of the golf course. Flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

66. E -T1 -4 (Segment 1). At upstream end of golf course, facing downstream towards first cart crossing bridge. Feature type is classified as tiled drainage (buried stream/pipe) because the feature is primarily piped through the extent of the golf course. Flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

67. E -T1 -4 (Segment 1). At first cart path crossing, facing downstream. Water flows beneath bridge and drains into small pipe across the fairway. Feature type is classified as tiled drainage (buried stream/pipe) because the feature is primarily piped through the extent of the golf course. Flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

68. E -T1 -4 (Segment 1). Downstream side of second cart path crossing. Water flows out of pipe upstream of cart path crossing and then again drains into pipe to traverse another fairway. Feature type is classified as tiled drainage (buried stream/pipe) because the feature is primarily piped through the extent of the golf course. Flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

69. E -T1 -4 (Segment 1). Facing downstream of second cart path crossing, no surface water due to piping along fairway, water outlets into grassed area. Feature type is classified as tiled drainage (buried stream/pipe) because the feature is primarily piped through the extent of the golf course. Flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

70. E -T1 -4 (Segment 1). Facing downstream towards third cart path crossing. Feature is not piped through this section. Feature type is classified as tiled drainage (buried stream/pipe) because the feature is primarily piped through the extent of the golf course. Flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

71. E -T1 -4 (Segment 1). Facing upstream towards third cart path crossing. In background of photo water is pooling at surface where it has overwhelmed the pipe. In foreground, pipe outlets into grasses area, where flow is relatively fast and erosion has occurred around the outlet. Wetted depth is 14cm. Feature type is classified as tiled drainage (buried stream/pipe) because the feature is primarily piped through the extent of the golf course. Flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

72. E -T1 -4 (Segment 1). Facing downstream towards fourth cart path crossing. Water flows at surface after outletting from pipe. Feature type is classified as tiled drainage (buried stream/pipe) because the feature is primarily piped through the extent of the golf course. Flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

73. E -T1 -4 (Segment 1). Facing downstream towards fifth cart path crossing. Overland flow through piped section downstream of fourth cart path crossing. Hole in pipe as indicated by bubbling water in photo. Feature type is classified as tiled drainage (buried stream/pipe) because the feature is primarily piped through the extent of the golf course. Flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

74. E -T1 -4 (Segment 1). Facing upstream from fifth cart path crossing, wide area of water pooling due to broken pipe. Two pipe outlets upstream of cart path crossing. Feature type is classified as tiled drainage (buried stream/pipe) because the feature is primarily piped through the extent of the golf course. Flow condition is surface flow substantial.



*Matrix Solutions Inc.
March 8, 2015 (Site Visit 1)*

75. E -T1 -4 (Segment 1). Facing upstream towards fifth cart path crossing where feature appears to be open to surface, wetted width approximately 3.5m. Feature type is classified as tiled drainage (buried stream/pipe) because the feature is primarily piped through the extent of the golf course. Flow condition is surface flow substantial.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

76. E -T1 -4 (Segment 1). Facing upstream at upstream end of golf course. No water or standing water only noted. Feature type is classified as tiled drainage; flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

77. E -T1 -4 (Segment 1). Facing upstream towards first cart path crossing, feature is piped, no surface flow. Feature type is classified as tiled drainage; flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

78. E -T1 -4 (Segment 1). Pipe outlet at second cart path crossing, facing downstream. No water noted. Feature type is classified as tiled drainage; flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

79. E -T1 -4 (Segment 1). Facing upstream towards second cart path crossing, within area where pipe outlets to surface. Standing water noted at the outlet only. A depression bare of grass was noted indicating previous flows. Feature type is classified as tiled drainage; flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

80. E -T1 -4 (Segment 1). Facing downstream towards third cart path crossing, where feature is at surface. Feature type is classified as tiled drainage; flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

81. E -T1 -4 (Segment 1). Facing upstream to third cart path crossing, feature is piped beneath fairway. Feature type is classified as tiled drainage; flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

82. E -T1 -4 (Segment 1). Evidence of erosion by flows downstream of pipe outlet in section between third and fourth cart path crossing. Feature type is classified as tiled drainage; flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

83. E -T1 -4 (Segment 1). Facing downstream towards fourth cart path crossing. Dry defined depression, evidence of previous flows from pipe outlet. Feature type is classified as tiled drainage; flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

84. E -T1 -4 (Segment 1). Facing upstream towards fourth cart path crossing. Feature piped beneath fairways. Feature type is classified as tiled drainage; flow condition is no surface water.



*Matrix Solutions Inc.
June 1, 2015 (Site Visit 1)*

85. E -T1 -4 (Segment 1). Facing downstream from fifth cart path crossing where feature is at surface. Feature type is classified as tiled drainage; flow condition is no surface water. **Management Recommendation: Conservation**



*Matrix Solutions Inc.
March 8, 2015 (Site Visit 1)*

86. E -T1 -4 (Segment 2). Natural conditions downstream of last cart path crossing, until confluence with E -T1 -3 (approx. 40m). Feature type is classified as defined natural channel (visible banks) and flow condition is surface flow substantial.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

87. E -T1 -4 (Segment 2). At upstream end of Segment, facing upstream towards to sixth cart path crossing. Feature type is defined natural channel (visible banks) and flow condition is standing water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

88. E -T1 -4 (Segment 2). Channel bed within Segment. Feature type is defined natural channel (visible banks) and flow condition is standing water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

89. E -T1 -4 (Segment 2). Facing downstream to confluence with E -T1 -3. Feature type is defined natural channel (visible banks) and flow condition is standing water. **Management Recommendation: Protection.**



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

90. HDF -4. At upstream end of feature where flow initiates. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

91. HDF -4. Facing upstream to upstream end of feature, cattail growth in wetted area was frequent. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

92. HDF -4. Facing upstream where feature drains into small pipe beneath fairways. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

93. HDF -4. Facing upstream, feature is piped beneath fairway and outlets again downstream of a cart path. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

94. HDF -4. Facing upstream, frequent cattail growth is seen in feature. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

95. HDF -4. Facing upstream. Progressing further downstream, feature dimensions were relatively consistent throughout. Wetted width varied between 7cm to 15cm. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

96. HDF -4. Facing upstream, feature enters pipe again. Note additional smaller feature joining in left side of photo (HDF -4a). Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

97. HDF -4. Facing upstream from downstream end of feature. Feature is piped to the downstream outlet at a pond. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

98. HDF -4. Outlet at golf course pond downstream end. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

99. HDF -4. Facing upstream at upstream end of feature. Feature type is swale and flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

100. HDF -4. Facing upstream, area where feature is densely vegetated with cattails and grasses before entering a pipe. Feature type is swale and flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

101. HDF -4. Facing downstream, defined depression with evidence of previous flows. Feature type is swale and flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

102. HDF -4. Facing downstream, feature runs along edge of manicured golf course green. Feature type is swale and flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

- 103. HDF -4.** Facing downstream towards golf course pond at downstream end. Feature is piped through last Segment. Feature type is swale and flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

- 104. HDF -4.** Downstream end of feature outletting to pond. Feature is piped through last Segment. Feature type is swale and flow condition is no surface water. **Management recommendation: No management required**



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

105. HDF -4a. Facing upstream from confluence with HDF -4. Feature type is swale and flow condition is standing water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

106. HDF -4a. Feature at downstream end joining HDF -4. Feature type is swale and flow condition is no surface water. **Management Recommendation: No management required**



*Matrix Solutions Inc.
March 8, 2016(Site Visit 1)*

107. HDF -3. Upstream end of feature, facing upstream. Feature type is swale, flow condition is standing water



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

108. HDF -3. Facing upstream, mid -feature. Cattail growth noted within feature. Feature type is swale, flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016(Site Visit 1)*

109. HDF -3. Facing downstream at downstream end of feature. Feature flows through two small pipes for path crossings before entering the golf course pond. Feature type is swale, flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

110. HDF -3. Downstream end of feature at golf course pond. Feature type is swale, flow condition is standing water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

111. HDF -3. Facing upstream, near downstream end of feature. Feature heavily vegetated with cattails. Feature type is swale; flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

112. HDF -3. Downstream end of feature at golf course pond. Feature type is swale; flow condition is no surface water. **Management Recommendation: No management required.**



*Matrix Solutions Inc.
March 8, 2015 (Site Visit 1)*

113. HDF -2. Facing western golf course pond. Feature is a surface connection between the two golf course ponds. Feature type is pond outlet; flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2015 (Site Visit 1)*

114. HDF -2. Facing eastern golf course pond. Feature is a surface connection between the two golf course ponds. Feature type is pond outlet; flow condition is surface flow minimal.

No Photo documentation from May 28, 2015 (Site Visit 2)

115. HDF -2. Feature is a surface connection between the two golf course ponds. Feature was dry at time of assessment. Feature type is pond outlet; flow condition is no surface flow. **Management Recommendation: No management required**



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

116. HDF -1 (Segment 1). At upstream end of feature, facing downstream. Upstream end has more water due to outlet from golf course ponds. Feature type is multi -thread and flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

117. HDF -1 (Segment 1). Within feature, flow is distributed in pockets, lacks a continuous flow path. Wetted depth 5 cm to 10 cm. Feature type is multi -thread and flow condition is standing water.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

118. HDF -1 (Segment 1). Facing upstream towards golf course within Segment. Typical conditions, tall grasses with areas of pockets water. Feature type is multi -thread and flow condition is standing water.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

119. HDF -1 (Segment 1). Upstream end of feature at pond outlet from golf course. Feature type is multi -thread and flow condition is standing water.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

120. HDF -1 (Segment 1). Facing downstream from upstream end of Segment, dense vegetation through feature, including some cattails. Feature type is multi -thread and flow condition is standing water.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

121. HDF -1 (Segment 1). Standing water throughout feature up to 20cm. Feature type is multi -thread and flow condition is standing water.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

122. HDF -1 (Segment 1). Facing upstream from downstream end of Segment. Note dense vegetation. Water beginning to focus along boundary between cropland and vegetation. Feature type is multi-thread and flow condition is standing water. **Management Recommendation: Conservation**



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

123. HDF -1. Transition point between Segment 1 and 2, facing upstream. Large area of ponded water as a result of farm lane depression.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

124. HDF -1. Tadpoles noted in farm lane crossing ponded water area.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

125. HDF -1 (Segment 2). Facing downstream within Segment. Water becomes more concentrated between crops and grasses. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

126. HDF -1 (Segment 2). Facing downstream, flow path is more defined. Feature type is swale and flow condition is surface flow minimal. Wetted depth is 18 cm.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

127. HDF -1 (Segment 2). Facing downstream towards E -T1 -2. Definition is lost approaching E -T1 -2. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

128. HDF -1 (Segment 2). Looking towards confluence location with E -T1 -2. Flow discontinues in this area, a confluence could not be identified in the field based on presence of flow or topography. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

129. HDF -1 (Segment 2). Upstream end of Segment, facing downstream. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

130. HDF -1 (Segment 2). Facing downstream, flow concentrated along boundary between cropland and vegetated area. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

131. HDF -1 (Segment 2). Facing downstream. Dense vegetation, some wetland species (cattails). Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

132. HDF -1 (Segment 2). Facing downstream towards E -T1 -2. Flow is reduced through this section. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

133. HDF -1 (Segment 2). At downstream end of feature, feature goes dry and is not able to be identified through tall grass section to confluence with E -T1 -2. Confluence could not be located. Feature type is swale and flow condition is surface flow minimal. **Management Recommendation: Conservation**



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

134. W -T1 -2b (Segment 1). Upstream end of Segment 1 facing downstream. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

135. W -T1 -2b (Segment 1). Facing downstream within Segment. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

136. W -T1 -2b (Segment 1). Downstream end of feature. Feature makes a turn westward and drains towards Sixth line. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

137. W -T1 -2b (Segment 1). Upstream end of feature, some erosion due to CSP outlet. Feature type is swale and flow condition is no surface water.



*Matrix Solutions Inc.
May 28, 2015 (Site Visit 2)*

138. W -T1 -2b (Segment 1). Facing downstream, feature has been cut as a furrow through field. Feature type is swale and flow condition is no surface water. **Management Recommendation:**
Mitigation



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

139. W -T1 -2b (Segment 3). Upstream end of Segment, facing upstream. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

140. W -T1 -2b (Segment 3). Within Segment, dense vegetation. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

141. W -T1 -2b (Segment 3). Within Segment, dense vegetation including some wetland species (cattails). Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
March 8, 2016 (Site Visit 1)*

142. W -T1 -2b (Segment 3). Downstream end of Segment where water drains to CSP beneath farm lane crossing, facing downstream. Feature type is swale and flow condition is surface flow minimal.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

143. W -T1 -2b (Segment 3). Downstream end of Segment facing upstream. Feature is densely vegetated with wetland vegetation (cattails), tall grasses, and deciduous trees. Feature type is swale and flow condition is no surface water.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

144. W -T1 -2b (Segment 3). Small depression noted within vegetation, no water noted. Feature type is swale and flow condition is no surface water.



*Matrix Solutions Inc.
July 3, 2015 (Site Visit 3)*

145. W -T1 -2b (Segment 3). Dense wetland vegetation within feature. Feature type is swale and flow condition is no surface water. **Management Recommendation: Conservation (based on important riparian habitat)**

APPENDIX D-3
Headwater Drainage Feature Summary Table
Updated August 2017

Drainage Feature Segment	Segment Code	Step 1 Hydrology Modifiers		Step 2 Riparian	Step 3 Fish Habitat	Step 4 Terrestrial Habitat	Protocol Management Recommendation	Final Management Recommendation	Notes/ Rationale
HT-2b-3c	S1	Contributing	Ag	Limited (code 3)	Contributing	Limited	Mitigation	Mitigation	Channel definition noted during HDF site visit on Jan 19 2017
HT-2b-3b	S1	Contributing	Ag	Limited (code 3)	Contributing	Limited	Mitigation	No Management	Higher flow than normally anticipated due to timing of first visit. Modified through agricultural usage. Feature could not be located on second visit.
HT-2b-3a	S1	Limited or recharge	Ag	Limited (code 3)	Contributing	Limited	No Management	No Management	Higher flow than normally anticipated due to timing of first visit. Modified through agricultural usage. Feature could not be located on second visit.
HT-2b-3	S1	Contributing	Ag	Valued (code 4)	Contributing	Limited	Mitigation	Mitigation	Larger feature. Presence of healthy vegetation on second visit indicative of wetter conditions later into the dry season.
HT-2b-2	S1	Contributing		Important (code 7)	Contributing	Valued	Conservation	Conservation	Management recommendation is "Conservation" due to "important" riparian vegetation consisting of wetland and scrubland.
	S2	Contributing		Valued (code 4)	Contributing	Limited	Mitigation	Conservation	Mitigation recommendation based on hydrology. Recommendation is increased to "Conservation" as a result of higher classification in upstream segment.
	S3	Contributing		Valued (code 4)	Contributing	Limited	Mitigation	No HDF recommendation, segment has been upgraded to 'watercourse'	Receives a "Mitigation" classification based on hydrology. Standing water at downstream end of segment (Site Visit #2), defined bed/banks through length of segment, and gravel substrates on the bed suggest that this is a permanent feature of higher importance. Segment is classified as a 'watercourse' consistent with segment downstream of Trafalgar Road.
HT-2b-4	S1	Limited or recharge	Ag	Important (code 7)	Contributing	Contributing	Conservation	Conservation	Management recommendation is "Conservation" due to "important" riparian vegetation consisting of wetland.
	S2	Limited or recharge	Ag	Valued (code 4)	Contributing	Contributing	Conservation	Conservation	Scored as Conservation due to upstream and section considered as Conservation
	S3	Limited or recharge	Ag	Limited (code 3)	Contributing	Contributing	Conservation	Conservation	Scored as Conservation due to upstream section considered as Conservation. The segment also has defined bed and banks approaching the Trafalgar Road culvert and gravel substrate suggesting higher value.
HT-2b-4b	S1	Limited or recharge	Ag	Limited (code 3)	Contributing	Limited	No Management	No Management	Based on hydrology, standing water at the first visit. Feature was appears to be cut through furrowing to help drain the fields in the spring.
HT-2b-4a	S1	Limited or recharge	Ag	Limited (code 3)	Contributing	Limited	No Management	No Management	Based on hydrology, standing water at the first visit. Feature was appears to be cut through furrowing to help drain the fields in the spring.

Drainage Feature Segment	Segment Code	Step 1 Hydrology	Step 1 Modifiers	Step 2 Riparian	Step 3 Fish Habitat	Step 4 Terrestrial Habitat	Protocol Management Recommendation	Final Management Recommendation	Notes/ Rationale
E-T1-4	S1	Contributing		Limited (code 3)	Contributing	Limited	Mitigation	Conservation	Management recommendation is "Mitigation" based on hydrology. Based on the amount of flow noted at Site Visit #1, historic aerial photos, and conditions upstream of the study area, the management recommendation has been increased to "Conservation". It is noted that upstream of the golf course the feature appears to be a defined watercourse based on a review of aerial photography. Modification by the golf course has made this feature difficult to assess fully. It is thought that with removal of the golf course this could potentially be a more significant feature than it currently appears to be, based on upstream conditions.
	S2	Valued		Important (code 5)	Valued	Contributing	Conservation	Protection	Management recommendation is "Conservation" due to surrounding riparian vegetation dominated by scrubland. Management recommendation is increased to "Protection" as a result of both defined bed and banks and standing water at Site Visit #2, suggesting more permanence and importance hydrologically.
HDF-1	S1	Important	Golf course ponds outlet at upstream end	Limited (Code 3)	Contributing	Valued	Protection	Conservation	Management recommendation is "Protection" based on "important" hydrology classification as a result of water during Site Visit #3. Terrestrial habitat is "valued" due to presence of tadpoles in isolated pool during Site Visit #3. Management recommendation is reduced to "Conservation" as the golf course ponds outlet to the feature and it is unclear how this impacts the natural hydrology of the feature.
	S2	Important		Limited (Code 3)	Contributing	Limited	Protection	Conservation	Management recommendation is "Protection" based on "important" hydrology classification as a result of water during Site Visit #3. Management recommendation is reduced to "Conservation" as the golf course ponds outlet to the feature and it is unclear how this impacts the natural hydrology of the feature.
HDF-2	S1	Important		Important (code 7)	Contributing	Valued	Protection	Protection	Management recommendation is "Protection" based on "important hydrology classification as a result of water noted during Jan 19 2017 site visit. Additionally ELC classification as SWM1-1 (White Cedar-Hardwood Mineral Mixed Swamp) can be considered wetland, resulting in important riparian and terrestrial.

Drainage Feature Segment	Segment Code	Step 1 Hydrology Modifiers		Step 2 Riparian	Step 3 Fish Habitat	Step 4 Terrestrial Habitat	Protocol Management Recommendation	Final Management Recommendation	Notes/ Rationale
	S2	Contributing	Outlet from west to east pond	Limited (code 3)	Contributing	Contributing	Protection	Protection	Management recommendation is based on hydrology. This feature is a small swale that connects the west golf course pond to the east golf course pond; therefore, hydrology is a result of the pond water levels. Suggest reducing recommendation to "No Management". Increased to Protection due to protection in upstream segment
HDF-3	S1	Limited or recharge		Limited (code 3)	Contributing	Limited	No Management	No Management	Standing water at Site Visit #1, no management required.
HDF-4	S1	Contributing		Limited (code 3)	Contributing	Limited	Mitigation	No Management	Management recommendation of "Mitigation" is based on hydrology. Difficult to determine management due to potentially altered drainage on golf course, suggested that "No Management" recommendation.
HDF-4a	S1	Limited or recharge		Limited (code 3)	Contributing	Limited	No Management	No Management	Standing water at site visit 1, no management required.
W-T1-2b	S1	Contributing	Ag	Limited (code 3)	Contributing	Limited	Mitigation	Mitigation	Management recommendation of "Mitigation" based on hydrology.
	S2	Contributing*		Contributing* (code 2)	Contributing*	Limited*		Mitigation*	Management recommendation of "Mitigation" based on hydrology.
	S3	Contributing		Important (code 5)	Contributing	Contributing	Conservation	Conservation	Management recommendation of "Conservation" based on "important" riparian vegetation classification due to scrubland.

*Hydrology and fish habitat for W-T1-2b (S2) were based on the up- and down- stream classification, while riparian and terrestrial were based on a review of aerial photographs. Final management recommendation is preliminary based on a lack of field confirmation.

APPENDIX D-4
Headwater Drainage Feature Mapping
Updated August 2017

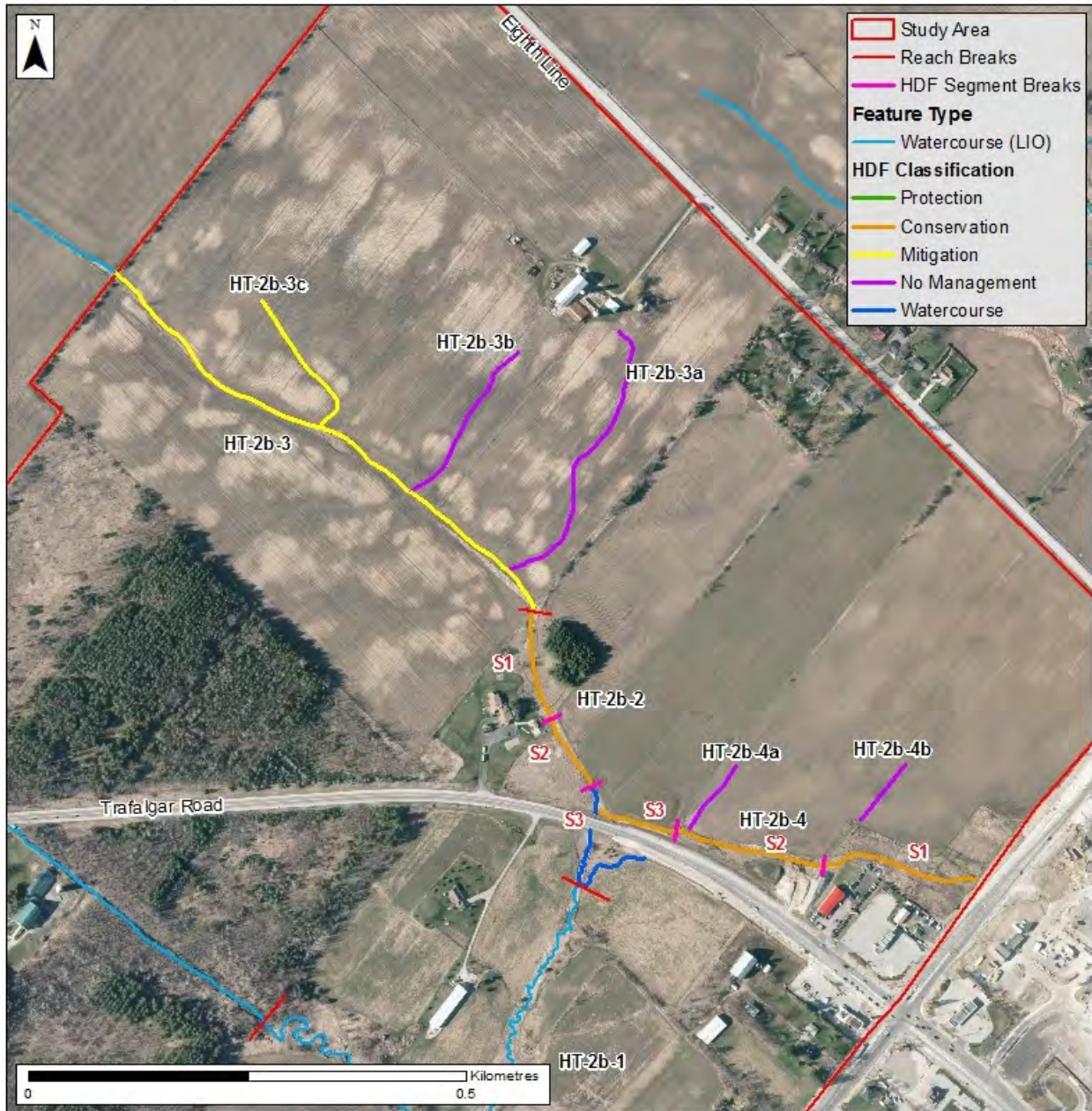


FIGURE D-4-1 Final management recommendations for HDFs in the eastern portion of the study area

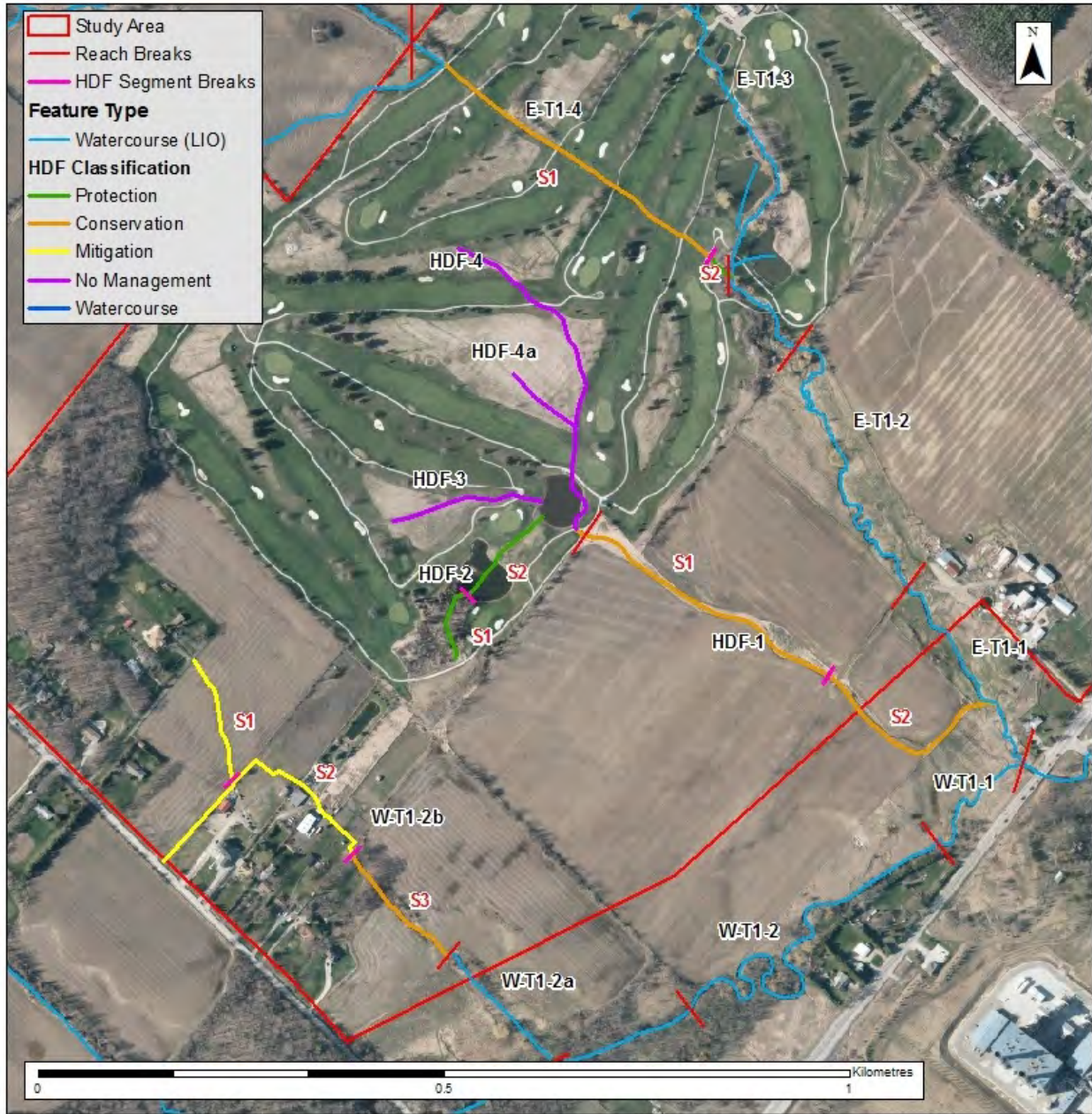


FIGURE D-4-2 Final management recommendations for HDFs in the western portion of the study area