NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 31, 2021 Project No. 2114

Stacey Laughlin
Senior Policy Planner
City of Guelph
1 Carden Street
Guelph, ON N1H 4Y2

Dear Ms. Laughlin,

RE: 2054 Gordon Street, Guelph – Springfield Golf Course
Technical Review of H6

On behalf of the owners of 2054 Gordon Street (Springfield Golf Course), Natural Resource Solutions Inc. (NRSI) has completed a comprehensive Technical Review of the 'H6' Headwater Drainage Feature (HDF) on Map NH-4A of the Clair-Maltby Comprehensive Environmental Impact Study (CEIS – June 12, 2021) (Beacon 2021). This Technical Review is being submitted as part of comments on the Clair-Maltby Secondary Plan and CEIS (both dated June 12, 2021).

H6 is located in the Hanlon Creek Subwatershed, and within a 37.99ha subcatchment (SW42) as shown on Figure No. HYD2 of the CEIS (Beacon 2021). H6 is shown on CEIS Map NH-4 and the Clair-Maltby Secondary Plan Schedule E (June 2021) as originating within the Springfield Golf Course lands south of a buried tile drain and extending southeast for approximately 320m to join H7 within a portion of the Halls Pond Provincially Significant Wetland (PSW) complex south of the subject property. The most recent iteration of Map NH-4A in the June 2021 CEIS shows H6 as a dashed purple line indicating the presence of an HDF (also labelled as a 'confirmed HDF' on Schedule E of the draft Clair-Maltby Secondary Plan). Note that while the CEIS is authored by Wood, this Technical Review cites the report as 'Beacon 2021' to remain consistent with previous submissions and to recognize that the natural heritage component of the CEIS was completed by Beacon Environmental.

On April 9, 2019, NRSI's Ecohydrologist conducted a site walk at 2054 Gordon Street with staff from the City of Guelph and Beacon Environmental to review the portion of H6 on the property. A letter was then submitted by NRSI's Ecohydrologist and Senior Terrestrial and Wetland Biologist to the City on May 27, 2019 that summarized the site walk and discussions with City staff and Beacon Environmental. This letter also indicated that the information collected during the April 9, 2019 visit was inconclusive, and provided the recommendation that further investigation be completed in accordance with the Evaluation, Classification and Management of Headwater Drainage Features Guidelines (TRCA and CVC 2014). The latter document will be referred to herein as the "Headwater Guideline".

At the request of the owners, NRSI biologists completed a series of field surveys and desktop analyses in 2021 to accurately determine the character and functions of H6. This included a full assessment following the Headwater Guideline, including 3 seasonal site visits to obtain a thorough understanding of the feature's hydrological and ecological functions. We recommend that H6 be removed from future mapping iterations since it does not meet the definition of an HDF as set out in the Headwater Guideline. The following Technical Review provides the details of our analysis to support these recommendations.

Definition of Headwater Drainage Feature

The Headwater Guideline (TRCA and CVC 2014) defines HDFs as:

> "*non-permanently flowing drainage features that may not have defined bed or banks; they are first-order and zero-order intermittent and ephemeral channels, swales and connected headwater wetlands, but do not include rills or furrows.*"

Unconnected wetlands are not HDFs, and are therefore not considered in the Headwater Guideline as stated on page 6 of the document. Ontario Stream Assessment Protocol (OSAP) Version 10, Section 4: Module 11- Unconstrained Headwater Sampling (Gorenc and Stanfield 2017) elaborates on the definition of an unconnected feature:

> "*A water flow feature that is not connected to the drainage network except by groundwater infiltration. These features drain to kettle wetlands or ponds etc., that have no outlet to the drainage network except via groundwater.*"

H6 is unconnected, in accordance with this definition. The Headwater Guideline also states that while unconnected wetlands are not considered, they may still need to be assessed through an Environmental Impact Study (EIS). Consideration of landscape-level connectivity and the maintenance of the hydrological regime in wetland features to be protected in the long-term would form a key part of such EIS analyses. However, the management recommendations for HDFs, as detailed in the Headwater Guideline, are not meant to be applied to unconnected wetlands.

The following sections of this Technical Review further discuss the character and function of H6 in the context of the Headwater Guideline to emphasize that it is not an HDF.

Methods

NRSI biologists trained and experienced in the application of the OSAP V10.S4.M11 Unconstrained Headwater Sampling protocol (Gorenc and Stanfield 2017) assessed the character and function of H6 over the course of 3 separate site visits in 2021.

- Visit 1 was completed on March 19, 2021 and coincided with early spring freshet-like conditions.
- Visit 2 was completed on May 7, 2021, after the melt/thaw-related interflow had ceased but before vegetation growth could obscure H6.
- Visit 3 was completed on August 4, 2021 following at least 3 days without a significant precipitation event as defined in the Headwater Guideline and OSAP HDF Modules.

All visits were completed on days with good visibility and no precipitation. Information from the preliminary visit on April 9, 2019 was reviewed and included in the analysis of H6.

During each site visit, H6 was walked from south to north. During visit 1, the portion of H6 within the Springfield Golf Course was subdivided into segments based on changes in vegetation, topography, and the presence of standing water. Map 1 identifies the segments that were delineated in the field on the subject property, and the currently mapped extent of H6 (Beacon 2021) that extends off-property to the south. Each segment was given a unique identifier (numbered in a north to south manner) based on the naming convention suggested in the OSAP Module 11 methods.

Information collected, where appropriate and present, for each segment included the following:

- Feature type;
- Flow conditions;
- Riparian conditions;
- Feature vegetation;
- Feature or bankfull widths and depths;
- Sediment deposition and transport;
- Flow measurements (if applicable);
- Site features;
- Channel connectivity; and
- Representative photographs.

Following the completion of all field surveys, the data was assessed using the criteria outlined in the Headwater Guideline, and each segment was assigned a classification for each of 4 function categories: Hydrology, Riparian Condition, Fish Habitat, and Terrestrial Habitat.

Freshet Conditions in 2021

As is typical in southern Ontario, brief melt/thaw events interspersed with periods of freezing temperatures comprise the spring freshet. In spring 2021, the first major melt event occurred on March 10, and 11 when air temperatures segmented 15.5°C and 17.8°C (Government of Canada 2021) before returning to seasonally cool levels. No additional melt events occurred between March 11 and March 19, 2021. The conditions observed during Visit 1 on March 19, 2021 are therefore assumed to be a reflection of the runoff of meltwater from these earlier dates.

Existing Conditions

There are 4 segments of H6, labeled ‘H6-1’ through ‘H6-4’ as shown on Map 1. Representative photographs of each segment are provided in Appendix I. The following paragraphs describe H6 from north (H6-4) to south (H6-1) and additional site conditions as observed during site visits.

Halls Pond PSW Complex

Wetland units to the north and south of the Springfield Golf Course are part of the Halls Pond PSW complex (MNRF 2021). The CEIS and Secondary Plan (June 2021) maps do not identify the wetland unit immediately north of the large irrigation pond on the subject property as part of H6 (‘north wetland’ on Map 1). At the northern property boundary, a narrow (1m-wide), paved trail separates the wetland from the irrigation pond on the subject property. During all 3 site visits in 2021, minimal flow (<0.5L/s) was observed entering the irrigation pond from the wetland through a small plastic drain pipe under the paved trail. During very wet years, water may also flow overland across the paved trail. The CEIS identifies the Ecological Land Classification (ELC) of the off-site wetland north of the property as an Open Aquatic (OAO) feature (Beacon 2021).

Irrigation Pond and Buried Tile Drain

The CEIS identifies the irrigation pond as a continuation of the off-site Open Aquatic feature. However, the pond is not included in the Halls Pond PSW complex, as per Grand River Conservation Authority (GRCA) wetland mapping (shown on Map NH-5A of the CEIS) or Natural Heritage Information Centre (NHIC) mapping (MNRF 2021). It is also not mapped as part of H6 (Beacon 2021). The pond measures approximately 80m in length and 45m in width, and is generally encircled by a narrow (5m) band of naturalized riparian vegetation and manicured lawn. Water levels in the pond are controlled by a shut-off valve. When water levels are high and the valve is open, flows are conveyed southwards through a buried tile drain. A pumping system is also installed in the western corner of the pond that presumably provides water to the golf course irrigation system as needed. Photographs of the irrigation pond and buried tile drain area are provided in Appendix I.

The buried tile drain extends from the irrigation pond for 95m before its outlet to a 0.3m corrugated steel pipe (csp) culvert under a paved golf cart pathway (Map 1). A small, white irrigation system pipe also passes through this culvert (Appendix I). The entire area with the buried tile drain is comprised of manicured lawn. No water was observed discharging from the tile drain outlet during any of the 3 site visits in 2021; it is unclear if this was a result of the shut-off valve being closed, or insufficient water levels in the irrigation pond. During the preliminary visit in 2019, minimal flow (<0.5L/s) was observed exiting the tile drain, and the pond shut-off valve was confirmed to be open on this date.

As mapped in Figure No. HYD2 of the CEIS, the north wetland, irrigation pond, and buried tile drain area are part of a smaller subcatchment (SW45, 11.04ha), separate from the subcatchment containing H6 (SW42, 37.88ha). It is our interpretation that H6 is therefore not connected to the Halls Pond PSW unit north of the Springfield Golf Course property (see additional discussion in the Analysis section below).

Segments H6-4 to H6-1

Segment **H6-4** is 120m long and extends from the 0.3m csp at the southern end of the buried tile drain area to a small wetland (H6-3) (Map 1). It passes under a small wooden golf cart span bridge as well as through a 0.15cm PVC pipe below a second paved golf cart path just north of H6-3. Segment H6-4 is categorized as a *no defined feature* using the OSAP Feature Type codes (Feature Type 4). During the preliminary visit in 2019, golf course maintenance staff indicated that no tile drain is present in this area. The segment was dry during all 3 visits in 2021. During the preliminary site visit on April 9, 2019, the minimal flow observed exiting the buried tile drain pooled in the upstream area of H6-4, creating an area of standing water and saturated soils. However, standing water conditions continued for approximately 80m only, and the remainder of the segment was dry. Vegetation within and adjacent to segment H6-4 is manicured lawn.

Segment **H6-3** is a small, 0.02ha marsh feature comprised almost entirely of cattails (*Typha* sp.) (OSAP Feature Type 6). Standing water was present during visits 1 and 2. By visit 3, the segment was dry (although damp soils were observed). Riparian vegetation consists of manicured lawn. During site visits in 2021, wildlife observed using this small patch of cattails was limited to a few Red-winged Blackbirds (*Agelaius phoeniceus*) during visit 2 (May 7, 2021) and an adult Gray Treefrog (*Hyla versicolor*) during visit 3 (August 4, 2021). Segment H6-3 is currently mapped as a wetland by the GRCA; however, new information collected as part of the CEIS has resulted in the recommendation that the small marsh be excluded from GRCA wetland mapping as shown on Map NH-5A (Beacon 2021).

Water from segment H6-3 discharges to a buried tile drain that characterizes segment **H6-2** (Map 1). The tile drain extends for approximately 27m from the marsh feature to a small wooden golf cart span bridge. The tile drain discharges underneath a wooden golf cart span bridge (Appendix I) before entering the pond to the south (segment H6-1). No flow was observed exiting the tile drain during any of the site visits in 2021. During the preliminary visit on April 9, 2019, minimal flow was observed draining to segment H6-1.

Segment **H6-1** is a man-made stormwater management (SWM) pond measuring 30m in length and 20m in width, and is generally encircled by a narrow (3-8m) band of naturalized riparian vegetation and manicured lawn. The pond was constructed specifically to convey flows to the wetland south of the subject property. The segment receives inputs from both H6-2 and a second tile drain that enters the pond at its western corner via a small headwall (Appendix I). While H6-2 was not flowing during any 2021 visit, minimal flow was observed exiting the second western tile drain on visit 1 (March 19 2021) only. A catch basin in the southeastern corner of the pond provides flow conveyance via a pipe to the south wetland. Water overtopped the invert of the catch basin on visit 1 (March 19, 2021) only. Segment H6-1 is currently mapped as a wetland by the GRCA; however, new information collected as part of the CEIS has resulted in the recommendation that the SWM pond (like segment H6-3 above) be excluded from GRCA wetland mapping as shown on Map NH-5A (Beacon 2021).

Fish Habitat in H6

During 2021 field investigations, NRSI biologists observed 2 fish species in the irrigation pond: Brook Stickleback (*Culaea inconstans*) and Goldfish (*Carassius auratus*). An unknown fish species was also observed in the SWM pond comprising segment H6-1. The buried tile drain area represents a barrier to the southward migration of fish from the irrigation pond; fish may be able to travel between the irrigation pond and the north wetland for a very short period in the spring, and likely during very wet years only. This temporary connection provides opportunities for non-native, highly invasive Goldfish to invade the PSW and cause potentially detrimental effects to the ecological function of the wetland. Fish in the H6-1 SWM pond are entirely restricted to this feature due to the presence of a tile drain to the north and a catch basin/pipe system to the south.

Permanent watercourses are absent from the Secondary Plan Area (SPA), but do occur in the Hanlon Creek Subwatershed (within which H6 is located) further to the north. The ponds and wetlands in the SPA are therefore considered isolated (Beacon 2021).

Analysis and Discussion

According to Figure No. HYD2 in the CEIS, the north wetland, irrigation pond, and buried tile drain area are part of a separate subcatchment (SWM45). The minimal flow and ponding water observed immediately south of the buried tile drain area (i.e., in the north portion of H6-4) during the preliminary visit (April 9, 2019) is interpreted to indicate the southern edge of subcatchment SWM45. This interpretation is supported by the remaining southern section of H6-4, a non-tile-drained segment, being dry on the same date. In H6's subcatchment SWM42 to the south, standing water in the small marsh (H6-3) and the minimal flow observed entering the man-made SWM pond (H6-1) during the preliminary visit represent local runoff from this separate subcatchment. Additional hydrogeological studies at future development stages may be necessary to confirm the presence of a drainage divide within the golf course lands.

Based on the results of field investigations in 2021 (in addition to the preliminary visit in 2019), NRSI has confirmed that H6 is not an HDF. H6 is not connected to the north wetland, but does provide flows and allochthonous inputs to the south wetland for a very brief period during early

spring. Since this south wetland is considered an unconnected wetland, H6 does not meet the definition of an HDF as outlined in the Headwater Guideline. However, to ensure a comprehensive analysis of all hydrological and ecological functions of the area, a technical analysis, as outlined in the Headwater Guideline, has been conducted. This provides fulsome details for the City's review of this technical document. Each segment was evaluated for its function in 4 separate categories: Hydrology, Riparian Condition, Terrestrial Habitat, and Fish Habitat. Table 1 contains a detailed account of how each segment was evaluated using the Headwater Guideline criteria. The results of the analysis in Table 1 were compared with the Headwater Drainage Feature Assessment Evaluation Matrix in Table 4.5.1 of the CEIS Phase 1/Phase 2 Characterization Report (Beacon 2021). In the latter report, H6 is referred to as 'HC-H6-R1'.

The Hydrology function of H6 varied between Limited (segment H6-4), Contributing (H6-2) and Valued (H6-3) based on the flow conditions observed during 2019 and 2021 site investigations (Table 1). Beacon Environmental staff assigned a Hydrology function of Limited to H6 based on the results of the preliminary visit only. This designation did not consider the minimal flows entering H6-1 from the tile drain in H6-2 that were documented by NRSI's Ecohydrologist during the same April 9, 2019 preliminary site visit. The analysis presented in the CEIS also did not describe any hydrology 'modifiers' for H6. Golf course activities and maintenance have significantly altered the form of H6 overall (e.g., tile drain installed in segment H6-2, regular lawn mowing, historical removal of riparian and segment vegetation). As per the Headwater Guideline, these modifications require consideration when determining the appropriate management recommendations for HDFs.

The Riparian Condition function was determined to be Contributing for all segments except for the small marsh in segment H6-3. The marsh in segment H6-3 was assigned an Important function due to the feature type being 'wetland'. All other segments were assigned a Contributing function based on the presence of mowed lawn or limited amount of scrubland vegetation. The CEIS Phase 1/Phase 2 Characterization Report assigned a Riparian Condition function of 'Important (feature type is wetland)'; however, the small marsh in segment H6-3 is the only portion of H6 on the Springfield Golf Course that meets the criteria for designation as a 'wetland' feature type.

The Terrestrial Habitat function was determined to be either Limited (segments H6-4 and H6-2) or Valued (segments H6-3 and H6-1), as supported by the data summarized in Table 1. The CEIS Phase 1/Phase 2 Characterization Report assigned a Terrestrial Habitat function of 'Important (wetlands with breeding amphibians)' to H6; however, it is our understanding that amphibian breeding in the H6-3 marsh and the H6-1 man-made SWM pond has not been confirmed.

The Fish Habitat function was determined to be Contributing for H6 overall. Fish are present in H6-1, but the population is entirely isolated in the SWM pond due to barriers to movement (i.e., tile drain, catch basin) at both the north and south ends. Although the presence of fish in the PSW unit south of the subject property is not known, H6 does provide limited flows, nutrients, and allochthonous inputs to the off-site wetland for short periods during the early spring. The CEIS Phase 1/Phase 2 Characterization Report also assigned a 'Contributing' Fish Habitat function to H6 (Beacon 2021).

Table 1. Analysis of H6

Segment	Hydrology	*Modifiers*	Riparian Condition	Terrestrial Habitat	Fish Habitat
H6-4 *Photos 15-20 (Appendix I)*	**Limited Function** This segment, classified as 'no defined feature', was dry during all 3 visits in 2021. Flow condition during the preliminary visit in 2019 included observations of minimal flow exiting the buried tile drain area to the north and ponding in the northern portion of H6-4 where it presumably infiltrated rather than being conveyed to southern sections of H6.	*Historic and ongoing golf course activities (e.g., mowing) have modified this segment and continue to do so.*	**Contributing Function** Riparian vegetation is comprised entirely of mowed lawn, which results in a 'Contributing Function' classification.	**Limited Function** The mowed lawn in segment H6-4 does not provide opportunities for wildlife movement between natural features, nor are conditions suitable for breeding amphibians.	**Contributing Function** Overall, H6 transports some allocthonous materials (detritus, insects etc.) to the wetland south of the subject property. The presence of fish in the south wetland is currently unknown; any populations present represent isolated populations since the Halls Pond Wetland Complex is not connected to any watercourses.
H6-3 *Photos 21-24 (Appendix I)*	**Valued Function** This segment, classified as a wetland, contained standing water during visits 1 and 2, but was dry (with saturated soils) by visit 3. These flow conditions combined with the wetland feature type result in a 'Valued Function' classification.	*N/A*	**Important Function** Feature type is 'wetland', which results in the 'Important Function' classification.	**Valued Function** No evidence of breeding amphibians was observed, however targeted anuran call surveys are needed to confirm the absence of this ecological function since a suitable hydroperiod is present. The small wetland may provide stepping-stone habitat for amphibians and other low-mobility	**Contributing Function** Overall, H6 transports some allochthonous materials (detritus, insects etc.) to the wetland south of the subject property. The presence of fish in the south wetland is currently unknown; any populations present represent isolated populations since the Halls Pond Wetland Complex is

Segment	Hydrology	*Modifiers*	Riparian Condition	Terrestrial Habitat	Fish Habitat
				wildlife based on its location within 400m of the wetland south of the subject property and its proximity to the man-made pond in H6-1.	not connected to any watercourses.
H6-2 *Photos 25-30 (Appendix I)*	**Contributing Function** This segment, classified as a tile drain, was dry during all 3 visits in 2021. Flow condition during the preliminary visit in 2019 included observations of minimal flow discharging from the tile drain to the man-made pond in H6-1. In recognition of the drainage connection between the small marsh to the north and the pond to the south, segment H6-2 is assigned a 'Contributing' hydrological function.	*The installation of the tile drain comprising this segment has modified its historical form.*	**Contributing Function** Riparian vegetation is comprised entirely of mowed lawn, which results in a 'Contributing Function' classification.	**Limited Function** The tile drain feature type and presence of mowed lawn result in the 'Limited Function' classification.	**Contributing Function** Overall, H6 transports some allochthonous materials (detritus, insects etc.) to the wetland south of the subject property. The presence of fish in the south wetland is currently unknown; any populations present represent isolated populations since the Halls Pond Wetland Complex is not connected to any watercourses.
H6-1 *Photos 31-36 (Appendix I)*	**Anthropogenic Pond** H6-1 is a man-made, in-line SWM pond that provides flow retention but disrupts natural geomorphological processes and thermal regimes. Ponds are therefore not assigned a specific Hydrology classification. The Headwater Guideline indicates that the positive contributions and negative impacts of in-line ponds to	*Anthropogenic modifications to the pond area have altered the form of the segment.*	**Contributing Function** Riparian areas within 10m of the pond are comprised of a thicket vegetation, which is categorized as 'scrubland' in the Headwater Guideline.	**Valued Function** No evidence of breeding amphibians was observed, however targeted anuran call surveys are needed to confirm the absence of this ecological function since a	**Contributing Function** Overall, H6 transports some allochthonous materials (detritus, insects etc.) to the wetland south of the subject property. The presence of fish

Segment	Hydrology	*Modifiers*	Riparian Condition	Terrestrial Habitat	Fish Habitat
	the overall drainage system should be identified.		'Scrubland' riparian conditions are typically assigned an 'Important Function'. However, the narrow (3-8m) width of the riparian vegetation extent diminishes its potential to provide an important habitat function on the landscape scale. However, the thicket areas around the pond (especially between the pond and the property boundary) connect to naturalized vegetation communities south of the subject property. The Riparian Function has therefore been reclassified to 'Contributing'.	suitable hydroperiod is present. The pond may provide stepping-stone habitat for amphibians and other low-mobility wildlife based on its location within 400m of the wetland south of the subject property.	in the south wetland is currently unknown; any populations present represent isolated populations since the Halls Pond Wetland Complex is not connected to any watercourses.

Based on the results of the single site visit in early spring (April 9, 2019), Beacon Environmental staff have designated the management recommendation for H6 as 'Protection'. This designation assumes that the entire length of H6 is a wetland, which is inaccurate. The only wetland portion of H6 within the Springfield Golf Course is the small marsh that represents just 25m of the approximate 320m length of H6. Moreover, the application of the management recommendations outlined in the Headwater Guideline to unconnected wetlands is inappropriate given that unconnected wetlands are not considered in the document (as discussed earlier in this Technical Review). The Headwater Guideline also states that "*Classification should consider the influence of modifiers and professional judgement used to determine the appropriate classification, where applicable.*" In the case of H6, it appears that the 'Protection' management recommendation by Beacon Environmental staff has not considered the highly-modified character of the various segments within the Springfield Golf Course.

Recommendations

Based on the site conditions observed in 2019 and 2021, and a review of the CEIS and associated mapping (Beacon 2021), NRSI requests that H6 be removed from future iterations of Map NH-4A of the CEIS and Schedule E of the Clair-Maltby Secondary Plan, as well as other mapping related to the Clair-Maltby Secondary Plan and Subwatershed Study. H6 is not an HDF as defined by the Headwater Guideline and OSAP headwater modules. It does, however, provide flows to the wetland south of the subject property for a brief period in the early spring, as it was designed to do. The restrictive 'Protection' management recommendation that has been put forth in the CEIS should not be applied to H6 because it is not an HDF, and has been significantly modified by golf course activities that have altered its form and function.

Since the south wetland forms part of the Halls Pond PSW complex, development activities within 120m are regulated by the GRCA through Ontario Regulation 150/06 in addition to the Provincial Policy Statement (PPS, OMMAH 2020). The long-term protection of the wetland will require the maintenance of its existing hydrological regime, to which H6 currently contributes. In the context of the total area of the subcatchment (37.88ha), the flows that travel through H6 in the early spring are likely to represent minor volumes at the local and landscape scale.

At future development stages, a feature-based water balance analysis for the south wetland will be needed to determine the runoff and recharge contributions of H6 and determine the appropriate stormwater management approach within the wetland's catchment area. In addition, detailed geotechnical, hydrogeological, and ecological studies prepared to inform future development applications will determine the appropriate measures needed to manage site drainage, identify opportunities and thresholds for infiltration and groundwater recharge, and mitigate impacts to ecological features and functions from proposed changes in land use.

Should you have any questions or comments regarding this Technical Review of H6, please contact the undersigned.

Sincerely,

Natural Resource Solutions Inc.

Nyssa Hardie, M.Sc.
Ecohydrologist

Desta Frey, M.Sc. P.Biol.
Terrestrial and Aquatic Biologist

References

Beacon Environmental. 2021. Clair-Maltby Comprehensive Environmental Impact Study and Management Plan (Natural Heritage Component). Final Draft for Community Engagement June 12, 2021. Prepared by Wood for the City of Guelph.

Gorenc, S. and L. Stanfield. 2017. Ontario Stream Assessment Protocol (OSAP). Version 10. Section 4. Module 11. Unconstrained Headwater Sampling.

Government of Canada. 2021. Historical Climate Data for Guelph Turfgrass Station. Updated: 2021-07-09. Available: https://climate.weather.gc.ca/historical_data/search_historic_data_e.htm

Ministry of Natural Resources and Forestry (MNRF). 2021. Natural Heritage Information Centre (NHIC): Make a Natural Heritage Area Map Application. Published: 2014-07-17. Updated 2021-05-27. Available: https://www.ontario.ca/page/make-natural-heritage-area-map-map

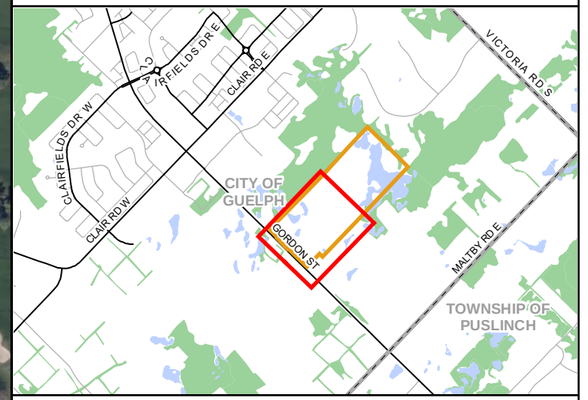
Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC). 2014. Evaluation, Classification and Management of Headwater Drainage Features Guidelines. January 2014. https://cvc.ca/wp-content/uploads/2014/02/HDFA-final.pdf

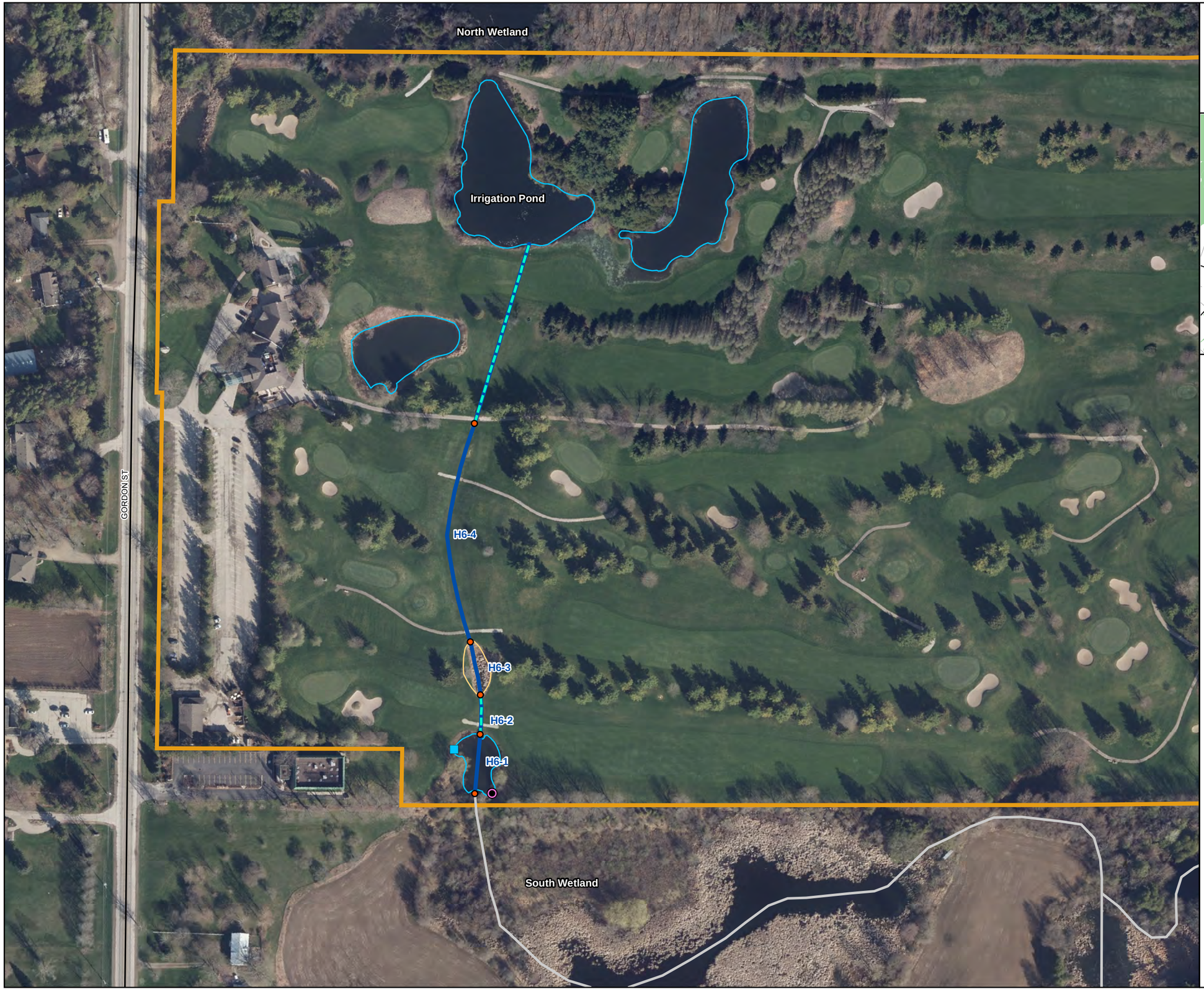
Maps

Map 1

Springfield Golf Course

Technical Review of H6





Legend

- Subject Property
- Primary Road
- Pond
- Small Wetland
- Catch Basin Outlet
- Drain Inlet and Headwall

Drainage Features

- Surveyed Segments
- CEIS-Mapped HDF (2021)
- Segment Marker
- Buried Tile Drain

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Project: 2114 Date: August 30, 2021	NAD83 - UTM Zone 17 Size: 11x17" **1:2,000**

0 20 40 60 80 100 120 140 Metres

Path: X:\2114_SpringfieldGolfCourse_ClairMaltby\NRSI_2114_Map1_DrainageFeatures_4K_2021_08_30_LEH.mxd

Appendix I
Photographs of H6

Photo 1

North Wetland: facing northwest.
Visit 1 (March 19, 2021)

Photo 2

North Wetland: facing northwest.
Visit 2 (May 7, 2021)

Photo 3

North Wetland: facing northwest.
Visit 3 (August 4, 2021)

Photo 4

Irrigation Pond: facing northwest.
Visit 1 (March 19, 2021)

Photo 5

Irrigation Pond: facing northwest.
Preliminary Visit (April 9, 2019)

Photo 6

Irrigation Pond: facing northwest.
Visit 2 (May 7, 2021)

Photo 7

Irrigation Pond: facing northwest.
Visit 3 (August 4, 2021)

Photo 8

Buried Tile Drain Area: facing northwest.
Visit 1 (March 19, 2021)

Photo 9

Buried Tile Drain Area: facing southeast.
Visit 1 (March 19, 2021)

Photo 10

Buried Tile Drain Area: facing southeast.
Preliminary Visit (April 9, 2019)

Photo 11

Buried Tile Drain Area: facing northwest.
Visit 2 (May 7, 2021)

Photo 12

Buried Tile Drain Area: facing northwest.
Visit 3 (August 4, 2021)

Photo 13

Buried Tile Drain Area: irrigation pond shut-off valve.
Preliminary Site Visit (April 9, 2019)

Photo 14

Buried Tile Drain Area: outlet location at culvert under paved golf cart path.
Visit 1 (March 19, 2021)

Photo 15

H6-4: View of segment, facing northwest.
Visit 1 (March 19, 2021)

Photo 16

H6-4: View of northern-most portion of segment, facing northwest.
Visit 1 (March 19, 2021)

Photo 17

H6-4: View of segment, facing northwest.
Preliminary Visit (April 9, 2019)

Photo 18

H6-4: View of standing water in northern-most portion of segment, facing northwest.
Preliminary Visit (April 9, 2019)

Photo 19

H6-4: View of segment, facing northwest.
Visit 2 (May 7, 2021)

Photo 20

H6-4: View of segment, facing northwest.
Visit 3 (August 4, 2021)

Photo 21

H6-3: View of segment, facing west.
Visit 1 (March 19, 2021)

Photo 22

H6-3: View of northern portion of segment, facing northwest.
Preliminary Visit (April 9, 2019)

Photo 23

H6-3: View of segment, facing west.
Visit 2 (May 7, 2021)

Photo 24

H6-3: View of segment, facing west.
Visit 3 (August 4, 2021)

Photo 25

H6-2: View of segment, facing north.
Visit 1 (March 19, 2021)

Photo 26

H6-2: View of segment, facing northwest.
Preliminary Visit (April 9, 2019)

Photo 27

H6-2: tile drain outlet under cart path bridge.
Visit 1 (March 19, 2021)

Photo 28

H6-2: tile drain outlet under cart path bridge.
Preliminary Visit (April 9, 2019)

Photo 29

H6-2: View of segment, facing northwest.
Visit 2 (May 7, 2021)

Photo 30

H6-2: View of segment, facing northwest.
Visit 3 (August 4, 2021)

Photo 31

H6-1: View of segment, facing north.
Visit 1 (March 19, 2021)

Photo 32

H6-1: View of segment, facing south.
Preliminary Visit (April 9, 2019)

Photo 33

H6-1: View of segment, facing north.
Visit 2 (May 7, 2021)

Photo 34

H6-1: View of segment, facing north.
Visit 3 (August 4, 2021)

Photo 35

H6-1: Catch basin outlet in eastern corner of pond.
Visit 2 (May 7, 2021)

Photo 36

H6-1: Drain inlet and headwall in western corner of pond.
Visit 1 (March 19, 2021)