TECHNICAL MEMORANDUM

DATE 22 October 2025 **Project No.** CA-GLD-1791470A

TO Andreanne Simard - Director of Lands, Resources and Environment, Stephen May - Lands Manager, Western Region
CBM Aggregates
CC Craig DeVito, Warren Aken, Paul Menkveld - WSP; Neal DeRuyter - MHBC

FROM Courtney Huber **EMAIL** **courtney.huber@wsp.com**

HEADWATER DRAINAGE FEATURE ASSESSMENT - PROPOSED CBM ABERFOYLE SOUTH LAKE PIT

1.0 INTRODUCTION

WSP Canada Inc. (WSP) has been retained by CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada), to provide consulting services for the proposed CBM Aberfoyle South Pit Expansion (the Site).

In order to fully address stakeholder comments and ensure CBM has the required information available to respond, WSP has undertaken a Headwater Drainage Feature Assessment associated with drainage on the Aberfoyle South Pit Expansion Site.

For the purpose of this memorandum, the following definitions are used:

- **Site** - the total land area within the property owned by CBM that is proposed for licensing under the ARA. The Site is approximately 44 ha.
- **Extraction Limit** – The total area within the Site in which aggregate is proposed for extraction. The total area of the Extraction Limit is approximately 27 ha.
- **Study Area** - The Study Area for the headwater drainage feature assessment encompasses the drainage features connecting to Mill Creek and associated unnamed tributaries on the Site.

This assessment s undertaken to compliment the Water Report for this application, which includes characterization of larger surface water features and a surface water balance (which allocates surplus to infiltration and run off) (WSP 2023a).

2.0 METHODS

Headwater Drainage Feature (HDF) assessments were conducted to confirm the flow and connection of the surface water features on the Site. Potential HDFs, drainage patterns and linkages between the Site and nearby Mill Creek and associated tributaries were identified during the HDF assessments. The assessments are based on data collected in the on-site surface water features according to Ontario Stream Assessment Protocol (OSAP) Section 4 Module 11 – Unconstrained Headwater Sampling (Gorenc and Stanfield, March 2017) and the *Evaluation, Classification, and Management of Headwater Drainage Features Guidelines* (HDF Guidelines) developed by the Toronto and Region Conservation Authority and Credit Valley Conservation (TRCA and CVC, 2014) to evaluate and classify each feature.

The HDFs were defined with the following characteristics, as outlined by the HDF Guidelines: *Evaluation* (Part 1), *Classification* (Part 2) and *Management* (Part 3).

2.1 Part 1 – Evaluation

Based on a review of aerial imagery, it was concluded that the HDFs on the subject property were 'low sensitivity sites' (i.e., features that are ill-defined, contain only ephemeral flow and are unlikely to contain sensitive species and/or habitat) and as such, a Rapid Survey Technique was used for assessment, as outlined in the HDF Guidelines (TRCA and CVC, 2014).

The Unconstrained Headwater Sampling as outlined by OSAP (2017), allows for a rapid assessment method for characterizing the amount of water and sediment transport and storage capacity and drainage feature types found on an extended landscape where access is generally unconstrained. The Unconstrained Headwater Sampling specifically identified three Sampling events:

Sample Event 1: Conducted in the short period of time following a major freshet event, which in Ontario generally occurs during late winter and spring, and before new vegetative growth covers and disrupts any newly deposited sediment.

Sample Event 2: Conducted in late April through mid-May, after the melt/thaw related interflow has ceased. This survey should be completed prior to leaf out so that vegetation growth does not impact findings, preferably, after at least three days with no precipitation.

Sample Event 3: Conducted in July to mid-September, following at least three days without a significant (i.e. flow generating) precipitation event.

Information collected during the three sample events encompassed the following general parameters, where relevant:

- Feature Type (e.g., defined natural channel, channelized, not defined, etc.)
- Riparian Conditions (e.g., none, cropped land, forest, etc.)
- Flow Conditions (e.g., no water, standing water, interstitial flow, minimal or substantial flow)
- Feature Vegetation
- Feature / Bankfull Widths / Depths
- Sediment Deposition / Transport
- Flow Measures
- Longitudinal Gradient
- Site Features (e.g., roughness)
- Channel Connectivity

The HDFs assessed on the subject property were mapped on an aerial photography base, shown on Figure 1 in Appendix A – *Headwater Drainage Feature Assessment Mapping.*

2.2 Part 2 – Classification

The data collected during the HDF evaluation phase (Part 1: Evaluation) was used to apply appropriate classifications to the HDFs being assessed, identifying the functions of each HDF that were considered during Part 3: Management Recommendations. Following the Guidelines, a classification was applied to each of the following four categories: Hydrology; Riparian; Fish and Fish Habitat; and Terrestrial Habitat (see Table 1).

2.3 Part 3 - Management

The classification categories identified in Part 2 provide the basis of the management recommendations provided. A flow chart in the Guidelines provides guidance through the process of translating the classification results to management recommendations for the overall Site.

3.0 RESULTS

The first HDF assessment was conducted on the Site, on August 30, 2024, to capture *Sampling Event 3* (OSAP 2017) for the summer assessment, additional HDF assessments were conducted in the spring of 2025. The second site visit, representing *Sampling Event 1* (OSAP 2017), occurred on March 19, 2025, following a major freshet event and before new vegetation growth covered and disrupted any newly deposited sediment. A third visit, representing *Sampling Event 2* (OSAP 2017), was conducted on May 5, 2025, after the melt/thaw related interflow had ceased. Event 2 also was completed prior to leaf-on so that vegetation growth did not impact findings.

The HDFs assessed focussed on the main agricultural field where the Extraction Limit is located as well as the surrounding forested areas located to the southeast and northwest of the property. Prior to onsite field investigations and during the initial Site assessment (Summer 2024) nine areas were highlighted as potential HDFs (Figure 1). This summer assessment only provided base-line flow, therefore the following spring assessments (freshet & spate) provided further insight.

The agricultural field was observed as having many wet areas during the spring assessments which hold water in low-lying areas and remain in a relatively stagnant state on the property in the spring and become dry in the summer. Of the nine potential HDFs, seven (HDF 3 to HDF9) were dry or only contained stagnant water in the spring assessment and were all dry in the summer assessment. It was observed that the remaining two features (HDF1 and HDF2) provided some movement of water off the property and were moved forward through the unconstrained HDF assessment.

In total, two segments were assessed under the HDF Guidelines in the Study Area: HDF1, and HDF2. The branches of the HDFs were determined to contain shallow flowing water in the spring of 2025, therefore a full Unconstrained Headwater Drainage Feature Assessment was conducted. The results of the HDF assessments are provided below.

- **HDF1**: Channelized through active cropland; native vegetation, contributing terrestrial habitat, but no direct fish use. This feature was actively flowing during the spring field assessment, conveying flow from the agricultural field.
- **HDF2**: Swale through active cropland; native vegetation, contributing terrestrial habitat, but no direct fish use. This feature was actively flowing during the spring field assessment, conveying flow from the agricultural field.

The classification and management recommendation for each HDF feature segment resulting from the field evaluations of the two features is provided in Table 1 along with management recommendations in accordance with the *Guidelines*, below.

Table 1: Summary of HDF functional classifications and management recommendations

Drainage Feature Segment	Step 1		Step 2	Step 3	Step 4		Management Recommendation
	Hydrology*	Modifiers	Riparian	Fish Habitat	Terrestrial Habitat	Modifiers	
HDF 1	FC – 4 (Minimal surface flow) FT – 2 (Channelized) ***Contributing Functions - Ephemeral***	Active Agriculture / Channelized	Cropped Land ***Limited Functions***	Allochthonous transport only ***Contributing Functions***	RC – 3 (Cropped Land & 6 (Scrubland) Movement Corridor. ***Contributing Functions***	Active Agriculture	Mitigation, however following modifiers the management was reduced to **Maintain Recharge** "Maintain overall infiltration rates at site"
HDF 2	FC – 4 (Minimal surface flow) FT – 2 (Channelized) ***Contributing Functions - Ephemeral***	Active Agriculture & Wetland Feature /Channelized	Cropped Land ***Limited Functions***	Allochthonous transport only ***Contributing Functions***	RC – 3 (Cropped Land), 6 (Scrubland) & 7 (Wetland) Movement Corridor ***Contributing Functions***	Active Agriculture	Mitigation, however following modifiers the management was reduced to **Maintain Recharge** "Maintain overall infiltration rates at site"
HDF 3	FC – 1 (No Surface Water) FT – 4 (No defined feature) ***Limited or Recharge***	Active Agriculture	Cropped Land ***Limited Functions***	Allochthonous transport only ***Contributing Functions***	No terrestrial habitat present ***Limited Functions***	Active Agriculture	***No Management Required***
HDF 4	FC – 1 (No Surface Water) FT – 4 (No defined feature) ***Limited or Recharge***	Active Agriculture	Cropped Land ***Limited Functions***	No connection to a fishery. ***No Function***	No terrestrial habitat present ***Limited Functions***	Active Agriculture	***No Management Required***
HDF 5	FC – 1 (No Surface Water) FT – 4 (No defined feature) ***Limited or Recharge***	Active Agriculture	Cropped Land ***Limited Functions***	No connection to a fishery. ***No Function***	No terrestrial habitat present ***Limited Functions***	Active Agriculture	***No Management Required***
HDF 6	FC – 1 (No Surface Water) FT – 4 (No defined feature) ***Limited or Recharge***	Active Agriculture	Cropped Land ***Limited Functions***	No connection to a fishery. ***No Function***	No terrestrial habitat present ***Limited Functions***	Active Agriculture	***No Management Required***

Drainage Feature Segment	Step 1		Step 2	Step 3	Step 4		Management Recommendation
	Hydrology*	Modifiers	Riparian	Fish Habitat	Terrestrial Habitat	Modifiers	
HDF 7	FC – 1 (No Surface Water) FT – 4 (No defined feature) ***Limited or Recharge***	Active Agriculture	Cropped Land ***Limited Functions***	No connection to a fishery. ***No Function***	No terrestrial habitat present ***Limited Functions***	Active Agriculture	***No Management Required***
HDF 8	FC – 1 (No Surface Water) FT – 4 (No defined feature) ***Limited or Recharge***	Active Agriculture	Cropped Land ***Limited Functions***	No connection to a fishery. ***No Function***	No terrestrial habitat present ***Limited Functions***	Active Agriculture	***No Management Required***
HDF 9	FC – 1 (No Surface Water) FT – 4 (No defined feature) ***Limited or Recharge***	Active Agriculture	Cropped Land ***Limited Functions***	No connection to a fishery. ***No Function***	No terrestrial habitat present ***Limited Functions***	Active Agriculture	***No Management Required***

* FC = OSAP Flow Condition Codes; FT = OSAP Feature Type Codes, RC= Riparian Condition Code

4.0 RECOMMENDED MANAGEMENT

Based on the assessment in Section 3.0, two drainage segments (HDF1 and HDF2) were assessed at the *Maintain Recharge,* while the seven remaining drainage segments were assessed as *No Mitigation Required* (as outlined in Table 1).

The following recommended management, outlined by the HDF *Guidelines (*TRCA and CVC, 2014*),* are in place for ***No Management*** of HDFs on site:

- The feature that was identified during desktop pre-screening has been field verified to confirm that no feature and/or functions associated with headwater drainage features 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.

The following recommended management, outlined by the HDF *Guidelines (*TRCA and CVC, 2014*),* are in place for ***Maintain Recharge*** of HDFs on site:

- Maintain overall water balance by implementing mitigation measures to promote infiltration of rainwater runoff.
- Terrestrial features have been assessed in the Natural Environment Report Proposed Aberfoyle South Pit Expansion (WSP 2023b) and there are no notable terrestrial functions associated with them.

5.0 CONCLUSION

The HDF assessment was undertaken to compliment the Water Report. The Headwater Drainage Feature Assessment associated with drainage on the Aberfoyle South Pit Expansion Site has two drainage segments (HDF1 and HDF2) assessed at the *Maintain Recharge.*

To evaluate if recharge has been maintained the surface water balance, included in Section 6.5 of the Water Report (WSP 2023a), presents predicted changes in infiltration. Under existing conditions 70% of surplus water infiltrates. As a result of the creation of a pit pond on the Site, surplus is captured and infiltrated, maintaining and marginally increasing recharge as a proportion of the Site water balance. In operational conditions and in post-rehabilitated conditions Site wide recharge is maintained and slightly enhanced from from 70% to 76% of surplus. Therefore, the Water Balance of the Site shows that the proposed development promotes infiltration and therefore fulfills the recommendations outlined above in Section 4.0.

WSP Canada Inc.

[redacted]

Courtney Huber, H.B.Sc
Aquatic Ecologist

[redacted]

Daniel Eusebi, BES, RPP, MCIP
Senior Principal Ecologist

CH/PGM/DE/ld

Attachments: Appendix A – Headwater Drainage Feature Mapping
Appendix B – Unconstrained HDF Assessment Forms
Appendix C – Photo Reference

REFERENCES

Gorenc and Stanfield. 2017. Ontario Stream Assessment Protocol (OSAP) Section 4 Module 11 – Unconstrained Headwater Sampling Guideline.

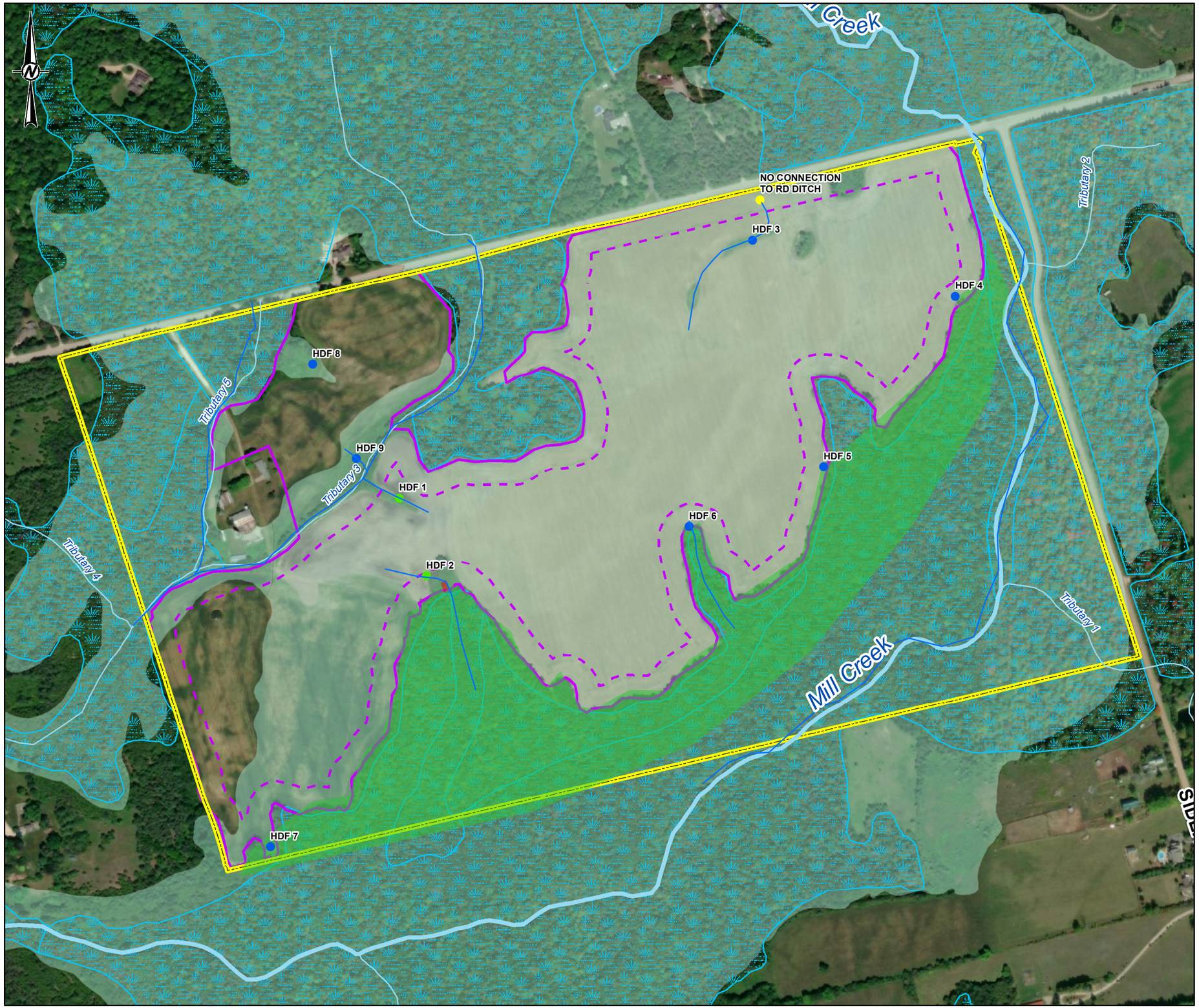
Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC). 2014. Evaluation, Classification and Management of Headwater Drainage Features Guideline.

WSP, 2023a. Water Report Level 1/2 Aberfoyle South Pit Expansion. Report dated November 2023.

WSP. 2023b. Natural Environment Report Proposed Aberfoyle South Pit Expansion. Report dated November 2023.

APPENDIX A

Headwater Drainage Feature Mapping



LEGEND

- NO CONNECTION TO RD DITCH
- STAGNANT WATER, NO FLOW
- SURFACE RECHARGE
- DRAINAGE LINES
- WATERCOURSE
- CEDAR SWAMP - FLOODED
- OUTLET PIPE (SOUTH)
- PROVINCIALLY SIGNIFICANT WETLAND (EVALUATED)
- PROPERTY BOUNDARY
- LICENCE BOUNDARY / SITE BOUNDARY
- PROPOSED EXTRACTION AREA
- FLOODPLAIN (GRCA)

0 100 200 300 400

1:5,000 METRES

REFERENCE(S)

1. BASEDATA: MNRF LIO, OBTAINED 2019
2. PRODUCED USING INFORMATION UNDER LICENSE WITH THE GRAND RIVER CONSERVATION AUTHORITY © GRAND RIVER CONSERVATION AUTHORITY, 2021
3. IMAGERY SOURCE: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY IMAGE SEPTEMBER 2016

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC.(CANADA)

PROJECT
ABERFOYLE SOUTH PIT EXPANSION

TITLE
HEADWATER DRAINAGE FEATURE ASSESSMENT

CONSULTANT

wsp

YYYY-MM-DD	2025-07-10
DESIGNED	SO
PREPARED	SO
REVIEWED	GWS
APPROVED	GWS

PROJECT NO.	CONTROL	REV.	FIGURE
1791470	0008	0	**9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

Path: S:\Clients\CBM_Aggregates\Aberfoyle_P69\9_PRO\1791470_CBM40_PRO\0008_South_Pit_Extension\1791470-0008-CH-0009.mxd

APPENDIX B

Unconstrained HDF Assessment Forms

Unconstrained Headwater Drainage Feature Assessment

Date (yyyy/mm/dd): 2024083 0 Project #: CA-GLD-1791470A Recorder/Crew: CH

Stream Name: N/A Stream Code: NA Site Code: HDF1

Site Limits: Upstream WP# 43°25'59.06"N, 80°11'33.19"W Field Assessment: ☒ Sample 1 Unconnected HDF:

Downstream WP# 43°26'0.53"N, 80°11'36.95"W ☐ Sample 2 ☐ Not connected to

Direction of Assessment: ☐ Upstream ☒ Downstream ☐ Sample 3 downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☒ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☒ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☒ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☒ Cropped (3) ☐ Meadow (4) ☒ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☒ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m):	5	10	20	Elevation (cm) :	3	7	10	Gradient (º):	n/a

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☒	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☒	☐	☐	☐

Feature Roughness ☒ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☒ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): 0.8 Bankfull Depth (mm) 20

Entrenchment Total: ☐ >40 m ☒ <40 m Left Bank ____ m Right Bank ____ m Total width ____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☒ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0.2	0.04	0.04	0.05	0	0	0									

Sediment Transport

Adjacent ☐ None (1) ☒ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): ____ ____ ____ ____ ____

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: yyyy/mm/dd 20240830 Project #: CA-GLD-1791470A Field Assessment: ☒ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____
WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____

Groundwater Indicators ☒ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☒ Absent ☐ Present Comment: No sampling conducted

WP#	Photo #	Code	Category	Description
1	1	HDF1	4	Start of HDF in agricultural field
2	2	HDF1	4	End of HDF with ocnvergence of Tributary 3

Additional Notes:

Site Break ☒ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

Unconstrained Headwater Drainage Feature Assessment

Date (yyyy/mm/dd): 2025/03/19 Project #: CA-GLD-1791470A Recorder/Crew: CH

Stream Name: N/A Stream Code: NA Site Code: HDF1

Site Limits: Upstream WP# 43°25'59.06"N, 80°11'33.19"W Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# 43°26'0.53"N, 80°11'36.95"W ☒ Sample 2 ☐ Not connected to

Direction of Assessment: ☐ Upstream ☒ Downstream ☐ Sample 3 downstream network

Flow Influence ☒ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☒ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☒ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☒ Cropped (3) ☐ Meadow (4) ☒ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☒ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m):	5	10	20	Elevation (cm) :	3	7	10	Gradient (º):	n/a

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☒	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☒	☐	☐	☐

Feature Roughness ☒ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☒ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): 0.8 Bankfull Depth (mm) 20

Entrenchment Total: ☐ >40 m ☒ <40 m Left Bank m Right Bank m Total width m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☒ Estimated (4)

Wetted Width (m)	Wetted Depth (mm) 1 2 3	Hydraulic head (mm) 1 2 3	Volume (L) 1 2 3	Distance (m) 1 2 3	Time (s) 1 2 3
0.7	0.11 0.15 0.12	1 1 1			

Sediment Transport

Adjacent	☐ None (1)	☒ Rill (2)	☐ Rill and Gully (3)	☐ Gully (4)	☐ Outlet Scour (5)
	☐ Sheet Erosion (6)		☐ Instream Bank Erosion (7)		☐ Other (8)
Feature	☒ None (1)	☐ Rill (2)	☐ Rill and Gully (3)	☐ Gully (4)	☐ Outlet Scour (5)
	☐ Sheet Erosion (6)		☐ Instream Bank Erosion (7)		☐ Other (8)

Sediment Deposition Measures (mm):

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: yyyy/mm/dd 20250319 Project #: CA-GLD-1791470A Field Assessment: ☐ Sample # 1 ☒ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____
WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____

Groundwater Indicators ☒ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☒ Absent ☐ Present Comment: No sampling conducted

WP#	Photo #	Code	Category	Description
1	1	HDF1	4	Start of HDF in agricultural field
2	2	HDF1	4	End of HDF where it converges with Tributary 3

Additional Notes:

Site Break ☒ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

Unconstrained Headwater Drainage Feature Assessment

Date (yyyy/mm/dd): 2025050 5 | Project #: CA-GLD-1791470A | Recorder/Crew: CH

Stream Name: N/A | Stream Code: NA | Site Code: HDF1

Site Limits: Upstream WP# 43°25'59.06"N, 80°11'33.19"W | Downstream WP# 43°26'0.53"N, 80°11'36.95"W

Direction of Assessment: ☐ Upstream ☒ Downstream

Field Assessment: ☐ Sample 1 ☐ Sample 2 ☒ Sample 3

Unconnected HDF: ☐ Not connected to downstream network

Flow Influence ☐ Freshet (1) ☒ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☒ Interstitial Flow (3) ☐ Substantial Flow (5) ☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7) ☒ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8) ☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☒ Cropped (3) ☐ Meadow (4) ☒ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☒ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m):	5	10	20
Elevation (cm):	3	7	10

Gradient (º): n/a

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☒	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☒	☐	☐	☐

Feature Roughness ☒ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☒ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): 0.8 Bankfull Depth (mm) 20

Entrenchment Total: ☐ >40 m ☒ <40 m Left Bank ____ m Right Bank ____ m Total width ____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☒ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)	Hydraulic head (mm)	Volume (L)	Distance (m)	Time (s)
	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
0.55	0.05 0.11 0.07	0.5 0.5 0.5			

Sediment Transport

Adjacent ☐ None (1) ☒ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): ____ ____ ____ ____ ____

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: yyyy/mm/dd 20250505 Project #: CA-GLD-1791470A Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ☒ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____
WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____

Groundwater Indicators ☒ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☒ Absent ☐ Present Comment: No sampling conducted

WP#	Photo #	Code	Category	Description
1	1	HDF1	4	Start of HDF in agricultural field, N
2	2	HDF1	4	End of HDF where it converges with Tributary 3, M

Additional Notes:

Site Break ☒ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

Unconstrained Headwater Drainage Feature Assessment

Date (yyyy/mm/dd): 2 0 2 4 0 8 3 0 | Project #: CA-GLD-1791470A | Recorder/Crew: CH

Stream Name: N/A | Stream Code: NA | Site Code: HDF2

Site Limits: Upstream WP# 43°25'56.72"N 80°11'35.74"W | Downstream WP# 43°25'55.75"N 80°11'32.01"W

Direction of Assessment: ☐ Upstream ☒ Downstream

Field Assessment: ☒ Sample 1 ☐ Sample 2 ☐ Sample 3

Unconnected HDF: ☐ Not connected to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☒ Baseflow (3)

Flow Condition ☐ Dry (1) ☒ Standing Water (2) ☐ Interstitial Flow (3) ☐ Minimal Flow (4) ☐ Substantial Flow (5)

Feature Type ☐ Defined Natural Channel (1) ☒ Channelized or Constrained (2) ☐ Multi-thread (3) ☐ No Defined Feature (4) ☐ Tiled Feature (5) ☒ Wetland (6) ☐ Swale (7) ☐ Roadside Ditch (8) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☒ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☒ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m):	5	10	20
Elevation (cm):	2	5	8

Gradient (º): n/a

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☒	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☒ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☒ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): 4 | Bankfull Depth (mm) 10

Entrenchment Total: ☐ >40 m ☒ <40 m | Left Bank ____ m | Right Bank ____ m | Total width ____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☒ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)	Hydraulic head (mm)	Volume (L)	Distance (m)	Time (s)
	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
1.2	0.05 0.08 0.05	0 0 0			

Sediment Transport

Adjacent	☒ None (1)	☐ Rill (2)	☐ Rill and Gully (3)	☐ Gully (4)	☐ Outlet Scour (5)
	☐ Sheet Erosion (6)		☐ Instream Bank Erosion (7)		☐ Other (8)
Feature	☒ None (1)	☐ Rill (2)	☐ Rill and Gully (3)	☐ Gully (4)	☐ Outlet Scour (5)
	☐ Sheet Erosion (6)		☐ Instream Bank Erosion (7)		☐ Other (8)

Sediment Deposition Measures (mm): ____ ____ ____ ____ ____

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: yyyy/mm/dd 20240830 Project #: CA-GLD-1791470A Field Assessment: ☒ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____
WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____

Groundwater Indicators ☒ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☒ Absent ☐ Present Comment: No sampling conducted

WP#	Photo #	Code	Category	Description
1	1	HDF2	4	Start of HDF in agricultural field
2	2	HDF2	4	Forested Area near drainage pipe

Additional Notes:

Site Break ☒ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

Unconstrained Headwater Drainage Feature Assessment

Date (yyyy/mm/dd): 2025031 9 | Project #: CA-GLD-1791470A | Recorder/Crew: CH

Stream Name: N/A | Stream Code: NA | Site Code: HDF2

Site Limits: Upstream WP# 43°25'56.72"N 80°11'35.74"W | Downstream WP# 43°25'55.75"N 80°11'32.01"W

Direction of Assessment: ☐ Upstream ☒ Downstream

Field Assessment: ☐ Sample 1 ☒ Sample 2 ☐ Sample 3

Unconnected HDF: ☐ Not connected to downstream network

Flow Influence ☒ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☒ Interstitial Flow (3) ☐ Substantial Flow (5) ☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7) ☒ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8) ☐ Multi-thread (3) ☒ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☒ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☒ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m):	5	10	20
Elevation (cm):	2	5	8

Gradient (º): n/a

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☒	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☒ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☒ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): 8 Bankfull Depth (mm) 10

Entrenchment Total: ☐ >40 m ☒ <40 m Left Bank ____ m Right Bank ____ m Total width ____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☒ Estimated (4)

Wetted Width (m)	Wetted Depth (mm) 1 2 3	Hydraulic head (mm) 1 2 3	Volume (L) 1 2 3	Distance (m) 1 2 3	Time (s) 1 2 3
6.6	0.2 0.026 0.19	1 1 1			

Sediment Transport

Adjacent	☒ None (1)	☐ Rill (2)	☐ Rill and Gully (3)	☐ Gully (4)	☐ Outlet Scour (5)
	☐ Sheet Erosion (6)		☐ Instream Bank Erosion (7)		☐ Other (8)
Feature	☒ None (1)	☐ Rill (2)	☐ Rill and Gully (3)	☐ Gully (4)	☐ Outlet Scour (5)
	☐ Sheet Erosion (6)		☐ Instream Bank Erosion (7)		☐ Other (8)

Sediment Deposition Measures (mm): ____ ____ ____ ____ ____

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: yyyy/mm/dd 20250319 Project #: CA-GLD-1791470A Field Assessment: ☐ Sample # 1 ☒ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____

WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____

Groundwater Indicators ☒ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☒ Absent ☐ Present Comment: No sampling conducted

WP#	Photo #	Code	Category	Description
1	1	HDF2	4	Start of HDF in agricultural field
2	2	HDF2	4	Forested Area near drainage pipe

Additional Notes:

Site Break ☒ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

Unconstrained Headwater Drainage Feature Assessment

Date (yyyy/mm/dd): 2025050 5 | Project #: CA-GLD-1791470A | Recorder/Crew: CH

Stream Name: N/A | Stream Code: NA | Site Code: HDF2

Site Limits: Upstream WP# 43°25'56.72"N 80°11'35.74"W | Downstream WP# 43°25'55.75"N 80°11'32.01"W

Direction of Assessment: ☐ Upstream ☒ Downstream

Field Assessment: ☐ Sample 1 ☐ Sample 2 ☒ Sample 3

Unconnected HDF: ☐ Not connected to downstream network

Flow Influence ☐ Freshet (1) ☒ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☒ Interstitial Flow (3) ☐ Substantial Flow (5) ☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7) ☒ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8) ☐ Multi-thread (3) ☒ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☒ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☒ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☒ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m):	5	10	20	Elevation (cm):	2	5	8	Gradient (º):	n/a

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☒	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☒ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☒ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): 7 | Bankfull Depth (mm) 10

Entrenchment Total: ☐ >40 m ☒ <40 m | Left Bank ____ m | Right Bank ____ m | Total width ____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☒ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
5.5	0.16	0.02	0.13	1	1	1									

Sediment Transport

Adjacent	☒ None (1)	☐ Rill (2)	☐ Rill and Gully (3)	☐ Gully (4)	☐ Outlet Scour (5)
	☐ Sheet Erosion (6)		☐ Instream Bank Erosion (7)		☐ Other (8)
Feature	☒ None (1)	☐ Rill (2)	☐ Rill and Gully (3)	☐ Gully (4)	☐ Outlet Scour (5)
	☐ Sheet Erosion (6)		☐ Instream Bank Erosion (7)		☐ Other (8)

Sediment Deposition Measures (mm): ____ ____ ____ ____ ____

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: yyyy/mm/dd 20250505 Project #: CA-GLD-1791470A Field Assessment: ☐ Sample # 1 ☒ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____

WP# _____ Perched Height (mm): _____ Jumping Height (mm): _____

Groundwater Indicators ☒ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☒ Absent ☐ Present Comment: No sampling conducted

WP#	Photo #	Code	Category	Description
1	1	HDF2	4	Start of HDF in agricultural field
2	2	HDF2	4	Forested Area near drainage pipe

Additional Notes:

Site Break ☒ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

APPENDIX C

Photo Reference

Photo 1: HDF1 taken 2025-03-19 during Sample Event 1 – Spring Freshet. Photo looking northeast from the agricultural field.

Photo 2: HDF1 taken 2025-05-05 during Sample Event 2 – Spring Spate. Photo looking northeast from the agricultural field.

Photo 3: HDF1 taken 2024-08-30 during Sample Event 3 - Summer. Photo looking northeast from the agricultural field.

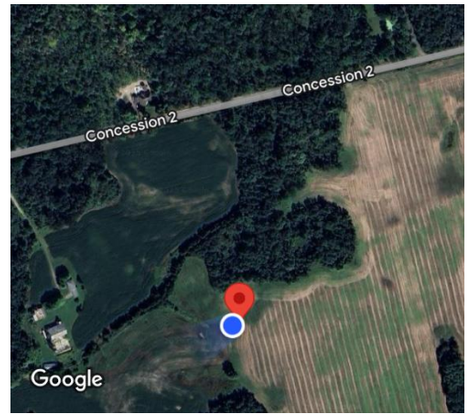


Photo 4: HDF1 location of photos at 43°25'59.06"N, 80°11'33.19"W

Photo 5: HDF2 taken 2025-03-19 during Sample Event 1 – Spring Freshet. Photo looking northeast from the agricultural field where the HDF started.

Photo 6: HDF2 taken 2025-05-05 during Sample Event 2 – Spring Spate. Photo looking northeast from the agricultural field where the HDF started.

Photo 7 : HDF2 taken 2024-08-30 during Sample Event 3 - Summer. Photo looking northeast from the agricultural field where the HDF started.

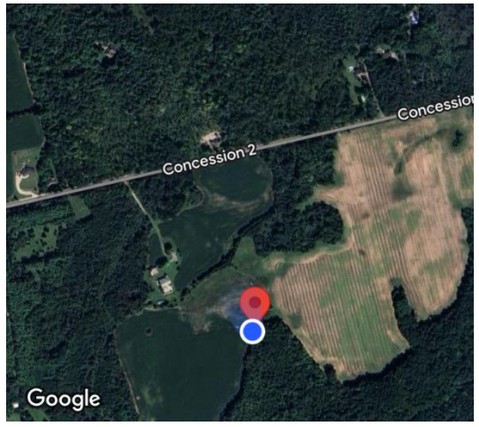


Photo 8: HDF2 location of photos at 43°25'55.75"N 80°11'32.01"W

Headwater Drainage Feature Assessment, CBM Aberfoyle South Pit
REPRESENTATIVE PHOTOGRAPHS

Date Taken: 2024/2025

Project No: CA-GLD-1791470A

Figure No: 1