



August 29, 2016

HESL Job #: J160071

Finley McEwen  
20 Queen Street West, 5th Floor  
Toronto, Ontario  
M5H 3R4

Dear Mr. McEwen:

**Re: Engagement Letter – Mansfield Ski Club – Receiving Water Assessment for Surface Discharge of Treated Wastewater Effluent to the Pine River**

We are pleased to confirm our understanding of the terms of engagement to complete the scope of work in the attached work plan for a receiving water assessment for a surface discharge of treated domestic wastewater effluent to the Pine River from a proposed redevelopment/expansion of the Mansfield Ski Club (MSC), located at 628213 Side Rd 15, Mansfield, Ontario, in the Township of Mulmur.

The budget for this project is \$45,249 plus HST, as detailed in the table below. The budget also includes the costs for Tammy Karst-Riddoch to attend the pre-consultation meeting with MOECC on August 9, 2016 and for a site visit that included collection and analysis of water chemistry data to inform the work plan approach.

We will submit our invoices monthly. Our invoices will be sent via email and addressed to the recipient of this letter, who, we understand, accepts responsibility for payment of all amounts properly charged in accordance with the terms of this engagement. Invoices are payable on receipt.

Every effort is made to ensure the accuracy of all invoices. Should you identify any errors, please notify us within 30 days of receipt of the invoice, failing which, all invoices are assumed to be correct.

If you are in agreement with our understanding of the terms of this engagement as described above, please sign the authorization form below, make a copy for yourself and return a copy to us for our files. If you have any questions, please feel free to give me a call.

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## Budget Breakdown

Item	Cost
<b>Professional Fees</b>	
MOECC Pre-consultation (August 9)	\$ 540
Reconnaissance Site Visit (August 10)	\$ 660
Task 1. Compilation of Data and Background Information	\$ 550
Task 2. Field Work	\$ 11,520
Task 3. Low Flow Analysis	\$ 1,440
Task 4. Water Quality Summary	\$ 1,040
Task 5. Natural Heritage and Beneficial Use Constraints	\$ 1,040
Technical Memorandum	\$ 3,780
MOECC Pre-consultation	\$ 1,440
Task 6. Assimilative Capacity Assessment	\$ 7,200
Final Report	\$ 9,150
Subtotal	\$ 38,360
<b>Disbursements</b>	
Field Equipment Rental	\$ 1,890
Laboratory (August 10 site visit)	\$ 94
Laboratory (Task 2 Field Work)	\$ 1,913
Shipping and Incidentals	\$ 400
Mileage (field work and meetings)	\$ 1,274
Subtotal	\$ 5,571
<b>3% Administration</b>	\$ 1,318
<b>Total</b>	<b>\$ 45,249</b>

\*based on HESL corporate rates for ALS Laboratories.

We would like to thank MTE for selecting Hutchinson Environmental Sciences Ltd. for this most interesting assignment. We look forward to working with you to bring this project to a successful conclusion.

Sincerely,

Per: Hutchinson Environmental Sciences Ltd.



Tammy Karst-Riddoch, Ph.D.

Senior Aquatic Scientist

[tammy@environmentalsciences.ca](mailto:tammy@environmentalsciences.ca)

Attach.



Hutchinson Environmental Sciences Ltd.

EL28072015\_J160071\_Mansfield Ski Club final

## Engagement Letter - Authorization

**HESL 160071**

**Mansfield Ski Club – Receiving Water Assessment for Surface Discharge of Treated Wastewater  
Effluent to the Pine River**

**August 29, 2016**

Mansfield Ski Club

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Signing Authority

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Date

Hutchinson Environmental Sciences Ltd.



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Tammy Karst-Riddoch

August 29, 2016

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Date



August 29, 2016

HESL Job #: J160071

Finley McEwen  
20 Queen Street West, 5th Floor  
Toronto, Ontario  
M5H 3R4

Dear Mr. McEwen:

**Re: Work Plan – Mansfield Ski Club – Receiving Water Assessment for Surface Discharge of Treated Wastewater Effluent to the Pine River**

Hutchinson Environmental Sciences Ltd. (HESL) is pleased to submit this work plan to complete a receiving water assessment for a surface discharge of treated domestic wastewater effluent to the Pine River from a proposed redevelopment/expansion of the Mansfield Ski Club (MSC), located at 628213 Side Rd 15, Mansfield, Ontario, in the Township of Mulmur.

The existing MSC operates seasonally from late December to early April. Sanitary servicing for the site (an existing Chalet Building and an Operations Building) is by a private on-site sewage treatment system (Northern Purification System) with subsurface disposal to a leaching bed. The proposed redevelopment of the site is to include the existing Chalet Building, and renovation of the Operations Building and new development providing a total of 1,595 m<sup>2</sup> of commercial retail space and 93 residential units.

The Site Servicing and Stormwater Management Report<sup>1</sup> (WMI 2016) for the redevelopment reported that sewage flows from the site will increase from 14,740 L/day to 116,765 L/day with the proposed redevelopment, which will necessitate a new sanitary sewage treatment system to accommodate the expanded flows. A package plant was proposed consisting of a Waterloo Biofilter System with UV disinfection and sodium aluminate dosing with disposal of the effluent to a new onsite wetland stormwater management facility. The effluent would then be conveyed off site a distance of 1,050 m via a series of grass-covered roadside ditches, swales and two existing dry ponds/basins for surface discharge to the Pine River as the ultimate receiver. The proposed effluent treatment objectives were 10.0 mg/L for carbonaceous oxygen demand (CBOD5) and total suspended solids (TSS), 0.5 mg/L for total phosphorus (TP), 3.0 mg/L for total ammonia nitrogen (TAN) and a geometric annual mean concentration of 100 organisms/100 mL for *Escherichia coli*. The proposed effluent treatment limits were 15 mg/L for CBOD5 and TSS, 1.0 mg/L for TP, 5.0 mg/L for TAN and a geometric annual mean concentration of 200 organisms/100 mL for *E. coli*.

As previously discussed, the proposed effluent conveyance route (i.e., roadside ditches, swales, dry ponds) would provide minimal dilution of the effluent and would thereby represent a 'dry ditch' discharge. The conveyance route passes through residential lands which could be of concern to local residents and the

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<sup>1</sup> WMI & Associates Limited, 2016. Site servicing & stormwater management report. Mansfield Ski Club, Township of Mulmur. Report WMI 15-319. June 2016.

Ministry of Environment and Climate Change (MOECC). Moreover, the Pine River near the subject property is a high quality receiver that supports a sensitive trout fishery and is used by local residents for recreation (swimming and fishing). Better treatment objectives are therefore likely warranted to protect the beneficial uses of the river. These concerns were also expressed by MOECC at the pre-consultation meeting at the Guelph District Office on August 9<sup>th</sup>, 2016, and further supported by the results of a site reconnaissance visit by HESL on August 10<sup>th</sup>, 2016.

Alternate methods of effluent disposal may be feasible including direct discharge to the Pine River to the northwest of the subject property at the existing pump house, or discharge to an onsite 3-5 acre pond that is located in the northeast corner of the subject property and draining to the Pine River through a conduit. These options would avoid issues associated with an open, dry ditch discharge, and be more amenable to the MOECC.

During our site visit, we observed five large trout in the Pine River upstream of the rock weir adjacent to the pump house on the subject property, confirming the presence of trout habitat. We collected water samples from the centre of the river immediately downstream of the weir, which were analysed for total phosphorus (TP), orthophosphate (PO<sub>4</sub>), total ammonia nitrogen (TAN), nitrate (NO<sub>3</sub>), nitrite (NO<sub>2</sub>) and total suspended solids (TSS). Results indicated that the river at this location had very low concentrations of phosphorus (TP = 0.0053 mg/L, PO<sub>4</sub> = <0.003 mg/L), TAN (<0.02 mg/L) and TSS (<2.0 mg/L). NO<sub>3</sub> was elevated at 2.1 mg-N/L but was below the Canadian Environmental Quality Guideline (CEQG) of 3.0 mg-N/L. A farm with cattle was located across the river just upstream of the sampling location that is likely a source of nitrate at this sampling location, in addition to other rural land uses upstream. Based on these results, the Pine River adjacent to the subject property likely has capacity to receive effluent from the MSC, however, additional data are required to confirm the status of the river, in particular for the period of operation of the MSC from December to April.

A surface discharge of treated effluent to the Pine River requires a receiving water assessment to determine the impacts of that effluent on water quality in the river. Key to this assessment is the determination of suitable effluent quality and a discharge location so that the size and quality of the effluent plume in the river meets the guidelines of the MOECC to protect water quality and beneficial uses. Based on our project understanding and input from the MOECC at the Pre-consultation Meeting, we have developed a comprehensive work plan to complete this assessment with the objectives to:

1. Characterize the existing water quality and flows of the Pine River at the proposed discharge location and determine its assimilative capacity to receive treated effluent,
2. Identify environmental and beneficial usage constraints for the discharge,
3. Recommend alternative discharge options (e.g., direct to river or via an existing man-made pond) and locations based on identified constraints,
4. Complete a mixing zone analysis at the point of effluent discharge to the Pine River to determine the size of the mixing zone and provide recommendations for a discharge configuration to minimize the size of the mixing zone,
5. Recommend appropriate treatment objectives and limits based on the assimilative capacity of the river and results of the mixing zone analysis, and
6. Develop a water quality monitoring program to confirm the results of the assessment and to monitor the effects of the discharge on water quality of the Pine River.



## **Work Plan**

We propose the following work plan tasks to complete the assessment:

### **Task 1. Compilation of Data and Background Information**

We will work with WMI & Associates Limited to confirm and document details of the preferred servicing approach including expected effluent volumes, treatment objectives and the specific discharge location.

We will compile relevant water quality and flow data for the Pine River from the following sources:

- ❖ Water Survey of Canada Station Pine River near Everett (02ED014) located approximately 10 km downstream of the study site. Continuous flow data are available for this station from 1967 to 1970;
- ❖ Provincial Water Quality Monitoring Network (PWQMN) Station 03005701002 located upstream of the Nottawasaga River at Mill Street, Angus, ON. Long-term data are available for this site from 1972 to 2015, which is typically monitored monthly from April to November by the Nottawasaga Valley Conservation Authority (NVCA).

We will also contact the MOECC and the NVCA to request any additional water quality monitoring data or information that may be relevant to the assessment including fish inventories, fish habitat and benthic invertebrate assessments.

### **Task 2. Field Work**

While the above water quality and flow data exist for the Pine River, site-specific data closer to the proposed discharge location and for the full period of discharge are required for the assimilative capacity assessment and the mixing zone analysis (Task 6). We therefore propose to sample water quality and stream flows monthly from September 2016 until April 2017 at two locations in the river (immediately downstream of the rock weir near the MSC pump house and at the crossing of the river at Airport Road (Regional Road 18). Water quality monitoring parameters will include:

- ❖ Field parameters (pH, temperature, dissolved oxygen, conductivity);
- ❖ TP;
- ❖ Nitrogen species (TAN, NO<sub>3</sub>, NO<sub>2</sub>, and total Kjeldahl nitrogen (TKN));
- ❖ Total suspended solids (TSS);
- ❖ Carbonaceous biochemical oxygen demand (CBOD<sub>5</sub>); and
- ❖ *E. coli*.

Water samples will be shipped to ALS Laboratories in Waterloo, Ontario, for analysis of all chemical parameters. River discharge will be measured at both sampling locations using the transect method and a Flo Mate or equivalent meter.

It is our understanding that the NVCA has conducted fish habitat and benthic invertebrate assessments in the Pine River that are likely suitable to document these biological characteristics for the purposes of the receiving water assessment. If additional information is required, we will submit a revised work plan to collect this information.



### Task 3. Low Flow Analysis

Effluent discharge to any receiver requires the determination that the receiver can effectively assimilate or dilute the effluent. In Ontario streams and rivers, the 7Q20 low-flow statistic is used as a basic design flow to determine the assimilative capacity of a stream or river. The 7Q20 flow represents the minimum 7-day average flow with a recurrence period of 20 years. This value determines the 5% chance of there not being adequate streamflow to properly dilute the point discharge.

We will calculate the 7Q20 flows in the Pine River at the proposed discharge site using the most recent 20-year data record from WSC Station, pro-rated and for the watershed area upstream of the proposed discharge location and verified with the measured flows from Task 2. We will also use this dataset to calculate the mean, minimum, maximum, and lower quartile (25<sup>th</sup> percentile) flows to fully describe flow and dilution potential of the river.

### Task 4. Water Quality Summary

We will summarize water quality data from the PWQMN Station and results of the Task 2 monitoring. Data will be assessed against applicable Provincial Water Quality Objectives (PWQO) to determine the policy status of the Pine River to receive treated effluent at the proposed discharge location in accordance with MOECC policies and guidelines<sup>2</sup>:

- ❁ Policy 1 - In areas which have water quality better than the PWQO, water quality shall be maintained at or above the objectives;
- ❁ Policy 2 - Water quality which presently does not meet the PWQO shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the objectives.

### Task 5. Documentation of Natural Heritage and Beneficial Use Constraints

We will perform a desk-top search to document natural heritage features and beneficial uses of the Pine River in the vicinity of the proposed discharge that may pose constraints to siting the discharge location and configuration of the effluent plume, to include:

- ❁ Water takings for drinking water,
- ❁ Recreation (swimming and fishing) areas,
- ❁ Sensitive fish habitat,
- ❁ Natural heritage features, and
- ❁ Aquatic Species at Risk (SAR) and critical habitat

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<sup>2</sup> Ontario Ministry of Environment and Energy (MOEE), 1994. *Water Management, Policies, Guidelines, Provincial Water Quality Objectives*. Queen's Printer for Ontario. 32 pp.



## Task 6. Assimilative Capacity Assessment

The assimilative capacity assessment will be completed using a mass balance modeling approach to determine water quality in the Pine River at the point of complete mixing of the effluent and a CORMIX model to determine the size and shape of the mixing zone. CORMIX is a software system developed by Cornell University for the analysis, prediction, and design of aqueous toxic or conventional pollutant discharges into diverse water bodies<sup>3</sup>. CORMIX requires a small number of inputs in order to generate meaningful simulation data, which will be gathered from our background review and field work (Tasks 1 to 3).

Modeling will be conducted for low flow conditions over the proposed operational period of the package plant (December to April) to inform recommendations for effluent limits and the discharge configuration under different flow, water quality and temperature regimes of the river. A preferred discharge location and configuration (i.e., single port discharge versus multi-port discharge) will be recommended that provides the most rapid assimilation but that also considers any identified constraints from Task 4. Factors including temperature (water density) of the water, the number of ports, and the location of the discharge in relation to banks and the river bottom all affect the resulting discharge mixing zone.

Recommendations for effluent limits will be based on the above modeling and MOECC's requirements in *Deriving Receiving Water Based, Point-Source Effluent Requirements for Ontario Waters*<sup>4</sup>, which provides requirements for point-source discharges and the procedures for determining effluent requirements for an Environmental Compliance Approval (ECA). This assessment will also consider the need to meet the condition of "no acute lethality" at the discharge point to the creek based on unionized ammonia concentration.

## Task 7. Reporting and Meetings

Completion of the full receiving water assessment will not be possible until early summer of 2017 once the field work in Task 2 is completed. To permit design planning to move forward, we will prepare a technical memorandum that documents the preliminary results of Tasks 1 to 5 (to include results of two Task 2 field events) in October 2016. We anticipate that this technical memorandum will provide sufficient information for pre-consultation with MOECC to get an approval in concept on the design, to be refined and finalized once all data have been collected. This will allow MOECC to comment on a) the proposed field study in advance of the critical operation period of the MSC from December to April, and b) the approach to the assimilative capacity assessment and mixing zone modelling (Task 6). We will prepare meeting minutes from the pre-consultation meeting and revise our work plan if necessary to address MOECC concerns.

We will complete a technical report for submission to the MOECC in support of the Environmental Compliance Approval application that summarizes the field investigations, constraints, assimilation assessment, recommendations for effluent limits and for continued water quality monitoring to track the influence of the discharge in the future.

Over the course of the project, we will provide monthly updates on the progress of the study.

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<sup>3</sup> Doneker, R. L. and G. H. Jirka, 2007. *CORMIX User Manual*, USEPA: EPA-823-K-07-001.

<sup>4</sup> Ontario Ministry of the Environment (MOE). 1994. *Deriving receiving water based point source effluent requirements for Ontario waters. PIBS#3302 Procedure B-1-5.*





## **Schedule**

The following schedule is proposed to complete the ACS:

Technical Memorandum of preliminary results – October 28, 2016

MOECC Pre-consultation Meeting – Week of October 31, 2016

Field Work – September, 2016 to April, 2017 (monthly)

Final Report – May 31, 2017

We thank MSC for inviting Hutchinson Environmental Sciences Ltd. to submit this work plan. Please do not hesitate to contact us if you have any questions.

Sincerely,  
Hutchinson Environmental Sciences Ltd.

Tammy Karst-Riddoch, Ph.D.



Senior Aquatic Scientist

[tammy@environmentalsciences.ca](mailto:tammy@environmentalsciences.ca)

