

**Pollution: any detrimental physical,
chemical or biological change in the nature
of water.**

- Federal office of the Environment
Waters Protection Act, article 4

Montreux Clean Beach Project II (MCBP II)

Project plan draft version

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Executive Summary

This project is the second in a series of projects designed to combine the removal of macro-pollutants from the shoreline with effective data collection methods. The first project Montreux Clean Beach Project I (MCBPI) was designed to explore and research trends in diffuse aquatic pollution while actively removing trash at specific locations on Lake Léman. Montreux Clean Beach Project II (MCBP II) improves on the first project and provides an efficient low cost process for data collection and trash removal based on existing technologies and proven methods.

The hammerdirt association operates under the premise that removal of trash in the ecosystem is essential and that all efforts of waste input reduction (education, infrastructure improvements) should be based on independent, verifiable data that is collected in the field. Serious efforts to quantify the amount of litter in the natural environment prefer survey methods that detail pieces per defined area/location versus mass or volume measurements.

MCBP II is designed and inspired by the citizen science method. Following the citizen science model we have reached out to the major universities in the region (UNIL and EPFL), researchers internationally and state and local officials. The feedback received from these individuals was essential in developing the format for MCBP II.

Comprised of two active members, hammerdirt is a nonprofit association that has strict and rigorous membership requirements. We have no political or religious affiliations, we are driven by our desire to swim in lakes and rivers that are litter free and create an environment that leverages technology and citizen participation to solve problems now and in the future.

This project is currently unfunded, if you or your organization would like to sponsor this project please contact hammerdirt for full financial details.

We would like to thank the following individuals and organizations:

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Problem

There is a constant flow of waterborne litter that accumulates on the shoreline. Composed primarily of fragmented plastics, foams and cigarette butts the quantity and accumulation rate of debris remains unknown.

Accumulation of litter on the shoreline represents multiple challenges to the communities responsible for maintaining and preserving the environment. Removing litter from natural surfaces such as sand and gravel has an elevated cost. The work is tedious, physical and must be done by hand (OFEV, 2011).

The origin of litter on the shoreline is difficult to determine, a portion can be attributed to inconsiderate beachgoers; however a large portion of the litter is small, weathered and mixed in with naturally occurring debris such as branches and leaves (Erismann & Erismann, 2015).

Goals:

The MCBPII has three goals:

1. Remove the litter that accumulates on the shoreline at specific locations
2. Collect data to quantify current accumulation rates using a standard methodology that can be utilized by researchers interested in the problem
3. Produce a training manual and volunteer recruiting scheme

To achieve these goals we have identified the following objectives that build upon the results of the first project

1. Litter collection and identification in accordance with an established international protocol
2. Stream line data entry and minimize administrative overhead
3. Communicate results on a regular basis
4. Research and communicate current trends relevant to this project
5. Develop a method that is repeatable and expandable

Methodology

This project is an application of citizen science (Science et Cité, 2015). By applying the best methods of citizen science we add value to the work done by volunteers to create a data set that covers a large temporal and geographic expanse that would otherwise be impossible (Silvertown, 2009) (European Commission, 2013).

The primary activity is removing the debris from the shoreline, this is known as a “beach litter survey” (Technical subgroup on marine litter, 2013). The activities associated with beach litter surveys and citizen science projects can be separated into three distinct categories (Bonney, et al., 2009) (Technical subgroup on marine litter, 2013).

1. Removal of trash
2. Counting and categorizing
3. Communicating/educating

Volunteer participation cleanup efforts have a long history in Switzerland; NetLeman, a bi-yearly event removes pollutants from the lake bed, annual events such as les Grangettes, Summit Foundation events and national cleanup day mobilize hundreds of individuals to collect and dispose of trash.

By reducing the time between cleanup operations, utilizing low cost technologies to quantify data and making the data available publicly we facilitate data mining and exploitation by universities and other researchers (Catlin-Groves, 2012).

Benefits

Macro-pollutant removal from the shoreline has a direct and immediate benefit to the communities concerned both environmentally and aesthetically. The material is removed entirely from the ecosystem and no longer has the potential of becoming a greater problem by fragmentation into secondary micro plastics (Wright, Thompson, & Galloway, 2013). Additionally important data is collected that may be used to determine the best solutions for diffuse aquatic pollution problems such as:

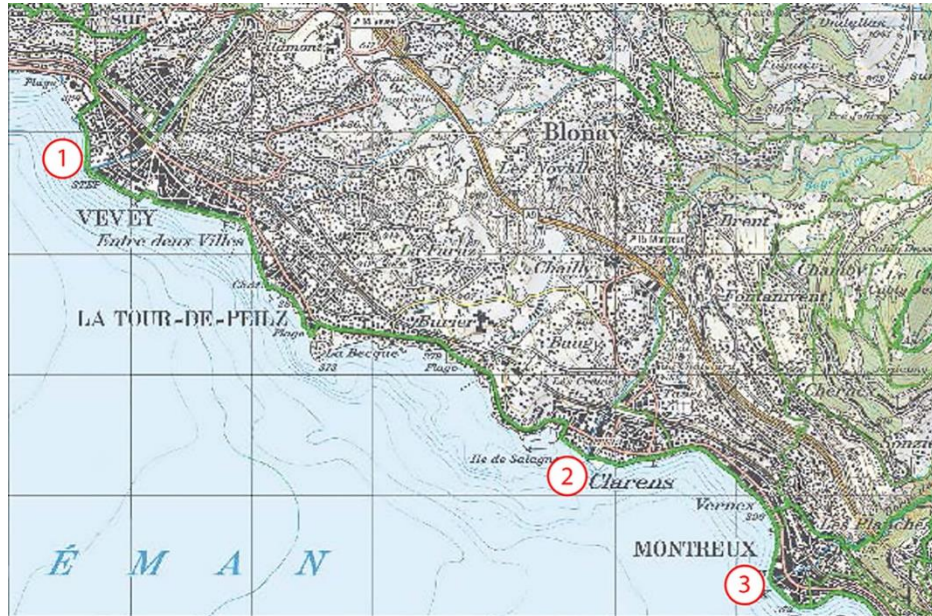
- Data can be used for antilitter campaigns (Mader-Feigenwinter, 2015)
- Data can be used by local authorities (Thonney, 2015)
- Data can be used for research (Hoellein, Westhoven, & Lyandres, Abundance and environmental drivers of anthropogenic litter on 5 Lake Michigan beaches: A study facilitated by citizen science data collection, 2014)

Surveillance over a large geographical area has the potential to function as an early warning system, “...*serving as a starting point for intensive targeted monitoring or theoretical research...*” (Dickinson1, et al., 2012).

The benefits of this project are direct, immediate and long term. The data collected will serve as a baseline for quantifying shoreline pollution that can be used today to display trends and in the future to measure the effects of a wide variety of independent variables.

Locations

For MCBP II we have selected three river mouths in the region: Baye de Montreux, Baye de Clarens and the Veveyse. These sites have public access and are in close proximity to public transport.



The three sites included in MCBP II span a coastal population of 57'464 and an average density of 4'130/km².

These sites are part of a larger district, "Préfecture de la Riviera-Pays-d'Enhaut" that has a population of 83'423 and a density of 290/km²

	Name	Length (km)	River basin (km ²)	Flow (avg m ³ /sec)	Coordinates	Strahler
1	Veveyse	19,5	62,2	2,14	46° 27' 40" N 6° 50' 07" E	5 ²
2	Baye de Clarens	8,1	14,4	no info	46° 26' 23" N, 6° 53' 20" E	no info
3	Baye de Montreux	9,98	39,8	0,51	46° 25' 51" N 6° 54' 31" E	4

Table 1

Usage and access

Neither the Baye de Clarens, the Baye de Montreux nor the Veveyse are "official beaches" as defined by the CIPEL (<http://www.cipel.org/plages-du-leman/>), although both the Bayes are popular beaches frequented regularly by tourists and locals alike, and the Veveyse is a popular fishing site.

All three sites are located on the "boardwalk" and are accessible by stairs/ladder (Baye de Montreux), by scaling a small wall (Baye de Clarens) or stepping down the break water (Veveyse). None of these beaches are wheelchair accessible but are frequented by a wide demographic range.

Services

All sites are in relative close proximity to shopping centers, hotels and restaurants particularly the Baye de Montreux. Near the Baye de Clarens there are two food stands in operation from May to October.

The Process

Removal of Trash

Macro pollutant removal is a key element of the project and when executed according to an established methodology important data is collected that may be used to determine the best solutions for diffuse aquatic pollution problems.

The systematic removal process will be applied to the same sites over a period of twelve months, thus capturing seasonal variations.

The Removal Process

1. Removal of pollutants greater than 1cm at selected sites
2. Collected material is spread on a flat surface and photographed
3. Measurements of the surface area at the collection site are recorded
4. GPS coordinates are recorded

Counting and Categorizing

The MCBPII uses an international standard developed by the EU and UNEP for categorizing the macro-pollutants found during a beach litter survey (Technical subgroup on marine litter, 2013) (Cheshire & Adler, 2009). However based on the experiences of MCBPI we have singled out specific items that are of importance locally.

The Counting Process

1. Separate material according to defined categories
2. Count each item in each category
3. Record quantities
4. Photograph
5. Dispose of material

There are 137 different categories in the Marine Litter Watch (MLW) item list, 47 of those items were regularly found during the course of MCBPI. For MCBPII we use the same codes and categories of the MLW protocol. However, we use the “Open Data Kit” (ODK) to create our own forms and store our data. The ODK is a suite of open source tools that is easily customizable and very reliable on a variety of software platforms including AndroidOS. Customizing our forms allows us to record the items most commonly identified at the top of the list thus saving time in the field.

The debris is collected and spread on a flat surface it is separated into categories according to the MLW survey. The quantities of items per category are entered directly into the smartphone. The data is stored on the phone, eliminating the need for network coverage during the operation. Once the phone is in range of a WIFI antenna the data can be uploaded to our remote server. The uploaded data and photos are exploitable immediately.

The MLW protocol and full item list can be found at [Marine Litter Watch website](#).

Our data and forms are stored with: [kobotoolbox](#).

Communicating/educating

The MCBII will communicate results to four distinct groups:

1. Local and regional authorities and political organizations
2. Academics locally and internationally
3. Other NGOS in the same field locally and internationally
4. General public

Communications

Hammerdirt is an association with no political affiliations or any other agenda than that previously stated. This philosophy is a continuation of MCBPI. The communication of individual operations and monthly aggregate reports will follow a set sequence as defined below.

The blog and Facebook: communicating daily results

The daily results will be summarized within 24 hour of each operation in a blog post. The contents of the blog post will follow a standardized format that includes:

1. Location, day, date and time of survey
2. Total number of pieces found
3. Photos of material removed, any uncategorized items, location and participant(s)
4. Surface area in m²

The facebook post will include the same information and can include photos of the individuals, wildlife and interesting scenery.

Interested parties can subscribe to the facebook page or the blog to receive this information. [Blog link](#) [Facebook page](#)

Slideshare: communicating monthly aggregate results

Each month a report containing the cumulative data for each site will be released. The minimum data that will be presented for each site is as follows:

1. Total number of operations
2. Total number of items found per category
3. Total surface area surveyed in m²

Inclusion of other comparative or descriptive statistics is an option that can be exercised by the staff of hammerdirt. The release of monthly aggregate reports will be announced on Facebook and the blog.

The plagepropres.ch website: communicating trends

The [plagespropres.ch](#) website, updated monthly, will contain a summary of the aggregate information for each location and a cumulative trend analysis for the project.

The pulse article: communicating knowledge

The members of hammerdirt are passionate about their work and have developed a large knowledge base on many topics related to aquatic pollution, hydrology, statistical analysis and the technologies related to these fields.

One [pulse](#) article per month will be published and shared on LinkedIn, a professional worldwide network. These focused articles are designed to share knowledge and increase the visibility of our work (Kapko, 2015). The subject of each article will be determined by hammerdirt.

The end of project report: communicating results

The end of project report for MCBPII will follow the model of the first activity report (Erismann & Erismann, 2015). However the data collected in MCBPII, will allow for a more detailed time series and statistical analysis of the quantity of trash collected (Rogers & Salm, 2015).

In MCBPII the dependent variable is density of trash (by category) per meter squared. This can be regressed against any number of independent variables for each site, such as:

1. Population density
2. Local Budget for litter prevention
3. Local Budget for litter remediation
4. Hotel nights sold
5. Demographic data
6. Distance from mass transit
7. Weather data (wind, precipitation)
8. Hydrology data (currents, lake levels, lake temp, wave height)

The survey used for MCBPII has over 100 categories that can be expressed in pieces per meter squared, thus allowing for an unprecedented depth of statistical analysis of diffuse aquatic pollution.

[Monitoring: ensuring the project is on track](#)

The MCBII is designed to be transparent operationally and administratively. The time and location of cleanup operations will be published weekly. Citizens, partners or any interested party may observe and/or participate in operations without notifying the project manager.

We encourage individuals to participate and validate our measurements. Interested parties should subscribe to the blog or the Facebook page to receive the schedule of events.

The data collected is open for all noncommercial use. Interested parties should contact hammerdirt to receive the latest data set.

Human resources:

MCBP II is designed as a pilot project. To attain the goals and accomplish the tasks as described in the preceding sections two qualified individuals working full time are required. Figure 2

The estimated times are based on the experience from MCBPI.

TASK	Hours : start up tasks and end of project analysis	Hours : per week
Coordination with state and local officials	20	1,5
Setting up : forms, file system, standardize blog and FB post , identify pulse articles, standardize monthly reports, update plagespropres.ch	32	0,5
Training of surveyors (2 days x 2 people) plus one instructor from EPFL	48	0,0
Carrying out the surveys 12 operations per week 4 hours per operation	0	48,0
Data input, organization and publication of final report	40	0,0
Download and organize data on local spreadsheet, place images in folders prepare images for social media posts	0	9,0
Data analysis monthly report	0	2,5
Blog post and Fb post 1/2 hour per operation	0	6,0
Update of plagespropres.ch	24	2,0
Pulse article : research and writing of article	0	5,0
Communication of activities social media		2,0
Administration and bookkeeping	16	3,0
TOTAL HOURS	180	80

Table 2

Material resources:

Hammerdirt association and our projects are designed to limit fixed overhead expenses and leverage employee participation. This project is designed to be executed and managed in the field by the two participants. There is no provision for fixed office space nor the associated costs.

Engagement of volunteers and or visitors will either be at the field or at a predetermined location. Arrangements have been made with other associations for the use of facilities for conferences and meetings.

Item	Qty
Communication and computer hardware	
Computer/ keyboard/monitor	2
Android smartphones	2
Software, internet acces, data plans	
Software license, monthly subscription MS Office	2
Software license, monthly subscription Adobe CC	2
Internet connction	1
Server space	1
Cell phone data plan	2
Subscption to Swiss meteo data (2 sites)	2
Personal equipment/transportation	
Public transportation monthly pass	2
Work shirts	6
Non disposable gloves	4 pair
Work pants	4
Work jacket	2

Table 3

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