YIP

Your Ideas to Practice

Conflicts and Water Management

Organised by

srh

UNIVA
La Universidad Católica

BADEN-
WÜRTTEMBERG
STIPENDIUM®

Baden-
Württemberg
Stiftung
WIR STIFTEN ZUKUNFT

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Mexico

The SRH Program

Monday 13th

11:00 am	Official welcome by rectorate and dean School, room 202
12:00 pm	Lunch in our Cube + Campus tour together with our international office
02:00 pm	Kick-Off YIP project: Introduction to Humanitarian Engineering by Prof. Dr. Aaron Brown, MSU Denver
04:00 pm	Tour through Heidelberg -> Discover the water and architectural highlights of the city of Heidelberg
07:00 pm	Tour and visit brewery and joint dinner in the "Kulturbrauerei" in old town of Heidelberg

Tuesday 14th

10:00 am - 03:00 pm	Workshop: Introduction into the topics Situation in Mexico incl. Explorer App Guadalajara, Lago Chapala, Rio Lerma) Best practice examples School, room 305
03:00 pm	Visit the "Energiepark Pfaffengrund", Stadtwerke Heidelberg
06:00 pm	Visit "Bahnstadt" Heidelberg and dinner

Wednesday 15th

10:00 am	Workshop: Intercultural communication School, room 213
11:00 am	Peraparation Water Sampling Constructed Wetland
02:00 pm	"Erlebnisgarten" Worms: Focus Constructed Wetland - including water sampling and analysis
05:00 pm	City tour Worms

Friday 17th

09:30 am	Conficts in Mexico by Luke Hally, HIIK School, room 202
11:15 am	Digitalisation in Water Technology / Integration of VR / AR in poster presentation
12:30 pm	Lunch in our Cube
02:00 pm	Digitalied Training in Water Sector using VR, AR and Moodle Platform incl. visit of the waterwater treatement plant Heidelberg via VR glasses
03:00 pm	Continuation project work
05:00 pm	Joint barbecue at Neckarwiese Heidelberg

Activties on holiday

Thursday 16th:

- Excursion Klimaarena Sinsheim
- Teltschik Tower Wilhemsfeld
- Visit Neckargemünd
- Canoe Trip on Neckar and Elsenz
- Visit horse farm in Spechbach

Weekend 18th and 19th:

- Visit of Stuttgart incl. Mercedes Benz and Porsche museum
- Visit of Heidelberg incl. Castle of Heidelberg

Monday 20th

09:30 am	Lecture Innovation Management School, room 203
11:15 pm	Presentation of project ideas and definition of questions for next innovation workshop
01:00 pm	Lunch in our Cube
02:00 pm	Meeting with Rolf Stahlhofen, Water is Right School, room 202
04:00 pm	Preparation for excursion

Tuesday 21st

7:30 am	Departure from SRH University Heidelberg
9:30 - 11:30 am	Visit of Taubergießen (by small boat; genuine river wetland)
01:00 - 03:00 pm	Visit of ZAK Kahlenberg
06:30 pm	Dinner at Jägerhaus (between Fridingen and Beuron; Upper Danube Valley)
08:00 - 09:00 pm	Lecture: Introduction to karstification and karstwater hydrology

Wednesday 22nd

09:00 am	Walk up to the Castle of Bronnen
03:00 pm	Visit of wastewater treatment plant "ZVK Steinhäule" in Ulm
08:00 pm	Workshop: Applying innovation methods for defining project ideas

Thursday 23rd

09:30 am	Visit of the Egau Waterworks
01:00 pm	Guided visit of the drinking water treatment and supply facilities at LW Langenau including visit of a theme park water" ("Erlebniswelt Wasser")
08:00 pm	Workshop: Defining project ideas

Friday 24th

09:30 am	Common breakfast at Altvaterbaude
10:30 am	Common cleaning of our hut
12:00 pm	Visit of the wild cave "Falkensteiner Höhle"

Saturday 25th

11:00 am	Preparation Outdoor poster session
15:00 pm	Outdoor poster session with final barbecue

DEMO CRATIA

Democratia-Aqua-Technica

YIP II – YOUR IDEAS TO PRACTICE: DEVELOPING SUSTAINABLE SOLUTIONS FOR WATER POLLUTION IN A GLOBAL COOPERATION

'EDUCATION IS THE MOST POWERFUL WEAPON WHICH YOU CAN USE TO CHANGE THE WORLD'
NELSON MANDELA

YIP
Your Ideas to Practice

STRUGGLE FOR RESOURCES MARK THE HISTORY OF MANY COUNTRIES

IMPORTANT FOR

SOCIO - ECONOMIC DEVELOPMENT

SOCIETY | STATE

YOUR IDEAS TO PRACTICE

SRH HEIDELBERG
PROF. DR. ULRIKE GAYH

UNIVA MEXICO
PROF. DR. LIVIER DE REGIL

4 PROJECT BASED EVENTS

RESEARCH QUESTION

#1 HOW TO AVOID OR REDUCE POLLUTION OUTSIDE THE LIMITS OF HEAVY METALS IN LAKE CHAPALA TO IMPROVE THE SOCIAL, ECONOMIC, HEALTH AND ENVIRONMENTAL CONDITIONS OF PEOPLE ?

TEAM (1)

#2 HOW TO IMPROVE THE WATER QUALITY OF THE SANTIAGO RIVER THROUGH THE TREATMENT OF WASTEWATER FOR USE IN AGRICULTURE

TEAM (2)

STUDENTS DEVELOP INNOVATIVE TECHNICAL SOLUTIONS FOR SUSTAINABLE WATER RESOURCE MANAGEMENT

CONTRIBUTE TO THE PREVENTION AND REDUCTION OF LOCAL CONFLICTS OF USE

STUDENTS GO THROUGH COMPLETE CYCLE OF A PRACTICAL PROJECT → EXPERIENCE INTERCULTURAL PROJECT MANAGEMENT

JUNE 11-28th

STUDY VISIT IN GERMANY

PRACTICAL TRAINING IN MEXICO

30.8-8.9

GRAPHIC RECORDED 3/5/23 by IRINA.PFENNING@INOVIS.CO

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The Project

Introduction

Innovation

The existing bridge between implementation of water technology and long-standing water conflicts, present opportunities for students and young researchers to come forward with more and more innovative, futuristic and sustainable solutions which aid in preventing future conflicts.

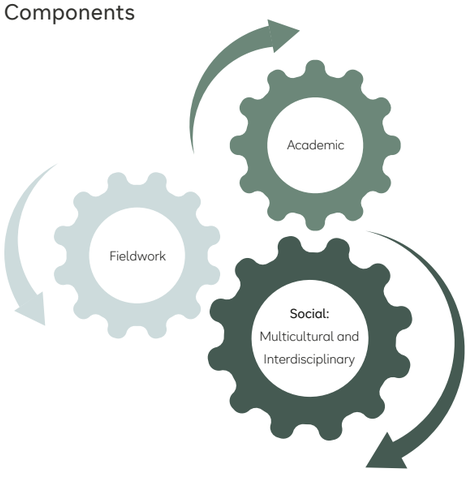
The main advantage of this program is that students will have their chance to prove their ideas from the very beginning step of formulating ideas, going through steps such as collaborating with other students, discussing their ideas with technical experts, all the way through to doing actual practical works and laboratory experience, and finally presenting their solutions to an international audience.

Goal

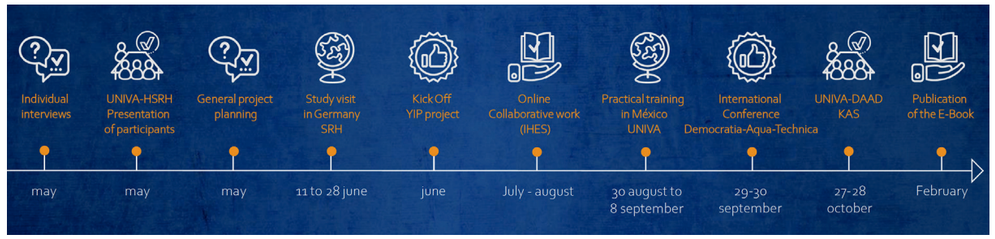
To promote Research and Development regarding
Water Conflicts among young students

- Participants will work on **sustainable developments and innovative ideas for water resource management** in the Lerma-Chapala-Santiago basin, in order to eliminate any future conflicts, or at the least, to restrict.
- Students will get more exposure to the cycle of **practical projects** and will get more experience regarding **international project management** which is a significant topic these days.

Components



Description of the program



Duration

6 months

Project:

Design of a apropiate technology prototype to improve the quality of water extracted from Lake Chapala and the Santiago River basin, used by small scale agriculture and the population of small communities.

Execution

Research question

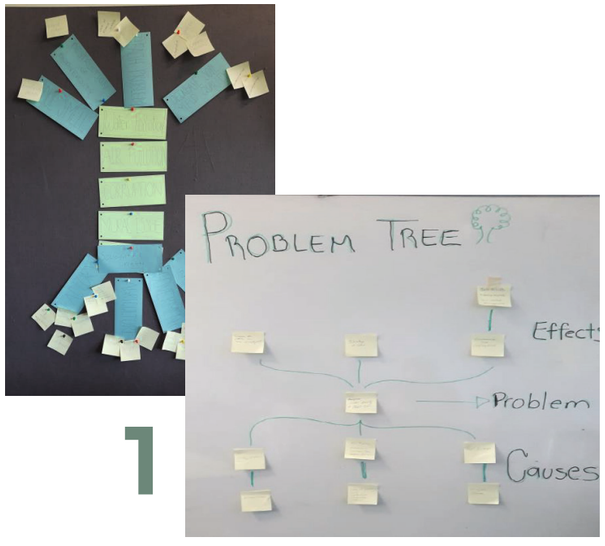
TEAM #1
How to avoid or reduce pollution outside the limits, of heavy metals, in Lake Chapala to improve the social, economic, health and environmental conditions of people?

TEAM #2
How to improve the water quality of the Santiago River through the treatment of wastewater for use in agriculture?

"Education is the most powerful weapon which you can use to change the world."

Nelson Mandela
Nobel Peace Prize 1993

Determination of the
Research problem



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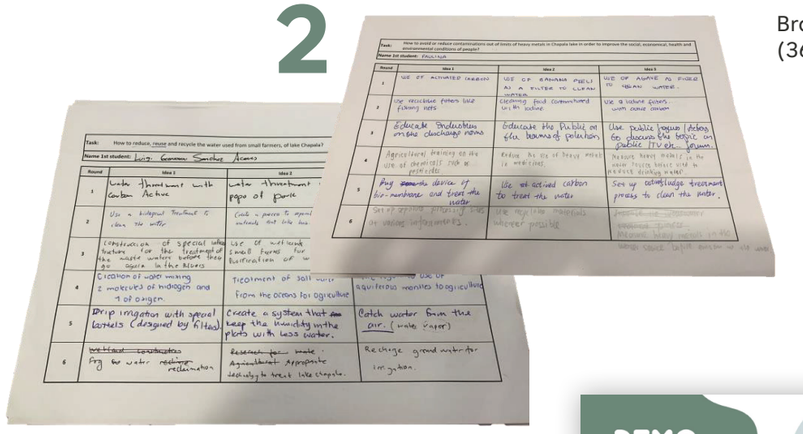
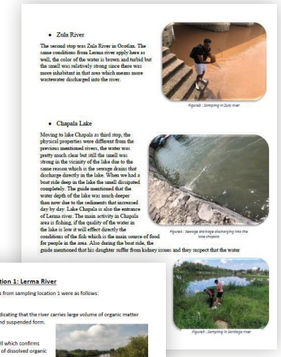


Brainstorming
(365 method)

5

Parameters
Temp
pH
Conductivity
DO
TDS
Turbidity
Salinity
Hardness
Alkalinity
Chromium
Free Chloride
Bromine
Nitrate
Nitrate
Sulphate
Chromium
Cadmium

Parameters for
the analysis of
water samples



Sampling Location 1: Lerma River

Visual Observations from sampling location 1 were as follows:

1. Colour:

Brownish colour indicating that the river carries large volume of organic matter in both dissolved and suspended form.

2. Smell:

Strong soil like smell which confirms earlier observation of dissolved organic matter.

3. Visual Observations:

Many trees and bushes around the banks of the river covering approx. 90% of river.

Plastic wastes around the banks of the rivers

4. Activities:

Markets and Shops around. But no direct human contact observed with the water body.

5. Community:

Community is aware about the situation but no actions taken.
Most Shops which generate organic wastes were observed among the community. Eg: Vegetable shops, restaurants etc
Community Population around the river was observed to be between the age of 30-65 years. With majority being older generations

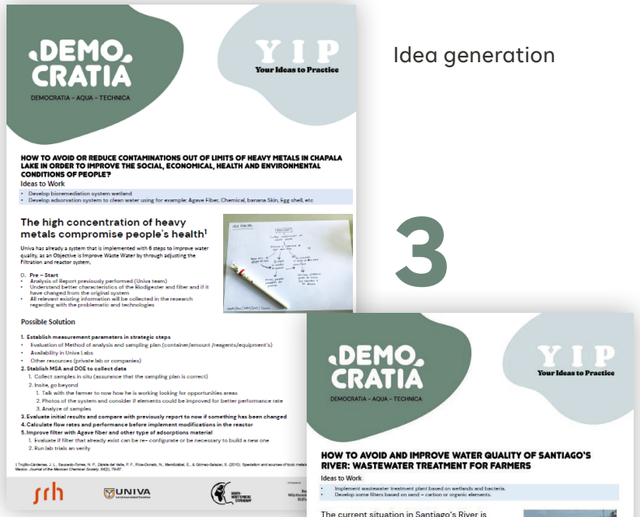
6. Aquatic life:

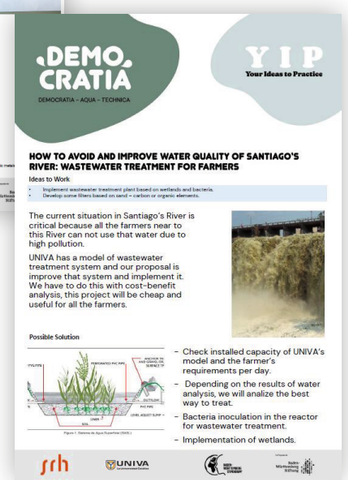
No signs of aquatic life could be seen in the river, maybe because of high COD or BOD levels

6

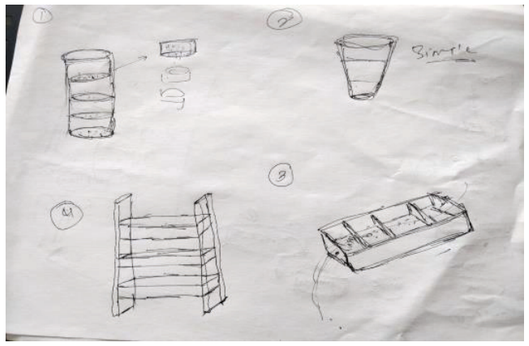
Sampling
(Fieldwork Diaries)

3





Idea generation



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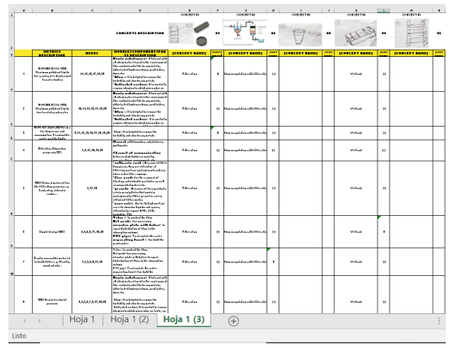
Concept sketch



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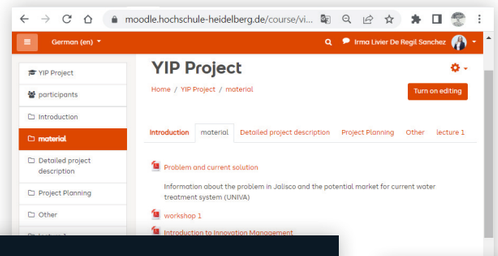
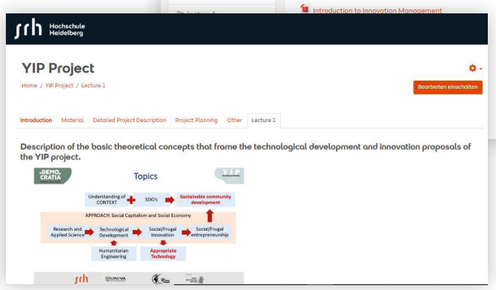
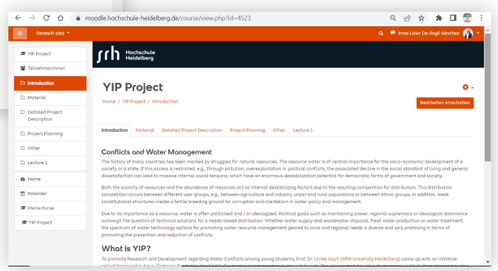
Proof of
concept
(POC)

4

Work
online







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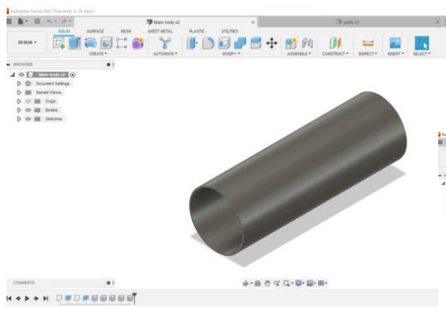
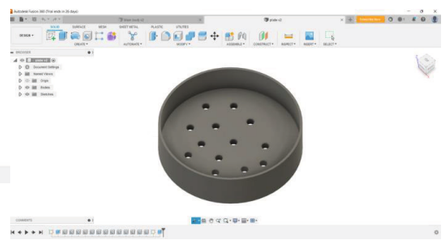
Wireframe prototypes





6 Posters

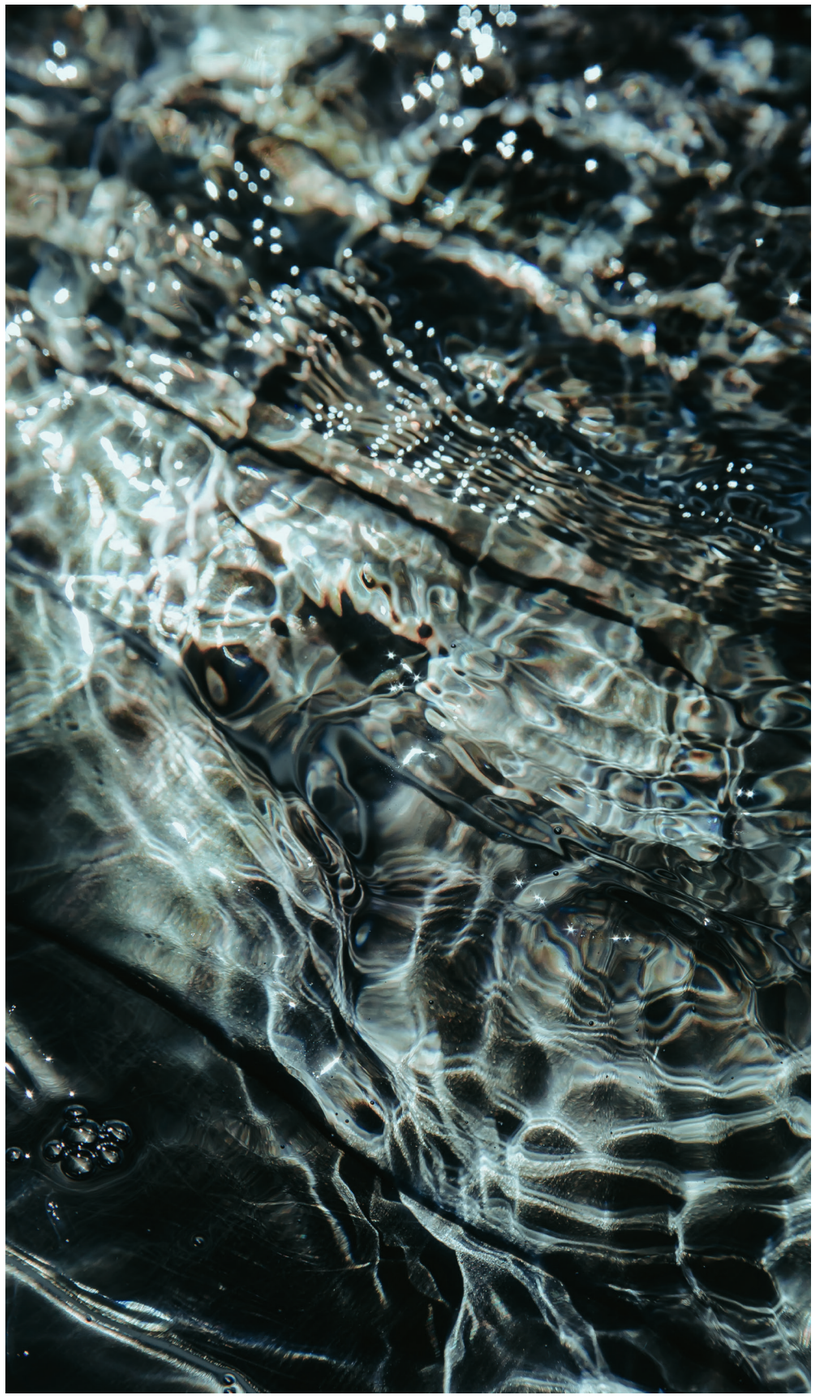
5 Conferences

1 UNIVA Institutional research colloquium

1 Paper +

1 Book chapter

3 Technological product proposals



The Research

Research Title

"Design of an appropriate technology prototype to improve the quality of water used for small-scale agriculture, extracted from Lake of Chapala and the Santiago River basin:
A comparative study of water samples obtained from a wetland in Germany (advance)

Background

- The city consumes about 164,308.44 cubic meters of water per day. 50% and 60% comes from Lake Chapala.
- Jalisco, the national leader in agricultural production, leading together with Michoacan the market for pig farms which pollute water.
- Wastewater treatment by the traditional method costs $2.00 to $3.00/m3 and handles a flow of between 0.015 to 3 L/s, the initial investment varies according to the characteristics of the water to be treated and the removal that is required.
- Dr. Pascoe of Research UNIVA campus Guadalajara began a technological development project for the physical-biological treatment of liquid waste from biodigesters in pig farms, which was affected by the COVID-19 pandemic.
- The treatment of liquid waste with the proposed system would only have electricity costs if an aerator is used for the sludge reactor, which can be replaced by a pre-strainer filter that does not consume electricity, the only expenses would be investment and system maintenance.

State of Question

Dotor-López, Zúñiga-Cruz, Cruz-Monterrosa, Díaz-Ramírez, & Rayas-Amor (2017).
Quantification of heavy metals in strawberry crops (Fragaria Xananassa Duch. var. festival) in Tenancingo and Villa Guerrero, Mexico State.

The determination of heavy metals was carried out by atomic absorption spectrophotometry. The results show that Al and Zn were the elements present in the highest quantity (mg kg-1) both in strawberry fruits, as well as in soil and water. Cr was detected in Villa Guerrero in fruit and water, while Pb was recorded in fruit from Tenancingo.

Pérez Cutillas, Amado Álvarez, Segovia Ortega & Alarcón Cabañero (2019).
Environmental degradation and its effects on surface water pollution in the Conchos river basin (Chihuahua - Mexico).

The need to adopt substantial changes in agricultural uses and practices, and to reform comprehensive management systems related to the treatment of urban and industrial effluents, in order to improve water quality and avoid possible risks to public health.

Caldera-Villalobos, Cabrera-Munguía, Flores-Guía, Viramontes-Gamboa, Vargas-Correa, Cano-Salazar & Claudio-Rizo (2021).
Removal of water pollutants using composite hydrogels comprised of collagen, guar gum, and metal-organic frameworks.

The basicity of the organic linkers played an important role in improving adsorption performance and physical properties. Interestingly, the hydrogels neutralized the pH of the wastewater during the adsorption operation.

Problem

LERMA RIVER

- Over-exploitation of water tables
  Soil erosion in 390,000 Ha
- Bad agricultural practices
  Waste of water
- Uncontrolled expansion of settlement
- Unhealthy riverbeds
- Treatment of 1/3 of residual water, it is not reused
- Inadequate hydraulic infrastructure

Reference: Gobierno del Estado de México. (s.f.).

CHAPALA LAKE

- Population with public health problems: chronic renal failure, congenital malformations and cancer.
- Average concentration of arsenic above the maximum limit of the WHO, and below the limit of the NOM on drinking water.
- Fecal concentration is seven times higher than wastewater; discharges do not go through treatment before being deposited in water bodies.
- Supplies more than 5 million people of the AMG.

Reference: Macías Ascanio, A.S. (mayo-julio 2022).

SANTIAGO RIVER

- Water contamination with organic load, heavy metals and others
- Natural purification capacity exceded
- Land use changes
- Human settlements
- Industrial activity
- Agricultural activities
- Poor waste disposal

Reference: Gobierno de Jalisco. (s.f.).

General objective

Design the prototype of an appropriate technology that improves the quality of water used in small-scale agriculture, extracted from Lake Chapala and the Santiago River basin.

Specific objectives

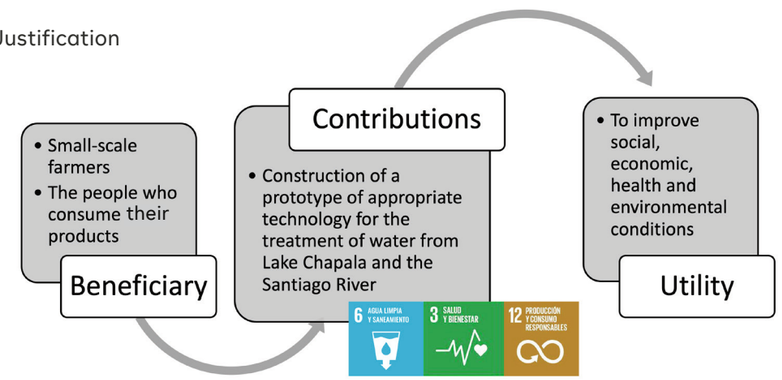
1. Characterize the water from the samples obtained in Jalisco, Mexico by analyzing them comparatively with the physical, chemical and biological characteristics of water samples obtained in Baden-Württemberg, Germany.
2. Determine the design and components of an appropriate technology in terms of the user and the expected results in relation to the water characteristics of the samples obtained in Jalisco, Mexico.
3. Validate the operation of a prototype of appropriate technology at the laboratory level using water from Lake Chapala and the Santiago River.
4. Demonstrate improvement in the quality of water extracted from Lake Chapala and the Santiago River basin.

Research hypothesis

Descriptive Hypothesis #1:
Off-limit heavy metal contamination in Lake Chapala will be prevented or reduced by:
a) A bioremediation system in a wetland
b) An adsorption system to clean the water using organic waste such as agave fiber, banana peel, egg shell and chemicals.

Descriptive hypothesis #2:
The water quality of the Santiago River will be improved through the treatment of residual waters with
a) A plant based on wetlands and bacteria.
b) Filters based on sand-carbon and/or organic elements.

Justification



Theoretical Framework

HUMANITARIAN ENGINEERING:
Merges technical areas with other disciplines to find appropriate, sustainable, participatory solutions aimed at increasing community resilience. It offers a holistic view of engineering, of the application of scientific and technological knowledge in the development of intermediate technologies for social welfare and the common good, appropriate to teaching-learning for the development of skills.
Bauer & Brown (2014)

APPROPRIATE TECHNOLOGY:
Intermediate technology with sustainable design concepts; solutions that are often not based solely on technology. In addition to engineering, other areas of knowledge are necessary to derive adequate solutions and using the beneficiary's own resources.
Schumacher (1973)

RESIDUAL WATER:
liquid waste collected through the sewage network for delivery to a treatment plant can be domestic, industrial, agricultural, rainwater, and uncontrolled.
Knobelsdorf Miranda (2018)

WATER POLLUTION:
suspended matter, inorganic compounds, conductivity, nutrients, organic matter, toxic organic compounds, pathogenic organisms, thermal
Dewisme (1997)
Matia, et al. (1999)

PARAMETERS FOR WATER CHARACTERIZATION:
physical, chemical, and biological; suspended matter, inorganic compounds, conductivity, nutrients, organic matter, toxic organic compounds, pathogenic organisms, thermal
Dewisme (1997)
Matia, et al. (1999)

FRUGAL INNOVATION:
Do more with fewer resources for more people, without sacrificing quality and at low cost
Navi Radjou (2014)
Del Giorgio Solfa y Amendolaggine (Febrero de 2020)
Bound y Thornton (2012); Shivaraman et al (2012); Rajadurai y Parameshwari (2014).

Tabla 3.2. Parámetros comúnmente empleados para la caracterización de un ARU (Directiva 91/271; Escaler, 1997).

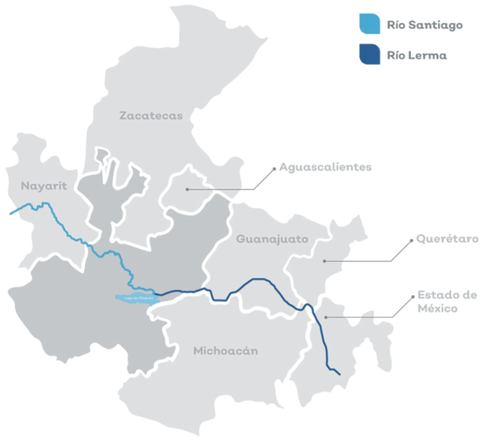
Físicos	Químicos	Biológicos
Sólidos totales (ST), mg/l • Suspendidos • Volátiles Temperatura, °C Turbiedad, UNT [a]	Materia orgánica, mg O_2/l • Demanda bioquímica de oxígeno (DBO_5) • Demanda química de oxígeno (DQO) pH Alcalinidad, mg $CaCO_3$/l Nitrógeno, mg N/l • Orgánico • Amoniacal (NH_3-N, NH_4^+-N) • Nitritos (NO_2^--N) • Nitratos (NO_3^--N) Fósforo, mg P/l • Orgánico • Reactivo soluble (PO_4^{-3} -P)	Organismos patógenos • Coliformes, número/100 ml • Virus, ufc/100 ml [b]

[a] unidades nefelométricas de turbiedad
[b] unidades formadoras de colonias

Contextual Framework: Lerma-Chapala-Santiago Hydrological Basin

- Second longest tributary in Mexico
- The Lerma River rises in the State of Mexico, flows through Querétaro, Guanajuato and Michoacán, to Lake Chapala, Jalisco. The source of the Santiago River, which runs 475 kilometers until it empties into the Pacific Ocean in Nayarit.
- In Jalisco it passes through Ocotlán, Poncitlán, Juanacatlán, El Salto, Tonalá, Guadalajara Metropolitan Area and other municipalities.
- Lake Chapala and the Santiago River supply water to Guadalajara Metropolitan Area, industries and small producers in Jalisco.

Source: Gobierno de Jalisco. (s.f.). Revivamos el río Santiago. Recuperado de https://riosantiago.jalisco.gob.mx/



Methods and Techniques

APPROACH:
- Mixed (Qualitative and quantitative)

LEVEL OR SCOPE OF INVESTIGATION:
- Descriptive
- Correlational

TYPE OF RESEARCH (OVER TIME):
- Cross-sectional with the population

Of the advance

- The research was carried out with wastewater from conventional toilets in a nature park in Worms, Germany.
- Wastewater samples were obtained from four wells with different conditions. Some wells were equipped with aeration pumps to supply oxygen, others had an activated carbon unit.
- In-situ characterization of pH, dissolved oxygen, and the temperature was performed using test leads and the HACH multimeter.
- The samples were kept in a refrigeration box with ice to transport them to the Water Lab of the SRH University Heidelberg, where the BOD concentrations were determined; COD; SO42-; NO3-; Cr; Cd, and Pb using HACH reagents and the DR 3900 spectrophotometer.

General instruments of the project

	Instruments or techniques	Indicator analyzed	Sample
Qualitative	Depth interviews	Perception of water quality, use and expectation	Population of the Lake Chapala region
	Focus group	Capacity of the population to solve the problem	Population of the Lake Chapala region
	Observation tables and records	Observable physical characteristics of water	Water samples obtained in Baden-Würtemberg and Jalisco
Quantitative	Log tables	Physical, chemical and biological characteristics of water	Water samples obtained in Baden-Würtemberg and Jalisco

Partial Conclusions

According to analysis led by Dr. Kenneth Bedu-Addo at the SRH University Water Laboratory Heidelberg :

- The BOD/COD ratio of the wetland wastewater for the inlet and outlet values of Wells 1 and 4 was 069 and 05, indicating that microbes are likely to biologically treat the wastewater with the 70% resulting removal of the BOD.
- The lower DQO removal efficiency in the constructed wetland, 57.90%, could be attributed to the higher fractions of inert DQO that constitute a part of the black water.
- The pH of the wastewater from the constructed wetlands ranged from 7.2 to 8.4, which favors the growth of microbes necessary for the decomposition of organic matter in the blackwater.
- To optimize the efficiency of nutrient and metal removal in the constructed wetland, further research involving plants and sediments over a longer period should be conducted.

A Presentation

Performance evaluation of the Worms subsurface flow constructed wetland for treating black water using in-situ and ex-situ analytical methods Source: Springer

Introduction

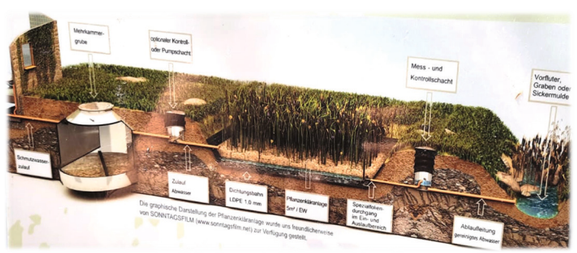
Constructed wetlands

Easy to operate, environmentally friendly, effective in organic matter and nutrient removal among others are nature based wastewater treatment technologies.
Use natural environmental components through physical, chemical, and biological processes for BOD reduction through microbial breakdown (biological process), settling of suspended particulate (physical process), removal of nitrates, removal of phosphates and removal of heavy metals through adsorption, chelation, and precipitation (chemical processes).

There are three major categories of constructed wetlands:

- Free water surface wetlands (FWS)'' with exposed water surface
- Vertical subsurface flow constructed wetland (VSFCWs)'' with vertical feeding pattern
- Horizontally fed subsurface flow constructed wetland (HSFCWs)'' with water level beneath a porous media

Is a subsurface flow constructed wetland (SFCWs) with a permeable soil foundation.
The wastewater level at the Worms constructed wetland is below the soil level, which is suitable for the cold climate in Germany.
The system at Worms is designed to mitigate the impacts of odour and huge land usage associated with wetlands through improved sorption and exchange rates while minimizing the footprint of the constructed wetland.

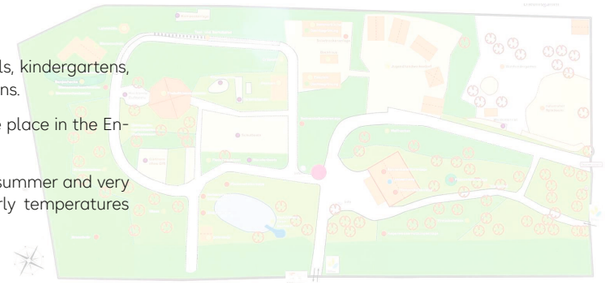


Worms Constructed wetland

Objective

The study's objective was to evaluate the effectiveness of four wells concerning wastewater treatment in the subsurface constructed wetland at Worms as part of a study to find innovative ways to improve the treatment efficiency of the wetland in the face of increasing pressure on the facility.

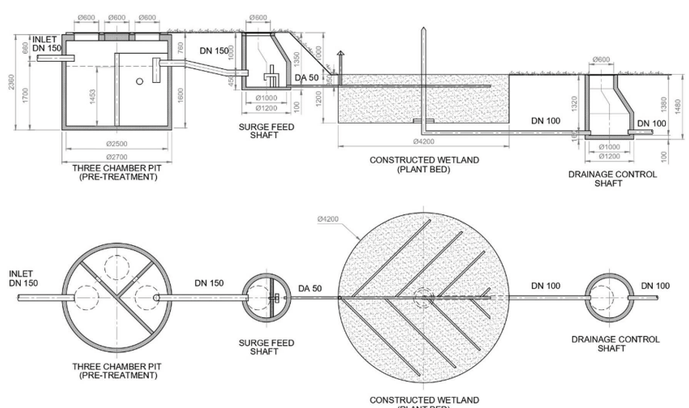
Worms adventure garden



- Environmental education facility used by schools, kindergartens, environmental associations and interested citizens.
- A kindergarten is integrated where lessons take place in the Environment House.
- The climate is predominantly warm during the summer and very cold and windy during winter with mean yearly temperatures ranging between −1 °C to 25.6 °C.

Description of study area

- The subsurface flow constructed wetland consisting of 5-chamber pits with fine filter for the treatment of wastewater via activated soil zones penetrated by the roots of plants to create favorable conditions for the degradation of substances around the root area.
- Mechanically pre-treated wastewater is treated in "vertically flowing overgrown soil filters" according to the 'Palutec soil filter principle' after which the wastewater is discharged into a floor filter via distribution pipes lying on a rolling gravel pack.
- The wastewater seeps vertically into the bed through the soil body with specified grain distribution which ensues purification viz interaction of mechanical and biological processes (Mall Umweltsysteme).



Layout of Palutec sewerage treatment plant at the Worms adventure garden. Adapted from Mall Umweltsysteme's graphic for Stadtverwaltung, Worms

Methods

Blackwater samples from conventional flushing toilets at the Worms Nature Park in Germany were collected from four wells.

In-situ pH-analysis was done using test strips, and validation done with the HACH HQ40d multimeter.
Water metals test strips were used for a preliminary on-site heavy metal assessment.

Snap and composite samples were collected in sterilised sampling bottles from a well with anaerobic conditions, a well fitted with an activated carbon unit for the removal of heavy metals, a well fitted with an aeration pump for the supply of oxygen to create aerobic conditions and a well for collecting the effluent after treatment.

To ensure that the original state of the black water samples were maintained, the wastewater samples were placed in a cool box packed with ice during transportation of the samples to the water lab at SRH University, Heidelberg.

A HACH Digital Reactor Block 200 (DRB200), HACH LCK cuvette tests with unique barcodes labels and HACH's UV-VIS spectrophotometer DR3900 were used for the determination of BOD, COD, NH_4-N, NO_3 N, Cr Cd and Pb concentrations of the black water samples.

Post the lab analysis, the data was corrected for outliers and analyzed using GraphPad Prism 7.0 and MS Excel.

Field work

Taking measurements

Reagent reading

Data register

Wells

On-site tests:

- Oxygen infusion
- Activated carbon treatment using HACH multimeter/test leads

Off-site tests in Water Lab:

- Use of HACH barcode reagents
- DR 3900 spectrophotometer .

Results and discussion

Removal efficiency of the constructed wetland was in the order BOD (70%) > COD (57.90%) > NH4 N (48.1%) > NO3 N (22.5%).
The BOD, COD, NH_4-N , NO_3-N range between wells 1 and 4 were 55 mg/l -182 mg/l, 110 mg/l -261 mg/l, 100 mg/l -193 mg/l and 1.00 mg/l -1.29 mg/l respectively.

Parameter	BOD		Removal	COD		Removal	NH_4-N		Removal	NO_3-N		Removal
Sampling Point	In (mg/l)	Out (mg/l)	(%)	In (mg/l)	Out (mg/l)	(%)	In (mg/l)	Out (mg/l)	(%)	In (mg/l)	Out (mg/l)	(%)
Well 1	-	182	-	-	261	-	-	193	-	-	1.29	-
Well 2 BAC	182	103	43.4	261	258	1.15	193	162	16.1	1.29	1.27	1.55
Well 2 AAC	103	88	14.6	258	243	6.90	162	158	2.5	1.27	1.26	0.79
Well 3	88	65	26.1	243	225	7.40	158	155	1.9	1.26	1.32	NR
Well 4	65	55	32.3	225	110	51.10	155	100	35.5	1.32	1.00	24.2
Wells 1 and 4	182	55	70	261	110	57.90	193	100	48.1	1.29	1.00	22.5

NR=No elimination

Table 1: Removal efficiencies of the Worms constructed wetland for BOD; COD; NH_4-N and NO_3-N

The pH and Cr range between wells 1 and 4 were 7.8-8.4 and 0.018-0.044 mg/l respectively. Cr had a removal efficiency of 59.1%. This pH is conducive for the growth microbes required for the microbial breakdown of organic matter in the wastewater at an optimum pH range of 6.5-8.5.

The four studied wells had a neutral to slightly alkaline environment with a pH range of 7.2-8.4 necessary in preventing the formation of bonds with a potential of breaking down cells of microbes which could slow down their growth rate and ultimately kill them. There was no removal for Pb .

Parameter	pH		Inc/Dec	Cr		Removal	Cd		Removal	Pb		Removal
Sampling Point	In (mg/l)	Out (mg/l)	(%)	In (mg/l)	Out (mg/l)	(%)	In (mg/l)	Out (mg/l)	(%)	In (mg/l)	Out (mg/l)	(%)
Well 1		7.8	-		0.044	-		BDL	-	0.2	0.2	0
Well 2 BAC	7.8	7.2	+7.7	0.044	0.043	2.27	BDL	BDL	-	0.2	0.2	0
Well 2 AAC	7.2	7.3	-1.4	0.043	0.034	20.9	BDL	BDL	-	0.2	0.2	0
Well 3	7.3	7.2	+1.4	0.034	0.040	NR	BDL	BDL	-	0.2	0.2	0
Well 4	7.2	8.4	+16.7	0.040	0.018	55	BDL	BDL	-	0.2	0.2	0
Wells 1 and 4	7.8	8.4	+7.6	0.044	0.018	59.1	BDL	BDL	-	0.2	0.2	0

Inc, Dec and BDL represents increase, decrease and **below detection limit** respectively

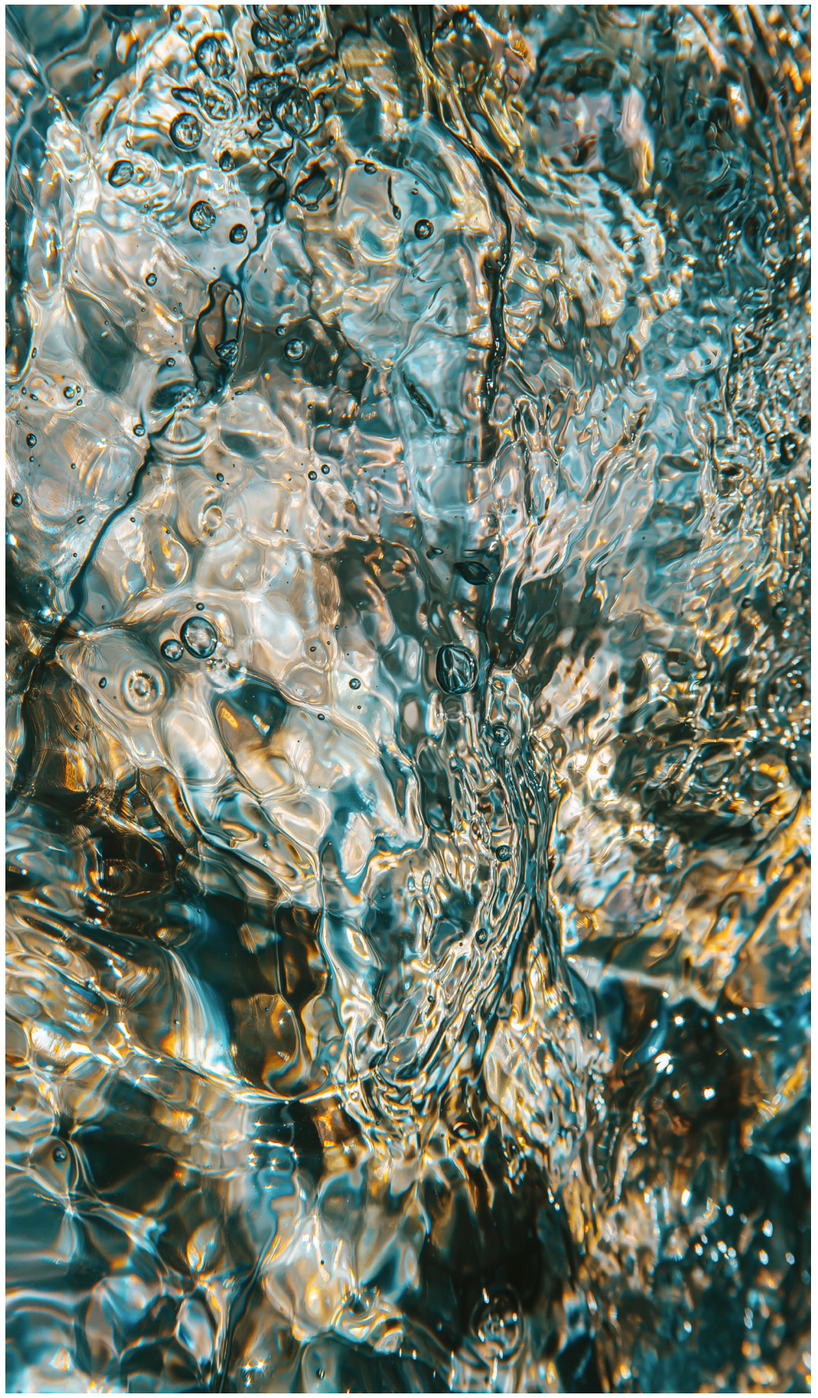
Table 2: Removal efficiencies of the worms constructed wetland for chromium, cadmium and lead

Conclusions

Three out of the four wells exceeded the value of 150 mg/l for the COD (Table 1) Exceeded the "Framework Wastewater Management Regulation" BOD value of 40 mg/l

The lower COD removal efficiency of 57.90% compared to the BOD removal efficiency of 70% for the constructed wetland at Worms was significantly lower than the values reported by studies from other countries.

- The significant differences in the removal efficiency of the constructed wetland at Worms could be attributed to two actors:
    a) The **age of the facility**, with its attendant reduction in good oxygen supply, affects aerobic processes for the system.
    b) **Increased hydraulic capacity of the system**, contributed by high daily wastewater generation, which is more than the system's initial design.
- The low COD removal efficiency could also be attributed to the **higher fractions of the inert COD** present in the black water.
- The organic form of nitrogen in the wastewater was converted to nitrate (NO_3^-) under aerobic and anaerobic conditions.
- Ammonia nitrogen (NH3-N) was removed via hydrophytes absorption, volatilization, nitrification, and denitrification in the constructed wetland
- **Percentage NH4 removal of 48.1% for well 4 was in agreement with some studies but significantly lower** than reported values from other studies.



A Project

Evaluation of the ability of corn cob derived biochar to remove ammonia nitrogen from livestock wastewater

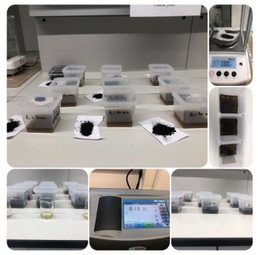
By Hamza Elouassif

In the framework of the YIP project and during the practical training in Mexico, participants visited a farmland where pigs were elevated, and corn was produced as a crop. Through discussion with farmers, it was revealed that there were no necessary technologies for waste treatment nor professional guidance from the government for farmers to familiarize themselves with the different techniques. The waste was directly disposed to the water bodies.

The testimony of the farmer owner reminded the participants of the zero waste strategy adopted by the circular economy plan, and the idea of using residues from corn crops to treat wastewater generated from livestock animals and converting it to biochar came out. The focus was on ammonia nitrogen, known to be present in high concentrations in livestock wastewater.

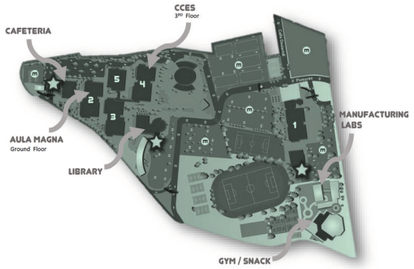
The biochar was prepared by pyrolysis at two different temperatures 350°C (CCBC-350°C) and 450°C (CCBC-450°C). The physical properties of the biochar were investigated using scanning electron microscopy (SEM) analysis. The ammonia adsorption capacities and removal efficiencies of the two biochar were investigated using batch experiments by changing the pH of the wastewater solution as well as the contact time. Statistical analysis was used to interpret the experiments' results based on Duncan multiple range test method. The highest ammonia removal efficiency of 83.98% was recorded by CCBC-450°C after 90 min of contact time under alkaline pH wastewater conditions whereas the lowest removal efficiency of 34.64% was obtained for CCBC-350°C after 30 min exposure to wastewater at initial pH condition.

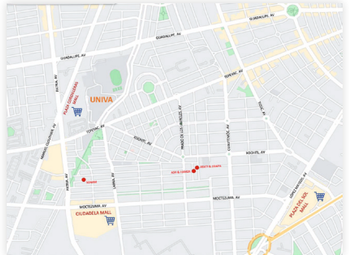
This study will contribute to the ongoing YIP project and can be adopted to solve the water & wastewater issues that can be identified during the project.



The UNIVA Program

Information





UNIVA Guadalajara

Prados de Tepeyac, Zapopan, Jalisco, México

Tuesday 30th

08:30 am Coming Home with host families

12:00 pm Welcome meeting by UNIVA authorities
Aula Magna, Building 2

12:30 pm Kick-Off meeting "The Concept Selection"
Presentation of the different concepts
Aula Magna, Building 2

01:30 pm Meal
Cafeteria

02:30 pm UNIVA Campus Guadalajara Tour

03:00 pm Lecture/Workshop "Identification of the User's Needs"
Design of the user interview guide
Topography Lab – CIDEC

04:00 pm Cultural Tour: Guadalaajara Downtown
Departure from Manufacturing Lab CIDEC

04:30 pm Visit to Cabañas Cultural Institute

07:30 pm Dinner out (Tacos)
Departure from Juárez St. and Paseo Alcalde

Wednesday 31st

07:00 am Departure from UNIVA
Manufacturing Lab – CIDEC

08:00 am Visit to La Barca
End of Lerma river

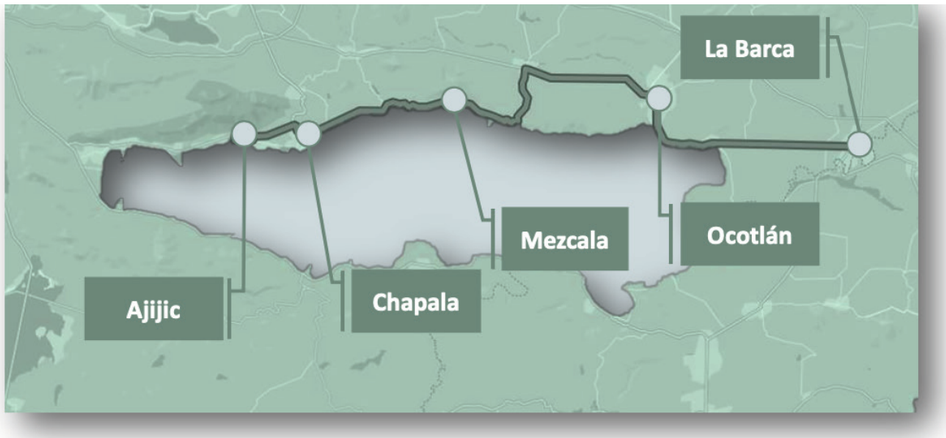
09:00 am Visit to Ocotlán
Santiago and Zula rivers rise

10:30 am Visit to Mezcala and Mezcala Island
Lake of Chapala and boat ride

12:30 pm Visit to Chapala Downtown
Lake pier walk

01:30 pm Meal and visit to Ajijic Downtown
Lake pier walk

(Meeting with Sociedad Amigos del Lago de Chapala)



Note: Sampling and Interviews with towners

Thursday 01st

08:00 am Departure from UNIVA
Manufacturing Lab – CIDEC

09:00 am Visit to Juanacatlán
Santiago River

10:00 am "Concept Test" at "La Mezquitera" Farm
Interview with small producer about his needs

01:00 pm Arrival to UNIVA/Home (Meal)

04:30 pm Lecture/Workshop "Concept Assessment"
Topography Lab – CIDEC

05:30 pm Departure to Andares and Zapopan Downtown
Cultural city walk
From Manufacturing Lab - CIDEC

08:00 pm Dinner out

Note: Sampling and Interviews with towners

Friday 02nd

07:30 am Departure from UNIVA
Manufacturing Lab – CIDEC

09:00 am Arrival to Tequila
Walk trough Tequila Town

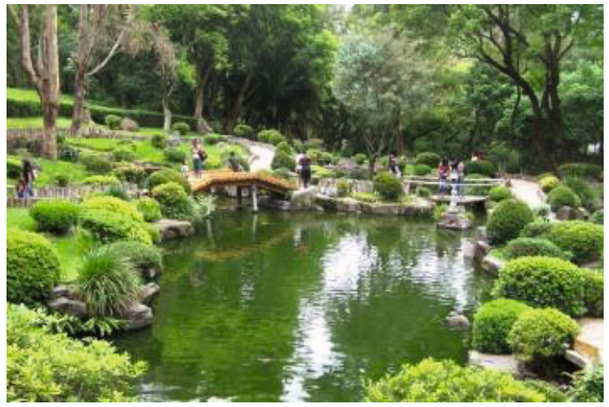
10:00 am Visit to Tequila Casa Cuervo
Jose Cuervo Company

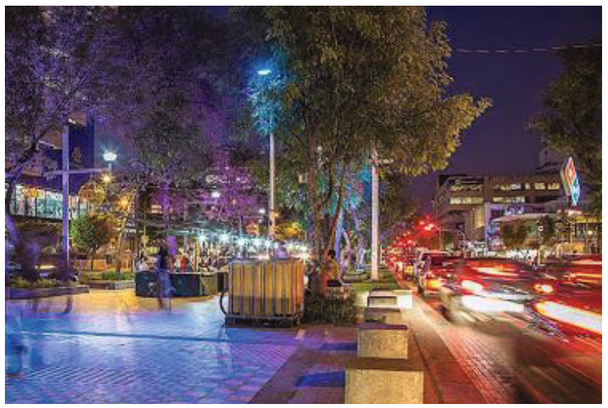
01:00 pm Meal at Teuchitlán
Close to the Dam "La Vega"

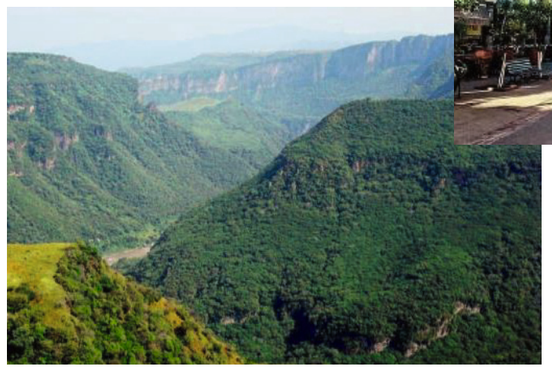
03:00 pm Tour to Guachimontones
Archealogical zone

Saturday 03rd

09:00 am	Lecture/Workshop “Design/Architecture and Business Analysis” Topography Lab – CIDEC
10:00 am	Workshop “Built Prototype” Manufacturing Lab - CIDEC
01:30 pm	Picnic at Colomos Park & Visit Cit’s Old Water Pumps Departure from Manufacturing Lab, bring lunch to share
09:00 pm	Night at Chapultepec Ave. or Mariachi Gala in Degollado Theater (Optional Dinner out)





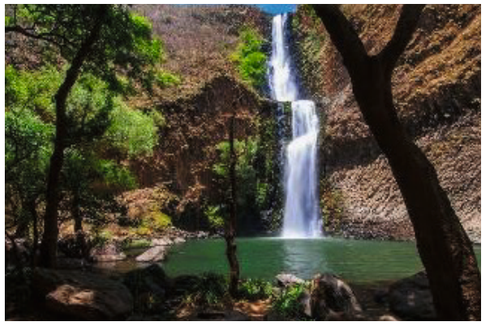


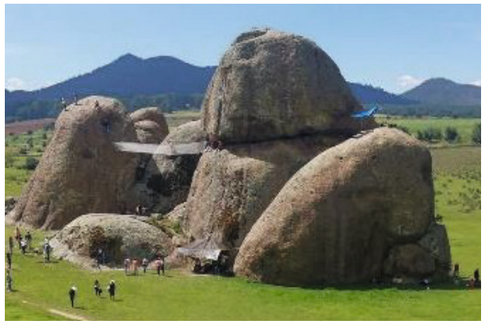
Sunday 04th

11:00 am	“Torta Ahogada” Breakfast Chapultepec Zone
12:00 pm **12:30 pm**	Bike Tour in Chapultepec Zone Or Hiking in “Barranca de Huentitán” Bike tour trough the old suburb of the city or hiking through the Huentitán canyon over the Santiago river
02:30 pm	Meal at Tlaquepaque
04:30 pm	Tour in Tlaquepaque Downtown Town of artisans

Monday 05th

07:00 am	Departure from UNIVA Manufacturing Lab - CIDEC
08:30 am	Lecture "Artificial Wetland for Water Treatment" Visit to wetland in Atequizayán , Zapotlán El Grande
11:00 am	To the UNIVA Cabin at Tapalpa Accommodation
12:30 pm	Tour to "El Salto" Waterfall
02:00 pm	Meal at Talpapa Visit to Tapalpa Town
04:00 pm	Tour to Valley of the Enigmas Visit to "Las Piedrotas " (Huge Stones)
06:30 pm	Dinner & night for reflection Bonfire at the UNIVA cabin, bring food to prepare and share





Tuesday 06th

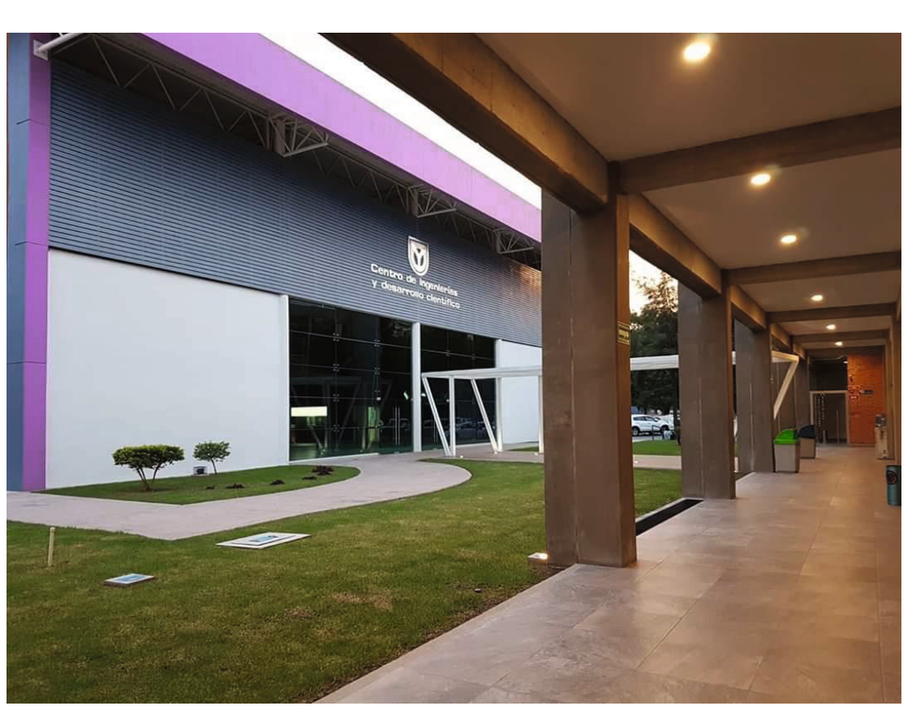
09:00 am	Breakfast at the UNIVA Cabin Bring food to prepare and share
12:00 pm	Arrival to UNIVA/Homes
05:00 pm	Lecture "Water: Biotechnology Approach" Topography Lab – CIDEC
05:30 pm	Workshop "Build a Prototype" Manufacturing Lab - CIDEC
	(Optional Dinner at "La Chata")

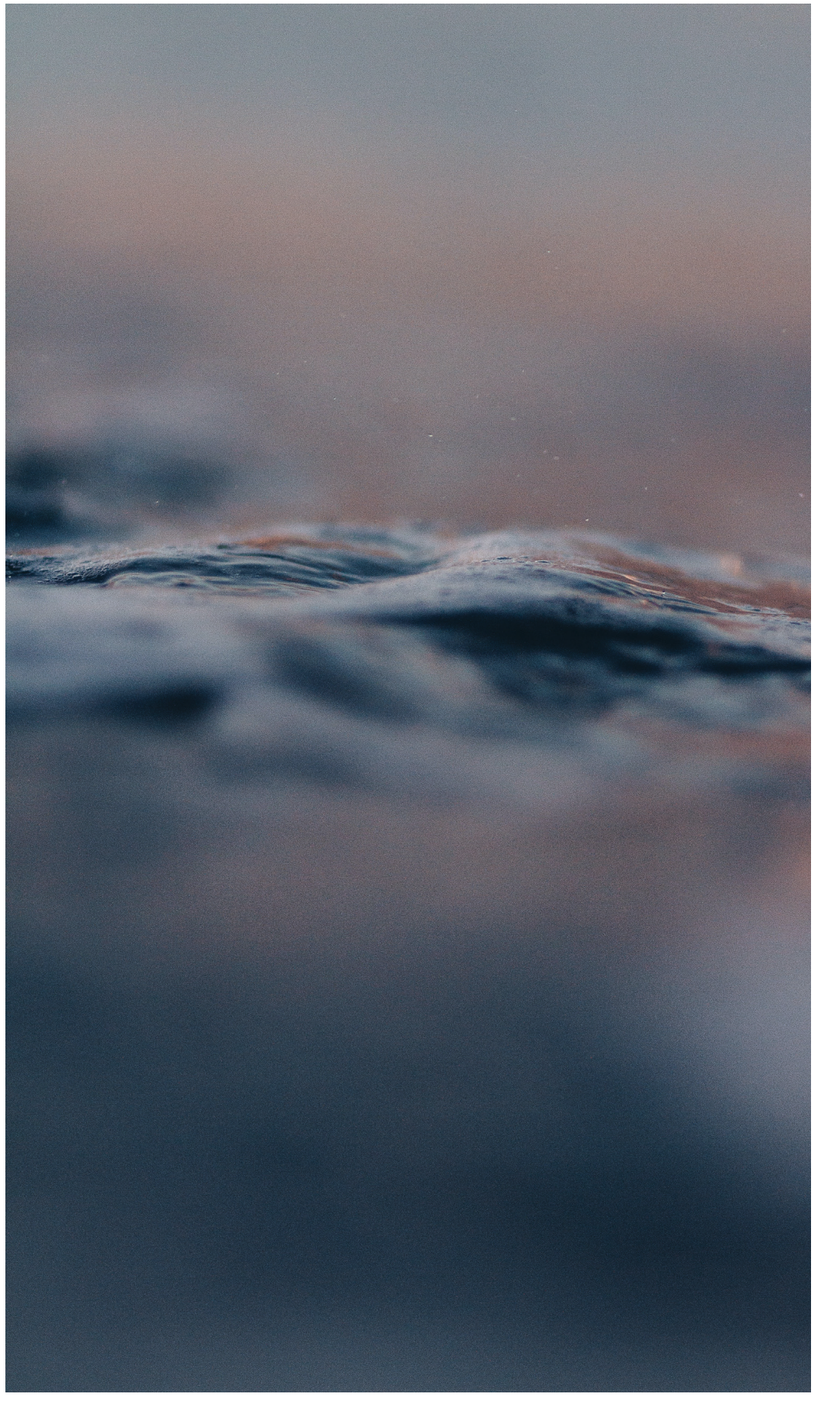
Wednesday 07th

08:30 am	Departure from UNIVA Manufacturing Lab - CIDEC
09:30 am	Visit to the Zoo GDL
01:30 pm	Arrival to Home
05:00 pm	Workshop "Build a Prototype" Manufacturing Lab - CIDEC
07:00 pm	Gala Dinner Chapalita restaurant zone

Thursayday 08th

09:00 am	Lecture “Sustainable Water Consumption in the SME” Topography Lab – CIDEC
09:30 am	Workshop “Prototype Assessment” Manufacturing Lab/ Topography Lab – CIDEC
11:00 am	Final Session Discussion of results and feedback about the process Topography Lab – CIDEC
12:30 pm	Arrival to Home (Meal)
03:00 pm	Closing Meeting Invite host families Group photo Aula Magna, Building 2
04:00 pm	Departure to the Airport





Digital City Rallies

We have developed digital city rallies for La Piedad, Lago Chapala and Gaadalajara. The city of Guadalajara has relied on Lake Chapala as a principal source of water since the 1950s and it is regulated by the Intermunicipal Potable Water and Sewage System (SIAPA). The lake comprises 52% of drinking water to the inhabitant of Metropolitan Area of Guadalajara. Lake Chapala is extremely endangered. Eleven million people live in the catchment area (about 10 % of the total population of México), and the potential for conflict over regional water resources is high due to their overexploitation and contamination.

There are numerous towns and cities along the coast of Lake Chapala, including Chapala, Ajijic, Jocotepec, San Luis Soyatlán, Tizapan El Alto, Ocotlán and so on.
We went to: La Barca (Lerma River sample), Ocotlán (Zula & Santiago Rivers samples), Mezcala (Island), Chapala (Lake Chapala sample), Juanacatlán (Santiago river sample), Puente Grande (farmer)

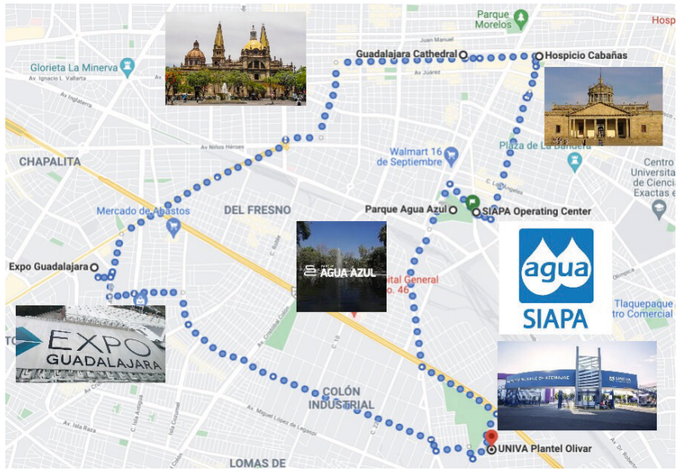
Juanacatlán

La Barca

Guadalajara's metropolitan area

Guadalajara is the proud capital of the state of Jalisco, Mexico. It is in the Western-Pacific area of Mexico, in the Atemajac Valley of about 5,100 feet (1,550 meters) elevation. The Guadalajara Metropolitan Area has a reported population of 5,002,466 inhabitants, making it the second most populous metropolitan area in Mexico, behind Mexico City.

Its climate is dry and mild except for the rainy season, which extends from July to mid-September.



La Piedad

In 1871 the title of city was named La Piedad de Cavadas in memory of the priest José Cavadas Corzolt. The famous Cavadas Bridge built over the Lerma River serves as the border between Michoacán and Guanajuato. The Lerma River is used for the generation of Electric Power in a place „El Salto" 17 km northwest from city of La Piedad, which has about 1890 MW installed capacity. The City of La Piedad has international agreements with its different pairings. Woodland, California, USA is the sister city of la Piedad.

Visit the website our website for more information:
www.yip-aqua.org

Or find us on Instagram:
@ hshd_water_technology

And YouTube: