Two days training on the operation and management of WWTPs

9-10 September, Murcia

Operation of WWTPs

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INDEX

1. INTRODUCTION

- Why is wastewater treatment and regeneration needed?
  - Essential water character
  - Lesser resource availability
  - Economical, social and political significance
  - To allow the water reuse

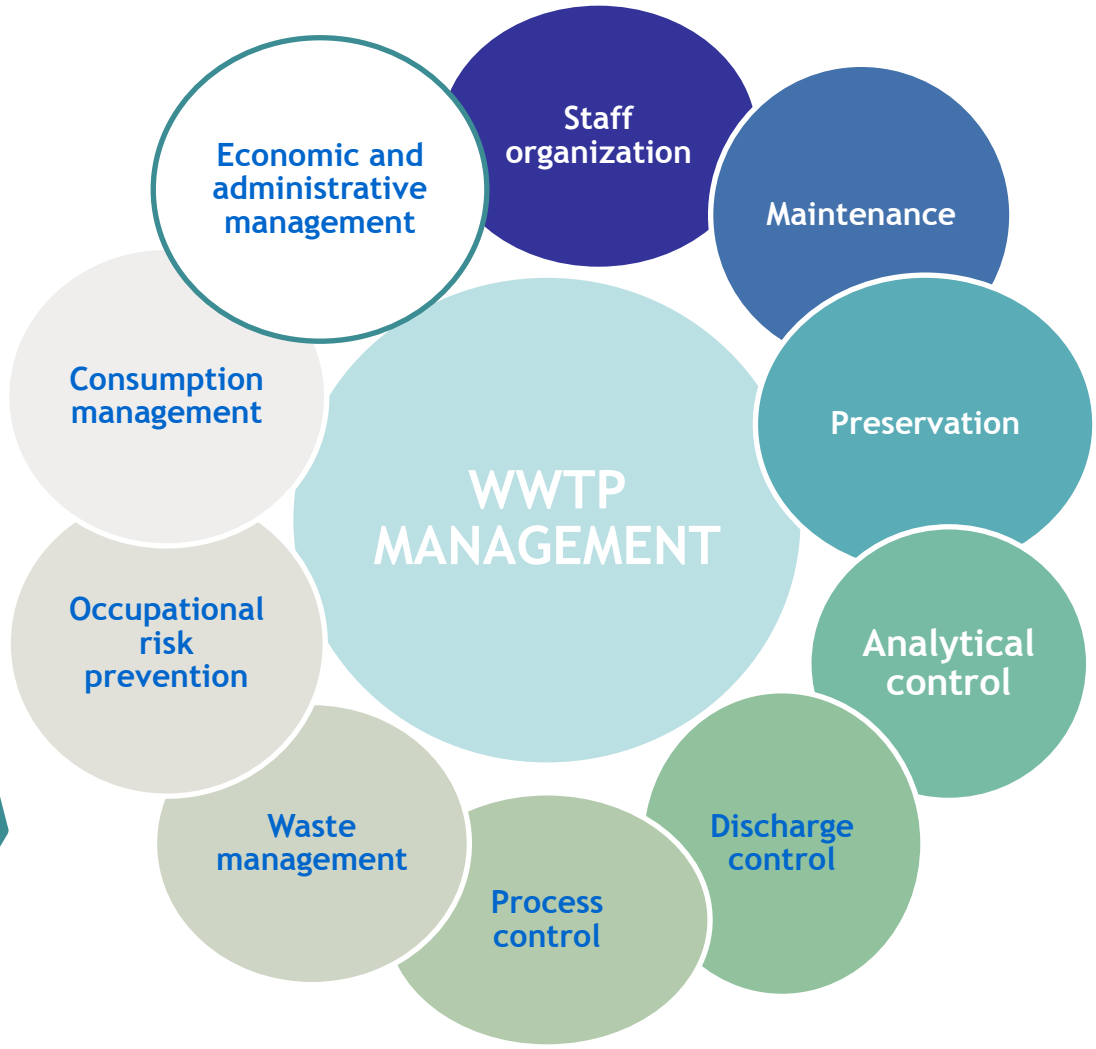
- Wastewater quality control as a priority:
  - Resource availability ➔ Water quality
  - Who pollutes pays ➔ Who prevents wins
  - Prevention plans
  - Installation of instruments and control systems

OPERATION ON WWTP

OBJECTIVES

Achieving treatment performance according to current legislation and minimal environmental, economic and social costs.

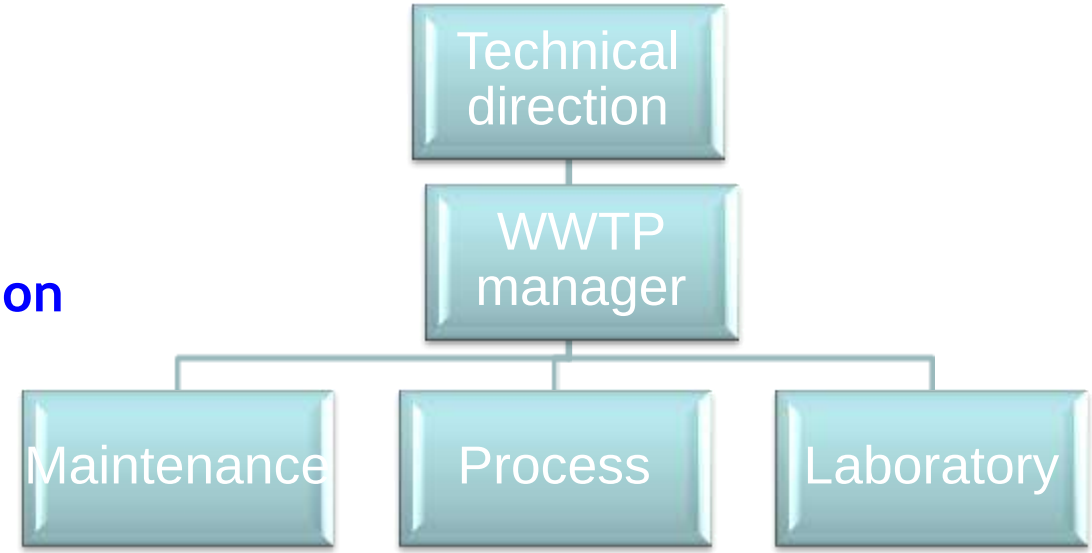
ENSURING ALWAYS THE SAFETY OF STAFF



2.2.1. STAFF ORGANIZATION.

The WWTP staff is organized in functional areas according to specialization. The main areas are:

- **Operation: WWTP and collectors.**
- **Maintenance.**
- **Laboratory.**
- **Administration.**
- **Technical Direction**
- **Occupational Risk Prevention**



2.2.1. STAFF ORGANIZATION.

The staff responsible for the operation of the plant must carry out a series of tasks and inspections:

- Tasks operation
- Managing alarms and warnings
- Sampling
- Regular measurements of parameters (height of sludge, pH, ...) related to plant processes.

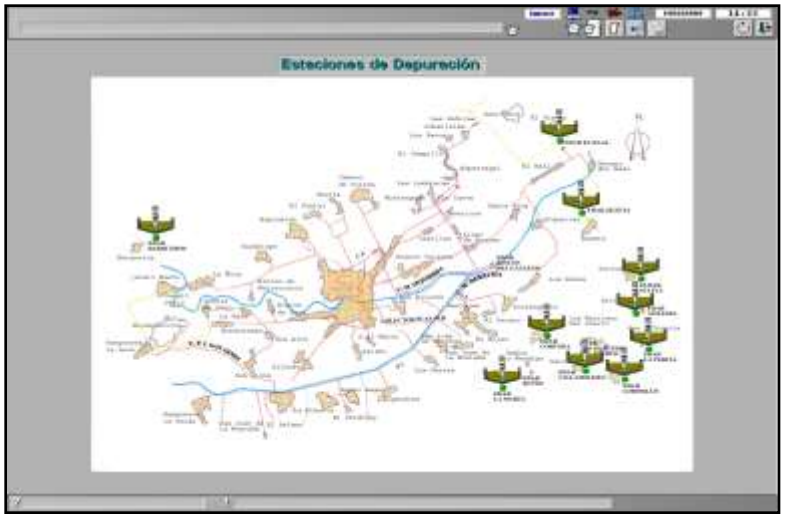
2.2.2. COMMUNICATIONS.

SCADA

There is a SCADA (Supervisory Control and Data Acquisition) system installed in each WWTP managed by Aguas de Murcia.

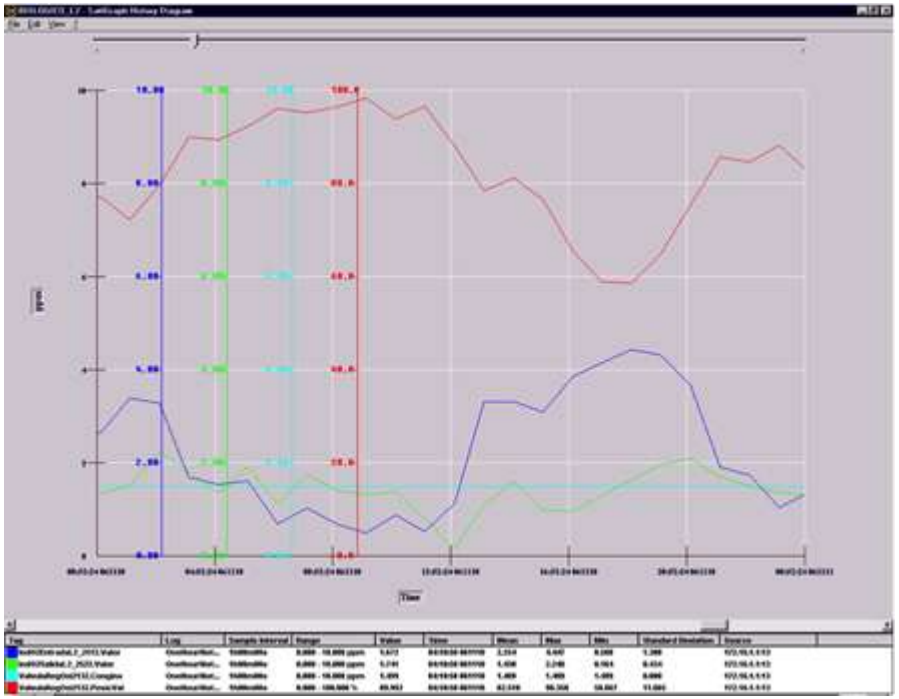
REMOTE CONTROL

A remote station complex net that collects data and sent all the information needed at the WWTP allows to know in real time the system state and so operate the plants in a immediate way.



2.2.2. COMMUNICATIONS.

SENSORS AND FLOW METERS



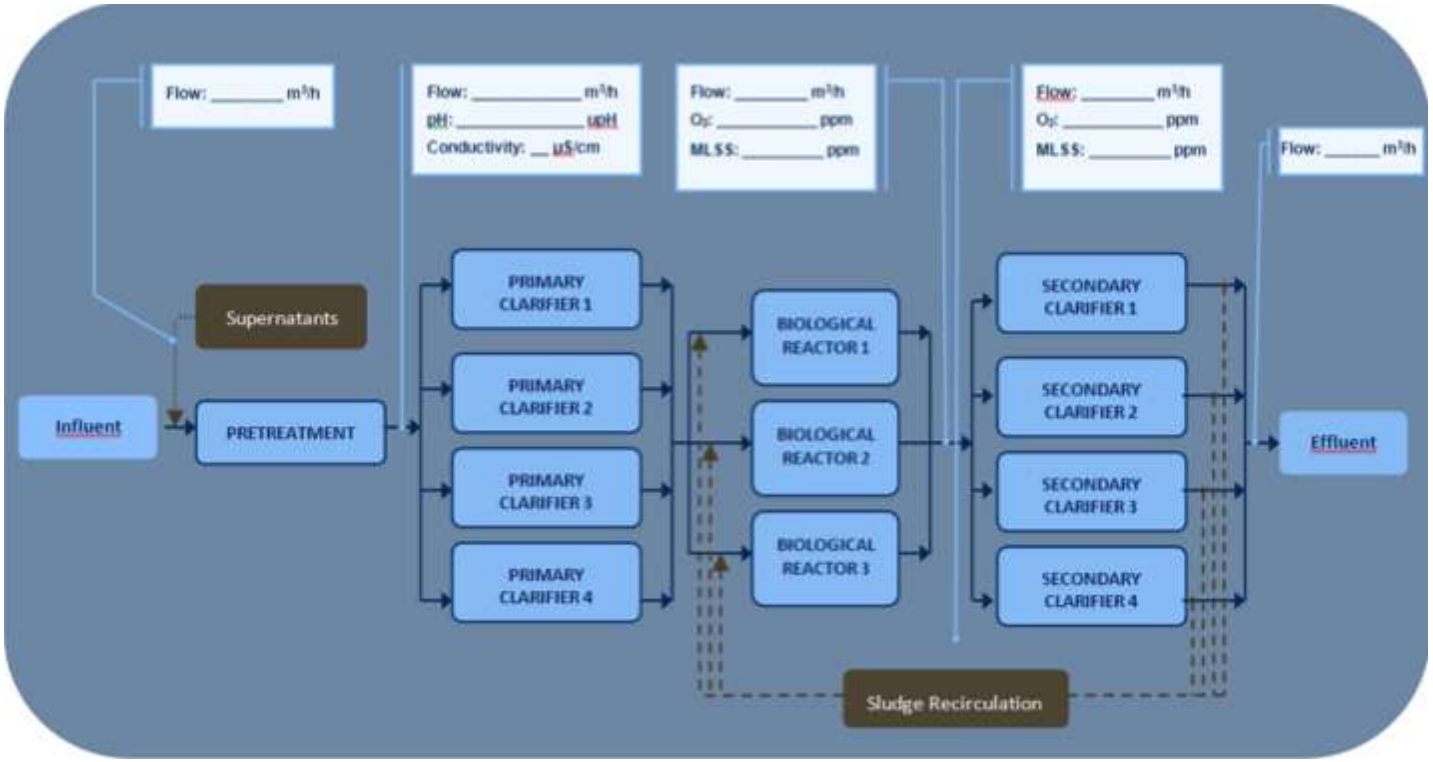
2.2.3. ANALYTICAL CONTROL.

To be able to control a process of wastewater treatment is essential to collect information that allow to determine the status and the operating plant mode.

This information is based mainly on the analytical results of samples of wastewater and sludge from each of the WWTP managed.

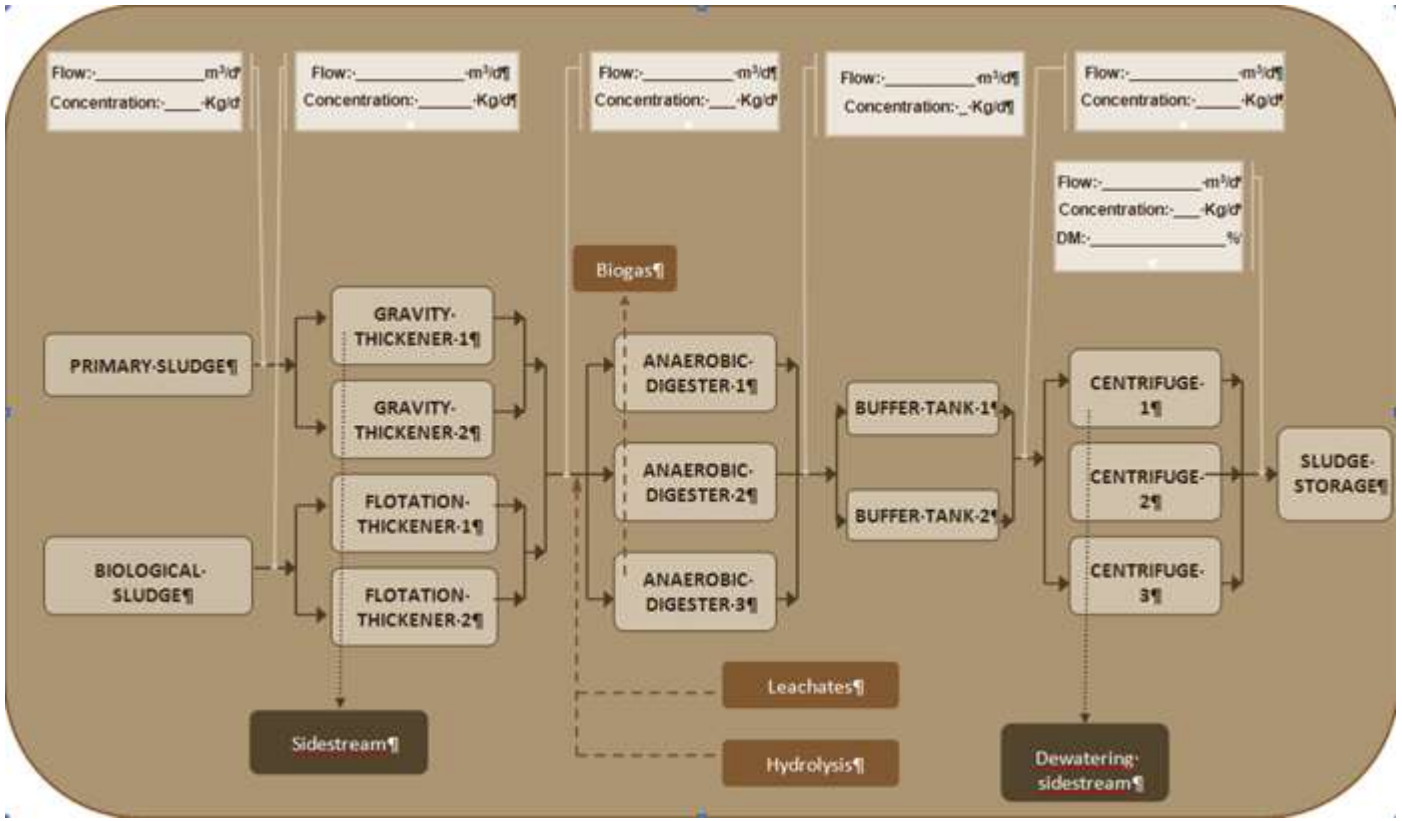
2.2.3. ANALYTICAL CONTROL.

Representative sampling points in water line



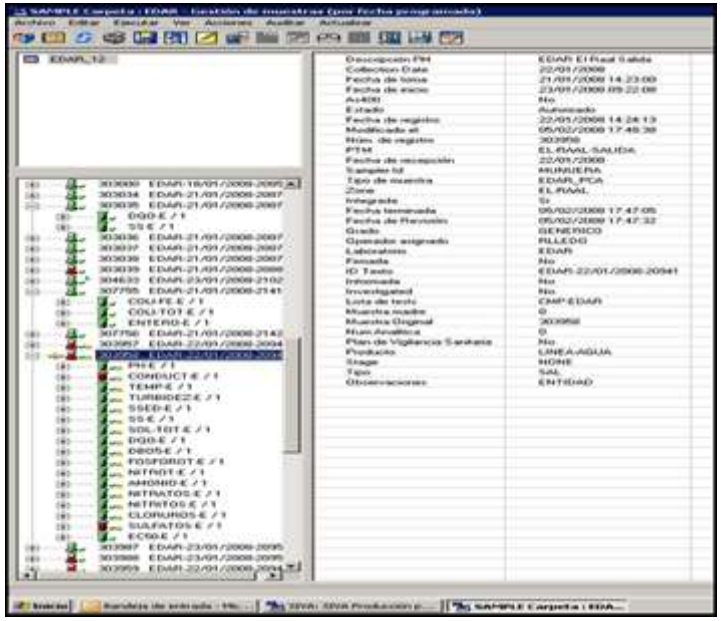
2.2.3. ANALYTICAL CONTROL.

Representative sampling points in sludge line



2.2.3. ANALYTICAL CONTROL.

- Sampling: preferably by 24 h autosampler and according to protocols for sampling, storage and transport.
- Techniques used: "Standard Methods"
- Interlaboratory comparison exercises.
- Control and management of data carried out by a computer application.
- Plan for equipment calibration.



2.2.3. ANALYTICAL CONTROL.

Control Analytical control of wastewater

- **Chemical parameters**
- **Physical parameters**
- **Microbiological parameters**

CHEMICAL PARAMETERS:

- Organic matter
- Oil and greases
- BOD, COD and TOC
- Dissolved oxygen
- Pesticides
- Nutrients
- Metals

PHYSICAL PARAMETERS

- pH
- Conductivity
- Organoleptic characteristics
- Turbidity
- Solids

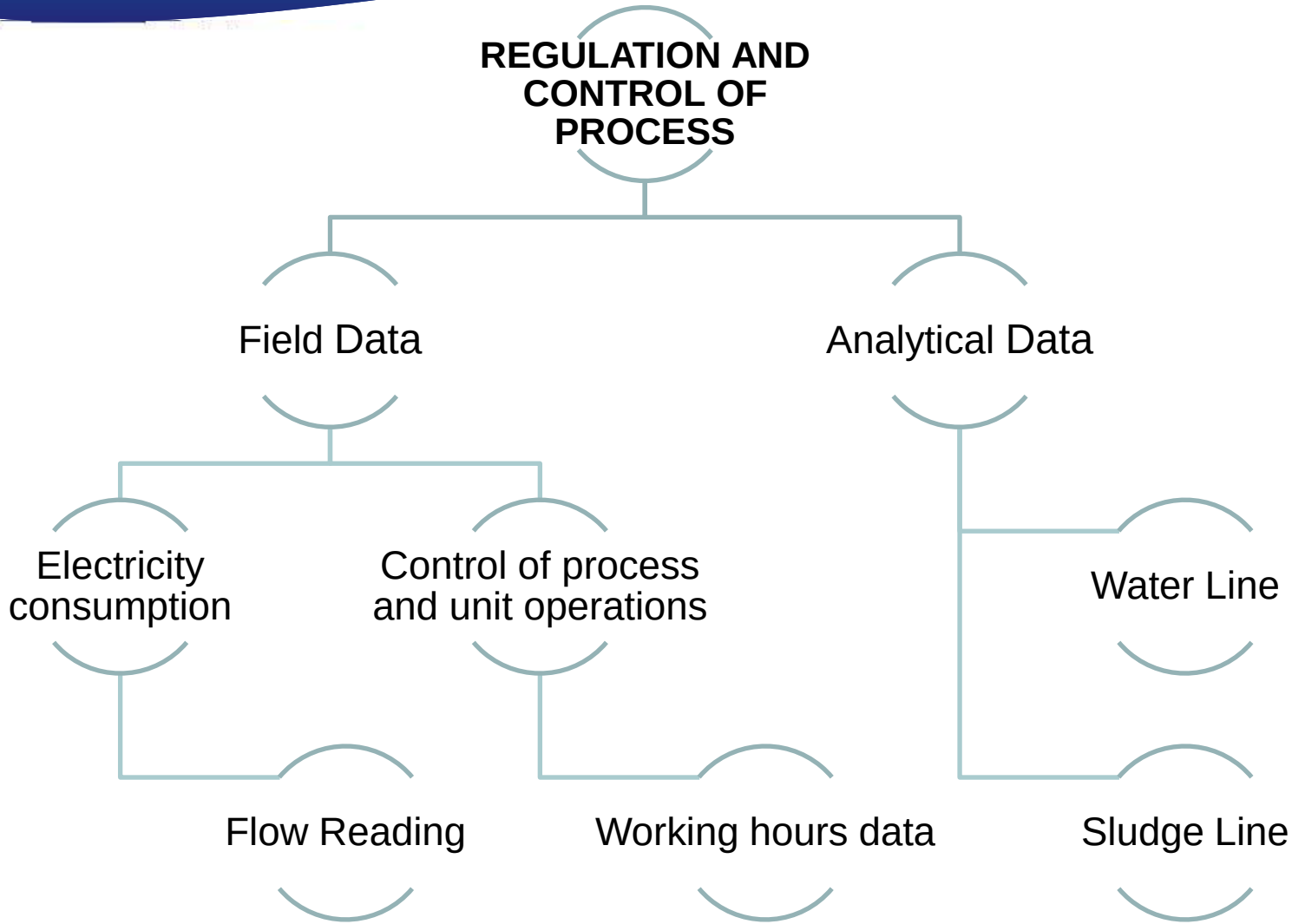
MICROBIOLOGICAL PARAMETERS:

- Fecal and Total Coliform
- Fecal Enterococci
- E.Coli
- Eggs of nematode

- **WASTEWATER TREATMENT** ➔ succession of stages or unit operations under which pollution is progressively removed from the influent , obtaining a right quality discharge.
- Each unit operation is characterized by its aim and its specific operating parameters.
- Process control is the knowledge of the values of the parameters defining the state of the different processes.

2. OPERATION ON WWTP

RESOURCES



OPERATING CALCULATIONS. Theoretical calculations of ratios required for the assessment of the performance of management as:

- Yields
- Operating hours of main equipment.
- Waste production ratios.
- Hydraulic Operating Parameters.
- Operating parameters of biological process: Cm, Cv.
- Age of sludge, oxygen requirements, sludge production microscopic observation.
- Reagent consumption ratios.

WATER QUALITY

- Suspended solids (mg/l)
- COD (mg O2/l)
- BOD5 (mg O2/l)
- Total Nitrogen (mg/l)
- Total Phosphorus (mg/l)

RATIOS

- Sludge production (dry matter Kg/m^3)
- Energy ratio (Kwh/m3)
- Energy (per Kg BOD5 removed KWh/Kg)

VARIABLES DE PROCESO

- **Cm**
- **Edad del fango**
- **IVF (Índice volumétrico del fango)**
- **% RtMV**
- **Relación AGV/ALCALINIDAD**
- **pH**
- **T^a**

MINIMUM FINAL QUALITY

- Suspended solids < 35 mg/l
- COD< 125 mg O2/l
- BOD5< 25 mg O2/l
- Total Nitrogen <30 mg/l
- Total Phosphorus< 8 mg/l

Setting or corrections of operating variables.
Study of alternatives on the operation of the process line.
Action plan :

- Taking readings of field instrumentation, flow meters, sensors.
- Inspection of the operation of stages.
- Control of set points.
- Waste control.
- Reagents control.

OPERATING EXPENDITURES

The monetary value of the factors necessary to carry out the operation and maintenance of facilities are made up of:

- Fixed costs
- Variable costs

Another breakdown

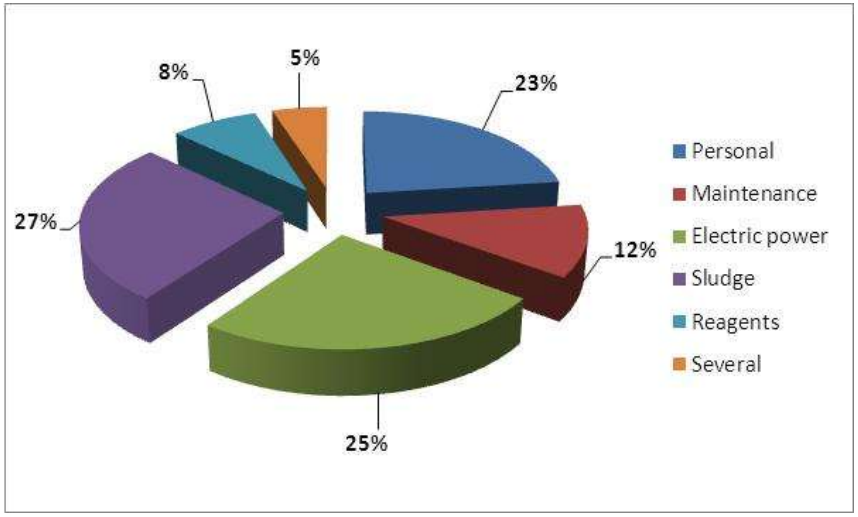
- Direct costs
    - Operation and maintenance
    - Energy consumption
    - Sludge management
    - Staff
- Indirect costs

DIRECT COSTS	INDIRECT COSTS
Operation	Management
Maintenance	Administrative discharge control: authorization, inspection and sanctions
Replacement of Facilities	

DIRECT COSTS – OPERATION AND MAINTENANCE.

Direct costs relating to the operation and maintenance can be broken down into items according to different concepts:

- Staff.
- Maintenance.
- Electricity.
- Waste management.
- Reagents.
- Other expenses.



Breakdown of operation and maintenance costs

The most important budget in the distribution of costs of a WWTP are Staff, Energy and Waste Management.

OPERATING EXPENDITURES

ENERGY

- Control of energy consumption.
- Optimization of consumption.
- Study and optimization of the electricity tariff.
- Historical data of energy consumption.
- Analysis of daily and weekly load consumption.
- Historical data of the contracted power and billed.
- Historical data for reactive energy.

WASTE MANAGEMENT

Identification of waste generated:

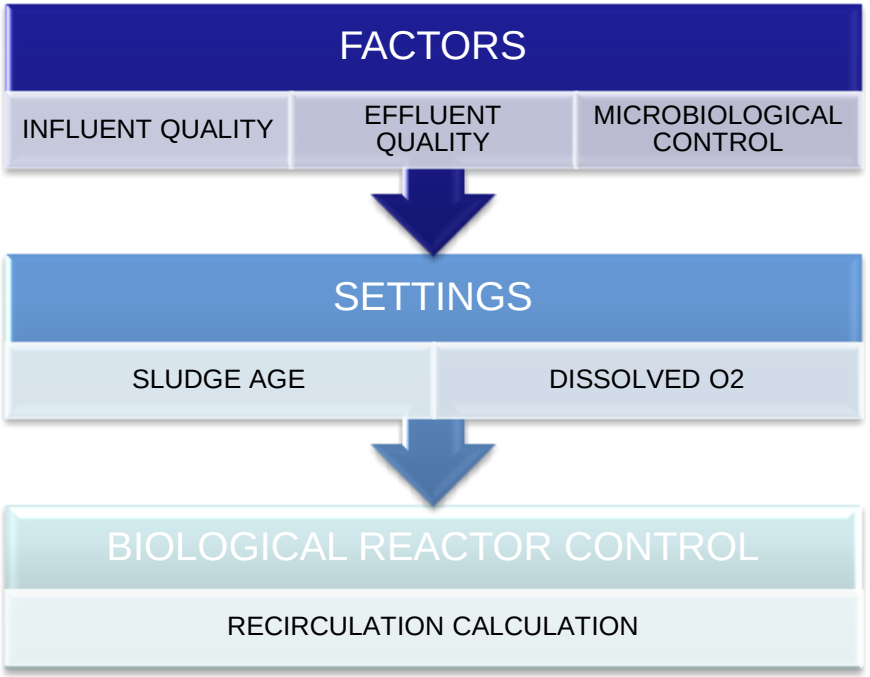
- **Screening (Municipal Solid Waste, MSW).**
- **Grit removal (MSW).**
- **Fat and grease removal (Hazardous waste, HW, or MSW).**
- **Sludge (HW or MSW).**

MANAGEMENT OF REAGENTS

- Control of chemical consumption.
- Dose setting.
- Study of the need of addiction of different types of reagents.
- Control of consumption ratios.
- Improvements for consumption optimization.

STRATEGIES TO OPERATE A BIOLOGICAL REACTOR

- The parameters used for controlling the operation are:
- Airflow Control.
- Sludge age.
- Mass loading rate
- Mixed liquor suspended solids (MLSS)
- Biomass in sludge.
- Decantability.

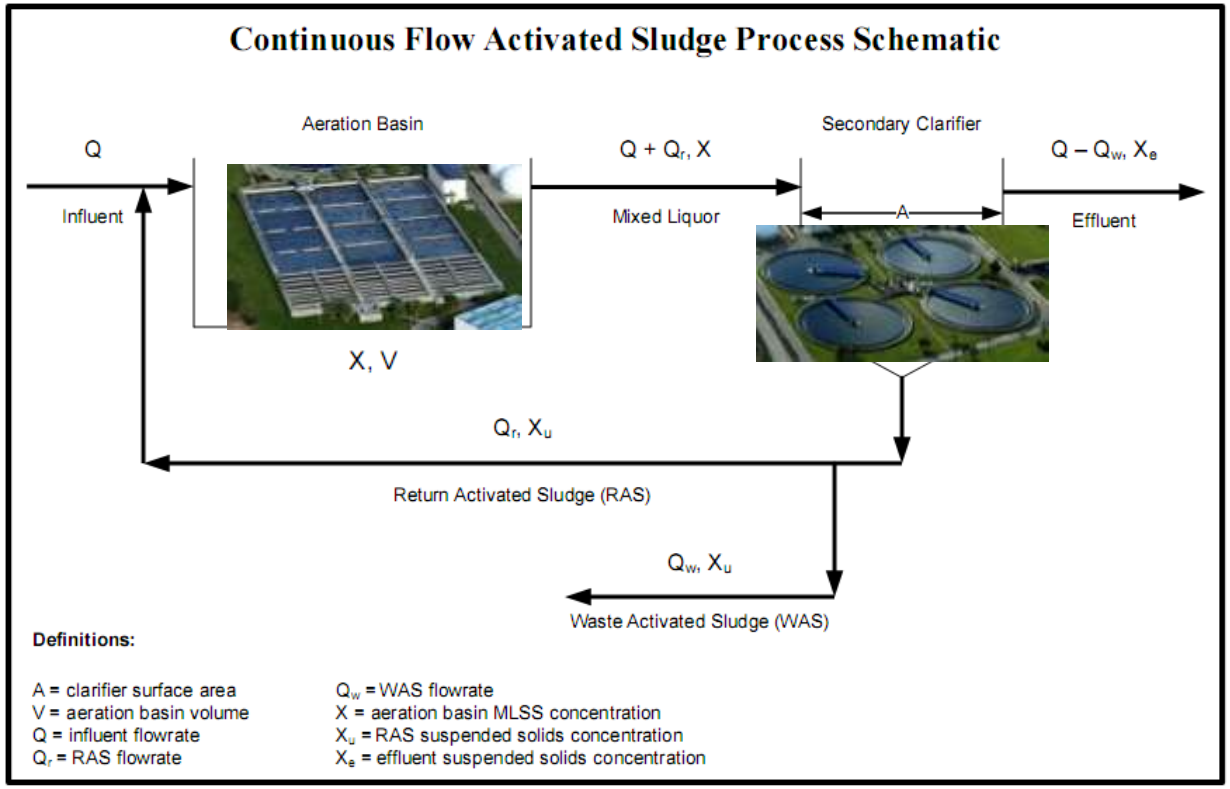


3. COSTES DE EXPLOTACIÓN

Sludge age is the average solids retention time in the biological treatment process.

$$R_s = \frac{V \times X}{Q_w \times X_u}$$

Where,
R_s = sludge age, days
V = aeration tank volume, million gallons
X = mixed liquor suspended solids concentration, mg/L
Q_w = sludge wasting rate, million gallons per day
X_u = solids concentration of the waste sludge, mg/L



مع خالص شكري وامتناني

Thank you for your attention

Merci pour votre attention

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