Environmental Engineering

GRADUATION PROJECT
CE 496-498

PREPARED BY

DR. MOHAB KAMAL

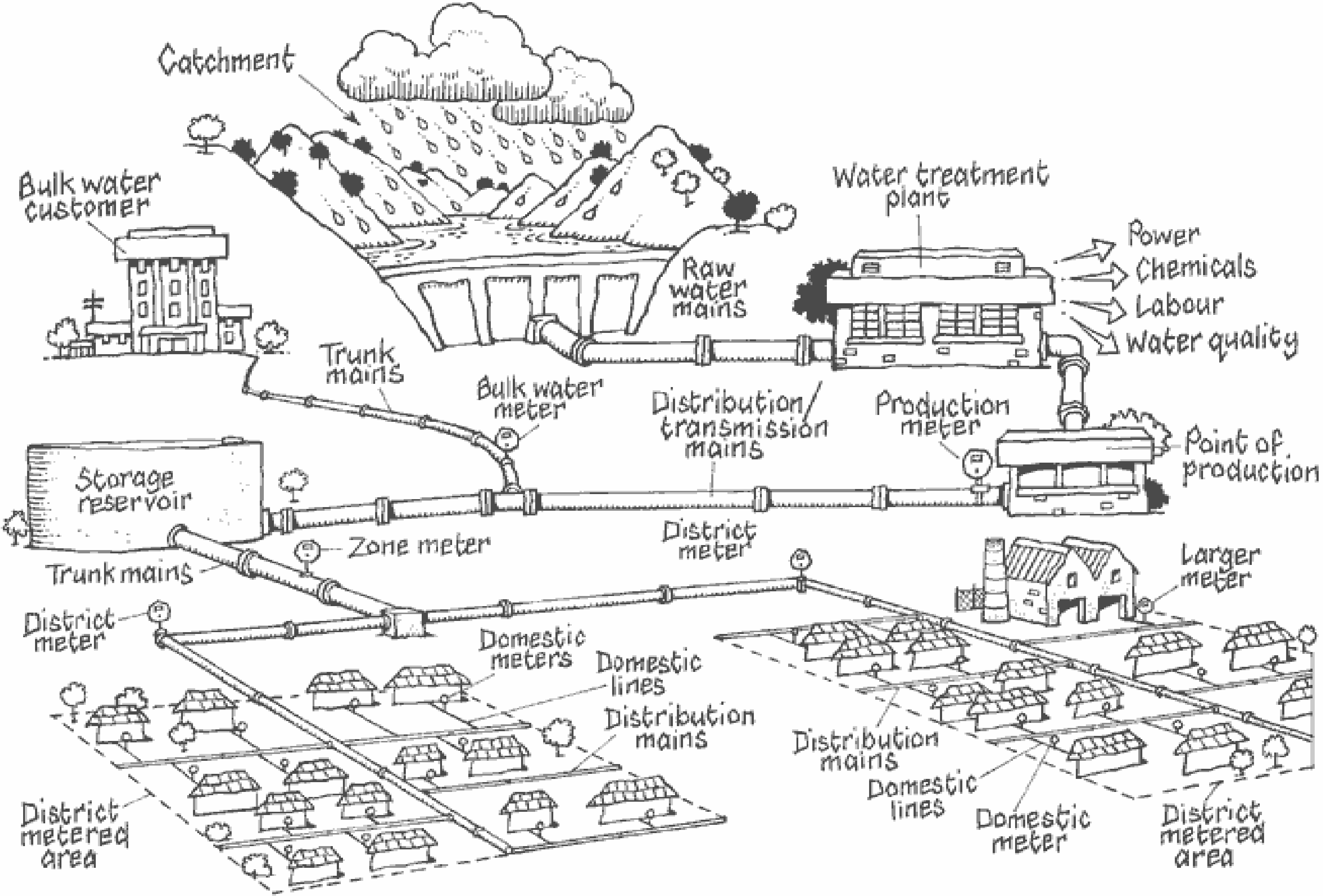
Assistant Professor
Environmental Engineering Group
Civil Engineering Department

Course Description

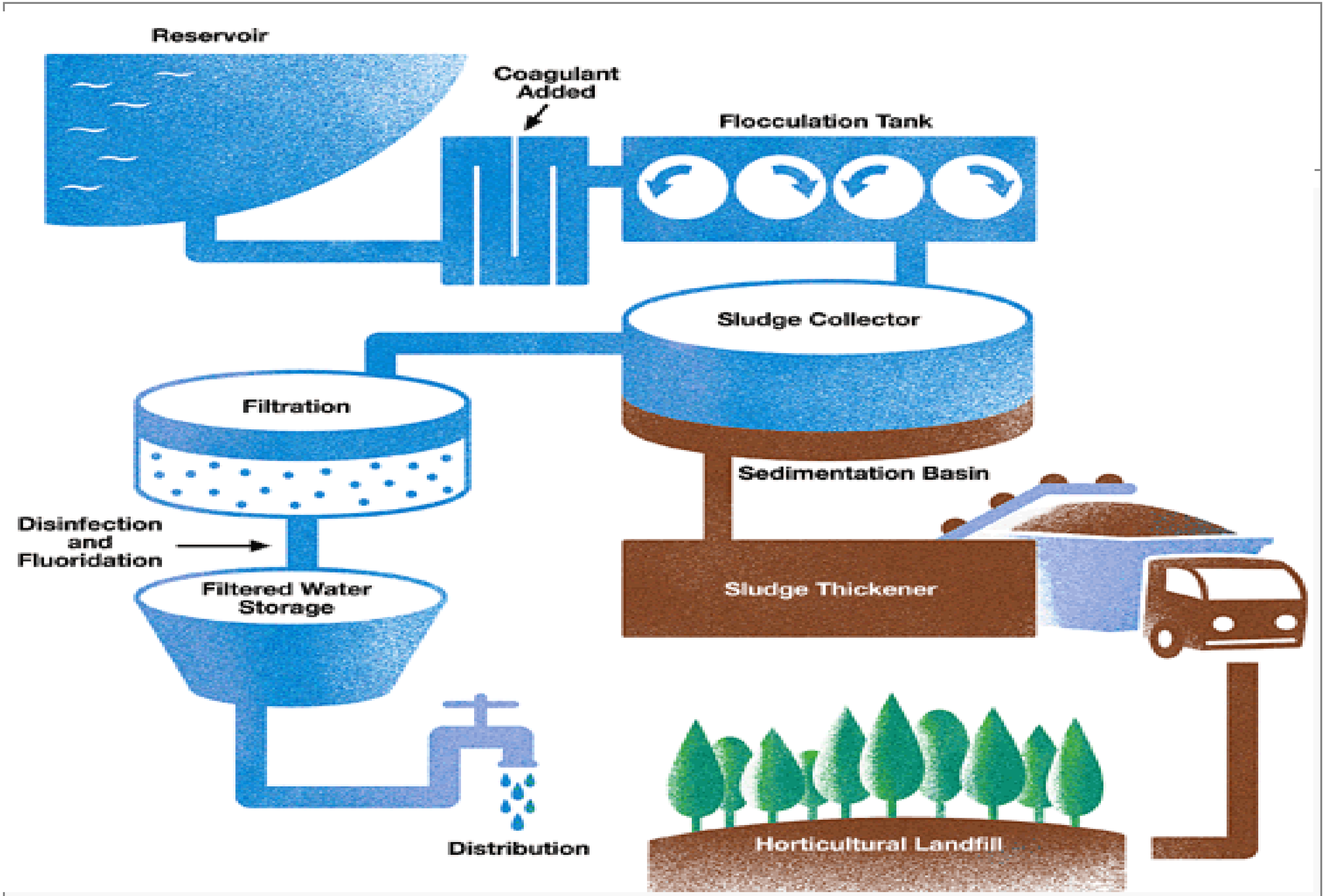
- This is the first phase of the capstone design project that is a continual project over two semesters, and involves number of students working as one team tackling different aspects of the civil engineering works. This phase introduces knowledge of ethical responsibilities, public policies, administration, leadership, and contemporary issues related to Civil Engineering practice. It also includes project selection, data collection, identification of real-life constraints (e.g. economy, environmental, global, and contemporary issues), generation of possible design alternatives considering client needs, selection of the preferred alternative, and preparation of a work plan for implementing and completing the project. All work conducted during the semester must be compiled in a final report and orally presented to the examining committee.

Introduction

- The graduation project in Environmental Engineering main ideas are as follow:
  - Traditional Projects
    - Water Treatment Plants
    - Pumping Station
    - Storage Tanks
    - Water Distribution System
    - Wastewater Collection System
    - Wastewater Treatment Plants
    - Storm Water Collection System

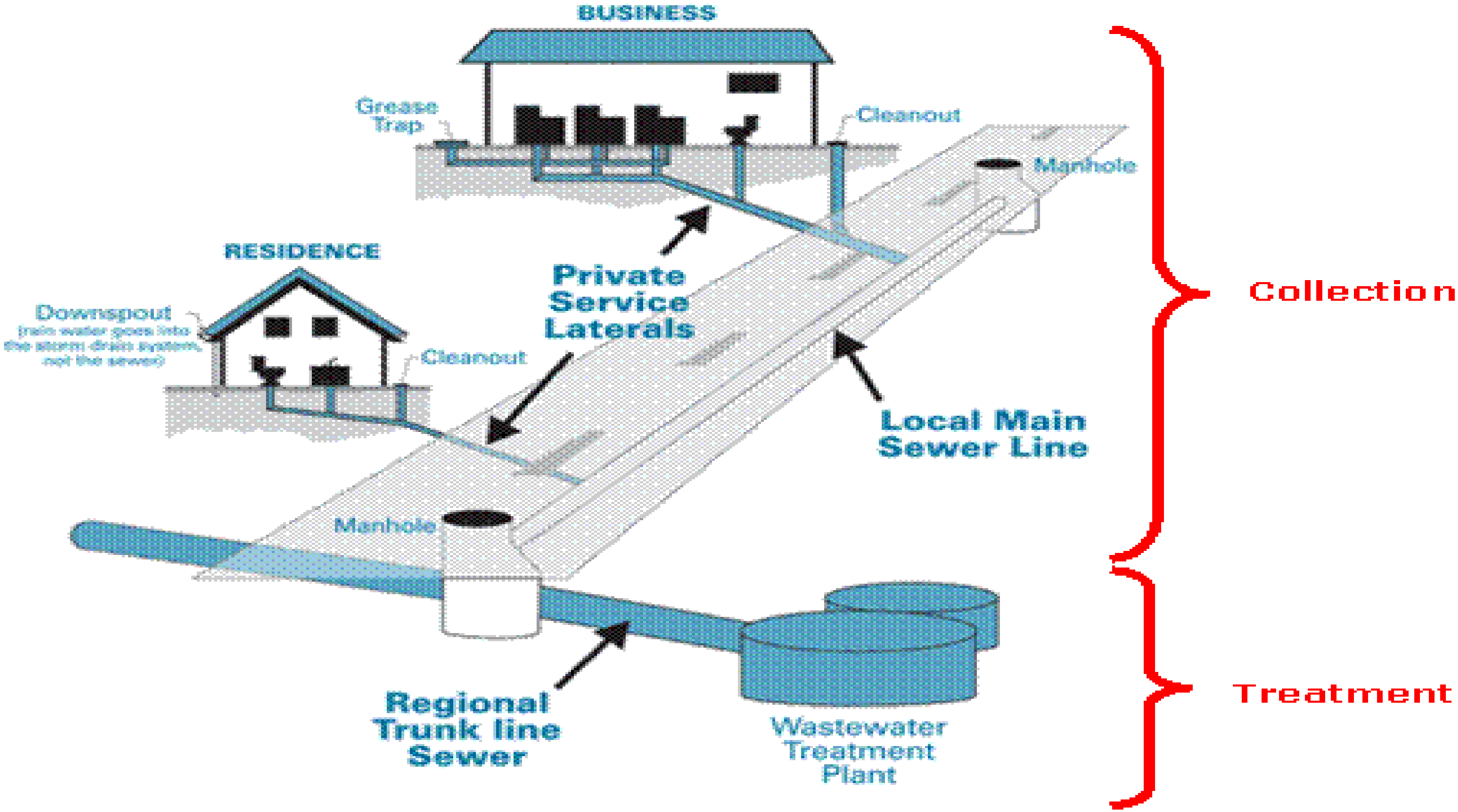


Water Supply System

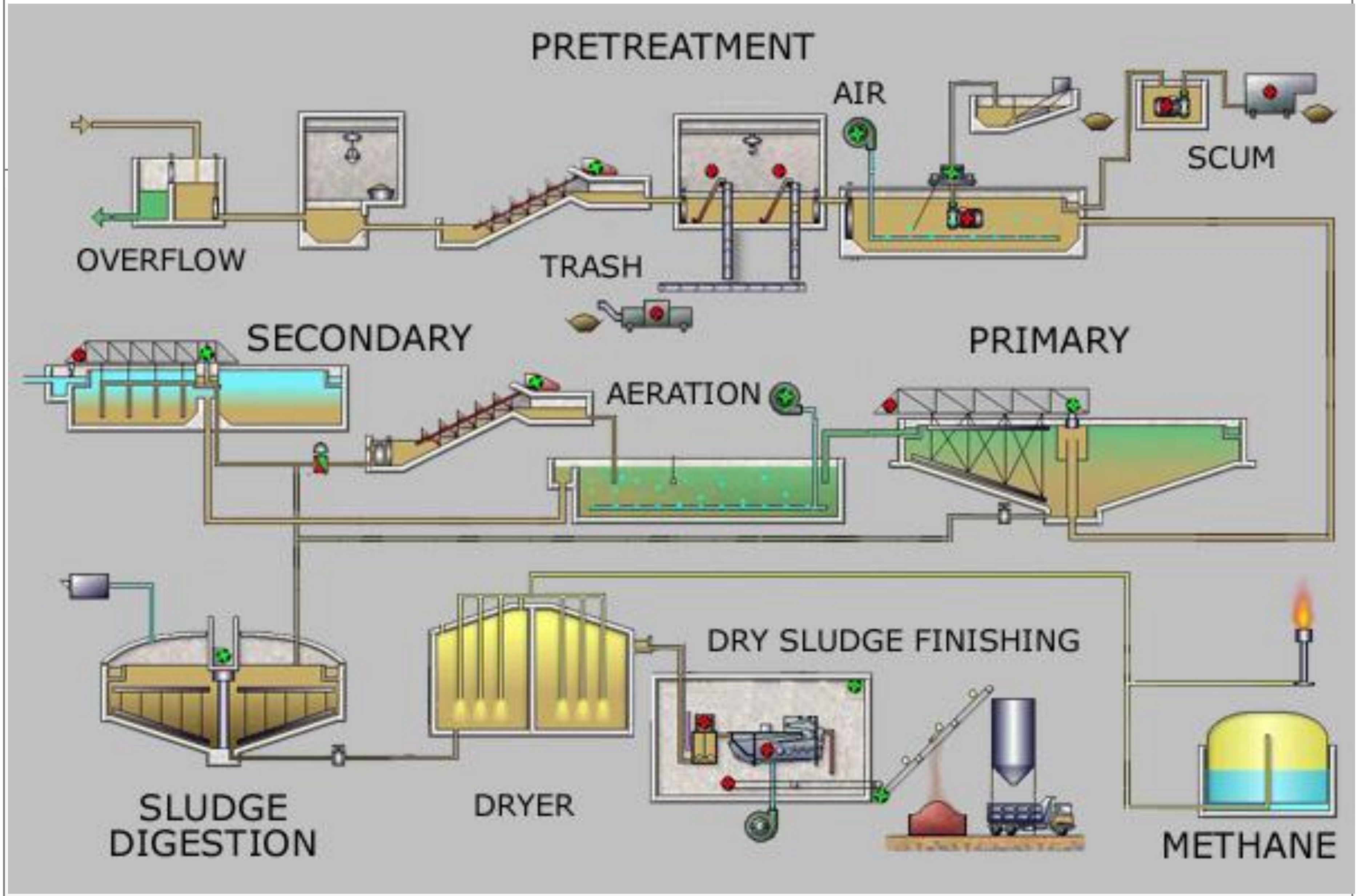


Water Treatment System

Water Treatment System



Wastewater System

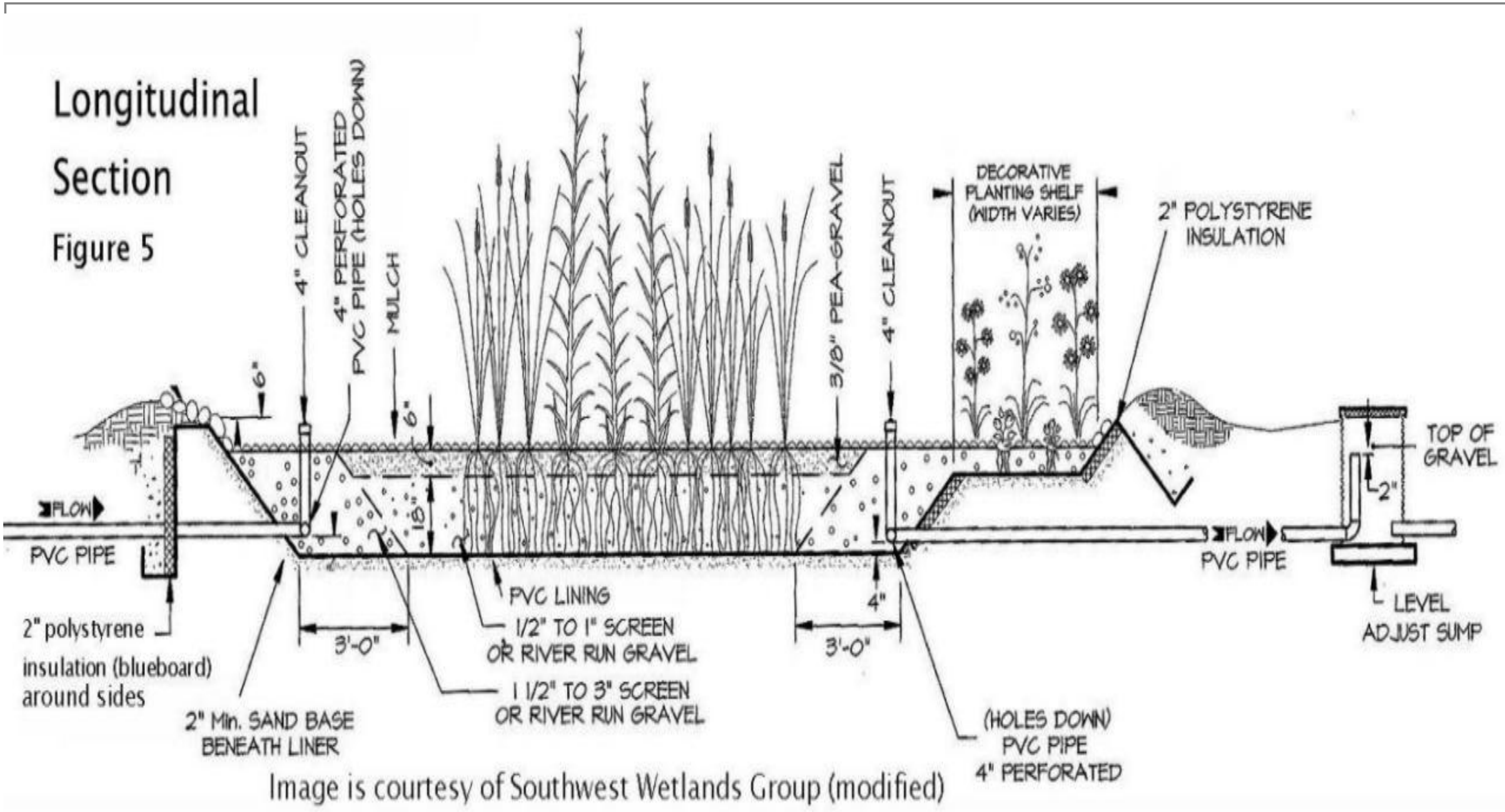


Wastewater Treatment System

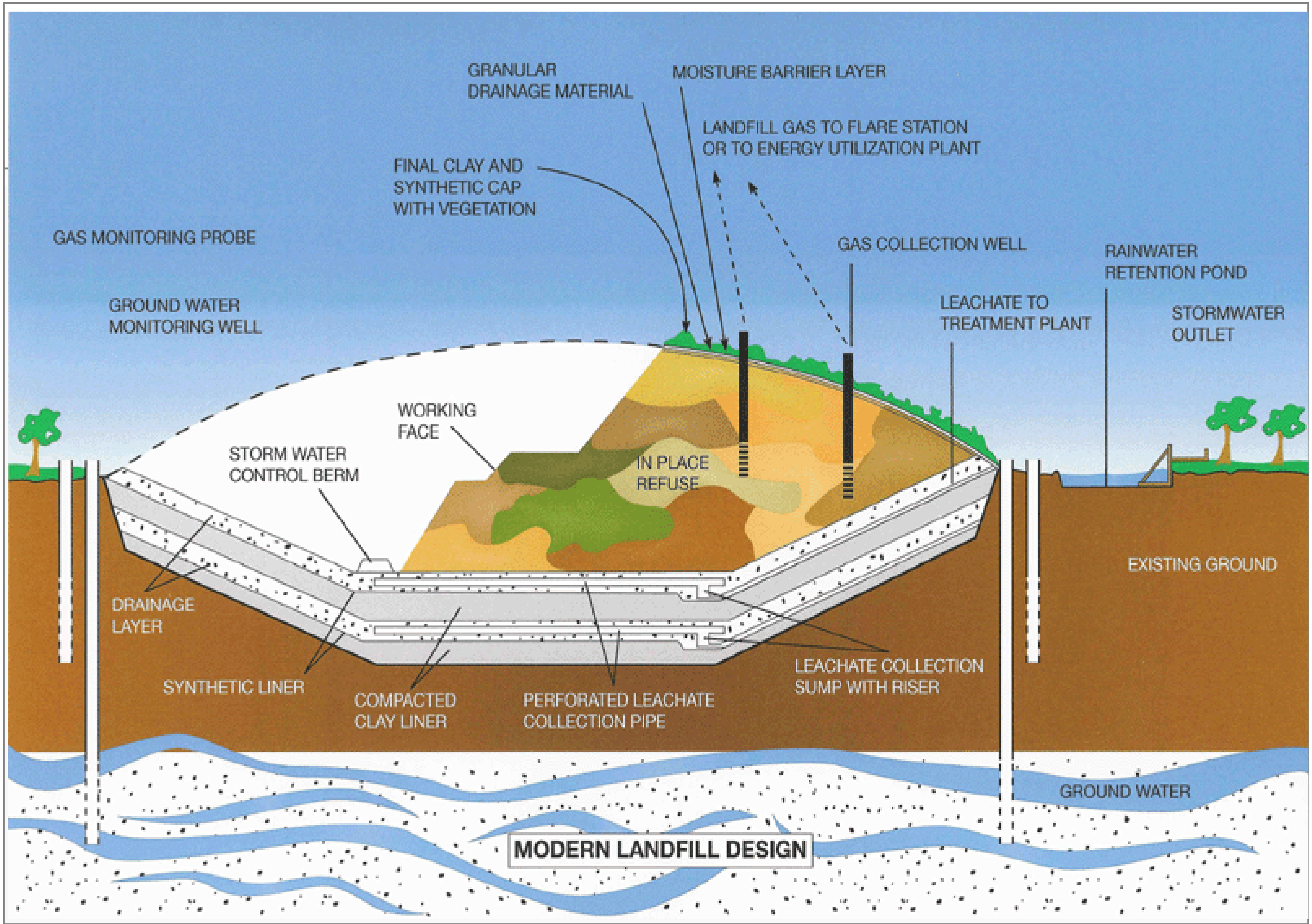
Wastewater Treatment System

Introduction

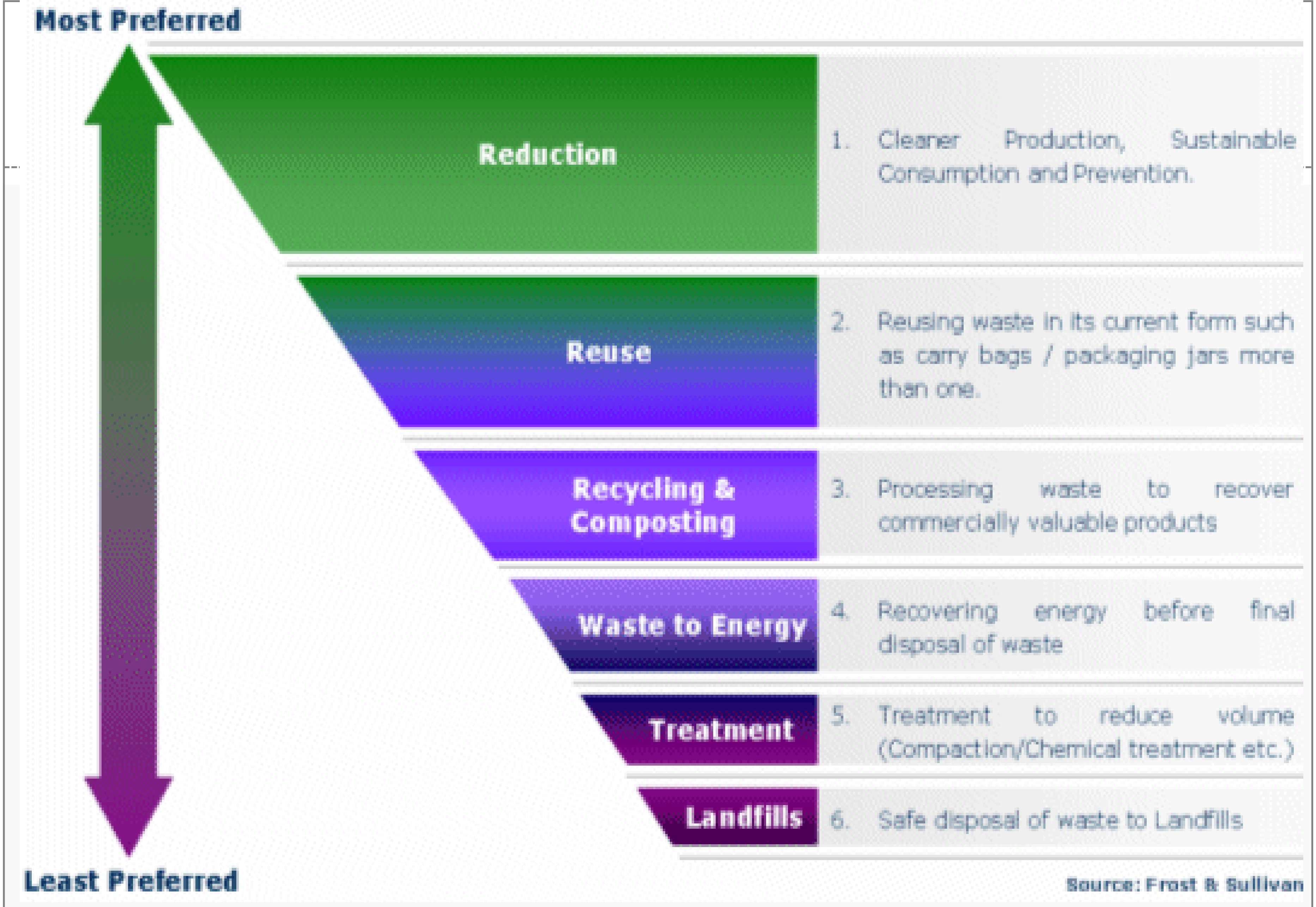
- Contemporary Issues Projects
  - Constructed Wetland Design
  - Solid Waste Management
  - Wastewater Recycling
  - Landfill Design
  - Environmental Impact Assessment of Activities



Constructed Wetland Treatment System



Landfill System



Solid Waste Management

Graduation Project Steps

- Project selection,
- Data collection,
- Identification of real-life constraints (e.g. economy, environmental, global, and contemporary issues),
- Generation of possible design alternatives considering client needs,
- Selection of the preferred alternative, and
- Preparation of a work plan for implementing and completing the project
- Compile a final report and oral presentation to be submitted to the examination committee.

Case Study: Water Supply System

Water Supply Components

- Water sources structures (Dams, wells, reservoirs)
- Surface water & Groundwater
- Pipelines from source
- Water treatment plant components
- Pumping stations
- Storage (elevated tanks)
- Distribution System

Case Study: Water Supply System

Preliminary studies for water supply projects:

The main factors required to be studied to supply a city with water system are:

- Sources of water available
- Quantity of water
- Population (present and future)
- Water consumption (present and future)
- Design Period (30 – 50 years)

Case Study: Water Supply System

The design includes the following steps:

- Prepare a detailed map of the area to be served showing topographic contours (or controlling elevations) and locations of present and future streets and lots.
- Mark the layout of the pipe network including main feeders, secondary feeders, distribution mains and storage reservoirs.
- Estimate the present and expected population and the spatial distribution of the population.
- Estimate the design flow.
- Disaggregate flow to various nodes of the system.
- Assume sizes of pipes based on water demands and code requirements.

Case Study: Water Supply System

The design includes the following steps:

- Analyze the system (for each sub-area) for flows, pressures and velocities and adjust sizes to ensure that pressures at nodes and velocities in pipes meet the criteria (i.e. pressure = 40 – 75 psi, velocity = 1 –2 m/s) under a variety of design flow conditions.
- This can be done in a variety of ways and this what we mean by the hydraulic analysis of a water distribution system (the determination of flows, head-losses in various pipelines and the resulting residual pressure).
- Note: Variables in the head-loss equation:
  - Length (L)
  - Diameter (d)
  - Flow (Q)
  - Head-loss (hL or S)
  - Roughness (C)
  - Known variables: L and C

Example: Water Quantity/Population Density

- Estimate the expected average water consumption rate (Lpcd) for the area shown below. Data on the expected saturation population densities and water demands are also given.

Example: Water Quantity/Population Density

Industrial Area
30 ha
30,000 L/ha.d

Mosque
2 ha; 2000 c
50 Lpcd

High rise Buildings
50 ha
350 c/ha
450 Lpcd

Hospital
10 ha
200 beds – 700 Lpd/bed
400 employees --- 300 Lpd/employee

School
5 ha; 1500 students
200 Lpcd

Commercial Area
120 ha
200 people/ha; 30,000 L/ha.d

Park and Playground
15 ha
15,000 L/ha.d

University
60 ha
10,000 students
200 Lpcd

Single-family dwellings
200 ha
70 person/ha
450 Lpcd

Example: Water Quantity/Population Density

- **Solution:** **Average water consumption = 21,560 / 69,600 = 0.31 m3/c.d = 310 Lpcd**

Zone	Area (ha)	Population	Consumption (Lpha.d)	Consumption (Lpcd)	Total consumption (m^3/d)
Industrial	30	-	30,0000	-	900
Mosque	2	2000	-	50	100
High-rise Buildings	50	350x50=17,500	-	450	7,875
Hospital	10	200 beds 400 employee	-	700 300	140 120
School	5	1500	-	200	300
Commercial	120	200x120=24,000	30,000	-	3,600
Park and playground	15	-	15,000	-	225
University	60	10,000	-	200	2000
Single-family dwellings	200	70x200=14,000	-	400	6,300
Total		69,600	-		21,560

Example: Consumption Discharge

- For a town of Pop. 60000 cap. And an average water consumption of 200 L/c/d. If the Pop. Increased at a rate of 2% per year and the increase of water consumption is 10 % of the percentage increase of Pop. Per year. Find the max. monthly, daily and hourly consumption discharge now and after 30 years.

Example: Consumption Discharge

- Solution

  Qaverage (now) = Pop. (now) × W.C. (now)

  = 60000 × 200 = 12 × 106 L/d = 12000 m3/d

  Qmax. Monthly = 1.4 (12000) = 16800 m3/d

  Qmax. daily = 1.8 (12000) =21600 m3/d

  Qmax. hourly = 2.7 (12000) =32400 m3/d

  At future Qaverage (future) = Pop. (future) × W.C. (future)

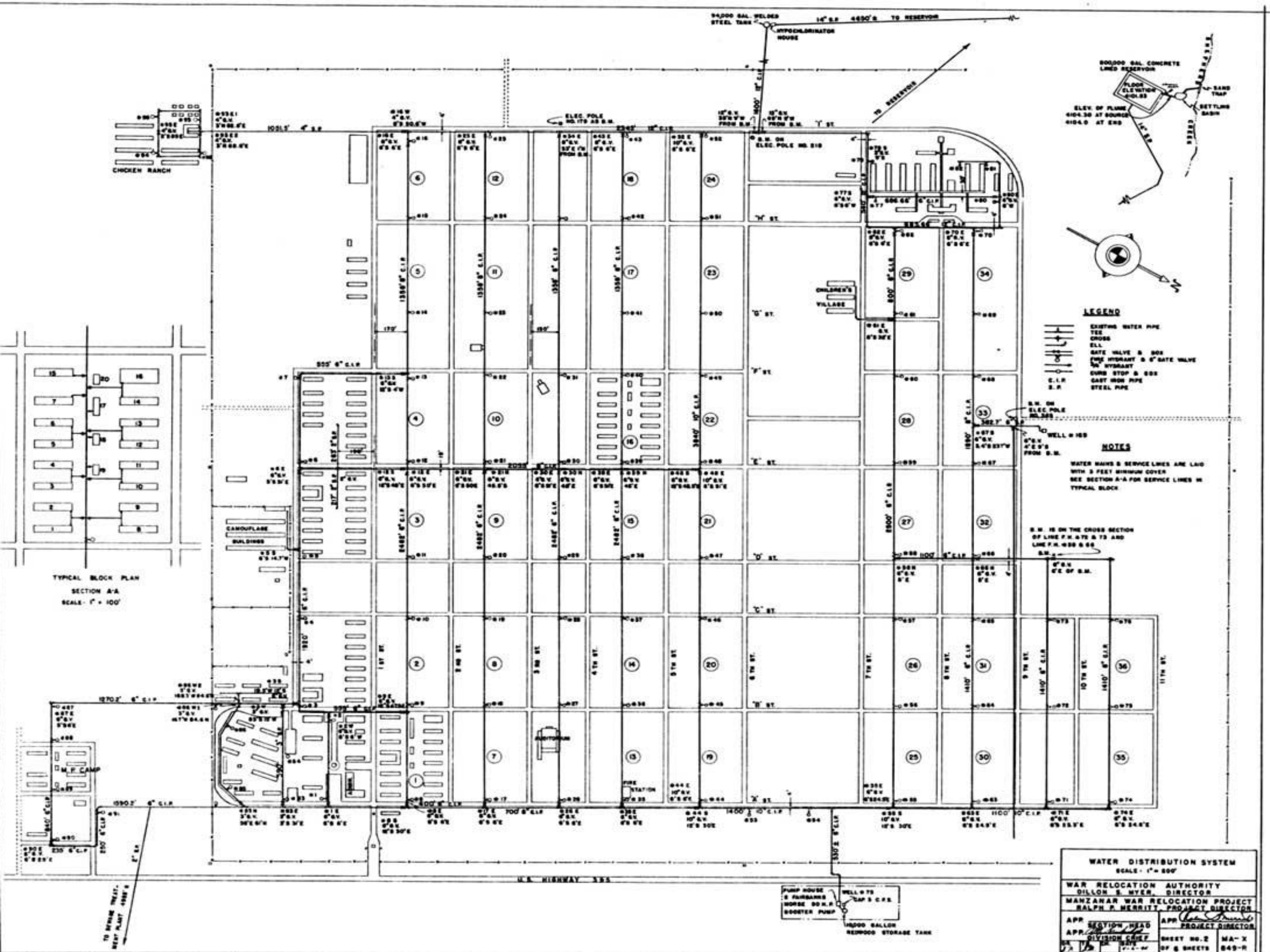
  P30 = 60000 (1+2/100)30 = 108680 capita

  W.C30 = 200 (1+2/1000)30 = 212.4 L/c/d

  Qmax. monthly = 1.4 (108680 × 212.4) = 32317 m3/d

  Qmax. daily = 1.8 (108680 × 212.4) = 41550 m3/d

  Qmax. hourly = 2.7 (108680 × 212.4) =62325 m3/d



LEGEND
EXISTING WATER PIPE
TEE
CROSS
ELL
GATE VALVE & BOX
FIRE HYDRANT & 6" GATE VALVE
CURB STOP & BOX
C.I.P. CAST IRON PIPE
S.P. STEEL PIPE
NOTES
WATER MAINS & SERVICE LINES ARE LAID WITH 3 FEET MINIMUM COVER
SEE SECTION A-A FOR SERVICE LINES IN TYPICAL BLOCK
TYPICAL BLOCK PLAN
SECTION A-A
CHICKEN RANCH
M.P. CAMP
CAMOUFLAGE BUILDINGS
CHILDREN'S VILLAGE
AUDITORIUM
FIRE STATION
HYPOCHLORINATOR HOUSE
TO RESERVOIR
WELL # 169
U.S. HIGHWAY 395
PUMP HOUSE
WATER DISTRIBUTION SYSTEM
SCALE - 1" = 500'
WAR RELOCATION AUTHORITY
DILLON S. MYER, DIRECTOR
MANZANAR WAR RELOCATION PROJECT
RALPH P. MERRITT, PROJECT DIRECTOR
APP. SECTION HEAD
APP. DIVISION CHIEF
APP. PROJECT DIRECTOR
SHEET NO. 2 OF 6 SHEETS
MA-X 849-R