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USAID/Lebanon WWTP for Small Communities Design for Lower Cost Operations

Construction & Startup

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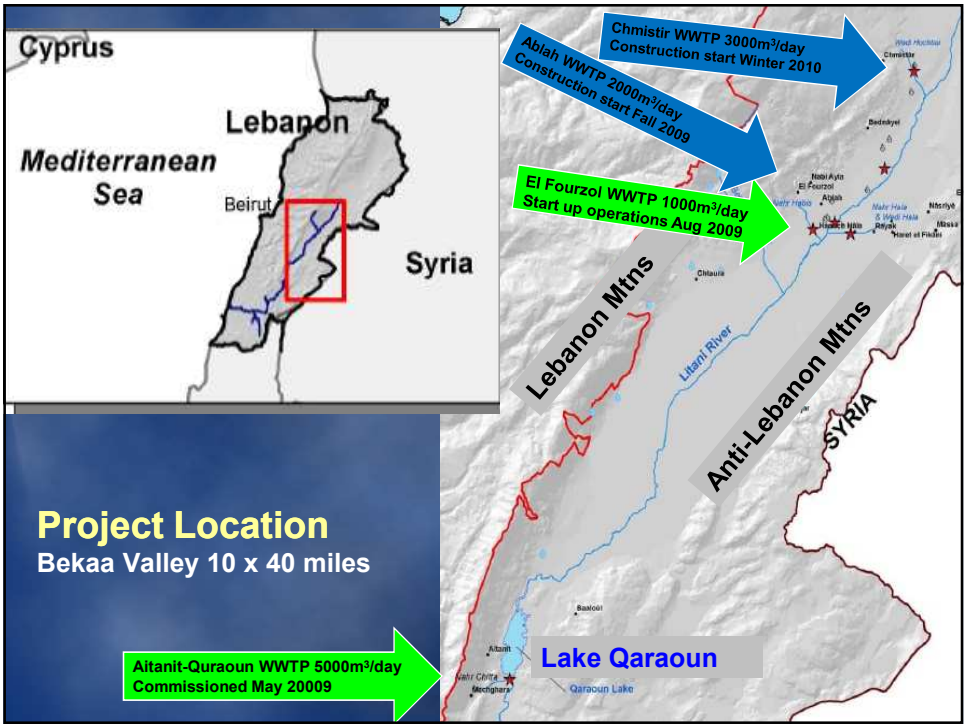
Agenda

- Review of project and design objectives
- *Treatment processes:*
  - *Primary sedimentation – Activated Tricking Filter - Secondary sedimentation – disinfection*
- Construction of WWTPs using non-conventional design approach for process structures and equipment – How is it going?

Review-Plants design

- In 2005, CDM under contract with USAID designed several small WWTPs for communities in the Bekaa Valley in Lebanon to help clean up the Latana River.
- Primary design objectives:
  - Low energy inputs to keep operating cost down.
  - Simple to operate and maintain
  - Secondary level of treatment
- Seven plants were design
- Fall 2005 funding for two plants - modified D/B approach:
  - Aitanit-Qaraoun WWTP - 5,000m^3/day (1.3 mgd)
  - El Fourzol WWTP - 1,000m^3/day (0.3 mgd)
- Summer 2009 USAID funded construction of 2 more plants



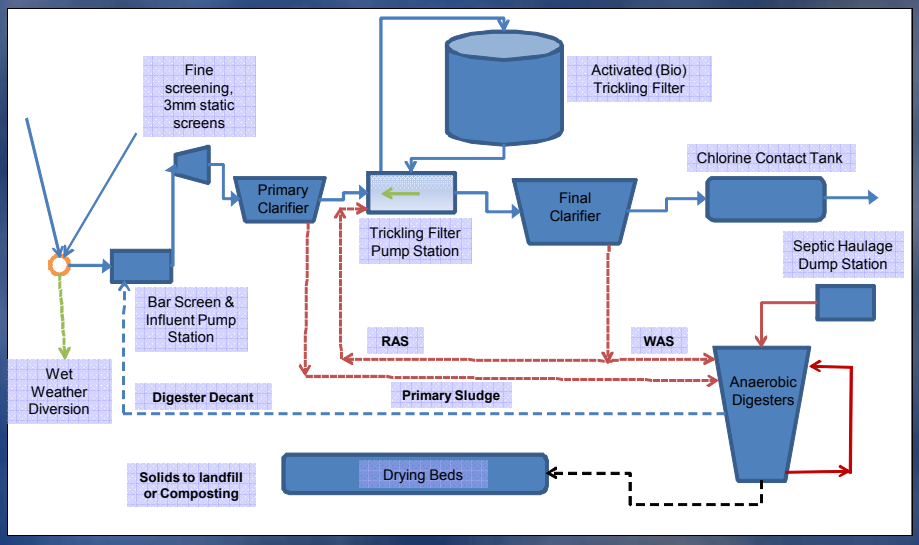
Summary of WWTP Design Criteria

- Design flow, 132 l/d/c (35 gal/d/c)
- Raw WW characteristics 400 mg/l BOD5
- Secondary Treatment
- Minimize O&M (energy) costs
- Simple O&M, through familiar equipment and simple visible processes
- Future upgrade for N & P removal
- Robust processes and structures

Table 1: Assumed Plant Influent and Effluent Characteristics

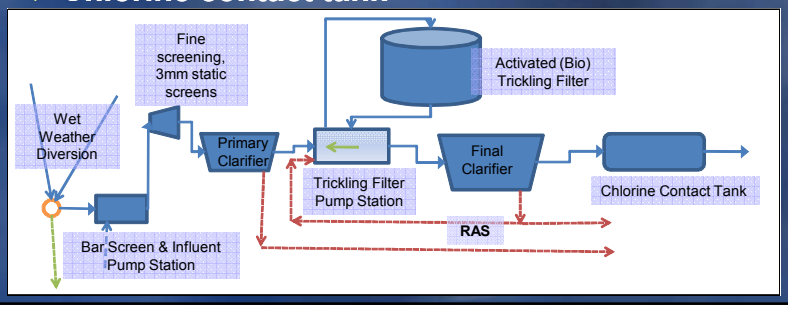
	BOD_5 (mg/l)	TSS (mg/l)	Total N[1] (mg/l)	Total P[1] (mg/l)
Raw Wastewater Influent	400	350	85	15
Effluent Requirements (ELV)	25	60	30	10

Process Flow Diagram

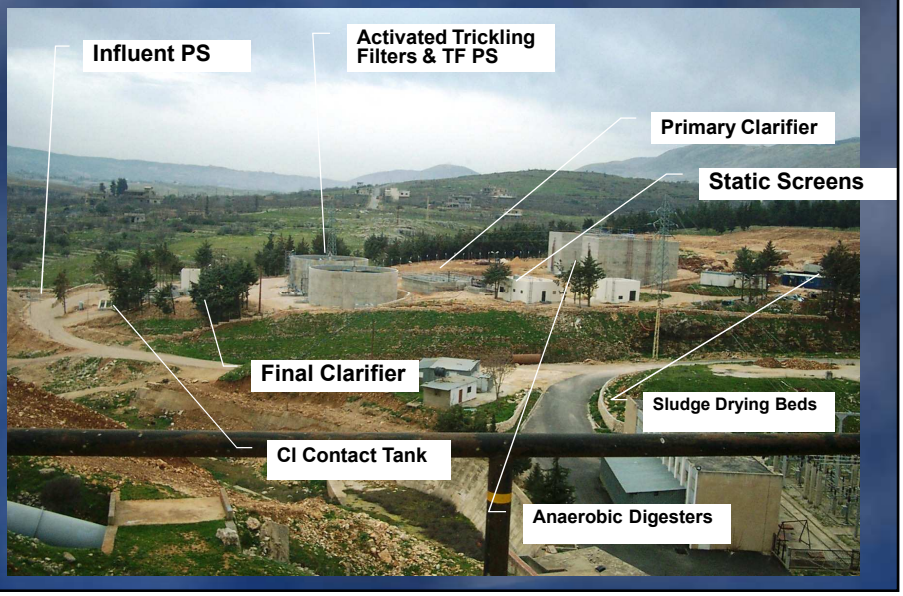


Treatment Process- Liquid Stream

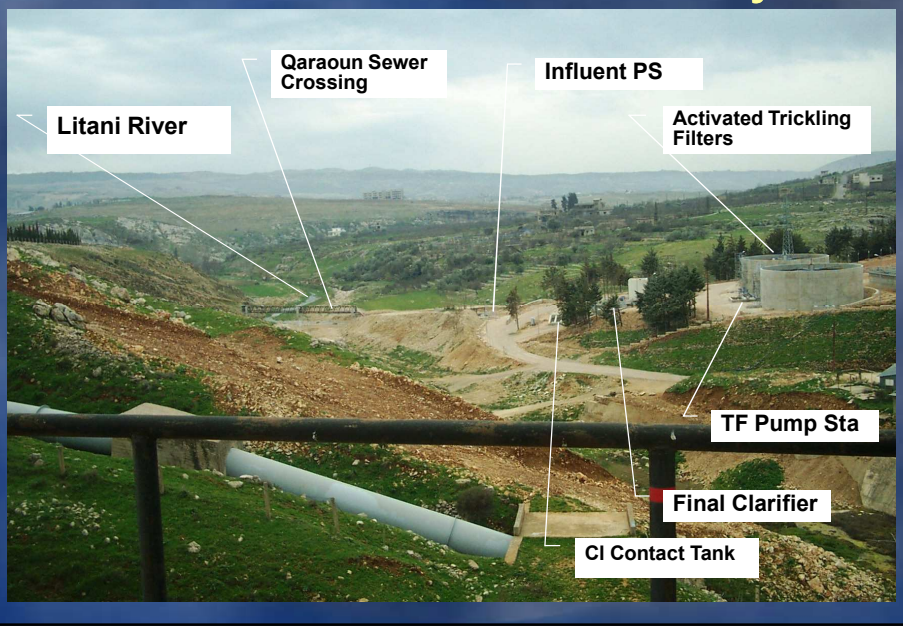
- Wet weather diversion
- Bar screen and influent pump station
- Fine screen – static screen
- Primary clarifier- multiple hopper bottom
- Activated trickling filter (RAS to TF)
- Final clarifier- multiple hopper bottom
- Chlorine contact tank



Aitanit-Qaraoun WWTP 5000m^3/day (1.3 MGD)



Aitanit-Qaraoun WWTP 5000m³/day

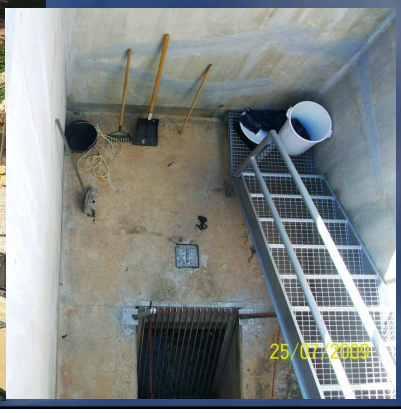


Bar screen & Influent Pump Station

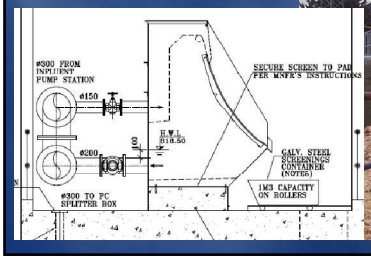
Existing sewer line follow rivers

Manually cleaned bar screen

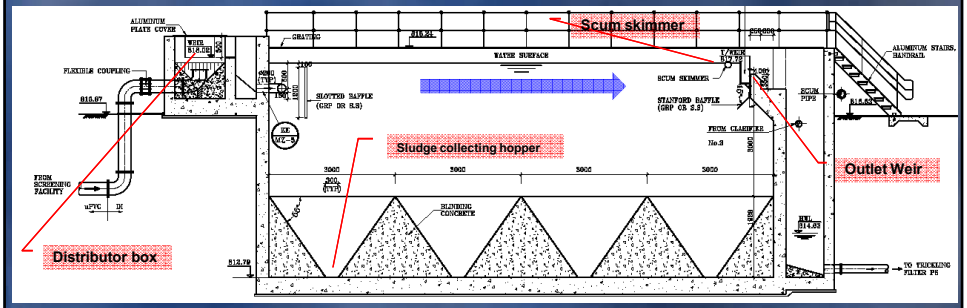
Submersible pumps



Static Screens & Septic Haulage



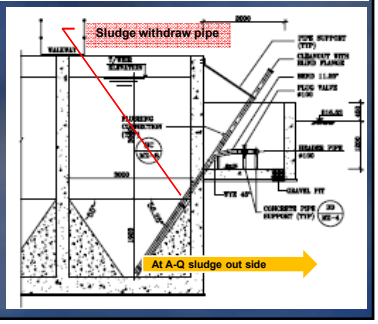
Primary Clarifier



Plug flow multi hopper bottom clarifier

Hopper bottom clarifier to eliminate mechanical collector

Sludge collection pipe for each hopper



Primary Clarifier

Hopper bottom primary clarifier at El Fourzol

Aitanit with one primary clarifier in operation

Note scum skimming system

Primary Clarifier

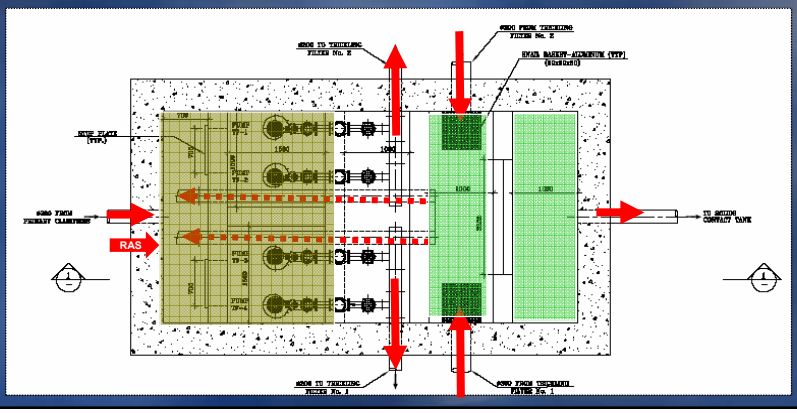
At Anitanit plant the sludge collection system was modified

At El Fourzol plant sludge collection build at as designed

PC to Trickling Filter Pump Station

Trickling Filter Pump Station

- Pumps water to trickling filters
- Receives TF return
- Recycle flow for TF (5x influent Q)
- Flow balancing (recycle and final clarifier)
- Receive RAS from final clarifier



Trickling Filter Pump Station

Submersible pumps

Outlet weir to balance flow

Basket on return to collect snails

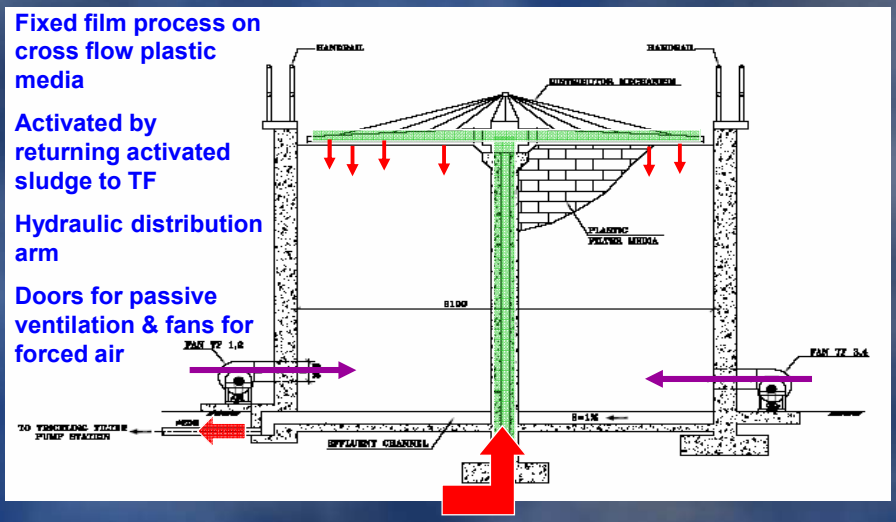
Activated Trickling Filters

Fixed film process on cross flow plastic media

Activated by returning activated sludge to TF

Hydraulic distribution arm

Doors for passive ventilation & fans for forced air



Activated Trickling Filters

Media protected with top grating

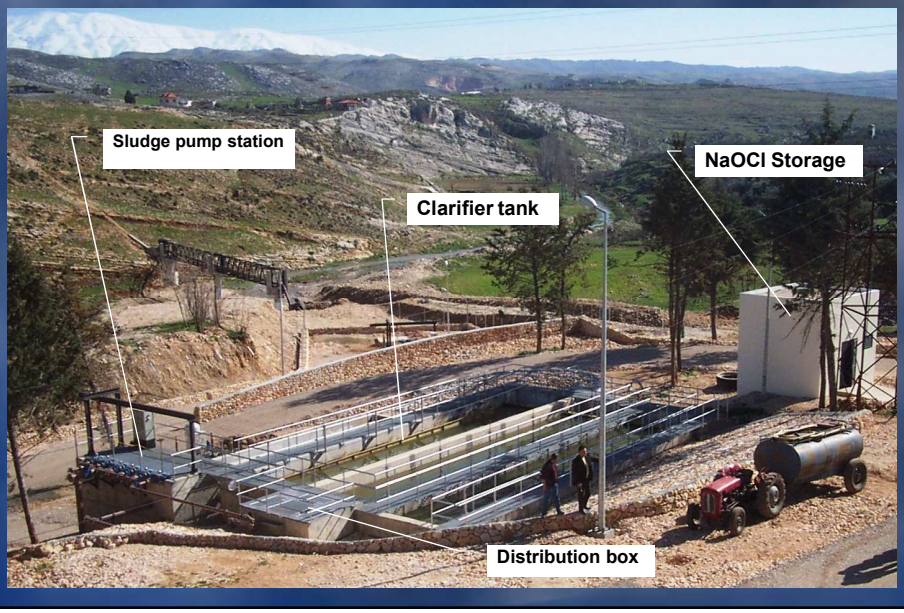
Support system for media

Activated Trickling Filters (ventilation)

Vent doors are shut when fan is running

Fans needed with air temp = water temp and for greater process flexibility

Final Clarifier

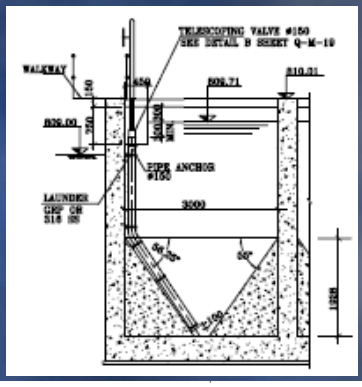


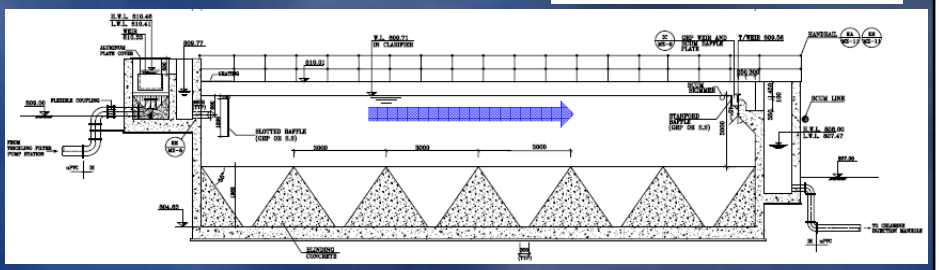
Final Clarifier

Plug flow multi hopper bottom clarifier

Activated sludge withdraw with telescoping valves in launder trough

Scum removal by split rotating pipe





Final Clarifier

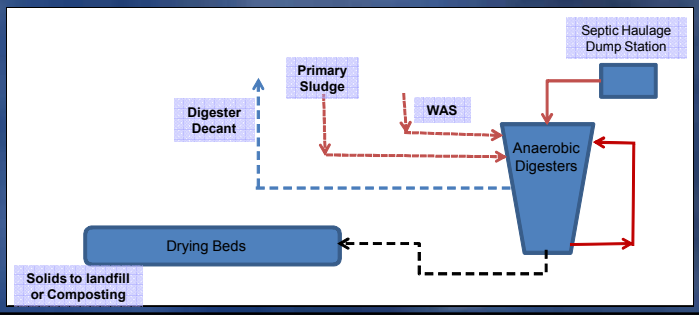
- See how the river water looks in Feb.
- Telescoping valves withdrawing sludge from hopper, launder channels sludge to pump station sump

Chlorine Contact Tank

- Two basins
- Effluent disinfection & plant water supply
- Effluent discharge to the river

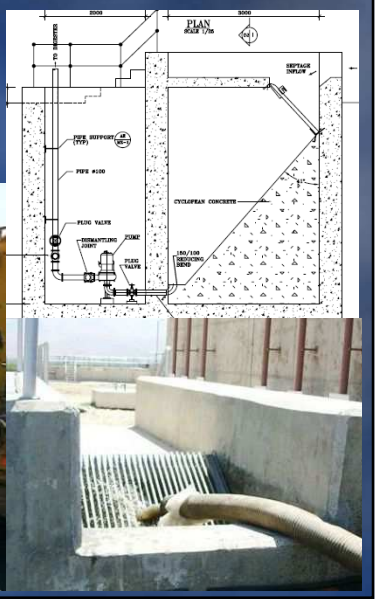
Solids Stream

- Anaerobic digesters thicken and digest sludge receives from:
  - Septic haulage
  - Primary clarifier
  - Final clarifier (wasted activated sludge)
- Sludge drying beds for final treatment



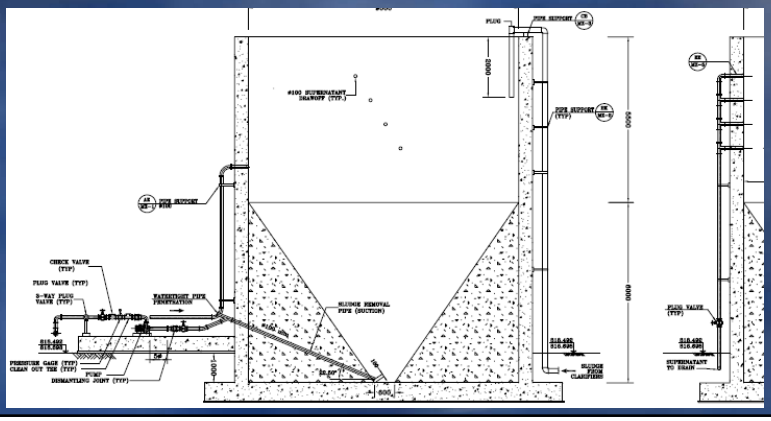
Septic Haulage

- Provide place to dump septic tank pumpage instead of the river
- Enhances anaerobic digestion process



Anaerobic digesters

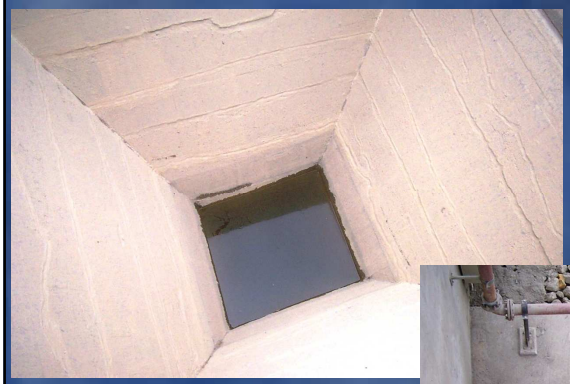
- Open top tanks to prevent gas buildup (no boom)
- Hooper bottom
- Sludge settling and decanting
- Solids pumps provide mixing & pumping of digested solids to drying beds



Anaerobic digesters

- Four digester tanks at Aitanit plant for decanting and solids ageing
- Decanting pipes on facing surface

Anaerobic digesters



- Hopper bottom difficult to construct
- Redundant sludge pump and suction pipe

Solids Drying Beds

- After digestion the solids are sent to the drying beds
- Finished solids to be used as soil amendment, composting, or land filled

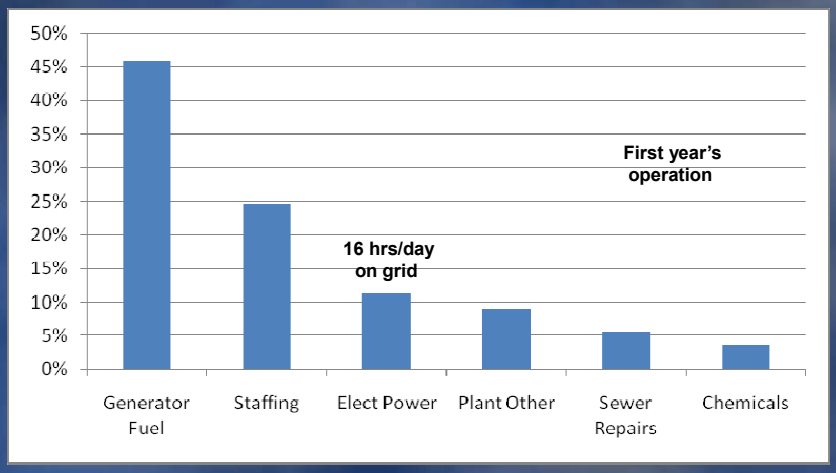
Current Status

- Aitanit WWTP sewer flow was received on April 23, 2009
- Aitanit WWTP commissioned on May 5, 2009. First operation modern WWTPs in Lebanon
- El Fourzol WWTP sewer flow was received on August 3, 2009
- Ablah WWTP anticipated construction start date September 21, 2009
- Chmistar WWTP anticipated construction state date February 2010 – reduce for new site

Preliminary feedback on "Simple to operate and maintain" objective

- Robust design: Process & structures
- Hopper bottom clarifier & Digester
- Flows will not necessary be there when needed
- Low O&M costs & Low Capital costs challenging to reconcile
  - Single hopper bottom vs. multi hopper bottom
  - Concrete tank vs. steel or FRP tanks
  - Locally made vs. imported products

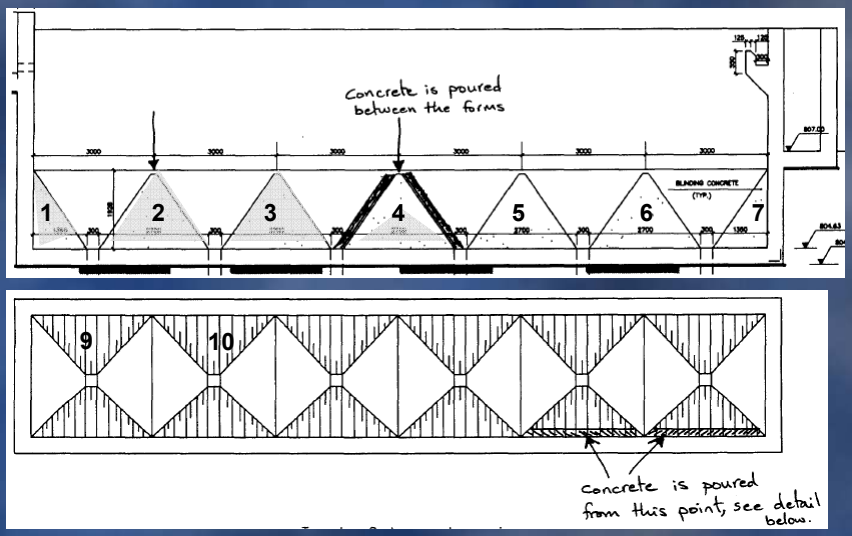
Projected O&M Costs – El Fourzol WWTP for 1,000m^3/day (0.3 MGD) plant



Feedback on Construction Project Management

- Subcontracting:
  - Bidding without BOQ
  - Level of experience/ technical capacity
- Hopper bottom tank construction
- TF Tower Construction
- Local manufacturing
- Schedule

Hopper Bottom Clarifier Construction



Project team

- Sana Saliba, USAID Program officer
- Construction team (CDM Constructors):
  - Ra'ed Ghantous, (Project Manager)
  - Matt Antill, (Commissioning Operator)
  - Issam Deeb, (Engineer)
- Design team (CDM, Inc.):
  - Rod Reardon, PE (Lead Process Engineer)
  - Misti Burkman, PE (Project Engineer)
  - John Crippen, PE (Project Manager)
  - Bruce Soule, PE (Regional Manager)
  - Matt Antill, (O&M Specialist & Operator)
  - Dar Al_Handasah , Engineering Subcontracor

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Thank you

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