Typical Water Supply System and

Transmission Network Design

For

Different Level Collection Tanks in Hilly Regions

Presented by

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Content

1. Brainstorming in the story of bottled water

2. About a typical water supply system and its components
   Common brainstorming words in the subject of water supply

3. Design process for a typical water supply system
   Using software

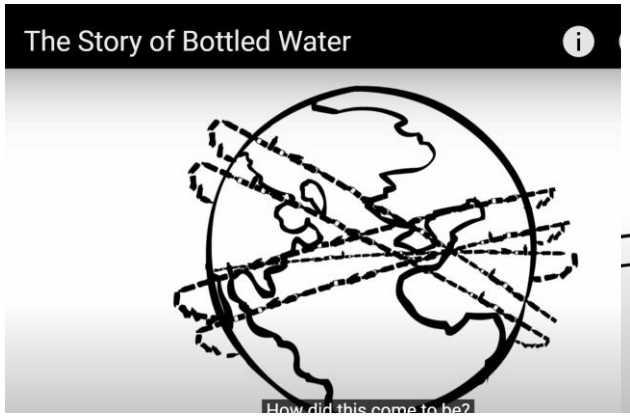
4. About Hilly Region Falam Town Water Supply Project

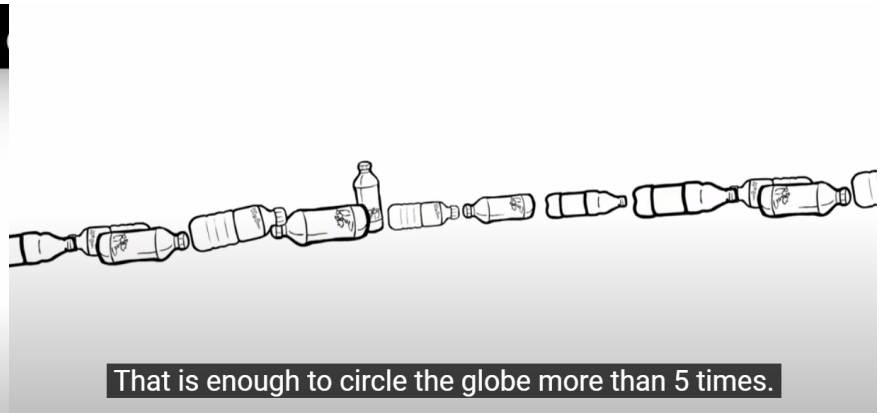
5. Lesson Learnt 3min

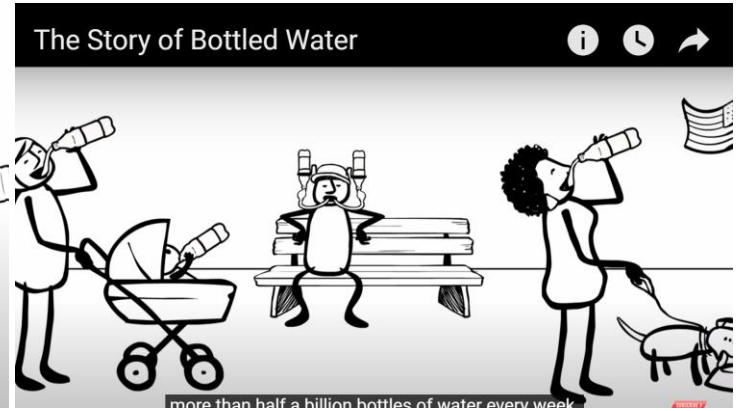
1. The Story of Bottled Water(https://youtu.be/Se12y9hSOM0)

- The development of the habit of using purified drinking water and the risk of environmental pollution

Let's make tap water quality drinkable







In US, More than half a billion bottles of water every week that is enough to circle the globe more than 5 times

1 Liter bottle water = 500 Kyats

1 m^3 of Tap water = 200 Kyats

For 1 m^3 (1000 Liter) bottle water = 500000 Kyats

500000 / 200 = 2500 Times

6.5min

1. The Story of Bottled Water(https://youtu.be/Se12y9hSOM0)

Production of polyethylene terephthalate bottles worldwide from 2004 to 2021

(in billions)

Characteristic	Production in billion units
2021*	583.3
2016	485
2014	475
2004	300

Opportunities Fund II, a Norfund investee, announced this month its new investment in a plastic bottles recycler company in Myanmar.

Myanmar, a country of 54 million people, consumes approximately 2 billion plastic bottles per year.

1.5min

2. About A Typical Water Supply System and Its Components

- Water sources , Rivers, Creeks , Spring, Dam, Canal , Tube Wells, Lake, Radial Collector Wells, Dug wells, Intake System, Siphon System
- Reservoirs, Ground Tanks, Elevated Tanks, Public Tanks,
- Electric Sub station , Transformers , HT Line , LT Line, Motors, Pumps, Control Panel
- Transmission Main, Distribution Main, Secondary Main, Tertiary Network, Pipe Fitting, Air Valve, Surge Vessel, Non Return Valve, Gate Valve, Fire Fighting System, Wash Out, Score valve, Strainer
- Water Treatment Plant, Chemical Dosing System, Sludge Management System
- Disinfection System(Chlorine, UV, Ozone, H_2O_2)(Pros&Con)
- Water Meters, House connection, Public Taps
- Water Quality Monitoring and Control System, Laboratory
- Water 4.0, SCADA System, IOT, Real Time, PLC, Digital Twin, AI

10min

2. **Brainstorming Words** for Water Supply Subject "brainstorming can generate some wonderful idea and solve problems"

- Lifespan
- Payback period, IRR
- Holistic view
- QMS(Quality assurance, quality control)
- "C" value(can change pressure and head)
- Safety Factor (more safe more expensive)
- Surge pressure(pump housing, impeller, check valve) sleeve
- Thrust block
- Pump motor, rpm, control panel, material
- Corrosive soil, corrosive water
- Chlorine(concrete cover, rebar), UV, ozone, H_2O_2 (trihalomethanes)(1974-2005)
- SUS 304, 310, 316(Molybdenum) (non corrosive materials)(Weldability, durability, high temp resist;)
- Pipe type, material, manufacturer policy, pressure classes
- Lap shear test, lap tensile test, joint tensile test, joint pressure test

20min

2. **Brainstorming Words** for Water Supply Subject "brainstorming can generate some wonderful idea and solve problems"

- Pipeline compaction(dewatering, compactor, hilly region, budget)
- EPDM rubber(Lifespan of DI is 100yrs but lifespan of rubber seal?)
- Water Treatment Plant(slow sand, rapid sand, Ro, Actiflo, Lamella, tube settler, auto backwash gravity filter, sludge management system)
- RCC Tank, Brick tank, Fiber Tank, PE 100 Tank, Steel Tank
- Rebar HRB 335, 400, 500, HRB 500E, HRBF500E, RRB400,RRB400W, RRB500, CRB550, CPB550, CRB600H(hot rolled ribbed bar, cold rolled ribbed bar, cold rolled plain bar, remain heat treatment ribbed bar, E(earthquake), F(fine grains) (Yield and Tensile Strength, maximum elongation)
- Sulphate resistance, chlorine resistance cement, grade30, 40 concrete
- Water4.0, SCADA System, PLC, Digital Twin, Real Time, AI
- EIA, SIA
- OSH

15min

3. Design Process For A Typical Water Supply System

- Feasibility study
  - Water sources and water quality(ensuring sufficient water resources, location and good quality)
  - Financing
  - Water tariff(willing to pay)
  - Shortest payback period(comparison between income and expenditure)
  - Available land (spaces for WTP, Reservoirs, PH)
  - Authority sanction
  - Weather(evaporation, percolation, day demand, hourly demand, WTP design, L/C/D)
- Conceptual design(from idea to paper)
  - How many ways and alternative do you have to choose(Gravity flow or pumping or combine)
  - Intake methods and structure
  - Type of Transmission main and routing and distributions, safety factor, pressure class
  - 24/7 supply system or intermittent supply
  - Need to treat or not

10min

3. Design Process For A Typical Water Supply System

- Conceptual design(from idea to paper)

  Residual pressure at user points

  Hourly peak demand and maximum day demand, fire fighting, greening(safety factor)

  Project year(population growth rate(normal or migration)) , town plan

  Renewable energy

  EIA&SIA

- Basic design

  River water, canal intake, pumping and gravity, treatment, Tr main size, route, distribution & secondary main size & rout, tertiary type and size, residual pressure 2bar, hourly demand 1.5time, maximum day demand 2 time, design period 30yrs, solar , EIA&SIA

- Final design(detail design)

5min

3. Design Process For A Typical Water Supply System

There are 5 types of software used in design process

- Google Earth
- Auto Cad
- Epanet
- GIS
- Microsoft(Word, Excel, PP, Notepad)

3min

3. Design Process For A Typical Water Supply System

Using software

- Feasibility study and pre surveying work by using Google Map (before detail survey)
  - Terrain of project and surrounding areas can be roughly checked
    - Distance
    - Level
    - Area
    - Topography
    - Historical image(can check and count residence)
- Topographic survey work by using Total Station and RTK Instrument for georeferencing of projected areas, pipeline network and reference drawing
- Auto-Cad drawing for network detail design and shop drawing
- Epanet for network detail design and Hydraulic Simulation
- GIS for maintenance and data records

15min

3. Design Process For A Typical Water Supply System

- Designer should do pre survey work to check terrain of whole project and surrounding areas carefully and patiently by taking time.
- Designer should defined pipe sizes and classes according to terrain for economical and technical issue (means economical diameter)

1min

3. Design Process For A Typical Water Supply System

- Needs to do check and balances working pressure and pipe classes along pipeline route
- Need to do discussion and point out to choose smoothest way of pipeline route to keep the working pressure as consistent as possible along the pipeline
- Should define residual pressure of user points where is the highest of the Project Area which should be decided by all stakeholders

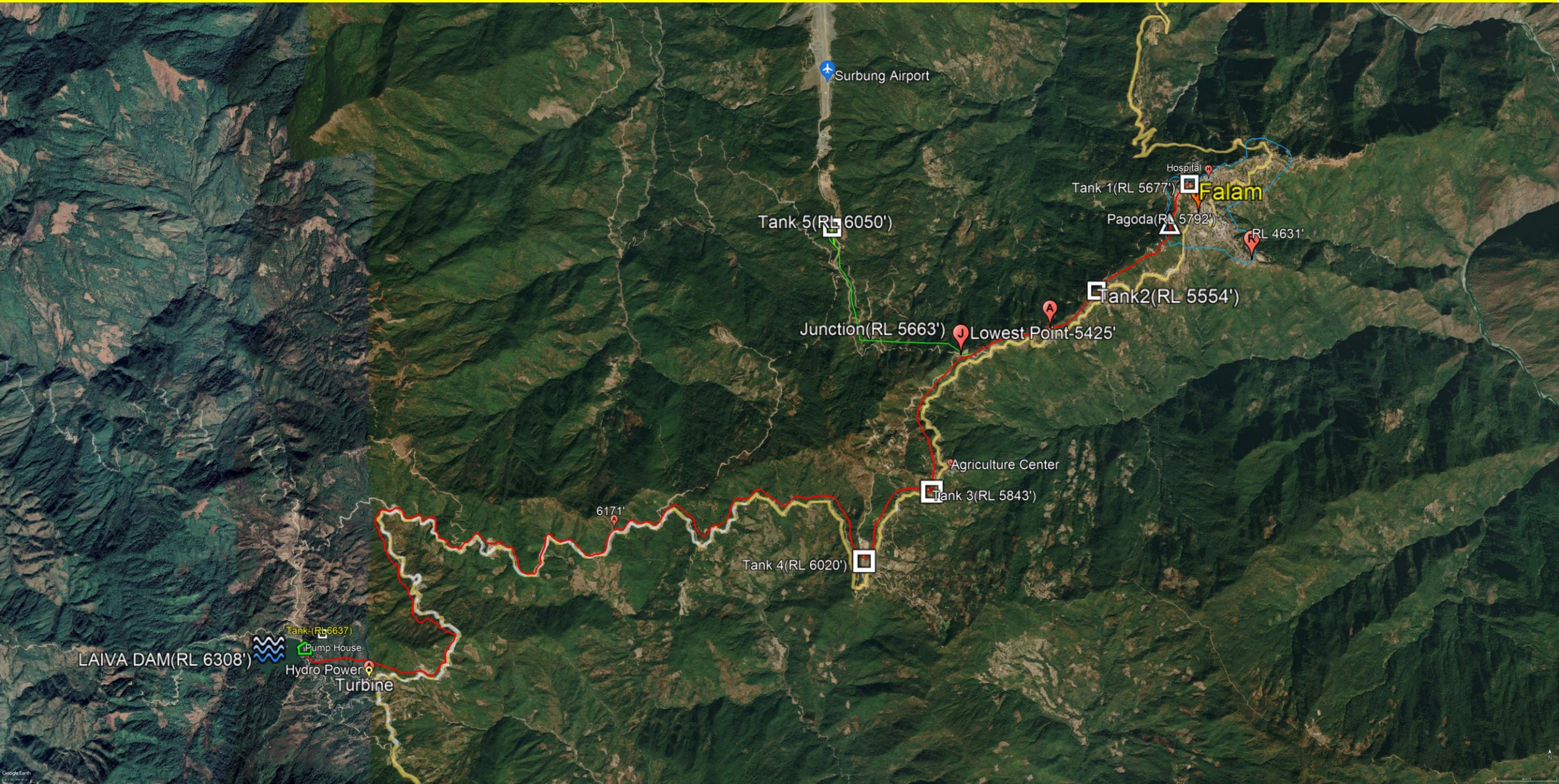
1min

4. Profile of Falam Town Water Supply Project

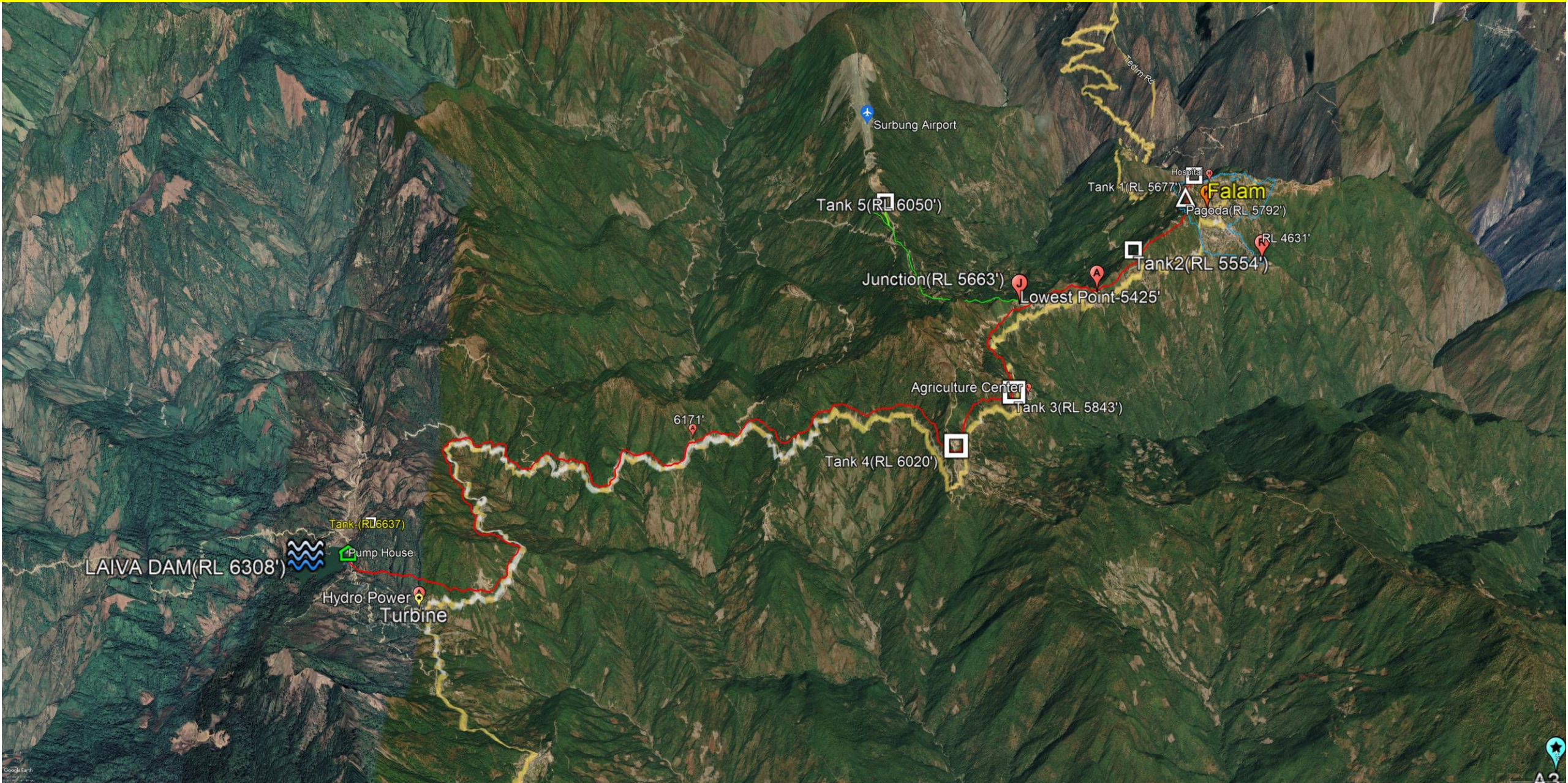
➢ Total Wards	-	4 Nos
➢ Total Houses	-	1439 Nos
➢ Household	-	1779 Nos
➢ Population	-	11076 Nos
➢ Total Average Water Demand	-	276900 Gallon(2018)
➢ Total Average Water Demand	-	633600 Gallon(2048)
➢ Water Transportation and distribution	-	Gravity flow combined Pumping(24/7)
➢ Type of Transmission Main	-	HDPE (19 Miles)
➢ Design flow rate	-	440 GPM
➢ Number of collection Tanks	-	5 Nos
➢ Water Source	-	Laiva Dam

10min
S14-36

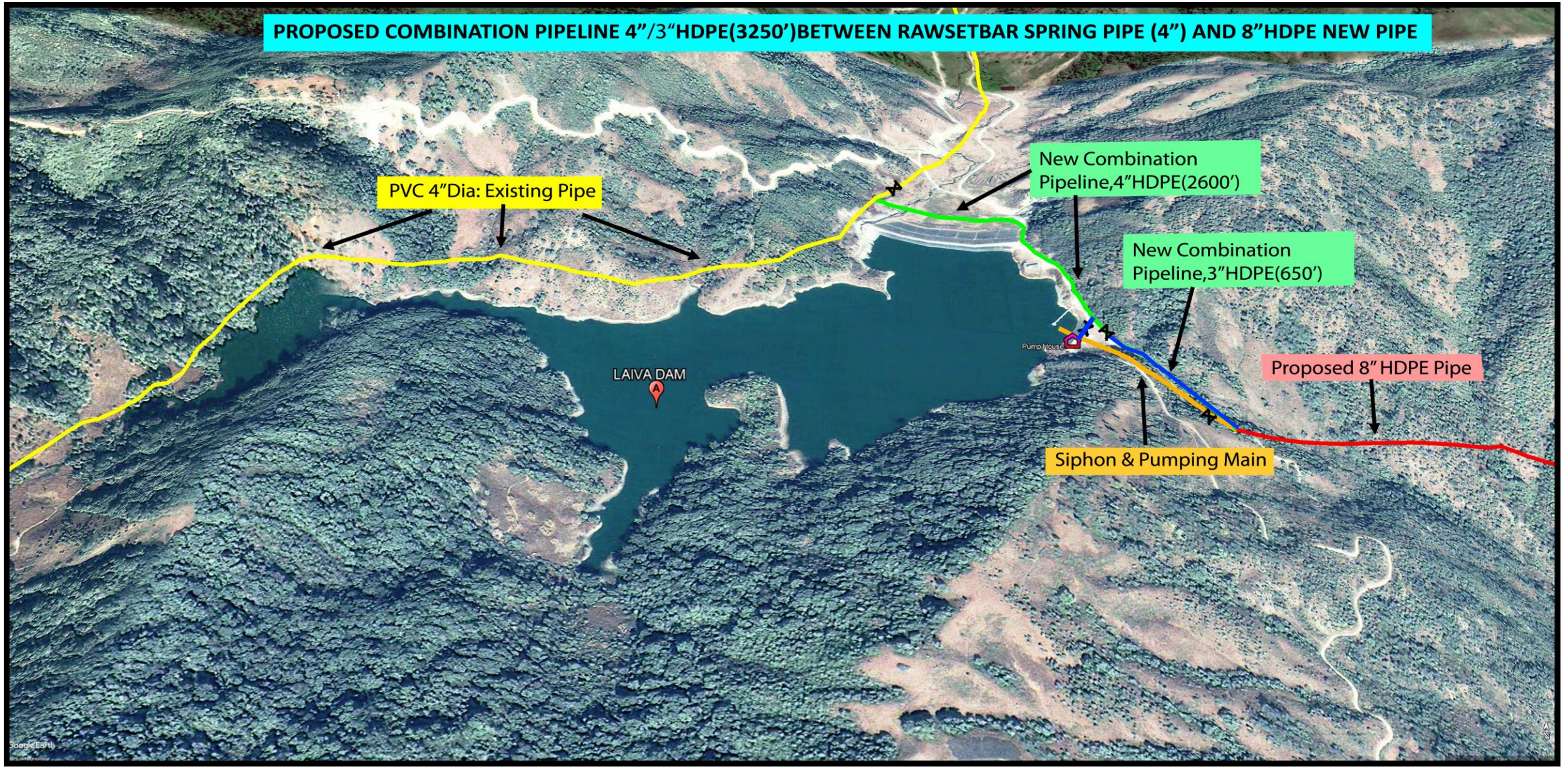
4. Arial view of transmission main pipeline and ground tanks location of Falam



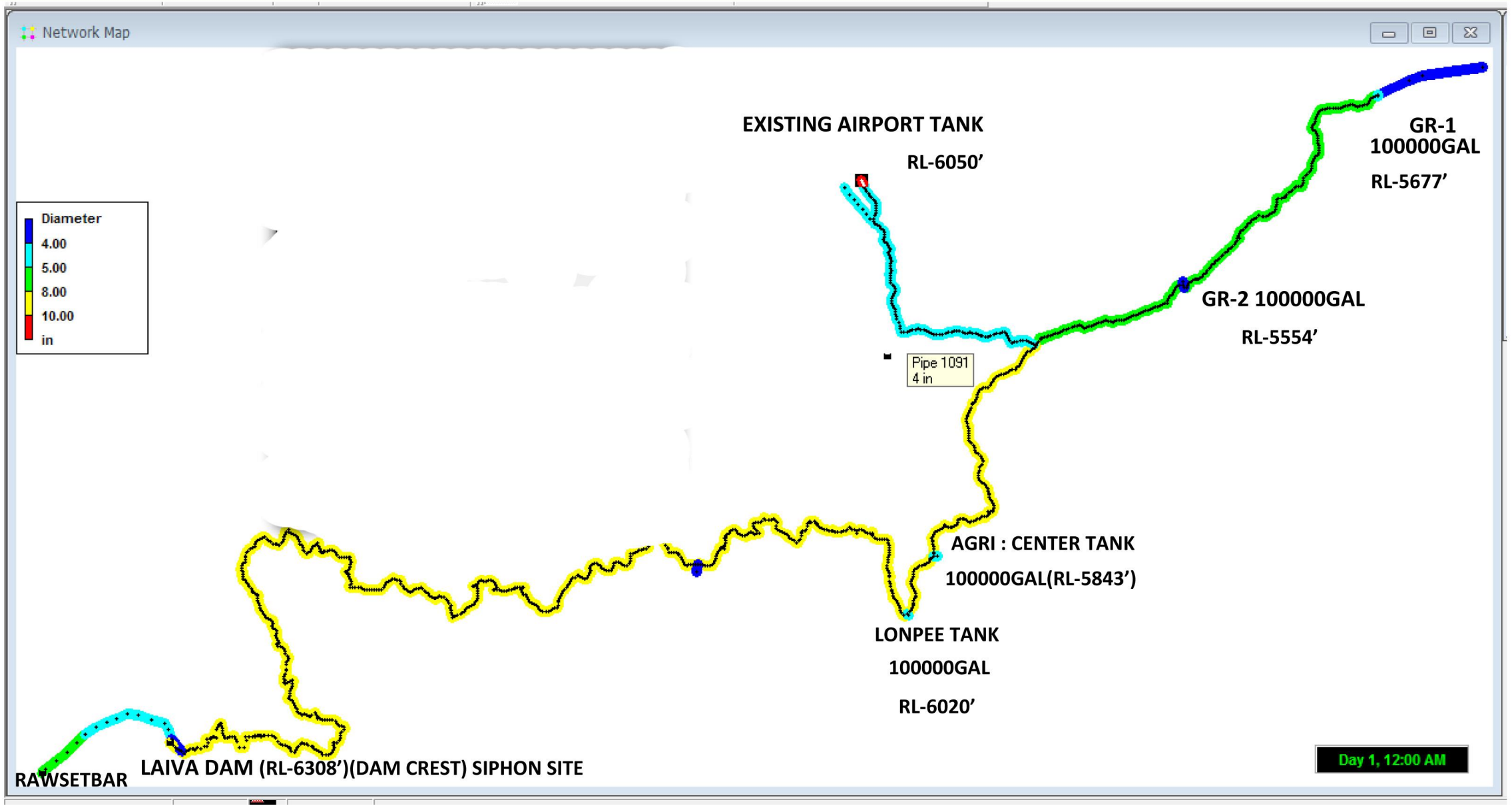
4. Arial view of transmission main pipeline and ground tanks location of Falam



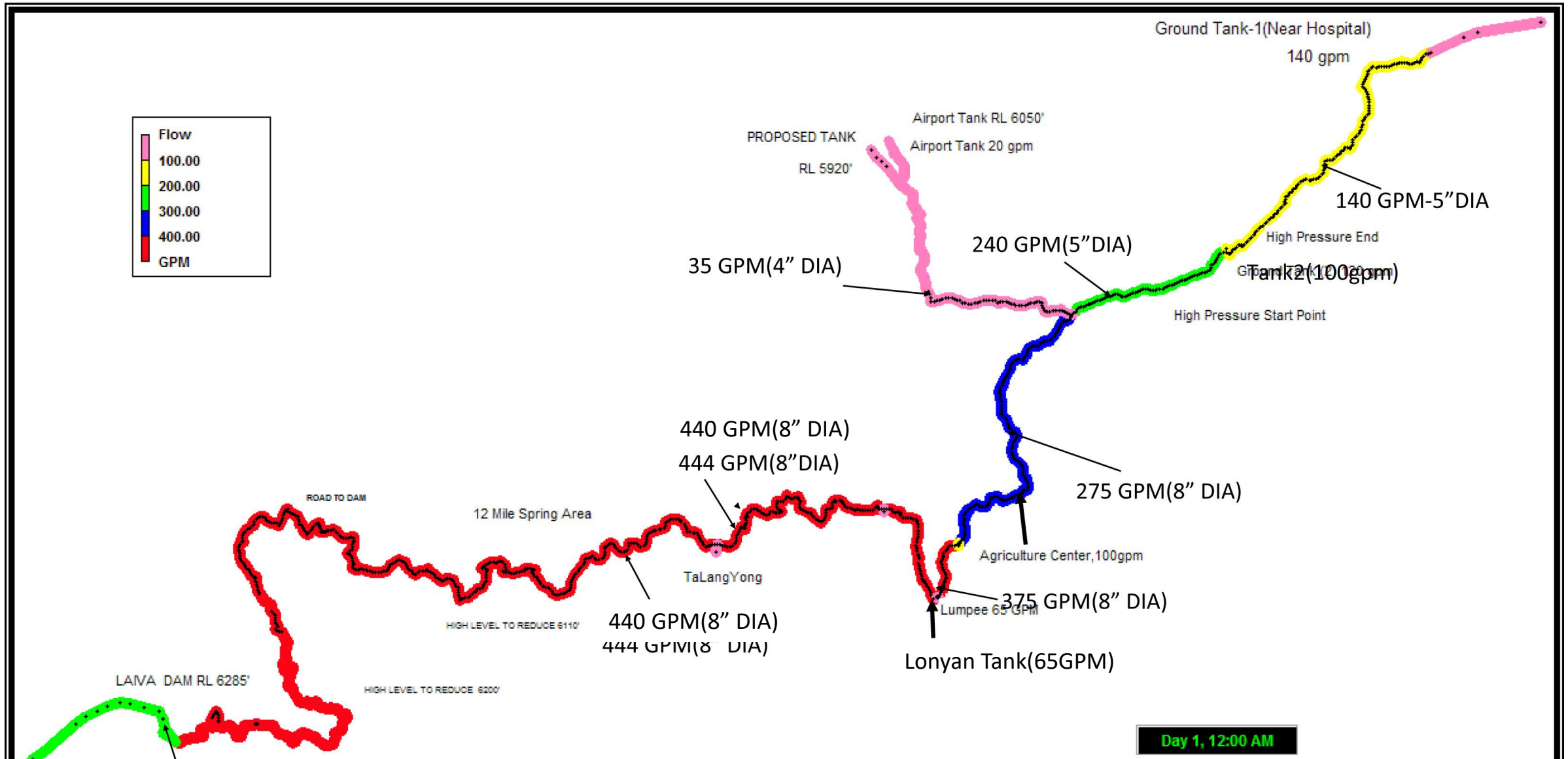
4. Arial View Of Laiva Dam



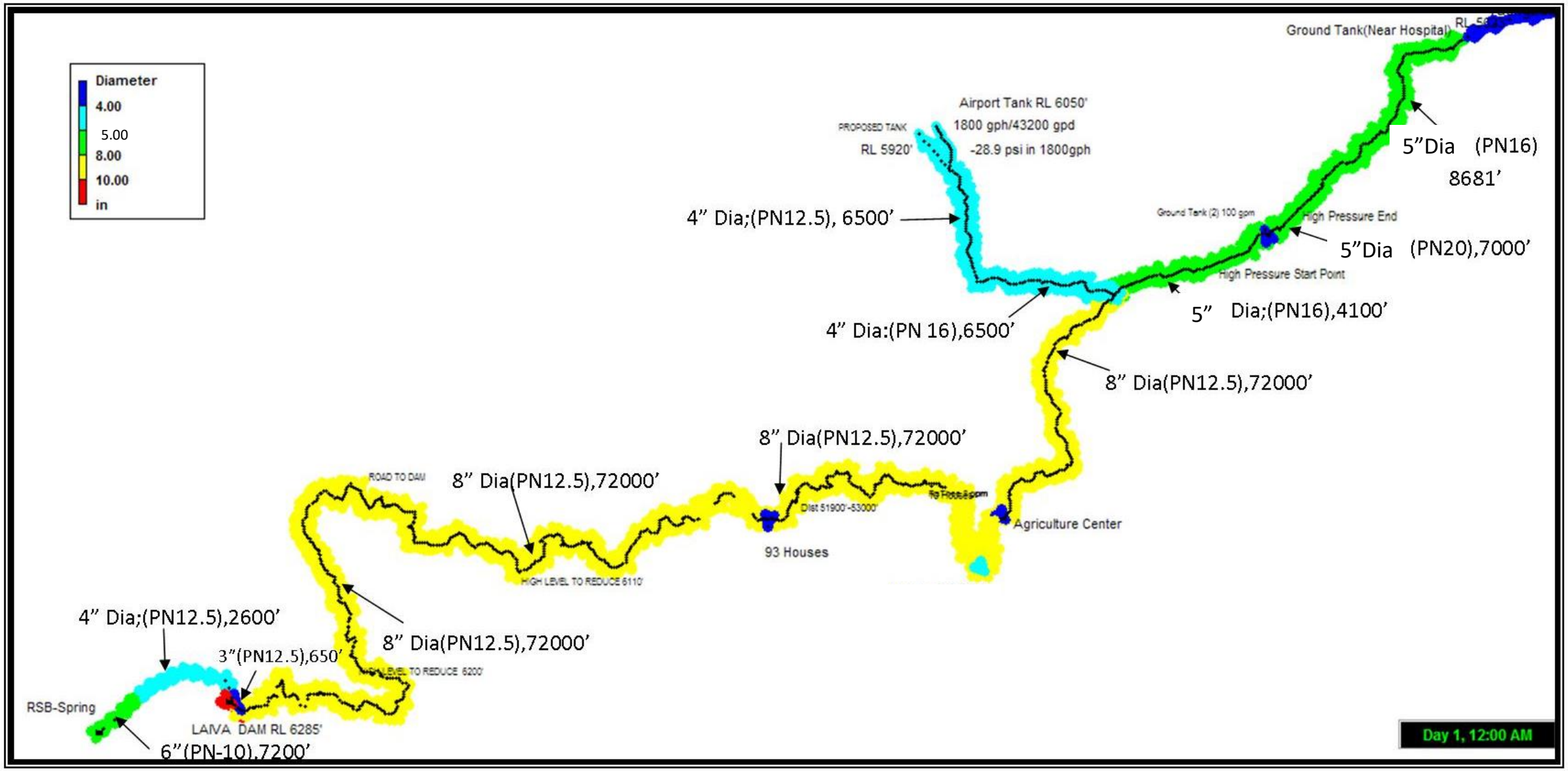
TANKS LOCATION MAP OF FALAM WATER SUPPLY PROJECT



SCHEMATIC DIAGRAM FOR TRANSMISSION MAIN PIPE OF FALAM TOWN WATER SUPPLY PROJECT



PROPOSED PIPE DIAMETER MAP



4. Real Time Kinematic and Total Station Setting

4. Real Time Kinematic Measuring

4. Ground Control Point Setting and RTK Measuring

4. Ground Control Point Setting and RTK Measuring

4. Real Time Kinematic Measuring

4. Station Ground Control Point Setting

4. Pontoon, Centrifugal Pump and 8” Transmission Main

4. No Intake structure for Town Water Supply System in Laiva Dam

- Liva Dam was built to produce hydroelectricity, and no additional intake structure was built for the city's water supply system
- So we have made some negotiation with Authority from Irrigation department to construct additional intake structure, but didn’t get permission due to technical issue

4. Pontoon and Siphon Intake Construction Work

4. Siphon Intake Structure Construction Work

4. Dual HDPE Transmission Main Pipeline Construction Work

4. Four Collection Tanks Construction Work

4. Four Collection Tanks Construction Work

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4. Four Collection Tanks Construction Work

4. What Kind of Challenges Have We Faced

- The project consists of a 19-mile long transmission main pipeline, and the pipeline includes many areas with elevation differences ranging from 250’ to 900’
- Most of the pipeline's area is densely forested hills and mountains
- There are 5 collection tanks which have different locations and level.
- High level difference between collection tanks, user points
- No intake structure in the dam for town water supply system. The first project of Siphon System
- Poor Weather
- Poor logistic
- Land slide
- Blood-sucker
- Labor Shortage

5. Lesson Learnt(a)

- There are different safety factor depends on Pipe Brands, Policy of Pipe Manufacturer, and Policy of Government. More safety factor will create more cost. So we need to approach holistic view
- Almost all city water supply systems are facing losses in Myanmar
- Should be autonomous(Responsibility and accountability)
- Available land (WTP, GT, ET, TW)
- Tank structure
- Life cycle cost(Planning + Design + Execution + OM + Replacement or upgrade or disposal cost)
  - Pressure class and price of pipe network (include tertiary)
  - Type of motor pump and control system
  - Chemical cost + energy cost + Labor charges +overhead
- Drone survey for water resource , quality monitoring & pipeline route

5min

5. Lesson Learnt(b)

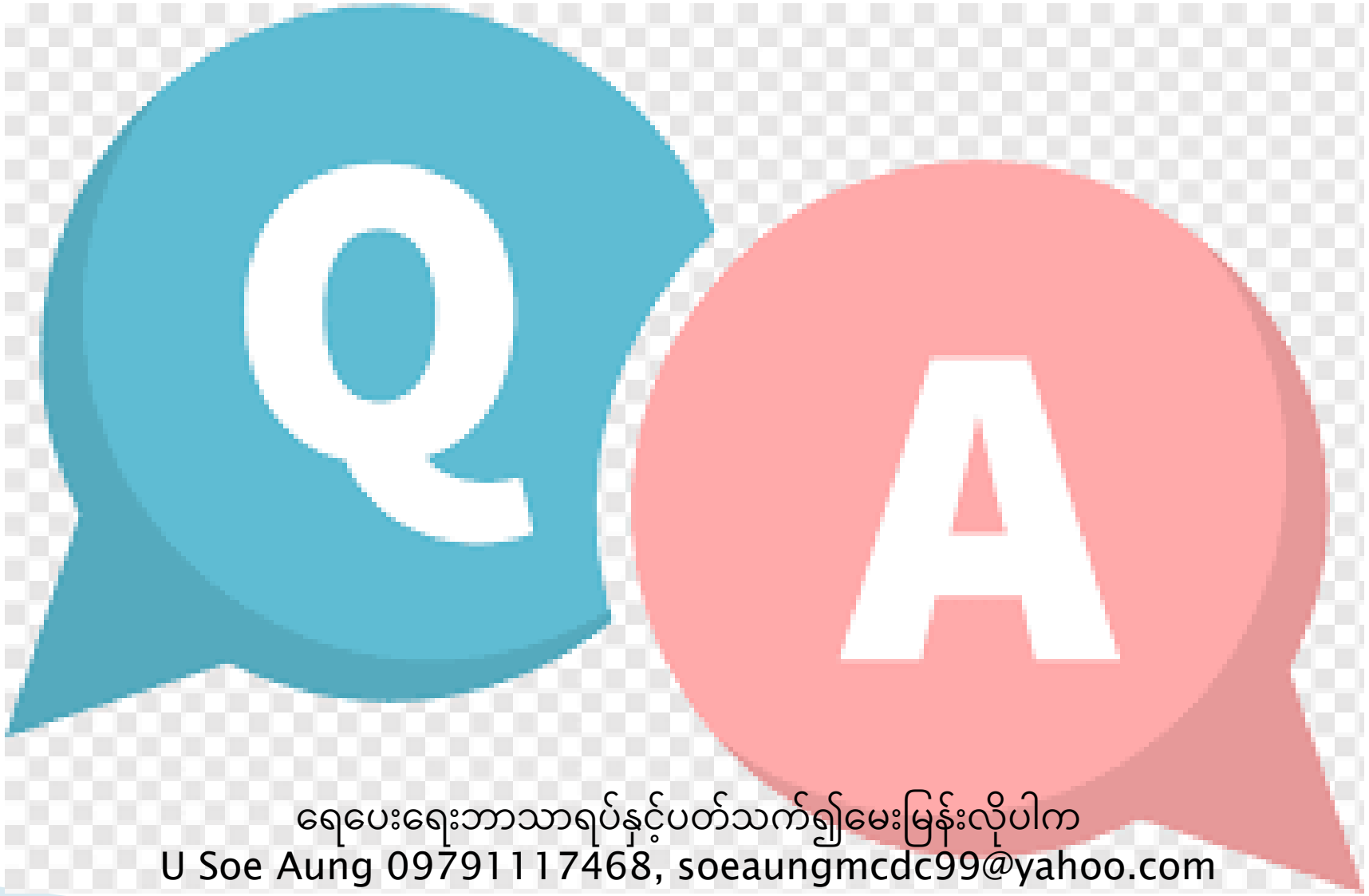
- Capacity building and training program
- Track record
- Cold weather and butt fusion Joint of HDPE
- Back filling of Pipeline and doing compaction work(dewatering, compactor, hilly region, budget)
- Notice post erection work for every 100’ of pipeline
- Conflict among Road, Drain, Cable and Water Pipeline
- Foreign materials to get into the pipes due to children’s playing while stacked in the work site and laid out to connect the pipe
- Electricity cost
- Metering System
- IWA water balance

5min

5. Conclusion(Today's World)

- Globalization
- Under the word "globalization", because the world is a village, countries are already houses in the village
- Technology is changing over time and it is not easy to catch up with our time and money
- But, let each of us work hard until we die with unceasing perseverance

1 min



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Thanks For Your Time