POTENTIAL BENEFIT OF A HYDROPOWER UNIT AT THE MPOFANA OUTFALL

PRESENTATION AT THE CESA BREAKFAST SESSION

17 JULY 2024

POINTS OF DISCUSSION

- OVERVIEW OF UUW NETWORK AS ORIENTATION
- BACKGROUND
- DISCUSSION
- FINANCIAL BENEFIT
- PROGRESS TO DATE

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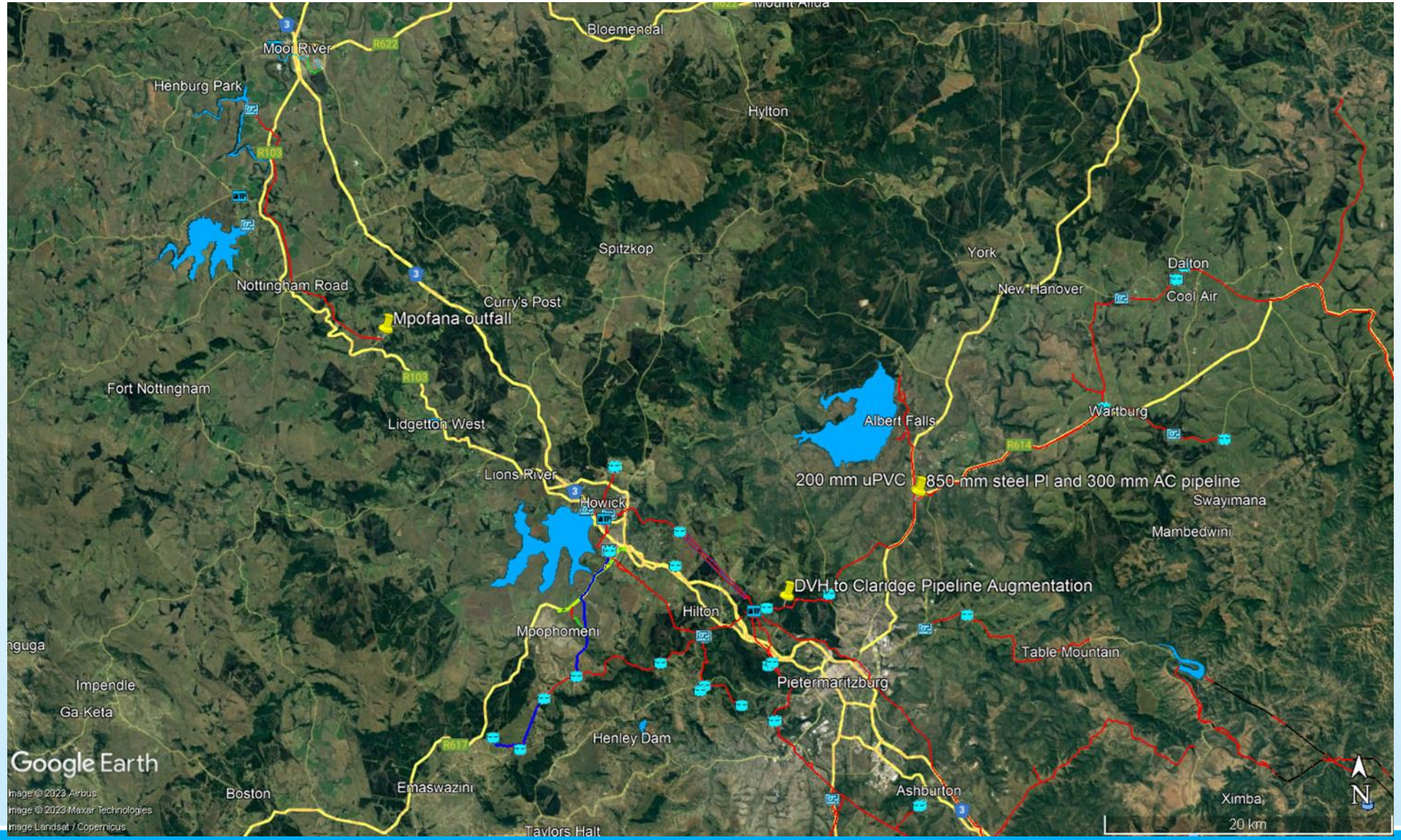
OVERVIEW OF UUW NETWORK



BACKGROUND

- In August 2009, uMngeni-uThukela (UUW) Water's Infrastructure Development Division (previous Engineering and Scientific Services – E&SS) initiated a reconnaissance study to determine the potential of hydropower schemes on uMngeni-uThukela Water's network
- Various sites for potential hydropower generation were identified and also the potential of alternative energy sources as a comparison to hydropower units.
- The table below shows the potential sites for hydropower generation and the expected theoretical power that can be produced at each site. This is based on the formula as noted below:

$P_{th} = \rho\ q\ g\ h$ (1)

where

P_{th} = *power theoretically available (W)*

ρ = *density (kg/m^3) (~ 1000 kg/m^3 for water)*

q = *water flow (m^3/s)*

g = *acceleration of gravity (9.81 m/s^2)*

h = *falling height, head (m)*

BACKGROUND

No.	Site	Static Head (m)	Flow (cumecs)	Potential power (kw)
1	Midmar dam to before the tunnels	22	3.8	700
2	Inlet to DV Harris	40	1.2	400
3	53 Pipeline	125	0.4	350
4	Sweetwaters to Blackridge	40	0.35	120
5	Worlds view to Umlaas Road	30	0.85	220
6	Mpofana outfall of the MMTS 2 Scheme	221	3.5/4.5	5100

- As uMngeni-uThukela Water is a Water Services Provider (WSP), its primary purpose is to produce potable water and is not allowed to sell or generate electricity unless it is for own use.

  Section 7 of the current Draft Sustainable Hydropower Generation Policy (July 2016) stipulates the types of approved utilisation on DWS water resources and owned infrastructure. This project will adhere to Section 7 (a) which reads:

  > a) Demand Management/Energy efficiency/Own use -
  >
  > Where the utilisation will result in the energy generated to be used in own operations e.g. DWS contract IPP to generate electricity to use in their operations.
  >
  > This type of own-use generation is generally considered as a load reduction intervention, in contrast to contributing to the electricity generation function.

- It was thus prudent to rather focus on the Mpofana Hydropwer unit as it yielded the greatest potential for power generation. Furthermore, the potential power is the exact need of the Power requirements of the Spring Grove High Lift Pumps. This confirmed the need for the Detailed Feasibility Study undertaken in 2012.

BACKGROUND

Alternative renewable energy sources were assessed as a comparison to the potential Mpofana Hydropower unit, namely, Wind and Solar Energy:

- Wind Energy proved not a viable option as the region does not get much wind.
- The current cost for a 3 MW solar unit, as a direct comparison to the 5.1 MW Hydropower potential at the Mpofana outfall, is R105 million (R130 million for the hydropower unit). However, the batteries can only run for 10 hours, which means that UUW will have to switch to grid power during peak times.
- Furthermore, the Solar Plant would require a large land area. Current estimate is 4 acres for a 1 MW plant, thus a 5 MW solar plant would require a land area of 20 acres (81 000 sq meters)
- The Mofana Hydropower thus proved to be the preferred option as the basic infrastructure is in place and will have minimal environmental impact.
- A Detailed Feasibility was conducted in 2012 to determine the viability of implementing a hydropower unit at the Mpofana outfall of the MMTS 2 System.

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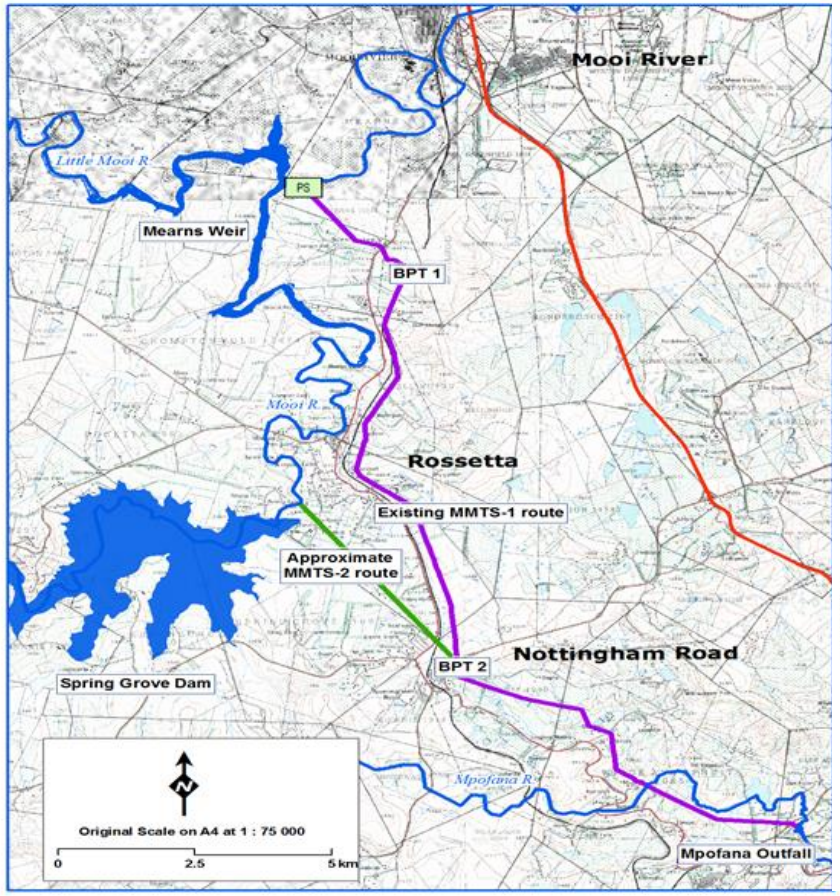
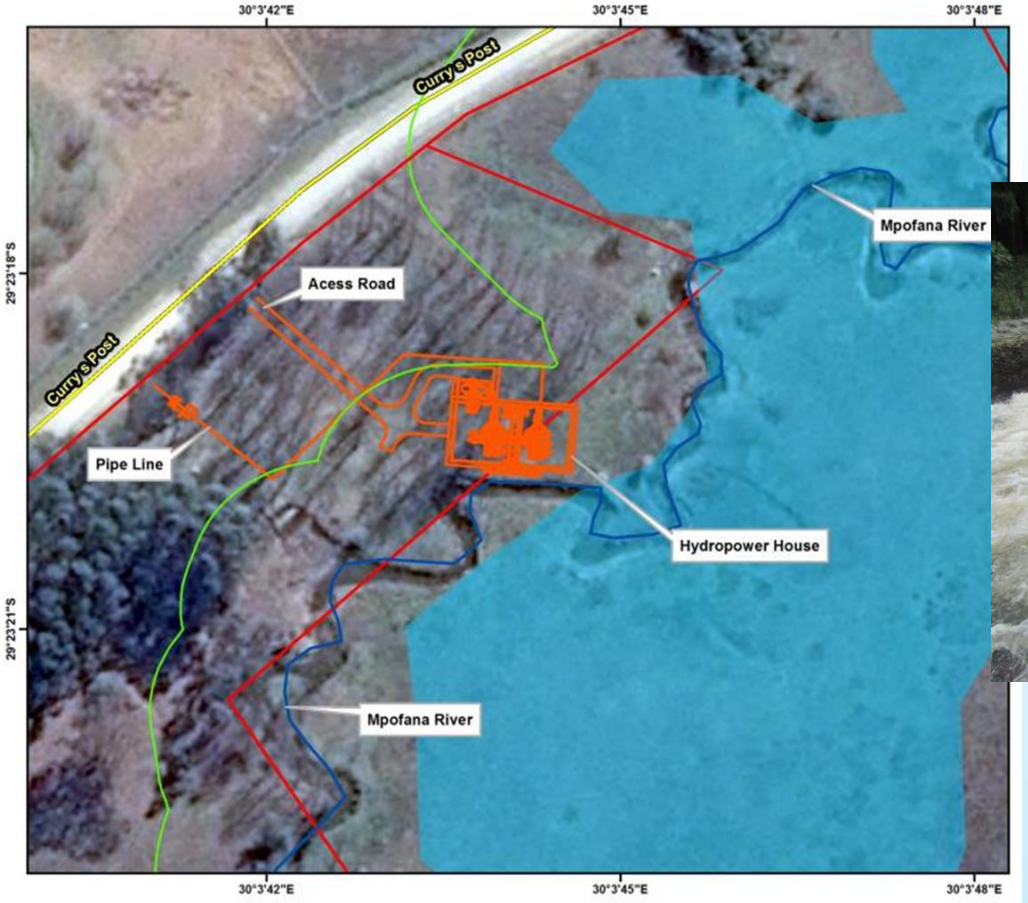
BACKGROUND





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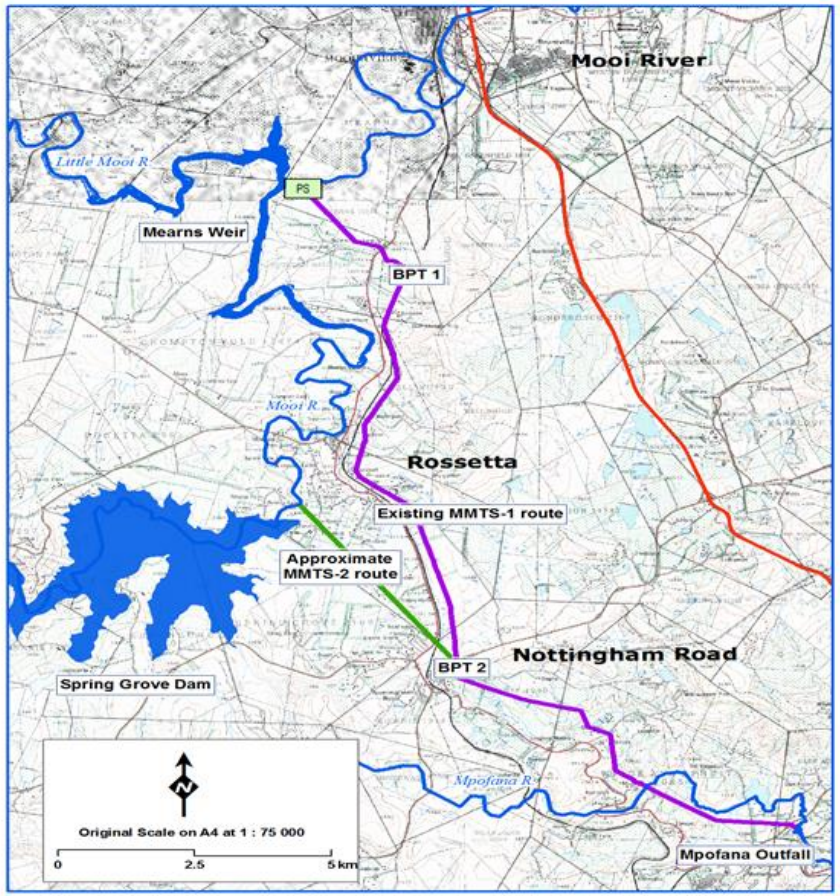
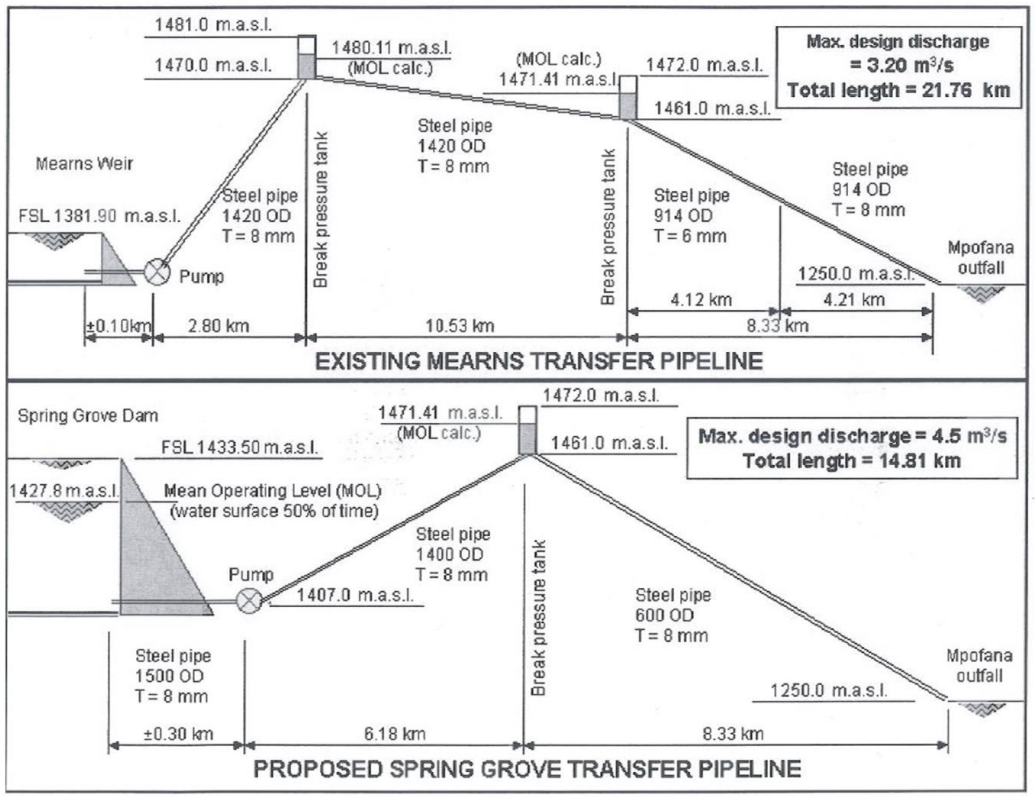
BACKGROUND



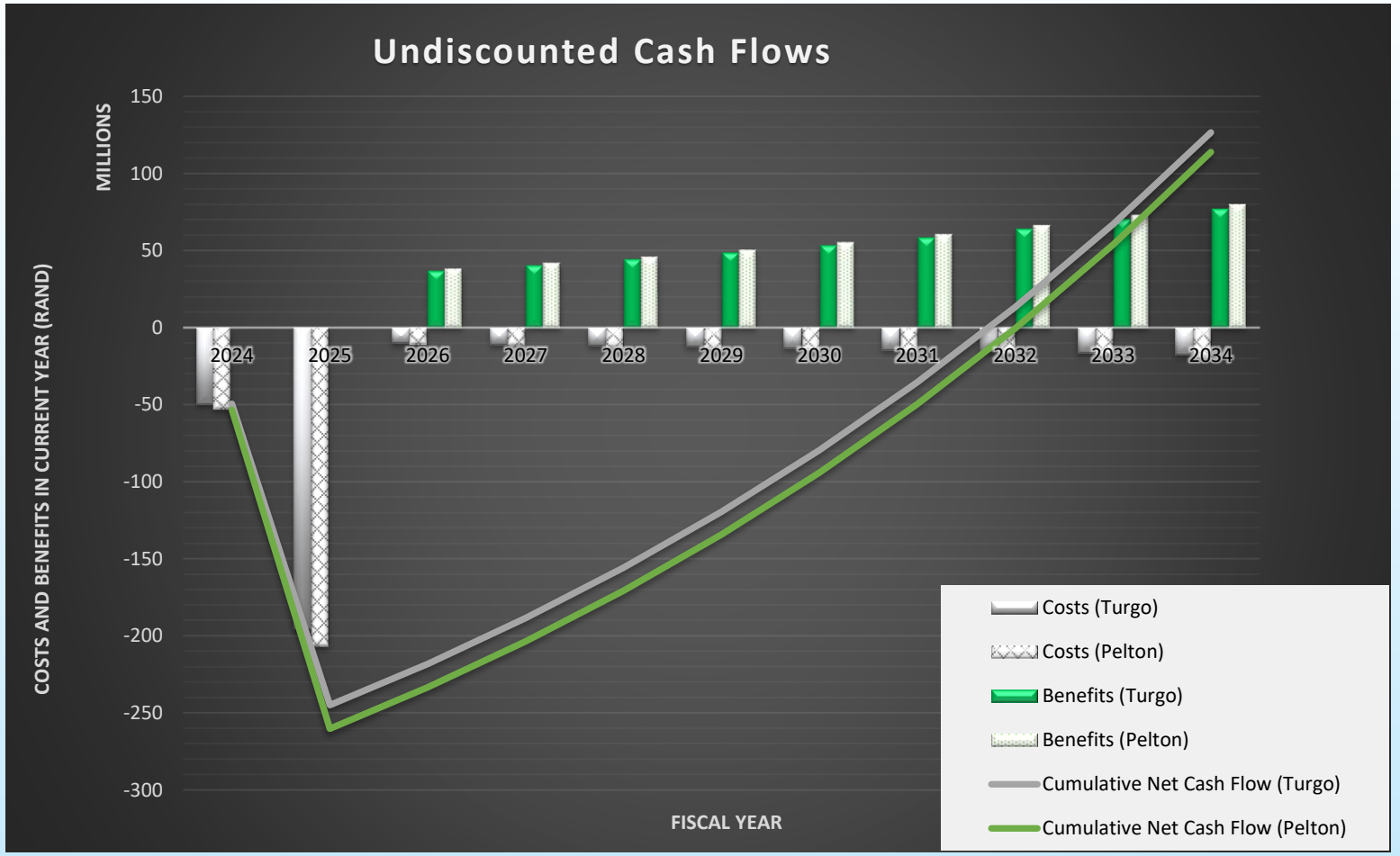


DISCUSSION

- As noted, the Hydropower unit at the Mpofana Outfall, proved to be the most viable option to consider.
- The cost-benefit analysis based on 2023/2024 prices noted that the key advantage relates to the offset of the energy cost of the Spring Grove Pump Station by means of the hydropower unit with a discounted payback as shown below.
- The financial viability was undertaken including both capital and operational costs. The analysis was undertaken with the assumption that the MMTS-2 would only be operating for six months of the year and it is clear from the first figure that even under this scenario the project is financially feasible.
- At present the MMTS-2 operates for more than 95% of the year and it is likely that this will continue for at least the next ten years. If this were the case then the scheme would be paid off in an even faster time period as shown in the sensitivity analysis.

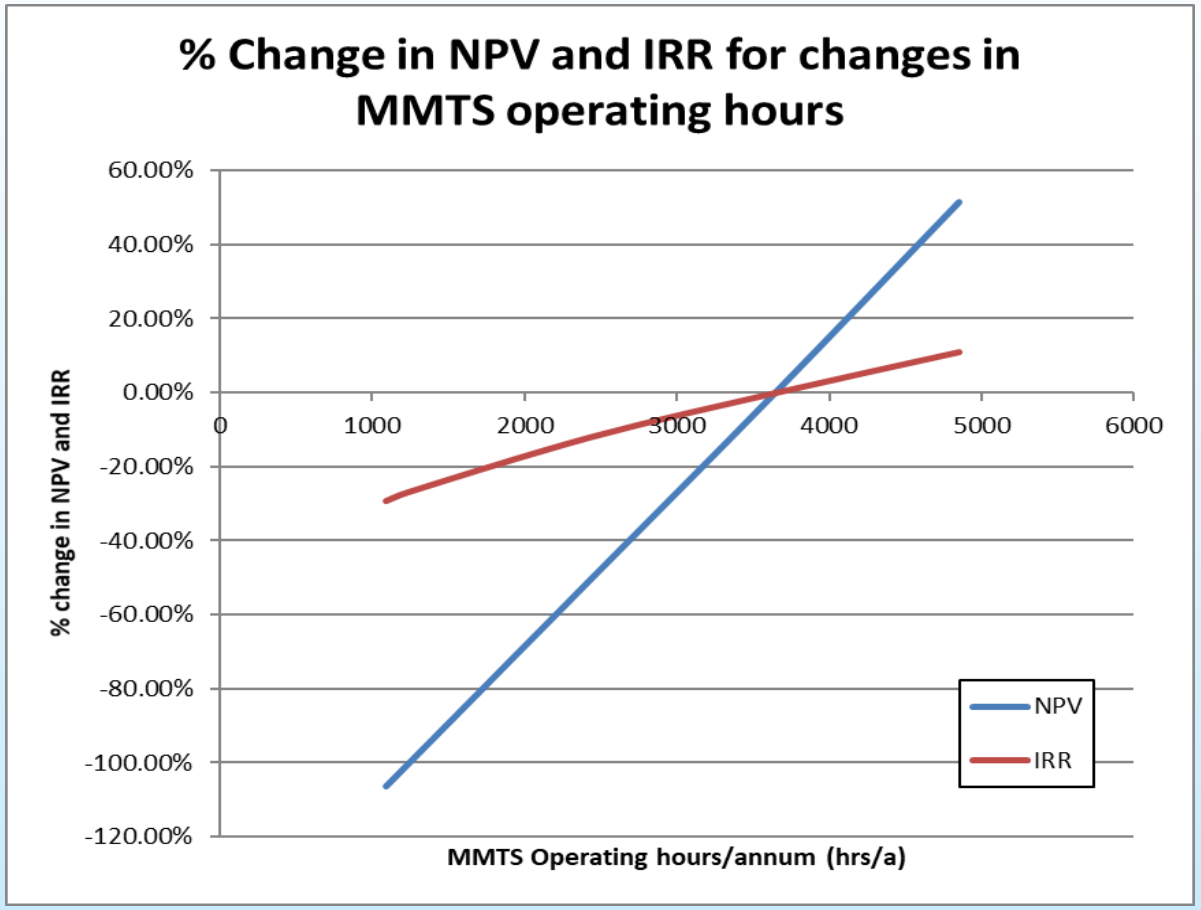
DISCUSSION

- COSTS AND BENEFITS IN CURRENT YEAR 2024



DISCUSSION

- SENSITIVITY ANALYSIS BASED ON OPERATING HOURS OF MMTS-2



DISCUSSION

- Electricity tariff varies between R1.61 to R3.40 per kWh
- On average, one can assume a tariff of R1.83 per kWh for businesses.
- uMngeni-uThukela Water's power usage for the Mearns and Spring Grove pumps for the period 2020 to 2021* is:
  - Mearns – 19 860 160 kWh per annum (operating 5 months)
  - Spring Grove – 15 203 314 kWh per annum (operating 5 months)
- This amounts to a total annual energy cost of
  - Mearns – R 36 344 092.00
  - Spring Grove – R 27 822 064.00

- The potential of implementing the Mpofana Hydropower unit will thus save uMngeni-uThukela Water approx. R 36m per annum after the break-even period. This does not include tariff increases.
- This, in turn, will have an positive impact on the annual tariff setting for potable water.
- Other studies currently underway:
  - In-pipe hydropower units
  - Power generation using methane gas from Waste Water Works

* Due to heavy rainfall over the 2021/2022 period, the receiving streams and rivers were in flood and the transfer scheme was not operational.

PROGRESS TO DATE

- In August 2023, UUW appointed Gibb (Pty) Ltd as the PSP for the Detailed Architectural, Mechanical, Civil and Electrical Design of the Hydropower Unit.
- Gibb appointed Zinnzame as the CPG partner responsible for the civil design and MBB for the mechanical design.
- A preliminary design was completed by end of June 2024 with consensus reached on the type of turbines and the layout of the powerhouse with the visitor's center.
- The final design will be submitted by the end of October 2024.

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PROGRESS TO DATE

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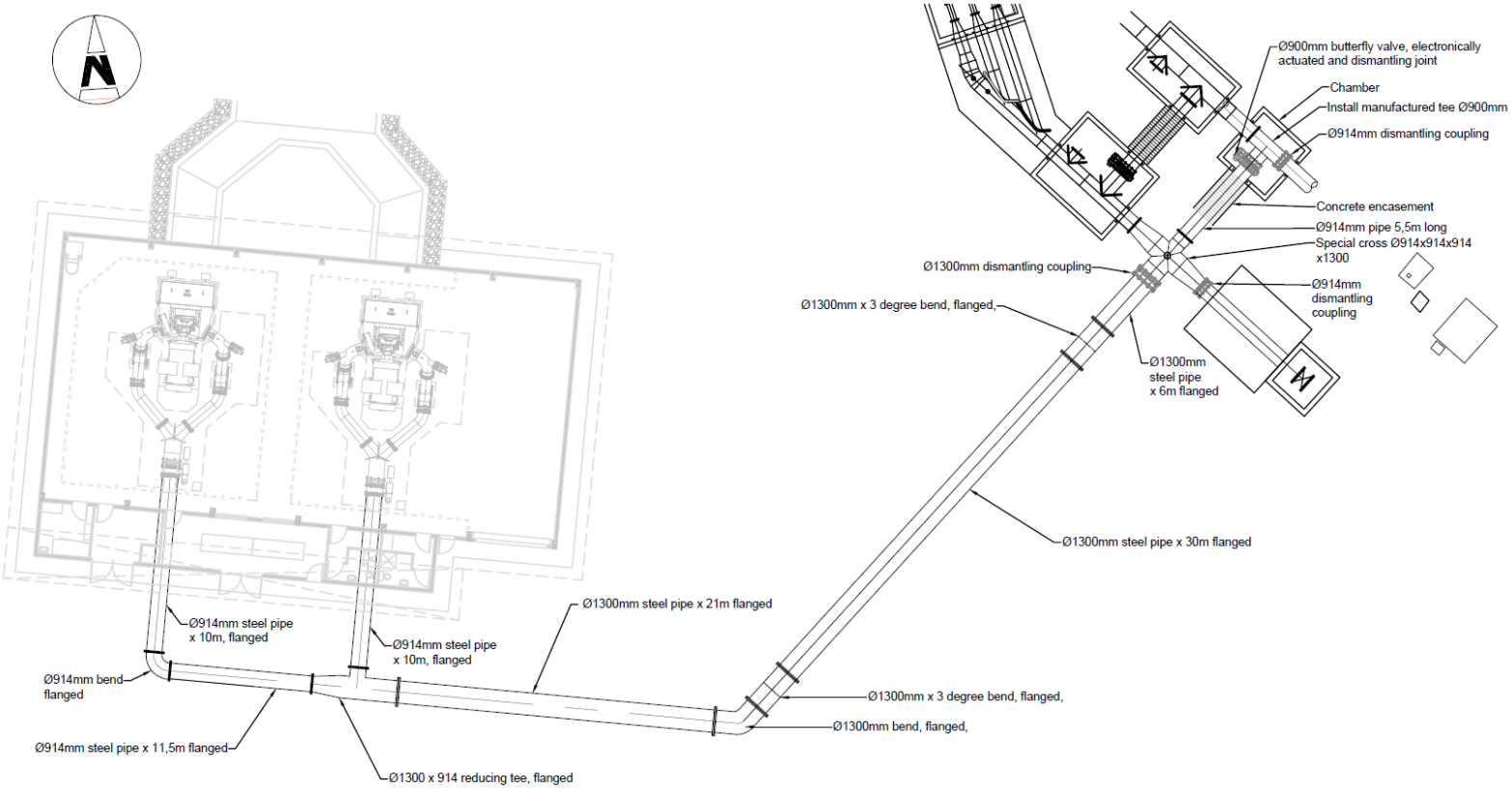

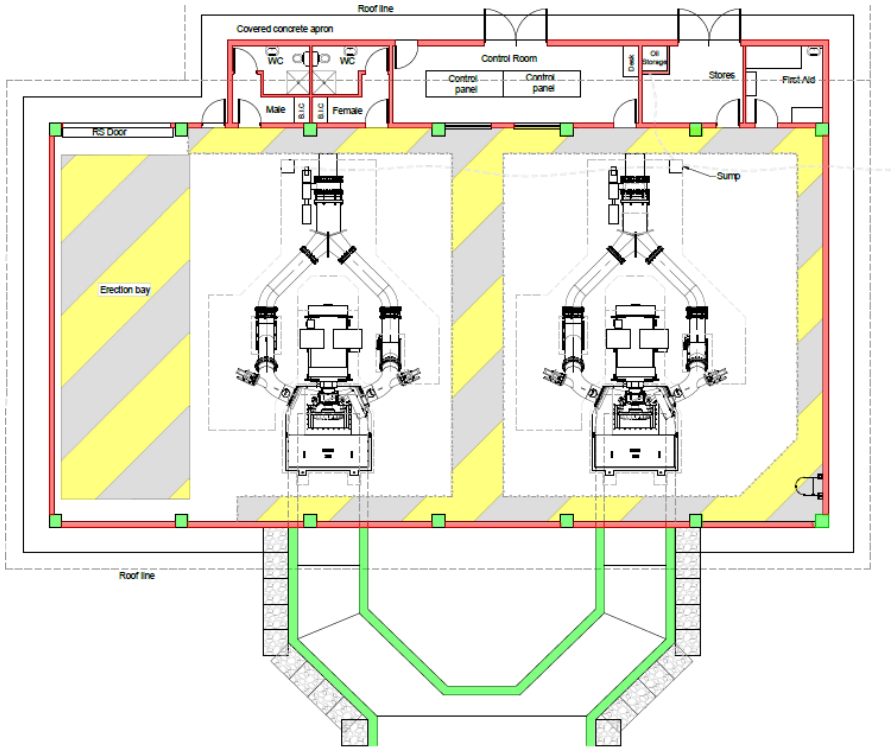

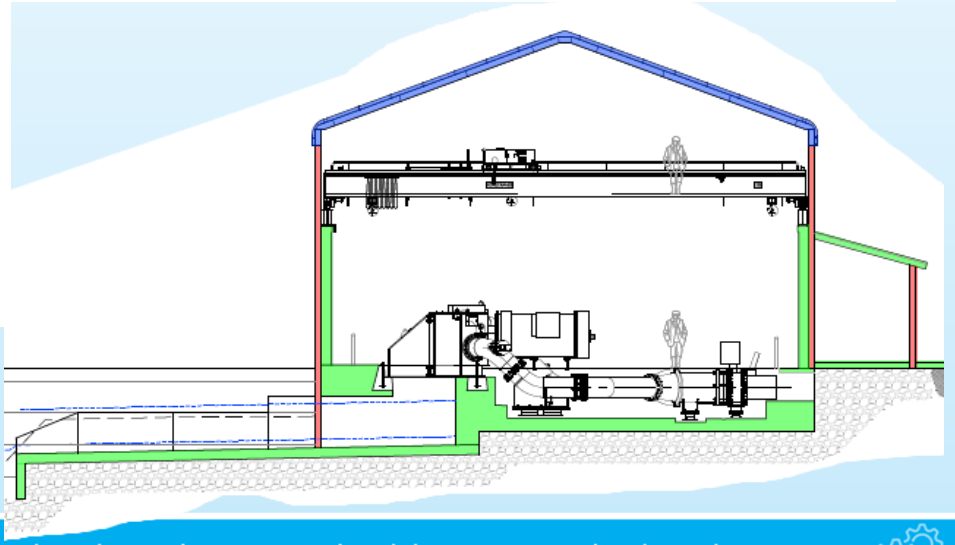

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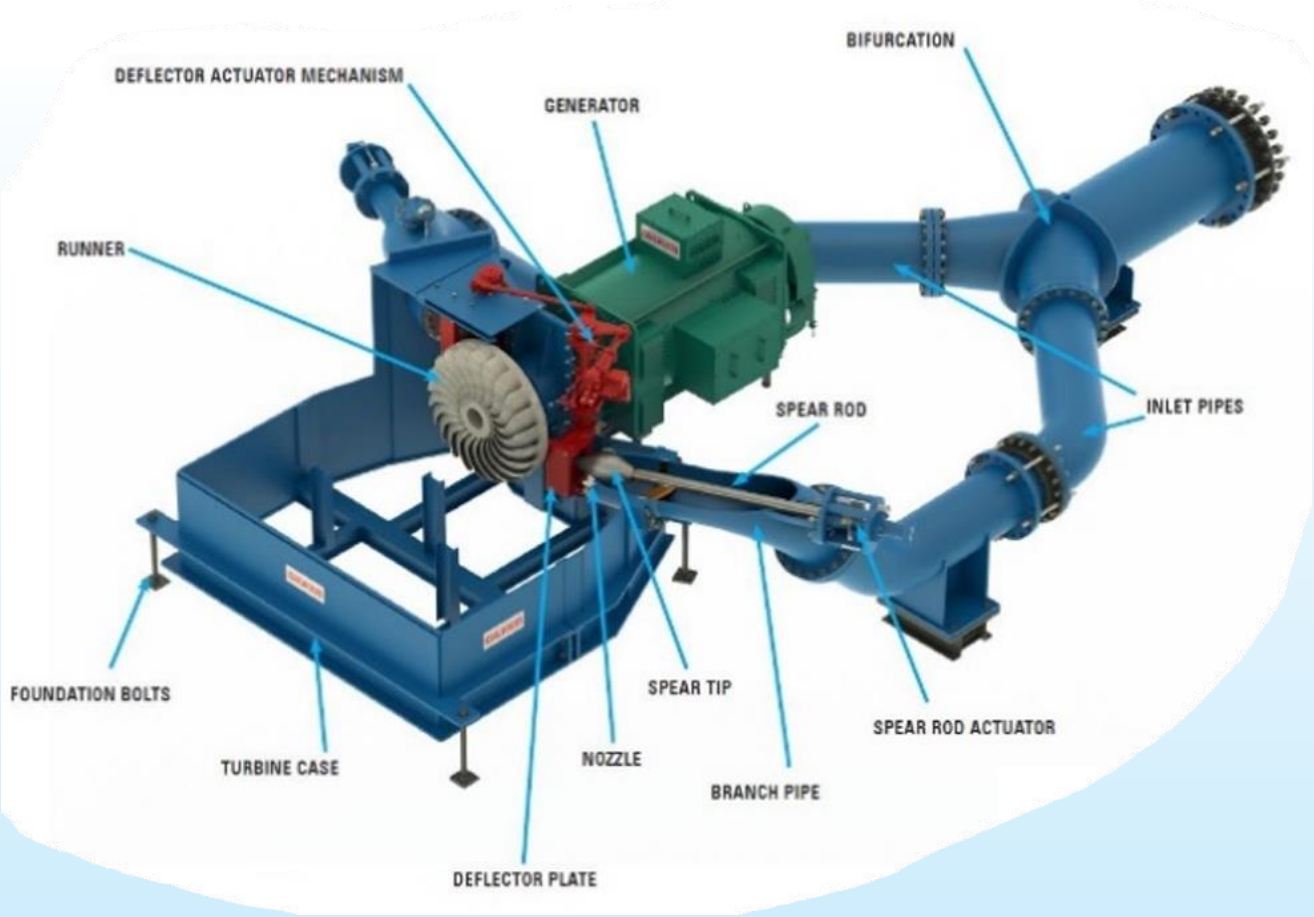
PROGRESS TO DATE



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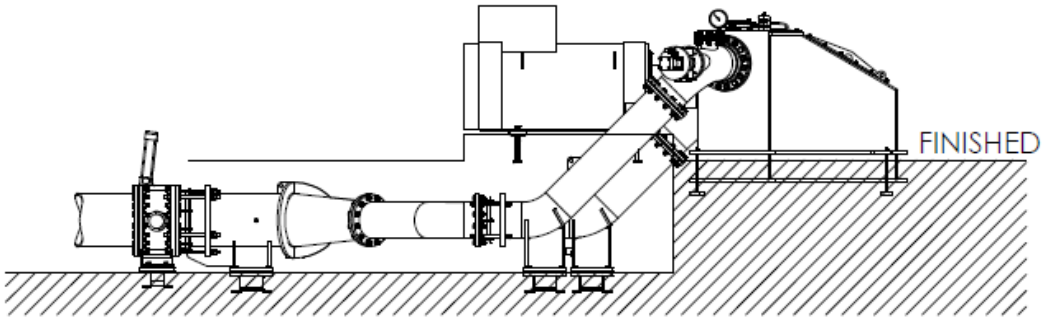

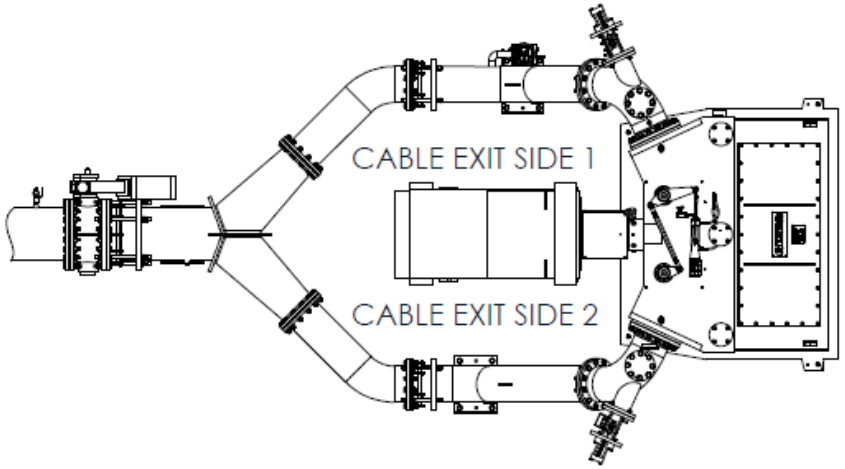

BELOW GROUND PIPEWORK

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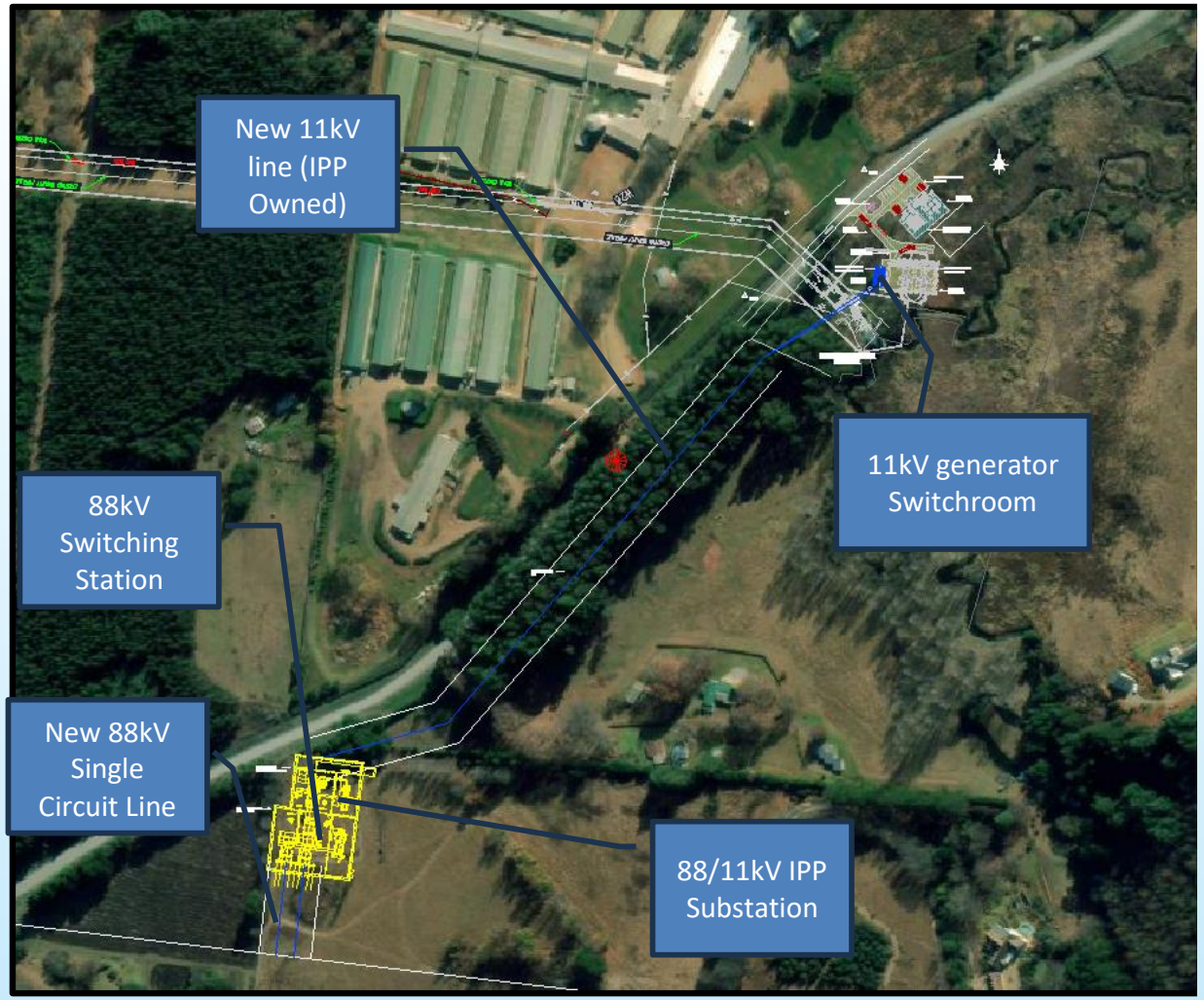
PROGRESS TO DATE



Thank you