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AUGMENTING CAPE TOWN'S WATER SUPPLY

An Alternative Solution

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Introduction

Decreasing water availability due to climate change and increasing population resulted in an **urgent need for augmenting Cape Town's water supply**

All possible alternatives/proposed solutions need to be considered in terms of **benefits and risks:**

- Environmental
- Financial
- Social (including legal and political)
- Practical

These factors ultimately influence the **feasibility and sustainability** of the chosen solution(s)

An Alternative Solution

Cape Town = Winter Rainfall Area

A better solution than trying to source water
from within the region could be to source
from another climatic region

(summer rainfall area)

Given its size and current use, as well as potential positive impact on the
water security of a much larger area, the **Vanderkloof Dam**
seems to be the best option

Are there more alternatives ?

The seven largest dams in South Africa

Dam	Completed	River	Capacity (mil. m ³)
Gariep	1971	Orange	5,343
Vanderkloof	1977	Orange	3,188
Sterkfontein	1980	Nuwejaarspruit	2,616
Vaal	1938	Vaal	2,536
Pongolapoort	1973	Pongola	2,446
Bloemhof	1970	Vaal	1,269
Theewaterskloof	1980	Riviersonderend	480

Vanderkloof Dam Specifications

The Vanderkloof Dam (Orange River) is the **second largest dam in South Africa**. Capacity: 3187.5 million m³.

50% of capacity can supply **29 million people for one year** at a consumption of 150 liter/person/day

The Vanderkloof Dam is augmented by the Gariep Dam, 50 km upstream, the **largest dam in South Africa**. Capacity: 5343 million m³.

These dams are **in the summer rainfall area**. During winter (low rainfall) the effect of additional abstraction will be limited.

Vanderkloof Dam Specifications

Capacity of Vanderkloof compared to:

- Theewaterskloof Dam: **6.6 x larger**
- Voëlvlei Dam: **19 x larger**
- Bergrivier Dam: **25 x larger**
- Wemmershoek Dam: **55 x larger**

Vanderkloof Dam Specifications

Difference in elevation between Theewaterskloof Dam:

> 1000 m

Distance between Voelvlei Dam and Vanderkloof as the crow flies:

700 km

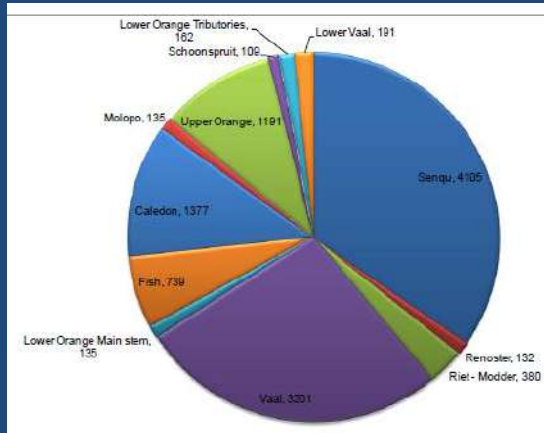
Vanderkloof Dam Specifications

Compare the Orange River catchment to the Berg River catchment.

Of the 6 main metropolitan areas in South Africa only 2 are supplied by a portion of the Orange River Basin.



Vanderkloof Dam Specifications



The annual runoff from the catchment feeding the Vanderkloof Dam (Senque, Caledon, Upper Orange) is 6,673 million m³. If 400 000 m³ per day is transferred for 3 months (summer), it amounts to 0.5% of the annual runoff.



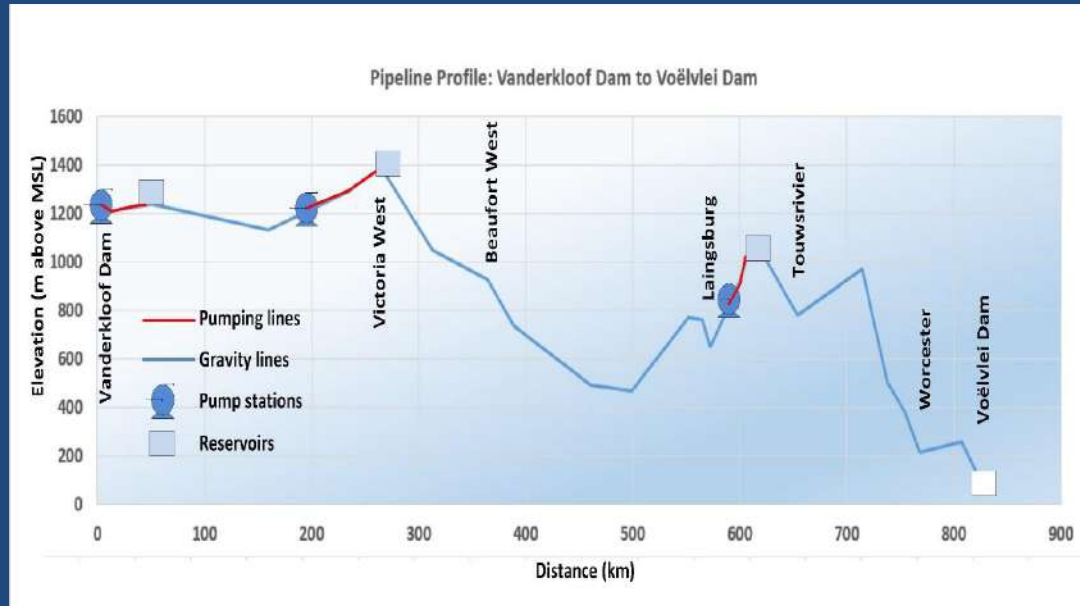
Department of Water Affairs, South Africa, 2012. *DEVELOPMENT OF RECONCILIATION STRATEGIES FOR LARGE BULK WATER SUPPLY SYSTEMS ORANGE RIVER: SURFACE WATER HYDROLOGY AND SYSTEM ANALYSIS REPORT: Report No. P RSA D000/00/18312/7*

Pipeline(s) to the Western Cape



Preliminary optimized route between Vanderkloof and Voëlvlei is **824 km**

Vanderkloof Dam – Voëlvlei Dam Pipeline



Length of pumping lines: **120 km**. This is a conservative estimate as detailed surveys will result in a more optimized route.

Length of gravity lines: **704 km**

Three pump stations

Headloss due to friction: **412 m** (> 1000 m available)

Pipeline(s) to the Western Cape: Some technical aspects

Requirements to convey 400 million liters of water (1/2 the daily consumption of Cape Town and adjacent towns in the Cape Winelands and Berg River municipalities):

- Flow of 2.1 m³/s in 2 x 1.7 m diameter pipelines.
- Flow of 1.5 m³/s in 3 x 1.4 m diameter pipelines.

Why 2 or 3 pipelines ?

- More sustainable option with regard to maintenance and shut downs.
- More pump alternatives (smaller pumps)
- Route preparation the same.
- Project can be phased over time as the demand increase.

Pipeline(s) to the Western Cape: Some technical aspects

Abstraction of 400 000 m³/day for one month is **< 0.4%** of the total capacity of the Vanderkloof Dam.

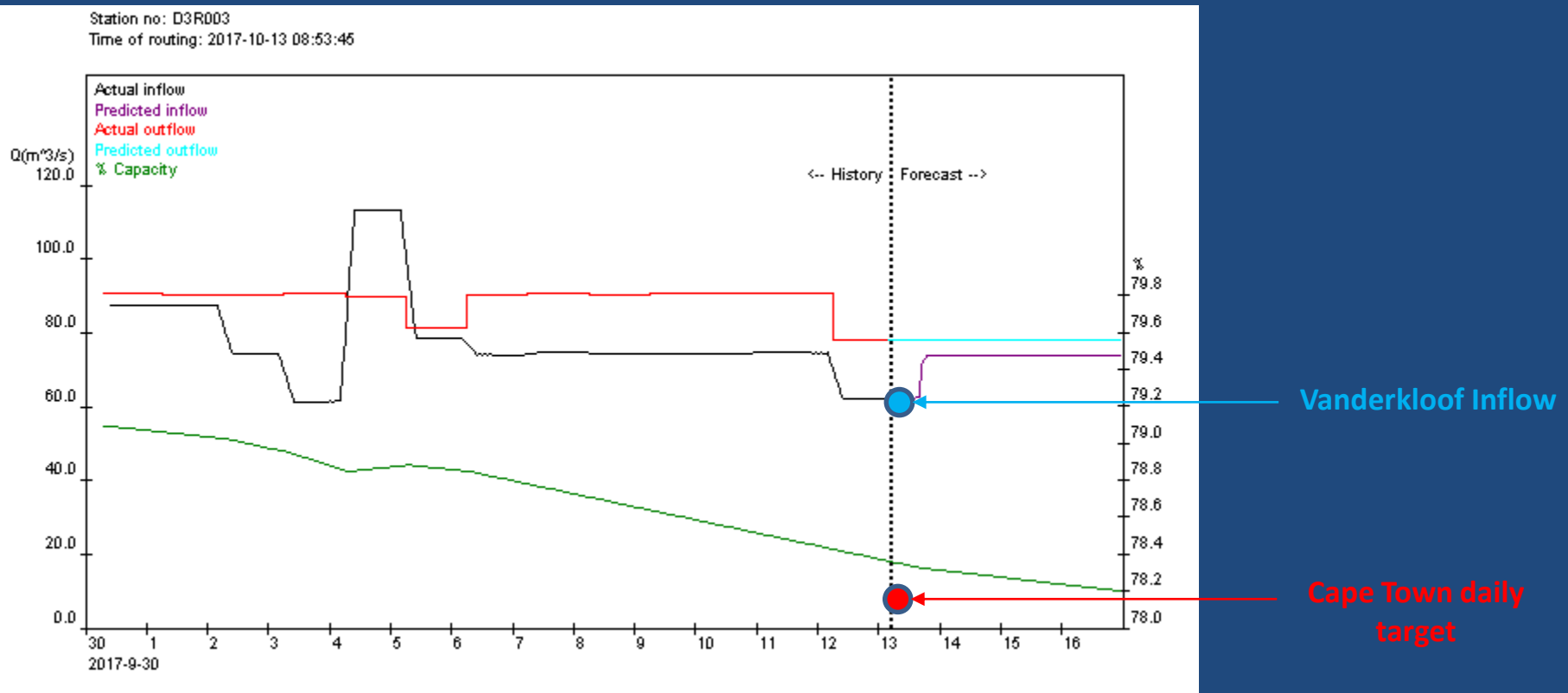
Environmental impact: Limited to construction (temporary) as for most of the line **existing servitudes for roads, rails or power lines** can be followed. Insignificant when compared to alternative new resources (**groundwater extraction, new dams or brine discharges to the surf zone**).

No new treatment plants (or additional process plant) are required.

Immediate and long term solutions to **frequently drought stricken Karoo towns** (e.g. Victoria West, Beaufort West, Laingsburg, etc.) saving millions of Rands.

Pipeline(s) to the Western Cape: Some technical aspects

Present inflow to Vanderkloof (13/10/2017) is > 60 cumec (or 6.9 million m³/day) which is > 10 times the present daily target of Cape Town (500 000 m³).



Project Benefits

Cost: Preliminary estimates:

< 50% of estimated cost for desalination plant

Employment: Preliminary estimates include:

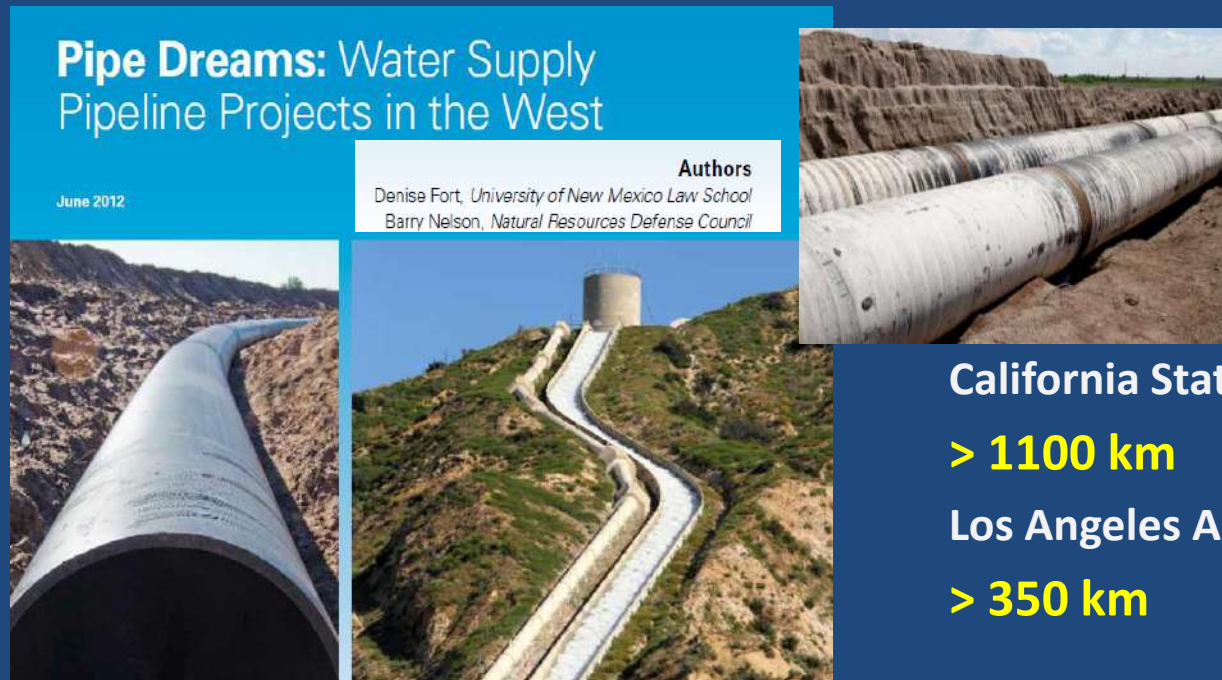
> 200,000 man days

Local/national work force: All expertise and facilities are locally available – South African companies.

Available gravity head: Possible generation of electricity – turbines in pipelines.

Is this a far fetched idea (Pipe dream)?

Water conveyance systems in the USA – Coastal Cities



California State Water Project:

> 1100 km

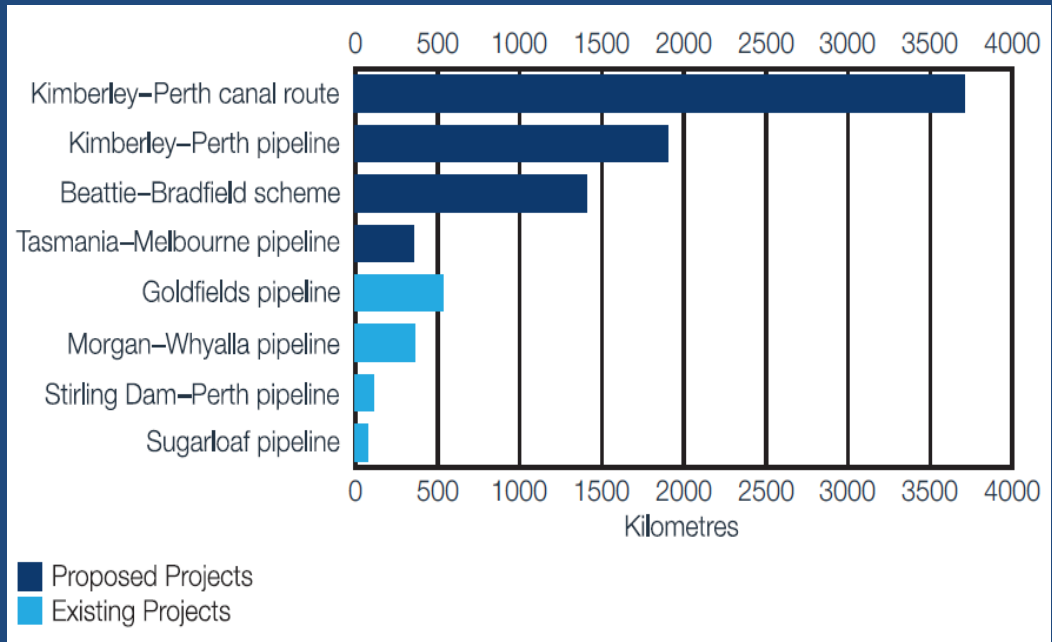
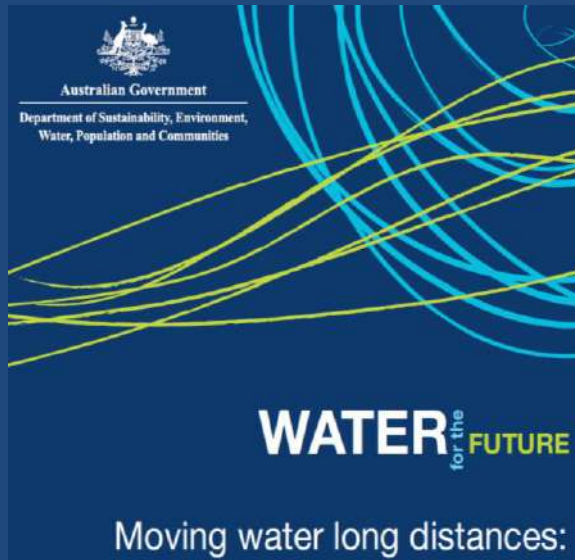
Los Angeles Aquaduct:

> 350 km

Transbasin diversions: **Source from other climate region**

Is this a far fetched idea (Pipe dream)?

Australia – Coastal Cities



Is this a far fetched idea (Pipe dream)?

Due to rapid urbanization and industrial developments there was in **1959** already 353,000 miles of **WATER**, gas and oil pipelines in the USA and pipelines worth > \$ 2 milliard were added in 3 years time.

pushing across the nation thousands of miles of pipeline to give the United States the world's greatest and most intricate web of underground carriers. These are the men who have more than doubled the nation's 335,000 miles of pipeline that existed at the end of World War II; who have added \$2,000,000,000 worth of new lines in the last three years alone. They have made it possible to ship a gallon of crude from a Texas oil field to a Great Lakes refinery for less than the cost of mailing a post card the same distance.

Laying of pipelines today—for oil, natural gas, water and many other products—


and desert.

One of the most spectacular jobs in recent years was laying 53 miles of pipe over the nation's rugged roof—the Continental Divide in Colorado. It all started when the Air Force decided to build its academy at Colorado Springs.

For years, the city had had an adequate water supply, piped down the mountain-side from the Pikes Peak area. But the academy made a big jump in water needs, and that meant going over the mountains for a new source.

Construction of the academy was only a few months away when a pipe-laying crew went into action. There was still snow in the mountains and the winds sweeping down the canyons were biting cold. There was solid rock to go through and the ditch had to be seven feet deep. There were treacherous inclines and fast-water streams to be traversed. But 60 days later the pipe was in—almost a mile of pipe per day laid over the divide.

How does a crew accomplish a job like this in such a hurry? Well, both men and equipment have to be good.



Map routes
The Oil and Gas Journal

Map shows maze of crude oil and product pipelines. Below, tractors laying pipe on mountain slopes get help from winches

MAY 1959 POPULAR MECHANICS

These were trans-state and trans-basin lines to provide for water scarce urban developments.

How can WAMTech Contribute?

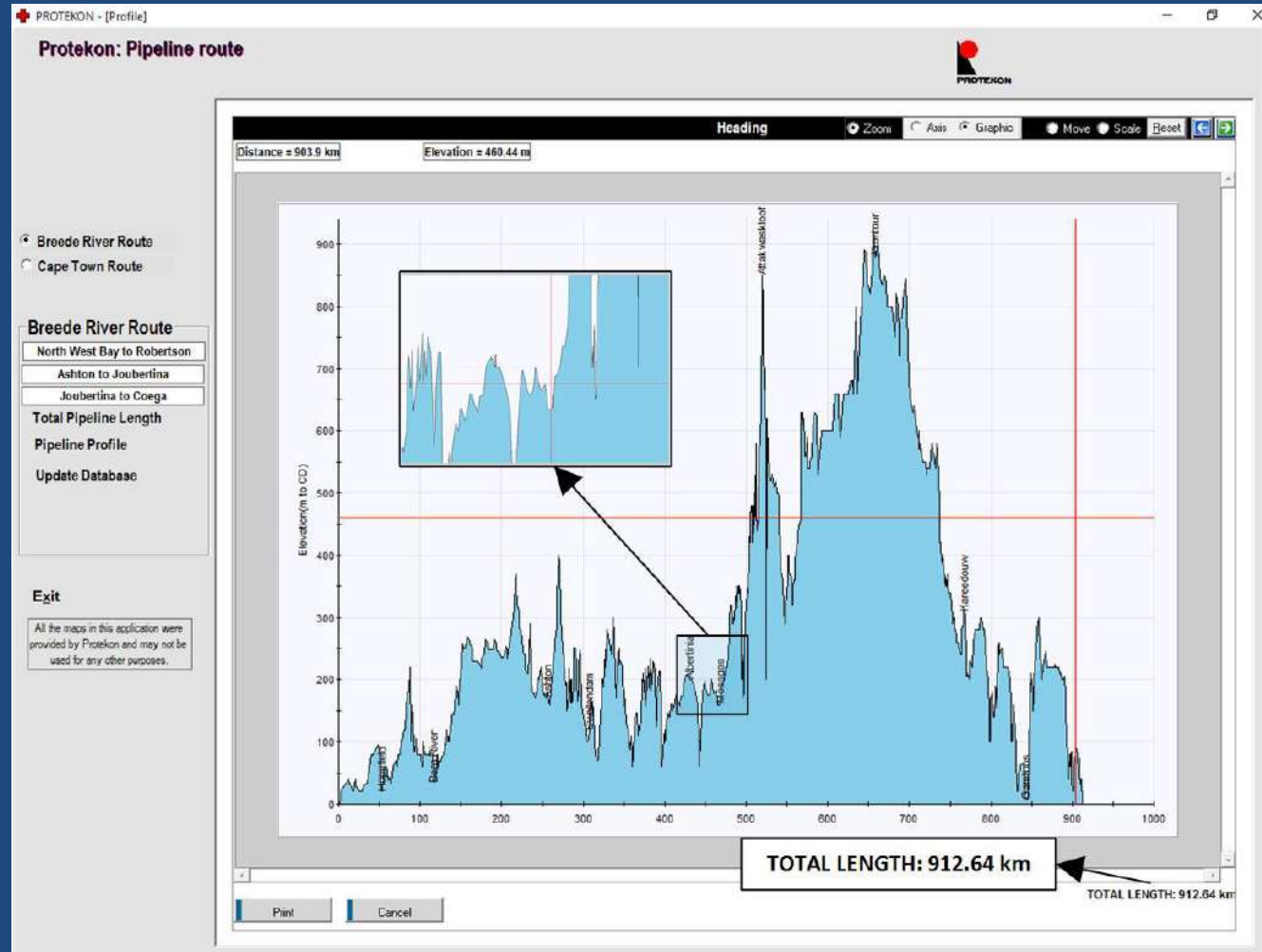
Experience.....

First feasibility study for gas pipeline from Saldanha Bay via Moss gas to Coega in the Eastern Cape.

Two routes:

- Via Cape Town
- Via Breede Valley

> 900 km

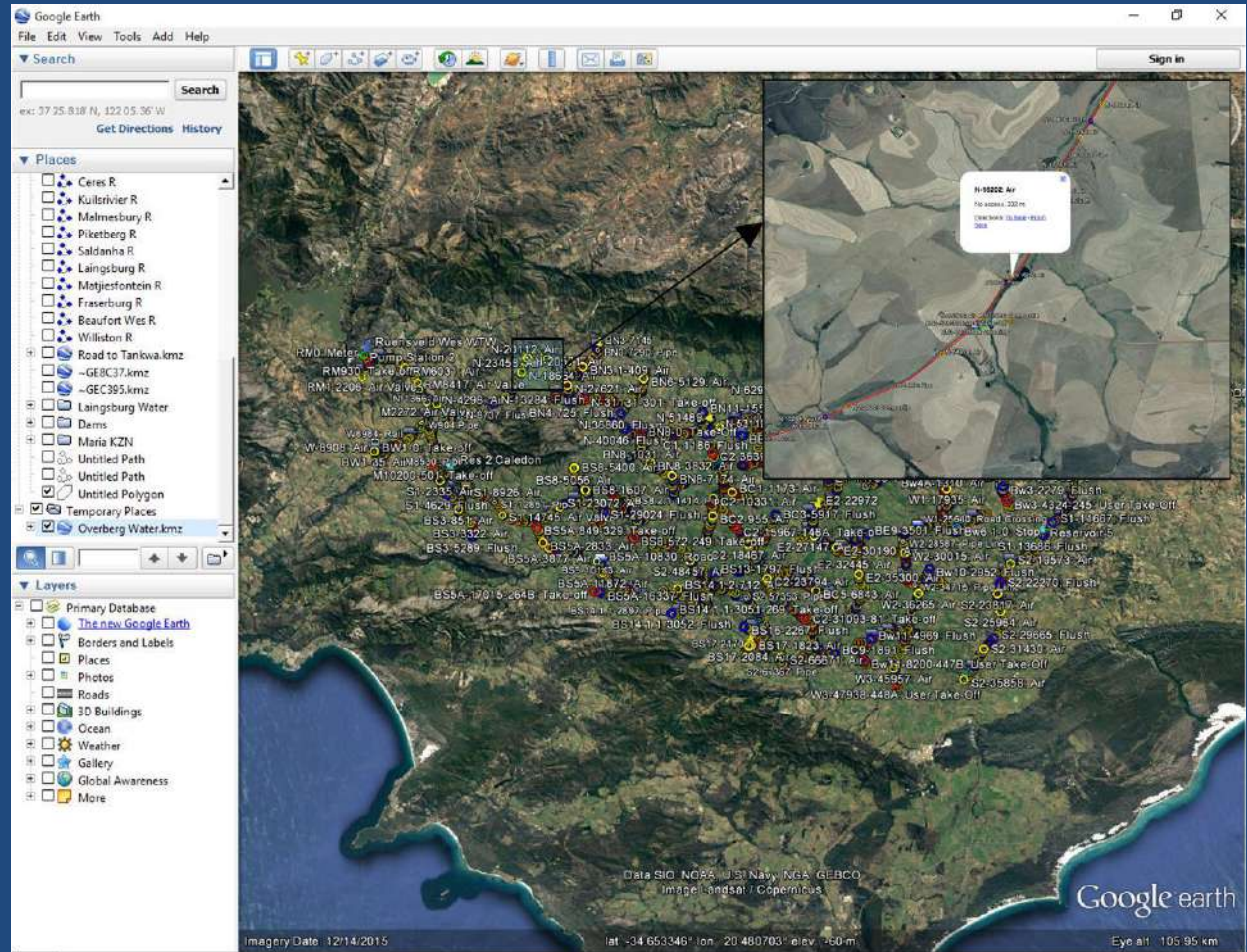


How can WAMTech Contribute?

Experience.....

Assessment of existing
900 km pipeline –
Overberg Water

Same tools and
technology applied as
for Protokon / PetroSA
pipeline.



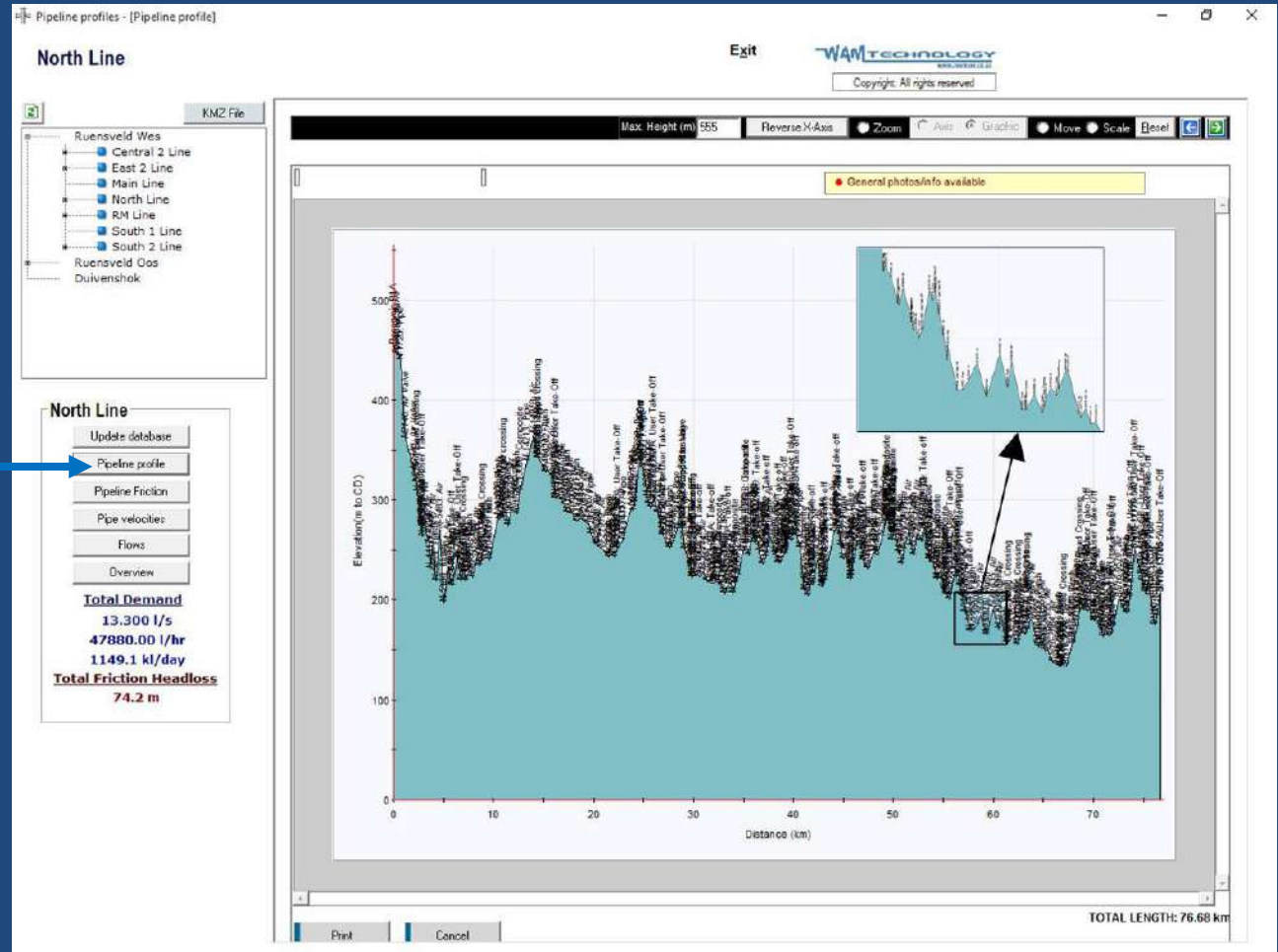
How can WAMTech Contribute?

Experience.....

Assessment of existing 900 km pipeline – Overberg Water

Pipeline Profile

- Pipe details
- Air valves
- Flush valves
- Valve chambers
- Road/Rail crossings
- River crossings
- Take-off points



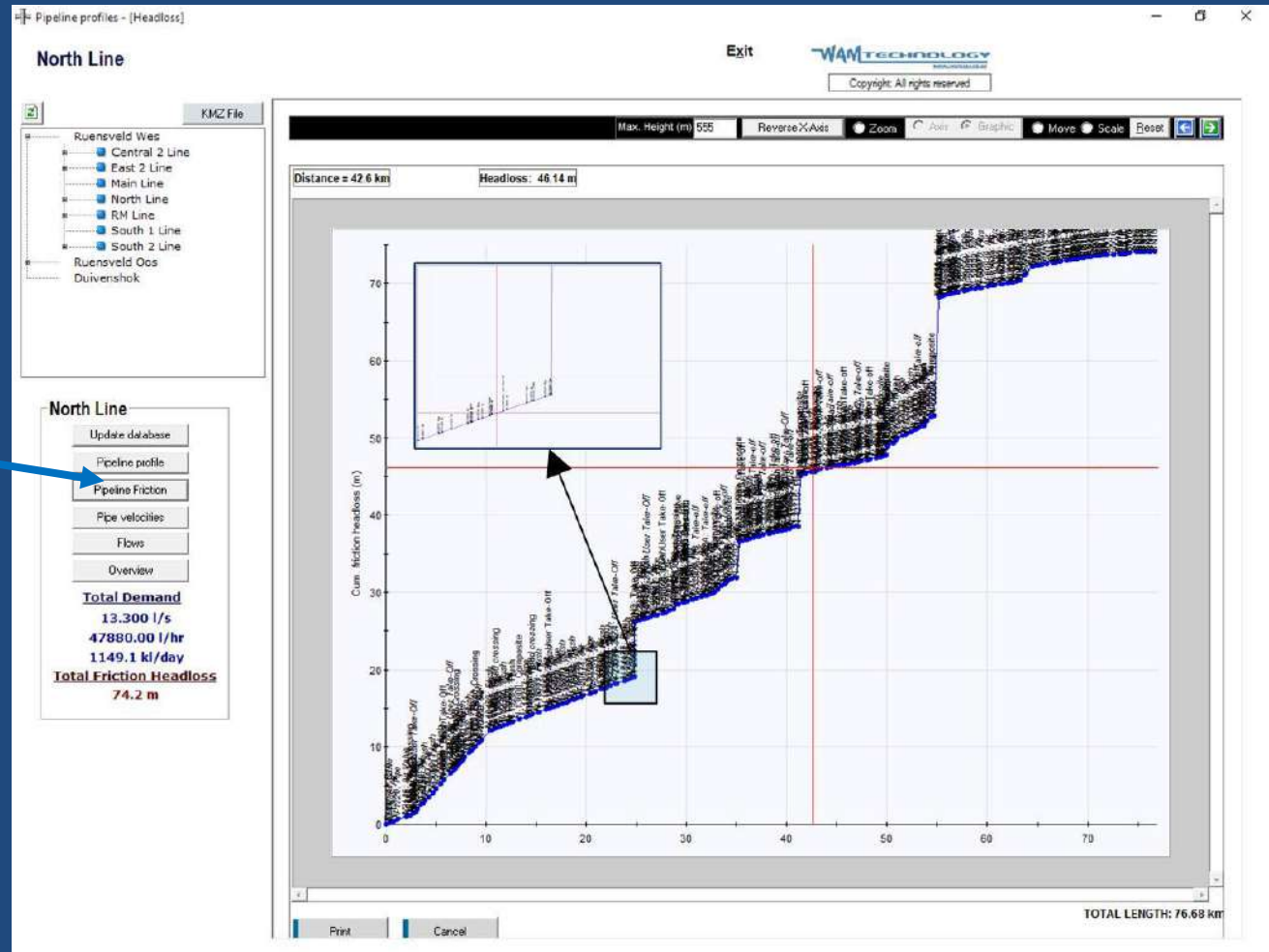
How can WAMTech Contribute?

Experience.....

Assessment of existing 900 km pipeline – Overberg Water

Pipeline Friction

- Headloss
- Velocities
- Flow rates



Thank You