HDD Technology

the answer to NSCC cleaner beaches

North Shore City Council were experiencing some capacity constraints to their wastewater systems which had adverse effects on the local streams and beaches in the Birkenhead area.

As part of the Project CARE initiative to clean up these beaches by 2021, the 2nd stage of the Birkdale construction programme called for some innovative design solutions to allow the installation of a pipeline under sportsfields, through bush reserves, driveways and a garage at depths of up to 32m.

The contract was awarded to **Smythe Contractors Ltd** and the non disruptive Directional Drilling approach was selected to install a 950m long by 560mm dia sewer pipeline in one continuous operation.

This ambitious project is the longest and largest Directional Drill shot undertaken in the New Zealand construction industry and called for serious equipment to perform the task.

Smythe invested in the largest Maxi Rig to reach NZ shores, the American Augers DD440T with 200 tonnes of pullback force and 60,000ft lbs of torque. This configuration weighs in at 50 tonne and manoeuvres into position on a 25 tonne track frame, which is ideally suited for New Zealand ground conditions.

Drill rigs of this size regularly perform 1000m of 1.0m dia HDPE or steel pipe installations world-wide and was our machine of choice because of its capacity to satisfy our clients immediate, and future design requirements for large pipe installations in this country. Its robust, no nonsense approach to large pipe installation was also an important consideration when selecting "the right tool for the job."

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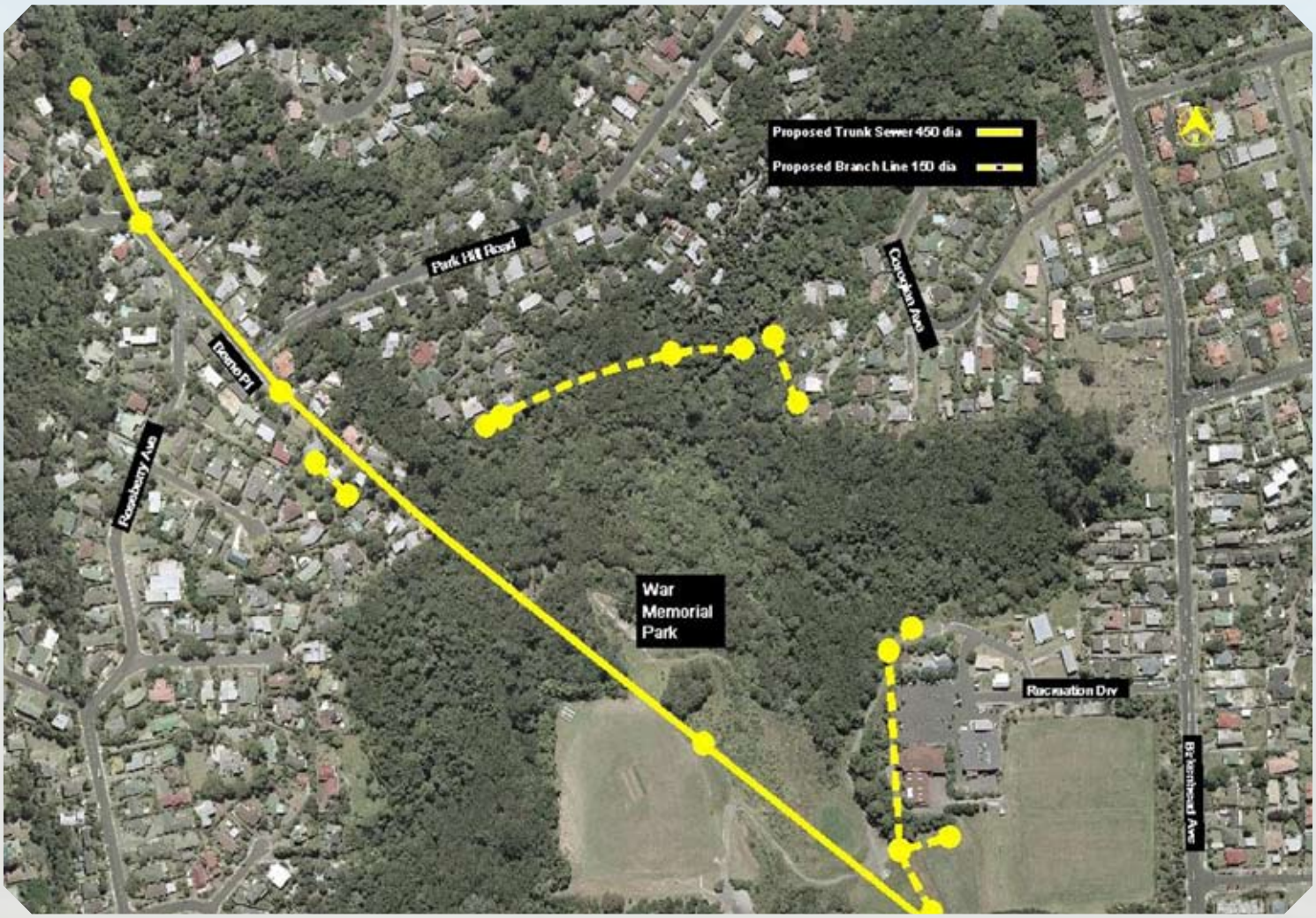
Breaking new ground every day

Planning Birkdale C



A project of this magnitude requires copious amounts of planning and forward thinking to identify and mitigate risk, and ultimately provide the surety of installation the client was seeking.

Smythe Contractors, **OPUS/SKM** worked together to minimise consenting processes and disruption to the neighbouring residents, by developing a trenchless design solution of a magnitude which had not been attempted in this country.

A computer designed drill plan was undertaken to link the bases of 3 deep manholes ranging from 12 to 32m along its path. In addition to these structures, the route passed beneath a sports-field, freshwater stream and between residential properties, and beneath a garage before arriving at a reserve area some 950m from its origin.

The final pipe alignment included both horizontal and vertical curves to be drilled at 30+m depth and at grades of < 1% to 6% through the predominant sandstone material found in the North Shore.

Smythe's elected to use our Digitrak Steering system which utilises the earth's magnetic field to determine bearing and position of the steering head. However after we identified that local magnetic interference was causing deviations in our planned course, a more sophisticated steering system along with an experienced operating engineer was engaged from Europe.

Combining these new steering resources with **Smythe's** drilling expertise; the pilot hole successfully linked the 5 key manholes over the 950m after a lot of navigational challenges.

Forming the Tunnel

The key to successful pipe installations by directional drilling means, is the drilling and preparation of the pipe tunnel. As the geology of this area indicated the presence of East Coast Bays sandstone of variable hardness, the combination of the DD440T Drill rig and aggressive enlargening reamers were selected to grind through these materials to create an 820mm dia tunnel from end to end.

This exercise generated large volumes of drilling fluids to lubricate and transport the cuttings to collection ponds. The expansive drill platform area in War Memorial Park allowed us the room to construct processing ponds. These were used in conjunction with fluid recycling equipment to recover as much of the drilling fluids as possible during the drilling, reaming and pullback phases.

Smythe's anticipate future projects of this magnitude will have lesser processing area, and 100% recycling would be typical to reduce pond sizes and the overall footprint of Drill Rig platforms.

Pipe Fabrication

Where do you fabricate a 1000m length of 560mm dia sewer pipe within populated residential areas?

The solution lay in a local walkway where magazines of pipes were welded together into manageable lengths for assembly during the pullback operation. Each length was inspected and pre-tested to ensure the integrity of the pipeline prior to installation.

The Pipe Pullback

The pullback of 950m of 560mm dia HDPE with a Maxi Rig was new territory for **Smythe Contractors** and we were looking forward to putting the new *DD440T* through her paces.

Normally the pipe pullback is a continuous 24hr operation, with minimal delays or stoppages to reduce the risk of jamming the pipe. With this Birkdale contract, the absence of a noise consent, and interruptions to butt weld the pipe strings together, restricted our pullback hours from 7.00am to 7.00pm over a 5 day period.

This raised concerns that by stopping the pullback for 12 hours overnight, the increased loads due to settling of drilling fluids and clays gripping the pipe circumference could increase to risk of restarting pullback the next morning.

To mitigate this risk of high pullback resistance, a lot of emphasis was placed on a drill fluid (Mud Design) that both retained the hole profile and reduced friction around the pipe circumference. We estimated that 5 days were required to complete the pipe pullback, and due to good hole preparation and mud design, the pullback pressures never rose above their overnight readings.

The full 950m was successfully installed as planned without exceeding the allowable design loads of the product pipe, and using only 30% of the DD440T's pullback capacity.

Conclusion

- We have much more pullback in reserve for those larger 1.0m dia pipe installations, and greater lengths.
- That drilling projects of the magnitude of this Birkdale Project, ie.with flat gradients and long curved alignments are not commonly internationally, and are very challenging to install. But the **Smythe Team** like a challenge.
- With the correct resources, equipment and personnel, these types of trenchless installations are achievable.
- After 30+ years of contracting, **Smythe Contractors** continue to grow and learn from each experience we encounter on these pioneering projects.
- The successful completion of this project will be a significant milestone for all parties associated with this contract, ie. the client, consultant, contractor, residents and environment.

Mission Statement (Courtesy of NSCC)

"North Shore City Council is committed to finding innovative solutions that offer financial advantages and have clear benefits for our residents. In the case of the Birkdale Sewer Upgrade, open trenching works would have caused major environmental disturbance through the reserve and significant disruption to many residents and road users. Through Smythe's technology and experience and SKM/Opus engineering expertise, we have been able to achieve a very difficult sewer upgrade with minimum disruption."

SMYTHE CONTRACTORS SERVICES INCLUDE

Directional drilling, Directional rock drilling, Micro tunnelling, Thrusting, Pipe ramming, Slip lining, Pipe bursting, Landslip correction, Casing advance, Trenching, Drain laying, Sewers, Ducts, Cables,

THE COMPLETE JOB.

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