Tonkin+Taylor

Dams + Hydro

From generating and storing renewable energy, to providing fresh drinking water, irrigation water, and managing flood hazards, dams are critical assets for future water and energy security.

Tonkin + Taylor has been assessing, designing and monitoring dams for over 60 years, throughout New Zealand, Australia and internationally.

Our services

We have extensive experience on both large and small dams across a range of end uses including hydropower, flood detention, water supply, and energy storage. Our experience further covers appurtenant and ancillary infrastructure, including power stations, spillways, penstocks, bridges, inlet structures, tunnels and roads.

Our capabilities include investigation (often in remote and challenging terrains), assessment, design, consenting, construction supervision, and commissioning of new dams and upgrade works. We also offer expertise in ongoing safety management, safety reviews, surveillance, regulatory compliance, and deficiency management of existing dams during operation, as well as expertise in decommissioning at the end of a dam's service life.

In an evolving context of natural hazards, climate change, and regulations, we provide clients and communities solutions with diverse benefits, while also allowing them to plan for, and efficiently manage, the risks inherent in water detention structures.

Investigation and feasibility studies

- Project definition and value engineering
- Geotechnical investigations and assessments
- Hydrogeological assessments and modelling
- Hydrology and hydro energy modelling
- Hydrological and flood hazard studies
- Hydraulic and civil engineering design
- Dam break hazard assessments, including complex 2D flood modelling
- Potential Impact Classification (PIC) / ANCOLD consequence category assessments
- Environmental assessments including compliance, water and soil science, contaminated land, and impact assessments
- Expert witness services

Geology and geotechnical engineering

- Site geology and morphological mapping
- Structural geological mapping
- Geological hazard identification and risk assessment
- Geological risk mitigation and management
- Groundwater and hydrogeological evaluation
- Drilling including in challenging locations such as on steep slopes
- Risk assessment and management for intrusive investigations close to existing structures
- Slope stability assessment
- Liquefaction and seismic hazard assessment
- Soil and rock slope design
- Internal erosion analysis and filter design
- Rock and soils materials assessment
- Tunnelling investigation and design
- Dam foundation investigation and design
- Slope and groundwater instrumentation and monitoring

Dam design, construction support and documentation

- Failure Mode and Effects Analysis (FMEA)
- Detailed design and documentation
- Design review during construction
- Construction supervision
- Preparation of tender documentation and specifications
- Commissioning
- Development of Dam Safety Management Systems
- Peer review

Structural engineering

- Civil works
- Seismic design
- Powerstations

Hydropower

- Hydroenergy generation assessment
- Scheme planning, concept, feasibility and detailed design
- Civil works
- Independent review

Hydrology

- Catchment yield
- Low flow and flood frequency analyses
- Probable Maximum Precipitation and Flood (PMP PMF)
- Catchment water balance

Dam safety management

- Surveillance, monitoring, and evaluations
- Instrumentation and calibration
- Dam safety reviews
- Deficiency management
- Risk-based frameworks and tools
- Asset valuation
- Training
- Regulatory compliance

Track record

Dam design + construction

Heretaunga Water Storage, Hawkes Bay, NZ (2020-23)
Scoping assessment and concept design for potential water storage sites and scheme in the Ngaruroro and Karamu River catchments. Included desktop site selection and review, catchment and flood hydrology, initial site ranking and concept design of 8 shortlisted dam scheme options. Further stage, prefeasibility level design and investigations for three potential water storage sites and schemes which included catchment and flood hydrology, site investigations, geometric, structural and geotechnical design, construction cost estimates, and risk assessments. Subsequently, site investigations and prefeasibility design for Option 3 dam site (up to 27 Mm^3 storage with 58 m high ECRF/Zoned earthfill dam) including reservoir landslide complex assessments and consideration of proximity to major active fault.

Waimea Community Dam/Hydro add on, Tasman, NZ (2004-19)
Prefeasibility engineering, environmental and economic assessments for multiple sites and options; feasibility storage and allocation options assessment; hydrological and yield modelling, site investigations, geological model development, dam design, and fish passage design to support resource consent; detailed design and risk assessment for selected 53 m high concrete faced rockfill dams (CFRD) and feasibility design of hydroelectric power add-on. Partnered with international CFRD experts, the ECI contractor and local consultants.

Ruataniwha Water Storage Scheme, NZ (2009-19)
Prefeasibility and feasibility studies, conceptual design, options analysis, geotechnical investigations, hydrological analysis, water demand modelling, and engineering design development for the large scale irrigation storage and distribution scheme, including design of a 83 m high dam on Makaroro River with significant hydropower generation, 21 km of canals and 135 km of pipework to irrigate over 25,000 ha in the Ruataniwha Plains. Also preparation of expert evidence and environmental court attendance to support the successful resource consent process.

Wairarapa Water Use Scheme, NZ (2011-17)
Concept followed by prefeasibility study to develop options for water storage, harvesting and distribution infrastructure for irrigation, hydro energy generation, in-stream ecosystem enhancement, and recreational and cultural use. 243 scheme options were shortlisted to five schemes. T+T was the lead consultant for the prefeasibility study and earlier phases that developed the scheme concept; our role included water resource investigations, hydro energy assessments, supply-demand modelling, geotechnical investigations, infrastructure design, multi-criteria analyses across environmental, social, cultural, technical and financial aspects, Regional Plan review, cost estimation, and community engagement.

Kauri Cliffs (2019-)
Design and construction observation for a Medium PIC zoned earth embankment dam in Northland. Complex volcanic geology foundations. 600,000 m^3 live storage and ~15 m high dam for irrigation.

Dam 19 Auxiliary Spillway Upgrade, NZ (2011)
Upgrade works to increase the spillway capacity of the existing Dam 19, which services Kinleith Mill. This included detailed hydraulic design and optimisation of the auxiliary spillway inlet structure, chute and energy dissipation structure.

Mahinerangi Dam, NZ (2010-12)
Initial geotechnical investigations and geological mapping. Initial stability evaluation. 3D finite element modelling and initial structural assessment. Detailed geotechnical investigations. Resource consent scoping study. Refined 3D Finite Element modelling. Development of remedial options. Detailed design of selected remedial option.

Dam safety

Dilmans, Kaniere Forks & McKays HEPs CDSR, West Coast, NZ (2023-24)
Comprehensive dam safety review (CDSR) for the dam and appurtenant structure components for three run-of-river hydropower schemes on the West Coast. Includes High PIC zoned earthfill dams in high seismic environment on complex glacial till foundations.

Waipori and Deepstream HEP CDSR, Dunedin, NZ (2018)
CDSR for hydroelectric power scheme in Dunedin.

Snowy Hydropower, NSW, Australia (2013-14)
CDSRs for the Tumut Pond (concrete arch), Tumut 2 (concrete gravity), Khancoban (earthfill), Murray 2 (concrete arch) and Jindabyne (rockfill) Dams.

Hydropower

Aniwhenua Hydropower Headpond Remediation, Bay of Plenty, NZ (2015-16)
Forensic investigations, consents, and rehabilitation design to keep the headpond of the 18.5m high sloping earth core rockfill dam operational; construction monitoring to ensure the complex and challenging project was completed on time and to budget. Included removal of rip rap on headpond embankment face and base, construction of temporary EPDM lined coffer dams, temporary stream diversion to enable repair works, and construction of liner underdrain system and collector pipe.

Arnold River, West Coast, NZ (2011-13)
Concept to feasibility level design and investigation of the 40 MW hydroelectric power scheme diverting water from the Arnold River. Included geotechnical site investigations, river intake design, headrace and tailrace canal design, penstock design, power station design.

Lake Rochfort Hydropower, NZ (2010-13)
The scheme features additional capacity for stream diversion into the lake, a new 2.2 km long penstock from the lake to the base of Mt Rochfort, and a new powerhouse with a single pelton wheel turbine. A geomembrane faced rockfill dam has been constructed to seal the cutting through the lake edge where the 1 m diameter HDPE penstock was installed. The design capacity of the scheme is 4.2 MW produced from a head of up to 415 m. Our role included geology, geotechnical engineering, dam safety, infrastructure design, and construction monitoring.

Hydrology

Taheke Hydropower, Bay of Plenty, NZ (2024-25)
Hydrology services to support consenting and concept design of the proposed Taheke Hydro Project. Included conducting a catchment water balance analysis to confirm overall water availability and scrutinise inter-annual trends, examining low flow frequency behaviour and comparing findings with regional long-term flow records, characterising the flow regime at four or five specific locations including examining seasonal flow duration curves and monthly flow tabulations, and assessing potential climate change effects on the river flow regime.

Waimangaroa Hydropower, NZ (2024-25)
Hydrology services to support the feasibility assessment of a potential new hydroelectric power project based on the Waimangaroa River. Included development of synthetic long-term flow series for the specified locations in the Waimangaroa catchment, deriving flow-probability curves for the specified sites, calculation of the 7-day mean annual low flow (MALF), minimum, mean and median flows, and flood frequency analysis for 1-year, 10-year, 100-year and 1000-year horizons.

Patea Hydropower Dam, Taranaki, NZ (2024-25)
Peer review of hydrology for Patea scheme including inflow and flood hydrology. This dam is the fourth largest in New Zealand as well as being the first of its kind constructed from tertiary sandstone and siltstone as fill materials. The scheme has three 10,233 kW vertical turbine and generator sets giving a total output capacity of 31.7 MW and an average output of 110 GWh per year.

Flood detention dams

Morey St FDD, Rotorua, NZ (2021–25)
Design lead for two large flood detention dams in Rotorua from preliminary design through to construction including site investigations, PIC assessment and FMEA workshops. Two High PIC structures on challenging volcanic soil foundations (including pumice, ash and liquefiable sands).

Nanako FDD, Tauranga, NZ (2020-25)
Development and delivery of an integrated catchment solution to provide flood attenuation and water quality treatment to enable residential development in the Pyes Pa West Area. Included preparation of a stormwater management plan, optioneering for flood mitigation options, providing direction to the flood and modelling (done by others). Once preferred solution was identified, T+T undertook preliminary design, dambreak assessment, PIC assessment, detailed design and obtaining building consents for two flood detention dams (Kennedy Road Dam Upgrade and Dam 5) and a stormwater treatment wetland (Wetland 5). Inputs included civil engineering, dam engineering, stormwater management, hydraulic design, ecological management plans and geotechnical engineering. Also provided construction observation and contract administration services for the dams during construction.

Linton Park East FDD, Rotorua, NZ (2020-25)
Preliminary design, detailed design and construction monitoring for upgrade of an existing dam, new dam is high potential impact classification (PIC).

Near Pacific

Taveuni Hydropower, Fiji (2021–22)
Preliminary civil engineering and hydrology assessments for two proposed run-of-river hydropower schemes (Lavena Scheme on the Wainisairi Creek (target capacity of 4 MW) and Salialevu Scheme on the Drekeniwailevu Creek (target capacity of 2 MW).

Tina River Hydropower, Solomon Islands (2010-18)
Review Consultant for the 15-20 MW Tina Hydropower Project including the preferred option of a 40 m high RCC dam. Review consultant through feasibility and into procurement, review of the Feasibility Study, in particular output, including the technical, economic/financial, environmental, and social aspects of the project, assisting IFC in preparing a financial model for the project, preparing, negotiating, and revising the relevant technical and economic sections of the Contractual Documents, and assisting in the implementation of the tender process up to financial closure.

Small Hydro Stations, Samoa (2015)
Under EPC Contract for rehabilitation of the Samasoni, Fale ole Fee and Alaoa Small Hydro Stations. Provided civil works and tender concept design works. Schemes consist of a 2 m high concrete Coanda screen weirs, penstocks, powerhouses and tailraces.

International

Hydropower

Ilaguen 1 + 2 Hydropower, Isabela, Philippines (2014-18)
Ilaguen 1 - detailed design for 19 MW run-of-river hydropower scheme with a 28 m high concrete weir, large diameter penstock for 93 cumec flow and a three unit conventional powerhouse. Ilaguen 2 - concept design for 14 MW run-of-river hydropower scheme with a 28 m high concrete weir, large diameter penstock for 93 cumec flow and a three unit conventional powerhouse.

Mangima Hydropower, Bukidnon, Philippines (2022-25)
12 MW run-of-river hydropower scheme located on the Mangima River. Provided design support and technical review of scheme design from concept to construction, design inputs into concrete gravity diversion weir with reinforced concrete energy dissipation basin on schist rock, twin bay gated sluiceway, gated side intake structure with twin bay desander, 6 km long low pressure headrace pipe (HDPE), steel tower simple surge tank, above ground steel penstocks, surface powerstation with two units, and tailrace channel.

Catuiran Hydropower Scheme, Oriental Mindoro, Phillipines (2012-18)
Design support and technical review of 8 MW run-of-river hydropower scheme from concept to construction. Design inputs into 28 m high concrete gravity ogee weir with flip bucket on rock, sluiceway, gated side intake structure with twin bay desander (underground), 3 km long low pressure tunnel in schist rock, surge shaft, above ground steel penstocks, surface powerstation with two units, and tailrace channel.

Mat-I Hydropower, Claveria, Philippines (2022-)
Technical advisor support for the design and construction of a 4.8 MW run-of-river hydroelectric power project. Part of an EPC contract supporting the lead designer.

Lake Mainit Hydropower, Mindanao, Philippines (2012-18)
25 MW hydropower project which involves tapping the existing Lake Mainit and diverting flow through a ridge to the Bohol Sea via a gated intake, 3 km long 5.8 m diameter concrete lined horseshoe tunnel section, surge tank, 5.8 m diameter penstock trifurcating to 2.9 m diameter penstocks. Provided detailed design and optimisation of all civil structures, geotechnical site investigations and interpretation of geology, production of Design Report, technical specifications for civil works and design advice during construction.

Cantakoy Hydropower Scheme, Bohol, Philippines (2011-12)
8 MW hydropower project includes a 35 m high concrete gravity dam with three radial gate-controlled chute spillways incorporated into the structure plus a gated sluice channel adjacent. Provided detailed design and optimisation of all civil structures, geotechnical site investigations and interpretation of geology, preparation of a Design Report, preparation of technical specifications for civil works, dam and integrated spillway optimisation report, and design advice during construction.

Tudaya 1 + 2 Hydropower Scheme, Philippines (2010-11)
Detailed design for the 13 MW, two station cascade involving three diversion weir and intakes, two desanding basins, 1.2 km tunnel, low pressure conveyance pipelines, penstocks, power houses and access roads.

Sibulan Hydropower Scheme, Mindanao, Philippines (2007-10)
Detailed design, review, and construction project management for this two station cascade scheme (42 MW) with conveyance pipe lines, tunnels, penstocks, dams, weirs, head ponds, power stations, access roading as well as transmission and mechanical and electrical Plant.

Dam safety

Ambuklao and Binga Hydropower, Benguet, Philippines (2012-13) (2024-25)
Ambuklao comprises a 129 m high central core rock fill dam with radial gated ogee spillway, steep chute and flip bucket outlet, a 75 MW underground power station and 327 million m^3 capacity storage. Binga is downstream of Ambuklao and comprises a 107 m high zoned earth-rock fill embankment with inclined core, radial gated ogee spillway with steep chute and flip bucket, a 100 MW power station. Services included dam safety audits, PMF routing studies, dam break studies, seismic review study, rehabilitation works scoping, design, costing, dam monitoring database design and set-up, flood forecasting and warning system reviews, operation, maintenance and surveillance and rehabilitation standards review, preparation of OMS manuals and emergency action plans, and quantitative landslide risk assessment study. In 2024-25, CDSR undertaken.

Magat Hydropower Dam, Isabela, Philippines (2024)
CDSR of High PIC rockfill and concrete gravity dam facilities including in country site visit.

Bujagali Hydropower Dam, Uganda, Africa (2007-11 (pre commissioning), 2023-25 (operational phase))
Environmental and social impact assessment plus dam break analysis and emergency preparedness planning for this greenfield 250 MW hydropower project pre construction (2007-11). Operational phase inputs (2023-25) covering substantial update to EPRP, in country consultation, and 2024 CDSR undertaken.

Huoi Quang Hydropower Dam, Vietnam (2011-20)
Technical review of the hydropower, engineering geology, hydrology, hydraulics, structural and civil aspects of the headworks through design and construction for the 520 MW, 104 m high concrete gravity dam and 4.6 km headrace tunnel. Dam safety panel adviser.

Contact us

Dewi Knappstein

Business Lead – Dams (parental leave)

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Dewi is a senior water resources and geotechnical engineer with 15 years' experience in geotechnical investigation, dam design, hydraulic design, stormwater design, and coordination of multidisciplinary water projects. This experience has been accrued on flood management, irrigation, water supply, viticulture, hydroelectric and road projects in New Zealand, Australia, Malaysia and the Philippines.

Nick Russ

Business Lead – Dams (parental cover 2026)

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Nick is a civil engineer with 18 years' experience in New Zealand, Canada and the United Kingdom. His experience includes construction, observation of dam spillway construction, design of dam remedial works, dam safety monitoring and contract administration.

Dominic Fletcher

Principal Dams + Hydropower Engineer, International

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Dominic has over 18 years' experience in dam and hydropower scheme consenting, design, construction, and dam safety engineering in New Zealand and internationally. He has specific experience in the design and construction of run of river and on river storage mini hydropower schemes. Dominic's international experience includes several major hydropower projects in the Philippines, where he led technical design.

David Leong

Technical Director – Hydrology + Hydraulics

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David has over 30 years' experience in hydrology, hydraulics and the associated aspects of hydroelectric power generation. His analytical and design skills are derived from water supply, flood management, transportation, and hydropower projects, from scoping study to detailed design, and due diligence to forensic investigation.

Tim Morris

Technical Director – Dams + Water Resource Engineering

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Tim has well over 20 years' experience, with substantial design and review experience in a variety of roles. He has provided design, peer review and compliance review contributions to major projects involving multifaceted water storage, hydropower, and transmission infrastructure in New Zealand.

Tim Haxell

Engineering Geologist

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Tim has over 11 years' experience across dam, transportation and quarry projects throughout New Zealand and the South Pacific. He has particular expertise in design and coordination of site investigations, assessment of engineering geological models, geological risks and slope hazards for dams.

Kevin Ng

Water Engineer

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Kevin has over 13 years' experience in water resources and civil engineering. He has been involved in multiple roles relating to dam safety, flood hazard, dam upgrade and design projects across New Zealand, the Pacific and Africa.

Jason Lim

Geotechnical Engineer

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Jason is a geotechnical and civil engineer who specialises in analysis and design for complex engineering problems. He has over 13 years' experience in site specific and seismic hazard assessments for dams and infrastructure across New Zealand. He also specialises in numerical stability analysis of earth and hydraulic retaining structures.

Greg Clark

Civil + Structural Engineer

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Greg has over 24 years' civil and structural engineering design and contract experience on large scale and heavy civil engineering projects. His expertise includes concept and detailed design, structural assessment and reporting, contract administration and construction supervision on both structural and civil projects.