ARA TŪHONO – PŪHOI TO WARKWORTH: DELIVERING WORLD-CLASS CONNECTIONS

2020 IECA ENVIRONMENTAL EXCELLENCE AWARDS

Ara Tūhono
Pūhoi to Warkworth
A NZ Transport Agency PPP Project

NX2 NORTHERN EXPRESS GROUP

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New Zealand Government

SECTION 1: SUBMISSION SUMMARY

Ara Tūhono translates to 'a connecting pathway', and the connections being made by the first stage of the project, from Pūhoi to Warkworth, will extend far beyond the 18.5km long motorway we are building.

The new motorway will create a robust and reliable transport route between Auckland and Northland, providing significant improvements in safety, more consistent travel times, and a better freight connection between Northland and the Upper North Island. Beyond the road, we are building connections with the land and people.

The Project is not without challenges, particularly the diverse geographical and geological landscape which has tested the Project Team. The challenging landscape and the variable climatic conditions has meant the Team has had to adapt to rapidly changing situations. But with challenge comes opportunity and the Project has taken the opportunity to connect and share lessons learnt from one of the largest earthworks projects in New Zealand with the Project Partnership, community, and the wider Erosion and Sediment Control industry.

Overcoming these challenges has been a collective effort from the Projects Earthworks and Engineering Teams which has allowed us to meet programme milestones while demonstrating that we can work beyond our regulatory framework and still achieve positive environmental outcomes.

Ōkahu Viaduct artist impression

SECTION 2: ENTRY OVERVIEW

The Ara Tūhono – Pūhoi to Warkworth project is an 18.5 km long motorway, connecting the Johnstone's Hill Tunnels north of Orewa through to Warkworth. It has been designed to offer a safer and more reliable travel route than the existing State Highway 1 and help further develop infrastructure and roading networks within the Northland Region.

The Project is unique in its geological and geographical features, comprising of steep hill country to flat farmland and flood plains. Ground conditions have been variable, with weak substrates resulting in a large amount of ground improvement works being required. The difficult topography has also created ongoing challenges with how ESC is managed across the Project's length with unstable ground conditions leading to innovative ways to manage run-off when traditional ESC devices are not able to be built. One of the biggest challenges that has been faced by the Project Team is the number of slips that have occurred, the largest being a 60,000 m^3 slip in the steepest gully of the Project – an immense effort was required to stabilise this material when 200 mm of rainfall was predicted in the coming week.

The Project takes pride in its environmental compliance and through using an Adaptive Monitoring Programme has been able to achieve sediment yields that are far below what was predicted in theoretical modelling. This has helped the Project gain approval for open area extensions up to 26 ha over the original open area set limits. A strong relationship with the regulator, coupled with no significant environmental incidents or infringement notices, has shown the Construction Team that with a high standard of environmental compliance comes increase in productivity.

The 2019/2020 Earthworks Season was set to be one of the largest for the Project, with 118 ha open at the peak of the season, but the call for New Zealand to enter mandatory self-isolation during COVID-19 left the Project with only 48 hours to prepare for a four week site closure, including preparing and planning appropriate response strategies for any rain over this period.

A collaborative relationship with the project stakeholders and a strong community and communications focus has allowed the project to share good news stories, innovations and updates to the residents and community via a range of different media outlets. The Project also hosts a range of site visits for the Construction Industry as well as sharing lessons learnt and providing opportunities to suppliers to test their products on one of New Zealand's largest earthworks projects.

Carting rock in Central North

CN8 Culvert

Central North enabling works

Ara Tūhono Pūhoi to Warkworth A NZ Transport Agency PPP Project

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SECTION 3: PROJECT TIMELINE & MILESTONES

The Ara Tūhono – Pūhoi to Warkworth project is 18.5 km long motorway which connects the Johnstone's Hill Tunnels through to Warkworth.

The completion of this roading project has three main goals –

1. Improve the safety, reliability, and resilience of the state highway for motorists, tourism and freight
2. Improve the connection between Northland, Auckland, and the Upper North Island
3. Support population growth and encourage a growing economy

The Waka Kotahi NZ Transport Agency project is being delivered by the Northern Express Group (NX2) under a Public-Private Partnership (PPP) delivery model. This sees Fletcher Construction and Acciona Infrastructure working together as a Construction Joint Venture to design and construct the motorway. The motorway will then be passed over to subsidiaries of both Fletcher and Acciona for a 25-year maintenance period following which the asset will be handed over to Waka Kotahi NZ Transport Agency.

Enabling works for the motorway commenced late 2016 and the motorway was scheduled to open at the end of 2021, but the COVID -19 Alert Level 4 lockdown in April 2020 meant nearly five weeks of the earthmoving season was lost. The resumption of work under Alert Level 3 with strict health and safety protocols also impacted the works programme. The new safer, more resilient route between Pūhoi and Warkworth is now expected to be opened to motorists in time for the busy Queen's Birthday weekend in 2022.

PROJECT MILESTONES

NOVEMBER 2016
Start of Enabling Works

JANUARY 2017
Start of Main Works

JANUARY 2018
Start of Structures

OCTOBER 2017
Start of Bulk Earthworks

NOVEMBER 2019
Start of Pavement Works

March 2020
COVID 19

JULY 2020
Te Arawhiti ki Pūhoi (Pūhoi Viaduct) Completion
Te Arawhiti Pua Ngahere (Kauri Eco Viaduct) Completion

SEPTEMBER 2020
Te Arawhiti ki Ōkahu
(Ōkahu Viaduct) Completion

NOVEMBER 2020
Earthworks Completion

OCTOBER 2020
All Structures Complete

Early 2022
Pavements complete

May 2022
Motorway open to traffic

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SECTION 4: DISTINCTIVE FEATURES, CHALLENGES & ACCOMPLISHMENTS

The surrounding environment of the Pūhoi to Warkworth motorway Project provides several distinct features which have presented both challenges and accomplishments along the way. The designation traverse's difficult geological terrain paired with a highly variable climate which has required adaptive thinking. No one could have predicted COVID-19 at the peak of what was to be the final earthworks season and this has provided a further unique challenge for the Project to overcome.

A CHALLENGING ENVIRONMENT

The project area is largely characterised by low undulating hill country in the north and steeper rolling hill country with distinctive complex incised landforms of interconnected ridge and valley systems in the Central and Southern parts.

The steep terrain along much of the project alignment has seen much of the overlying soils being either unstable, or highly susceptible to erosion when exposed by construction activities.

The northern length of the project contains extensive alluvial deposits in low lying areas around Warkworth carved out by major rivers and subsequently infilled with deep, soft estuarine and alluvial sediments.

The underlying geology also strongly influences the groundwater along the length of the alignment with elevated groundwater levels, seepage lines, springs, and perched leaky water tables common from north to south.

The Projects alignment covers an extensive network of rivers and streams which reflect the relative complexity of the landform along the majority of the alignment. Seven bridges will transverse the major tributaries of the Mahurangi and Pūhoi Rivers, with 6780 metres of culvert to convey the remaining tributaries.

The low-lying nature of the Warkworth area presents its own challenges, such as the Mahurangi River flood plain through which the motorway traverses; enter the 11-barrel flood relief culverts.

Building access in Central North

Rock batter in Central North

CASE STUDY: 11 BARREL CULVERT

The 11-barrel culvert Construction Erosion Sediment Control Plan (CESCP) presented significant challenges and innovative out of the box thinking in its development as the implementation of the pre-load by default created a potential blockage of the flood plain the culverts were designed to mitigate. To provide the necessary flood relief, a flood relief channel was to be excavated through the fill embankment during flood events. A series of rainfall trigger thresholds were established which determined the level of response required.

When an alert level 3 was reached (i.e. Widespread rainfall greater than 50 mm within 6 hours or 100 mm within 24 hours), the response required mobilising plant to remove the sand backfill of the relief channel as rapidly as practical with this sand stockpiled as far above the 100-year flood level as practical.

Construction of the 11-barrel culvert is well underway and when complete it will be the biggest culvert built to date in New Zealand consisting of 187 x concrete pipes weighing 10 tonnes each. Each barrel will be 42m long and 2400mm in diameter.

11-barrel culvert in construction

A CHALLENGING CLIMATE

During the first earthworks season (2017/2018), the project received 202% of the normal summer rainfall; Auckland's second wettest season on the record books (NIWA, 2018). At a time when the project was trying to 'get out of the ground', this wet season significantly slowed progress on gully muck outs, drainage improvements, and culvert works, putting us on the backfoot for bulk cut to fill earthworks during this first season.

Gully muckout in central South

SRP in bottom of Gully

ADAPTING TO THE CHALLENGES

Challenging geological formations present daily obstacles for the Pūhoi to Warkworth Project team with the diverse landscape keeping us our toes.

The complex geology has resulted in extensive ground improvements and stabilisation mechanisms, resulting in over 2 million cubic metres of additional dirt to move on top of the original the 7.5 million scope.

Not only does this create many technical and constructability issues, it also presents significant environmental challenges.

Designing and building erosion and sediment controls in a diverse landscape has presented unique challenges. The steep hill country often required controls at the bottom of steep gullies in highly erodible and unstable ground conditions with difficult access. In some instances, floc dosing hoses run for over 50m to enable a safe accessible location to refill chemical treatment.

In the flat country ground conditions were often not sufficient to support ESC devices so alternative solutions such as dewatering tanks are required.

ADAPTIVE MONITORING FRAMEWORK

Despite the geographical and geological challenges, the environment presented, the Project's response to environmental management has quantitively demonstrated that the structural and non-structural ESC practises are exceeding expectations when it comes to the reduction of sediment discharged from site.

While adaptive monitoring is not a new concept, the Project used the approach as a unique opportunity to demonstrate that the earthworks could be managed in this challenging environment and within the regulatory framework.

When it comes to ESC there is no set regulatory discharge standard in place for the Project, rather a monitoring approach that is founded on continuous improvement. Through intensive data collection and analysis, the Project has demonstrated that the sediment yield during construction to date is several orders of magnitude below that which was initially predicted during the consenting phase.

While the wet 2017/2018 season presented a challenge for moving dirt, it did allow for data collection under the Adaptive Monitoring Programme (AMP). This framework enabled the crucial increase in open area limits which ensured the first seasons earthworks backload, and additional earthworks scope, could be completed in the two remaining earthworks seasons.

ADAPTING TO THE CHALLENGES – CASE STUDY: CN8A GULLY LANDSLIDE

THE CHALLENGE

The CN8A gully is in the remote and rugged Central North Section of the project. The area comprises steeply incised gullies and unstable slopes. Many of the gullies within the area have thick alluvial deposits combined with historical slip and landslide material. CN8A gully is one of the largest gullies in the project and conveys the ecologically diverse upper west branch of the Mahurangi River through its base. The gully will hold upon its completion triple barrel culverts (1x 2.5m and 2x 2m diameter) to convey the natural rivers flows with 800,000 m^3 of fill sitting over top with a maximum height of 50 m.

During routine excavation activities at the top of a bluff on the northern face of the CN8A Gully, an earthworks operator noticed what appeared to be localised slumping of the mid excavation face. Calling in the geotechnical team for a closer look it was identified that the activities Profilometer had not just triggered but had actually snapped in two. The hillside was on the move creating an immediate threat to the CN8A workforce and downstream natural environment.

With an extreme weather event forecast in five day's time, and the potential for the uncontrolled migration of 60,000 m^3 of material, it was a race against time. Also, downstream was Watercare's primary potable water intake for the Rodney District and the township of Warkworth.

With an exclusion zone being placed on the lower northern slope and gully floor, a combined team approach was needed to address the short-term risk of a significant environmental incident occurring, while also addressing the potential short- and medium-term health and safety risks associated with the unstable northern slope. To unload the potential slip material using conventional methods could take at least six weeks.

Emergency exploratory test pits were dug and determined that a previously unknown and unforeseen Circular Slip was evident deep down in the hill side face, and a significant perched aquifer had formed in the interbedded alluvial layers. To alleviate these lateral pressures that this aquifer presented, emergency drilling rigs needed to be mobilised fast.

CN8A slip

CASE STUDY CONT: CN8A GULLY LANDSLIDE – RISING TO THE CHALLENGE

The overland Stream Diversion that was in place for the main works would be overwhelmed should the imminent landslide occur. It was critical to install a larger secondary 1050 mm diameter culvert line over a distance of 140 m, in addition to the base 650 mm culvert already in place, AND to provide an overland flow path higher on the southern bank away from the potential slip failure zone.

With the weather forecast deteriorating further the team worked tirelessly throughout the week and managed to complete the required installation of the 140 m length of 1050 mm culvert and the overland flow path at 8:30pm on the Friday night.

Prior to the emergency works Auckland Council and specialist external environmental consultants were brought in to assess the site and existing and proposed controls. Both were kept updated daily throughout. In fact, Auckland Council inspected the CN8A gully mitigation works on Thursday as part of their regular site inspection and were "extremely impressed" with the lengths the team had gone to to prevent a potentially significant environmental incident.

With the immediate risk abated, by Friday afternoon the weather forecast was showing over 200 mm of rain over the next 36 hours, and although the forecasted rainfall over the weekend did not eventuate torrential rain still caused the Mahurangi Stream flows to exceed the original culvert diversion capacity which would have caused significant environmental damage and downstream disruption for the already completed civil and culvert works.

With the completion of these emergency works our risk of a major reputational, safety, and environmental incident, and the potential discharge of large volumes of sediment into the tributary of Mahurangi River was significantly reduced.

Emergency stream diversion installed for incoming weather event

CN8A following slip removal & culvert installation

ACCOMPLISHMENTS

To date the total earthworks cut volume for the project is 7,979,796.56 m^3.

These earthworks volumes would not have been possible to achieve within the consented open area limits. However, through the AMP the project has demonstrated that actual sediment yields are well below what was predicted which has allowed the regulator to grant approval for up to 26 ha over and above the consented open area limits.

Through creating good connections and establishing and fostering a collaborative relationship with the regulator, the project has implemented best practise erosion and sediment controls (as per the Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region - GD05), while being able to adapt the principles of GD05 to the challenging conditions unique to the project site.

The tangible benefits of good environmental practise and continuous improvements include increased productivity which has significant cost implications on a large-scale earthworks project such as this.

PUSHING THE BOUNDARIES OF GD05

GD05 sets the standard for Erosion Sediment Control in the Auckland region based on practical ESC methodologies and technologies that reflect the evolution of industry best practice and technological innovation. Given the dynamic and challenging landscape the Pūhoi to Warkworth motorway is being built in, standard controls were not always going to be practical.

In several instances there was no 'real estate' to build an SRP due to designation restrictions and/or the nature of the landscape, so oversized devices were built. Typically, Sediment Retention Ponds (SRP) are restricted to a 5-ha catchment to limit the length of overland flow paths, reduces maintenance, and limit the size of flocculant treatment devices.

Through careful management, the project has built three SRPs with contributing catchments of over 7ha and these have all consistency performed well during rain events. The lead up to these ponds often consists of hefty upstream sediment controls measures such as dropout pits and check dams, and the use of multiple floc sheds.

To understand the performance of these larges ponds, an automated monitoring system was set up on a 7.5 ha pond in the Pūhoi catchment. The value in setting this system up is to gather data over the duration of a storm event to inform the validity of the manual grab samples and determine pond treatment efficiencies. Additionally, the automated monitoring devices allow for an accurate measurement of sediment load. Based on inflow and outflow sediment loads, the average treatment efficiency from the SRP was 96%, with a median sediment removal efficiency of 98%. This exceeds the typical treatment efficiencies SRPs are designed to achieve.

7.5 ha pond in Pūhoi Catchment

ADAPTIVE MONITORING PROGRAMME

Through the AMP it has been demonstrated that the projects actual sediment yield is significantly below the modelled yield that was predicted during the consenting phase.

HOW IT WORKS

Adaptive monitoring enables a 'plan-do-check-act-learn' approach whereby on-going monitoring and reporting creates a continuous feedback loop which can subsequently assist and improve the environmental measures, monitoring methodology, and general works.

A manual grab sample is taken at the outlet of all SRPs during or immediately after rainfall events which exceed 25 mm/24-hour and/or 15 mm/hour (known as 'trigger events'). These samples are sent to the lab to determine Total Suspended Solid (TSS) concentrations. The results from these samples, in addition to observations made during trigger event inspections, are used to inform modifications required in relation to erosion and sediment controls. There may be a subsequent action to put in place including alternative measures to manage ESC if existing measures have been unable to achieve their theoretical outcomes. For example, poor water quality may require a change in chemical treatment due to changes in the soil in the catchment as cuts have progressed. An adaptive response would be to undertake a bench test to determine the optimum dose rate for the catchment.

The sediment yield is calculated using the manual grab samples and validated through the data collected from the Projects four automated sampling units which capture the TSS through the full lifecycle of a rainfall event.

CALCULATING A SEDIMENT YIELD

The TSS results are used to calculate the sediment discharged (t) from each control during a trigger event, by establishing the quantity of water discharged from site via a sediment control and multiplying this by the TSS result taken from that control. This result was then divided by the total earthworked area in the catchment of the control. This established the total sediment yield per hectare for each individual trigger rainfall event for each pond. This can be represented as the following:

$$SY_s = \frac{Vol_n \cdot TSS_n}{EA_n}$$

Where:

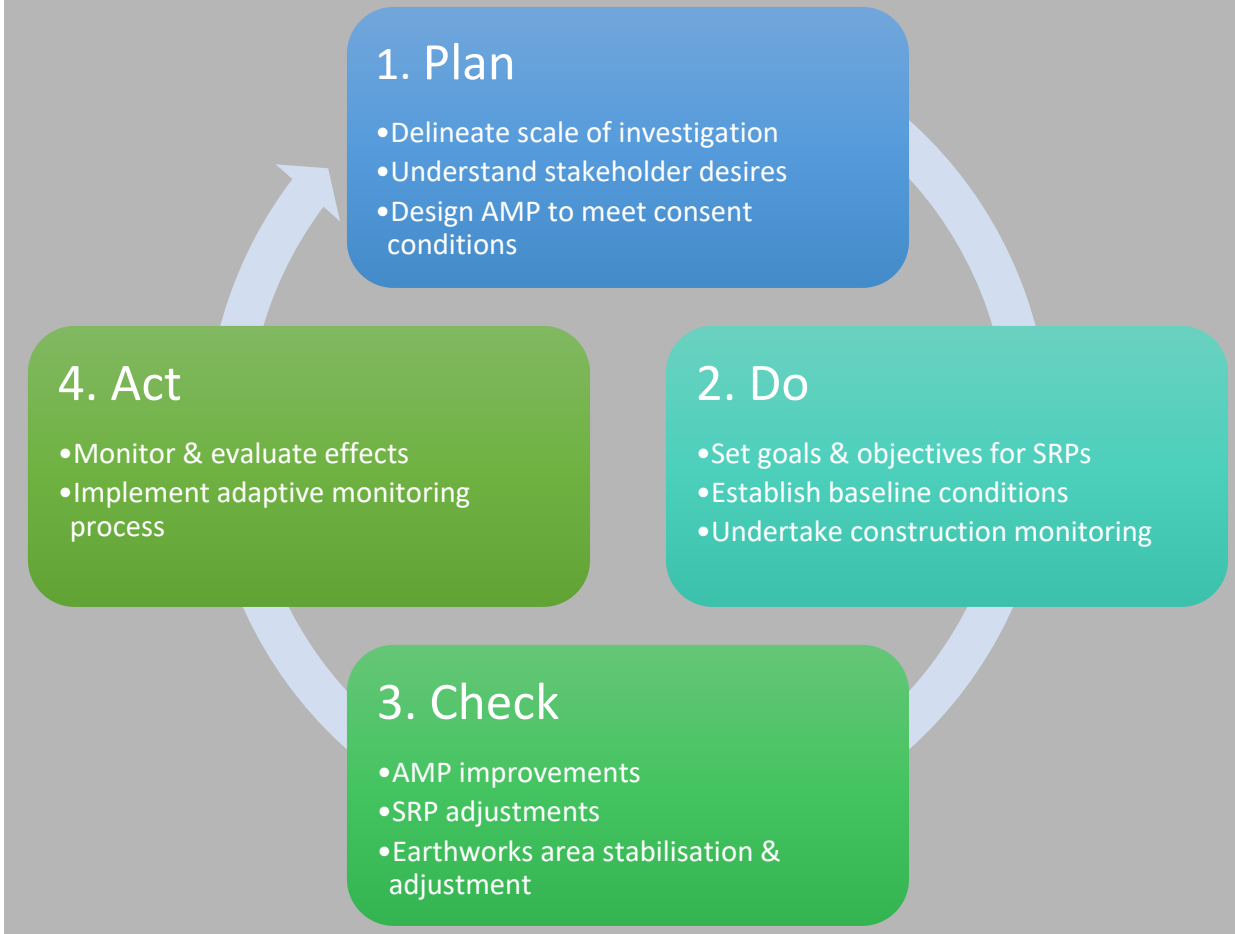
- SY_s is the sediment yield for each storm event for each pond
- Vol_n is the quantity of water that has passed through the sediment control (refer formula below)
- TSS_n is the TSS result measured at the outlet of the sediment control for that event
- EA_n is the earthworked area within the catchment of the monitored control.

$$Vol_n = P_c \cdot (R_n - S)$$

Where:

- P_c is the total catchment contributing water to the pond (including earthworks and stabilised areas).
- R_n is the rainfall depth for the duration of the storm event sourced from the relevant site rain gauge. (Note: the duration of a storm event is defined as the period where the rain gauge measured 0mm of rainfall over a 6hr period through until the rain gauge measured 0mm of rainfall over a 6hr period).
- S is ground soakage – during the summer should it not have rained for 6 days prior to the storm event 12mm of soakage is allowed; 0mm of soakage is allowed for during the winter (source TP227).

Adaptive Monitoring Approach



The environmental team applies the principles of adaptive management to all environmental management processes by integrating any identified changes, detected through monitoring and reporting, into future work processes and control measures to ensure the best practicable approach is taken. A conceptual understanding of the application of adaptive monitoring to this Project is outlined in the diagram.

The adaptive monitoring approach specifically relates to the management of sediment discharges from earthworks to avoid, remedy, and mitigate any adverse effects on the receiving environment. Adaptive Monitoring adds value through the incremental improvements that reduce ESC maintenance costs and improve overall environmental performance.

The Adaptive Monitoring Frameworks has also provided a feedback loop to determine the total amount of open area of earthworks available to the project at any one time, and as a final method of managing effects on the environment. The greater open area increases production and reduces programme risk.

Collecting a water sample following a trigger event

A UNIQUE CHALLENGE – COVID 19

The 2019/2020 earthworks season saw the project excavate over 2.2 million cubic metres of dirt and rock with around 1.4million m^3 of fill placed. At the peak of the season in March 2020 we had 118 ha open across the project (15% extra open area above the consented limit).

Monday 24th March 2020 saw the announcement of the nationwide Level 4 COVID-19 lockdown which gave the project just 48 hours to shut down the site for a minimum of four weeks, at a time that we would typically be finishing earthworks and undertaking landscaping in preparation to closing down the site for the winter period.

Within 48 hours the project came to a complete halt with all hands-on deck to prep the site for any rain that might occur throughout lockdown period. This included installing cut-offs, bunds, and stabilisation of high-risk areas with polymer and hay.

The short lockdown preparation timeframe highlighted the project's proactive environmental management systems which remained in place throughout summer, regardless of the extended fine weather window we were experiencing at the time.

While some essential environmental, safety, and traffic management works continued during the COVID-19 Alert Level 4 shutdown, the majority of the project was completely shut down throughout.

Despite being well prepared for rain during the COVID-19 lockdown period, the transition into Level 3 saw winter arriving with rainy days becoming all too frequent all too quickly. Efforts turned from moving dirt to shutting down 118ha of area as quickly as possible. Pre COVID-19 the plan was to get the majority of the batters landscaped to final design. However, with winter incoming the opportunity to get areas shaped and top soiled was lost within a short space of time. This resulted in much more temporary stabilisation being required than was programmed and planned for and increased pressure to have areas closed out in a timely fashion. As we moved further into autumn the wet weather played havoc with site access for stabilisation plant and equipment further delaying things.

Following a return to work from COVID -19 the Project has closed out 70 ha of open area – an impressive effort from our stabilisation subbie and Project owned hay mulching tractor.

Site inspection during COVID 19 lockdown

Hay & Hydroseed stabilisation of a Tip Site

Hay stabilisation along the alignment

SECTION 5: BENEFITS

ENVIRONMENTAL

To date, the project has not received any infringement notices or fines issued by Auckland Council with respect to consent compliance or environmental issues. Auckland Council currently undertakes fortnightly compliance inspections, with the average compliance score across the project being 1.28, based on a scoring system from 1 - 4, from 2017-2020 inspections. Our Erosion and Sediment Control Compliance Rate (ESCCR) 0.280 – this is the equivalent of TRIFR and is measured against Auckland Council scores / million hours worked.

ESC training sessions are regularly taught by external experts for project employees, ranging from labourers to engineers, as well as regular toolbox discussion on a wide range of topics, including flocculent, spills, pumping, and noise and vibration to name a few.

Annual marine monitoring undertaken throughout the Mahurangi and Pūhoi estuaries has indicated no adverse effects on the downstream marine environment. There have been no links to increased sedimentation or a decrease in species abundance or presence related to project activities.

Mitigation planting plays an important part in the environmental legacy that the project will leave for the Mahurangi and Pūhoi catchments. The removal of indigenous vegetation and subsequent mitigation planting to a 10 (gain) to 1 (loss) ratio is one of the largest of any roading projects in New Zealand's history, and has provided the opportunity for expansive planting to be undertaken across the project. This includes planting along stream lengths that were previously farmland.

Labour crew installing a level spreader in a newly constructed SRP

Installing a decant in a newly constructed SRP

Spill kit training at a weekly Toolbox session

Ecologically significant area – Kauri Eco-Viaduct

Labour crew installing pipe on the Project

Gecko capture and release from the project site

COMMUNITY

The Ara Tūhono – Pūhoi to Warkworth project undertakes a considerable amount of community engagement, this includes a range of events, presentations, and communication such as –

- Project Open Days – Allowing environmental management and ecology to be showcased
- Local Schools Programme – introducing children to environmental science through presentations and interactive activities
- Mentorship of high school students by project team members
- Project Newsletters – showing the local community and stakeholders' achievements, telling good news stories, and letting them know about upcoming works
- Project Information Centre and Pop-up stall at community events
- Presentations – the Project is committed to giving a minimum of 10 presentations per year to inform different groups of Project updates and construction progress.
- Social Media – the Project uses social media to keep the wider community updated on progress and important information relating to the Project

The Project is also working collaboratively, encouraging communication, and building and maintaining effective relationships with the Waka Kotahi NZ Transport Agency's mana whenua treaty partners Hōkai Nuku. As the kaitiaki for the Project Hōkai Nuku seeks the active protection of the environment as well as areas of cultural significance.

Environmental management is not often considered by the public so through these showcases we are able to highlight what goes on behind the scenes to maintain a healthy environment and manager the actual and potential environmental effects of the motorway's construction.

SHARING A HONGI

COMMUNITY EVENTS & PROJECT OPEN DAYS

DEMONSTRATING HOW FLOCCULANT WORKS

SHOWING HOW A FLOC SHED WORKS

SHOW & TELL WITH THE LOCAL SCHOOLS PROGRAMME

INDUSTRY

The project presents various learning opportunities for the ESC industry including:

- Playing host to various field trips for those within the industry (IECA, EPN, other earthworks projects – e.g. Transmission Gully, Waikato Expressway, and Auckland Council). These field trips provide an opportunity to see the practicalities of ESC principles and practices on site and understand challenges that are faced by the Project Team.
- Presentations at 2018 IECA conference and 2017 and 2019 Auckland Council ESC Field Day.
- Working with suppliers who can test their products and innovations in one of the largest earthworks projects in the country.

The quantitative and qualitative data that is collected through the AMP can be used to inform practises for future projects and help improve sediment yield predictions and the associated applications. The adaptive monitoring programme has demonstrated that a numerical TSS limit is not required to achieve good environmental outcomes.

Hosting a field trip

Auckland Council ESC Field Days

ORGANISATION

Balancing environmental management with production can be difficult. However, through the adaptive monitoring programme we have been able to demonstrate that with good environmental compliance comes increased productivity.

This required a collaborative approach with the Construction Team as well as the regulator to be able to adapt to the challenges presented on regular basis.

Increasing the consented open area limit has enabled the Project to front load and extend the earthworks season thereby de-risking the pavements programme and Project completion timeframes. Taking a big picture approach to environmental compliance and upskilling staff through external training in the early days of the project has allowed the construction team to focus on production, while maintaining environmental compliance along the journey.

The PPP model has enabled the partnership of two companies that otherwise may not have banded together. Acciona is a Spanish construction company, who have partnered with Fletcher Construction to take on their first project within New Zealand – Ara Tūhono Pūhoi to Warkworth. The PPP partnership has presented a few new challenges to overcome, including differences in environmental standards. And let's not forget that Spain has a mainly consistent climate with very clear wet and dry seasons, the opposite is true for New Zealand.

Pavement preparation underway

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