

INSPECTION & TEST PLAN

Inspection and Test Plan and Number		OP06_f01 Inspection & Test Plan Workbook			
Project Name		Kiwirail – North Auckland Line Recovery ch - CH 134.75		Version:	1
Date:		19/02/2024		Approved in RFI#:	TBC
Documents / Specifications Referenced:		T+T North Auckland Line Remediation Works			

ITP#	Work Pack Element(s)	Drawing / Specification Ref.	Specification Detail Summary	Acceptance Criteria	Test Spec & Frequency	Control Type i.e. Checksheet / Records	Hold / Witness	External (Requested by PS4) // Internal (JFC Requirement)	PS3 Owner	Hold / Review / Witness	PS4 Owner Sign Off
1.01	Check IFC Drawings	Kiwirail – North Auckland Line Recovery 136km Construction Issue (Rev A)	Ensure latest revision is being used	Correct drawings	Prior to works, updated accordingly based on formal correspondence	Controlled IFC drawings being used – Checkpoint on QA	HOLD	Internal	JFC	REVIEW	T&T
2.0 BULK EARTHWORKS											
2.01	Source Selection Criteria - Ballast	T+T NAL Recovery Specifications: 2.3.1; Table 2.1	Ballast shall comply with the requirements of KiwiRail C-ST-FO-4110 Formation, v.1 March 2019. If existing ballast material is proposed by the contractor to be stripped and re-used in construction, the ballast stockpile shall be inspected and approved by the Engineer prior to reinstatement.	Ballast material shall meet the requirements stated in document T-SP-MM-60140 Supply of Crushed and Screened Stone Ballast	Spec and frequency must comply with Kiwirail C-ST-FO-4110	Aggregate Test Report	HOLD	External	JFC	REVIEW	T&T
2.02	Source Selection Criteria - Sub-ballast (GAP40)	T+T NAL Recovery Specifications: 2.3.2; Table 2.1	The GAP40 shall comply with the NZTA M/4 specification for basecourse aggregate. Fill materials shall be sourced from areas of cut or from alternative sources. If the Contractor wishes to propose materials from alternative sources then they shall provide details of such sources for the Engineer's approval	Allowable Particle Size: < 40 mm • (1*) Percentage Fines (0.07mm): <7% • (2*) Weathering Quality Index: The aggregate shall have a quality index > or = to CA • (3*) Crushing Resistance Test: <10% fines passing 2.36 mm sieve under test load of 130 kN • (4*) Broken Face Content: 50% for >37.5 mm fraction and 19 mm – 37.5 mm fraction	Min. 2 tests per source 1* = Testing method NZS 4402:1986 Test 2.8.1 2* = Testing method NZS 4407:2015 Test 3.11 3* = Testing method NZS 4407:2015 Test 3.10 4* = Testing method NZS 4407:2015 Test 3.14	Aggregate Test Report	HOLD	External	JFC	REVIEW	T&T
2.03	Source Selection Criteria - Structural Fill/Hardfill GAP65	T+T NAL Recovery Specifications: 2.3.5; Table 2.1	Defines a well graded aggregate, with slightly weathered to unweathered fragments of rock up to maximum 65 mm characteristic dimension and which is relatively free of fines and other mineral matter such that when compacted the rock fragments can achieve point-to-point contact. Fill materials shall be sourced from areas of cut or from alternative sources. If the Contractor wishes to propose materials from alternative sources then they shall provide details of such sources for the Engineer's approval	• Allowable Particle Size: < 65 mm • (1*) Percentage Fines (0.07mm): <7% • (2*) Weathering Quality Index: The aggregate shall have a quality index > or = to CA • (3*) Crushing Resistance Test: <10% fines passing 2.36 mm sieve under test load of 130 kN • (4*) Broken Face Content: 50% for >37.5 mm fraction and 19 mm – 37.5 mm fraction	Min. 2 tests per source 1* = Testing method NZS 4402:1986 Test 2.8.1 2* = Testing method NZS 4407:2015 Test 3.11 3* = Testing method NZS 4407:2015 Test 3.10 4* = Testing method NZS 4407:2015 Test 3.14	Aggregate Test Report	HOLD	External	JFC	REVIEW	T&T



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2.04	Source Selection Criteria - Rockfill	T+T NAL Recovery Specifications: 2.3.6; Table 2.1	<p>Defines a well graded aggregate with slightly weathered to unweathered fragments of rock up to maximum 300 mm characteristic dimension and which is relatively free of fines and other mineral matter such that when compacted the rock fragments can achieve point-to-point contact.</p> <p>Fill materials shall be sourced from areas of cut or from alternative sources. If the Contractor wishes to propose materials from alternative sources then they shall provide details of such sources for the Engineer's approval</p>	<ul style="list-style-type: none"> Allowable Particle Size: < or = 300mm (1*) Percentage Fines: nil (2*) Weathering Quality Index: The aggregate shall have a quality index > or = to CA (3*) Crushing Resistance Test: <10% fines passing 2.36 mm sieve under test load of 130 kN (4*) Broken Face Content: nil 	<p>Min. 2 tests per source</p> <p>2* = Testing method NZS 4407:2015 Test 3.11 3* = Testing method NZS 4407:2015 Test 3.10</p>	Aggregate Test Report	HOLD	External	JFC	REVIEW	T&T
2.05	Earthworks Tolerances	T+T NAL Recovery Specifications: 2.4.9	All earthworks shall adhere to the lines, levels and grades shown on drawings or Engineer's instruction. Accuracy of surfaces under metal courses or concrete structures must preserve min. thicknesses of overlying layers.	<p>Tolerances shall otherwise be as follows:</p> <ul style="list-style-type: none"> Subgrade surfaces 0mm to - 30mm Batters 0mm to +100mm Rockfill surfaces ±200mm Other surfaces 0mm to + 75mm 	For every section of earthworks completed	Photos, QA Checksheet(s)	HOLD	External	JFC	REVIEW	T&T
2.06	Inspection of stripped surface	T+T NAL Recovery Specifications: 2.4.10	<ul style="list-style-type: none"> The Engineer must be notified before any cut or fill begins. The Engineer will inspect the stripped surface and decide if additional excavation, undercutting, backfilling, or other works such as drainage are needed. No cut or fill can proceed in the area until the Engineer approves the commencement after necessary inspections and approvals have been completed. 	The Engineer inspects and approves the stripped surface and any required works. No cut or fill is allowed until the Engineer gives approval.	<ul style="list-style-type: none"> Inspect prior to any cut or fill begins Re-inspect after cut (prior to fill) 	Written confirmation of Engineers approval	HOLD	External	JFC	HOLD	T&T
2.07	Standards and Testing - General	T+T NAL Recovery Specifications: 2.9	<p>General Testing – The locations and levels of all in-situ tests shall be recorded within 0.2m horizontally and 0.1m vertically</p> <p>All testing, both in-situ and laboratory, is to be carried out using an IANZ accredited testing organisation. Full details of the proposed testing organisation(s) shall be submitted to the Engineer for their approval.</p>	<p>General Testing – The locations and levels of all in-situ tests shall be recorded within 0.2m horizontally and 0.1m vertically</p> <p>All testing, both in-situ and laboratory, is to be carried out using an IANZ accredited testing organisation. Full details of the proposed testing organisation(s) shall be submitted to the Engineer for their approval.</p>	For all compaction testing completed	Written confirmation of Engineers approval of the proposed testing organization	HOLD	External	JFC	REVIEW	T&T
2.08	General Undercutting (Outside the track formation area)	T+T NAL Recovery Specifications: 2.5.6	<p>The requirements for general undercutting outside the track formation area, i.e. within gullies, for the fill foundations and below areas of cut</p> <p>All organic materials, other unsuitables, materials with an undrained shear strength of less than 75 kPa or less than 3 blows per 100 mm using a Scala penetrometer to 1.5 m depth, or otherwise shown on the drawings, or instructed by the Engineer, shall be undercut.</p>	<ul style="list-style-type: none"> Shear Vane: Target Criteria: No individual reading less than 75 kPa Or Scala Penetrometer: Target Criteria: 3 blows/100mm to a depth of 1.5m 	<p>Shear vane and/or Scala testing</p> <p>Frequency not specified - Engineer to confirm</p>	Photos, QA Checksheet(s), Written instruction by the Engineer	HOLD	External	JFC	HOLD	T&T

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			The depth of the undercut in materials will be specified by the Engineer when the material at the subgrade level has been exposed and evaluated.								
2.09	Formation Undercutting	T+T NAL Recovery Specifications: 2.5.7	<p>Undercuts are required if the foundation soils do not meet the minimum design requirements.</p> <p>Prior to the placement of any fill the foundation shall be inspected and approved by the Engineer.</p> <p>Two stages to expedite testing and decision making on extents of undercut:</p> <ul style="list-style-type: none"> • 1) Initial testing using the Scala penetrometer probes to a minimum of 1.5 m depth below the base of the foundation. • 2) Further testing to be undertaken after excavation to the depth of the proposed undercut surface (where required) using local test pitting or full excavation of identified soft soil then undertake Scala penetrometer and shear vane testing to confirm strength of founding layers and extent/depth of any remaining softer material and/or depth to competent material. 	<p>Rail Embankments</p> <p>Shear vane – No individual reading less than 80 kPa and average reading >100 kPa.</p> <p>Scala - 3 blows/100mm (for cohesive soils); 5 blows/100mm (for granular soils)</p> <p>Formation for ballast and trackset</p> <p>Scala/Shear vane – equivalent CBR value as set out in C-ST-FO-4110.</p>	<p>Rail Embankments:</p> <ul style="list-style-type: none"> • <u>Shear Vane:</u> 1 test per 5m x 5m grid and minimum of 6 tests. • <u>Scala Penetrometer:</u> 1 test per 5m x 5m grid and minimum of 6 tests. <p>Formation for ballast and track set:</p> <ul style="list-style-type: none"> • <u>Shear Vane / Scala Penetrometer:</u> Three tests every 5m length of track 	QA Checksheet(s), Photos, Written confirmation from the Engineer	HOLD	External	JFC	HOLD	T&T
2.10	Conditioning and Spreading of Fill	T+T NAL Recovery Specifications: 2.7.2	Before fill is placed in any area, the Contractor shall notify the Engineer that the fill foundation has been stripped, drained, including subsoil drains and prepared as required by the drawings and Specification and is ready for the Engineer's inspection and approval.	The fill foundation has been stripped, drained, including subsoil drains and prepared as required by the drawings and Specification.	Engineer to inspect and approve before fill is placed in any area	QA Checksheet(s), Photos, Written confirmation from the Engineer	HOLD	External	JFC	HOLD	T&T
2.11	Pre-Construction Compaction Testing	T+T NAL Recovery Specifications: 2.9.3	Before placing any fill the Contractor shall carry out lab testing on any material to be used for testing to confirm the max dry density and optimum water content of each material type.	Test results shall be provided to the Geotech Engineer to confirm the target dry densities and water contents for each material	Testing shall be undertaken by an IANZ accredited testing organization and undertaken according to the standards outline in Table 2.3	IANZ test results, Written confirmation from the Engineer	HOLD	External	JFC	REVIEW	T&T
2.12	Compaction Requirements – Buttress Fill (cohesive)	T+T NAL Recovery Specifications: 2.9.5, Table 2.4	Fill materials shall be compacted so as to achieve the minimum target criteria. Should any test result fail to meet the min. target criteria the Contractor shall propose remedial measures for the Engineer's approval	<ul style="list-style-type: none"> • <u>Shear Vane:</u> Target Criteria: Average reading over 10 consecutive readings shall not be less than 100 kPa with no individual readings less than 80 kPa. • <u>In-situ Dry Density:</u> Target Criteria: ≥ 95% Maximum Dry Density. • <u>Air Voids:</u> 	<ul style="list-style-type: none"> • <u>Shear Vane:</u> Minimum Test Frequency: 1 set per 250 m3 of fill. • <u>In-situ Dry Density:</u> Minimum Test Frequency: 1 set of NDM test per 250 m2 of fill lift • <u>Air Voids:</u> 	QA Checksheet(s), IANZ test Results	HOLD	External	JFC	WITNESS	T&T

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				Target Criteria: Average reading over 10 consecutive readings shall not exceed 6%, with no single reading exceeding 8%.	Minimum Test Frequency: 1 set of NDM test per 250 m2 of fill lift						
2.13	Compaction Requirements – Sub-ballast (GAP40)	T+T NAL Recovery Specifications: 2.9.5, Table 2.5	Before placing any fill the Contractor shall carry out lab testing on any material to be used for testing to confirm the max dry density and optimum water content of each material type.	<ul style="list-style-type: none"> <u>In-situ Dry Density:</u> Target Criteria: ≥ 98% Maximum Dry Density. <u>Clegg Hammer Test:</u> Target Criteria: Single test minimum clegg impact value ≥ 18. Average CIV ≥ 22 (over 5 consecutive tests) 	<ul style="list-style-type: none"> <u>In-situ Dry Density:</u> Minimum Test Frequency: 1 set of NDM test per 50 m2 of fill lift. <u>Clegg Hammer Test:</u> Minimum Test Frequency: 1 test per 50 m2 of fill lift. 	QA Checksheet(s), IANZ test Results	HOLD	External	JFC	WITNESS	T&T
2.14	Compaction Requirements – Structural Fill / Hardfill (GAP65) / Rockfill	T+T NAL Recovery Specifications: 2.9.5, Table 2.5	Fill materials shall be compacted so as to achieve the minimum target criteria. Should any test result fail to meet the min. target criteria the Contractor shall propose remedial measures for the Engineer's approval	<ul style="list-style-type: none"> <u>In-situ Dry Density:</u> Target Criteria: ≥ 95% Maximum Dry Density. <u>Clegg Hammer Test:</u> Target Criteria: Single test minimum clegg impact value ≥ 18. Average CIV ≥ 22 (over 5 consecutive tests) (equivalent CBR of >15%). 	<ul style="list-style-type: none"> <u>In-situ Dry Density:</u> Minimum Test Frequency: 1 set of NDM test per 50 m2 of fill lift and every 1m lift. Minimum of 3 tests per approach embankment. <u>Clegg Hammer Test:</u> Minimum Test Frequency: 1 test per 50 m2 of fill lift. 	QA Checksheet(s), IANZ test Results	HOLD	External	JFC	WITNESS	T&T
2.15	Grassing	T+T NAL Recovery Specifications: 2.9.12	The Contractor shall submit to the Engineer for approval their proposed seed mixture fertiliser type and respective application rates prior to commencement of the grassing	Engineer to approve the proposed seed mixture fertiliser type and respective application rates	Prior to commencement of grassing	Specification for the seed mixture fertiliser type & application rate, Written confirmation from the Engineer	HOLD	External	JFC	HOLD	T&T
3.0 GEOSYNTHETICS SPECIFICATION											
3.01	Pre-commencement	T+T NAL Recovery Specifications: 3.3.1	Before any geosynthetic installation is commenced, or fill is placed in any area, the Contractor shall advise the Engineer	<p>The Contractor shall be responsible for the correct setting out of the work and shall see that the specified locations, orientations, lengths, depths, spacings, and levels are strictly adhered to.</p> <p>Engineer to confirm requirements</p>	Before any geosynthetic installation is commenced, or fill is placed in any area, the Contractor shall advise the Engineer, with at least one working days' notice	Written confirmation from the Engineer	HOLD	External	JFC	WITNESS	T&T
3.02	Geogrid	T+T NAL Recovery Specifications: 3.4.1	Specific geogrid reinforcement types are shown on the drawings. Alternative, equivalent geogrids may be approved by the Engineer. The alternative geogrids shall have similar performance characteristics equivalent to or better those of the specified materials.	<p>The following information shall be provided to the Engineer to allow approval of the proposed alternative geogrids:</p> <ul style="list-style-type: none"> Roll widths Minimum overlap width between rolls Characteristics initial strength Material reduction factor – creep rupture Creep limited strength based on creep rupture Material reduction factor – installation damage in sand and gravel Material reduction factor – environmental effects at 100 years design life Long term design strengths in sand and gravel (at 100 years design life) Coefficient of interaction for pullout Coefficient of direct sliding 	Engineer to approve prior to use of alternative geogrid	Written Confirmation from the Engineer, Geogrid Spec	HOLD	External	JFC	REVIEW	T&T

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3.03	Separation Geotextile	T+T NAL Recovery Specifications: 3.4.2	Specific separation geotextile types are shown on the drawings. Alternative, equivalent geotextiles may be approved by the Engineer. Separation geotextile shall be non-woven, needle-punched geotextile that have similar performance characteristics equivalent to or better than those of the specified materials and shall meets the requirements of TNZ F/7:2003	Specification for Geotextile Wrapped Aggregate Subsoil Drain Construction as follows: 1) Filtration Class 2, Strength Class B for separation under or within embankments (including drainage blanket applications). 2) Filtration Class 1, Strength Class C for separation behind the reinforced slope facing (e.g. Green Terramesh units or similar). 3) Filtration Class 1, Strength Class D for separation under rockfill in embankments (including drainage blanket applications)	Engineer to approve prior to use of alternative geotextiles	Written Confirmation from the Engineer, Geogrid Spec	HOLD	External	JFC	REVIEW	T&T
3.04	Tolerances	T+T NAL Recovery Specifications: 3.5.5	The front facing of the slope shall be aligned so that the front face varies not more than 100 mm from a 5 m straight edge held horizontally and vertically. Curved slopes shall be constructed with a uniform angular change so that the slope presents an evenly curved surface pleasing to the eye. The maximum horizontal gap between adjacent geogrids at the slope face shall be 10 mm.	Front face varies not more than 100 mm from a 5 m straight edge held horizontally and vertically. The maximum horizontal gap between adjacent geogrids at the slope face shall be 10 mm.	For every section of geosynthetic installed	Photos	HOLD	External	JFC	REVIEW	T&T
3.05	Quality Assurance – information to be supplied	T+T NAL Recovery Specifications: 3.7, Table 3.1	On delivery of geosynthetics, the Contractor is to provide the following information: • Product name • Name and address of producer/supplier • Manufacturer's compliance certificate	The following information to be supplied: <u>Geosynthetics:</u> 1- Product Name 2- Name and Address of producer/supplier 3- Manufacturer's compliance certificate <u>Separation Geotextile:</u> 4- Checklist for directional placement, tensioning, laps, spacing, damage <u>Geogrid:</u> 5- Checklist for directional placement, tensioning, laps, spacing, damage	Min. frequency: 1- Check each lot (1 roll) 2- Check each lot (1 roll) 3- Check each lot (1 roll) 4- 1 checklist per 100m2 of geosynthetic installed 5- 1 checklist per geosynthetic is installed	Dockets, Compliance Certificate	HOLD	External	JFC	REVIEW	T&T
3.06	Quality Assurance – Material Testing	T+T NAL Recovery Specifications: 3.7, Table 3.2	Testing requirements as per Table 3.2 of the Specifications	Geogrid – Tensile strength (Machine Direction) – ISO10319	1 test per batch – min. tensile strength shall be shown on the drawings	Test results	HOLD	External	JFC	REVIEW	T&T
4.0 SUBSOIL DRAINAGE – COUNTERFORT DRAINS											
4.01	Pre-commencement	T+T NAL Recovery Specifications: 4.3	Before any subsoil or bored inclined drain installation is commenced or fill is placed in any area the Contractor shall advise the Engineer.	The Contractor shall be responsible for the correct setting out of the work and shall see that the specified locations, gradients, depths and levels are strictly adhered to.	Engineer to be given at least one working days' notice, so that they may inspect the area and confirm the requirements.	Written confirmation from the Engineer	HOLD	External	JFC	WITNESS	T&T
4.02	Materials – Drainage Pipe	T+T NAL Recovery Specifications: 4.4.1.1	Drainage pipe material as per spec and or drawings or as instructed by the Engineer	Counterfort drainage pipes shall generally be 100 mm diameter. SDR 11 HDPE pipe, or as shown on the drawings or as instructed by the Engineer.	Visual inspection and check pipe matches spec and or drawings prior to installation	Photos, QA Checksheet(s), Material Dockets	HOLD	External	JFC	REVIEW	T&T

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				The pipes shall be slotted as specified on the drawings with the slots carefully formed to 2 mm width (+/- 0.2 mm) and clear of all debris and swarf. The drainpipes shall comply with the relevant specifications referred to in TNZ F/2.															
4.03	Materials – Filter Material and Backfill	T+T NAL Recovery Specifications: 4.4.1.2	The counterfort drain pipe shall be surrounded and immediately overlain by filter materials as defined in TNZ F/2 and Table 4.1	<div>Filter material shall be placed in the trench to the thickness shown on the drawings or as instructed by the Engineer.</div> <div>Table 4.1: Grading of backfill<table><tr><th>Test sieve aperture</th><th>Percentage passing</th></tr><tr><td>53 mm</td><td>100</td></tr><tr><td>13. 2 mm</td><td>10 maximum</td></tr><tr><td>4.75 mm</td><td>0</td></tr></table></div> <div>Backfill material for the remainder of the trench shall be either clean well graded 40/20 or 20/7 material; or filter material as defnied in TNZ F/2 and Table 4.1, or as instructed by the Engineer</div>	Test sieve aperture	Percentage passing	53 mm	100	13. 2 mm	10 maximum	4.75 mm	0	Visual inspection and check materials match spec and or drawings and or Engineers instruction	Photos, QA Checksheet(s), Material Dockets	HOLD	External	JFC	REVIEW	T&T
Test sieve aperture	Percentage passing																		
53 mm	100																		
13. 2 mm	10 maximum																		
4.75 mm	0																		
4.04	Trench Excavation	T+T NAL Recovery Specifications: 4.4.2.2	Trench grade and depth as shown on the drawings or as instructed by the Engineer	<div>Trench widths shall be a minimum of 300 mm increasing to a minimum of 600 mm for trenches greater than 1 m deep.</div> <div>Trenches shall be excavated to depth/grade as shown on drawings or as instructed by the Engineer</div>	For every section of trench excavated	Photos, QA Checksheet(s)	HOLD	External	JFC	WITNESS	T&T								
4.05	Bedding and Installation of Drainage Pipe	T+T NAL Recovery Specifications: 4.4.2.3	Installation of pipe and bedding material as per spec and or drawings	<div>The drainage pipe lengths shall be joined following the manufacturer’s instructions or as approved by the Engineer, with the pipe jointing such as to leave a smooth flush internal surface.</div> <div>Min. 75mm of filter material which completely surrounds the drainage pipe</div>	For every section of pipe installed	Photos, QA Checksheet(s)	HOLD	External	JFC	WITNESS	T&T								
4.06	Backfilling	T+T NAL Recovery Specifications: 4.4.2.4	Contractor to propose, for the Engineers approval, a method of compaction and testing procedures to demonstrate that relative density has been achieved.	<div>The drain pipe installation shall be inspected and approved prior to backfilling.</div> <div>Backfill above the filter material shall be carefully placed in 300mm layers and compacted into a min Relative Density of 70%</div>	<div>Method of compaction and testing to be reviewed by the Engineer</div> <div>Each length of pipe installed to be inspected and approved by the Engineer</div>	Photos, QA Checksheet(s), Compaction methodology	HOLD	External	JFC	HOLD	T&T								
5.0 SUBSOIL DRAINAGE – COLLECTOR DRAIN																			
5.01	Materials – Drainage Pipe	T+T NAL Recovery Specifications: 4.4.1.1	Drainage pipe material as per spec and or drawings or as instructed by the Engineer	Collector drain pipes shall generally be 100 mm diameter SDR 11 HDPE pipe, or as shown on the drawings or as instructed by the Engineer. The pipes shall not be slotted unless shown otherwise on the drawings. The drain pipes and any connectors shall comply with the relevant specifications referred to in TNZ F/2.	Prior to use of material on site	Photos, QA Checksheet(s), Material Dockets	HOLD	External	JFC	REVIEW	T&T								

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5.02	Materials – Filter Material and Backfill	T+T NAL Recovery Specifications: 4.5.1.2	Filter and backfill materials as per spec and or drawings or as instructed by the Engineer.	<p>Collector drain pipe shall be surrounded and immediately overlain by filter materials as defined in TNZ F/2 and Table 4.1</p> <p>Table 4.1: Grading of backfill</p> <table><tr><th>Test sieve aperture</th><th>Percentage passing</th></tr><tr><td>53 mm</td><td>100</td></tr><tr><td>13. 2 mm</td><td>10 maximum</td></tr><tr><td>4.75 mm</td><td>0</td></tr></table> <p>Filter material shall be placed in the trench to the thickness shown on the drawings or as instructed by the Engineer.</p>	Test sieve aperture	Percentage passing	53 mm	100	13. 2 mm	10 maximum	4.75 mm	0	Prior to use of material o site	Photos, QA Checksheet(s), Material Dockets	HOLD	External	JFC	REVIEW	T&T
Test sieve aperture	Percentage passing																		
53 mm	100																		
13. 2 mm	10 maximum																		
4.75 mm	0																		
5.03	Trench Excavation	T+T NAL Recovery Specifications: 4.5.2.2	Trench grade and depth as shown on the drawings or as instructed by the Engineer.	<p>Trench widths shall be a minimum of 300 mm increasing to a minimum of 600 mm for trenches greater than 1 m deep.</p> <p>Trenches shall be excavated to depth/grade as shown on drawings or as instructed by the Engineer</p>	For every section of trench excavated	Photos, QA Checksheet(s)	HOLD	External	JFC	WITNESS	T&T								
5.04	Bedding and Installation of Drainage Pipe	T+T NAL Recovery Specifications: 4.4.2.3	Installation of pipe and bedding material as per spec and or drawings	<p>The drainage pipe lengths shall be joined following the manufacturer’s instructions or as approved by the Engineer, with the pipe jointing such as to leave a smooth flush internal surface. The collector drain pipes shall be joined using “T” junctions to counterfort drain pipes at locations shown on the drawings or as instructed by the Engineer,</p> <p>Min. 75mm of filter material which completely surrounds the collector drain pipe.</p>	For every section of pipe installed	Photos, QA Checksheet(s)	HOLD	External	JFC	WITNESS	T&T								
5.05	Backfilling	T+T NAL Recovery Specifications: 4.4.2.4	Backfilling of each section shall follow on immediately after installing the drain pipe and filter material	<p>The collector drain pipe and connections with counterfort drainpipes shall be inspected and approved prior to backfilling.</p> <p>Backfill above the filter material shall be carefully placed in 300mm layers and lightly compacted into place using an excavator bucket or similar approved.</p>	Each length of pipe and connection(s) installed to be inspected and approved by the Engineer	Photos, QA Checksheet(s), Compaction methodology	HOLD	External	JFC	HOLD	T&T								
6.0 SUBSOIL DRAINAGE - OUTLET STRUCTURES																			
6.01	Materials & Construction	T+T NAL Recovery Specifications: 4.6	Materials used and construction as per drawings or in other sections of this spec.	<p>Materials to be used for the outlet structures shall be as specified on the drawings or in other sections of this Specification.</p> <p>Outlet structure shall be constructed in accordance with the drawings and relevant sections of this Specs.</p>	For every section of outlet structure	Photos, Dockets, QA Checksheet(s)	HOLD	External	JFC	REVIEW	T&T								
7.0 SUBSOIL DRAINAGE - TRACKSIDE DRAINS																			

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7.01	Materials & Construction	T+T NAL Recovery Specifications: 4.7	Materials used and construction as per drawings and in accordance with Kiwirail Standards.	Materials to be used for the trackside drain shall be as specified on the drawings and in accordance with KiwiRail Standards Corridor Drainage C-ST-CD-4102. Trackside drains shall be constructed in accordance with KiwiRail Standards Corridor Drainage C-ST-CD-4102.	For every section of trackside drain	Photos, Dockets, QA Checksheet(s)	HOLD	External	JFC	REVIEW	T&T
8.0 GROUND ANCHORS - BARS											
8.01	Anchor Bars	T+T NAL Recovery Specifications: 5.3.1.1	All anchors bars should be grade 500E as specified in the drawings. Mill certs shall be submitted to the Engineer for each batch.	All anchors bars should be grade 500E as specified in the drawings. Mill certs shall be submitted to the Engineer for each batch of bar showing the ultimate late, the yield, and percentage of elongation at yield load and the modulus of elasticity. Bar shall be hot dip galv with min. coating thickness of 600gm/m2	For each batch of bar	Mill certs, Dockets	HOLD	External	JFC	REVIEW	T&T
8.02	Cement Grout	T+T NAL Recovery Specifications: 5.3.2	Cement used for grouting shall comprise fresh Portland Cement complying with NZS3122 : 1995, water and approved additives. The proportions of cement, water and additives shall conform to NZS 3109 to produce a cement-rich grout having a standard-cured compressive strength of not less than 20 MPa at 7 days and 40 MPa at 28 days when tested in accordance with NZS 3112.	Cement for grouting must have a compressive strength of not less than 20 MPa at 7 days and 40 MPa at 28 days. Sand or other materials shall not be used unless approved by the Engineer.	Compressive testing at 7 and 28 days for each batch of concrete poured	Dockets, QA Checksheet(s), Lab Test Results	HOLD	External	JFC	REVIEW	T&T
8.03	Anchor Fabrication	T+T NAL Recovery Specifications: 5.4.1	Anchors shall be fabricated under controlled (factory) conditions in accordance with the approved method statement including the shop/fabrication drawings), using organisations and persons experienced in that type of work.	The fabricated anchors will be inspected by the Engineer prior to installation. Any anchor which is in any way damaged or fails to meet the specified requirements will be rejected	Inspection by Engineer prior to installation	Written confirmation of Engineer's approval	HOLD	External	JFC	HOLD	T&T
8.04	Drilling Logs	T+T NAL Recovery Specifications: 5.4.2	The Contractor must use suitable equipment and techniques for the site, drillholes must be 150mm in diameter, air drilling unless approved by the Engineer, and polymer drilling fluids should not be used.	Drillholes must be performed according to drawings or Engineer's instructions, within 2° alignment The summary log shall record at least the following: <ul style="list-style-type: none"> • Ground anchor number and type • Date and time of the start and finish of the drilling • Length, diameter and inclination of the hole <ul style="list-style-type: none"> • Method of drilling hole • Ground conditions encountered and ease of drilling • Depth at which rock was encountered <ul style="list-style-type: none"> • Any water encountered • Location and extent of air loss • Problems such as caving that occurred during drilling and any drilling fluid, flushing medium or casing used • Length of casing used 	Drilling logs provided within 1 working day of completion of drilling hole.	Drilling Log	HOLD	External	JFC	REVIEW	T&T

ITP#	Work Pack Element(s)	Drawing / Specification Ref.	Specification Detail Summary	Acceptance Criteria	Test Spec & Frequency	Control Type i.e. Checksheet / Records	Hold / Witness	External (Requested by PS4) // Internal (JFC Requirement)	PS3 Owner	Hold / Review / Witness	PS4 Owner Sign Off
				<ul style="list-style-type: none"> • Date and time of clearing out the hole • Length of bar installed and any as built details which vary from those shown on the Drawings • Date and time of grouting • Nominal and actual volume of grout placed 							
8.05	Installation	T+T NALRecovery Specifications: 5.4.3	Before anchor installation, clean the drillhole with air and wait for approval from the Engineer. Install anchors according to fabricator's recommendations and Contractor's method statement, ensuring fixed length is within the specified anchorage zone. Handle equipment to prevent damage to anchor strands and corrosion protection. Provide centralizers if needed. Keep individual anchor records for installation dates and problems.	Installation of an anchor will not be permitted until the relevant drillhole log has been approved by the Engineer.	Engineer to approve drillhole log prior to install	Written confirmation of Engineer's approval	HOLD	External	JFC	HOLD	T&T
8.06	Grouting	T+T NALRecovery Specifications: 5.4.4	The grouting equipment must produce homogenous grout free of lumps and undispersed cement, with a pumping system featuring valves and calibrated pressure gauges for continuous grout circulation and pumping with an accuracy of +/- 0.1 MPa grout pressure, following the Contractor's approved method statement.	<p>The grouting procedures shall be as per the Contractor's approved method statement and shall conform to the requirements of BS 8081.</p> <p>The Contractor shall keep records of all grouting works. The information provided shall be as listed in the Contractor's method statement but as a minimum shall not be less than specified in BS 8081.</p>	Records provided to the Engineer within 1 working day of completion of each and every any stage of grouting	Grout Records	HOLD	External	JFC	REVIEW	T&T
8.07	Stressing (Lock off)	T+T NALRecovery Specifications: 5.5	After completion of backfilling behind the wall and around the ground anchor, and following the Engineer's written approval, the anchor headworks shall be completed with the anchor plate and nut installed.	The anchor nut shall then be tightened and locked off to 25 kN	Following Engineer's approval	Photos, QA Checksheet(s)	HOLD	External	JFC	REVIEW	T&T
8.08	Ground Anchor Acceptance Test – 83.84km only	T+T NALRecovery Specifications: 5.6.1	One acceptance test is required during construction for the ground anchors at 83.84 km site only. Acceptance tests shall be carried out on anchors forming part of the permanent works as a measure of quality control.	<p>The testing will be in accordance with BS 8081:2015 and ISO 22477-5:2018.</p> <p>Test anchors must be axially loaded, either by cutting the slope perpendicular to the anchor or using a stressing chair. If a ground anchor fails acceptance testing, the Contractor informs the Engineer and conducts additional testing.</p>	The Contractor shall give the Engineer at least 2 working days' notice of testing to be carried out. The Engineer will be present during the testing.	Written confirmation of Engineer's approval, Test Results	HOLD	External	JFC	HOLD	T&T
8.09	Anchor Stressing & Testing	T+T NALRecovery Specifications: 5.6.2	The Contractor shall keep records of all anchor stressing and testing.	The information provided shall be as listed in the Contractor's method statement but as a minimum shall not be less than specified in BS 8081.	The Engineer must receive stressing records and test results for a specific anchor within 5 working days of its completion.	Stress and Test Records	HOLD	External	JFC	REVIEW	T&T
8.10	Acceptance Load Test	T+T NALRecovery Specifications: 5.6.3	The objectives of the acceptance load tests are to take any "slack" out of the installed anchor system and to demonstrate that installed anchors are able to provide at least the design working load capacity.	<p>The creep rate α for acceptance test shall be checked according to Annex A of ISO 22477-5:2018.</p> <p>$\alpha = (sb-sa)/\log(tb/ta) < 2$ mm</p> <p>where: sa is the displacement of the anchor head at the time ta; sb is the displacement of the anchor head</p>	The tests shall be carried out on all the installed anchor and at a location to be agreed by the Engineer on site.	Acceptance Test Results, Written confirmation of Engineer's approval,	HOLD	External	JFC	HOLD	T&T

ITP#	Work Pack Element(s)	Drawing / Specification Ref.	Specification Detail Summary	Acceptance Criteria	Test Spec & Frequency	Control Type i.e. Checksheet / Records	Hold / Witness	External (Requested by PS4) // Internal (JFC Requirement)	PS3 Owner	Hold / Review / Witness	PS4 Owner Sign Off
			Loading Procedure as outlined in Table 5.1 of the Specifications 5.6.3.3	at the time tb; ta is the start of the respective time interval; and tb is the end of the respective time interval. The ground anchor with creep rates exceeding the above criteria will be deemed to have failed.	Acceptance ground anchor tests shall be undertaken prior to placement of the timber lagging						
9.0 GROUND ANCHORS – TIE-BACK											
9.01	Anchor Bars	T+T NAL Recovery Specifications: 6.3.1.1	All anchors bars should be grade 500, complying to the requirements of BS 8081 and BS 5986. Mill certs shall be submitted to the Engineer for each batch.	Mill certs shall be submitted to the Engineer for each batch of bar showing the ultimate tensile, the yield, and percentage of elongation at yield load and the modulus of elasticity. Bar shall be hot dip galv with min. coating thickness of 600gm/m2	For each batch of bar	Mill certs, Dockets	HOLD	External	JFC	REVIEW	T&T
9.02	Cement Grout	T+T NAL Recovery Specifications: 5.3.2	Cement used for grouting shall comprise fresh Portland Cement complying with NZS3122 : 1995, water and approved additives. The proportions of cement, water and additives shall conform to NZS 3109 to produce a cement-rich grout having a standard-cured compressive strength of not less than 20 MPa at 7 days and 35 MPa at 28 days when tested in accordance with NZS 3112.	Cement for grouting must have a compressive strength of not less than 20 MPa at 7 days and 30 MPa at 28 days. Sand or other materials shall not be used unless approved by the Engineer. Water cement ratio shall not be less than 0.4	Compressive testing at 7 and 28 days for each batch of concrete poured	Dockets, Lab Test Results	HOLD	External	JFC	REVIEW	T&T
9.03	Deadman Anchor Blocks	T+T NAL Recovery Specifications: 6.4.1	Deadman anchor block excavation should follow the drawings' levels and dimensions, with appropriate plant used to avoid disturbance. Temporary support or battering of excavation sides is approved by the Engineer. Reinforcing steel should be placed, and the sides and base cleaned of loose or softened material. The completed excavation and reinforcing steel must be inspected and approved before placing concrete, and the backfill must comply with the Specification and drawings.	Excavation and reinforcing steel comply with the drawings. Engineer to inspect and approve before placing concrete	Pre-pour inspection prior to concrete pour	Written Confirmation of Engineer's Approval, Phoros, QA Checksheet(s)	HOLD	External	JFC	HOLD	T&T
9.04	Tie-back Anchor Fabrication	T+T NAL Recovery Specifications: 6.4.2	Anchors shall be fabricated under controlled (factory) conditions in accordance with the approved method statement including the shop/fabrication drawings), using organisations and persons experienced in that type of work.	The fabricated anchors will be inspected by the Engineer prior to installation. Any anchor which is in any way damaged or fails to meet the specified requirements will be rejected	Inspection by Engineer prior to installation	Written confirmation of Engineer's approval	HOLD	External	JFC	HOLD	T&T
9.05	Tie-back Anchor Installation	T+T NAL Recovery Specifications: 6.4.3	The installation of a tie-back anchor bar must follow the drawings or the Engineer's instructions, with the contractor marking the alignment for approval. The trench must be excavated to the required depths and minimize damage. The bar, wrapped in Densotape and uPVC duct, should be connected to the deadman anchor and anchor headworks. The contractor must maintain records of the installation date and any issues encountered.	Installation of a tie-back anchor bar must follow the drawings or the Engineer's instructions. Engineer to approve alignment	Inspection by Engineer prior to installation	Written confirmation of Engineer's approval	HOLD	External	JFC	HOLD	T&T

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9.06	Deadman ground beam and anchor bar backfill	T+T NAL Recovery Specifications: 6.4.3	After the deadman ground beam reaches its design strength, the excavation around it and the tie-back anchor bar trench must be backfilled with approved material, following the Engineer's approval. This backfilling must be carried out in a controlled manner, ensuring the deadman and tie-back anchor bar are not disturbed or damaged.	Approved backfill material to be used. Backfilling to be carried out to the Engineer's approval	Engineers approval Prior to backfill	Written confirmation of Engineer's methodology and approval	HOLD	External	JFC	HOLD	T&T
9.07	Stressing (Lock off)	T+T NAL Recovery Specifications: 6.5.1	After completion of backfilling behind the wall and around the ground anchor, and following the Engineer's written approval, the anchor headworks shall be completed with the anchor plate and nut installed.	The anchor nut shall then be tightened and locked off to 25 kN	Following Engineer's approval	Photos, QA Checksheet(s)	HOLD	External	JFC	REVIEW	T&T
10.0 PILE SPECIFICATIONS											
10.01	Preliminary, Site Datum, and Grid References	T+T NAL Recovery Specifications: 7.1.1 & 7.1.2	The Auckland Structural Group's Piling Specification Rev G, dated 12 March 2002, is used for piling construction, with project-specific requirements modifying it. Drawings show levels in NZVD2016 Vertical Datum.	The Auckland Structural Group (ASG) Piling Specification Rev G, dated 12 March 2002, is to be used for piling construction, with project-specific requirements modifying it. All levels shown on the Drawings are in terms of NZVD2016 Vertical Datum. Pile locations are shown on the Drawings.	Prior to construction of piles		HOLD	External	JFC	REVIEW	T&T
10.02	Method Statement	T+T NAL Recovery Specifications: 7.1.4	The method statement shall describe all proposed equipment, and detail the construction sequence including but not limited to: <ul style="list-style-type: none"> • Programme of the works, detailing the timing and sequence of individual portions of the works; • Full details of the installation plant to be used, including manufacturer's information and proof of servicing/recent upkeep; • Full details of proposed plant set-up and loading throughout the works to inform on the local stability during the construction; • Proposed phasing of excavation/filling operations such that the design stresses in the piles (and any supporting frames) are not exceeded; • (Driven piles) Pile driving methodology and equipment for driving piles; • A contingency plan to be adopted in the event of encountering obstructions, to minimise disruption and delay; and, • Example Pile Construction Card. 	Acceptance of Method Statement by the Engineer	At least two weeks prior to construction of piles	Method Statement	HOLD	External	JFC	HOLD	T&T
10.03	Tolerances	T+T NAL Recovery Specifications: 7.1.5	Tolerances specified shall apply for the construction of the piles unless otherwise specified on the drawings or agreed with the Engineer	The following tolerances shall apply, unless otherwise: <ul style="list-style-type: none"> • Position of pile head (at underside of cap) shall not vary more than -25/+ 75 mm horizontally (- towards rail / + away from rail) and +/- 25 mm vertically from the true position as specified on the drawings. • The maximum permitted deviation of the piles from the vertical, at any depth, 	Tolerances to be inspected during construction of each pile	QA Checksheet(s), Photos	HOLD	External	JFC	REVIEW	T&T

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				shall not be greater than 1H:75V deviation from the vertical.							
10.04	Inspections	T+T NALRecovery Specifications: 7.1.7	The Engineer is required to have the opportunity to observe all phases of piling operations and inspect specific items, including driving piles and required testing. They must have access to all parts of the works included in the contract and be given at least three working days' notice when work is ready for inspection or testing. The Contractor must arrange inspection facilities and replace or rectify defective or unsuitable parts or materials at their expense, as per the Principal's contract documents.	Engineer must be given opportunity to observe all phases of the piling operation. The Engineer shall have at all reasonable times access to all parts of the works included in the Contract.	Engineer given at least 3 working days' notice of when work is ready for inspection or testing	QA Checksheet(s), Written Confirmation of Engineers Approval	HOLD	External	JFC	WITNESS	T&T
10.05	Producer Statements	T+T NALRecovery Specifications: 7.1.9	Producer Statement – Construction (PS3) are required for each structure for the construction of the piles, with relevant construction records.	PS3 submission for each structure of the construction of the piles with relevant records	Post construction	Producer Statement (PS3)	HOLD	External	JFC	REVIEW	T&T
10.06	Pile Embedment	T+T NALRecovery Specifications: 7.2.4	Set cards (showing sets and rebound) shall be inspected by the Engineer and embedment depth agreed upon.	Sets and embedment agreed with the Engineer	Agreed with Engineer prior to driving pile	Written Confirmation of Engineers Approval	HOLD	External	JFC	HOLD	T&T
10.07	Piling Records	T+T NALRecovery Specifications: 7.2.6	<p>The piling record must be submitted on professionally formatted, clearly typed documents and only accepted after verification by the Engineer or the nominated site representative:</p> <ul style="list-style-type: none"> • The date and time of installation. • Sequence of driving (if driving in groups) • The level of the bed at the commencement of operations. <ul style="list-style-type: none"> • The pile number or location. • The type and size of the piling hammer. • The type and condition of the piling helmet and packing. • Details of any variations in the penetration resistance. <ul style="list-style-type: none"> • Any apparent deviation from specified location and inclination • The length of the complete pitched pile. • The toe level of the pile before and after driving. <ul style="list-style-type: none"> • The distance driven. • The distance drilled. • The level of the top of the rock. • The set at 0.5 m intervals over the last 3 m of driving. • The final set and rebound (averaged over the last 10 blows). • Details of any interruption to driving 	Review cards by the Engineer	Records provided to the Engineer within 24 hours of pile completion	Piling Records	HOLD	External	JFC	REVIEW	T&T
11.0 STRUCTURAL SPECIFICATION – CONCRETE WORKS											
11.01	Aggregates	T+T NALRecovery Specifications: 9.1.3.2	The Contractor shall provide the Engineer with details of the types and source of supply of the aggregates	<p>Fine and coarse aggregates shall comply with the requirements of NZS 3121 and NZS 3111. The maximum size of coarse aggregate shall be 19 mm.</p> <p>Proposed aggregates are non-reactive as defined in clause 6.1 of the CCANZ</p>	At least two weeks before work is to commence.	Mix Design (Aggregate source)	HOLD	External	JFC	HOLD	T&T

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				report no. TR3, Alkali Silica Reaction: Minimising the Risk of Damage to Concrete : Guidance Notes and Recommended Practice (2 no. edn) 2003. Once approval has been obtained for the aggregates to be used, neither the quality nor source shall vary without the prior approval of the Engineer.							
11.02	Reinforcing Steel	T+T NALRecovery Specifications: 9.1.3.8	Reinforcing bars to comply with specifications	Reinforcing bars shall be higher ductility plain carbon steel grade 300E or 500E as shown on the drawings, and shall comply with AS/NZS 4671 Grade 250N or grade 500N reinforcement is permitted where specifically indicated on the drawings. Grade 250L or 500L is not permitted.	For every reinforcing bar(s) used	Dockets	HOLD	External	JFC	REVIEW	T&T
11.03	Concrete Mix Design (from a non approved ready mix concrete producer)	T+T NALRecovery Specifications: 9.1.4.1	The Contractor shall supply to the Engineer details of the concrete mix design for approval. These shall include the following: a weights of aggregates and water b cement weight c water/cement ratio by weight d target slump e target compressive strength f admixtures g concrete grade h mix designation	Engineer to approve mix design prior to commencement of concrete works	At least two weeks notice	Mix Design	HOLD	External	JFC	HOLD	T&T
11.04	Concrete Mix Design (from an audited NZRMCA plant)	T+T NALRecovery Specifications: 9.1.4.2	The Contractor shall advise the Engineer of the mix details, concrete supplier and provide all supporting documentation if requested to do so to confirm the audit status of the ready mix plant.	Engineer to review and approve mix design if requested to do so	Upon request of the Engineer	Mix Design	HOLD	External	JFC	WITNESS	T&T
11.05	Delivery Records	T+T NALRecovery Specifications: 9.1.4.2	Records shall be kept at the batching plant for each batch incl the following: i Batch number and docket number which can be referred back to the batch plant ii Specified slump iii Mix designation (minimum strength, aggregate size and admixtures) iv Specified strength v Date and time of mixing vi Quantity delivered vii Actual weight and type of cement, fine and coarse aggregate, weight of free water and hence the free water / cement ratio.	Records must meet the approved Mix Design	Records for each batch of concrete ordered	Concrete Dockets	HOLD	External	JFC	REVIEW	T&T
11.06	Testing – Slump Test	T+T NALRecovery Specifications: 9.1.6.2	The results of slump tests taken on samples of concrete supervised by the Engineer at the point of delivery shall be the only basis for defining the slump of the mixes supplied.	Tolerances for slump shall be in accordance with Table 9.1 (Snippet below).	At least one slump test on each batch of concrete	In-situ Slump Test Results	HOLD	External	JFC	REVIEW	T&T

ITP#	Work Pack Element(s)	Drawing / Specification Ref.	Specification Detail Summary	Acceptance Criteria		Test Spec & Frequency		Control Type i.e. Checksheet / Records	Hold / Witness	External (Requested by PS4) // Internal (JFC Requirement)	PS3 Owner	Hold / Review / Witness	PS4 Owner Sign Off																					
<div>Table 9.1: Concrete mixes</div> <table><thead><tr><th>Grade designation</th><th>Maximum aggregate size (mm)</th><th>Specified compressive strength (MPa)</th><th>Method of placement</th><th>Specified slump (mm)</th><th>General location</th><th>Additional data</th></tr></thead><tbody><tr><td>30 (normal mix)</td><td>19</td><td>30</td><td>NBC</td><td>100</td><td>Deadman anchor</td><td>++ Max shrinkage 750 microstrains at 56 days</td></tr><tr><td>17.5 (normal mix)</td><td>19</td><td>17.5</td><td>Gravity</td><td>100</td><td>Site concrete</td><td>Mix approval not required</td></tr></tbody></table>														Grade designation	Maximum aggregate size (mm)	Specified compressive strength (MPa)	Method of placement	Specified slump (mm)	General location	Additional data	30 (normal mix)	19	30	NBC	100	Deadman anchor	++ Max shrinkage 750 microstrains at 56 days	17.5 (normal mix)	19	17.5	Gravity	100	Site concrete	Mix approval not required
Grade designation	Maximum aggregate size (mm)	Specified compressive strength (MPa)	Method of placement	Specified slump (mm)	General location	Additional data																												
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17.5 (normal mix)	19	17.5	Gravity	100	Site concrete	Mix approval not required																												
11.07	Testing – Compressive Strength Test	T+T NALRecovery Specifications: 9.1.6.2	Compressive testing to be undertaken	Three specimens tested at 28 days and another at 7 days (if required). Test results must comply with the parameters set on the approved mix design		Three compressive strength specimens shall be moulded for each 75m3 of concrete placed.		Compressive Strength Lab Test Results	HOLD	External	JFC	REVIEW	T&T																					
11.08	Testing – air entrainment	T+T NALRecovery Specifications: 9.1.6.5	Air entrainment tests shall be carried out in accordance with NZS 3104 clause 2.15.3.1 and percentage of air entrained determined in accordance with NZS 3112 Part 1	. Air entrainment values for the work shall be between 3% and 6% for concrete with nominal aggregate size greater than 20 mm, and 4 to 8% for 10 to 20 mm nominal aggregate size.		At least one test on each batch of concrete		Lab Test Results	HOLD	External	JFC	REVIEW	T&T																					
11.09	Testing - Reinforcement	T+T NALRecovery Specifications: 9.1.6.5	The contractor is required to provide a steel manufacturer's test certificate for each reinforcement material grade supplied. Independent testing shall also be carried out by the Contractor: One tensile and two bend tests shall be carried out on a random sample of every bar size, type and grade, for every 250 tonnes batch of reinforcing steel delivered to the site, with a minimum of one series of tests for each bars size, type and grade. The tests shall be carried out in accordance with AS/NZS 4671, by an independent TELARC registered testing laboratory and the samples shall be selected by the Engineer.	Reinforcing steel shall be deemed acceptable if it complies fully with the requirements of AS/NZS 4671		Prior to use of reinforcement		Test certificates, Tensile and Bend Tests Results	HOLD	External	JFC	HOLD	T&T																					
11.10	Concrete Placing	T+T NALRecovery Specifications: 9.1.7.4	Engineer or rep to be advised before any concrete is placed to inspect the formwork and reinforcement	Engineer or rep to approve pre-pour inspection		At least 48 hours before concrete placement		QA Checksheet(s), Written Confirmation of Engineer's/Rep Approval	HOLD	External	JFC	HOLD	T&T																					
11.11	Curing Compounds	T+T NALRecovery Specifications: 9.1.7.8.4	Curing compound details shall be approved in writing by the Engineer, such details shall be accompanied by test certificates to show that the compound will give satisfactory results for the proposed application	The compound shall be applied in strict accordance with the Manufacturer's Specification and shall be applied as soon as the surface water has disappeared		At least 6 days prior to use of curing compound		Curing Compound Spec Sheet, Confirmation of Engineer's/Rep Approval	HOLD	External	JFC	HOLD	T&T																					
11.12	Cast-in items	T+T NALRecovery Specifications: 9.1.8.1	Holding down bolts and inserts shall be secured and fixed before the concrete is placed or, if shown on the drawings or if directed by the Engineer, recesses or blockouts shall be made in the concrete and the holding down bolts or inserts shall be grouted in place, or embedded in the second-stage concrete	The position tolerance on cast-in items shall be as follows: • bolts and inserts +/- 10 mm All cast-in items shall meet the durability requirements of the New Zealand Building Code.		Visual check prior to concrete placement		Photos, QA Checksheet(s)	HOLD	External	JFC	REVIEW	T&T																					

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11.13	Construction Joint	T+T NALRecovery Specifications: 9.1.9.1	Construction joints shall be formed in the position shown on the drawings unless a change is approved by the Engineer	Construction joints shall be formed in the position shown on the drawings unless a change is approved by the Engineer	Contractor to confirm joint locations with Engineer prior to concrete pour	Photos, QA Checksheet(s)	HOLD	External	JFC	HOLD	T&T
11.14	Sealants	T+T NALRecovery Specifications: 9.1.9.3	Joints show on the drawings shall be sealed, with works undertaken in accordance with manufacturer's instructions and by an experienced applicator. Contractor shall submit details of the proposed sealant and applicator to the approval of the Engineer	Engineer to approve proposed sealant and applicator	Prior to sealant works	Joint material spec, Applicator's credentials, Confirmation of Engineer's Approval	HOLD	External	JFC	HOLD	T&T
11.15	Tolerances and Surface Finishes	T+T NALRecovery Specifications: 9.1.10	All concrete work shall be set out and constructed to achieve the structural tolerances specified in The Specs & drawings.	Surface finish as follows: Below Ground (surfaces not seen) Finish: F1 U1 Surfaces in contact with water Finish: F5 U4 All channels Finish: F4 U3	For every concrete pour	Photos, QA Checksheet(s)	HOLD	External	JFC	REVIEW	T&T
11.16	Concrete Repair	T+T NALRecovery Specifications: 9.1.11	Contractor shall advise the Engineer of the presence of any defective concrete	Repair of imperfections to be completed within 7 days of removal of forms. Engineer to approve repair methods and materials used	For concrete works that require repair	Material Specs, Repair Methodology, Written Confirmation of Engineer's Approval	HOLD	External	JFC	HOLD	T&T
11.17	Slab on Grade	T+T NALRecovery Specifications: 9.1.12	The Contractor must adhere to minimum requirements before placing concrete ground slabs, compact the subgrade using a footpath roller or plate compactor, obtain Engineer's approval before hardfill is placed, and remove soft spots as directed.	Engineer to inspect and approve subgrade before hardfill is placed	Before placing concrete ground slabs	Written Confirmation of Engineer's Approval	HOLD	External	JFC	HOLD	T&T
11.18	Shop Drawings	T+T NALRecovery Specifications: 9.1.14	The Contractor is required to create shop drawings for precast units and concrete metal work, which must be submitted to the Engineer for approval before commencing operations. The Contractor is responsible for the accuracy of these drawings, ensuring competent tradesmen can fabricate structures to the dimensions and standards specified in the specifications.	Shop drawings reviewed and approved by Engineer	Prior to fabrication or pre-cast units and metal work cast into concrete	Shop Drawings, Written Confirmation of Engineer's Approval	HOLD	External	JFC	HOLD	T&T
12.0 STRUCTURAL SPECIFICATION – STRUCTURAL STEELWORK & METALWORK											
12.01	Origin of Steel	T+T NALRecovery Specifications: 9.2.5	The Contractor shall submit steel source steel list as described in the SCNZ Report to the Design Engineer for review.	Evidence of conformity meeting the requirements of the SCNZ Report shall be submitted to the Construction Reviewer for review	Prior to procurement of steel	Steel Source List	HOLD	External	JFC	REVIEW	T&T
12.02	Inspections	T+T NALRecovery Specifications: 9.2.7	The contractor must inform the Engineer of shop work commencement in advance, offer necessary assistance for material observation, and ensure reasonable access to work locations. The contractor must cooperate with the Engineer in arranging inspections and keeping them informed about all stages of work.	Engineer to provide approval of inspection.	The following inspections are required by the Engineer: • Random inspection during the fabrication process; • After completion of fabrication and application of all protective coatings; and • After erection in final location in the works.	Written Confirmation of Engineer's Approval	HOLD	External	JFC	HOLD	T&T

ITP#	Work Pack Element(s)	Drawing / Specification Ref.	Specification Detail Summary	Acceptance Criteria	Test Spec & Frequency	Control Type i.e. Checksheet / Records	Hold / Witness	External (Requested by PS4) // Internal (JFC Requirement)	PS3 Owner	Hold / Review / Witness	PS4 Owner Sign Off
12.03	Bolts, Nuts, and Washers	T+T NALRecovery Specifications: 9.2.8.3	The contractor must ensure the bolt, nut, and washer set have correct markings, and unmarked bolts should not be used. If no certification is provided, the Engineer may reject the bolts or request testing in accordance with AS/NZS 1252 Appendix A	If there is no certification provided the Engineer may reject the bolts and nuts or request them to be tested in accordance with AS/NZS 1252 App	Prior to use of bolts, nuts, and washers.	Certification for the bolts and nuts	HOLD	External	JFC	WITNESS	T&T
12.04	Fabrication	T+T NALRecovery Specifications: 9.2.10.1	The Engineer approves all quality control and checking procedures, and after a component's fabrication and erection, the Contractor must promptly provide the Engineer with the results of all quality control checks for that component.	Engineer to approve quality control and checking procedures	Prior to and during fabrication	QC and Checking Procedures, Written Confirmation of Engineer's Approval	HOLD	External	JFC	HOLD	T&T
12.05	Tolerances	T+T NALRecovery Specifications: 9.2.10.2	General Tolerances Straightness length/500 Structural dimensions + 3 mm Plan position of structural members + 5 mm Level of structural members + 5 mm.	Fabrication tolerances shall not be exceeded. If the assembled item's tolerance doesn't meet the clause, the Contractor and Engineer must agree on a method for achieving acceptable tolerances	For every section of steelwork and metalwork installed	QA Checksheet(s), Photos	HOLD	External	JFC	REVIEW	T&T
12.06	Welding	T+T NALRecovery Specifications: 9.2.10.17	Before any welding is commenced, the Contractor shall advise the Engineer so that they may have an opportunity to inspect any of the prepared surfaces.	Surfaces cleaned, prepared, and prepped for welding	Before any welding is commenced	Email trails	HOLD	External	JFC	WITNESS	T&T
12.07	Weld Quality Control	T+T NALRecovery Specifications: 9.2.10.17	An independent Welding Inspector will conduct all necessary inspections, tests, and reports, including NDT testing, for welding defects, and must be qualified to AS/NZS1554. The Welding Inspector must be approved by the Designer, and their details, including company, technical qualifications, and curriculum vitae	The Welding Inspector shall record all details of its inspections and shall submit a weekly written report covering progress, testing, rework and welding quality matters for that week. Welding procedure sheets shall be prepared by the fabricator and approved by the Welding Inspector.	Inspector details must be submitted two weeks before commencing structural steelwork fabrication.	Welding Procedure Sheets, Written Confirmation from Welding Inspector	HOLD	External	JFC	HOLD	T&T
12.08	Corrosion Protection	T+T NALRecovery Specifications: 9.2.13.3	Corrosion protection shall be fabricated and erected in accordance with a quality plan meeting the requirements of AS/NZS9002 Applicators shall have in place formal written quality assurance procedures appropriate to the scope of work, prior to commencing work on application of the corrosion protection system.	The Quality Plan shall allow for the engagement of an independent Corrosion Protection Inspector to carry out inspections and coating thickness measurements and provide corresponding reports in accordance section 11 of AS/NZS 2312.	Prior to fabrication of corrosion protection	Quality Plan, Written Confirmation from Corrosion Protection Inspector	HOLD	External	JFC	HOLD	T&T
12.09	Storage and Handling	T+T NALRecovery Specifications: 9.2.14.2	The Contractor shall lay down the steelwork on the site at the position agreed with the Engineer	Prior to erection all steelwork shall be cleaned as necessary to the satisfaction of the Engineer.	Prior to erection of steelwork	Photos, Written Confirmation from Engineer	HOLD	External	JFC	WITNESS	T&T
12.10	Erection Method	T+T NALRecovery Specifications: 9.2.14.3	A detailed method statement shall be prepared covering structural steel erection	Engineer to review and approve method statement prior to erection of steel on site	2 weeks before commencing structural steel erection on site	Method Statement, Written Confirmation of Engineer's Approval	HOLD	External	JFC	HOLD	T&T
13.0 CIVIL SPECIFICATION – PIPES & ASSOCIATED WORKS (GRAVITY DRAINAGE SYSTEM)											
13.01	Manhole Foundation	T+T NALRecovery Specifications: 10.1.3.3.2	The manhole structure shall be constructed or placed on a levelling course placed on top of the subgrade material.	The suitability of the subgrade material shall be confirmed by the Engineer	Prior to placement of levelling course	QA Checksheet(s), Test Result(s), Written Confirmation of Engineer's Approval	HOLD	External	JFC	HOLD	T&T

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			The levelling course shall comprise a 100 mm minimum layer of compacted approved AP20 granular material or concrete.								
13.02	Manhole Testing	T+T NALRecovery Specifications: 10.1.3.3.3	The Engineer may require a watertightness test to be carried out at manholes.	The manhole shall be considered watertight if the drop does not exceed 0.2 litre per square metre of internal cross-section area per metre depth of the manhole.	Upon request	Test Result, Photos, Written Confirmation of Engineer's Approval	HOLD	External	JFC	WITNESS	T&T
13.03	Transport, Handling, and Storage of Materials	T+T NALRecovery Specifications: 10.1.4.2	Materials will be inspected by the Engineer, at their discretion, upon delivery to Site or as soon thereafter as practicable.	Damaged or unsatisfactory materials noted at that time will be marked and the Contractor shall either replace the item or if the Engineer permits, repair the defect in an approved manner.	At the Engineer's discretion	Written Confirmation of Engineer's Acceptance	HOLD	External	JFC	WITNESS	T&T
13.04	Tolerance	T+T NALRecovery Specifications: 10.1.4.5	For all culverts: <ul style="list-style-type: none"> An overall slope tolerance of + / - 0.5% is acceptable for installed culvert unless absolute maximum or minimum grades are stated on the Drawings. Each separate pipe shall be individually set to line and within 10 mm of the invert levels shown on the Drawings provided that the deviation from a string line extending over two pipe lengths shall not exceed 10 mm. No sections of pipe shall be laid with an adverse (negative) grade unless shown otherwise on the Drawings 	Tolerances are adhered to	For every section of pipe laid	QA Checksheet(s), Photos	HOLD	External	JFC	REVIEW	T&T
14.0 CIVIL SPECIFICATION – TRENCHING, BEDDING, AND BACKFILLING											
14.01	Trenching	T+T NALRecovery Specifications: 10.2.5.1.1	Trench excavation to be carried out in accordance with KiwiRail Civil Engineering Standard Culverts C-ST-CD-4103 Section 7.1.2.	Excavation in line with KiwiRail Civil Engineering Standard Culverts C-ST-CD-4103 Section 7.1.2..	For every section of trench	QA Checksheet(s), Photos	HOLD	External	JFC	REVIEW	T&T
14.02	Unsuitable Foundation	T+T NALRecovery Specifications: 10.2.5.1.4	If trench bottom material isn't suitable for pipe foundation, Contractor must over-excavate upon receipt of order from the Engineer, and backfill with approved material.	Over excavation required if trench invert is less than the CBR values in Table 10.1 (snippet below). Replacement material tested for strength using Clegg Hammer or Scala and shall achieve equivalent CBR strength values given in Table 10.1.	<ul style="list-style-type: none"> For pipe diameters < 1,000 mm: testing at 10 m maximum centres for each placed layer. For pipe diameters 1,000 mm to 1500 mm: testing at 5 m maximum centres for each placed layer. For pipe diameters > 1,500 mm: testing at 2.5 m centres for each placed layer. 	QA Checksheet(s), Clegg and or Scala Test Results, Photos	HOLD	External	JFC	REVIEW	T&T

ITP#	Work Pack Element(s)	Drawing / Specification Ref.	Specification Detail Summary	Acceptance Criteria	Test Spec & Frequency	Control Type i.e. Checksheet / Records	Hold / Witness	External (Requested by PS4) // Internal (JFC Requirement)	PS3 Owner	Hold / Review / Witness	PS4 Owner Sign Off										
<div>Table 10.1: Trench invert strengths</div> <table><tr><td>Trench situation</td><td>Minimum required CBR value at trench design invert level</td></tr><tr><td>In non-road areas</td><td>3.5</td></tr><tr><td>In permanent road areas with depth to trench invert less than 0.6 m</td><td>5</td></tr><tr><td>As in 2. but with depth to trench invert greater than 0.6 m</td><td>3.5</td></tr><tr><td>Beneath temporary construction haul roads</td><td>add 3 to the above permanent road case CBR's</td></tr></table>												Trench situation	Minimum required CBR value at trench design invert level	In non-road areas	3.5	In permanent road areas with depth to trench invert less than 0.6 m	5	As in 2. but with depth to trench invert greater than 0.6 m	3.5	Beneath temporary construction haul roads	add 3 to the above permanent road case CBR's
Trench situation	Minimum required CBR value at trench design invert level																				
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As in 2. but with depth to trench invert greater than 0.6 m	3.5																				
Beneath temporary construction haul roads	add 3 to the above permanent road case CBR's																				
14.03	Pipe Bedding & Support	T+T NALRecovery Specifications: 10.2.5.2	Pipe bedding to be carried out in accordance with KiwiRail Civil Engineering Standard Culverts C-STCD-4103 Section 7.1.3.	Pipe bedding in line with KiwiRail Civil Engineering Standard Culverts C-STCD-4103 Section 7.1.3	For every section of pipe bedding and support	QA Checksheets, Photos, Test Results	HOLD	External	JFC	REVIEW	T&T										
14.04	Backfilling	T+T NALRecovery Specifications: 10.2.5.2	Backfilling to be carried out in accordance with KiwiRail Civil Engineering Standard Culverts C-ST-CD-4103 Section 7.1.3.	Backfilling in line with KiwiRail Civil Engineering Standard Culverts C-STCD-4103 Section 7.1.3	For every section pipe backfilled	QA Checksheets, Photos, Test Results	HOLD	External	JFC	REVIEW	T&T										
15.0 CIVIL SPECIFICATION – TRENCHLESS METHODS																					
15.01	Rock Armour Grading	T+T NALRecovery Specifications: 10.4.3.1.1	Rock armour material shall be well graded as indicated on the drawings.	Poorly graded or gap graded armour rock shall not be permitted except as approved by the Engineer.	For every section of rock armour	Rock Specifications	HOLD	External	JFC	REVIEW	T&T										
15.02	Rock Armour - Placement	T+T NALRecovery Specifications: 10.4.4.4	The placement method of armour and underlayers directly on geotextile filter fabric shall be approved by the Engineer prior to placement	Engineer to approve methodology	Prior to rock armour placement	Method Statement, Written Confirmation of Engineer's Approval	HOLD	External	JFC	HOLD	T&T										
15.03	Tolerances	T+T NALRecovery Specifications: 10.4.5.2	Rock materials must be placed according to the drawings' levels, dimensions, and slopes, and the surface profile must be measured using the specified tolerances: - Subgrade levels -0.1 m to +0.1 m - Armour underlayer thickness (average per profile): -0.1 m to +0.2 m - Armour rock thickness (average per profile): -0.1 m to +0.5 m	Tolerances are adhered to	For every section of rock material placed	QA Checksheet(s), Photos	HOLD	External	JFC	REVIEW	T&T										

Sub-contractor ITPs (Refer to OP06_f09 ITP Index for Subcontractors)

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Drainage (Directional Drilling) – Pipe Installation							(ENTER SUBCONTRACTOR)			ENGINEER	
30											



ITP#	Work Pack Element(s)	Drawing / Specification Ref.	Specification Detail Summary	Acceptance Criteria	Test Spec & Frequency	Control Type i.e. Checksheet / IANZ Records	Hold / Witness	Internal / External	PS3 Owner	Hold / Witness	PS4 Owner
31											
32											
33											
34											
Sub Activity 2 (INSERT QA SHEET NAME)							(ENTER SUBCONTRACTOR)		ENGINEER		
35											
36											
37											
38											
39											

ITP Induction Sign On

ITP Induction Sign-on		
Name	Date	Signature