



River Management Lines for the Ōroua and Pohangina Rivers

January 2026

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Pohangina River near 6.5-mile mark
(January 2025, Ruby Stevens)

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Executive summary

Horizons Regional Council (Horizons) engaged Tonkin & Taylor Ltd (T+T) to establish potential river management lines for two major tributaries of the Manawatū River: the Pohangina and Ōroua Rivers. This work builds on the *Natural Character Index Assessment* completed by T+T in August 2025 and applies the “Room for the River” guidelines outlined in *Application of Room for the River for NZ Rivers and Streams* (Christensen, 2023). This assessment looks to support Horizon’s nature-based solutions investigation (Horizons Regional Council, 2025).

Three key inputs have been assessed and subsequently digitised to provide potential management lines for the Pohangina and Ōroua Rivers. These inputs provide a series of lines encompassing anticipated lateral channel adjustment at a range of timescales, identifying the natural bounds of probable river movement, and historic and recent river behaviour. This approach allows the definition of a corridor in which erosion potential (as a result of river movement) may be expected. Each of these management lines are further explained in sections below:

- 1 The long-term natural corridor of the river was delineated using LiDAR-derived Digital Elevation Models (DEMs), Relative Elevation Models (REMs), and geological mapping. This generated the ‘EMAX’, which is the maximum erodible valley floor corridor reflecting the Erodible Floodplain. Christensen (2023) suggests that this typically includes Late Pleistocene and Holocene deposits, but for much of the Pohangina and Ōroua Rivers, these are present as a series of strath river terraces, which means their margins are formed by the underlying bedrock that confines the river channel and sets a boundary on lateral migration.
- 2 The portion of the valley floor occupied by the active channel, derived from analysis of historical and contemporary aerial imagery (~1942–2024). This generated the ‘EFONC’ which refers to the ‘functional erodible river corridor’ reflecting recent channel behaviour over the past 80 years.
- 3 Six empirical river regime equations, combined with New Zealand Catchment Board “Rules of Thumb”, were applied to reach parameters to estimate average channel and buffer management widths for each reach. Equation inputs included channel slope, median sediment size, and mean annual flood flows.

Further refinement of these lines, in conjunction with the review of current river management practices, and stakeholder consultation, will be needed to provide locally a negotiated minimum mobility corridor or envelope of channel adjustment known as the EMIN. We understand the derivation of the EMIN will be completed at a later date, following community consultation.

1 Introduction

1.1 Purpose and Scope

Tonkin & Taylor Ltd (T+T) have been engaged by Horizons to derive sets of river management lines for selected extents of the Pohangina and Ōroua Rivers. The purpose of this assessment is to highlight areas of potential erosion for both river corridors and outline potential management lines that can be used by Horizons to guide future river management practices. This assessment utilises both the “Room for River” philosophy in accordance with the NZ Room for the River guidelines (Christensen, 2023), and builds on the Natural Character Index Assessment recently completed for both Rivers (Tonkin & Taylor Ltd, 2025).

1.2 Site Context

The Pohangina and Ōroua Rivers comprise the two major north-western tributaries within the Manawatū Catchment (Figure 1.1).

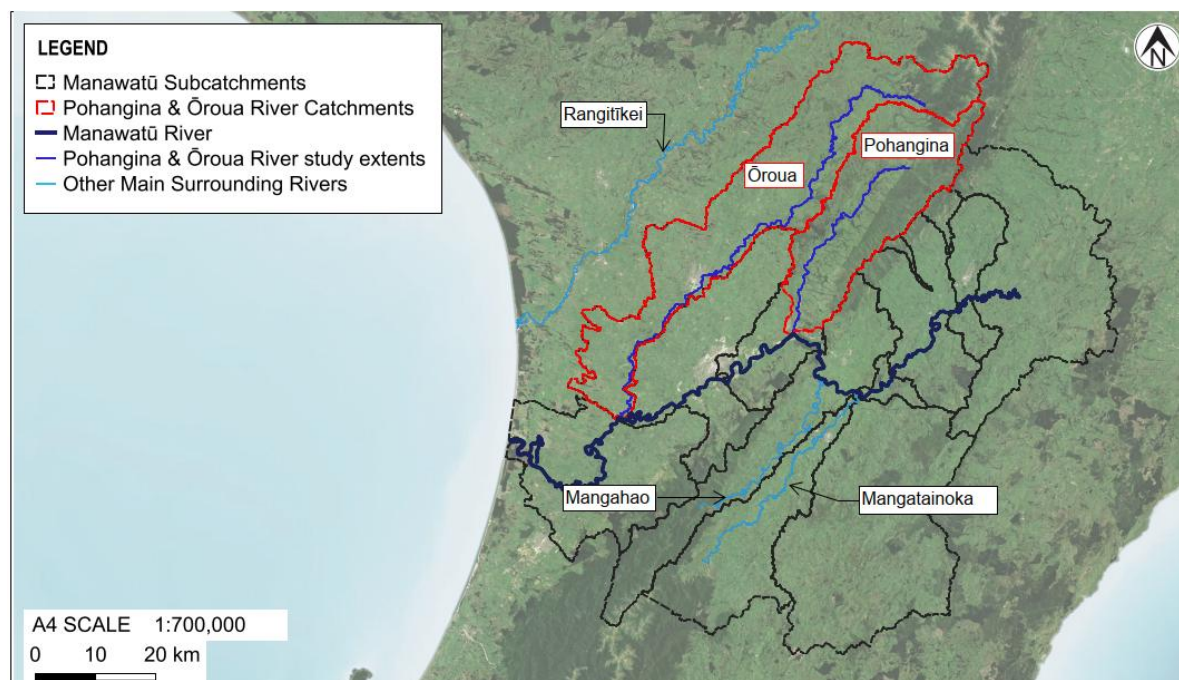


Figure 1.1. Geographical context of the Pohangina and Ōroua Rivers within the Manawatū catchment.

1.2.1 Pohangina River

The Pohangina River is situated in the southwest of the North Island and is a tributary of the Manawatū River. The river has a length of approximately 71 kilometres, and a catchment area of approximately 551.5 km². The headwaters of the river are located in the western and southern Ruahine Ranges and eventually joins the Manawatū River at Ashhurst. The study reach of the Pohangina River is approximately 50 km long and extends from Piripiri Stream (within the Ruahine Ranges) towards the confluence of the Manawatū River. The Pohangina catchment is characterised by steep relief, with the Ruahine Ranges rising to 1568 m above sea level in the catchment (Figure 1.2). The lower terrain to the west of the Ruahines comprises dissected soft-rock hill country. Along the Pohangina River, bank protection works, such as anchored tied tree work and groynes, are present primarily between Pohangina township and the rivers' confluence with the Manawatū River.

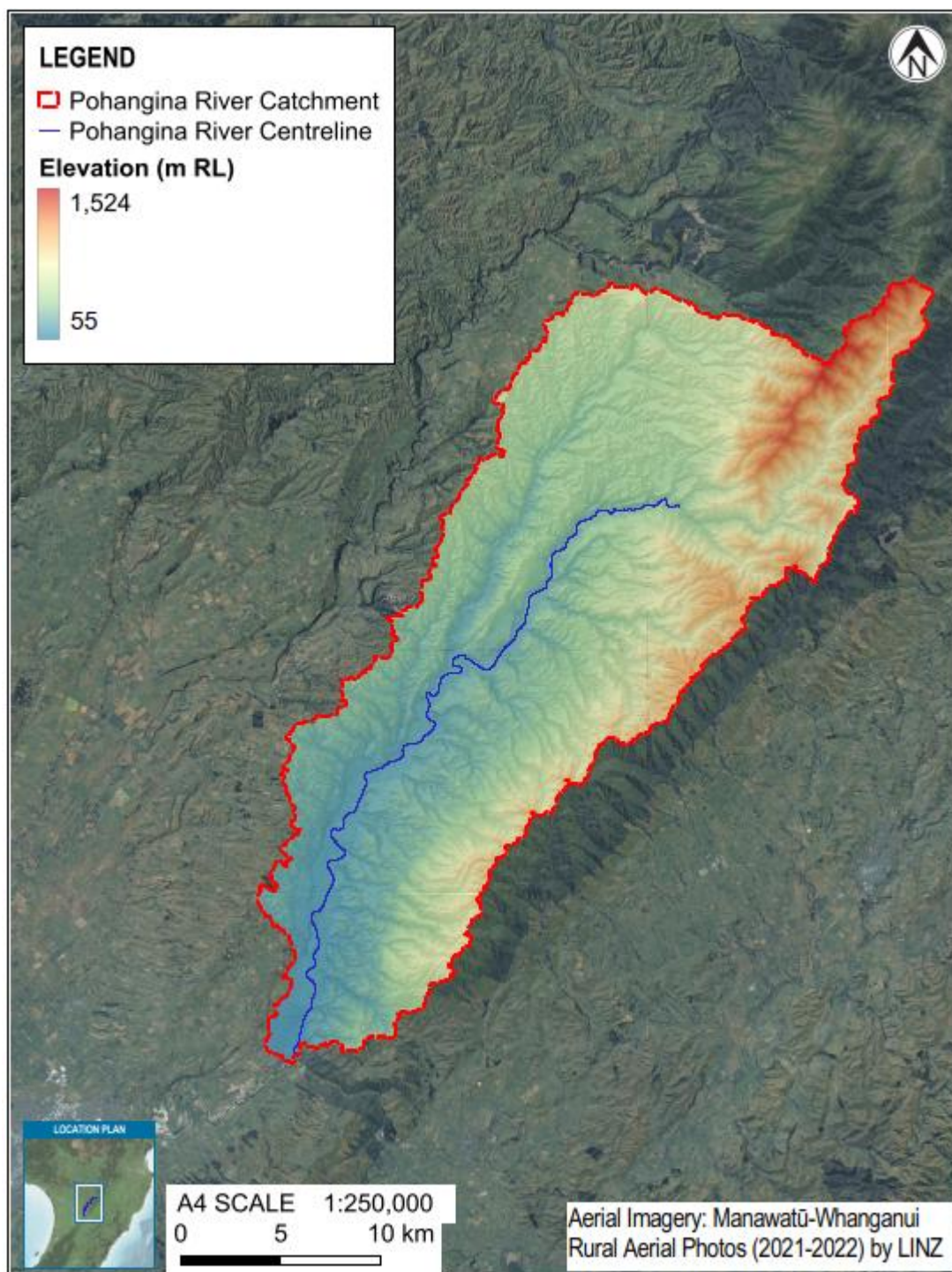


Figure 1.2: Topography of the Pohangina Catchment and surrounding area (Land Information New Zealand, 2025).

Within the study area, geological units primarily consist of sand and gravel alluvium (contemporary floodplain, Holocene and Late Pleistocene river terraces), as well as weak sedimentary sandstone (Eastern province sedimentary rock and Neogene sedimentary rock of the Whanganui Basin). Comprehensive description of lithology experienced within the study reach is outlined in Figure 1.3 below. The Ruahine Ranges border the east of the catchment and consist primarily of hard, fractured greywacke rock, which is prone to physical weathering and landslides, especially during heavy rainfall events. This process delivers the large volumes of coarse material which contributes to the river's dynamic sediment load and geomorphic character. These conditions predispose the

Pohangina River to a dynamic behaviour as the river channel adjusts to variable flows (floods) and pulsed sediment (gravel) inputs.

The land use of the catchment generally consists of grassland, scrub/scrubland and indigenous forest with an urban area (Ashhurst town) at the lower portion of the catchment (Figure 1.4).

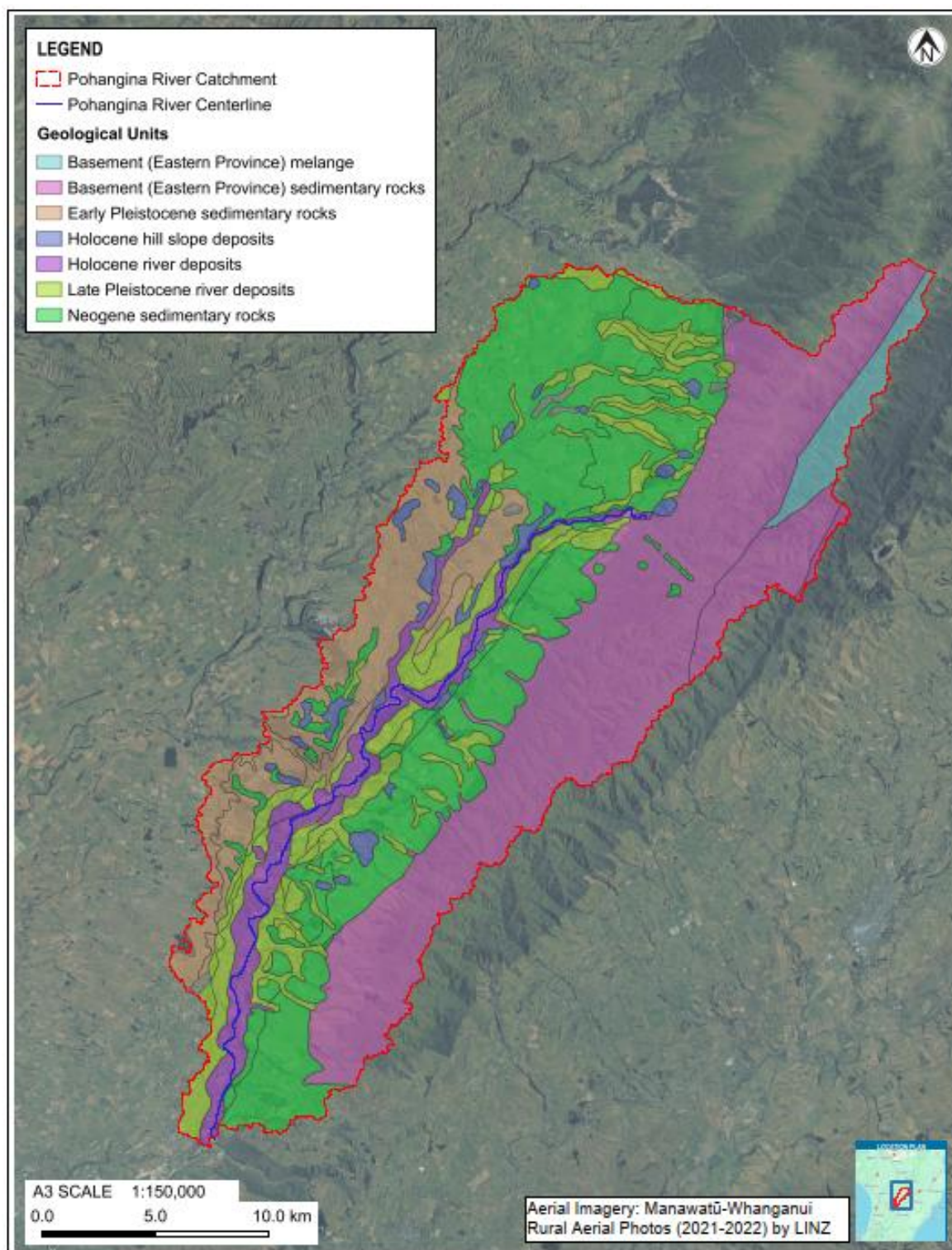


Figure 1.3: Geological Units within the Pohangina River Catchment (Heron D. , 2023).

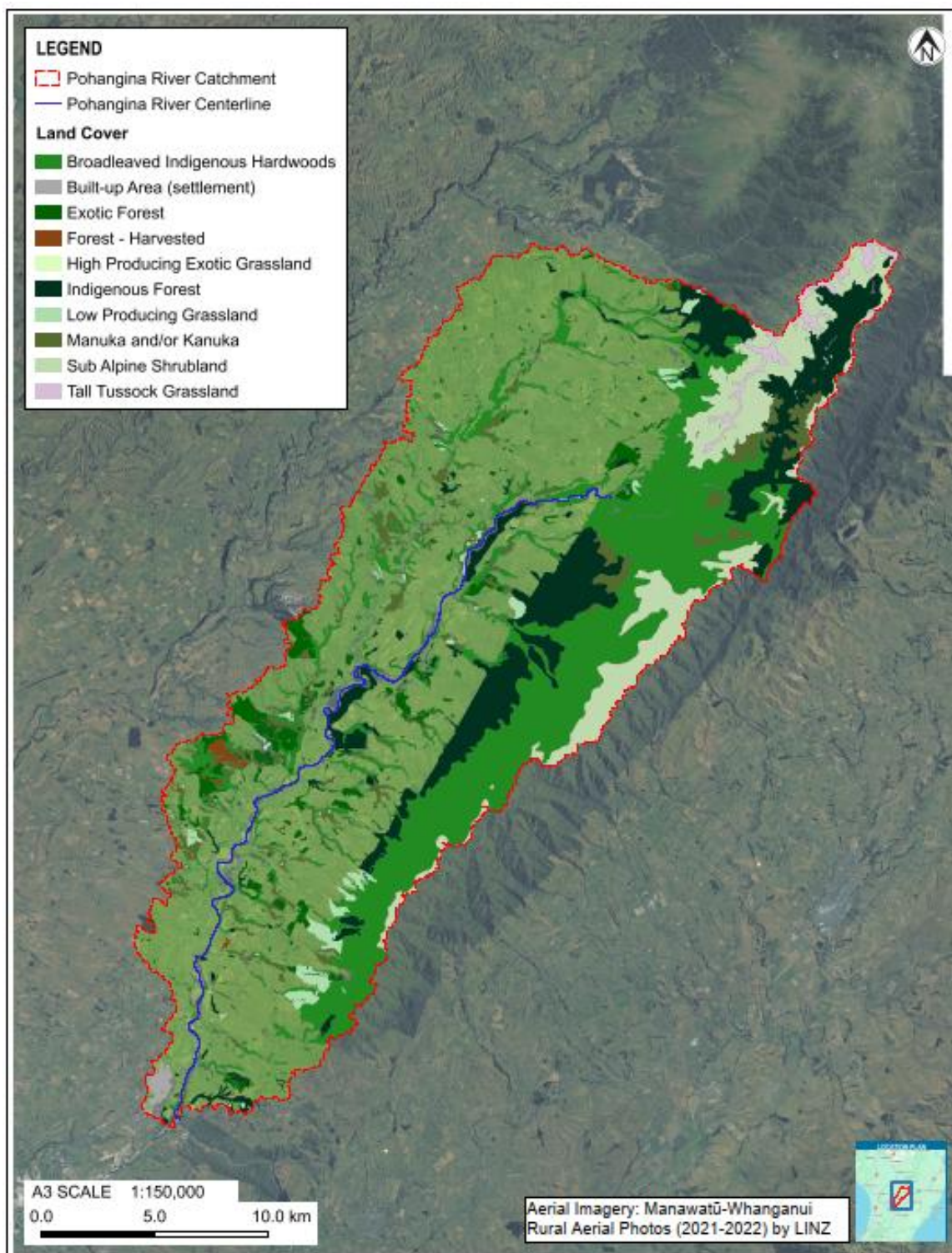


Figure 1.4: Land Cover of the Pohangina River Catchment (Landcare Research, 2024).

1.2.2 Ōroua River

The Ōroua River, like the Pohangina, is situated in the southwest of the North Island and is a tributary of the Manawatū River. The river has a length of approximately 141 kilometres, and a catchment area of approximately 903 km². The headwaters of the river are located in the western Ruahine Ranges, from here the river flows southwest through Feilding and eventually joins the Manawatū River at Rangiotu between Palmerston North and Shannon. The study reach of the Ōroua

River is approximately 115 km long and extends from Umutoi Creek (within the Ruahine Ranges), towards the confluence of the Manawatū River. The upper Ōroua catchment is characterised by steep relief, with the Ruahine Ranges rising to 1695 m above sea level in the catchment (Figure 1.5). Beyond the Ruahines, the mid-catchment of the Ōroua drains dissected soft-rock hill country. The lower catchment is characterised by low relief of the Taonui basin. Stopbanks are established along the lower reaches, extending approximately from Feilding to the Manawatū confluence. Within the stop banked sections of the lower Ōroua the active channel is perched above the surrounding land, which elevates the risk of channel avulsion.

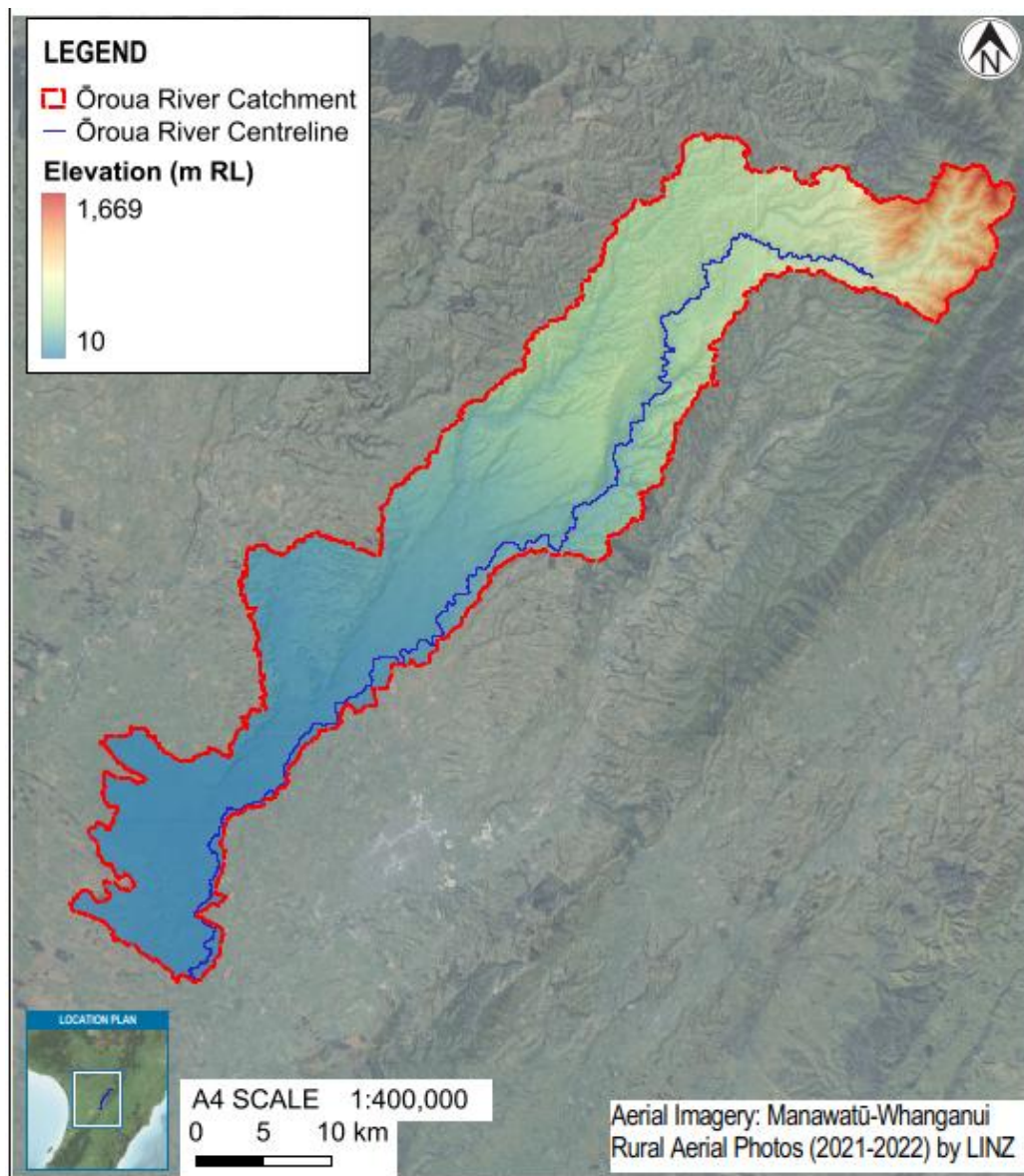


Figure 1.5: Topography of the Ōroua Catchment and surrounding area (Land Information New Zealand, 2025).

Geological units within the study reach primarily consist of sand and gravel alluvium (contemporary floodplain, Holocene and Late Pleistocene river terraces), as well as weak sedimentary sandstone (Eastern province sedimentary rock and Neogene sedimentary rock of the Whanganui Basin). The Taonui basin is a drained swamp, comprising peats and sands, and the south-western catchment drains a coastal dune field (sand country). Comprehensive description of lithology experienced within the study reach is outlined in Figure 1.6 below. A significant portion of Ōroua sediment originates from the river's headwaters in the greywacke-dominated Ruahine Ranges. These ranges

consist primarily of hard, fractured greywacke rock, which is prone to physical weathering and landslides, especially during heavy rainfall events. This process delivers large volumes of coarse material—ranging from gravel to boulders—into the upper reaches of the river, where it is transported downstream and contributes to the river’s dynamic sediment load and geomorphic character. These conditions predispose the Ōroua River to a dynamic behaviour as the river channel adjusts to variable flows (floods) and pulsed sediment (gravel) inputs. A gravel-sand transition is noted to occur within the lower reaches.

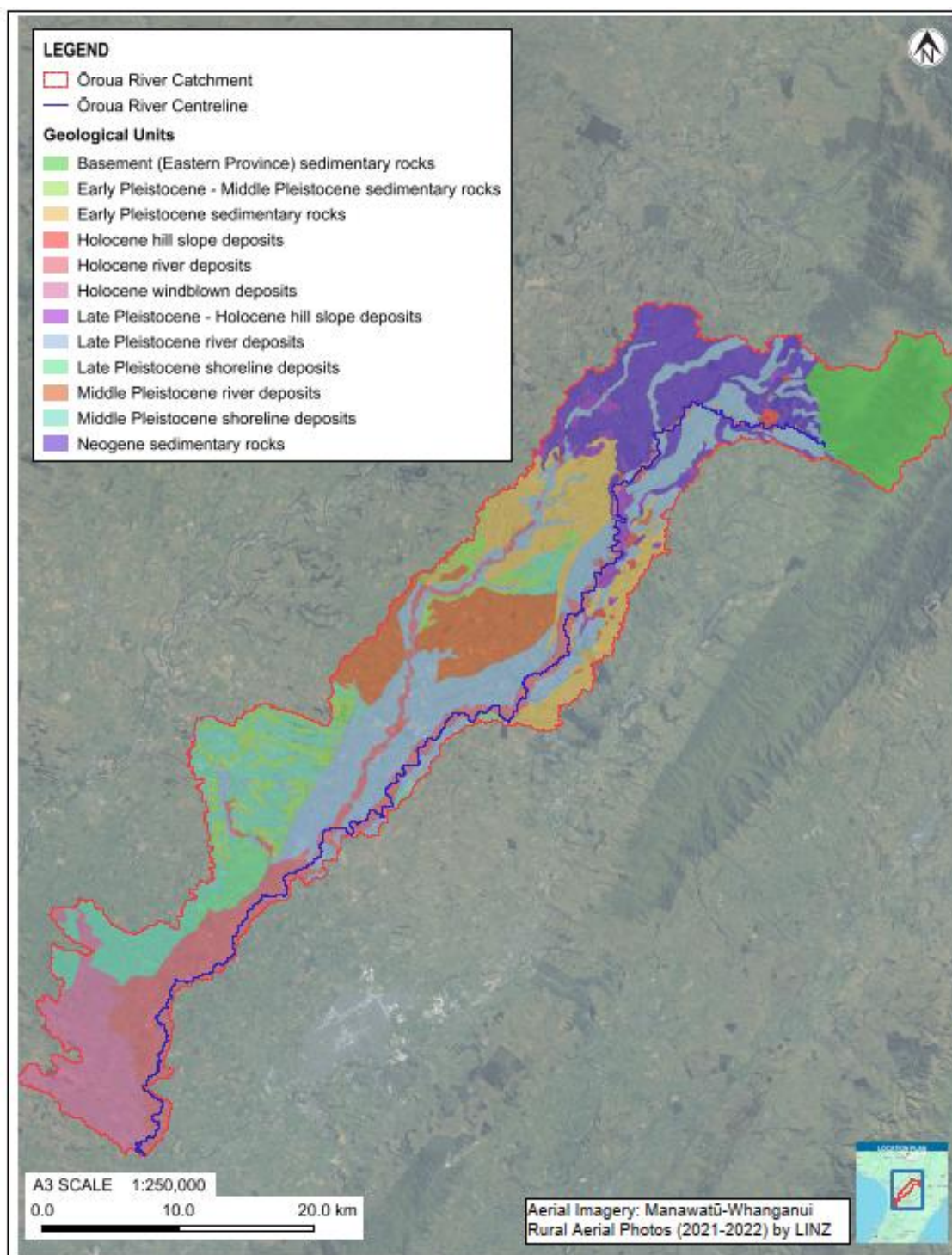


Figure 1.6: Geological Units within the Ōroua River Catchment (Heron D. , 2023).

The land use of the catchment is similar to the Pohangina and generally consists of high producing exotic grassland, some short-rotation cropland, and indigenous forest within the Ruahine Ranges, with an urban area (Feilding town) at the mid to lower reach of the Ōroua (Figure 1.7).

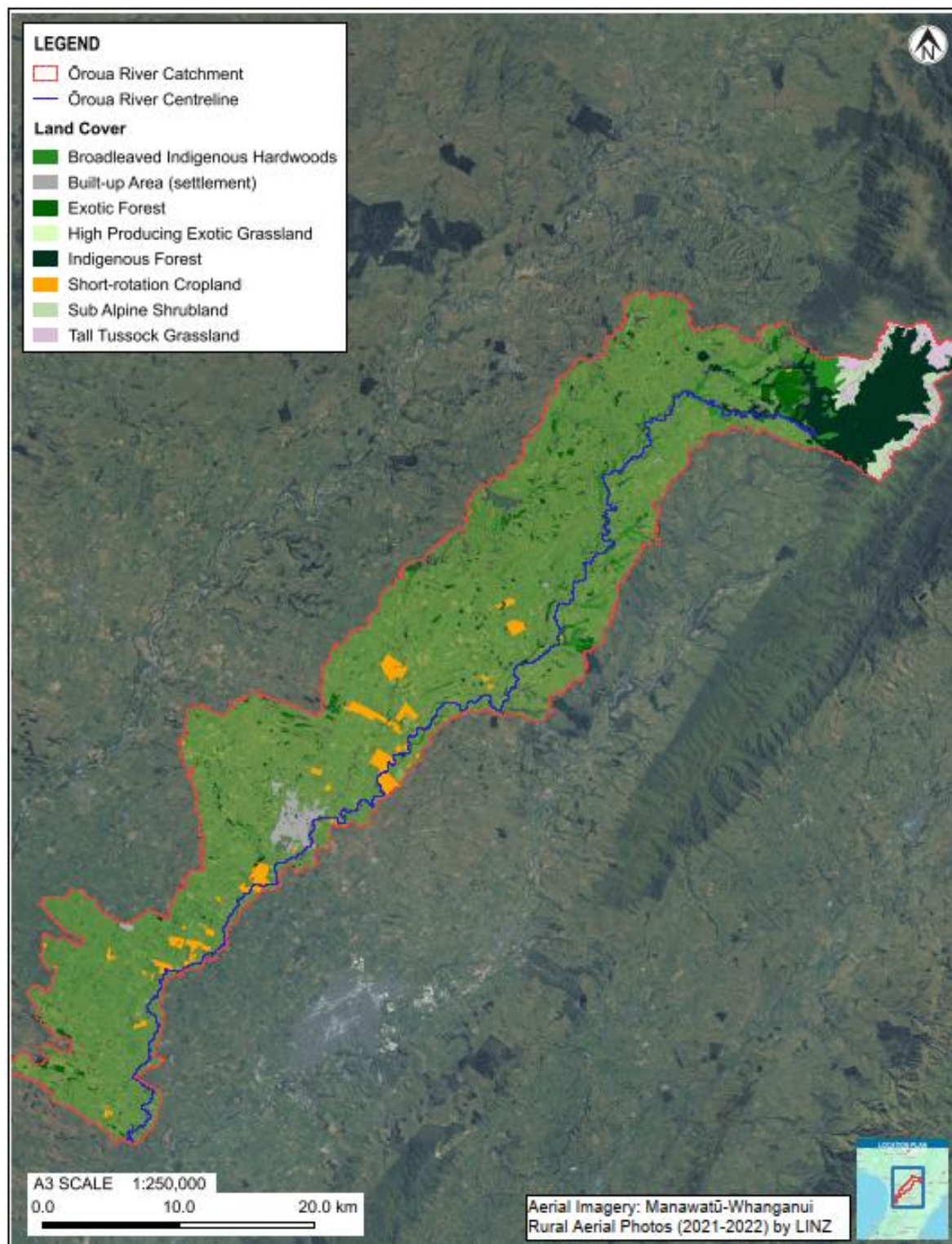


Figure 1.7: Land Cover of the Ōroua River Catchment (Landcare Research, 2024).

2 Management Line Methodology

Three key inputs have been assessed and subsequently digitised to provide potential management lines for the Pohangina and Ōroua Rivers. These inputs provide a series of lines encompassing anticipated lateral channel adjustment at a range of timescales, identifying the natural bounds of probable river movement, and historic and recent river behaviour. This approach allows the definition of a corridor in which erosion potential (as a result of river movement) may be expected. Each of these management lines are further explained in sections below and presented together in Appendix A and B for the Pohangina and Ōroua respectively.

Further refinement of these lines, in conjunction with the review of current river management practices, and stakeholder consultation, will be needed to provide an appropriate design River Management Envelope known as the EMIN. Since the EMIN is a locally negotiated minimum mobility corridor or envelope of channel adjustment (Piégay, 2005), the EMIN as such has not been derived within this assessment and we understand it is to be completed at a later date, following community consultation.

2.1 EMAX

The EMAX refers to the maximum erodible valley floor corridor reflecting the erodible floodplain, and the long-term natural corridor of the river. For much of the Pohangina and Ōroua Rivers, these are present as a series of strath river terraces, which means their margins are formed by the underlying bedrock that confines the river channel and sets a hard boundary on lateral migration, making erosion unlikely. The extent of the EMAX has consequently been defined principally through geomorphic mapping of the river corridor, particularly with reference to a Relative Elevation Model (REM)¹ and generally coincides with geomorphological features such as river terraces or valley margins. Figure 2.1 provides an example of how the EMAX was derived from the REM.

Downstream of Feilding, the Ōroua River flows through the Taonui Basin. The basin is a low-lying area on the Manawātū Plains that represents the infilled palaeoestuary of the Manawātū River (Clement, 2017), more recently comprising lagoon and swamp environments, which have since been drained for agriculture. As the Ōroua River traverses the Taonui Basin, other than sand dunes on its south western margin, there are no obvious geomorphic features delineating the limits of the river corridor, such as terraces or valley walls, which challenges determination of the EMAX extent. To determine the EMAX through the Taonui Basin, the 2005 DEM was used to identify the Ōroua's palaeochannels, the limits of which were used to estimate EMAX (Figure 2.2).

¹ 2024 Relative Elevation Model (REM) and 2005 REM (both provided by Horizons) used to determine the EMAX for the Pohangina and Ōroua Rivers respectively. 250K Geology layer from Geological and Nuclear Sciences Ltd (accessed August 2025) also used to determine EMAX for both rivers.

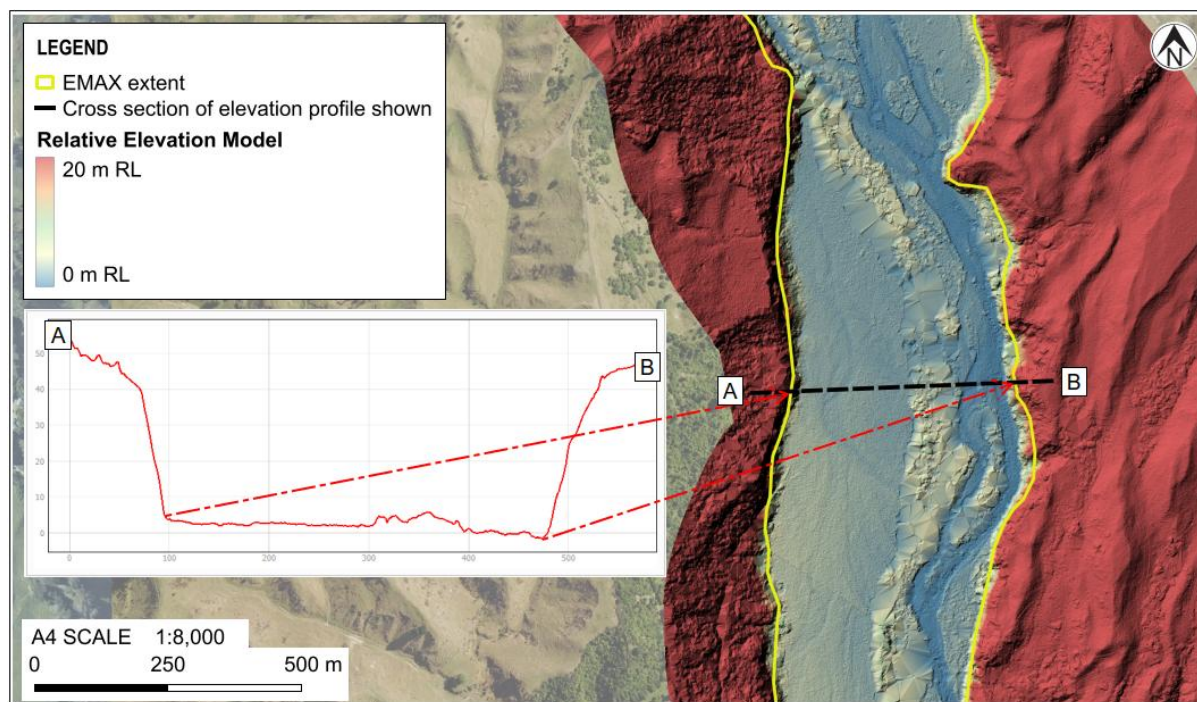


Figure 2.1. Example within the Ōroua River of the EMAX extent derivation from REM.

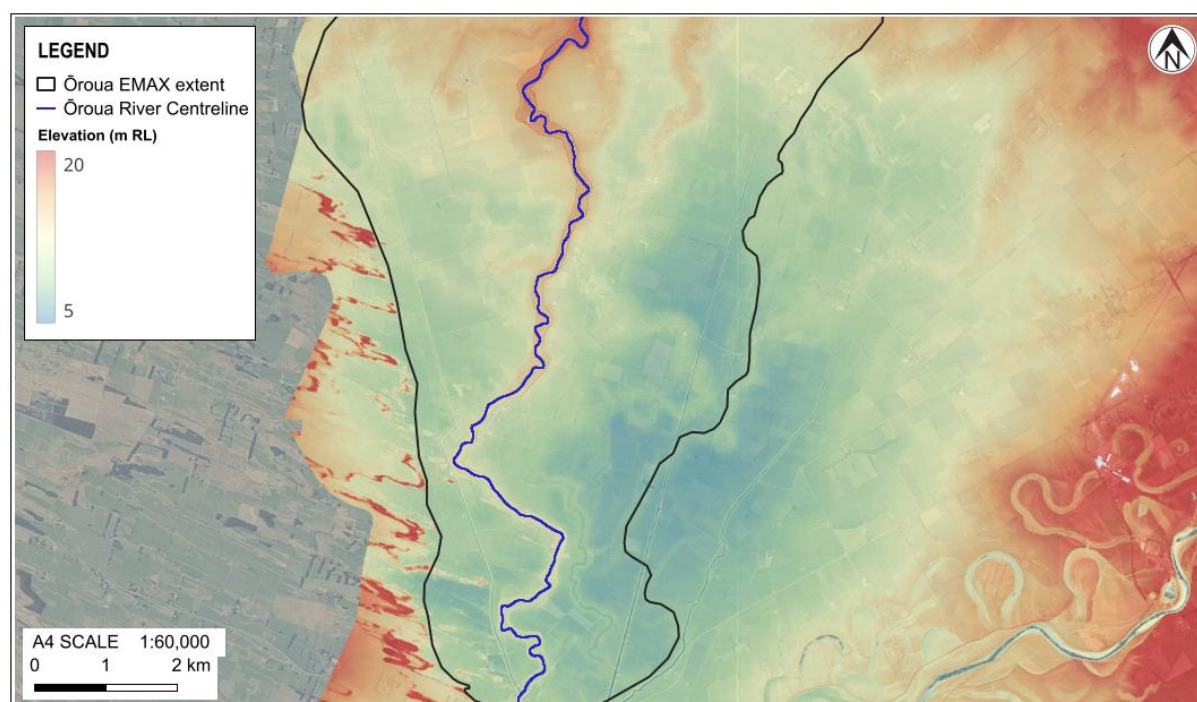


Figure 2.2. Estimated extent of the Ōroua's EMAX through the Taonui Basin, using 2005 LiDAR.

2.2 EFONC

The EFONC, or ‘functional mobility corridor’ represents recent channel behaviour over the past ~50 to 80 years. It is derived from active channel extents using available aerial imagery for the following three epochs and allow provision to capture the impacts of a recent large flood event (such as Cyclone Gabrielle in 2023), particularly on the Pohangina. Epochs assessed include:

- 1 The earliest complete aerials available (1942 & 1958 for the Pohangina and 1958 & 1984 for the Ōroua).
- 2 The closest complete aerials prior to Cyclone Gabrielle (2021).
- 3 The closest complete aerials directly after Cyclone Gabrielle (2024).

The widest extents of active channel lines² have been used to define the EFONC extent within this assessment. Refer to Figure 2.3. The EFONC extent does not distinguish between different river behaviours, such as lateral channel movement or the contraction and expansion of the active channel. In other words, wider sections of the functional mobility corridor may result from either lateral adjustment across the valley floor, e.g. in the case of a meander bend migration; or an episode of discrete channel expansion, e.g. in response to a flood, or in response to a complete channel shifting, e.g. in the case of an avulsion. In any case, the EFONC represents the room the river has required to adjust either laterally, or via channel expansion, or avulsion in its recent history.

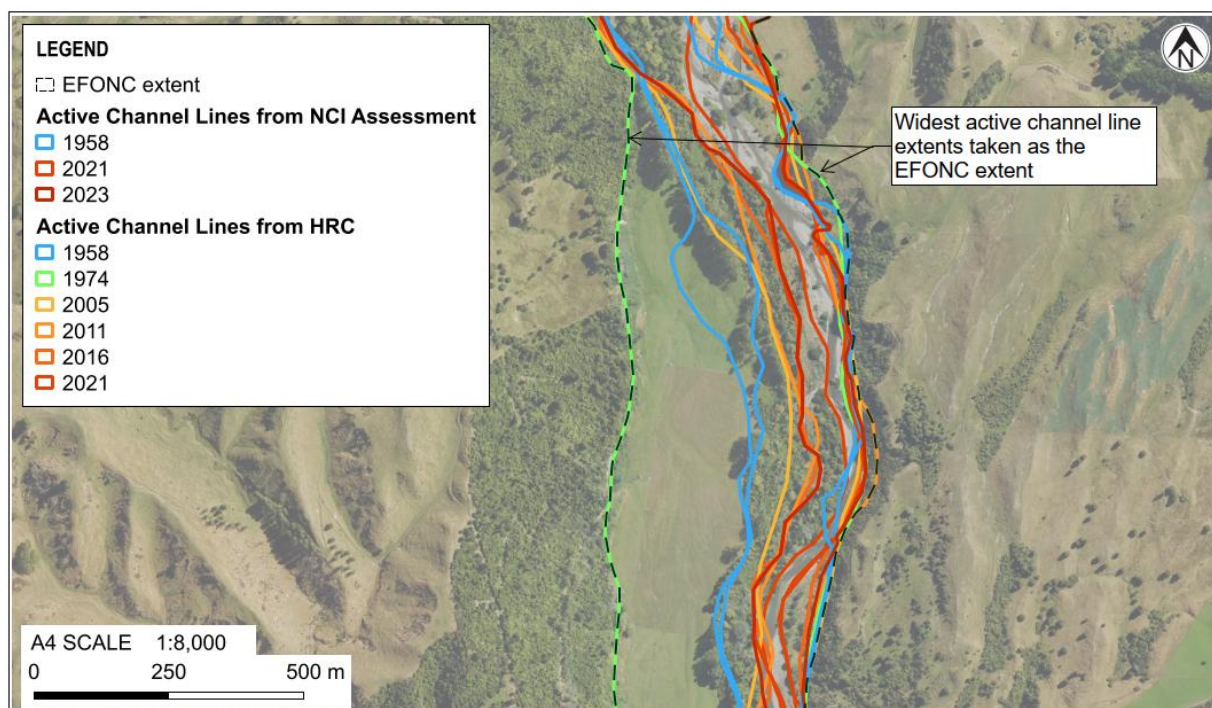


Figure 2.3. EFONC extents in relation to various active channel lines.

2.3 Regime Equations

The River Regime Equations are a set of six equations used to estimate the channel width expected to develop when river geometry is in a quasi-equilibrium state with the sediment transport ‘regime’, that is, slope and cross-section are in adjustment such that sediment transport equals sediment supply. The Regime Equations are based on dominant flow meander theory (equations 1-3) and threshold of motion meander theory (equations 4-6). Further information about each type of

² Derived from Natural Characteristic Index Assessment for Pohangina and Ōroua River, Tonkin and Taylor (2025) and digitised active channel extents based on historic imagery ranging from 1937 – 2024 provided by Horizons

equation including diagrammatic figures for type A/B channels can be found within the Room for the River guidelines³. It should be noted that these regime equations were developed for application in low gradient, meandering sand-bed rivers, where sediment transport approximates sediment supply. In steep gradient, gravel-bed rivers, the quasi-equilibrium state between channel geometry and sediment transport breaks down. The relationship between channel geometry and bankfull flow (or the Mean Annual Flood [$Q_{2.33}$]) in gravelly rivers is also complex. Nevertheless, incorporating slope and grain size components makes some attempt to adapt these regime equations for local conditions, which were further adjusted using Catchment Board “Rules of Thumb” (see below).

$$(1) W = 4.85 \times Q_{2.33}^{0.5} \text{ (Lacey, 1929)}^4$$

$$(2) W = 1.45 \times \frac{Q_{2.33}^{0.5}}{S^{0.2}} \text{ (Altunin, 1962)}^5$$

$$(3) W = 1.45 \times \frac{Q_{2.33}^{0.5}}{S_c^{0.2}}. \text{ Where } S_c = \frac{0.33d_{50}^{1.15}}{Q_{2.33}^{0.46}} \text{ (Altunin, 1962)}^6$$

$$(4) W = 1.22 \times \frac{Q_{2.33}^{0.46}}{d_{50}^{0.15}} \text{ (Henderson, 1966)}^7$$

$$(5) W = 2.065 \times \frac{Q_{2.33} \times S^{1.167}}{d_{50}^{1.5}} \text{ (Henderson, 1966)}^8$$

$$(6) W = \left[3.1 + 0.405 \left(\ln \left(\frac{0.672 \times d_{50}^{1.15}}{S \times Q_{2.33}^{0.42}} \right)^2 \right) \right] \times Q_{2.33}^{0.47} \text{ (Chang, 1988)}$$

Where:

W = Width (m)

$Q_{2.33}$ = Mean average flood (adjusted for climate change) ($\frac{m^3}{s}$)

S = Channel Slope ($\frac{m}{m}$)

d_{50} = Median sediment size (m)

All six equations require inputs for the mean annual flood ($Q_{2.33}$), the channel slope (S), and median sediment size (D_{50}). Given the variability within each of these inputs for the length of the Pohangina and Ōroua Rivers, both the rivers were split into multiple sub-reaches based on channel slope (S) derived from river cross section surveys⁹. Derivation methodology of $Q_{2.33}$ and D_{50} data parameters for each sub-reach are presented in below sections.

Cross sectional data was extensive for the Ōroua River, extending along the entire length of study reach and therefore allowed for robust delineation of stream gradient. Cross section data for the upstream section of the Pohangina (chainage 39,770 m to 44,126 m, i.e. ‘Reach 5’) was limited. LiDAR data were used in this area to supplement slope calculations. Figure 2.4 shows the sub-reach

³ Application of Room for the River for NZ Rivers & Streams (Christensen, 2023)

⁴ Applies to low gradient sand canals.

⁵ Applies to lowland sand rivers in Russia at actual slope.

⁶ Applied to lowland sand rivers in Russia at critical slope for Type B channels.

⁷ Applies to Type B Channel at Critical Slope. The equation shown uses D_{50} rather than S (as presented in the application of the Room for the River guidelines). Usage of D_{50} (rather than S) is correct and has been confirmed by the Author for the Room for River guidelines.

⁸ Applies to Type A Channel at Actual Slope. The equation shown uses D_{50} rather than S (as presented in the application of the Room for the River guidelines). Usage of D_{50} (rather than S) is correct and has been confirmed by the Author for the Room for River guidelines.

⁹ River cross-section surveys, taken in 2023 for the Pohangina and 2022 for the Ōroua, provided by Horizons, were used to calculate slopes using the thalweg points. Changes in gradient (based on visual observation) were used to delineate sub-reaches.

definitions within reach river. Reach 1 starts at the downstream end (Lower Manawatū confluence) for both rivers.

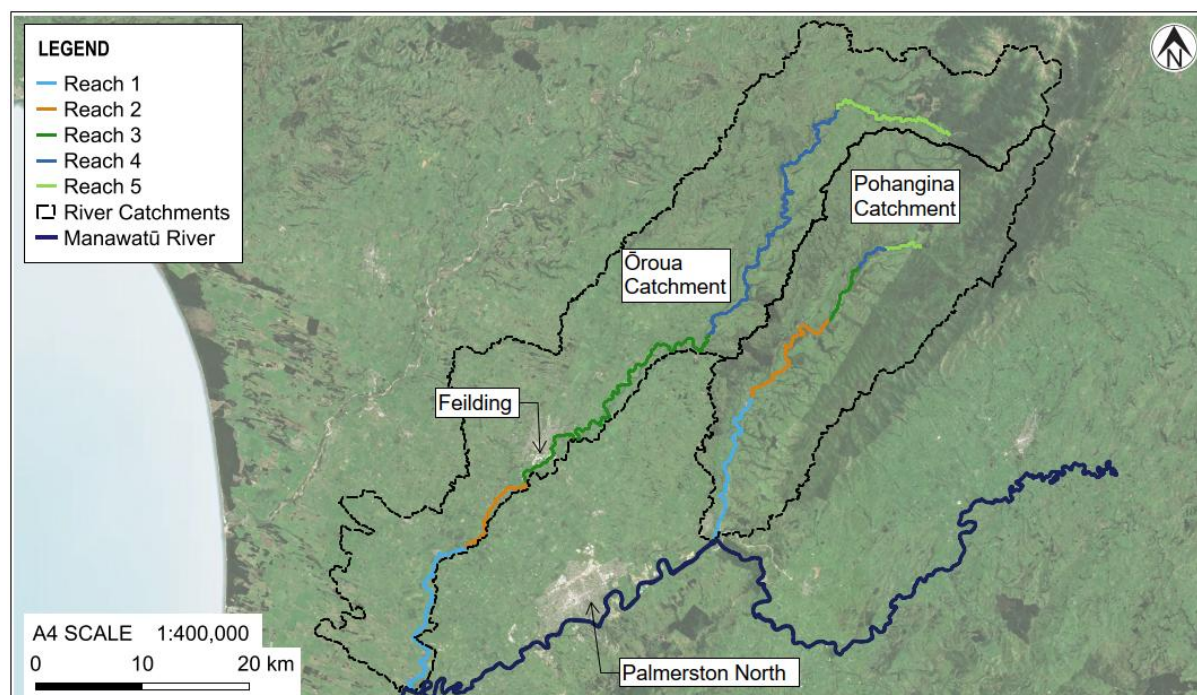


Figure 2.4. Geographic location of determined reaches for the Pohangina and Ōroua Rivers.

The “Rules of Thumb” are a set of multipliers with specific rules that are applied to the resultant widths of the river regime equations to generate channel management widths.

These NZ Catchment Board “Rules of Thumb” were used to manipulate widths calculated from the regime equations, providing channel and buffer management widths appropriate to the New Zealand context.

The fairway types used in this assessment for the Pohangina and Ōroua Rivers include wide, and semi-braided¹⁰, for which the “Rules of Thumb” are outlined below (Table 2.1). Channel widths and buffer widths derived from the regime equations have been labelled as ‘Channel Management Lines’ and ‘Buffer Management Lines’ respectively. Together, these are referred to as ‘Regime Management Lines’ within this assessment.

Table 2.1: Catchment Board “Rules of Thumb” fairway types, channel and buffer widths

Fairway	Channel	Buffer
Semi-braided	1.7 - 2.5 x Dominant Flow Meander [Equations (1), (2) or (3)]	1.5 x Major Meander [Equation (5) or (6)]
Wide (Single thread)	1.7 x Dominant Flow Meander [Equations (1), (2) or (3)]	2 x Minor Meander [Equation (4)]

2.3.1 Average Channel Slope (S)

The average slopes for each reach are presented in Table 2.2 and have been used as the slope inputs (S) in the regime equations for each corresponding river reach (Figure 2.4). It is noted the average reach slopes within the Ōroua River are generally flatter given the terrain across which the river

¹⁰ Wide and semi-braded categorisation was based on visual observations of both rivers

flows and greater distance from the Ruahine Ranges compared with the shorter, steeper Pohangina, which runs adjacent to the Ranges for its entire length.

Longitudinal profiles of each river showing reach delineation are represented in Figure 2.6 and Figure 2.7.

Table 2.2: Average sub-reach slope for the Pohangina and Ōroua Rivers.

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5
Pohangina Slope (m/m)	0.004	0.005	0.007	0.0095	0.014
Ōroua Slope (m/m)	0.0008	0.0027	0.0042	0.0054	0.0073

2.3.2 Sediment Size (D_{50})

Grain size data, in the form of Wolman Pebble Count samples collected from the wetted channel in 2025, were provided to T+T by Horizons for nine sites along the Pohangina River and 15 sites along the Ōroua River (Figure 2.5).

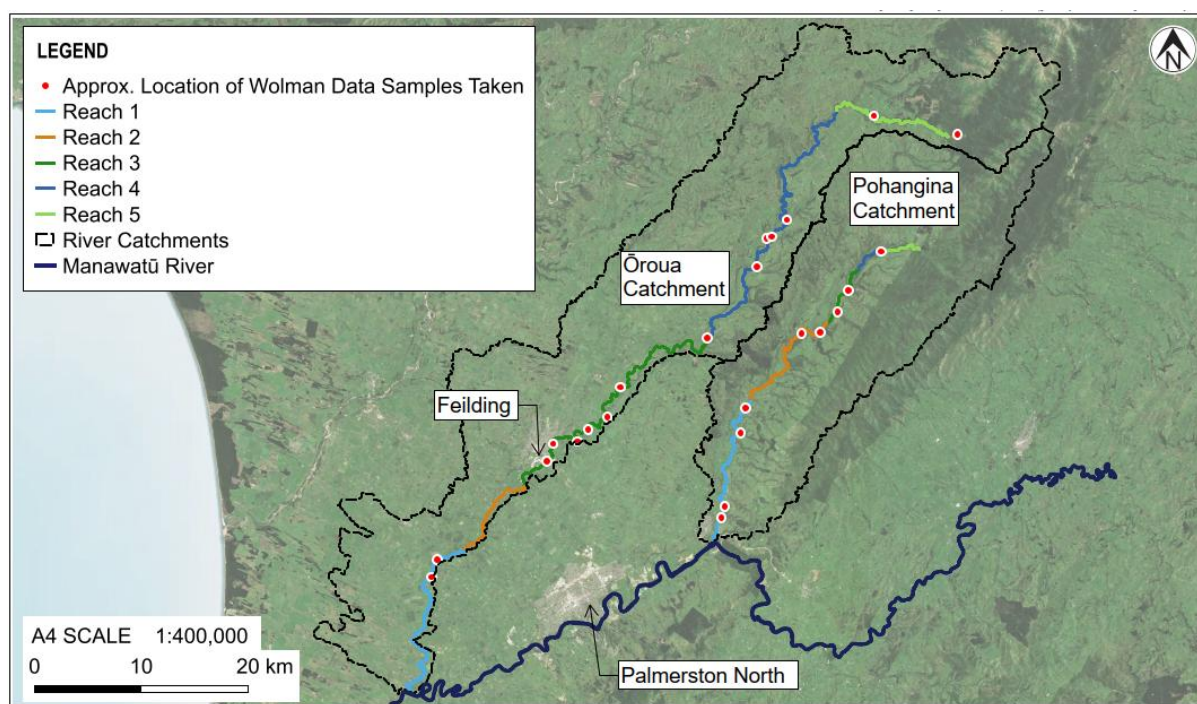


Figure 2.5. Locations of Wolman pebble count samples taken along the Pohangina and Ōroua Rivers.

Sediment size cumulative frequency graphs were generated at each site and a corresponding D_{50} value was determined. Given the local variability in D_{50} calculated along each river, a best fit linear relationship trendline for D_{50} was plotted. The trendline was then used to estimate a D_{50} value for each sub-reach, using the midpoint chainage of each reach as the x-value as shown in Figure 2.6 and Figure 2.7. The reach specific D_{50} values that were used for river regime equation inputs for the Pohangina and Ōroua Rivers are shown in Table 2.3.

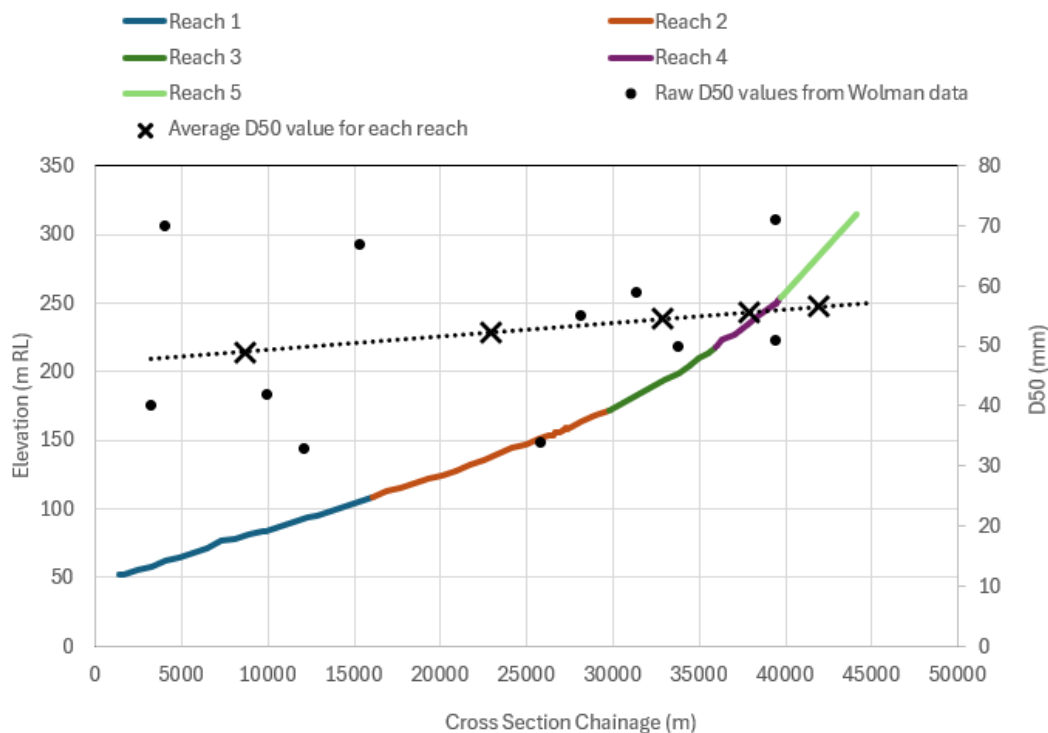


Figure 2.6. Reach long profile and D_{50} data derived from Wolman sampling and average D_{50} value for each reach (used within Regime Equations) for Pohangina River.

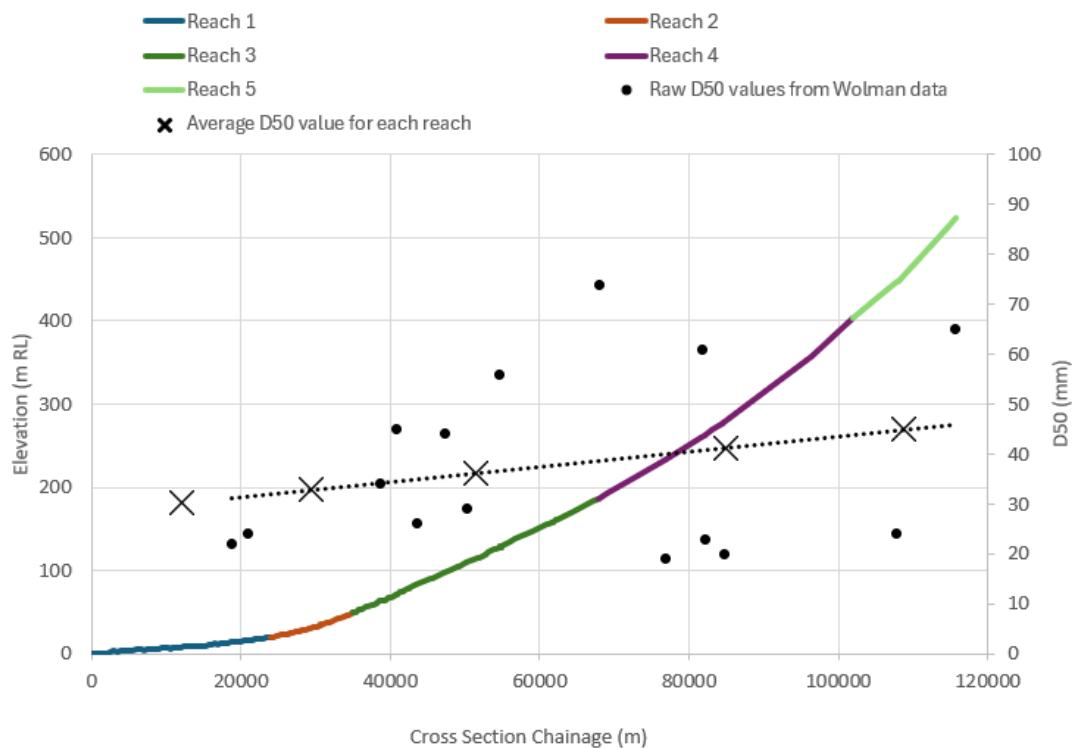


Figure 2.7. Reach long profile and D_{50} data derived from Wolman sampling and average D_{50} value for each reach (used within Regime Equations) for Ōroua River.

Table 2.3: Adopted D₅₀ values (mm) for each respective reach of the Pohangina and Ōroua Rivers

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5
D ₅₀ - Pohangina	49	52	54	56	56
D ₅₀ - Ōroua	30	33	36	41	45

We note that limited grain size sampling was completed within the lower bounds of the Ōroua River (Reach 1). Coincidentally we note that there is a gravel/sand transition somewhere along this reach, raising concerns that the D₅₀ calculated within this reach (and used within this assessment) may be too large. Further sampling is recommended to confirm the location of this transition and subsequently improve D₅₀ accuracy within this reach.

2.3.3 Mean Annual Flood Flows

NIWA conducted a flood frequency analysis (FFA) for Horizons in March 2025¹¹ (NIWA, 2025). Two gauging stations were identified and used within this assessment. These are: Pohangina at Mais Reach and the Ōroua at Almadale Slackline. Locations of these stations are within Reach 1 for the Pohangina and Reach 3 for the Ōroua respectively. As recommended in the report, flows selected for the Pohangina at Mais Reach were based on the generalised extreme value (GEV) fitted distribution. For the Ōroua at Almadale Slackline, the available FFA results that include historical data which were used to determine the mean annual flood input for the regime equations (Table GGG-5 from the report)¹².

For reaches where gauged flow was not available, base Mean Annual Flood flows were interpolated by first finding a ratio between known FFA values at gauged reaches and the Mean Annual Flood values obtained from New Zealand River Flood Statistics (NZRFS)¹³ (which takes into account catchment size). This ratio was then applied to the NZ River Statistics Mean Annual Flood values for each ungauged reach to get an estimated FFA value. Once a base Mean Annual Flood flow was determined (either through known FFA or ratioed with NZ River statistics data), a 25% scaling factor (increase) was added to account for climate change. This flow estimated methodology was determined in accordance with e-mail correspondence with Horizons dated 15 August 2025.

Table 2.4 and Table 2.5 show the mean annual flood flows used (displayed in red) as regime equation inputs for the Pohangina and Ōroua reaches, respectively.

Table 2.4: FFA, NZRFS, scaled NZRFS, and climate change-adjusted flows for the Pohangina River reaches

Reach	FFA 2025 flow (m ³ /s)	NZRFS flow (m ³ /s)	Extrapolated FFA 2025 flow based on the NZRFS flows (m ³ /s)	Climate change accounted flows (m ³ /s)
1	585	349	-	731
2	N/A	342	575	718
3	N/A	282	474	592

¹¹ Report provided by Horizons to T+T July 2025

¹² From Table GGG-5 in the FFA Appendices, the flood peak estimate flow for the 2 year return period event was used as agreed with Horizons on August 15th 2025.

¹³ [NZ Flood Statistics Henderson Collins V2 AGO](#)

Reach	FFA 2025 flow (m ³ /s)	NZRFS flow (m ³ /s)	Extrapolated FFA 2025 flow based on the NZRFS flows (m ³ /s)	Climate change accounted flows (m ³ /s)
4	N/A	253	425	532
5	N/A	274	461	576

Table 2.5: FFA, NZRFS, scaled NZRFS, and climate change-adjusted flows for the Ōroua River reaches

Reach	FFA 2025 flow (m ³ /s)	NZRFS flow (m ³ /s)	Extrapolated FFA 2025 flow based on the NZRFS flows (m ³ /s)	Climate change accounted flows (m ³ /s)
1	N/A	286	223	279
2	N/A	290	226	283
3	160.9	206	-	201
4	N/A	277	216	271
5	N/A	218	170	213

3 Application of River Regime Equations

3.1 Channel Management Lines

Channel widths using the “Rules of Thumb” for all river fairway types were first calculated for each sub-reach. These channel widths were then compared to the EFONC widths within that sub-reach. The resultant channel width that best matched the EFONC width (for each sub-reach) was chosen as the appropriate regime equation for the channel width.

The channel centreline was derived from the 2024 active channel extent and half of the calculated channel width was then applied to both sides of the channel centreline to visually display the regime equation widths. Buffer widths were then applied to the edge of channel widths to display the buffers.

In most cases the EFONC represents a minimum extent of likely future river behaviour with climate change increasing flood frequency and sediment flux. The decision to best match the calculated regime equation widths to the EFONC highlights the importance of deriving the EFONC lines themselves. This methodology aligns with the commentary outlined in the room for rivers guidance and a higher weighting is given to the EFONC in determining channel management lines.

Table 3.1 summarises the relevant regime equations and associated channel widths that best match the EFONC extent for each river reach.

Table 3.1: Selected fairway type, regime equation, and channel widths for reaches of the Pohangina and the Ōroua

	Pohangina			Ōroua		
Reach	Fairway	Equation	Channel width (m)	Fairway	Equation	Channel width (m)
1	Wide (Single thread)	3	307	Wide (Single thread)	3	193
2	Wide (Single thread)	3	293	Wide (Single thread)	3	191
3	Semi-braided	3	376	Semi-braided	3	224
4	Wide (Single thread)	1	190	Semi-braided	3	259
5	Wide (Single thread)	2	139	Wide (Single thread)	3	150

Stopbanks are noted in the downstream reaches of the Ōroua (Reach 1 & 2 – approximately chainages 0 m – 40075 m) and the generated EFONC used within this assessment takes these stopbanks into consideration. However, it is noted that there is limited available historic aerial imagery pre-dating this stopbank construction, meaning the actual undisturbed width of the active channel is somewhat uncertain. It is also noted that the current channel (within the stopbanks) is perched above the surrounding floodplain due to aggradation¹⁴. The observed aggradation suggests that the river needs more space than the existing stopbanks allow, to deposit sediment and maintain

¹⁴ Dykes, R., & Fuller, I. (2018). Assessment of LiDAR for detecting floodplain morphology and sediment movement in the Ōroua River. Horizons Report 2018/EXT/1593.

a stable sediment transport rate without elevating the risk of channel avulsion and flood risks to the surrounding floodplain.

To account for this phenomenon, a wide (single thread) fairway was selected despite the calculated channel width being greater than the extent of the EFONC.

3.1.1 Natural confinement

Along the Ōroua and Pohangina, there are many sections of partial confinement. Partial confinement is when the channel is able to move freely along 10-90 % of its length, with the balance confined by terraces, valley margins, bedrock or artificial confinement such as stopbanks. In many cases confining features closely relate to the EMAX. Where management lines generated from the regime equations show channel widths overlapping a confining feature, the channel management lines were manually adjusted and brought within the confined boundary. To allow the river the same width indicated by the regime equations, the channel management line was widened on the unconfined side to account for the narrowing on the confining terrace side (illustrated in Figure 3.1)

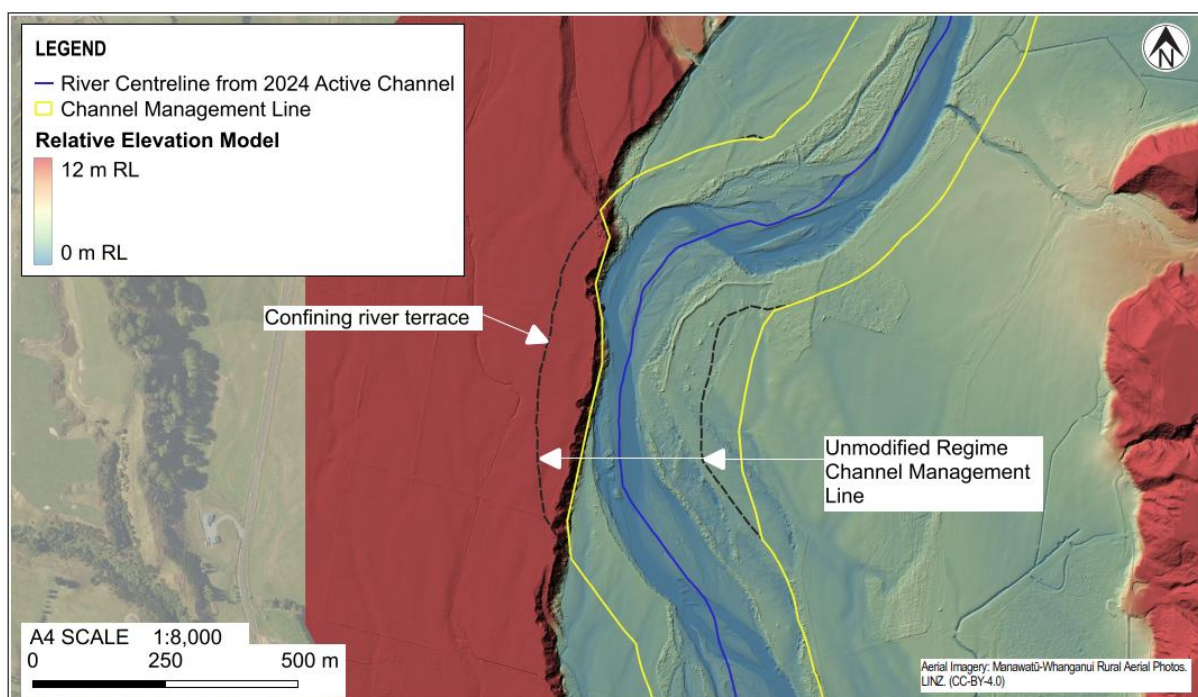


Figure 3.1. Example where Channel management line has been modified for partially confined sections.

In fully confined reaches and where the unmodified channel management extents were wider than confining features, the management lines were brought in (illustrated in Figure 3.2). It is noted that that in these locations the channel widths are narrower than the calculated width from the relevant regime equation. Areas like this highlight that though the regime equations offer a predicted envelope of river movement, they don't consider physical or site constraints. It is up to the user to undertake these manual adjustments and modify for local features accordingly.

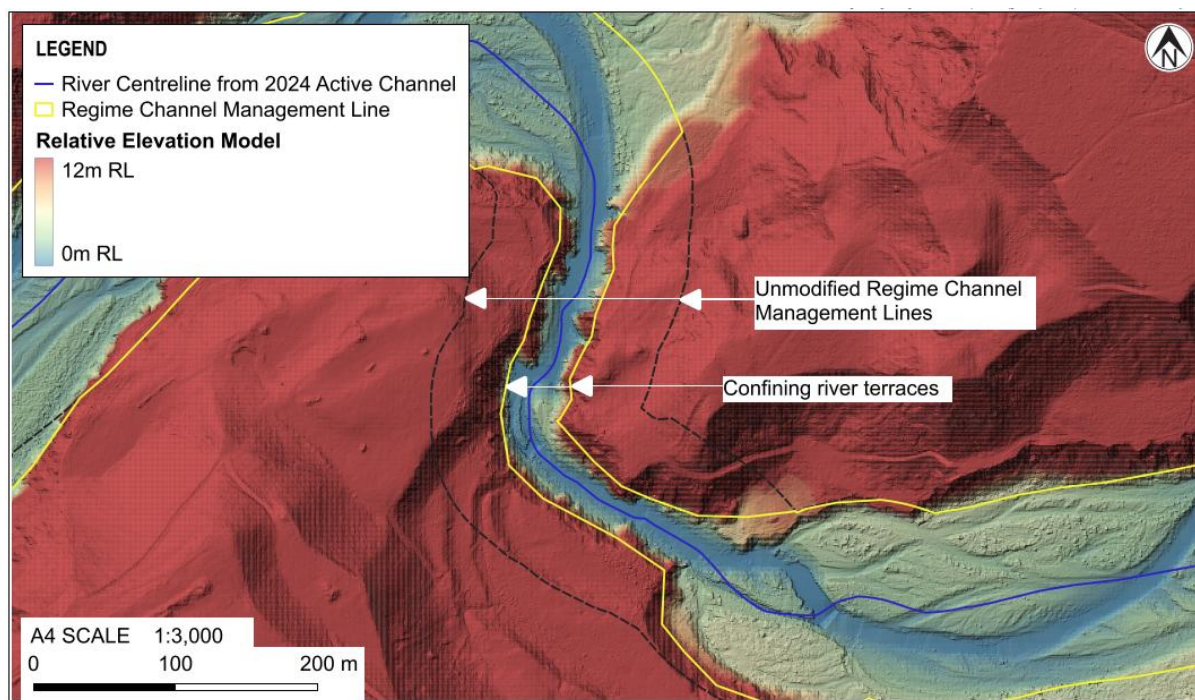


Figure 3.2. Example of modification to the regime channel management lines where the active channel is fully confined.

3.2 Channel Buffer Management Lines

The buffer widths calculated for each reach and river are displayed in Table 3.2. The buffer widths derived from the regime equations were applied to both sides of the channel management lines.

Table 3.2: Selected fairway type, regime equation, and channel buffer widths for reaches of the Pohangina and the Ōroua Rivers

	Pohangina			Ōroua		
Reach	Fairway	Equation	Buffer width (m)	Fairway	Equation	Buffer width (m)
1	Wide (Single thread)	4	80	Wide (Single thread)	4	55
2	Wide (Single thread)	4	78	Wide (Single thread)	4	55
3	Semi-braided	6	117	Semi-braided	5	151
4	Wide (Single thread)	4	66	Semi-braided	5 & 6	228 & 77
5	Wide (Single thread)	4	68	Wide (Single thread)	4	46

In some areas the calculated buffer zones were noted to exceed the EMAX extents (i.e. buffer zones extended further than areas of geological confinement such as valley walls or strath terraces). It is acknowledged that these areas of geological confinement are not immune from erosional processes and can retreat as a result of river erosion (albeit likely at a low rate and with a low probability within next 100 years).

Outputs of this assessment only consider modifications to both the channel and buffer management lines as a result of natural confinement¹⁵. Maps outlining the EFONC, EMAX and management lines for the Pohangina and Ōroua study reaches are provided in Appendix A and Appendix B respectively.

3.3 Regime Equation Sensitivity Testing

Horizons requested a high level sensitivity analysis for the six regime equations to better understand the sensitivity of the equations to changes in median sediment size and mean annual flood flow. It is noted that the sensitivity testing was completed to provide a high level understanding of how the regime equation change to input parameters. Catchment specific nuances of Pohangina or Ōroua systems have not been considered in this sensitivity assessment.

The effects on the widths derived from the regime equations were assessed for a 25% increase and decrease to the median sediment size (D_{50}) and flow input variables. Slope as a standalone input variable was not considered as it was assumed that a reduction in D_{50} could correlate to a reduction in slope¹⁶. Table 3.3 and corresponding Figure 3.3 show percent changes of widths for all 6 equations. We have highlighted results from equation 3 and 4 in red as these equations were predominantly used in this assessment for the channel width and the buffer widths respectively.

Generally, the sensitivity testing of regime equations show:

- 1 The equations are more sensitive to changes in flows than to sediment size, with Equation 5 being an exception.
- 2 Equation 1 and 2 are not dependent on median sediment size.
- 3 Among the regime equations, Equation 5 shows the greatest sensitivity to variations in both flow and sediment size.

Table 3.3: Percent changes of widths derived from regime equations for 25% changes to sediment size and flow inputs

Regime Equation	25% d50 decrease	25% d50 increase	25% flow decrease	25% flow increase
1	0%	0%	-13%	12%
2	0%	0%	-13%	12%
3	7%	-5%	-16%	14%
4	4%	-3%	-12%	11%
5	54%	-28%	-25%	25%
6	9%	-6%	-15%	14%

¹⁵ Agreed with Horizons at workshop undertaken on 2 October 2025.

¹⁶ Based on Sternbergs Law of downstream finings.

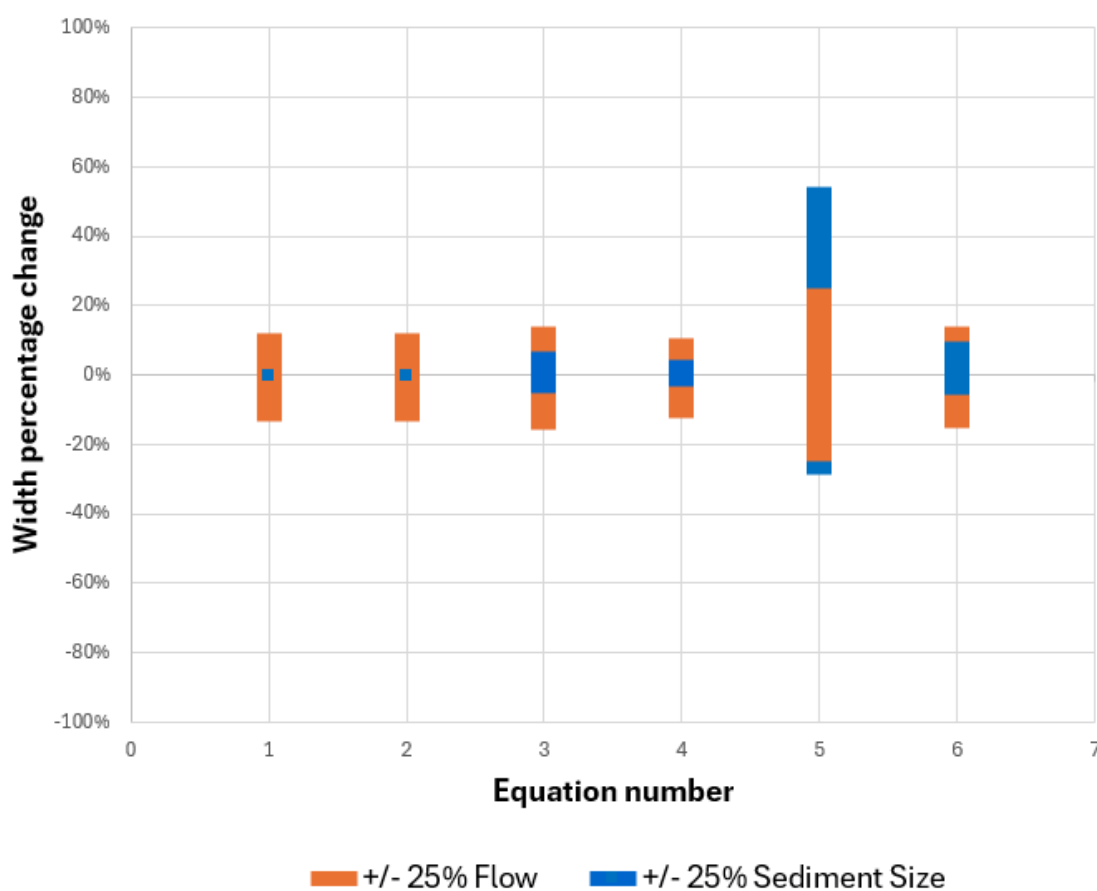


Figure 3.3. Sensitivity of sediment size and flow on regime equation output (width).

The sensitivity testing shows the regime equations are more sensitive to flow than median sediment size, except for Equation 5 which is more sensitive to changes in sediment size. It is also noted that most geomorphic work (erosion and sediment transport) takes place during floods, particularly in gravel bed rivers. Larger, less frequent floods are capable of performing significant geomorphic work, resulting in substantial channel adjustment. If empirical equations are to be used to define future design and buffer widths, larger flood magnitudes should be considered to accommodate the potential for significant adjustment, particularly in light of predicted future increases in flood magnitude.

4 Discussion and Recommendations

Although this assessment does not deliver the final set of design management lines (EMIN), it does provide 3 sets of management lines that can be used to inform the EMIN. The EMAX line represents the full extent of the erodible floodplain, the EFONC line reflects historical channel migration, and the regime management lines are based on estimates of average channel and buffer widths. None of the lines on their own will be suitable to apply as the EMIN for the entire rivers' length. A holistic approach that considers all lines should be taken to derive appropriate design management lines (EMIN).

It is recommended that the widest extent out of the EFONC and the regime management lines should be adopted as the EMIN for negotiation. Generally, adopting the widest extent of the EFONC and regime management lines gives a reasonable approximation of the likely width of the active river corridor in future. However, further assessment is required in some areas. Areas like these are highlighted in Appendix D, for which, a recommendation for the channel management line has been made. These recommendations have been made based on river channel trajectory and floodplain morphology. It should be noted that these recommendations are not extensive and are just examples of where the management lines may need adjusting. Additionally, it is recommended that further geomorphic analysis is undertaken for any areas of controversy or interest to ensure further accuracy when deriving the final EMIN lines.

4.1 Previous Recommendations for Lower Reaches of the Ōroua River

Fuller (2020) completed an assessment identifying high level recommendations to mitigate and slow further sediment aggradation within the lower Ōroua and Manawatū Rivers. These recommendations are summarised below. Further investigation and effects assessments for reach recommendation is needed to confirm suitability of implementation but are provided to provide valuable insight into the creation of final EMIN lines.

- 1 Provision of increased accommodation space for overbank sedimentation in the lower Ōroua and Manawatū Rivers¹⁷. The suggested areas are all within the Taonui Basin and provide space for sedimentation that would be present if the stop banks had not been implemented. These areas are recommended as locations that would provide higher relative benefit in terms of providing space for sediment deposition to reduce aggradation risks.
- 2 Re-connect the main river channel to palaeochannels so that the area available for natural sedimentation and accommodation of flood flows will be increased. Figure 4.1 shows an area recommended for re-establishing connectivity between the main channel and palaeochannels.
- 3 Make use of land depressions to act as sediment traps, through which the channel could be re-directed to encourage sedimentation (Figure 4.3). These zones also provide more room for sedimentation to reduce the risks of channel avulsion and flooding.
- 4 Utilising the confluence of the Ōroua and Manawatū as a sedimentation basin which would provide a large amount of room for sedimentation to occur (Figure 4.4).

¹⁷ The lower reaches of the Ōroua are experiencing aggradation which increases the risk for channel avulsion and flood risk. This aggradation occurs where stopbanks prevent the Taonui Basin from acting as a distributed sediment sink and therefore concentrate sediment deposition between the stopbanks.

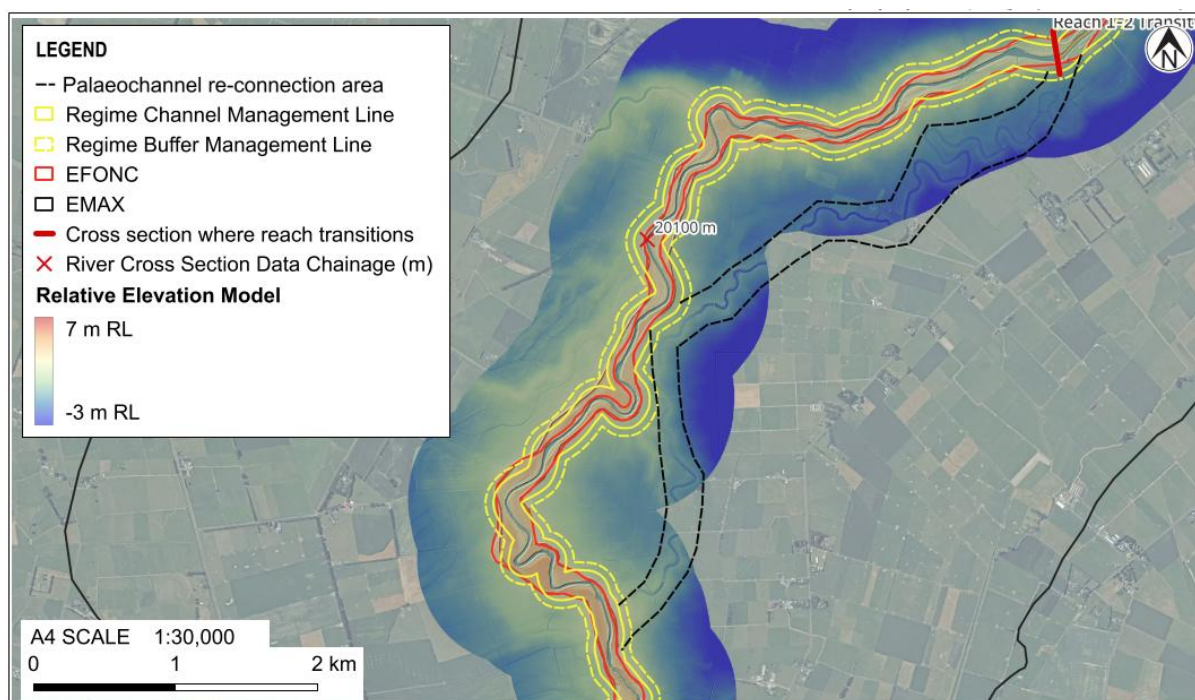


Figure 4.1: Example 1 of reconnection to palaeochannels.

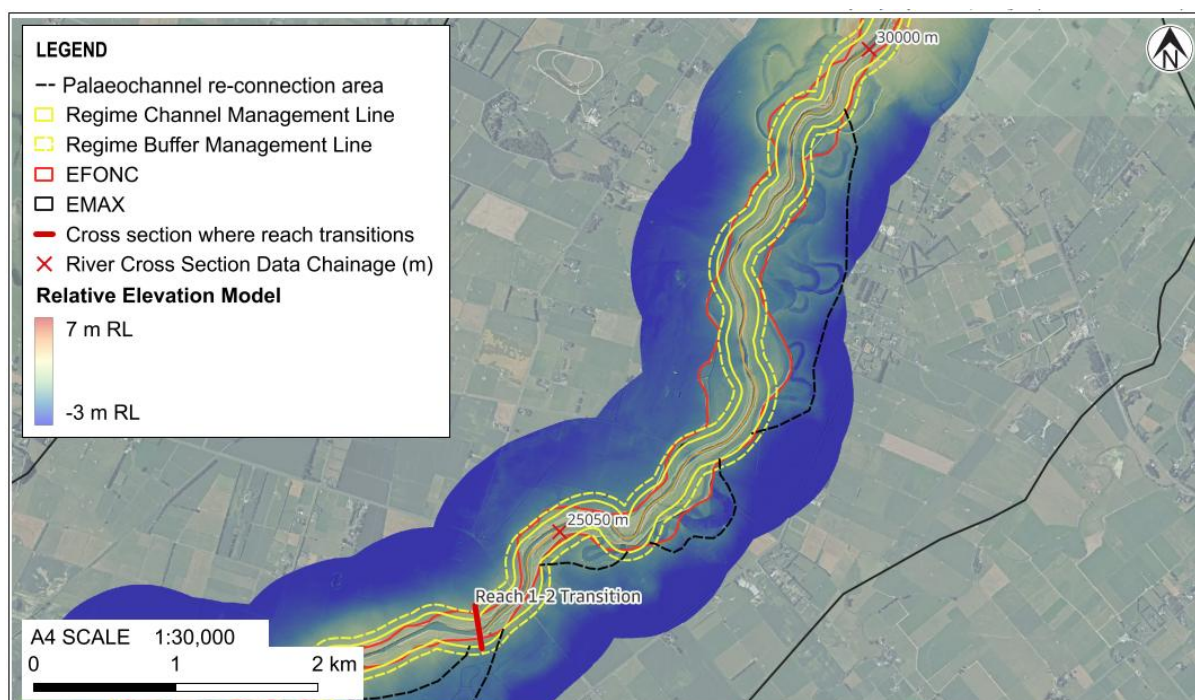


Figure 4.2: Example 2 of reconnection to palaeochannels.

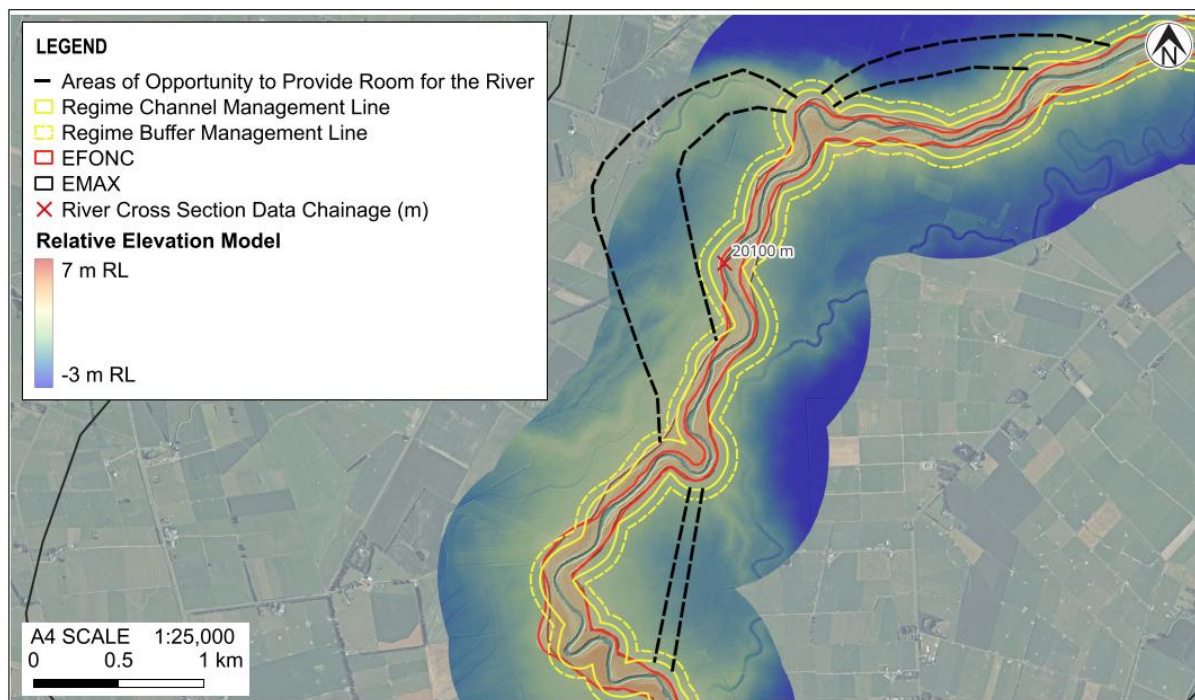


Figure 4.3: Redirection of channel example.

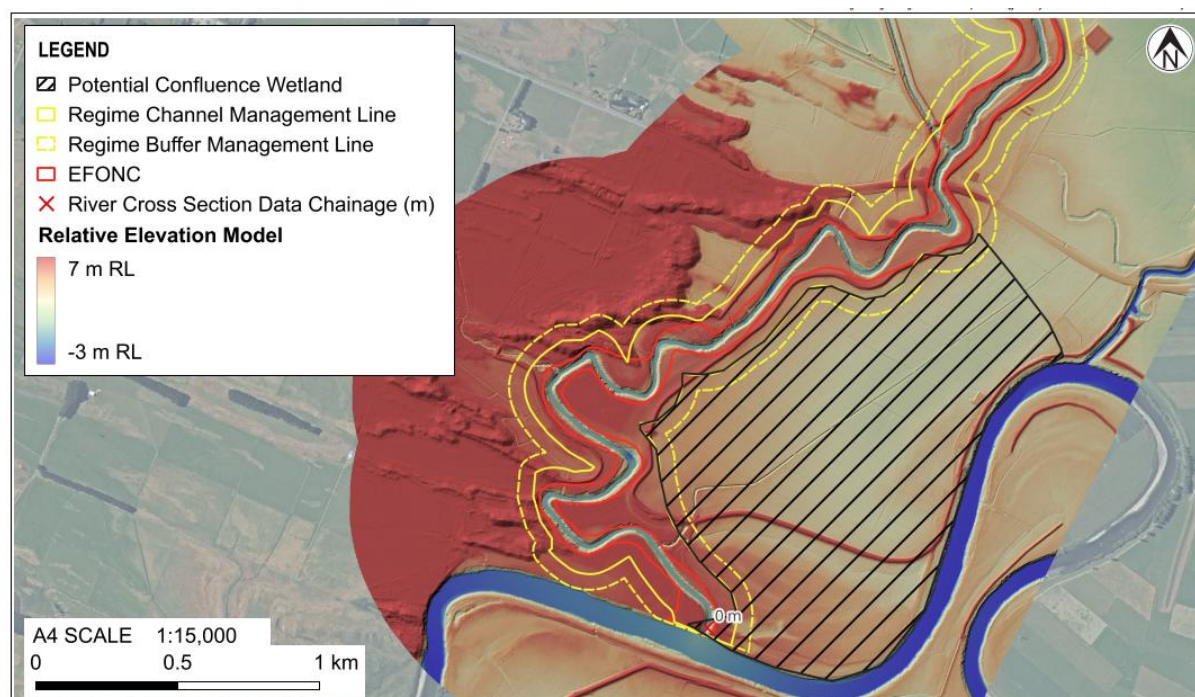


Figure 4.4: Utilising the confluence of the Ōroua and Manawatū as a sedimentation basin.

5 Limitations

A key limitation in the application of regime equations to define design channel and buffer widths lies in their original purpose. These equations were developed to describe (and therefore accommodate) the translation of actively migrating meanders in sand-bed river channels. Gravel bed river channels behave quite differently. Movement of gravelly bedload is intermittent, in contrast to 'live-bed' sandy channels. Gravelly rivers are less predictable in their adjustment, which occurs when their bedload is mobilised during sufficiently large flood events. This unpredictability means that, for example, the channel may avulse, or bends may become 'forced' in response to build up of gravel on the inside bend margin, because it does not flow freely like sand. Arguably, therefore, gravelly rivers require more room than sandy rivers to accommodate their unpredictability. Furthermore, design channel widths and buffer widths are here informed by the Mean Annual Flood. Most geomorphic work (erosion and sediment transport) takes place during floods, exclusively so in gravel bed rivers. Larger, less frequent floods are capable of performing significant geomorphic work, resulting in substantial channel adjustment. If empirical equations are to be used to define future design and buffer widths, larger flood magnitudes (e.g. Q_{100} , Q_{500}) should also be considered to accommodate the potential for significant adjustment, particularly in light of predicted future increases in flood magnitude.

The room required for a gravel bed river to efficiently convey its bedload and adjust its channel form is best defined using a geomorphic approach. The recommended lines in this report seek to apply this approach in conjunction with the empirically derived corridors and buffers, where the swath of the active channel in the past ~80 years is used to guide these lines in conjunction with the local floodplain morphology evident in the REM. This corridor reflects the extents of river adjustment over the best part of a century and can be considered to provide a reasonable approximation or prediction of where the river channel might migrate in coming decades. However, even this approach is limited because these ~80 years of river behaviour do not accommodate the potential geomorphic response to larger floods than have occurred in this period, which could result in reworking of the erodible floodplain (EMAX). A precautionary approach is therefore advised when considering any activity on the floodplain.

6 Conclusions

This assessment provides a base for Horizons to understand potential river management lines based on three sets of lines (EMAX, EFONC and regime equation widths). Further interrogation of these management lines, in conjunction with the review of current river management practices, and stakeholder consultation, can be used to provide an appropriate river management envelope known as the EMIN. To assist with this consultation, we also provide a set of recommendations for the channel management lines, which are informed by river channel trajectory and floodplain morphology. These recommendations consider likely channel mobility and adjustment beyond the existing historic mobility corridor (EFONC) and river regime management lines, within the constraints of the EMAX. Otherwise, whichever is widest (EFONC or river regime management lines) is recommended to form the basis for EMIN negotiation.

7 References

- Altunin, S. (1962). Regulirovanie rusel (in Russian). *River Training*, Moscow SLIP.
- Chang, H. (1988). *Fluvial Processes in River Engineering*.
- Christensen, K. (2023). *Application of Room for the River for NZ Rivers & Streams*. Wellington: Christensen Consulting Ltd.
- Clement, A. J. (2017). Facies architecture, morphostratigraphy, and sedimentary evolution of a rapidly-infilled Holocene incised-valley estuary: The lower Manawatu valley, North Island New Zealand. *Marine Geology*, 390, 214-233.
- Fuller, I. (2020). *LMS shovel ready sedimentation - assessment ICF*.
- Henderson, F. (1996). Open Channel Flow.
- Heron, D. (2023). Geological map of New Zealand 1:250 000 (4th ed.). Lower Hutt, NZ.
- Horizons Regional Council. (2025). *Managing Natural Resources*. Retrieved from Nature-Based Solutions Investigation - Ōroua and Pohangina Rivers: <https://www.horizons.govt.nz/managing-natural-resources/nature-based-solutions-investigation-oroua-and-poh>
- Lacey, G. (1929). Stable channel in alluvium. *Min. Inst. CivilEngrs*, 259-285.
- Land Information New Zealand. (2025). New Zealand DEM Hillshade. New Zealand .
- Landcare Research. (2024, Nov). LCDB v5.0 - Land Cover Database version 5.0, Mainland, New Zealand.
- NIWA. (2025). *Appendices to Flood Frequency in Horzins Region Report of March 2025*. NIWA.
- Piégay, H. D. (2005). A review of techniques available for delimiting the erodible river corridor: a sustainable approach to managing bank erosion. *River Research and Applications*, 21(7), 773-789.
- Tonkin & Taylor Ltd. (2025). *Pohangina and Oroua Natural Character Index Assessment*. Tonkin & Taylor Ltd.
- Wolman, M. G. (1957). River Flood Plains: Some Observations On Their Formation. *Geological Survey Professional Paper 282-C*, 87 - 109.

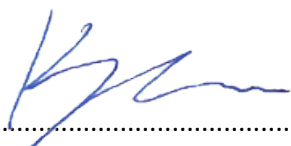
8 Applicability

This report has been prepared for the exclusive use of our client Horizons Regional Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

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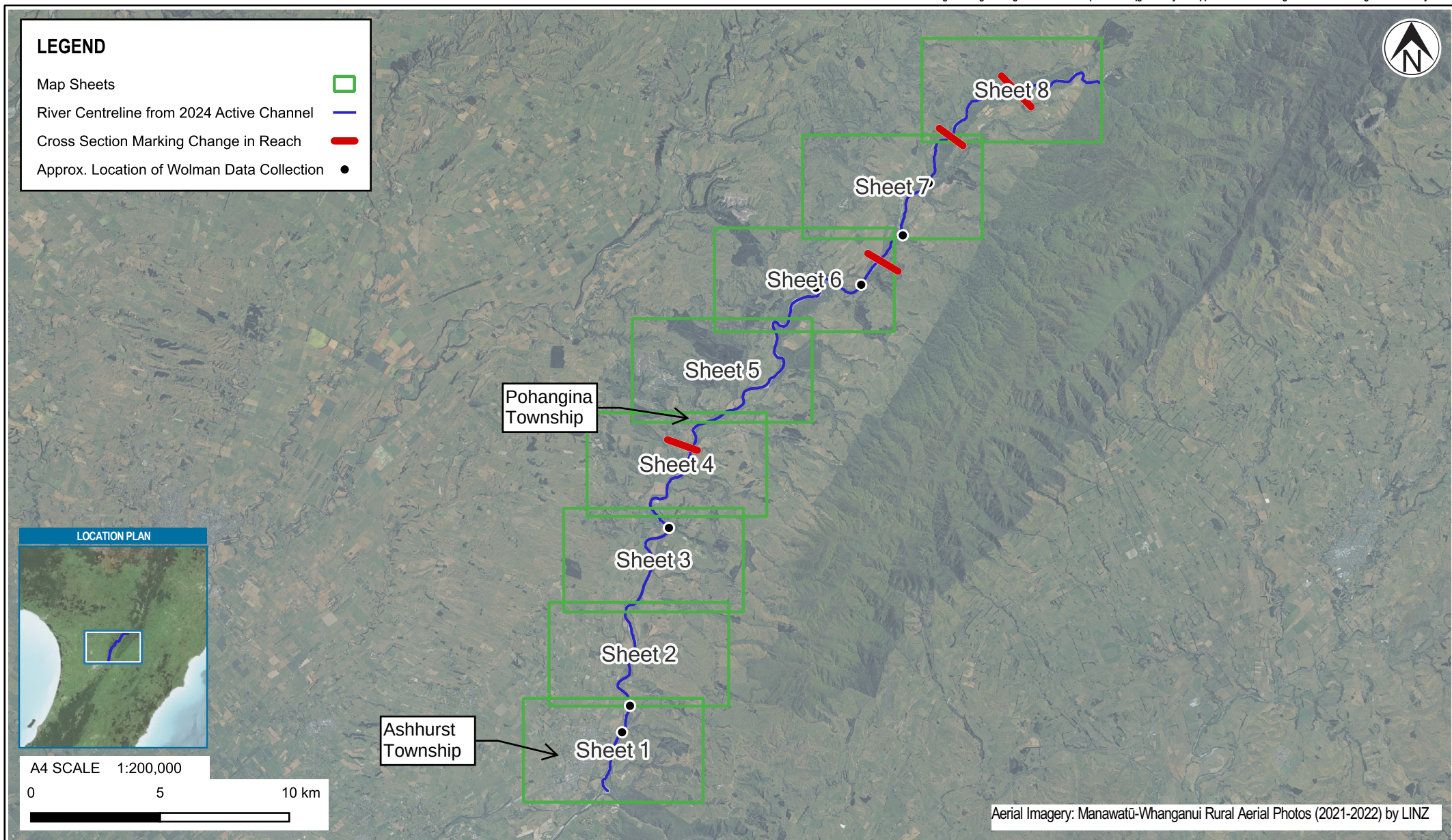
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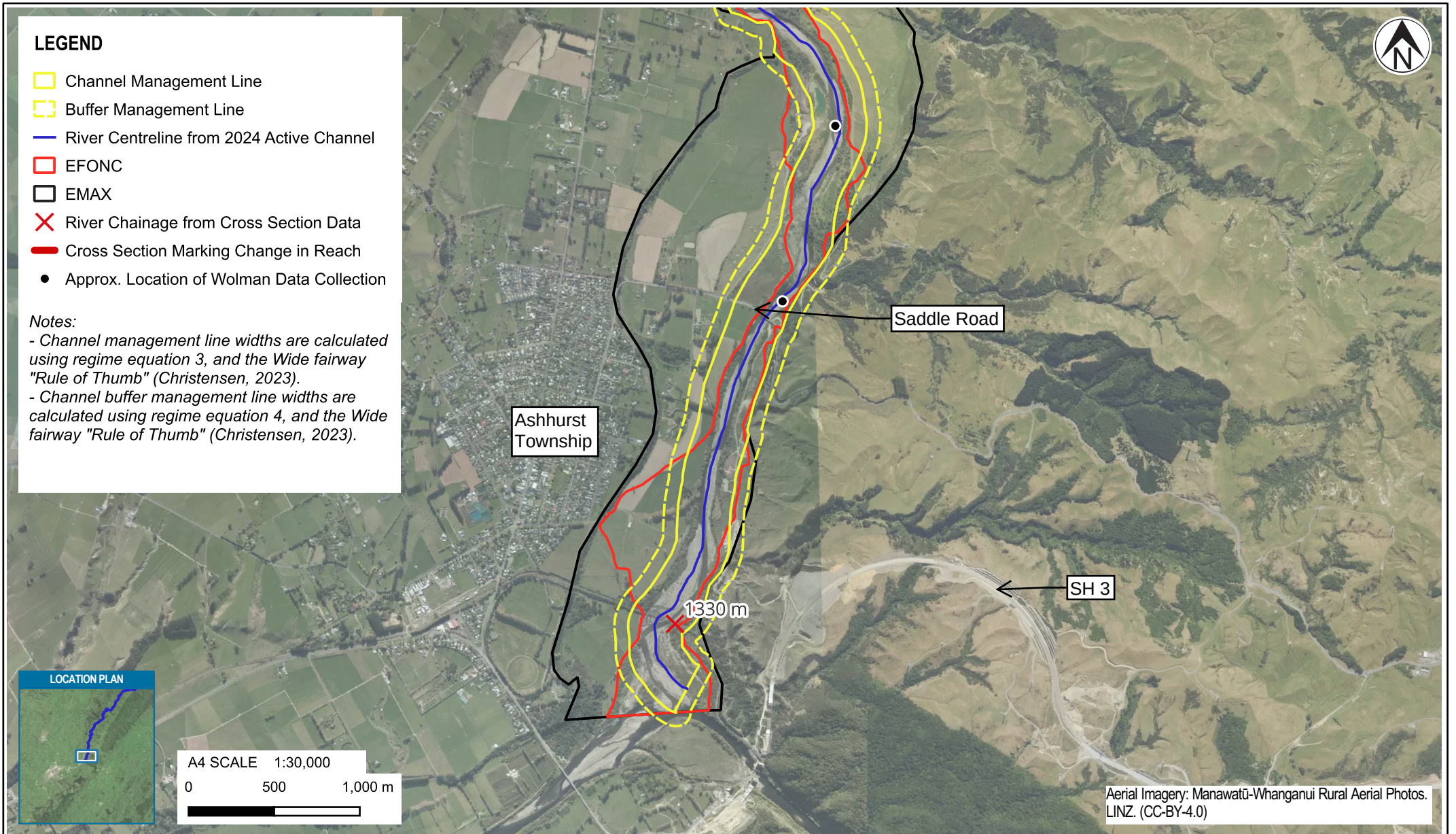
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Appendix A Pohangina – EFONC, EMAX and Regime Management Lines



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	Third version (14/01/26)	3	JESH	CHECKED	KJOH	JAN.26			
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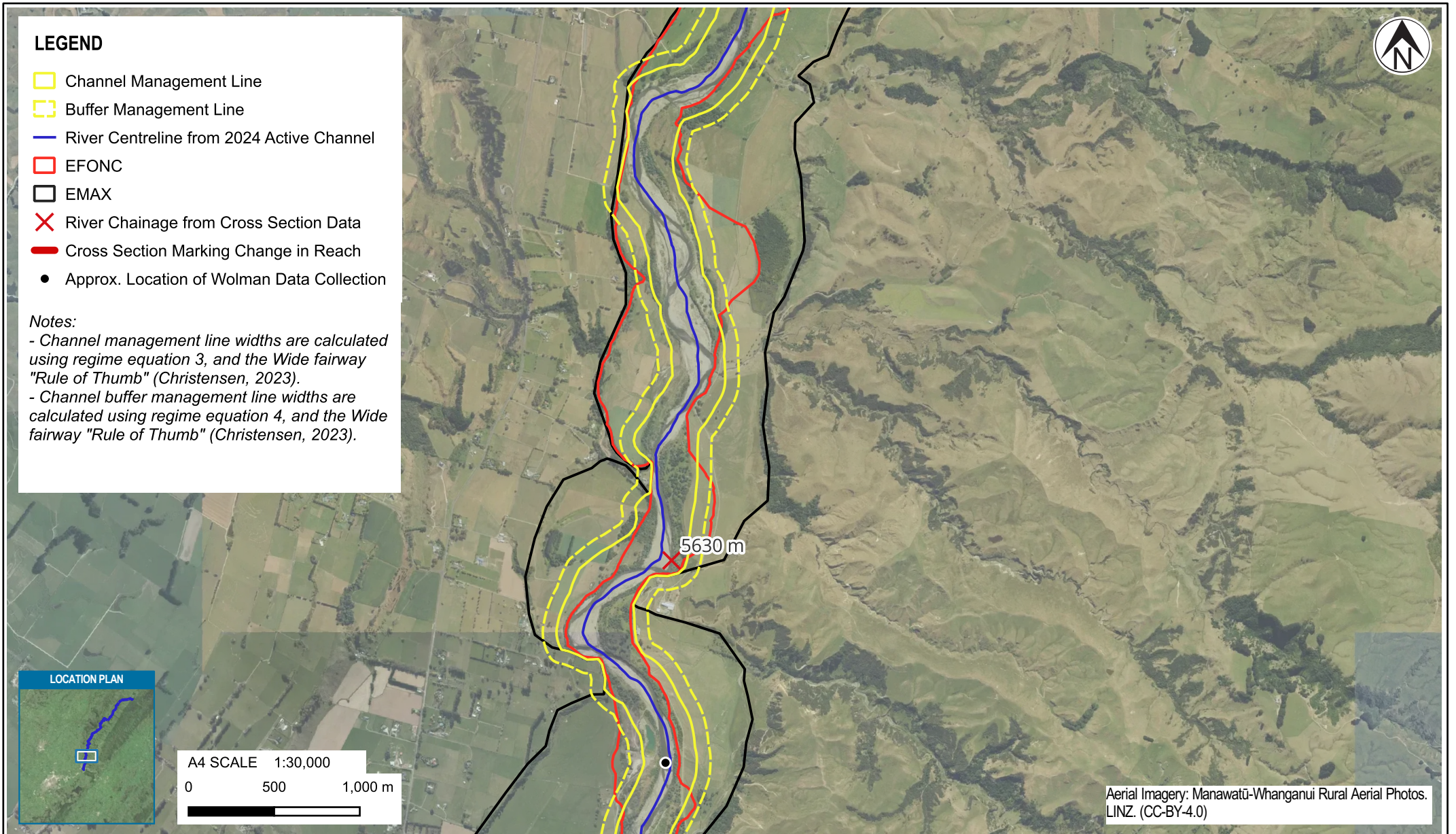
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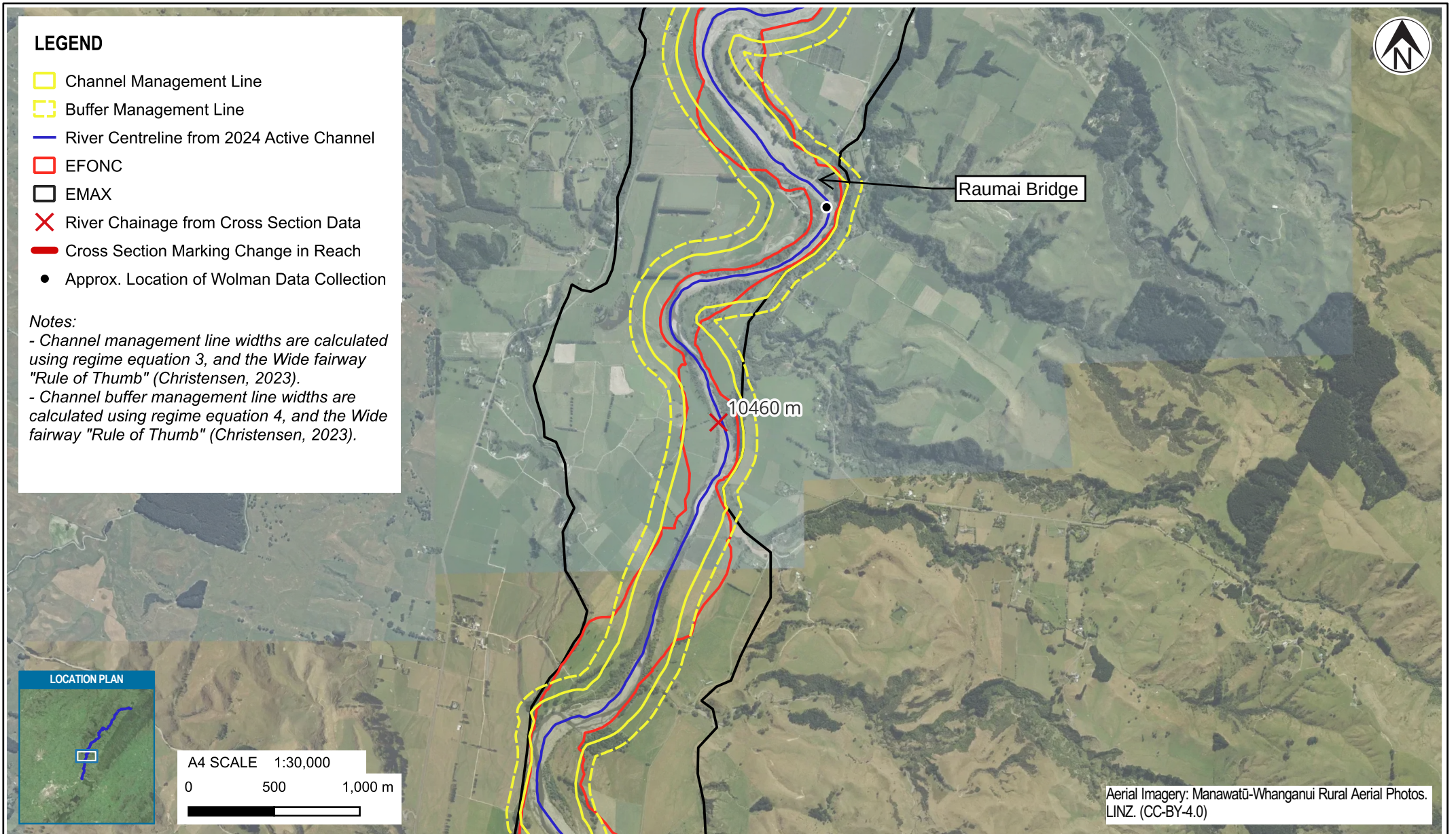
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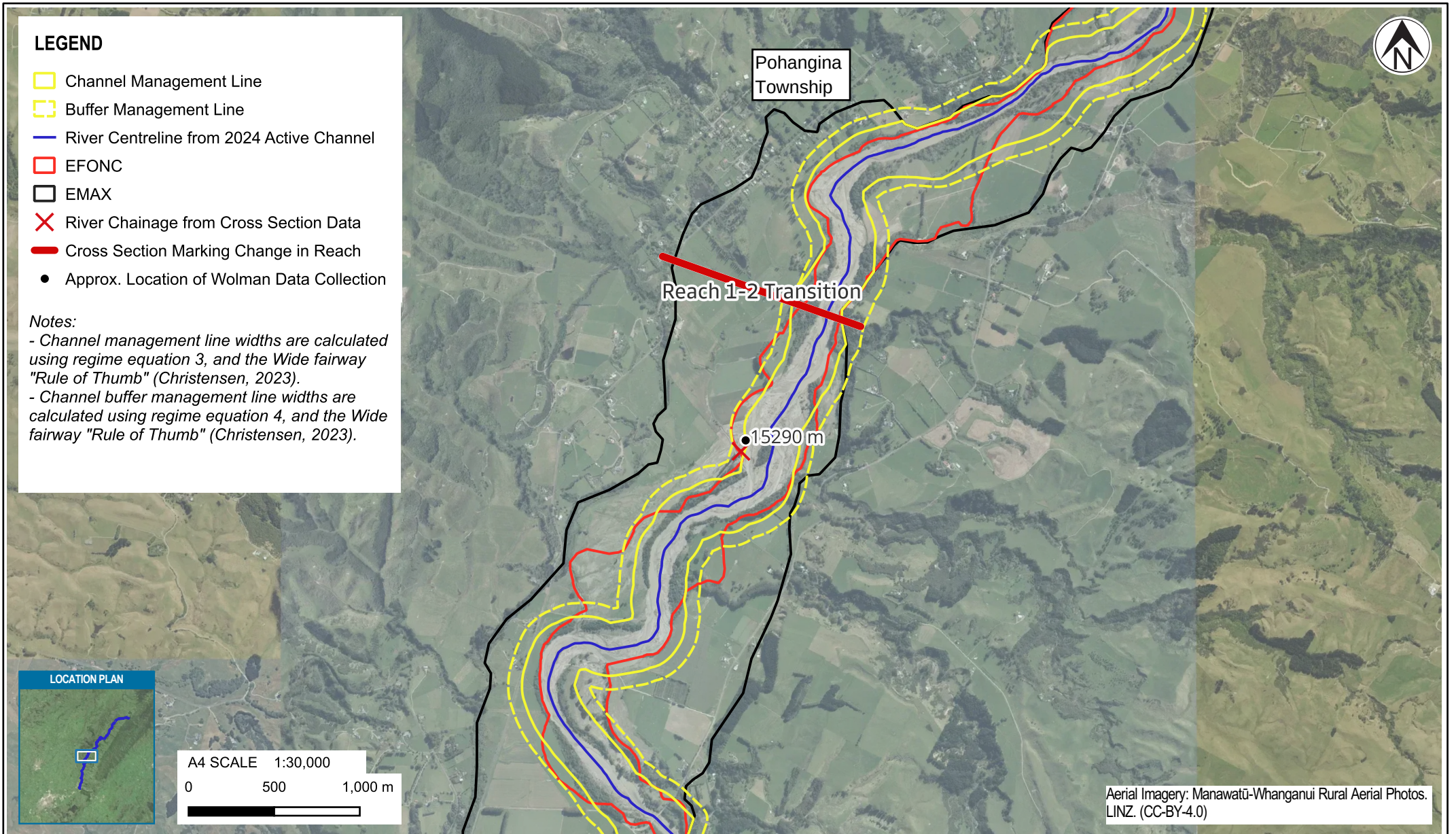
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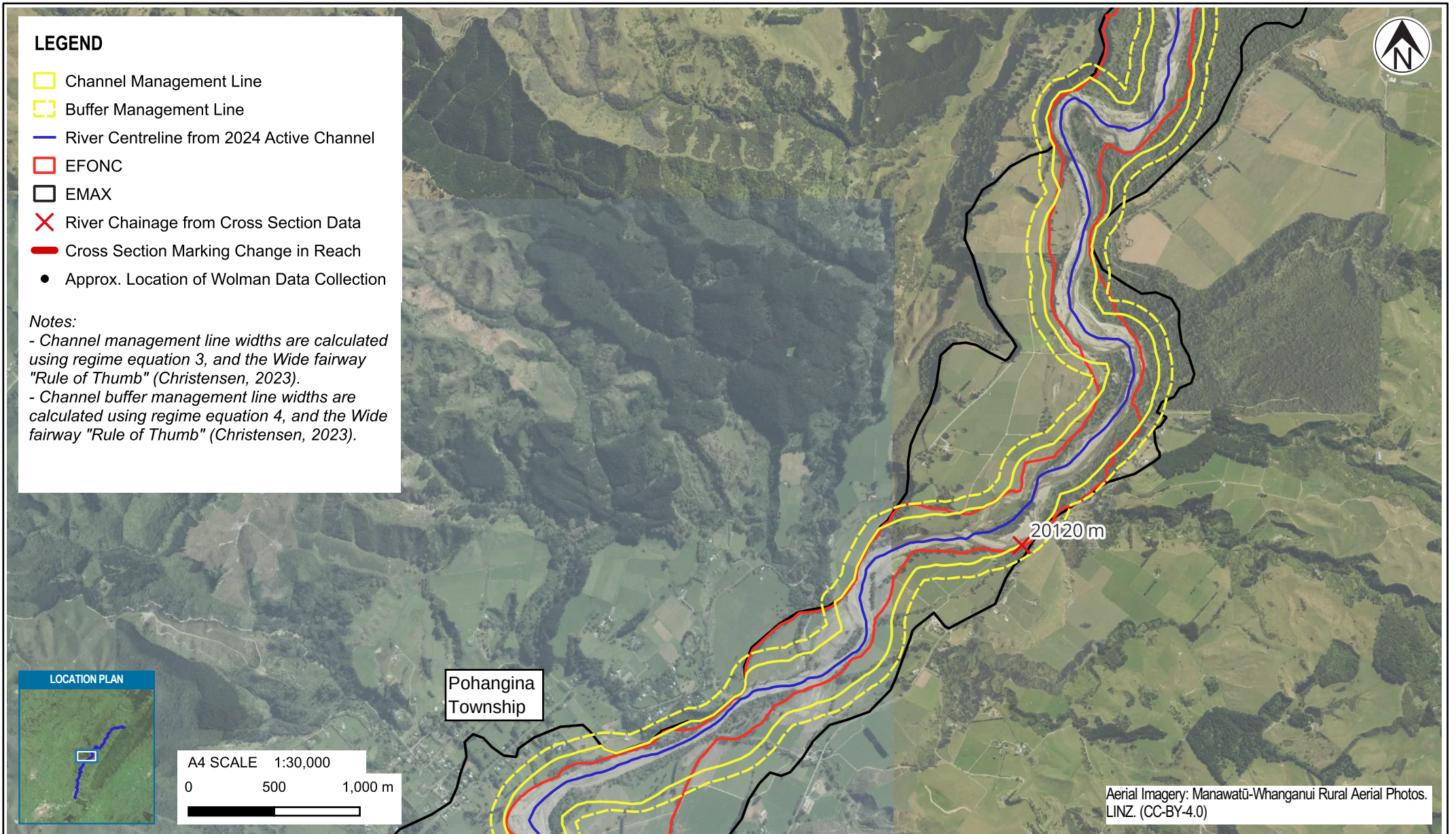
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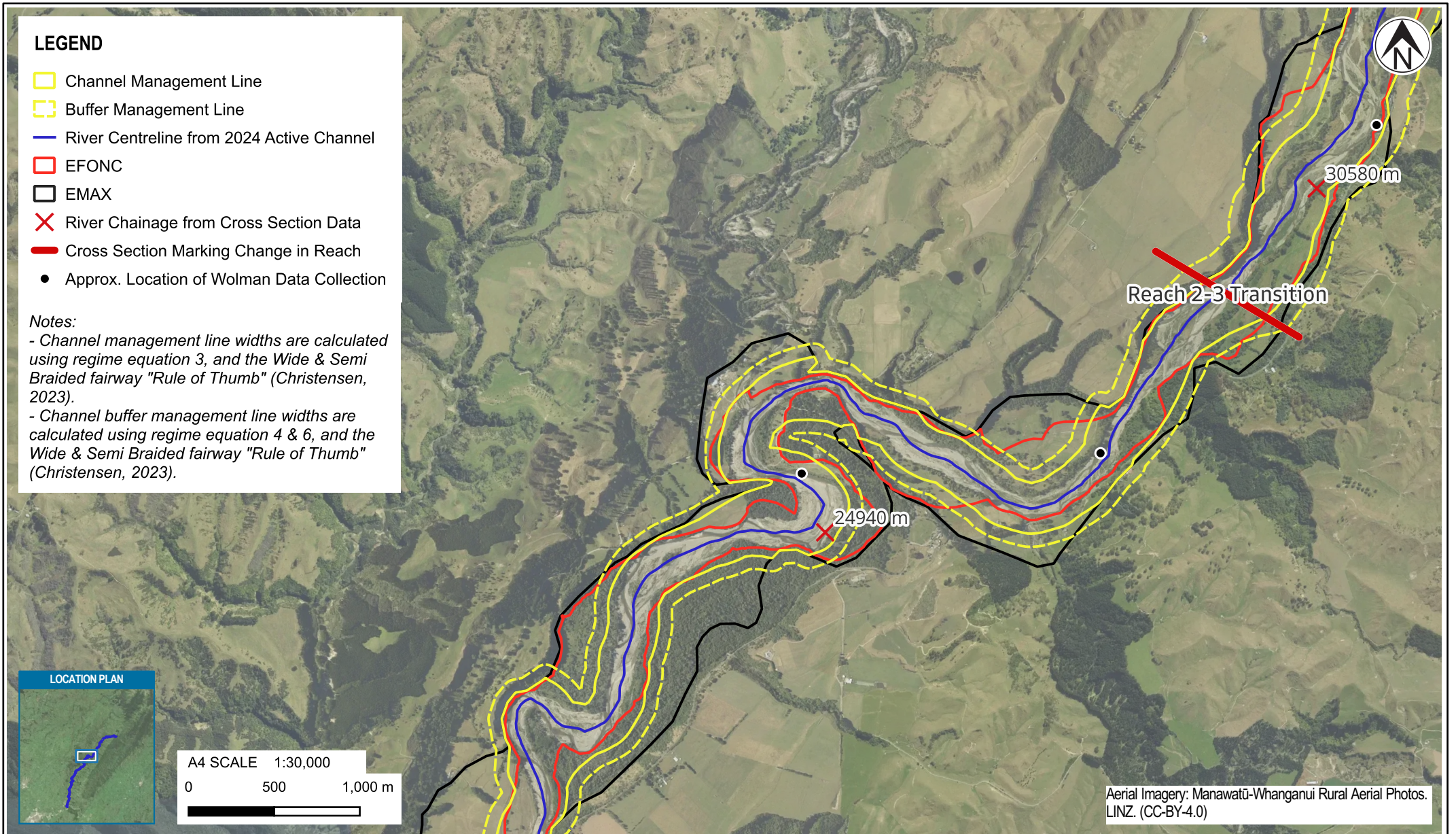
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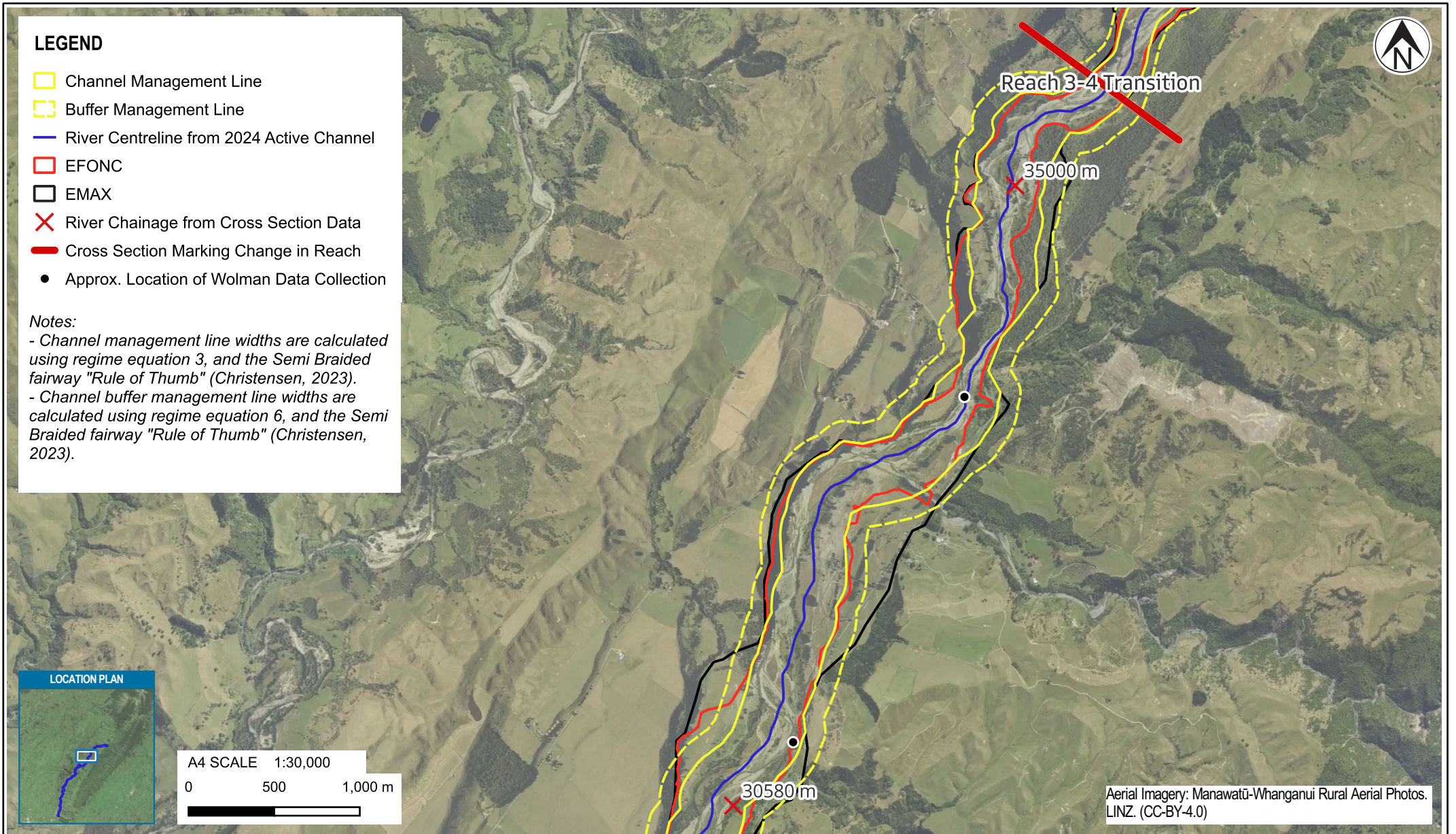
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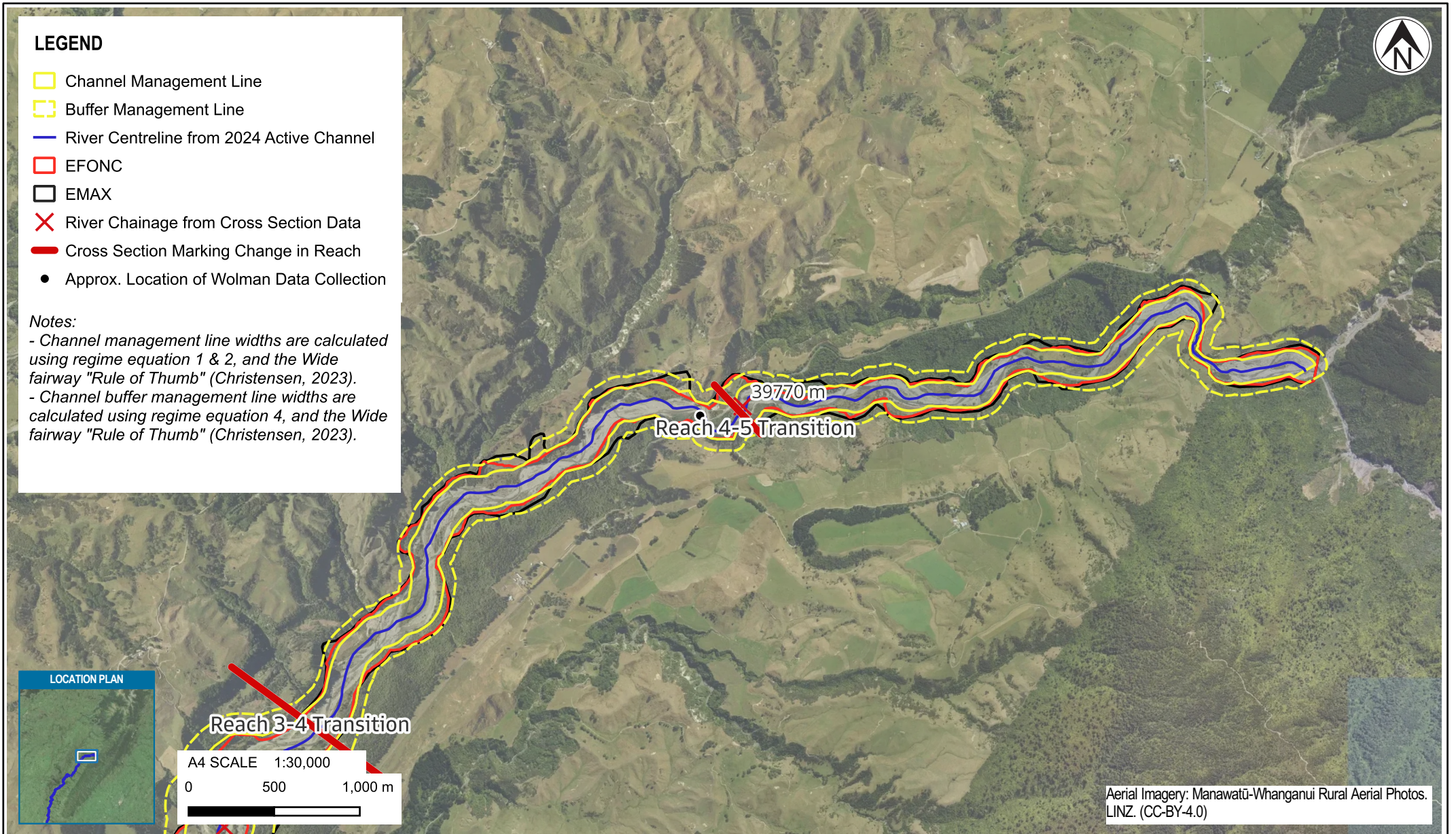
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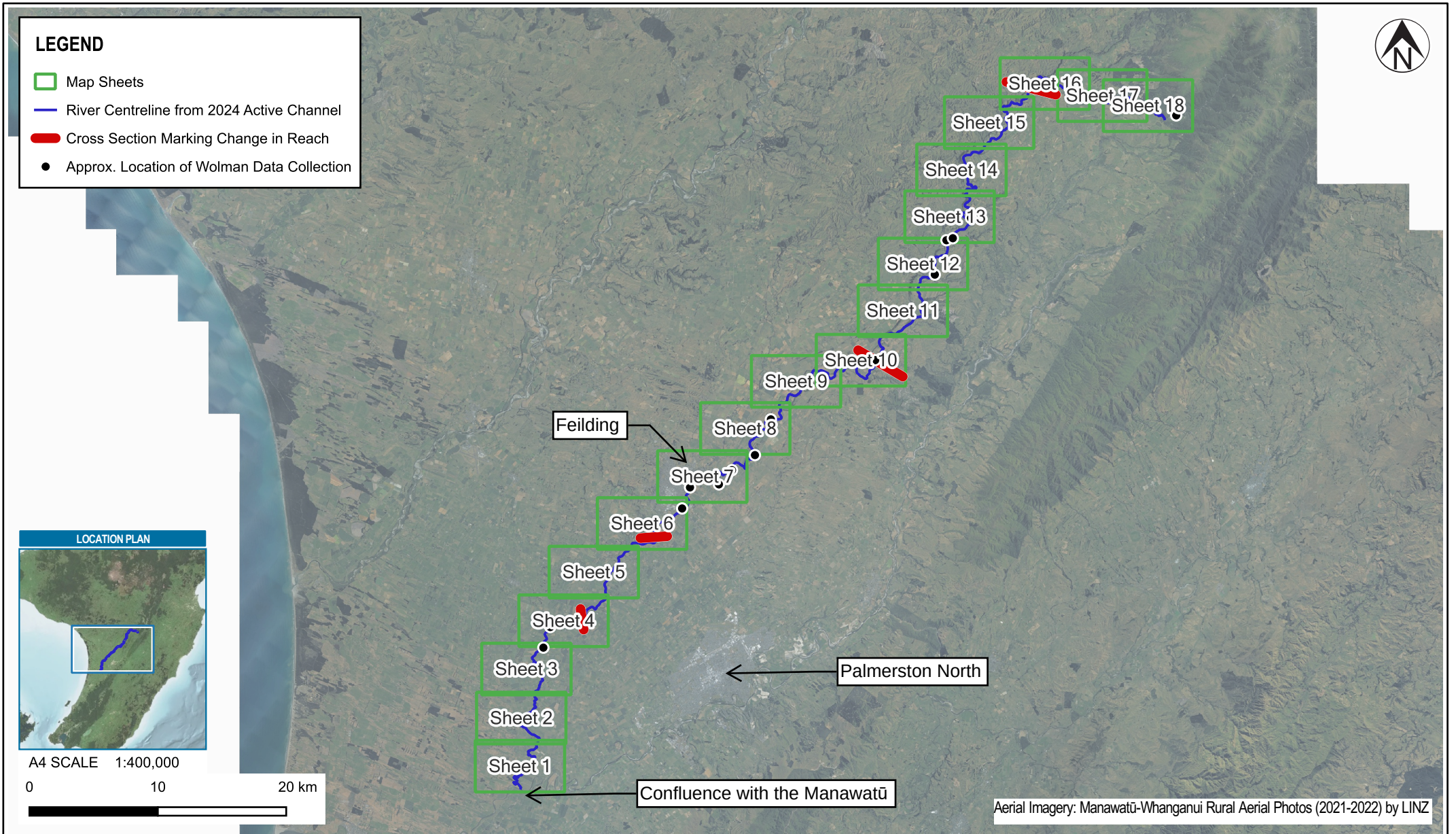
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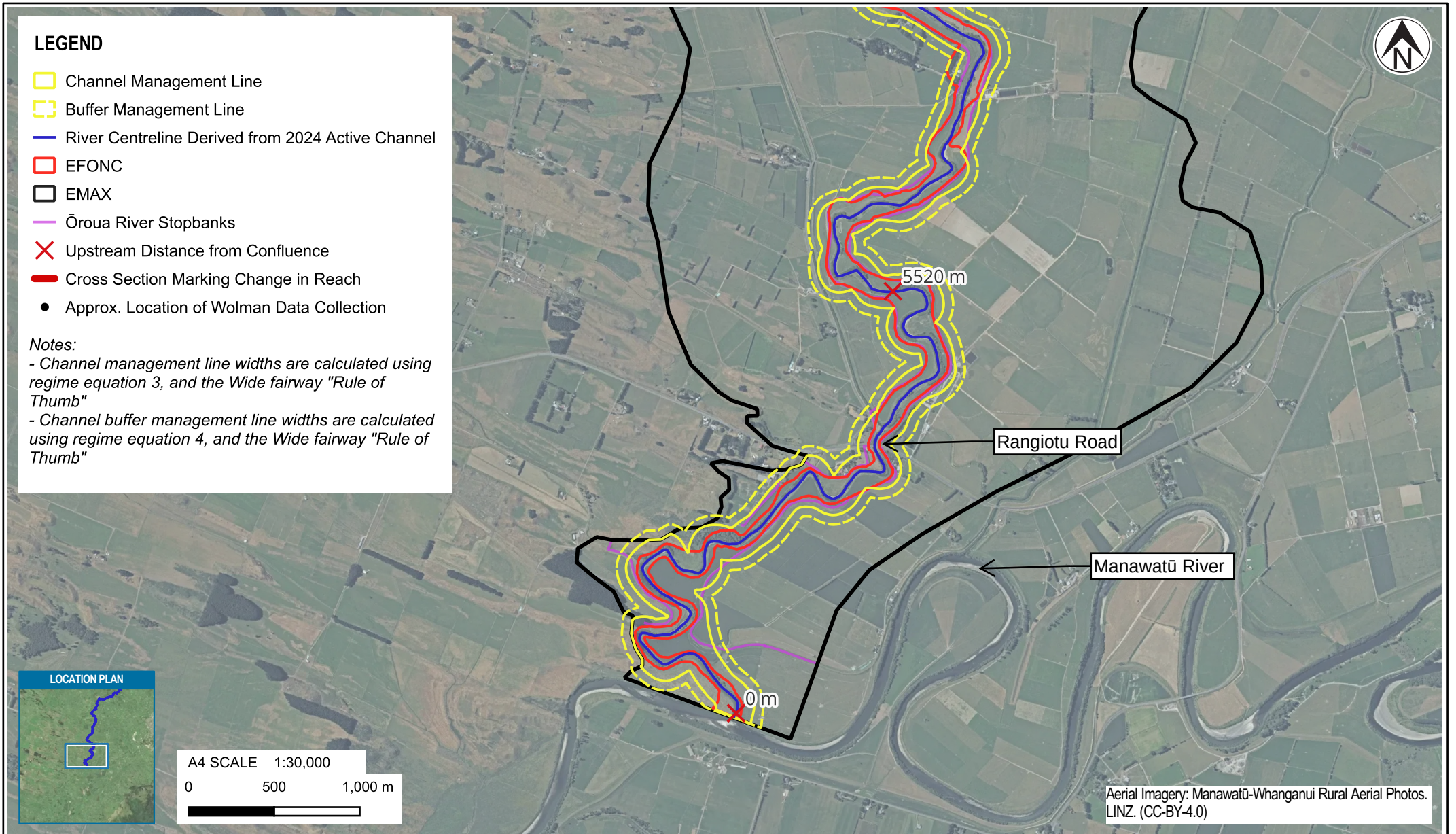
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Appendix B Ōroua – EFONC, EMAX and Regime Management Lines



NOTES:	REVISIONS		NO.	BY	PROJECT No. 1092594.0001			CLIENT	HORIZONS REGIONAL COUNCIL			
	First version (10/11/25)		1	JESH	DESIGNED	JESH	JAN.26	PROJECT	ŌROUA AND POHANGINA MANAGEMENT LINES			
	Second version (27/11/25)		2	JESH	DRAWN	JESH	JAN.26	TITLE ŌROUA RIVER MAP SERIES INDEX				
	Third version (15/01/26)		3	JESH	CHECKED	KJOH	JAN.26					
					 28/01/26							
					APPROVED	DATE	SCALE (A4)	1:400,000	FIG No.	FIGURE 2-0	REV	3



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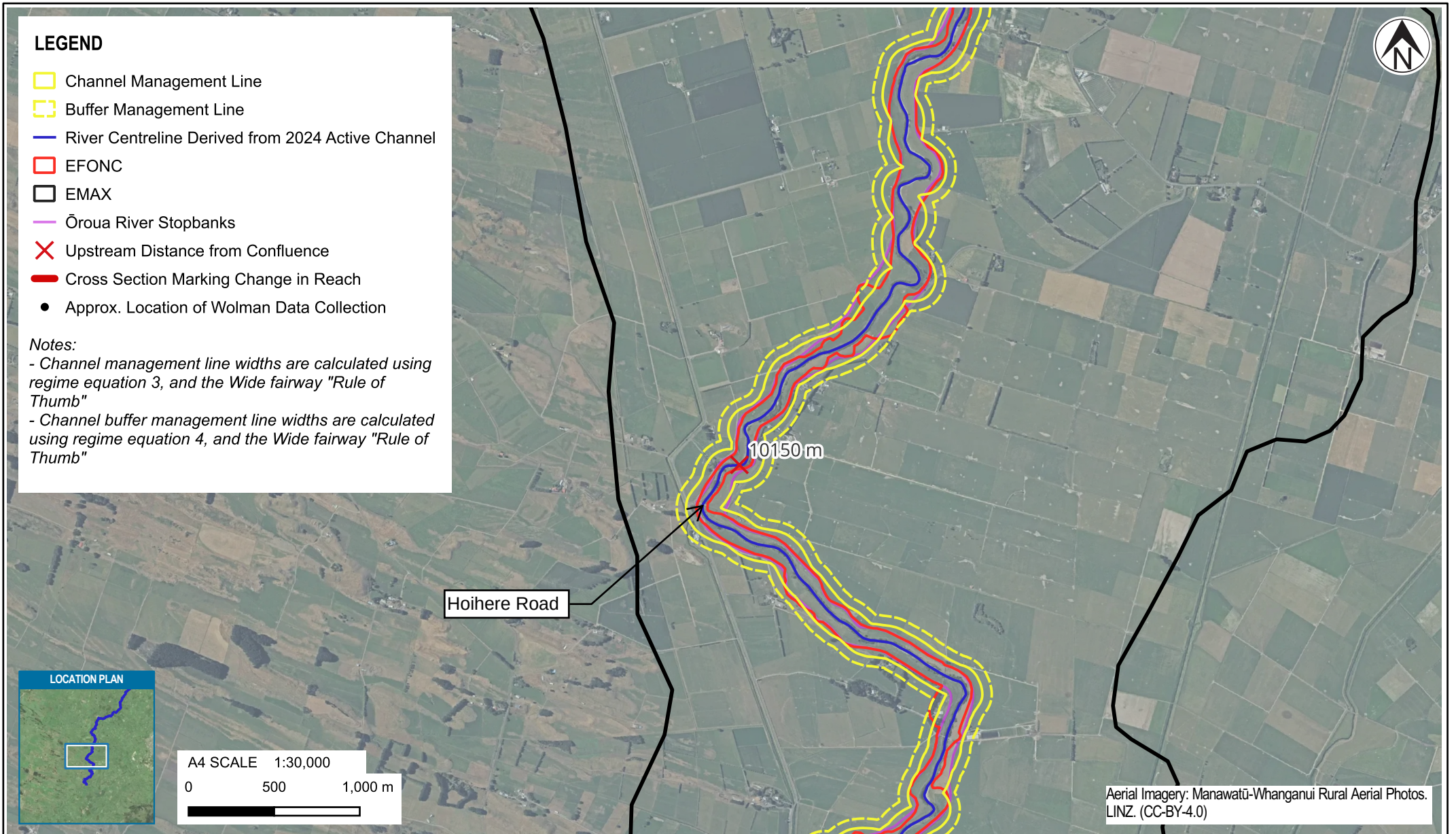
TITLE ŌROUA RIVER

EFONC, EMAX, and River Regime Management Lines

SCALE (A4) 1:30,000

FIG No. FIGURE 2-1

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EFONC, EMAX, and River Regime Management Lines

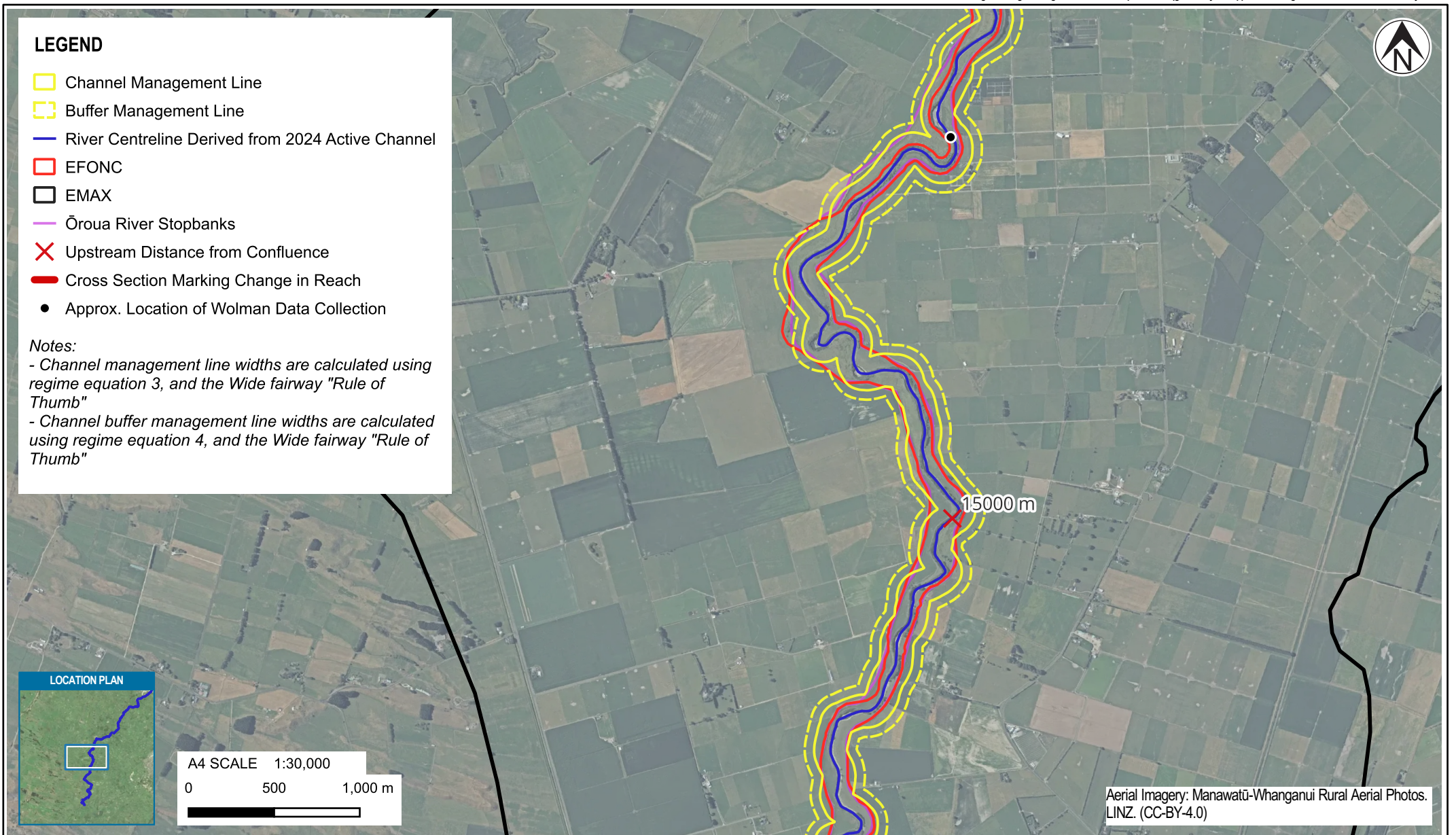
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FIG No.

FIGURE 2-2

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TITLE

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EFONC, EMAX, and River Regime Management Lines

SCALE (A4)

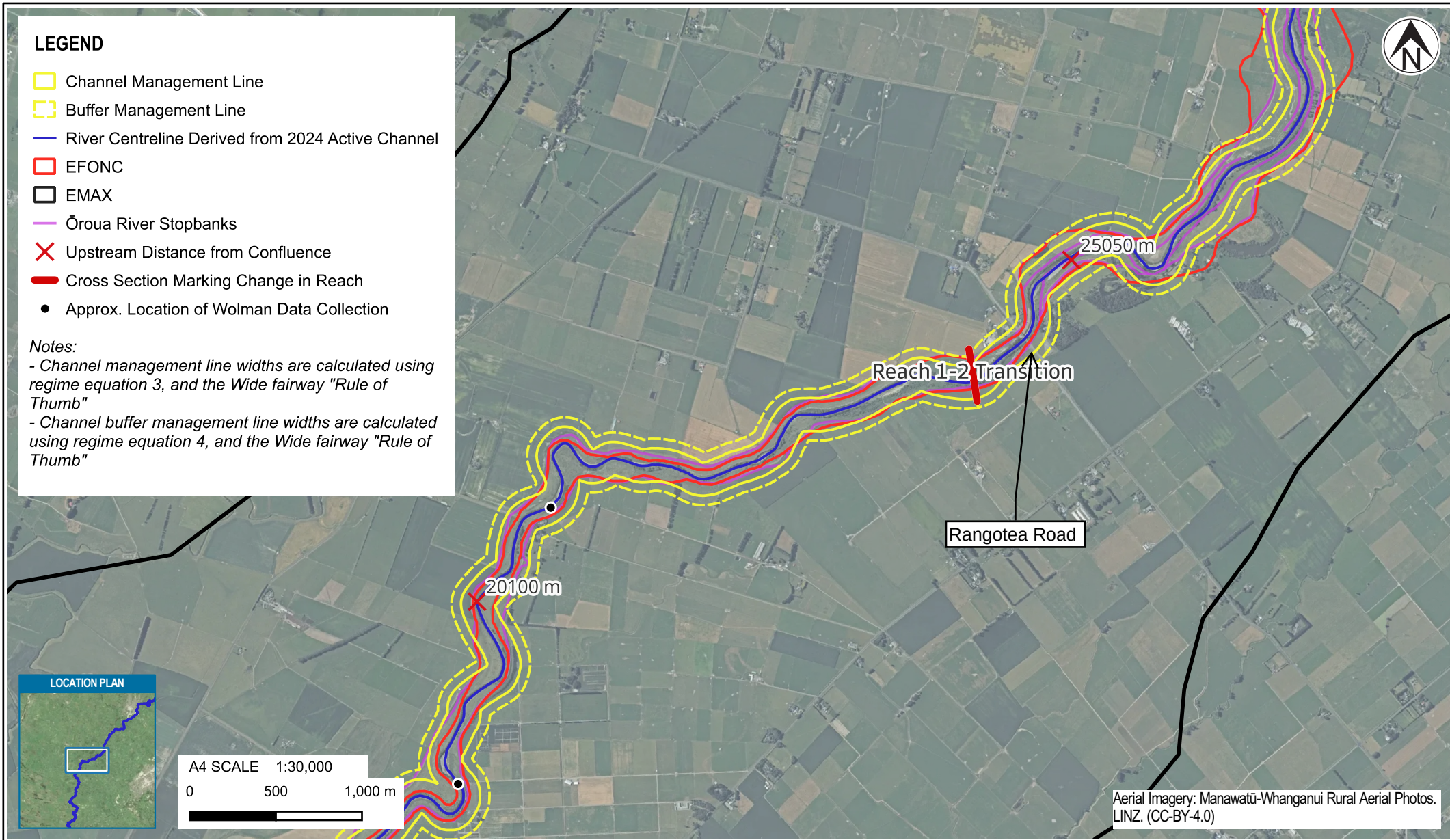
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FIG No.

FIGURE 2-3

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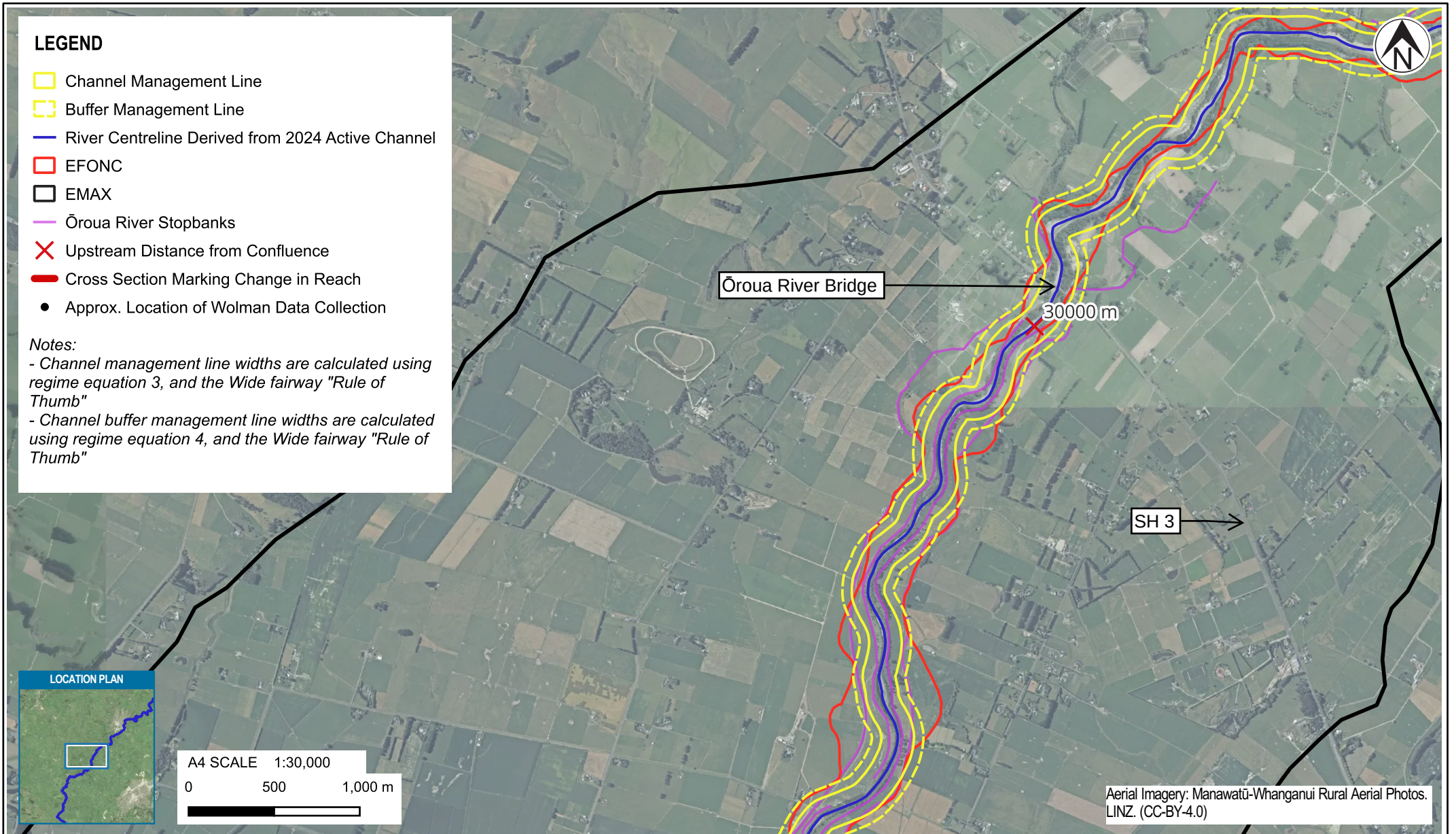
TITLE ŌROUA RIVER

EFONC, EMAX, and River Regime Management Lines

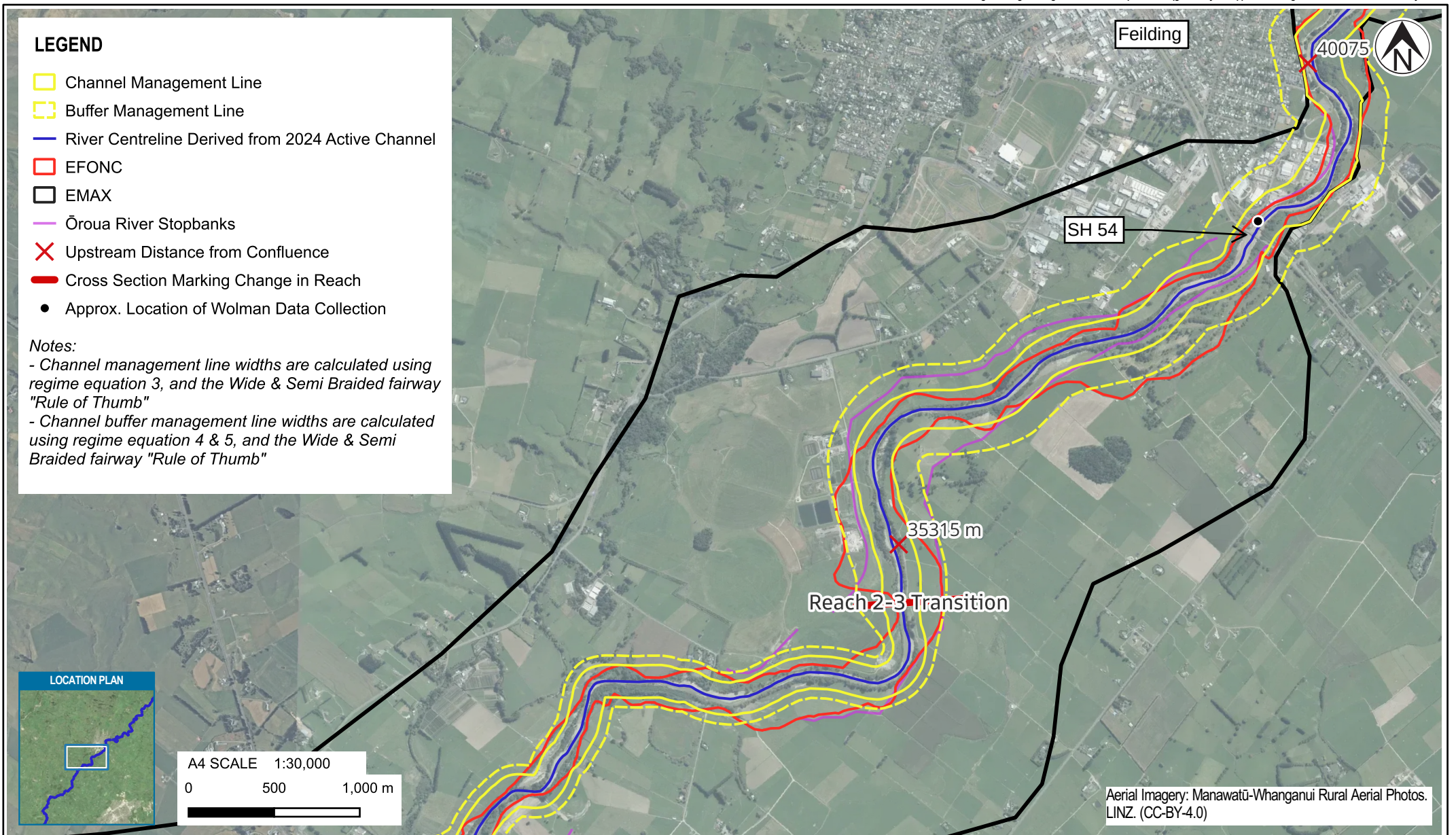
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FIG No. FIGURE 2-4

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		First version (18/09/25)			1	JESH	DESIGNED	JESH	JAN.26	PROJECT POHANGINA AND ŌROUA MANAGEMENT LINES							
		Second version (27/11/25)			2	JESH	DRAWN	JESH	JAN.26	TITLE ŌROUA RIVER EFONC, EMAX, and River Regime Management Lines							
		Third version (15/01/26)			3	JESH	CHECKED	KJOH	JAN.26								
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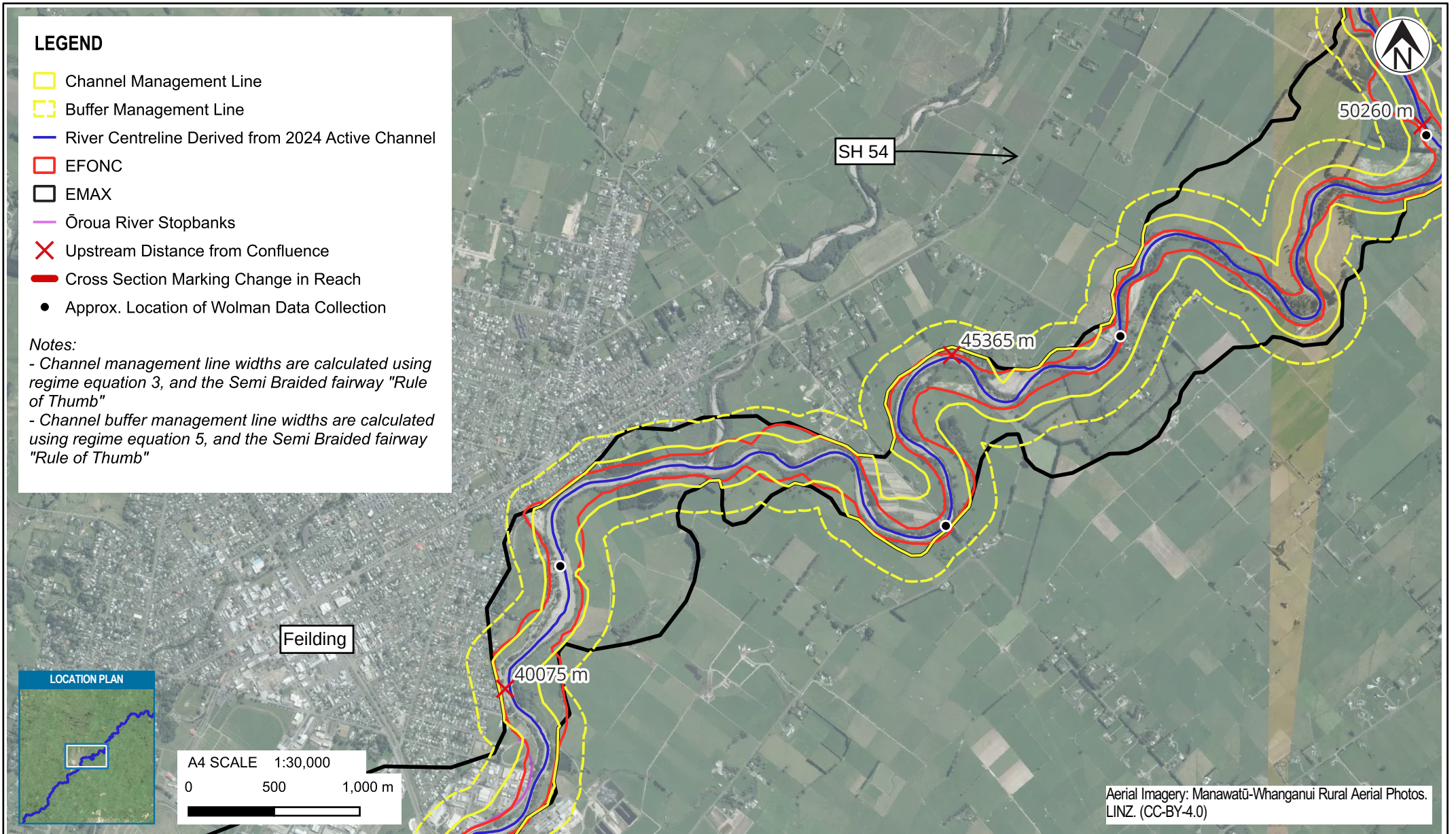
TITLE ŌROUA RIVER

EFONC, EMAX, and River Regime Management Lines

SCALE (A4) 1:30,000

FIG No. FIGURE 2-6

REV 3



LEGEND

- Channel Management Line
- - - Buffer Management Line
- River Centreline Derived from 2024 Active Channel
- EFONC
- EMAX
- - - Ōroua River Stopbanks
- X Upstream Distance from Confluence
- Cross Section Marking Change in Reach
- Approx. Location of Wolman Data Collection

Notes:

- Channel management line widths are calculated using regime equation 3, and the Semi Braided fairway "Rule of Thumb"
- Channel buffer management line widths are calculated using regime equation 5, and the Semi Braided fairway "Rule of Thumb"

LOCATION PLAN



A4 SCALE 1:30,000
0 500 1,000 m

Aerial Imagery: Manawātū-Whanganui Rural Aerial Photos.
LINZ. (CC-BY-4.0)

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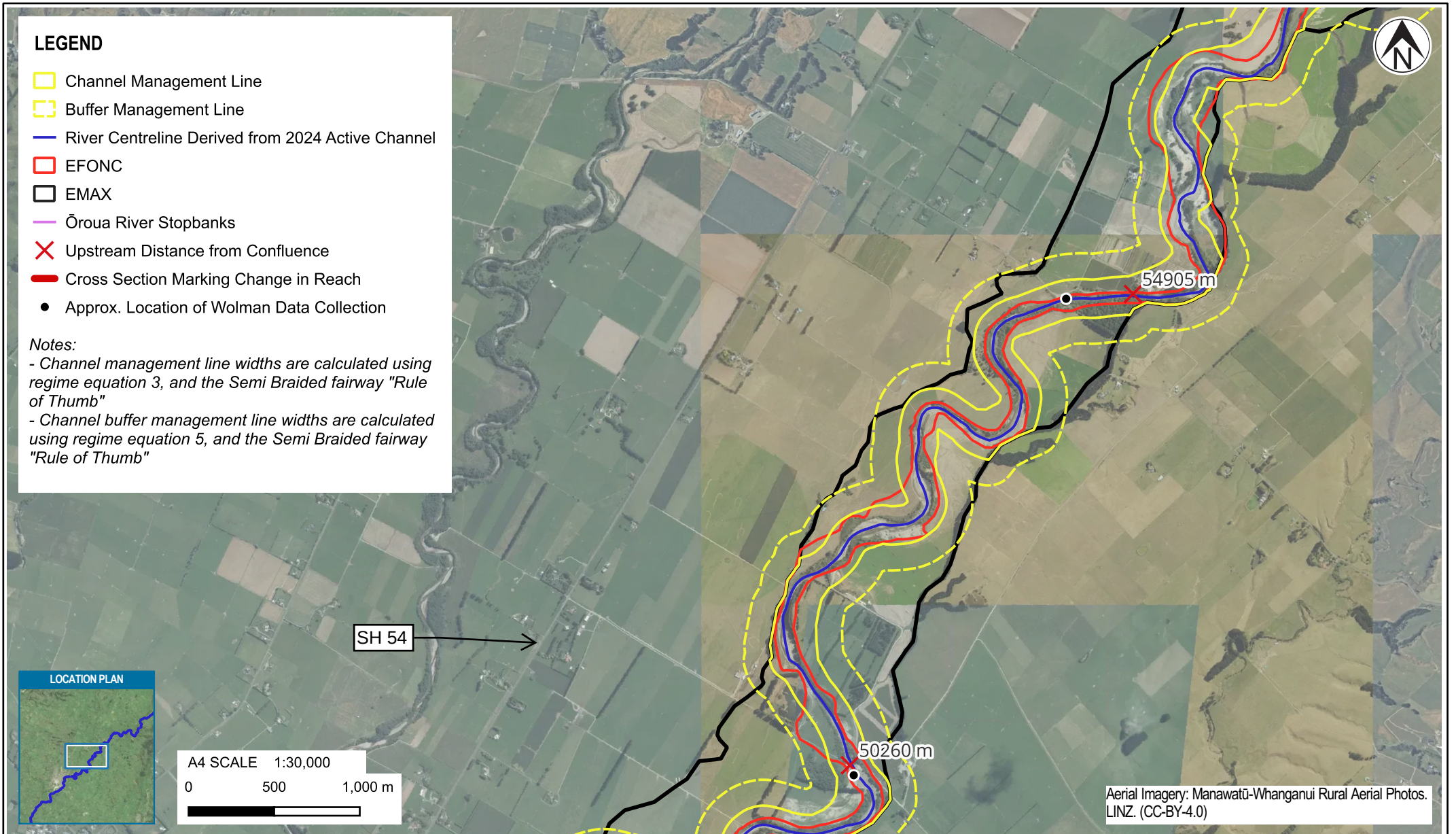
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FIG No. FIGURE 2-7

REV 3



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SCALE (A4)

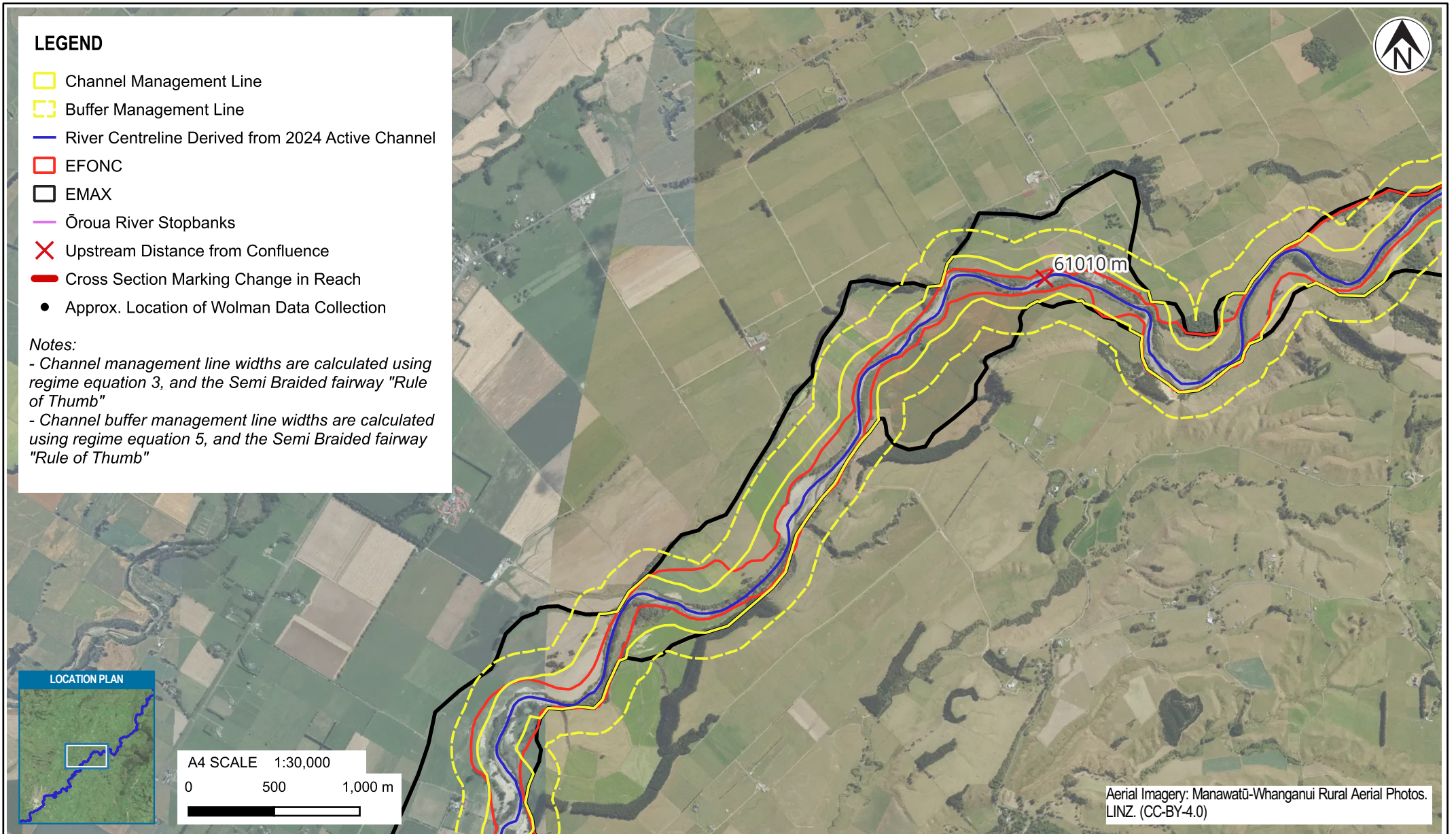
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FIG No.

FIGURE 2-8

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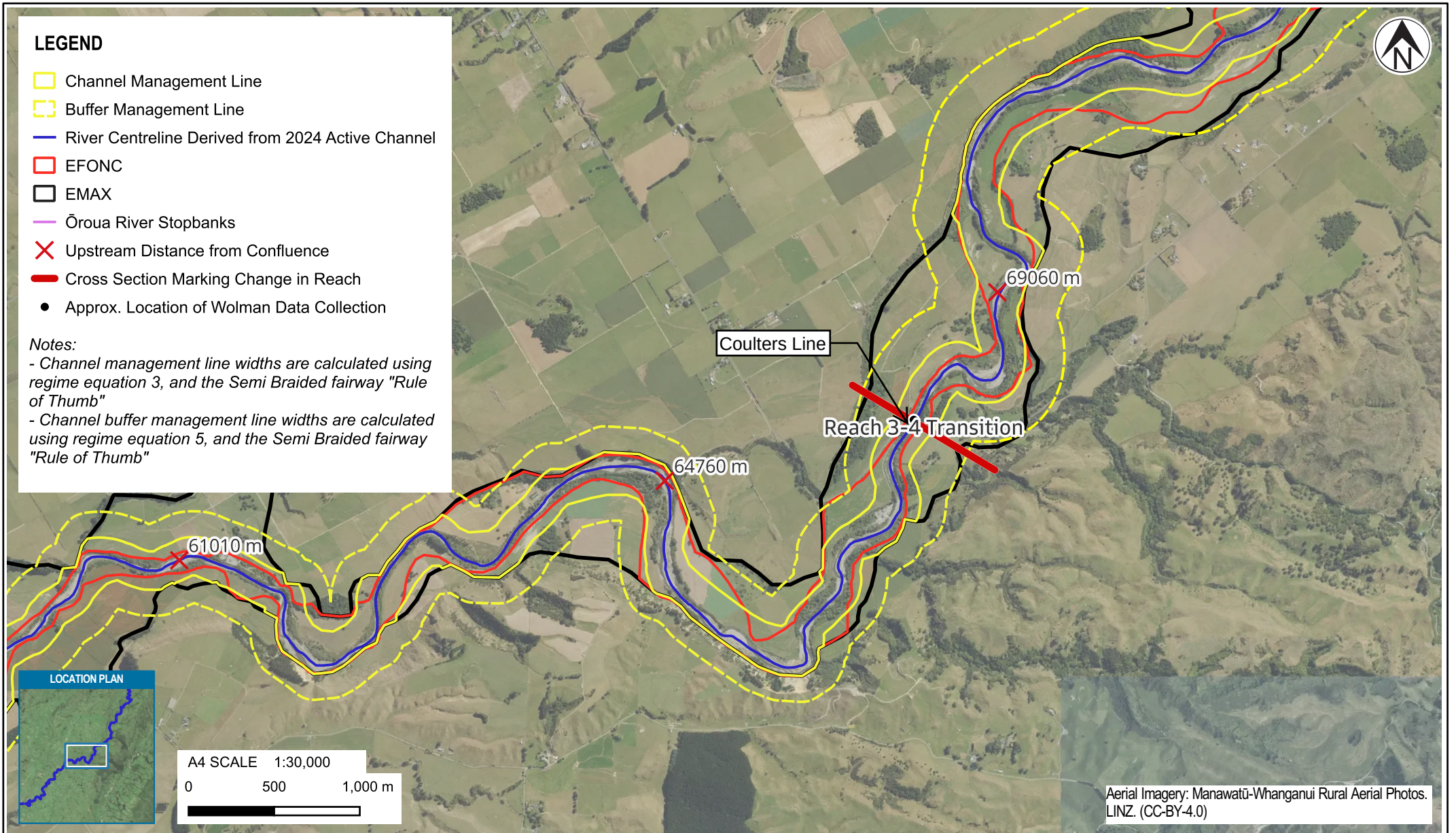
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SCALE (A4) 1:30,000

FIG No. FIGURE 2-9

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POHANGINA AND ŌROUA MANAGEMENT LINES

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EFONC, EMAX, and River Regime Management Lines

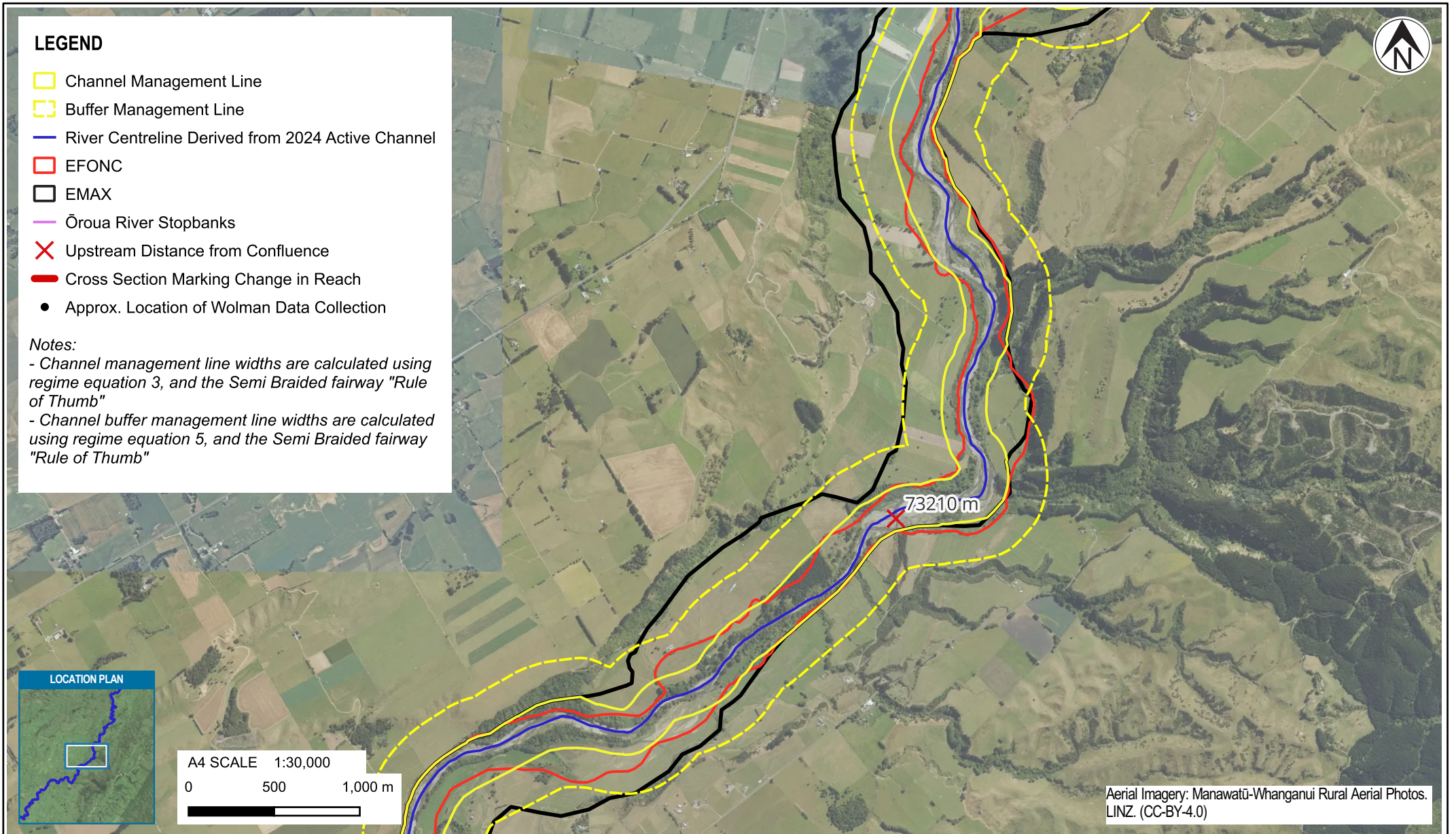
SCALE (A4)

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FIG No.

FIGURE 2-10

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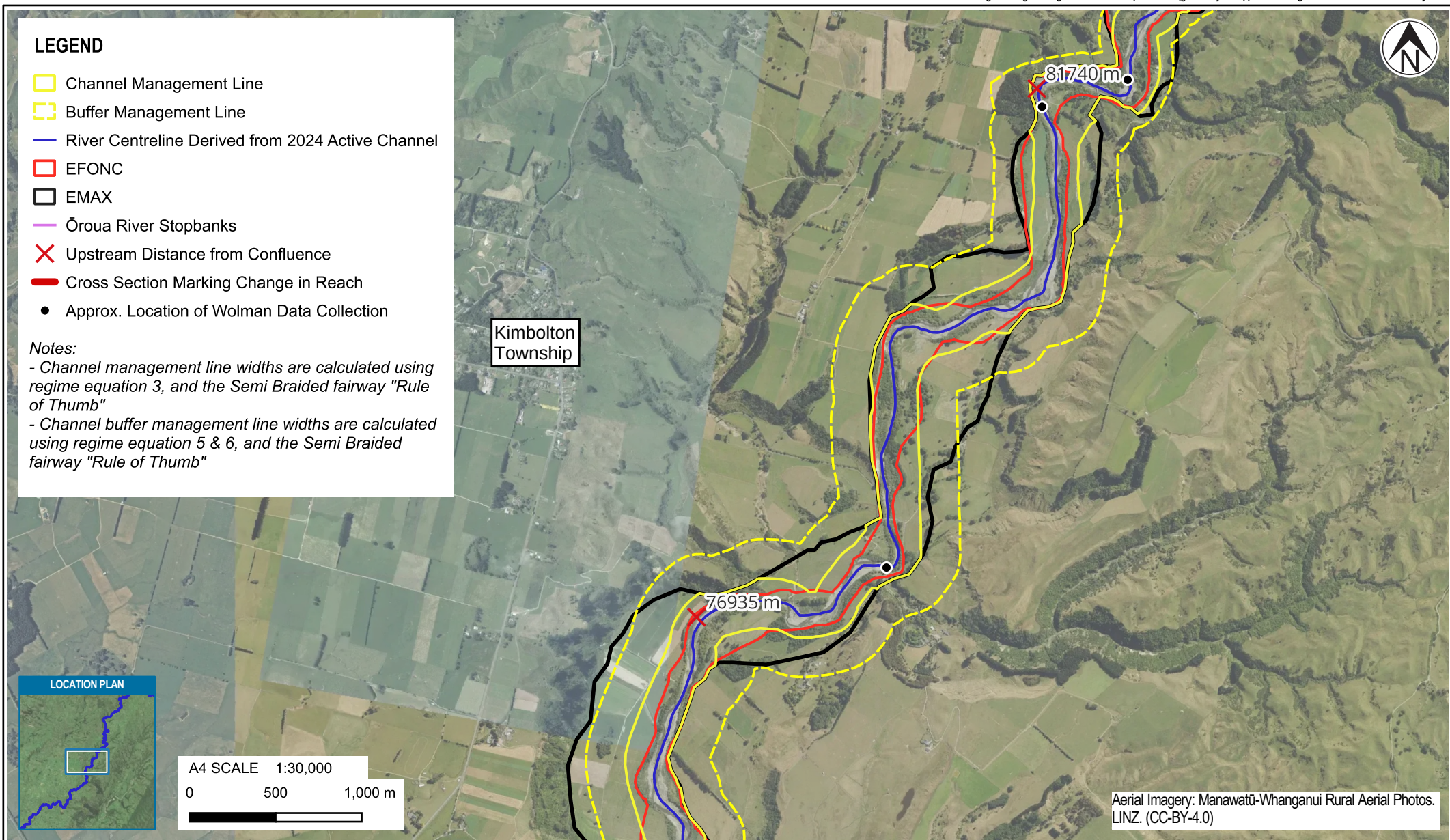
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SCALE (A4) 1:30,000

FIG No. FIGURE 2-11

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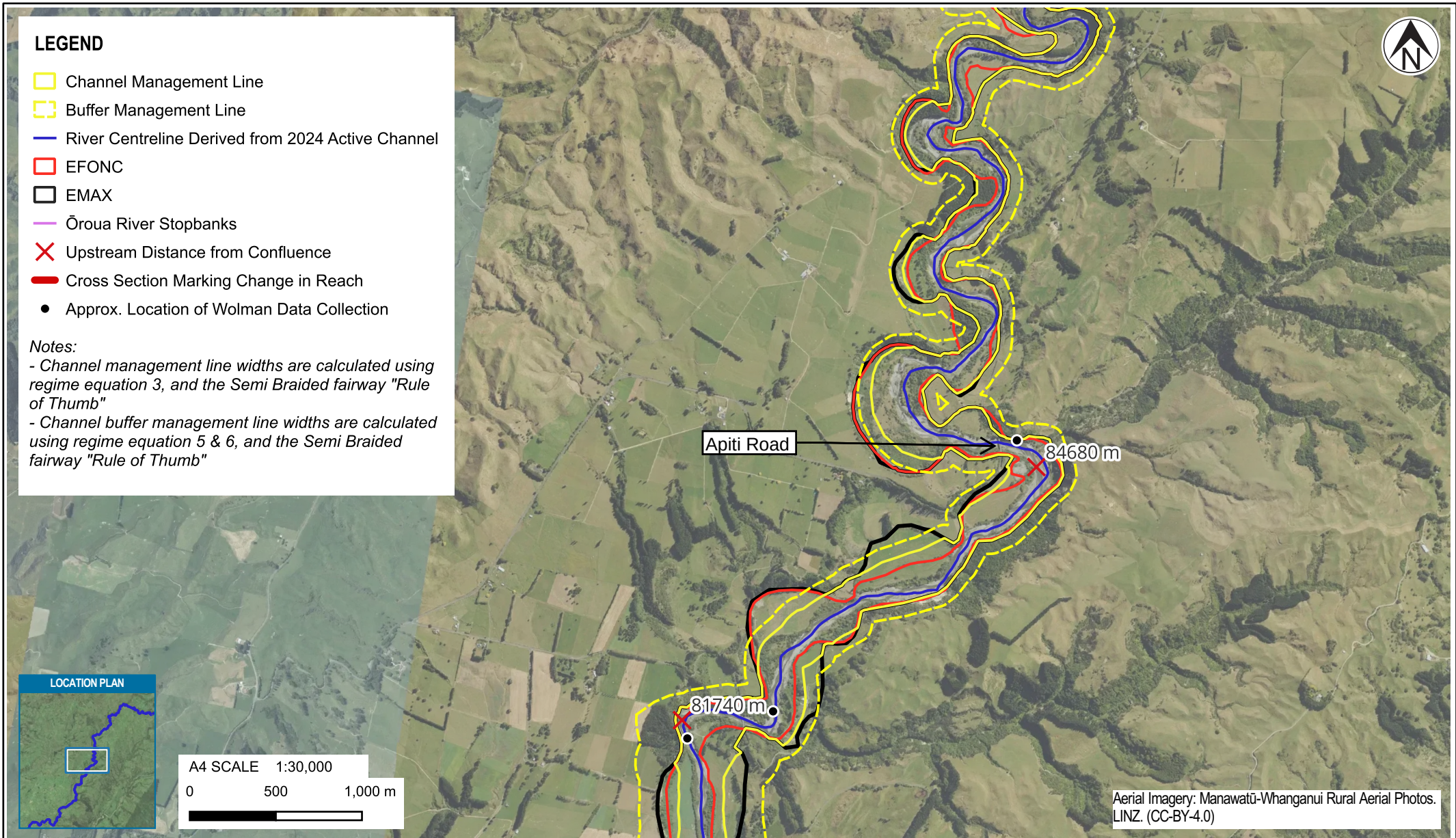
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EFONC, EMAX, and River Regime Management Lines

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FIG No. FIGURE 2-12

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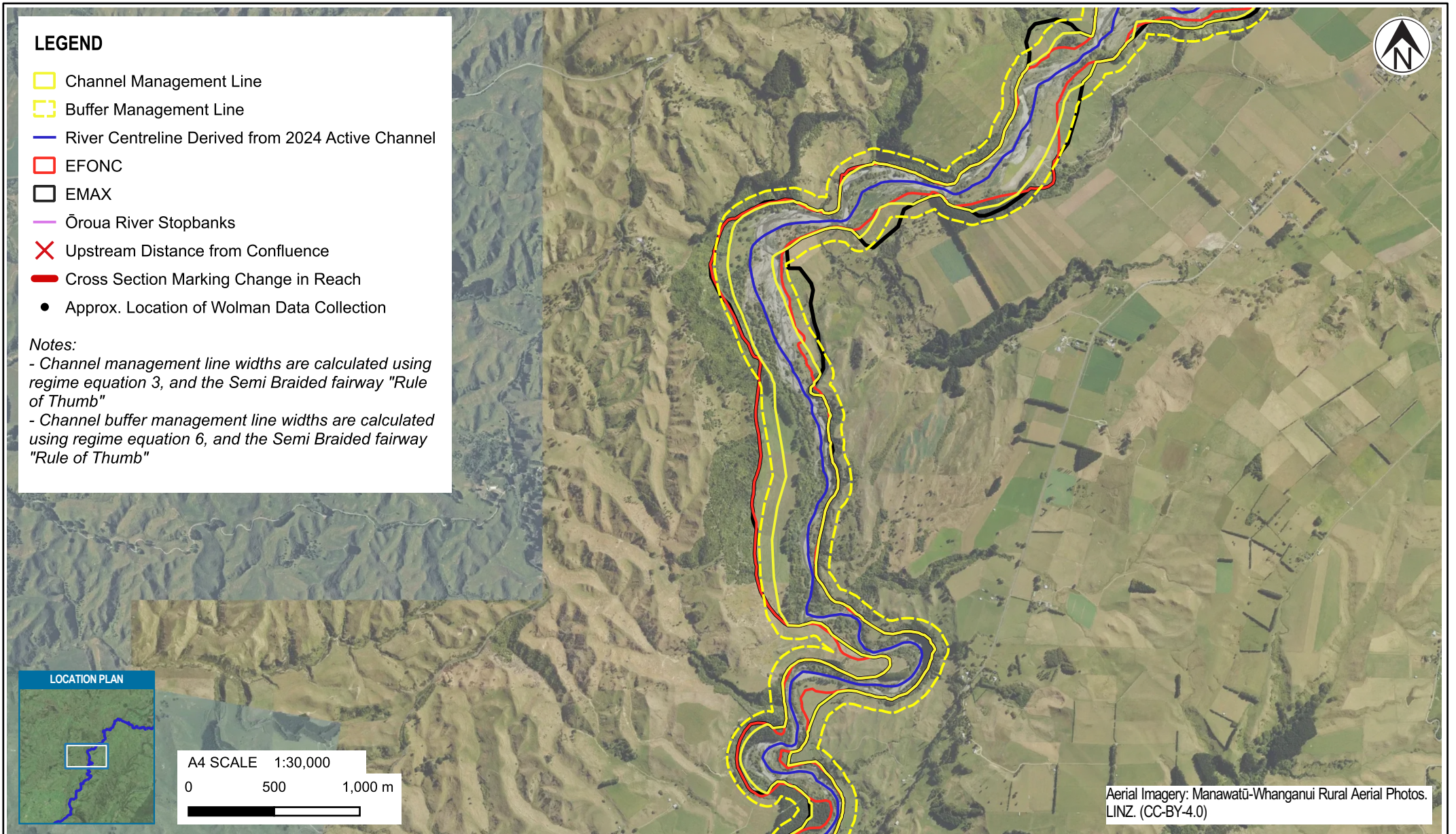
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FIG No. FIGURE 2-13

REV 3



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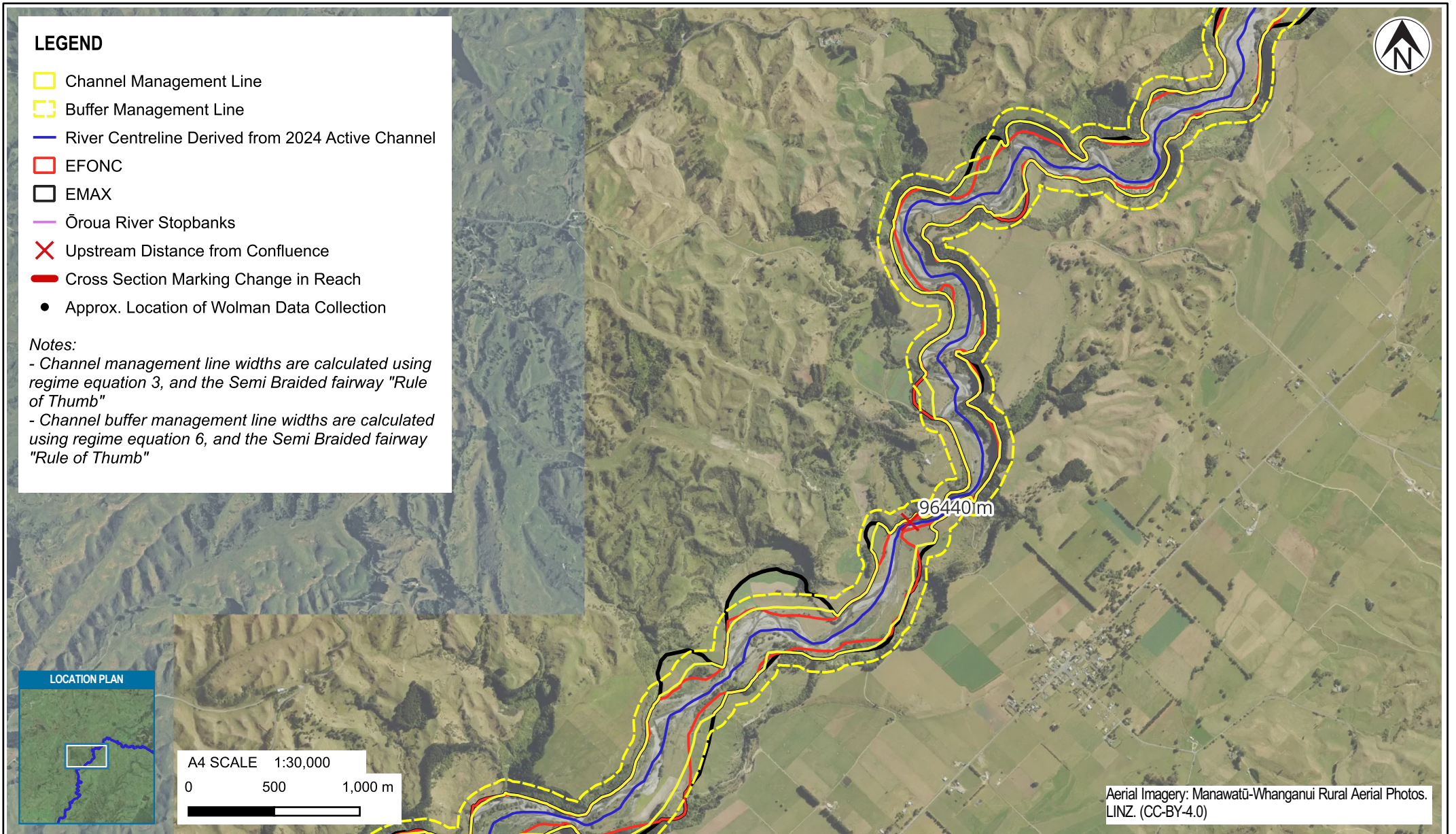
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EFONC, EMAX, and River Regime Management Lines

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FIG No. FIGURE 2-14

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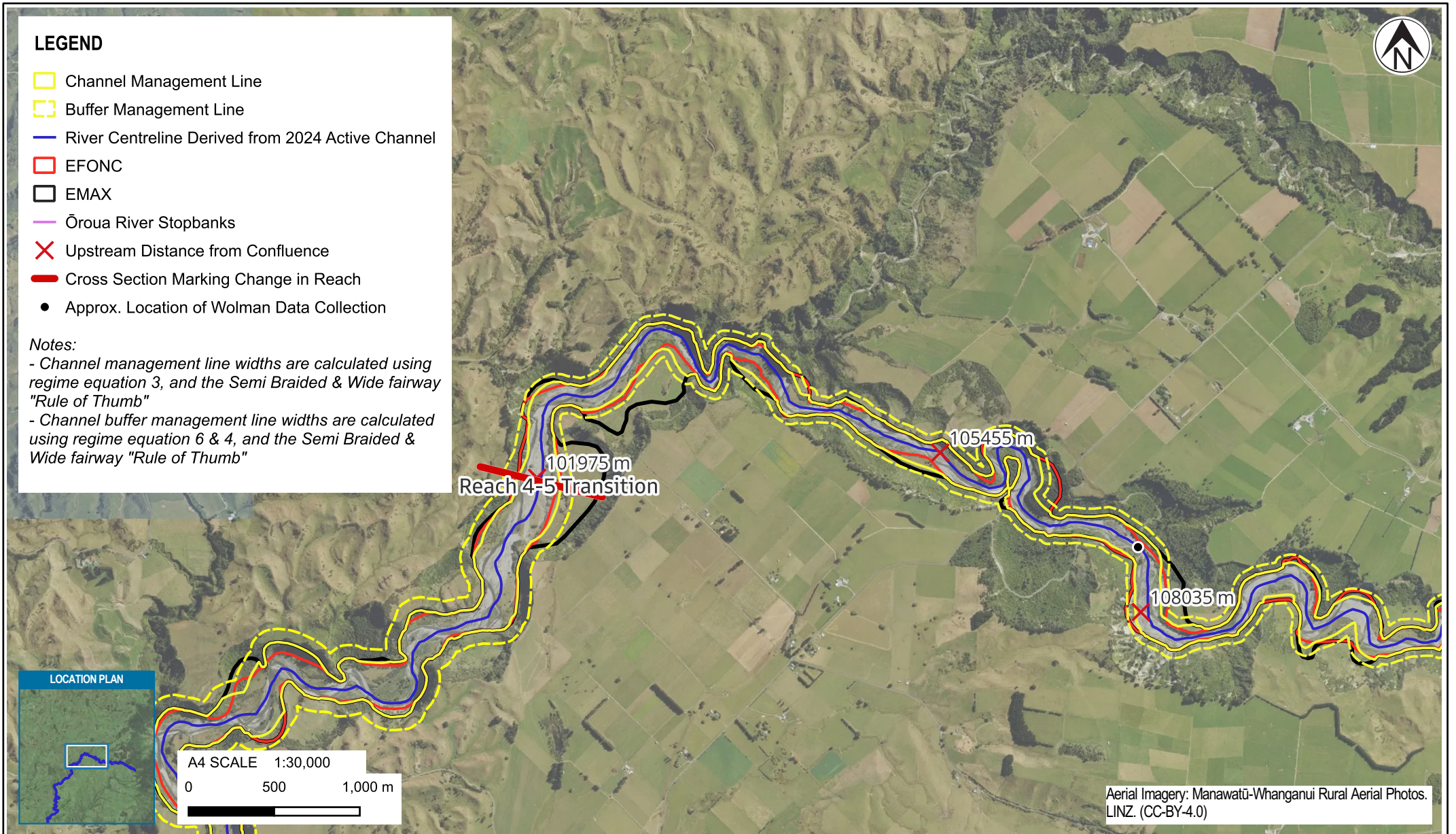
SCALE (A4)

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FIG No.

FIGURE 2-15

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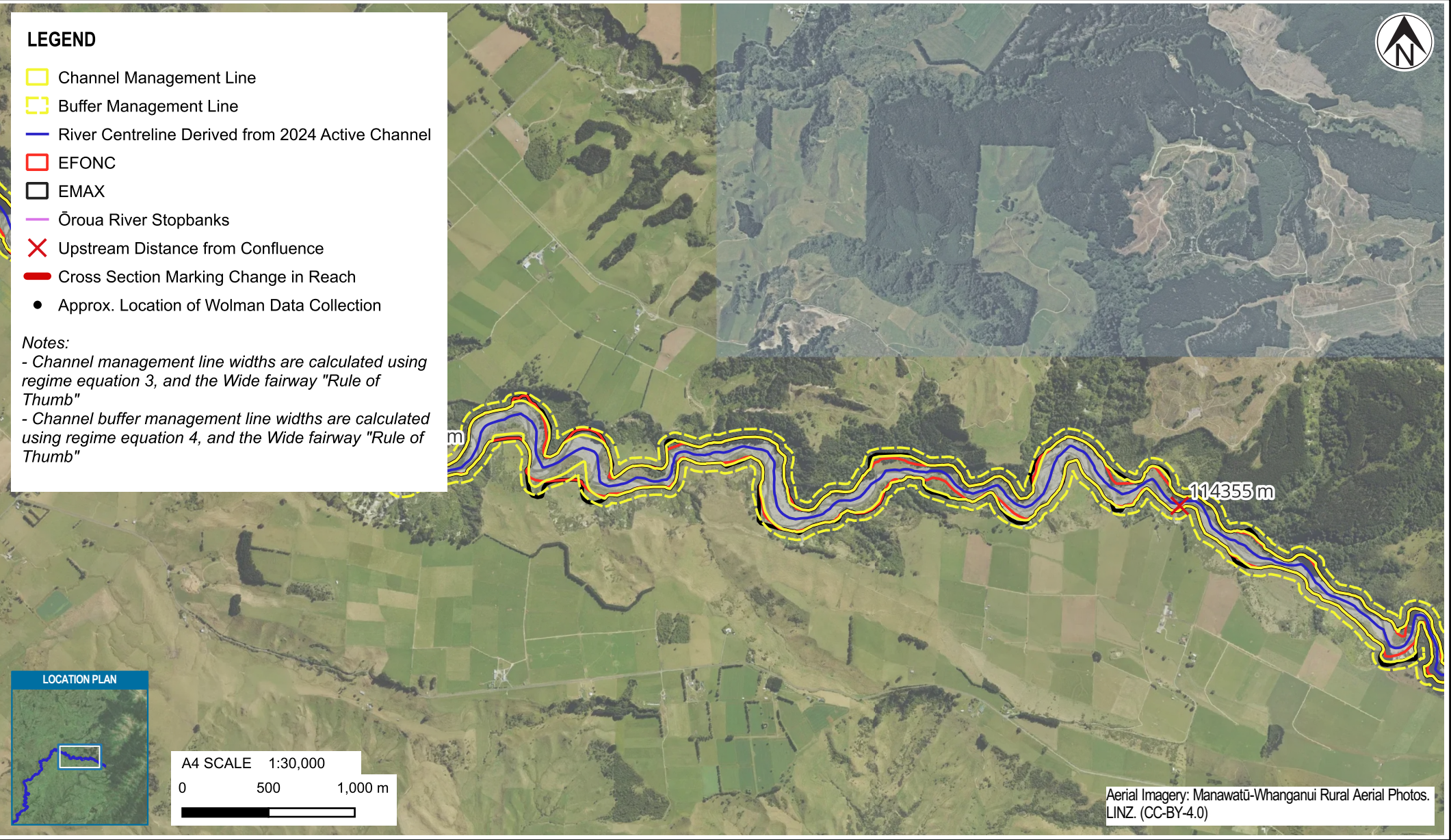
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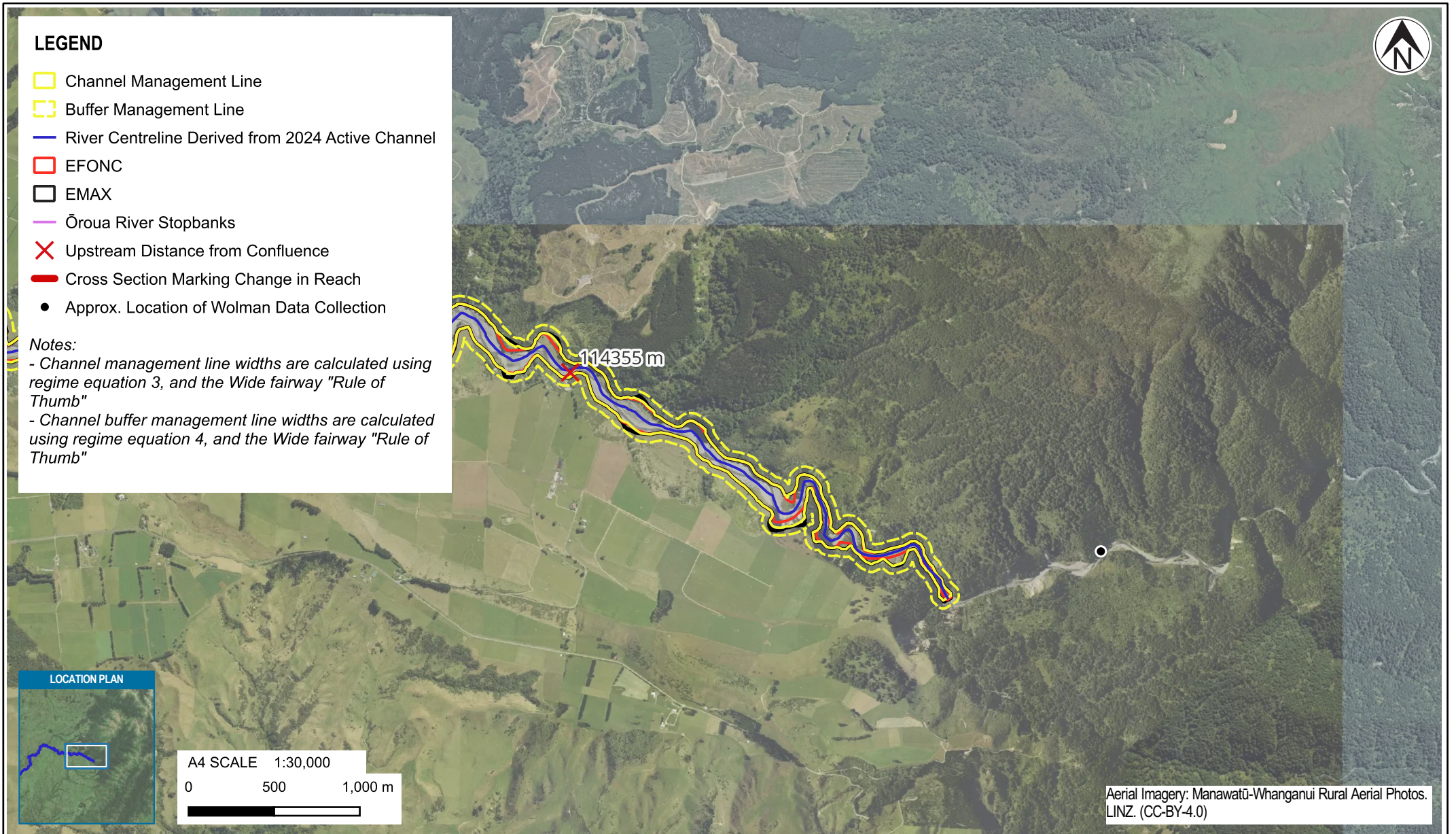
FIG No.

FIGURE 2-16

REV 3



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		First version (18/09/25)			1	JESH	JESH	JAN.26	FIG No. FIGURE 2-17	
		Second version (27/11/25)			2	JESH	JESH	JAN.26	REV 3	
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POHANGINA AND ŌROUA MANAGEMENT LINES

TITLE

ŌROUA RIVER
EFONC, EMAX, and River Regime Management Lines

SCALE (A4)

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FIG No.

FIGURE 2-18

REV

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Appendix C River Regime Equation Outputs

Table Appendix C.1: Range of widths under “Rule of Thumb” calculations and selected channel and buffer widths for the Pohangina River.

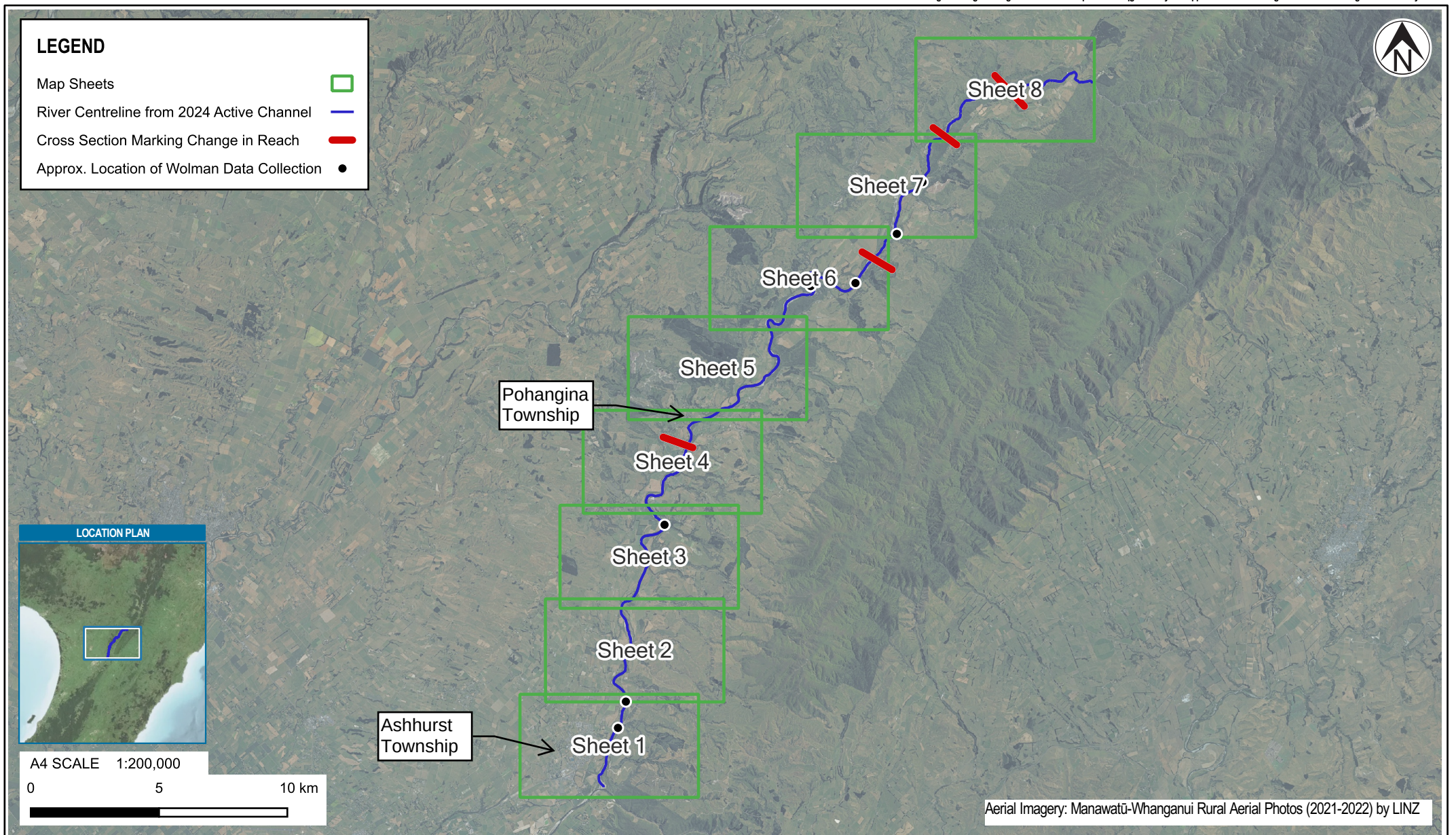
Input Parameters	Reach				
	1	2	3	4	5
Range of channel widths	80 m – 994 m	79 m – 949 m	78 m – 827 m	77 m – 769 m	82 m – 799 m
Range of buffer widths	20 m – 328 m	19 m – 321 m	17 m – 391 m	17 m – 440 m	17 m – 712 m
Fairway type	Wide	Wide	Semi-braided	Wide	Wide
Selected channel width	307 m	293 m	376 m	190 m	139 m
Selected buffer width	80 m	78 m	117 m	66 m	68 m
Channel width equation & Multiplier ¹⁸	Eqn. 3 × 1.7	Eqn. 3 × 1.7	Eqn. 3 × 2.5	Eqn. 1 × 1.7	Eqn. 2 × 1.7
Buffer width equation & Multiplier	Eqn. 4 × 2	Eqn. 4 × 2	Eqn. 6 × 1.5	Eqn. 4 × 2	Eqn. 4 × 2

Table Appendix C.2: Range of widths under “Rule of Thumb” calculations and selected channel and buffer widths for the Ōroua River.

Input Parameters	Reach				
	1	2	3	4	5
Range of channel widths	26 m – 623 m	48 m – 618 m	42 m – 494 m	51 m – 570 m	47 m – 486 m
Range of buffer widths	14 m – 170 m	14 m – 168 m	12 m – 151 m	13 m – 228 m	11 m – 222 m
Fairway type	Wide	Wide	Semi-braided	Semi-braided	Wide
Selected channel width	193 m	191 m	224 m	259 m	150 m
Selected buffer width	55 m	55 m	151 m	228 & 77 m	46 m
Channel width equation & Multiplier	Eqn. 3 × 1.7	Eqn. 3 × 1.7	Eqn. 3 × 2.5	Eqn. 3 × 2.5	Eqn. 3 × 1.7
Buffer width equation & Multiplier	Eqn. 4 × 2	Eqn. 4 × 2	Eqn. 5 × 1.5	(Eqn. 5 & 6) × 1.5	Eqn. 4 × 2

¹⁸ The multipliers are from the NZ Catchment Board “Rules of Thumb” (Christensen, 2023).

Appendix D Recommended Modifications to Channel Management Lines



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TITLE POHANGINA RIVER
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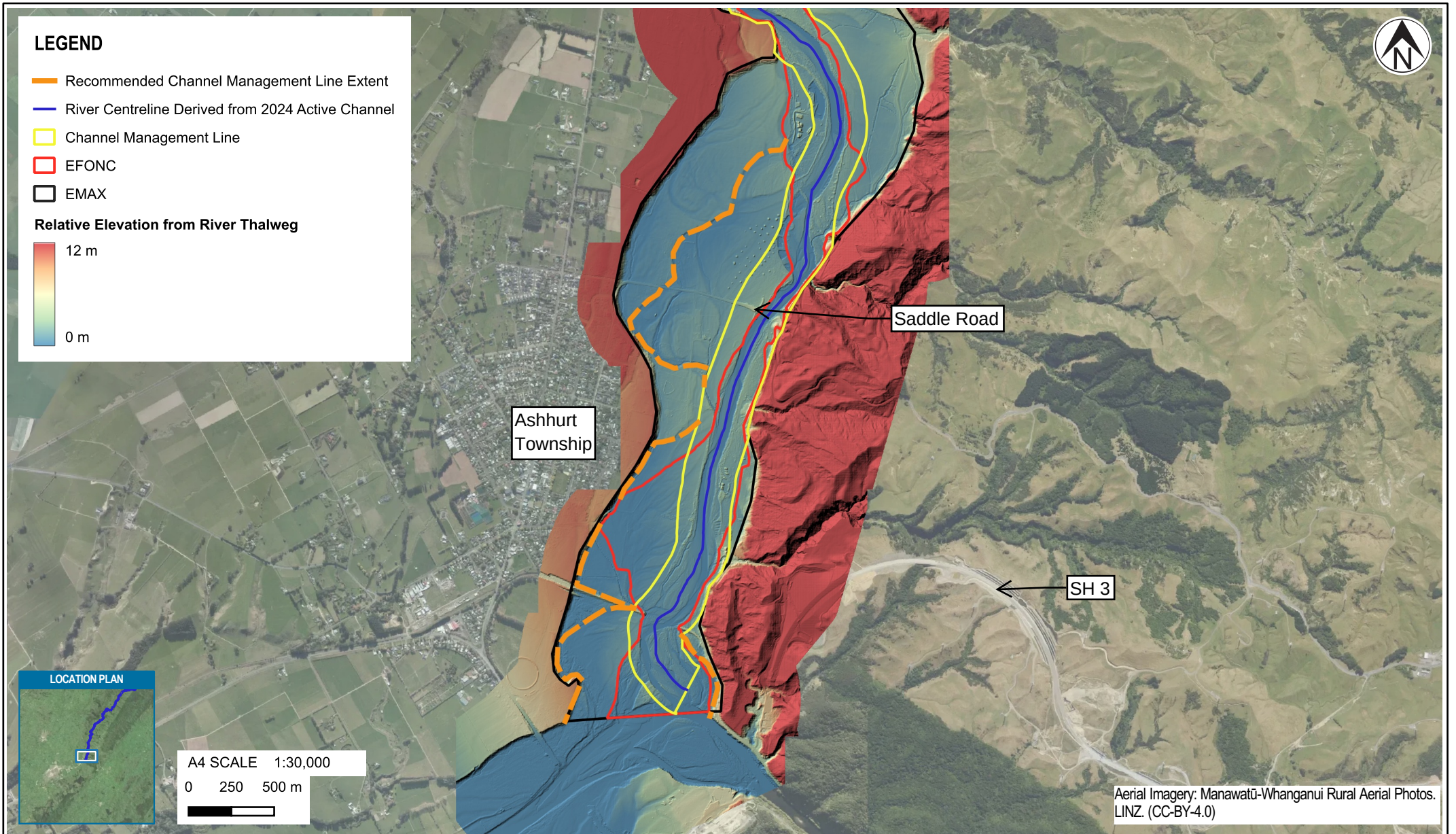
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SCALE (A4) 1:200,000

FIG No. FIGURE 3-0

REV 2



NOTES:

Although relative elevations extend to values lower than 0 m and higher than 12 m, the symbology range is clipped to 0–12 m for visual representation. Values outside this range are rendered using the colours for 0 m and 12 m respectively.

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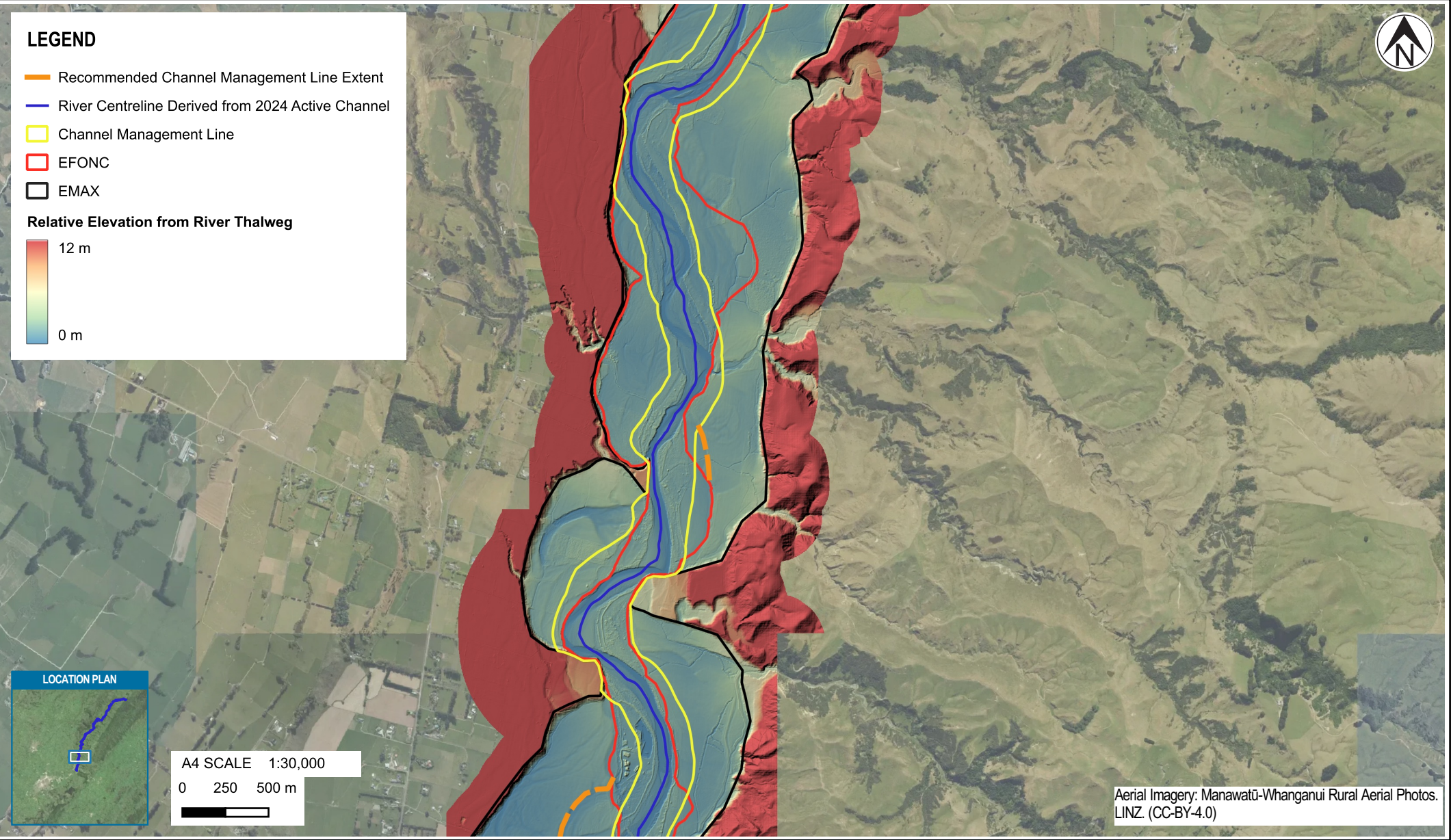
PROJECT POHANGINA AND OROUA MANAGEMENT LINES

TITLE POHANGINA RIVER
Channel Management Line Recommendations

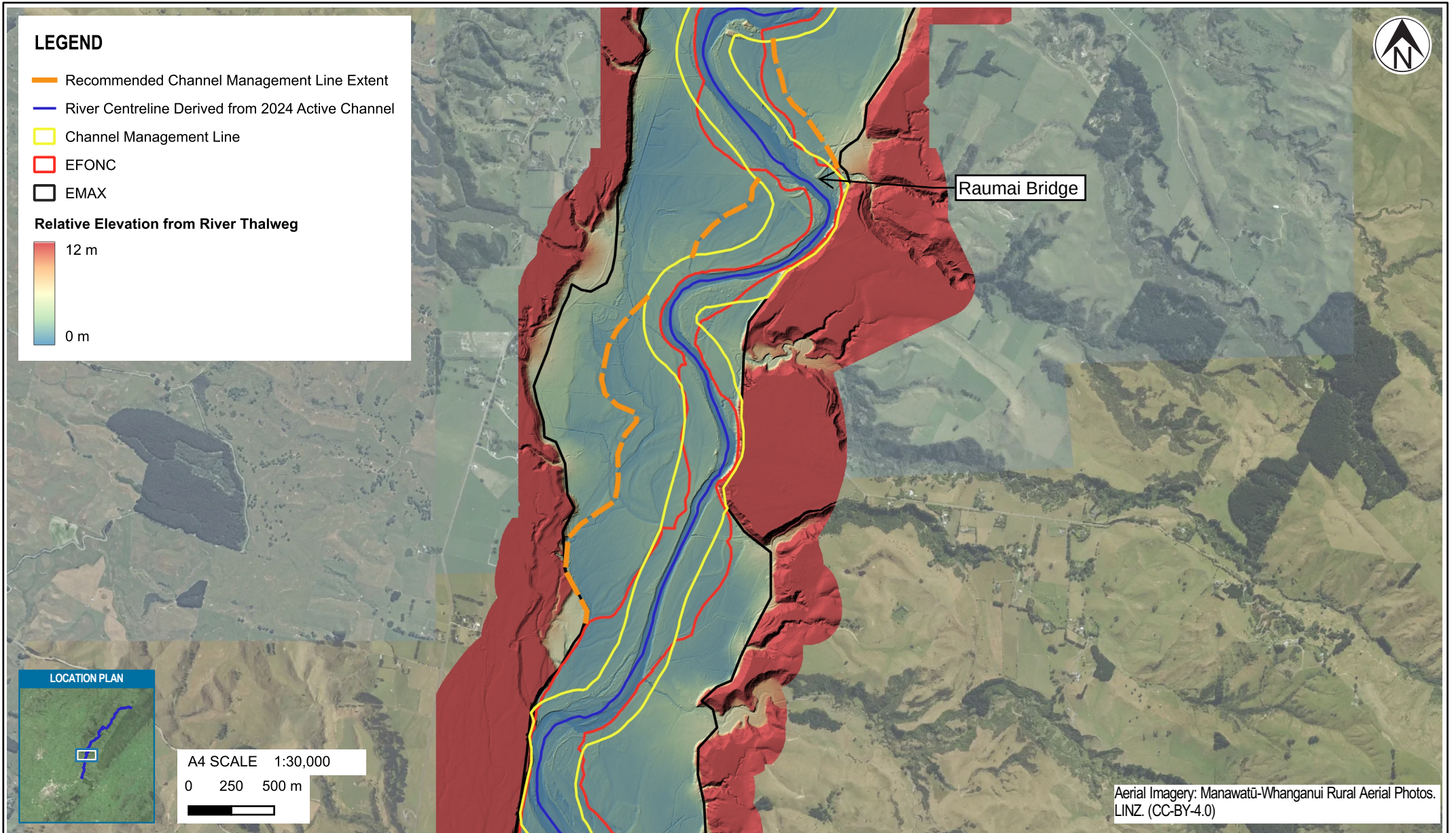
SCALE (A4) 1:30,000

FIG No. FIGURE 3-1

REV 2



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						28/01/26			TITLE POHANGINA RIVER Channel Management Line Recommendations			
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							SCALE (A4)	1:30,000	FIG No.	FIGURE 3-2	REV	2



NOTES:

Although relative elevations extend to values lower than 0 m and higher than 12 m, the symbology range is clipped to 0–12 m for visual representation. Values outside this range are rendered using the colours for 0 m and 12 m respectively.

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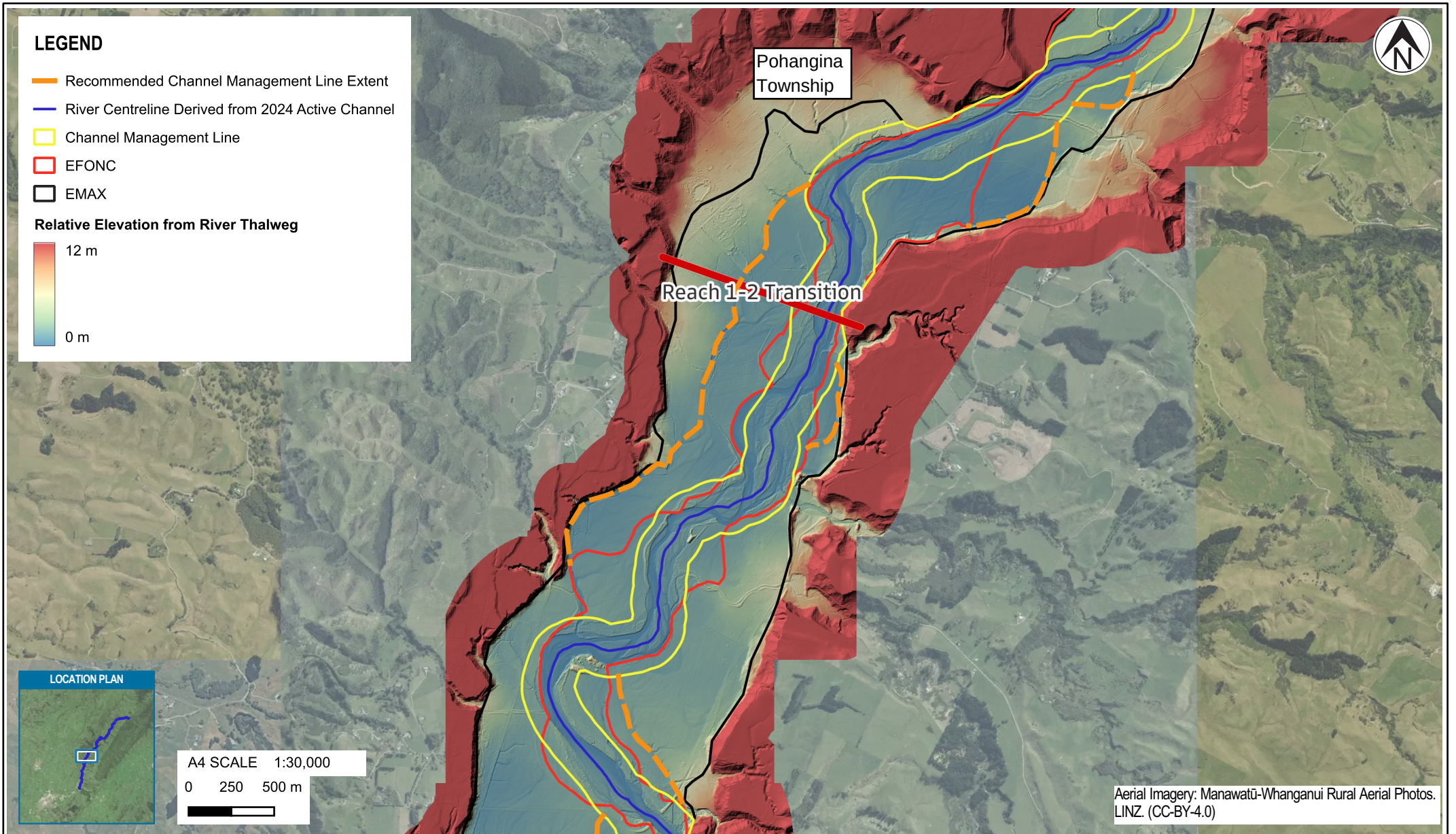
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FIG No. FIGURE 3-3

REV 2



NOTES:

Although relative elevations extend to values lower than 0 m and higher than 12 m, the symbology range is clipped to 0–12 m for visual representation. Values outside this range are rendered using the colours for 0 m and 12 m respectively.

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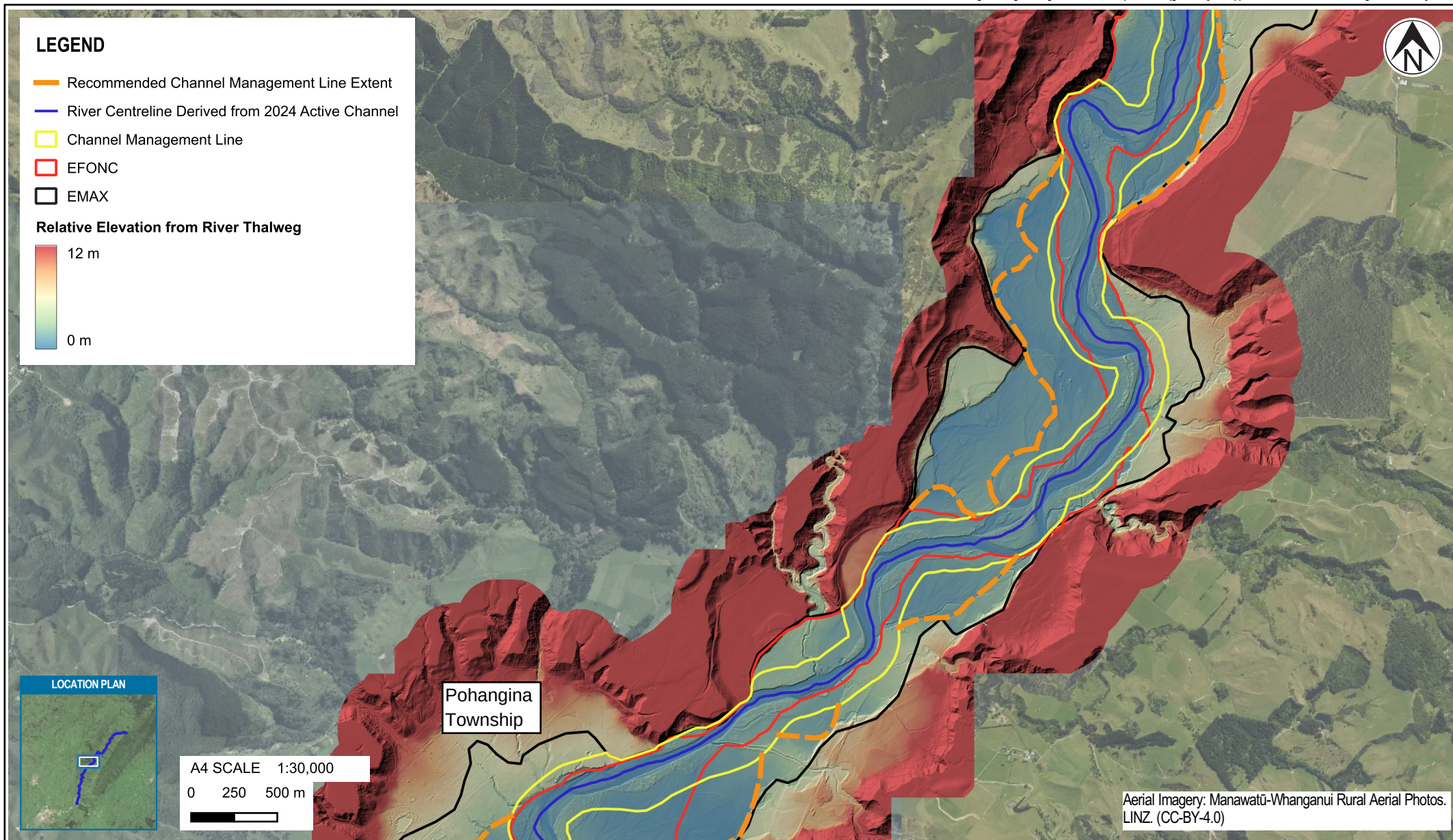
TITLE POHANGINA RIVER

Channel Management Line Recommendations

SCALE (A4) 1:30,000

FIG No. FIGURE 3-4

REV 2



NOTES:

Although relative elevations extend to values lower than 0 m and higher than 12 m, the symbology range is clipped to 0–12 m for visual representation. Values outside this range are rendered using the colours for 0 m and 12 m respectively.

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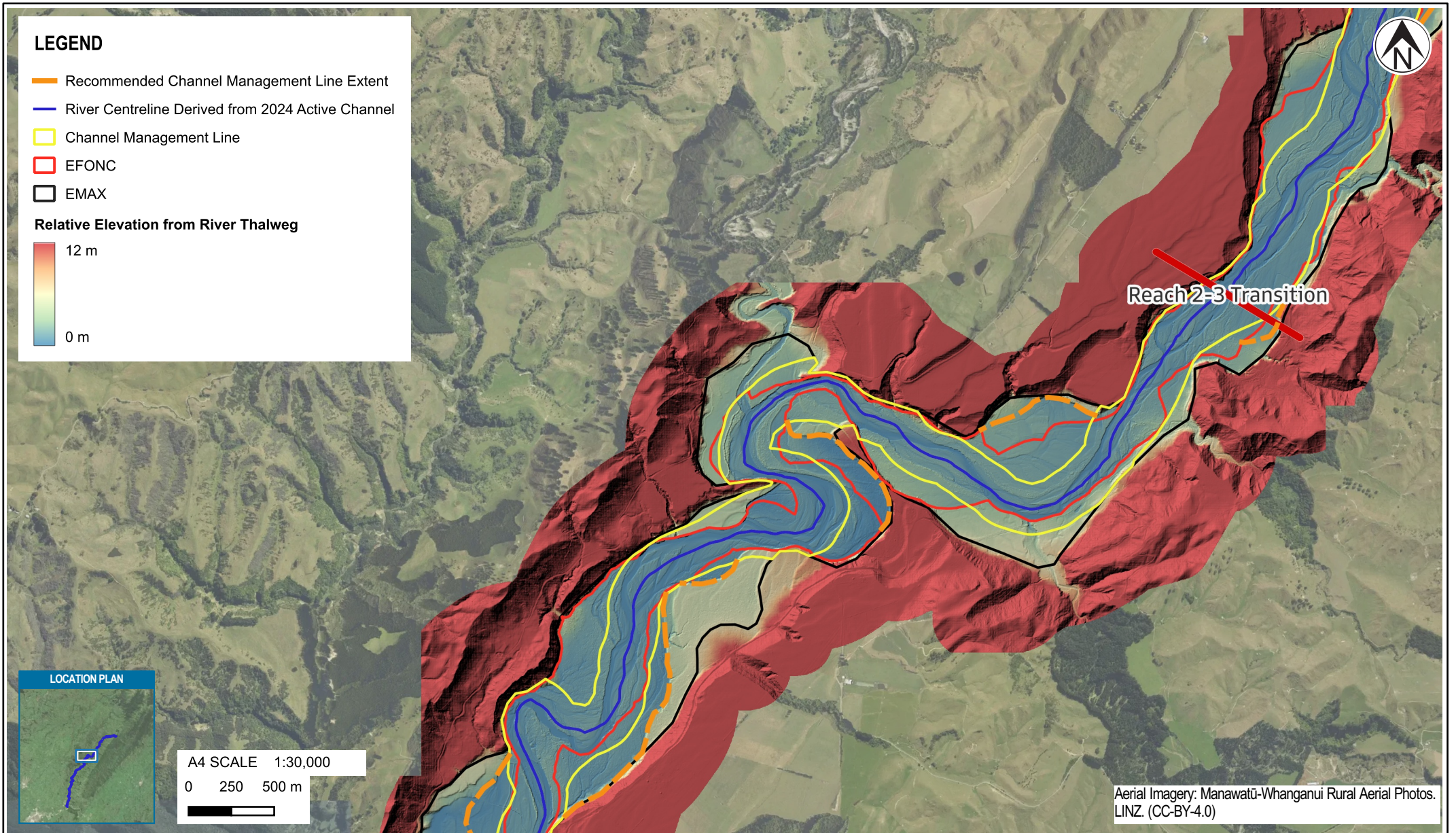
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TITLE POHANGINA RIVER
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SCALE (A4) 1:30,000

FIG No. FIGURE 3-5

REV 2



NOTES:

Although relative elevations extend to values lower than 0 m and higher than 12 m, the symbology range is clipped to 0–12 m for visual representation. Values outside this range are rendered using the colours for 0 m and 12 m respectively.

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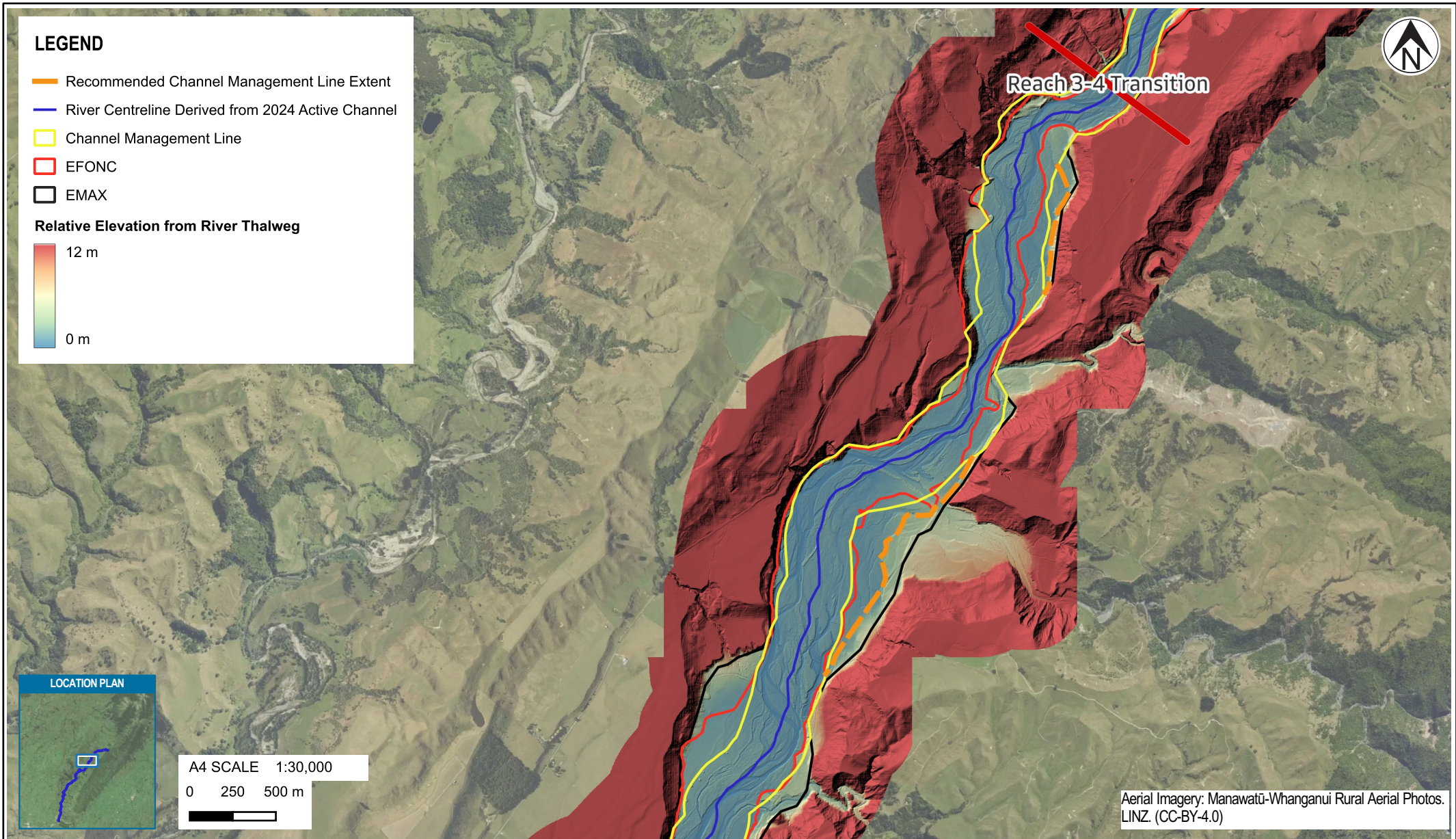
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TITLE POHANGINA RIVER
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FIG No. FIGURE 3-6

REV 2

**NOTES:**

Although relative elevations extend to values lower than 0 m and higher than 12 m, the symbology range is clipped to 0–12 m for visual representation. Values outside this range are rendered using the colours for 0 m and 12 m respectively.

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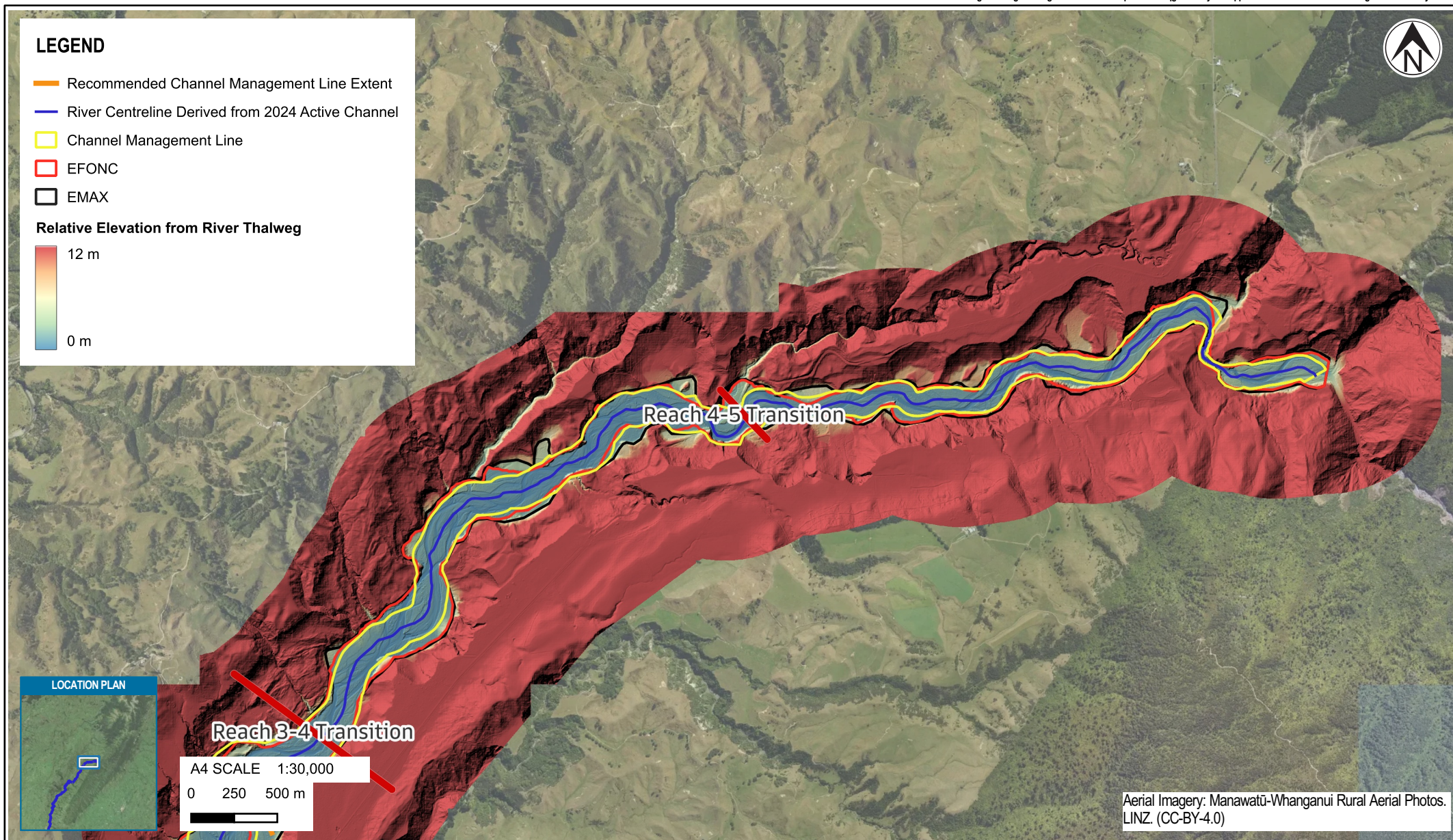
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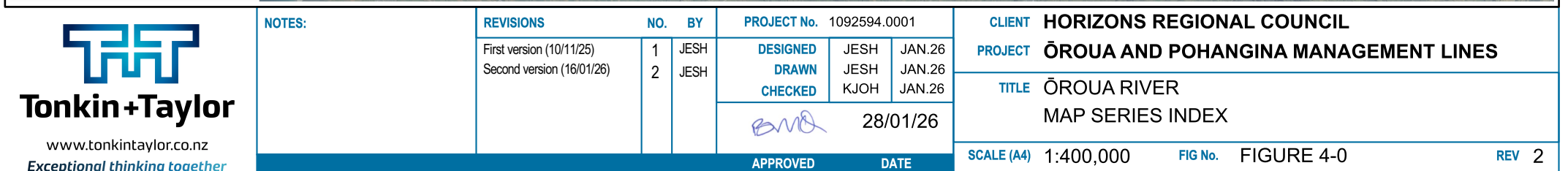
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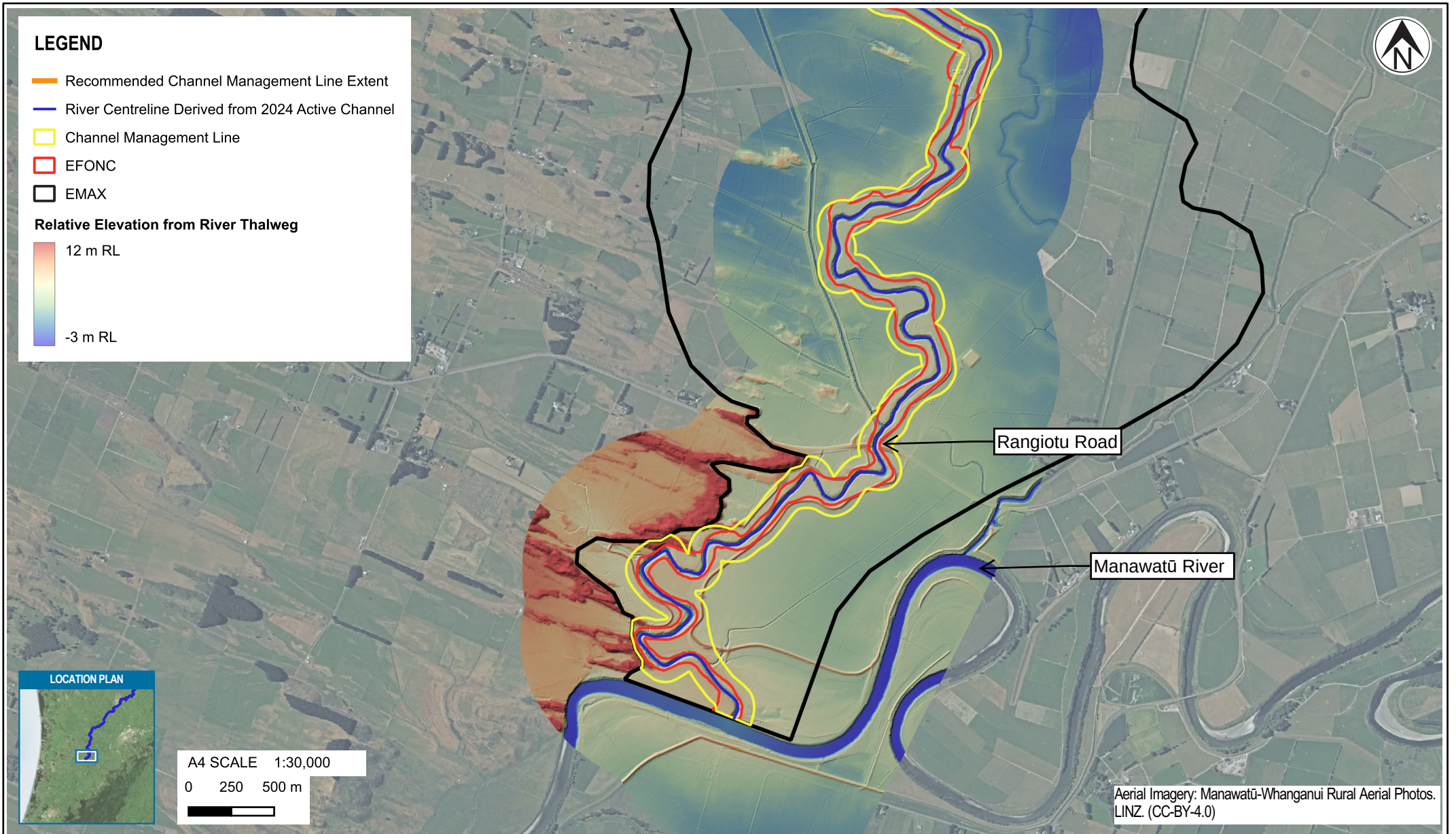
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SCALE (A4) 1:30,000**FIG No.** FIGURE 3-7**REV** 2

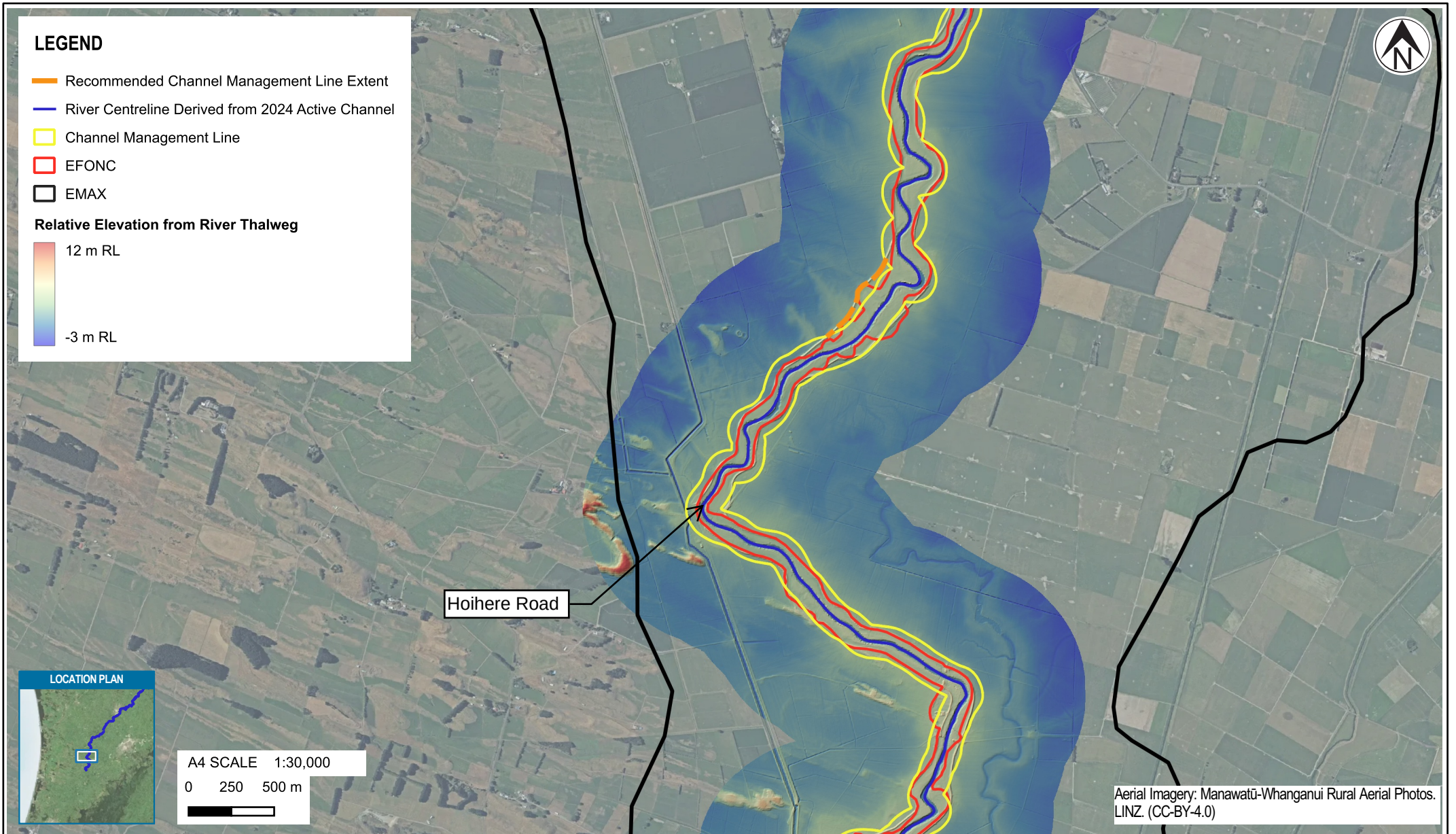


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											 28/01/26			Channel Management Line Recommendations									
									APPROVED			DATE			SCALE (A4) 1:30,000			FIG No. FIGURE 3-8			REV 2		

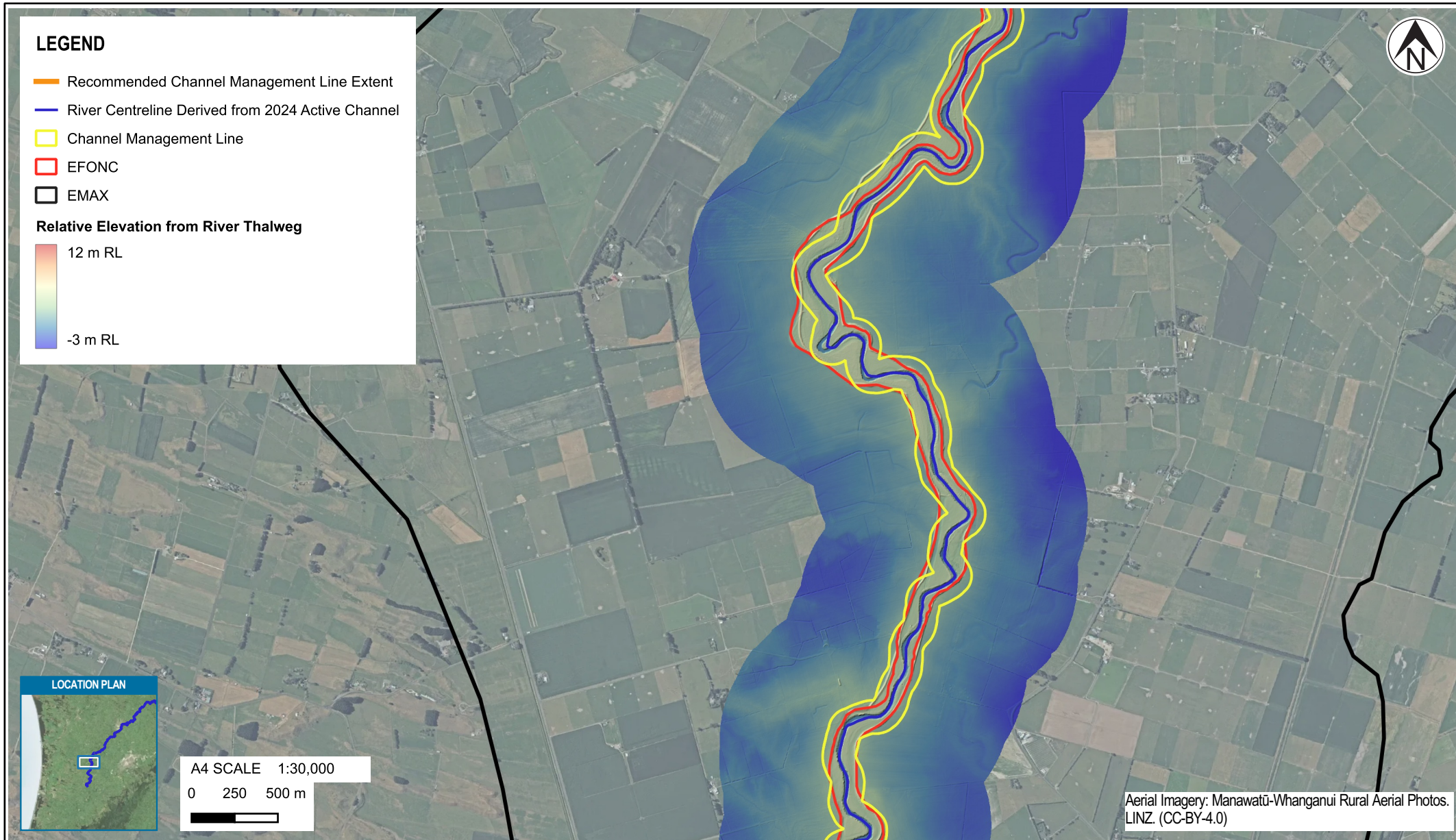




 Tonkin+Taylor www.tonkintaylor.co.nz <i>Exceptional thinking together</i>	NOTES: Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.	REVISIONS			NO.			BY			PROJECT No. 1098938			CLIENT HORIZONS REGIONAL COUNCIL								
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																	28/01/26						TITLE ŌROUA RIVER
															Channel Management Line Recommendations								
															SCALE (A4) 1:30,000			FIG No. FIGURE 4-2			REV 2		



NOTES:

Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

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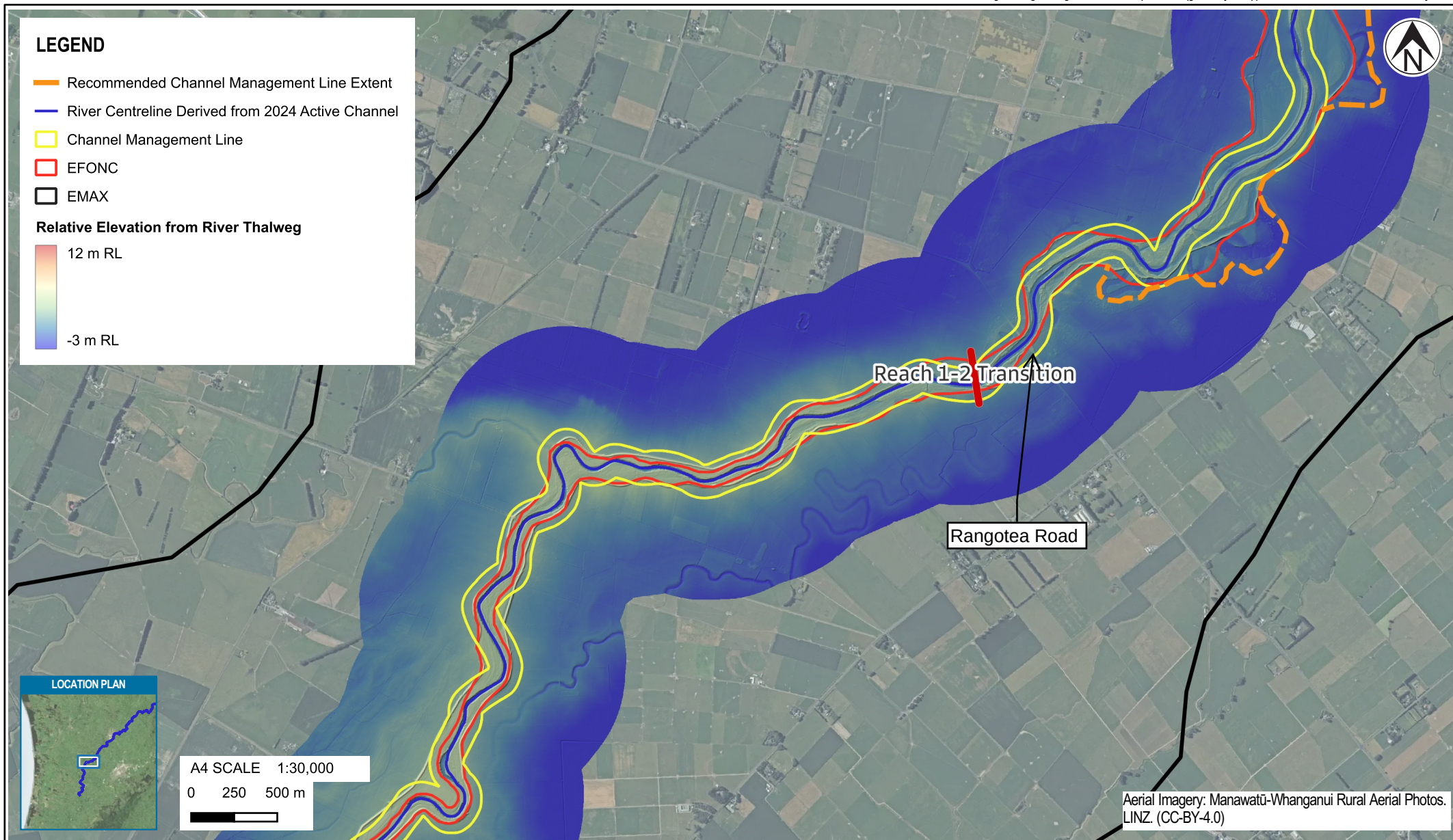
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Channel Management Line Recommendations

SCALE (A4) 1:30,000

FIG No. FIGURE 4-3

REV 2



NOTES:

Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

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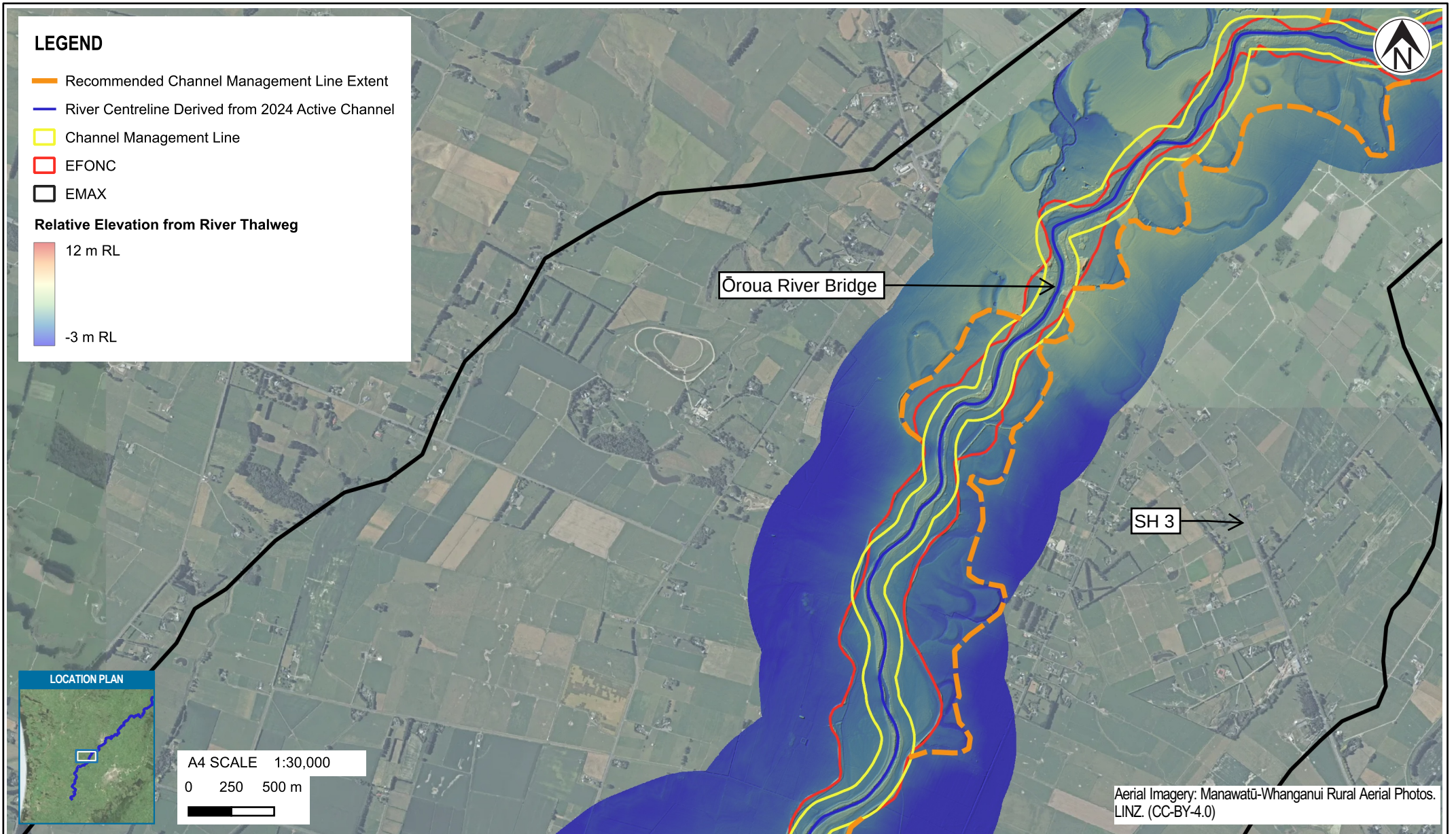
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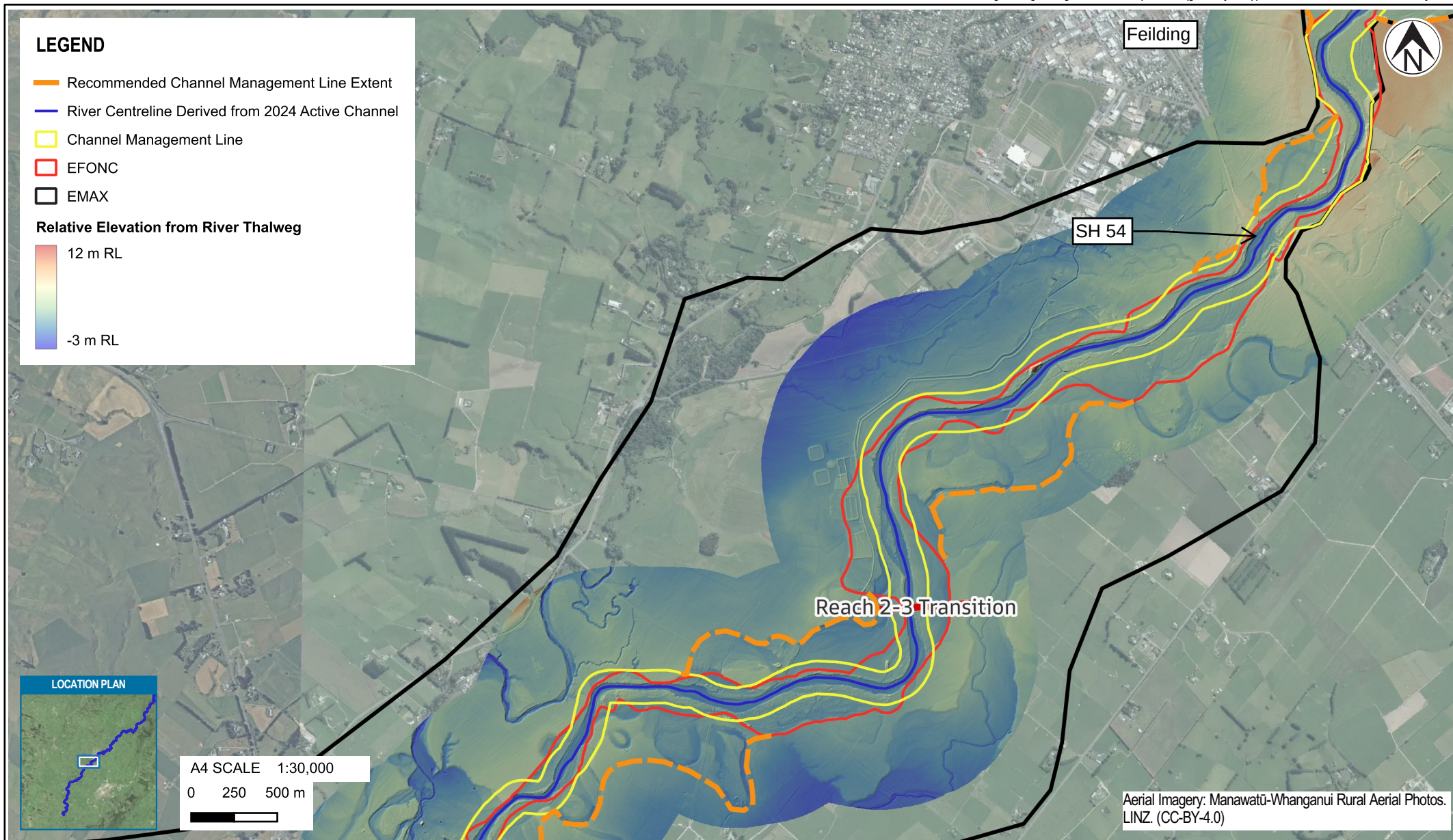
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FIG No. FIGURE 4-4

REV 2



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NOTES:

Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

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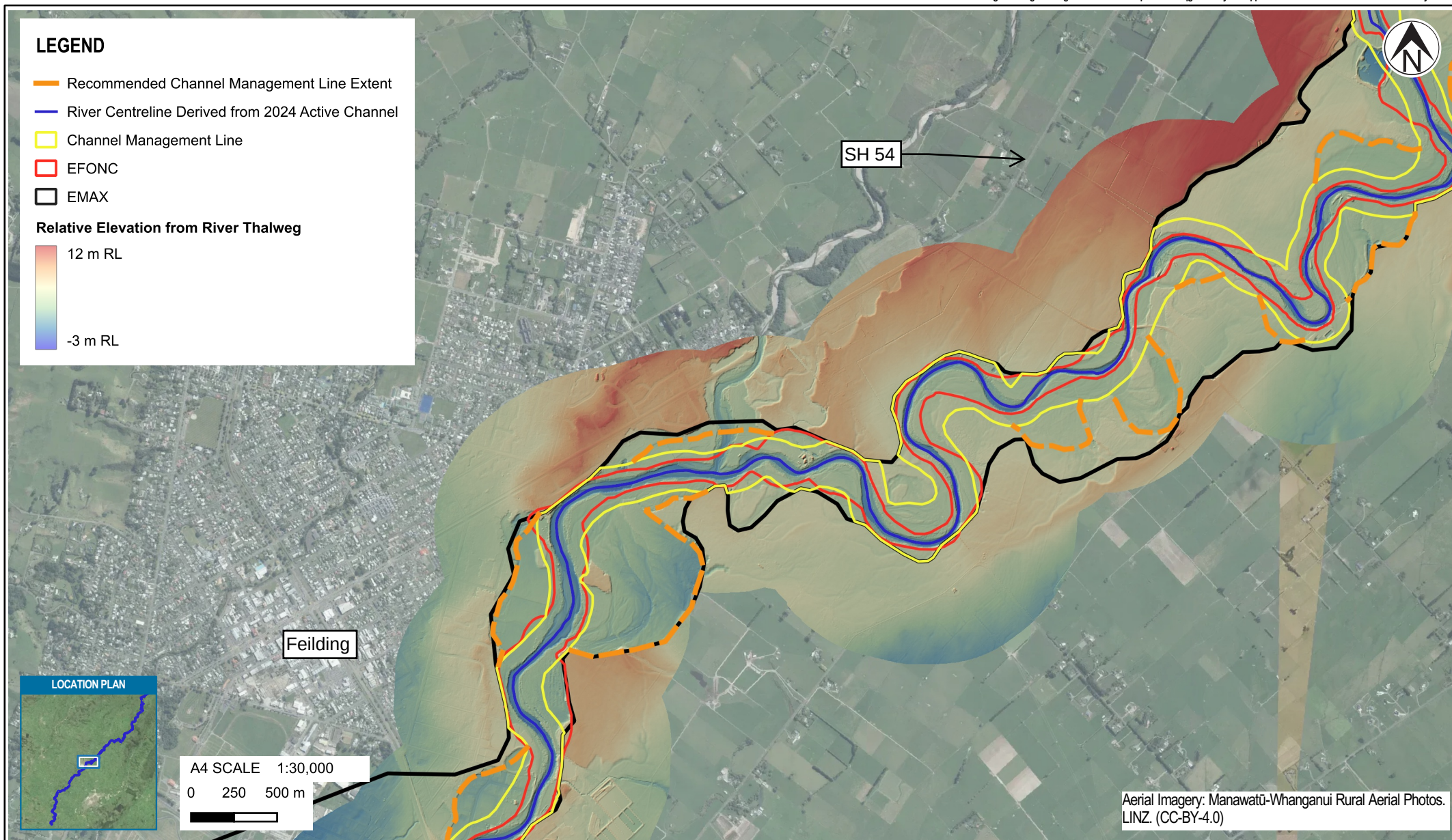
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Channel Management Line Recommendations

SCALE (A4) 1:30,000

FIG No. FIGURE 4-6

REV 2

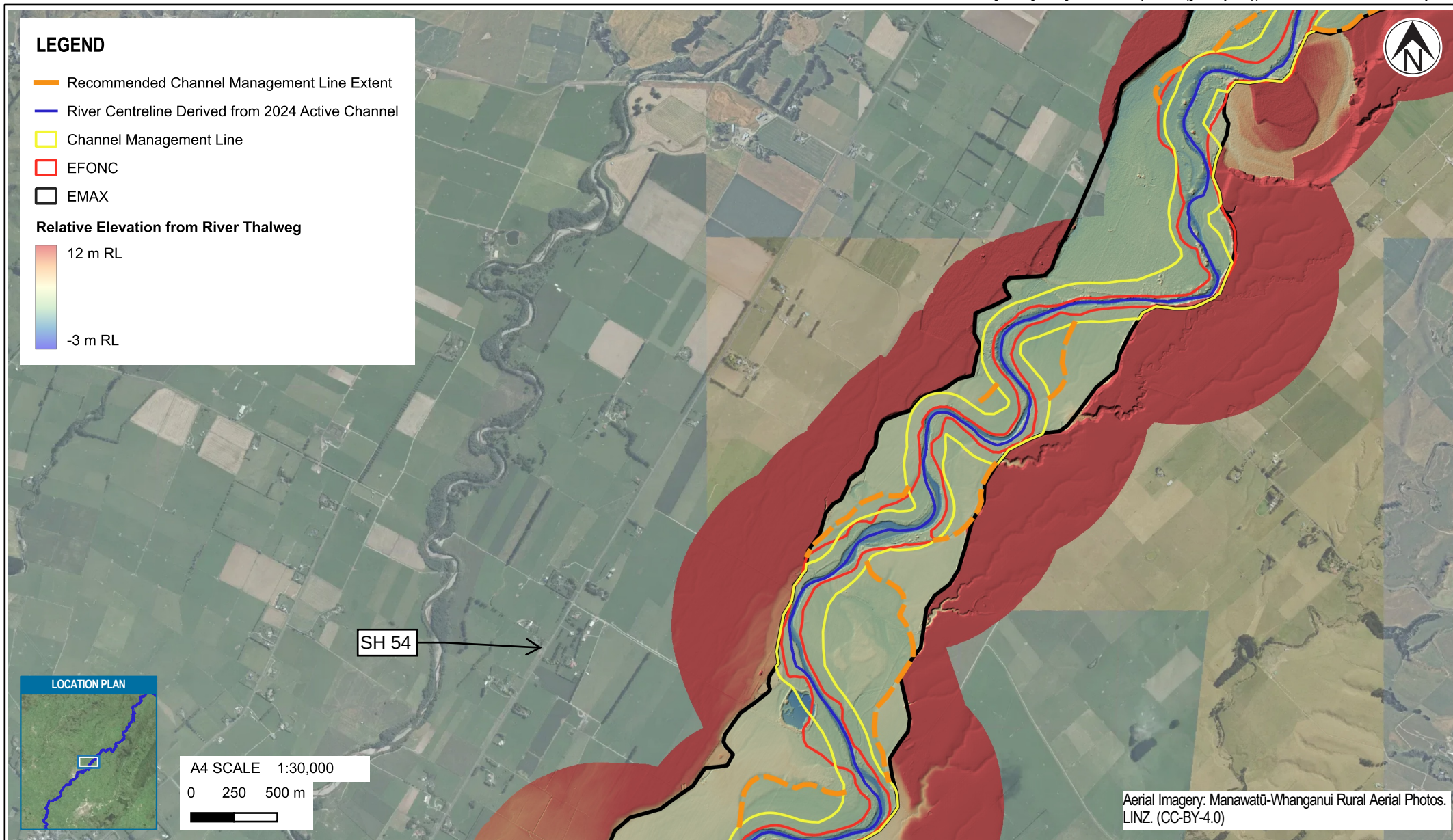


NOTES:
Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

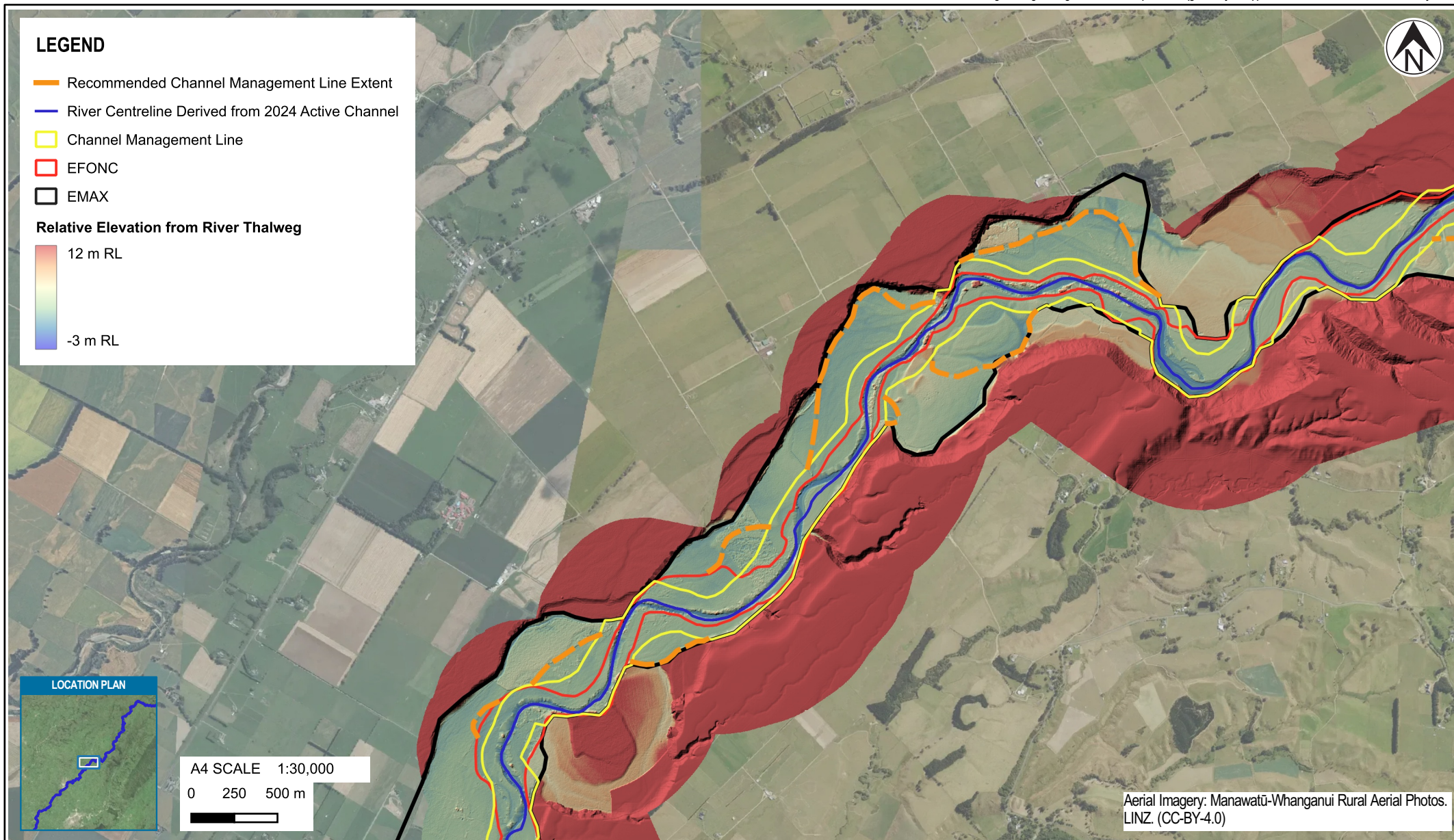
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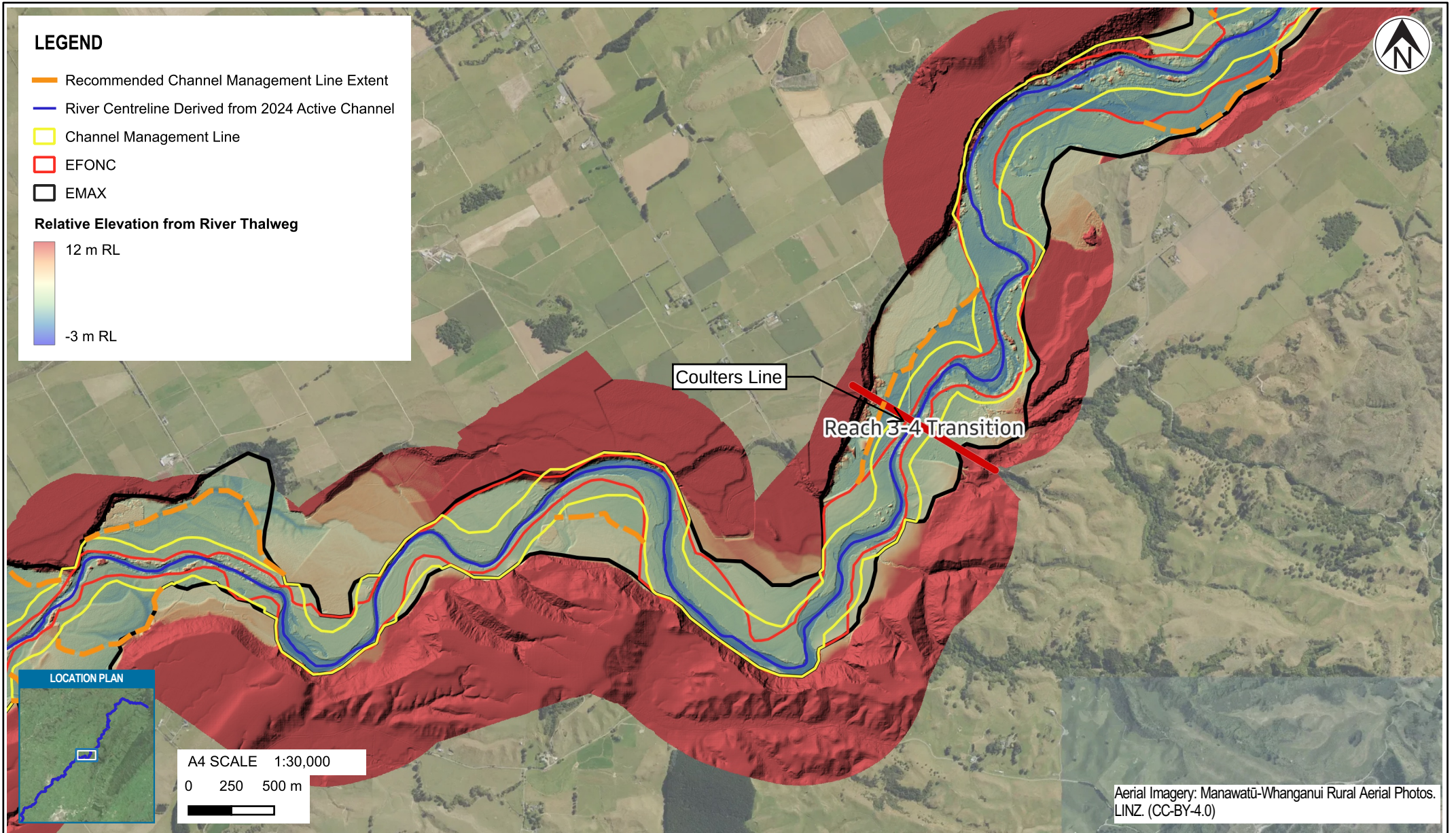
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PROJECT	POHANGINA AND OROUA MANAGEMENT LINES
TITLE	ÖROUA RIVER Channel Management Line Recommendations
SCALE (A4)	1:30,000
FIG No.	FIGURE 4-7
REV	2



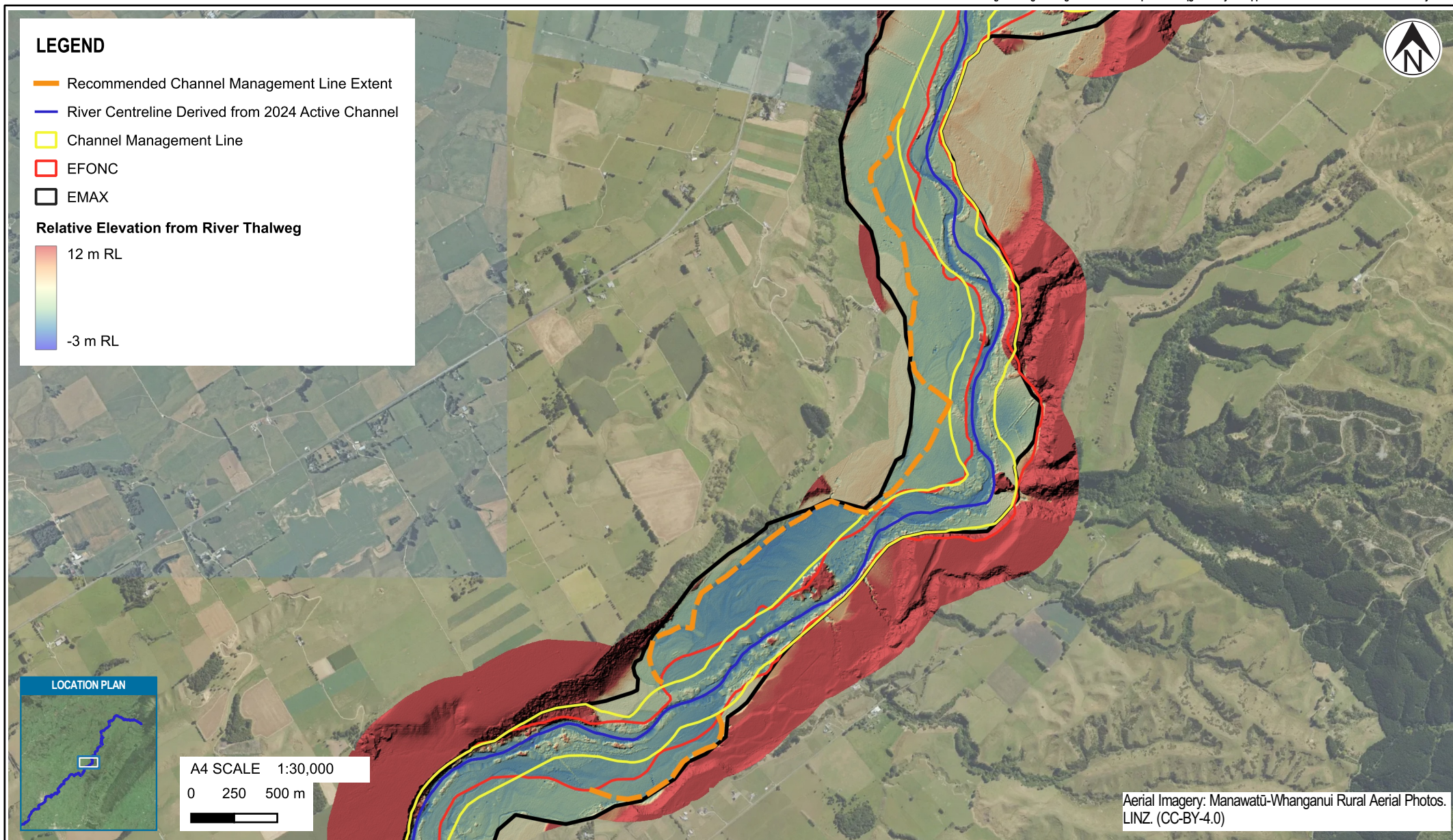
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						 28/01/26								
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		Second version (16/01/26)		2	JESH	DRAWN	JESH	JAN.26								
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								28/01/26		TITLE	ŌROUA RIVER					
								Channel Management Line Recommendations			SCALE (A4)	1:30,000	FIG No.	FIGURE 4-9	REV	2



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TITLE ŌROUA RIVER																							
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															SCALE (A4) 1:30,000			FIG No. FIGURE 4-10			REV 2		



NOTES:

Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

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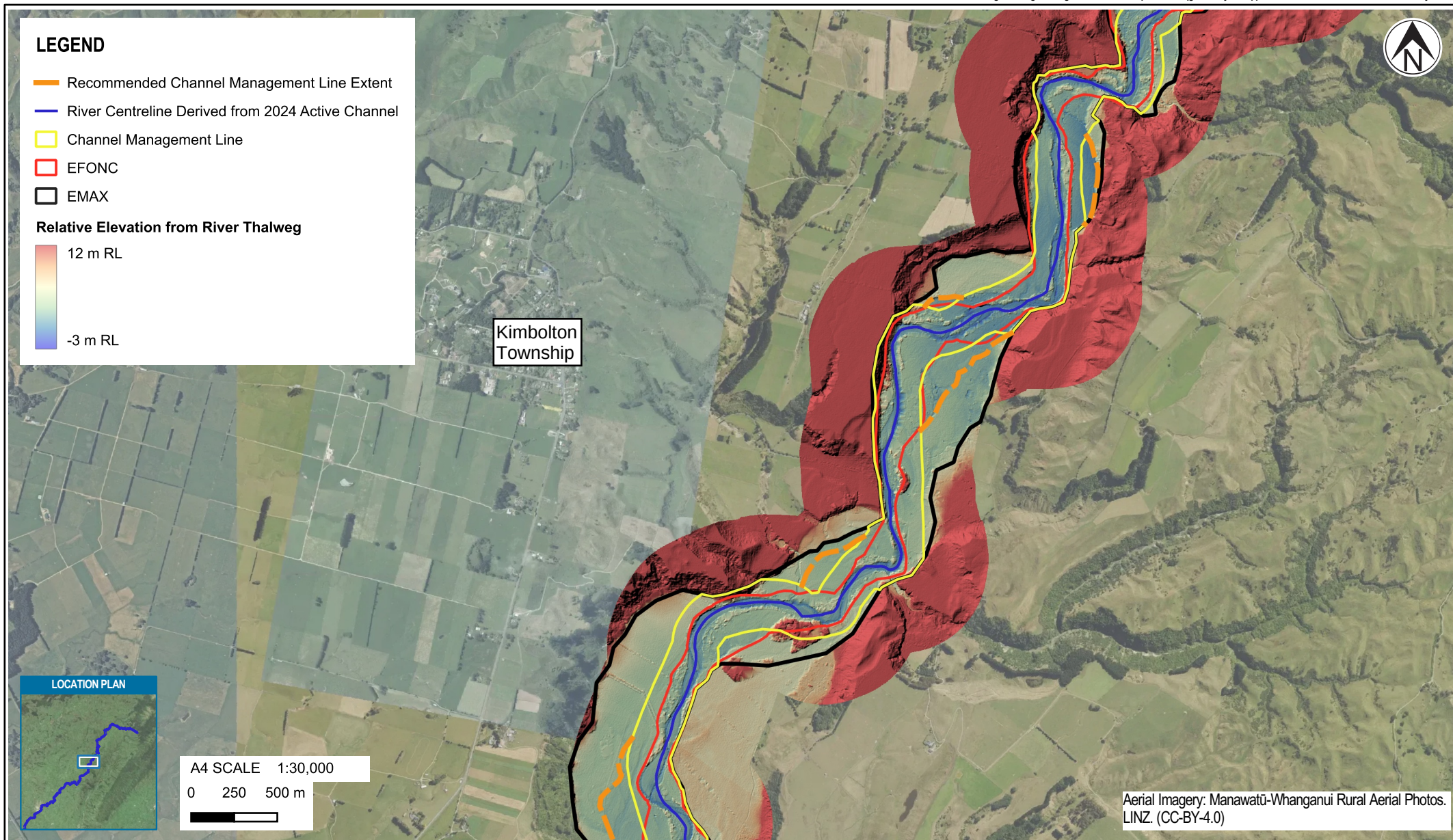
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SCALE (A4) 1:30,000

FIG No. FIGURE 4-11

REV 2



NOTES:

Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

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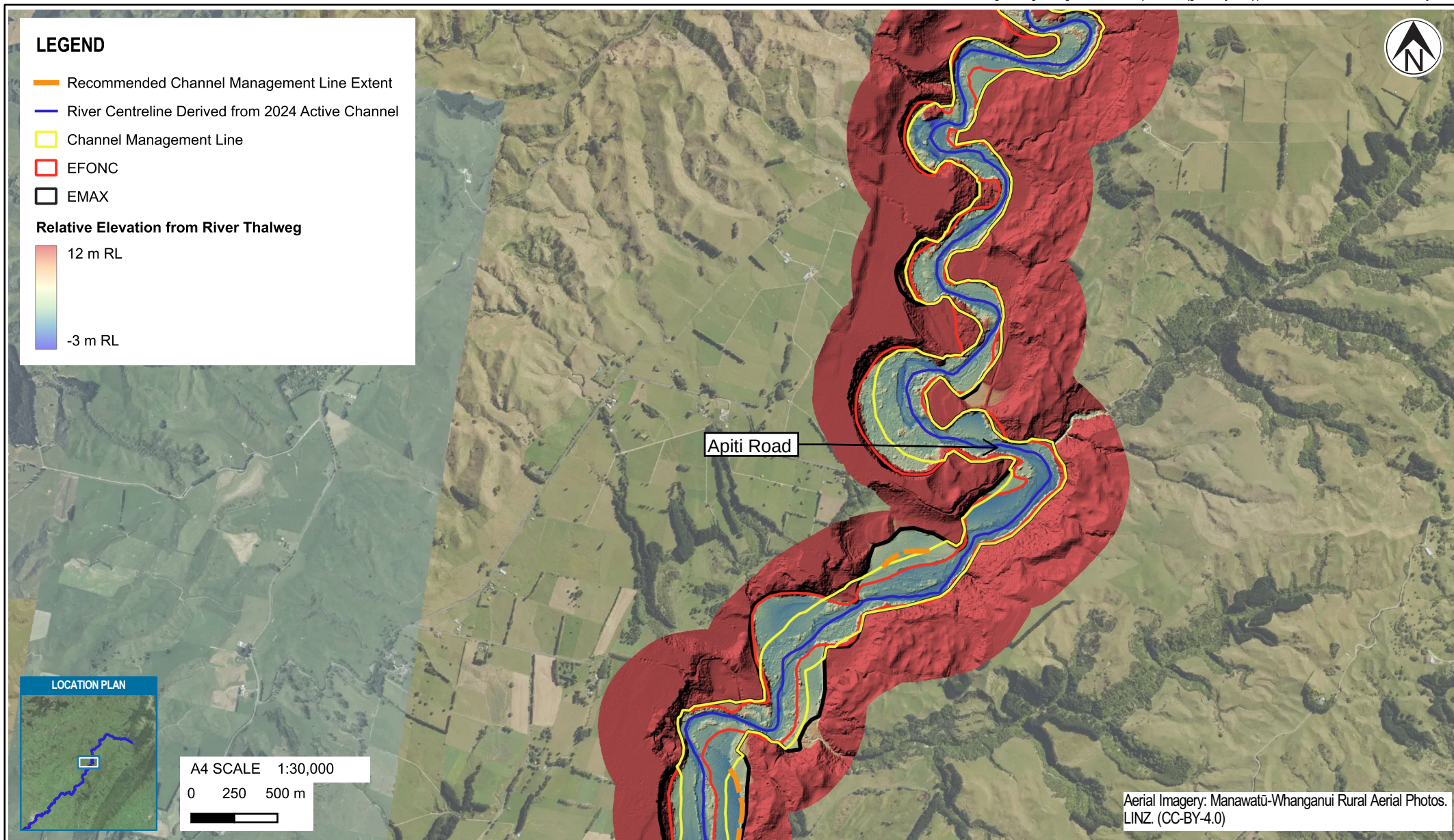
TITLE ŌROUA RIVER

Channel Management Line Recommendations

SCALE (A4) 1:30,000

FIG No. FIGURE 4-12

REV 2



NOTES:

Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

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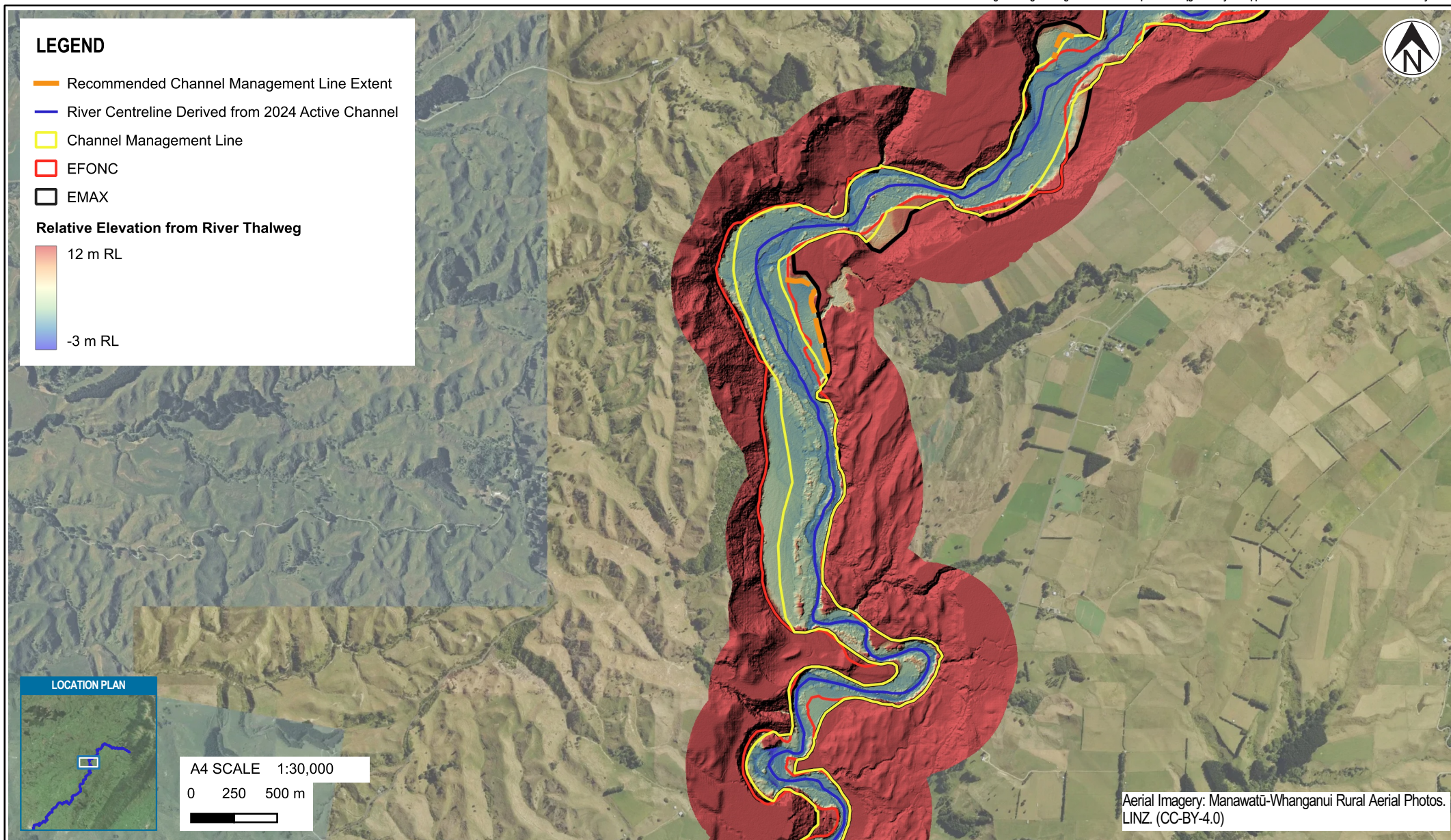
TITLE ŌROUA RIVER

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SCALE (A4) 1:30,000

FIG No. FIGURE 4-13

REV 2

**NOTES:**

Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

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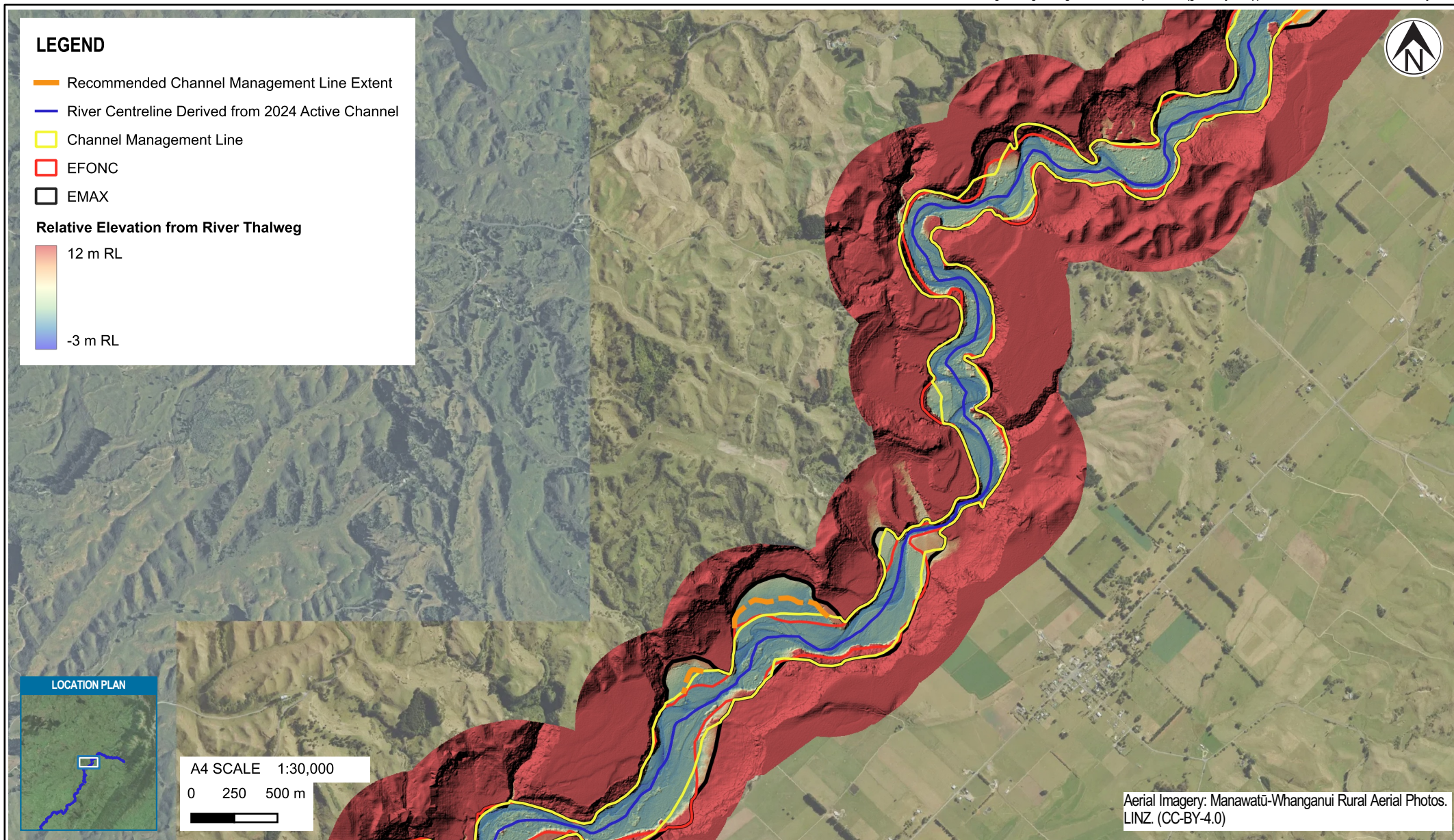
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SCALE (A4) 1:30,000

FIG No. FIGURE 4-14

REV 2



NOTES:

Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

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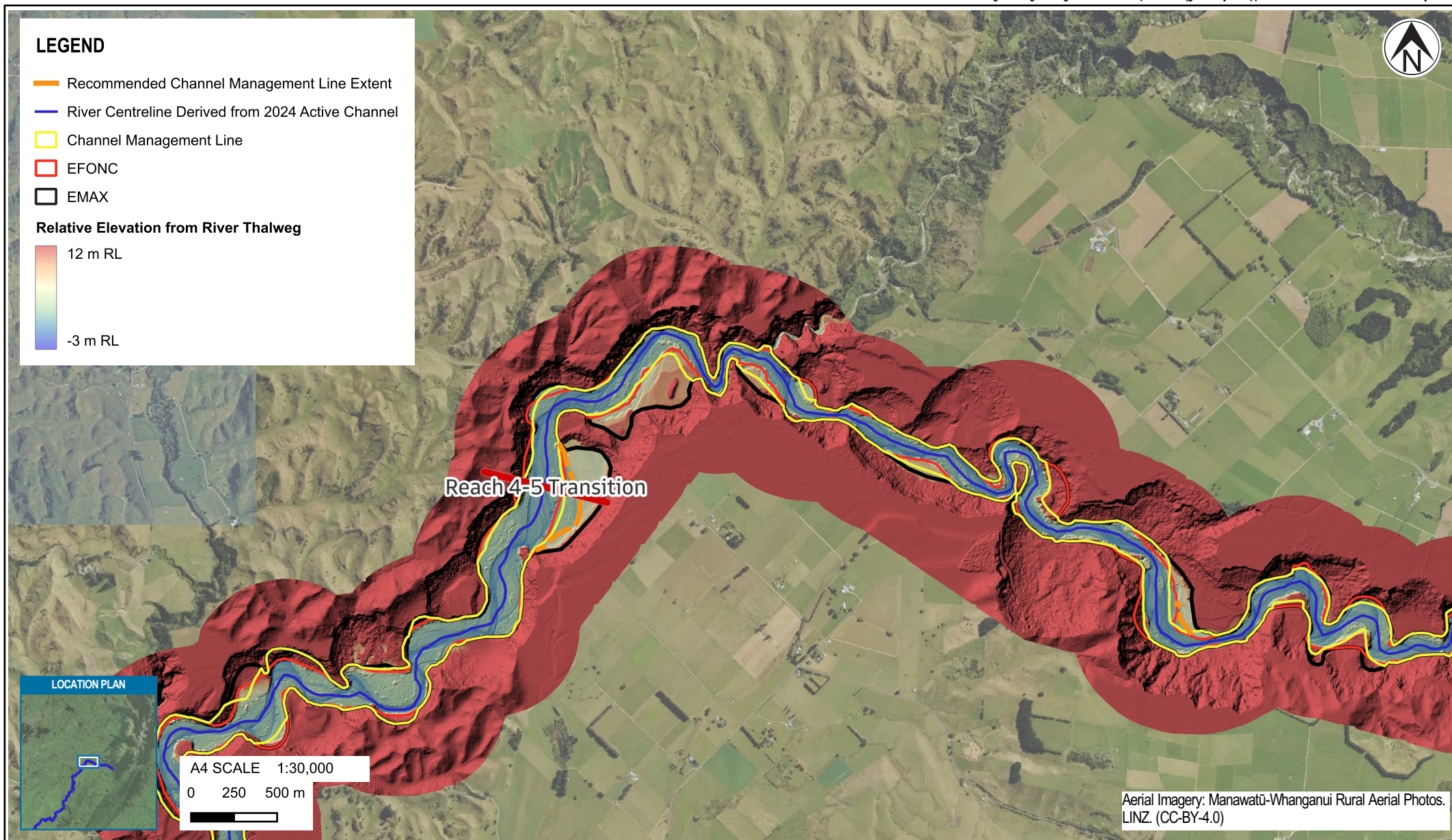
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SCALE (A4) 1:30,000

FIG No. FIGURE 4-15

REV 2



NOTES:

Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

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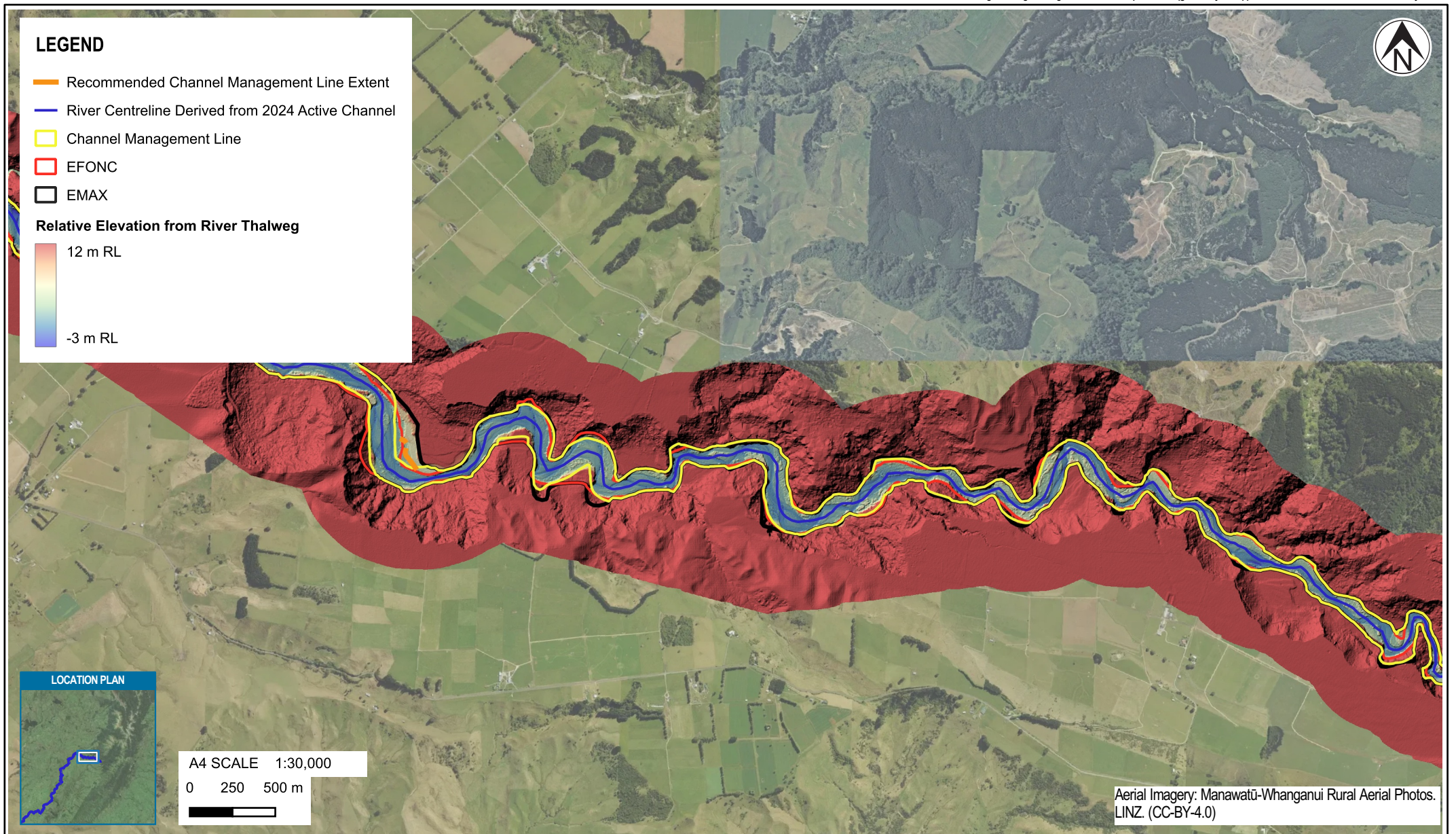
TITLE ŌROUA RIVER

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SCALE (A4) 1:30,000

FIG No. FIGURE 4-16

REV 2



NOTES:

Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

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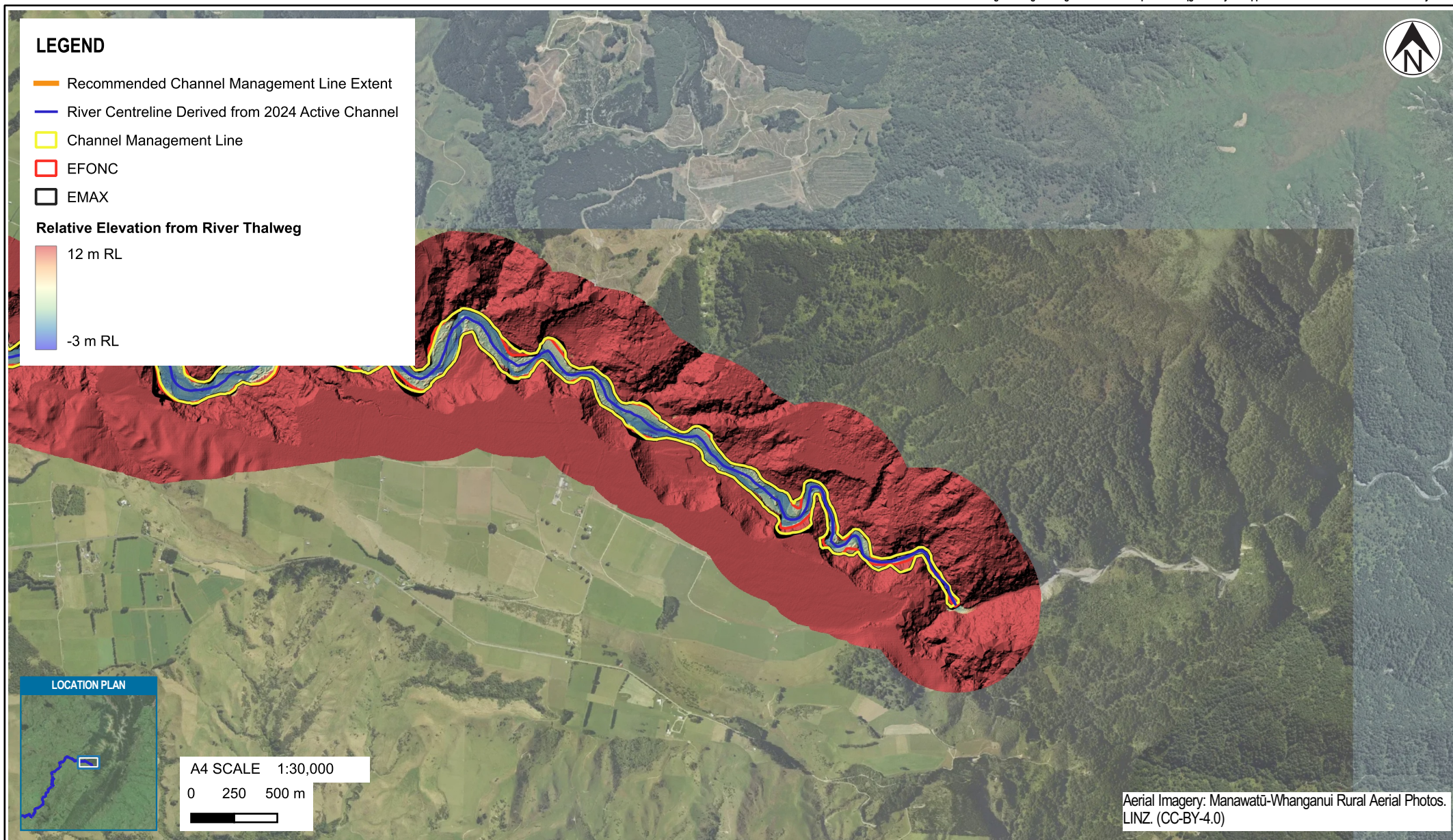
TITLE ŌROUA RIVER

Channel Management Line Recommendations

SCALE (A4) 1:30,000

FIG No. FIGURE 4-17

REV 2



NOTES:
Although relative elevations extend to values lower than -3 m and higher than 12 m, the symbology range is clipped to -3–12 m for visual representation. Values outside this range are rendered using the colours for -3 m and 12 m respectively.

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TITLE	ŌROUA RIVER Channel Management Line Recommendations		
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REV	2		





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