Land Information New Zealand
Toitū te whenua

New Zealand National River Network
Draft Dataset Specification

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1 Purpose and Summary

Over the next decade, the LINZ Topographic Office is working towards its vision of recognising the way location information can help unlock new patterns and knowledge, particularly when it is combined with other types of information. One of our strategic goals is to improve national scale datasets and maximise their opportunities for reuse by a variety of national and regional stakeholders.

After consultation in 2017 with some members of other NZ agencies, regional councils, and interested scientists and resilience planners, this document sets a draft specification for a national river network dataset. As a leader in providing spatial data for New Zealand, this river network dataset would provide components for various stakeholders to study long term flood risk modelling, environmental assessment, resilience planning, and managing downstream hydrologic effects on communities and infrastructure as a result of earthquake or other climatic events.

2 Dataset Specification

The river network dataset is designed to represent the flow of water through river systems at a national scale. It is composed of vector polyline features arranged in a convergent geometric network containing downstream flow direction as a function of topological connectivity and line feature direction.

The features of the national scale river network dataset would initially be derived from the current LINZ Topographic 1:50,000 scale (Topo50) river centreline data. To provide topological connectivity, the dataset will include additional artificial centrelines through other Topo50 scale features: river polygons, lakes and wetlands. To provide network connectivity in braided rivers, generalized centrelines are drawn through polygons representing the maximum extent of the combination of Topo50 river polygons and shingle polygons. All polyline network features would include feature direction consistent with natural water flow direction as can best be determined.

Current Topo50 features have a spatial accuracy of +/- 22 meters, though in some cases this may be higher. The initial release of this river network dataset will use existing spatial accuracy as found in the most recent version of Topo50 data.

The initial version of the river network dataset will include three related geometries:

1. River Network Centreline features: a convergent geometric vector network polyline dataset which may include portions of open river watercourses, river polygon centrelines, lake centrelines, canal centrelines, drains, wetland centrelines, glacier flows, piped watercourses, or culverts.

2. River Node Point features: a point dataset representing all nodes of features where river network polylines intersect, or where real world attribution changes occur.

3. Braided river polygon features: a polygon dataset representing braided rivers containing the maximum extent of the combination of river polygon features and river shingle polygon features. These polygon features are created to better represent river network flow through complex systems subject to frequent changes in time, as well as simplify the creation of artificial network centrelines representing these regions within the river network dataset.

A schematic of these features is shown in figure 1.

This dataset will be derived initially from the Topo50 river centrelines, but will remain as a standalone independent rivers network dataset, with no linkages to the Topo50 datasets. Due to the complexity of updating this dataset after the initial release, the intention is to update it on an annual or greater cycle.

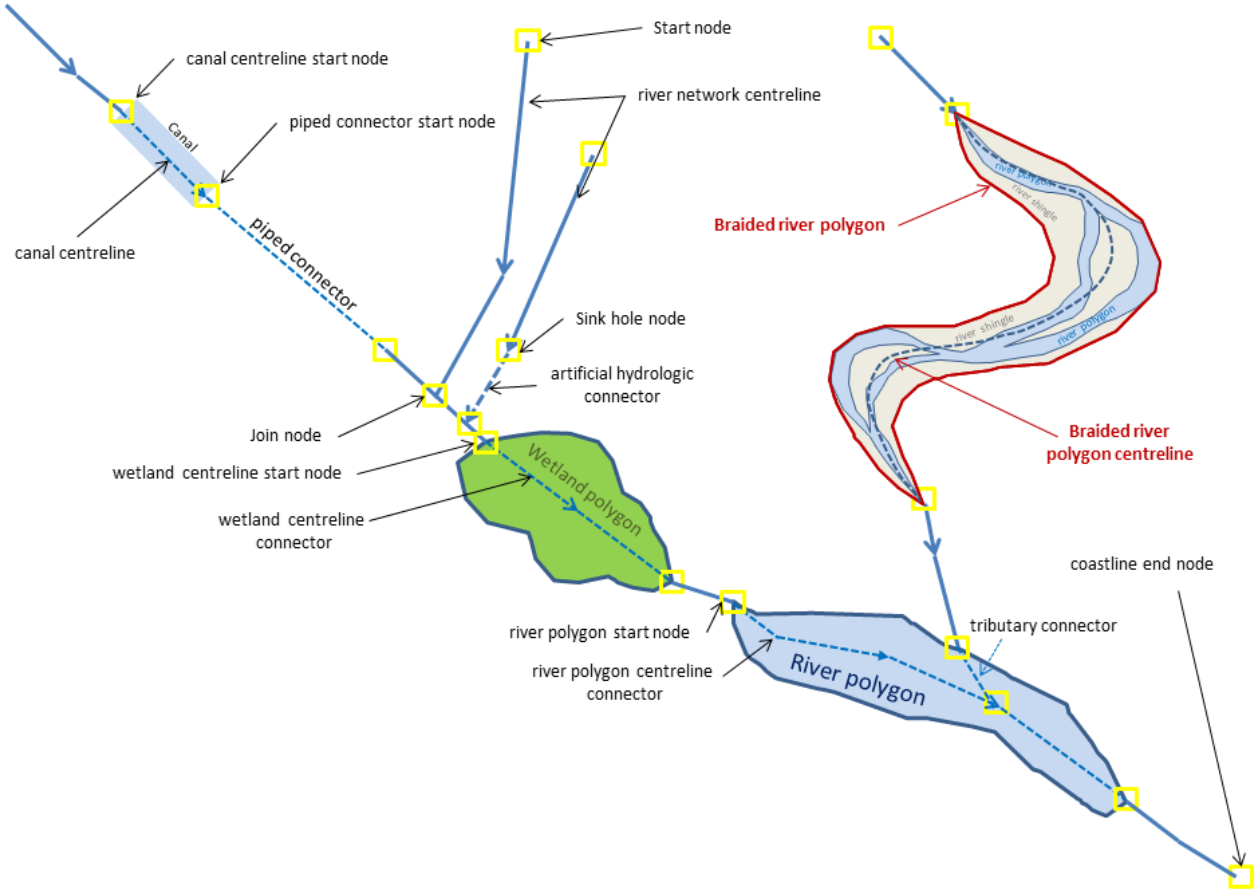

Figure 1. Schematic of geometry of the river network. Blue lines represent river network polyline feature geometry. Yellow squares represent river node point geometry where river network polyline features intersect. Red polygons represent braided river polygon features.

2.1 River Network Centreline Geometry

The river network centreline geometry consists of polyline geometry with a single convergent flow path for water through a river network. As shown in figure 1, these flow paths may represent open natural watercourses as individual polylines, or artificial connectors through water polygons.

2.1.1 Open natural watercourses

Open natural watercourses are represented by polylines derived from Topo50 river centerlines, and feature line direction is made consistent with natural water flow through a river system.

2.1.2 Drains and water races

Drains and water races are represented by polylines derived from Topo50 drain and water races datasets, but will be included where they are required to ensure connectivity of the river network where possible, otherwise excluded from the initial river network release.

2.1.3 Network divergence

In some instances the river network geometry requires the inclusion of flow path polylines which may not adhere to the convergent-only flow path model. An attribute will be included to allow the selection of all features which do conform to the convergence-only model, and prevent inclusion of divergent flow features.

2.2 Artificial river network connectors

For portions of river systems where existing Topo50 river centreline features do not connect with nearby downstream features, artificial polyline connectors are added to allow continuity and connectivity to support the convergent network capabilities of the dataset, as well as other assessment purposes.

2.2.1 Sinkholes

For river centerlines which end as sinkhole nodes in the Topo50 dataset, artificial connector lines to logical downstream features are created where possible.

2.2.2 Water polygons

For river centerlines along flow paths through Topo50 river polygons, canal polygons, swamp polygons, or lake polygons, artificial connector centerlines are created through these objects.

2.2.3 Braided river polygons

For portions of river systems that are braided, flow paths are represented by artificial connectors generalized from polygons of the maximum extent of the combination of Topo50 river polygons as well as Topo50 river shingle polygons. These braided river polygon features are the third related feature geometry of the network dataset.

2.2.4 Pipes

For portions of river systems which drain into piped connections under roads or through urban areas, flow paths are represented by artificial piped connector features where possible. These artificial connections are not intended to represent actual real world piped connections, but instead represent generalized flow through an urban area to connect upper open watercourses with downstream river features and ocean end points.

2.3 River Network Centreline Attributes

A list of river network centreline attributes is described below.

2.3.1 river_network_id

A unique feature identifier which is both unique and persistent for the life of the feature object.

2.3.2 river_type

A code to represent the feature type, such as open watercourse, river polygon centreline, lake centreline, wetland centreline, drain, canal centreline, artificial underground connector, water race, flume, siphon, glacier flow centreline, tributary connector etc.

2.3.3 image_id

LINZ is working on a national imagery surveys layer which will allow users to identify imagery date for openly available national datasets. This id represents a specific record of imagery information from which a feature is derived or updated from. This attribute is related to the CAPTURESOURCE and PROVIDER attributes. This will initially be empty for all features, as current Topo50 river centrelines were predominantly derived from historical photogrammetry.

2.3.4 capture_source

Identifies how the feature was captured into the dataset, such as digitize from imagery, delineation from elevation datasets, captured by GPS, or other methods. This attribute is related to the IMAGE_ID and the PROVDER attributes.

2.3.5 provider

Identifies the agency or source of the feature/attribute update. Improves the ability to identify features where local knowledge has improved the dataset. This attribute is related to the IMAGE_ID and CAPTURESOURCE attributes.

2.3.6 prime_flow

The river network is designed to be used mainly as a convergent only network. However, there are specific cases where diversions need to be represented. This attribute indicates the first feature where a divergence exists, thereby allowing sub-setting the dataset as a convergent only network.

2.3.7 name_status

Indicates whether the river name and extent is official or unofficial as recorded in the NZ Gazetteer. In addition, the extents of named river features which have not been verified are attributed as provisional.

2.3.8 name_ascii

The ascii river name of the feature. These names are extrapolated from the LINZ Topo50 maps.

2.3.9 macronated

This is used to determine whether the name attribute has macronated characters.

2.3.10 name

This is the river name attribute with macronated characters.

2.3.11 order_strahler

The Strahler stream order of the feature, and hierarchical structural coding system of river networks, for environmental assessment or modelling by catchment and river size. In some instances this attribute can also be used to help in scale dependent cartography.

2.3.12 from_node

Unique identifier of the upstream node (node_id in the river nodes dataset) for this segment. This is a way to allow some functions to trace up and downstream in a way that is independent of geometry direction (ie some models can't trace direction based on geometry alone). Has an opposite function to the to_node attribute.

2.3.13 to_node

Unique identifier of the downstream node (node_id in the river nodes dataset) for this segment. This is a way to allow some functions to trace up and downstream in a way that is independent of geometry direction (ie some models can't trace direction based on geometry alone). Has an opposite function to the from_node attribute.

2.4 River Network Node Geometry

The network node features is a point geometry dataset which is a companion to the network centreline dataset, and represents the start and endpoints of network centerline features. Nodes can represent the upper and lower reaches of rivers, as well as points of intersection between network centreline features.

Nodes at the upper and lower reaches of network polylines define the beginning (start nodes) as well as the lowest reaches of river systems near the sea or sinkholes (end nodes).

Nodes at intersections represent the convergence of different rivers as well as points where different types of open watercourse features intersect, such as lake centrelines, wetland centrelines, river polygon centrelines, canal centrelines, or braided river polygons . As shown in figure 1.

For siphons and other water diversions where water features cross one another without mixing, nodes are not created when river network polyline features cross.

2.5 River Network Node Attributes

A list of attributes for the river network node geometry is described below:

2.5.1 node_id

A unique node feature identifier which is both unique and persistent for the life of the node feature object.

2.5.2 down_river_rnid

The unique id of the river network feature identifier from the river network centreline dataset which is downstream of this node.

2.5.3 node_type

A coded attribute which identifies the type of node. For example, this attribute would allow identification of start nodes, end nodes, join nodes, or piped feature start nodes, amoung others.

2.6 Braided River Polygon Geometry

The braided river polygon features represent boundaries of the maximum extent of Topo50 river polygon features and shingle features. These polygons are a companion to the river network centreline features, where they are used as the basis for the creation of braided river centrelines.

2.7 Braided River Polygon Attributes

A list of braided river polygon attributes is described below:

2.7.1 braid_id

A unique id feature identifier which is both unique and persistent for the life of the braided river feature object.

2.7.2 name_ascii

The ascii river name of the polygon feature. These names are extrapolated from the LINZ Topo50 maps.

2.7.3 macronated

Indicates whether the name attribute contains macronated characters.

2.7.4 name

This is the same as the name_ascii attribute but with macronated characters.

3 Attributes Not Implemented

The initial release of the LINZ River Network Dataset is intended to provide as much geometry and attribute information which can be gathered given agency resources and external information readily available at the time of release. Many other features and attributes for this river network dataset were considered. It is hoped with sufficient resources, feedback, and local information from regional sources, future updates of this river network dataset may include improvements in spatial accuracy, attribute and flow direction information.

Below is a list of attributes not selected for inclusion in this initial release of the river network dataset. The items listed below are included for reviewers of this draft document to provide context for feedback and understanding of what this initial release is designed to accomplish.

While it is understood spatial accuracy of river network centerlines compared to current imagery is important for a variety of uses, future updates of spatial accuracy will be dependent on resources available to accomplish this task on a national scale.

3.1 River Network Centreline Attributes Not Implemented

3.1.1 water_type_id

The unique id of a water feature through which a centreline feature extends. For example, if a wetland centreline is drawn through a wetland, this attribute is the id of that wetland polygon in a Topo50 wetland dataset. Due to resource requirements, this will not be included in this initial release.

3.1.2 catchment_id

The id of the catchment draining to this feature. This value should also be associated to the downstream node of a feature of the river node dataset. Since a catchment dataset has not yet been developed, this attribute will not be included in this initial release.

3.1.3 length

The length of the river network segment. Required for calculating river distance and distance to the sea. Since spatial accuracy might likely change in future releases, and this attribute can be easily calculated with most geospatial packages, this attribute is not included in this release.

3.1.4 scale

A coded value representing the scale each feature can be displayed for cartographic purposes. Examples could include: 1= scale of 10k ; 2= scale of 50k; 3=scale of 250k ; 4=scale of 1000k. The solution to adequately automate the calculation of this attribute has yet to be determined. Intially, some aspects of the order_strahler attribute could be used to provide a basis for cartographic display at different scales. Alternatively, since the river network centreline dataset contains convergent flow direction as a function of feature direction, representation of rivers at different scales could be accomplished in some GIS packages using these methods: https://anitagraser.com/2017/04/17/better-river-styles-with-tapered-lines/

3.2 River Network Node Attributes Not Implemented

3.2.1 node_elev

The elevation of the node as determined from an associated DEM model. Could be used to calculate average slope between two nodes, and thus the average slope of a network centreline feature. Since an improved higher resolution national scale elevation dataset has yet to be developed (or an improvement over the current LINZ elevation dataset based on 20m contours), this attribute will not be included in this initial release.

3.2.2 node_type for mean high water spring coastline

A code representing a node which intersects the mean high water spring coastline. A national scale dataset representing mean high water spring coastline has yet to be developed for integration into this dataset, so this attribute will not be included.

3.3 Braided River Polygon Attributes Not Implemented

3.3.1 ave_braid_width

Where an artificial braided river polygon centerline is created, this is the average width of the river polygon along the length of the braided river polygon centreline. Due to complications in calculating this attribute where braided river polygons are complex, the initial release of this dataset will not include this attribute.