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An analysis of wetland loss between 2001/02 and 2015/16

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Stella Belliss, James D Shepherd, Peter Newsome, John Dymond

Landcare Research

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Landcare Research, Gerald Street, PO Box 69040, Lincoln 7640, New Zealand,
Ph +64 3 321 9999, Fax +64 3 321 9998, www.landcareresearch.co.nz

Reviewed by:	*Approved for release by:*
Anne-Gaelle Ausseil RPA leader Landcare Research	Alison Collins Portfolio Leader – Characterising Land Resources Landcare Research

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Summary

Project and client

The Ministry for the Environment (MfE) contracted Landcare Research to produce an analysis of wetland loss since the creation of the Wetlands of National Importance (WONI) national wetlands layer and up to the summer of 2015/16, reported by region and accompanied by a log of wetland polygons requiring future editing.

Objective

- To produce a log file of wetland polygons and provide this to MfE so that they can edit and improve the WONI national wetlands layer.

Methods

- A workflow was devised using WONI, a 2015/16 Sentinel-2A satellite imagery mosaic, plus other relevant image layers to allow efficient and effective viewing of the current wetland polygons of New Zealand
- An operator worked through all the wetlands polygons, agreeing or disagreeing with them. Where there was disagreement, the polygons were flagged and the required modifications logged.
- The results were provided as a logfile, accompanied by a brief report outlining the process.

Results

- A workflow was generated, derived from that used for previous destock checking.
- A log file of WONI wetland polygons that require updating to the summer of 2015/16 was produced and provided to MfE.
- The number of wetlands that need either removing or altering is 3,569 out of a total of 14,553; this total increased to 14,632 when the regional metrics were calculated, since a few (less than 0.5%) of the wetlands straddled regional boundaries. This higher figure was used in all the analyses.
- Seventy-six percent of the wetlands, comprising a little over half the total national area identified by WONI as wetlands, were recorded as unchanged. Only 214 wetlands (1.5% of the total national number) were no longer present. However, 746 (5%) of the WONI wetlands were recorded as partially lost. Six percent of the wetland polygons appeared to be errors. In addition, 11.5% were flagged as correct but in need of improvements in the polygon line work.
- Wetland metrics are also provided by region

Conclusions

- This checking methodology enables very large numbers of image elements to be quickly and efficiently visually inspected and judged, creating a file of wetland polygons for consideration in subsequent layer improvements.
- Addressing the changes flagged by this exercise should help to bring the WONI layer up to date, bringing about a marked improvement in the timeliness and correctness of the WONI layer.

Recommendations

- The Landcare Research checking workflow enabled this task, to be carried out comprehensively and rapidly, despite being labour intensive. With this system, MfE could consider regular updates of this layer, perhaps to coincide with Land Cover Database updates.

1 Introduction

MfE contracted Landcare Research to produce an analysis of wetland loss since the creation of the WONI national wetlands layer and up to the summer of 2015/16, reported by region and accompanied by a log of wetland polygons requiring future editing.

The WONI wetland layer was derived from a number of inputs, including a national cover of Landsat Enhanced Thematic Mapper images taken between 1999 and 2003 (Ausseil et al. 2008). For ease of use, the date of the WONI wetlands layer is taken as summer 2001/02.

2 Background

2.1 The nature of the problem

Wetlands are probably New Zealand's most depleted ecosystem, and they remain the most vulnerable. Less than 10% of the original wetlands remain, and they continue to be lost as a result of land intensification, general neglect, and ignorance about their biodiversity value and role as regulators of water and nutrients. With notable exceptions, the remaining wetlands are generally small and tenuous: their area-to-perimeter ratio tends to be small and their exposure to surrounding land-use pressures is generally high.

Wetlands are also morphologically diverse. 'Wetland' is not a vegetation type: it is an edaphic condition that can support a range of vegetation types. This, combined with their size, shape and phenology, makes them a difficult target for image classification systems, and even for visual observation.

As a result, wetlands have not yet been comprehensively, reliably and accurately mapped at the national level, although two recent databases are tantalisingly close to providing an acceptable framework for national monitoring:

- Waters of National Importance (WONI, Ausseil et al. 2008), which is now a component of the FENZ (Freshwater Environments of New Zealand) database (Leathwick et al. 2010), managed by the Department of Conservation (DOC)
- The New Zealand Land Cover Database (LCDB), presently in its fourth edition (Landcare Research 2015).

Both these databases have shortcomings in terms of comprehensiveness, resolution and accuracy. Sometimes these shortcomings coincide in an area, and in other areas one database is clearly superior to the other. In some areas one or both databases may already have satisfactory levels of comprehensiveness, resolution and accuracy for national

reporting. The main difference between them is that WONI is becoming out of date[1] and LCDB is deficient in its typology of wetlands.

In addition, regional councils manage their own environmental (including wetland) databases. These vary in detail, comprehensiveness and resolution. In several regions these are likely to surpass the two national databases in comprehensiveness, resolution and accuracy, and will include additional information such as wetland condition and species composition.

The Environmental Reporting Act 2015 creates a joint obligation on MfE and Statistics NZ for regular national reporting on New Zealand's environment through synthesis and domain reports. To date, reporting of wetlands has simply compared extent in 2008 with pre-human extent (Environment Aotearoa 2015). Hitherto, synthesis and domain reports have not been able to give detail about contemporary changes in wetland extent, due to lack of data, although much of this data does exist in two national databases and in sub-national data sets maintained by some regional councils.

To improve the currency of wetland reporting, MfE has contracted Landcare Research to produce an analysis of wetland loss for the period 2005−2016, reported by region. Since mapping loss consumes time and resources, Landcare Research and MfE agreed upon a methodology that would require checking wetland polygons in WONI and recording a log of wetland polygons requiring future editing.

MfE also required recommendations for ongoing wetland monitoring and reporting, utilising the strengths of existing databases, and both existing and planned monitoring. This is addressed in a separate report (Newsome, in prep.).

2.2 The solution proposed by Landcare Research to update the wetlands layer

This task is designed to address the immediate need for a statistic on contemporary change in wetland extent in the upcoming 2018 synthesis report (loss only). This is a desktop solution. It involves a visual comparison of the WONI wetlands, as mapped, for 2001/02, from Landsat imagery, against 2016 Sentinel-2 satellite imagery. The Landsat imagery used for WONI had eight spectral bands at 30 m spatial resolution, plus a panchromatic band at 15 m; Sentinel imagery has 13 spectral bands at resolutions varying from 10 to 60 m. (See Table 1 for a brief outline of the characteristics of these two satellite sensors, plus the other satellite imagery used in the screening tool.)

The operator's decisions are captured by an adapted form of Landcare Research's in-house screening software developed to facilitate Kyoto Land Use Mapping (LUM) (MfE 2012). This

[1] In 2014, Landcare Research was contracted by DOC to update the published WONI dataset with new information from regional councils. However, funding was insufficient to complete the task and so this partially-updated layer was not released (Anne-Gaelle Ausseil, pers. comm. 2017). The object if this work was to estimate wetland loss from the official statistic, based on the published version of WONI, so the partially-updated layer was not used as the baseline of this analysis.

software controls the panning/zooming and selection process across multiple screens of evidence and captures operator decisions and comments for onward processing.

Although this visual inspection will not capture deterioration in the condition of wetlands, it does detect wetland disappearance and erosion of wetland extent with reasonable confidence. Supplementary comments on the wetland polygons also suggest future database improvement, such as erroneous polygons and inaccurate boundaries.

Table 1 Brief details of the satellite sensors used in the WONI checking exercise

	Sensor		
	Landsat ETM+ and OLI	**SPOT-5**	**Sentinel-2A**
Number of spectral bands	9	4	13
Spatial resolution	8 bands at 30m 1 panchromatic band at 15m	3 bands at 10m 1 band at 20m	4 VNIR bands at 10m 6 bands at 20m 3 bands at 60m
Repeat cycle	16 days	Up to 11 times every 26 days with variable look angles	Every 10 days
Swath width	185 km	60 km	290 km
Comments		SPOTMaps is a natural colour image product derived from SPOT 5 data	Includes red edge bands to aid vegetation discrimination

3 Objective

The objective of this work was to deliver information on the contemporary changes in national wetland extent with respect to published MfE/Statistics New Zealand figure. Official statistics prior to this analysis were based upon the published WONI (nominally 2003). Ideally, an analysis would hope to quantify wetland loss from 2005-2016 but, because funding was insufficient to support re-mapping of partially-lost WONI polygons, our objective became to review all WONI polygons and record:

- wetlands entirely lost between 2003 and 2016
- wetlands partially lost between 2003 and 2016
- wetlands requiring future editing for reasons of land use change, inaccurate boundaries, or original error

4 Methods

4.1 Overview

A workflow was devised using WONI, a 2015/16 Sentinel-2A satellite imagery mosaic, plus other relevant image layers (e.g. available SPOT imagery at different dates) to allow efficient and effective viewing of the current wetland polygons of New Zealand. We worked through the polygons, checking whether they are still extant. Where there were changes, these were flagged and the recommended modifications were logged.

4.2 Workflow for checking wetland polygons

The operator's decisions are captured by an adapted form of Landcare Research's in-house screening software developed to facilitate Kyoto LUM. This software controls the panning/zooming and selection process across multiple screens of evidence and captures operator decisions and comments for onward processing. It comprises a control panel, which contains information about the wetland polygon under examination, plus a set of drop-down menus for data entry, as well as a set of images to examine.

4.2.1 Control panel

The map accuracy control panel keeps track of the progress through the file and also allows the operator to go directly to any numbered polygon. Drop-down menus can be used to enter information and comments, if required. However, it is faster and easier to enter information via the keyboard. Here, the key is:

- W = wetland OR you can enter N = next/no change
- C = complete loss of wetland
- I = improve line work (see comments in section 4.3.3)
- E = error (see comments in section 4.3.4)
- L = partial loss of wetland (see comments in section 4.3.6).

Figure 1 shows the control panel.

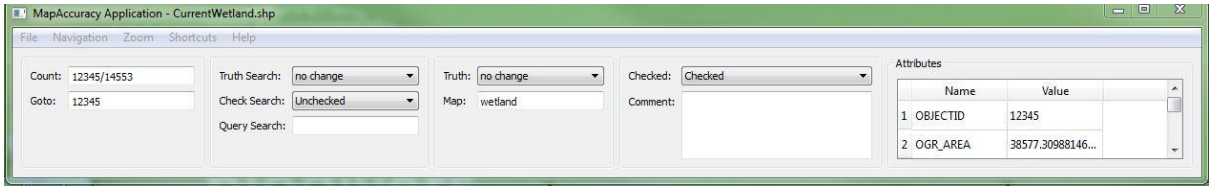

Figure 1 The map accuracy control panel.

4.2.2 Images

Wetlands can be ephemeral entities and can look very different over time, so it is valuable to have a series of images to examine. Eight images were loaded into the map accuracy for examination, in two rows of four, as follows:

'1990' baseline Landsat mosaic 1988–1993	Landsat-7 mosaic 2001/02 (band combination NIR, SWIR, red)	Sentinel-2A 2015/16 (band combination NIR, SWIR, red)	SPOTMaps 2006–2008 (band combination red, green, blue)
SPOT-5 mosaic 2011–2013 (band combination NIR, SWIR, red)	SPOTMaps 2013/14 (band combination red, green, blue)	Landsat-8 mosaic 2014/15 (band combination NIR, SWIR, red)	SPOT-5 mosaic 2006–2008 (band combination NIR, SWIR, red),

Originally the images were laid out in chronological order, left to right and then top to bottom. However, since the two ruling images are the Landsat-7 mosaic 2001/02, from which the WONI was derived, and the summer 2015/16 Sentinel-2A mosaic, from which the prime judgements were to be made, it was easier to have these right next to each other to avoid extra eye movements. With this small modification the wetlands could be worked through quickly.

Overlain on each image are the WONI polygons in outline. This reference layer was a simplification of the published WONI Current Typology data set. Internal differentiation of type and subdivisions inherited from evidential layers was dissolved out, leaving just the peripheral boundary. This reduced the number of wetland 'patches' we had to examine to a manageable number.

The polygon under consideration is outlined in yellow: if the map view also includes other wetlands polygons, these are outlined in red on one of the ancillary layers. Figure 2 shows an example where two polygons are visible in the map view.

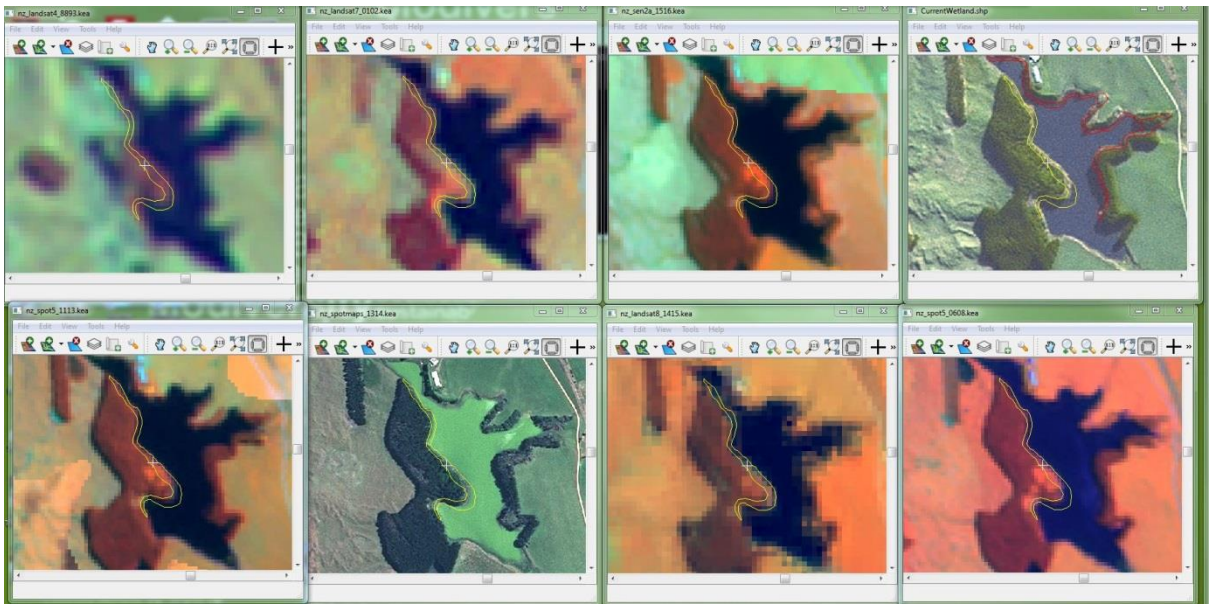

Figure 2 Example of the image layout, with the polygon under examination outlined in yellow on all the eight images. Another polygon in the layer, not under current examination, is outlined in red and shown in the top right image. Locality: Taranaki.

4.3 Comments on using the workflow and using the classification key

4.3.1 Prime data sources

The critical images to consider are the LCDB2, on which WONI was based, and the Sentinel-2 mosaic 2015/16; the rest of the images are ancillary. Therefore, most of the decisions should be made from these two.

4.3.2 General 'rules'

WONI defines wetlands on a series of factors and rules, including topography, and there are situations where a wetland may be present but is not visible in a satellite image. If there was no evidence to be seen in the imagery, WONI was deemed to be correct (see example in Appendix 1G). These situations included:

- where a polygon denotes a wetland but looks just the same as areas around it (e.g. polygons in forested areas are hard to judge, especially if there is no obvious barer patch)
- where the designated wetland looks like a small shelterbelt or a remnant stand of trees: in situations where the trees are on/near a creek, or somewhere near a pond or randomly left in an otherwise developed landscape, then agree that it is a wetland; however, if the remnant trees are on a high area or look like a woodlot, then mark the polygon as an error; again, if the wetland polygon of trees has been clear-felled, it may be an error.

In addition, many of the wetland polygons in Northland were very small – too small to call in some cases − so the WONI classification was accepted.

4.3.3 Line work improvement

The desire to mark a large number of polygons as requiring improved line work needed to be repressed. However:

- the need for line work improvement was flagged in situations where more than 25% of the polygon is wrong or in the wrong place (see example in Appendix 1E)
- most of the polygons derived from region growing could do with the line work being simplified. However, not all of them were flagged for this. Those that were very small and/or those that would not become much smaller or larger from improvements in their line work were left as is (see example in Appendix 1D).

Sometimes the division of wetlands into segments is indecipherable in the imagery. This is another situation where the WONI wetland layer is accepted rather than flagging an improvement in the line work.

4.3.4 Errors

In general there are very few errors in the WONI data set. One of the more common types of error occurs where the polygon is a single pixel or a very small sliver of pixels in close proximity to a larger wetland polygon and is likely to have been caused by an artefact of the drawing process.

Other errors have no obvious cause. Some of them may be attributable to region-growing moving away from the correct wetland area and into adjacent landforms; others may be derived from original inputs to the WONI layer other than the imagery (e.g. given point locations or polygons) (see example in Appendix 1C).

4.3.5 Complete loss

If a wetland was clearly visible on the Landsat image 2001/02 but not on the Sentinel image, we flagged the polygon as a 'complete loss'. This was relatively uncommon. Examples of total loss are shown in Appendix 1B.

4.3.6 Partial loss

Partial loss of a wetland typically shows up as a paddock, or paddocks, being carved off the edges of the wetland area. Partial loss was flagged if any of the WONI polygon had been drained and developed, regardless of the area/percentage of the polygon involved. Examples of partial loss are shown in Appendix 1A.

4.3.7 Misregistration

There is a lot of misregistration of WONI over the imagery (see example in Appendix 1F). This was sometimes apparent in all the imagery, and sometimes only in some. It slowed the work, because the operator had to pause to see where the polygon was supposed to be. Due to the variation in this problem, such misregistration was not recorded as needing line work improved. Instead, affected polygons were treated as if they were in the right place and judged accordingly.

Many of the lakes/tarns appear to be correctly registered most of the time.

It may be that coordinate conversion is playing a part in the misregistration: earlier mosaics were first produced in the New Zealand Map Grid (NZGD1949 projection) and subsequently have been re-projected to New Zealand Transverse Mercator 2000. However, no systematic pattern to the misregistrations was apparent to the operator.

5 Results

A workflow was generated, adapted from Landcare Research's in-house screening software developed to facilitate Kyoto LUM. A log file of 2001/02 WONI wetland polygons that require modification to update them to 2016 was produced and provided to MfE.

The number of wetlands that need either removing or altering is 3,569 out of a total of 14,553; this total increased to 14,632 when the regional metrics were calculated, since a few (less than −0.5%) of the wetlands straddled regional boundaries. This higher figure was used in all the national and regional category calculations.

The national totals are shown in Table 2. These are expressed both as the number of polygons falling into each change/no change category, and as the number of hectares affected. The former is a reasonable metric for the amount of work involved in making the improvements to the data set; the latter gives a better indication of the state of the wetlands in terms of the areas affected.

Table 2 Results of the survey of wetland loss: national totals

Category	No of wetlands	% of wetlands	Hectares	% of wetland area
No change	11, 063	76	132,953	53
Partial loss	746	5	31,581	12.6
Complete loss	214	1.5	1,247	0.5
Improve line work	1,699	11.5	79,646	32
Error	910	6	4,179	1.7
Total	14,632	100	249,609	99.8

Seventy-six percent of the wetlands, comprising a little over half the total national area identified by WONI as wetlands, were recorded as unchanged. Only 214 wetlands (1.5% of the national total) were no longer present. However, 746 (5%) of the WONI wetlands were recorded as partially lost.

Six percent of the wetland polygons appeared to be errors. In addition, 11.5% were flagged as correct but in need of improvements in the polygon line work. However, note that neither the 'partial loss' nor the 'improve line work' categories are accurate metrics for the area affected; area here is the area in hectares of the wetlands that have been flagged as needing attention to update and improve their depiction. In the partial loss case, the area will have decreased − perhaps by only a little, perhaps by a lot. In the case of a polygon needing line work improvement, it might end up with a decrease or increase in the area or, it might remain constant but with a more accurate rendition of the true outline of the feature.

Wetland metrics have also been analysed region by region. These regional figures are shown in Tables 3−6 Tables 3 and 4 give the number of polygons in each North Island and South Island region, respectively, and the percentage of these that fall into each of the four change and one no-change categories. Tables 5 and 6 show the results as percentages of the total areas involved.

Table 3 Number of wetlands per North Island region and the percentages that fall into each category

Region	Total polygons	% no change	% partial change	% complete loss	% improve line work	% error
Northland	719	72	4.6	0.7	21.1	1.5
Auckland	2,184	79.6	2.3	2	9.7	6.3
Waikato	422	67.5	13.5	2.1	12.3	4.5
Bay of Plenty	845	78	1.65	0.35	2.95	17.0
Hawkes' Bay	288	76.4	6	0.3	15.6	5
Gisborne	193	67.4	10.3	3.1	18.1	1.0
Taranaki	337	76	3.2	1.5	9.8	9.5
Manawatu-Wanganui	861	81.4	5.3	0.7	8.7	3.8
Wellington	331	82	5.4	0.6	4.5	7.5
National	14,632	76	5	1.5	11.5	6

Table 4 Number of wetlands per South Island region and the percentages that fall into each category

Region	Total polygons	% no change	% partial loss	% complete loss	% improve line work	% error
Tasman	432	72.4	6.7	2.0	13.0	5.8
Nelson	8	75.0	0	0	0	25.0
Marlborough	250	64.8	11.2	2.4	12.4	9.2
Canterbury	1,924	70.4	9.8	2.2	12.2	5.4
West Coast	1,764	65.0	5.5	2.1	11.6	15.7
Otago	2,418	79.6	2.7	0.5	15.0	2.2
Southland	1,656	83.1	4.2	1.6	10.0	0.96
National	14,632	76	5	1.5	11.5	6

Table 5 Areas of wetlands per North Island region and the percentages that fall into each category

Region	Total area (ha)	% no change	% partial loss	% complete loss	% improve line work	% error
Northland	14,056	51.14	7.0	0.07	41.7	0.02
Auckland	2,533	43.25	19.92	0.26	34.8	1.74
Waikato	28,212	51.8	15.0	1.16	31.97	0.07
Bay of Plenty	3,287	85.6	7.9	0.2	5.7	0.6
Hawkes' Bay	2,456	79.2	3.4	0.03	16.3	0.5
Gisborne	939	44.2	17.8	1.3	34.5	2.2
Taranaki	3,024	56.1	7.6	0.4	33.7	2.1
Manawatu-Wanganui	6,983	55.4	16.6	0.2	27.2	0.6
Wellington	2,765	57.7	37.2	0.2	4.5	0.3
National	249,609	53	12.6	0.5	32	1.7

Table 6 Areas of wetlands per South Island region and the percentages that fall into each category

Region	Total area (ha)	% no change	% partial loss	% complete loss	% improve line work	% error
Tasman	5,212	24.3	3.5	0.45	70.5	1.14
Nelson	3	99.0	0	0	0	1.0
Marlborough	1,543	46.9	20.15	3.2	17.7	12.1
Canterbury	19,850	53.1	29.3	0.5	15.0	2.0
West Coast	88,417	43.2	12.2	0.36	44.0	0.1
Otago	27,049	42.3	8.5	0.3	37.3	11.6
Southland	47,272	78.8	8.4	0.6	12.0	0.1
National	249,609	53	12.6	0.5	32	1.7

Particular regions that appear to need further assessment include Northland and Gisborne, where around 20% of the polygons were flagged as benefiting from line work improvements; and Marlborough, Gisborne and Waikato, where over 10% of the WONI wetlands were flagged as affected by partial losses. Nelson, the West Coast and the Bay of Plenty recorded the highest percentages of errors; however, the tiny Nelson area contains only eight WONI polygons, and thus the 25% error metric for this region is somewhat insignificant.

Examples of the workflow and the decisions made for individual wetlands are illustrated at the end of this brief report (appendix 1).

6 Conclusions

This checking methodology enables very large numbers of image elements to be quickly and efficiently visually inspected and judged, creating a file of wetland polygons for consideration in subsequent layer improvements.

Note that this method is comprehensive in that it has enabled all the WONI polygons to be checked. However, it is addressing quantities only: the quality of the wetlands is not covered by this methodology.

Addressing the changes flagged by this exercise should bring about a marked improvement in the WONI layer by bringing it up to date as well as improving some of the line work to better depict the wetlands.

7 Recommendations

The Landcare Research checking workflow enabled this task, although labour intensive, to be carried out comprehensively and rapidly. With this system, MfE could consider regular updates of this layer, perhaps to coincide with NZ Land Cover Database updates.

It might have been useful to expand the classification categories to capture more information about the need to improve the line work. For example this category could have been split into:

- improve line work to smooth the edges
- improve line work to expand the wetland
- improve line work to contract the wetland (i.e. not a loss of wetland *per se*).

8 Acknowledgements

Thanks to Anne-Gaelle Ausseil for reviewing and to Ray Prebble for editing services.

9 References

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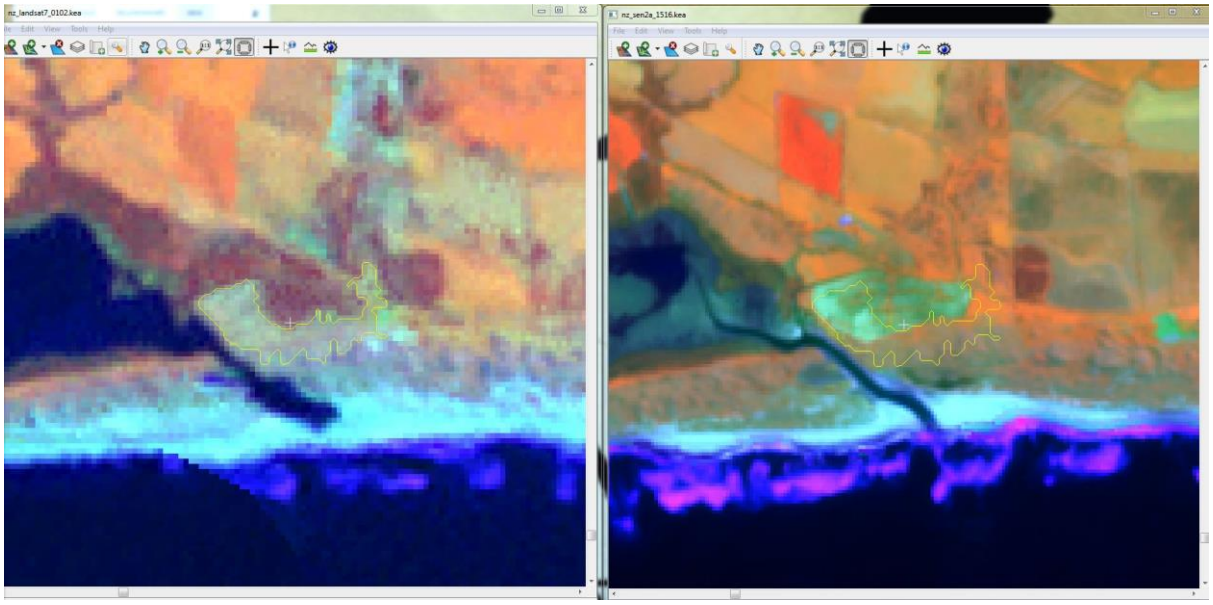
Appendix 1 Examples of the wetland polygon decisions

A: Partial loss

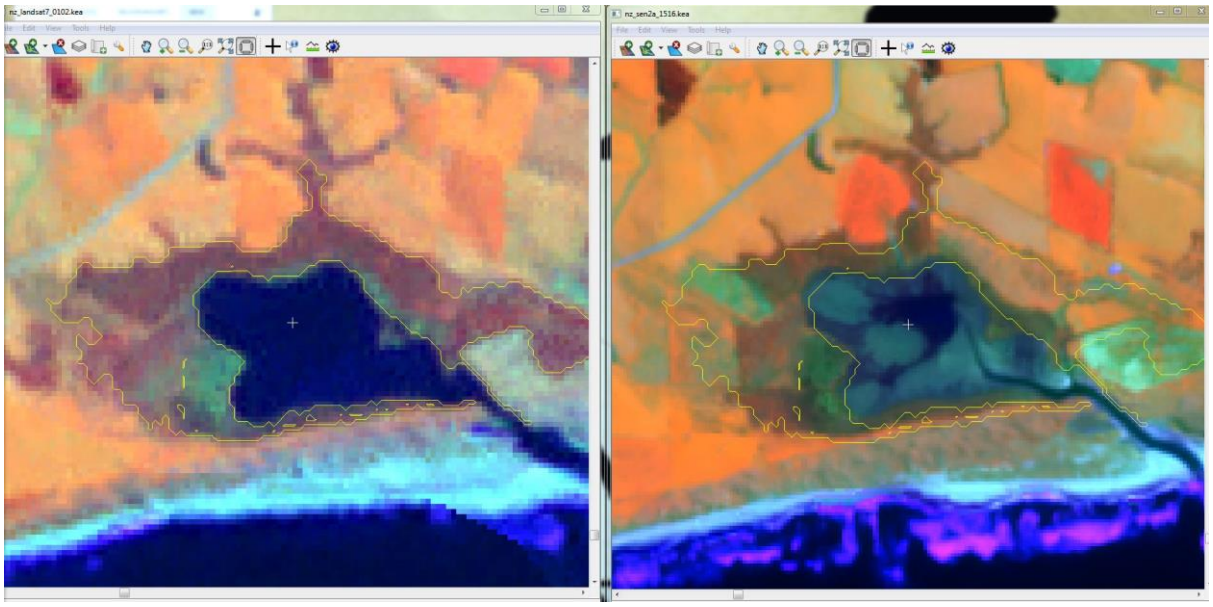


Polygon 21

Area = 6.25 ha

Locality: Southland

Comments: Clearly a wetland area but a lot of drainage and development is going on.

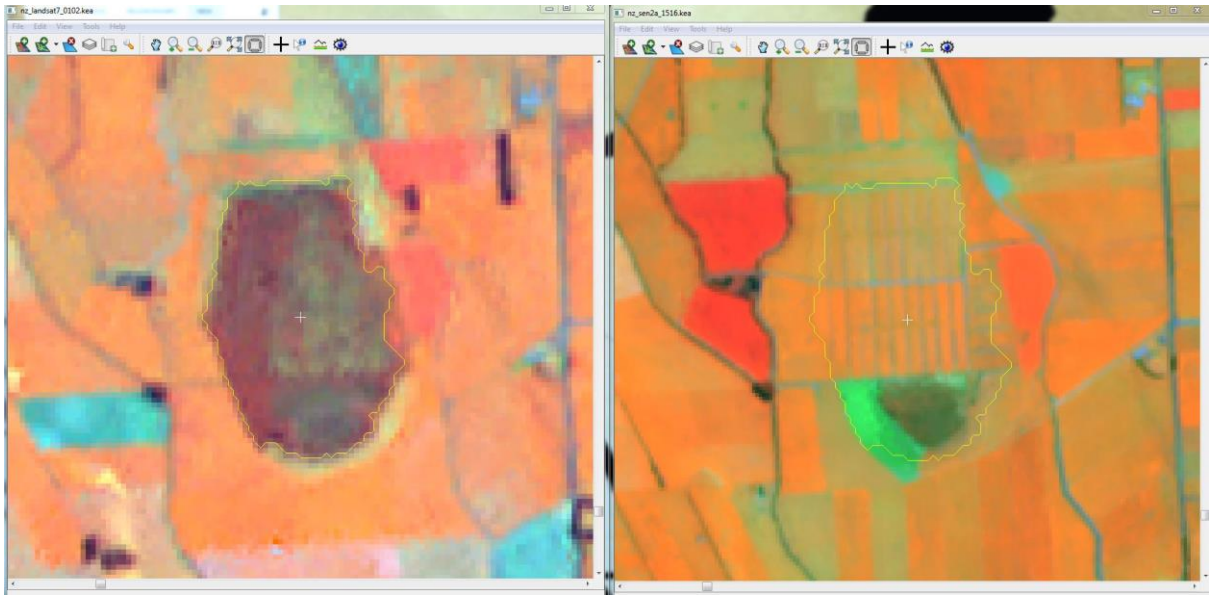


Polygon 26

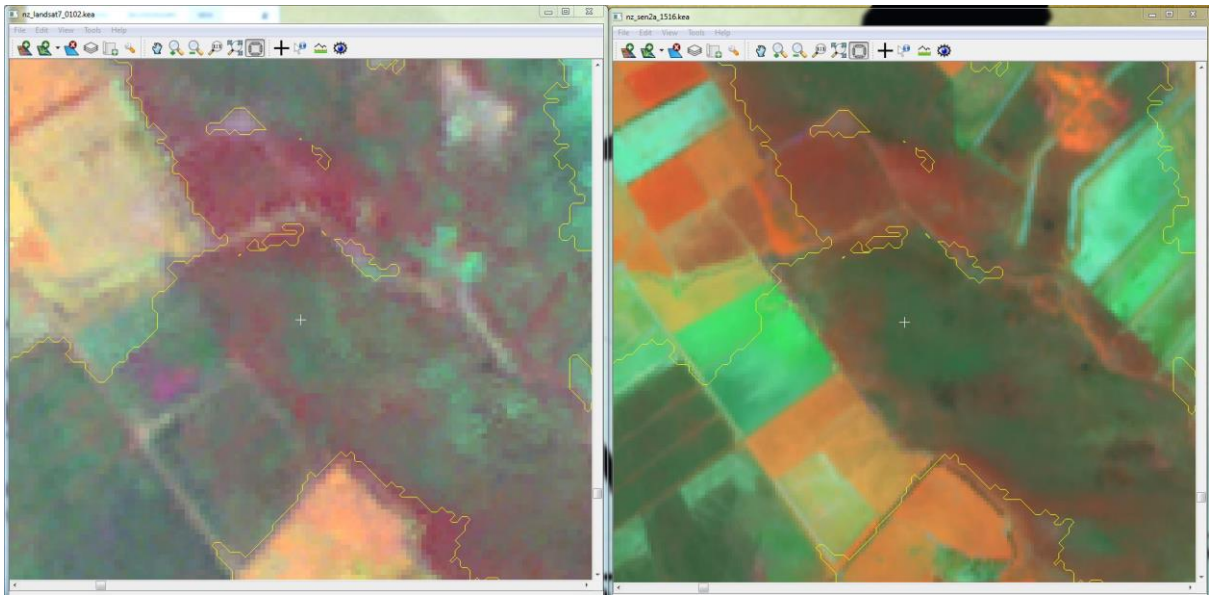
Area = 39.9 ha

Locality: Southland

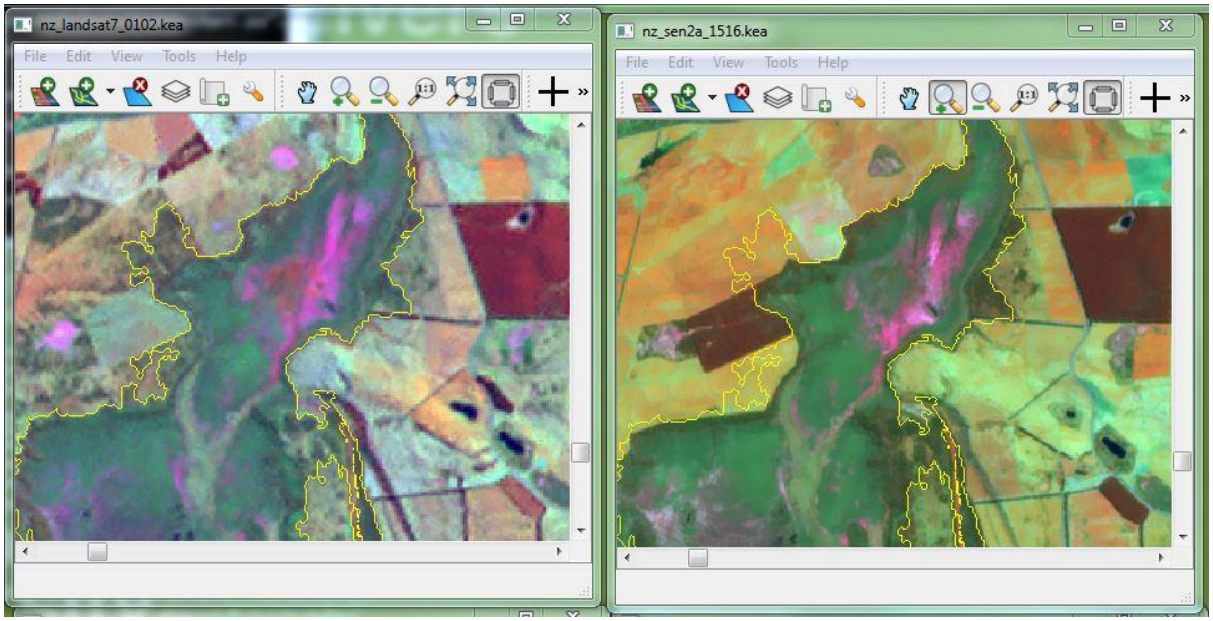
Comments: Paddock development to the east and west of the wetland.



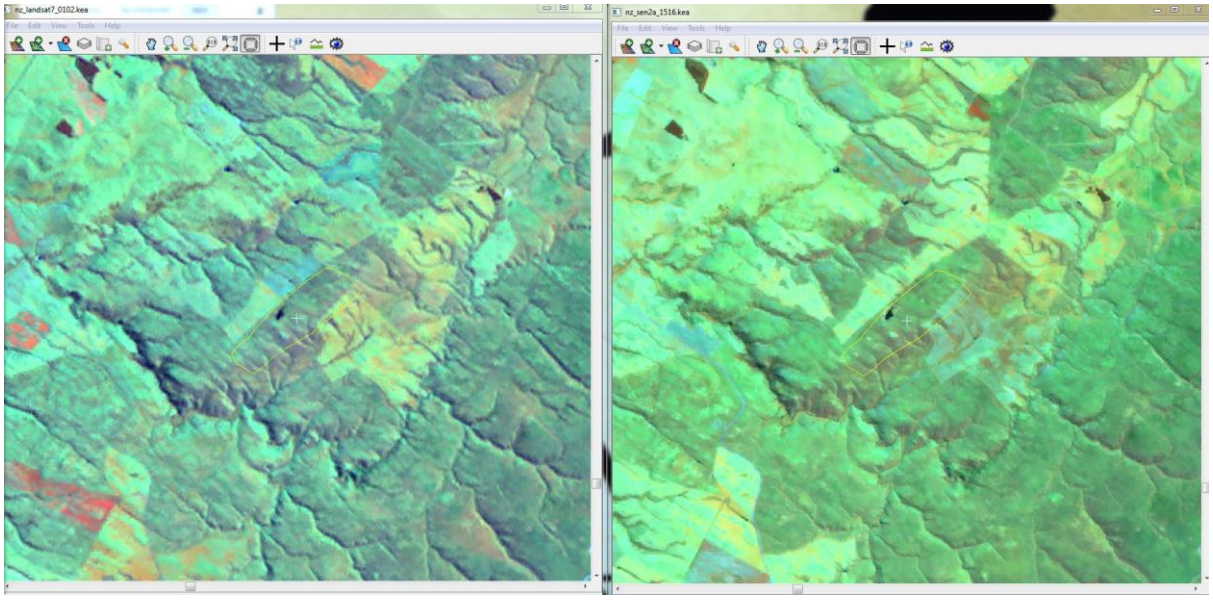
Polygon 391
Area = 35. 8 ha
Locality: Southland
Comments: Most of the wetland now drained.



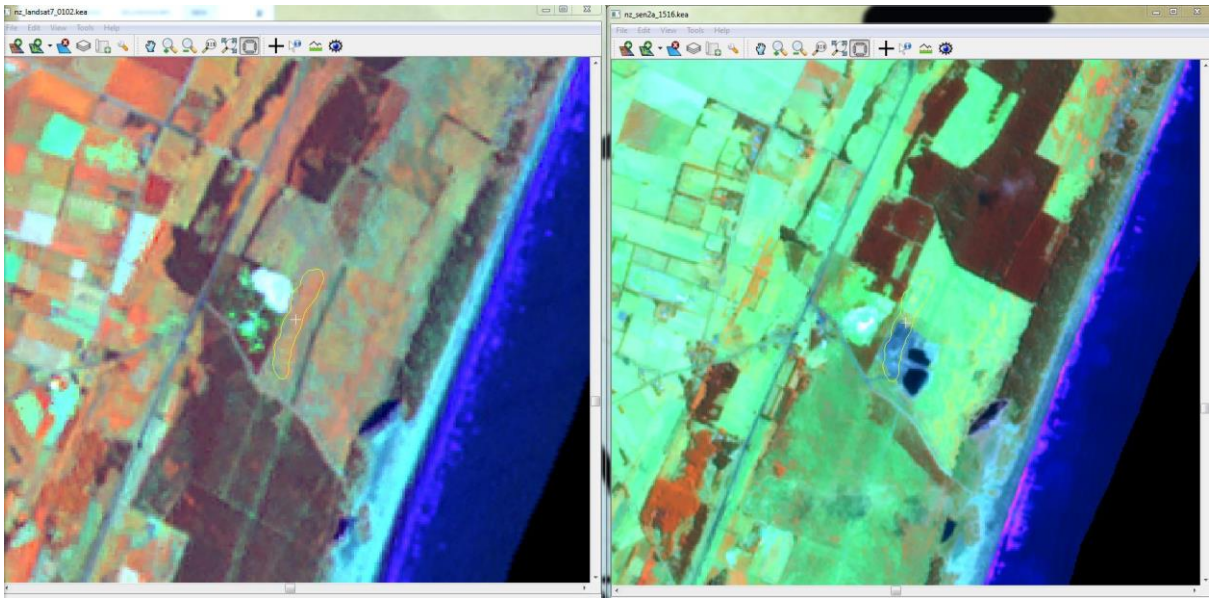
Polygon 1090
Area = 340.2 ha
Locality = Southland
Comments: Paddock development is in the process of cutting this large wetland into two.



Polygon 1687
Area = 955.9 ha
Locality: Southland
Comments: Original; wetland is still large but paddocks are being carved off the edges.



Polygon 2365
Area = 73.1 ha
Locality: Southland
Comments: Paddocks encroaching on the wetland.

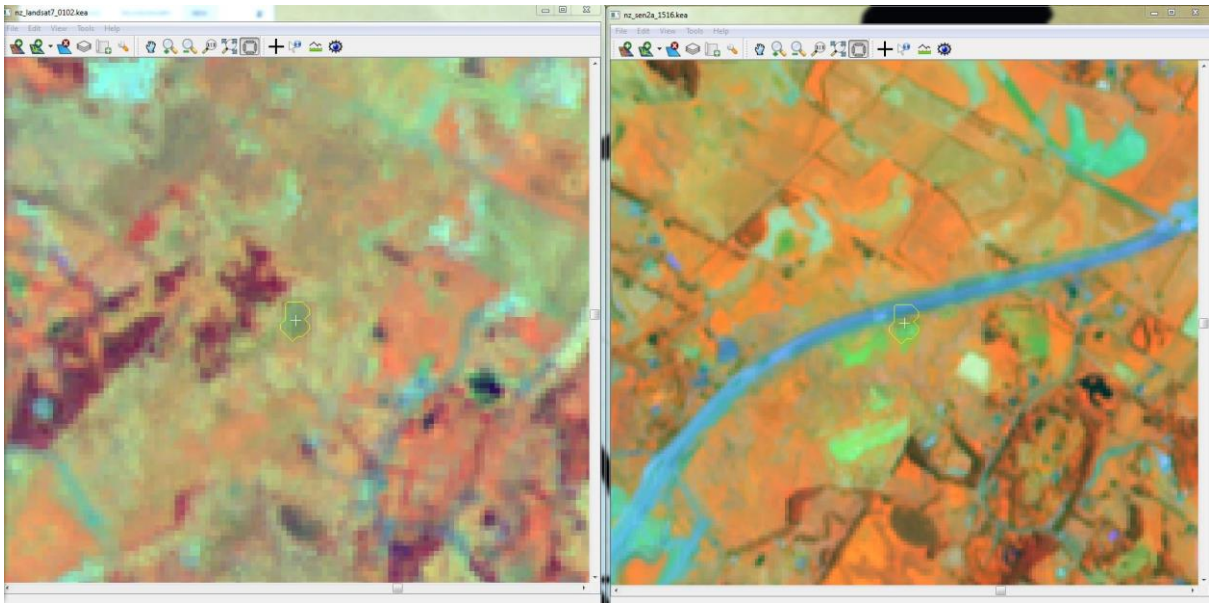


Polygon 6367

Area = 6.86 ha

Locality: Canterbury

Comments: Polygon is well placed over the wetland in all images. Bottom of the wetland is now replaced by construction, but pond established to the east of it. Look at the polygon only and record as partial loss.



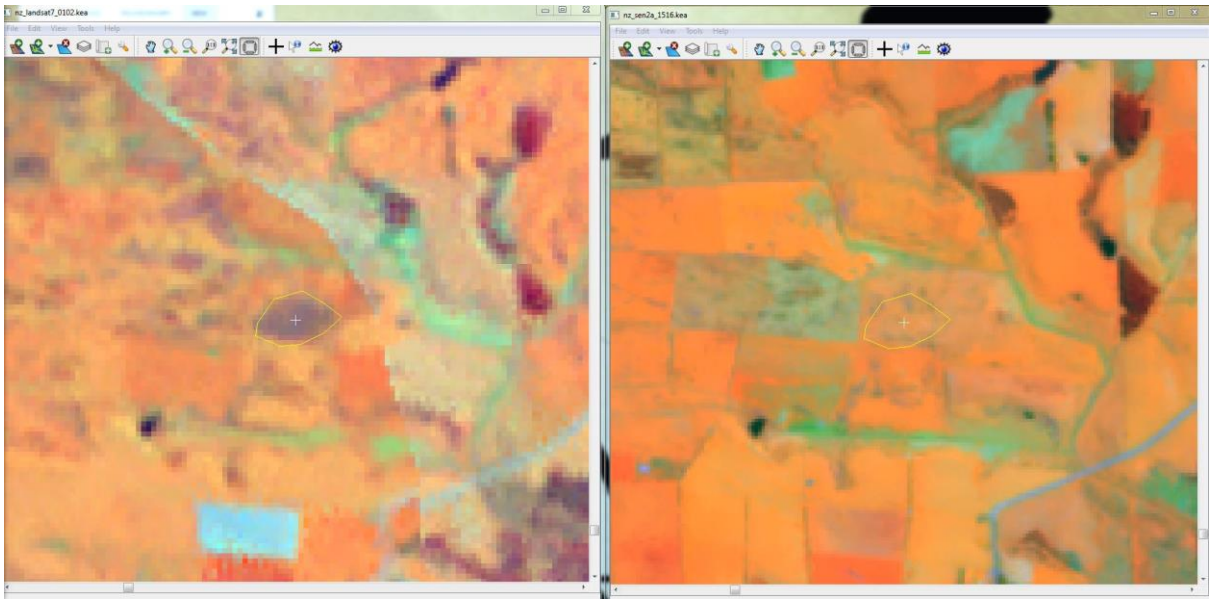
Polygon 8470

Area = 0.72 ha

Locality: Kapiti coast

Comments: Wetland areas have been bifurcated by the motorway extension. Marked as partial loss but will soon be complete loss.

B: Completely gone

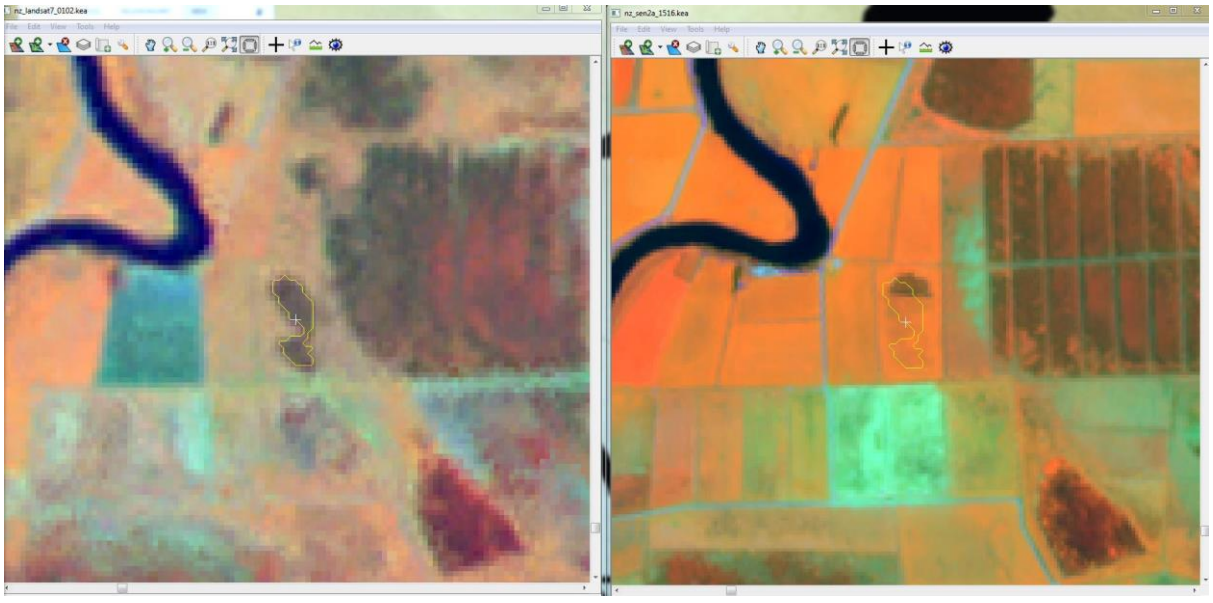


Polygon 27

Area = 2.67 ha

Locality: Southland

Comments: Wetland replaced by improving pasture. Classified as completely gone.

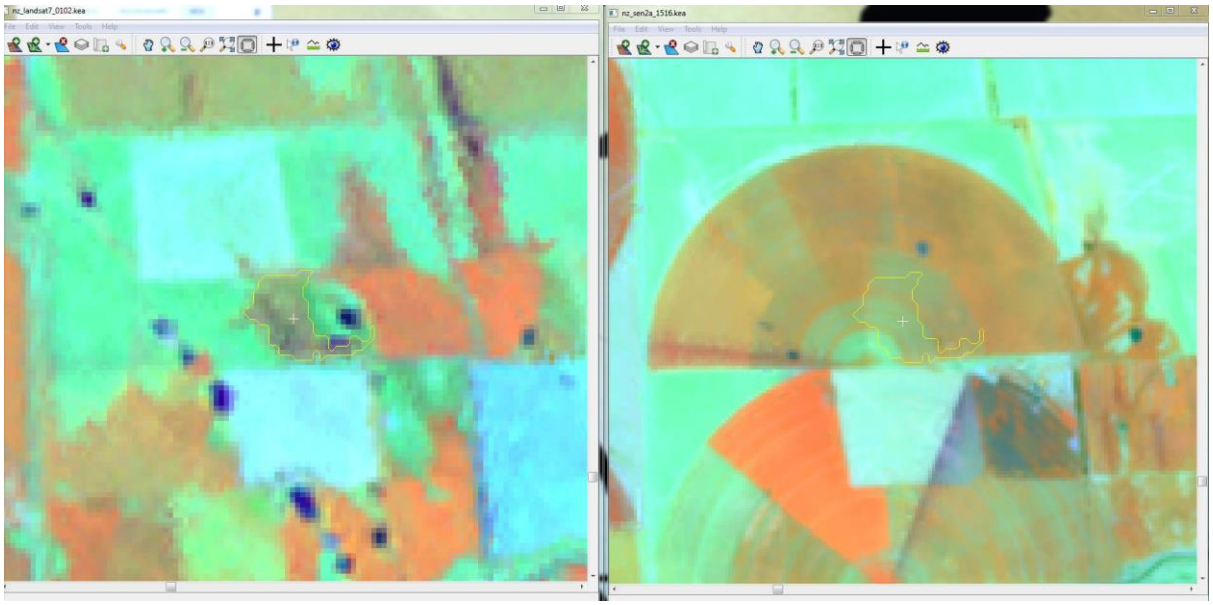


Polygon 70

Area = 1.7 ha

Locality: Southland

Comments: Virtually all the wetland now gone to developed paddock; just a small area of scrub left. Classed as completely gone.

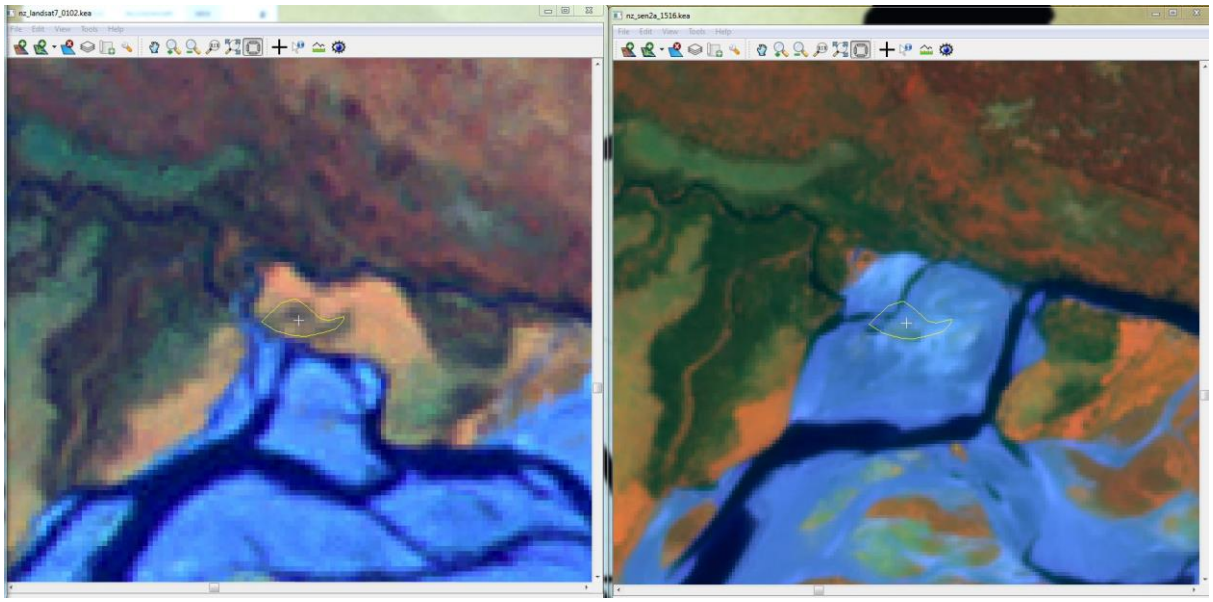


Polygon 3465

Area = 4.17 ha

Locality: Southland

Comments: Wetland completely gone and replaced by irrigation circle.

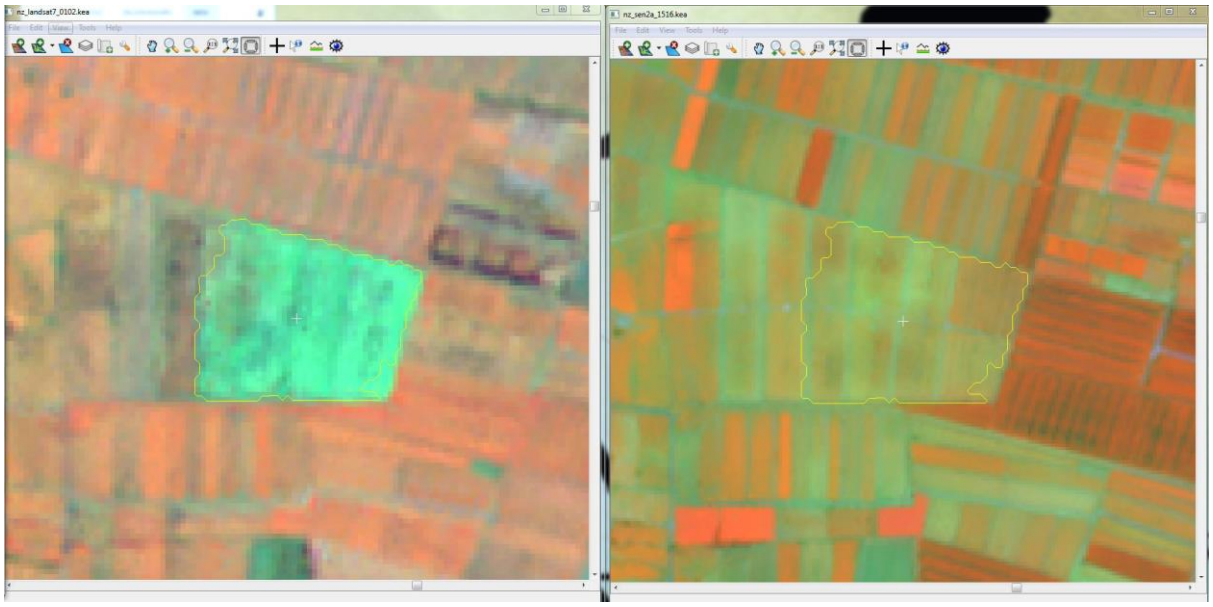


Polygon 6775

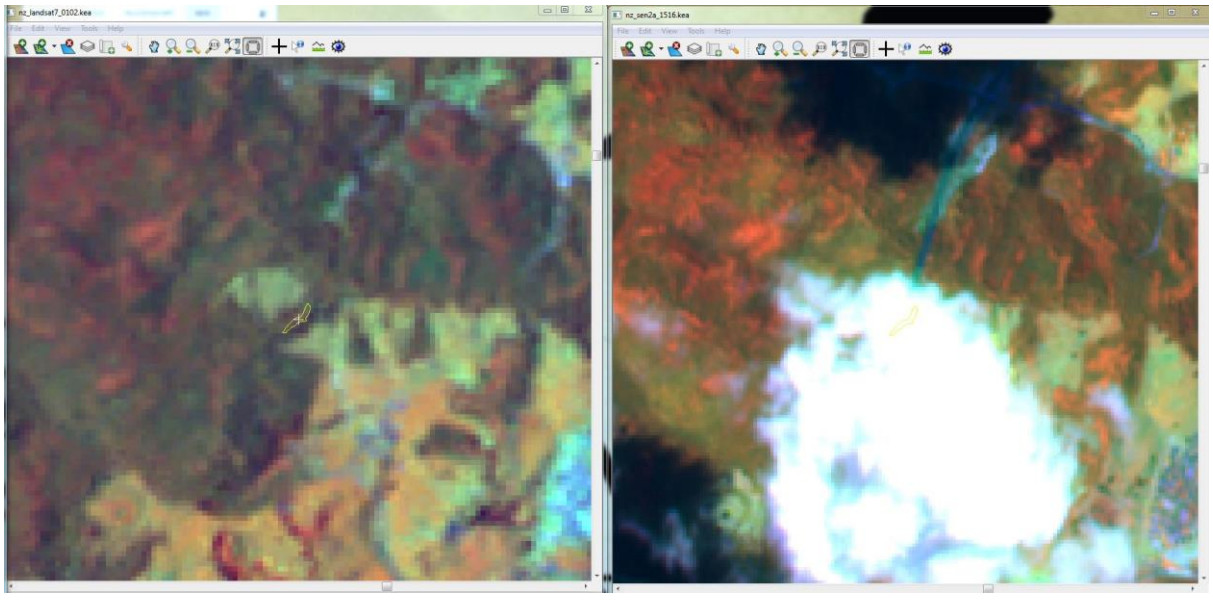
Area = 1.47 ha

Locality: West Coast

Comments: A wetland in 1990 and in the WONI imagery, partially gone in the next image date and completely gone in the rest. Part of the river instead of a wetland. Classed as complete loss.

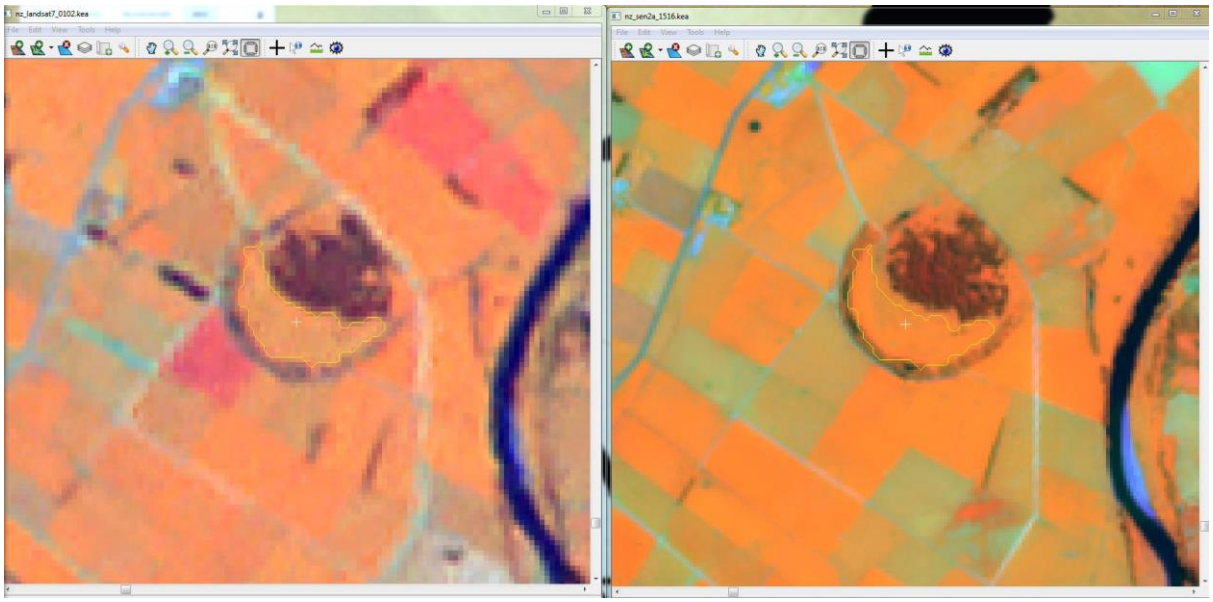


Polygon 11113
Area = 27.7 ha
Locality: Waikato
Comments: Complete loss of wetland to paddocks.



Polygon 12512
Area = 0.16 ha
Locality: North Auckland
Comments: Wetland loss to motorway development.

C: Error

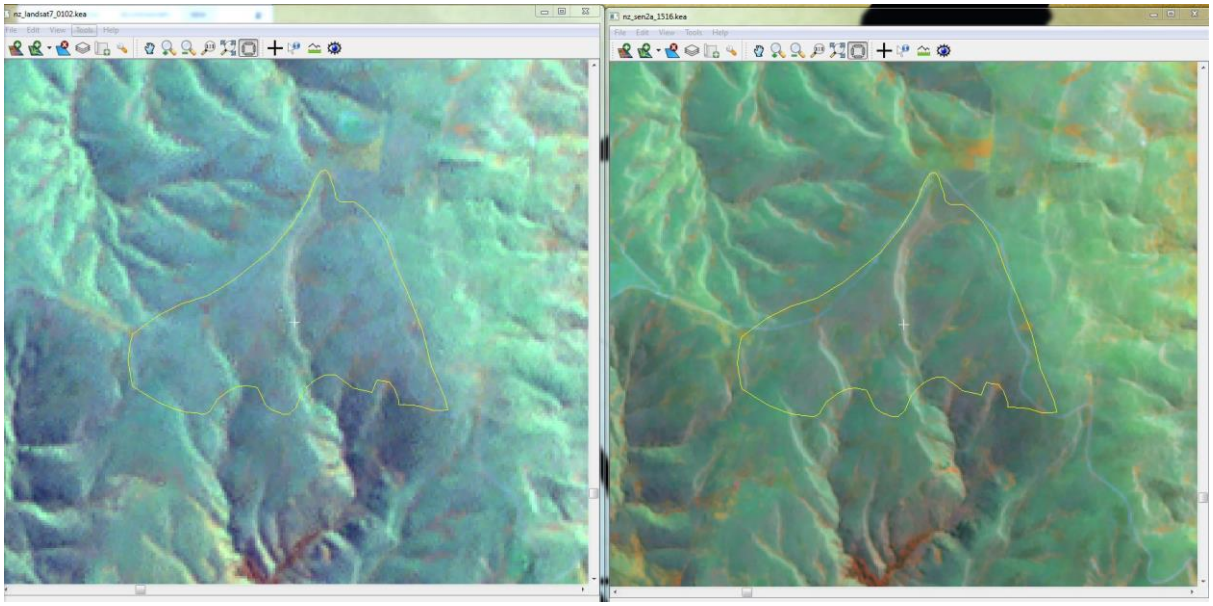


Polygon 225

Area = 5.9 ha

Locality: Southland

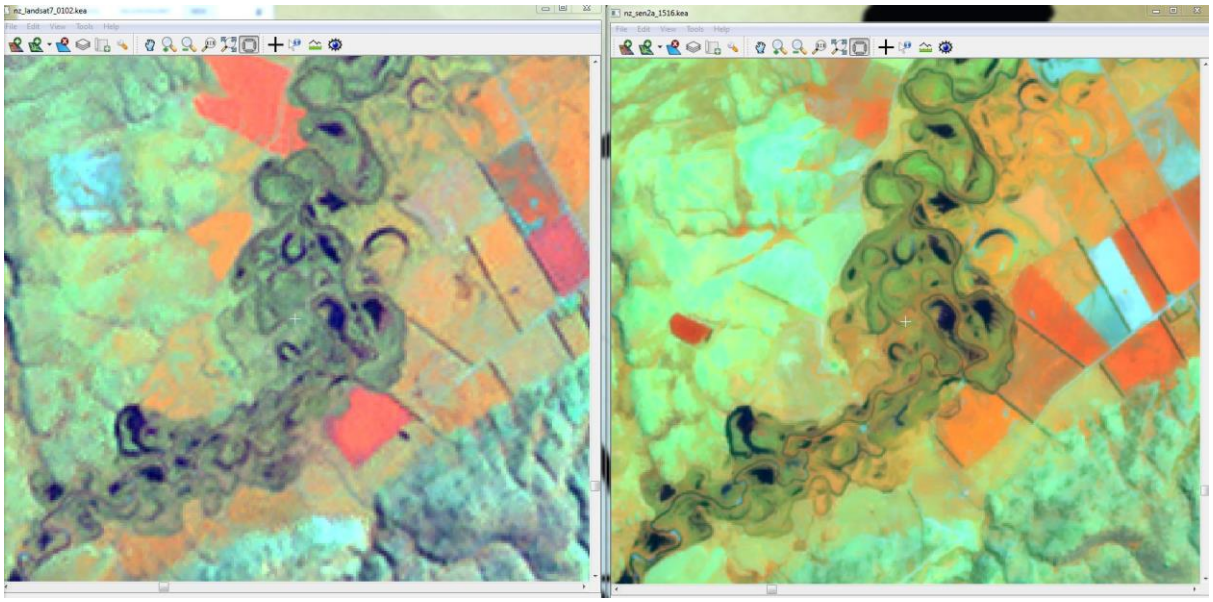
Comments: From the image evidence this paddock was not a wetland during the time interval of these images.



Polygon 1467

Area = 141.8 haLocality: Otago

Comments: Polygon does not look like a wetland at any of the image dates.

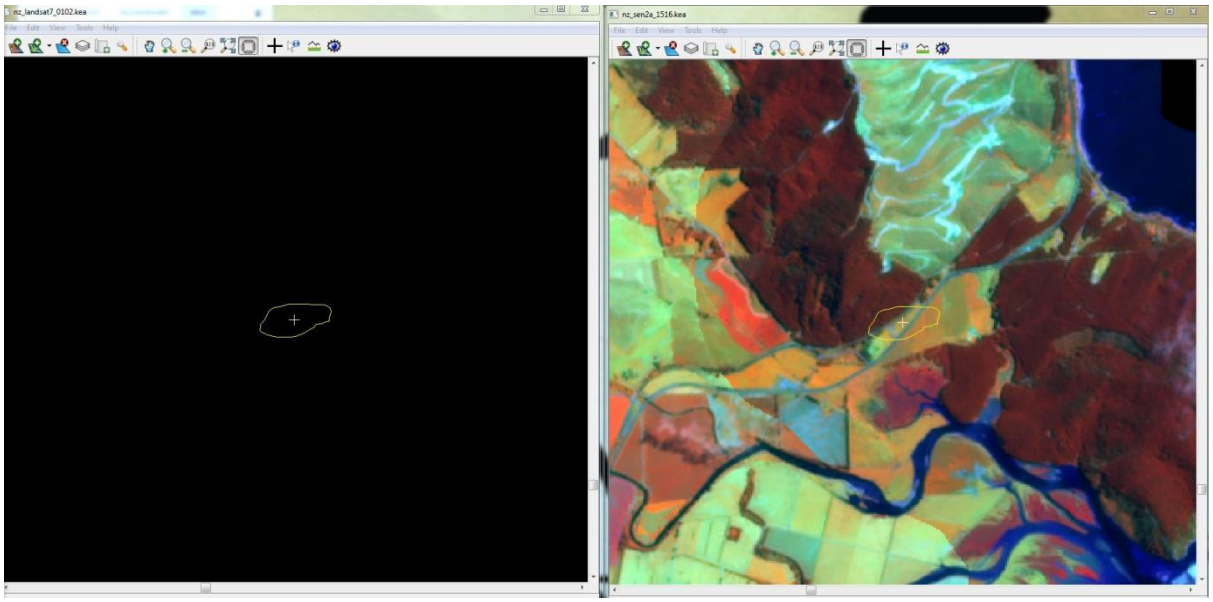


Polygon 2033

Area = miniscule

Locality: Otago

Comments: Crosshair is on a single pixel, which is barely visible at the highest magnification. It is at/on the margin of an extensive wetland that needs the line work improved. Classified as an error.

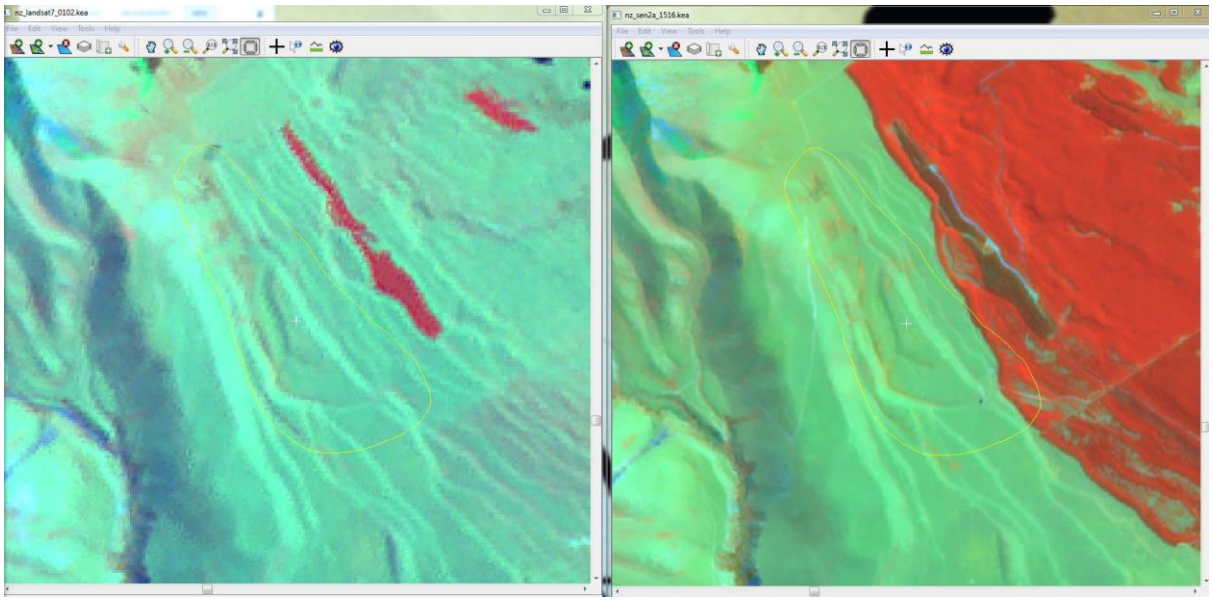


Polygon 2353

Area = 6.13 ha

Locality: Otago coast.

Comments: No data for the WONI image date and cloud in the 1990 baseline mosaic but we suspect it was never there.

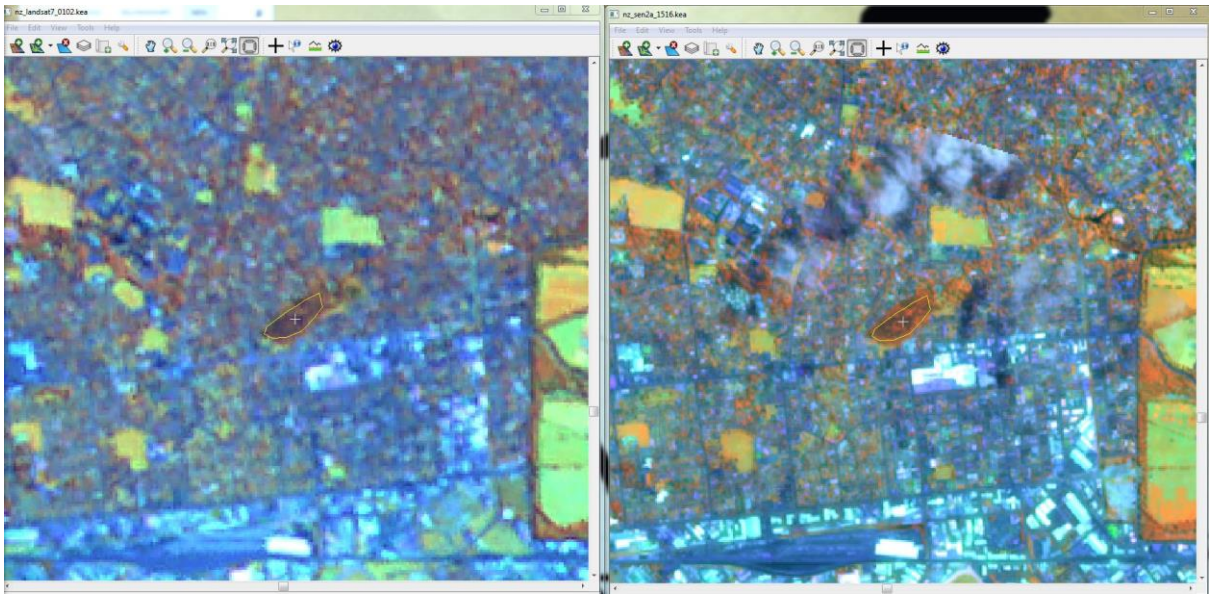


Polygon 5395

Area = 125.2 ha

Locality: Canterbury

Comments: There is a very small area of wetland here, especially in the north of the polygon, but most of it looks like hill country. Classified as error.

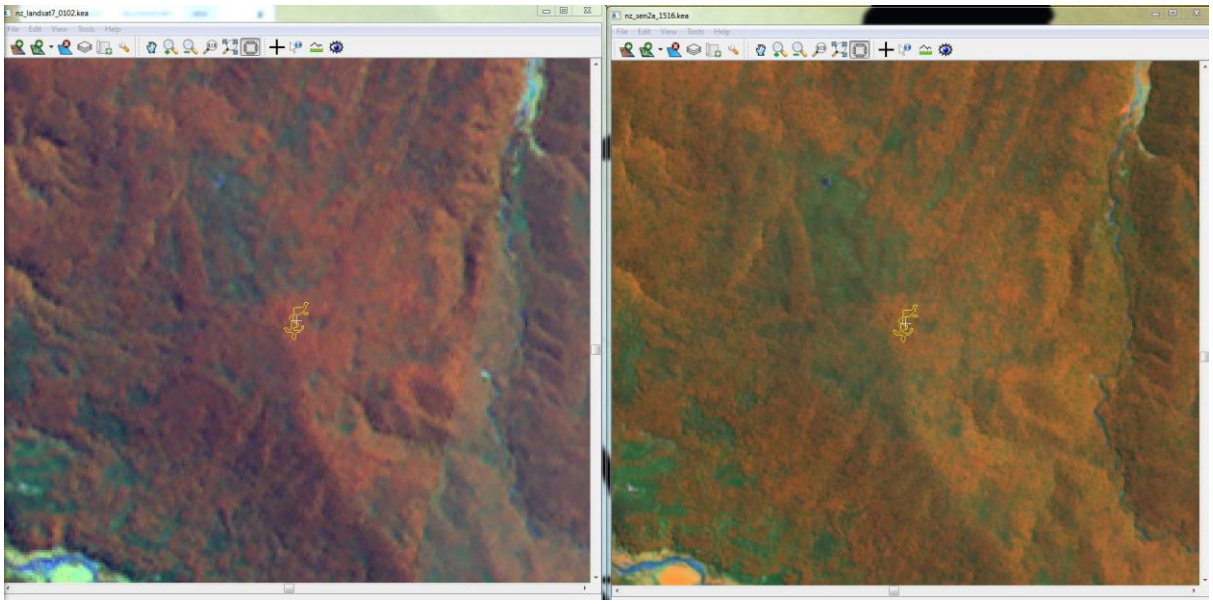


Polygon 5883

Area = 4.29 ha

Locality : Canterbury

Comments: This is Riccarton Bush. If this was in a rural setting we would be more likely to think that remnant bush was left because it was boggy. Classified as an error.

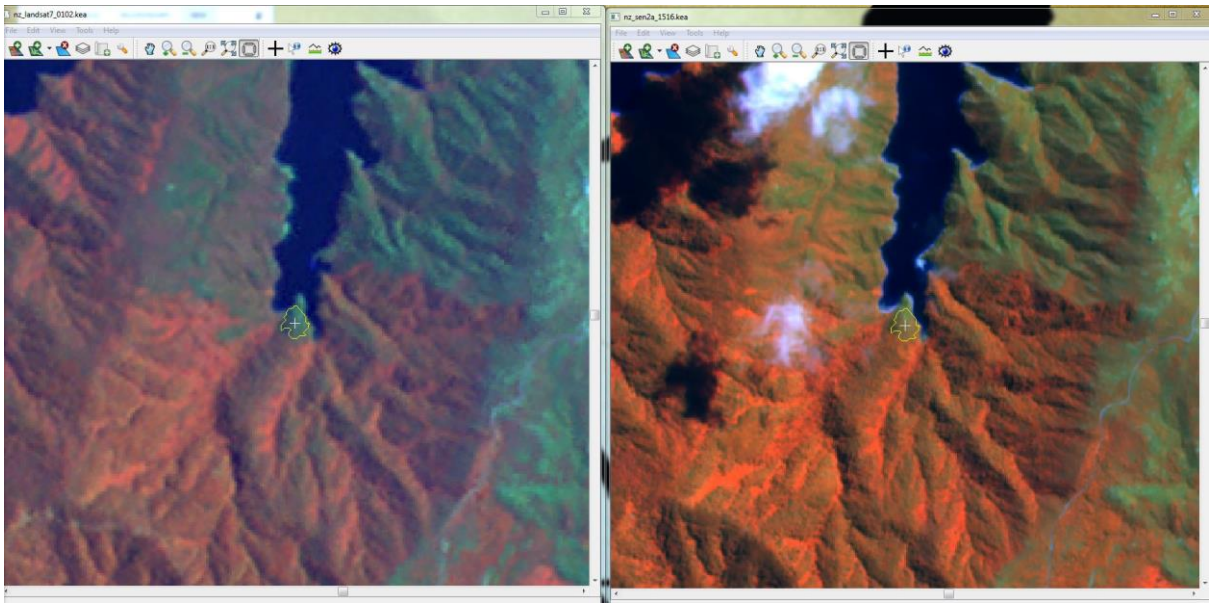


Polygon 7615

Area = 0.78 ha

Locality : Nelson

Comments: This looks like an area of random forest selected for no apparent reason. Marked as error.

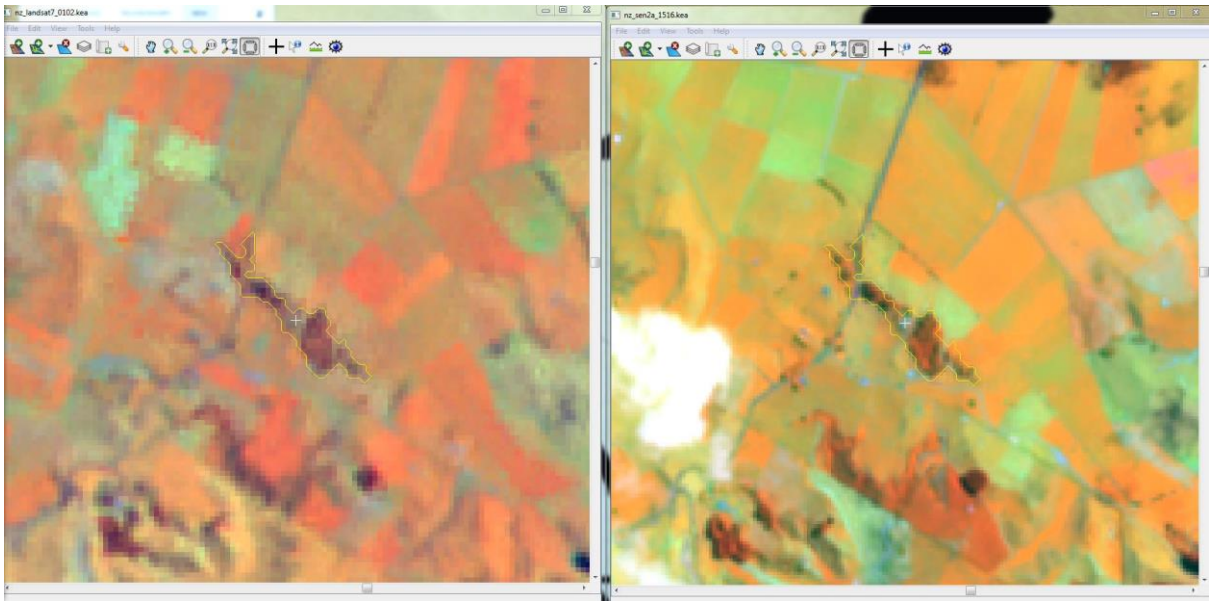


Polygon 8559

Area = 1.96 ha

Locality: D'Urville Island

Comments: This is an area of rock or a promontory pushing into a north-facing bay. Looks like bare-ish high ground. Classified as an error.

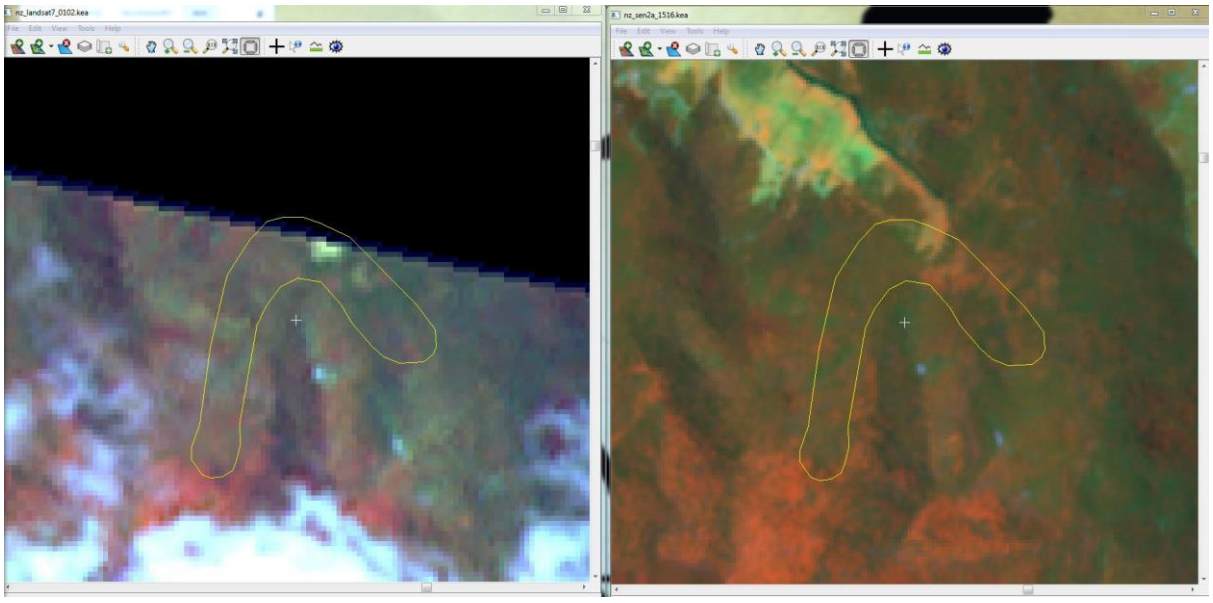


Polygon 9658

Area = 4.17 ha

Locality: Taranaki

Comments: Row of trees, shrubs and a house could look like the pattern of a wetland but the house is in the middle: unlikely to build in the middle of a swamp and no signs of a creek either side. Classified as an error.



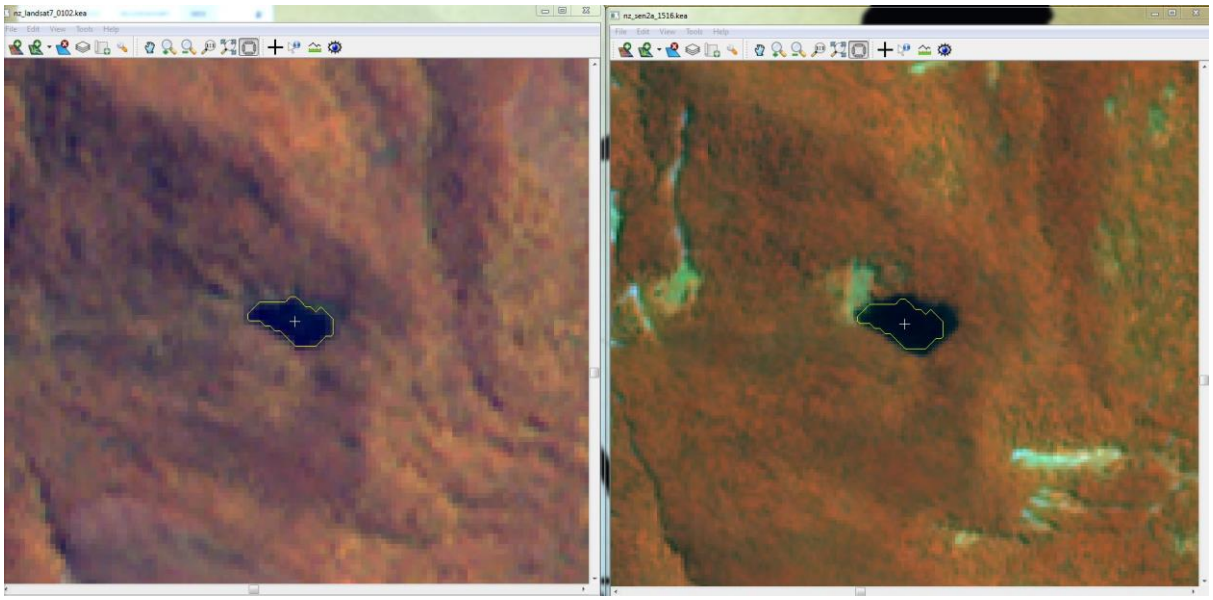
Polygon 13389

Area = 18.6 ha

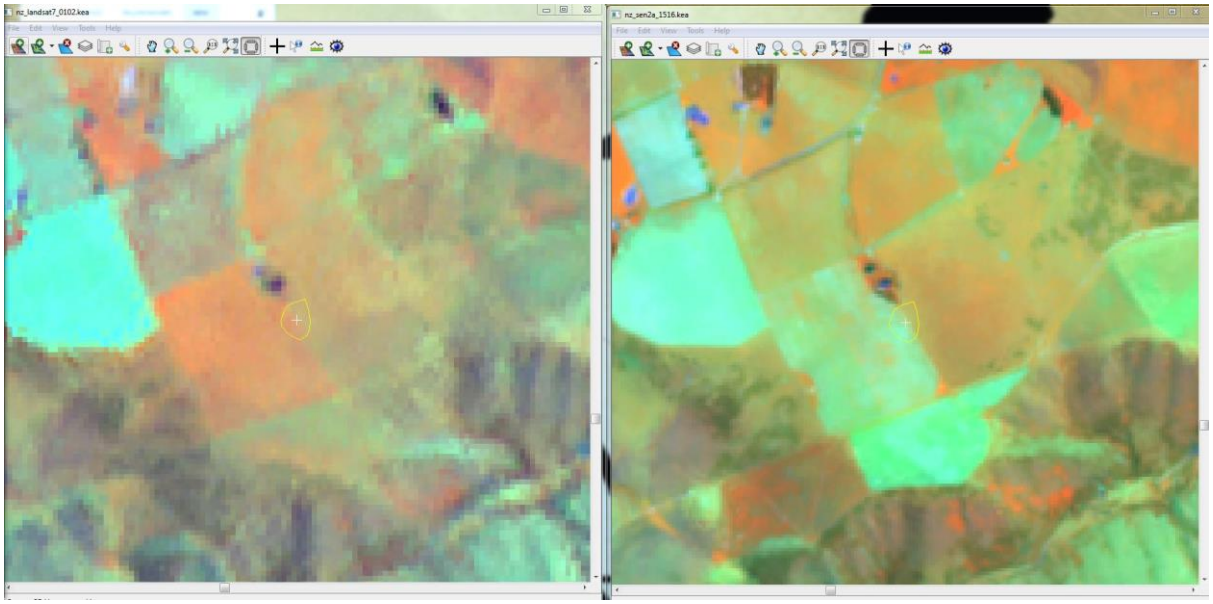
Locality: Great Barrier Island

Comments: No apparent reason for this polygon. Classified as an error.

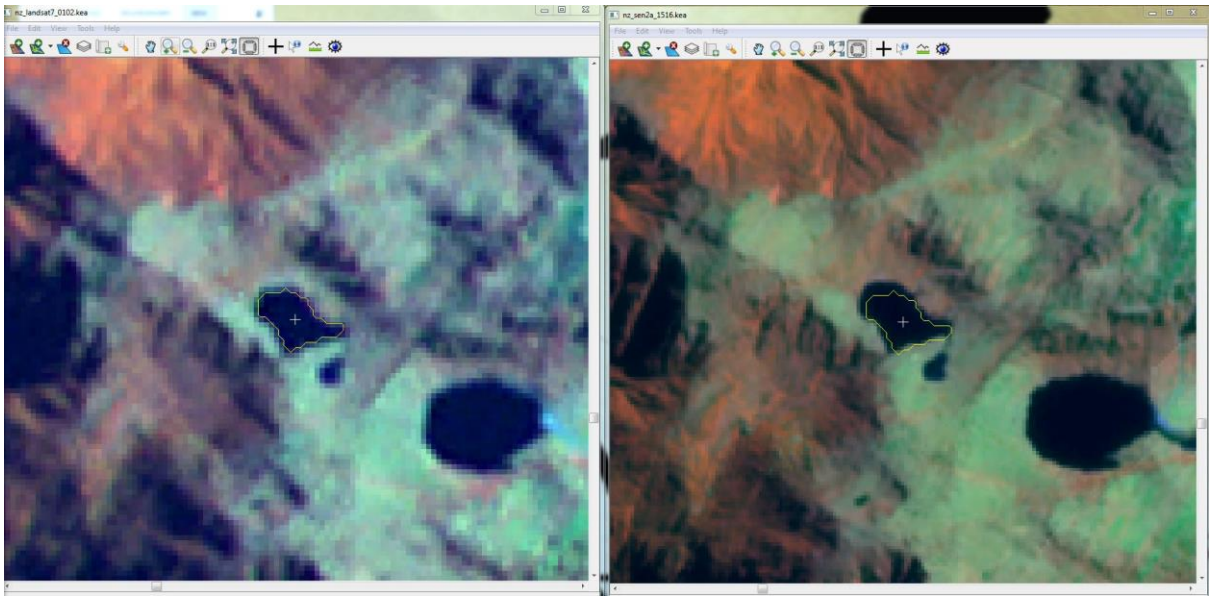
D: Accept WONI wetland classification



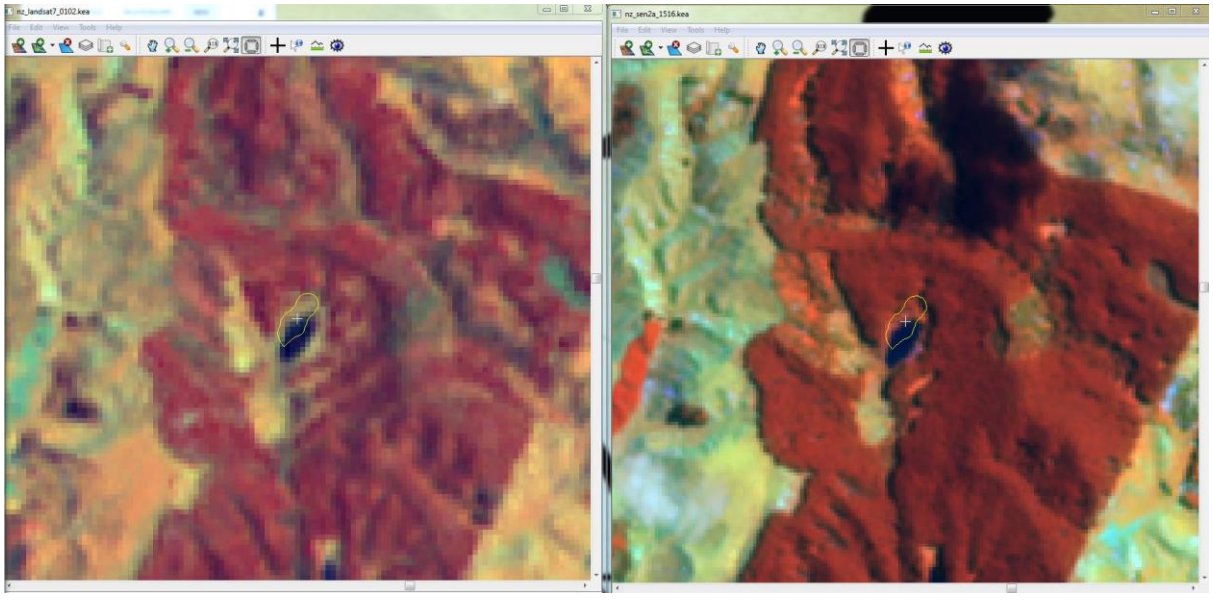
Polygon 7042
Area = 2.2 ha
Locality: West Coast / central divide
Comments: Example of a well-registered wetland.



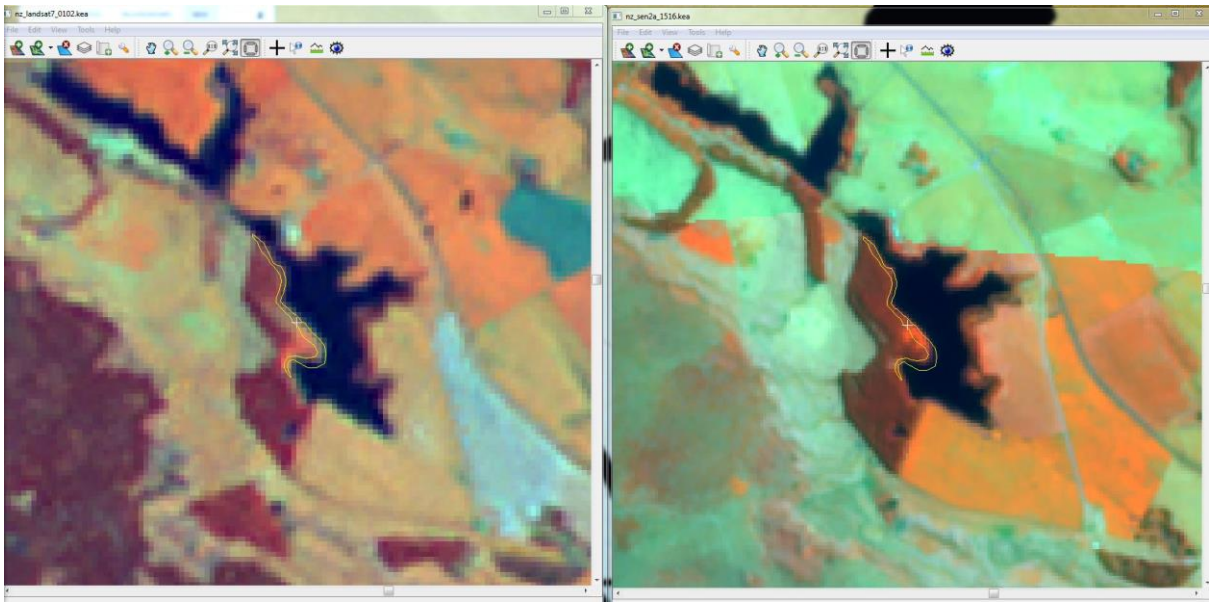
Polygon 5453
Area = 0.75 ha
Locality: inland Canterbury
Comments: Misregistration at all dates but classified as wetland – no change



Polygon 5475
Area = 2.39 ha
Locality: South Westland
Comments: WONI polygon correct in all image dates, although smaller lake just below it is missing.
Classified as wetland – no change.



Polygon 9260
Area = 0.96 ha
Locality: Wanganui
Comments: Pond misregistered at all dates but classed as wetland – no change.



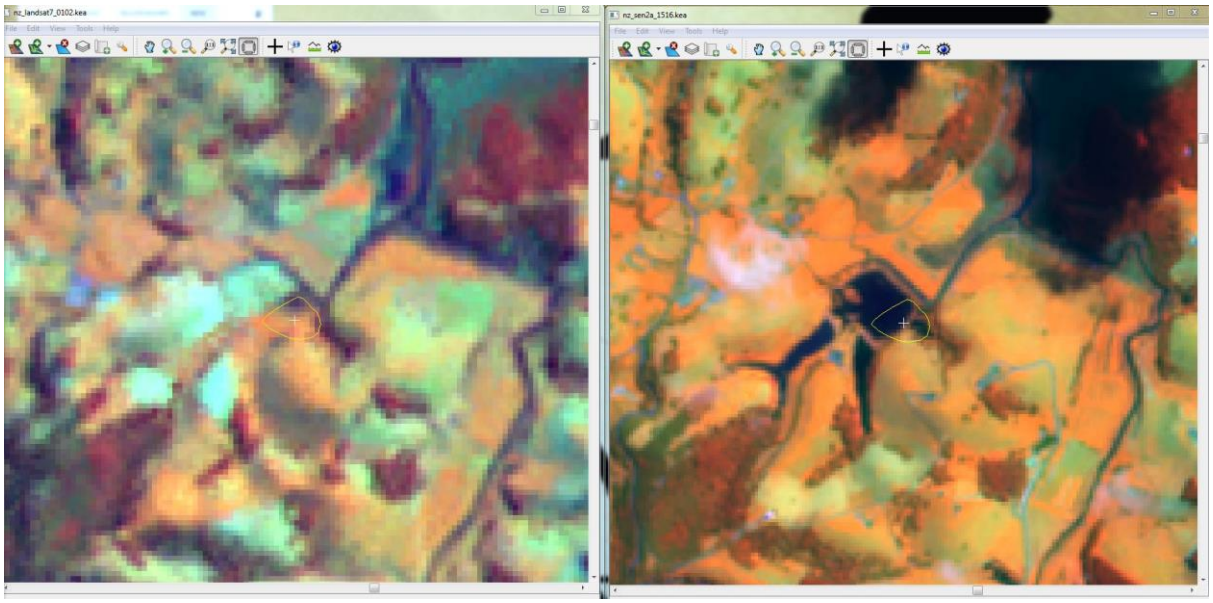
Polygon 9318

Area = 1.0 ha

Locality: Taranaki

Comments: Pond-side vegetation classed as wetland but not the pond itself. Classed as wetland − no change.

E. Improve line work

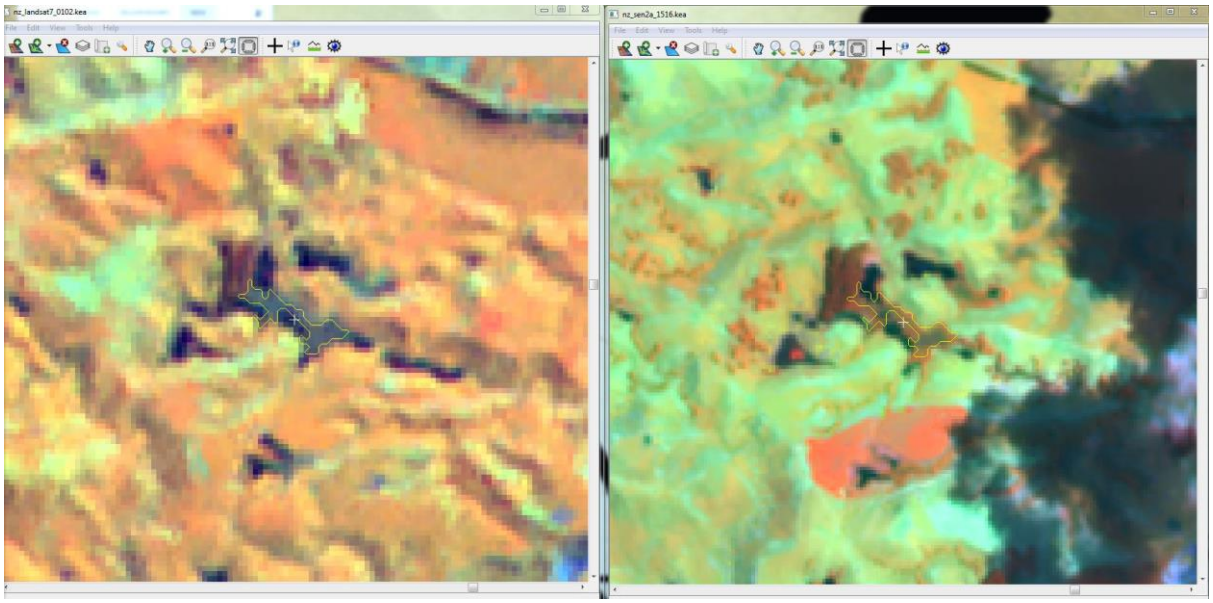


Polygon 13968

Area =1.4 ha

Locality: Whangarei

Comments: A series of new ponds have been developed alongside and overlapping a former wetland. Classified as improve line work.

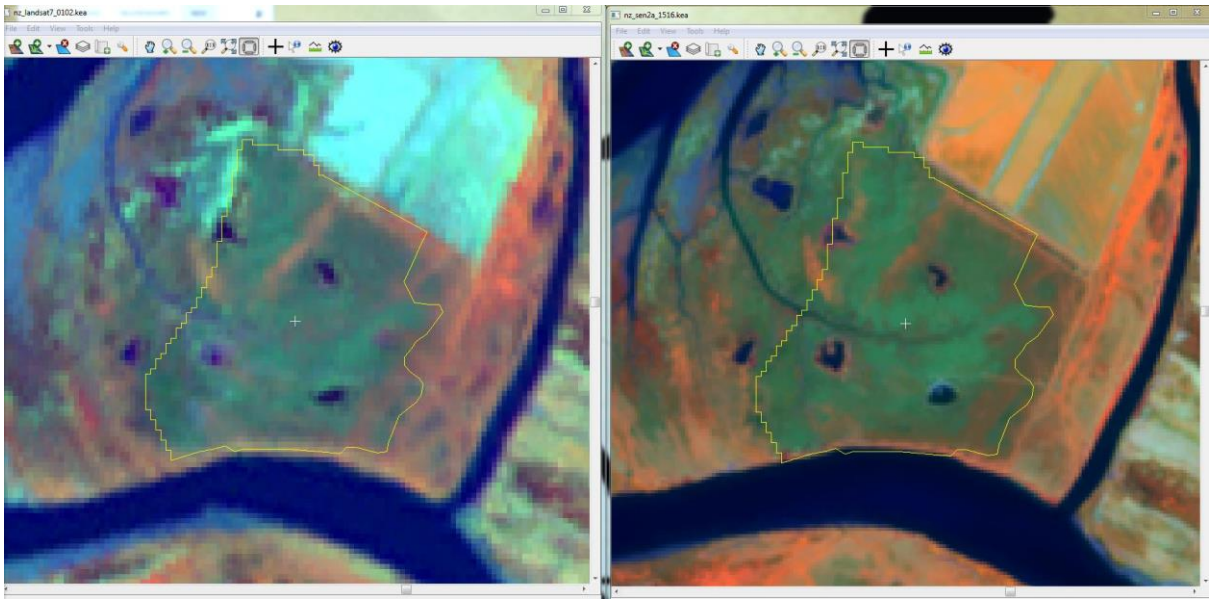


Polygon 9159

Area =1.5 ha

Locality: Hawke's Bay

Comments: Polygon picks up bog but not the surrounding ponds. Classified as improve line work.

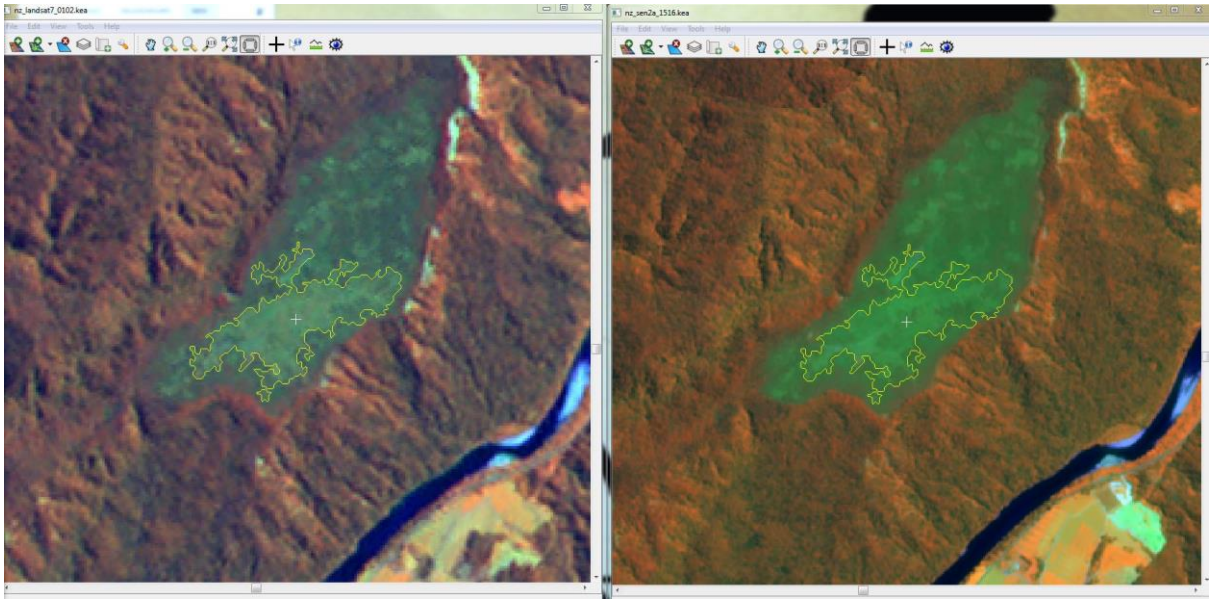


Polygon 8881

Area = 53.7 ha

Locality: Manawatu

Comments: Not all of wetland included in the polygon. On visual evidence it should be larger. Classified as improve line work. Note: It is possible that the rest of this wetland area has not been included because it is estuarine with brackish water.

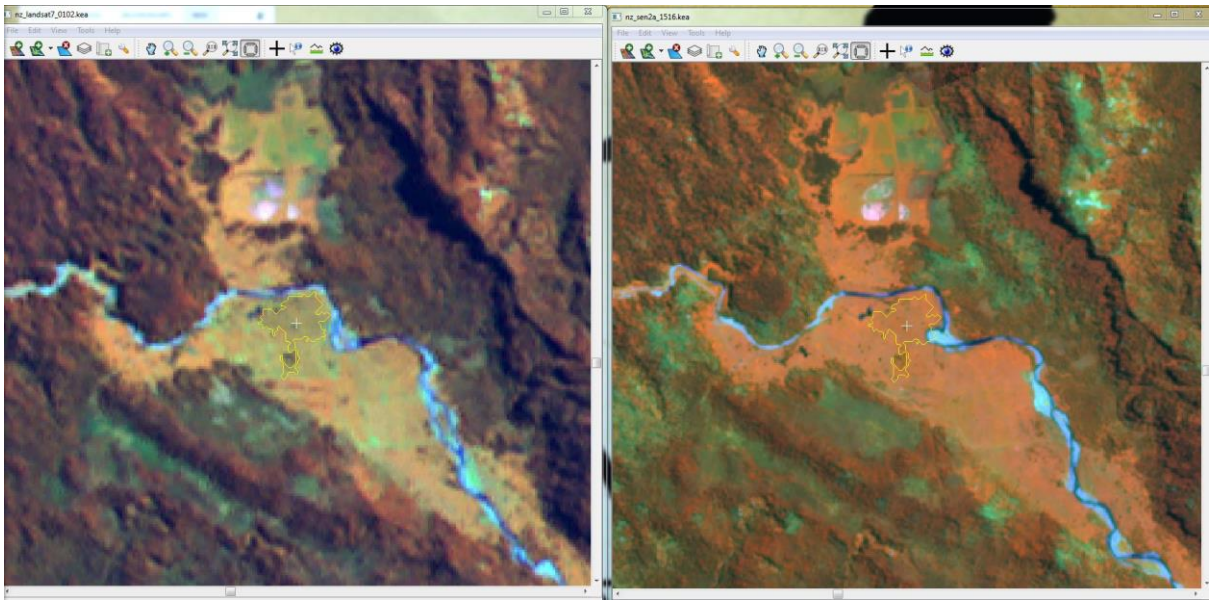


Polygon 7595

Area = 38.5 ha

Locality: Northwest Nelson

Comments: Wetland has been mapped by region-growing and could be at least double the current size based on other wetland polygons growing into similar shrublands. Classified as improve line work.

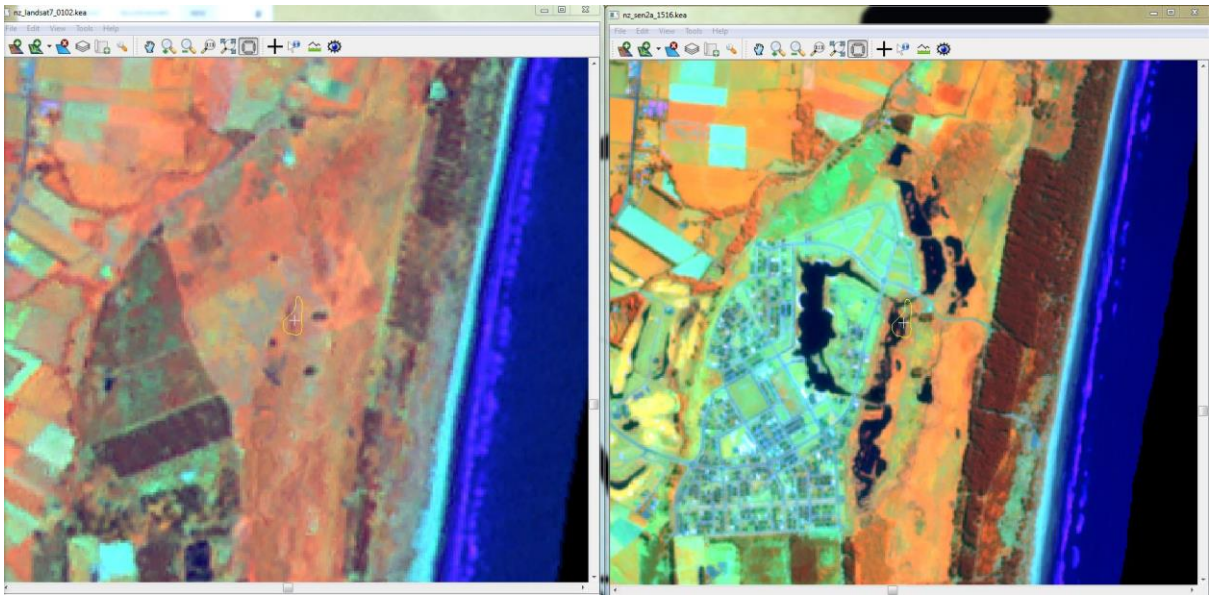


Polygon 7286

Area =7.9 ha

Locality: Westland

Comments: Polygon is mainly over pasture and misses the ponding area to the northwest. Classified as improve line work.

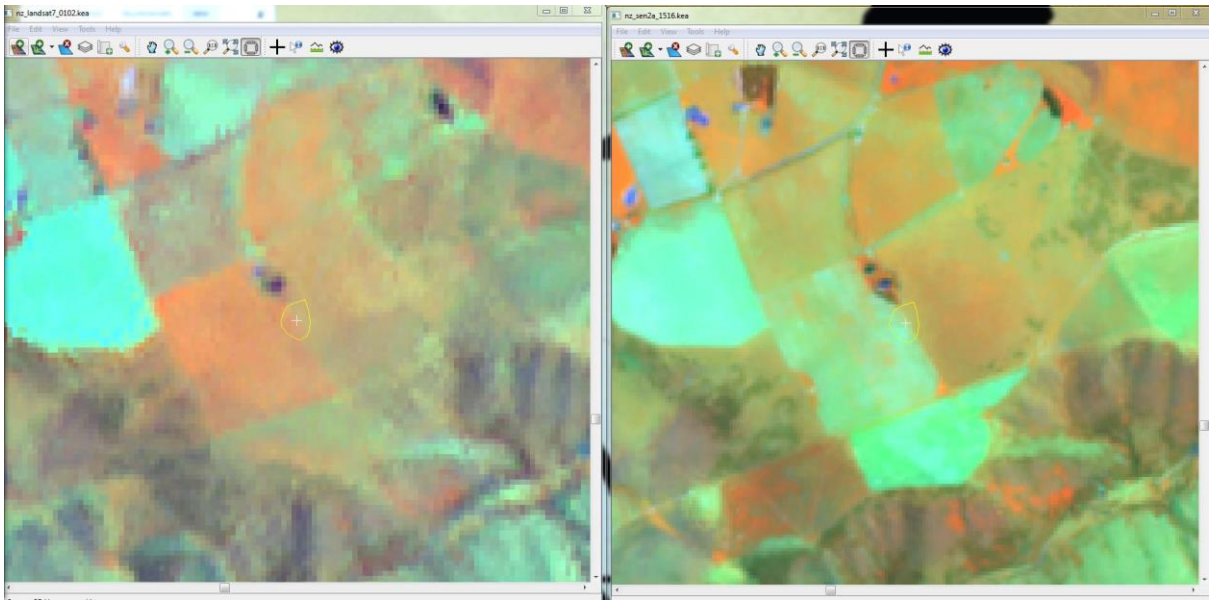


Polygon 6261

Area = 1.5 ha

Locality: Canterbury

Comments: Original wetland has gone but has been replaced by artificial lakes. Classified as improve line work.

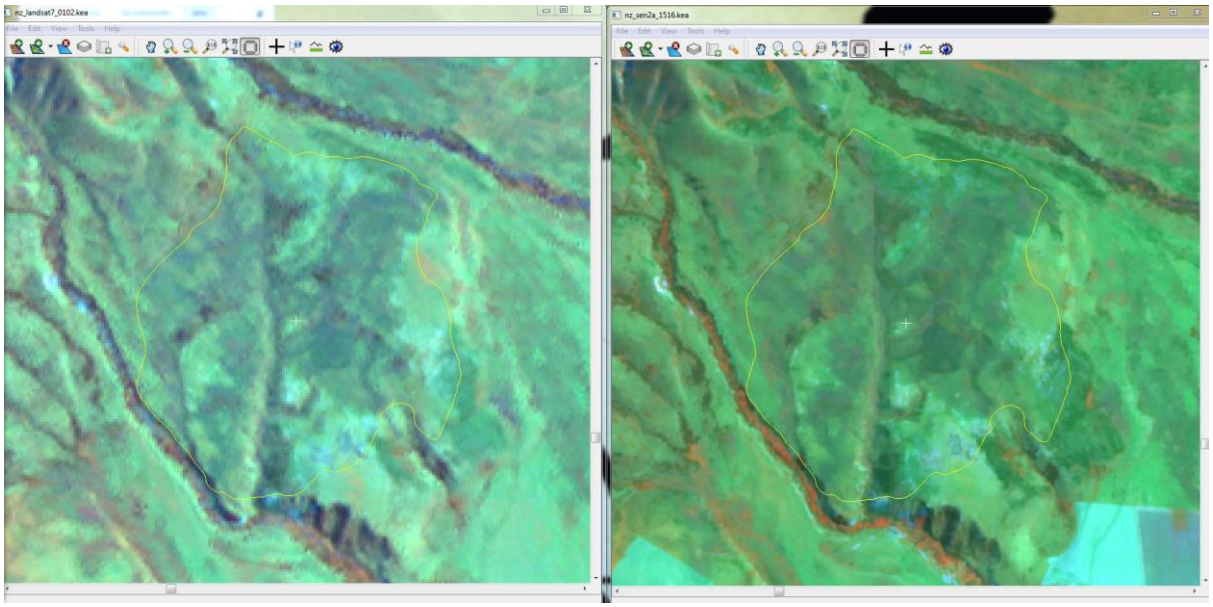


Polygon 5433

Area = 0.5 ha

Locality: Canterbury

Comments: Polygon is in the wrong place and the wrong orientation and is the wrong size. Classified as improve line work.



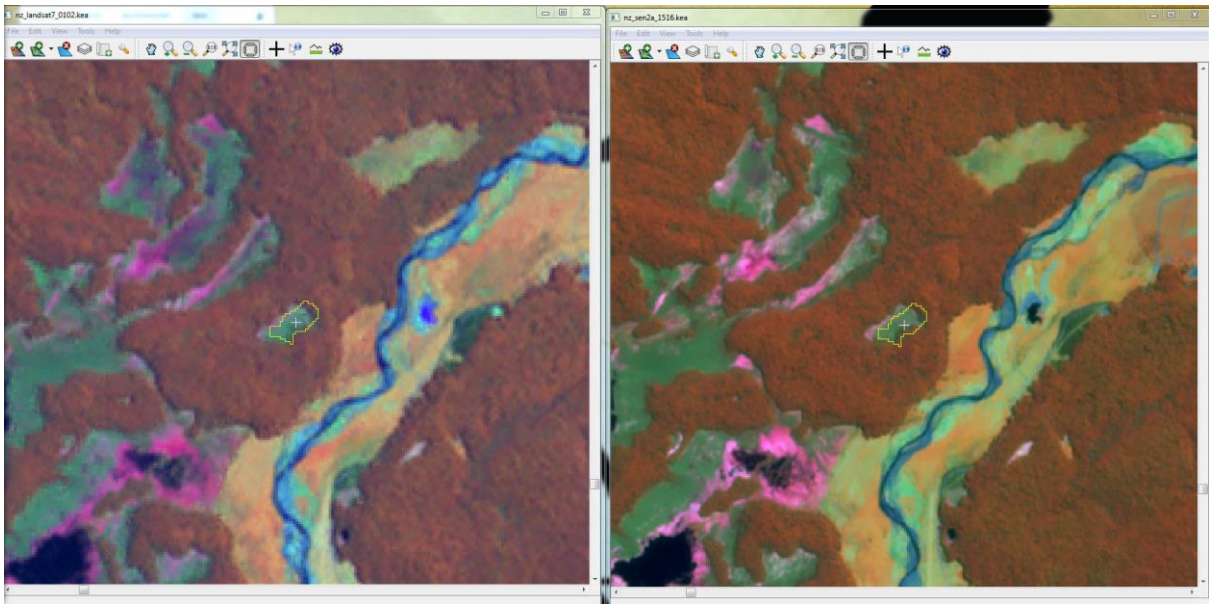
Polygon 4633

Area = 0.29 ha

Locality: Canterbury

Comments: Looks like there are some small wetlands within the perimeter of the polygon but most of it looks just like the surrounds. Classified as improve line work.

F: Examples of misregistration

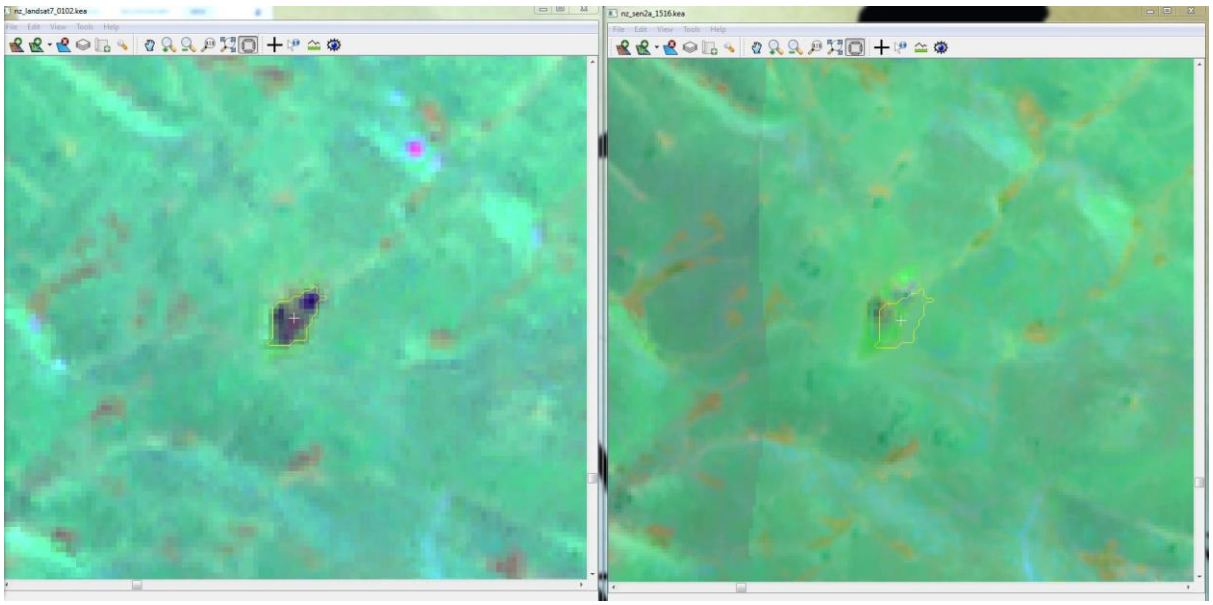


Polygon 2879

Area = 3.5 ha

Locality: Otago

Comments: The same misregistration on all images. Classified as wetland − no change.

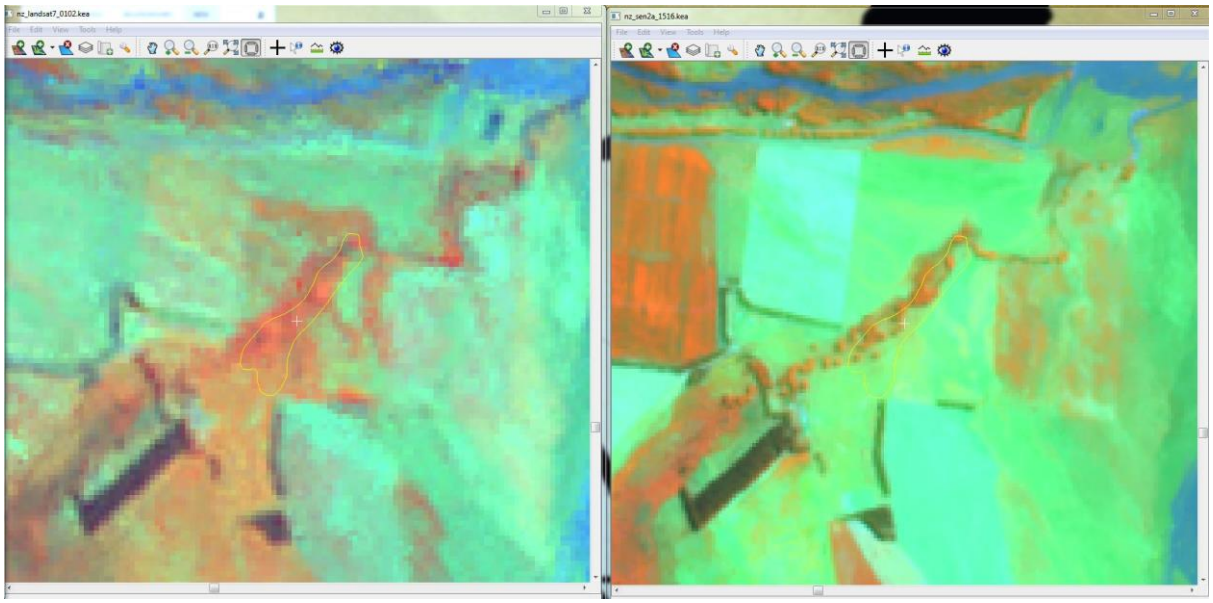


Polygon 3165

Area = 1.6 ha

Locality: Otago

Comments: Good registration on 1990 baseline and in WONI imagery, but misregistration on later data sets. Classified as wetland − no change.

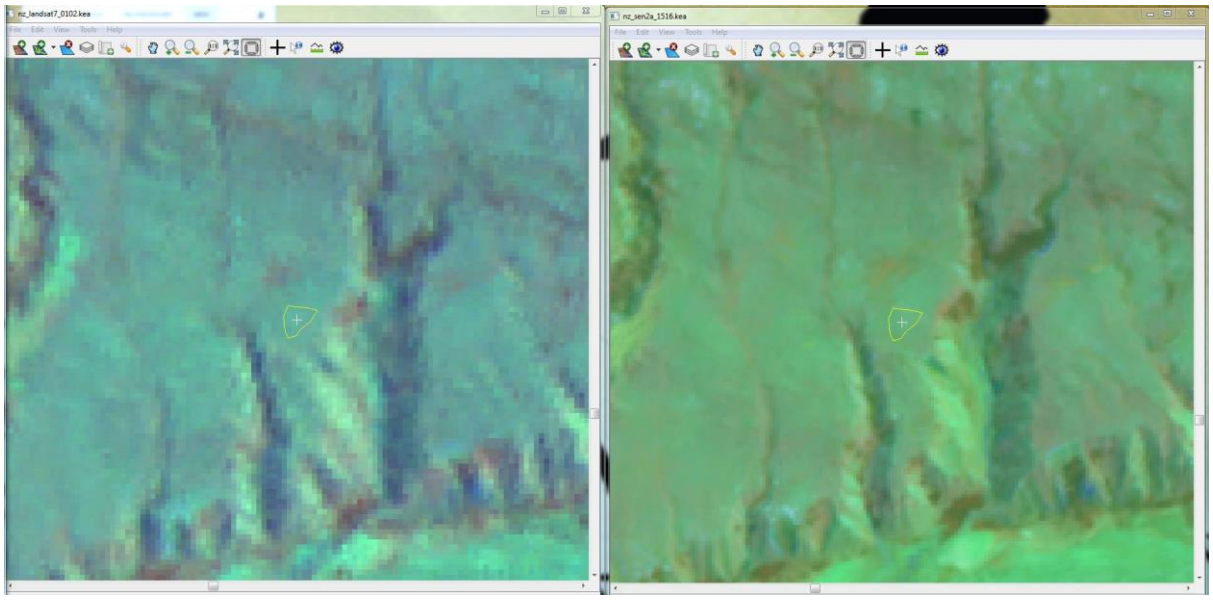


Polygon 5075

Area = 4.5 ha

Locality: South Canterbury

Comments: Typical misregistration. Classified as wetland – no change.

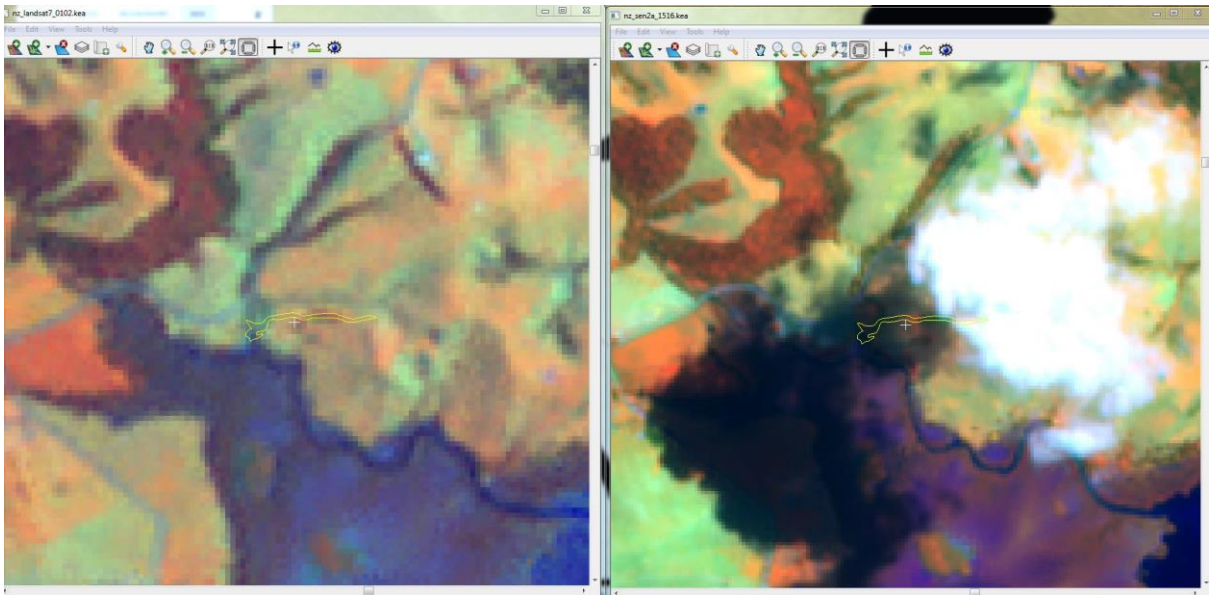


Polygon 5723

Area = 0.6 ha

Locality: Canterbury

Comments: There is seepage above the polygon, a possible seepage below it, and a gully that might be damp to the southwest. The polygon is probably supposed to be over the northernmost feature. Classified as improve line work.



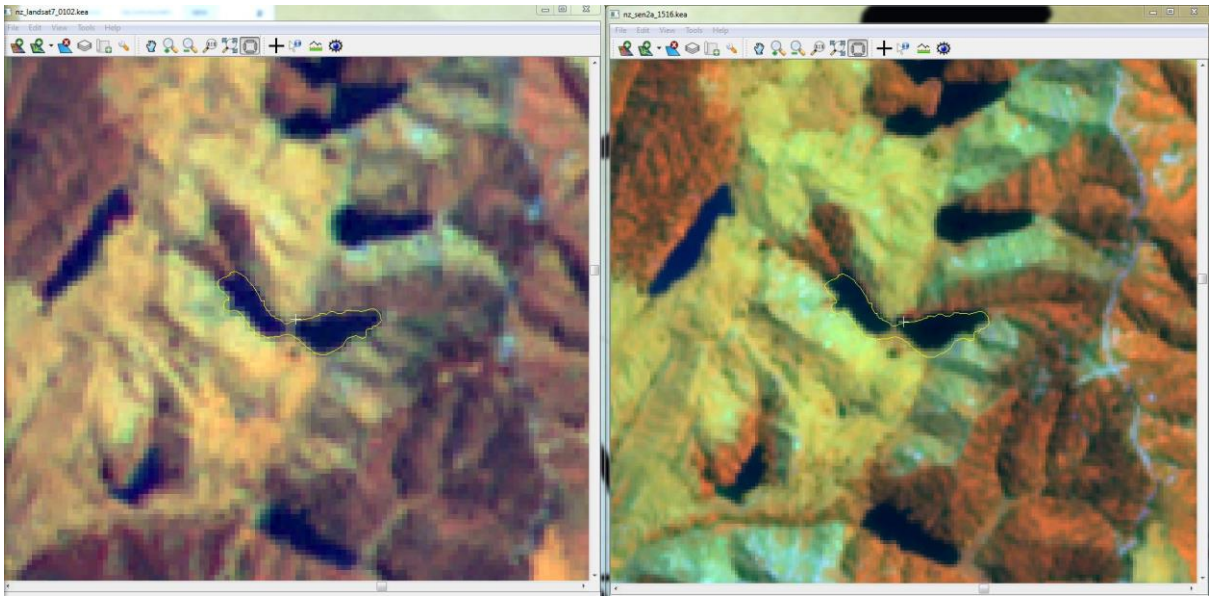
Polygon 13034

Area = 0.58 ha

Locality: Northland

Comments: Misregistration in all images on rolling hill country. Classified as wetland – no change.

G: Excellent registration



Polygon 9402

Area = 4.0 ha

Locality: Taranaki

Comments: Perfectly defined lake. Classified as wetland – no change.