

## **An Introduction to Triangulating the Location of a Transmittered Kiwi**

### **Introduction**

This paper provides an overview of the procedure to identify the location of a Kiwi fitted with the radio transmitter by using “triangulation”. This involves taking bearings to the signal from two different locations and plotting these on a map. The point at which the bearings intersect on the map indicates the location of the Kiwi. It is these three points that form a triangle which gives its name to the process.

To locate a Kiwi using triangulation you will require:

1. The Kiwi to be fitted with a Transmitter;
2. Radio tracking equipment comprising Yagi Antenna and a Tracking Receiver;
3. A large scale Topographic (Topo) map of the area;
4. A compass;
5. A straight edge (usually part of the compass); and
6. A pencil or a fine tip felt pen if using a laminated map.

### **True North and Magnetic North**

The use of a compass is required to determine bearings when doing triangulation. This requires an understanding of “True North” versus “Magnetic North” (known as Magnetic Declination).

A compass needle points to “Magnetic North” rather than “True North” which is geographic North and as shown as the vertical lines on a map. We have to take this declination into account when taking compass readings and transferring these to a map. Magnetic North actually varies from year to year and it varies across the length of NZ. For practical purposes however it is 23 degrees (East) for most of the country. Ie, In NZ your compass needle will point to 23 Deg (Magnetic North) and not 0 Deg (True North).

Some compasses can be setup to factor out the Magnetic North difference and therefore read directly as True North. With a basic compass without this feature you must make the correction. You will need to determine if the compass you are using has an offset feature for Magnetic North and that this offset is correctly set (23deg). A compass with the offset feature will have an additional small graduated scale by the “N” of the dial in the range of +/- 40 deg or so. When set for NZ this scale reading will be at the 23 E deg mark.

### **The Compass**

A good compass is essential for doing triangulation work. There are three types that might be used:



The basic Compass

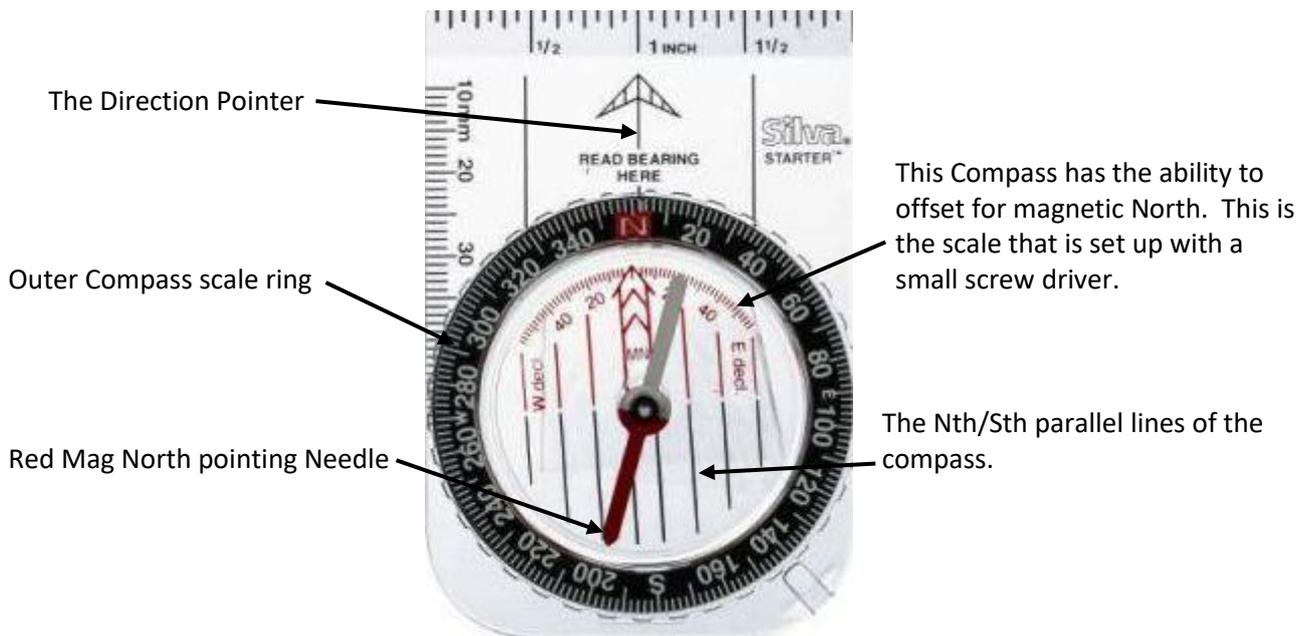


Compass with straight edge and measurement scales



Fully featured compass with inbuilt magnetic north offset

The basic compass is OK for taking bearings but lacks the straight edge and scales for working with Topo maps. The fully featured compass is preferred as it can be set to offset magnetic north. A compass with a straight edge will do the job and the magnetic north offset can be factored out manually.



### Take a Bearing

To take a bearing with a compass that **has** the magnetic north offset already setup:

1. Aim the direction pointer on the compass at the distant point.
2. Rotate the outer (compass scale) ring until the red compass needle points at 0 (North) on the scale.
3. Read the compass direction to the distant point from the circular scale at the point it lines up with the direction pointer.

To take a bearing with the compass that **has no** magnetic north offset setting:

1. Aim the direction pointer on the compass at the distant point.
2. Rotate the outer (compass scale) ring until the red compass needle points at 23 Deg (ie magnetic north) on the scale.
3. Read the compass direction from the circular scale at the point it lines up with the direction pointer.

### **Stage 1 – Locating the Kiwi and getting the 1<sup>st</sup> Bearing**

Once the initial identification of a Kiwi signal is picked up on the tracking equipment the first step is to determine this initial (1<sup>st</sup>) bearing. It is best to take bearings:

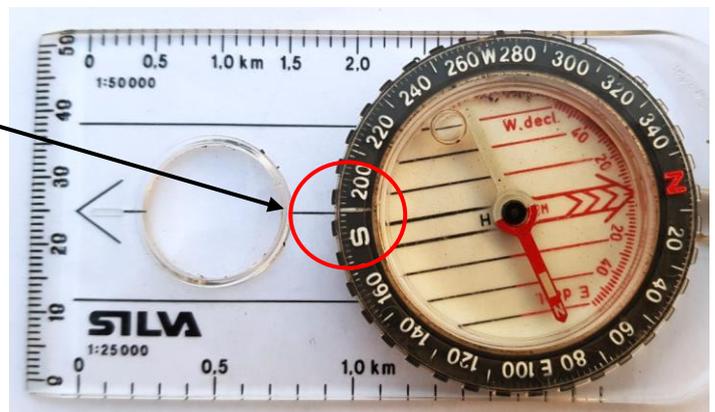
- From a known point that is easily identified on your map (eg track junction, trap location, high point etc). If no convenient feature use a Map Grid reference point (ie an Easting and a Northing);
- From a location where the signal isn't too strong as this will result in a more accurate bearing being able to be determined. Where a signal is very strong it is more difficult to determine a precise bearing (ie of the maximum signal) with the Yagi as it can be easily heard over a wide pointing range/angle;
- Sometimes the "peak" will still appear to be quite broad resulting in some difficulty deciding the precise direction. In this case looking for the two edges of the signal and halving the angle may give a better result (refer the Remutaka Conservation Trust paper on "Introduction to Tracking");
- When the direction to the Kiwi is determined using the tracking equipment note a distant feature in this same direction.

The compass is now used to measure this 1<sup>st</sup> bearing. Depending on which type of compass you are using, use the procedure outlined above to get a compass direction reading (the 1<sup>st</sup> bearing) to the distant feature.

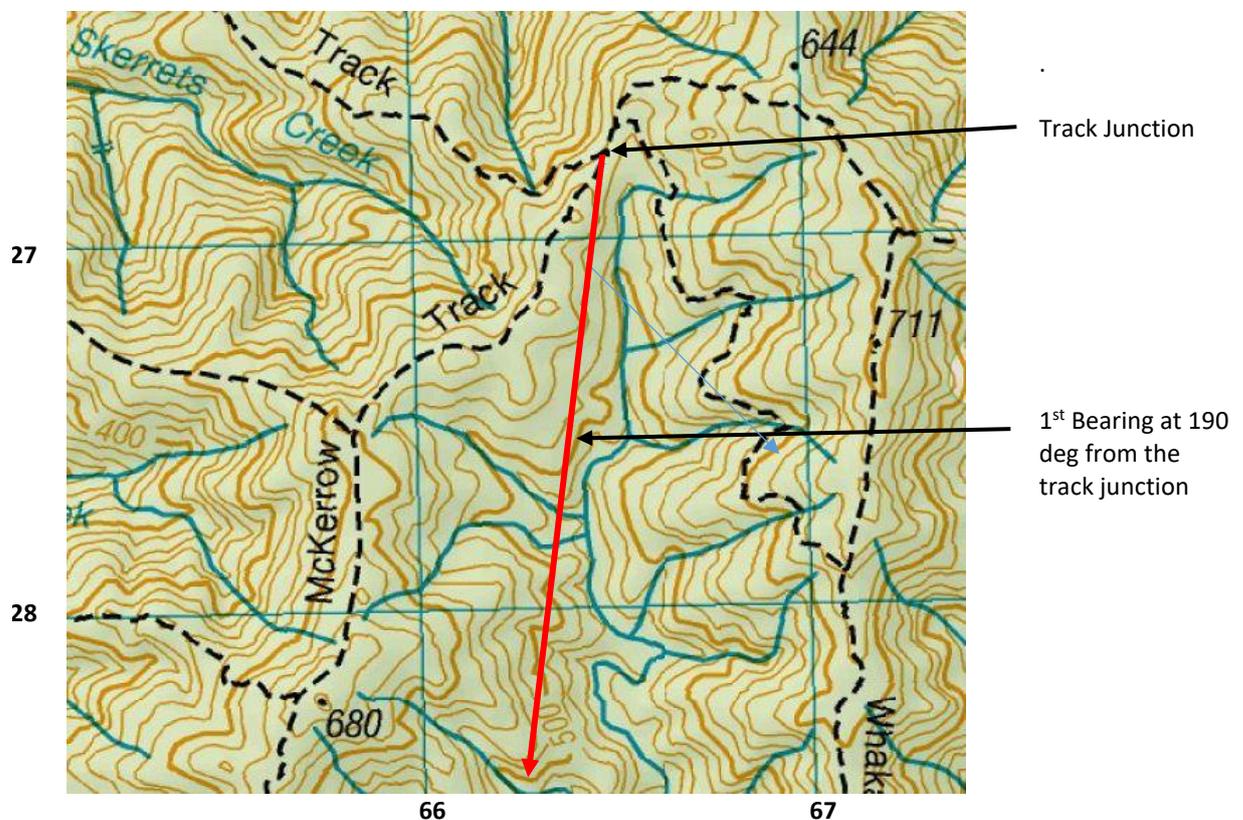
### **Stage 2 – Transferring the 1<sup>st</sup> Bearing on to the Topo Map**

Let's assume that you have taken a compass bearing of 190 deg from the Junction of the Sunny Grove, McKerrow and Whakanui Tracks to your Kiwi signal. To transfer this 1<sup>st</sup> bearing to your Topo Map:

1. Check that the angle of 190 deg is correctly set where the outer ring of the compass intersects with the direction arrow.



2. Being careful not to disturb the 190 deg setting, lay the compass on the Topo Map and orientate it so that North/South parallel lines of the compass align exactly with the North/South grid lines of the map – North on the compass to North on the map.
3. Slide the compass straight edge left or right so as to bring the straight edge exactly over the track junction. Keep the compass Nth/Sth parallel lines aligned with the Nth/Sth grid on the map as you do this.
4. Using your straight edge, draw a line with your pencil or Felt Pen from the track junction out in the direction of the Kiwi (the red line on the map below).
5. As you know 180 deg is directly due South, look at your 190 deg bearing line and confirm that it looks correct (ie just a little more to the West than 180 deg).



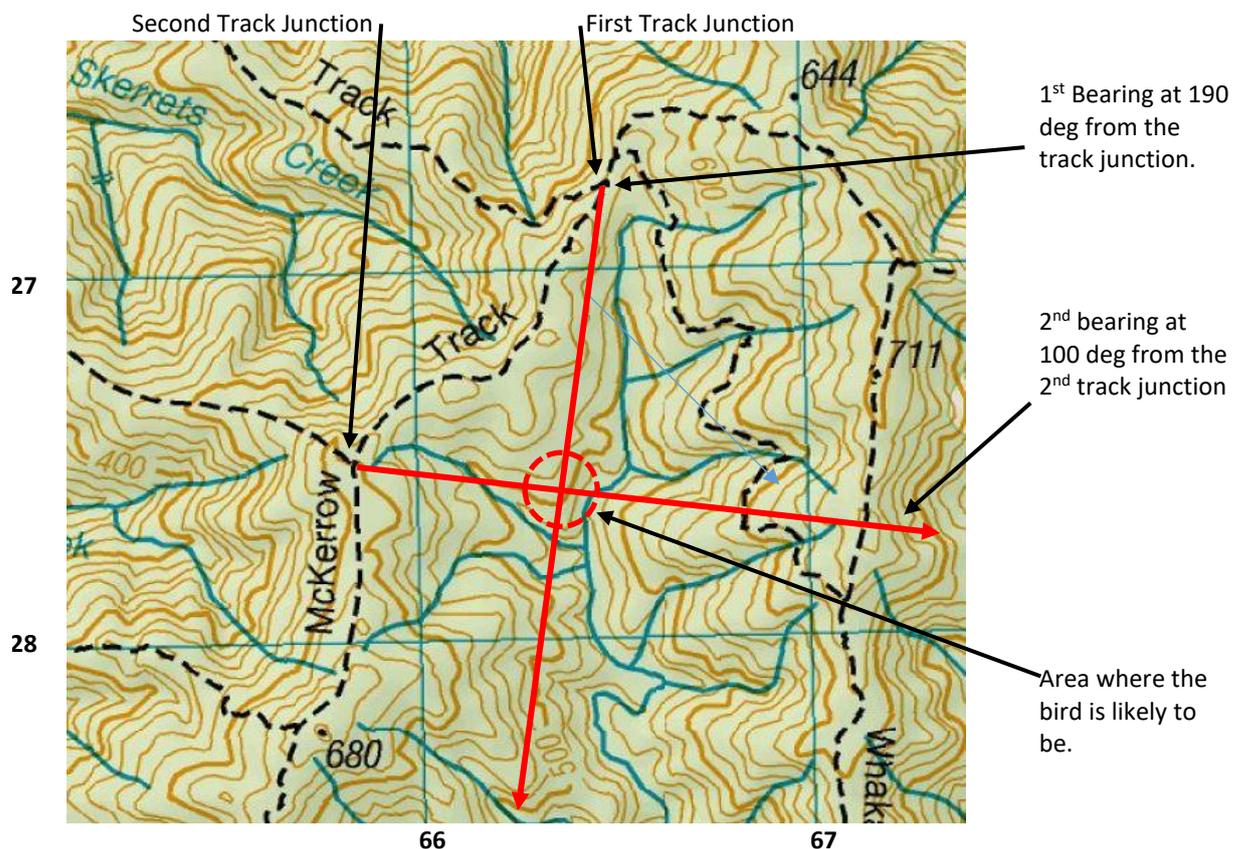
### **Stage 3 – Getting the 2<sup>nd</sup> bearing and transferring it to the map**

You now have a first bearing to the Kiwi but the problem is that you don't quite know where on that bearing the bird is! If the signal is very strong it could be quite close, if the signal is weak it could be a long way off in that direction.

To get a better indication of where that elusive Kiwi might be it is necessary to now get a second bearing from another location and transfer this on to our map. This is known as "Triangulation". This requires a walk to another location to get a second bearing from a different angle to our 1<sup>st</sup> bearing. A reasonably wide angle of say 60-90 degrees between the two locations is desirable to get reasonable accuracy.

In our example we are going to walk south on the McKerrow Track to the next track junction for the second bearing. Repeating the procedure as in Stage 1 we fix the new bearing as 100 deg using our compass. To transfer this 2<sup>nd</sup> bearing to our Topo Map:

1. Check that the angle of 100 deg is set where the outer ring of the compass intersects with the direction arrow.
2. Lay the compass on the Topo Map and without disturbing the 100 deg setting, orientate it so that North/South of the compass aligns exactly with the North/South of the map. The parallel lines within the compass circle will assist with this alignment.
3. Slide the compass straight edge left or right so as to bring the straight edge exactly over the second track junction. Keep the compass Nth/Sth parallel lines aligned with the Nth/Sth of the map grid as you do this.
4. Using your straight edge, draw a line with your pencil or Felt Pen from this second track junction out in the direction of the Kiwi (the 2<sup>nd</sup> red line on the map below).



The point at which the bearings intersect as above is where the two measurements indicate the bird is located. It can be seen however that small differences in the results as measured and plotted can result in a significant shift in where the bearings intersect. Whilst the potential error can be minimised by taking several measurements or even by taking a 3<sup>rd</sup> bearing from another location the accuracy of our two bearing should provide a good indication of where the bird is likely to be (at the time you took the measurements!).

This triangulation technique requires a little practice to be able to do this quickly and confidently in the field. A few practice sessions in your local area just working with your map and compass will help, ie you don't need the tracking gear. Just pick out a distant feature you can see (eg a hilltop, water reservoir or other feature), take two bearings on it as set out above and then transfer them to a map. With practice your two plot lines should intersect close to the feature you were sighting!

Happy Triangulation!

Alan Thompson  
Remutaka Conservation Trust