SPECIALIST ASSESSMENT – HERITAGE AND ARCHAEOLOGY CRITERION

PALMERSTON NORTH REGIONAL FREIGHT HUB MULTI CRITERIA ANALYSIS AND DECISION CONFERENCING PROCESS

PREPARED FOR KIWIRAIL

June 2020

INSITE ARCHAEOLOGY LTD
ARCHAEOLOGY & HERITAGE MANAGEMENT SERVICES
Phone: 027-421-0803 Email: info@insitearchaeology.com
48 Liverpool Street, Levin (5510)

18 September 2019

Daniel John Parker M.A. (Hons) Anthropology
NZ Archaeological Association
International Association of Landscape Archaeology

The following is a comparative assessment of the archaeological potential of long list site options for the purpose of informing the MCA workshop for KiwiRail's future Palmerston North Rail and Freight Hub. The output of this assessment is based on methods that were developed for an MCA of the New Zealand Transport Agency's Otaki to North of Levin route options, though some minor changes and improvements have been made to the analysis and interpretation of the data.

The assessment is based on the spatial analysis of information supplied by or digitised from:

- ~100%[1] of the pre-1900 Māori Land (ML), Survey Office (SO) and Deposited Plans (DP) created by the government land survey agencies prior to the establishment of Land Information New Zealand (LINZ), the controlling agency at the present time.
- The New Zealand Archaeological Association Site Recording Scheme Database (ArchSite)
- LiDAR derived topographic data provided by Horizons Regional Council
- Land Information New Zealand's Data Service (data.linz.govt.nz)
- Heritage New Zealand's List of significant heritage places (https://www.heritage.org.nz/the-list)
- Heritage information supplied by the Manawatu District and Palmerston North City councils

Information was also available from a number of other sources that were not utilised for this stage of analysis. Prior knowledge or a preliminary review of these sources confirmed the presence of useful information, but it was not possible to incorporate these sources in a neutral way within the current timeframe. These sources may be of use to future stages and are:

1 Confirmation of a full 100% coverage is not possible as some records may be indexed out of sequence; such as when a misplaced or lost plan is relocated and accessioned at a later date.

- Surveyor's field books
- Māori Land Court Minute Books
- Historic newspapers
- Published books and pamphlets
- Historic aerial photography

The main effect of excluding these sources from the analysis is that, outside of central Palmerston North City, 19th century sites of European/colonial association are under-represented.

Criteria and Definitions

The constraints discussed below were identified from the sources listed above and they are the known components that have been used to analyse the following criteria:

1. Impacts on recorded archaeological sites
2. Potential impacts on unrecorded archaeological sites
3. Impacts on heritage buildings and listed sites

Comment is provided where further research is expected to identify additional constraints, but the concluding scores are assigned based only on what is known or can be reasonably estimated at the present time[2]. Mitigation measures are likely to be possible/appropriate for some options, but more detailed information would be required to discuss this in a meaningful manner. Therefore, mitigation is not included in the discussion that follows.

The Heritage New Zealand Pouhere Taonga Act (HNZPTA) is the controlling legislation for the administration of archaeological sites and s6 of the act defines an archaeological site as:

(a) any place in New Zealand, including any building or structure (or part of a building or structure), that -

  (i) Was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and

  (ii) Provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and

(b) Includes a site for which a declaration is made under section 43(1)

The HNZPTA definition provides a simple test to determine if a known place or location is an

2 e.g., archaeological sites are likely to be under-represented at Bunnythorpe and other 19th century villages within the study areas, but the degree to which sites may be under-represented at these locations is purely speculative at this time. Therefore, this information is not considered when evaluating the option scores but is provided to indicate there is the potential for scores to be re-evaluated as the project develops and further information is collated.

archaeological site, but a full assessment of archaeological potential must also incorporate an analysis of the unknown site potential. Patterns in the distribution of archaeological sites, as defined in the HNZPTA, can be used to infer the unknown potential, but a more accurate picture is developed by studying a broader range of information, one that also includes:

> any place with an historic Māori name-association and any unnamed features of the natural environment that are generally regarded as having been focal points for past human activity.

This enables many rivers, streams, lakes, swamps, hill and dunes etc., to be included in the analysis. Although these features of the natural landscape may not meet the HNZPTA definition of what is an archaeological site, there are a wide range of sources (Māori Land Court Minute Books, 19th century ethnographies, oral traditions etc) that indicate these places have, or are likely to have, an archaeological component that is unrecognised due to issues of surface visibility or a limited history of landscape study. In some cases, the place name associated with a landscape feature indicates that there is likely to be an archaeological site somewhere within the immediate or general vicinity of the named location.

There are a small number of heritage buildings and archaeological sites listed by the Manawatu District and Palmerston North City councils in the options areas. In general, these are sites or places that meet the definition used in the HNZPTA and where these sites duplicate records from the NZAA or other sources only the original source record was referenced in order to avoid double counting.

Because of the expanded definition of what is an ‘archaeological site’ that is used in this assessment, it is important to distinguish how particular terms are used throughout this briefing note. ‘Known’ sites are places that meet the strict definition of an archaeological site as defined in the HNZPTA, while ‘unknown’ or ‘potential’ sites are places that fall under the expanded definition outlined above. Where reference is made to ‘archaeological potential’, this encompasses all sites that fall under the HNZPTA and expanded definition.

Constraints

Table 1 summarises the known and potential archaeological constraints within each of the long list site options. Records of the NZAA, historic buildings and named places are known constraints. Named rivers and streams are constraints where there is a high or elevated potential for archaeological sites to be encountered. Nineteenth century roads and railways are both known and potential constraints: the roads and railways themselves are archaeological sites and there is also a high potential for other unknown sites to be clustered nearby. Option 9 was assessed on the basis of the footprint of the existing facility.

Table 1: List of known and potential constraints grouped by site option.

OPTION	CONSTRAINTS
1	1 x NZAA Site Record (T24/4, Lot 2 DP 5798) 2 x named streams (Makahika and Taonui) 1 x NIMT Railway 2 x 19th century roads (Newbury Line and Te Ngaio Road)
2	1 x 19th century house 1 x MDC listed heritage buildings (St. Dominics School for the Deaf, Pt Upper Aorangi 1C1) 5 x named streams (Makahika, Mangaone, Otokonui, Taonui and Waitokatoka) 1 x NIMT Railway 2 x 19th century roads (Nannestad's Line and Taonui Road)
3	2 x named streams (Makahika and Mangaone) 1 x NIMT Railway 6 x 19th century roads (Clevely Line, Kairanga-Bunnythorpe Road, Maple Street, Richardson's Line, Robert's Line and Te Ngaio Road)
4	1 x NIMT Railway 5 x 19th century roads (Clevely Line, Parr's Road, Richardson's Line, Robert's Line and Stoney Creek Road)
5	2 x 19th century roads (No. 1 Line – Longburn and Rongotea Road)
6	5 x 19th century buildings/structures (Longburn, 4 where NIMT Railway crosses SH 56) 1 x MDC listed heritage building (Lot 1 DP 34162) 1 x named place 1 x NIMT Railway 1 x Foxton-Palmerston North Tramway 4 x 19th century roads (Foxton Line, Karere Road, No. 1 Line – Longburn and Rongotea Road)
7	5 x 19th century buildings/structures (Longburn, 4 where NIMT Railway crosses SH 56 and Longburn freezing works) 2 x named streams and rivers (Mangaone and Manawatu) 4 x named places (3/4 between SH 56 and Manawatu River) 1 x NIMT Railway 1 x Foxton-Palmerston North Tramway 1 x 19th century roads (Foxton Line)
8	1 x NZAA Site Record (S24/49, railway bridge foundations beside SH 56) 7 x 19th century buildings/structures (adjacent to SH 56) 1 x named streams (Mangaone) 1 x NIMT Railway 1 x Foxton-Palmerston North Tramway 4 x 19th century roads (Foxton Line, No. 1 Line – Longburn, Rongotea Road and Shirriff's Road)
9	1 x 19th century building 2 x 19th century roads (Milson Line and Tremaine Avenue)

Assessment of Archaeological Potential

Using the expanded definition, above, archaeological sites and landscape place names were digitised in ArcGIS. Where line or polygon data was available from the LINZ Data Service this was used – i.e., for rivers, streams, roads and railways – but in most cases sites were digitised as points at the approximate mid-point (for lines) or geometric centroid (for polygons). Separate classes of data were then converted to a raster format with a 1000 m cell resolution using the following methods:

- Named rivers were converted to raster with a value = 1 and no data = 0
- Named streams, creeks and drains were converted to raster with a value = 1 and no data = 0
- Nineteenth century roads and railways were converted to raster with a value = 1 and no data = 0
- NZAA site record data was converted to raster using a point density method and the values normalised to a 0 to 1 scale
- All non-stream or river iSA point data was converted to raster using a point density method and the values normalised to a 0 to 1 scale
    - Separate point densities were calculated and normalised for 19th century urban centres (Palmerston North, Foxton/Awahou etc)

The data sets were transformed to ordinal rasters to allow the separate classes of data to be combined into a single model using a raster math function in several iterations with various weightings applied. The model that was thought to provide the best interpretation of the collated data was selected from these outputs. The model that is presented below was produced by the addition of the above classes with the following weightings applied:

- Named rivers = 100%
- Named streams = 25%
- Nineteenth century roads and railways = 10%
- NZAA site records = 100%
- iSA point data (rural and urban) = 100%

The NZAA site records and iSA point data were given their full weighting because these data points represent known or recorded archaeological sites. Named rivers were also allotted a full weighting as they are a known focal point of historic Māori and European occupation and archaeological sites can be expected to be found at any point along their banks. Full weighting for rivers also provides allowance for more extensive NZAA and iSA sites recorded as points to cross cell-boundaries. While named streams were also focal points for occupation, the reduced weighting reflects their generally lower importance relative to the major rivers. Nineteenth century roads and railways are included as a proxy for late 19th century residential

and industrial occupation but at a weighting that reflects generally low occupation densities in rural areas (high density 19th century occupation zones are represented in the NZAA and iSA point data sets).

The combined raster was classified into three values for archaeological potential – Low, Medium and High – using a geometric interval and the results were smoothed using a cubic convolution function. The sum total of the underlying values was calculated for each option as a guide to the rank order of the options, but the final score was determined on the basis of my personal knowledge of the archaeological potential (known and unknown) within each of the option areas and related attributes that were not modelled, such as the likely extent, complexity, and archaeological values of the identified sites.

It should be noted that, although quantitative methods are used during the process, the source material – both archaeological and cultural – does not have any intrinsic quantitative value and therefore the interpretation and scoring of the data must be subjective, by necessity. The purpose of this exercise is to allow multiple layers of archaeological and cultural information to be combined in a controlled and predictable computer-modelling environment, so that I can explore deeper patterns in the data and test the assumptions that underlie my interpretation of the archaeological record. The end product of this process, a model of the archaeological potential within the study area, enables me to communicate a suite of relatively complex archaeological information in a visual manner that is easily understandable to most lay persons. The model that is presented does not follow any specific guidelines or industry standards – there are none in New Zealand – but represents one of the various ways that the distribution of the archaeological potential can be interpreted and it is, in my opinion, the most appropriate one.

Assumptions

As previously discussed, 19th century sites of European/colonial association are known to be under-represented outside of the Palmerston North city centre. However, inclusion of the 19th century road and rail network in the analysis acted as a general proxy in the absence of more detailed information. Historic newspaper articles and published works have stated that the road and rail network was an important factor in the economic development of the Manawatu and it is reasonable to expect that European/colonial sites will be clustered in relative proximity to the road or rail network.

Overall, the model that has been produced is assumed to be a reasonable representation of not just the known, but also the unknown archaeological potential. The basis for this understanding is that the model, for the most part, conforms with independent data that was not used in its construction: this being environmental data indicating that away from the major rivers the landscape was covered in a dense podocarp forest for most of its occupied history until the last decades of the 19th century. While the entire landscape has been occupied for many centuries, the archaeological potential is greatest near open land alongside the major rivers and streams or near late-19th century urban centres, roads and railways.

Summary

Of the nine options that were analysed, redeveloping the existing site is adjudged to be the lowest impact option: while there is some archaeological potential, this is likely to have been adversely affected by the existing development and the archaeological values somewhat compromised. For all other areas the northern options, 1 to 4, score better than the southern options, 5-8. There are few known sites inside the northern options and higher risk areas set back from the Oroua River reflect the potential for unknown sites to be encountered in the vicinity of named streams. Additional constraints are likely to be identified as other sources of information are incorporated at later stages of this project. In particular, further sites should be expected in the vicinity of Bunnythorpe and at places adjacent to the NIMT Railway. Of the four northern options, Option 4 was assessed to have the lowest archaeological potential, with no known sites or named streams falling within the option's area.

Of the four southern options, Options 7 and 8 have the highest archaeological risk, being the two options closest to the Manawatu River and incorporating a number of known sites. There is also a very high potential for unknown sites to be encountered in these areas. Options 5 and 6 score much better, though there are some risks for Option 6 around SH 56 and the NIMT Railway at Longburn where a late 19th century settlement was established.

New constraints are likely to be identified as future research is targeted to better understand the European/colonial heritage of the district and this is likely to result in increased scores for options that are currently have a low score. However, any new information is not expected to change the overall preference for sites that are located away from the major rivers. The options are scored as follows:

Table 2: Site options and associated scores.

OPTION	ASSESSMENT	SCORE
1	There are 6 constraints within this option, two of them being named streams. Archaeological potential is greatest along the eastern and western extremities of the area, but new sites should be expected along the NIMT Railway and close to 19th century settlements. A Medium Low impact should be expected for this option, potentially increasing to a Medium impact pending further research.	2
2	There are 10 constraints within this option, 5 of them being named streams. Archaeological potential is greatest at its western extent, where this option approaches a small 19th century farming settlement and the Oroua River. New sites should be expected along the NIMT Railway and close to 19th century settlements. A Medium impact should be expected for this option, potentially increasing to a Medium High impact pending further research.	3
3	There are 9 constraints within this option, 6 of them being 19th century roads and 2 being named streams. There is a high potential for sites to be found here and new sites should be expected along the NIMT Railway and the 19th century road network. As no specific sites have been identified at this time, the option is assessed to have Medium Low impact.	2

OPTION	ASSESSMENT	SCORE
4	The 6 constraints within this option are the NIMT Railway and the 19th century road network. There are no specific sites identified at this time and this land remain as dense forestry until relatively late. This is a Low impact option.	1
5	The two constraints identified within this option are 19th century roads. The potential for archaeological sites at this location is somewhat reduced by the fact that this section of the NIMT Railway was not constructed until after 1900. New sites should be expected in the vicinity of the 19th century road network, but overall this is expected to be a Low impact option.	1
6	There are 13 constraints within this option area, including 1 listed heritage building (MDC) and 5 19th century buildings at Longburn. New sites can be expected to be identified adjacent to the Foxton-Palmerston North Tramway (SH56) and the historic road network. A Medium impact should be expected for this option, potentially increasing to a Medium High impact pending further research.	3
7	There are 14 constraints within this option area that abuts the Manawatu River at its eastern extent. In addition to the 19th century buildings at Longburn there are multiple named streams and places close to the river, including 3 large forest clearings that extend more than 2 km from the river bank and that have been focal points of residential and horticultural occupation. There is a high archaeological potential (both known and unknown) within this option area and given the number of extensive sites, selection of this option is likely to have a High impact.	5
8	There are 15 constraints within this option area that abuts the Manawatu River at its eastern extent. In addition to the 19th century buildings alongside the former railway (SH 56), there are multiple named streams and places close to the river, including 2 large forest clearings that have been focal points of residential and horticultural occupation. There is a high archaeological potential (both known and unknown) within this option and selection of this option is likely to have a High impact.	5
9	There is one former 19th century building within the existing freight centre and there is moderate potential for other sites to be uncovered. However, the existing development is likely to have adversely affected the survival and archaeological values of any sites that or may have been present within this area. This is expected to be the Lowest impact option.	1

INSITE ARCHAEOLOGY LTD
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Phone: 027-421-0803 Email: info@insitearchaeology.com
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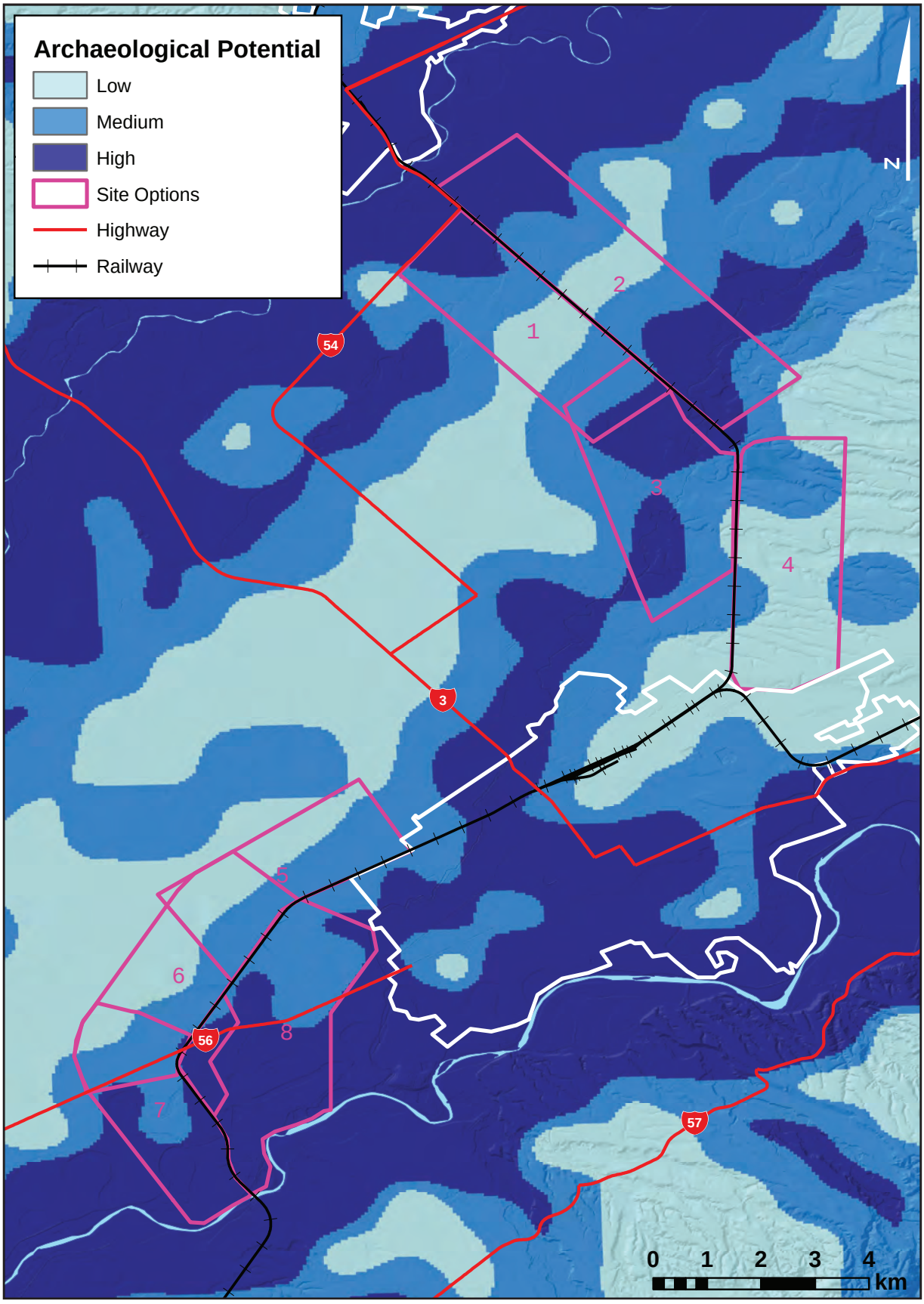

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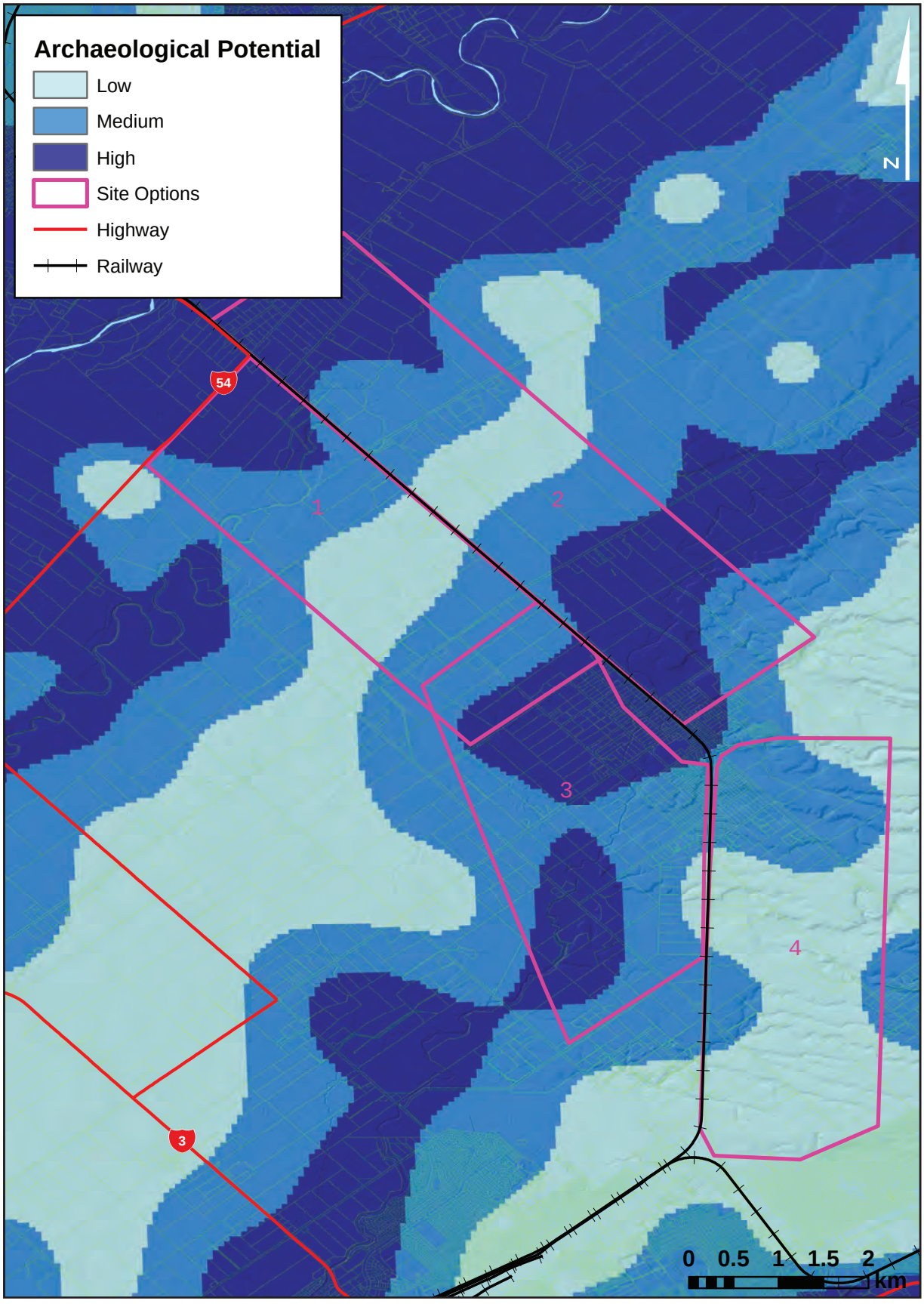

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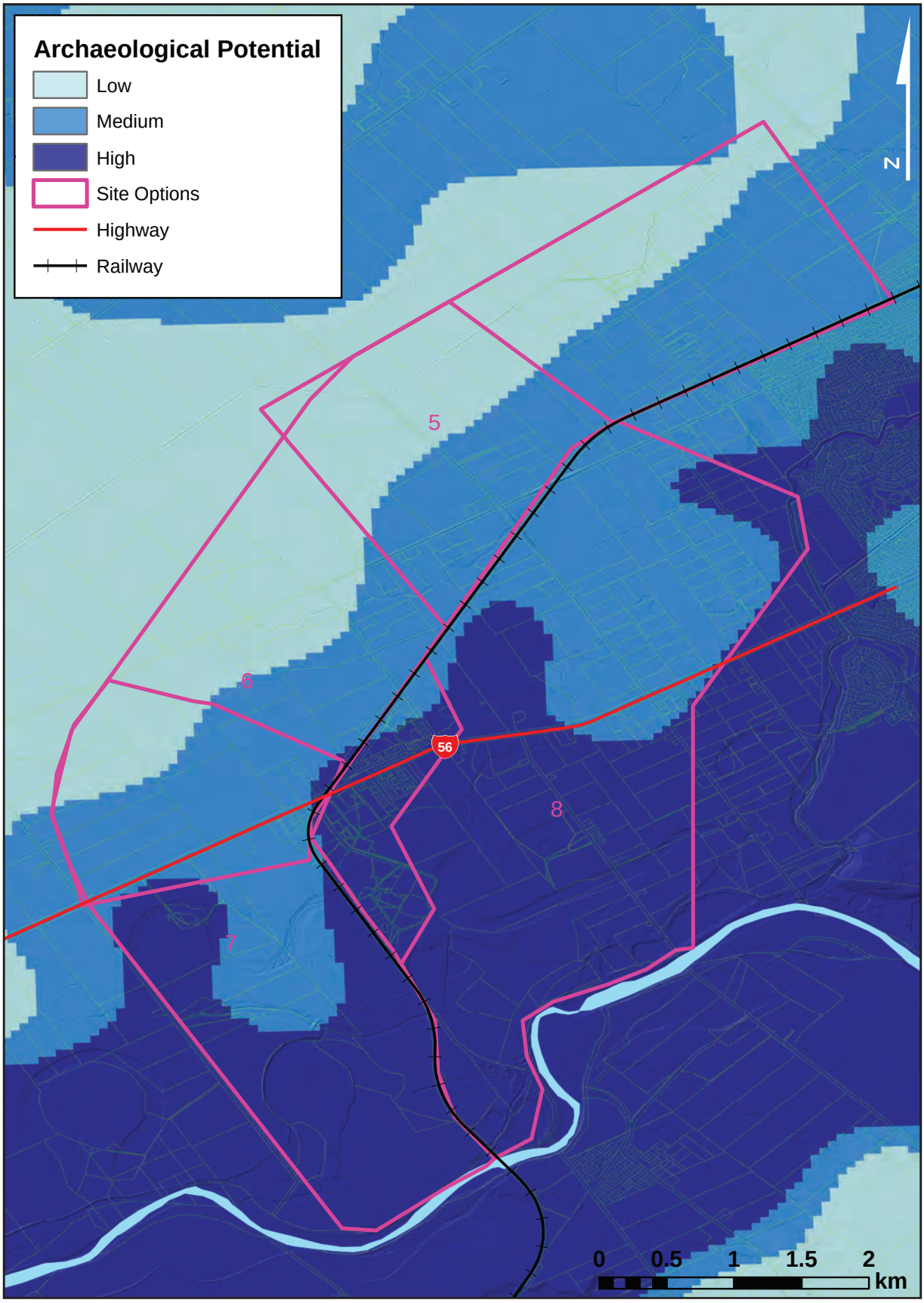

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Addendum to the Workshop 2 Heritage and Archaeology Assessment

Reasons for the addendum

The reason for this addendum is to provide a further assessment of the area options with the masterplan layout applied

Further assessment

During Workshop 2, participants acknowledged that having a specific site to assess within the areas identified could potentially result in changes to the scores presented at Workshop 2.

As a result, after Workshop 2, the masterplan was applied to the area options assessed in Workshop 2, and sites within those areas identified. The rail connection was included on the refined options, and the implications for connecting to the North Island Main Trunk line were identified.

There are two layout options for areas 1 and 2 (Options 1a, 1b, 2a, 2b). Three layouts were originally developed for area 3, however only one layout was taken forward for assessment because the others did not meet the project objectives. Area 4 could only accommodate one layout option. There were significant constraints at the ends of areas 5 and 6, therefore the parts of these two areas without the constraints were combined to create site 5.

Sites in areas 7, 8 and 9 were not identified as these areas were fatally flawed at Workshop 2.

Assessments

The following table sets out the heritage and archaeology assessment and scoring for each of the site options. For details regarding the distribution of archaeological potential, see discussion and figures presented in the Heritage & Archaeology pre Workshop 2 report dated 18 September 2019 (please note that option areas 1, 3 and 5 in the pre Workshop 2 report do not include the full extent of the detailed site options 1b, 3a, 3b and 5, below).

Site Option	Score	Assessment
Option 1a	1	Negligible impact in high risk areas around named streams and high impact in medium and low potential areas. Identified constraints are: • 3 x named streams (Makahika, Mangaone and Taonui) • 2 x 19th century roads • 1 x NIMT Railway
Option 1b	1	Low impact in high risk areas around named streams and high impact in medium and low potential areas. Identified constraints are: • 3 x named streams (Makahika, Mangaone and Taonui) • 3 x 19th century roads • 1 x NIMT Railway
Option 2a	1	Low impact in high risk areas around named streams and high impact in low potential areas. Identified constraints are: • 3 x named streams (Makahika, Mangaone and Taonui) • 3 x 19th century roads • 1 x NIMT Railway
Option 2b	3	Low impact in medium risk areas and high impact in high potential areas around named streams. Identified constraints are: • 4 x named streams (Makahika, Mangaone, Taonui and Waitokatoka) • 4 x 19th century roads • 1 x NIMT Railway

Phone: 027-421-0803 Email: info@insitearchaeology.com
48 Liverpool Street, Levin (5510)

Site Option	Score	Assessment
Option 3	1	Negligible impact in high risk areas and high impact in medium and low potential areas. Identified constraints are: • 6 x 19th century roads • 1 x named stream (Mangaone) • 1 x NIMT Railway
Option 4	1	Negligible impact in high risk areas and high impact in low potential areas. Identified constraints are: • 5 x 19th century roads • 1 x NIMT Railway
Option 5	3	Low impact in high potential areas, but two 19th century buildings adjacent to SH 56 overpass will be affected. High impact in medium potential areas. Minor changes to design could result in this option receiving a lower score. Identified constraints are: • 2 x 19th century buildings/structures • 3 x 19th century roads • 1 x named stream (Mangaone) • 1 x NIMT Railway • 1 x Foxton-Palmerston North Tramway

Conclusion

Applying the masterplan concept to each of the site options enabled scoring to be refined to a finer grained level of analysis where the relative impacts to zones of low, medium or high archaeological potential could be more accurately evaluated as well as the identification of specific sites likely to be adversely affected. Most option scores improved as a result of this refined assessment, predominantly due to the confirmation of reduced effects in higher risk areas surrounding rivers and streams. There was no change to scoring for Option 2b due to confirmation of high impacts in the high potential zone surrounding the Makahika, Mangaone and Waitokatoka streams. The score for Option 5 was changed from 1 to 3 as this option was refined from the original assessment to create a new site 5 (as explained above). The new option 5 included parts of a high potential zone and specific sites at Longburn that were originally part of Option 6 and therefore the revised option 5 has a higher impact.

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48 Liverpool Street, Levin (5510)

14 November 2019

Daniel John Parker

M.A. (Hons) Anthropology
NZ Archaeological Association
International Association of Landscape Archaeology

The following is a comparative assessment of the archaeological potential of short list site options for the purpose of informing the Multi-Criteria Assessment (MCA) workshop 3 for KiwiRail's future Palmerston North Rail and Freight Hub. The output of this assessment is based on methods that were first developed for an MCA of the New Zealand Transport Agency's Otaki to North of Levin route options, though some minor changes and improvements have been made to the analysis and interpretation of the data.

The comparative assessment of long list site options, for workshop 2, was based on the spatial analysis of information supplied by or digitised from:

- ~100%[1] of the pre-1900 Māori Land (ML), Survey Office (SO) and Deposited Plans (DP) created by the government land survey agencies prior to the establishment of Land Information New Zealand (LINZ), the controlling agency at the present time.
- The New Zealand Archaeological Association Site Recording Scheme Database (ArchSite)
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- Heritage New Zealand's List of significant heritage places (https://www.heritage.org.nz/the-list)
- Heritage information supplied by the Manawatu District and Palmerston North City councils

All of the above sources have been retained for this stage of assessment and new information has also been sourced in the form of:

- 19th century cadastral parcels digitised from early survey plans

1 Confirmation of a full 100% coverage is not possible as some records may be indexed out of sequence; such as when a misplaced or lost plan is relocated and accessioned at a later date.

- Publicly available historic aerial photography
- Historic newspapers

The new information was added to address known gaps regarding late 19th century sites of predominantly European/colonial origin. Of these new sources the only comprehensive coverage is the 19th century cadastral parcel layer, which was digitised for the entirety of the areas potentially affected by the freight hub and roading alterations and is used as a proxy measure for the intensity of 19th century colonial occupation. Publicly available oblique photography enabled a number of 19th century buildings to be identified in and around Bunnythorpe. Digitised and searchable historic newspapers (https://paperspast.natlib.govt.nz/) were studied using keywords such as 'Bunnythorpe', 'Taonui', 'Mugby'[2] and 'Trondhjem/Trondheim'[3], though the quantity of search returns meant that only a small portion were able to be reviewed in the time available.

While 19th century sites of European/colonial association are still under-represented, the new information has provided an improved understanding that is sufficient to guide the assessment at this stage of the project. However, further in-depth research will be required at later stages and the following sources are likely to be of use:

- Surveyor's field books
- Māori Land Court Minute Books
- Historic newspapers
- Historic rates books
- Published books and pamphlets
- Historic aerial photography

Criteria and Definitions

The constraints discussed below were identified from the sources listed above and they are the known components that have been used to analyse the following criteria:

1. Impacts on recorded archaeological sites
2. Potential impacts on unrecorded archaeological sites
3. Impacts on heritage buildings and listed sites

Comment is provided where further research is expected to identify additional constraints, but the concluding scores are assigned based only on what is known or can be reasonably estimated at the present time[4]. Mitigation measures are likely to be possible/appropriate for

2 An early name for Bunnythorpe.
3 An early name for Taonui.
4 e.g. not all cadastral parcels in and surrounding Bunnythorpe were occupied with the same intensity during the 19th century, but it is not possible to distinguish the relative differences between all parcels at this time. Therefore, all cadastral parcels are evaluated equally in this assessment but the potential for scores to be re-

some options, but more detailed information would be required to discuss this in a meaningful manner. Therefore, mitigation is not included in the discussion that follows.

The Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA) is the controlling legislation for the administration of archaeological sites and s6 of the act defines an archaeological site as:

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> any place with an historic Māori name-association and any unnamed features of the natural environment that are generally regarded as having been focal points for past human activity.

This enables many rivers, streams, lakes, swamps, hill and dunes etc., to be included in the analysis. Although these features of the natural landscape may not meet the HNZPTA definition of what is an archaeological site, there are a wide range of sources (Māori Land Court Minute Books, 19th century ethnographies, oral traditions etc) that indicate these places have, or are likely to have, an archaeological component that is unrecognised due to issues of surface visibility or a limited history of landscape study. In some cases, the place name associated with a landscape feature indicates that there is likely to be an archaeological site somewhere within the immediate or general vicinity of the named location.

There are a small number of heritage buildings and archaeological sites listed by the Manawatu District and Palmerston North City councils in the options areas. In general, these are sites or places that meet the definition used in the HNZPTA and where these sites duplicate records from the NZAA or other sources only the original source record was referenced in order to avoid double counting.

Because of the expanded definition of what is an ‘archaeological site’ that is used in this assessment, it is important to distinguish how particular terms are used throughout this briefing note. ‘Known’ sites are places that meet the strict definition of an archaeological site as defined in the HNZPTA, while ‘unknown’ or ‘potential’ sites are places that fall under the

evaluated as the project develops and further information is collated is acknowledged.

expanded definition outlined above. Where reference is made to 'archaeological potential', this encompasses all sites that fall under the HNZPTA and expanded definition.

Assessment of Archaeological Potential

The previously assessed scores for the long list site options are used as the starting point for the current assessment as the information presented at workshop 2 remains relevant to the current short list options (Table 1).

The long list options were evaluated using a composite raster based on archaeological information identified in the sources discussed above[5] with the assigned scores based on an interpretation of the overall archaeological potential (known and unknown) for each option. Further detail provided about the freight hub concept has enabled some previously identified constraints to be removed as they will not be affected by the assessed design option. A small number of new archaeological sites have been identified inside the boundaries of the short list options[6] and the entire network of 19th century cadastral parcels underlying all short list options was digitised from historic survey plans. This new information was assessed alone and was not incorporated into an updated composite raster. The primary reasons being that the small number of new sites would not change the model to a significant degree[7] and it was not immediately clear how the cadastral parcels should be integrated and weighted with the other more easily scalable data. The scores presented below in Table 3 revise the earlier long list scores in response to a refined understanding of the potential adverse effects to archaeological sites (known and unknown)

Table 1: Original scoring and assessment of long list site options.

SITE	ASSESSMENT	SCORE
2	There are 10 constraints within this option, 5 of them being named streams. Archaeological potential is greatest at its western extent, where this option approaches a small 19th century farming settlement and the Oroua River. New sites should be expected along the NIMT Railway and close to 19th century settlements. A Medium impact should be expected for this option, potentially increasing to a Medium High impact pending further research.	3
3	There are 9 constraints within this option, 6 of them being 19th century roads and 2 being named streams. There is a high potential for sites to be found here and new sites should be expected along the NIMT Railway and the 19th century road network. As no specific sites have been identified at this time, the option is assessed to have Medium Low impact.	2
4	The 6 constraints within this option are the NIMT Railway and the 19th century road network. There are no specific sites identified at this time and the land remained as dense forestry until relatively late. This is a Low impact option.	1

5 See the Heritage & Archaeology pre Workshop 2 report dated 18 September 2019 for details on how the raster of archaeological potential was developed and interpreted.

6 Predominantly late 19th century buildings,

7 The model of archaeological potential draws upon a substantial body of data consisting of almost 10,000 sites of archaeological or cultural significance distributed across much of the lower North Island and the new sites were located in areas that had already been predicted to have a high or medium archaeological potential.

previously identified and those that have recently been identified from new information. The primary driver for the revised scores is the 19th century cadastral parcel network and historic newspaper articles and advertisements pertaining to European/colonial occupation in and around Bunnythorpe.

Constraints

Table 2 summarises the known and potential archaeological constraints within each of the short list site options. Records of the NZAA, historic buildings and named places are known constraints. Named rivers and streams are constraints where there is a high or elevated potential for archaeological sites to be encountered. Nineteenth century roads and railways are both known and potential constraints: the roads and railways themselves are an archaeological site and there is also a high potential for other unknown sites to be clustered nearby. In the absence of more detailed records, 19th century cadastral parcels are used as a proxy for the density of European/colonial occupation: they are a potential constraint as not all parcels were intensively occupied/developed during the 19th century.

Table 2: Known and potential constraints grouped by short listed site option. New constraints idenified during research for workshop 3 are denoted with an *.

SITE	CONSTRAINTS
2	1x Trondhjem/Trondheim Saw Mill and cottages* 1 x 19th century house* 3 x named streams (Makahika, Mangaone and Taonui) 1 x NIMT Railway 2 x 19th century roads (Nannestad's Line and Taonui Road) 50x 19th century cadastral parcels (freight hub predominantly rural)*
3	1x Bunnythorpe School* 1x Tremewan's Store and house* 1 x named stream (Mangaone) 1 x NIMT Railway 7x 19th century roads (Clevely Line, Kairanga-Bunnythorpe Road, Maple Street, Parr's Road, Richardson's Line, Robert's Line and Te Ngaio Road) 124x 19th century cadastral parcels (freight hub predominantly town/suburban)*
4	1x 19th century cottage* 1x named stream (Mangaone) 1 x NIMT Railway 5 x 19th century roads (Kairanga-Bunnythorpe Road, Maple Street, Richardson's Line, Robert's Line and Stoney Creek Road) 47x 19th century cadastral parcels (freight hub predominantly rural with some suburban parcels)*

Assumptions

As discussed above and in the Heritage & Archaeology pre Workshop 2 report dated 18 September 2019, 19th century sites of European/colonial association are known to be under-represented

outside of the Palmerston North city centre. Bunnythorpe does not appear to have developed as rapidly as other settlements to the north of Palmerston North (i.e., Ashhurst, Stoney Creek and Whakarongo), but historic newspaper accounts indicate a thriving farming community in the wider landscape. Without extensive archival analysis the details of 19th century European/colonial occupation can only be guessed, but the 19th century cadastral parcel network is used here as a proxy to measure the potential occupation intensity where; 1 parcel = 1 occupation = 1 potential archaeological site. Although this 1:1:1 'equation' is known to be incorrect in many cases, the sources reviewed suggest that the errors are likely to cancel each other out and that the 'equation' is suitable[8], in theory. While the actual archaeological potential for any given cadastral parcel may be higher or lower, the 1:1:1 'equation' recognises that options affecting a large number of small and high density urban and suburban parcels are more likely to adversely affect archaeological sites.

Overall, the new information assessed for workshop 3, in conjunction with the model of archaeological potential produced for workshop 2, is assumed to be a reasonable representation of not just the known, but also the unknown archaeological potential. The basis for this understanding is that the workshop 2 model, for the most part, conformed with independent data that was not used in its construction: this being environmental data indicating that away from the major rivers the landscape was covered in a dense podocarp forest for most of its occupied history until the last decades of the 19th century. With the three short listed options located away from the Manawatu and Oroua rivers in a landscape that was heavily forested until the later decades of the 19th century, there is a shift in emphasis towards better understanding the European/colonial archaeological potential. Further research will be required for later stages of the project, but the additional information needs of workshop 3 are adequately addressed through the use of the 19th century cadastral parcel network as a proxy measure.

Summary

Refined design plans and further research has resulted in scores for all three short listed options that are different from their earlier workshop 2, long list scores. A small number of new archaeological sites have been identified within the extent of each site option that reinforce the patterns previously addressed in the Heritage & Archaeology pre Workshop 2 report dated 18 September 2019. As a result, these sites have had little impact on the revised scores. Changes between the long and short list scores are primarily driven by the evaluation of archaeological potential in regards to the 19th century cadastral parcel network and historic newspaper articles and advertisements pertaining to European/colonial occupation in and around Bunnythorpe. The new scores favour options that are situated in predominantly rural areas where European/colonial occupation is expected to be less intensive and at a lower density. Options located in former urban and suburban areas are awarded higher scores as the intensity and density of occupation is likely to be greater at these locations. No potential fatal flaws have been identified at this time.

Short list options are scored below.

8 There are instances where land is known to have been unoccupied/developed prior to 1900, but there are also instances where land parcels are known to have several phases of occupation/development prior to 1900.

Table 3: Scoring and assessment of short list site options.

SITE	ASSESSMENT	SCORE
2	Recent research has identified two new archaeological sites that would be affected by option 2: the Trondheim/Trondhjem saw mill and settlement at Taonui, and a cottage at Bunnythorpe. Carrying over from research for workshop 2, three named streams, the NIMT railway and two 19th century roads will also be affected. Fifty 19th century land parcels will be affected, but most of this would be from changes to the road network. Only 10 parcels will be directly affected by construction of the freight hub, all of them rural. Further sites should be expected within this option, but in smaller numbers than options 3 and 4. A Medium-Low impact should be expected for this option.	2
3	Recent research has identified two new archaeological sites that would be affected by option 3: the Bunnythorpe School and Tremewan's store/ house at the corner of Campbell Road and Dixon's Line. Carrying over from research for workshop 2, one named stream, the NIMT railway and five 19th century roads will also be affected. One hundred and twenty-four 19th century land parcels will be affected, many of them small, high density urban or suburban sections at Bunnythorpe. There is a Medium-High potential for substantial adverse effects to archaeological sites associated with this option, though further research may determine the actual potential to be lower.	4
4	Recent research has identified one new archaeological site that would be affected by option 4: a cottage on Railway Road (opposite the Glaxo building). Carrying over from research for workshop 2, one named stream, the NIMT railway and seven 19th century roads will also be affected. Forty-seven 19th century land parcels will be affected, being predominantly lower density suburban or rural sections. There is a Medium potential for substantial adverse effects to archaeological sites associated with this option, though further research may determine the actual potential to be lower.	3

Figure 1: Trondheim/Trondhjem saw mill and settlement as viewed from adjacent railway station.

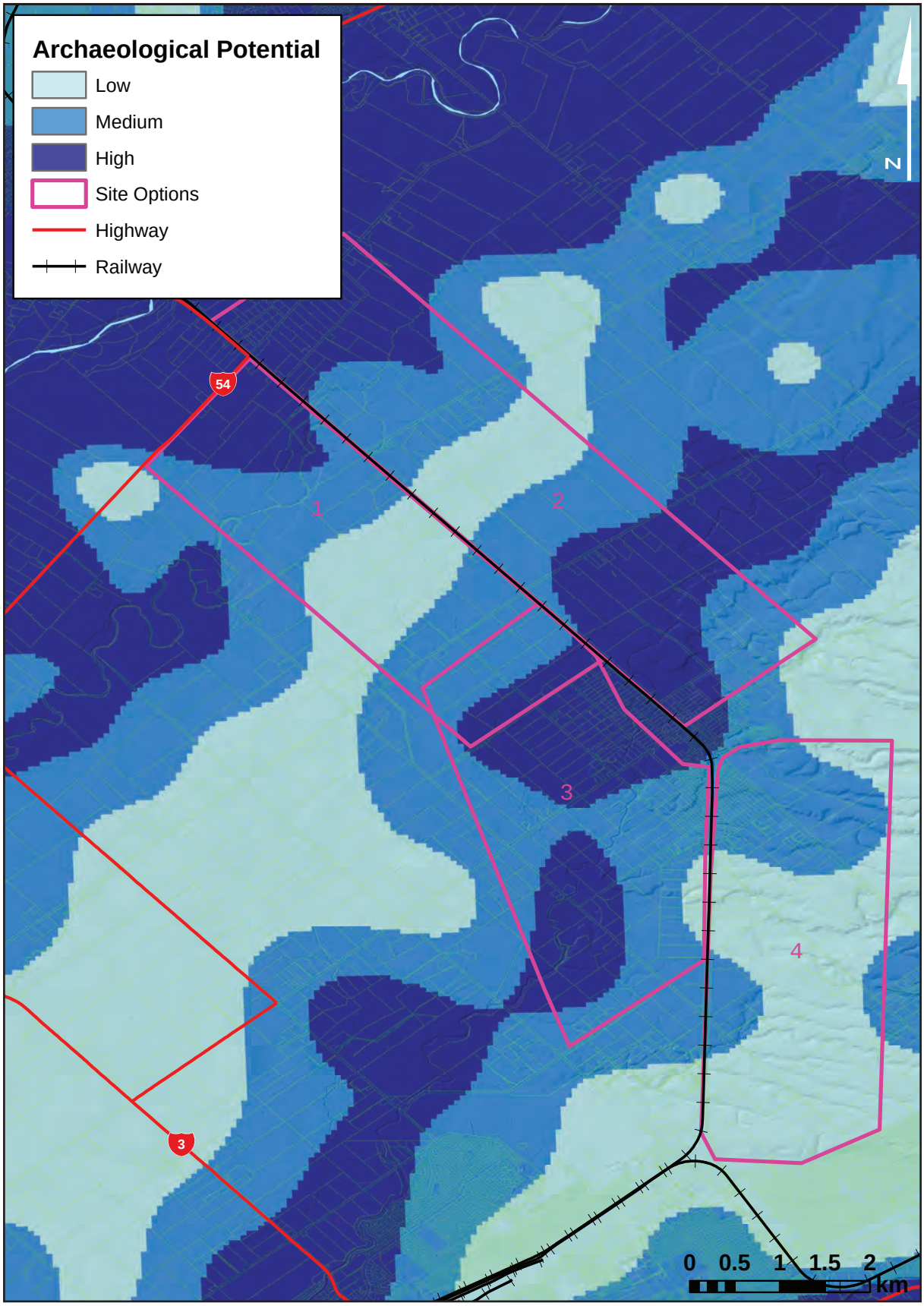

Figure 2: Archaeological potential as modelled for long list site options 1-4 at workshop 2.