

Infrastructure Projects

Southern



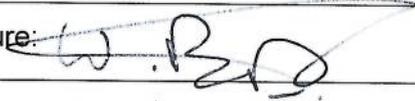
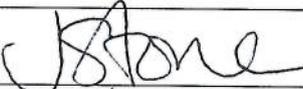
Welborne Station Pre-GRIP Feasibility Study

157132-NRS-REP-EMF-000001

28 November 2017



Document management

Prepared by: Will Brotherhood	Signature: 
	Date: 29/11/2017
	Job Title: Project Engineer (Track)
Reviewed by: Nana Bio	Signature: 
	Date: 29/11/2017
	Job Title: Project Engineer (Civils)
Accepted by: Chris Thurbon	Signature: 
	Date: 29/11/17
	Job Title: Scheme Project Manager
Endorsed by: Jill Stone	Signature: 
	Date: 29/11/17
	Job Title: Sponsor

Version number	Comments	Date
0.1	First draft issued to Sponsor for comment.	12/10/2017
0.2	Amended to incorporate comments received from Sponsor.	06/11/2017
0.3	Updated based on clients feedback	27/11/2017
1.0	Final version	28/11/2017

Executive Summary

Network Rail Infrastructure Projects Southern Development (IPSD) team have been commissioned by the Network Rail System Operator (the internal client for this work) to undertake a Pre-GRIP (Governance for Railway Investment Projects) feasibility study on behalf of Fareham Borough Council. The Council is progressing plans to develop a new community development known as Welborne which will be located to the north of Fareham in Hampshire.

The key aim of the study was to investigate the feasibility of providing a new railway station on the Eastleigh to Fareham line (also known as the Botley line) to allow the Welborne development to be connected to the railway network and to identify potential locations.

The Eastleigh to Fareham line is approximately 9miles long and it is proposed that the new station is located on a 4mile stretch of single line. It is anticipated that the proposed station would be implemented in two phases;

- Phase 1 would include a single station platform serving the current single line. It is assumed that the single line will be re-aligned to its optimum position in anticipation of future double tracking.
- In Phase 2, the single line section is double tracked and requires 2 platforms to serve anticipated increases in demand.

The station would be a category F station in accordance with written guidance from the Department for Transport. This is classified as a non-staffed station and there is no mandatory requirement for a station building. Platform shelter, seating and information helpline facilities have been proposed in this feasibility study.

This study has investigated 4 options as summarised below-

Option	Location	Distance from Welborne Development	Number of car parking spaces	Order of magnitude estimate (Phase 1 + 2)
Option 1	ELR: ETF 81.1052M.Yds to 81.1322M.Yds	2.5Km	Up to 500	£85m-£98m
Option 2	ELR: ETF 81.1052M.Yds to 81.1322M.Yds	1.1Km	Up to 15	£54m-£62m

Infrastructure Projects

Option 3	ELR: ETF 81.1052M.Yds to 81.1322M.Yds	0km but requires new link into development	Up to 100	£69m-£79m
Option 4	ELR: ETF 81.1052M.Yds to 81.1322M.Yds	0km but requires new link into development	Up to 200	£68m-£78m

In all four options, the platform works can be accommodated within the current NR land boundary. Land beyond the NR boundary is required for the proposed station building and new infrastructure such as parking, access road and new structures to facilitate access links to the wider road network. Future design studies should investigate requirements for temporary and permanent land take requirements in more detail.

When comparing the options, Option 4 offers the most favourable solution in terms of accessibility as it is located adjacent to the proposed Welborne development. It provides flexibility to the developer and allows the new station to be integrated with the future transport strategy of Welborne.

Contents

1. Introduction	7
2. Overview of existing infrastructure.....	9
3. Design Constraints	14
4. Options Review	18
4.2 Overview of Option 1	19
4.3 Overview of Option 2.....	21
4.4 Overview of Option 3.....	24
4.5 Overview of Option 4.....	27
5. Multi-Disciplinary Review	30
5.1 Civils and geotechnical.....	30
5.2 Track.....	30
5.3 Electrification & Plant (E&P).....	30
5.4 Signalling	31
6. Environmental	32
7. Pros and cons of options	33
8. Hazard Identification	34
9. Order Of Magnitude.....	35
10. Recommendations and next steps	38

Glossary of Terms / List of Abbreviations

Term	Explanation / Meaning / Definition
CARRS	Civil Assets Reporting and Records system
DC	Direct Current
DIA	Diversity and Inclusion Assessment
E&P	Electrification and Plant
ETF	Eastleigh to Fareham
GRIP	Governance of Railway Infrastructure Projects
HV	High Voltage
NR	Network Rail
RMM	Rail Method Measurement
SSSI	Special Site of Scientific Interest
TOC	Train Operating Company
XLPE	Cross Linked Polyethylene

1. Introduction

1.1.1 Network Rail IP Southern Development has been commissioned by Fareham Borough Council via the internal client (Network Rail System Operator) to undertake a high level feasibility study aimed at providing a new station on the Botley line. The new station will serve the proposed new community of Welborne which will be located on the north of Fareham.

1.1.2 The boundaries of the Welborne Development and the surrounding areas are provided in [Figure 1].

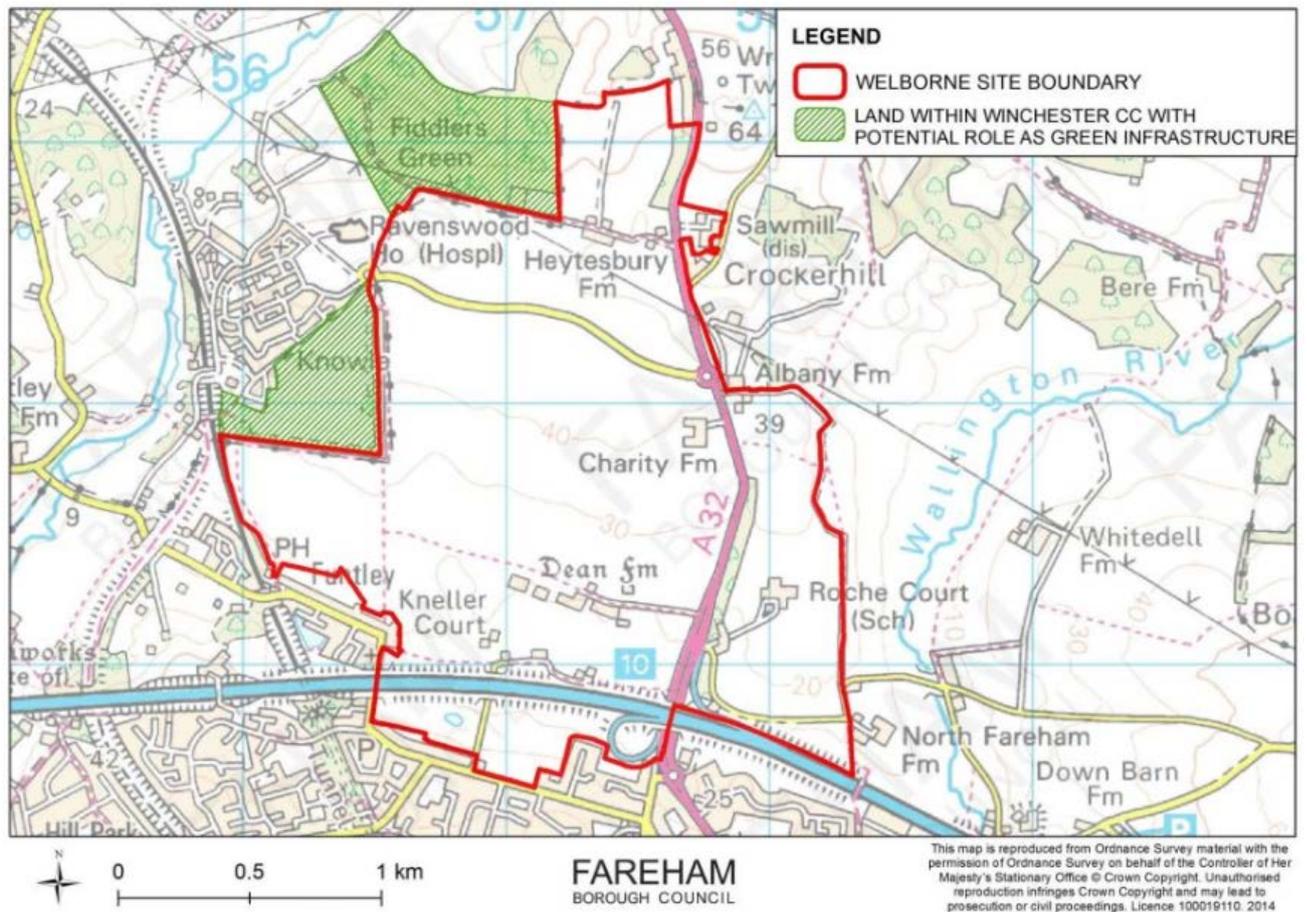


Figure 1 - Boundaries of Welborne development site

1.1.3 A layout of the railway line is provided in [Figure 2]. The line is third rail electrified and there are currently 2 trains per hour in peak times and 1 train per hour in off peak times in each direction between Portsmouth and Waterloo via Eastleigh.

Infrastructure Projects

Botley Line



Figure 2 - Single line section of Botley line (in red)

1.1.4 This study has investigated two phases as instructed by the client and they are based on the infrastructure assumptions below;

- Phase 1 is based on the current infrastructure and assumes that the single line between Fareham North and Botley remains unchanged. The level of station facilities shall be designed assuming a Category F station.
- Phase 2 assumes that the single line section is double tracked and the new station would require an island platform or 2 single face platforms.
- It is assumed that the single line will be located in its optimum position in Phase 1 and include active provision for Phase 2 without the deconstruction of existing platform infrastructure.

2. Overview of existing infrastructure

- 2.1.1 The Eastleigh to Fareham line (ETF) is approximately 9 miles long and starts at 74miles 4chains and ends at 83miles 46chains approximately. The ETF line connects the train service between Waterloo Station and Portsmouth Station. It is a double track Direct Current (DC) fed electrified line which converges into a single line at approximately 79miles shown in **[Figure 3]**.
- 2.1.2 There are 2 stations along the route – Hedge End and Botley. The line speed is 70mph on both double and single line sections.
- 2.1.3 The railway landscape varies between embankments, cuttings, tunnels and bridges and there are approximately 200 known structures along the route according to Network Rail’s Civils Asset Reporting and Recording System (CARRS). There are approximately 80 structures within the single line section.

LOR	Seq.	Line of Route Description	ELR
SW135	002	Eastleigh to Fareham	ETF
Location	Mileage M	Ch	Running lines & speed restrictions
HEDGE END	76	76	
BOTLEY	78	72	
Tapnage Tunnel 122 Yards	81	35 to 81 40	

Figure 3 - Layout of single line at Botley Station (Extract from NR Sectional Appendix)

2.1.4 The area of interest for the proposed new station lies on the single line section and is bounded by Tapnage Tunnel to the north and Fareham Number 2 Tunnel to the south. The latter tunnel carries the railway underneath the strategic M27 motorway. The River Meon runs east to west and crosses the railway at approximately 82miles. The railway is carried by the multi-span Knowle Viaduct over the River Meon **[Figure 5]**.

LOR	Seq.	Line of Route Description	ELR
SW135	003	Eastleigh to Fareham	ETF
Location		Mileage M Ch	Running lines & speed restrictions
Fareham No.1 Tunnel 147 Yards		83 13 to 83 20	
Fareham No.2 Tunnel 553 Yards		83 21 to 83 46	

Figure 4 - End of single line (Extract from NR Sectional Appendix)



Figure 5 - Knowle viaduct river span

- 2.1.5** There are a number of signals within the single line section; however, only one signal is impacted by this study. This is signal E821R which is a repeater signal for E821 (located south of Fareham Tunnel) that controls the exit route in the down direction towards Fareham. Other signals located within the single line section are E826R and E826 which are the repeater signal and respective signal that control the exit route in the up direction towards Eastleigh. These signals are located to the North of Tapnage Tunnel but fall outside the geographic boundaries of this study.



Figure 6- Signal E821

Infrastructure Projects

2.1.6 There are several culverts within the single line section and the sole footbridge on the route called Knowle Halt footbridge is located at 82miles and 884yards shown in **[Figure 7]**.



Figure 7 - Knowle Halt Footbridge

2.1.7 Table 1 summarises the known assets in the area.

	Number of assets	Commentary
Culverts	22	
Viaducts	3	Botley viaduct and Knowle viaduct (Over River Meon)
Tunnels	3	Tapnage Tunnel and Fareham Number 1 and 2 Tunnels.
Underline Bridges	11	
Overline Bridges	13	Includes Asylum Bridge and M27 extension to Fareham Number 2 Tunnel
Retaining walls	27	
Footbridges	4	Only Knowle Halt footbridge is located within proposed station area
Signal posts and other structures	14	

Table 1 - Register of assets (ETF - 73miles to 84miles)

2.1.8 A vertical profile of the land bordering the railway corridor is provided in **[Figure 8]**

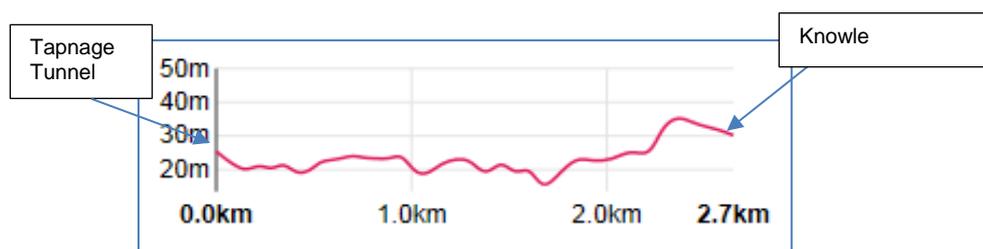


Figure 8 - Site vertical profile

- 2.1.9 The single section of the ETF line was historically a two track railway until the second line was removed in the 1970s. The remaining single track is believed to have been relocated to the centre of the formation to reduce maintenance costs associated with maintaining gauging and clearance through structures with limited headroom.
- 2.1.10 An initial review of the horizontal alignment based on the Network Rail 5 mile line diagram indicates that a transition between two curves exists from 81miles 990 yards to 82miles 1650 yards. Starting from the low mileage end, the curve radius is 1590m in a right hand curve which transitions into a left hand curve of radius 2633m at mile 82 605 yards.
- 2.1.11 The steepest vertical alignment identified from the Network Rail 5 mile line diagram is a 1 in 466 gradient and this is within acceptable tolerances for locating station platforms. The gradient changes to 1 in 517 and then to 1 in 7650. This can be seen in **[Figure 9]**. A risk assessment and site topographical survey will be required for each option to validate the vertical alignment but generally the alignments are not considered prohibitive to providing a new station.

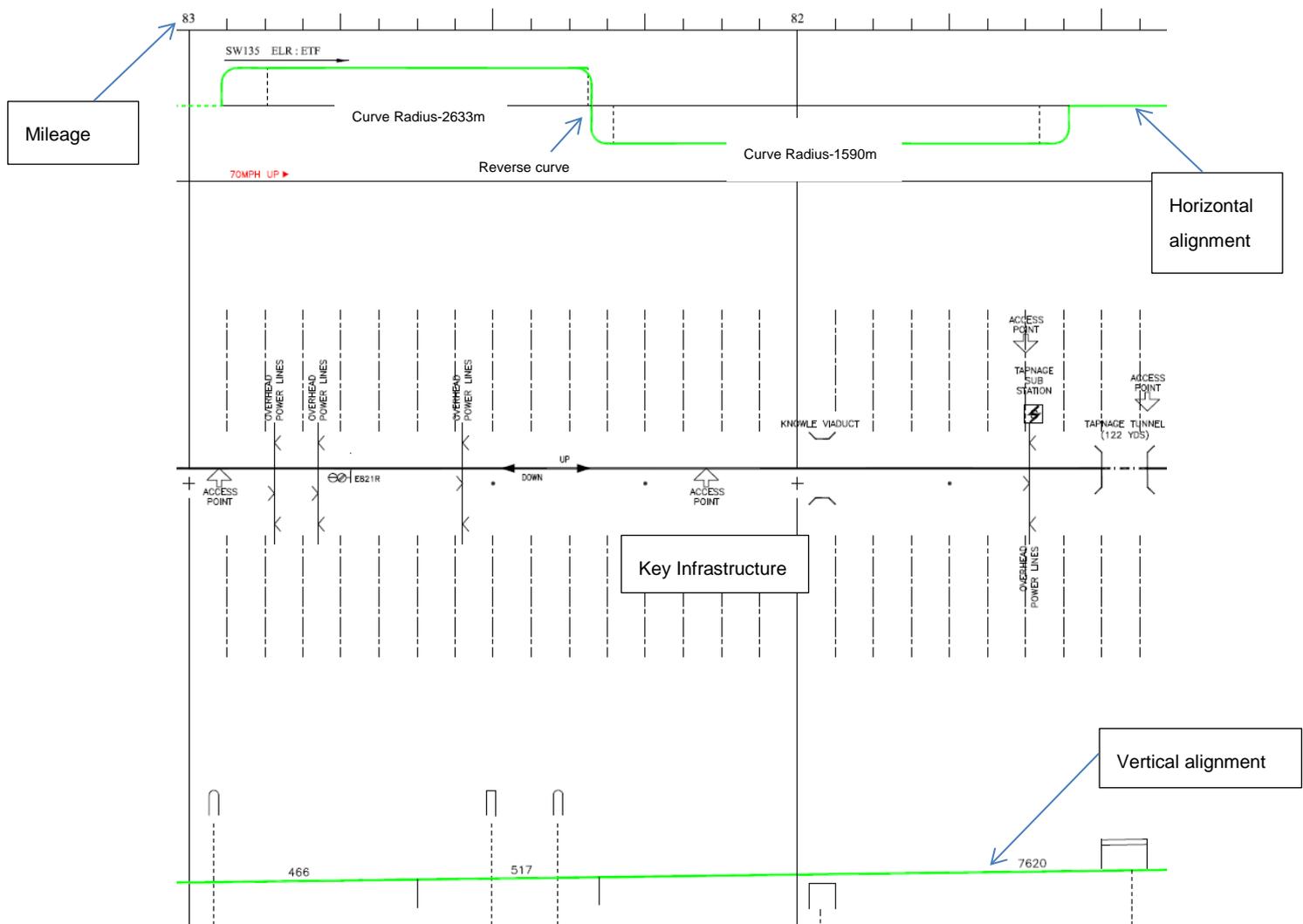


Figure 9- Extract from Network Rail 5 mile line diagram

3. Design Constraints

- 3.1.1 This study has investigated four options as per the instruction issued by the client. All 4 options lie between Tapnage tunnel and Fareham No.2 Tunnel. The options are numbered from low mileage to high mileage.
- 3.1.2 The key drivers of option development were accessibility, impact on existing railway infrastructure and ground conditions.
- 3.1.3 Evidence from the British Geological Society and NR asset records suggests that the underlying ground supporting the railway is mainly chalk and this has resulted in significant land slips in some areas. The landscape changes significantly south of the M27 boundary and there are challenging ground conditions which potentially include a high water table and soft chalk. Providing a new railway station in this area is likely to incur significant costs and pose substantial accessibility issues. These are the leading reasons for constraining the location of the station north of Fareham Tunnel.
- 3.1.4 Two key boundaries have been identified - Tapnage tunnel to the north and Fareham number 2 tunnel to the south. Locating a new station north of Tapnage tunnel would pose accessibility challenges for residents of the new Welborne development. Options north of the tunnel would also require a significant upgrade in the existing roadway in order to accommodate the additional expected traffic levels.
- 3.1.5 The limits defined above can be seen highlighted in blue below.

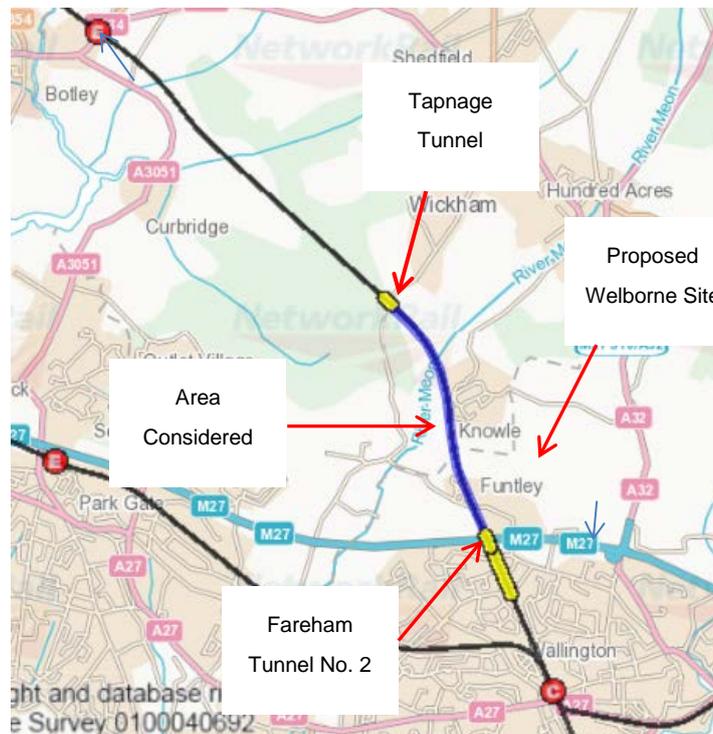


Figure 10 - Single line route between Botley and Fareham

3.2 Permanent land take requirements

- 3.2.1** For each option, Phase 1 and Phase 2 have been considered but an outline has only been drawn for phase 2. For phase 1, the land impacts will be the same to the eastern side of the railway corridor (Welborne development side) as it is expected that any single platform option would active passive provision for the second platform to be installed at a later date.
- 3.2.2** It is proposed that the single platform associated with Phase 1 is located to the eastern side of the railway to allow direct connection to the new Welborne development. This eliminates the need for a footbridge which would be required if the platform is located to the western side of the railway.
- 3.2.3** It has been assumed that half of rail corridor, shown in **[Figure 11]**, required to accommodate track and platform infrastructure for Phase 2 is required for Phase1.
- 3.2.4** The proposed platforms in all phases are 250m in length to accommodate a 12-car train with the necessary stopping allowances. The required railway corridor width is 15.9m for Phase2 which allows for the track to be double tracked and a footbridge with lifts/stairs for passenger interchange to be provided between platforms. In Phase1 this would be halved to 8m as discussed previously.

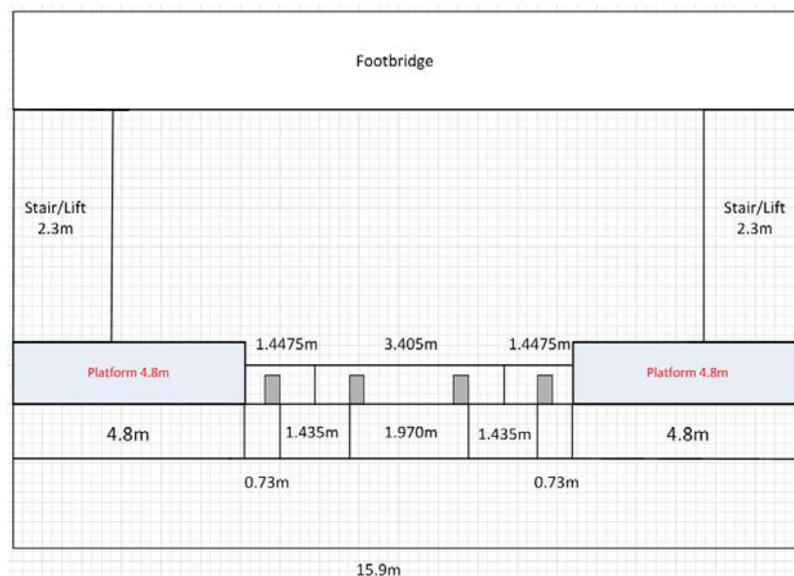


Figure 11- Cross section of station allowances (not to scale)

- 3.2.5** In both scenarios the category of station will be either category E or F (small staffed/unstaffed) station based on the station predicted passengers per annum provided by the client. The station category has been established from guidance provided by the Department for Transport. A summary of the guidance can be seen in **[Figure 12]**.

Infrastructure Projects

Description	No. Stations	%	Av Daily Passengers (per station)	% of Customers	Criteria (per annum)
A. National Hub ²	25	1	90,000	42	Over 2m trips: over £20m
B. National Interchange	66	3	13,000	15	Over 2m trips: over £20m
C. Important Feeder	275	10	5,000	20	0.5 – 2m trips: £2-20m
D. Medium Staffed	302	12	2,500	13	0.25-0.5m trips: £1-2m
E. Small Staffed	675	27	700	8	Under 0.25m trips: under £1m
F. Small Unstaffed	1,192	47	100	2	Under 0.25m trips: under £1m
Total	2,535	100	111,300	100	

Association of Train Operating Companies (ATOC) and National Audit Office

Figure 12- Station categorisation (Better Rail Station. Department for Transport. 2009)

3.2.6 This station category is consequently used to establish the station facilities required [Figure 13] and [Figure 14].

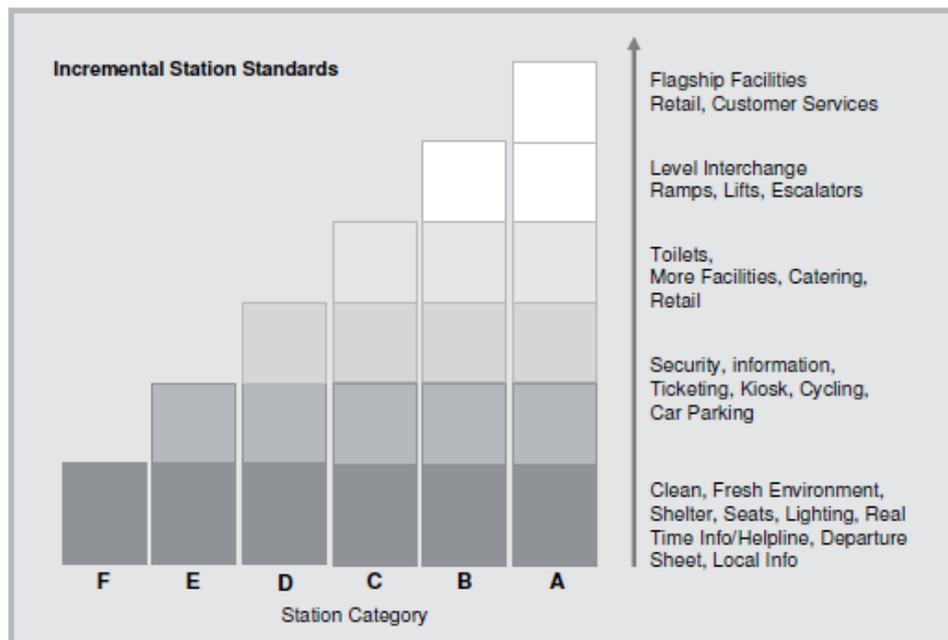


Figure 13- Typical facilities to be considered at each station

Category	Definition
A – National Hub	Major station providing a gateway to the rail network from a large area, and acts as a significant interchange hub
B – Regional Hub	Large station providing a gateway to the rail network from a large area. Often served by more than one TOC with a mix of service types. May be a terminus for some services
C – Important Feeder	Significant ‘feeder’ station, on a busy trunk route or as a subsidiary hub station. Often with services from more than one TOC and a regular long-distance service
D – Medium Staffed	Medium-sized, staffed station, with a core inter-urban business or high-volume inner-suburban business
E – Small Staffed	Small, staffed station often with just one member of staff at any one time, or for only part of the day
F – Small Unstaffed	Small, unstaffed station

Figure 14- Definition of Station Categorisation (Network Rail, 2011)

- 3.2.7** The above guidance confirms that there is no mandatory requirement for a station building. As all the facilities considered for category F can be accommodated on the platform and have been allowed for in the platform width. However, with this being a new station it is considered prudent to consider category E facilities. This is consistent with the approach taken for similar schemes. Consequently, a station building of 144m² has been allowed for and this is shown in green on the option drawings.
- 3.2.8** A full Diversity Impact Assessment (DIA) will be required as the project develops to validate the assumptions made for station facilities.
- 3.2.9** Car parking provision has been investigated for all options and a range of car parking spaces, including provision for disabled parking, have been proposed. The car parking numbers provided are for guidance only and a full accessibility review should be undertaken in future design studies in conjunction with the Train Operating Company (TOC) to validate these proposals. This should align with the transport strategy proposals for the Welborne development.

4. Options review

4.1.1 This section outlines the 4 options developed for the new station. Shown in [Figure 15] is the location of each option.



Figure 15- Overview of option locations

4.2 Overview of Option 1

4.2.1 Option 1 is located at approximately 81 miles 1052 yards between Titchfield Lane and Mayles Lane. The new station will be located approximately 150m from the tunnel portal. [Figure 16] shows the general arrangement and location.

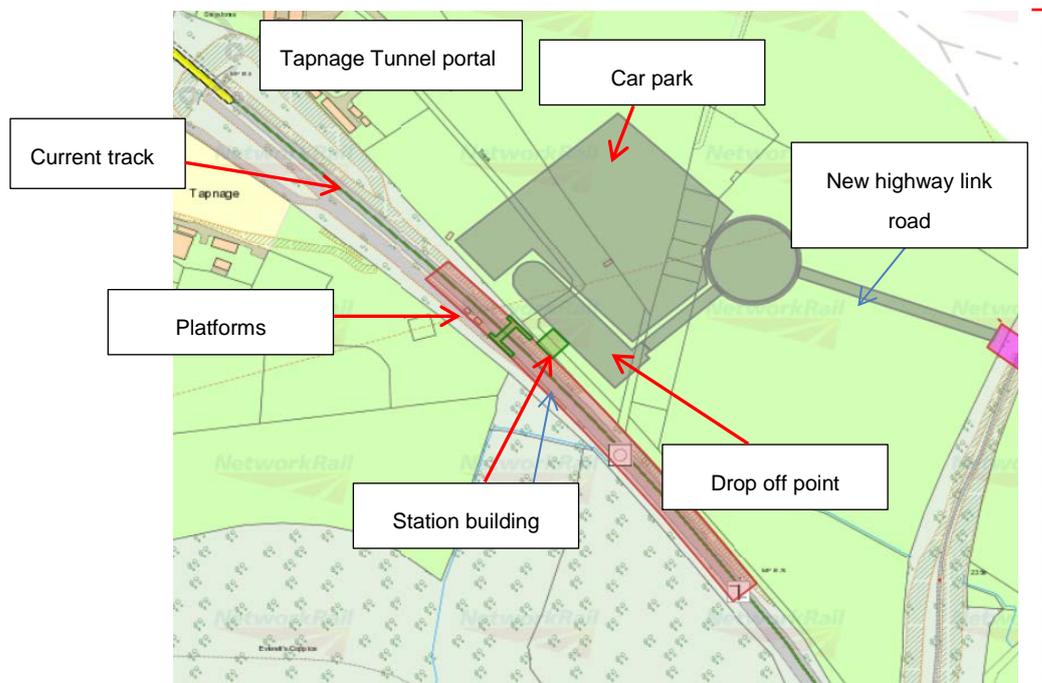


Figure 16- Option 1 proposed layout

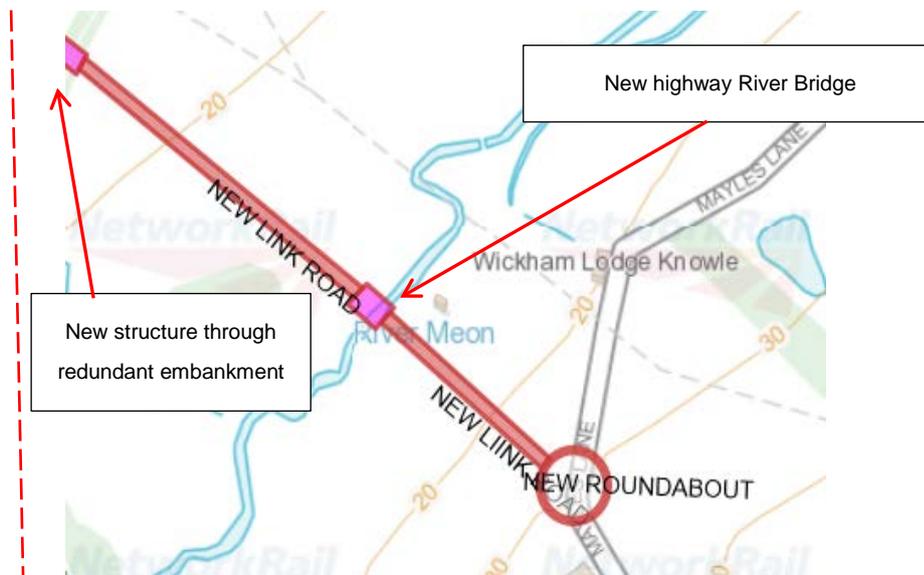


Figure 17- Option 1 proposed layout continued

- 4.2.2 The north end of the proposed platform location is within a cutting which will require earthworks to widen. This cutting extends for roughly a third of the platform where the land bordering the railway then flattens to the same level as the railway corridor.
- 4.2.3 Two access routes were investigated for the station – the first option would require a 3mile round trip from the proposed new development via Funtley road and Titchfield Lane. The second option involves the provision of a new access road between Titchfield lane and Mayles Lane. This will require a new multi-span overbridge over the River Meon. The latter option offers better accessibility benefits and therefore has been shown in **[Figure 17]**.
- 4.2.4 There are non-railway electricity pylons within close proximity of the tunnel entrance that run in the east-west direction across the railway. Their exact position will need to be established with a site survey and incorporated in future design studies.
- 4.2.5 Option 1 offers the best solution for car parking and it is estimated that up to 500 car parking spaces can be provided. There is a golf course (Wickham Park Golf Club) adjacent to the proposed car parking area and the Golf club will need to be consulted in future design studies.
- 4.2.6 The land required outside of the NR boundary for this option would be around 21,782m². This is dependent on highway arrangement and car parking. This can be seen **[Figure 18]**

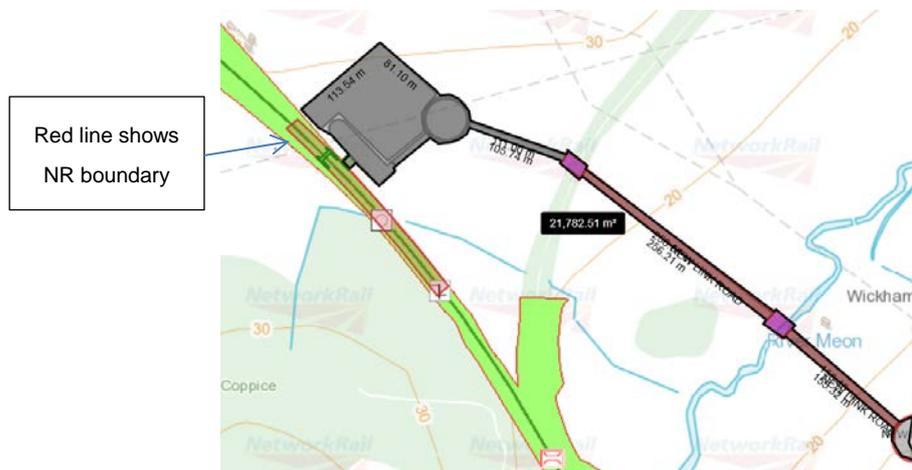


Figure 18- Option 1 additional land take outside NR land boundary (NR highlighted in green)

4.3 Overview of Option 2

4.3.1 Option 2 is located at the old Knowle Halt station site which was decommissioned in the 1960s. A layout of the proposed station site is shown in **[Figure 19]**.

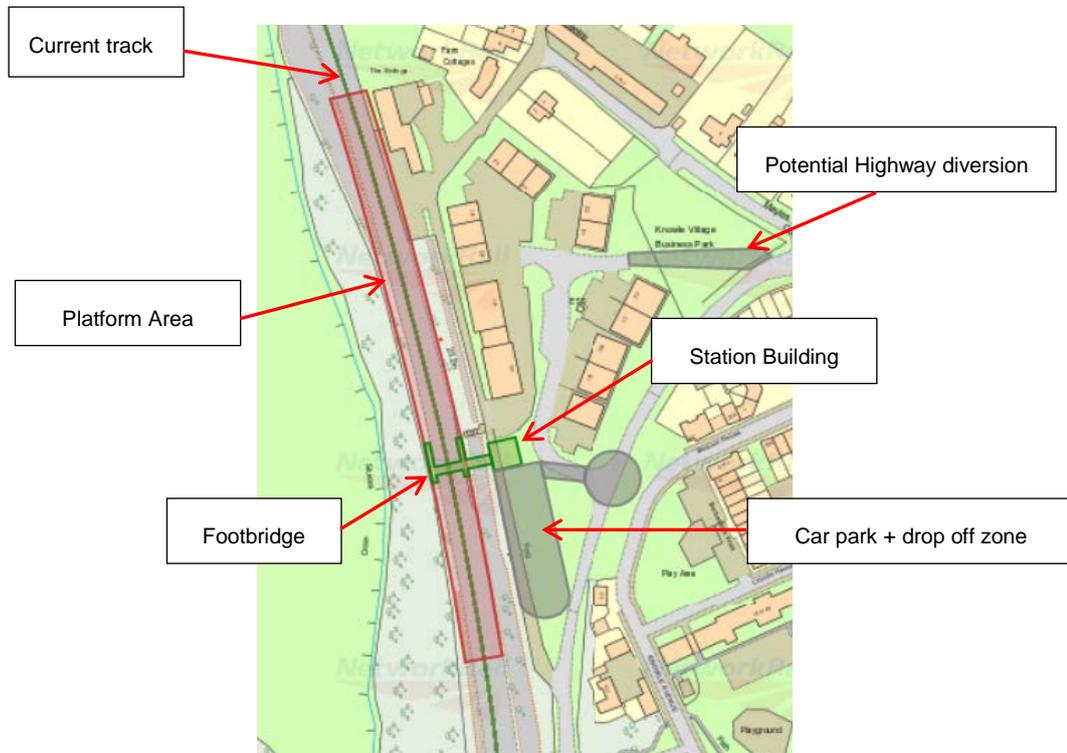


Figure 19- Option 2 Proposed layout

- 4.3.2 Photographs from NR asset records show that the coping stones to the redundant platforms have been removed and obscured by vegetation. Asset records also confirm that the original platform would need to be extended to meet the required 250m length platform for this project.
- 4.3.3 It is proposed that the redundant platform is removed and new platform infrastructure is constructed in its footprint. It is anticipated that construction could be completed offline with minimal impact on the operational railway.
- 4.3.4 The original station building is still in situ however available records suggest that it is currently being used as a cafeteria. The site is also constrained by a number of industrial units. This has led to the drop off zone and station building being positioned at the country end of the platform. The existing land use within the immediate vicinity of the redundant station will need to be established by future design studies.

Infrastructure Projects

- 4.3.5 Option 2 will require some alteration to the local highway to improve vehicle circulation and also ensure they are integrated with the proposed drop off point.
- 4.3.6 Up to 15 car parking spaces and 3 disabled bays can be provided with this option.
- 4.3.7 There is minimal land clearance for the platforms to be accommodated adjacent to the railway however there is a small height difference between the proposed station building and the platforms which will require a ramp or lift.
- 4.3.8 The land required outside of the NR boundary for this option would be around 2048m². This is dependent on the final highway arrangement and car parking **[Figure 20]**. It is anticipated that some land take will be required to create a diversionary route into the industrial estate. This has been highlighted in **[Figure 19]**.
- 4.3.9 The area highlighted for the car parking and drop off zone can be used as a worksite for the station build. Temporary land take would potentially be required to allow the construction of the additional platform in Phase2.
- 4.3.10 There is also a private access road which needs to be realigned to allow for the creation of a drop off zone to the new station.



Figure 20- Option 2 land take including NR land boundary

- 4.3.11 There is an opportunity to re-use the original station building and utilise its car park. The car park currently has 8 spaces (in addition to the 18 spaces identified in 4.3.6)

and the road leading to it would require enhancement work to meet anticipated traffic levels from the proposed Welborne Development. This opportunity has not been included in the currently proposed layout for Option 2 as Network Rail does not own this building and therefore it would need to be purchased.



Figure 21- Original Station Building and car park

4.4 Overview of Option 3

4.4.1 Option 3 is located approximately 200m from the location of Option 2 between Mayles Lane and Funtley road. This option identifies an area of land that is less constrained than Option 2, thus reducing the impact on future construction activities on adjacent properties.

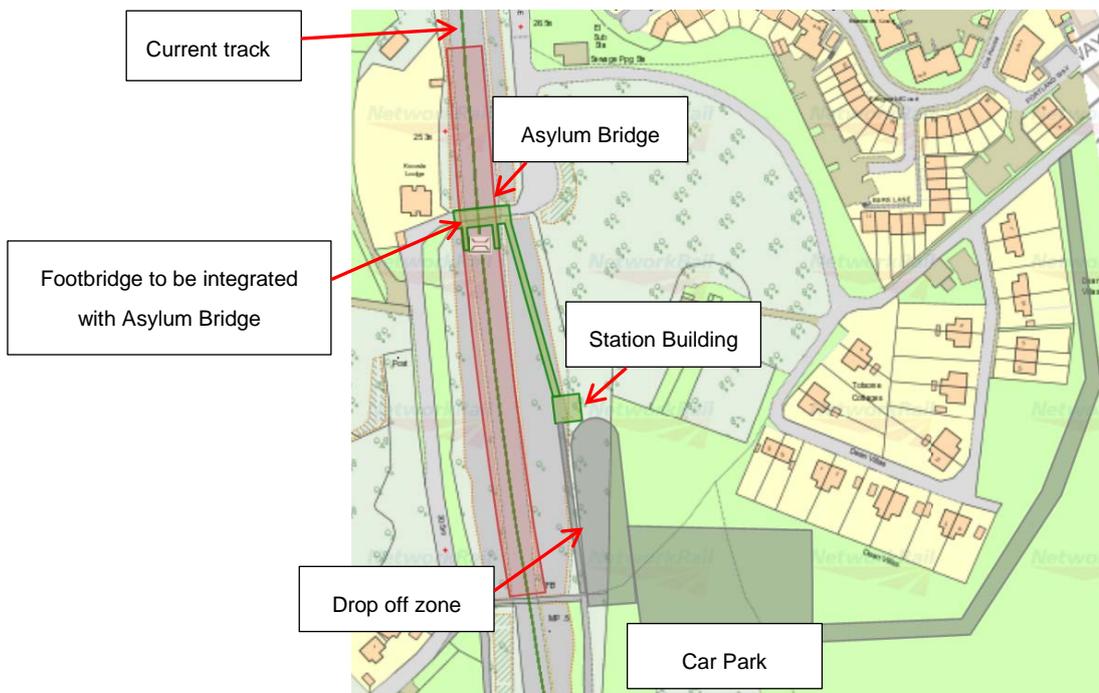


Figure 22- Option 3 Proposed Layout

4.4.2 Due to the narrow roads in the immediate vicinity of Asylum Bridge and the limited space, the proposed location for car parking and drop off zone has been shown to the south of the station. This will require an access road however there may be an opportunity to link this directly to the new Welborne development and reduce the impact on properties.

4.4.3 The availability of space consequently allows an increased number of parking facilities to be provided with Option 3. It is envisaged that up to 100 car parking spaces could be provided.

4.4.4 The site is constrained by Knowle footbridge at the southern end and Asylum Road bridge on the northern end. The latter bridge is a highway bridge with a width restriction and generally in poor condition. It is plausible that the bridge will require reconstruction in Phase1 as the single line would need to be re-aligned to its optimum position. Consequently, it is proposed that Asylum Bridge is reconstructed in Phase1 and provision is made in the new bridge to allow platform interchange thus eliminating the need for a separate footbridge.

Infrastructure Projects

4.4.5 Both platforms will be located within a cutting and alterations to the landscape will be required to link the station drop off zone to platform access and interchange facilities.

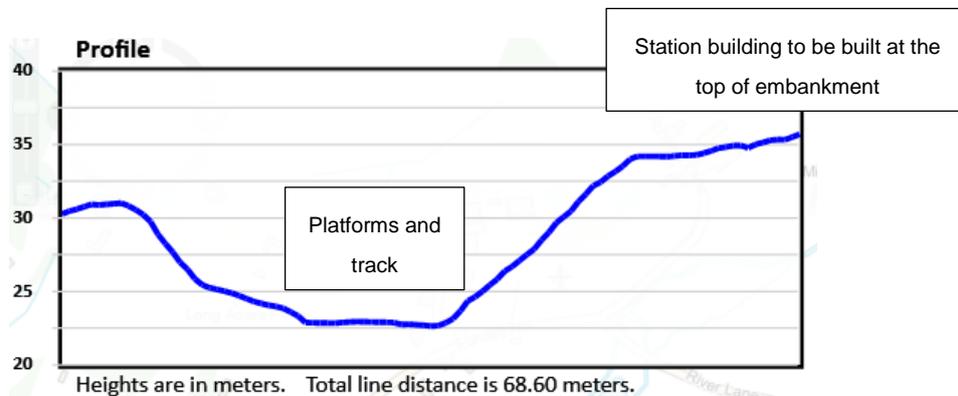


Figure 23- Profile of cross section

4.4.6 It needs to be ascertained during future design works whether there are track gauging issues at Asylum Bridge. This will require a topographical survey and gauging survey.

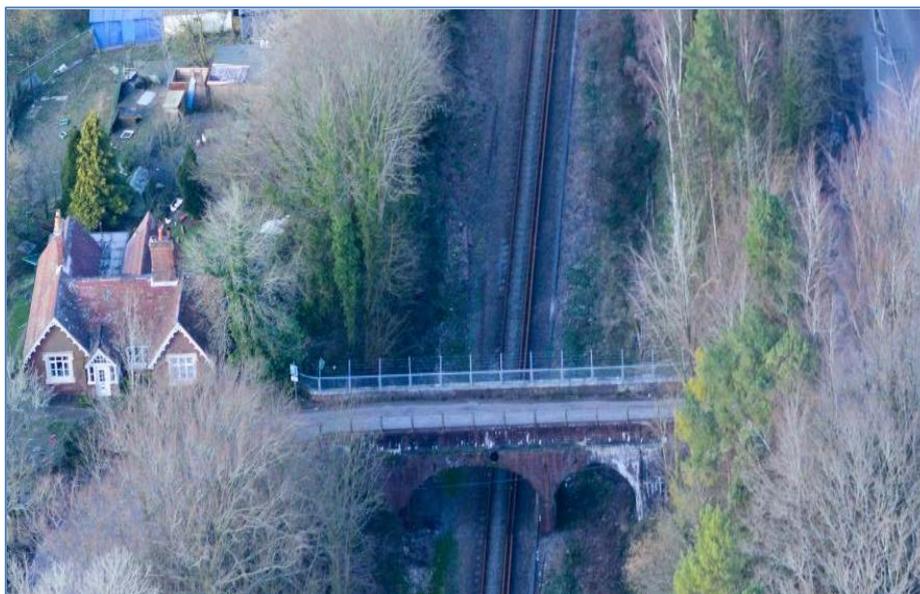


Figure 24 - Asylum Bridge

Infrastructure Projects

4.4.7 The land required outside of the NR boundary for this option would be around 7567m². This is dependent on highway arrangement and car parking [Figure 25].



Figure 25 - Option 3 land take including NR land boundary (highlighted in green)

4.5 Overview of Option 4

- 4.5.1 Option 4 is the closest site to the proposed Welborne development. The proposed station location can be seen in **[Figure 26]**.
- 4.5.2 The site provides sufficient area to support the provision of station facilities and car parking however this will impact on the Welborne development land.
- 4.5.3 The land immediately adjacent to the station is at a similar level to the rail corridor and it is anticipated that earthwork requirements would be minimal.

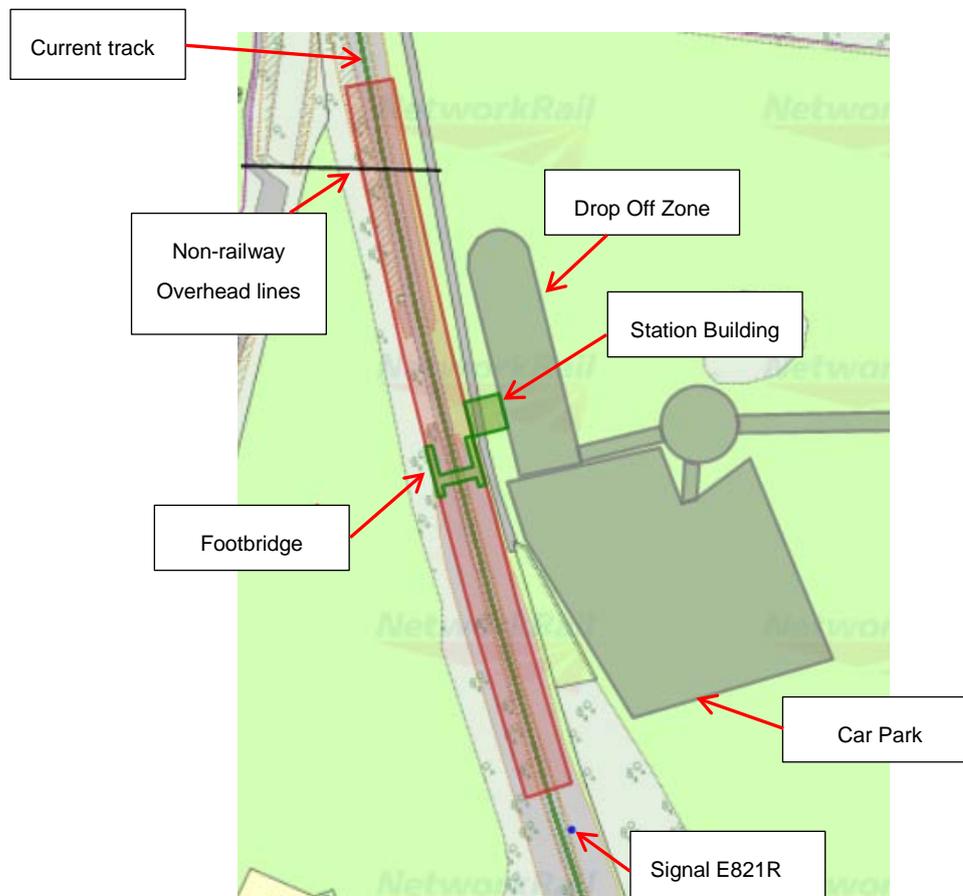


Figure 26 - Option 4 proposed station location

- 4.5.4 The proposed station location has taken into consideration the location of signal E821R.
- 4.5.5 Initial assessment confirms that up to 200 car parking spaces could be provided with this option. The final number will depend on the parking and local transport strategy for the Welborne development. An allowance for a drop off zone has been included in the above figure.

- 4.5.6 There are non-railway overhead electrical power lines that run above the proposed platform ends in this option. These have been highlighted in black in **[Figure 26]**. The height of these would have to be ascertained with a survey and incorporated into future design studies.
- 4.5.7 The land area required outside of the NR boundary is approximately 9600m².

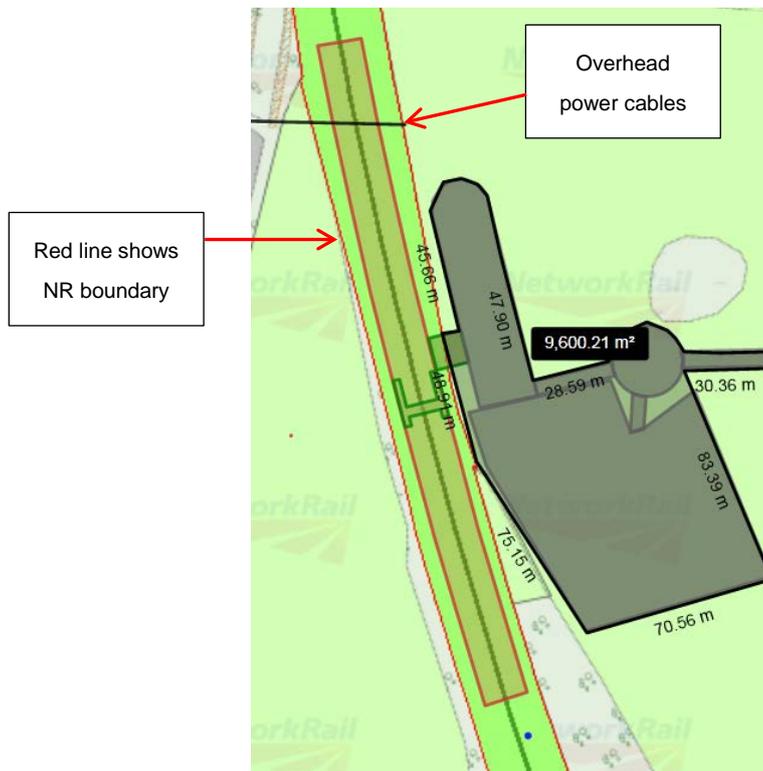


Figure 27- Option 4 land take outside NR land boundary (NR highlighted in green)

4.6 Summary of options.

4.6.1 The four options and their associated key provisions are summarised in [Table 2].

	Number of car parking spaces	Core land area required for construction (Non-NR & permanent land only) in square metres.	Platform interchange facility	Distance from Welborne Development
Option 1	500	21,782	Footbridge	2.5Km
Option 2	15	2,048	Footbridge	1.1Km
Option 3	100	7,567	Existing road bridge	0km. Dependent on access strategy of Welborne development.
Option 4	200	9,600	Footbridge	0km. Dependent on access strategy of Welborne development.

Table 2 – Option summary and key provisions

5. Multi-Disciplinary Review

5.1 Civils and geotechnical

- 5.1.1 Option 1 requires the most onerous civils intervention and there is significant interface with the existing highway. A full ground investigation will be required for all options to ascertain the nature of ground conditions and whether the assets proposed (footbridges, platforms and station buildings) can be provided without significant remedial works.
- 5.1.2 Where existing structures do not meet the standard gauge for a double track railway, they will need to be modified or reconstructed. This issue is pertinent to Asylum Bridge and Funtley Road Bridge.

5.2 Track

- 5.2.1 Network Rail current standards dictates that a platform's minimum radius should be 1000m to ensure a safe stepping distance is maintained throughout the platform length. And therefore all possible locations within the constraints satisfy this. However it is non-preferred to have platforms installed where transition elements exist between 2 circular curves and therefore the station location should ideally not be located between mile 82 and 550 yards and mile 82 and 660 yards. This only affects option 3 and makes it non-preferred in terms of track.
- 5.2.2 The vertical alignment throughout all 4 of the options is within current NR standards for a platform and is not considered a factor in deciding station location. This is based on the assumption that no splitting or stabling of rolling stock will occur at the proposed station.
- 5.2.3 It would be preferable to re-align the existing single line in Phase 1 to allow for future provision of a second track and platform in Phase 2. Removing the need to modify the Phase 1 infrastructure in Phase 2. This approach would also bring constructability benefits and minimise track access as it allows the new platform to be constructed off line away from the track.

5.3 Electrification & Plant (E&P)

- 5.3.1 There are no E&P engineering concerns that prohibit the implementation of any of the proposed locations.
- 5.3.2 For the commissioning of Phase 1, when the track work is slewed to the proposed alignment of the easterly platform face, the top contact conductor rail will have to be relocated on to the other side of track. The conductor rail will now be sited within the proposed 6 foot of Phase 2, once the second platform and line have been constructed.

There shall not be any breaks in the conductor rail throughout the length of the station options.

- 5.3.3 There is a high voltage (HV) trough route, containing feeder 2648 that runs along the line (east of the track) that would require cutting and diverting. The HV cable is of XLPE (cross linked polyethylene) construction so can be cut and extended if required to reroute in the area of the proposed station options. Common practice is either to run it through the platform in buried ducts or to run the route behind the platforms enclosed in a trough route. In all station options it is preferable to divert the route away from construction activities and then run the HV cables within buried ducts within the platform once construction is completed. This will require switch-outs and I&E of the HV feeder.
- 5.3.4 With the signalling system being a single line section there are no signalling power supplies in the proposed station options.

5.4 Signalling

- 5.4.1 It is envisaged that no significant signalling infrastructure interventions would be necessary for the implementation of Phase 1
- 5.4.2 It is anticipated that the signalling arrangement will require alteration if the railway is converted to a two track railway in Phase 2. Integration of new signalling arrangements with the proposed station would be required and active provision must be made in Phase 1 to minimise abortive works.

6. Environmental

- 6.1.1 Using NR’s geospatial tool Geo-RINM Viewer, Defra’s MAGIC mapping tool and the Environment Agency, a desktop environmental study was undertaken using publicly available information. This assessment covers the Options outlined in this report, including potential land requirements for the car park and access road (referred to as the ‘Site’ for each Option). Further consideration will be required to assess the impacts of temporary construction activities when the details of these are understood.
- 6.1.2 The following protected sites have been identified within 1km of the Site
- Botley Wood and Everett’s and Mushes Copses SSSI, located immediately to the south-west of the location of option 1.
 - Ancient woodland (Mushes Copse, Quob Copse, and Botley Wood) are located at various locations and all impacts should be avoided.
- 6.1.3 No tree protection orders were identified across the site.
- 6.1.4 While the old Knowle Halt station building is in-situ and used by a local business, no listed building or heritage protection were identified for the building.
- 6.1.5 The proposed site for the new station is located in a flood zone 1, indicating that there is a low probability of flooding. A flood zone 3 which indicates a high probability of flooding is located in the immediate vicinity of the River Meon and this would need to be incorporated for any design proposals for option 1.
- 6.1.6 No Conservation Areas, Listed buildings or Ancient Monuments could be identified on Geo-RINM.

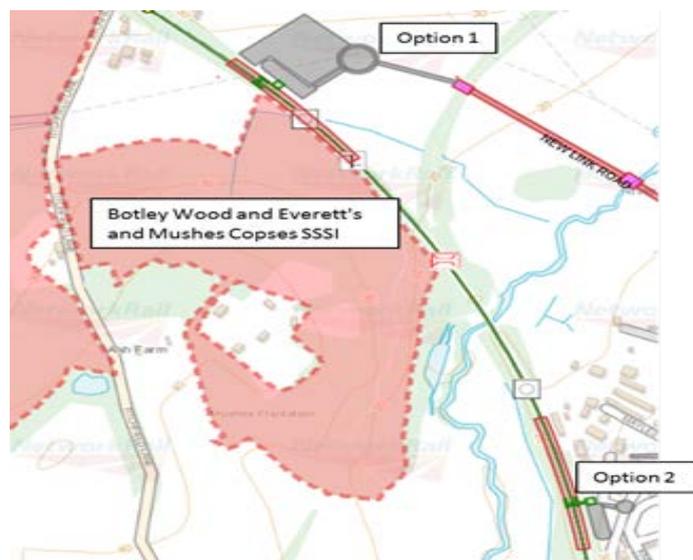


Figure 28- Location of Botley Wood and Everett’s and Mushes Copses

7. Pros and cons of options

7.1.1 The table below provides a high level summary of each option.

Option	Pros	Cons
<p>Option 1 - New station south of Tapnage tunnel at 81miles and 892yards. Station is located close to golf course on Titchfield Lane.</p>	<ol style="list-style-type: none"> 1. Larger land area available 2. Provides largest car parking area. 3. Minimal interface with residential properties 	<ol style="list-style-type: none"> 1. Interface with non-railway overhead power lines 2. Significant new highway structures required 3. Long journey time from proposed Welborne development. 4. Interface with River Meon. 5. Interface with Botley Wood and Everett's and Mushes Copses SSSI. 6. Interface with golf course.
<p>Option 2 – Located at previous location of redundant Knowle Halt Station</p>	<ol style="list-style-type: none"> 1. Allows the use of redundant Knowle Halt station facilities and existing access routes. 2. Integration with railway systems less onerous as the site is a previous location of a station. 	<ol style="list-style-type: none"> 1. Limited car parking spaces 2. Impact on adjacent properties during construction. 3. Potential local heritage issues with old station.
<p>Option 3 – Located close to Asylum Bridge and in close proximity to proposed Welborne development</p>	<ol style="list-style-type: none"> 1. Located close to highway access and allows east-west connection across railway. 2. Presence of Highway Bridge may eliminate the need for platform interchange in scenario 2 when railway is double tracked. 	<ol style="list-style-type: none"> 1. Reconstruction of Asylum Bridge potentially required. 2. Impact on adjacent properties. 3. Major earthworks due to site being in a cutting 4. Car Park would require major earthworks 5. Impact on lineside neighbours 6. Interface with Botley Wood and Everett's and Mushes Copses SSSI
<p>Option 4 - Located approximately 200m from option 3 and close proximity to Welborne development.</p>	<ol style="list-style-type: none"> 1. Option offers closest proximity to proposed Welborne development. 2. New station access strategy can be directly integrated with development. 3. Minimal earthworks as the site is on level land and not on an embankment or cutting 	<ol style="list-style-type: none"> 1. Non-railway Overhead Power Lines within the vicinity of the platform ends.

Table 3- Pros and cons of each option

8. Hazard Identification

8.1.1 A high level summary of the key safety hazards identified across the site are highlighted below.

Reference	Hazard	Location
001	Underlying soft chalk and poor ground conditions.	All options but less onerous for Option 2 and 4.
002	Overhead electricity cables	Option 1 and 4
003	Gauging issues at bridges	All options but significant for Option 3
004	Narrow roads	All options
005	Weak structures and overbridges	All options
006	Electricity from third rail	All options
007	Buried Services and HV cable routes	All options

Table 4- Hazard Identification

9. Order Of Magnitude

- 9.1.1 The order of magnitude estimate range was created by Network Rail's Cost Planning & Assurance team. The estimating team were asked to estimate all 4 options and to split these between Phase 1 and Phase 2 costs.
- 9.1.2 Phase 1 consists of the first platform together with ticket office, waiting room, access road, car parking, access road to the highway and any necessary bridge reconstruction for twin tracking. Phase 2 consists of the second platform, waiting room, footbridges and lifts if required together with the 6.5km (4 mile) of single track to convert the route to a double track configuration between approximately Botley and Fareham No.2 tunnel.
- 9.1.2 A cost estimate was produced for both single and double platforms at the locations. This is summarised in **[Table 5]** and **[Table 6]** respectively. The estimates are based on the Railway Method of Measurement (RMM) and include a risk allowance of between 53% (low range) and 76% (high range) in accordance with NR guidance for projects at pre-GRIP stage.

OPTION 1				
RMM VOLUME 1 REF	RMM GROUP ELEMENT	Phase 1	Phase 2	TOTAL COST (GBP£)
1	TOTAL DIRECT CONSTRUCTION WORKS (A)	17,851,250	17,722,500	35,573,750
2	TOTAL INDIRECT CONSTRUCTION COSTS (B)	5,355,375	5,316,750	10,672,125
	TOTAL CONSTRUCTION COSTS (A+B)	23,206,625	23,039,250	46,245,875
3	TOTAL PROJECT/DESIGN TEAM FEES AND OTHER PROJECT DEVELOPMENT COSTS (C)	4,652,036	4,618,484	9,270,519
	BASE COST BEFORE RISK (A+B+C)	27,858,661	27,657,734	55,516,394
	BASE ORDER OF MAGNITUDE COST- LOW RANGE	43,000,000	42,000,000	85,000,000
	BASE ORDER OF MAGNITUDE COST- HIGH RANGE	49,000,000	49,000,000	98,000,000

Table 5- Option 1 Breakdown of Order of Magnitude Estimate for Phase 1 & 2

OPTION 2				
RMM VOLUME 1 REF	RMM GROUP ELEMENT	Phase 1	Phase 2	TOTAL COST (GBP£)
1	TOTAL DIRECT CONSTRUCTION WORKS (A)	5,551,350	16,972,500	22,523,850
2	TOTAL INDIRECT CONSTRUCTION COSTS (B)	1,665,405	5,091,750	6,757,155
	TOTAL CONSTRUCTION COSTS (A+B)	7,216,755	22,064,250	29,281,005
3	TOTAL PROJECT/DESIGN TEAM FEES AND OTHER PROJECT DEVELOPMENT COSTS (C)	1,446,682	4,423,034	5,869,715
	BASE COST BEFORE RISK (A+B+C)	8,663,437	26,487,284	35,150,720
	BASE ORDER OF MAGNITUDE COST- LOW RANGE	13,000,000	41,000,000	54,000,000
	BASE ORDER OF MAGNITUDE COST- HIGH RANGE	15,000,000	47,000,000	62,000,000

Table 6 - Option 2 Breakdown of Order of Magnitude Estimate for Phase 1 & 2

OPTION 3				
RMM VOLUME 1 REF	RMM GROUP ELEMENT	Phase 1	Phase 2	TOTAL COST (GBP£)
1	TOTAL DIRECT CONSTRUCTION WORKS (A)	8,401,000	20,322,500	28,723,500
2	TOTAL INDIRECT CONSTRUCTION COSTS (B)	2,520,300	6,096,750	8,617,050
	TOTAL CONSTRUCTION COSTS (A+B)	10,921,300	26,419,250	37,340,550
3	TOTAL PROJECT/DESIGN TEAM FEES AND OTHER PROJECT DEVELOPMENT COSTS (C)	2,189,301	5,296,044	7,485,344
	BASE COST BEFORE RISK (A+B+C)	13,110,601	31,715,294	44,825,894
	BASE ORDER OF MAGNITUDE COST- LOW RANGE	20,000,000	49,000,000	69,000,000
	BASE ORDER OF MAGNITUDE COST- HIGH RANGE	23,000,000	56,000,000	79,000,000

Table 7- Option 3 Breakdown of Order of Magnitude Estimate for Phase 1 & 2

OPTION 4				
RMM VOLUME 1 REF	RMM GROUP ELEMENT	Phase 1	Phase 2	TOTAL COST (GBP£)
1	TOTAL DIRECT CONSTRUCTION WORKS (A)	6,996,000	21,322,500	28,318,500
2	TOTAL INDIRECT CONSTRUCTION COSTS (B)	2,098,800	6,396,750	8,495,550
	TOTAL CONSTRUCTION COSTS (A+B)	9,094,800	27,719,250	36,814,050
3	TOTAL PROJECT/DESIGN TEAM FEES AND OTHER PROJECT DEVELOPMENT COSTS (C)	1,823,158	5,556,644	7,397,801
	BASE COST BEFORE RISK (A+B+C)	10,917,958	33,275,894	44,193,851
	BASE ORDER OF MAGNITUDE COST- LOW RANGE	17,000,000	51,000,000	68,000,000
	BASE ORDER OF MAGNITUDE COST- HIGH RANGE	19,000,000	59,000,000	78,000,000

Table 8 - Option 4 Breakdown of Order of Magnitude Estimate for Phase 1 & 2

10. Recommendations and next steps

- 10.1.1 It is recommended that a full accessibility review is undertaken at GRIP Stage 1 once further details of the proposed Welborne development become available.
- 10.1.2 Requirements capture should be undertaken at GRIP 1 to inform output definition requirements. This should be a joint workshop between NR, South Western Railway, Fareham Borough Council and the developer of Welborne.
- 10.1.3 Future Design studies should review existing topographical survey information such as LIDAR in order to establish a more accurate view of the landscape.
- 10.1.4 A full cost review should be undertaken at GRIP 1 to validate the order of magnitude estimate.
- 10.1.5 Future design studies should obtain site information of the redundant Knowle Halt station in order to establish the existing condition of infrastructure and any future decommissioning requirements.
- 10.1.6 Consultation with local conservation authorities should be undertaken to understand the impact of the proposals and any local requirements. This will inform future Environmental impact assessments.
- 10.1.7 When comparing the options, Option 4 offers the most favourable solution in terms of accessibility as it is located adjacent to the proposed Welborne development. It provides flexibility to the developer and allows the new station to be integrated with the future transport strategy of Welborne.



Network Rail Infrastructure Projects

Southern

Waterloo General Offices, Station Approach

London SE1 8SW

T +44(0)20 7902 3063

www.networkrail.co.uk

This document is the property of Network Rail Infrastructure Limited. It shall not be reproduced in whole or part nor disclosed to a third party without the written permission of Network Rail Infrastructure Limited. Uncontrolled copy once printed from its electronic source. Published and Issued by Network Rail Infrastructure Limited, Kings Place, 90 York Way, London N1 9AG Copyright 2017 Network Rail Infrastructure Limited. All rights reserved.