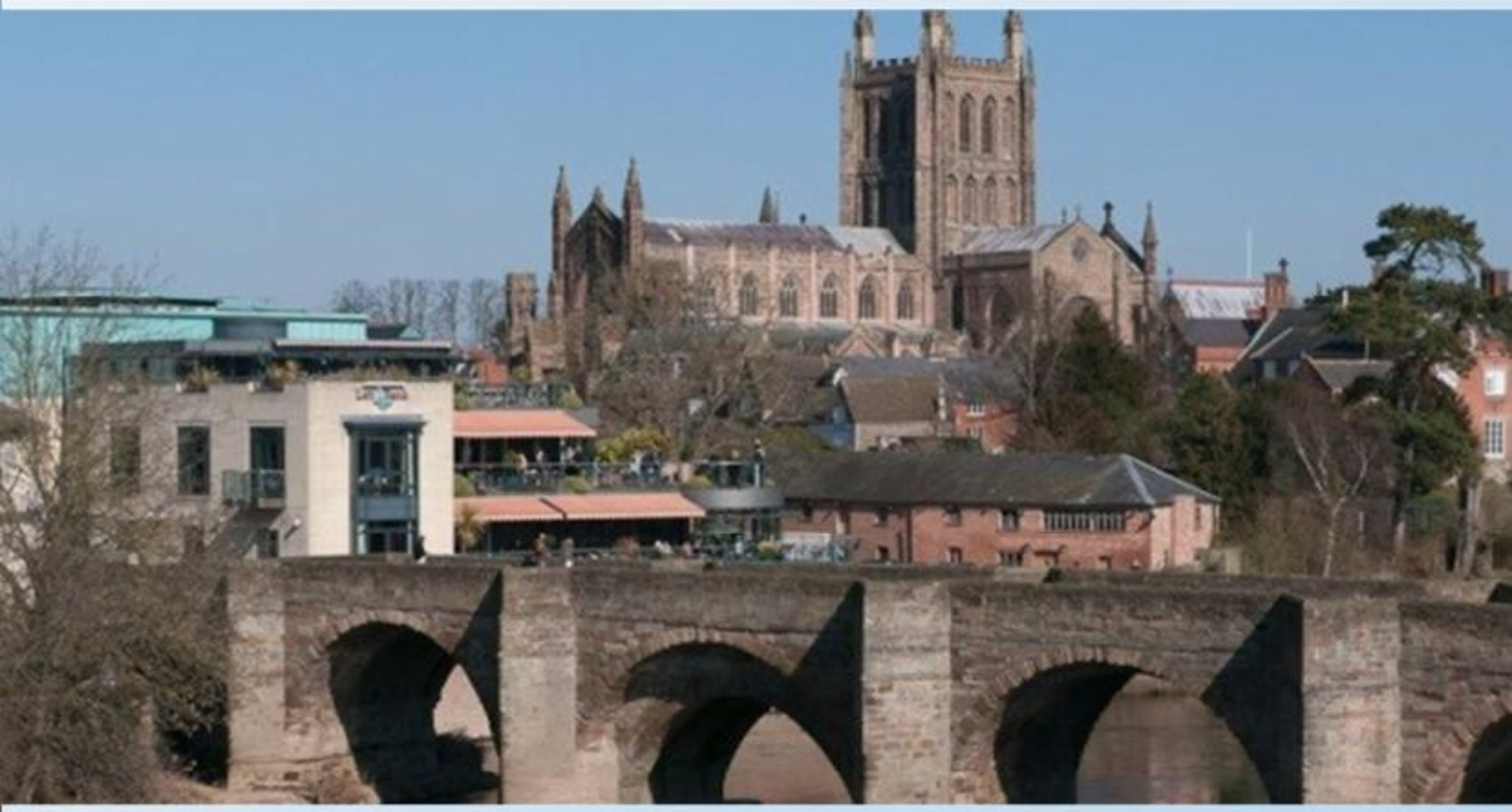
Herefordshire Council

HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

Stage 2 Scheme Assessment Report



70024065-WSP-XX-XX-RP-HE-00003 V2
JUNE 2018

Herefordshire Council

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Stage 2 Scheme Assessment Report

PROJECT NO. 70024065
OUR REF. NO. 70024065-WSP-XX-XX-RP-HE-00003 V2

DATE: JUNE 2018

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

1.1.1. This Stage 2 Scheme Assessment Report (SAR) develops upon the Stage 1 SAR (70024065-WSP-XX-XX-RP-HE-00002) and Stage 1 WebTAG Corridor Assessment Framework (CAF - http://councillors.herefordshire.gov.uk/documents/s50053657/Appendix%202%20for%20HTP%20Options%20Consultation%20Phase%202.pdf) which identified shortlisted Hereford Bypass options as proposed within Herefordshire Local Plan Core Strategy 2011-2031. The report documents the factors to be taken into account in choosing between options and the environmental, engineering, economic and traffic advantages, disadvantages and constraints associated with individual options. Along with the Environmental Assessment Report (EAR – 70024065-WSP-XX-XX-RP-EN-00007), Route Selection Report (RSR – ref 70024065-WSP-XX-XX-RP-HE-00004) and the Phase 2 Consultation Report (P2CR - 70024065-WSP-XX-XX-RP-EN-00008) the findings of this report will inform the Preferred Route Report (PRR – ref 70024065-WSP-XX-XX-RP-HE-00006) to be taken forward to Cabinet for a decision on the Preferred Route. The suite of supporting documents to the PRR are shown below.

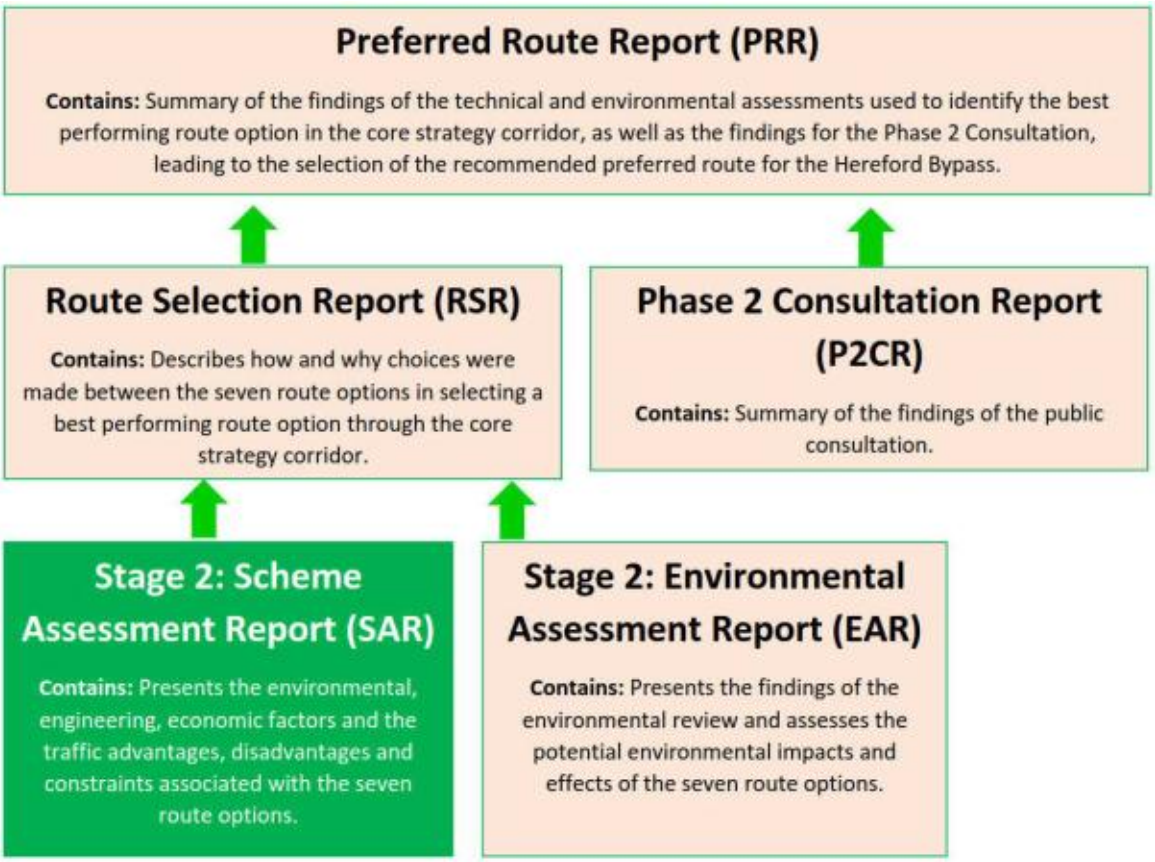

Figure 1 – Hereford Bypass - Preferred Route Documents

1.2 REPORT STRUCTURE

1.2.1. This report has been prepared in accordance with Design Manual for Roads and Bridges (DMRB) TD37/93). The report structure follows TD37/93 advice with full engineering content.

1.3 THE DEVELOPMENT OF THE ROUTE CORRIDORS

1.3.1. The Hereford Bypass forms part of the Hereford Transport Package (HTP), which combines a bypass with walking, cycling, bus and public realm improvements. The objectives are:

- Facilitating economic growth.
- Encouraging sustainable development.
- Improving regional connectivity.
- Provide network resilience.
- Encouraging healthier lifestyles.
- Improve air quality and reduce noise.
- Reduced severance.
- Improving safety.

1.3.2. The Herefordshire Local Plan Core Strategy 2011-2031 established the need for a bypass, referred to as the Hereford Relief Road in policy since 2007, as a means to achieve the Core Strategy housing and wider development aspirations. The bypass is an integral part of the Hereford Transport Package (HTP).

1.3.3. The Study of Options Report (Amey, 2010) referred to an assessment of the Eastern Inner Corridor, Eastern Outer Corridor, Western Inner Corridor, and Western Outer Corridor. The report concluded that the Western Routes have less of an environmental impact when compared to the Eastern Routes. As a result of the appraisals, the study recommended that the inner routes were preferable to the outer routes, also on environmental grounds.

1.3.4. Much work has been carried out by HC over recent years leading to the identification of a corridor for the bypass to the west of the city. This corridor is shown in diagrammatic form in the Hereford Key Diagram taken from the adopted Herefordshire Local Plan Core Strategy 2011-2031, as reproduced in Figure 2.

1.3.5. A first consultation on the HTP took place between April and May 2017. As well as seeking views on the current transport challenges in Hereford, the consultation also introduced the HTP and asked for feedback on the proposed bypass corridor and ideas for walking, cycling, bus and public realm improvements. A Phase 1 Consultation Report was prepared, the content of which has further informed the development of the possible route corridors options.

1.3.6. Specifically the Phase 1 Consultation confirmed that there was broad agreement among respondents that traffic conditions in Hereford need to be improved, with congestion identified as one of the biggest problems in the city. Also the principle of a bypass road to solve some of Hereford's transport challenges was supported.

1.3.7. Respondents felt that the most important factors to consider when identifying possible bypass route corridor options were:

- The likelihood of the route to reduce traffic in Hereford and reduce congestion.
- The impact on the landscape and notable sites, such as historic buildings.
- The impact on homes.
- The potential for improved facilities for pedestrians, cyclists and bus users.

1.3.8. The possible route corridor options were identified through multi-disciplinary workshops involving a mix of transportation, highways and environmental professionals, as advocated by WebTAG. This ensured that a range of issues were covered, including traffic routeing, highway alignments and environmental constraints.

1.3.9. The Environmental Constraints Plan (Appendix B) shows that within and adjacent to the Core Strategy Corridor is the River Wye Special Area of Conservation and Site of Special Scientific Interest, Ancient Woodland, Scheduled Monuments, Grade II* and Grade II listed structures and the River Wye and Yazor Brook and associated flood zones. A number of trees have been recorded in the Core Strategy Corridor as being Ancient or Veteran, subject to a Tree Preservation Order and / or Category A value. There are also a number of residential areas, footpaths and bridleways, unregistered parks and gardens and sites of importance for nature conservation within the area.

1.3.10. The possible route corridor options also recognise the potential impact on existing development, particularly homes and businesses along A438 Kings Acre Road and A4103 Roman Road. This was addressed by identifying locations on these largely east-west roads where a north-south bypass and junction would cause least disruption. A number of these locations were identified for each road, indicating the preferred crossing points.

1.3.11. Whilst the allocated development sites at Three Elms and Holmer West lie partly within the Core Strategy Corridor, they were not included as a constraint in the identification of possible route corridor options.

1.3.12. The identification of possible route corridor options drew upon work undertaken previously by the Council (as reported on the Council's website – (https://councillors.herefordshire.gov.uk/documents/s50035695/Hereford%20Relief%20Rd%20Cabinet%20Report%20final.pdf) as well as considering possible new route corridor options. All possible route corridor options sat within, or very close to, the overall Core Strategy Corridor

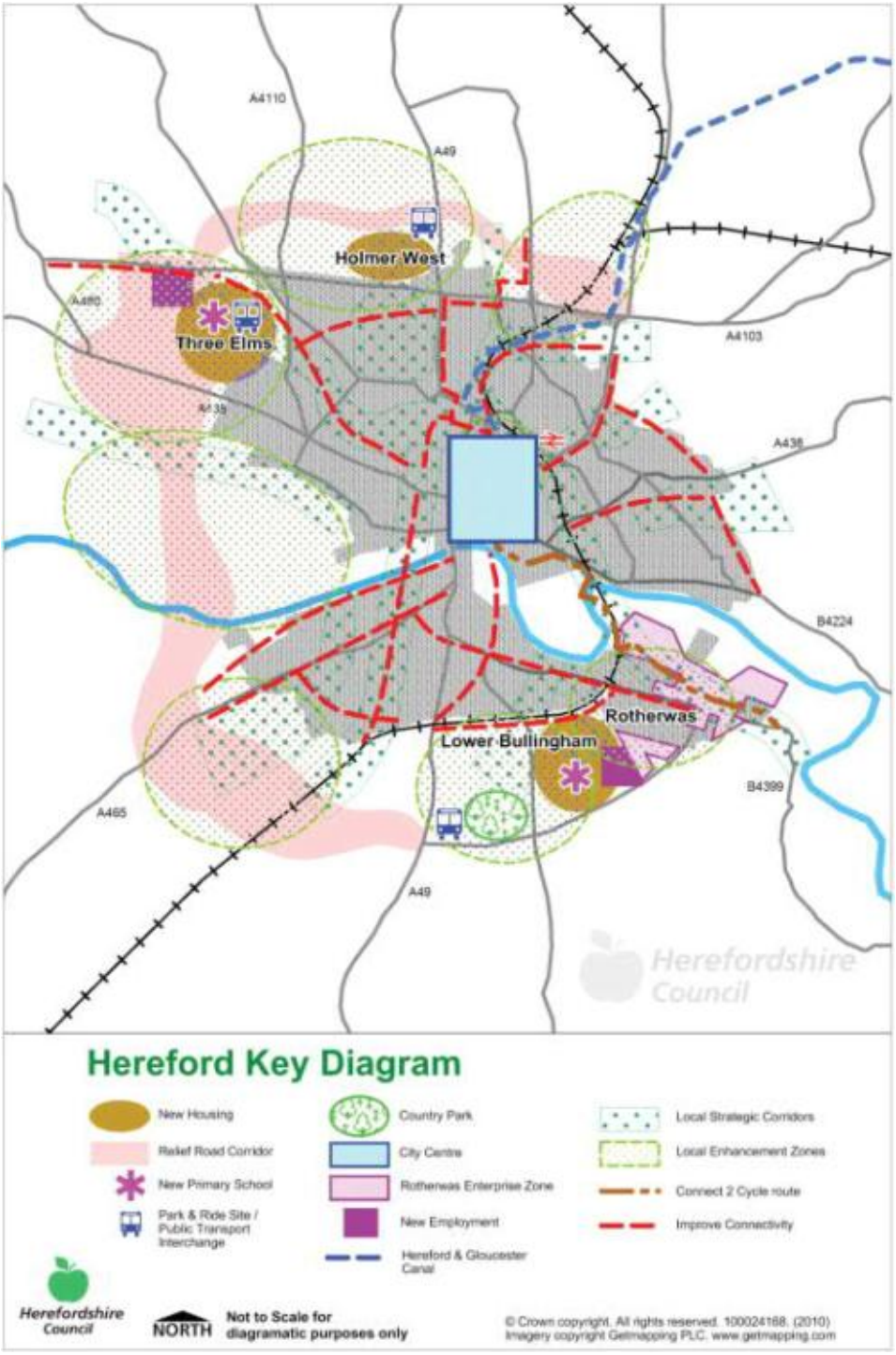

Figure 2 - Herefordshire Local Plan Core Strategy: Hereford Key Diagram

1.3.13. The possible route corridor options also recognise the potential impact on existing development, particularly homes and businesses along A438 Kings Acre Road and A4103 Roman Road. This was addressed by identifying locations on these largely east-west roads where a north-south bypass and junction would cause least disruption. A number of these locations were identified for each road, indicating the preferred crossing points.

1.3.14. Whilst the allocated development sites at Three Elms and Holmer West lie partly within the Core Strategy Corridor, they were not included as a constraint in the identification of possible route corridor options.

1.3.15. The identification of possible route corridor options drew upon work undertaken previously by the Council as reported on the Council's website: https://councillors.herefordshire.gov.uk/documents/s50035695/Hereford%20Relief%20Rd%20Cabinet%20Report%20final.pdf) as well as considering possible new route corridors. All possible route corridor options sit within, or very close to, the overall Core Strategy Corridor. By following the above process, 24 possible route corridor options were identified, which have been reduced to seven through the Corridor Assessment Framework process as reported through the Corridor Assessment Framework Report which can be found here:http://councillors.herefordshire.gov.uk/documents/s50053657/Appendix%202%20for%20HTP%20Options%20Consultation%20Phase%202.pdf.

2 EXISTING CONDITIONS - ENGINEERING

2.1 DESCRIPTION OF LOCALITY

2.1.1. For locations identified in the sections below refer to Appendix A

2.1.2. Hereford is a cathedral city, civil parish and the county town of Herefordshire, England. It lies on the River Wye, approximately 16 miles (26km) east of the border with Wales, 24 miles (39km) southwest of Worcester, and 23 miles (37km) northwest of Gloucester. With a population of just over 58,000[1] it is the largest settlement in the county.

2.1.3. The dominant choice of mode for the purpose of travelling to work in Hereford City is the car, accounting for 64.6% of modal share. The contribution of sustainable modes is dominated by journeys by foot, with 21.8%. The bicycle accounts for 7.9% of modal share, and public transport 3.9%.

2.1.4. HC is committed to improving infrastructure links in and around Hereford as guided by Herefordshire Local Plan Core Strategy Policy HD3 – (To) *"improve Hereford's economy by increasing connectivity to the national and local transport networks by reducing congestion and improving journey time, and specifically a Western Bypass – (To) reduce the volume of traffic from the city centre and enable the delivery of walking, cycling and bus improvements on the existing highway network".*

2.2 TOPOGRAPHY

2.2.1. The topography within the Core Strategy Corridor is characterised as initially falling north from the A465 before a significant ridge on the southern side of the River Wye floodplain. After a slightly lesser northern bank to the Wye floodplain the ground rises north prior to crossing a ridge in advance of the A438 Kings Acre Road. Between the A438 Kings Acre Road and A4103 Roman Road the land falls nominally north to the Yazor Brook floodplain close to A4103 Roman Road. After an initial rise to Tillington Road there is a more pronounced North-East rise to the A4110 Canon Pyon Road passing over a ridgeline into the head of a southern falling valley. Thereafter the Core Strategy Corridor adopts a cross slope orientation to the predominantly south falling ground clipping a minor peak before connecting back to the A49.

2.3 GEOTECHNICAL

GEOLOGY

2.3.1. The geology within the Core Strategy Corridor has been assessed by reviewing the BGS Geological Sheet Map, the online BGS GeoIndex, the BGS Lexicon, and information provided within the Envirocheck Report.

2.3.2. Geological mapping indicates the presence of a shallow syncline feature within the area, with the regional dip of the bedrock being less than 10°. An inferred fault is shown on geological mapping approximately 300 metres west of Belmont Lodge, part of the former Belmont golf course. The fault is orientated North West – South East and the displacement is unknown. Another fault is observed 200 metres north of Arundel Farm, the displacement is unknown.

CONTAMINATED LAND

2.3.3. A summary of potential sources of contamination (as indicated in the PSSR) are listed below.

- Arable land including multiple orchards, nursery and a former golf course;
- Former hydraulic rams, tanks and pumping houses;
- Historic industries; blacksmiths, garages and filling stations;
- Former railway line;
- Made Ground associated with the infilling of ponds;
- Demolished buildings;

[1] 2011 Census Key Statistics Herefordshire Council

- Roads (A465, A438 and A49).

2.3.4. Potential contaminants include ground gas and a range of organic and inorganic contaminants including the potential for asbestos. This list includes but is not limited to pesticides, herbicides and hydrocarbons including fuels and oils along with ash (often high in heavy metals).

MINING & MINERAL EXTRACTION

2.3.5. No mines or mineral deposits are recorded within the Core Strategy Corridor.

HYDROGEOLOGY & SURFACE WATER ABSTRACTION

2.3.6. A total of four surface water abstractions are located within 1km of the Core Strategy Corridor, of these only one is located within the corridor and appears to be registered to the owner of Pinston House at approximate National Grid Reference (NGR) 347680 / 242530 (Ref. 6).

2.4 FLOODING AND HYDRAULIC CULVERTS

FLOODING

2.4.1. The principal watercourse in the hydraulic study area is the River Wye. The River Wye is classified as a Main River and has a GQA Grade of A (graded from A – very good to F-bad) and flow rate of >80 cumecs. There is a Flood Zone 3 associated with the River Wye and also indicates surface water flooding risk to areas adjacent to watercourses and low-lying land. The risk ranges from a high (1 in 30-year return) to low (1 in 1000-year return) risk.

2.4.2. Yazor Brook is ranked as second to the River Wye in terms of fluvial flood risk in Hereford and has a GQA Grade of B (flow >0.31cumecs). Within the Core Strategy Corridor, the Yazor Brook is located and crosses the A4103 Roman Road.

2.4.3. There are a number of unnamed water courses located within the study area including numerous small natural watercourses and man-made ditches and a number of small ponds or pools.

2.4.4. Surface run-off from the existing main road network in the Core Strategy Corridor is generally captured by traditional kerb and gully drainage directed to un-attenuated watercourse outfalls or on lesser roads over the edge to adjacent ditches/land.

HYDRAULIC CULVERTS

2.4.5. Preliminary site inspection has identified three existing hydraulic culverts within the Core Strategy Corridor.

Ruckhall Lane Culvert

2.4.6. The culvert passes beneath the Ruckhall Lane. At the time of the preliminary surveys carried out in 2017 the culvert headwalls were inaccessible so no direct measurements and condition assessment could be made. It is estimated that the culvert is approximately 900mm in diameter. The southern inlet is preceded by an agricultural ditch, the northern outlet is served by ≈2m wide shallow watercourse.

A4103 Yazor Brook Culverts

2.4.7. Two culverts associated with Yazor Brook have been identified passing beneath A4103 Roman Road. Both culverts are close to existing residential properties. At the time of preliminary surveys carried out in 2017 the culvert headwalls were inaccessible due to dense vegetation and land access limitations so no direct measurements or condition assessment could be made.

2.4.8. The western culvert which conveys Yazor Brook is approximately 14m in length and would appear to have reinforced concrete headwalls suggesting it is of relatively modern construction. It is anticipated that the culvert itself has a span of 3 to 4m either formed of precast box/portal units or prestressed beams supported on reinforced concrete abutments.

2.4.9. The eastern culvert appears to serve as a drainage measure to the adjacent fields outfalling into Yazor Brook. It is most likely a small diameter pipe culvert.

2.5 STRUCTURES

There are no significant structures within the Core Strategy Corridor other than the hydraulic culverts listed in Section 2.4 above.

2.6 LAND USE

2.6.1. A majority of the land within the Core Strategy Corridor is in agricultural use but there are also significant areas of residential, commercial and leisure use.

AGRICULTURE

2.6.2. A significant portion of the land within the Core Strategy Corridor is rural, arable land.

RESIDENTIAL

2.6.3. The ribbon development along A438 Kings Acre Road together with Bovingdon Park (a site of some 70 static caravans off A4103 Roman Road) are the main residential blocks within the Core Strategy Corridor. There are also several smaller centres of residential development off B4349 Clehonger Road, A4103 Roman Road/Towtree Lane and A4110 Canon Pyon Road together with numerous farmhouse and other isolated rural dwellings.

2.6.4. Several larger residential areas are located just outside the Core Strategy Corridor including: Woodfield Gardens, a collection of some 30 homes associated with the Belmont Abbey complex to the west of the corridor; and Dorchester Way, an estate of some 80 homes on the southern bank of the River Wye to the east of the corridor.

2.6.5. The Herefordshire Local Plan Core Strategy 2011-2031 is linked to the development of housing to the north west of the city centre. The Bypass is considered to be 'necessary infrastructure' to enable the development of the strategic housing sites at Holmer West (aligned to Policy HD4 of the Core Strategy) and Three Elms (aligned to Policy HD5 of the Core Strategy).

COMMERCIAL

2.6.6. The Hereford Wyevale garden centre, associated nurseries and livestock market along with other small businesses are located between the A438 Kings Acre and A4103 Roman Road corridors.

2.6.7. A small industrial area is located at the A438/A480 junction together with a small static caravan park with a second larger static caravan site at Bovingdon Park off the A4103 Roman Road.

2.6.8. Hereford Community Farm is located off Warham Lane (U73023) north of the River Wye offering adult social care activities, such as horse-riding in adjacent fields.

LEISURE

2.6.9. There are multiple recreational routes and public access areas/fields within the Core Strategy Corridor. Of particular note is the Greenbank Meadow (Queen Elizabeth II Diamond Jubilee Field in Trust managed by the Herefordshire Wildlife Trust) located south of Warham House on the north bank of the River Wye.

2.6.10. Drovers Wood is so named because of a nearby public trail that was once an ancient sheep drovers' route into Hereford. A mixture of new planting and veteran oak trees, this Woodland Trust site, established in 2000, is a used by local residents.

2.7 HIGHWAY NETWORK

The main roads forming the existing highway network passing through the Core Strategy Corridor are as follows:

Table 1 - Existing Highway Network

Route	Name	Standard	Speed Limit	Comment
A465	Abergavenny Road	Single carriageway with at grade junctions and private accesses	60mph	Major route between Abergavenny and Hereford, partially maintained by the Welsh Government and partially by HC
B4349	n/a	Single carriageway with multiple at grade junctions and private accesses	60mph	Connects the surrounding towns of Kinstone, Madley and Clehonger with Hereford.
A438	Kings Acre Road	Single carriageway with multiple at grade junctions and private accesses	40mph	Connects Kings Acre with Hereford. This road serves the Kings Acre residential area and the Wyevale industrial area.
A480	n/a	Single carriageway with at grade junctions and private accesses	60mph	Connects the Kings Acre Road with Roman Road and thee villages to the north west of Hereford such as Credenhill and Yazor
A4103	Roman Road	Single carriageway with multiple at grade junctions and private accesses	60mph	Connects Stretton Sugwas into the city centre
A4110	Canon Pyon Road	Single carriageway with multiple private accesses	40mph	Connects the village of Portways with Hereford
A49(T)	n/a	Single carriageway with multiple private accesses	60mph	Falls under the responsibility of the Highways Agency

2.7.1. There are traffic-related issues currently in the Belmont area to the south of Hereford City Centre. This is particularly evident on the approach to the junction of the A49 (T) and the A465, near what is locally referred to as the Asda Roundabout.

2.7.2. There are also multiple minor roads located in the countryside. The most significant of these are Ruckhall Lane, Warham Lane (U73023), C1189 (Lower Breinton Road) and Hill Road (Upper Breinton Road – U73022), Towtree Lane and Tillington Road.

2.8 NON- MOTORISED USERS PROVISION AND ACCESS

2.8.1. The city of Hereford is relatively well served with walking and cycling facilities. Within the Core Strategy Corridor there are multiple existing public footpaths and bridleways.

2.9 PUBLIC AND COMMUNITY TRANSPORT

2.9.1. There are two bus stations located in Hereford, the City Bus Station and the Country Bus Station. There are other boarding stations around the city including on Commercial Road, Blueschool Street and at the Railway Station. The City Bus Station services are primarily local bus routes in Hereford, whereas the Country Bus Station services the wider county bus routes.

2.9.2. Hereford Railway Station is the main railway station in Herefordshire, located in the north-east of the city centre. Hereford is well served by rail with Hereford Railway Station on two main lines: The Welsh Marches Line running between south and north Wales and Manchester currently run by Arriva Trains Wales; and is also the western terminus for the Cotswold Line for trains operated by West Midlands Trains (towards Birmingham), and Great Western Railway (towards London).

2.9.3. There are a significant number of bus stops on and in the vicinity of the A49 to the north and south of the city centre. Where the A49 runs through the city centre area, bus stops are not located along the A49 with Hereford City Bus Station located less than 1km to the east of the road from the junction with the A438 and wider bus stops in the city centre area.

2.9.4. There are eight existing Park and Share/Cycle sites located around the edges of the city and linked to the highway network, with proposals for additional sites further to the north and south of the A49.

2.10 TRAFFIC FLOWS

2.10.1. This section covers the following:

- Vehicle flows on the Hereford network
- Vehicle flows on the A49(T) corridor
- HGV flows on the HGV corridor
- Daily flow profile on the A49(T) bridge

2.10.2. A programme of traffic surveys was undertaken in 2016 to update and refine the existing Hereford traffic model. The survey programme included:

- Roadside Interview Data (RSIs)
- Car Park Interview Data (CPIs)
- Automatic Traffic Counts (ATCs)
- Manual Classified Junction Counts (MCJCs)
- Manual Classified Link Counts (MCLCs)
- Journey Time Data

2.10.3. Vehicle flows in the AM peak 2016 (07:00 – 10:00) reference case model are shown in **Figure 3.** This shows that there is a significant amount of vehicle flow being carried over the A49(T) Bridge flowing in from arterial routes in the current situation. The A465, A49 (T) north and south of the bridge, A4103 Roman Road, A438 and Commercial Road all carry significant amounts of traffic in the 2016 AM peak.

Figure 3 - Vehicle Flows - AM Peak

2.10.4. Vehicle flows in the Inter-peak (10:00 – 16:00) reference case model are shown in **Figure 4**.

2.10.5. This shows that there is a significant amount of vehicle flow being carried over the A49 (T) Bridge flowing in from arterial routes. The A465, A49 (T) north and south of the bridge, A4103 Roman Road, A438 all carry significant amounts of traffic. There is notably less flow in the Inter-peak than in the AM and PM peaks.

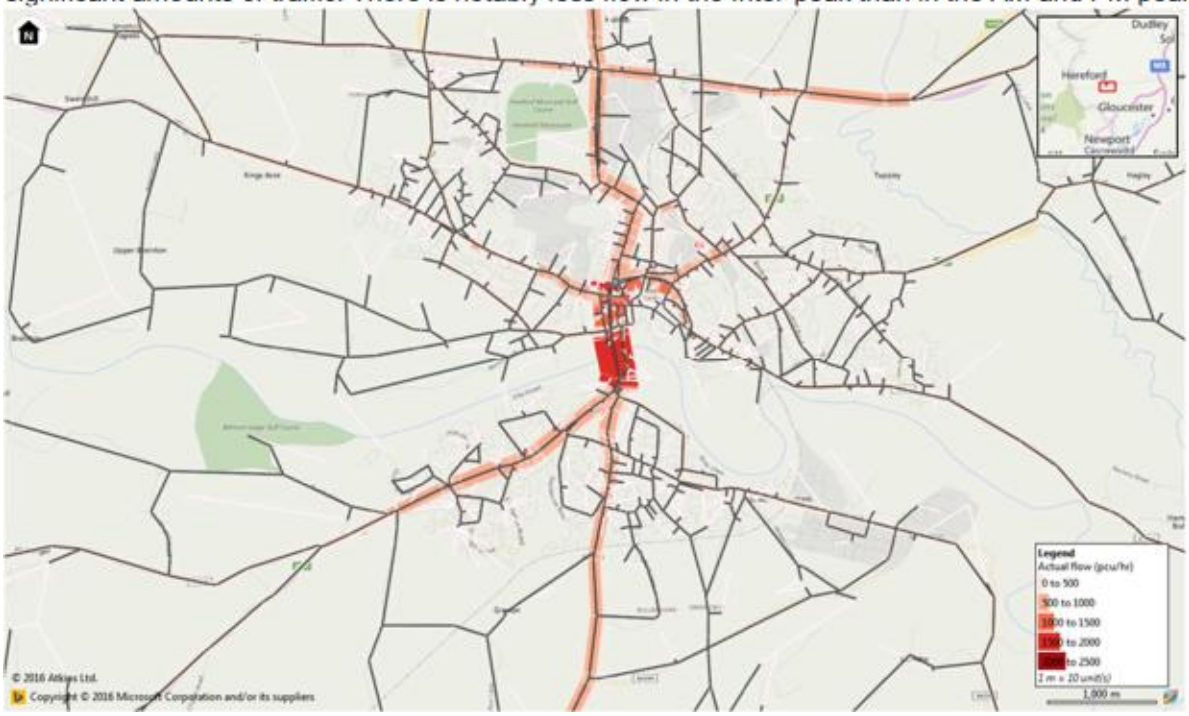

Figure 4 - Vehicle flows in the Inter-peak

2.10.6. Vehicle flows in the PM Peak (16:00 – 19:00) reference case model are shown in **Figure 5**. This also shows that there is a significant amount of vehicle flow being carried over the A49 (T) Bridge flowing in from arterial routes. The A465, A49 (T) north and south of the bridge, A4103 Roman Road, the A438 through the city centre, the A438 near Lugwardine and Commercial Road all carry significant amounts of traffic.

Figure 5 - Vehicle Flows – PM Peak

2.10.7. **Table 2** summarises the results of the traffic counts on the A49 corridor undertaken in July 2016. The location of the survey sites on the A49 (T) are shown on **Figure 6**.

ATC Site	Site Name	24-hour	AM Peak Hour	PM Peak Hour
51	East of Dinmore	13,239	1,020	1,151
3	Holmer Road	21,113	1,563	1,501
10	Widemarsh Brook	25,316	1,761	1,803
43	Edgar Street	20,062	1,410	1,249
17	A49(T) Greyfriars Bridge	44,296	2,827	3,121
33	South of Holme Lacy Rd	19,757	1,369	1,539
28	Ross Road (Red Hill)	14,253	1,064	1,185
30	Norton Brook Farm	15,569	1,401	1,295

Table 2 - A49 Traffic Survey Results (July 2016)

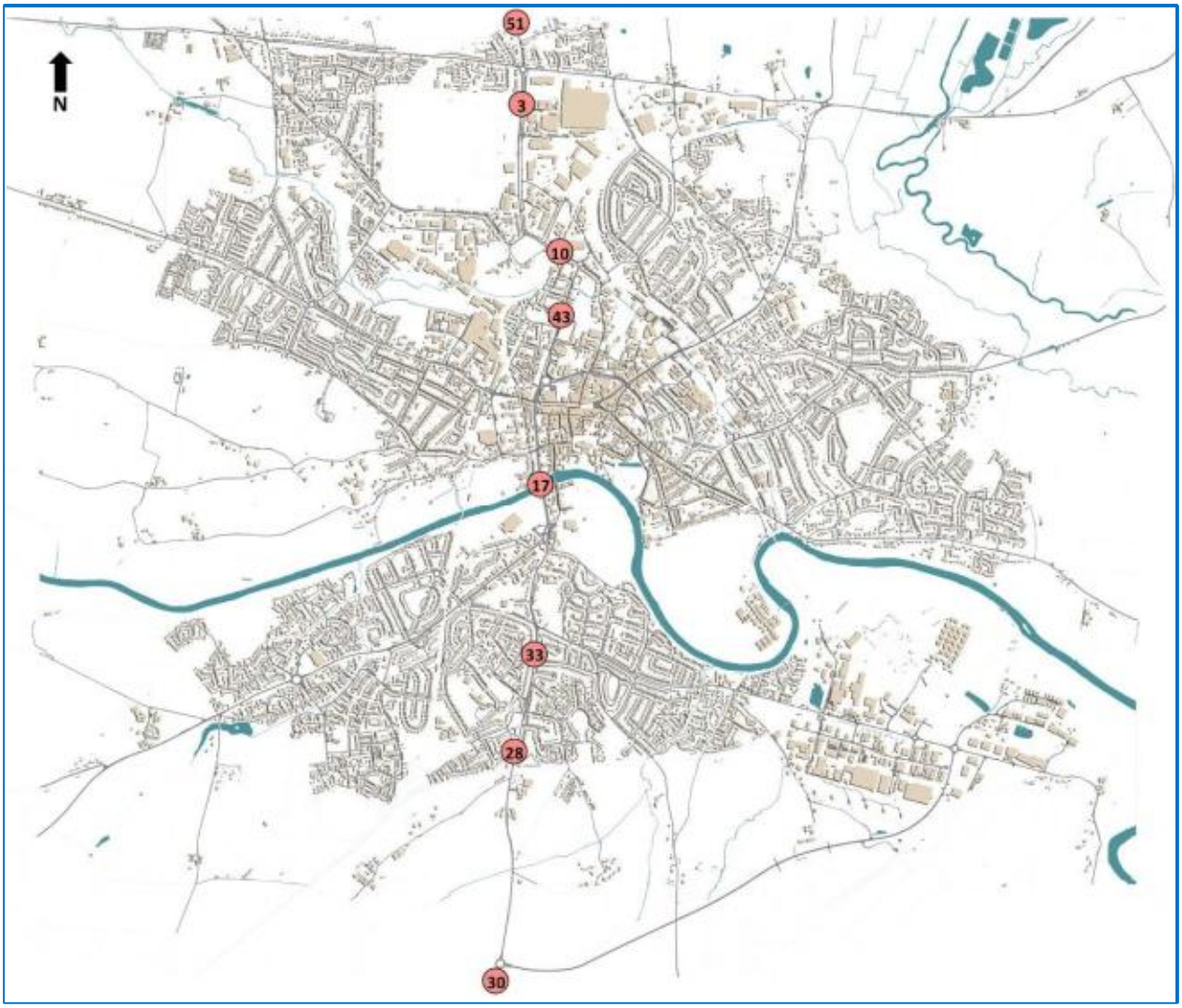

Figure 6 - ATC Sites on the A49 (T)

2.11 TRAFFIC ACCIDENTS

2.11.1. A desk based study has identified several accident datasets for the Hereford area. **Figure 7** shows the distribution and severity of road traffic accidents within the Hereford area.

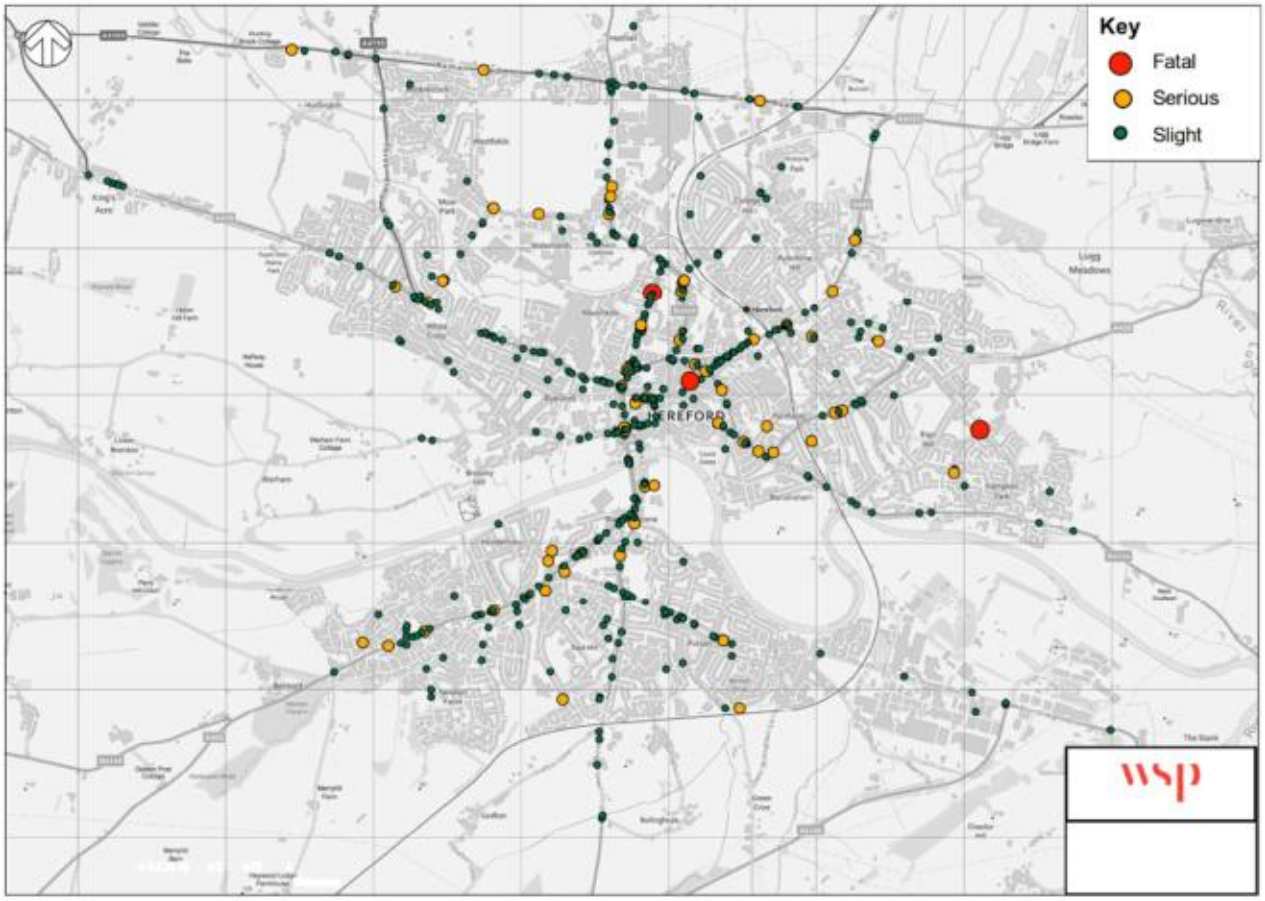

Figure 7 - Hereford All PIC Accidents (01/12/11 to 30/11/16)

2.11.2. The distribution of accidents shows distinct correlation with the higher flow arterial routes including; A438 Kings Acre and A4103 Roman Road as they pass through the Core Strategy Corridor.

2.11.3. A majority of the recorded accidents were slight in severity, with severe accidents also generally occurring on arterial routes. There were three fatal traffic accidents in the city of Hereford between 2011 and 2016 in the north and east of the city on the A49, A438 and Hampton Dene Road / Gorsty Lane junction.

2.11.4. The greatest clusters of accidents occur at the junction of the A465 and A49 to the north and south of the city centre, and around the A438 / A49 to the north-east.

2.12 STATUTORY UNDERTAKERS

2.12.1. In November 2017, the main Statutory Undertakers were contacted to identify their plant within and adjacent to the Core Strategy Corridor. The responses are summarised as below:

- British Telecom (telecoms) - Underground and overhead cables (no Virgin Media plant recorded).
- Cadent (gas) - Low and medium pressure gas mains. Medium pressure mains are located along the B4349, A4103 and Tillington Rd.
- Western Power Distribution (electricity) - underground and overhead cables ranging from Low Voltage to 11kV. There are no National Grid 132kV lines or pylons within the Core Strategy Corridor.
- Dwr Cymru Welsh Water - Water supply mains, combined / foul water / surface water sewers. There are also private water supply pipes.

2.12.2. The main statutory undertakers' apparatus tends to be located in, or follow, key arterial routes with lesser plant located within the local side road network. Other than Low Voltage overhead electricity there are minimal statutory undertakers' assets in private fields.

3 EXISTING CONDITIONS – ENVIRONMENTAL

3.1 ENVIRONMENT BASELINE CONDITIONS

AIR QUALITY

3.1.1. HC has declared two Air Quality Management Areas (AQMAs), both due to exceedance of the annual mean limit for NO2. One of these, AQMA Hereford, is located within the study area along the A49 corridor through the centre of Hereford.

3.1.2. A 12-month baseline air quality survey was undertaken in 2017. The survey covered both the proposed Core Strategy Corridor and existing routes through Hereford, which included several roadside/kerbside and sensitive receptor sites to establish the existing nitrogen dioxide concentrations. The results show that all levels of NO2 were found to be below the annual mean limit.

NOISE AND VIBRATION

3.1.3. A baseline noise survey was carried out in March 2017 to establish the current noise climate at the surroundings of the proposed Scheme and to validate the results of the noise model prepared for Stage 2.

3.1.4. Details of the noise survey are presented in 'Hereford Transport Package – Baseline Noise Survey', dated March 2017, included in Appendix 6-3 of the Environmental Assessment Report (EAR). Figure 1 of the baseline survey report shows the location of the noise measurements.

3.1.5. Long-term unattended measurements were made at four positions (LT1-LT4) continuously over the entire survey period. Weather data comprising wind speed, wind direction and rainfall was measured over the survey period at LT3 using an anemometer and a rain gauge. Short-term attended measurements were also made at five positions (ST1-ST5).

3.1.6. The study area includes 28501 residential properties and 188 other sensitive receptors which include healthcare, educational facilities and places of worship. There are 12 Noise Important Areas (NIAs) within the study area with approximately 676 residential properties within the area.

LANDSCAPE

3.1.7. The landscape study area is set at a 2km radius from the proposed Scheme. A desk-based study followed by a field survey has been conducted in order to establish a clear understanding of the site and its wider landscape setting, identifying its landscape character, resources, value and sensitivity to the proposed scheme.

Landscape Character

3.1.8. The study area lies within Natural England's National Character Area (NCA) 100 Herefordshire Lowlands (Natural England 2013) with the key characteristics identified;

- Undulating landscape with steep-sided hills in the centre;
- Wide meandering river valleys which drain the area, including the Wye which offers a major ecological and recreational asset;
- Localised traditional and bush orchards and occasional hop fields planted with windbreaks; and
- Timber framed black and white buildings are characteristic with stone and red brick also used frequently as building materials.

Local Landscape Character

Hereford Landscape Character Assessment

3.1.9. The proposed Scheme lies within the Herefordshire Lowlands National Character Area and is located within the following Landscape Character Types as defined in the HC Landscape Character Assessment (updated 2009):

- 7.10 Principal Timbered Farmlands;
- 7.14 Riverside Meadows;
- 7.15 Wet Pasture Meadows;
- 7.18 Wooded Estatelands; and
- 7.21 Principal Settled Farmlands.

3.1.10. These landscape types are likely to be of medium to high sensitivity to highway development.

Locally Designated Parks and Gardens

3.1.11. Within the study area are several Unregistered Parks and Gardens including the garden associated with;

- Belmont House;
- Warham House;
- Huntington Court; and
- Burghill Hospital.

3.1.12. There is no boundary within the park and there are a number of listed buildings, frequent mature parkland trees and the extensive grassland managed using grazing sheep.

Cultural and Heritage Assets

3.1.13. Historic and environmental designations are an indication of the quality of the landscape, and identify sites where potential visual receptors may be highly sensitive, such as visitors to designated sites experiencing them in the context of their setting. There are numerous cultural assets within the study area, including conservation areas, listed buildings and ancient woodland.

Access and Public Rights of Way

3.1.14. There are no National Trails within the study area. However, there is an extensive network of Public Rights of Way (PRoW), including green lanes and bridleways. The Wye Valley Walk is a long distance recreational route following the course of the Wye River, between Chepstow and Plynlimon. The network of PRoW comprises;

- Clehonger footpath 7 and 7A to the south of the River Wye;
- Breinton footpath 1 along the River Wye (also forming the Wye Valley Walk);
- Breinton footpath 2 and 8 to the north of the River Wye;
- Breinton Bridleway 4 and Hereford Bridleway 25 to the south of A438 Kings Acre;
- Breinton Bridleway 3 and 9 to the south of A438 Kings Acre Road;
- Hereford footpath 1, 35, 37 and 55 between A438 Kings Acre Road and A4103 Roman Road;
- Burghill footpath 11 to the north of A4103 Roman Road; and
- Pipe and Lyde footpath 9 to the north of A4103 Roman Road

3.1.15. There are no areas of Registered Common Land or land designated under the Countryside and Rights of Way (CROW) Act within the study area. However, there are small pockets of open access land around Ruckhall to the west and west/south west of Breinton Common.

Visual Receptor baseline

3.1.16. Visual receptors are the people who live in or visit the landscape, and who would experience views of the proposed Scheme.

3.1.17. The visibility towards the location of the proposed Scheme options is restricted to varying degrees by screening elements that obscure or block the views, including intervening hedgerows, woodland belts and copses, and built form. However, visibility is potentially increased from locations away from the proposed Scheme options as a result of rising ground.

3.1.18. The following groups of people are considered to be key visual receptors in relation to the proposed Scheme:

- Local communities (e.g. villages and settlements) and isolated residential properties. The sensitivity of residential receptors is generally high, depending on location and existing views. They can be very susceptible to changes in view and visual amenity relating to changes to the highway. Receptors are typically identified as single or grouped visual receptors.
- People in their places of work. Views from places of work are typically of low to moderate sensitivity as enjoyment of the landscape is not generally the focus. Views can therefore accommodate changes more easily and are less susceptible to change in the landscape.
- People using regionally and nationally promoted footpaths, cycle routes, bridleways, users of the local rights of way network and areas of open access or common land. There are a number of PRoWs and walking trails within the study area. The views from the PRoWs are highly regarded by the users and enjoyed for their scenic value. Views and therefore highly susceptible to changes or any loss of visual amenity. The sensitivity of views from PRoWs, designated paths and open access land have been judged to be high and very high.
- Visitors at publicly accessible sites including, for example, Unregistered/ Registered Parks and Gardens, historic sites, and other visitor attractions; and

- Road users. The sensitivity of road users is generally considered to be low as enjoyment of the countryside is not typically the focus of travel and views are transient in nature.

3.1.19. There are some visual receptors that could experience potentially significant effects in close proximity the proposed Scheme.

ECOLOGY

3.1.20. All proposed Scheme options are situated around the western outskirts of Hereford and would bisect the River Wye SAC and Site of Special Scientific Interest (SSSI) and a mosaic of important, common and widespread habitats. The study area has potential to support protected species including bats, badgers *Meles meles*, dormice *Muscardinus avellanarius*, otters *Lutra lutra*, water voles *Arvicola amphibius*, breeding and wintering birds, reptiles, great crested newts (GCN) *Triturus cristatus*, fish, aquatic and terrestrial invertebrates and flora.

Statutory Designated Sites

3.1.21. The River Wye SAC and SSSI are designated due to their European and UK important freshwater riverine habitats, and the ability to support large populations of migratory fish, otters and white-clawed crayfish *Austropotamobius pallipes*, as well as freshwater pearl mussel *Margaritifera margaritifera*.

Non-Statutory Designated Sites

3.1.22. There are several non-statutory designated sites within the desk study area. Those within the study area plus 100m radius are descried below (using descriptions provided by Herefordshire Biological Records Centre (HBRC), as these are the sites most relevant to the selection of a preferred route:

- Belmont Wood and Hunderton Rough Special Wildlife Site (SWS) is a mixed woodland with a dense understorey;
- The River Wye SWS is one of the largest, relatively unpolluted, unmodified river systems in the country.
- Breinton Wood SWS is a mixed woodland;
- Kings Acre Reserve SWS (Wyevale Wood Herefordshire Wildlife Trust Reserve) is an area of grazed grassland, damp in parts, and with mature trees over most of the site;
- Railway Line near Green Farm is part of a dismantled railway line near Green Farm, comprising mostly bramble;
- Yazor Brook is an important habitat forming a part of a narrow corridor through arable farmland;
- Pond at Huntingdon Court is the smaller and western of the two ponds at Huntingdon, located in a private garden in a widening of the Yazor Brook.

Habitats

3.1.23. A phase 1 Habitat Survey was undertaken which consisted of primarily terrestrial habitats including arable land and grazed pasture with semi-natural broadleaved woodland, traditional orchards, wood pasture and parkland. A number of aquatic habitats were also present, including running water (rivers and streams), associated riparian habitats and ponds. The majority of the land parcels were bounded by intact mature hedgerows. Residential and commercial buildings including a horticultural business and associated greenspace are also scattered throughout.

Ancient Woodland

3.1.24. Several ancient woodlands are present adjacent to the proposed route corridor options. These include:

- Wye Coppice and Rough Coppice: Located approximately 100m to the north of the River Wye;
- Wyevale Wood (formally known as Green Lane Wood): located 600m to the south of A438 Kings Acre Road;
- Hunderton Rough (Hunderton wood): located immediately south of the River Wye; and
- Newton Coppice and Hayleasow Wood: located south of the A465.

3.1.25. Species surveys are ongoing; however, some results have been gathered to date and include the habitats within and adjacent to the possible route corridor options are suitable for the following species or groups:

- Badger - 29 records within 2km. Suitable habitat and setts were found throughout the survey area.
- Dormouse - 8 records within 2km, this species is not being considered further.
- Otter - Qualifying feature of the River Wye SAC and 14 records within 2km, Otter were seen twice in habitats adjacent to the River Wye during other survey types undertaken in 2017.
- Water vole - No records or evidence of species within 2km, however the Yazor Brook offers suitable habitat to support water voles.

- Bats - 2270 records within 2km from several species including records of bat roosts. Suitable roosting, commuting.
- Birds - 3500 records within 2km consisting of 26 species listed under Schedule 1 of the Wildlife and Countryside Act 1981, 16 species listed under Section 41 of the Natural Environment and Rural Communities Act (NERC) 2006, 24 red-listed species and 61 amber-listed species (as defined by the UK Birds of Conservation Concern (BoCC) 2015).
- Reptiles - 79 records of reptiles within 2km, the study area also contained large areas of habitat which was considered to be suitable for foraging, resting and breeding reptiles.
- Amphibians - 97 records of five species of amphibians including 22 records of GCN within 2km, field surveys for GCN are continuing into 2018.
- Fish - The 2017 fish survey of the River Wye, Yazor Brook and smaller tributaries found a diverse range of species of conservation concern all within the EU Habitats Directive Annex II fish species that are listed as reasons for the designation of the River Wye SAC comprising; Twaite Shad, Atlantic Salmon, Bullhead, River lamprey. The River Wye was also found to contain instream habitats which are suitable for critical spawning and nursey life-stages and evidence they were being actively used for and by a number of conservation species named above.
- Terrestrial invertebrates - A total of 461 species were identified, including 42 currently with conservation status, and these include 6 British Red List species. Two of these species are listed under Section 41 of the 2006 Natural Environment & Rural Communities (NERC) Act as Species of Principal Importance for the conservation of biodiversity (Noble Chafer *Gnorimus nobilis* and Red-winged click beetle *Ampedus rufipennis*).
- Aquatic invertebrates - Aquatic invertebrate surveys were undertaken in summer 2017; spring and autumn sampling will be undertaken in 2018. The survey area encompassed stretches of the River Wye, Yazor Brook and smaller tributaries.
- Higher plants - The botanical surveys undertaken in 2017 focussed on habitat assessments (e.g. National Vegetation Classification, River Corridor Surveys, Habitats of Principal Importance assessments). Further botanical survey work will be undertaken in 2018 based on the findings of the 2017 assessments. During the work undertaken to date, no protected (considered for the purposes of this report to be those fully protected under Schedule 8 of the Wildlife and Countryside Act 1981) or notable plants were recorded in any of the land parcels surveyed.
- Invasive non-native plants - Several species listed in Schedule 9 of the WCA 1981 were recorded during various surveys undertaken to date, including Japanese knotweed *Fallopia japonica*, giant hogweed *Heracleum mantegazzianum* and Himalayan balsam Impatiens *glandulifera*.
- Lower plants - Surveys are due for completion in 2018, however based on survey work undertaken in 2017 the surveys found willows along the River Wye covered in a specialist community of inundation zone bryophytes, including nationally scarce moss *Orthotrichum sprucei*.
- Fungi - Surveys are due for completion in autumn 2018, however based on survey work undertaken in 2017 most of the fungi species recorded are widespread and commonly encountered across much of Britain. Less commonly reported fungi were also found, but have been previously found within Herefordshire. None of the species recorded during the survey are BAP priority species, or featured on the British 'Red List', Schedule 8 of the Wildlife & Countryside Act 1981 (as amended) or Section 41 of the NERC Act (2006).

HERITAGE

3.1.26. All of the statutory designated assets within the study area are all of national importance or sensitivity. There are no World Heritage Sites or non-designated assets of national importance within the 1km and 500m study areas.

3.1.27. There is a total of 41 designated heritage assets present within 1km of the study area which comprise:

- Two scheduled monuments (Moated site SW of the church in Breinton & Churchyard cross in St
- Bartholomew's churchyard in Holmer);
- One Grade I (Church of St Bartholomew in Holmer) and Two Grade II* Listed Buildings (Abbey Church of St. Michael and All Angels [Belmont Abbey] & Belmont House);
- 34 Grade II Listed Buildings;
- Two Conservation Areas; and
- 76 non-designated assets present within 500m of the scheme of which eight are Parks and Gardens.

WATER ENVIRONMENT

3.1.28. The study area includes surface water features, such as watercourses and ponds, up to a minimum of 0.5km from the Core Strategy Corridor. This distance is considered appropriate to assess the potential direct effects of the Scheme, such as pollutants transported in surface water runoff, pollutants conveyed in drainage systems, and works within the river channel.

3.1.29. Surface water features in the area includes the River Wye and Yazor Brook.

River Wye and Tributaries

3.1.30. The River Wye flows in an easterly direction through the study area. The river is bordered predominantly by agricultural land within and upstream of the study area, although immediately downstream of the study area the river enters the urban extent of Hereford and eventually flows through Hereford town centre. The River Wye is designated as a main river and is therefore under the jurisdiction of the Environment Agency.

3.1.31. The quality of the River Wye is assessed against the objectives of the Water Framework Directive (WFD). The stretch 'Bredwardine Br to Hampton Bishop' is located within the study area. The watercourse is assessed to have an overall status of moderate, with an ecological status of moderate and a chemical status of good (2016 Cycle 2 results). The watercourse is described as being substantially natural in character.

Belmont Stream

3.1.32. The small ordinary watercourse flows in an easterly direction beneath Ruckhall Lane to the south of the River Wye. The watercourse confluences with the Newton Brook to the west of the study area at approximate NGR SO496388, and in turn discharges to the River Wye shortly downstream.

Yazor Brook and Tributaries

3.1.33. Yazor Brook rises in Burton Hill to the north-west of Yarsop, approximately 9km to the north-west of the study area, and flows in a south-easterly direction towards Hereford. It is designated as an ordinary watercourse and is therefore under the jurisdiction of HC as Lead Local Flood Authority (LLFA). The Yazor Brook is designated as a Site of Importance for Nature Conservation (SINC) within the study area and is assessed to have an overall status of moderate, with an ecological status of moderate and a chemical status of good. The watercourse is described as being substantially natural in character, although downstream sections have been heavily modified within Hereford.

Yazor Brook Tributary

3.1.34. A tributary of the Yazor Brook flows in a south-westerly direction between Tillington Road and Towtree Road, passing beneath A4103 Roman Road at NGR SO481423 and confluencing with the Yazor Brook approximately 70m to the south of A4103 Roman Road. The value of the watercourse for aquatic ecology is likely to be low.

3.1.35. There are a large number of smaller watercourses, land drains and ponds that are located within the study area. The watercourses are designated as ordinary watercourses and are therefore under the jurisdiction of HC as LLFA. The quality of these watercourses is not monitored against the objectives of the WFD and there are no known ecological designations, however as these features are in hydraulic connectivity with the River Wye and Yazor Brook and they may support protected species.

Surface water abstractions

3.1.36. A review of the Environment Agency's Water Abstraction Licenses map identified several licensed surface water abstractions within 1km of the proposed route corridor options. One is abstracted from the Yazor Brook just upstream of the proposed route corridor options, and another is abstracted from an unnamed watercourse feeding a pond, located upstream of all proposed route corridor options. Water abstracted from these points is reported to be used for irrigation, and private-pond and lake through-flow.

Groundwater

3.1.37. A review of the EA's Groundwater map identifies a groundwater Source Protection Zone (SPZ) within the study area. All proposed route corridor options pass through either the total catchment zone (SPZ3) or the outer zone (SPZ2) of the SPZ. Several of the proposed route corridor options pass within 200m of the inner zone (SPZ1), the centre of which is located approximately 0.3km to the east of the study area.

Flood Risk

3.1.38. A review of the Environment Agency's Flood Map for Planning indicates that the most significant source of flood risk to the study area is associated with fluvial flooding from the Yazor Brook and the River Wye. The most notable mapped surface water flood risks within the study area are associated with the alignment of the River Wye and Yazor Brook, and other ordinary watercourses that discharge to the River Wye which have a catchment too small to include within the Environment Agency's Flood Map for Planning (typically less than 3km2).

River Wye

3.1.39. Within the study area the floodplain of the River Wye is well defined by natural topography that defines the natural floodplain extent, with ground levels rising steeply from a floodplain level of approximately 50mAOD. There is little differentiation between the high-risk Flood Zone 3 and medium risk Flood Zone 2, supporting the description of a well-defined floodplain. The vast majority of the River Wye floodplain is defined as functional floodplain Flood Zone 3b.

3.1.40. Downstream of the study area, the centre of Hereford is protected against flooding from the River Wye by the Hereford Flood Defence Scheme constructed in 2007 that comprises raised defences along the south bank of the River Wye, broadly between Belmont and St Martins. The scheme aimed to provide a 0.5% (1 in 200) annual probability standard of protection.

Yazor Brook

3.1.41. Within the study area the floodplain of the Yazor Brook is not as well defined by adjacent topography. Land on either side of the watercourse is indicated to be located in the high-risk Flood Zone 3 and medium risk Flood Zone 2. The Yazor Brook also poses flood risk to urban areas of Hereford located downstream of the study area.

3.1.42. Flood management works were completed at the crossing of the Yazor Brook with A4103 Roman Road in 2004. In summary the scheme comprised:

- An overflow channel from the Yazor Brook immediately upstream of the Pinston House pond. The channel measures approximately 1m wide at the base, 1m high and with side slopes of 1:1. Flood waters are diverted into the channel via a weir that conveys water south and beneath A4103 Roman Road through a pipe culvert. The channel reconnects to the Yazor Brook immediately downstream of The Bolts.
- A flood relief culvert beneath A4103 Roman Road. The culvert comprises a 2.4m by 0.9m box culvert that conveys overland flood flows from the Yazor Brook into a short ditch to the south side of A4103 Roman Road. The ditch subsequently conveys this water back into the Yazor Brook as it emerges from beneath A4103 Roman Road.

3.1.43. The Yazor Brook Flood Alleviation Scheme (FAS) was also constructed in 2012 and includes a weir offtake from the Yazor Brook at Credenhill upstream of the study area, with flows entering an approximate 1.4km culvert that discharges flow to the River Wye at The Old Weir.

PEOPLE AND COMMUNITIES

3.1.44. From the west of Hereford the current views from the roads which would be directly affected by the proposed route corridor options include: A49; A4110 Canon Pyon Road; A4103 Roman Road; Tillington Road; A438 Kings Acre Road; Breinton Lane; Ruckhall Lane; B4349; A465: and, Unnamed/single tracked roads.

3.1.45. The frustration experienced by Motorised Travellers on the existing road network towards the south and west of Hereford is considered to be primarily influenced by congestion on the existing road network through Hereford. Drivers may also experience frustration due to route uncertainty as a result of users taking diversions, particularly during peak hours to avoid the A465 and A49.

3.1.46. There are a large number of PRoW within and around the study area. The proposed route corridor options are located on the western outskirts of Hereford and the nearest communities comprise areas of residential dwellings at: Holmer; Huntington; Stretton Sugwas; Kings Acre; Upper Breinton, Breinton and Warham; and, Belmont. Within this part of Hereford, the area is mainly rural and agricultural and there are no major developments and all community facilities are predominately located within Hereford. These communities may be affected as access to facilities and services to the larger communities within Hereford may be affected by the proposed route corridor options.

3.1.47. The Greenbank Meadow (Queen Elizabeth II Diamond Jubilee Field in Trust managed by the Herefordshire Wildlife Trust) is considered to be an area of designated public open space. The playing fields are located to south of Warham House and north of the River Wye.

3.1.48. There are several residential properties and farm steads within proximity of the proposed Scheme. The following areas have been identified as strategic locations for growth to the west of Hereford:

- Three Elms; and
- Holmer West.

PEOPLE AND HEALTH

3.1.49. Desk-based research has been carried out on readily available data to provide context on the local economy and local population.

3.1.50. The data summary from the Public Health Profile available through the facts and figures Hereford website[2] indicated that:

- Total population within Hereford is 189,309 (ONS, 2017)[3];
- Female life expectancy at birth in Herefordshire is significantly longer than nationally in the latest period for which there is statistically comparable data (2009-11);
- Women born in Herefordshire live on average to 83.6 years and men live on average to 79.4 years.
- People living in Herefordshire at age 65 are also expected to live significantly longer than nationally;
- Life expectancy at 65 years is around 19 further years for men and 22 further years for women;
- However, people born in the most deprived areas of Herefordshire have a shorter (4-5 years) life expectancy than those living in the least deprived areas.

Health inequalities

3.1.51. Life expectancy is 4.9 years lower for men and 3.5 years lower for women in the most deprived areas of Herefordshire than in the least deprived areas (Males = 80% in Hereford, 79% England Value for and Females = 83.9% in Hereford, and 83.1% for England).

Deprivation

3.1.52. The deprivation for Hereford is lower compared to the national average.

Lifestyle

3.1.53. In general, the indicators of public health are higher in Hereford thank the England average

Children

3.1.54. The percentage of 16-18-year olds not in education, employment or training (NEET) has reduced marginally over the period. However, this exceeds the figure for England overall.

Collisions Risk

3.1.55. In Hereford, the population experience higher numbers of fatalities or instances of being seriously injured on roads whilst in a car, when compared to walking, cycling, or when on a motorbike. However, in general the number of people seriously injured or killed in a traffic collision has decreased significantly over the years (between 1997 and 2014).

Qualifications

3.1.56. The adult population of Hereford is assessed as having a lower percentage of professional qualifications when compared to the rest of England.

[2] http://fingertipsreports.phe.org.uk/health-profiles/2016/e06000019.pdf
[3] https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesrevisiontool

Earnings

3.1.57. The gross weekly pay, for both male and female full-time works is below that of the national average for England (£81 less for males, and £84 for females). The data therefore indicates that the local economy in Hereford may be performing poorer compared to the national average.

Employment

3.1.58. In comparison to the national average, a lower percentage of people within Hereford are in full time jobs, however a higher percentage are in part time jobs.

Social Profile

3.1.59. Hereford has a higher proportion of older residents than England and Wales as a whole, with 24% of the population aged over 65 which comprises 24% compared to 18% nationally. The total population of Hereford has grown by eight per cent which has been entirely due to net immigration. The current (mid-2016) estimate of the county's resident population is 189,300 people of which Males are 49.5% and Females 50.5%.

MATERIALS AND WASTE

3.1.60. The proposed bypass will require materials to create new carriageways and the alterations of existing ones. Each of the proposed route corridor options are likely to vary significantly in terms of material usage due to their differences in scale but are likely to use the same broad categories of materials, primary materials, for example aggregates, or secondary, recycled materials brought in from off site, possibly produced by another nearby construction project.

3.1.61. Each of the route corridor options will result in the production of surplus material which may need to be disposed of as waste. In the case of this scheme surplus material is likely to require disposal from excavations for new carriageways or carriageway widening, any material from the removal of existing infrastructure, and materials bought to site that are not used for their original purpose (such as damaged or over-ordered goods).

3.1.62. The operation and maintenance of the current Hereford Transportation Package assets will require the consumption of some materials, and will generate some arisings that may need to be disposed of as waste.

3.1.63. Material resource use and its associated environmental effect is identified within the extraction and transport of primary raw materials and the manufacture of products and their subsequent transport to construction sites. Large scale schemes such as the Hereford Bypass will consume moderate quantities of both virgin materials with lower levels of secondary and recycled materials generated.

3.1.64. The project is likely to result in surplus matter which will require disposal as waste. This usually arises from two sources comprising:

- Existing site waste such as concrete from removal of an existing structure and excavation of materials from earthworks; and
- Materials brought on to the site, but not used for their intended purpose e.g. damaged goods.

3.1.65. The operation and management of the current Hereford Transportation Package asset is also likely to require some specialist components (light bulbs, signage – for example) as well as some bulk material (cement, concrete, sand and gravel) for minor works and repairs of the highway.

3.1.66. The operation and maintenance of the current Hereford Transportation Package asset is likely to generate small volumes of waste from littering, light replacement, signage replacement, replacement of reflective road studs (cats' eyes) and minor barrier refurbishments, among others. Accordingly, the anticipated effects and effects of disposing of this waste are – in the context of construction schemes – deemed minor.

GEOLOGY AND SOILS

Made Ground

3.1.67. The study area is predominantly rural and agricultural, therefore may contain only localised areas of Made Ground of unknown provenance. It is assumed that these are likely present in areas associated with historical or current developments such as within the location of the former railway line. Made Ground / reworked ground is anticipated to be present within the location of the A465, and other highways within the study area.

Superficial Deposits and Bedrock Geology

3.1.68. The presence of superficial deposits is variable across the study area. The bedrock geology across the study area comprises the Raglan Mudstone Formation, consisting of red mudstones and silty mudstones with

calcretes and sandstones. It is anticipated to underlay the entire study area. BGS archived borehole logs are limited with depth to bedrock ranging from 1.6 to 4.0 metres below ground level (bgl), down to 12 -14 m bgl in the centre of the study area.

Mineral Resources

3.1.69. The study area contains river sand and gravel resources that form the floors of the River Wye valley within the alluvium.

Soil Quality – Agricultural Land Classification

3.1.70. The study area contains Grade 1 (excellent) and Grade 2 (very good) agricultural land as classified under the Agricultural Land Classification (ALC) system. A small proportion of the study area, south of the River Wye has been classified as Grade 3 (good to moderate).

Groundwater Quality

3.1.71. Groundwater quality for the Wye Secondary Devonian ORS catchment within the Secondary A aquifer is monitored against the WFD. The current overall and chemical status is poor. The catchment is classified as a Drinking Water Protected Area.

Groundwater Abstractions

3.1.72. There are 36 No. licenced water abstractions within 1 km of the site, of these 6 No. abstractions are located within the study area. These are related to a farm immediately adjacent to the B4349 at Clehonger Court, the livestock market and Wyevale Garden Centre.

Historic Land Use

3.1.73. The study area has historically remained generally undeveloped, arable land with occasional residential houses, farm buildings, roads, woodlands and tracks.

- A well is identified in a dense area of woodland approximately 20m south of the River Wye. Between 1928 and 1972, a hydraulic ram, tank, and a pumping house are identified adjacent to the well. By 1977 a pump house was labelled north of the river, and well, tank and pump house to the south no longer identified.
- In 1991 the junction from the main road to Belmont Estate has been realigned a distance of 90m to the east.
- Tanks associated with housing are identified across the study area, including Wyevale Nurseries in 1991.
- Ponds are identified across the study area and surrounding area.
- North of the A438 two properties were built by 1904. A tank and well are identified on the historical mapping.
- A smithy is labelled immediately north of the A438 in 1904.
- By 1972 a garage and poultry house is identified in Kings Acre, next to the A438 Kings Acre Road. No longer labelled by 2000.
- A railway line runs through the centre of the study area south east to north-west south of Huntingdon village, shown to be in a cutting for approximately 400m, at grade for 50m and on embankment for 217m. Between 1929 and 1973, the railway line was dismantled. By 1991 there is very little evidence of the dismantled railway line and associated earthworks.
- A fuel filling station is located on the junction between the A480 and A438 in 1970.
- The channel of Yazor Brook appears to have been changed by 1970, with four buildings being located in the same location.
- In 1993 a water tap and pumping station is identified on the junction between the A4103 and Towtree Lane.

3.1.74. The study area is currently predominately rural, agricultural land with occasional villages, farm houses and buildings and residential properties close to road infrastructure.

Potential sources of Contamination

3.1.75. The following potential sources of contamination have been identified on-site from current or historical land use:

- Agricultural land including orchards, a nursery and golf course;
- Historical hydraulic ram, tank and pumping house;
- Identified historical tanks across study area;
- Historical industries including a blacksmith, garage and fuel filling station;
- Former railway line (now dismantled and no longer evident);

- Pumping station; and
- Made Ground associated with potentially infilled ponds, embankments of the former railway line, highways, and numerous demolished buildings.

3.1.76. The potential contaminants associated with agricultural land include pesticides, herbicides and hydrocarbons including fuels. There is also the potential for burial pits, and the potential for anthrax spores to be present.

CLIMATE

3.1.77. In the UK, national greenhouse gas emissions on a national scale decreased in 2015 by 38% from 1990. In 2015, UK net CO2 emissions were estimated at 403.8 million tonnes, a decrease of 3.8% in comparison to 2014 levels[4]. Similar statistics for 2016 were provisional[5] at the time of writing in March 2018, but these indicated a 7.4% reduction in UK net CO2 emissions to 374 million tonnes. This decrease was largely due to the increased use of renewables and nuclear sources for energy supply; CO2 emission due to transport increased by 1%.

3.1.78. There were 37.3 million vehicles licensed for use on roads in the UK in 2016, which increased from 36.5 million in 2015. However, of these additional 0.8 million vehicles, 42,000 were ultra-low emission vehicles (ULEVs), which represents an increase of 40% since 2015[6].

3.1.79. The UK construction industry is the largest consumer of natural resources, with an average of over 400 million tonnes of material consumed every year. This accounts for approximately 10% of the total UK carbon emissions[7]. Therefore, approximately 40.38 million tonnes of CO2 are attributed to the embodied carbon of construction materials.

[4] Department for Business, Energy and Industrial Strategy (2015) 2015 UK Greenhouse Gas Emissions [online] available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/589602/2015_Final_Emissions_Statistics_one_page_summary.pdf

[5] Department for Business, Energy and Industrial Strategy (2016) 2016 UK Greenhouse Gas Emissions (provisional) [online] available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/604408/2016_Provisional_Emissions_statistics.pdf

[6] Vehicle Licensing Statistics: Annual 2016, Department for Transport (April 2017)- https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/608374/vehicle-licensing-statistics-2016.pdf

[7] Alinden, B. (2014) Embodied Energy and Carbon, ICE [online] available at: https://www.ice.org.uk/knowledge-and-resources/briefing-sheet/embodied-energy-and-carbon .

4 DESCRIPTION OF SCHEME CORRIDORS

4.1 DESCRIPTION OF CORRIDORS

4.1.1. The Corridor Assessment Framework (CAF) reporting has resulted in the 24 'long list' corridor options being sifted down to the seven 'short list' corridors, as described below and shown on drawing No 70024065-WSP-XX-XX-DR-HE-00003 in Appendix C and the Engineering Layout Plans in Appendix D.

4.1.2. The seven corridors share commonalities as shown below;

- Start at the A465 to the south, with the proposed western junction of the Southern Link Road (SLR), to provide an A49 to A49 bypass of the city centre, (in combination with the SLR).
- End at a proposed junction with the A49 to the north of the city centre
- Provide connectivity with A438 Kings Acre Road and the A4103 Roman Road
- Have high level crossings of the River Wye and low level at Yazor Brook
- Avoid key environmental constraints and minimise disruption to the built environment
- The road standard for each route option would be the same
- Same horizontal alignment to the east of Canon Pyon Road

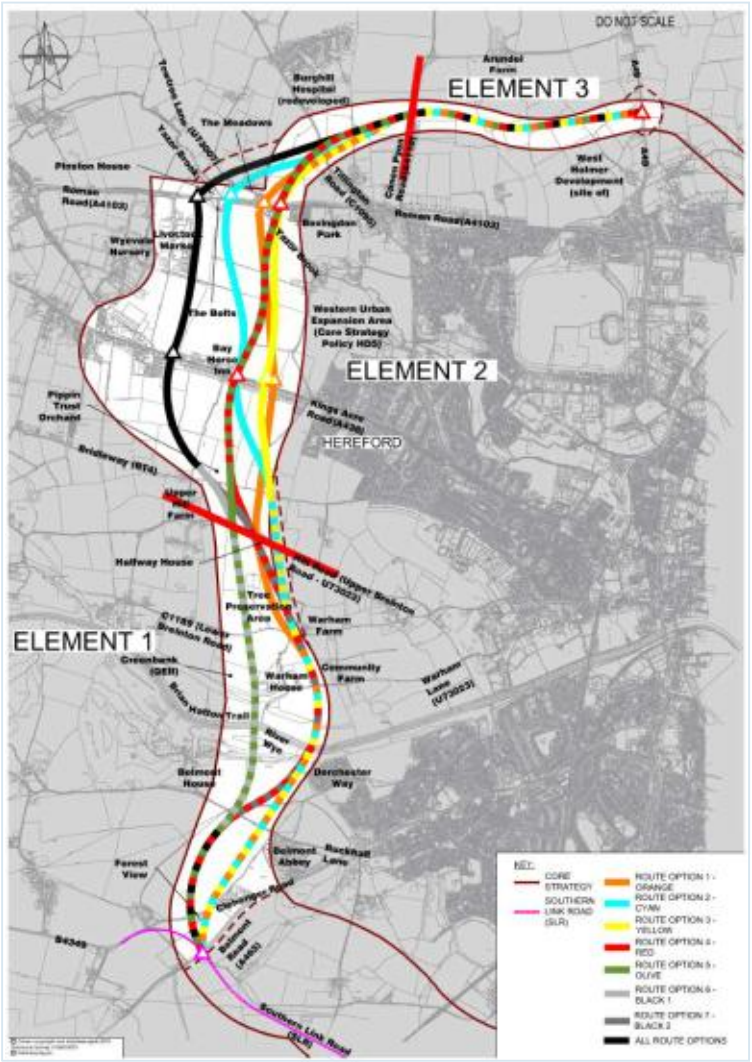

Figure 8 – Possible Route Corridor Options

4.2 CORRIDOR 1 - ORANGE

4.2.1 Corridor 1 - Orange is 7.9km long and starts at the proposed SLR A465 roundabout taking a North-East path to the eastern side of Forest View under Clehonger Road and Ruckhall Lane and through Belmont Park in a cutting before a high-level viaduct crossing of the Wye on a sweeping left-hand curve. Rising the bypass passes over C1189 (Lower Breinton Road) before entering cutting and under Hill Road (Upper Breinton Road – U73022) and a NMU overbridge. On leaving the cutting the bypass falls towards a new roundabout on A438 Kings Acre Road east of The Bay Horse Inn. The bypass takes a diagonal path to the North West through the potential Western Urban Expansion Area, also known as 'Three Elms' passing over Yazor Brook to a new roundabout on A4103 Roman Road at Towtree Lane. A right-hand turn takes the bypass in cutting under Tillington Road and the A4110 Canon Pyon Road exiting on an easterly embankment over Lyde NMU underpass and terminating at a new roundabout on the A49 Trunk Road west of Holmer.

4.3 CORRIDOR 2 - CYAN

4.3.1 Corridor 2 - Cyan is 8.2km long and its route is common with Corridor 1 - Orange between its start at the proposed SLR A465 roundabout and where it diverges just south of C1189 (Lower Breinton Road). At this point the bypass rises passing over C1189 (Lower Breinton Road) before entering cutting and under Hill Road (Upper Breinton Road – U73022) and a NMU overbridge. On leaving the cutting the bypass falls towards a new roundabout on A438 Kings Acre Road immediately east of The Bay Horse Inn. The bypass again cuts through the potential Three Elms site, moving gradually away as it heads north passing over Yazor Brook to a new roundabout on A4103 Roman Road near The Bolts with connection to Towtree Lane. A right-hand turn takes the bypass in cutting under Tillington Road and the A4110 Canon Pyon Road exiting on an easterly embankment over Lyde NMU underpass and terminating at a new roundabout on the A49 Trunk Road west of Holmer.

4.4 CORRIDOR 3 - YELLOW

4.4.1 Corridor 3 - Yellow is 7.9km long and its route is common with Corridors 1 – Orange and 2 – Cyan between the start and where Corridor 1 - Orange diverges south of C1189 (Lower Breinton Road), where Corridors 2 - Cyan and 3 - Yellow diverge at the proposed NMU footbridge north of Hill Road (Upper Breinton Road – U73022). On leaving the cutting the bypass falls towards a new roundabout on A438 Kings Acre Road east of The Bay Horse Inn. The bypass takes a diagonal path through the potential Three Elms site passing over Yazor Brook to a new roundabout on A4103 Roman Road east of Towtree Lane. A right-hand turn takes the bypass in cutting under Tillington Road and the A4110 Canon Pyon Road exiting on an easterly embankment over Lyde NMU underpass and terminating at a new roundabout on the A49 west of Holmer.

4.5 CORRIDOR 4 - RED

4.5.1 Corridor 4 - Red is 8.1km long and starts at the proposed SLR A465 roundabout taking a northerly path to the western side of Forest View under Clehonger Road and Ruckhall Lane and through Belmont Park in a cutting. The corridor then takes the high-level viaduct crossing of the River Wye on a sweeping left-hand curve at the same location as Corridors 1 – Orange, 2 – Cyan and 3 - Yellow. Upon exiting the viaduct, the corridor diverges from horizontal alignment of Corridors 1 – Orange, 2 – Cyan and 3 - Yellow. Rising the bypass passes over C1189 (Lower Breinton Road) before entering cutting and under Hill Road (Upper Breinton Road – U73022) and a NMU overbridge. On leaving the cutting the bypass falls towards a new roundabout on A438 Kings Acre Road immediately east of The Bay Horse Inn (location of which is shared with Corridor 2 - Cyan). The bypass follows the western boundary of the potential Three Elms site passing over Yazor Brook to a new roundabout on A4103 Roman Road. A right hand turn then takes the bypass on embankment over Tillington Road and then in cutting under A4110 Canon Pyon Road exiting on an easterly embankment over Lyde NMU underpass and terminating at a new roundabout on the A49 Trunk Road west of Holmer.

4.6 CORRIDOR 5 - OLIVE

4.6.1. Corridor 5 - Olive is 7.8km long and shares its horizontal alignment with Corridor 4 – Red from its starts at the proposed SLR A465 roundabout to immediately south of Ruckhall Lane. The corridor passes through Belmont Park in a deep cutting before a straight high-level viaduct crossing of the Wye. Rising the bypass passes immediately west of Warham House and over C1189 (Lower Breinton Road) before entering cutting and under Hill Road (Upper Breinton Road – U73022) and a NMU overbridge. At this point the corridor converges back with the horizontal alignment of Corridor 4 – Red until the proposed junction with the A49 Trunk Road.

4.7 CORRIDOR 6 – BLACK 1

4.7.1 Corridor 6 – Black 1 is 8.3km long and has a common alignment with Corridor 5 - Olive from its start to Hill Road (Upper Breinton Road – U73022) where it has entered a cutting and goes underneath a NMU overbridge. While in the cutting the bypass takes a left-hand curve North West exiting to fall towards a new roundabout on A438 Kings Acre Road east of Conifer Walk. The bypass passes immediately east of Hereford Livestock Market to a new roundabout on A4103 Roman Road west of Pinston House. A right-hand turn takes the bypass over Yazor Brook and ponds then on embankment over Tillington Road and then in cutting under the A4110 Canon Pyon Road exiting on an easterly embankment over Lyde NMU underpass and terminating at a new roundabout on the A49 Trunk Road west of Holmer.

4.8 CORRIDOR 7 BLACK 2

4.8.1 Corridor 7 - Black 2 is 8.7km long and shares its alignment with Corridor 4 – Red from its start until Hill Road (Upper Breinton Road – U73022) where it shifts to Corridor 6 - Black1, converging at the proposed NMU overbridge. Corridor 6 - Black 1 and Corridor 7 - Black 2 then align together to the new roundabout on the A49 Trunk Road west of Holmer

4.9 COST ESTIMATE

4.9.1. The rates used, are primarily from SPON'S Civil Engineering and Highway Price Book 2018 or historic rates deemed to be appropriate for the size and nature of the scheme and are based on current prices.

4.9.2. No allowance has been made for the treatment and removal of contaminated/hazardous material, such as asbestos in any part of the estimates.

4.9.3. An Optimism Bias of 32% had been applied to the total estimated cost using guidance and calculations as specified within the supplementary green book.

4.9.4. Percentage uplifts for Contractors overheads, preliminaries, statutory undertaker, preparation and supervision costs are included in the total estimate costs.

4.9.5. In relation to Preliminaries; where no detailed information is available, it is suggested that when preparing a preliminary estimate an addition of between 15% and 35% of net contract value is made to cover contractor's oncosts, both time and non-time related. A 25% has been included.

4.9.6. Value Added Tax is excluded.

4.9.7. Landfill taxes have been applied to the unacceptable / surplus earthworks material being tipped off site.

Corridor	Estimated Total Cost (£)
Corridor 1 - Orange	151m
Corridor 2 - -Cyan	153m
Corridor 3 - Yellow	150m
Corridor 4 - Red	153m
Corridor 5 - Olive	149m
Corridor 6 – Black 1	160m
Corridor 7 - Black 2	166m

Table 3 - Estimated Total Cost

4.9.8. A breakdown of items of significant high cost can be found in the Engineering Assessment section below.

4.9.9. A further detailed summary table showing estimated costs for each route option is in Appendix F

4.10 CORRIDOR ASSESSMENT

4.10.1. Corridor options are going to be assessed to the follow criteria, as identified in the DMRB Volume 5, Section 1, Part 2, TA 37/93 – Scheme Assessment reporting

- Engineering
- Traffic and Economic
- Environmental

5 ENGINEERING ASSESSMENT

5.1 ENGINEERING STANDARDS

5.1.1. The process for identifying carriageway standard options is provided in the Design Manual for Roads and Bridges (DMRB): TA 46/97 TRAFFIC FLOW RANGES FOR USE IN THE ASSESSMENT OF NEW RURAL ROADS. This Advice Note sets out carriageway standard options for use as starting points in the assessment of new rural trunk roads. This assessment uses a Highway Assignment Model to determine the traffic flows on the network and new sections of road. To achieve a consistent approach, the route standard within this assessment has been assumed to be WS2+1.This allows the assessment to conduct a fair comparison of each route option, enabling the identification of an optimal route. A Variable Demand Modelling (VDM) model is currently being developed to enable the assessment of the associated Active Travel Measures (ATMs).

5.1.2. TA 46/97 TRAFFIC FLOW RANGES FOR USE IN THE ASSESSMENT OF NEW RURAL ROADS states the following:

Procedure for the Assessment of Carriageway Standards

The recommended procedure for the assessment of carriageway standard is as follows:

Step 1. Determine the high and low growth AADT flows forecast for the scheme's expected opening year. These estimates should take account of any induced traffic.

Step 2. Select for local assessment those carriageway standards that fall within the flow range for either or both of these traffic forecasts. For example, for a forecast flow range of 16,000 to 17,000 AADT, Table 2.1 shows that WS2 and D2AP standards are suitable for assessment

Carriageway Standard	Opening Year AADT	
	Minimum	Maximum
S2	Up to 13,000	
WS2	6,000	21,000
D2AP	11,000	39,000
D3AP	23,000	54,000
D2M	Up to 41,000	
D3M	25,000	67,000
D4M	52,000	90,000

TA46 Table 2.1

(Note - TA46/97 Table 2.1 does not reference the more recent. WS2+1 standard and TD70/08 – "Design of Wide Single 2+1 Roads". TD70 paragraph 2.1 states "provision of a WS2+1 road can be a more effective solution than other single carriageway road options at flows of up to 25,000 Annual Average Daily Traffic (AADT). It is generally accepted that WS2+1 roads provide improved traffic safety due to the unopposed overtaking)

Step 3. Consider whether there are any local circumstances (for example, unusually high or low construction costs, environmental constraints, operational considerations, major network changes in the evaluation period, etc.) which suggest that different standards other than those recommended in Table 2.1 should be assessed.

Step 4. Carry out the economic assessment to determine Net Present Values for each standard.

Step 5. Enter Net Present Values and/or benefit-cost ratios, and all other relevant factors into the impacts tables used in the assessment reports (see TD 37/93, DMRB 5.1.2) to inform the selection of the optimal standard.

All decisions on choice of carriageway standard should be based on the combined results of economic, operational and environmental assessments. The flow ranges given in Table 2.1 are determined only from the

economic assessments using COBA and QUADRO. They indicate the lowest flow at which a given standard is likely to be economically preferred to a lesser standard and the highest flow at which a given standard is likely to be economically preferred to a greater standard. An operational assessment should also be carried out to indicate the maximum flow which a given road standard can accommodate in the future under some stated conditions.

The operational assessment for each standard being locally assessed should include reference to Congestion Threshold (and hence Congestion Reference Flow) and Maintenance Considerations.

Congestion Threshold and Congestion Reference Flow

The congestion threshold is a measure of the maximum achievable hourly throughput of a link which should be considered as part of the scheme operational appraisal. Any increase in demand above this threshold can lead to flow breakdown, queueing and reduced throughput. It depends on many physical characteristics, for example, the proportions of different vehicle types, driver behaviour, distance between junctions, etc. It is not appropriate to define a fixed threshold value for any particular road standard. However, it is possible to estimate the maximum hourly throughput and it may be desirable to relate this to a daily flow. The threshold may be expressed in terms of annual average daily traffic (AADT) by identifying the likely ratio of peak to daily flow and applying this to the threshold hourly value. The resulting AADT is known as the Congestion Reference Flow (CRF).

Carriageway Standard		Trunk Road	Principal Road
Single 7.3m	(S2)	22,000	23,000
Wide Single 10m	(WS2)	32,000	33,000
Dual 2 lane all purpose	(D2AP)	68,000	70,000
Dual 3 lane all purpose	(D3AP)	103,000	104,000
		Motorway	
Dual 2 lane motorway	(D2M)	65,000	
Dual 3 lane motorway	(D3M)	97,000	
Dual 4 lane motorway	(D4M)	130,000	

5.1.3. Until the VDM modelling is completed it is only possible to undertake Steps 1 and 2 and early parts of Stage 3. The remainder of Step 3 and Steps 4 and 5 (as well as updating Steps 1 and 2) will refine the results. For example, the variable demand traffic model will provide better estimates of congestion relief and junction movements, which are likely to have an impact on economic performance than just link capacity alone. Further work on junction design will also help inform the detailed local impacts where the bypass intersects the existing highway network.

5.1.4. The current forecast traffic flows from the Highways Assignment Model for the Hereford Bypass are outlined below for the Opening Year (2026).

Section	Opening year (2026) 2-way AADT
A49(T) South	19,900
SLR (A49-A465)	13,500
Bypass (A465-A438)	17,600
Bypass (A438 – A4103)	11,300
Bypass (A4103 –A49)	7,000
A49(T) North	19,900

Table 4 - Hereford Bypass Traffic Forecasts

5.1.5. These are early estimates and may be subject to change as the traffic model is adjusted during the Variable Demand modelling and refined during the forecasting process.

5.1.6. TA46/97 – Traffic Flow Ranges for Use in the Assessment of New Rural Roads Table 2.1 (**Table 5 below**) details the relationship between traffic capacity and highway standard.

Carriageway Standard	Opening year AADT	
	Minimum	Maximum
S2	Up to 13,000	
WS2	6,000	21,000
WS2+1*	Up to 25,000*	
D2AP	11,000	39,000
* Not listed in TA46/97, AADT from draft TD70/08		

Table 5 - TA46/97 Table 2.1 - Opening Year Economic Flow Ranges

5.1.7. The results displayed in the table above indicate that a WS 2+1 carriageway would be sufficient to accommodate the expected levels of traffic. The maximum forecast traffic flow (17,600 AADT) is well within the Opening Year Economic Flow Range (25,000 AADT) and Congestion Reference Flow Range (33,000 AADT). This will be kept under review until the results of the VDM modelling is known. The results of the VDM modelling and discussions with Highways England and the Department for Transport will finalise the route standard; this will ensure the scheme meets future needs.

5.1.8. For the purposes of this Report a WS2+1 Highway standard has been adopted for all route options, as this accommodates opening year AADT figures and the requirements for overtaking, while limiting the land required and the optimum cost of construction.

5.1.9. For route corridor assessment purposes, the following design has been adopted. The carriageway would consist of three lanes with each lane 3.5m wide, with 1m hard strips. Two of the lanes will be separated from the other by a double white line 1m apart separating the directions of flow. These double white lines will incorporate a red coloured surface and diagonal white lining. Verges are a minimum 3.2m, to accommodate road side features (i.e. safety barriers, filter drains etc.) on straights and on the outside of bends, with locally widened 5.3m verges on the inside, to accommodate stopping sight distance with the associated design speed. Details of the alignment and extent of footway and cycleway provision on the bypass will be developed as the preferred route option is progressed.

5.2 DESIGN SPEED

5.2.1. For all corridors, a design speed of 100khp (60mph) has been adopted, in line with the proposed highway standards and the approved SLR, which in combination with the Bypass give a total bypass solution of the city centre. Junctions and their approaches have been designed to 70kph (40mph).

5.2.2. A design speed of 120kph (70mph) could be implemented for a dual carriageway solution.

5.3 ALIGNMENT

5.3.1. The chosen highways standard / design speed dictates the minimum geometric parameters of the design in accordance to the DMRB Volume 6, Section 1, Part 1, TD9/93 – Highway Link Design. It should be noted desirable minimum radii of 720m have been implemented on the horizontal curvature, which resulted in over widened verges on the inside of bends to accommodate the desirable minimum SSD. Desirable minimum crest values and absolute minimum sag values have been implemented.

5.3.2. This will preserve future flexibility to upgrade the route to dual carriageway utilising visibility over widened verges for width and maximum 2 step Relaxations at upgraded 120kph design speed. The standard on junction connector and side road diversions should be to County standards and consistent with adjacent highway so as not to introduce atypical properties from the usually higher threshold DMRB standard.

5.4 JUNCTION STRATEGY

5.4.1. Junction strategy and especially network connectivity impacts traffic patterns on the bypass and the surrounding road network. Typically, more junctions will draw local traffic onto the bypass whilst the increased junction delay will reduce its attractiveness to longer distance traffic. The objective of relieving city centre congestion suggests a strategic rather than local distributor bypass format capturing as large as possible proportion of the Hereford through traffic.

5.4.2. Early scheme definition discussion with HC / BBLP identified four scheme junctions:

- A465 Abergavenny to Hereford Road
- A438 Kings Acre Road
- A4103 Roman Road
- A49 Trunk road

5.4.3. Currently majority of the north-south traffic passes through the centre of Hereford on the A49 due to the limited number of River Wye crossing opportunities. The proposed Hereford Bypass (HBP) will direct traffic on the south-west of Hereford, towards the west around the city and connect to the A49 north of Hereford

5.4.4. For preliminary junction General Arrangements, please refer to the Engineering Layout plans in Appendix D, for route junction comparisons please refer to drawings 70024065-WSP-XX-XX-DR-HE-00018 and 00019 in Appendix E.

5.4.5. Junctions capacity testing has been undertaken on the preliminary traffic data, for each of the route junction options. This has determined that roundabout type junctions are required at all locations to meet Ratio of Flow to Capacity (RFC) requirements i.e. junctions will operate within capacity and therefore likely avoid regular queuing.

5.4.6. **Table 6** below provides a summary of the junction types for each route option, note all mainline Bypass approaches are 2 lane entries, unless identified otherwise.

	A465	A438	A4103	A49(T)
Route option 1 - Orange	5 Arm Roundabout	4 Arm Roundabout*	4 Arm Roundabout	3 Arm Roundabout
Route option 2 - Cyan	As Route option 1 - Orange	4 Arm Roundabout*	5 Arm Roundabout	As Route option 1 - Orange
Route option 3 - Yellow	As Route option 1 - Orange	4 Arm Roundabout*	4 Arm Roundabout	As Route option 1 - Orange
Route option 4 - Red	5 Arm Roundabout	4 Arm Roundabout	4 Arm Roundabout	As Route option 1 - Orange
Route option 5 - Olive	As Route option 4	As Route option 4	As Route option 4	As Route option 1 - Orange
Route option 6 – Black 1	As Route option 4	4 Arm Roundabout	4 Arm Roundabout	As Route option 1 - Orange
Route option 7 – Black 2	As Route option 4	As Route option 6	As Route option 6 - Black1	As Route option 1 - Orange
*Single lane entry on bypass mainline approaches				

Table 6 - Junction Options

5.4.7. The proposed 3 arm roundabout on the A49 (T) will be designed with adequate geometric design parameters for an additional arm to accommodate the future link between the A49 (T) and the A4103 Roman Rd north east of Hereford.

5.4.8. There are several minor roads/accesses that cross the route options; these will be accommodated by way of either over or under bridges.

5.4.9. Dualling of the route options would result in all mainline approaches and exits from the roundabout becoming minimum 2 lanes (i.e. route options 1 – 3 on the A438, would require alignment changes)

Junction Capacity

5.4.10. The capacity of the various junctions being considered have been assessed in 2032 and 2041 forecast years as per DMRB guidance.

5.4.11. Guidance identifies a Ratio of Flow Capacity (RFC) value of 0.85 or less typically demonstrates that a junction arm is operating within capacity and therefore regular queuing is unlikely.

5.4.12. Both Actual and demand flows have been assessed within the junction modelling software, with demand flows being slightly more robust than actual.

5.4.13. From the current assessment all arms are seen to be operating within capacity, with the exception of:

- The A438 Kings Acre Road East on Route option 1 - Orange for the 2032 PM peak (0.88 RFC, actual and demand)
- The A438 Kings Acre Road East and West on Route option 1 - Orange for the 2041 AM peak (0.88 and 0.90 RFC respectively, for both flows)

- The A438 Kings Acre Road East on Route option 1 - Orange for the 2041 PM peak (1.00 RFC, for both flows)
- The Bypass South at A438 Kings Acre Road on Route option 6 - Black1 and 7 - Black 2for the 2041 AM peak (0.87 and 0.88 RFC, for actual and demand flows respectively)
- The Bypass South at A438 Kings Acre Road on Route option 6 - Black1 and 7 – Black 2 for the 2041 PM peak (0.88 and 0.89 RFC, for actual and demand flows)

5.4.14. If Route option 1 - Orange becomes the preferred route, design parameter for the junction will be reviewed to accommodate the RFC, while aiming to limit further land take and maintain the horizontal position of the junction.

5.4.15. One or more of the following elements would be subject to change (increased) to accommodate RFC:

- Approach widths
- Entry width
- Flare lengths
- Entry radii
- Inscribed Circle Diameter
- Entry Angle

5.4.16. Issues identified with Route option 6 - Black1 and 7 – Black 2 are not foreseen to be of concern as results are based on 1 lane entries, where these route options are 2 lanes. This is anticipated to resolve the issue. If Route option 6 - Black1 or 7 – Black 2 becomes preferred route results will be revisited to validate this assumption.

5.4.17. Due to all junctions arms (apart from the aforementioned) operating within capacity within the design year (2041), there is potential to accommodate future growth beyond 2041, or revisit design parameter for reduced land take requirements. Please refer to the following sections, detailing ARCADY results, as growth potential / land take reduction may be limited in places. It should be noted ARCADY modelling has been based on 1 lane approaches on all arms at all locations, which is not currently the case for the majority of mainline approaches i.e. only applicable for the A438 junctions on Route options 1- Orange, 2 – Cyan and 3 - Yellow

5.4.18. It can be assumed all junctions apart from those above will operate better than identified below, due to 2 lane approaches.

A465 5 Arm Roundabout – Route options 1 - Orange, 2 - Cyan and 3 - Yellow

2032 – ARCADY Modelling Results

5.4.19. 2032 results show that all arms for the A465 roundabout across all peaks and flow sets operate comfortably below the theoretical capacity threshold of 0.85 RFC for the 2032 scenario. The longest delay is 6 seconds on the Bypass South East and the A465 South West in the PM peak and no queue length for any arm exceeds 2 Passenger Car Units (PCUs) across all peak periods.

2041 – ARCADY Modelling Results

5.4.20. Similarly, to the 2032 scenario, all arms operate comfortably below the theoretical capacity threshold for the 2041 scenario. The longest delay is recorded on the A465 South West (8 seconds) across both flow sets and no queue length exceeds 2 PCUs.

A465 5 Arm Roundabout – Route options 4 - Red, 5 - Olive, 6 – Black 1 and 7 – Black 2

2032 – ARCADY Modelling Results

5.4.21. Results show that all arms will operate comfortably below the theoretical capacity threshold.

5.4.22. The highest delay is recorded on the A465 South during the PM Peak Demand flow set at 6 seconds and no arm exceeds a queue length of 2 PCUs.

2041 – ARCADY Modelling Results

5.4.23. The results show that all arms for the 2041 scenario operate well below the theoretical capacity threshold.

5.4.24. The highest recorded delay is on the A465 South West during the PM Peak at 8 seconds across both flow sets. Furthermore, no arm experiences a queue length of more than 2 PCUs.

A438 4 Arm Roundabout – Route option 1 - Orange

2032 – ARCADY Modelling Results

5.4.25. Analysis shows that for the year 2032, the majority of arms remain within the theoretical RFC threshold of 0.85. The A438 Kings Acre Road East exceeds the value during the PM Peak period (0.88) across both flow sets.

5.4.26. The highest delay can be seen on the A438 Kings Acre Road East across the Actual and Demand flow sets, recording a delay of 33 seconds and a queue length of 7 PCUs in the PM Peak.

5.4.27. Despite being below the theoretical capacity threshold, there are some arms that have an RFC value close to 0.85. This includes the A438 Kings Acre Road West during the AM Peak with a value of 0.81 across the Actual and Demand flow sets.

5.4.28. The highest junction delay experienced was during the PM Peak period with a delay of approximately 14 seconds.

2041 – ARCADY Modelling Results

5.4.29. Results from the 2041 scenario show that a number of arms exceed the theoretical capacity threshold of 0.85, this including the A438 Kings Acre Road East and West which have RFC values of 0.88 and 0.90 across both flow sets respectively during the AM Peak period. The arm also exceeds theoretical capacity during the PM Peak period with an RFC value of 1.00 across both flow sets, delays of 87 seconds and a queue length of 20 PCUs.

5.4.30. The highest junction delay experienced was during the PM Peak period with a delay of approximately 29 seconds.

5.4.31. These results highlight there is no potential to accommodate future capacity at this junction beyond 2041 and design changes as identified previously will be required.

A438 4 Arm Roundabout – Route option 2 - Cyan

2032 – ARCADY Modelling Results

5.4.32. Results highlights that no arms exceed the theoretical capacity threshold of 0.85 across all peak periods and flow sets. The largest delay recorded is 10 seconds on the Bypass South during the AM Peak period across both flow sets and during the PM peak period across both flow sets. No arm exceeds a queue length of 3 PCUs.

2041 – ARCADY Modelling Results

5.4.33. Similarly to the 2032 scenario, the 2041 modelling results show that no arm exceeds the theoretical capacity threshold of 0.85. The Bypass South during the AM and PM Peak is near to this threshold with an RFC value of 0.80 and 0.81 across the Actual and Demand flow sets during the AM and 0.81 and 0.82 across both flow sets during the PM. This arm also has the highest delay time of 17 seconds during the AM Peak Demand flow set, however no arms exceed a queue length of 5 PCUs.

A438 4 Arm Roundabout – Route option 3 - Yellow

2032 – ARCADY Modelling Results

5.4.34. Results highlight that in the 2032 scenario all arms are comfortably within the theoretical capacity threshold of 0.85 RFC. The longest delay can be found on the Bypass South during the AM Peak period with 9 seconds and no arm exceeds a queue length of 2 PCUs.

2041 – ARCADY Modelling Results

5.4.35. Similar to the 2032 scenario, results for 2041 show that all arms operate comfortably within the 0.85 RFC theoretical capacity threshold. The highest delays recorded were on the Bypass South during the AM Peak Demand flow set with 13 seconds and no arm experiences queue lengths above 4 PCUs.

A438 4 Arm Roundabout – Route option 4 - Red and 5 - Olive

2032 – ARCADY Modelling Results

5.4.36. Modelling shows that all arms of the A438 roundabout are well within the 0.85 theoretical capacity threshold for the 2032 scenario. The Bypass South has the highest RFC value of 0.73 in the PM peak along with an 11 second delay and a 3 PCU queue length. No arm had a queue length of more than 3 PCUs.

2041 – ARCADY Modelling Results

5.4.37. Similarly, the 2041 scenario shows that all arms operate within theoretical capacity; however, the Bypass South during the AM and PM peaks is close to the threshold. During the AM Peak, the arm is expected to operate at an RFC of 0.81 for the Actual flows, and 0.82 for the Demand flows. During the PM Peak the arm is predicted to operate at an RFC value of 0.82 for the Actual flows, and 0.83 for the Demand flows.

5.4.38. The most significant delay on the junction is 17 seconds; this occurs on the Bypass South during the AM Peak across both flow sets, along with a maximum junction queue length (across all peaks) of 5 PCUs. There is also a queue length of 5 PCUs on the Bypass South during the PM Peak across both flow sets as well as a delay period of 16 seconds.

A438 4 Arm Roundabout – Route option 6 - Black1 and 7 – Black 2

2032 – ARCADY Modelling Results

5.4.39. ARCADY illustrates that in the 2032 scenario no arms exceed the 0.85 theoretical capacity. The Bypass South has the highest RFC value during the 2032 PM Peak of 0.79 across both flow sets as well as a delay of 14 seconds and a queue length of 4 PCUs, however no other arm for 2032 exceeds these values.

2041 – ARCADY Modelling Results

5.4.40. The 2041 scenario shows that the majority of arms across all peaks and flow sets are below the theoretical capacity threshold apart from the Bypass South during the AM Peak and the PM Peak. During the AM Peak, the arm has an RFC value of 0.87 and 0.88 for the Actual and Demand flows respectively. During the PM Peak, the arm has an RFC value of 0.88 and 0.89 during the Actual and Demand Flows.

5.4.41. The largest delays are also on the Bypass South during both the AM and PM peaks. The AM Peak has delays of 25 and 27 seconds across the Actual and Demand Flow sets, whilst during the PM Peak, there are delays of 25 and 26 seconds across both flow sets respectively.

5.4.42. The Bypass South also has the largest queue lengths with 8 PCUs in the AM Peak across both flow sets and 7 and 8 PCUs across the respective flow sets during the PM Peak.

5.4.43. These results are skewed by the aforementioned issue with number of approach lanes and therefore this is not actually foreseen to be an issue. It does however give the assumption modelling the correct number of lanes would not benefit this junction to the degree it would others.

A4103 4 Arm Roundabout – Route option 1 - Orange

2032 – ARCADY Modelling Results

5.4.44. The junction is forecast to perform within the theoretical capacity threshold across all peaks and flow sets during 2032 with no movements operating above an RFC value of 0.85. The worst performing arm during the AM and Inter-Peak is the A4103 West with and RFC value of 0.55 and associated delay of 5 seconds (1 PCU queue length) and RFC value of 0.33 and associated delay of 3 seconds (1 PCU queue length) respectively.

5.4.45. During the PM peak the worst performing arm is forecast to be the A4103 East with RFC values of 0.56 and associated delays of 8 seconds (1 PCU queue length) across both flow sets. Overall there is a 4 seconds junction delay across both flow sets in the AM and PM peak and 3 seconds delay in the Inter-peak across both flow sets.

2041 – ARCADY Modelling Results

5.4.46. The junction is forecast to perform within theoretical capacity during 2041 across all peaks and flow sets with no movements displaying an RFC value above 0.85. The worst performing arm during the AM Peak is the A4103 West with RFC values of 0.65 and associated delays of 7 seconds (2 PCU queue length).

5.4.47. The worst performing arm during both the Inter-Peak and PM peak is the A4103 East with an RFC value of 0.48 and associated delay of 7 seconds (1 PCU queue length) and an RFC value of 0.58 and associated delay of 10 seconds (2 PCUs queue length) across both flow sets respectively.

5.4.48. Across the AM and PM Peaks there is an overall junction delay of 5 seconds along with a 4 second delay in the Inter-Peak.

A4103 5 Arm Roundabout – Route option 2 - Cyan

2032 – ARCADY Modelling Results

5.4.49. During the 2032 scenario all arms of the junction are forecast to operate below the theoretical capacity threshold of 0.85.

5.4.50. The highest RFC on all arms is the A4103 West in the AM Peak Actual flow set with a value 0.68 and associated delays of 8 seconds and queue length of 2 PCUs. The longest delay of all arms across all peaks and flow sets is Towtree Lane during the AM Peak Actual flow set with 9 seconds.

5.4.51. Junction delays range from 6 seconds during the AM Peak to 5 seconds during the PM Peak, with a 4 second delay during the Inter-Peak period.

2041 – ARCADY Modelling Results

5.4.52. Similar to 2032, the 2041 scenario shows that all arms of the junction will operate below the RFC threshold meaning the junction has the potential to accommodate for future growth beyond 2041.

5.4.53. The highest RFC value is on the A4103 West during the AM Peak of 0.80 across both flow sets along with associated delays of 13 seconds and queue lengths of 4 and 5 PCUs respectively.

5.4.54. Junction delays range from 9 seconds during the AM Peak down to 6 seconds during the PM Peak. The Inter-Peak Junction delay is 5 seconds.

A4103 4 Arm Roundabout – Route option 3 - Yellow

2032 – ARCADY Modelling Results

5.4.55. All arms are forecast to operate comfortably within the theoretical capacity threshold of 0.85. The highest RFC on all arms is the A4103 West in the AM Peak flow sets with a value 0.53 and associated delays of 4 seconds and queue length of 1 PCU. No arm exceeds a delay greater than 5 seconds or a queue length of greater than 1 PCU.

5.4.56. The overall junction delays are 4 seconds during both the AM and PM Peak, and 3 seconds during the Inter-Peak.

2041 – ARCADY Modelling Results

5.4.57. Results for the 2041 scenario highlight that all arms are forecast to operate comfortably below the theoretical capacity threshold of 0.85. The highest RFC on all arms is the A4103 West in the AM Peak flow sets with a value of 0.62 and associated delays of 6 seconds and queue length of 1 PCU. No arm exceeds a delay of 6 seconds or a queue length of greater than 2 PCUs.

5.4.58. The overall junction delays are 5 seconds during both the AM and PM Peak, and 4 seconds during the Inter-Peak period.

A4103 4 Arm Roundabout – Route option 4 - Red and 5 - Olive

2032 – ARCADY Modelling Results

5.4.59. Junction arms are well within the theoretical capacity threshold of 0.85. The highest RFC on all arms is the A4103 West in the AM Peak flow sets with a value 0.51 and associated delays of 4 seconds and queue length of 1 PCU. No arms are forecast to have a delay above 5 seconds or a queue length of more than 1 PCU.

5.4.60. The overall junction delay during both the AM and PM Peak is 4 seconds whilst the Inter-Peak junction delay is 3 seconds.

2041 – ARCADY Modelling Results

5.4.61. Similarly, all junction arms are well within the theoretical capacity threshold of 0.85. The highest RFC on all arms is the A4103 West in the AM Peak flow sets with a value 0.60 and associated delays of 5 seconds and queue length of 2 PCUs. No arms are forecast to have a delay of above 5 seconds or a queue length of more than 2 PCUs.

5.4.62. The overall junction delay during both the AM and PM Peak is 5 seconds whilst the Inter-Peak junction delay is 4 seconds.

A4103 4 Arm Roundabout – Route option 6 - Black1 and 7 – Black 2

2032 – ARCADY Modelling Results

5.4.63. All arms operate well below the theoretical capacity threshold of 0.85. The A4103 West has the highest RFC Value of 0.59 during the AM Peak across both flow sets as well as the maximum delay period for the junction at 6 seconds and a queue length of 2 PCUs.

5.4.64. No arm exceeds the maximum delay period of 6 seconds or the maximum queue length of 2 PCUs.

5.4.65. The overall junction delay is 5 seconds during the AM and PM Peak and 4 seconds during the Inter-Peak.

2041 – ARCADY Modelling Results

5.4.66. Similar to the 2032 scenario results, all arms operate below the theoretical capacity threshold of 0.85. The A4103 West has the highest RFC Value of 0.70 during the AM Peak across both flow sets as well as the maximum delay period for the junction at 8 seconds and a queue length of 2 PCUs.

5.4.67. The overall junction delay for the AM and PM Peak is 7 and 5 seconds respectively, whilst the Inter-Peak period has a junction delay of 4 seconds.

A49 3 Arm Roundabout – All Route options

2032 – ARCADY Modelling Results

5.4.68. Junction options for the A49 roundabout are forecast to operate within the theoretical capacity threshold during all peaks and flow sets. During the AM and PM peaks the junction has an overall delay of 5 seconds and 4 seconds in the Inter-Peak across both flow sets.

5.4.69. The worst performing arm within the AM peak across both flow sets is the A49 North with forecast RFC values of 0.59. Similarly, the A49 North is the worst performing arm in the Inter-Peak with RFC values of 0.49 across both flows sets. This arm suffers from the highest queue lengths across all peaks and flow sets of 2 PCUs in the AM peak.

5.4.70. During the PM peak the A49 South is the worst performing arm with an RFC value of 0.57 across both flow sets. Similarly, this arm suffers from the highest delay of 6 seconds across all flows.

2041 – ARCADY Modelling Results

5.4.71. The A49 roundabout is forecast to operate within the theoretical capacity across all peaks and flow sets with RFC values below 0.85 across all arms. During the AM and PM peaks the junction has an overall delay of 6 seconds and 5 seconds in the Inter-Peak across both flow sets.

5.4.72. The worst performing arm across the AM and Inter-Peak is the A49 North with RFC values of 0.66 and associate delay of 7 seconds (2 PCUs) and an RFC value of 0.53 and associated delay of 5 seconds respectively. The worst performing arm within the PM peak is the A49 South with RFC values of 0.68 and respective delays of 8 seconds (2 PCUs) and 9 seconds (2 PCUs) across the Actual and Demand flow sets.

5.4.73. A summary of the total junction delays can be seen in Table 7 below, for ease of comparison;

Route option	Period	Junctions Delays (s)					Ranking
		A465	A438	A4103	A49(T)	Total	
Route option 1 - Orange	2041 AM	6	21	5	6	38	7th
	2041 IP	4	10	4	5	23	
	2041 PM	6	29	5	6	46	
Route option 2 - Cyan	2041 AM	6	9	9	6	30	4th
	2041 IP	4	5	5	5	19	
	2041 PM	6	8	6	6	26	
Route option 3 - Yellow	2041 AM	6	7	5	6	24	1st
	2041 IP	4	4	4	5	17	
	2041 PM	6	6	5	6	23	
Route option 4 - Red	2041 AM	7	9	5	6	27	2nd
	2041 IP	4	5	4	5	18	
	2041 PM	7	8	5	6	26	
Route option 5 - Olive	2041 AM	7	9	5	6	27	2nd
	2041 IP	4	5	4	5	18	
	2041 PM	7	8	5	6	26	
Route option 6 - Black1	2041 AM	7	14	7	6	34	5th
	2041 IP	4	4	4	5	17	
	2041 PM	7	13	5	6	31	
Route option 7 - Black 2	2041 AM	7	14	7	6	34	5th
	2041 IP	4	4	4	5	17	
	2041 PM	7	13	5	6	31	

Table 7 - Demand Flow Junction Delays

5.4.74 Delays can be reduced should it be required. This will be at the expense of increased land take and associated costs.

5.4.75 If dualling of the route becomes the preferred carriageway standard, junction capacity would need to be re-assessed accordingly, however it would be anticipated that with required changes to junctions (all approaches 2 lane) they would operate as efficiently / more efficiently than stated above.

5.5 OVERTAKING PROVISION

5.5.1. With appropriate positioning of change overs and differential acceleration lanes an all WS2+1 standard Hereford Bypass would provide ≈45% overtaking or ≈40% for entire A49 bypass, when combined with the

SLR. This is in accordance with the 40% requirement from TD 9/93 and in line with the HE policy (preferred 40% minimum overtaking).

5.5.2. There is no significant difference of overtaking between route options.

5.5.3. With dedicated overtaking lanes in both directions, dualling the scheme would result in 100% overtaking for the bypass and approximately 90% for the total A49 to A49 bypass. This far extends the DMRB requirement.

5.6 LAYBYS

5.6.1. The recommend spacing of laybys in both directions on a single carriageway road with 2-way AADT exceeding 8,000 is between 2km and 5km.

5.6.2. Lay-bys should not be sited on the single lane sections of carriageway, within 375m of a junction, on the inside or outside of bends with a radius less than 1440m, where all proposed horizontal curvature had a radius of 720m.

5.6.3. This had resulted in only 1 layby being realistically feasible in both directions, please refer to the Engineering Layout drawings in Appendix D. Note a type A geometric layout as detailed in TD69/07, with 80m parking provision has currently been used, however this is subject to demand, where patronage information is not currently available.

5.6.4. This solution meets requirements for the bypass, however in combination with the SLR and the existing A49 layby spacing's this is below standard.

5.7 MAINTENANCE LAY-BY AND HARDSTANDINGS

5.7.1. Maintenance lay-by and hardstanding provision will be determined in discussion with the Overseeing Organisation/Maintenance Authority. The preferred WS2+1 highway standard precludes verge side highway maintenance thus bypass maintenance will generally be from toe-of-earthworks access ways serviced from side roads and other nominated access points.

5.7.2. At junction maintenance hardstanding's will be appropriate to the type of the highway infrastructure to be maintained. At a minimum maintenance lay-by will be provided in the vicinity of street lighting distribution cabinets and/or any traffic signal controllers.

5.7.3. Dualling would allow for maintenance from the road and not the toe of earthworks as stated above, while maintaining at least 1 dedicated lane in each direction. Again, maintenance lay-bys and hardstanding provisions would be discussed with the Overseeing Organisation / Maintenance Authority.

5.8 EARTHWORKS AND GROUND CONDITIONS

5.8.1. Until more detailed geotechnical information becomes available all route options have been designed with both embankments and cuttings be cut to a conservative 1 in 3 slope.

5.8.2. Similarly, geotechnical information is insufficient for detailed foundation design but it is assumed that structures will have either spread footing or piled foundations.

5.8.3. The hydro morphology of the Core Strategy Corridor is unknown but permeability is assumed to be insufficient for direct ground infiltration and would be further complicated by several water abstraction zones in the A438 Kings Acre Road / A4103 Roman Road area.

5.8.4. The following table identifies the cut and fill, along with surplus / deficit earthwork requirements. As currently not enough information is known on the sub strata, these values assume all excavation is acceptable and can be re-used within the scheme.

Route option	Cut (m3)	Fill (m3)	Surplus (+) / Deficit (-) (m3)
Route option 1 - Orange	308,000	311,000	-3,000
Route option 2 - Cyan	323,000	277,000	46,000
Route option 3 - Yellow	321,000	289,000	32,000
Route option 4- Red	419,000	419,000	0
Route option 5 - Olive	418,000	384,000	35,000
Route option 6 - Black1	438,000	414,000	24,000
Route option 7 - Black 2	421,000	384,000	38,000

Table 8 - Cut and Fill

5.8.5. Dualling the route options would result in greater cut and fill volumes, having a greater cost impact on the scheme.

Land take

5.8.6. Earthwork requirements have a direct impact on land take i.e. the deeper the excavation or higher the embankment the greater extent of 1 in 3 earthworks slopes to interface with the existing ground level.

5.8.7. All route options have been designed for the vertical alignment to follow, in its majority, the rolling profile of the countryside, with areas of cutting and embankments arising to reflect the following;

- Carriageway design standards;
- Accommodate the continued connectivity of the surrounding road network i.e. meet headroom requirements of over / under bridges;
- Provide at grade junctions with A465 (SLR), A438 Kings Acre Road, A4103 Roman Road and the A49 (T);
- Achieve minimum clearance of the River Wye;
- Balance earthworks calculations as far as practical.

5.8.8. **Table 9** indicates the maximum embankment / excavation depths and preliminary land take requirements, excluding ATM and environmental features.

Route option	Bypass Length (km)	Max Height Embankment (m)	Max Depth Cutting (m)	Preliminary Land take (ha)
Route option 1 - Orange	7.9	7.7	8.8	49
Route option 2 - Cyan	8.2	5.2	8.8	47
Route option 3 - Yellow	7.9	5.2	8.8	49
Route option 4 - Red	8.1	9.4	8.8	51
Route option 5 - Olive	7.8	12.9	10.2	48
Route option 6 - Black1	8.3	13.0	8.2	50
Route option 7 - Black 2	8.7	6.5	8.2	52

Table 9 - Preliminary Land Take Requirement

5.8.9. It is anticipated dualling could be accommodated within the footprint required for WS2+1, via steepened embankments and the over widened verge and a relaxation in the SSD i.e. land take areas would not change. In reality this would need to be reviewed to ensure its validity, when in combination with required widening on the inside of bends to achieve visibility to verge side features and to VRS within the central reserve.

Summary

5.8.10. Route option 4 - Red is the most likely to achieve a possible cut / fill balance, following preliminary bulk earthwork calculations. This is followed by Route option 1 - Orange requiring material to be imported. All other route options have similar volumes of disposal.

5.8.11. The Land take required is relatively similar for Route options 1-3 and 5, with slightly increased figures for the other options. This will be a significant cost on the scheme and also greater land required for proposals the greater the disturbance to the local stakeholders.

5.9 HIGHWAY DRAINAGE

5.9.1. In recognition of the uncertain material properties of site excavated materials to be re-tasked for embankments, with concern about the susceptibility of ingress of surface water and HE policy not to except filter drains in embankment (Departure from standard), a kerb and gully design solution has been implemented at all built up ground locations. In combination with kerb and gullies for surface water drainage, a fin drain is being installed for sub surface drainage.

5.9.2. Within cutting a combined surface and sub surface solution has been implemented, with the bypass un-kerbed with over the edge SWALE and filter drain arrangement.

5.9.3. Both systems will discharge via a carrier or combined carrier / filter drain to a dry attenuation pond prior to discharge to the local water courses or a soakaway pond.

5.9.4. Overland drainage will be captured in cut-off ditches, discharging directly to existing watercourses, wherever feasible. On occasion discharging to soakaway ponds, due to a lack of watercourse in a reasonable proximity of the outfall point.

5.9.5. At all roundabouts and at bridge decks, as required, a combined kerb drainage system is proposed in place of kerb and gully. This will discharge into aforementioned carrier pipe network.

5.9.6. Affected minor watercourses will be diverted and/or culverted.

5.9.7. Tabled below are the preliminary costs for drainage elements per route option including earthwork requirements for ponds and cut off ditches.

Route option	Estimated Cost (£)
Route option 1 - Orange	3.7m
Route option 2 - Cyan	3.6m
Route option 3 - Yellow	3.9m
Route option 4 - Red	3.6m
Route option 5 - Olive	3.5m
Route option 6 - Black1	6.2m
Route option 7 - Black 2	6.2m

Table 10 - Drainage Requirements

5.9.8. The increase in cost for Route option 6 - Black1 and Route option 7 - Black 2 is due to the crossing point of the Yazor Brook and the structures required to span the Brook and the existing ponds. Refer to Engineering Layout Plans in Appendix D.

5.9.9. Dualling would result in an increased drainage costs to accommodate the greater amount of surface water, due to the extra paved area i.e. greater amounts to attenuate, greater volumes in the pipe network and the implication on pipe sizes, along with drainage requirements for the central reserve.

5.10 FENCING

5.10.1. Temporary fencing will be immediately erected on site on commencement of the works, on the boundaries of the land as shown on the technical drawings. The fencing should be placed where permanent fencing cannot be erected immediately.

5.10.2. Permanent roadside fences have a significant effect on the appearance of the road so unnecessary fencing will be omitted. The fence does not need to follow property boundaries and generally an effort will be made to hide it between trees or in vegetation. Fencing will be erected with a 5m offset from the earthworks toe, unless otherwise shown on the engineering layouts, this is to allow access for maintenance vehicles. It shall be erected to present a flowing alignment both in plan and elevation following approximately the level of the ground. Where the ground is uneven or undulating extra posts, stakes and ground anchors will be provided to ensure that the bottom line wire does not rise more than 50mm above ground level.

5.10.3. Timber fencing shall be wooden post and rail fence with four rails type SPR 13/4 (HCD drawing number H3).

5.10.4. Wire dropper fences shall be as shown on HCD drawing numbers H4, H5, H6 and H7.

5.10.5. The otter fence will be only useful if guides to a safe crossing point. It should start at least 100m from the watercourse or underpass or crossing point on both sides of the road. The design includes a height of 2m with 1.5m above ground and 0.5m underground. Additional 0.3m of fence will be needed on top and bottom of the fence, where on the bottom it should be horizontal while on the top it should be at 45°. Both extensions should be in direction of otter approach to prevent digging under or climbing the fence. Gaps of the mesh or gaps between the fence and other structures should be 50mm or less.

5.10.6. It is more likely for bats to use provided crossing points if linear planting corridors or specific bat fence is used to lead bats to the entrance.

5.10.7. The purpose of an anti-dazzle fence is to cut off light from oncoming vehicle headlights and it is particularly effective alongside fast major roads which have adjacent minor road at the same level.

5.10.8. There is potentially no change to the fencing requirement with dualling as it is anticipated route options footprints should not be altered with dualling.

5.11 ROAD RESTRAINT SYSTEMS

5.11.1. As a >40mph road Hereford Bypass will need a full vehicle restraint system (VRS). The extent of this VRS will be subject to Road Restraint Risk Assessment Process (RRRAP) in accordance with TD 19/06. However, several general principles of where VRS will be provided can be assumed

- At verge side structural features such as piers, headwalls and parapets
- Throughout significant embankments, typically over 6m high
- Within rock cut/steep slope cuttings (ground conditions unknown / none intended at present)
- In the vicinity of water hazards such as attenuation ponds & rivers
- At verge side maintenance lay-by
- P4 termination of all single carriageway VRS, P1/P4 for dual carriageway

5.11.2. As the scheme is designed as a WS2+1 road there will be no central reservation throughout the scheme. As such a hazard on one side of the road will be treated as a hazard for both north and southbound lanes. This is significant as the DMRB states a different minimum distance for the VRS both in advance of and after the hazard; but given that in this case all hazards are being treated as in advance of the hazard the minimum distance has been derived as 30m either side of the hazard (As opposed to 30m in advance and 17.5m after the hazard).

5.11.3. As stated within the DMRB the ends of sections of VRS can themselves be considered a hazard, as they can easily collide with an errant vehicle. In order to minimise the risk posed by them, if the beginning/end of two sections of VRS are within 50m of each other they will be joined as to minimise the amount of protruding ends.

5.11.4. At sections of the scheme that utilise overbridges (Including the Wye Viaduct) a parapet system will be used to further increase safety for errant vehicles.

5.11.5. In addition to the RRRAP defined VRS the design will undertake a value engineering review for issues such as providing passive street furniture and/or closing minor VRS gaps.

5.11.6. The preliminary design of the VRS has been carried out for the seven 'shortlist' options using the criteria stated above, please refer to the engineering layouts at the back of this report and table below, quantifying preliminary lengths per route option. It should be noted values do not allow for parapets on side roads (overbridges), but do allow for the safety barriers on approach.

Route option	Total VRS (Safety Barrier and Parapet) (m)	Ends (No.)
Route option 1 - Orange	4490	78
Route option 2 - Cyan	5200	76
Route option 3 - Yellow	5310	76
Route option 4 - Red	6210	66
Route option 5 - Olive	5570	66
Route option 6 - Black1	6200	66
Route option 7 - Black 2	6690	78

Table 11 - VRS Requirements

Summary

5.11.7. Once a preferred route has been confirmed, a more detailed assessment will be completed, via the RRRAP. The detail that will be derived at that stage will be a revised minimum length quota, as well as working width and set back etc. It will also tell us in more detail if a hazard is tolerable (And thus no VRS protection is required.).

5.11.8. From preliminary figures Route option 1 - Orange can be seen as the most economic design solution, in terms of VRS requirements.

5.11.9. Dualling would result in additional VRS down the central reserve required for dual carriageway, resulting in an additional cost. There would also be the potential for widening the carriageway not only to achieve visibility on the verge side but to the central reserve, which may result in additional land being required if the current verge widths / slope steepening cannot accommodate. The exact impact of visibility would need to be reviewed if dualling becomes the preferred option, however this would have significant cost associated with increased cut and fill.

5.12 PAVEMENT

5.12.1. Subject to confirmation of expected traffic and geotechnical properties it is recommended that Hereford bypass and associated parking lay-by's be constructed on a capping (for economy) & sub-base foundation with flexible composite pavement construction surfaced with a (max level 2) low noise Thin Surface Course System (TSCS). A minimum 55 PSV on the mainline and 68+ PSV at junction approaches and the circulatory carriageway is assumed at this stage. Locally sourced recycled materials if available should be considered for improved sustainability.

5.12.2. Lower trafficked side, connector roads, entries and NMU routes will be guided by Herefordshire design standards but are expected to have sub-base only foundations supporting a fully flexible pavement with standard surface layer.

5.12.3. Hardstanding's and higher frequency access ways should be formed either in weight bearing geotextile mesh or cellular blocks to allow grass to grow through.

5.12.4. Private Means of Access (PMA) and lower trafficked access ways will be of JRC, un-bound aggregate or simply grassed as required/agreed.

5.12.5. Identified in the table below, are the cost estimates (exclusive of percentage uplifts and optimum bias) for each of the route option pavements.

Route option	Cost Estimate (£)
Route option 1 - Orange	10.7m
Route option 2 - Cyan	10.2m
Route option 3 - Yellow	9.4m
Route option 4 - Red	9.6m
Route option 5 - Olive	9.8m
Route option 6 - Black1	10.4m
Route option 7 - Black 2	11.0m

Table 12 - Pavement Cost Estimates

5.12.6. It can be seen Route option 3 – Yellow and Route option 5 - Olive perform best on cost, it was anticipated this would be the case due to scheme lengths.

5.12.7. Route option dualling would increase the carriageway cross section, resulting in additional pavement costs.

5.13 TRAFFIC AND ROAD MARKINGS

5.13.1. The provision of traffic signs and road markings will follow the scheme signage strategy with siting and face designs in accordance with the Traffic Signs Regulations and General Directions (TSRGD) and Traffic Signs Manual.

5.13.2. Hereford Bypass is a new completely offline bypass route so the reuse of existing traffic signage will be strictly limited. If any of the traffic signs at the proposed junctions (A465, A438 Kings Acre Road, A4103 Roman Road and A49) are relevant and in good condition they will be re-used, otherwise signs will be taken down and removed to tip off site.

5.13.3. New traffic signage will take the form of; pre-junction Advance Direction Signage (ADS), at-junction Local Direction Signage (LDS), mandatory/regulatory signage and information/tourist signage, all but the latter group will be illuminated.

5.13.4. Where appropriate larger traffic signs will be supported on passive supports to improve safety and avoid the need for VRS protection.

5.13.5. Preliminary layouts can be found of the engineering layouts in Appendix D.

5.13.6. Changes with regards to dualling, would result in additional centreline markings to accommodate the additional lane, with the double white line 1m apart which incorporate a red coloured surface and diagonal white lining, required for WS2+1 removed. Effect on marking is negligible.

5.13.7. All signing will remain relatively the same, albeit with the removal of signage required with WS2+1 changeover locations.

5.14 ROAD LIGHTING

5.14.1. Road lighting is proposed only at junctions and a maximum 5 sec travel time on bypass approaches (≈134m). This is in accordance with the existing junctions in the immediate vicinity and connecting Southern Link Road scheme. Where existing radial route street lighting is crossed by the bypass matching continuity lighting will be provided along connecting links to the new junction.

5.14.2. In view of the proximity of multiple of the new junctions to some of the residential areas a lower standard of lighting may be considered in conjunction with HC's policy for lighting which also includes phased dimming overnight, as appropriate.

5.14.3. Traditional street lighting methods operate from dusk till dawn. The street lighting at the proposed junctions and their approaches would operate at 100% dusk until 22:00 hours, 75% 22:00 hours to midnight and 50% midnight to 5:00 hours reducing carbon emissions and energy consumption.

5.14.4. Where appropriate lighting will be provided on passive street lighting columns to improve safety and avoid the need for VRS protection.

5.14.5. As all route option options have the same junction strategy each route option will be comparable, requiring roughly the same number of columns.

5.14.6. This will not change with dualling, as proposals will remain to only light junctions.

5.15 STRUCTURES

5.15.1. There is a requirement for multiple overbridges and underbridges to take the Hereford Bypass over/under topographical features and existing side roads. To achieve the vertical clearance required there may be a need to raise/lower the alignment of side roads. The most significant structure on all route options is the viaduct required to span the River Wye and its floodplain.

5.15.2. Overbridges will generally take the form of a single span steel composite deck with reinforced soil abutments – fully or semi integral.

5.15.3. Underbridges will generally take the form of in-situ reinforced concrete boxes with reinforced soil wing walls.

5.15.4. The River Wye viaduct will consist of a multi span steel composite ladder deck viaduct with reinforced concrete piers and abutments.

5.15.5. The Breinton equestrian footbridge will consist of a single span warren truss with reinforced concrete bank seats and wing walls.

5.15.6. Yazor Brook culverts will take the form of precast reinforced concrete with insitu reinforced concrete wing walls

5.15.7. Both Assessment of Existing Structures (AESR) and Appraisal of New Structures (ANSR) reports have been prepared for each of the original 'Spine' corridors. The ANSR provides details of the proposed structural forms for each route option.

5.15.8. Although the ANSR has not been extended to cover the proposed seven 'short list' route corridor options, apart from the River Wye viaduct the number and type of structures on each route option is expected to be very similar. The structure saving on the southern section of western route options will be off-set by an additional requirement in the northern section of the western routes, thus the lowest structural requirement will be for route options crossing from SW to NE and the highest for the converse.

5.15.9. The number of structures required and the cost estimate of these structures for each route option is given in the following table, it should be noted none of these values have any percentage uplifts included i.e. Contractors Overheads, Optimum Bias etc.

Route Option Route option	No.	Cost Estimate
Route option 1 - Orange	10	£34m
Route option 2 - Cyan	11	£34m
Route option 3 - Yellow	10	£34m
Route option 4 - Red	10	£33m
Route option 5 - Olive	10	£32m
Route option 6 - Black1	12	£34m
Route option 7 - Black 2	12	£36m

Table 133 - Structures Estimate

5.15.10. All seven proposed route options require a high-level crossing of the River Wye, which has a significant cost associated with it. There are two River Wye viaduct scenarios, of different length and width, which can be seen on drawing Nos. 70024065-WSP-XX-XX-DR-HE-00018 and 19 in Appendix E.

5.15.11. The eastern crossing (relevant for route options 1 – Orange, – 4 - Red and 7 – Black 2) is of curved construction and requires a greater width over its western counterpart to accommodate full SSD. This results in a total design width of 32.2m inclusive of a 2 x 0.5m allowance for parapets i.e. 12.3m greater than the standard 19.9m road width required on straight sections of the Bypass (exclusive of 0.5m widths for parapets). This additional width would accommodate dualling of the bypass should it be determined as the necessary standard following further assessment as described in section 5.1. This scenario has a total length of approx. 280m.

5.15.12. The western crossing (relevant for Route options 5 - Olive and Route option 6 – Black 1) is a straight crossing therefore narrower than its alternative. This results in a design width of 28m including the allowance for parapets i.e. 8.1m wider than the standard carriageway. This scenario, however, is required over a longer distance of approx. 365m.

5.15.13. All Route options have 10 structures required for the same common purposes i.e. to pass over or under the existing infrastructure, albeit at different locations. There are additional structures required on a number of the route options to deal with the crossing point at Yazor brook. Most notable are Route options 6 – Black 1 and 7 – Black 2 and the structures required to span the ponds. Preliminary costing identifies an additional £3m required to facilitate the construction of the additional structures.

5.15.14. It should also be noted that current widths over the River Wye viaduct, has been designed to accommodate dualling requirements, however not in combination with a high level NMU crossing should this be deemed a requirement following future assessment i.e. adjacent to the carriageway. Structure widths would need to be increased at an additional cost or an alternative crossing of the River Wye sought.

5.16 DEPARTURES AND RELAXATIONS FROM STANDARDS

5.16.1. Various constraints on a proposed route options for a road may mean that it cannot be reasonably designed to full standards. Any desirable or necessary reductions in standards are dealt with as design Relaxations or design Departures. All Departures must have formal approval from the Technical Approval Authority (TAA).

5.16.2. Based on the preliminary design work carried out on the route option options, one-step Relaxations may be encountered in relation to Stopping Sight Distance (SSD) along the mainline. This Relaxation however is considered justifiable, when greater than 1.5 times the SSD from junctions and the design here remains in accordance with Design Standards.

5.16.3. There are further Relaxations on options 2, 4 and 5, with regards to the siting of laybys'. Due to the winding nature of the scheme to reduce / avoid impacts on features of interest (environmental items, properties etc.), sections of straight are limited for positioning. The TD69/07 Standard recommends they should not be sited on the inside or outside of radius less than the appropriate value for the design speed, (1440m in this instance, where 720m have been used in the design as recommended by TD9/93). This results in any location where a layby encroaches a horizontal curve a Relaxation is required.

5.16.4. All options currently have at least 1 Departure, please refer to the **Table 14** below.

Route option	Number of Departures	Description
Route option 1 - Orange	2	1 – Full 215m SSD impeded on the mainline south bound approach to the A465 roundabout. 2 – WS2+1, conflicting changeover located on a horizontal curve radius below requirement. Approx. 75m overlap in position.
Route option 2 - Cyan	3	1 – Full 215m SSD impeded on the mainline south bound approach to the A465 roundabout. 2 – Full 215m SSD to the south bound layby impeded. 3 - Full 215m SSD impeded on the mainline south bound approach to the A4103 roundabout.
Route option 3 - Yellow	2	1 - Full 215m SSD impeded on the mainline south bound approach to the A465 roundabout. 2 - Full 215m SSD impeded on the mainline south bound approach to the A4103 roundabout.
Route option 4 - Red	1	1 - Full 215m SSD to the north bound layby impeded.
Route option 5 - Olive	1	1 - Full 215m SSD to the north bound layby impeded.
Route option 6 - Black1	2	1 – Inadequate separation between the north bound lay-by and the A4103 junction.] 2 - Full 215m SSD impeded on the mainline south bound approach to the A4103 roundabout.
Route option 7 - Black 2	2	1 – Inadequate separation between the north bound lay-by and the A4103 junction. 2 - Full 215m SSD impeded on the mainline south bound approach to the A4103 roundabout.

Table 144 - Departures

5.16.5. All Relaxations and Departures will be considered during detailed design, with the aim of being designed out, wherever possible.

5.16.6. To accommodate Full SSD (both for Relaxation and Departure) verges will be widened and appropriate verge side features positioned (VRS / ADS) outside of the visibility splay, where feasible.

5.16.7. Layby siting Relaxations, will be unavoidable, however due to the nature of the route options these Relaxations in line with verge widening are considered justifiable and the design will remain in accordance with design standards.

5.16.8. The conflicting changeover position on Route option 1 - Orange, will be moved approx. 75m to the north, if this route becomes the preferred route option.

5.16.9. Departures on Route options 6 Black 1 and 7 – Black 2 will be unavoidable for inadequate junction separation and therefore would require an application and formal agreement from the appropriate Authority.

5.16.10. It is foreseen dualling would have additional departures / relaxations to those identified above, as current geometric design parameters are those for a 100kph (60mph) design speed, where dualling would be 120kph (70mph).

5.17 FOOTWAY AND CYCLE ROUTES

5.17.1. All of the route option options intersect the A4103 Roman Road, which forms part of the National Cycle Network (mitigation options will be proposed in a separate Technical Note) and the provisions on A438 Kings Acre Road, which although does not form part of an NCN is an important Non-Motorised User (NMU) route in Hereford. In addition, the route options bisect a varying number of Public Rights of Way (PRoW). It is anticipated that provisions will be made for all footpaths, bridleways and cycleways.

Route option	Footpaths No.	Bridleway No.	Traffic Free Cycle Route
Route option 1 - Orange	3	2	1
Route option 2 - Cyan	3	2	1
Route option 3 - Yellow	3	2	1
Route option 4 - Red	3	1	1
Route option 5 - Olive	3	1	1
Route option 6 - Black1	3	2	1
Route option 7 - Black 2	3	2	1

Table 15 - Affected Public Rights of Way

5.17.2. Note an equestrian overbridge will be provided at the relevant location north of Upper Breinton Rd and a pedestrian underpass at Lyde for continued connectivity.

5.17.3. At all other locations existing routes will be diverted along the bypass mainline and use side roads / proposed overbridges as crossing points.

5.17.4. NMU crossing provisions of dropped kerbs and tactiles are currently proposed at both A438 and A4103 junctions for the continued connectivity of the footway and cycleway provisions currently on these roads. Further analysis of these provisions will be undertaken with regards to safety (RSA). If concerns are raised, alternative options in the form of signalised crossings will be reviewed. It should be noted at this stage, signals will have an impact on the junction capacity and may results in alternative options being required.

5.17.5. All route options are comparable, with only 4 and 5 offering less disruption. Cost savings for diversions are unknown at this stage, but foreseen as negligible between options, when taken in context of the total route option costs.

5.17.6. As alignment will not be changed, the decision to dual the route options will not have a greater effect on the number of PROW's impacted.

5.18 STATUTORY UNDERTAKERS

5.18.1. Effect of route options on statutory undertakers is unknown at this stage. However, from the preliminary layouts and potential conflict zones identified the following assumptions have been made.

Route option	Estimated Stats Work Complexity (0 – negligible 5 – high cost / delay)
Route option 1 - Orange	3
Route option 2 - Cyan	3
Route option 3 - Yellow	3
Route option 4 - Red	3
Route option 5 - Olive	2
Route option 6 - Black1	3
Route option 7 - Black 2	3

Table 16 - Stats Estimate

5.18.2. Information has been obtained on utilities plant within the Core Strategy Corridor which is displayed on the engineering drawings in **Appendix D**. Section C2 - Preliminary enquiries and C3 - Budget estimate requests were not made of the utilities companies so do not have details of non-archived plant information, future proposals or potential diversion. However, we have been advised of a Dwr Cymru proposal to provide a new water main connecting A49 and A4110 infrastructure within the northern section of the Core Strategy Corridor. At this stage it is considered premature to request modification/abandoning of Dwr Cymru's proposals. However, as the Hereford Bypass aligns to a preferred route it may be appropriate to make such representations. Although not considered in detail it would seem a route following the bypass northern fenceline would minimise interaction with the proposed water main and avoid the need to accommodate the main within the new Canon Pyon overbridge.

5.18.3. Dualling is not foreseen to have a greater effect on statutory undertakers.

5.19 AFFECT ON RESIDENTIAL / AGRICULTURAL BUILDINGS

5.19.1 This section of the report relates to residential and agricultural building which may be directly affected by the Route options (i.e. where proposed permanent works within the anticipated highway boundary would cross the footprint of an existing building).

5.19.2 There are residential properties along the entirety of the A438 Kings Acre Road within the Core Strategy Corridor, either one side or both. This results in all options affecting residential buildings due to the scheme requirement to provide connectivity to this road.

5.19.3 The A4103 is less densely populated and all route options are designed to miss properties, apart from Route option 2 - Cyan, which directly affects a single property "The Meadows".

5.19.4 With the open field element of the route options, there are further agricultural buildings directly affected by each route options footprint.

5.19.5 The table below identifies the number of residential and agricultural buildings which may directly affected by the footprint of the route options (i.e. where proposed permanent works within the anticipated highway boundary would cross the footprint of an existing building). The number of properties shown in the table have been assessed as proposed permanent works highway boundary fence line crossing an existing building outline, NOT where permanent works only breach land parcel e.g. garden/livestock containment area. This assessment has been based on the engineering standards as defined in this report and makes no allowance for mainline cycleway/footway/horse riding provision, landowner private means of access or construction access/haul roads etc. which have still to be assessed at a later stage of design.

5.19.6 The table does not consider environmental assessment for essential environmental mitigation areas/protected species measures.

5.19.7 This assessment has not considered buildings within close proximity to the route option footprint that may be acquired or demolished as they may be subject to Unacceptable Adverse Effects (UAE) from Noise. The number of properties that may be subject to Unacceptable Adverse Effects is reported in the appendices to the Route Selection Report..

Route option	Agricultural (No.)	Residential (No.)	Total (No.)
Route option 1 - Orange	1	5	6
Route option 2 - Cyan	4	6	10
Route option 3 - Yellow	4	5	9
Route option 4 - Red	4	5	9
Route option 5 - Olive	0	5	5
Route option 6 - Black1	0	5	5
Route option 7 - Black 2	4	5	9

Table 17 – Directly Affected Properties (i.e. where proposed permanent works within the anticipated highway boundary would cross the footprint of an existing building)

5.19.8 On this preliminary review, it can be seen Route option 5 - Olive and Route option 6 – Black 1 perform best in this area.

5.19 VALUE ENGINEERING

5.19.1 Value Engineering principles such as optimising the alignment, structures and cut/fill balance will be considered during further development of the preferred option. This will include Value Engineering workshops.

5.20 ENGINEERING ASSESSMENT AND CONCLUSION

5.20.1 In conclusion, a summary of the Engineering judgements are identified below:

- Route option 5 - Olive followed by Route option 3 - Yellow, best on cost.
- Route option 3 - Yellow ranked best on junction delays. Route options 4 - Red and Route option - 5 Olive ranked second, albeit with foreseen improvements following remodelling (which Route option 3 - Yellow will not benefit from).
- Route option 4 - Red most likely to achieve a cut / fill balance, followed by Route option 1 – Orange.
- Land take requirements, relatively similar across all Route options, with Route option 2 - Cyan followed by Route option 5 - Olive requiring the least.
- Drainage requirements, similar for all route options, except Route option 6 - Black1 and Route option 7 – Black 2, coming in at over £2m more expensive. Route option 5 - Olive best on cost with Route option 2 - Cyan and Route option 4 - Red joint second.
- Route option 1 - Orange requires the least amount of VRS.
- Route option 3 – Yellow and Route option 5 - Olive pavement within a £0.4m difference, with Route option 3 - Yellow being most cost effective.
- Route option 5 - Olive best on structures cost.
- All current departures, are seen as resolvable and therefore not an issue, apart from those on 6 and 7 as these will be unavoidable and will require agreement.
- Route option 5 - Olive and Route option 6 – Black 1 interface with fewer PROW's.
- The estimated stats work for Route option 5 - Olive is anticipated to the least complex, resulting in lower anticipated cost and disruption.
- Route option 5 - Olive and Route option 6 – Black 1 have the least number of directly affected properties.

5.20.2 All the route options have merit and therefore it is recommended they all be taken forward for further assessment.

6 TRAFFIC AND ECONOMIC ASSESSMENT

6.1 MODELLING OVERVIEW

6.1.1 To appraise any potential scheme in line with Department for Transport requirements and Web-based Transport Analysis Guidance (WebTAG,) a traffic model has been developed, which is reported in the Local Model Validation Report. The Hereford traffic model has been built using new observed survey data, for a 2016 base year.

6.1.2 All model development has been undertaken in-line with current WebTAG guidance, particularly WebTAG Unit M3-1 highway assignment modelling (January 2014).

6.1.3 The Local Model Validation Report has been structured to be in accordance with WebTAG requirements and the industry best-practice. The report sets out the methodology behind building the highway network and trip matrix elements of the highway assignment model. The report then summarises the assignment outputs and how well the model performs when compared against observed survey data. The observed dataset has been split into calibration and validation datasets, with data being used to validate the model being independent to the calibration data.

6.1.4 The model has been developed to be reflective of a typical, average neutral month (June 2016), and has been developed using Simulation and Assignment of Traffic to Urban Road Networks (SATURN software version 11.3.12F). It is based on the latest available WebTAG parameters (January 2014 – Unit M3-1), and meets convergence requirements.

6.1.5 The trip matrix has been built using a combination of observed data (Roadside Interviews, Car Park Surveys and Household travel surveys). The observed dataset includes a total of 14 Roadside Interviews sites located specifically to form a cordon around the City to capture all movements travelling into and out of the city. This was supplemented with 20 Car Park Interview sites and household travel surveys. These datasets were merged to remove any double counting of trips into the city. To 'infill' trips between areas that have not been observed the trip matrix has been synthesised using a process that utilises planning data from the National Trip End Model (NTEM). This process has been summarised in further detail within the LMVR.

6.2 MODEL BASE UNITS

6.2.1 The capacity of the modelled network reflects the amount of road space available to vehicles. This is measured in terms of Passenger Car Units (PCUs) which are based on the average length of a private car (5.75m). Heavy Goods Vehicles (HGVs) clearly require more road space and so have a higher PCU factor. The matrices and predicted flows are presented in PCUs, which have been converted back into vehicles to produce all flow information referred to in diagrams and tables within this report. Cars (user classes 1 to 7) and Light Goods Vehicles (LGVs - user classes 8 and 9) have a PCU factor of 1.0. Other Goods Vehicles (user classes 10 and 11) have a PCU factor of 1.9 for vans less than 3.5 tonnes (OGV1) and a PCU factor of 2.9 for vans greater than 3.5 tonnes, articulated goods vehicles, 3+ axles rigid goods vehicles and Public Service Vehicles (PSVs) (OGV2).

6.3 TIME PERIODS

6.3.1 Traffic models should cover those time periods when the most significant flow changes are likely to occur.

6.3.2 The model has been split into three time periods that are listed below:

- AM Peak Hour (8:00am-9:00am);
- Interpeak Hour (Average between 10:00am-3:00pm); and
- PM Peak Hour (5:00pm-6:00pm).

6.4 NETWORK EXTENTS

6.4.1 The model is divided into two elements of the network; the simulation network and the buffer network. The simulation network includes the detailed study area that includes the key links and junctions within Hereford and surrounding highway network. The simulation network is to represent the road network as far as Bridge

Sollars to the west, the River Wye B3499 Bridge crossing to the east, the A49 South of the A49/B3499 Roundabout and the A49 North near Lugg in the North. The buffer network provides less detail than the simulation network and does not include the modelling of junctions and their impact on travel times. The buffer network becomes coarser the further it is located away from the simulation network. The buffer network extends as far as the M4 in the south, M5 to the East, A470 to Brecon in the West and the A49 as far as Ludlow to the north. The outer buffer network extends as far as to incorporate the entirety of the UK. The outer buffer network is represented by centroid connectors that connect the zone to the buffer network.

6.4.2 The traffic model coverage will include all trips travelling to/from Hereford and within Herefordshire. There is limited coverage for trips between areas located further away from Hereford. i.e. limited coverage for trips travelling from Scotland to London.

6.4.3 The simulation network represents the extent of the detailed study area. The model simulation area is shown below.

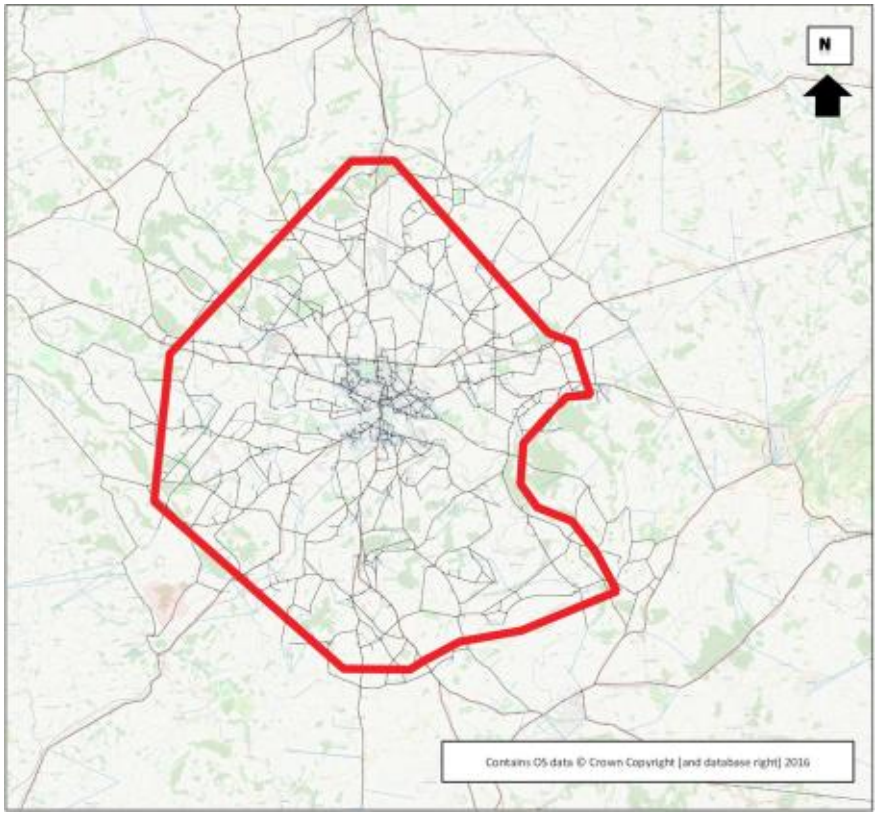

Figure 9 - Hereford All PIC Accidents (01/12/11 to 30/11/16)

6.5 LINK SPEED CODING

6.5.1 The model network has been built to represent the highway network during the data collection period in June 2016. To accurately code the network, discussions with HC and observations from site visits have been used. Integrated Transport Network (ITN) layer data (by Ordnance Survey, 2015) was used to provide a base network in GIS form to be edited.

6.5.2 Following a detailed inventory of the existing highway network and junction layouts, the primary road network was coded within the assignment model as a series of nodes and links.

6.5.3 Each link was surveyed to determine the link speed, layout and standard of that particular section of road. Node positions were checked using GIS mapping and link lengths checked within the SATURN network building program and validated using GIS.

6.5.4 Within the study area, some of the links are of a substantial length, and the primary source of delay for vehicles along these links is dependent on traffic density and un-modelled junctions. To replicate these delays, key main road and access links were assigned a speed-flow curve. The speed-flow parameters used in the network were based on standard curves contained in the Highway England's Regional Traffic Model (RTM) Handbook fitted to the formula used in SATURN. All links within simulation and buffer areas have been assigned a speed flow curve with the exception of stub links and very minor roads.

6.6 ORIGIN AND DESTINATION REVIEW

6.6.1 A sector system has been created in order to analyse the patterns of travel observed at the roadside interview survey. The boundaries of each sector are shown in **Figure 10**. The sector system represents the following areas:

- Sector 1 – South West Hereford (Belmont)
- Sector 2 – South East Hereford (Rotherwas and Green Crize)
- Sector 3 – North East Hereford (Tupsley)
- Sector 4 – North West Hereford (Warham Lane (U73023) and A438 Kings Acre Road
- Sector 5 – North Herefordshire
- Sector 6 – South Herefordshire
- Sector 7 – Wales
- Sector 8 – South England
- Sector 9 – The Midlands (Worcester and Birmingham)
- Sector 10 – Mid to North England and Scotland

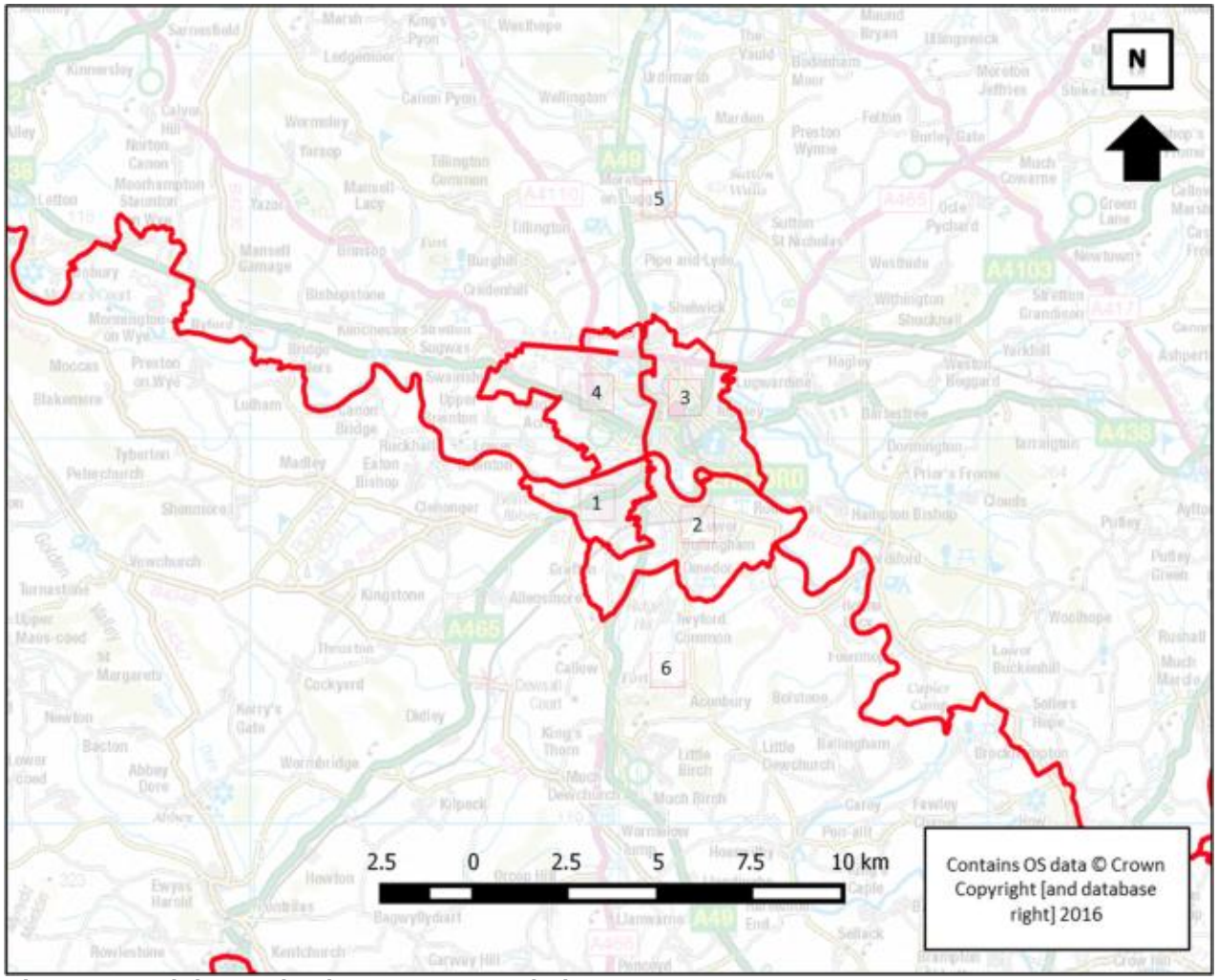

Figure 10 - Origin-Destination Sector Boundaries

6.6.2 These sectors are based on entry points into Hereford. Sectors 1 to 4 represent the internal sectors within Hereford with Sector 1 representing the A465 entry route, Sector 2 representing the A49(S) entry route, Sector 3 representing the A438 (E) and A4103 entry routes, and Sector 4 representing the A438 (W) and A49 (N) entry routes. Sectors 5 to 10 represent the external sectors which are divided across the main routes into Hereford from further afield.

6.6.3 The sectors were assigned based on Google Maps routing software to determine what route (road) a trip (car trip only) would take on its approach to Hereford. For example, a trip travelling from Abergavenny (represented in Sector 7) would approach Hereford on the A465, representing as a sector movement from Sector 7 to Sector 1.

6.6.4 A basic analysis of the RSI surveys was carried out and sector-to-sector movements of origins and destinations were generated in order to understand the surveyed vehicle movements.

12-HOUR PERIOD (07:00 – 19:00)

6.6.5 Table 18 presents the distribution of traffic movements by sector, during the 12-hour survey period, for all RSI sites. The traffic movements presented are calculated based on incoming trips only. Note that the data shown in **Table 18** includes data from all RSI sites and has not been factored to observed traffic flows, so the data should be treated accordingly.

		Destination Sector										
		1	2	3	4	5	6	7	8	9	10	Total
Origin Sector	1	0 (0.0%)	0 (0.0%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.0%)
	2	20 (0.2%)	48 (0.4%)	89 (0.8%)	19 (0.2%)	56 (0.5%)	18 (0.2%)	9 (0.1%)	5 (0.0%)	6 (0.1%)	0 (0.0%)	270 (2.4%)
	3	4 (0.0%)	17 (0.2%)	1 (0.0%)	0 (0.0%)	1 (0.0%)	3 (0.0%)	0 (0.0%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	27 (0.2%)
	4	0 (0.0%)	1 (0.0%)	7 (0.1%)	2 (0.0%)	2 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.0%)	1 (0.0%)	0 (0.0%)	14 (0.1%)
	5	245 (2.2%)	345 (3.1%)	2,967 (26.8%)	950 (8.6%)	703 (6.3%)	276 (2.5%)	102 (0.9%)	90 (0.8%)	74 (0.7%)	7 (0.1%)	5759 (52%)
	6	351 (3.2%)	286 (2.6%)	1,083 (9.8%)	281 (2.5%)	276 (2.5%)	126 (1.1%)	22 (0.2%)	15 (0.1%)	41 (0.4%)	12 (0.1%)	2,493 (22.5%)
	7	35 (0.3%)	49 (0.4%)	383 (3.5%)	113 (1%)	97 (0.9%)	38 (0.3%)	42 (0.4%)	35 (0.3%)	40 (0.4%)	21 (0.2%)	853 (7.7%)
	8	43 (0.4%)	84 (0.8%)	364 (3.3%)	104 (0.9%)	131 (1.2%)	18 (0.2%)	15 (0.1%)	0 (0.0%)	13 (0.1%)	6 (0.1%)	778 (7%)
	9	38 (0.3%)	58 (0.5%)	365 (3.3%)	145 (1.3%)	79 (0.7%)	55 (0.5%)	54 (0.5%)	8 (0.1%)	1 (0.0%)	0 (0.0%)	803 (7.2%)
	10	3 (0.0%)	11 (0.1%)	29 (0.3%)	10 (0.1%)	8 (0.1%)	3 (0.0%)	19 (0.2%)	4 (0.0%)	0 (0.0%)	0 (0.0%)	87 (0.8%)
	Total	739 (6.7%)	899 (8.1%)	5,289 (47.7%)	1,624 (14.7%)	1,353 (12.2%)	537 (4.8%)	263 (2.4%)	159 (1.4%)	176 (1.6%)	46 (0.4%)	11,085 (100%)

Table 18 - RSI Sector Analysis (07:00 – 19:00)

6.6.6 Based on the RSI data, shows that over the 12-hour survey period, the percentage of the total movements for internal to internal sector trips (highlighted by blue cells) was 1.9%. These movements are for trips with origins and destinations within the town, and we would expect these values to be low as they are within the RSI cordons. The number of trips travelling to Hereford over the 12-hour period (represented by trips originating from sectors 5-10, and travelling to sectors 1-4) equates to 77.2%. The percentage of through traffic (represented by trips originating from sectors 5-10, and travelling to sectors 5-10) is 22.8%.

6.6.7 The largest traffic movement over the 12-hour survey period is between Sector 5 and Sector 3 (26.8% of trips). These trips represent traffic travelling from North Herefordshire to North East Hereford (Tupsley).

6.7 HIGHWAY MODEL ASSIGNMENT

6.7.1 Assignment is the process that traffic models use to predict the routes that road users take between their origin and their destination. Route selection is based on travel costs.

6.7.2 Travel cost (and in particular time) is assumed to depend on the flows in the network. The default assignment procedure within SATURN was used, which is based on Wardrop's principle of traffic equilibrium. This principle states that "Drivers choose routes such that, at equilibrium, no individual trip maker can reduce his/her cost of travel by unilaterally changing route".

6.7.3 Such a model makes a number of assumptions, in particular:

- That network conditions and travel demand do not vary within the modelled period.
- The travellers in the network that have had a long-term experience with these conditions, so that they perceive the travel costs correctly and know the 'best' routes to take.
- That all drivers within a particular User Class perceive travel costs in the same way. Costs are a combination of time and vehicle running cost, termed 'generalised cost'.

6.7.4 The routing algorithms within the traffic model use a generalised cost function as the basis for calculating the varying costs along alternative routes and allocating trips to those routes. The cost of a route is the function of the time taken to travel along that route and the out-of-pocket costs relating to fuel and non-fuel associated with the distance travelled and speed achieved on the route.

6.7.5 Monetary values are attached to these parameters to provide a common unit for this calculation. The resulting model routing algorithm produces a cost for each possible route combining travel time, valued in 'Pence Per Minute' (PPM) and travel distance (linked to fuel costs) in 'Pence Per Kilometre' (PPK). The algorithm then selects the least cost route(s) for trips for the assignment.

6.7.6 The Pence Per Minute (PPM) model parameter was referenced from the time costs as stated from the TAG data book, worksheet A1.3.5. (https://www.gov.uk/government/publications/webtag-tag-data-book-july-2016).

6.7.7 The pence per kilometre (PPK) model parameter was based on the time costs from the TAG data book, worksheet A1.3.8. The guidance indicates that vehicle operating costs for economic assessment of schemes are based on a combination of fuel and non-fuel costs.

6.7.8 Generalised cost within a traffic model is used to represent the route choice element in the assignment process. This route choice needs to be based on how the driver perceives the cost of operating the vehicle, and so depends on the perception of these associated costs. Fuel costs are based on the fuel efficiency of the vehicle operating on the network via the following equation:

L = a/v+b+c.V+d.V2

Where;

L = Fuel consumption, expressed in litres per kilometre;

V = average speed, in kilometres per hour; and

a, b, c, d = parameters defined for each vehicle category.

6.7.9 The independent variable within this equation is traffic speed (kph), which is specific to the nature of traffic operating within the study area. Analysis of initial calibration assignments indicated that the study area speeds are as follows:

- AM Peak = 55.5 kph
- Inter - Peak = 60.9 kph
- PM Peak = 54.8 kph

6.7.10 The resulting fuel consumptions (in litres per kilometre) based on 2010 efficiency improvements taken from WebTAG data book A1.3.10.

6.7.11 The cost of fuel is based on the combination of resource costs, duty and the rate of VAT. This is tabulated in the TAG data book, worksheet A1.3.7.

6.7.12 The resulting costs (pence per km) of fuel for each vehicle type and for work and non-work trips are calculated by utilising the parameters specified above.

6.7.13 Non-fuel operating costs are calculated by vehicle and petrol type. These are calculated in a similar manner to fuel operating costs, whereby, a set of predefined parameters are utilised in conjunction with the following formula:

C = a1 + b1/V

Where;

C = cost in ppk (pence per kilometre) travelled;

V = average link speed in kilometres per hours;

a1 is a parameter for distance related costs defined for each vehicle category, and

b1 is a parameter for vehicle capital saving defined for each vehicle category (this parameter is only related to working vehicles)

6.7.14 The parameters in relation to a1 and b1 are stated in the TAG data book, worksheet A1.3.10. To determine the associated non-fuel vehicle costs (pence per km), the initial assignment speeds and non-fuel vehicle cost parameters are applied to the non-fuel operating cost function referenced above.

6.7.15 To determine the overall consumption costs respective to our model, the non-fuel operating costs and fuel operating costs are summed and weighted against the vehicle proportions as per fleet proportion data presented in the TAG data book, worksheet A1.3.9. This is representative of the total operating cost (pence per km) respective to the study area.

6.7.16 The generalised costs used in the model assignments are based on the values above and are summarised in **Table 19** below.

Trip Matrix	AM Peak Modelled Hour		Interpeak Modelled Hour		PM Peak Modelled Hour	
	PPM	PPK	PPM	PPK	PPM	PPK
Car (work)	45.12	13.75	44.22	13.45	41.97	13.80
Car (Commuting)	13.51	11.45	13.24	11.34	12.57	11.46
Car (Other)	16.17	11.45	16.89	11.34	17.60	11.46
LGV (Work)	23.46	18.04	23.46	18.18	23.46	18.03
LGV (Non-Work)	20.07	17.08	20.07	17.12	20.07	17.09
OGV1	21.01	31.07	21.01	30.37	21.01	31.20
OGV2	21.01	58.15	21.01	56.41	21.01	58.43

Table 19 - Assignment Generalised Costs

6.8 MODEL CALIBRATION AND VALIDATION

CALIBRATION AND VALIDATION RESULTS

6.8.1 88% of the calibration and validation links in the AM peak base year model met either the flow criteria or GEH criteria. This exceeded the required 85% benchmark of WebTAG.

6.8.2 92% of calibrated turns in the AM peak base year model met either the flow criteria or GEH criteria, which exceeded the required 85% benchmark of the WebTAG.

6.8.3 All of the modelled journey times in the AM peak base year model are within +/- 15% of the observed journey time from TrafficMaster.

6.8.4 89% of the calibration and validation links in the interpeak base year model met either the flow criteria or GEH criteria. This exceeded the required 85% benchmark of WebTAG.

6.8.5 94% of calibrated turns in the interpeak base year model met either the flow criteria or GEH criteria, which exceeded the required 85% benchmark of the WebTAG. .

6.8.6 All of the modelled journey times in the interpeak base year model are within +/- 15% of the observed journey time from TrafficMaster.

6.8.7 92% of the calibration and validation links in the PM peak base year model met either the flow criteria or GEH criteria. This exceeded the required 85% benchmark of WebTAG. This showed that the model provided a good fit with the observed link flows within Hereford.

6.8.8 96% of calibrated turns in the PM peak base year model met either the flow criteria or GEH criteria, which exceeded the required 85% benchmark of the WebTAG. This shows that the model provides a good fit with the observed turning flows at the key junctions within Hereford.

6.8.9 80% of the modelled journey times in the PM peak base year model are within +/- 15% of the observed journey time from TrafficMaster. This does not meet the WebTAG criteria. The routes that do fail are marginally outside the criteria.

6.8.10 The above information demonstrates that the base year model is sufficient for proceeding with forecasting. The LMVR is available in the Local Model Validation Report 70020236-2 (WSP, September 2017).

6.9 TRAFFIC MODELLING & FORECASTS

6.27.1 WSP are currently in the process of building a multi-modal transport model. The Hereford Transport Model (HTM) is a combination of a highway assignment model developed in SATURN, and a supporting mode choice model or Variable Demand Model (VDM) produced in VISUM.

6.27.2 The Highway Assignment Model has achieved validation (LMVR September 2017) and is suitable for providing robust traffic forecasts for the purposes of route choice. Upon selection of preferred route, the VDM will update the traffic flows for the bypass when considered along with the other element of the HTP - Active Travel Measures

Preliminary forecasts from the traffic model indicate bypass traffic flows of the magnitude indicated in the table below, however it must be stressed that these are early estimates and may be subject to change as the traffic model is adjusted and refined during the forecasting process.

Section	Opening year (2026) 2-way AADT
A49(T) South	19,900
SLR (A49-A465)	13,500
Bypass (A465-A438)	17,600
Bypass (A438 – A4103)	11,300
Bypass (A4103 –A49)	7,000
A49(T) North	19,900

. Table 20 - Hereford Bypass Traffic Forecasts

6.10 ECONOMIC PERFORMANCE

LINK TRANSIT & SAFETY BENEFITS

6.10.1 Work is currently ongoing in developing a full demand model to provide a Department for Transport WebTAG compliant assessment of reliable traffic forecasts to feed into the economics and benefits assessment of the Hereford Transport Package. On this basis and commensurate with the stage of Scheme Assessment Report 2, results on link transit and safety benefits will be calculated and presented in the economics assessment report to underpin the business case. It is however considered that the bypass in combination with Active Travel Measures (ATM) will provide sufficient city centre congestion relief and deliver both link and safety benefits.

7 ENVIRONMENTAL ASSESSMENT

7.1 ASSESSMENT OF ENVIRONMENTAL EFFECTS

7.1.1 For the Stage 2 EAR Assessment, whilst all seven possible route option options have been technically developed as individual route options independent of each other, the 'best performing route option' could be made up of alignments based on the best of each element. The route options have therefore been split into three elements to enable each element to be fully assessed as individual sections.

- Element 1 will assess four route options within the southern section: Orange, Cyan and Yellow, Red and Black 2, and Olive and Black 1;
- Element 2 will assess all seven route options individually within the central section; and
- Element 3 will assess a single route option (route is the same for all seven routes) within the northern section.

AIR QUALITY

CONSTRUCTION PHASE IMPACTS

7.1.2 During the construction phase, adverse impacts from dust and exhaust emissions could potentially occur at sensitive receptors within 200m of worksites associated with the proposed Scheme. Impacts would be temporary in nature and with appropriate mitigation, the risk of such impacts could be minimised. The residual effect is unlikely to be significant.

7.1.3 The approximate number of receptors that could be affected during the construction of the proposed Scheme are shown in **Table 21**

Route Option	Properties within 50m	Properties within 50-200m	Total number of properties within 200m
Route option 1 - Orange	18	91	109
Route option 2 - Cyan	16	111	127
Route option 3 - Yellow	13	133	146
Route option 4 - Red	9	72	81
Route option 5 - Olive	9	139	148
Route option 6 - Black1	10	129	139
Route option 7 - Black 2	10	96	106

Table 21 - Number of properties likely to be affected by the proposed Scheme

OPERATIONAL PHASE IMPACTS

7.1.4 Within the centre of Hereford, the greatest change would be an improvement at Victoria Street between the Edgar Street roundabout and Barton Road junction. The magnitude of change here is large. This is due to the overall rerouting of through traffic from the A49 through the centre of Hereford to the bypass. All modelled concentrations were well below the air quality threshold. There would be no increases in nitrogen dioxide within Hereford.

7.1.5 Outside of Hereford centre, the greatest decrease would be in Lulham, with further decreases seen at other receptors. This is due to traffic crossing the River Wye and rerouting onto the bypass rather than using the rural roads to the south-west of Hereford to cross the river. The greatest increase would be seen at receptor R28, on the A465 at Allensmore. This would be due to the increase in demand generated on the network by the bypass.

7.1.6 All impacts would be of small to imperceptible magnitude, with concentrations everywhere staying well below the annual mean criteria of 40µg/m3. On the basis of the information provided and assumptions made in the modelling there is no risk of any significant impacts arising from the operation of the proposed Scheme for all

options. Taking into account the guidance given by IAN 174/13 regarding evaluation of significant local air quality effects and using professional judgement, the local air quality impacts with the proposed Scheme would not give rise to a significant adverse effect.

7.1.7 During the operational phase across all of the proposed options all concentrations of NO_2 are expected to remain below the annual mean criteria.

NOISE

7.1.8 The assessment shows that the majority of receptors in the study area are likely to experience a negligible effect classified as a slight effect. Receptors concentrated near the A438, A4110 and in Belmont, south of the river Wye are likely to experience a slight to a large adverse effect. A minor beneficial effect, slight effect, is expected at receptors in the city centre. Some of them would be above the SOAEL therefore, this effect would be classified as significant.

7.1.9 The noise effect would be similar at all options. Small variations in the results suggests that Option 6 (Black 1) presents the least adverse effect, followed by Option 7 (Black 2).

7.1.10 The effect at NIAs in the city is likely to be slight to moderate beneficial. An indicative assessment has been provided for sensitive receptors at the proposed urban extension Land at Tree Elms and constraints are provided to suggest that Options 6 (Black 1) and 7 (Black 2) are likely to require a less onerous mitigation strategy.

LANDSCAPE

7.1.11 Full design proposals are as yet unknown and the magnitude of impact on landscape and visual receptors would be influenced by the design and extent of earthworks and structures. Works that have the potential to affect landscape and visual receptors include, but are not limited to, the excavation for the road option, additional land/ mitigation requirements for ecological, noise and flood compensation, lighting columns and above-ground infrastructure, compound areas, landscape planting, retaining ponds, temporary access routes, topsoil stripping, traffic management and hoardings/ fencing, stockpiles, artificial lighting, changes in noise and tranquillity levels, and presence of plant and traffic.

7.1.12 The construction of any of the proposed Scheme options may potentially impact trees protected by Ancient Woodland/Veteran tree status, Tree Preservation Orders and BS5837 Category A status trees as well as locally designated Traditional Orchard sites and associated Priority Habitats. Vegetation currently provides screening for views in and out of the Proposed Scheme as well as contributing to the overall character of the Core Study Area. Any loss of vegetation (such as of hedgerows or trees) may therefore adversely affect local visual amenity and local character. The appended engineering drawings are indicative only and do not include this potential vegetation loss.

7.1.13 There are several potential effects which are common to all of the proposed route options within Element 1, 2 and 3 of the scheme before mitigation. These include:

- Loss of tranquillity;
- Modification to landform;
- Change in local landscape character and visual amenity due to loss of hedgerows, ancient/veteran/tpo trees, ancient woodland, traditional orchards and agricultural fields;
- Change in local landscape character and visual amenity due to construction activities introducing new colour, activity, noise and artificial lighting;
- Change in local landscape character and visual amenity due to alteration of historic landscape patterns, such as disruption to Unregistered Parks and Gardens of Burghill Hospital and the park surrounding the grounds of Belmont Abbey and Warham House;
- Disruption to users of the local PRoW network and waterways;
- Change in local landscape character and visual amenity for users of the local PRoW network and waterways; and
- Change in local landscape character and visual amenity for local residents and visitors.

7.1.14 In summary, the route options are likely to be visible from two areas of the unregistered parks and gardens to the north and south of the River Wye. Views will in part be determined by the typology and character of the lowland landscapes, including scenic views looking west towards traditional orchards adjacent to the River Wye. Potential loss of vegetation screening may broaden views within 250m of the Proposed Scheme,

including for the scattered individual properties of Warham House, Bovingdon Park estate area and former Burghill Hospital.

7.1.15 Views from the linear riverine landscape of the River Wye and Yazor Brook will likely be subject to fragmented visual effects as a result of the proposed route options (i.e. through the introduction of new infrastructure such as an elevated bridge crossing over the River Wye). The existing flat, generally well defined floodplain characterised by the meandering tree-lined river edge and meadows of the watercourses currently provides extensive views along the edge of the watercourse corridor.

7.1.16 The construction of the proposed Scheme may potentially effect trees protected by Ancient Woodland/Veteran tree status, Tree Preservation Orders and BS5837 Category A status trees as well as locally designated Traditional Orchard sites and associated Priority Habitats. Vegetation currently provides screening for views in and out of the Proposed Scheme as well as contributing to the overall character of the Core Study Area. Any loss of vegetation (such as of hedgerows or trees) may therefore adversely affect local visual amenity and local character.

ECOLOGY

7.1.17 If construction works proceed without appropriate mitigation in place to preserve the biodiversity of the study area, the following potential effects may arise:

- Permanent and temporary Habitat loss and damage of Parkland Habitat of Principal Importance;
- Habitat fragmentation and degradation of the River Wye SSSI/SAC, e.g. construction phase effects such as sedimentation, lighting, noise, vibration and operation phase effects such as nitrogen deposition;
- Habitat damage and fragmentation of ancient woodlands, e.g. construction phase effects such as dust deposition, runoff, and operation phase effects such as nitrogen deposition;
- Habitat loss and damage of Special Wildlife Site woodland;
- Habitat loss and damage of hedgerows;
- Habitat damage of traditional orchards;
- Damage to ancient woodland/ mature/veteran trees;
- Fragmentation of wildlife corridors, such as hedgerows;
- Killing / injury / disturbance of protected and notable species during site clearance and construction;
- habitat loss;
- Fragmentation of wildlife corridors, such as hedgerows, and in particular the Bridleway (BT4) to the south of Drovers Wood, Wyevale Wood and between the Pippin Trust orchards; and
- Direct and indirect disturbance from construction activities including visual, noise, vibration and lighting; and
- Pollution caused by increased levels of dust, use of hazardous materials and incidental release of chemicals, fuels or waste materials.

7.1.18 If the Hereford Bypass becomes operational without appropriate mitigation in place to preserve the biodiversity of the study area, the following potential effects may occur:

- Habitat fragmentation due to the presence of an operational road;
- Direct mortality from passing traffic;
- Direct disturbance from operational use e.g. visual, noise and lighting; and
- Air quality changes resulting in deposition onto important habitats.

7.1.19 Likely effects on these features have been estimated based on proximity to the alignment. The likely effects identified range from major negative to neutral. The highest (most adverse) assessment score for each ecological feature provides the assessment score for the route option.

7.1.20 All the proposed route options (Black 1, Black 2, Cyan, Olive, Orange, Red and Yellow) were assessed to have a moderate adverse effect on ecology features.

HERITAGE

7.1.21 The route options have the potential to have the following effects to designated heritage assets and the unregistered parks and gardens within the 1km wider study area:

- Introduction of light, noise and movement into the settings of the assets;
- Loss of appreciation of the asset and its historical context due to built infrastructure and raised surfaces and embankments cuttings);
- Loss of and interruption to key views to and from the assets;

- Loss of historical association between assets; and
- Disruption to archaeological and earthwork remains due to ground disturbance.

7.1.22 Full design proposals for each of the route options are as yet unknown and the magnitude of effect on the settings of heritage assets will be largely influenced by the height of the route option, i.e. at grade, embankment or in a cutting. Other factors such as lighting and junction design will also have an effect.

7.1.23 Potential adverse effects upon the settings of designated assets are likely to include harm to the relationship between the asset and its setting so that the relationship is no longer readily appreciable; the interpretability of the significance of the asset being significantly reduced; a loss or reduction of rural tranquillity and/or where noise and air pollutants are likely to increase.

7.1.24 All route options are considered to have a minor to large adverse effect on designated heritage assets and unregistered parks and gardens within the 1km wider study area.

7.1.25 All of the proposed route options (Cyan, Orange, Yellow, Olive, Black 1 and Black 2) are considered to have a minor to moderate adverse effect on known non-designated heritage assets within the 500m study area: Route option 4 - Red is considered to have a moderate adverse effect on known non-designated heritage assets within the 500m study area.

7.1.26 All three elements have been combined to assess the potential effects below:

- Orange - A total of 55 heritage assets are expected to be affected by the Orange route option. These include five Scheduled Monuments, one Grade I listed building, two Grade II* listed buildings, 25 Grade II listed buildings, one conservation area and 12 non-designated assets. Adverse effects are also anticipated on hitherto unknown below-ground archaeology.
- Yellow - A total of 48 heritage assets are expected to be affected by the Yellow route option. These include five Scheduled Monuments, one Grade I listed building, two Grade II* listed buildings, 33 Grade II listed buildings, one conservation area and 12 non-designated assets. Adverse effects are also anticipated on hitherto unknown below-ground archaeology.
- Cyan - A total of 49 heritage assets are expected to be affected by the Cyan route option. These include five Scheduled Monuments, one Grade I listed building, two Grade II* listed buildings, 28 Grade II listed buildings, one conservation area and 12 non-designated assets. Adverse effects are also anticipated on hitherto unknown below-ground archaeology.
- Red - A total of 50 heritage assets are expected to be affected by the Red route option. These include five Scheduled Monuments, one Grade I listed building, two Grade II* listed buildings, 28 Grade II listed buildings, one conservation area and 12 non-designated assets. Adverse effects are also anticipated on hitherto unknown below-ground archaeology.
- Olive - A total of 44 heritage assets are expected to be affected by the Olive route option. These include five Scheduled Monuments, one Grade I listed building, two Grade II* listed buildings, 23 Grade II listed buildings, one conservation area and 12 non-designated assets. Adverse effects are also anticipated on hitherto unknown below-ground archaeology.
- Black 2 - A total of 50 heritage assets are expected to be affected by the Black 2 route option. These include four Scheduled Monuments, one Grade I listed building, two Grade II* listed buildings, 30 Grade II listed buildings, one conservation area and 11 non-designated assets. Adverse effects are also anticipated on hitherto unknown below-ground archaeology.
- Black 1- A total of 44 heritage assets are expected to be affected by the Black 1 route option. These include four Scheduled Monuments, one Grade I listed building, seven Grade II* listed buildings, 20 Grade II listed buildings, one conservation area and 11 non-designated assets. Adverse effects are also anticipated on hitherto unknown below-ground archaeology.

7.1.27 Elements 1, 2 and 3 would have adverse effects on a number of designated and non-designated heritage assets, including below-ground archaeological remains/earthworks, built heritage and landscaped parks.

7.1.28 It is recommended that investigation, mitigation and enhancement measures are taken into consideration for the preferred option to prevent loss or reduction of the appreciation/interpretability of designated assets and their settings, and to establish the nature, extent, significance and survival of both known and unknown below-ground archaeological remains.

WATER ENVIRONMENT

7.1.29 Potential effects to surface water features, groundwater features and flood risk during construction could arise from:

- Increased pollution risks from mobilised suspended solids, spillage of fuels or other harmful substances that may migrate to surface water and groundwater receptors;
- Effects to the hydromorphological and ecological quality of watercourses associated with works within or in close proximity to watercourses such as the installation and alteration of culverts, bridges and outfalls as well as realignment of watercourses, including longer term changes associated with sediment deposition;
- Increased flood risks associated with temporary works within areas of fluvial flood storage, works to existing watercourse alignments and culverts, and associated with changes to catchment permeability and hydrology.

7.1.30 Potential effects to surface water features, groundwater features and flood risk during operation could arise from:

- Polluted surface water runoff containing silts and hydrocarbons that may migrate or be discharged to surface water features or groundwater resources via the proposed highway drainage system;
- Permanent effect to the hydromorphological and ecological quality of watercourses associated with works within or in close proximity to watercourses such as the installation and alteration of culverts, bridges and outfalls as well as realignment of watercourses;
- Permanent effects to catchment hydrology caused by the introduction of a barrier to natural overland flow and changes to natural catchment dynamics associated with the proposed highway alignment, highway drainage system and watercourse diversions.
- Increased flood risk to people and property elsewhere as a result of construction within areas identified to be at risk of flooding, thus effecting flood flow conveyance and reducing floodplain storage, and effect to existing flood defences;
- Betterment of flood risk to people and property elsewhere by providing a barrier to the flow of flood waters thereby reducing downstream flood flow conveyance and flood risk;
- Flood risk to the Scheme as a result of construction within areas identified to be at flood risk;
- Increased rates and volumes of surface water runoff from an increase in impermeable area and/or changes to the existing drainage regime leading to a potential increase in flood risk.

7.1.31 All route options are considered to have a moderate to large adverse effect on water mainly linked potential risks to ecological, chemical and hydromorphological quality of the River Wye and Yazor Brook and potential increased flood risk to residential, commercial and rural areas.

7.1.32 A high level assessment of the potential effects has been undertaken. This takes into consideration mitigation measures that are considered to be good practice or have little effect to scheme design, such as the implementation of a Construction Environmental Management Plan (CEMP), provision of appropriate drainage, or appropriate crossing of a minor land drain. It does not take into consideration measures that will have a notable effect on the design of the scheme, such as the provision of a clear-span bridge structure or floodplain compensation.

PEOPLE AND COMMUNITIES

7.1.33 Effects to People and the Community would arise from the following actions:

- Increase in built form including the new road, earthworks, lighting, signage, traffic and new overbridges - notably a new viaduct over the River Wye which disrupt existing roads and PRoW;
- Severance in the community by segregating the west of Hereford from the main town centre;
- Loss of mature tree, shrub and hedgerow cover within the existing rural landscape which provide amenity value on PRoW;
- Driver uncertainty caused by diversions and road closures during the construction of the scheme.

7.1.34 The route options will have an effect on the views from the following roads: A49; A4110 Canon Pyon Road; A4103 Roman Road; Tillington Road; A438 Kings Acre Road; Breinton Lane; Ruckhall Lane; B4349; A465: and, Unnamed/single tracked roads.

7.1.35 All footpaths effected by the route options will see a localised permanent reduction in amenity due to the visual intrusion and increased noise levels. Journey length for some users may be increased due to closures/diversions. The integrity of existing PRoW will be maintained, and in some cases improved as a result of the bypass. The diversions in place will also improve the safety of pedestrians and will aim to improve connectivity on the NMU network which will be beneficial to the users.

7.1.36 Due to the location of the route options, it is anticipated there will be some moderate severance during the construction phase. The route options transverses a large area of agricultural land with several small roads

which lead to small individual farms and residential dwellings which will be affected. However, diversions to roads and PRoWs and crossings via underpasses and overbridges will be incorporated into the final design and therefore no severance between the communities is anticipated during the operation of the Scheme, although journey time length for travellers may be increased due to the new layout of the roads.

PEOPLE AND HEALTH

7.1.37 The environment is one of the largest influences upon a population's health, and has direct health effects through various media including air, land and water quality, as well as indirect effects, such as interaction of demographics, education and access to open spaces. However social influences can also significantly affect health. Social determinants of health, address conditions of everyday life that lead to health inequalities. The route options have the potential to effect upon a number of receptors across the study area in the following way:

- Direct effect on population and health through changes in driver stress;
- Indirect effect on population and health through changes in community severance;
- Direct effect on population and health through changes in accessibility;
- Direct effect on population and health through changes in route safety;
- Indirect effect on population and health through changes in amenity value;
- Direct effect upon health of the local population through changes in Air Quality and AQMA status;
- Direct effect upon health of the local population through changes in noise effects upon noise sensitive receptors; and
- Indirect effect upon health of the local population through changes in the status and function to the employment and commercial land affecting the local economy as well as employment status of the local population

MATERIALS AND WASTE

7.1.38 No information on the materials or waste generation associated with the route options is available at this early stage. However, in general it is assumed that route options with a larger development footprint, and larger scale ground works will produce a higher level of waste and require increased amounts of materials to complete.

7.1.39 The majority of the route options will require large amounts of primary and secondary materials for the proposed bypass construction. The route options will also require significant engineering works and supporting infrastructure to either go over or under roads that will be affected by the scheme, additional roundabouts and junction improvements are also required to allow the proposed route to merge with existing roads. All the route options require a viaduct structure in order to travel over the River Wye. Due to the amount of offline works, the scheme will require the disposal and re-use of top soil, vegetation waste and other spoil associated with the groundworks.

It is expected that the majority of the route options to have a major effect on materials.

GEOLOGY AND SOILS

7.1.40 An assessment of the potential effects has been undertaken. This takes into consideration mitigation measures that are considered to be good practice or have little effect to scheme design, such as the implementation of a CEMP, and standard good practice during construction. It does not take into consideration measures that will have a notable effect on the design of the scheme.

7.1.41 All route options would have a neutral to slight adverse effect on Geology, Geomorphology & Mineral Resources due to their potential effect on Glacial sand and gravel and river sand and gravel resources.

7.1.42 All route options would have a large adverse effect on soil due to their potential effect on Grade 1 & 2 agricultural land.

7.1.43 The following route options will have a slight adverse effect on groundwater due to potential risks to water quality (Source Protect Zone 3): Black 1 and Black 2.

7.1.44 The following route options will have a slight to moderate adverse effect on groundwater due to potential risks to water quality (Source Protect Zone 2): Cyan, Olive, Orange, Red and Yellow.

7.1.45 The proposed route options all have the potential to have an effect on mineral resources, soils, groundwater and surface water receptors. The most notable of these effects is the slight or moderate adverse effect to groundwater associated with the abstraction wells and surface water courses with all route options.

CLIMATE

7.1.46 With predicted changes in climate leading to shorter, more intense rainfall events, the proposed Scheme would be increasingly susceptible to flood events. Chapter 10 Water drainage of the EAR2 describes the flood zones across the study area and the susceptibility of the proposed Scheme to increased flooding due to climate change.

7.2 ENVIRONMENTAL MITIGATION

7.2.1 The following sections provide an overview of environmental mitigation options as detailed within the Stage 2 Environmental Assessment Report.

AIR QUALITY

CONSTRUCTION

7.2.2 To minimise the risk of adverse impacts during construction, industry best practice measures should be employed. Appropriate measures should be specified in the Construction Environmental Management Plan (CEMP). The measures used will depend on the circumstances but typically comprise:

- Damping down of dry surfaces, in-particular haul roads;
- Avoiding/minimising stockpiling of friable materials on-site in open areas;
- Locating stockpiles (if necessary) as far away from sensitive receptors as practicable;
- Seeding of long-term inactive stockpiles such as topsoil;
- On-site speed restrictions to minimise dust entrainment;
- Sheeting/covering of lorries carrying potentially dusty materials;
- Wheel/chassis cleaning prior to exit onto the public highway;
- Requiring all on-site plant to comply with the latest EU emission standards for non-road mobile machinery; and
- Requiring all contractor vehicles to be compliant with a minimum Euro emissions standard, for example Euro VI (6).

OPERATION

7.2.3 Mitigation of operational phase impacts will only be required if significant adverse effects are likely. This will be discussed as the preferred route progresses.

NOISE

Construction

7.2.4 A noise and vibration effect mitigation strategy will be defined once the Preferred Option is selected. The assessment undertaken for the Stage 3 ES, will provide an indication of key areas where mitigation is likely to be required. Thereafter, mitigation will be defined in the Construction Environmental Management Plan. In addition, contractors will have the possibility to seek consent from the Local Authorities through Section 61 of the Control of Pollution Act 1974 for the proposed construction activities. Details of the mitigation measures would be then stipulated as part of this consent.

7.2.5 During the construction phase, the contractor will be encouraged to apply Best Practicable Means to reduce residual noise. General methods of construction phase noise control may include:

- The appropriate selection of plant, construction methods and programming: Only plant conforming with or better than relevant national or international standards, directives or recommendations on noise or vibration emissions will be used. Construction plant will be maintained in good condition with regards to reducing noise output;
- Construction plant will be operated and maintained appropriately, having regard to the manufacturer's written recommendations or using other appropriate operation and maintenance programmes which reduce noise and vibration emissions. All vehicles and plant will be switched off when not in use;
- Design and use of site hoardings and screens, where necessary, to provide acoustic screening at the earliest opportunity. Where practicable, gates will not be located opposite buildings containing noise sensitive receptors;
- Choice of haulage routes and programming for the transport of construction materials, spoil and personnel to reduce the risk of increased noise and vibration effects due to the construction of the junction;
- The positioning of construction plant and activities to reduce noise at sensitive locations;

- Equipment that breaks concrete by munching or similar, rather than by percussion, will be used as far as is practicable; and
- The use of mufflers on pneumatic tools.

Operation

7.2.6 A likely mitigation strategy has not been defined at this stage and the results included in this assessment correspond to unmitigated effects. Mitigation measures often used in road schemes are listed below and they will be explored at Stage 3:

- Low noise surfacing in order to reduce tyre-surface interaction: An assessment of the effect of noise with and without this surface treatment should be undertaken in order to ascertain the potential cost-benefit of this measure. The noise level reduction at source for this measure will range between 1 to 3.5 dB, depending on the traffic speed;
- Noise Barriers / earth bund / cutting: The benefits of installing noise barriers (earth bunding or acoustic fencing) at specific locations may be a suitable control measure in certain areas. This mitigation strategy is likely to provide a noise level reduction between 5 to 10 dB, provided that the line-of-sight is obstructed; and
- Alteration to the horizontal or vertical alignment in order to reduce potential effects in key areas will be considered as a potential mitigation measure.

7.2.7 Based on the modelling results presented later in this chapter, areas near the proposed bypass are likely to receive an adverse significant effect. At Stage 3, emphasis will be given to study the possibility of mitigation measures, such as noise barriers and low noise surfacing, on the following areas:

- Segments of the route near the intersection with the A438;
- Segments of the route near the intersection with the A4110; and
- Segments of the route near Belmont, south of the river Wye.

LANDSCAPE

7.2.8 The crossing of the River Wye could have significant landscape and visual effects on the Wye Valley, a landscape of high sensitivity. Adverse visual effects could not be mitigated with screen planting in this case due to the likely elevation of the bridge and the open character of part of the floodplain. It is essential that the crossing is designed and incorporates an appropriate architectural style that is sensitive to this setting.

7.2.9 Ancient, veteran and notable trees, as well as those defined as of Class A quality in the Arboricultural Report, should be avoided through micro-siting of the route alignment. This involves avoiding the identified Root Protection Area (RPA) and protecting the trees during the construction period in accordance with BS5837:2012.

7.2.10 The first principle of the landscape design would be to retain and protect as much of the existing woodland, orchards and hedgerows as possible. The second principle would be to carry out new planting for landscape and visual mitigation and to replace any vegetation lost due to construction. Opportunities for landscape enhancement, such as improvement through the management of any retained areas of vegetation, should also be considered.

7.2.11 Permanent landscape mitigation proposals and enhancement measures would follow the guidance in the DMRB, Volume 10: Environmental Design and Management (Section 0: Environmental Objectives). Where opportunities exist during an iterative process to refine route design (e.g. sinuously connect embankments and cutting into the surrounding landscape), associated landscape proposals should also be designed to complement the existing landscape elements and environmental functions of the adjoining landscape and comprise locally occurring desirable native species of trees, shrubs, wildflowers and grasses as well as hedgerows and orchards.

Landscape Mitigation and Enhancement

The landscape and visual effects associated with the construction phase of a highway scheme are similar in their area of influence to the operational phase, but cannot generally be mitigated as it is not possible to screen the construction works completely. Whilst it is likely the construction effects may generally be more adverse where views of the exposed earthworks and the extended works area (including signage, traffic management, contractor's compounds etc.) would be available, they would be temporary effects.

The following mitigation measures are anticipated to form a common approach to the detailed design of the preferred option and have been incorporated when developing likely effects and effects:

- Sensitive earthworks design to minimise the effect of the cuttings and embankments and enable integration of the proposed options into the surrounding landscape;
- Where appropriate there is the potential for the grading out of earthworks at sensitive locations to avoid disjointed appearance of landform and aid integration of the option into landscape;
- Retention of existing established trees and vegetation wherever possible and incorporation of new native woodland planting to integrate with existing (where appropriate);
- Planting at junctions and adjacent to structures to help assimilate the junctions / structures into the landscape;
- Use of native woodland mixes that comprise a mix of trees and scrub species that reflect the inherent local woodland composition and enhance biodiversity;
- Replacement or enhancement of traditional orchards, including selection of suitable orchard fruit varieties;
- Retention or replacement of hedgerows, using native species appropriate to the local area; and
- Consideration as to the use of visual barriers (including green acoustic barriers), where planting depth may be insufficient to provide effective screening.

7.2.12 It should be noted that the nature of the scheme does not fit into the general scale or pattern of the surrounding landscape and it would therefore not be possible to fully integrate the route option into the landscape. However, measures should be taken to reduce the effect through retaining and protecting where possible, landscape elements of great significant value including watercourses such as the Wye River and Yazor Brook, protected trees and woodlands such as Wye and Rough Coppice, designated landscape parks, traditional orchards and settlement patterns. The potential effect of the development would be visually intrusive for existing views along the watercourses, disrupting the quality of the linear landscape, and fundamentally alter some of the protected views identified in the Breinton Neighbourhood Development Plan (2016).

7.2.13 The preferred route option should be designed to follow the natural topography of the landscape as far as possible. However, where cuttings and embankments are required, slopes should be slackened to integrate with the existing rolling landform characteristic of Herefordshire and mitigation planting should be subtly specified and positioned to integrate with surrounding landscape features.

ECOLOGY

7.2.14 Generic mitigation measures are described below. These measures are considered to be applicable to all route options. The measures described are those likely to be most appropriate given the identified constraints.

7.2.15 Key mitigation measures that are likely to be included within the design are broadly as follows:

- Measures that avoid the adverse effect (for example, the re-siting of construction compounds, or adjustments in road alignment etc.);
- Where the adverse effect cannot be avoided or reduced fully, measures that compensate for the loss of the particular ecological resource that is affected (for example, at least like-for-like replacement of lost habitats, etc.); and
- Enhancement by habitat creation, improved management and long-term monitoring.

7.2.16 Other general mitigation measures which may help to reduce the magnitude and significance of the construction and operational effects could include:

- Correct timing of works to avoid key periods for particular species, such as avoidance of the bird breeding season for habitat clearance;
- Habitat creation/enhancement: either through the translocation of existing habitats or seed banks; the enhancement of existing habitat; and / or the planting of new habitat.
- Translocation and/or exclusion of species (under appropriate licences / agreements) where required from the works footprint to pre-prepared receptor sites to minimise effects of habitat loss and species mortality;
- Appropriate design and use of lighting to minimise effects on bats and other light sensitive species;
- Re-establishing connectivity between habitats affected by road construction and incorporation of features within the detailed design which would restore connectivity for protected species whose habitat has been fragmented by the road;
- The use of screening during construction to minimise the spread of noise, dust, lighting etc. and potentially the use of fencing to temporarily exclude species by restricting access into particular areas (such as reptile exclusion fencing);
- Appropriate landscaping and re-landscaping of all new roadside verges and disturbed habitat specifically for species known to be present in the area (where suitable for network and safety priorities). All landscaping should use species of local provenance;

- Installation of surface water run-off attenuation and treatment features to ensure water discharged to watercourses would not compromise the conservation value of the watercourse or the species that live within it; and
- Implementation of general construction environmental best practice. This could include, but is not limited to, providing tool box talks for construction staff informing them of key ecological constraints within the area, the damping of haul routes to minimise the spread of dust, the use of drip trays and spill kits when refuelling vehicles and ensuring that open trenches are not left over night without safe means of egress for animals that may fall into them.

HERITAGE

7.2.17 It is proposed that, where viable, preliminary archaeological investigations are undertaken within the preferred option to establish the nature, extent, significance and survival of both known and unknown below-ground archaeological remains. This is likely to comprise a geophysical survey, followed by an appropriate form of intrusive investigation such as archaeological trial trenching. The results of these investigations can be used to devise a suitable programme of mitigation where appropriate. Mitigation measures such as open area excavations would be devised in consultation with the County Archaeologist.

7.2.18 In some instances, the scale, location, positioning and design of the road across the landscape would not accommodate suitable mitigation and the adverse effect would remain unchanged. Here, the opportunity to enhance the affected assets should be explored, such as the addition of interpretation panels at suitable locations and the opening up of lost key views from effected assets. Again, this is something that will result from a detailed assessment in Stage 3 following option selection. Therefore, high quality design will be important for the preferred route option that would have an adverse effect on the setting of heritage assets. This could include sensitive design to minimise the effect of high infrastructure (such as bridges), scale of cuttings and embankments for route options in particular Element 1 (Olive & Black 2, Orange, Cyan & Yellow). These will need to be carefully considered in Stage 3 as Element 1 would be located within Belmont Landscaped Park and Warham Landscaped Park, and close to Belmont Abbey, Belmont House and Warham House where it would interrupt the intervisibility between the historically associated assets. Potential effects on the setting of listed buildings and undesignated heritage assets would also be considered in the Stage 3 design.

WATER ENVIRONMENT

7.2.19 To mitigate the risks to the water environment as far as practicable, it is recommended that a CEMP be prepared and adopted during the construction stage to limit the risk of pollutants entering surface water features or discharging to ground. The CEMP will detail the procedures and methods that must be followed to minimise the potential environmental effects of construction activities. The CEMP will also describe the procedures to be followed in the event of an environmental emergency such as a fuel or chemical spillage. Mitigation measures and that are considered standard good practice will also be incorporated and considered further within the detailed design of the preferred option.

7.2.20 The following mitigation measures will be required:

- Provision of appropriate ecological mitigation measures for works within and in close proximity to watercourses, such as inclusion of a natural bed (if a culvert design is proposed) and inclusion of structures to maintain fish, eel and otter passage.
- A culvert may be required to maintain hydraulic connectivity due to the realignment of a watercourse which cannot be maintained within a cutting beneath Ruckhall Lane to mitigate the risk of flooding.
- Mitigation to address the identified flood risks associated with the crossing of the Yazor Brook is likely to include the following:
    - Provision of flood compensation storage upstream of the proposed crossing of Yazor Brook to the west of the proposed Scheme alignment.
    - Provision of a flood relief culvert beneath A4103 Roman Road to the west of the proposed junction to reduce flood risk to the properties adjacent to Towtree Lane and overtopping A4103 Roman Road.

7.2.21 However, the proposed mitigation measures present considerable residual risk in the event of blockage of the new flood relief culverts.

7.2.22 The scheme design will aim to minimise the amount of road closures and diversions during the construction phase to ensure the effects and journey times for all travellers are as small as possible. Best practise construction techniques will also reduce the effects generated from construction disturbance and will therefore have a reduced effect on the amenity value of the surrounding area.

Motorised Travellers

7.2.23 The preferred design solution should improve the experience of MT using the route and connecting roads. The following mitigation and enhancement measures will contribute to an improved experience for MT

- Where overriding landscape or design constraints do not restrict this, the view from the road for MT should not be further obstructed by new structure(s), and open views of the surrounding countryside should be retained; the delays currently experienced by MT using the existing roads, and connecting roads are expected to lead to frustration, and should be reduced. The best performing options will result in a reduction in Driver Stress associated with delays;
- Signage and layout should be clear to understand and avoid creating Route Uncertainty. Any diversions or closures undertaken during construction should be clearly advertised, and any diversionary routes should not lead to Uncertainty; and
- Best Practise landscape management techniques, as outlines in the DMRB, Volume 10, will be embedded in the design to ensure safety whilst respecting the environment. Embedded design to ensure safety whilst respecting the environment. Embedded design safety measures will reduce fear of accidents with other MTs and NMUs.
- These issues should be addressed at the subsequent phase of design.

Non-motorised users

- The preferred design solution should accommodate NMUs and either retain or improve the existing access arrangements. For example, the existing footpaths should be retained and where crossed by the route, provided with proper means of access to prevent severance. Any diversionary works or closure of NMU routes should be undertaken following proper consultation with affected groups or individuals, and the required consent orders obtained.
- Use of the best practise design with regards to the safety of NMU to improve the amenity of users of the footpaths in the surrounding area and adopt traffic management methods which maintain access for users such as pedestrians, cyclists and equestrians.
- Design any permanent diversions in NMU routes to provide the same, or improved standard of pathway
- Continue to facilitate opportunities to access visitor attractions and recreational opportunities throughout the route where possible
- Incorporate effective rationalisation between NMU routes, safe crossing points and provisions for access to public transport
- Existing types of access to PRoW should be retained, for example, by not introducing new barriers such as stiles and kissing gates which may restrict certain users.
- Enhance recreational value of the PRoW to introduce new routes to provide better connections between the existing PRoW which promote more circular routes of the Wye Valley which may help to promote more walking and cycling activities in the area.

Effects on Communities

Community Severance

7.2.24 Existing footpaths should be retained and where crossed by the route option, provided with proper means of access to prevent severance. PRoWs and bridleways should be diverted and remain open throughout the construction period where possible. The extent of diversions or closures are not known at this stage of design. Existing roads should be incorporated into the scheme, allowing for crossing points within the design.

Tourism and Recreation

7.2.25 Use of best practice construction methods during construction will reduce disruption to users of facilities within the vicinity of the scheme. This will include maintaining motorised traveller and NMU access to tourism and recreational facilities throughout the construction period. PRoWs and bridleways should be diverted and remain open throughout the construction period where possible.

Housing

7.2.26 The preferred design solution should be designed with future development in mind, in particular the Three Elms development north west of Hereford.

Agricultural Land

7.2.27 As significant areas of BMV agricultural land are required to enable development of the scheme option, once a preferred option has been decided there may be a need to undertake an Agricultural Effect Assessment. This should consider the effect of the preferred option on the existing agricultural business affected by the loss, and the future viability of any land which is severed by development. The Agricultural Effect Assessment will be undertaken in conjunction with a consultation with Defra and the affected land owners.

7.2.28 Although agricultural land required within the footprint of the route option will be lost permanently, the following measures can be implemented during construction:

- Agricultural land take – Ensure the scheme involves the permanent land take of the minimum amount of land necessary. Wherever possible, land required in addition for construction, for example for site compounds, would be returned to agricultural use;
- Severance during construction to be minimised through careful siting of construction compounds and lay down areas, and careful planning of construction activities through consultation with landowners;
- Crop loss and timing effects – crop loss can be reduced by giving advanced warning to enable farmers to plan ahead;
- Consideration of field drainage effects during the design phase; and
- Noise and dust to be kept to a minimum and within acceptable working limits, using best practice methods.

Effects on People

Economy

7.2.29 Where possible, the workforce and scheme supply chain should be sourced locally.

Social Profile

7.2.30 The design should take account of vulnerable groups such as the disabled, children and elderly people and particularly the users of Hereford Community Farm which will be significantly affected upon by the scheme.

Health Profile

7.2.31 Best practice construction methods should be used to minimise noise and emissions to air during construction.

7.2.32 PRoW should remain open where possible and diverted if necessary, instead of closures, to allow active travel and recreational use by residents.

PEOPLE AND HEALTH

7.2.33 The principles set out in Chapter 8 of the NPPF provide a useful indication of the potential opportunities for enhancement.

7.2.34 In addition, the following specific mitigation measures should be considered as part of the design, construction and operation of the scheme:

7.2.35 Where possible, the workforce and project supply chain should be locally sourced;

7.2.36 The design should take account of the vulnerable groups listed;

7.2.37 Best practice construction methods should be used to minimise noise and emissions to air, ground and water during construction; and

7.2.38 PRoW should remain open where possible and diverted if possible, instead of closures, to allow active travel and recreational use by residents.

MATERIALS AND WASTE

7.2.39 The effects of the Scheme options from materials and site arisings, and waste generation and disposal, are likely to occur on-site, off-site within the UK and, potentially, internationally.

7.2.40 It is expected that most direct and indirect effects will occur during site construction and the first full year of operation. Effects arising further into the operational lifecycle are expected to be negligible, and hence have been scoped out of this chapter.

Likely effects are set out in **Table 22**

Element	Direct Effects	Indirect Effects
Materials	Consumption of natural and non-renewable resources	Release of greenhouse gas emissions; Water consumption and scarcity; Environmental degradation and pollution; and Nuisance to communities (visual, noise, health)
Site arisings	Reduced need to consume primary resources	Reduced greenhouse gas emissions; and Reduced environmental degradation and pollution
Waste	Generation and disposal of waste	Release of greenhouse gas emissions; Environmental degradation and pollution; and Nuisance to communities (visual, noise, health)

Table 22 - Effects of Consuming Materials, Generating Site Arisings and Disposing of Waste

7.2.41 To limit potential effects upon resources and demonstrate that decisions made during detailed design, construction and operation represent long term value for money, a number of measures for materials resource efficiency and waste have been considered.

Mitigation during Design

7.2.42 A number of mitigation measures should be incorporated within the design of the preferred route to limit material and waste material effects of the scheme works and aim to reduce the requirement of additional imported materials. Currently there is not sufficient detail on the route options to determine which mitigation would be appropriate for each route option. Details of mitigation requirements will be outlined in the Environmental Statement more information is available on the proposed option designs. The details will be further refined for the final preferred route option.

7.2.43 Specific design-related mitigation measures could include:

- The proposed scheme works should aim to minimise export and import of fill materials, for example, by balancing earthworks,waste and fill volumes;
- Topsoil stripped as a result of the works should be reused where possible in order to establish landscaping features such as embankments and verges as well as to provide a basis for landscape planting;
- Where existing surfaces are to be replaced, this material should be re-used as either a sub-base or inclusion within new scheme construction;
- Gradient embankments designed to minimise material requirements;
- Construction compounds and site accesses are provisionally located to allow for the movement of material from one section of the site to another during construction;
- Using pre-cast concrete materials for structure designs;
- Consideration of materials at the preliminary stages of the design allow for mitigation to be incorporated into the design and for such measures to become a part of the scheme during construction. This approach would continue into the detailed design stage and would minimise the scale of additional measures required to mitigate residual effects, identifying the opportunity to design out waste prior to construction

Mitigation during Construction

7.2.44 Mitigation during construction should be managed through the implementation of an outline Site Waste Management Plan (SWMP) which will be developed for the preferred route option at Stage 3.

7.2.45 The SWMP will aim to ensure that the waste produced during the final detailed design stage when producing the preferred route option is considered with in accordance with the regulations. It ensures that building materials are managed efficiently, waste is disposed of legally and the opportunities for materials recycling, reuse and recovery are maximised.

7.2.46 Specific construction-related mitigation measures could include:

- Using site-won material within the scheme will mitigate the potential effects of using large quantities of raw materials and also limit HGV trips associated with construction;
- Materials will be sourced as locally possible to the proposed scheme;
- If feasible, imported material will be sourced from other construction sites in Herefordshire, where those sites have a surplus of material from earthworks. This will help mitigate the potential effects on natural resources and also be beneficial to the effects of the third-party development by re-using material that may otherwise be disposed of at landfill;

7.2.47 The waste volume from depth of excavation has been worked out as including a 600mm depth of cut for the road and 150mm depth of cut for topsoil. It is currently assumed that 80% of the excavated material will be suitable for use as fill material and 20% of the excavated materials will need to be disposed of in accordance with the Acceptable Waste Criteria by a licensed waste contractor.

7.2.48 Waste and fill balances with Geotechnical Investigation works are to be undertaken before exact volumes can be defined, therefore preliminary volumes within the route options tables have been estimated based on the current design undertaken.

Project Activity	Enhancement and Mitigation Measures	Lifecycle Stages in Which Measures will be Applied	Monitoring
Materials	Identification and specification of materials that can be acquired responsibly, in accordance with BES 6001 Responsible Sourcing of Construction Products.8	Design, construction	Incorporate on engineering plans configurations and layouts that show how the most effective use of materials can be achieved. Maintain records of materials that were acquired in accordance with BES 6001 Responsible Sourcing of Construction Products.
	Design for resource optimisation: simplifying layout and form, using standard sizes, balancing cut and fill, maximising the use of renewable materials, and materials with recycled or secondary content, and setting net importation as a scheme goal.	Design	
	Design for off-site construction: maximising the use of pre-fabricated structures and components, encouraging a process of assembly rather than construction	Design	
	Design for the future: considering how materials can be designed to be more easily adapted over an asset lifetime, and how deconstructability and demountability of elements can be maximised at end-of-first-life.	Design	
Site arisings	Design for recovery and reuse: identifying, securing and using materials at their highest value, whether they already exist on site, or are sourced from other schemes.	Design	Incorporate on engineering plans configurations and layouts that show how the most effective use of site arisings can be achieved. Implement a regime of comparing and contrasting data on site arisings in a Design Site Waste Management Plan (forecast), with construction data (actuals)
	Identify opportunities to minimise the export and import of materials.	Design, construction	
	Working to a proximity principle, ensuring arisings generated are handled, stored, managed and re-used or recycled as close as possible to the point of origin.	Design, construction	
	Forecast and identify the volume and type of woodland and other vegetative arisings that will be generated, and establish opportunities for high value re-use and recycling, both on and off site.	Design, construction	
	Identify areas for stockpiling and storing arisings that will minimise quality degradation and leachate, and will minimise damage and loss.	Design, construction	
	Ensure potential arisings and waste are properly characterised before or during design,	Design	

[8] British Research Establishment (BRE) BES 6001 The Framework Standard for Responsible Sourcing of Construction Products (Version 3.1 2014) [link]

Project Activity	Enhancement and Mitigation Measures	Lifecycle Stages in Which Measures will be Applied	Monitoring
	to maximise the potential for highest value reuse.		
	Capture information and data on site arisings recovered and diverted from landfill, by developing a Design Site Waste Management Plan once a preferred option has been selected.	Design	
	Implement a Materials Management Plan in accordance with the CL:AIRE9 Definition of Waste: Code of Practice.	Construction	
Waste to landfill	Engage early with contractors to identify possible enhancement and mitigation measures, and to identify opportunities to reduce waste through collaboration and regional synergies.	Design, Procurement	Implement a regime of comparing and contrasting data on waste in a Design Site Waste Management Plan (forecast), with construction data (actuals) Ensure all legal documentation (waste carrier registration, landfill licence, waste transfer documentation) associated with the management of construction and operational materials, site arisings and waste is recorded and retained

Table 23 - Enhancement and Mitigation Measures

7.2.49 The material requirements and waste generated by the route options contains limited information currently due to the design information available at this early stage in the design process. This assessment and effects will therefore be refined going forward as the design progresses and within the later EIA stages of the design.

GEOLOGY AND SOILS

7.2.50 A Construction Environmental Management Plan (CEMP) will be required to outline the mitigation, control and monitoring measures to be put in place to minimise the effect of the proposed options on ground conditions, land quality and water resources during the construction process.

7.2.51 No specific mitigation measures have been included within the Stage 2 EAR.

CLIMATE

7.2.52 The magnitude of greenhouse gas emissions associated with the construction phase of the proposed Scheme can be minimised by, amongst others:

- Selecting a design which requires less materials and construction activity (but not where this is at the expense of greater emissions at other lifecycle stages);

[9] CL:AIRE is the acronym for 'Contaminated Land: Applications in Real Environments'

- Maximising the use of construction materials and products with recycled or secondary and low carbon content, from renewable sources, and offering sustainability benefit;
- Using locally-sourced materials where available and practicable to minimise the distance materials are transported from source to site; and
- Using more efficient construction plant and delivery vehicles, and/or those powered by electricity of alternative/lower carbon fuels.

7.2.53 The magnitude of greenhouse gas emissions associated with the operational phase of the proposed Scheme can be minimised by, amongst others:

- Selecting a design which reduces regional end user (traffic) emissions by improving the efficiency and flow of traffic movements in the area of the proposed Scheme and the surrounding road network (for example, due to the layout, profile or construction/materials used) – relative to the do-nothing scenario and/or other junction options being considered;
- Designing, specifying and constructing the proposed Scheme with a view to maximising the operational lifespan and minimising the need for maintenance and refurbishment (and all associated emissions);
- Designing, specifying and constructing the proposed Scheme with a view to maximising the potential for reuse and recycling of materials/elements at the end-of-life stage;
- Specifying high efficiency mechanical and electrical equipment such as lighting and telecoms; and
- Operating, maintaining and refurbishing the proposed Scheme using best-practice efficient approaches and equipment.

7.2.54 In terms of climate resilience, there are a variety of means to minimise the potential effects, including;

- Ensure the proposed Scheme design (in particular the drainage system) provides for the Environment Agency Climate Change Allowances relating to peak rainfall;
- Design and specification of pavement construction, expansion joints and other elements which are resilient to anticipated increases in peak summer temperatures;
- Wind restraints/baffles and/or monitoring and alert systems, for any locations which are particularly susceptible to risks of increasing wind intensity; and
- Design and specification of pavement construction, drainage systems, embankments and other elements with a view to anticipated increases in peak rainfall as well as increased variability of ground conditions (wetting and drying).

7.3 PRESENTATION OF KEY ISSUES

Summary of Key Environmental Effects

	Orange	Yellow	Cyan	Red	Olive	Black 1	Black 2
Air Quality	During the construction phase 18 properties within 50m likely to be affected and 91 properties within 200m likely to be affected; During construction adverse impacts from dust and exhaust emissions could potentially occur at sensitive receptors within 200m of worksites; associated with the proposed Scheme. Impacts would be temporary in nature and with appropriate mitigation (see section 5.7), the risk of such impacts could be minimised; The greatest increase in annual NO2 concentrations during the operational phase would be at Edgewood, A438 Bramley Ct and Towtree House, however levels are still below annual mean criteria.	During the construction phase 13 properties within 50m likely to be affected and 133 properties within 200m likely to be affected; During construction adverse impacts from dust and exhaust emissions could potentially occur at sensitive receptors within 200m of worksites associated with the proposed Scheme. Impacts would be temporary in nature and with appropriate mitigation (see section 5.7), the risk of such impacts could be minimised; The greatest increase in annual NO2 concentrations during the operational phase would be at Edgewood, Hunting Brook West and Towtree House, however levels are still below annual mean criteria.	During the construction phase 16 properties within 50m likely to be affected and 111 properties within 200m likely to be affected; During construction adverse impacts from dust and exhaust emissions could potentially occur at sensitive receptors within 200m of worksites associated with the proposed Scheme. Impacts would be temporary in nature and with appropriate mitigation (see section 5.7), the risk of such impacts could be minimised; The greatest increase in annual NO2 concentrations during the operational phase would be at Edgewood and Hunting Brook West, however levels are still below annual mean criteria.	During the construction phase 9 properties within 50m likely to be affected and 72 properties within 200m likely to be affected; During construction adverse impacts from dust and exhaust emissions could potentially occur at sensitive receptors within 200m of worksites associated with the proposed Scheme. Impacts would be temporary in nature and with appropriate mitigation (see section 5.7), the risk of such impacts could be minimised; The greatest increase in annual NO2 concentrations would be at Forest View, A438 Bramley Ct, and Towtree House, however levels are still below annual mean criteria.	During the construction phase 9 properties within 50m likely to be affected and 139 properties within 200m likely to be affected During construction adverse impacts from dust and exhaust emissions could potentially occur at sensitive receptors within 200m of worksites associated with the proposed Scheme. Impacts would be temporary in nature and with appropriate mitigation (see section 5.7), the risk of such impacts could be minimised; The greatest increase in annual NO2 concentrations during the operational phase would be at Forest View, A438 Bramley Ct, and Towtree House, however levels are still below annual mean criteria.	During the construction phase 10 properties within 50m likely to be affected and 129 properties within 200m likely to be affected; During construction adverse impacts from dust and exhaust emissions could potentially occur at sensitive receptors within 200m of worksites associated with the proposed Scheme. Impacts would be temporary in nature and with appropriate mitigation (see section 5.7), the risk of such impacts could be minimised; The greatest increase in annual NO2 concentrations during the operational phase would be at Forest View, A438 Kings Acre Road, and A4110, however levels are still below annual mean criteria.	During the construction phase 10 properties within 50m likely to be affected and 96 properties within 200m likely to be affected; During construction adverse impacts from dust and exhaust emissions could potentially occur at sensitive receptors within 200m of worksites associated with the proposed Scheme. Impacts would be temporary in nature and with appropriate mitigation (see section 5.7), the risk of such impacts could be minimised; The greatest increase in annual NO2 concentrations during the operational phase would be at Forest View, A438 Kings Acre Road, and A4110, however levels are still below annual mean criteria.
Noise	Short and long-term effects are negligible or minor Element 2 has the highest number of properties which potentially qualify for Noise Insulation Regulations	Short and long-term effects are negligible or minor Element 2 has the highest number of properties which potentially qualify for Noise Insulation Regulations	Short and long-term effects are negligible or minor Element 2 has the highest number of properties which potentially qualify for Noise Insulation Regulations	Short and long-term effects are negligible or minor Element 2 has the highest number of properties which potentially qualify for Noise Insulation Regulations	Short and long-term effects are negligible or minor Element 2 has the highest number of properties which potentially qualify for Noise Insulation Regulations	Short and long-term effects are negligible or minor Element 2 has the highest number of properties which potentially qualify for Noise Insulation Regulations	Short and long-term effects are negligible or minor Element 2 has the highest number of properties which potentially qualify for Noise Insulation Regulations
Landscape	Effects to hedgerows and mature trees near Warham House – loss of two ancient/veteran/noble/TPO trees Effect of the addition of artificial lighting near Belmont Abbey	Route option uncharacteristic of the character area Effects to the character and setting of Belmont Park and Belmont Abbey Crossing at the river would cause visual	Route option uncharacteristic of the character area Effects to the character and setting of Belmont Park and Belmont Abbey Crossing at the river would cause visual fragmentation within the character area	Effects to the character and setting of Belmont Park and Belmont Abbey Crossing at the river would cause visual fragmentation within the character area Effect of the addition of artificial lighting near Belmont Abbey	Potential indirect effects to ancient woodland and potential loss of two ancient/veteran/noble/TPO trees. Effect to the cultural association with Effects to views from River due to visual fragmentation from the river crossing	Potential indirect effects to ancient woodland and potential loss of two ancient/veteran/noble/TP O trees. Effect to the cultural association with Brian Hatton and his paintings of Warham by permanently	Effects to the character and setting of Belmont Park and Belmont Abbey Crossing at the river would cause visual fragmentation within the character area

	Orange	Yellow	Cyan	Red	Olive	Black 1	Black 2
	Crossing at the river would cause visual fragmentation within the character area Effects to the character and setting of Belmont Park and Belmont Abbey Effect to Burghill Hospital Unregistered Park and Garden and Hospital Farm traditional orchard	fragmentation within the character area Effect of the addition of artificial lighting near Belmont Abbey Effect to Bridleway (BT4) and TPO woodland Change in local landscape character and visual amenity for users of the local PRoW network and waterways	Effects to the character area and wetland area of the Yazor Brook due to severance caused by the route option and the addition of hard surfacing, artificial lighting and traffic Effect to Burghill Hospital Unregistered Park and Garden and Hospital Farm traditional orchard Change in local landscape character and visual amenity for users of the local PRoW network and waterways	Loss of trees within Belmont Parkland in addition to effects on the character of Belmont unregistered Park and Garden due to disruption of views Loss of scattered trees and one ancient/veteran/notable tree and trees protected by TPO Loss of small area of Traditional Orchard	Effects to Wye Valley Walk Loss of tree cover and vegetation due to route option There is limited mitigation available at operation due to the nature of the bridge within an open river corridor but the design and structure of the bridge would define the quality of the built form within the character area and should be sympathetic and complimentary to its setting. Loss of small area of Traditional Orchard Effects to Burghill Hospital Unregistered Park and Garden due to reduction in parkland area	altering some of the views of the ground. Effects to views from River due to visual fragmentation from the river crossing Loss of tree cover and vegetation due to route option Effects and loss of land to Drovers Wood and fragmenting the roundabout and reduced in size Effects to Burghill Hospital Unregistered Park and Garden due to reduction in parkland area Effects to the character area and wetland area of the Yazor Brook due to severance caused by the route option and the addition of hard surfacing, artificial lighting and traffic	Effect of the addition of artificial lighting near Belmont Abbey Loss of trees within Belmont Parkland in addition to effects on the character of Belmont unregistered Park and Garden due to disruption of view Loss of small area of Traditional Orchard Effects to the character area and wetland area of the Yazor Brook due to severance caused by the route option and the addition of hard surfacing, artificial lighting and traffic Effects and loss of land to Drovers Wood and fragmenting the roundabout and reduced in size Effects to Burghill Hospital Unregistered Park and Garden due to reduction in parkland area Change in local landscape character and visual amenity for users of the local PRoW network and waterways.
Ecology	Damage to ancient woodland, double hedgerows and fragmentation of habitats; Potential effect to bats and bat foraging areas	Damage to ancient woodland, double hedgerows and fragmentation of habitats; Potential effect to bats and bat foraging areas; Loss of GCN habitat (pond)	Damage to ancient woodland, double hedgerows and fragmentation of habitats; Potential effect to bats and bat foraging areas	Damage to ancient woodland, double hedgerows and fragmentation of habitats; Potential effect to bats and bat foraging areas; Greatest loss of habitat within Belmont Park and several trees; Effects to Traditional Orchard Loss of GCN habitat (ponds)	Damage to ancient woodland, semi natural woodland, double hedgerows and fragmentation of habitats; Potential effect to bats and bat foraging areas; Greatest loss of habitat within Belmont Park and several trees; Effects to Traditional Orchard; Loss of GCN habitat (ponds);	Damage to ancient woodland, semi natural woodland, double hedgerows and fragmentation of habitats; Potential effect to bats and bat foraging areas; Greatest loss of habitat within Belmont Park and several trees; Effects to Traditional Orchard; Loss of GCN habitat (ponds); Effects to Drovers Wood	Damage to ancient woodland, semi natural woodland, double hedgerows and fragmentation of habitats; Potential effect to bats and bat foraging areas; Greatest loss of habitat within Belmont Park and several trees; Effects to Traditional Orchard; Loss of GCN habitat (ponds); Effects to Drovers Wood

	Orange	Yellow	Cyan	Red	Olive	Black 1	Black 2
Heritage	A total of 55 heritage assets are expected to be affected Adverse effects are anticipated to the setting of Belmont Abbey and Burghill Hospital by reducing historic views due to the increase in noise disturbance and light pollution rural tranquil setting of the assets.	A total of 48 heritage assets are expected to be affected. Adverse effects are anticipated to the setting of Belmont Abbey and Burghill Hospital by reducing historic views due to the increase in noise disturbance and light pollution rural tranquil setting of the assets.	A total of 49 heritage assets are expected to be affected. Adverse effects are anticipated to the setting of Belmont Abbey and Burghill Hospital by reducing historic views due to the increase in noise disturbance and light pollution rural tranquil setting of the assets.	A total of 50 heritage assets are expected to be affected. Adverse effects to the setting of Belmont Estate and Warham House and a number of Grade I-II* listed buildings due to the increase in noise disturbance and light pollution rural tranquil setting of the assets.	A total of 44 heritage assets are expected to be affected. Adverse effects to the setting of Belmont Estate and Warham House and a number of Grade I-II* listed buildings, Huntington Conservation Area due to the increase in noise disturbance and light pollution rural tranquil setting of the assets and by severing existing farmland and open views associated with Farmhouse at Upper Hill Farm.	A total of 44 heritage assets are expected to be affected. Adverse effects to the setting of Belmont Estate, Belmont Abbey and Warham House and a number of Grade II*listed buildings, due to the increase in noise disturbance and light pollution rural tranquil setting of the assets	A total of 50 heritage assets are expected to be affected Adverse effects to the setting of Belmont Estate, Belmont Abbey and Warham House and a number of Grade II listed buildings, due to the increase in noise disturbance and light pollution rural tranquil setting of the assets
Water Environment	Potential of increased sedimentation as a result of the works at the proposed crossing of Belmont Stream and Yazor Brook resulting in moderate adverse effect	Potential of increased sedimentation as a result of the works at the proposed crossing of Belmont Stream and Yazor Brook resulting in moderate adverse effect	Potential of increased sedimentation as a result of the works at the proposed crossing of Belmont Stream and Yazor Brook resulting in moderate adverse effect	Potential of increased sedimentation as a result of the works at the proposed crossing of Belmont Stream and Yazor Brook resulting in moderate adverse effect Realignment of the watercourse between C1189 (Lower Breinton Road) and Warham Lane (U73023) may be required. Minor adverse effects are anticipated on water quality at this stage.	Potential of increased sedimentation as a result of the works at the proposed crossing of Belmont Stream resulting in moderate adverse effect Major adverse effects to hydro morphological quality of the stream at this location if the alignment of Belmont Stream is altered and the downstream extents of Belmont brook experience a significant reduction in flow in order to maintain hydraulic connectivity with the downstream extent of the watercourse. Moderate adverse effects are considered likely to the water quality of a tributary of the Yazor Brook during the realignment of the Yazor Brook during the construction phase	Potential of increased sedimentation as a result of the works at the proposed crossing of Belmont Stream and Yazor Brook resulting in moderate adverse effect Major adverse effects to hydro morphological quality of the stream at this location if the alignment of Belmont Stream is altered and the downstream extents of Belmont brook experience a significant reduction in flow in order to maintain hydraulic connectivity with the downstream extent of the watercourse.	Potential of increased sedimentation as a result of the works at the proposed crossing of Belmont Stream and Yazor Brook resulting in moderate adverse effect Realignment of the watercourse between C1189 (Lower Breinton Road) and Warham Lane (U73023) may be required. Minor adverse effects are anticipated on water quality at this stage. Major adverse effects to hydromorphological quality of the stream at this location if the alignment of Belmont Stream is altered and the downstream extents of Belmont brook experience a significant reduction in flow in order to maintain hydraulic connectivity with the downstream extent of the watercourse. Given the uncertainty regarding the management of this risk of the proposed culvert and re-directing the watercourse which exists beneath Ruckhall Lane, the effect to the proposed Scheme and receptors elsewhere is

	Orange	Yellow	Cyan	Red	Olive	Black 1	Black 2
							considered to be major adverse at this stage of the assessment due to the potential of flooding to Ruckhall Lane.
People and Communities	Major effect on Belmont Abbey and well used PRoW associated with the grounds Moderate effect to PRoW which may result in closures and diversions and increased journey times and effects on recreational areas. 4 properties directly affected on Kings Acre Road (i.e. where proposed permanent works within the anticipated highway boundary would cross the footprint of an existing building). Major effect as high grade agricultural land will be lost. Moderate effect on Hereford Community Farm as the route option transverses the land.	Major effect on Belmont Abbey and well used PRoW associated with the grounds Moderate effect to PRoW which may result in closures and diversions and increased journey times and effects on recreational areas. 4 properties directly affected on Kings Acre Road (i.e. where proposed permanent works within the anticipated highway boundary would cross the footprint of an existing building). Major effect as high grade agricultural land will be lost. Effect on Three Elms Development Moderate effect on Hereford Community Farm as the route option transverses the land.	Major effect on Belmont Abbey and well used PRoW associated with the grounds Moderate effect to PRoW which may result in closures and diversions and increased journey times and effects on recreational areas. 3 properties directly affected on Kings Acre Road (i.e. where proposed permanent works within the anticipated highway boundary would cross the footprint of an existing building). Effect on Three Elms Development Moderate effect on Hereford Community Farm as the route option transverses the land.	Major effect on Belmont Abbey and well used PRoW associated with the grounds Moderate effect to PRoW which may result in closures and diversions and increased journey times and effects on recreational areas. 4 properties directly affected on Kings Acre Road (i.e. where proposed permanent works within the anticipated highway boundary would cross the footprint of an existing building). Effect on Three Elms Development Moderate effect on Hereford Community Farm as the route option transverses the land.	Major effect on Belmont Abbey and well used PRoW associated with the grounds. Major effect to Queen Elizabeth II playing fields and 'Unregistered Parks and Gardens' associated with Warham House. 4 properties directly affected on Kings Acre Road (i.e. where proposed permanent works within the anticipated highway boundary would cross the footprint of an existing building). Major effect as high grade agricultural land will be lost. Effect on Three Elms Development.	Major effect on Belmont Abbey and well used PRoW associated with the grounds. Major effect to Queen Elizabeth II playing fields and 'Unregistered Parks and Gardens' associated with Warham House. Major effects to Drovers Wood (permanent land take) Moderate effect to Warham House within Canterbury Close and Dorchester Way. 5 properties directly affected on Kings Acre Road (i.e. where proposed permanent works within the anticipated highway boundary would cross the footprint of an existing building). Major effect as high grade agricultural land will be lost.	Major effect on Belmont Abbey and well used PRoW associated with the grounds. Major effect to Queen Elizabeth II playing fields and 'Unregistered Parks and Gardens' associated with Warham House. Major effects to Drovers Wood (permanent land take) Moderate effect to Warham House within Canterbury Close and Dorchester Way. 5 properties directly affected on Kings Acre Road (i.e. where proposed permanent works within the anticipated highway boundary would cross the footprint of an existing building). Major effect as high grade agricultural land will be lost. Moderate effect on Hereford Community Farm as the route option transverses the land.
Materials and Waste	Negligible waste effect due to the net volume being de-minimus in nature and the cut and re-use of waste anticipated to balance more than the other options.	Slight significant effect due to cut and fill balances and the requirement for import of material for each option.	Negligible waste effect due to the net volume being de-minimus in nature and the cut and re-use of waste anticipated to balance more than the other options.	Slight significant effect due to cut and fill balances and the requirement for import of material for each option.			
Geology and Soils	Neutral effect on local geology, geomorphology and mineral resources. There is a potential for minor adverse effects to surface water and quality of SPZ2 and 3 associated with construction but the significance of the effect on surface water is unlikely to exceed slight/moderate.						
Climate Change	With predicted changes in climate leading to shorter, more intense rainfall events, the proposed Scheme would be increasingly susceptible to flood events. Chapter 10 Water drainage describes the flood zones across the study area and the susceptibility of the proposed Scheme to increased flooding due to climate change.						

GLOSSARY OF TERMS

Term	Description
AADT	Annual Average Daily Traffic
ADS	Advance Direction Signage
AESR	Assessment of Existing Structures
ALC	Agricultural Land Classification
ANSR	Appraisal of New Structures
AOD	Above Ordnance Datum
AQMA	Air Quality Management Areas
ARCADY	Assessment of Roundabout Capacity and Delay
ATC	Automatic Traffic Counts
ATM	Active Travel Measures
BGS	British Geological Survey
BMV	Best and Most Versatile
CAF	Corridor Assessment Framework
CEMP	Construction Environmental Management Plan
COBA	Cost-Benefit Analysis program
Core Strategy	The key planning policy document for Herefordshire, setting strategic policies on housing, employment and infrastructure
Core Strategy Corridor	The inner western corridor identified in the Herefordshire Local Plan Core Strategy 2011 – 2031. It is the area within which a single best performing route will be recommended to Herefordshire Council for consideration as the preferred route. Herein this will be referred to as the 'Core Strategy Corridor'. This corridor is shown in diagrammatic form in the Hereford Key Diagram taken from the adopted Herefordshire Local Plan Core Strategy 2011-2031
CPI	Car Park Interview Data
CRF	Congestion Reference Flow
DfT	Department for Transport, the governing department with responsibility for transport, including issuing guidance on the conduct of transport studies
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EAR	Environmental Assessment Report
EIA	Environmental Impact Assessment
Element	is used to describe a defined location within or 'section' of the Core Strategy Corridor in which there are similar relevant issues that allow a choice to be made on a single route through that particular location
ES	Environmental Statement
FAS	Flood Alleviation Scheme
GCN	Great crested Newt

Term	Description
GEH Criteria	an acceptance criterion for travel demand forecasting models as recognised in the UK Highways Agency's Design Manual for Roads and Bridges
GQA	General Quality Assessment
HBP	Hereford Bypass
HC	Herefordshire Council
HCD	MCHW - Highway Construction Detail
HD	Herefordshire Local Plan Core Strategy 2011 - 2031 Place shaping policy
HE	Highways England
HGV	Heavy Goods Vehicle
HTM	Hereford Transport Model
HTP	Hereford Transportation Package
IAN	Interim Advice Note
ITN	Integrated Transport Network
JRC	Jointed Reinforced Concrete
LDS	Local Direction Signage
LGV	Light Goods Vehicle
LLFA	Lead Local Flood Authority
LMVR	Local Model Validation Report
LT	Long Term
MCHW	Manual of Contract Documents for Highway Works
MCJC	Manual Classified Junction Counts
MCLC	Manual Classified Link Counts
MT	Motorised Travellers
NCA	Natural England's National Character Area
NCN	National Cycle Network
NERC	Natural Environment & Rural Communities
NGR	National Grid Reference
NIA	Noise Important Areas
NMU	Non-Motorised User
NPPF	National Planning Policy Framework
NTEM	National Trip End Model
OAR	Options Assessment Report
OH	Over Heads
ORS	Old Red Sandstone
PCU	Passenger Car Units
PMA	Private Means of Access
PPK	Pence Per Kilometre

Term	Description
PPM	Pence Per Minute
PRoW	Public Rights of Way
PRR	Preferred Route Report
PSSR	Preliminary Sources Study Report
PSV (Engineering)	Polished Stone Value
PSV (Traffic and Economic)	Public Service Vehicle
QUADRO	A maintenance assessment program
RFC	Ratio of Flow to Capacity
RPA	Root Protection Area
RRRAP	Road Restraint Risk Assessment Process
RSA	Road Safety Audit
RSI	Roadside Interview Data
RSR	Route Selection Report
RTM	Highway England's Regional Traffic Model
SAC	Special Area of Conservation
SATURN	Simulation and Assignment of Traffic to Urban Road Networks
SLR	Southern Link Road
Smithy	Forge, also called a smithy, the workplace of a smith or a blacksmith.
SOAEL	Significant Observed Adverse Effects Level
SPZ	Source Protection Zone
SSD	Stopping Sight Distance
SSSI	Site of Special Scientific Interest
ST	Short Term
SWMP	Site Waste Management Plan
SWS	Special Wildlife Site
(T)	Trunk Road
TA	DMRB - Advice Notes - Traffic Engineering and control
TAA	Technical Approval Authority
TAG	Transport Analysis Guidance
TD	DMRB - Standards - Traffic Engineering and control
TPO	Tree Preservation Order
TSCS	Thin surface Course System
TSM	Traffic Signs Manual
TSRGD	Traffic Signs Regulations and General Directions

Term	Description
ULEV	Ultra-Low Emission Vehicle
VRS	Vehicle Restraint System
WCA	Wildlife and Countryside Act
WebTAG	Web Transport Analysis Guidance
WFD	Water Framework Directive
WS2	Carriageway Standard - Wide Single
WS2+1	Carriageway Standard - Wide Single 2 + 1 Roads

Appendix A

LOCATION PLAN

DO NOT SCALE

ELEMENT 3

ELEMENT 2

ELEMENT 1

HEREFORD

Towtree Lane (U73007)
Yazor Brook
Burghill Hospital (redeveloped)
The Meadows
Arundel Farm
A49
Pinston House
Roman Road(A4103)
Tillington Road (C1095)
Canon Pyon Road(A4110)
West Holmer Development (site of)
Wyevale Nursery
Livestock Market
Bovingdon Park
Roman Road(A4103)
Yazor Brook
The Bolts
Western Urban Expansion Area (Core Strategy Policy HD5)
Bay Horse Inn
Pippin Trust Orchard
Kings Acre Road(A438)
Bridleway (BT4)
Upper Hill Farm
Halfway House
Hill Road (Upper Breinton Road - U73022)
Tree Preservation Area
Warham Farm
C1189 (Lower Breinton Road)
Greenbank (QEII)
Community Farm
Warham House
Warham Lane (U73023)
Brian Hatton Trail
River Wye
Belmont House
Dorchester Way
Belmont Abbey
Ruckhall Lane
Forest View
Clehonger Road
Belmont Road (A465)
B4349
Southern Link Road (SLR)

KEY:

- CORE STRATEGY
- SOUTHERN LINK ROAD (SLR)
- ROUTE OPTION 1 - ORANGE
- ROUTE OPTION 2 - CYAN
- ROUTE OPTION 3 - YELLOW
- ROUTE OPTION 4 - RED
- ROUTE OPTION 5 - OLIVE
- ROUTE OPTION 6 - BLACK 1
- ROUTE OPTION 7 - BLACK 2
- ALL ROUTE OPTIONS

Appendix B

ENVIRONMENTAL CONSTRAINTS PLAN

Medieval bridge 870m north east of Stretton Court Farm
Burghill Hospital
Huntington Court
Churchyard cross in St Bartholomew's churchyard
HEREFORD CP
BREINTON CP
BELMONT RURAL CP
CLEHONGER CP
Green Lane Wood
Green Lane Bridleway
Court Lawn Bank
Breinton Court
Moated site SW of the church
Wye Coppice
Warham House
Rough Coppice
River Wye
Old Hill Coppice
Belmont Lodge
Hunderton Wood
Newton Coppice
Belmont Meadows
0
250
500
1,000
Metres
Proposed Scheme - Orange Option
Proposed Scheme - Cyan Option
Proposed Scheme - Yellow Option
Proposed Scheme - Red Option
Proposed Scheme - Olive Option
Proposed Scheme - Black 1 Option
Proposed Scheme - Black 2 Option
Arboricultural Survey Results
Category A tree
Ancient tree
Notable tree
Veteran tree
GCN Presence/absence
PA - absent
PSCA - medium population
PSCA - small population
Scoped in - presence assumed
Scoped out - absence assumed
Source Protection Zone
Zone I - Inner Protection Zone
Zone II - Outer Protection Zone
Zone III - Total Catchment
Zone of Special Interest
Traditional Orchard
Pippin Trust Orchard
Drovers Wood (Woodland Trust)
Hereford Listed Traditional Orchard
Noise Action Planning Areas
Air Quality Management Areas
National Trust Ownership boundary
Ancient Woodland Inventory (AWI)
Unregistered Parks and Gardens
Local Nature Reserve (Eng)
Site of Special Scientific Interest (Eng)
Special Area of Conservation (Eng)
Ponds
Greenbank Meadow
Site of Importance for Nature Conservation
Listed Buildings
Grade I
Grade II
Grade II*
Local Green Space
Bridleway
Byway
Footpath
Watercourse
Scheduled Monument
Floodzone 3
Floodzone 2

REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS:

wsp

Kings Orchard, 1 Queen St, Bristol, BS2 0HQ
T +44 (0)1179 306200

CLIENT:
Balfour Beatty | Herefordshire Council
Working for Herefordshire

SITE/PROJECT:
HEREFORD TRANSPORTATION PACKAGE: HEREFORD BYPASS

TITLE:
ENVIRONMENTAL CONSTRAINTS & PROPOSED SCHEME

SCALE @ A0: 1:6,000	CHECKED: MT	APPROVED: MT
PROJECT No: 70024065	DESIGNED: JSdS / DRAWN: JSdS	DATE: 14/06/2018
DRAWING No: 70024065-WSP-XX-XX-DR-EN-000XX		REV: P02

printed on: 14 June 2018

by: DeSouzaJ

File name: \\uk.wspgroup.com\central data\Projects\700240xx\70024065 - Hereford Transport Package\E Models and Drawings\GIS\Mxd\Short List Options\Working Group_P02.mxd

Appendix C

SHORTLIST ROUTE CORRIDOR PLAN

DO NOT SCALE

Towtree Lane (U73007)
Yazor Brook
The Meadows
Burghill Hospital (redeveloped)
Arundel Farm
A49
Pinston House
Roman Road(A4103)
Tillington Road (C1095)
Canon Pyon Road(A4110)
West Holmer Development (site of)
Livestock Market
Wyevale Nursery
Bovingdon Park
Roman Road(A4103)
Yazor Brook
The Bolts
Western Urban Expansion Area (Core Strategy Policy HD5)
Bay Horse Inn
Kings Acre Road(A438)
Pippin Trust Orchard
Bridleway (BT4)
Upper Hill Farm
HEREFORD
Halfway House
Hill Road (Upper Breinton Road - U73022)
Tree Preservation Area
Warham Farm
C1189 (Lower Breinton Road)
Greenbank (QEII)
Community Farm
Warham House
Warham Lane (J73023)
Brian Hatton Trail
River Wye
Belmont House
Dorchester Way
Forest View
Belmont Abbey
Ruckhall Lane
Clehonger Road
Belmont Road (A465)
B4349
Southern Link Road (SLR)

KEY:

- CORE STRATEGY
- SOUTHERN LINK ROAD (SLR)
- ROUTE OPTION 1 - ORANGE
- ROUTE OPTION 2 - CYAN
- ROUTE OPTION 3 - YELLOW
- ROUTE OPTION 4 - RED
- ROUTE OPTION 5 - OLIVE
- ROUTE OPTION 6 - BLACK 1
- ROUTE OPTION 7 - BLACK 2
- ALL ROUTE OPTIONS

REV	DATE	BY	DESCRIPTION	CHK	APP
P06	27/06/2018	FW	KEY AND PLACE/FEATURE NAMES AMENDED	RT	MS
P05	07/06/2018	FW	PLACE/FEATURE NAMES ADDED	RT	MS
P04	10/01/2018	RT	KEY AMENDED	MG	MG
P03	07/12/2017	PP	ORIGINAL STYLES RESTORED	MG	MS
P02	30/11/2017	RT	50M CORRIDORS SHOWN	MS	MS
P01	13/11/2017	RT	FIRST ISSUE	MS	MS

DRAWING STATUS:

1 Capital Quarter, Tyndall St, Cardiff, CF10 4BZ, UK
T+ 44 (0) 292 076 9200
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CLIENT: Balfour Beatty / Herefordshire Council
Working for Herefordshire

PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:
SHORTLISTED CORRIDOR OPTIONS

SCALE @ A3:	CHECKED:	APPROVED:
NTS	MS	MS

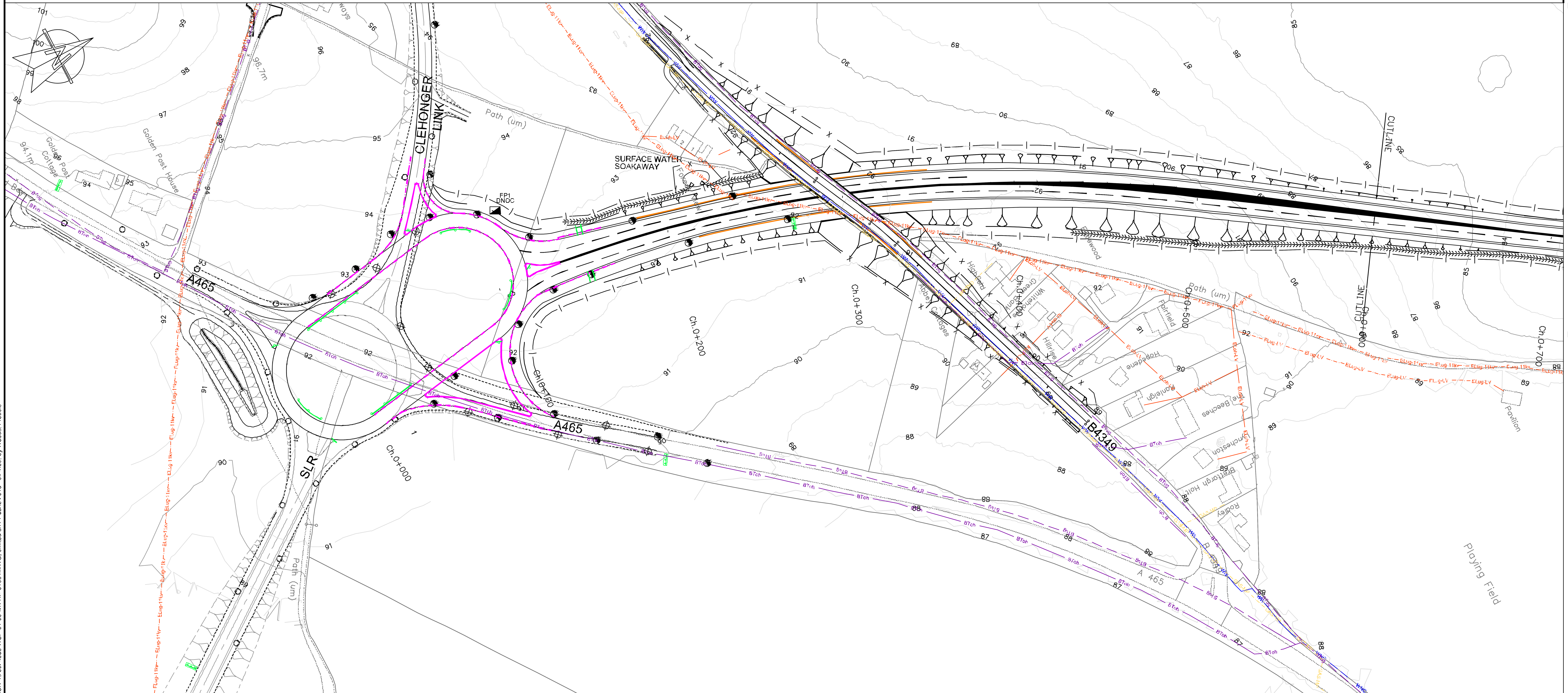
PROJECT No:	DESIGNED:	DRAWN:	DATE:
70024065	RT	RT	July 18

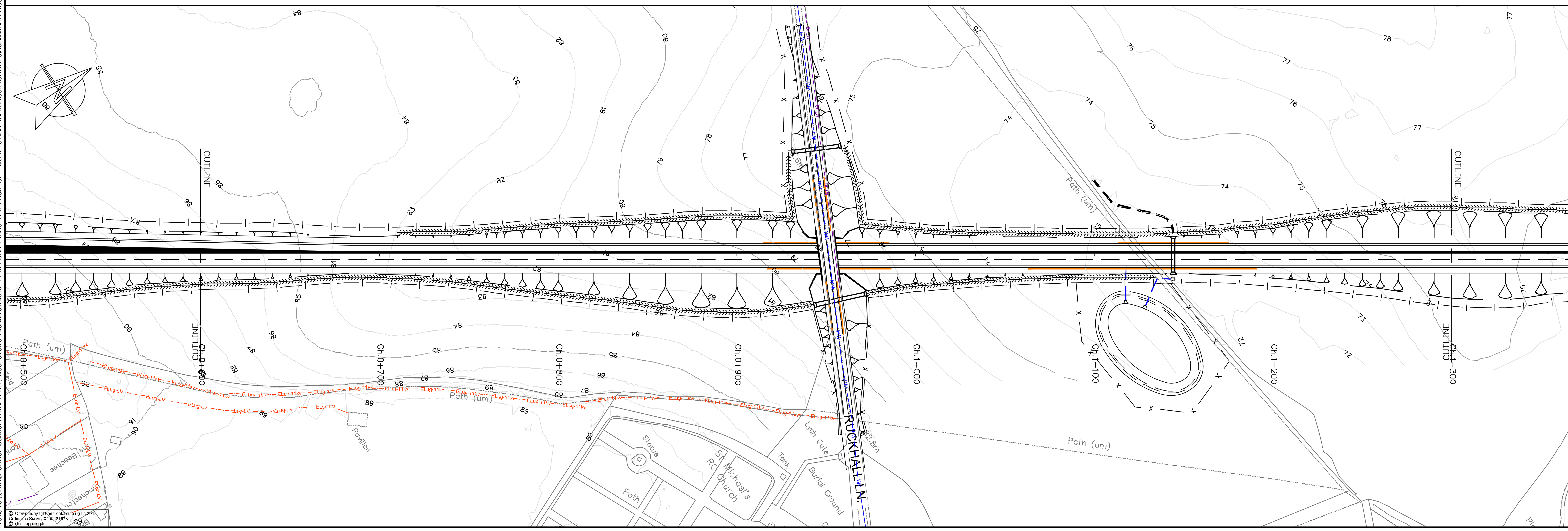
DRAWING No:	REV:
70024065-WSP-XX-XX-DR-HE-00003	P04

File name \\UK.WSPGROUP.COM\CENTRAL DATA\PROJECTS\700240XX\700240065 - HEREFORD TRANSPORT PACKAGE\E MODELS AND DRAWINGS\HIGHWAYS\ACAD\DRAWINGS\70024065-WSP-XX-XX-DR-HE-00003V2.DWG , printed on 02 July 2018 11:54:35, by Petkov, Petko

Appendix D

ENGINEERING LAYOUT PLANS





DO NOT SCALE

NOTES

1. OS 2D MASTERMAP (2012)
2. 1m CONTOURS PRODUCED FROM DTM COMPRISING COMBINATION OF GROUND SURVEY (2016) AND LIDAR DATA (2012)
3. PRELIMINARY DESIGN ALIGNMENT 100KPH WS2+1 STANDARD SUBJECT TO CONFIRMATION
4. PRELIMINARY DESIGN LINK / SIDE ROAD EARTHWORKS SUBJECT TO E/WKS BALANCE & CONSTRAINT ADJUSTMENT
5. LOCALISED HIGHWAY FEATURES E.G. MAINTENANCE HARDSTANDING & ACCESS POINTS NOT SHOWN
6. PRELIMINARY DESIGN ATTENUATION PONDS SIZE AND LOCATION SUBJECT TO HYDRAULIC MODELLING
7. ENVIRONMENTAL MITIGATION NOT SHOWN
8. PRELIMINARY DESIGN STRUCTURES SUBJECT TO STRUCTURAL REVIEW.
9. PRELIMINARY DESIGN JUNCTIONS (SUBJECT TO TRAFFIC PERFORMANCE CONFIRMATION)
10. PRELIMINARY DESIGN FENCELINE ASSUMES 5M TOE-OF-E/WKS MAINTENANCE STRIP
11. PRELIMINARY DESIGN CUT-OFF DITCHES AND WATERCOURSE DIVERSIONS SUBJECT TO HYDRAULIC MODELING.
12. PRELIMINARY DESIGN CROSS CULVERT SIZE/LOCATION SUBJECT TO HYDRAULIC REVIEW
13. PRELIMINARY DESIGN FENCELINES TYPES/LOCATIONS SUBJECT TO BOUNDARY/LANDOWNER REQUIREMENTS REVIEW.
14. PRELIMINARY DESIGN SIGNAGE LOCATIONS SUBJECT TO REVIEW.
15. PRELIMINARY DESIGN LIGHTING SUBJECT TO REVIEW.
16. PRELIMINARY DESIGN VRS SUBJECT TO ROAD RESTRAINT RISK ASSESSMENT PROCEDURE.

KEY

- EXISTING DETAIL
- PROPOSED DETAIL
- HIGHWAYS BOUNDARY FENCE
- STOCKPROOF FENCE
- WATER COURSE DIVERSION
- CARRIER DRAIN
- FILTER DRAIN
- CUT-OFF DITCH
- STRUCTURE
- CULVERT
- ATTENUATION POND
- WS2+1 MARKING
- SIGNAGE - ADS
- SIGNAGE - CHANGEOVER
- SIGNAGE - REGULATORY
- SIGNAGE - CHEVRON
- COMBINED KERB DRAINAGE
- KERBING
- VEHICLE RESTRAINT SYSTEM
- LIGHTING COLUMN
- EXISTING LIGHTING COLUMN TO RETAIN
- EXISTING LIGHTING COLUMN TO REMOVE
- LIGHTING FEEDER PILLAR
- HEADWALL

REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/03/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS:
S0 - WORK IN PROGRESS

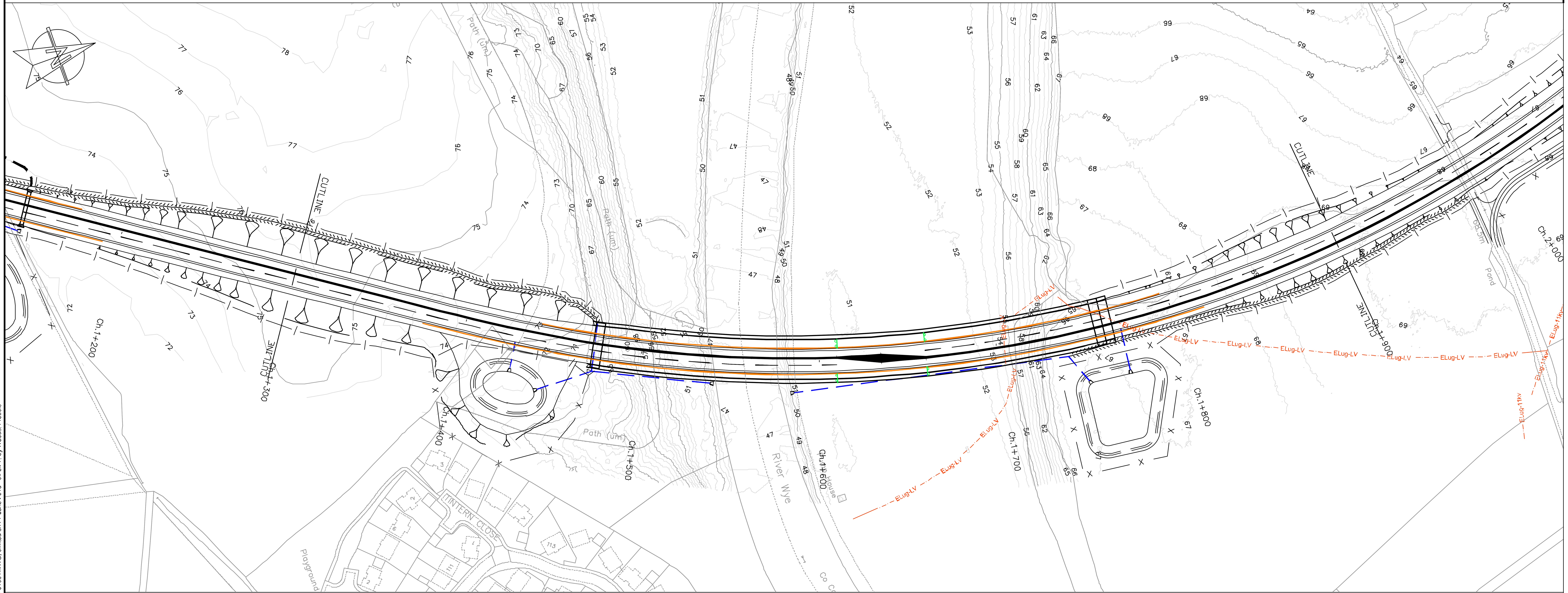
Balfour Beatty · Herefordshire Council · Working for Herefordshire · GROWTH DEALS · The Marches Local Enterprise Partnership · SKYLON PARK · wsp

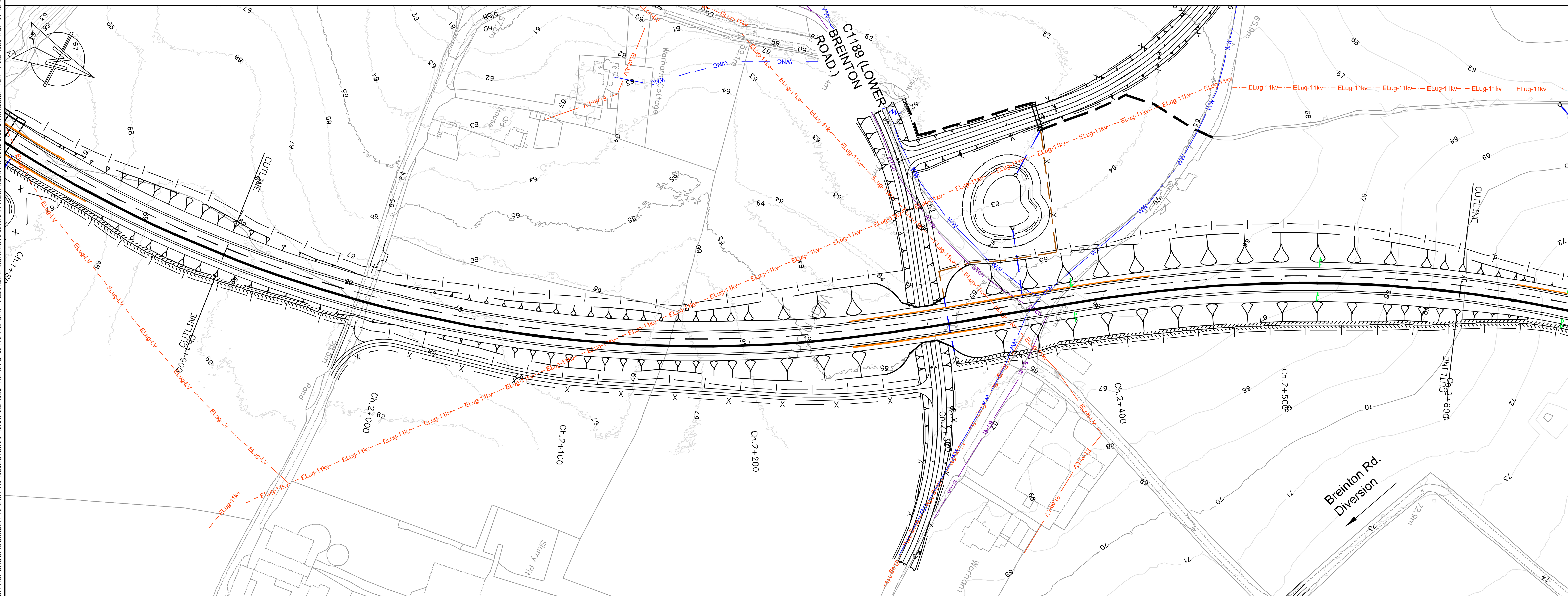
SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:
Route Option 1 - Orange
Ch.0+000 TO Ch.1+300

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP · DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-00-DR-HE-01001 · REV: P05





DO NOT SCALE

NOTES

1. OS 2D MASTERMAP (2012)
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16. PRELIMINARY DESIGN VRS SUBJECT TO ROAD RESTRAINT RISK ASSESSMENT PROCEDURE.

KEY

- EXISTING DETAIL
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- HIGHWAYS BOUNDARY FENCE
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- CARRIER DRAIN
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- CULVERT
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- SIGNAGE - CHEVRON
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- VEHICLE RESTRAINT SYSTEM
- LIGHTING COLUMN
- EXISTING LIGHTING COLUMN TO RETAIN
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- LIGHTING FEEDER PILLAR
- HEADWALL

REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE – PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS:
S0 - WORK IN PROGRESS

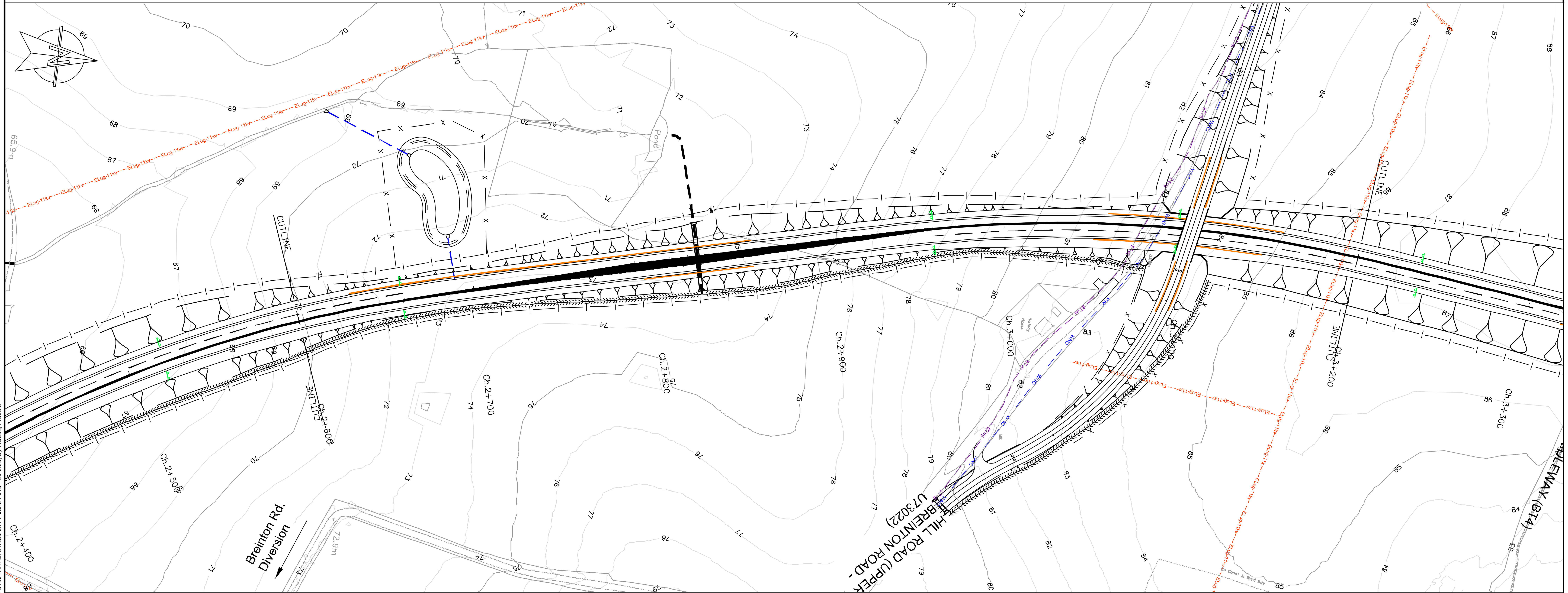
Balfour Beatty
Herefordshire Council
Working for Herefordshire
GROWTH DEALS
The Marches Local Enterprise Partnership
Herefordshire - Shropshire - Telford & Wrekin
HEREFORD 2020
SKYLON PARK
wsp

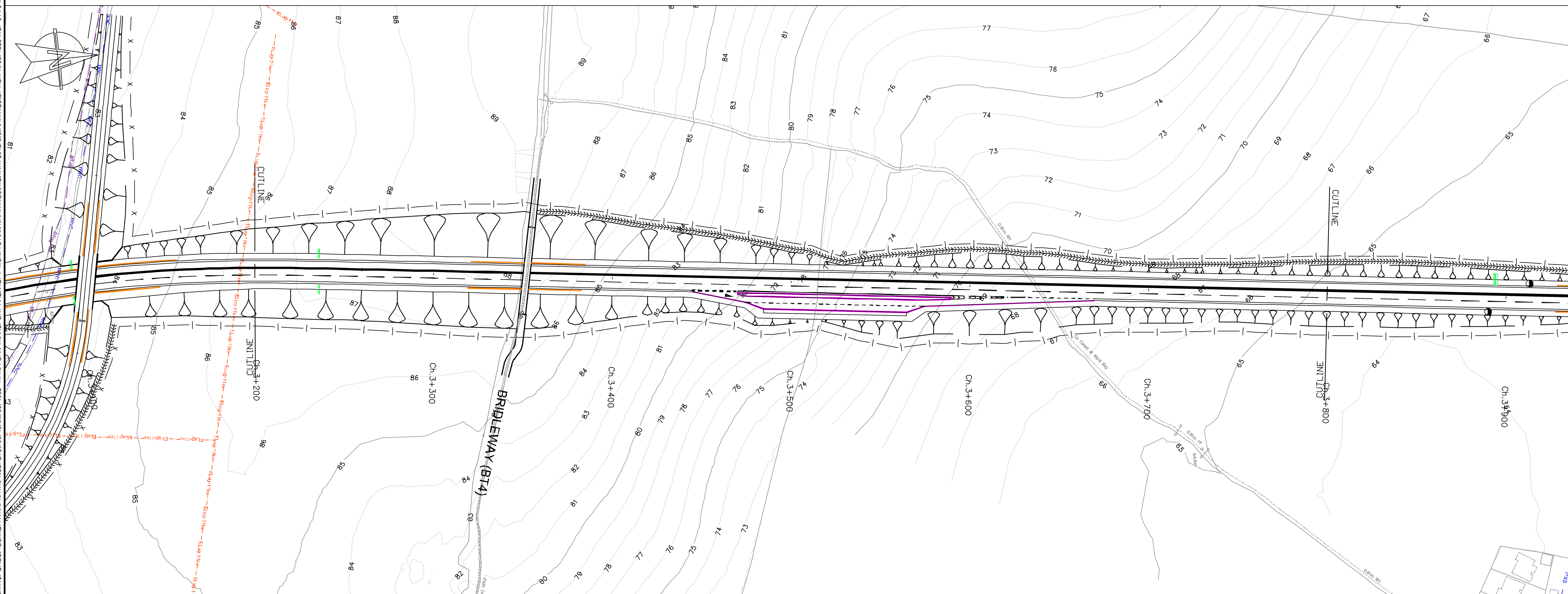
SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:
Route Option 1 - Orange
Ch.1+300 TO Ch.2+600

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP	DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-13-DR-HE-01001
REV: P05





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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS:
S0 - WORK IN PROGRESS

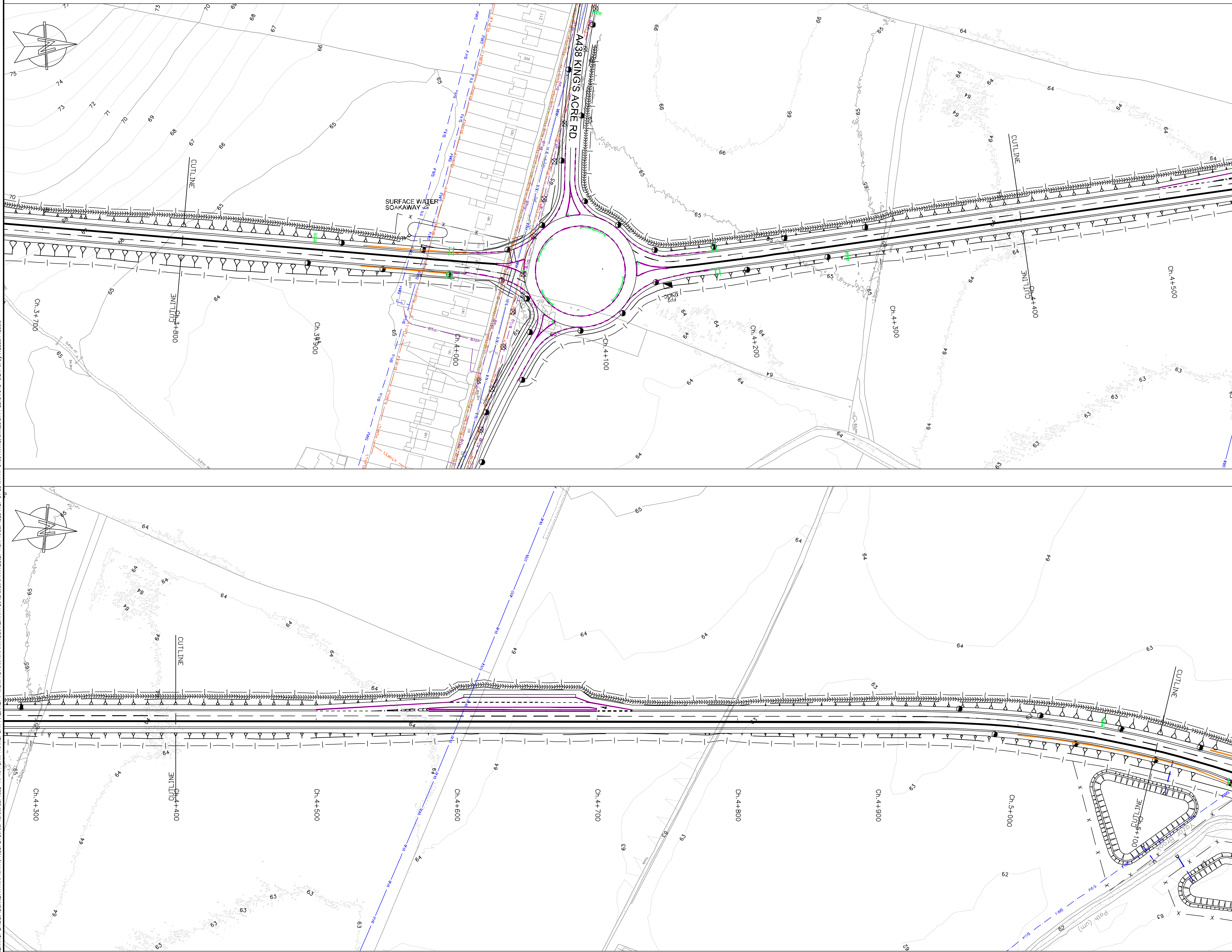
Balfour Beatty · Herefordshire Council · Working for Herefordshire · Growth Deals · The Marches Local Enterprise Partnership · Skylon Park · wsp

SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:
Route Option 1 - Orange
Ch.2+600 TO Ch.3+800

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP / DRAWN: FW	DATE: June 18

DRAWING NO: 70024065-WSP-01-26-DR-HE-01001 | REV: P05



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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE – PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.	RT	MG

DRAWING STATUS: S0 - WORK IN PROGRESS

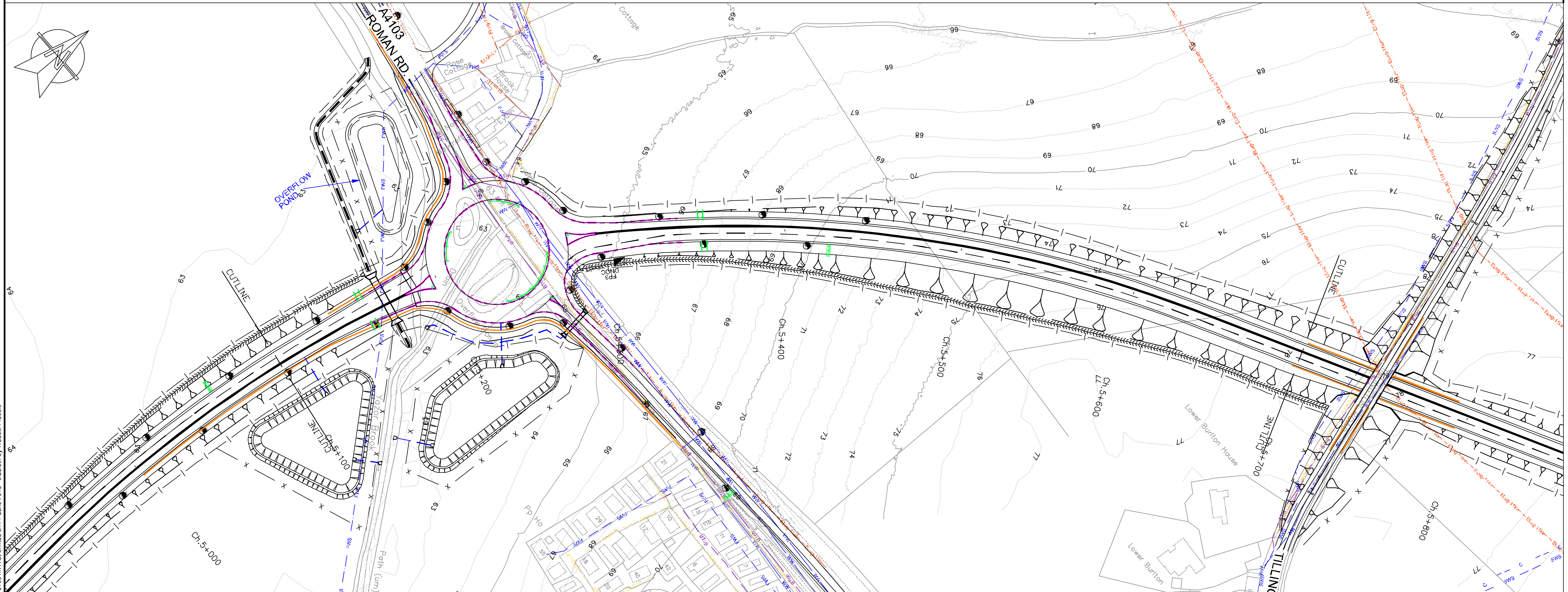
Balfour Beatty | Herefordshire Council | Working for Herefordshire | GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | WSP

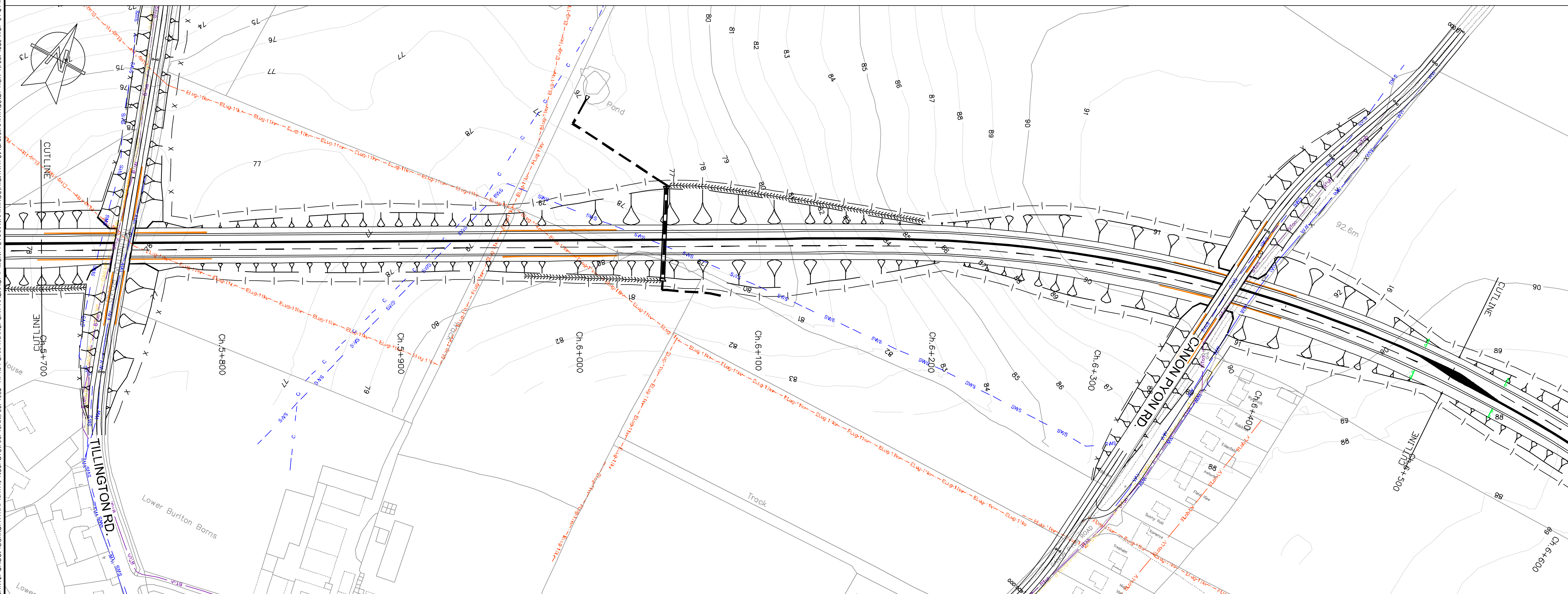
SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: Route Option 1 - Orange Ch.3+800 TO Ch.5+100

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-38-DR-HE-01001 REV: P05





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REV	DATE	BY	DESCRIPTION	CHK	APP
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DRAWING STATUS:
S0 - WORK IN PROGRESS

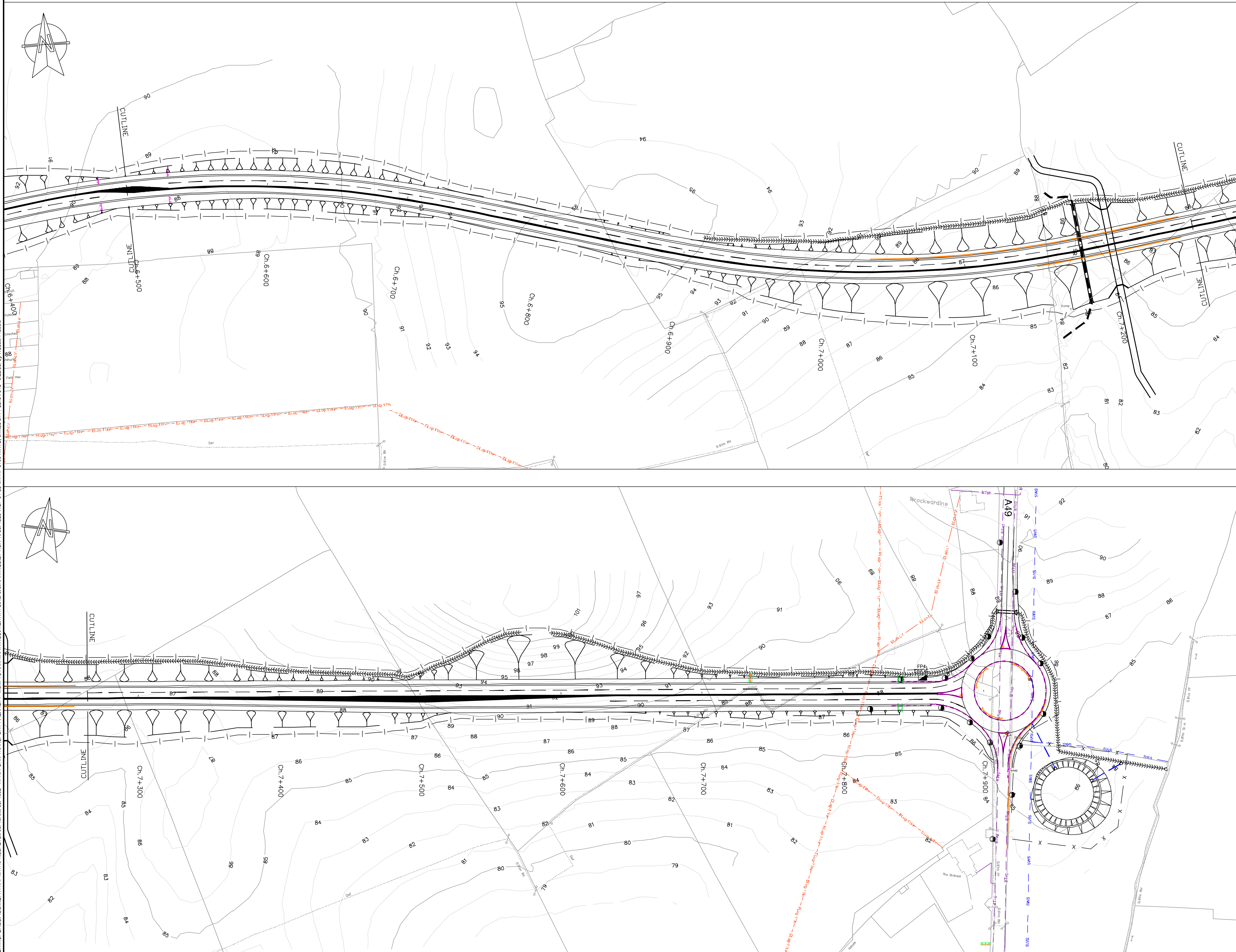
Balfour Beatty | Herefordshire Council | Working for Herefordshire

SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:
Route Option 1 - Orange
Ch.5+100 TO Ch.6+500

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP	DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-51-DR-HE-01001 REV: P05



DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

Balfour Beatty · Herefordshire Council · Working for Herefordshire · Growth Deals · The Marches Local Enterprise Partnership · Skylon Park · wsp

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: Route Option 1 - Orange Ch.6+500 TO Ch.7+950

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-65-DR-HE-01001 REV: P05

DO NOT SCALE

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Balfour Beatty | Herefordshire Council
Working for Herefordshire
GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | wsp

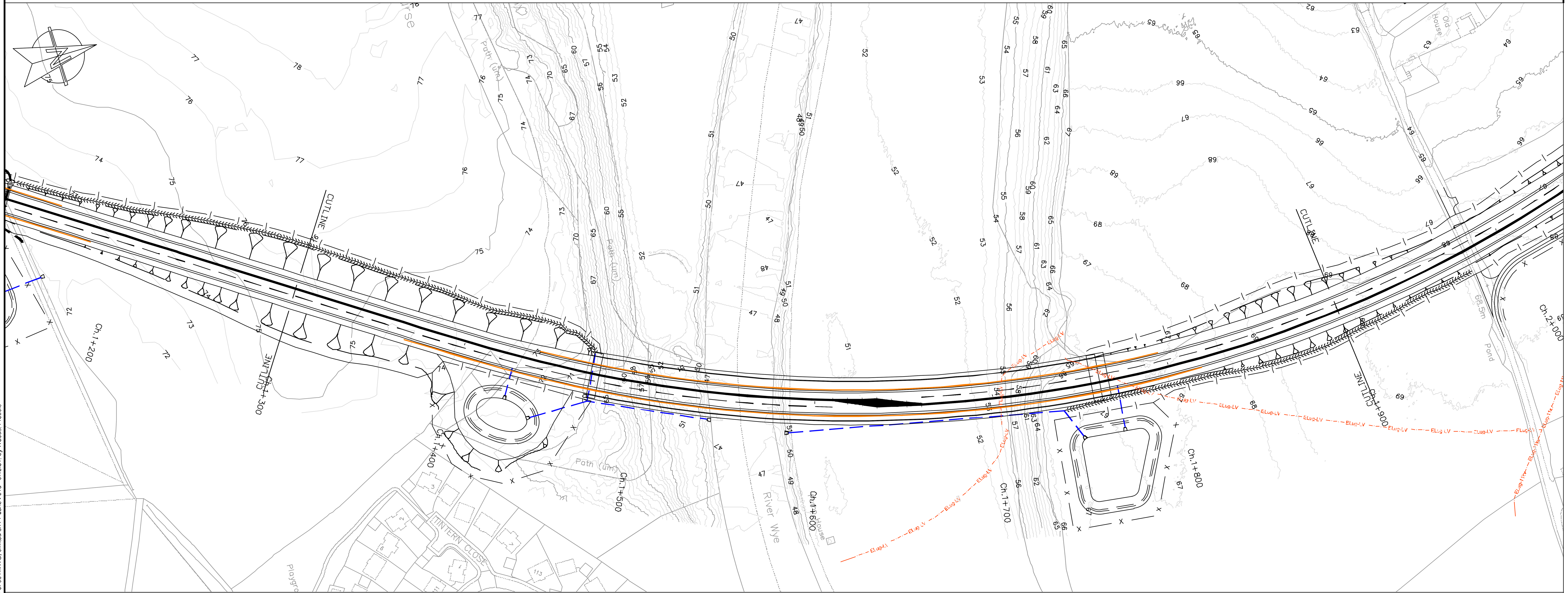
SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

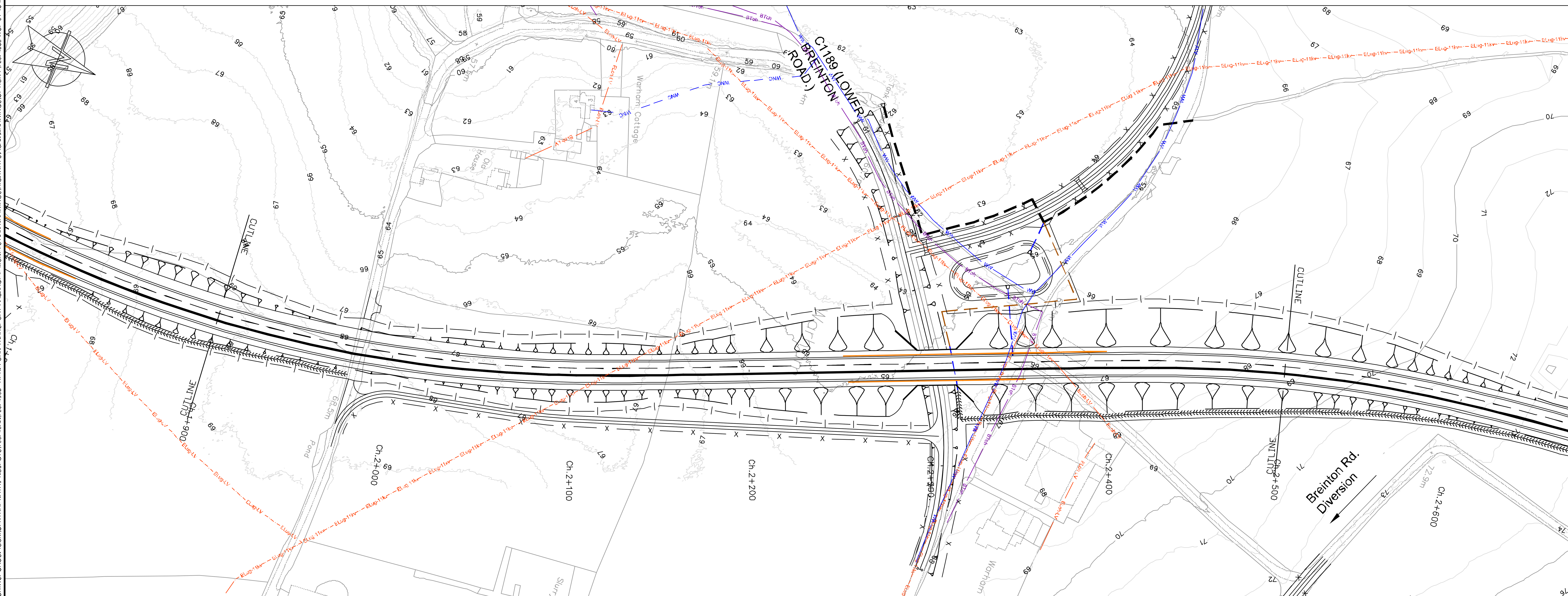
TITLE:
ROUTE OPTION 2 - CYAN
Ch.0+000 TO Ch.1+300

SCALE @ A1:	CHECKED:	APPROVED:
1:1250	RT	MG

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70024065	PP	FW	June 18

DRAWING NO: 70024065-WSP-01-00-DR-HE-02001 REV: P05





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SITE/PROJECT:

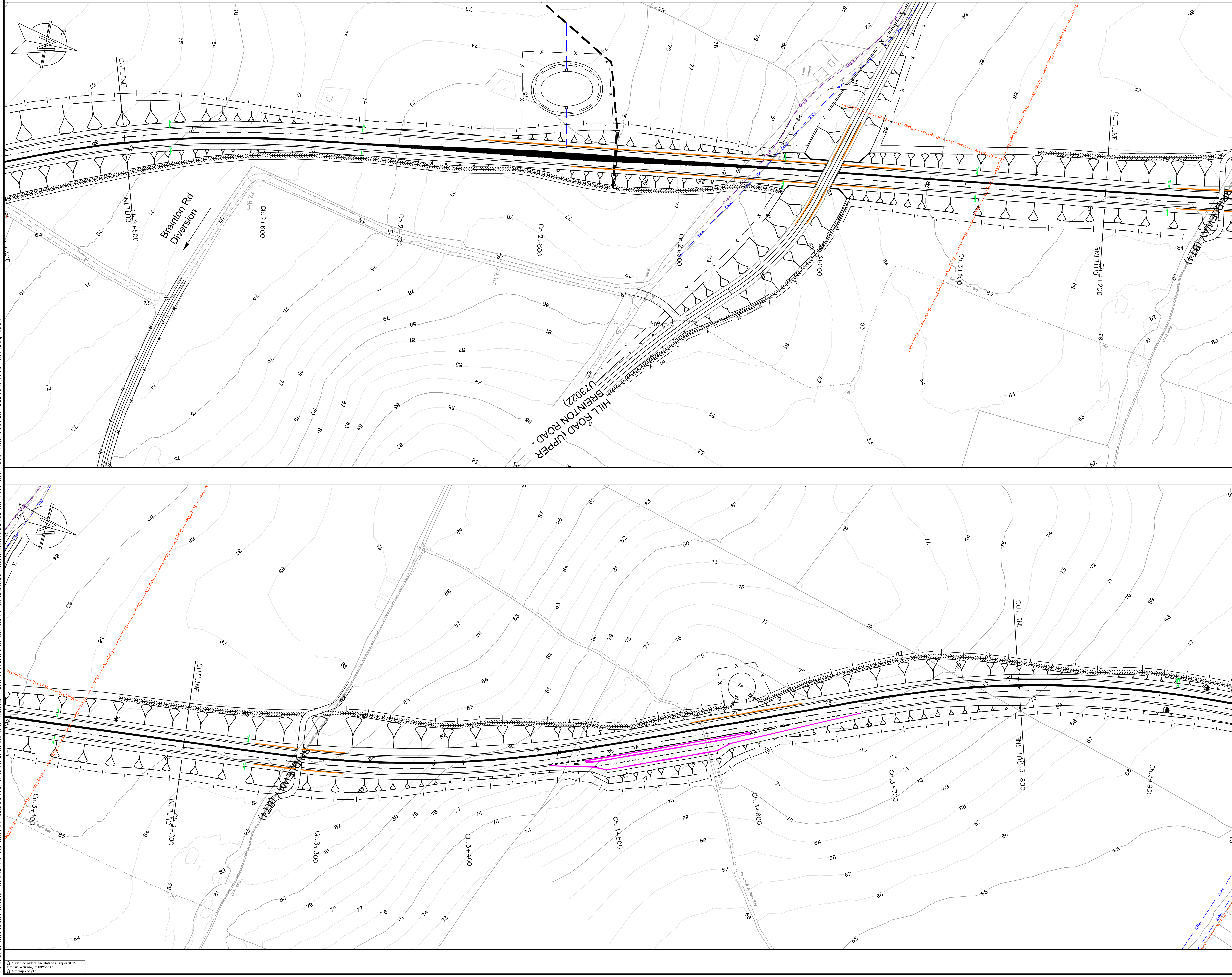
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:

ROUTE OPTION 2 - CYAN
Ch.1+300 TO Ch.2+500

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP / DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-13-DR-HE-02001 | REV: P05



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13. PRELIMINARY DESIGN FENCELINES TYPES/LOCATIONS SUBJECT TO BOUNDARY/LANDOWNER REQUIREMENTS REVIEW.
14. PRELIMINARY DESIGN SIGNAGE LOCATIONS SUBJECT TO REVIEW.
15. PRELIMINARY DESIGN LIGHTING SUBJECT TO REVIEW.
16. PRELIMINARY DESIGN VRS SUBJECT TO ROAD RESTRAINT RISK ASSESSMENT PROCEDURE.

KEY

- EXISTING DETAIL
- PROPOSED DETAIL
- HIGHWAYS BOUNDARY FENCE
- STOCKPROOF FENCE
- WATER COURSE DIVERSION
- CARRIER DRAIN
- FILTER DRAIN
- CUT-OFF DITCH
- STRUCTURE
- CULVERT
- ATTENUATION POND
- WS2+1 MARKING
- SIGNAGE - ADS
- SIGNAGE - CHANGEOVER
- SIGNAGE - REGULATORY
- SIGNAGE - CHEVRON
- COMBINED KERB DRAINAGE
- KERBING
- VEHICLE RESTRAINT SYSTEM
- LIGHTING COLUMN
- EXISTING LIGHTING COLUMN TO RETAIN
- EXISTING LIGHTING COLUMN TO REMOVE
- LIGHTING FEEDER PILLAR
- HEADWALL

REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 2 - CYAN Ch.2+500 TO Ch.3+800

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-25-DR-HE-02001 REV: P05

DO NOT SCALE

NOTES
1. OS 2D MASTERMAP (2012)
2. 1m CONTOURS PRODUCED FROM DTM COMPRISING COMBINATION OF GROUND SURVEY (2016) AND LIDAR DATA (2012)
3. PRELIMINARY DESIGN ALIGNMENT 100KPH WS2+1 STANDARD SUBJECT TO CONFIRMATION
4. PRELIMINARY DESIGN LINK / SIDE ROAD EARTHWORKS SUBJECT TO E/WKS BALANCE & CONSTRAINT ADJUSTMENT
5. LOCALISED HIGHWAY FEATURES E.G. MAINTENANCE HARDSTANDING & ACCESS POINTS NOT SHOWN
6. PRELIMINARY DESIGN ATTENUATION PONDS SIZE AND LOCATION SUBJECT TO HYDRAULLIC MODELLING
7. ENVIRONMENTAL MITIGATION NOT SHOWN
8. PRELIMINARY DESIGN STRUCTURES SUBJECT TO STRUCTURAL REVIEW.
9. PRELIMINARY DESIGN JUNCTIONS (SUBJECT TO TRAFFIC PERFORMANCE CONFIRMATION)
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- LIGHTING COLUMN
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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE – PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

Balfour Beatty | Herefordshire Council
Working for Herefordshire
GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | wsp

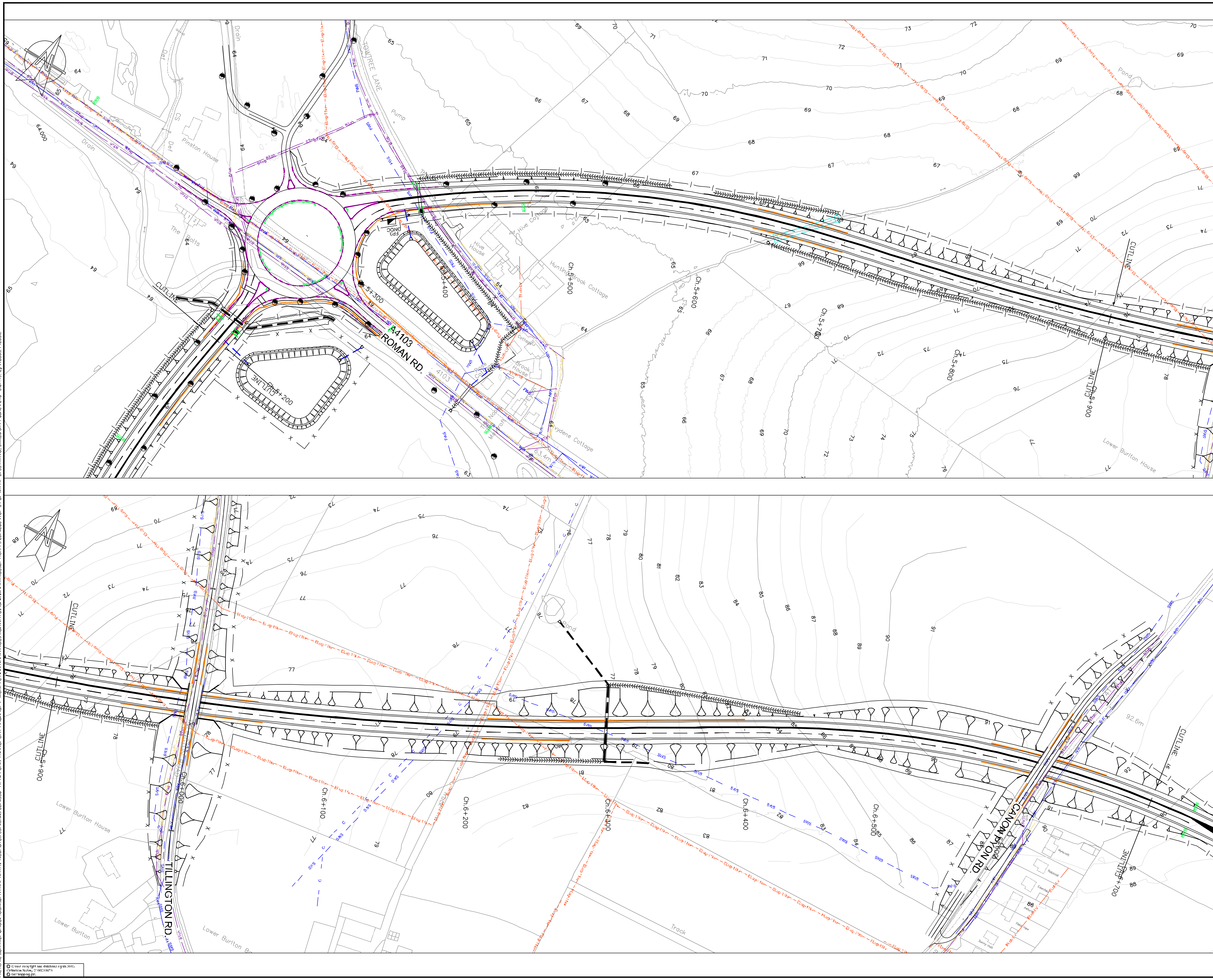
SITE/PROJECT: HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE: ROUTE OPTION 2 - CYAN
Ch.3+800 TO Ch.5+200

SCALE @ A1:	CHECKED:	APPROVED:
1:1250	RT	MG

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70024065	PP	FW	June 18

DRAWING No: 70024065-WSP-01-38-DR-HE-02001 REV: P05



DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.	RT	MG

DRAWING STATUS: S0 - WORK IN PROGRESS

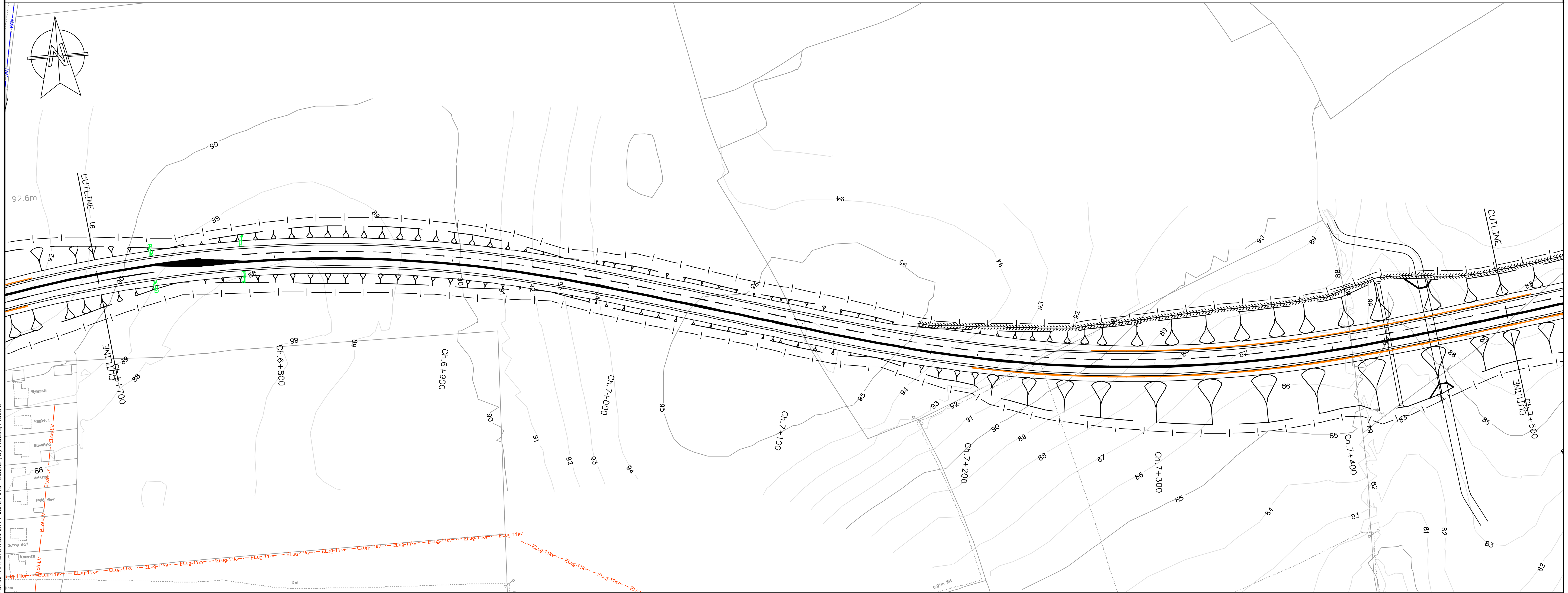
Balfour Beatty · Herefordshire Council · Working for Herefordshire · Growth Deals · The Marches Local Enterprise Partnership · Skylon Park · WSP

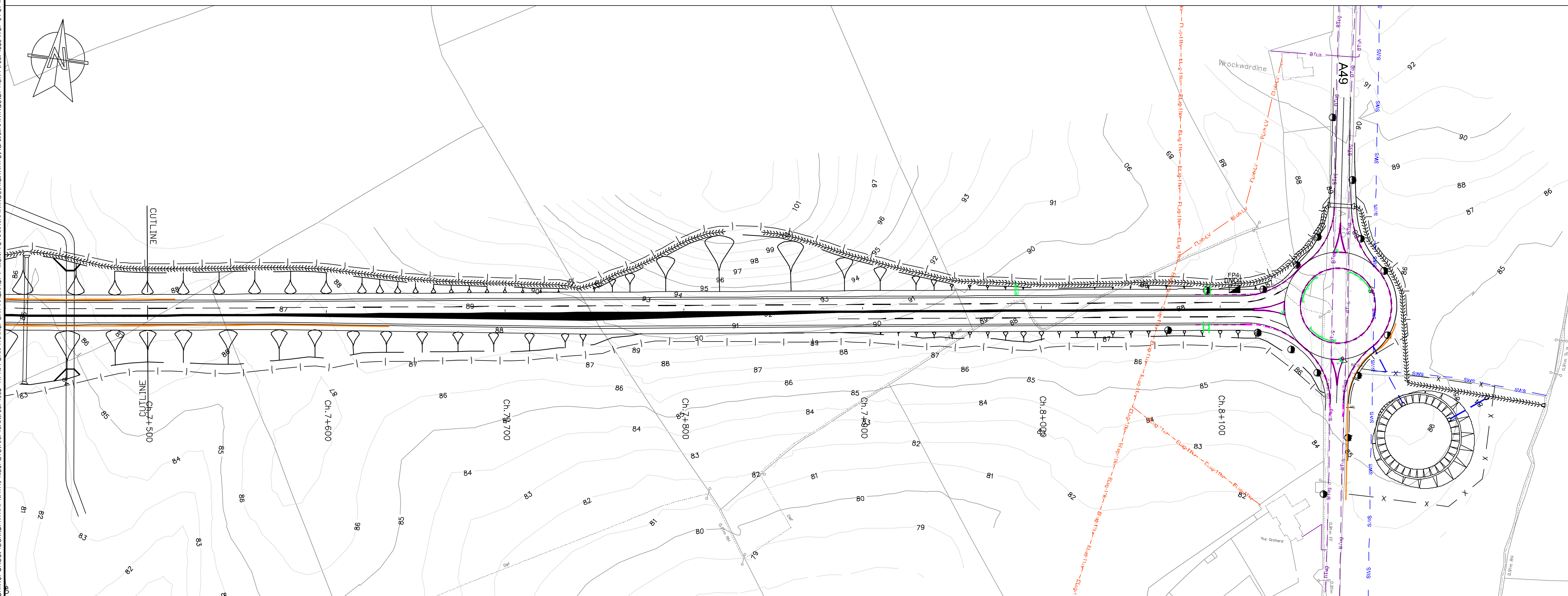
SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 2 - CYAN Ch.5+200 TO Ch.6+700

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-52-DR-HE-02001 REV: P05





DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.	RT	MG

DRAWING STATUS:

S0 - WORK IN PROGRESS

Balfour Beatty · Herefordshire Council · Working for Herefordshire · GROWTH DEALS · The Marches Local Enterprise Partnership · Skylon Park · wsp

SITE/PROJECT:

HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:

ROUTE OPTION 2 - CYAN
Ch.6+700 TO Ch.8+175

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP	DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-67-DR-HE-02001 REV: P05

DO NOT SCALE

NOTES
1. OS 2D MASTERMAP (2012)
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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

Balfour Beatty | Herefordshire Council | Working for Herefordshire | Growth Deals | The Marches Local Enterprise Partnership | SkyLon Park | WSP

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

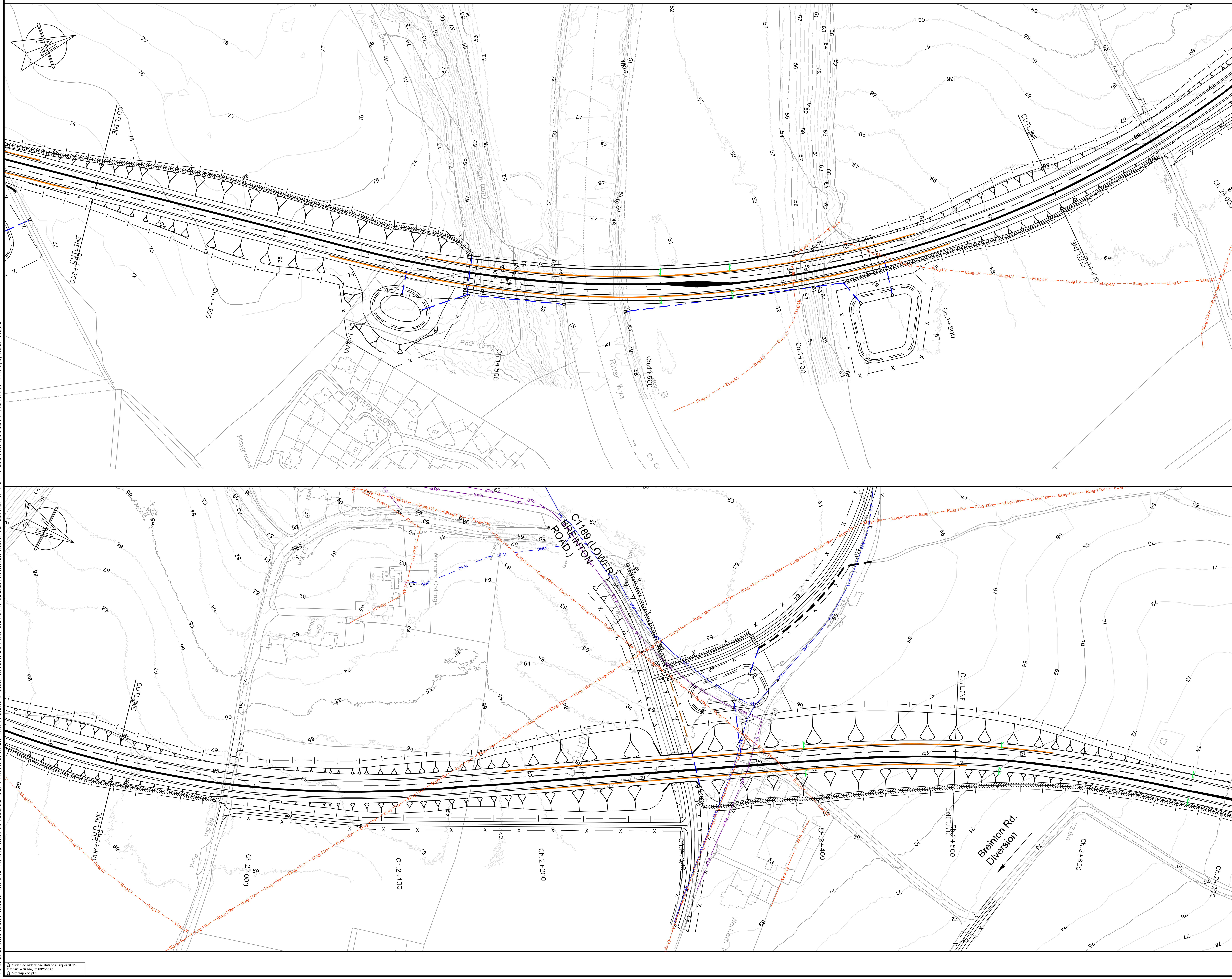
TITLE: ROUTE OPTION 3 - YELLOW
Ch.0+000 TO Ch.1+200

SCALE @ A1:	CHECKED:	APPROVED:
1:1250	RT	MG

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70024065	PP	FW	June 18

DRAWING NO: 70024065-WSP-01-00-DR-HE-03001 REV: P05

File name: \\UK-WSPGROUP.COM\CF\HAL DATA\PROJECTS\70024065 - HEREFORD TRANSPORT PACKAGE\03 MODELS AND DRAWINGS\HIGHWAYS\ACAD\DRAWINGS\OPTION 3\70024065-WSP-01-00-DR-HE-03001.DWG, printed on 27 June 2018 - 11:08:31, by Woods, Freddie



DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE – PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.	RT	MG

DRAWING STATUS: S0 - WORK IN PROGRESS

Working for Herefordshire

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 3 - YELLOW Ch.1+200 TO Ch.2+500

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-12-DR-HE-03001 REV: P05

DO NOT SCALE

NOTES
1. OS 2D MASTERMAP (2012)
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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE – PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

Balfour Beatty | Herefordshire Council
Working for Herefordshire
GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | wsp

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

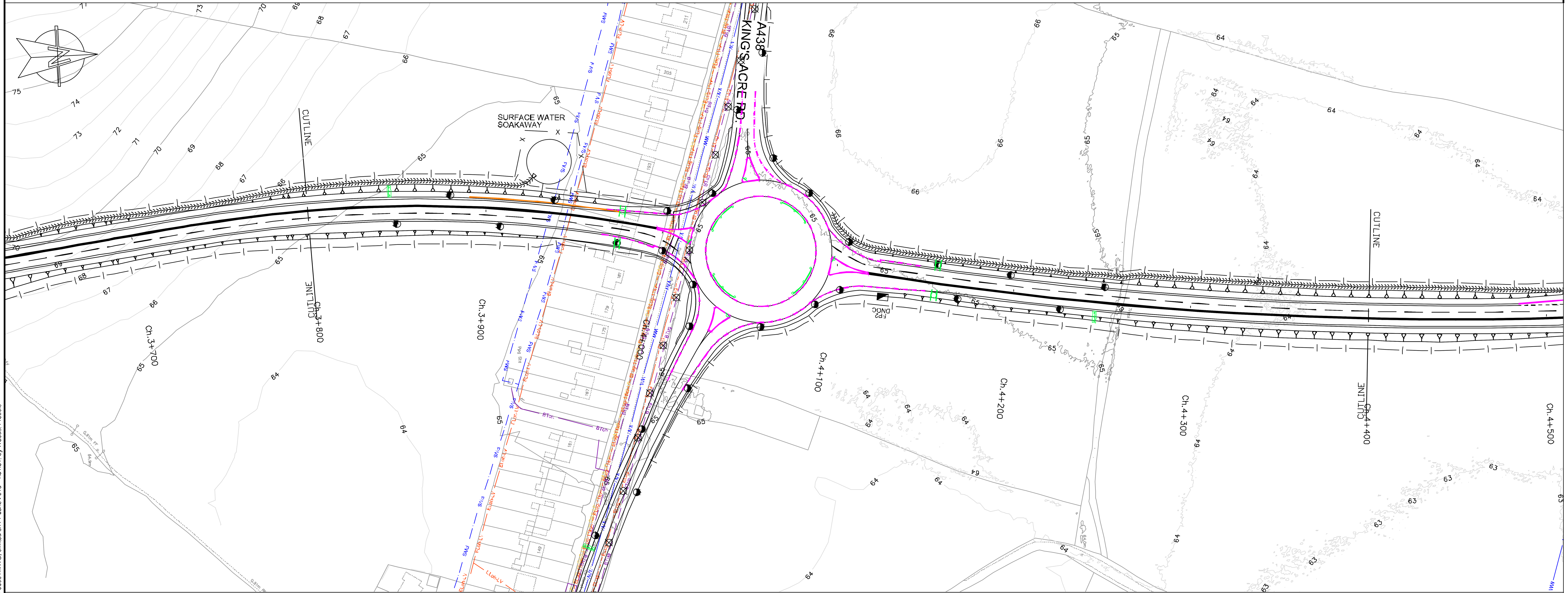
TITLE: ROUTE OPTION 3 - YELLOW
Ch.2+500 TO Ch.3+800

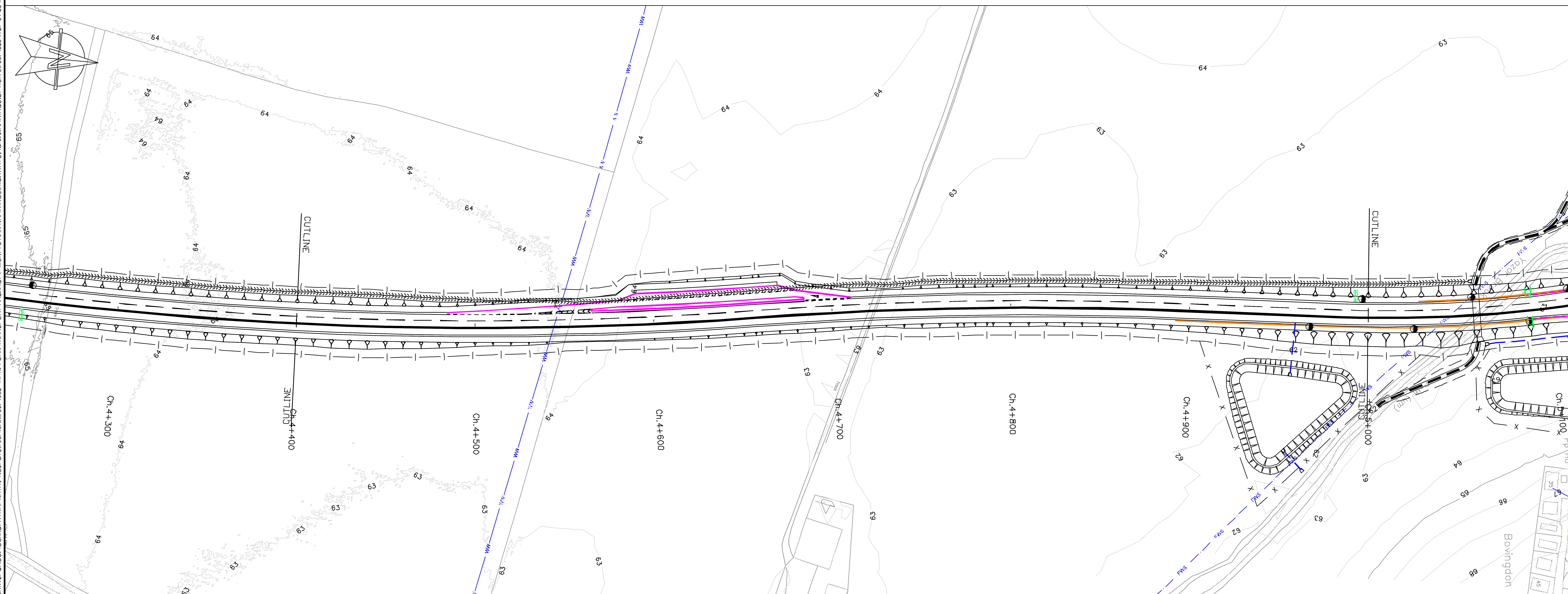
SCALE @ A1:	CHECKED:	APPROVED:
1:1250	RT	MG

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70024065	PP	FW	June 18

DRAWING NO: 70024065-WSP-01-25-DR-HE-03001 REV: P05

File name: \\UK-WSPGHQUP.COM\CF\HTRA1 DATA\PROJECTS\70024065 - HEREFORD TRANSPORT PACKAGE\3 MODELS AND DRAWINGS\HIGHWAYS\ACAD\DRAWINGS\OPTION 3\70024065-WSP-01-25-DR-HE-03001.DWG, printed on 27 June 2018 - 13:31:17, by Woods, Freddie





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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.	RT	MG

DRAWING STATUS: S0 - WORK IN PROGRESS

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE: ROUTE OPTION 3 - YELLOW
Ch.3+800 TO Ch.5+000

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP	DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-38-DR-HE-03001 REV: P05

DO NOT SCALE

NOTES
1. OS 2D MASTERMAP (2012)
2. 1m CONTOURS PRODUCED FROM DTM COMPRISING COMBINATION OF GROUND SURVEY (2016) AND LIDAR DATA (2012)
3. PRELIMINARY DESIGN ALIGNMENT 100KPH WS2+1 STANDARD SUBJECT TO CONFIRMATION
4. PRELIMINARY DESIGN LINK / SIDE ROAD EARTHWORKS SUBJECT TO E/WKS BALANCE & CONSTRAINT ADJUSTMENT
5. LOCALISED HIGHWAY FEATURES E.G. MAINTENANCE HARDSTANDING & ACCESS POINTS NOT SHOWN
6. PRELIMINARY DESIGN ATTENUATION PONDS SIZE AND LOCATION SUBJECT TO HYDRAULIC MODELLING
7. ENVIRONMENTAL MITIGATION NOT SHOWN
8. PRELIMINARY DESIGN STRUCTURES SUBJECT TO STRUCTURAL REVIEW.
9. PRELIMINARY DESIGN JUNCTIONS (SUBJECT TO TRAFFIC PERFORMANCE CONFIRMATION)
10. PRELIMINARY DESIGN FENCELINE ASSUMES 5M TOE-OF-E/WKS MAINTENANCE STRIP
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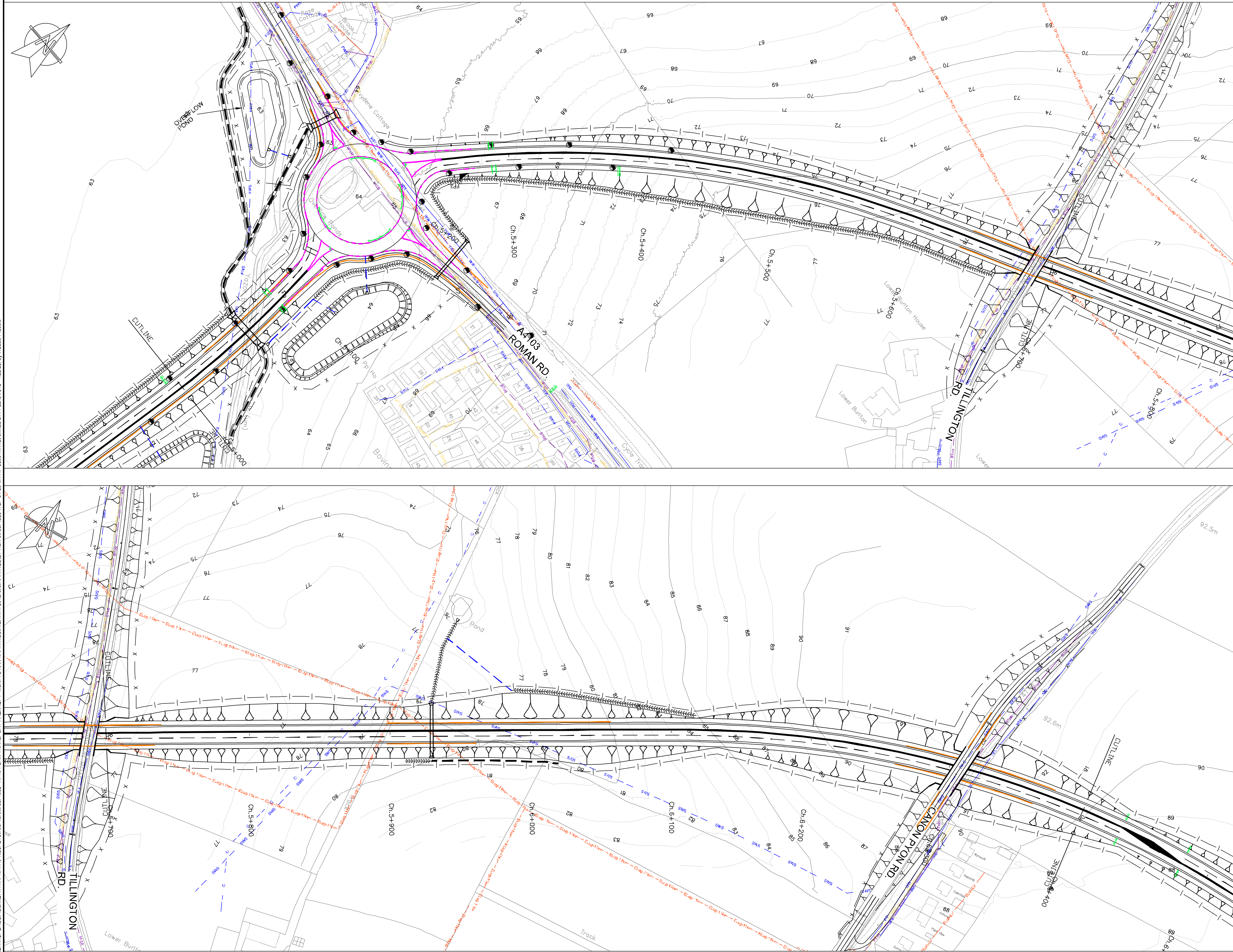
15. PRELIMINARY DESIGN LIGHTING SUBJECT TO REVIEW.
16. PRELIMINARY DESIGN VRS SUBJECT TO ROAD RESTRAINT RISK ASSESSMENT PROCEDURE.

KEY
- EXISTING DETAIL
- PROPOSED DETAIL
- HIGHWAYS BOUNDARY FENCE
- STOCKPROOF FENCE
- WATER COURSE DIVERSION
- CARRIER DRAIN
- FILTER DRAIN
- CUT-OFF DITCH
- STRUCTURE
- CULVERT
- ATTENUATION POND
- WS2+1 MARKING
- SIGNAGE - ADS
- SIGNAGE - CHANGEOVER
- SIGNAGE - REGULATORY
- SIGNAGE - CHEVRON
- COMBINED KERB DRAINAGE
- KERBING
- VEHICLE RESTRAINT SYSTEM
- LIGHTING COLUMN
- EXISTING LIGHTING COLUMN TO RETAIN
- EXISTING LIGHTING COLUMN TO REMOVE
- LIGHTING FEEDER PILLAR
- HEADWALL



REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

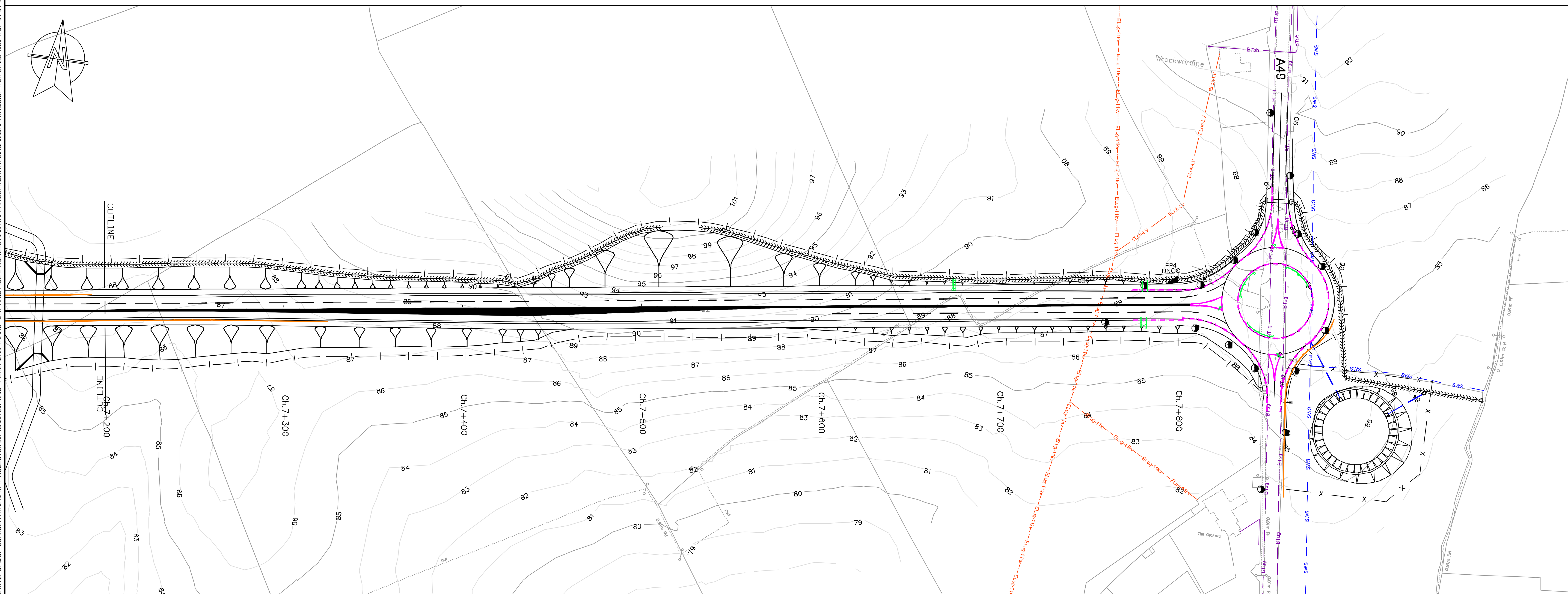
Balfour Beatty | Herefordshire Council | Working for Herefordshire | GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | wsp

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 3 - YELLOW Ch.5+000 TO Ch.6+300

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP / DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-50-DR-HE-03001 | REV: P05



DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

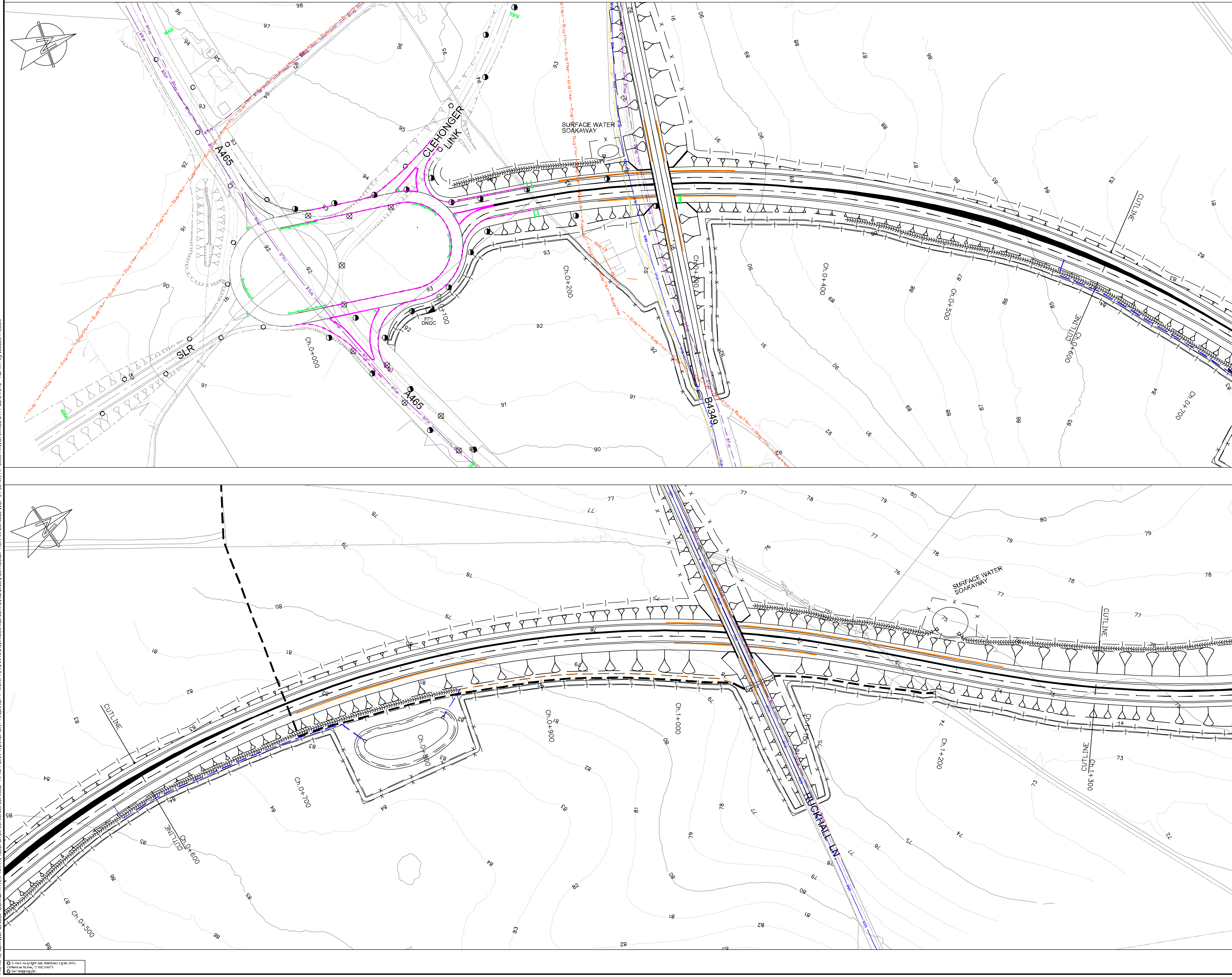
Balfour Beatty | Herefordshire Council | Working for Herefordshire | GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | wsp

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 3 - YELLOW Ch.6+400 TO Ch.7+815

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP	DRAWN: FW	DATE: June 18

DRAWING No: 70024065-WSP-01-64-DR-HE-03001 | REV: P05



DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/03/2018	PP	FIFTH ISSUE – PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

Balfour Beatty · Herefordshire Council · Working for Herefordshire · Growth Deals · The Marches Local Enterprise Partnership · Skylon Park · wsp

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE: ROUTE OPTION 4 - RED
Ch.0+000 TO Ch.1+300

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP / DRAWN: FW	DATE: May '18
DRAWING No: 70024065-WSP-01-00-DR-HE-04001		REV: P05

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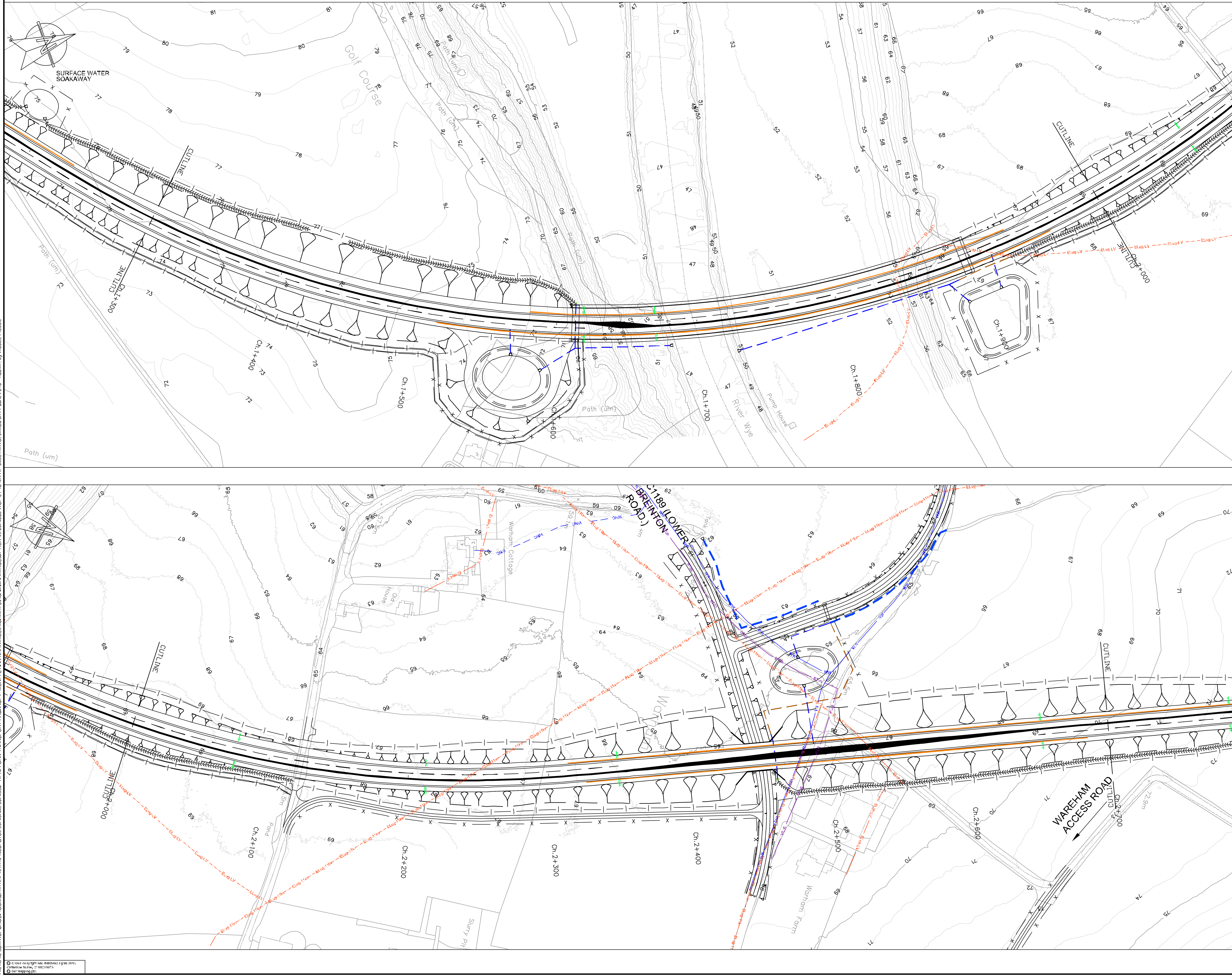

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS:
S0 - WORK IN PROGRESS

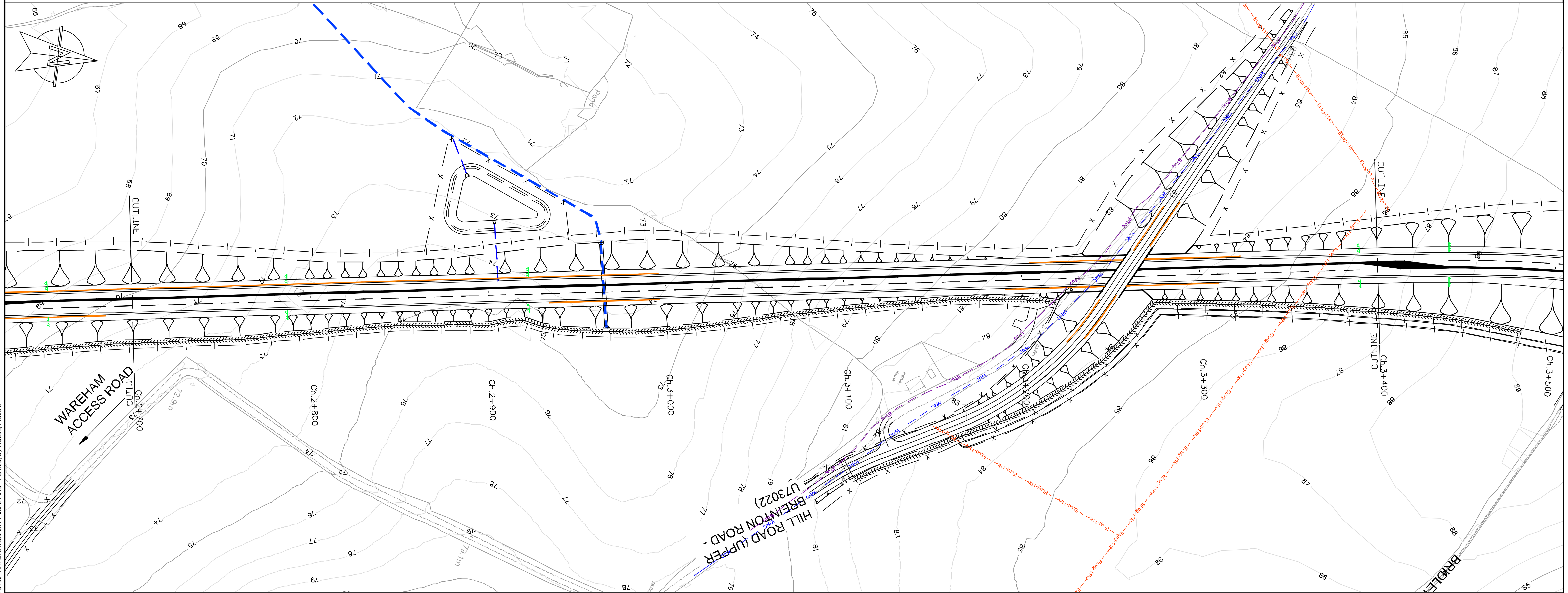
Balfour Beatty | Herefordshire Council | Working for Herefordshire | GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | wsp

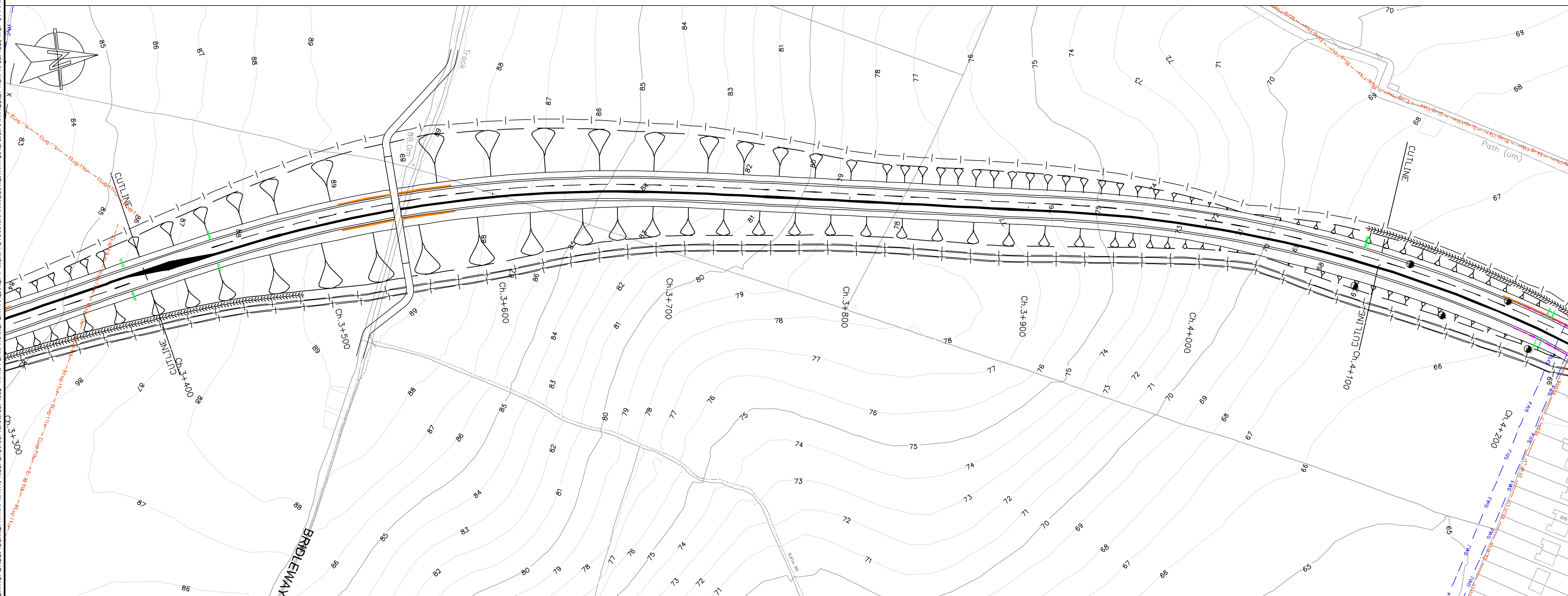
SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:
ROUTE OPTION 4 - RED
Ch.1+300 TO Ch.2+700

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP / DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-13-DR-HE-04001 | REV: P05





DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/03/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.	RT	MG

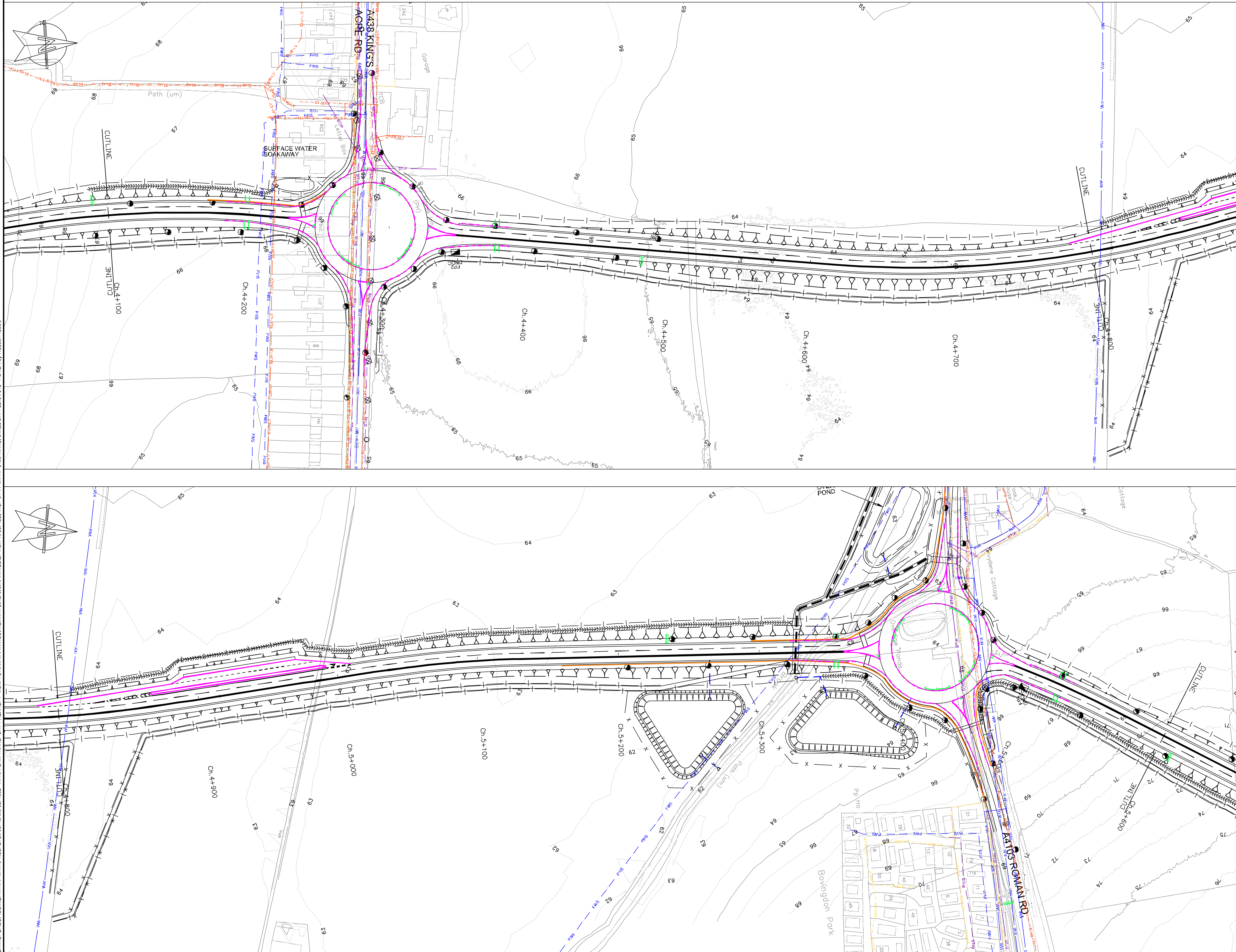
DRAWING STATUS: S0 - WORK IN PROGRESS

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 4 - RED Ch.2+700 TO Ch.4+100

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP / DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-27-DR-HE-04001 REV: P05



DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

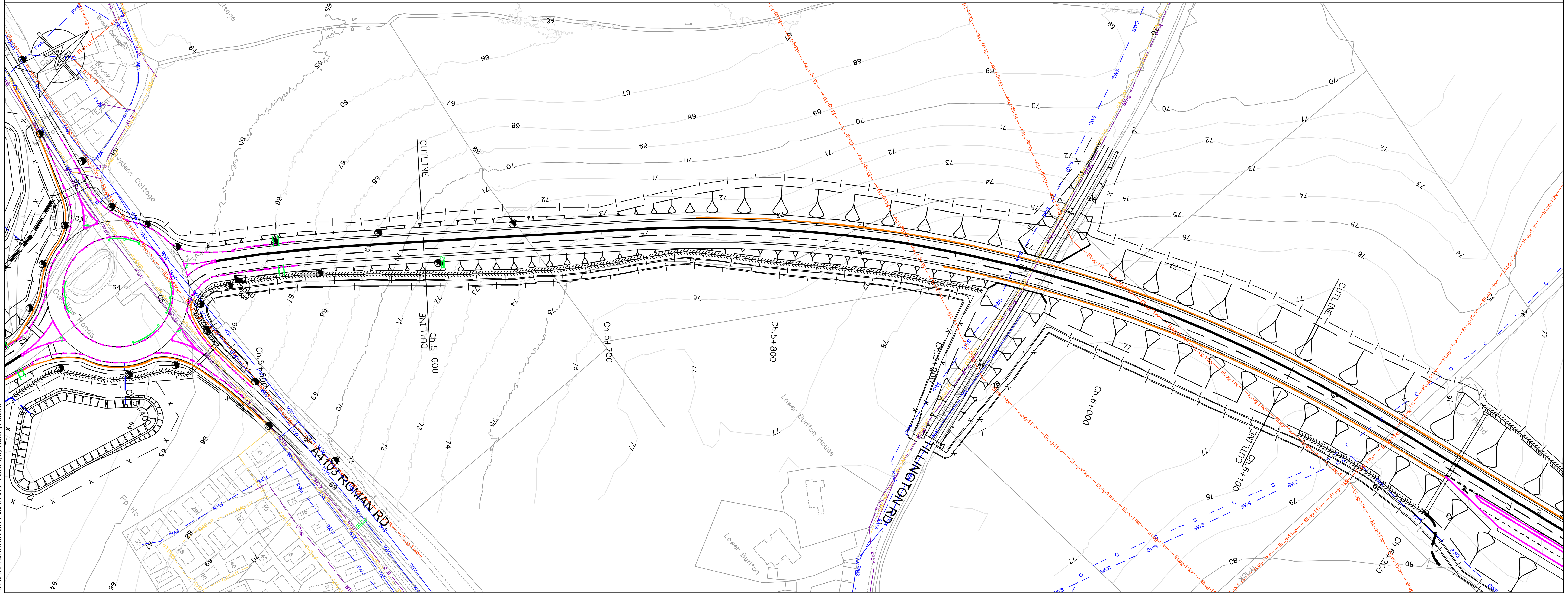
Balfour Beatty | Herefordshire Council | Working for Herefordshire | GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | wsp

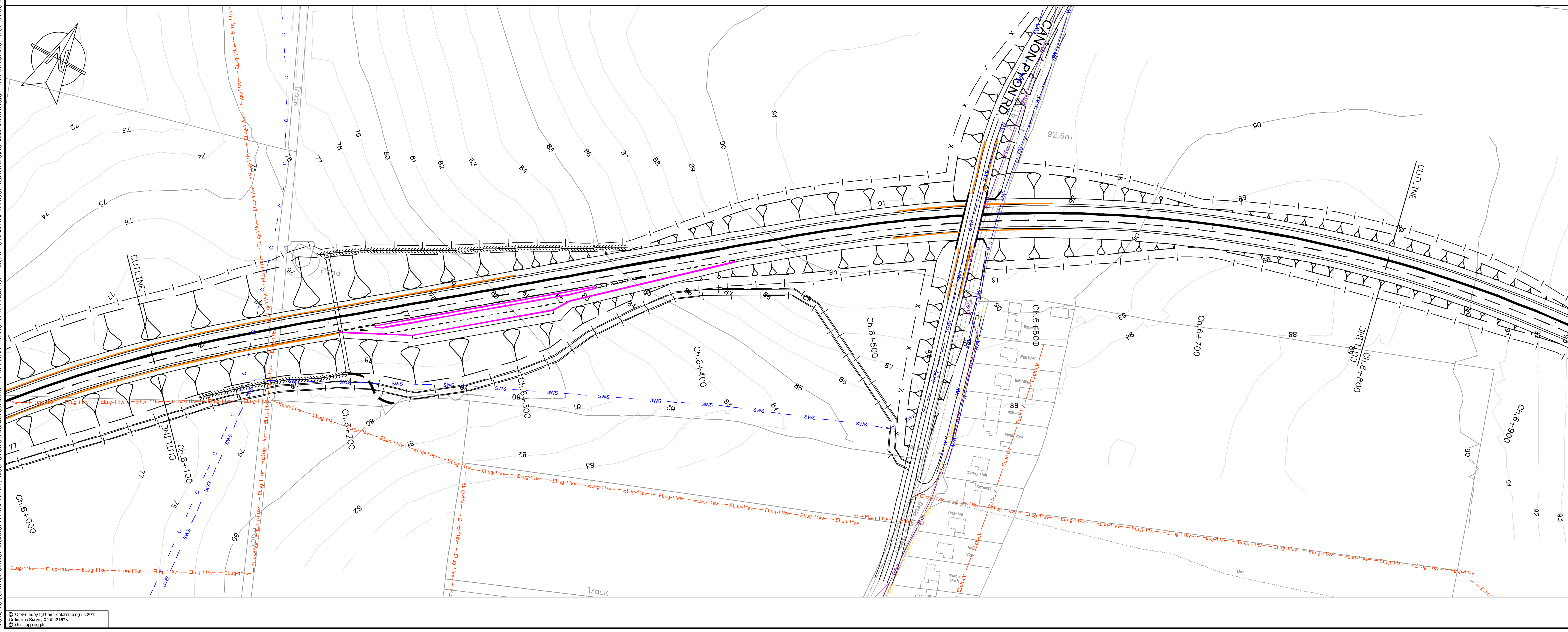
SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 4 - RED Ch.4+100 TO Ch.5+600

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-41-DR-HE-04001 | REV: P05





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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

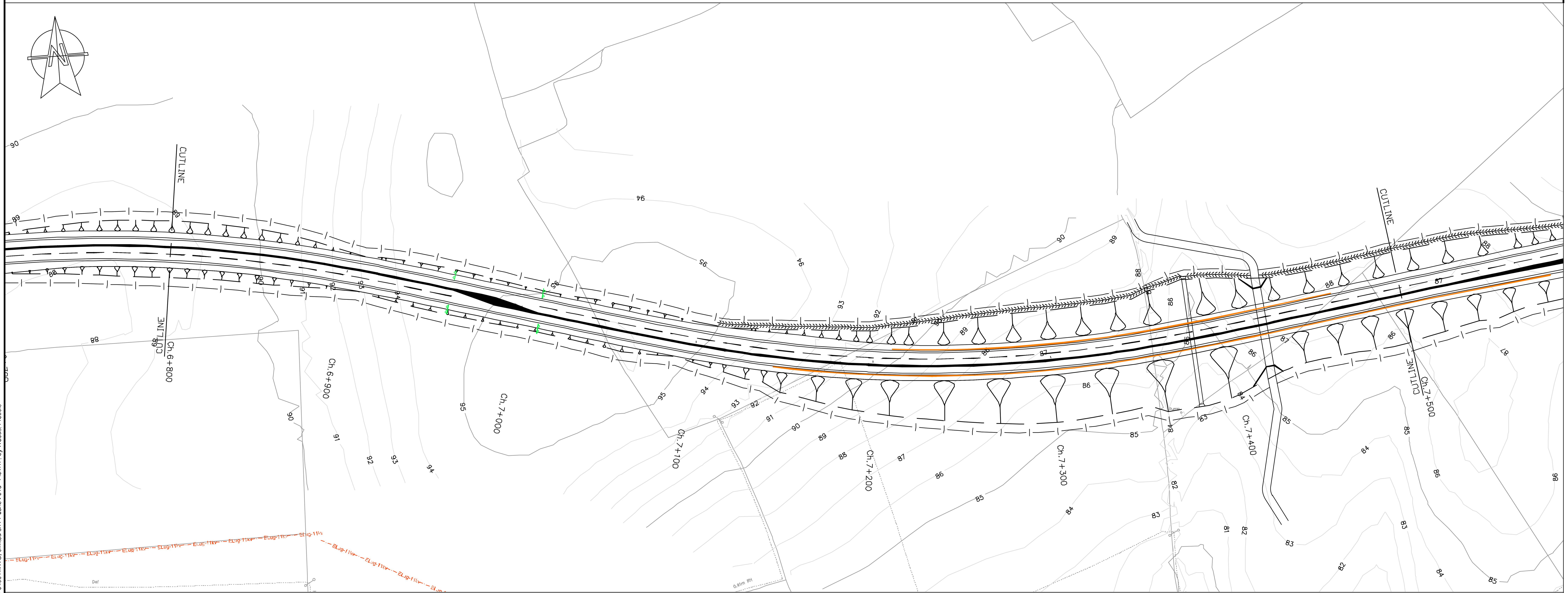
Working for Herefordshire

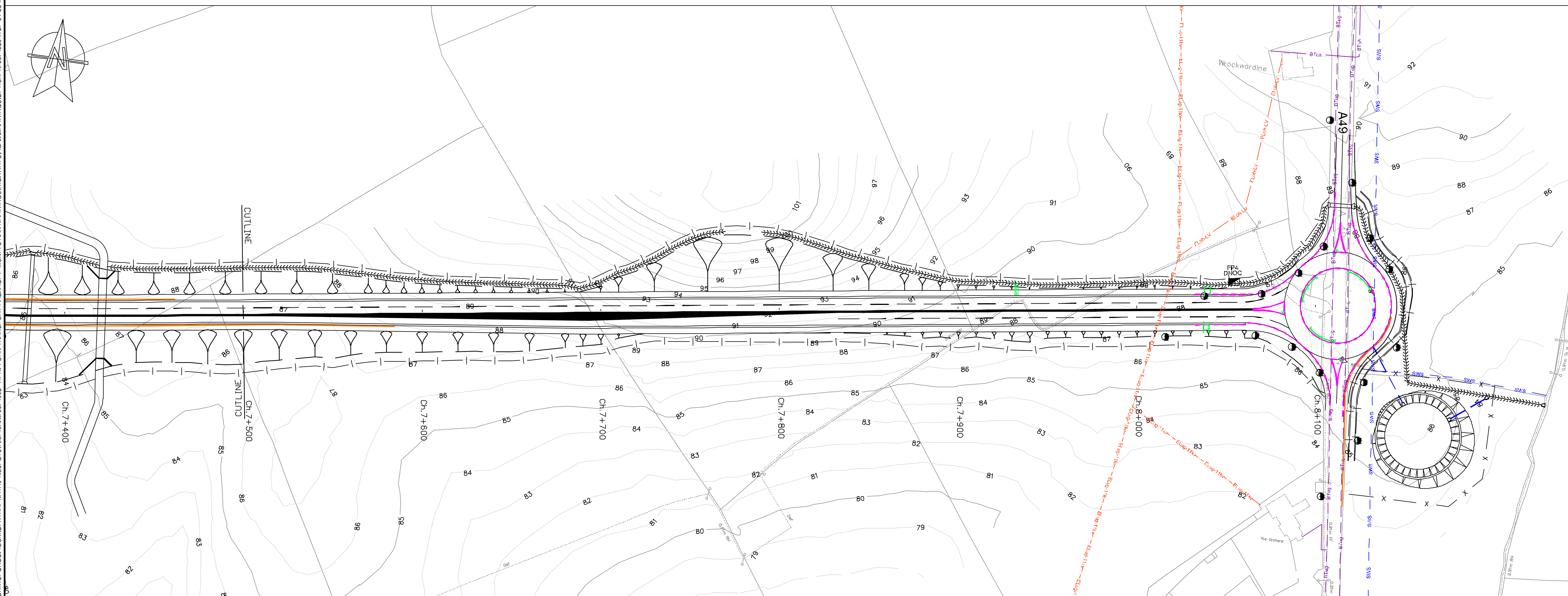
SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:
ROUTE OPTION 4 - RED
Ch.5+600 TO Ch.6+800

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-56-DR-HE-04001
REV: P05





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4. PRELIMINARY DESIGN LINK / SIDE ROAD EARTHWORKS SUBJECT TO E/WKS BALANCE & CONSTRAINT ADJUSTMENT
5. LOCALISED HIGHWAY FEATURES E.G. MAINTENANCE HARDSTANDING & ACCESS POINTS NOT SHOWN
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7. ENVIRONMENTAL MITIGATION NOT SHOWN
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15. PRELIMINARY DESIGN LIGHTING SUBJECT TO REVIEW.
16. PRELIMINARY DESIGN VRS SUBJECT TO ROAD RESTRAINT RISK ASSESSMENT PROCEDURE.

KEY

- EXISTING DETAIL
- PROPOSED DETAIL
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- WATER COURSE DIVERSION
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- LIGHTING COLUMN
- EXISTING LIGHTING COLUMN TO RETAIN
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- LIGHTING FEEDER PILLAR
- HEADWALL

REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS:

S0 - WORK IN PROGRESS

Balfour Beatty
Herefordshire Council
Working for Herefordshire
GROWTH DEALS
The Marches Local Enterprise Partnership
SKYLON PARK
wsp

SITE/PROJECT:

HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:

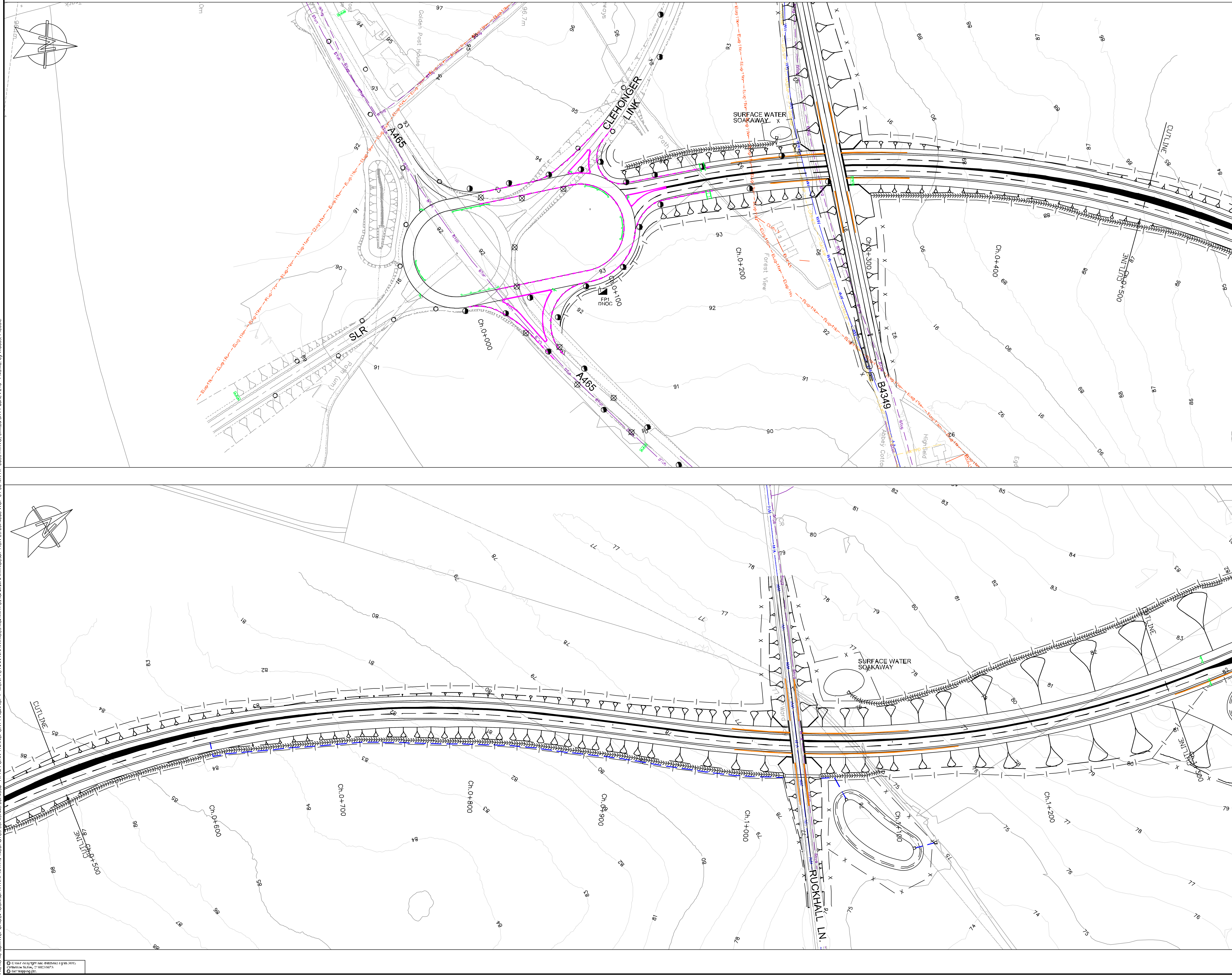
ROUTE OPTION 4 - RED
Ch.6+800 TO Ch.8+105

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP / DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-68-DR-HE-04001

REV: P05

DO NOT SCALE



NOTES

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/02/2018	PP	FIFTH ISSUE – PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS:
S0 - WORK IN PROGRESS

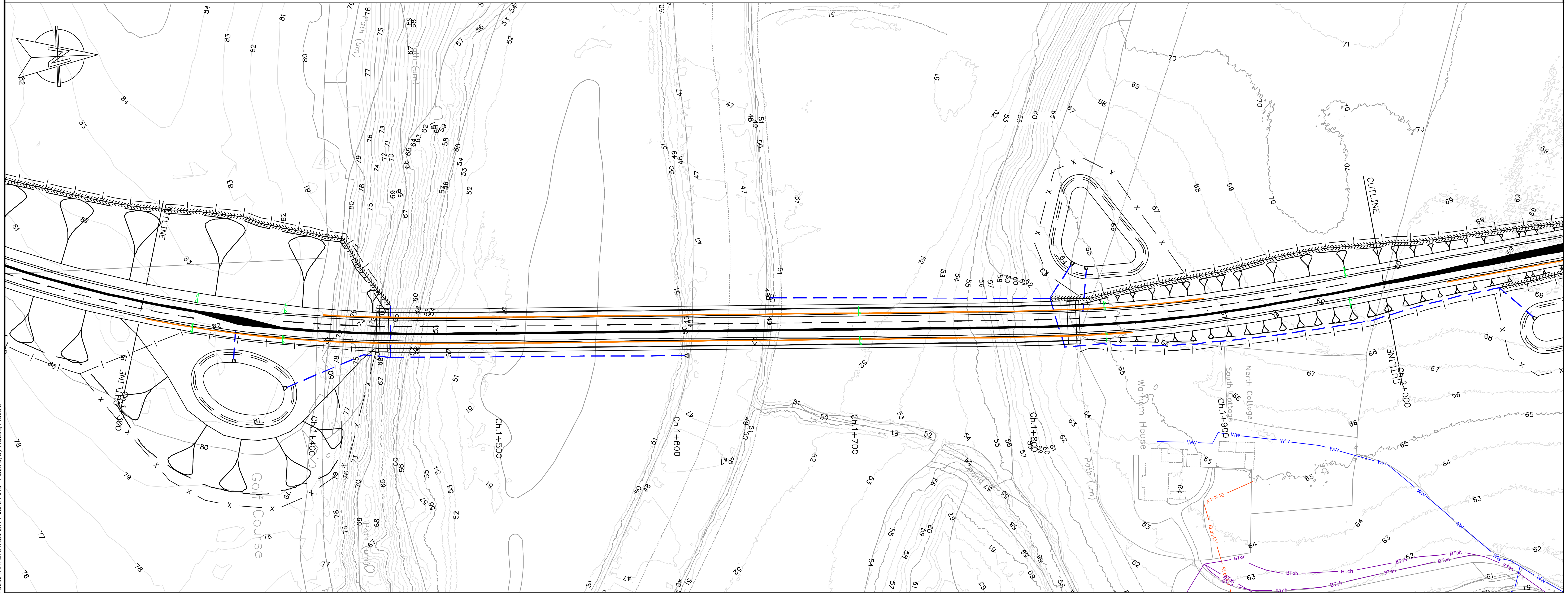
Balfour Beatty | Herefordshire Council | Working for Herefordshire | GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | wsp

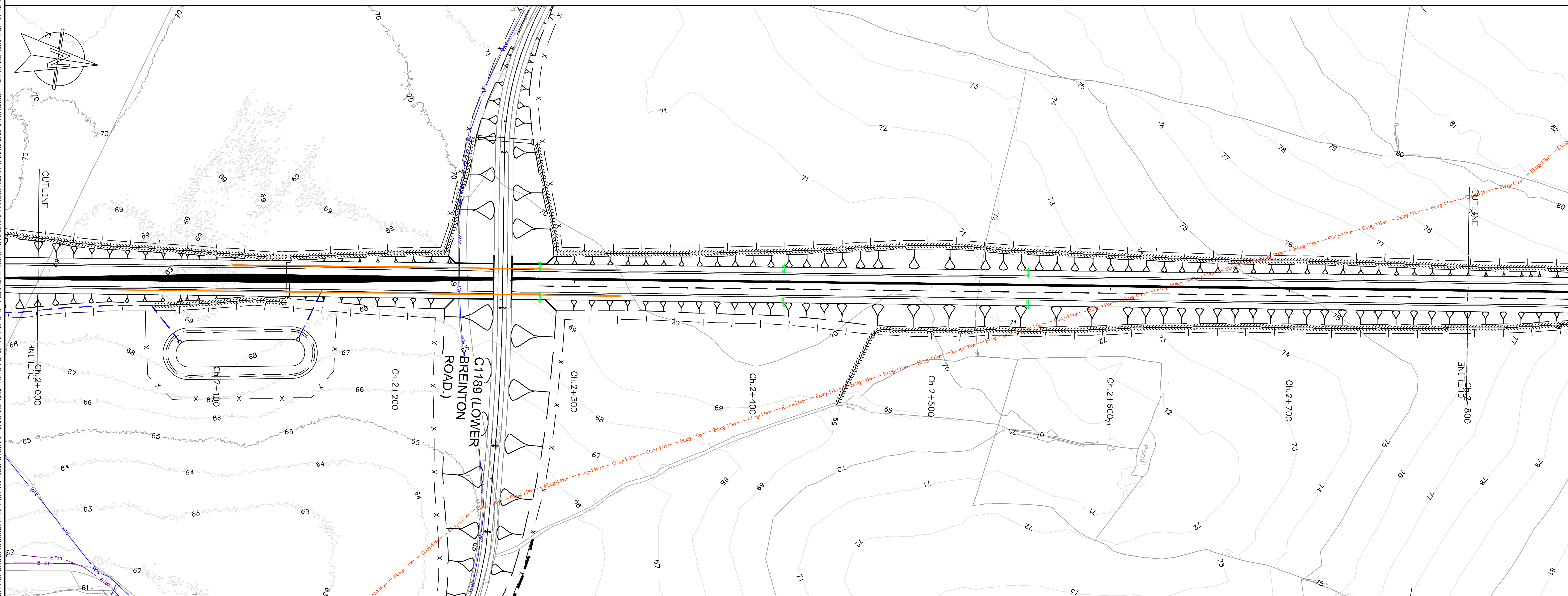
SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:
ROUTE OPTION 5 - OLIVE
Ch.0+000 TO Ch.1+300

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP / DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-00-DR-HE-05001 | REV: P05





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P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.	[illegible]	[illegible]

DRAWING STATUS:

S0 - WORK IN PROGRESS

SITE/PROJECT:

HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

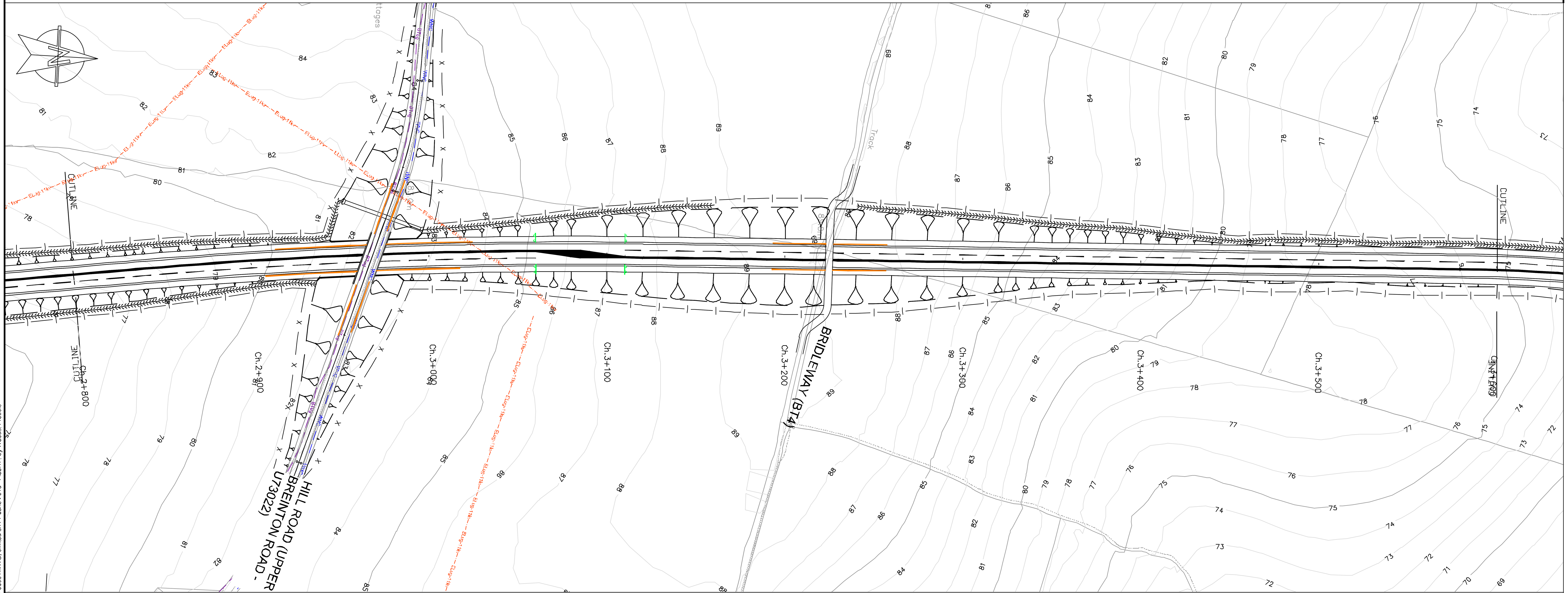
TITLE:

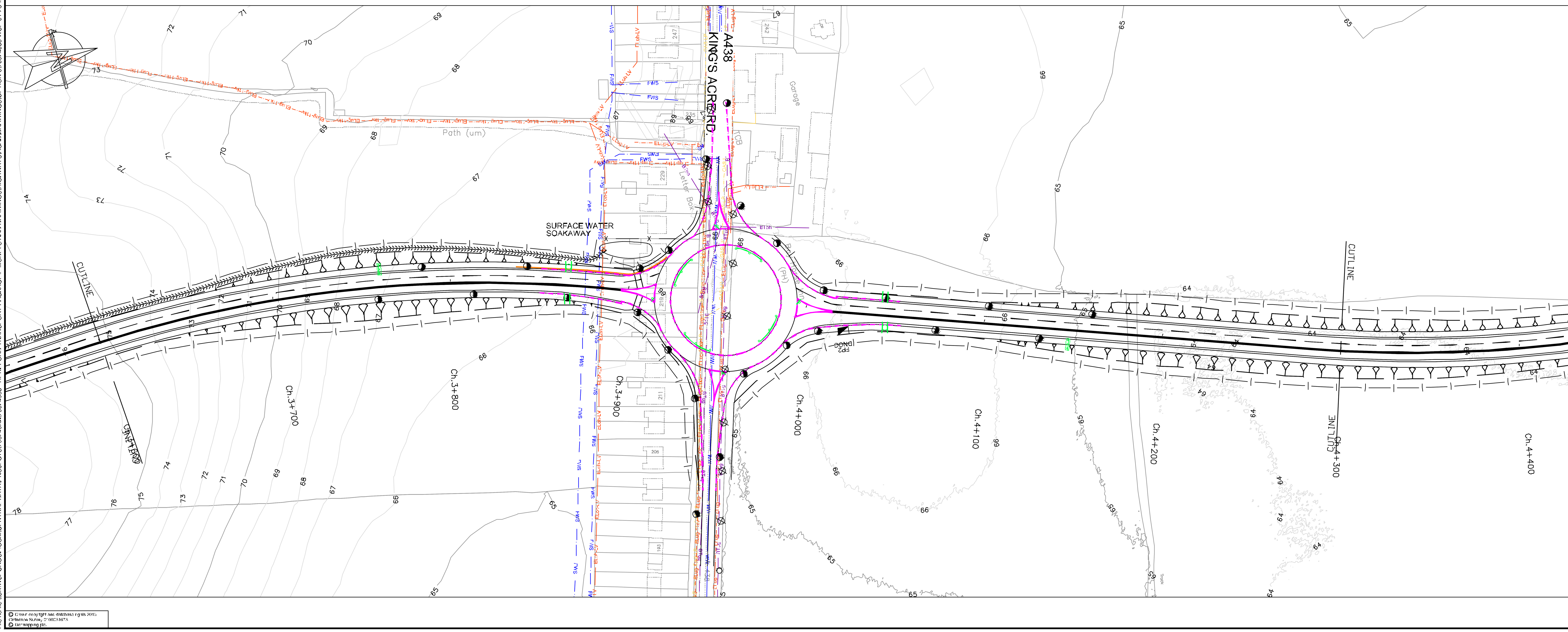
ROUTE OPTION 5 - OLIVE
Ch.1+300 TO Ch.2+800

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-13-DR-HE-05001

REV: P05





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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

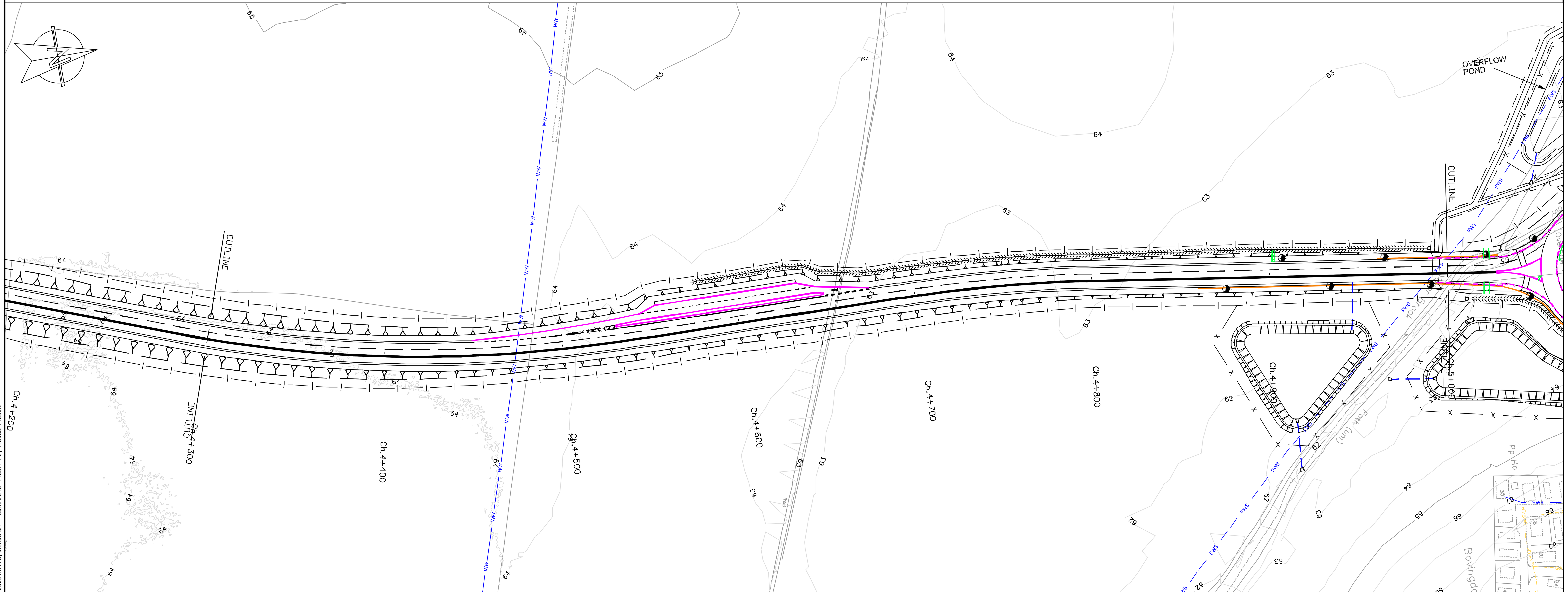
Balfour Beatty · Herefordshire Council · Working for Herefordshire · Growth Deals · The Marches Local Enterprise Partnership · Skylon Park · wsp

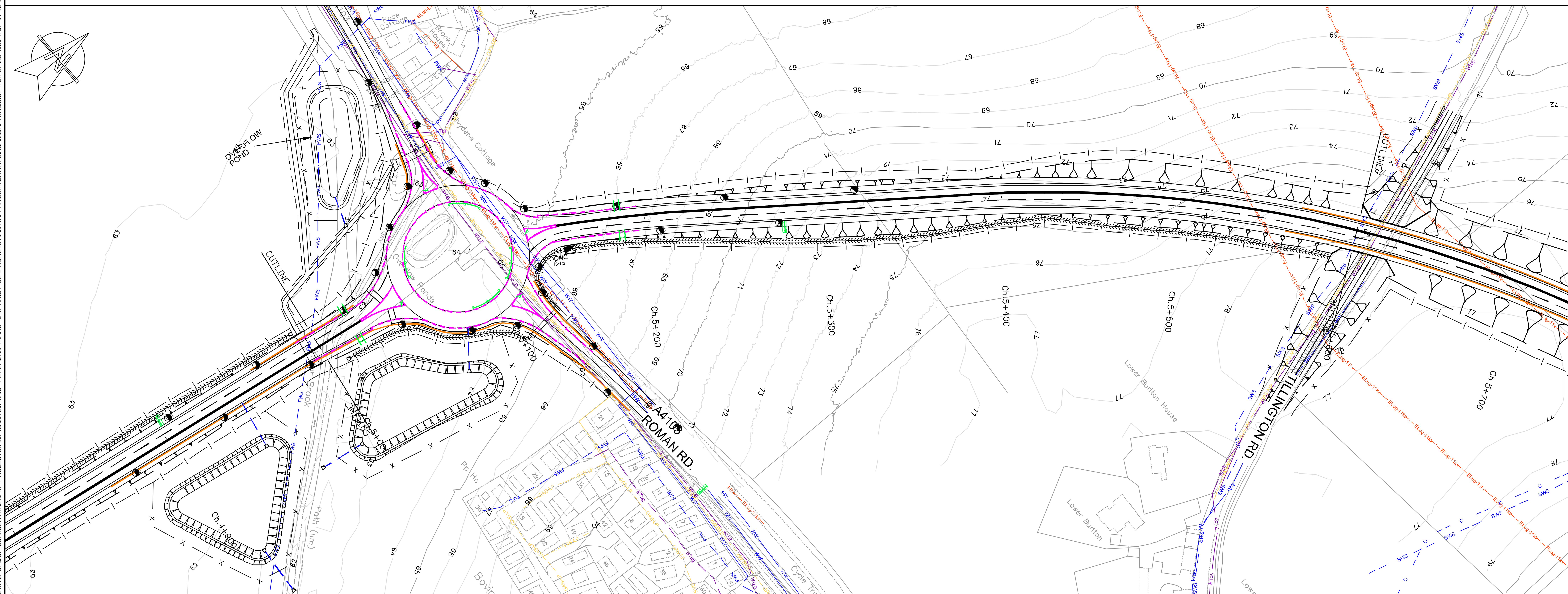
SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 5 - OLIVE Ch.2+800 TO Ch.4+300

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP	DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-28-DR-HE-05001 REV: P05





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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE – PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: S0 - WORK IN PROGRESS

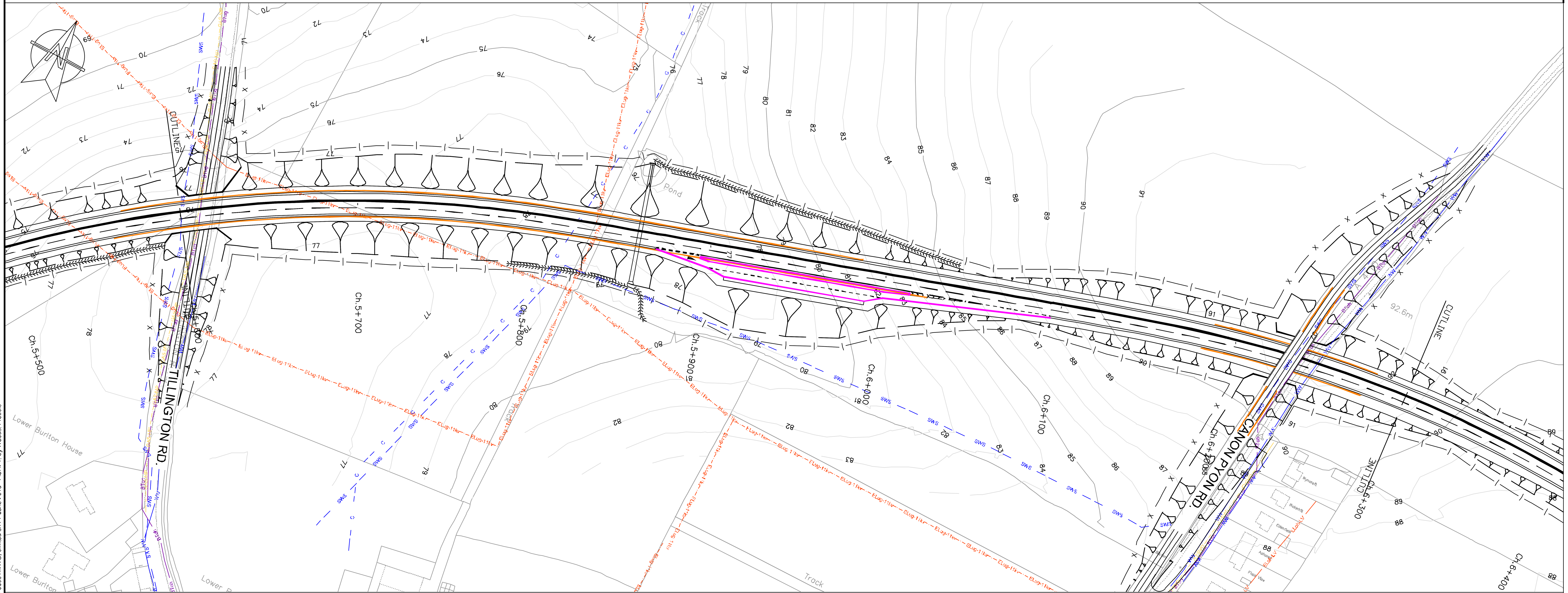
Balfour Beatty | Herefordshire Council | Working for Herefordshire

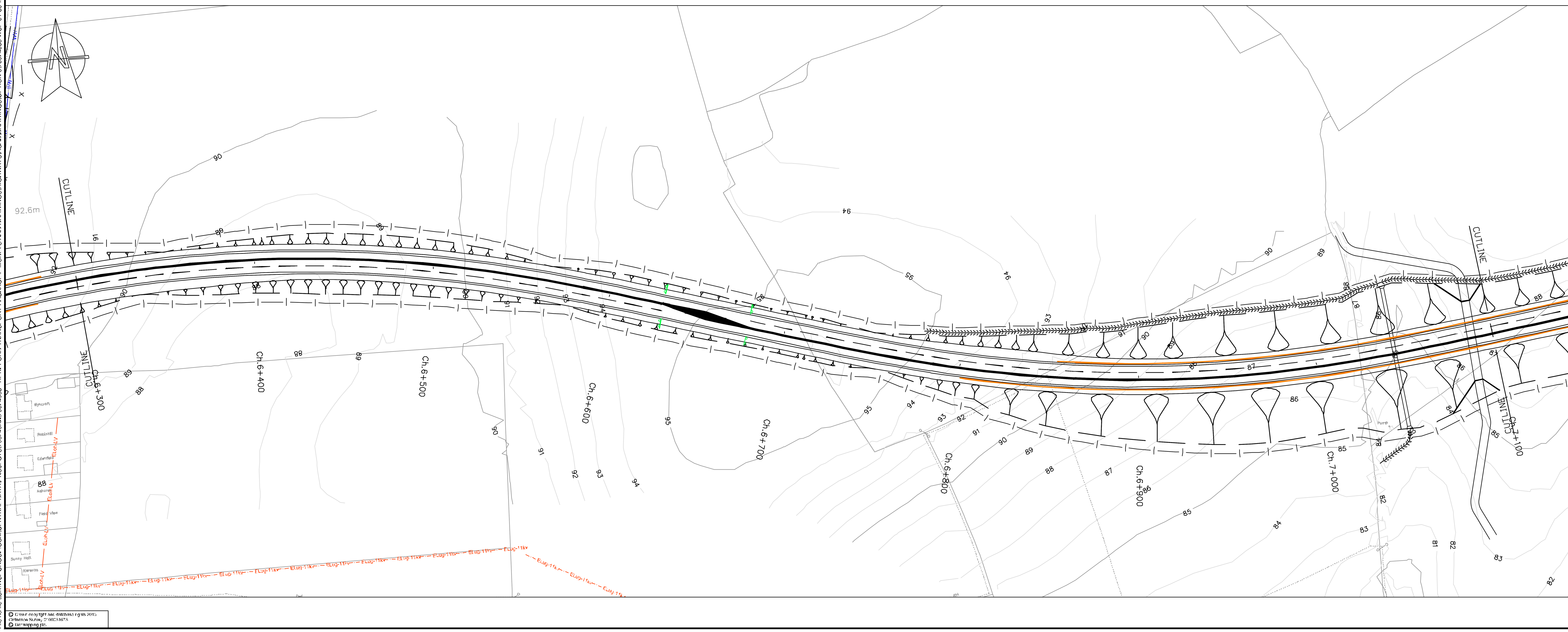
SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 5 - OLIVE Ch.4+300 TO Ch.5+600

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP	DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-43-DR-HE-05001 REV: P05





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DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
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DRAWING STATUS: S0 - WORK IN PROGRESS

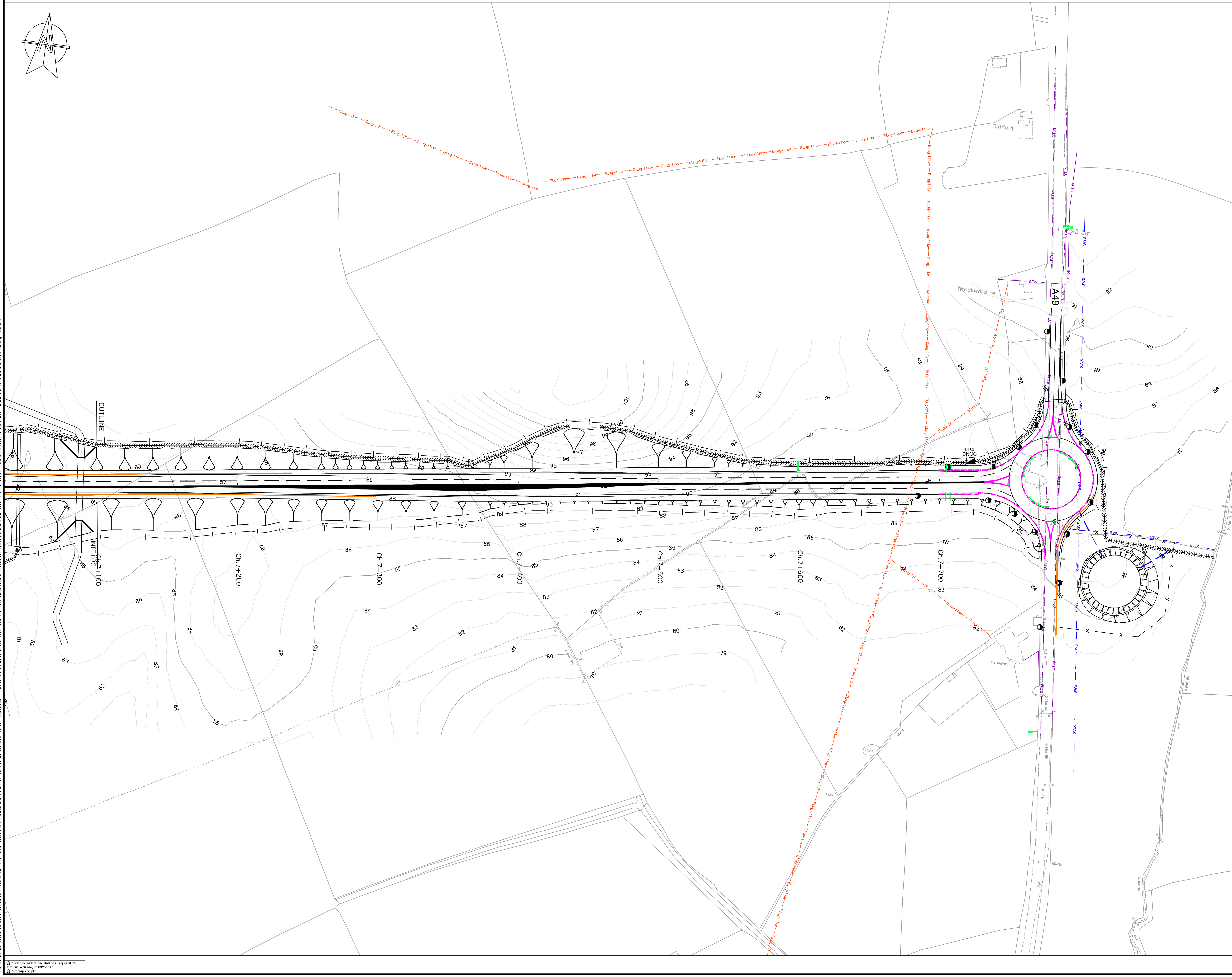
Balfour Beatty | Herefordshire Council | Working for Herefordshire | Growth Deals | The Marches Local Enterprise Partnership | Skylon Park | wsp

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 5 - OLIVE Ch.5+600 TO Ch.7+100

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP / DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-56-DR-HE-05001 | REV: P05



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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE – PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.	RT	MG

DRAWING STATUS:

S0 - WORK IN PROGRESS

Balfour Beatty · Herefordshire Council · Working for Herefordshire · Growth Deals · The Marches Local Enterprise Partnership · Hereford 2020 · Skylon Park · WSP

SITE/PROJECT:

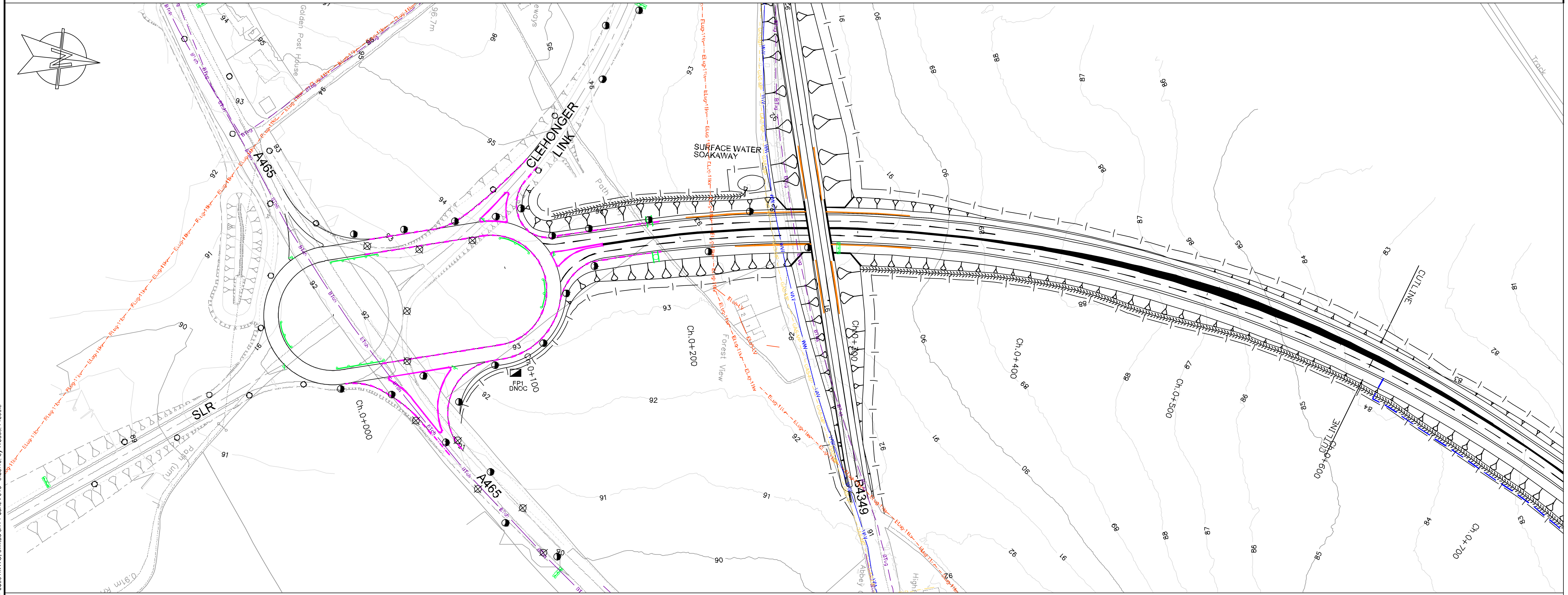
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

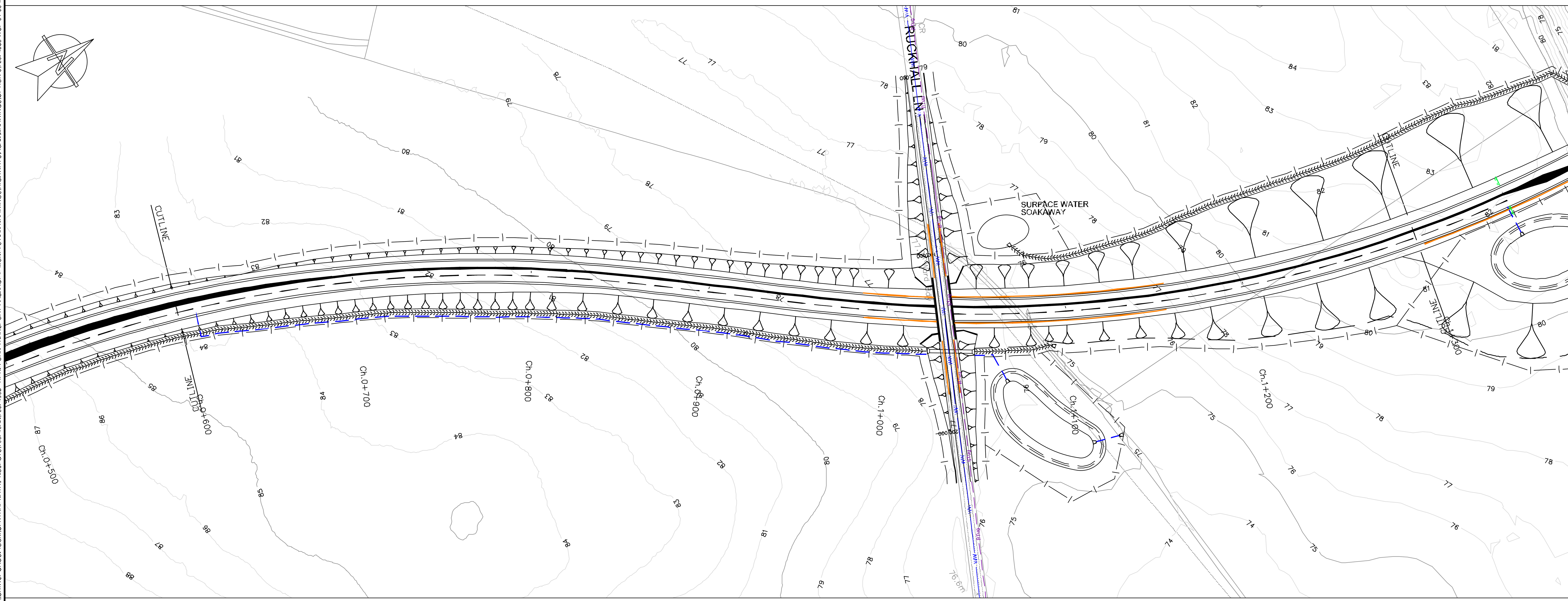
TITLE:

ROUTE OPTION 5 - OLIVE
Ch.7+100 TO Ch.7+775

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-71-DR-HE-05001 — REV: P05





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5. LOCALISED HIGHWAY FEATURES E.G. MAINTENANCE HARDSTANDING & ACCESS POINTS NOT SHOWN
6. PRELIMINARY DESIGN ATTENUATION PONDS SIZE AND LOCATION SUBJECT TO HYDRAULIC MODELLING
7. ENVIRONMENTAL MITIGATION NOT SHOWN
8. PRELIMINARY DESIGN STRUCTURES SUBJECT TO STRUCTURAL REVIEW.
9. PRELIMINARY DESIGN JUNCTIONS (SUBJECT TO TRAFFIC PERFORMANCE CONFIRMATION)
10. PRELIMINARY DESIGN FENCELINE ASSUMES 5M TOE-OF-E/WKS MAINTENANCE STRIP
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14. PRELIMINARY DESIGN SIGNAGE LOCATIONS SUBJECT TO REVIEW.
15. PRELIMINARY DESIGN LIGHTING SUBJECT TO REVIEW.
16. PRELIMINARY DESIGN VRS SUBJECT TO ROAD RESTRAINT RISK ASSESSMENT PROCEDURE.

KEY

- EXISTING DETAIL
- PROPOSED DETAIL
- HIGHWAYS BOUNDARY FENCE
- STOCKPROOF FENCE
- WATER COURSE DIVERSION
- CARRIER DRAIN
- FILTER DRAIN
- CUT-OFF DITCH
- STRUCTURE
- CULVERT
- ATTENUATION POND
- WS2+1 MARKING
- SIGNAGE - ADS
- SIGNAGE - CHANGEOVER
- SIGNAGE - REGULATORY
- SIGNAGE - CHEVRON
- COMBINED KERB DRAINAGE
- KERBING
- VEHICLE RESTRAINT SYSTEM
- LIGHTING COLUMN
- EXISTING LIGHTING COLUMN TO RETAIN
- EXISTING LIGHTING COLUMN TO REMOVE
- LIGHTING FEEDER PILLAR
- HEADWALL

REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: DRAFT

Balfour Beatty — Herefordshire Council — Working for Herefordshire

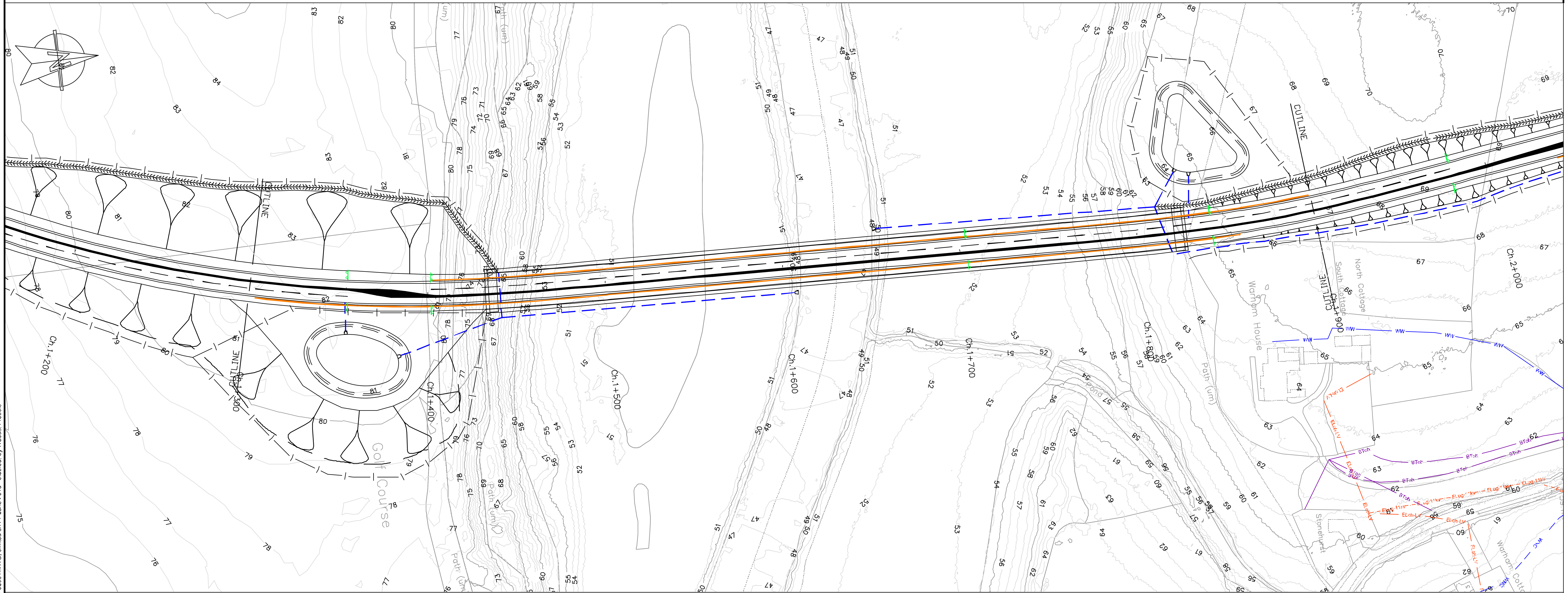
GROWTH DEALS — The Marches Local Enterprise Partnership — SKYLON PARK — wsp

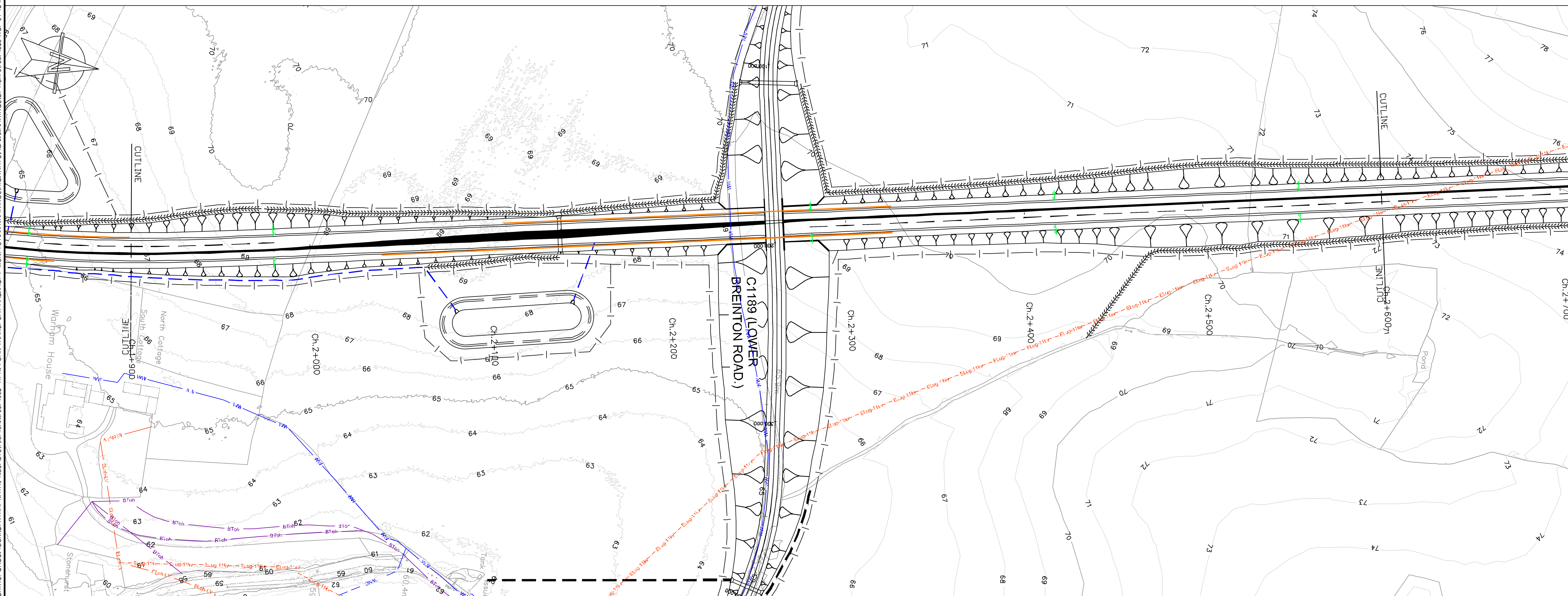
SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 6 - BLACK 1 Ch.0+000 TO Ch.1+300

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP / DRAWN: FW	DATE: May '8

DRAWING No: 70024065-WSP-01-00-DR-HE-06001 | REV: P05





DO NOT SCALE

NOTES
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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS:
DRAFT

Balfour Beatty — Herefordshire Council — Working for Herefordshire — Growth Deals — The Marches Local Enterprise Partnership — Skylon Park — WSP

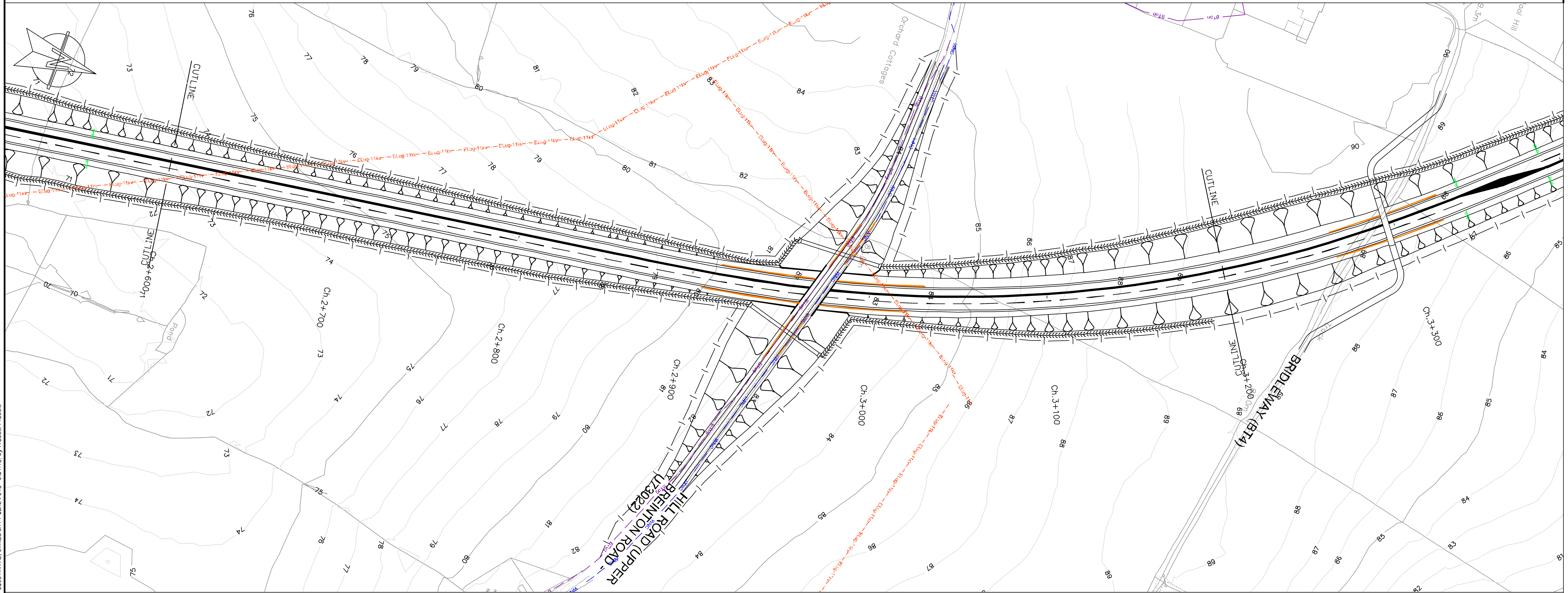
SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

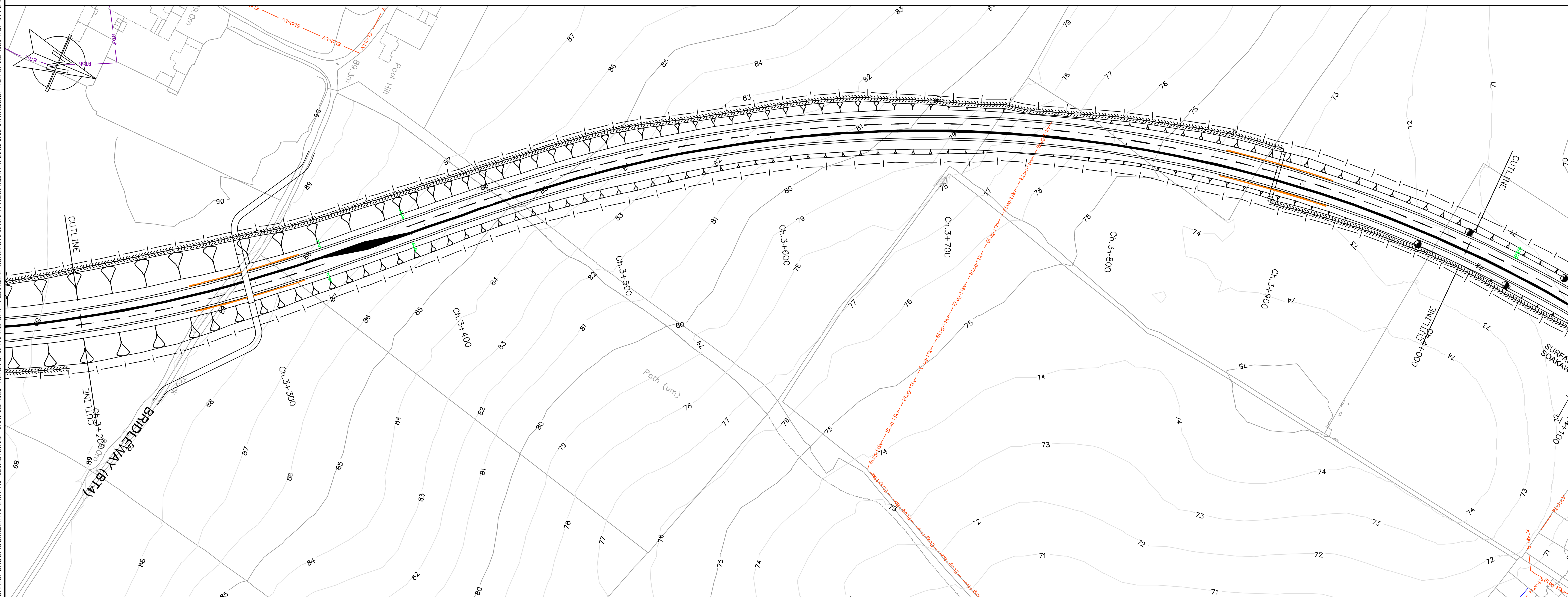
TITLE:
ROUTE OPTION 6 - BLACK 1
Ch.1+300 TO Ch.2+600

SCALE @ A1:	CHECKED:	APPROVED:
1:1250	RT	MG

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70024065	PP	FW	February 18

DRAWING No:	REV:
70024065-WSP-01-13-DR-HE-06001	P05





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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: DRAFT

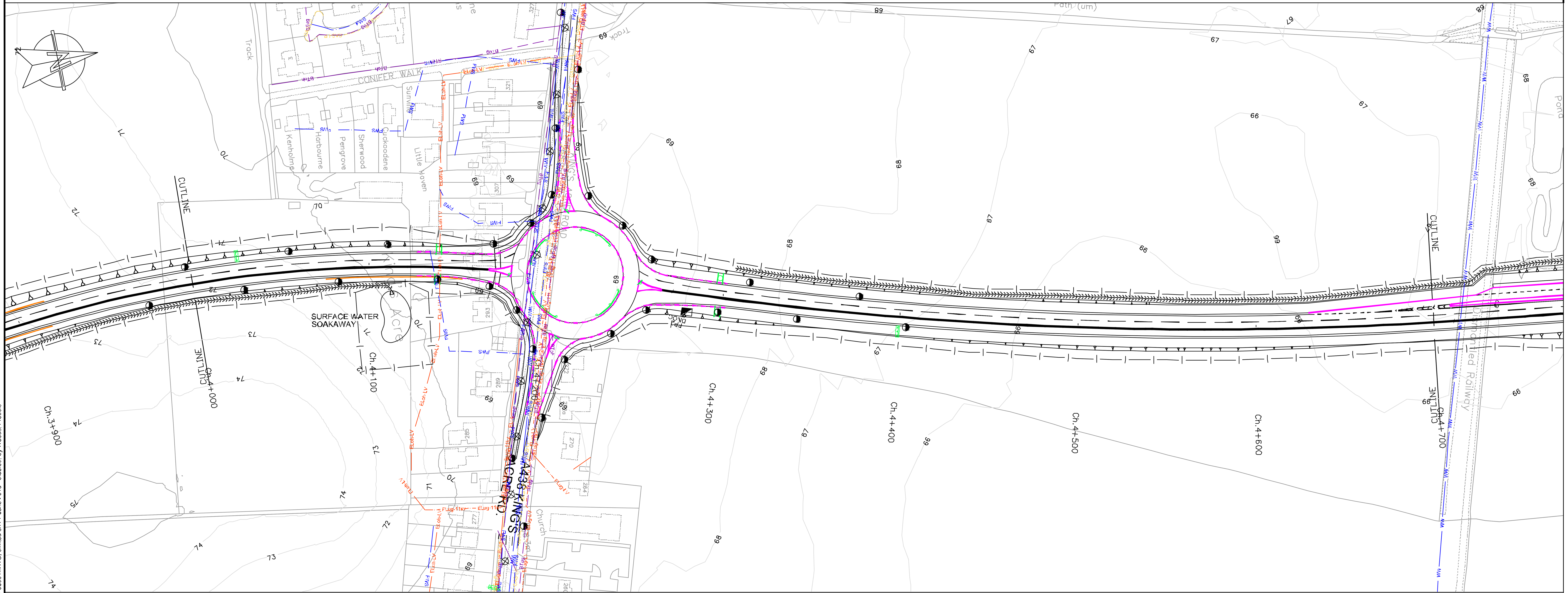
Balfour Beatty | Herefordshire Council | Working for Herefordshire | GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | wsp

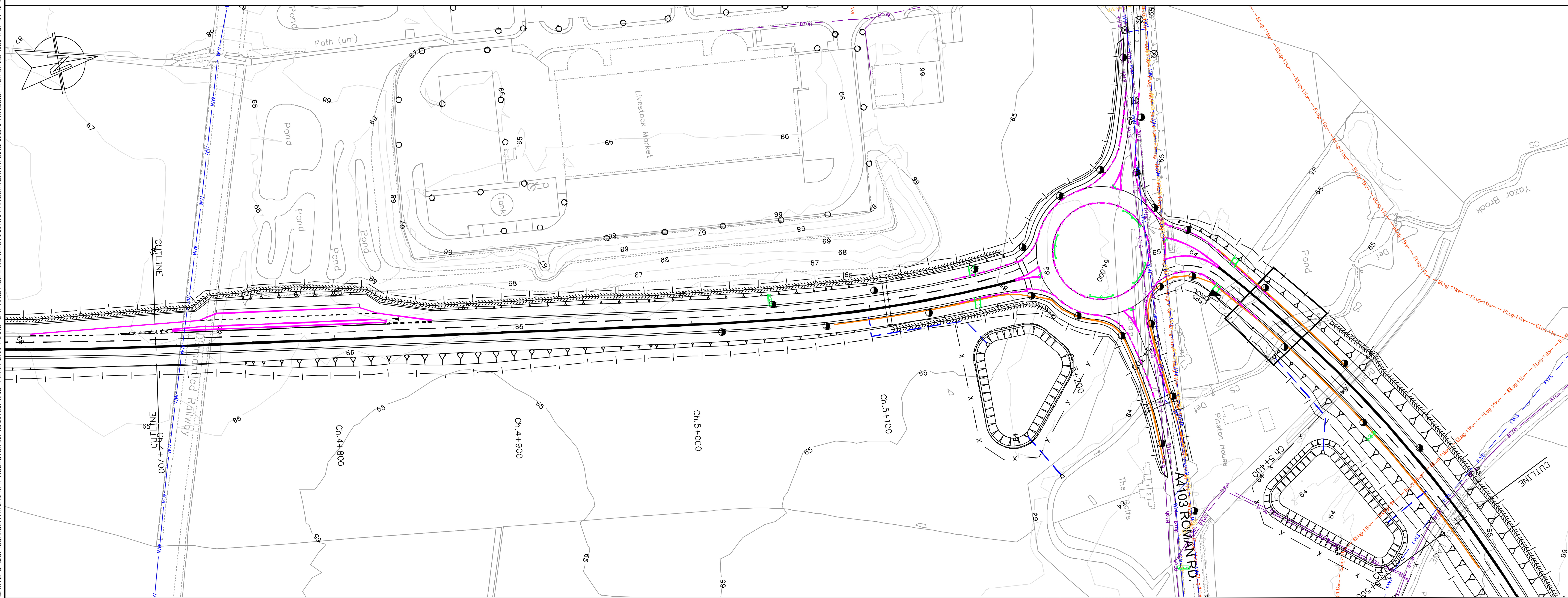
SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 6 - BLACK 1 Ch.2+600 TO Ch.4+000

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: February 18

DRAWING No: 70024065-WSP-01-26-DR-HE-06001 REV: P05





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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE – PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.	RT	MG

DRAWING STATUS: DRAFT

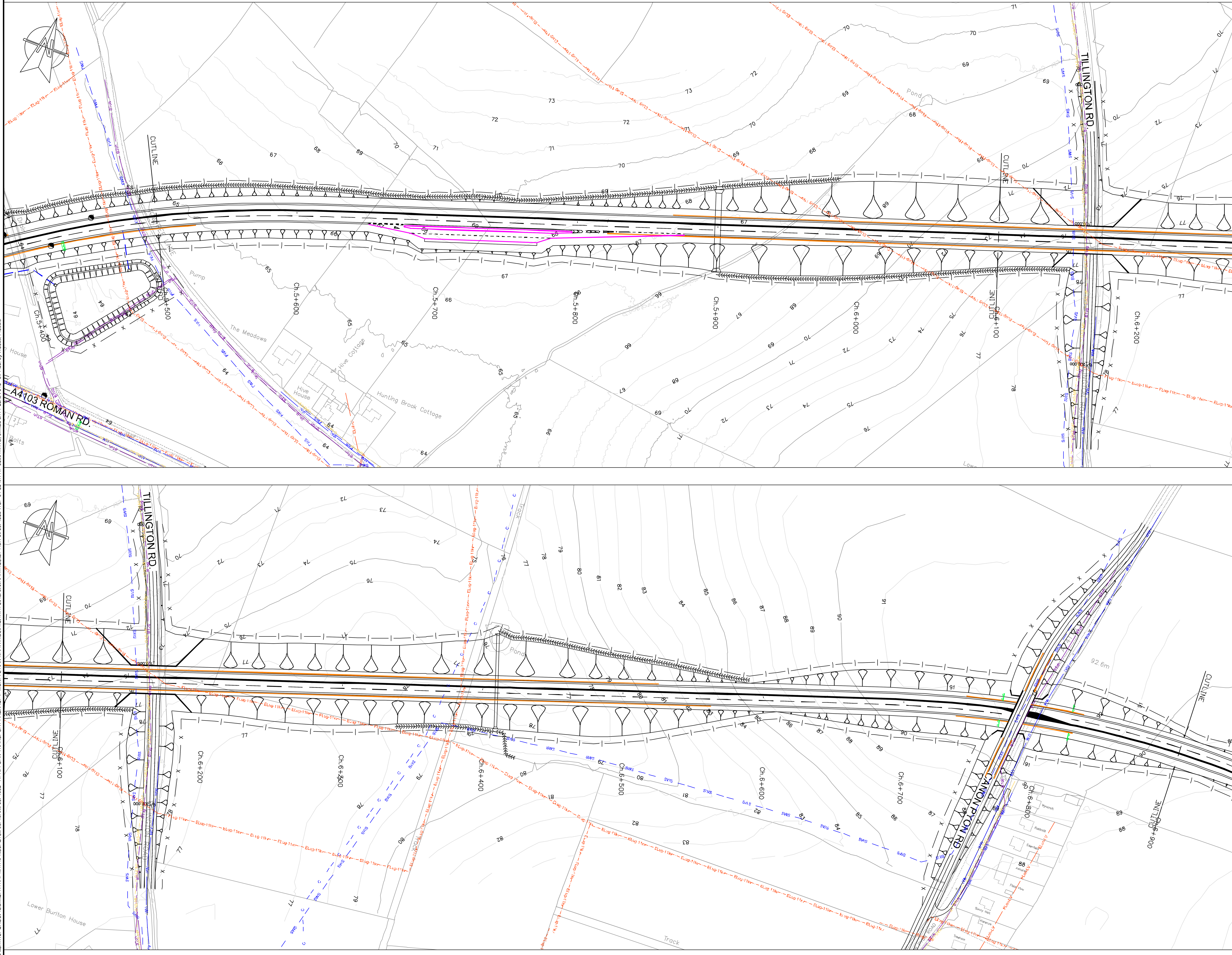
Balfour Beatty · Herefordshire Council · Working for Herefordshire · Growth Deals · The Marches Local Enterprise Partnership · Skylon Park · wsp

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE: ROUTE OPTION 6 - BLACK 1
Ch.4+000 TO Ch.5+500

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP	DRAWN: FW	DATE: February 18

DRAWING No: 70024065-WSP-01-40-DR-HE-06001 REV: P05



DO NOT SCALE

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- CULVERT
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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

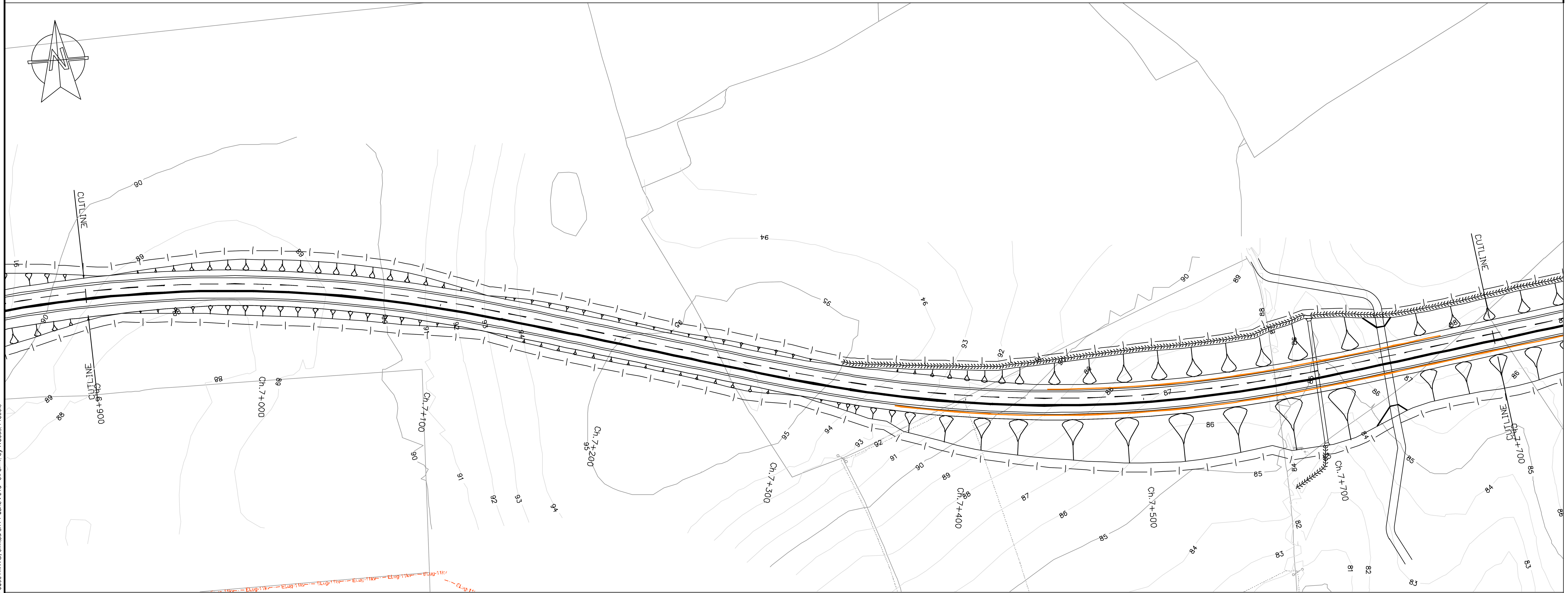
DRAWING STATUS: DRAFT

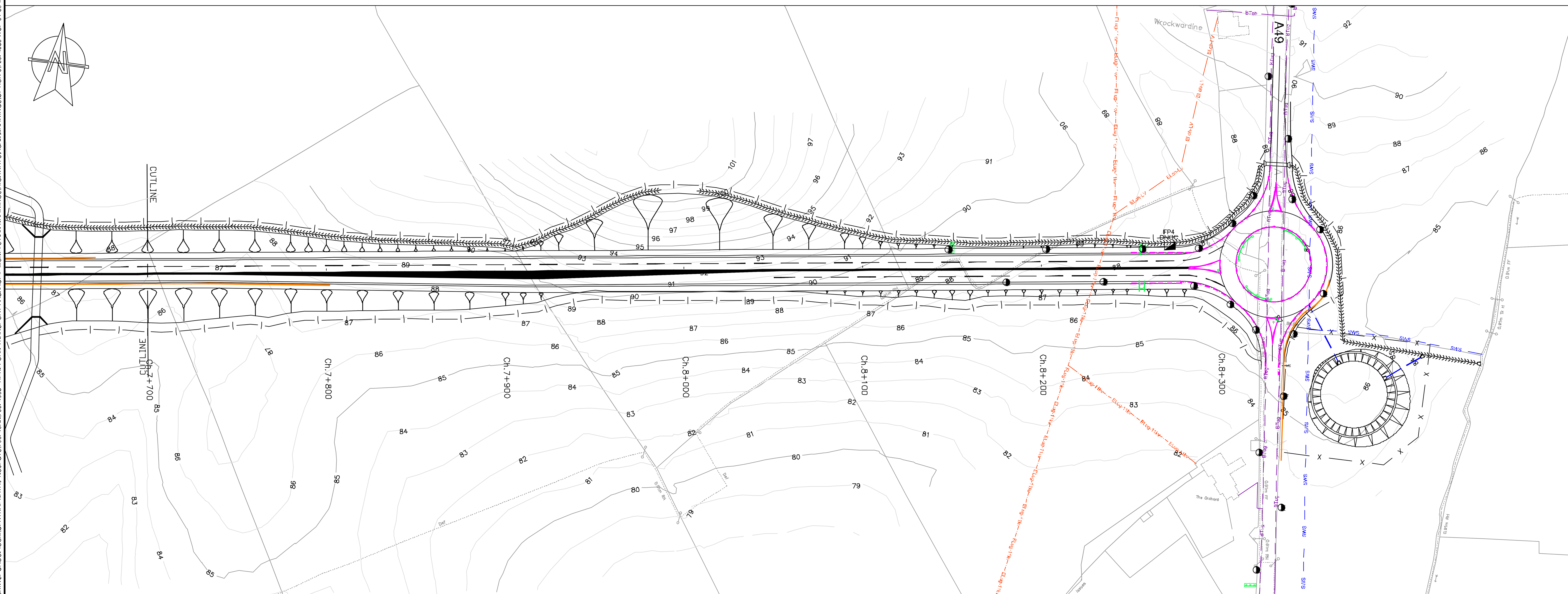
SITE/PROJECT: HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE: ROUTE OPTION 6 - BLACK 1
Ch.5+500 TO Ch.6+900

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: May '18

DRAWING No: 70024065-WSP-01-55-DR-HE-06001 REV: P05





DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	08/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: DRAFT

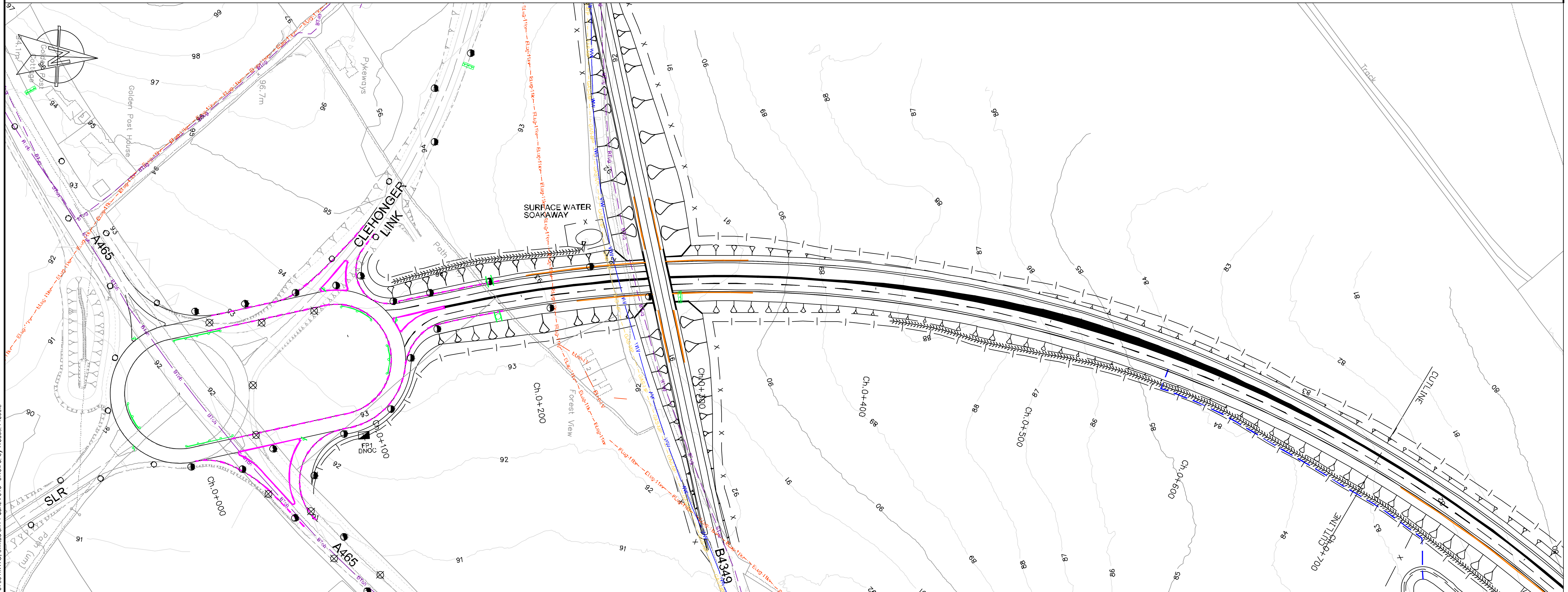
Balfour Beatty · Herefordshire Council · Working for Herefordshire · GROWTH DEALS · The Marches Local Enterprise Partnership · SKYLON PARK · wsp

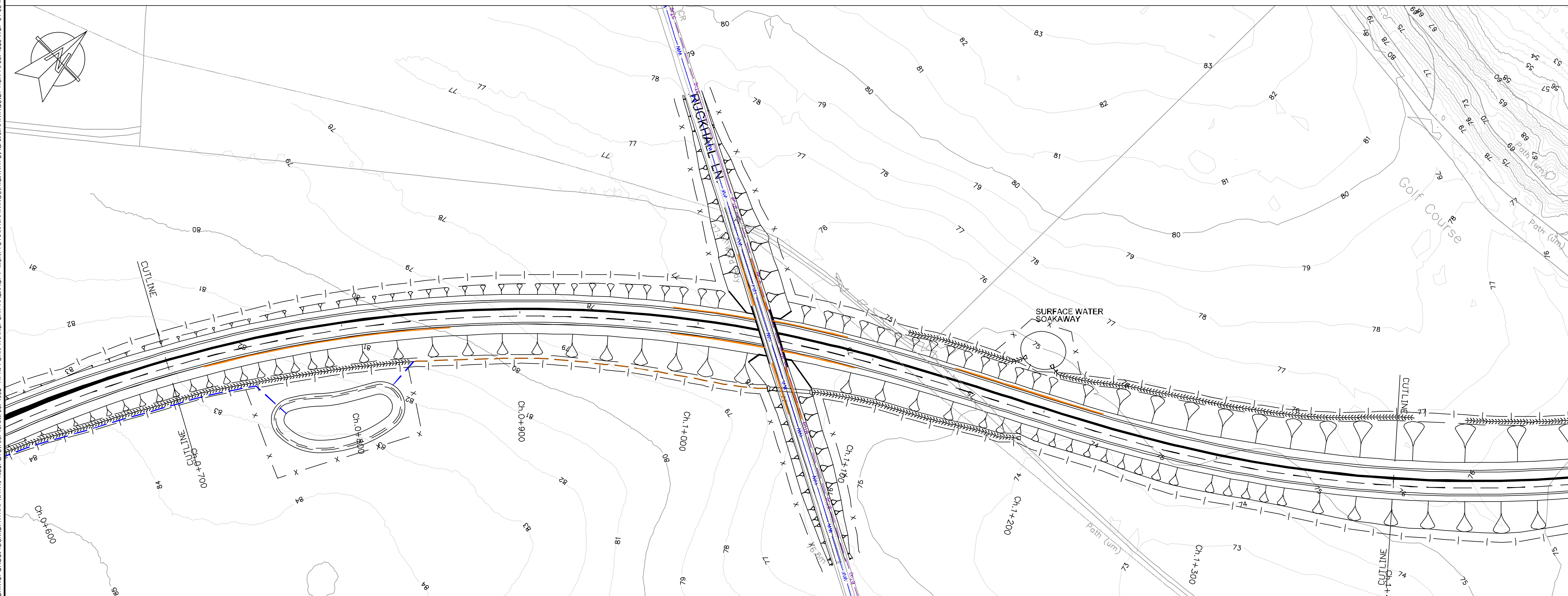
SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 6 - BLACK 1 Ch.6+900 TO Ch.8+330

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP / DRAWN: FW	DATE: May '18

DRAWING No: 70024065-WSP-01-69-DR-HE-06001 REV: P05





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REV	DATE	BY	DESCRIPTION	CHK	APP
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DRAWING STATUS: DRAFT

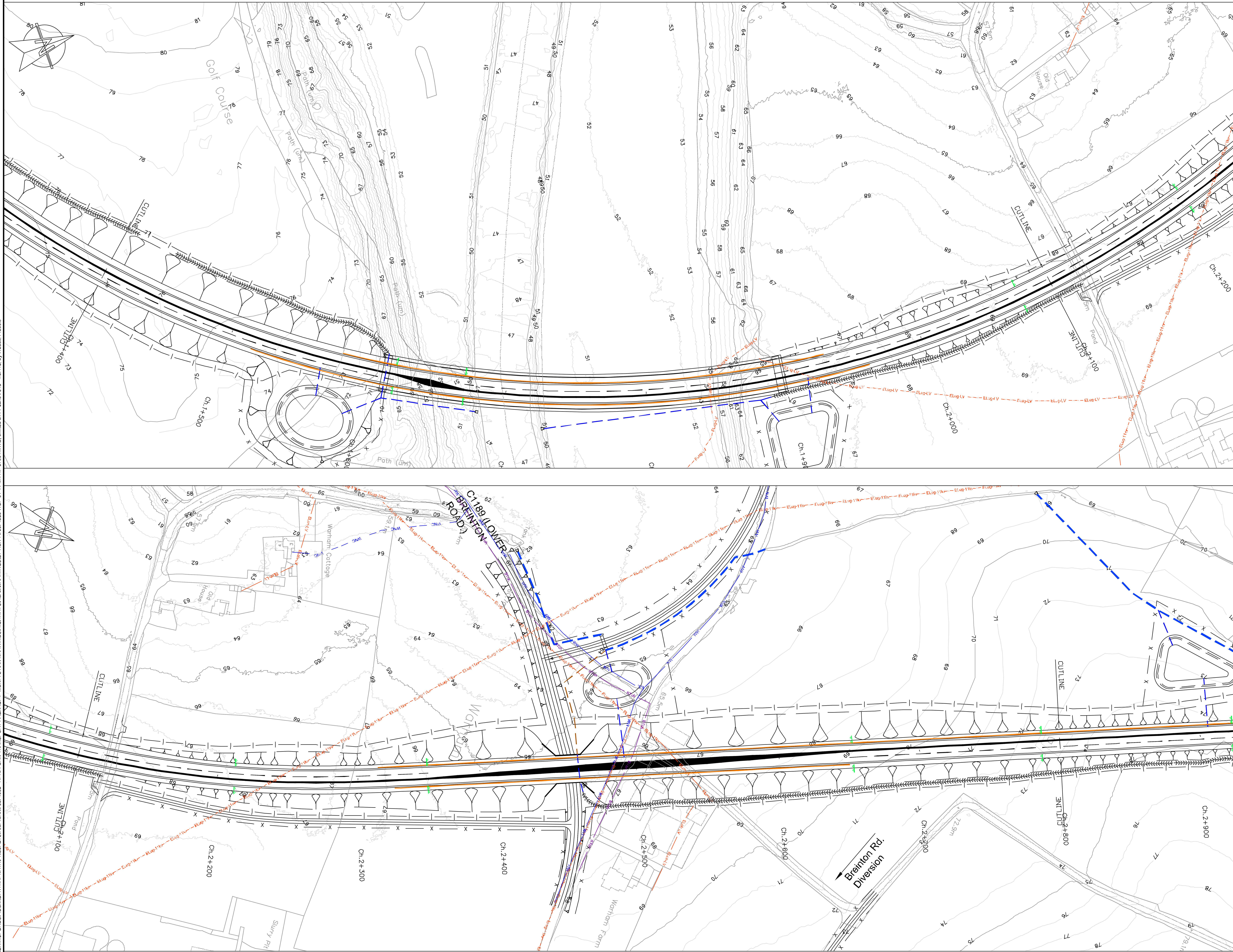
Balfour Beatty | Herefordshire Council | Working for Herefordshire | GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | wsp

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 7 - BLACK 2 Ch.0+000 TO Ch.1+400

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP / DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-07-00-DR-HE-07001 REV: P05



DO NOT SCALE

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- PROPOSED DETAIL
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- STOCKPROOF FENCE
- WATER COURSE DIVERSION
- CARRIER DRAIN
- FILTER DRAIN
- CUT-OFF DITCH
- STRUCTURE
- CULVERT
- ATTENUATION POND
- WS2+1 MARKING
- SIGNAGE - ADS
- SIGNAGE - CHANGEOVER
- SIGNAGE - REGULATORY
- SIGNAGE - CHEVRON
- COMBINED KERB DRAINAGE
- KERBING
- VEHICLE RESTRAINT SYSTEM
- LIGHTING COLUMN
- EXISTING LIGHTING COLUMN TO RETAIN
- EXISTING LIGHTING COLUMN TO REMOVE
- LIGHTING FEEDER PILLAR
- HEADWALL

REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.	RT	MG

DRAWING STATUS: DRAFT

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 7 - BLACK 2 Ch.1+400 TO Ch.2+800

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT No: 70024065	DESIGNED: PP	DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-14-DR-HE-07001 REV: P05

DO NOT SCALE

NOTES
1. OS 2D MASTERMAP (2012)
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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: DRAFT

Balfour Beatty | Herefordshire Council
Working for Herefordshire
GROWTH DEALS | The Marches Local Enterprise Partnership | SKYLON PARK | wsp

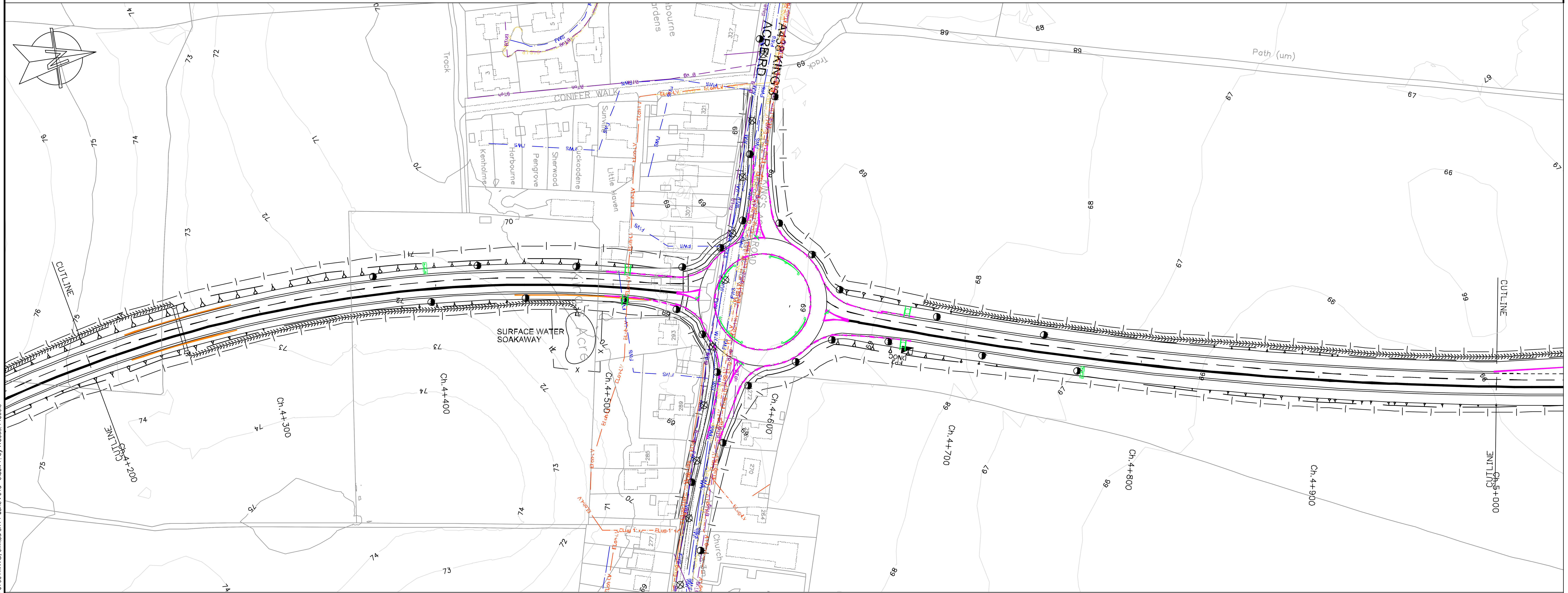
SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

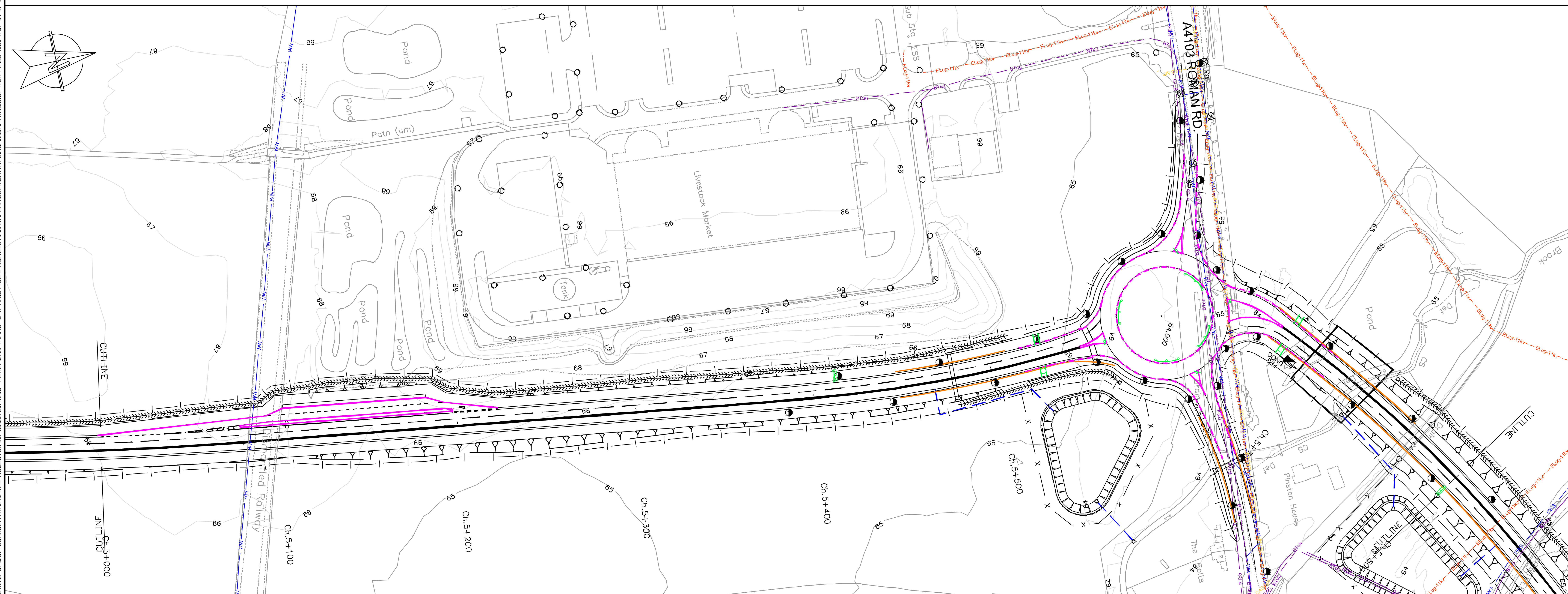
TITLE:
ROUTE OPTION 7 - BLACK 2
Ch.2+800 TO Ch.4+200

SCALE @ A1:	CHECKED:	APPROVED:
1:1250	RT	MG

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70024065	PP	FW	March 18

DRAWING NO: 70024065-WSP-01-28-DR-HE-07001 REV: P05





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DRAWING STATUS: DRAFT

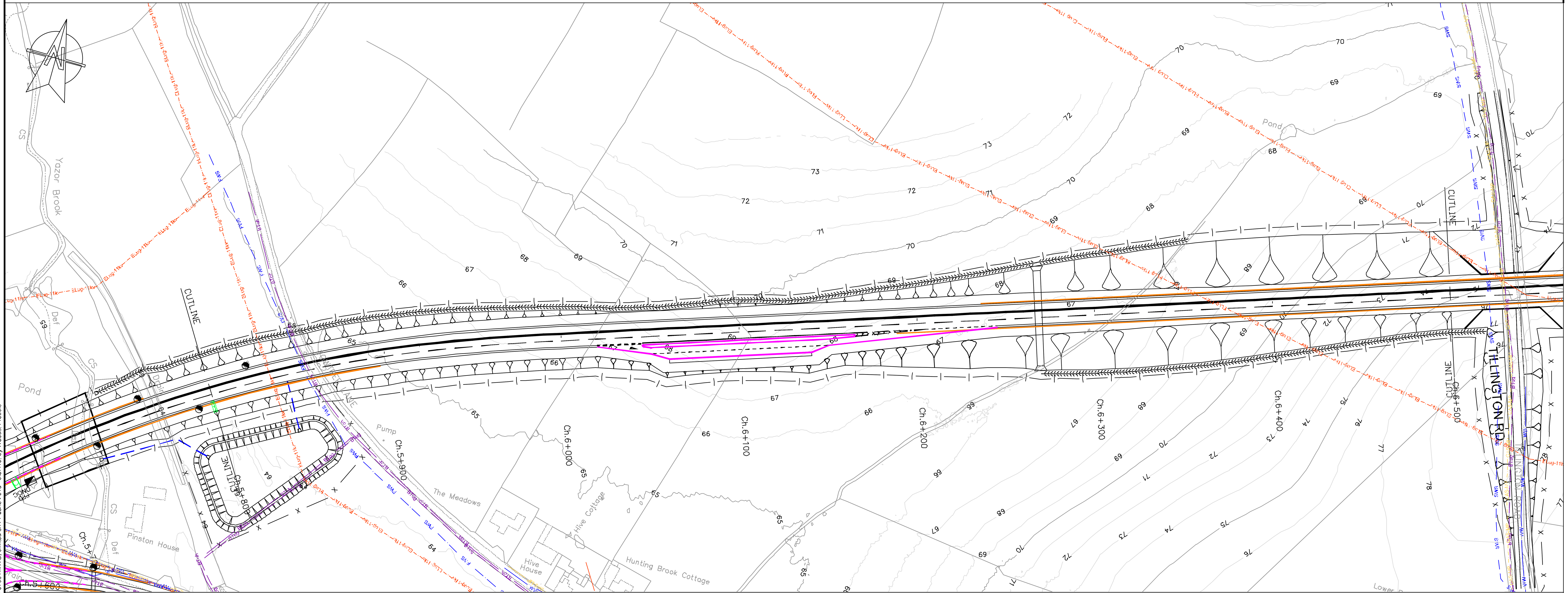
SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

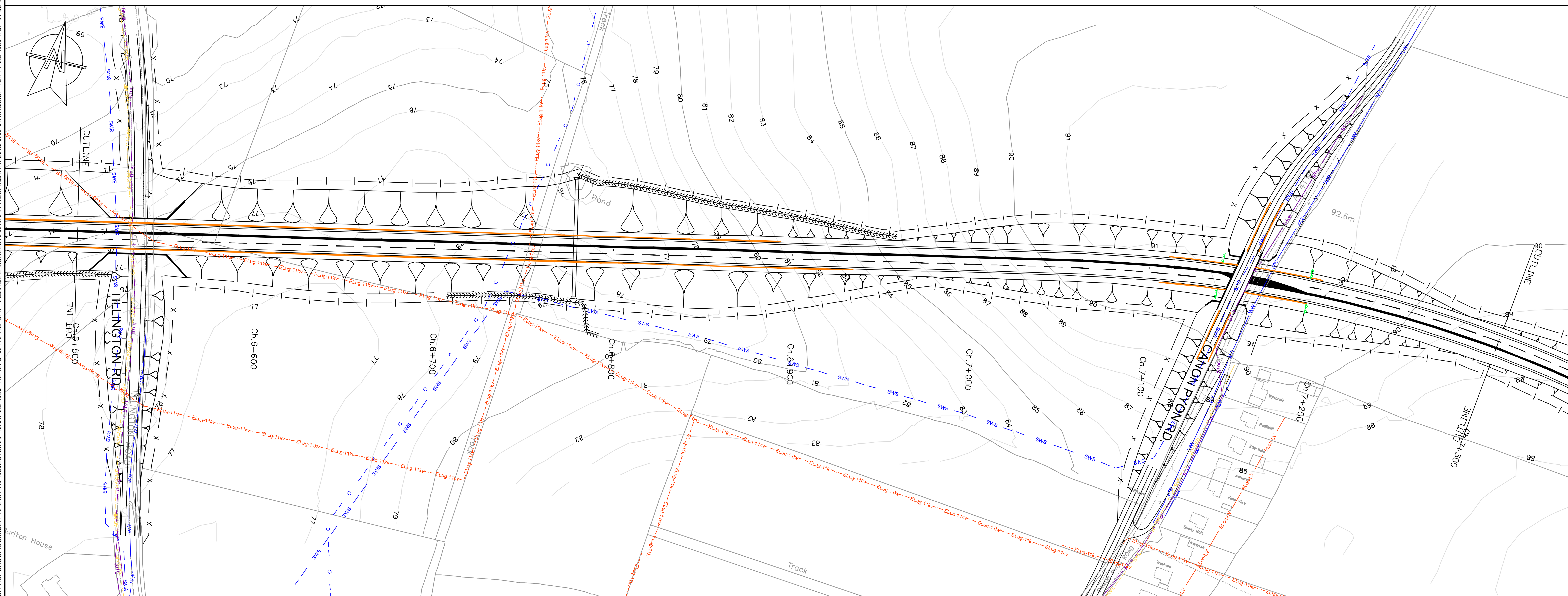
TITLE: ROUTE OPTION 7 - BLACK 2 Ch.4+200 TO Ch.5+800

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP	DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-42-DR-HE-07001 REV: P05

DO NOT SCALE





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P05	08/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: DRAFT

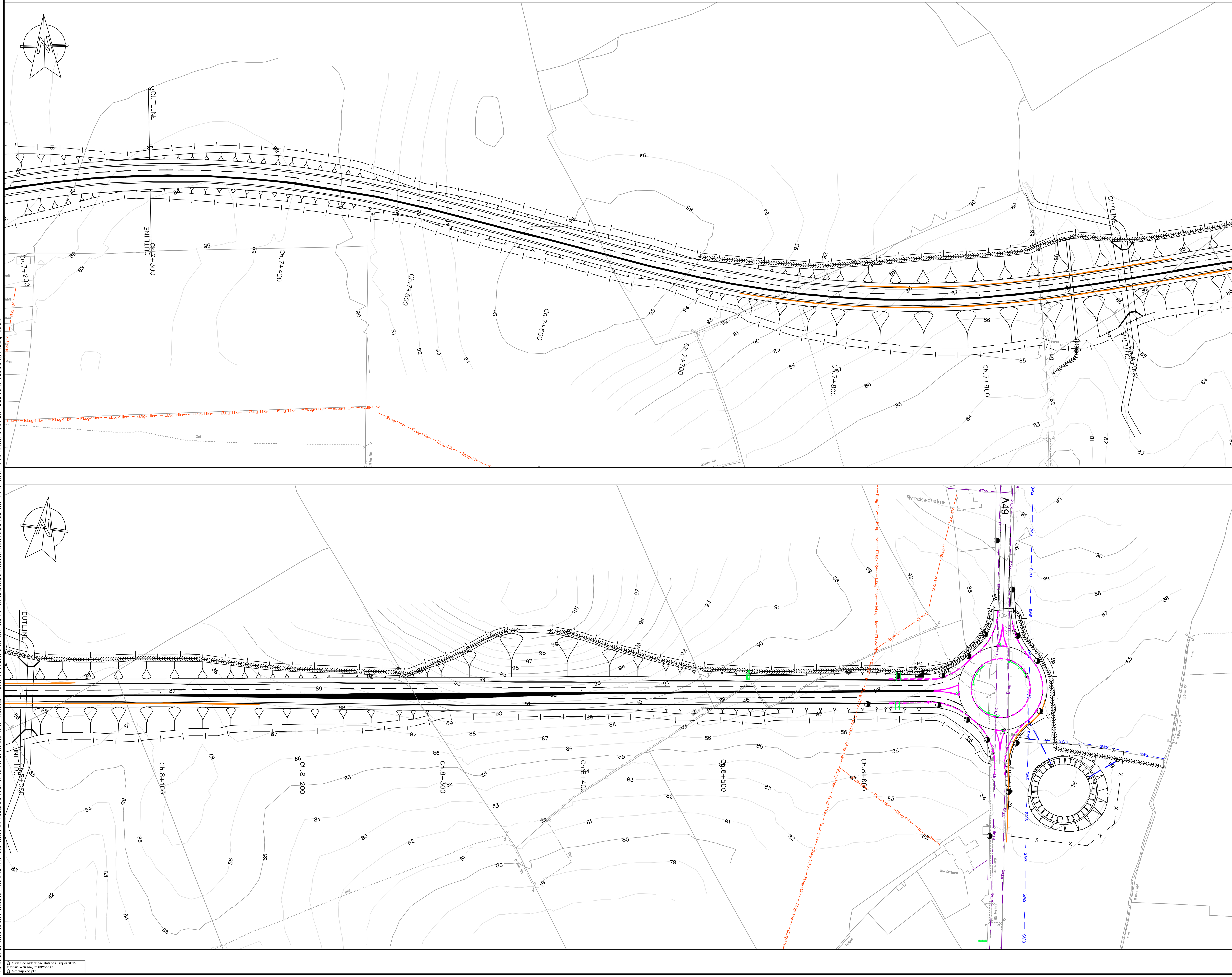
Balfour Beatty · Herefordshire Council · Working for Herefordshire · GROWTH DEALS · The Marches Local Enterprise Partnership · SKYLON PARK · wsp

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE HEREFORD BYPASS

TITLE: ROUTE OPTION 7 - BLACK 2 Ch.5+800 TO Ch.7+300

SCALE @ A1: 1:1250	CHECKED: RT	APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP	DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-58-DR-HE-07001 | REV: P05



DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
P05	06/02/2018	PP	FIFTH ISSUE - PRELIMINARY SIGNAGE, LIGHTING, KERBS AND VRS ADDED, DRAINAGE AND FENCELINES UPDATED.		

DRAWING STATUS: DRAFT

SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

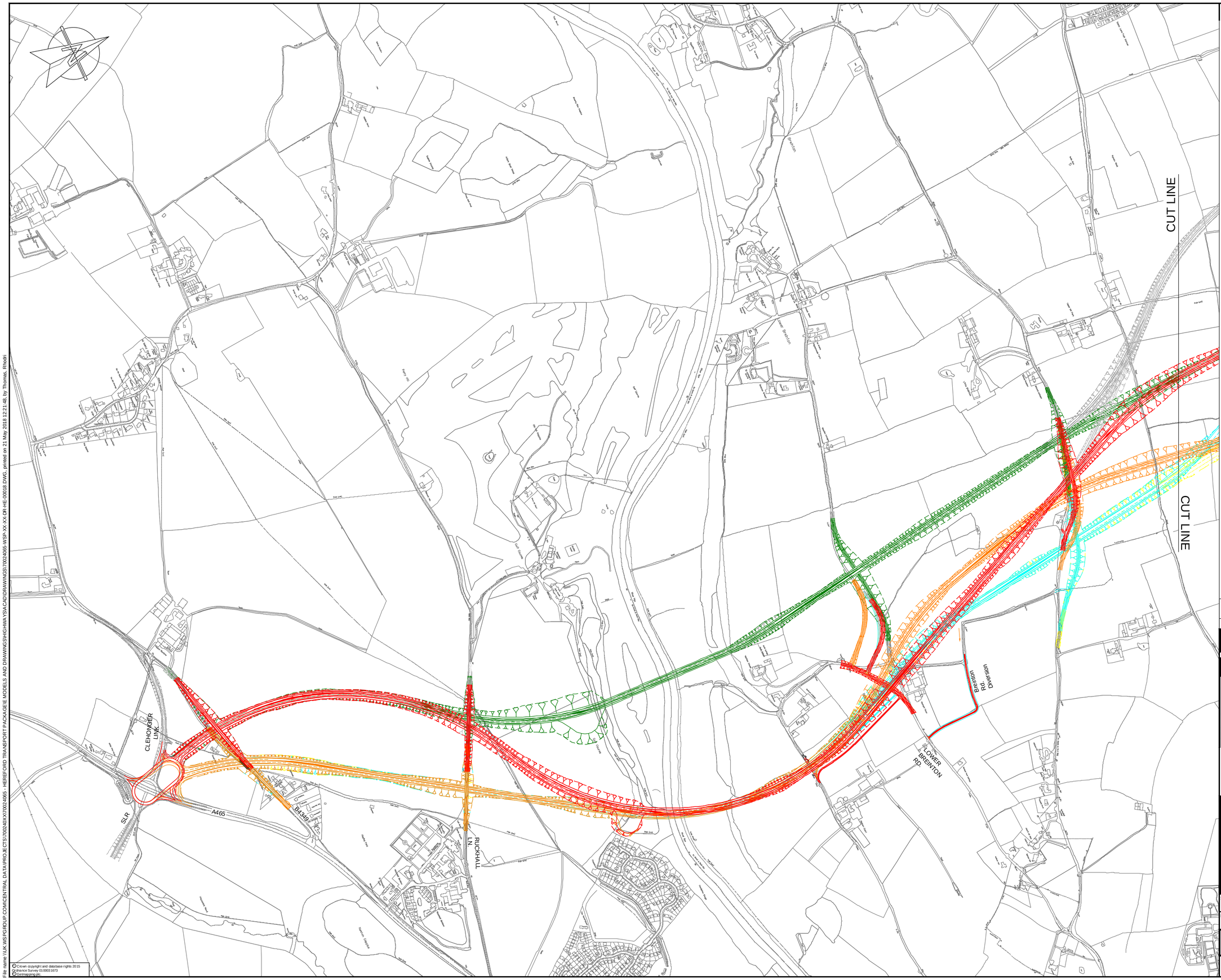
TITLE:
ROUTE OPTION 7 - BLACK 2
Ch.7+300 TO Ch.8+700

SCALE @ A1: 1:1250	CHECKED: RT		APPROVED: MG
PROJECT NO: 70024065	DESIGNED: PP	DRAWN: FW	DATE: March 18

DRAWING No: 70024065-WSP-01-73-DR-HE-07001 — REV: P05

Appendix E

ROUTE COMPOSITE PLANS



DO NOT SCALE

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KEY

- CORRIDOR 1
- CORRIDOR 2
- CORRIDOR 3
- CORRIDOR 4
- CORRIDOR 5
- CORRIDOR 6
- CORRIDOR 7

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/04/2018	FW	FIRST ISSUE	RT	RT

DRAWING STATUS: S0 - WORK IN PROGRESS

Balfour Beatty | Herefordshire Council | Working for Herefordshire | Growth Deals | The Marches Local Enterprise Partnership | Skylon Park | wsp

SITE/PROJECT: HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE: CORRIDOR COMPOSITE PLAN
SHEET 1 OF 2

SCALE @ A1:	CHECKED:		APPROVED:
1:5,000	RT		RT
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70024065	FW	FW	May 18

DRAWING No: 70024065-WSP-XX-XX-DR-HE-00018 REV: P01

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CUT LINE

CUT LINE

A438 KINGS ACRE RD.

A4103 ROMAN RD.

TILLINGTON RD.

CANON PYON RD.

A49

DO NOT SCALE

NOTES

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- CORRIDOR 3
- CORRIDOR 4
- CORRIDOR 5
- CORRIDOR 6
- CORRIDOR 7

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/04/2018	FW	FIRST ISSUE	RT	RT

DRAWING STATUS: S0 - WORK IN PROGRESS

Balfour Beatty · Herefordshire Council · Working for Herefordshire · GROWTH DEALS · The Marches Local Enterprise Partnership · Herefordshire · Shropshire · Telford & Wrekin · SKYLON PARK · wsp

SITE/PROJECT:
HEREFORD TRANSPORT PACKAGE
HEREFORD BYPASS

TITLE:
CORRIDOR COMPOSITE PLAN
SHEET 2 OF 2

SCALE @ A1:	CHECKED:	APPROVED:
1:5,000	RT	RT

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70024065	FW	FW	May 18

DRAWING No: 70024065-WSP-XX-XX-DR-HE-00019 REV: P01

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Appendix F

ROUTE OPTIONS SUMMARY COST ESTIMATES

PROCESS AND ASSUMPTIONS

The design of the proposed route corridor options are ONLY at the very early preliminary stage and so not all elements of the proposed route options have been designed in full and a number of assumptions have been made regarding the details of the scheme. These will be designed in full at the next Stage of development of the Preferred Route

The methodology applied in preparing the cost estimates is consistent with that required for this stage of development of a major highway scheme. Bills of Quantities have been prepared using the design model for each option and then rates applied against the quantities. A number of percentages have been applied for overheads, preliminaries, preparation and supervision costs etc. and the explanation of those has been detailed below.

Optimism Bias has been applied in accordance with the HM Treasury Green Book

Land costs based on land costs currently being used for the Southern Link Road.

The quantities used in the preparation of the cost estimates have been compiled using the drawings shown in Appendix D in the SAR2 document

The rates used in preparing the cost estimates are from SPON'S CIVIL ENGINEERING AND HIGHWAY PRICE BOOK 2018 or historic rates deemed to be appropriate for the size and nature of the scheme;

Cost estimates are at today's prices

All excavated material is suitable to be used as fill material within the scheme;

Construction depth of the road pavement is no more than 600 mm;

No allowance has been made for the treatment and removal of contaminated/hazardous material, such as ASBESTOS in any part of this estimate;

Landfill taxes have been applied to the unacceptable / surplus earthworks material being tipped off site;

Overheads are not included within the SPONS rates (as stated in Part 1, p51 SPONS). The percentage applied in the cost estimate covers estimating and commercial management, planning and design, purchasing, surveying, insurance, wages and bonuses and site safety. SPONS recommends a percentage of 5% to 10% onto net turnover. ***An assumed 5% has been applied;***

The level of profit is governed by the degree of competition, but SPONS recommends an addition of 5% to 15% onto net turnover. ***An assumed 10% has been applied*** ;

In relation to Preliminaries; where no detailed information is available, SPONS recommends that when preparing a preliminary estimate an addition of between 15% and 35% of net estimated value is made to cover contractor's oncosts, both time and non-time related. ***An assumed 25% has been applied*** ;

The Statutory Undertaker's percentage has been assessed based upon a prorata of the estimate allowed for within the Southern Link Road;

The percentage allowed for land costs and associated fees has been assessed upon a prorata of the length estimate based upon the estimated costs allowed for within the Southern Link Road;

Preparation costs (design, procurement etc. (DMRB Volume 13, part 2, chapter 7, 7.3) recommends a figure of 12% be used for the preparation costs. **An assumed 12% has been applied;**

Construction supervision costs (DMRB Volume 13, part 2, chapter 7, 7.4) recommends a figure of 5% be used for the construction supervision costs. **An assumed 5% has been applied;**

An ***Optimism Bias of 32%*** had been applied using guidance and calculations as specified within the HM Treasury The Green Book - Central Government Guidance On Appraisal And Evaluation – Supplementary Guidance. Substantiation of the mitigation factors for applying the 32% figure has been summarised in Appendix A of this Technical Note;

Value Added Tax has been excluded

HEREFORD TRANSPORT PACKAGE - HEREFORD BYPASS

	CONSTRUCTION COST	CONTRACTORS OH&P @15%	SUB TOTAL	PRELIMINARIES (INC T.M.) @ 25%	SUB TOTAL	STATUTORY UNDERTAKERS FEES	LAND COST FEES	SUB TOTAL	PREPARATION COSTS @12%	SUPERVISION COSTS @ 5%	SUB TOTAL	OPTIMISM BIAS @ 32%	TOTAL COST ESTIMATED
CORRIDOR 1 - ORANGE	£ 58,465,409.61	£ 8,769,811.44	£ 67,235,221.05	£ 16,808,805.26	£ 84,044,026.31	£ 4,202,201.32	£ 9,351,230.00	£ 97,597,457.63	£ 11,711,694.92	£ 4,879,872.88	£ 114,189,025.43	£ 36,540,488.14	**£ 150,729,513.56**
CORRIDOR 2 - CYAN	£ 59,091,148.26	£ 8,863,672.24	£ 67,954,820.50	£ 16,988,705.12	£ 84,943,525.62	£ 4,247,176.28	£ 9,676,747.50	£ 98,867,449.40	£ 11,864,093.93	£ 4,943,372.47	£ 115,674,915.80	£ 37,015,973.06	**£ 152,690,888.86**
CORRIDOR 3 - YELLOW	£ 58,218,179.45	£ 8,732,726.92	£ 66,950,906.37	£ 16,737,726.59	£ 83,688,632.97	£ 4,184,431.65	£ 9,292,045.00	£ 97,165,109.61	£ 11,659,813.15	£ 4,858,255.48	£ 113,683,178.25	£ 36,378,617.04	**£ 150,061,795.29**
CORRIDOR 4 - RED	£ 59,271,566.58	£ 8,890,734.99	£ 68,162,301.56	£ 17,040,575.39	£ 85,202,876.95	£ 4,260,143.85	£ 9,587,970.00	£ 99,050,990.80	£ 11,886,118.90	£ 4,952,549.54	£ 115,889,659.24	£ 37,084,690.96	**£ 152,974,350.19**
CORRIDOR 5 - OLIVE	£ 57,962,996.14	£ 8,694,449.42	£ 66,657,445.56	£ 16,664,361.39	£ 83,321,806.95	£ 4,166,090.35	£ 9,232,860.00	£ 96,720,757.29	£ 11,606,490.88	£ 4,836,037.86	£ 113,163,286.03	£ 36,212,251.53	**£ 149,375,537.56**
CORRIDOR 6 - BLACK 1	£ 61,918,623.08	£ 9,287,793.46	£ 71,206,416.54	£ 17,801,604.14	£ 89,008,020.68	£ 4,450,401.03	£ 9,824,710.00	£ 103,283,131.71	£ 12,393,975.81	£ 5,164,156.59	£ 120,841,264.10	£ 38,669,204.51	**£ 159,510,468.62**
CORRIDOR 7 - BLACK 2	£ 64,334,162.35	£ 9,650,124.35	£ 73,984,286.70	£ 18,496,071.67	£ 92,480,358.37	£ 4,624,017.92	£ 10,298,190.00	£ 107,402,566.29	£ 12,888,307.96	£ 5,370,128.31	£ 125,661,002.56	£ 40,211,520.82	**£ 165,872,523.38**

HEREFORD BYPASS - COST ESTIMATES FOR SAR2 - JUNE 2018

		PROPOSED ROUTE CORRIDORS						
SERIES	**ITEM**	**CORRIDOR 1 - ORANGE**	**CORRIDOR 2 - CYAN**	**CORRIDOR 3 - YELLOW**	**CORRIDOR 4 - RED**	**CORRIDOR 5 - OLIVE**	**CORRIDOR 6 - BLACK 1**	**CORRIDOR 7 - BLACK 2**
200	SITE CLEARANCE	£ 212,668.19	£ 262,177.86	£ 282,243.41	£ 270,745.30	£ 219,128.77	£ 238,489.81	£ 293,751.32
300	FENCING	£ 692,046.64	£ 687,164.64	£ 697,166.58	£ 689,144.78	£ 625,038.38	£ 659,393.22	£ 756,488.78
400	VEHICLE RESTRAINT SYSTEMS AND PEDESTRIAN GUARDRAILING	£ 549,188.06	£ 601,297.65	£ 600,570.22	£ 629,080.92	£ 630,915.90	£ 665,701.98	£ 699,707.76
500	DRAINAGE	£ 2,081,148.86	£ 1,940,911.71	£ 2,255,971.02	£ 1,964,214.37	£ 1,742,546.40	£ 1,951,150.68	£ 2,135,806.50
600	EARTHWORKS	£ 7,804,842.44	£ 8,762,565.36	£ 8,475,930.39	£ 10,041,456.18	£ 10,349,607.07	£ 10,704,536.06	£ 10,697,938.82
700	PAVEMENTS	£ 10,691,570.59	£ 10,221,949.35	£ 9,355,376.33	£ 9,606,159.04	£ 9,818,774.09	£ 10,412,521.94	£ 11,002,300.67
1100	KERBS, FOOTWAYS & PAVED AREAS	£ 1,183,865.66	£ 1,288,053.50	£ 1,308,548.36	£ 1,144,818.78	£ 1,229,376.08	£ 1,256,450.76	£ 1,173,460.93
1200	TRAFFIC SIGNS AND ROADMARKINGS	£ 314,663.99	£ 298,773.62	£ 315,801.96	£ 316,822.38	£ 315,908.88	£ 317,106.96	£ 318,266.96
1300	LIGHTING COLUMNS	£ 101,519.36	£ 158,624.00	£ 149,106.56	£ 149,106.56	£ 149,106.56	£ 168,141.44	£ 157,037.76
1400	ELECTRICAL WORK FOR ROAD LIGHTING COLUMNS	£ 43,108.59	£ 66,166.80	£ 62,318.63	£ 62,612.34	£ 62,612.34	£ 69,721.26	£ 65,574.39
3000	LANDSCAPING AND ECOLOGY	£ 1,044,253.55	£ 1,041,445.18	£ 1,041,445.18	£ 1,053,791.70	£ 1,048,281.26	£ 1,052,942.00	£ 1,052,634.76
	MINOR CULVERTS	£ 101,959.92	£ 125,543.34	£ 67,680.18	£ 119,490.48	£ 122,349.78	£ 151,492.14	£ 125,023.86
	STRUCTURES	£ 33,644,573.75	£ 33,636,475.25	£ 33,606,020.63	£ 33,224,123.75	£ 31,649,350.63	£ 34,270,974.83	£ 35,856,169.83
	SUB TOTAL- WORKS	£ 58,465,409.61	£ 59,091,148.26	£ 58,218,179.45	£ 59,271,566.58	£ 57,962,996.14	£ 61,918,623.08	£ 64,334,162.35
	ADD FOR CONTRACTOR'S OH&P (not included in above rates)	£ 8,769,811.44	£ 8,863,672.24	£ 8,732,726.92	£ 8,890,734.99	£ 8,694,449.42	£ 9,287,793.46	£ 9,650,124.35
	SUB TOTAL	£ 67,235,221.05	£ 67,954,820.50	£ 66,950,906.37	£ 68,162,301.56	£ 66,657,445.56	£ 71,206,416.54	£ 73,984,286.70
	PRELIMINARIES	£ 16,808,805.26	£ 16,988,705.12	£ 16,737,726.59	£ 17,040,575.39	£ 16,664,361.39	£ 17,801,604.14	£ 18,496,071.67
	SUB TOTAL	£ 84,044,026.31	£ 84,943,525.62	£ 83,688,632.97	£ 85,202,876.95	£ 83,321,806.95	£ 89,008,020.68	£ 92,480,358.37
	STATUTORY UNDERTAKER'S COSTS	£ 4,202,201.32	£ 4,247,176.28	£ 4,184,431.65	£ 4,260,143.85	£ 4,166,090.35	£ 4,450,401.03	£ 4,624,017.92
	LAND COSTS AND ASSOCIATED FEES	£ 9,351,230.00	£ 9,676,747.50	£ 9,292,045.00	£ 9,587,970.00	£ 9,232,860.00	£ 9,824,710.00	£ 10,298,190.00
	ESTIMATED CONSTRUCTION COST	£ 97,597,457.63	£ 98,867,449.40	£ 97,165,109.61	£ 99,050,990.80	£ 96,720,757.29	£ 103,283,131.71	£ 107,402,566.29
	PREPARATION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.3)	£ 11,711,694.92	£ 11,864,093.93	£ 11,659,813.15	£ 11,886,118.90	£ 11,606,490.88	£ 12,393,975.81	£ 12,888,307.96
	SUPERVISION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.4)	£ 4,879,872.88	£ 4,943,372.47	£ 4,858,255.48	£ 4,952,549.54	£ 4,836,037.86	£ 5,164,156.59	£ 5,370,128.31
	SUB TOTAL	£ 114,189,025.43	£ 115,674,915.80	£ 113,683,178.25	£ 115,889,659.24	£ 113,163,286.03	£ 120,841,264.10	£ 125,661,002.56
	Optimism Bias (HM Treasury Green Book - Supplementary Guidance)	£ 36,540,488.14	£ 37,015,973.06	£ 36,378,617.04	£ 37,084,690.96	£ 36,212,251.53	£ 38,669,204.51	£ 40,211,520.82
	ESTIMATED TOTAL COST	**£ 150,729,513.56**	**£ 152,690,888.86**	**£ 150,061,795.29**	**£ 152,974,350.19**	**£ 149,375,537.56**	**£ 159,510,468.62**	**£ 165,872,523.38**

Hereford Transport Package
Cost Estimate - Corridor 1

SERIES	ITEM	QUANTITY	UNIT	RATE	AMOUNT	
200	SITE CLEARANCE					
	General site Clearance	49	ha	£ 1,923.92	£ 94,272.08	
	Take up or down and remove to tip off site Lighting Columns	20	no	£ 164.97	£ 3,299.40	
	Demolition of residential properties	5	no	£ 5,451.00	£ 27,255.00	
	Demolition of agricultural properties	1	no	£ 15,056.00	£ 15,056.00	
	Demolition of boundary Wall	1	item	£ 1,547.00	£ 1,547.00	
	Take up or down and remove to tip off site kerbs	1364	m	£ 4.94	£ 6,738.16	
	Take up or down and remove to tip off site signs including posts	11	no	£ 50.69	£ 557.59	
	Take up or down and remove to tip off site four post and rail fence	2088	m	£ 15.58	£ 32,531.04	
	Take up or down and remove to tip off site chamber cover and frame	2	no	£ 5.95	£ 11.90	
	Take up or down and remove to tip off site electric pole	6	no	£ 164.97	£ 989.82	
	Take up or down and remove to tip off site telecom pole	5	no	£ 164.97	£ 824.85	
	Take up or down and remove to tip off site hedge	3064	m	£ 9.48	£ 29,046.72	
	Take up or down and remove to tip off site post	8	no	£ 50.69	£ 405.52	
	Take up or down and remove to tip off site gully	29	no	£ 4.59	£ 133.11	£ **212,668.19**
300	FENCING				£ -	
	Four post and rail fencing	15011	m	£ 26.13	£ 392,237.43	
	Concrete Foundation	8339.444444	no	£ 10.89	£ 90,816.55	
	Four post and rail fencing with sheep netting on post and wire	5961	m	£ 29.01	£ 172,928.61	
	Concrete Foundation	3311.666667	no	£ 10.89	£ 36,064.05	£ **692,046.64**
400	VEHICLE RESTRAINT SYSTEMS AND PEDESTRIAN GUARDRAILING				£ -	
	Safety Barrier on driven posts straight or curved exceeding 120 metres radius	3919	m	£ 36.19	£ 141,828.61	
	Short driven posts for single sided corrugated beam	1959.5	no	£ 28.17	£ 55,199.12	
	Extra over in concrete foundations	1959.5	no	£ 37.49	£ 73,461.66	
	Metal parapet 1.0m high straight or curved exceeding 50m radius	572	m	£ 188.19	£ 107,644.68	
	Terminal for untensioned single sided beam	78	no	£ 2,193.00	£ 171,054.00	£ **549,188.06**
500	DRAINAGE				£ -	
	300mm dia. Filter Drain average 1.50m deep on type A bedding	5560	m	£ 194.52	£ 1,081,531.20	
	150mm dia. Sewer Drain average 1.50m deep on type A bedding	1600	m	£ 99.04	£ 158,464.00	
	Chamber 1200mm dia. 2000mm depth	111	no	£ 1,855.59	£ 205,970.49	
	Precast concrete road gully with grating and cover	533	no	£ 736.06	£ 392,319.98	
	Headwalls	32	no	£ 7,152.00	£ 228,864.00	
	Extra over hard material in drainage	500.4	m3	£ 27.71	£ 13,866.08	
	Sealing redundant gullies	29	no	£ 4.59	£ 133.11	£ **2,081,148.86**
600	EARTHWORKS				£ -	
	Excavation of Acceptable material class 5A in cutting and other excavation	45417	m3	£ 1.65	£ 74,938.05	
	Excavation of Acceptable material excluding class 5A in cutting and other excavation	248920	m3	£ 3.76	£ 935,939.20	
	Excavation of Uacceptable material class U1 in cutting and other excavation	62230	m3	£ 4.65	£ 289,389.50	
	Extra over excavation for excavation in Hard Material in cutting and other excavation	3111.5	m3	£ 36.50	£ 113,569.75	
	Deposition	248920	m3	£ 1.43	£ 355,955.60	
	Imported acceptable material class 1 A/B/C	59517	m3	£ 25.04	£ 1,490,305.68	
	extra for aggregate tax	59517	m3	£ 5.41	£ 321,986.97	
	Disposal of material	78817.45	m3	£ 3.39	£ 267,191.16	
	add for up to 10km	78817.45	m3/km	£ 14.94	£ 1,177,532.70	
	Landfill tax	148255.6235	T	£ 2.76	£ 409,185.52	
	Landfill tax	1497.53155	T	£ 88.34	£ 132,291.94	
	Compaction of Fill	308437	m3	£ 0.77	£ 237,496.49	
	Imported Topsoil	0	m3	£ 24.46	£ -	
	Ditch	0			£ -	
	Excavation of unacceptable material class U1/U2	3876.84	m3	£ 4.65	£ 18,027.31	
	Disposal of material	3876.84	m3	£ 3.39	£ 13,142.49	
	add for up to 10km	3876.84	m3/km	£ 14.94	£ 57,919.99	
	Geotextile over weak soils	6246	m2	£ 4.31	£ 26,920.26	
	Ponds		m3		£ -	
	Excavation of unacceptable material class U1/U2 in new watercourses	9500	m3	£ 7.65	£ 72,675.00	
	Disposal of material	9500	m3	£ 3.39	£ 32,205.00	
	add for up to 10km	9500	m3/km	£ 14.94	£ 141,930.00	
	Geosynthetic clay liner to ponds	9116	m2	£ 9.65	£ 87,969.40	
	Topsoiling 150mm thick to surfaces at 10 degrees or less to the horizontal	192197	m2	£ 7.17	£ 1,378,052.49	
	Completion of formation	148033	m2	£ 1.15	£ 170,237.95	£ **7,804,842.44**
700	PAVEMENTS				£ -	
	Type 1 unbound mixture sub-base in carriageway, hardshoulder and hardstrip - 250mm thick	35886	m3	£ 45.56	£ 1,634,966.16	
	Dense asphalt concrete base, 250mm thick in carriageway, hardshoulder and hardstrip.	143544	m2	£ 37.69	£ 5,409,455.64	
	Dense asphalt concrete binder, 60mm thick in carriageway, hardshoulder and hardstrip.	143544	m2	£ 13.95	£ 2,002,151.71	
	Surface course, 40mm thick in carriageway, hardshoulder and hardstrip in carriageway	143544	m2	£ 10.28	£ 1,476,110.80	
	Red thermoplastic Screed	7900	m2	£ 5.57	£ 44,003.00	
	Tack Coat to Dft clause 920	143544	m2	£ 0.87	£ 124,883.28	£ **10,691,570.59**
1100	KERBS, FOOTWAYS & PAVED AREAS				£ -	
	Straight Kerbs 125 x 255mm	5575	m	£ 18.01	£ 100,405.75	
	Foundations to Kerbs 300mm x 150mm	5575	m	£ 5.90	£ 32,892.50	
	Combined kerb	6616	m	£ 139.13	£ 920,484.08	
	Footway 210mm Thick, 150mm subbase, 40mm binder, 20mm surface course.	4481	m2	£ 28.93	£ 129,635.33	
	Tactile Pavings	8	m2	£ 56.00	£ 448.00	£ **1,183,865.66**
1200	TRAFFIC SIGNS AND ROADMARKINGS				£ -	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign					
	face exceeding 18 square metres but not exceeding 19 square metres on 3 posts. - ADS	16	no	£ 9,346.00	£ 149,536.04	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign					
	face exceeding 0.25 square metres but not exceeding 0.5 square metres on tubular steel post. Reg signs	7	no	£ 555.91	£ 3,891.37	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign					
	face exceeding 0.25 square metres but not exceeding 0.5 square metres on existing columns. Reg signs	5	no	£ 113.27	£ 566.35	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign					
	face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. Rbout flag	16	no	£ 927.54	£ 14,840.64	
	Lit Chevron Sign	16	no	£ 814.84	£ 13,037.44	
	Nonlit chevron sign	32	no	£ 2,366.40	£ 75,724.80	
	Permanent enhanced retro reflective traffic sign as non lit sign					
	unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. - changeover	20	no	£ 505.62	£ 10,112.40	
	Proposed Road Markings	15	item	£ 1,600.00	£ 24,000.00	
	Road Studs	5277	no	£ 4.35	£ 22,954.95	£ **314,663.99**
1300	LIGHTING COLUMNS				£ -	
	Lighting Column 8m high, with bracket arm and lighting unit	64	no	£ 1,586.24	£ 101,519.36	£ **101,519.36**
1400	ELECTRICAL WORK FOR ROAD LIGHTING COLUMNS				£ -	
	Trenching, 300 to 450mm wide, depth not exceeding 1.5m	640	m	£ 18.82	£ 12,044.80	
	2 No. 100mm internal diameter UPVC duct in trench depth not exceeding 1.0 metres.	640	m	£ 5.00	£ 3,200.00	
	25mm2 3 core XLPE/PVC/SWA/PVC cable with copper conductors in duct.	640	m	£ 6.05	£ 3,872.00	
	Brick Chamber with galvanised steel cover	21.33333333	no	£ 881.13	£ 18,797.44	
	Feeder pillar 1111x1203mm	3	no	£ 1,731.45	£ 5,194.35	£ **43,108.59**
3000	LANDSCAPING AND ECOLOGY				£ -	
	Grass Seeding	19.2197	ha	£ 2,302.51	£ 44,253.55	
	Trees and shrubs allowance				£ 1,000,000.00	£ 1,044,253.55
	MINOR CULVERTS					£ **101,959.92**
	STRUCTURES					£ **33,644,573.75**
	SUB TOTAL					£ **58,465,409.61**
	ADD FOR CONTRACTOR'S OH&P (not included in above rates)	15%				£ **8,769,811.44**
	SUB TOTAL					£ **67,235,221.05**
	PRELIMINARIES	25%				£ **16,808,805.26**
	SUB TOTAL					£ **84,044,026.31**
	STATUTORY UNDERTAKER'S COSTS	5%				£ **4,202,201.32**
	LAND COSTS AND ASSOCIATED FEES	7.9	km	£ 1,183,700.00		£ **9,351,230.00**
	ESTIMATED CONSTRUCTION COST					£ **97,597,457.63**
	PREPARATION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.3)	12%				£ **11,711,694.92**
	SUPERVISION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.4)	5%				£ **4,879,872.88**
	SUB TOTAL					£ **114,189,025.43**
	Optimism Bias (HM Treasury Green Book - Supplementary Guidance)	32%				£ **36,540,488.14**
	ESTIMATED TOTAL COST					£ 150,729,513.56

Hereford Transport Package
Cost Estimate - Corridor 2

SERIES	ITEM	QUANTITY	UNIT	RATE	AMOUNT	
200	SITE CLEARANCE					
	General site Clearance	46.5	ha	£ 1,923.92	£ 89,425.73	
	Take up or down and remove to tip off site Lighting Columns	21.0	no	£ 164.97	£ 3,464.37	
	Demolition of residential properties	6.0	no	£ 5,451.00	£ 32,706.00	
	Demolition of agricultural properties	4.0	no	£ 15,056.00	£ 60,224.00	
	Demolition of boundary Wall	1.0	item	£ 1,761.00	£ 1,761.00	
	Take up or down and remove to tip off site kerbs	975.0	m	£ 4.94	£ 4,816.50	
	Take up or down and remove to tip off site signs including posts	10.0	no	£ 50.69	£ 506.90	
	Take up or down and remove to tip off site four post and rail fence	1941.0	m	£ 15.58	£ 30,240.78	
	Take up or down and remove to tip off site chamber cover and frame	5.0	no	£ 5.95	£ 29.75	
	Take up or down and remove to tip off site electric pole	7.0	no	£ 164.97	£ 1,154.79	
	Take up or down and remove to tip off site telecom pole	7.0	no	£ 164.97	£ 1,154.79	
	Take up or down and remove to tip off site hedge	3805.0	m	£ 9.48	£ 36,071.40	
	Take up or down and remove to tip off site post	11.0	no	£ 50.69	£ 557.59	
	Take up or down and remove to tip off site gully	14.0	no	£ 4.59	£ 64.26	£ **262,177.86**
300	FENCING				£ -	
	Four post and rail fencing	15294.0	m	£ 26.13	£ 399,632.22	
	Concrete Foundation	8496.7	no	£ 10.89	£ 92,528.70	
	Four post and rail fencing with sheep netting on post and wire	5562.0	m	£ 29.01	£ 161,353.62	
	Concrete Foundation	3090.0	no	£ 10.89	£ 33,650.10	£ **687,164.64**
400	VEHICLE RESTRAINT SYSTEMS AND PEDESTRIAN GUARDRAILING				£ -	
	Safety Barrier on driven posts straight or curved exceeding 120 metres radius	4644.0	m	£ 36.19	£ 168,066.36	
	Short driven posts for single sided corrugated beam	2322.0	no	£ 28.17	£ 65,410.74	
	Extra over in concrete foundations	2322.0	no	£ 37.49	£ 87,051.78	
	Metal parapet 1.0m high straight or curved exceeding 50m radius	583.0	m	£ 188.19	£ 109,714.77	
	Terminal for untensioned single sided beam	78.0	no	£ 2,193.00	£ 171,054.00	£ **601,297.65**
500	DRAINAGE				£ -	
	300mm dia. Filter Drain average 1.50m deep on type A bedding	3370.0	m	£ 194.52	£ 655,532.40	
	150mm dia. Sewer Drain average 1.50m deep on type A bedding	2556.0	m	£ 99.04	£ 253,146.24	
	Chamber 1200mm dia. 2000mm depth	75.0	no	£ 1,855.59	£ 139,169.25	
	Precast concrete road gully with grating and cover	852.0	no	£ 736.06	£ 627,123.12	
	Headwalls	36.0	no	£ 7,152.00	£ 257,472.00	
	Extra over hard material in drainage	303.3	m3	£ 27.71	£ 8,404.44	
	Sealing redundant gullies	14.0	no	£ 4.59	£ 64.26	£ **1,940,911.71**
600	EARTHWORKS				£ -	
	Excavation of Acceptable material class 5A in cutting and other excavation	46197.0	m3	£ 1.65	£ 76,225.05	
	Excavation of Acceptable material excluding class 5A in cutting and other excavation	221680.0	m3	£ 3.76	£ 833,516.80	
	Excavation of Uacceptable material class U1 in cutting and other excavation	55420.0	m3	£ 4.65	£ 257,703.00	
	Extra over excavation for excavation in Hard Material in cutting and other excavation	2771.0	m3	£ 36.50	£ 101,141.50	
	Deposition	221680.0	m3	£ 1.43	£ 317,002.40	
	Imported acceptable material class 1 A/B/C	101740.0	m3	£ 25.04	£ 2,547,569.60	
	extra for aggregate tax	101740.0	m3	£ 5.41	£ 550,413.40	
	Disposal of material	72580.4	m3	£ 3.39	£ 246,047.56	
	add for up to 10km	72580.4	m3/km	£ 14.94	£ 1,084,351.18	
	Landfill tax	136523.7	T	£ 2.76	£ 376,805.50	
	Landfill tax	1379.0	T	£ 88.34	£ 121,823.30	
	Compaction of Fill	323420.0	m3	£ 0.77	£ 249,033.40	
	Imported Topsoil	0.0	m3	£ 24.46	£ -	
	Ditch					
	Excavation of unacceptable material class U1/U2	4189.0	m3	£ 4.65	£ 19,478.94	
	Disposal of material	4189.0	m3	£ 3.39	£ 14,200.78	
	add for up to 10km	4189.0	m3/km	£ 14.94	£ 62,583.96	
	Geotextile over weak soils	6954.0	m2	£ 4.31	£ 29,971.74	
	Ponds		m3		£ -	
	Excavation of unacceptable material class U1/U2 in new watercourses	9295.0	m3	£ 7.65	£ 71,106.75	
	Disposal of material	9295.0	m3	£ 3.39	£ 31,510.05	
	add for up to 10km	9295.0	m3/km	£ 14.94	£ 138,867.30	
	Geosynthetic clay liner to ponds	8388.0	m2	£ 9.65	£ 80,944.20	
	Topsoiling 150mm thick to surfaces at 10 degrees or less to the horizontal	193577.3	m2	£ 7.17	£ 1,387,949.48	
	Completion of formation	142886.5	m2	£ 1.15	£ 164,319.48	£ **8,762,565.36**
700	PAVEMENTS				£ -	
	Type 1 unbound mixture sub-base in carriageway, hardshoulder and hardstrip - 250mm thick	34297.4	m3	£ 45.56	£ 1,562,588.41	
	Dense asphalt concrete base, 250mm thick in carriageway, hardshoulder and hardstrip.	137189.5	m2	£ 37.69	£ 5,169,986.31	
	Dense asphalt concrete binder, 60mm thick in carriageway, hardshoulder and hardstrip.	137189.5	m2	£ 13.95	£ 1,913,519.15	
	Surface course, 40mm thick in carriageway, hardshoulder and hardstrip in carriageway	137189.5	m2	£ 10.28	£ 1,410,765.36	
	Red thermoplastic Screed	8211.0	m2	£ 5.57	£ 45,735.27	
	Tack Coat to Dft clause 920	137189.5	m2	£ 0.87	£ 119,354.87	£ **10,221,949.35**
1100	KERBS, FOOTWAYS & PAVED AREAS				£ -	
	Straight Kerbs 125 x 255mm	8456.0	m	£ 18.01	£ 152,292.56	
	Foundations to Kerbs 300mm x 150mm	8456.0	m	£ 5.90	£ 49,890.40	
	Combined kerb	6617.0	m	£ 139.13	£ 920,623.21	
	Footway 210mm Thick, 150mm subbase, 40mm binder, 20mm surface course.	5681.0	m2	£ 28.93	£ 164,351.33	
	Tactile Pavings	16.0	m2	£ 56.00	£ 896.00	£ **1,288,053.50**
1200	TRAFFIC SIGNS AND ROADMARKINGS				£ -	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 18 square metres but not exceeding 19 square metres on 3 posts. - ADS	16.0	no	£ 9,346.00	£ 149,536.04	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on tubular steel post. Reg signs	7.0	no	£ 555.91	£ 3,891.37	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on existing columns. Reg signs	5.0	no	£ 113.27	£ 566.35	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. Rbout flag	16.0	no	£ 927.54	£ 14,840.64	
	Lit Chevron Sign	13.0	no	£ 814.84	£ 10,592.92	
	Nonlit chevron sign	26.0	no	£ 2,366.40	£ 61,526.40	
	Permanent enhanced retro reflective traffic sign as non lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. - changeover	20.0	no	£ 505.62	£ 10,112.40	
	Proposed Road Markings	15.0	item	£ 1,600.00	£ 24,000.00	
	Road Studs	5450.0	no	£ 4.35	£ 23,707.50	£ **298,773.62**
1300	LIGHTING COLUMNS				£ -	
	Lighting Column 8m high, with bracket arm and lighting unit	100.0	no	£ 1,586.24	£ 158,624.00	£ **158,624.00**
1400	ELECTRICAL WORK FOR ROAD LIGHTING COLUMNS				£ -	
	Trenching, 300 to 450mm wide, depth not exceeding 1.5m	1000.0	m	£ 18.82	£ 18,820.00	
	2 No. 100mm internal diameter UPVC duct in trench depth not exceeding 1.0 metres.	1000.0	m	£ 5.00	£ 5,000.00	
	25mm2 3 core XLPE/PVC/SWA/PVC cable with copper conductors in duct.	1000.0	m	£ 6.05	£ 6,050.00	
	Brick Chamber with galvanised steel cover	33.3	no	£ 881.13	£ 29,371.00	
	Feeder pillar 1111x1203mm	4.0	no	£ 1,731.45	£ 6,925.80	£ **66,166.80**
3000	LANDSCAPING AND ECOLOGY				£ -	
	Grass Seeding	18.0	ha	£ 2,302.51	£ 41,445.18	
	Trees and shrubs allowance				£ 1,000,000.00	£ 1,041,445.18
	MINOR CULVERTS					£ 125,543.34
	STRUCTURES					£ 33,636,475.25
	SUB TOTAL					£ 59,091,148.26
	ADD FOR CONTRACTOR'S OH&P (not included in above rates)	15.0%				£ 8,863,672.24
	SUB TOTAL					£ 67,954,820.50
	PRELIMINARIES	25.0%				£ 16,988,705.12
	SUB TOTAL					£ 84,943,525.62
	STATUTORY UNDERTAKER'S COSTS	5.0%				£ 4,247,176.28
	LAND COSTS AND ASSOCIATED FEES	8.2	km	£ 1,183,700.00		£ 9,676,747.50
	ESTIMATED CONSTRUCTION COST					£ 98,867,449.40
	PREPARATION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.3)	12.0%				£ 11,864,093.93
	SUPERVISION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.4)	5.0%				£ 4,943,372.47
	SUB TOTAL					£ 115,674,915.80
	Optimism Bias (HM Treasury Green Book - Supplementary Guidance)	32.0%				£ 37,015,973.06
	ESTIMATED TOTAL COST					£ 152,690,888.86

Hereford Transport Package
Cost Estimate - Corridor 3

SERIES	ITEM	QUANTITY	UNIT	RATE	AMOUNT	
200	SITE CLEARANCE					
	General site Clearance	48.6	ha	£ 1,923.92	£ 93,521.75	
	Take up or down and remove to tip off site Lighting Columns	22.0	no	£ 164.97	£ 3,629.34	
	Demolition of residential properties	5.0	no	£ 5,451.00	£ 27,255.00	
	Demolition of agricultural properties	4.0	no	£ 15,056.00	£ 60,224.00	
	Demolition of boundary Wall	1.0	item	£ 1,174.00	£ 1,174.00	
	Take up or down and remove to tip off site kerbs	1010.0	m	£ 4.94	£ 4,989.40	
	Take up or down and remove to tip off site signs including posts	11.0	no	£ 50.69	£ 557.59	
	Take up or down and remove to tip off site four post and rail fence	2693.0	m	£ 15.58	£ 41,956.94	
	Take up or down and remove to tip off site chamber cover and frame	3.0	no	£ 5.95	£ 17.85	
	Take up or down and remove to tip off site electric pole	11.0	no	£ 164.97	£ 1,814.67	
	Take up or down and remove to tip off site telecom pole	4.0	no	£ 164.97	£ 659.88	
	Take up or down and remove to tip off site hedge	4850.0	m	£ 9.48	£ 45,978.00	
	Take up or down and remove to tip off site post	7.0	no	£ 50.69	£ 354.83	
	Take up or down and remove to tip off site gully	24.0	no	£ 4.59	£ 110.16	£ **282,243.41**
300	FENCING					
	Four post and rail fencing	14953.0	m	£ 26.13	£ 390,721.89	
	Concrete Foundation	7476.5	no	£ 10.89	£ 81,419.09	
	Four post and rail fencing with sheep netting on post and wire	6531.0	m	£ 29.01	£ 189,464.31	
	Concrete Foundation	3265.5	no	£ 10.89	£ 35,561.30	£ **697,166.58**
400	VEHICLE RESTRAINT SYSTEMS AND PEDESTRIAN GUARDRAILING					
	Safety Barrier on driven posts straight or curved exceeding 120 metres radius	4727.0	m	£ 36.19	£ 171,070.13	
	Short driven posts for single sided corrugated beam	2363.5	no	£ 28.17	£ 66,579.80	
	Extra over in concrete foundations	2363.5	no	£ 37.49	£ 88,607.62	
	Metal parapet 1.0m high straight or curved exceeding 50m radius	572.0	m	£ 188.19	£ 107,644.68	
	Terminal for untensioned single sided beam	76.0	no	£ 2,193.00	£ 166,668.00	£ **600,570.22**
500	DRAINAGE					
	300mm dia. Filter Drain average 1.50m deep on type A bedding	5130.0	m	£ 194.52	£ 997,887.60	
	150mm dia. Sewer Drain average 1.50m deep on type A bedding	2313.0	m	£ 99.04	£ 229,079.52	
	Chamber 1200mm dia. 2000mm depth	103.0	no	£ 1,855.59	£ 191,125.77	
	Precast concrete road gully with grating and cover	771.0	no	£ 736.06	£ 567,502.26	
	Headwalls	36.0	no	£ 7,152.00	£ 257,472.00	
	Extra over hard material in drainage	461.7	m3	£ 27.71	£ 12,793.71	
	Sealing redundant gullies	24.0	no	£ 4.59	£ 110.16	£ **2,255,971.02**
600	EARTHWORKS					
	Excavation of Acceptable material class 5A in cutting and other excavation	45405.0	m3	£ 1.65	£ 74,918.25	
	Excavation of Acceptable material excluding class 5A in cutting and other excavation	231160.0	m3	£ 3.76	£ 869,161.60	
	Excavation of Uacceptable material class U1 in cutting and other excavation	57790.0	m3	£ 4.65	£ 268,723.50	
	Extra over excavation for excavation in Hard Material in cutting and other excavation	2889.5	m3	£ 36.50	£ 105,466.75	
	Deposition	231160.0	m3	£ 1.43	£ 330,558.80	
	Imported acceptable material class 1 A/B/C	89460.0	m3	£ 25.04	£ 2,240,078.40	
	extra for aggregate tax	89460.0	m3	£ 5.41	£ 483,978.60	
	Disposal of material	74465.4	m3	£ 3.39	£ 252,437.54	
	add for up to 10km	74465.4	m3/km	£ 14.94	£ 1,112,512.33	
	Landfill tax	140069.3	T	£ 2.76	£ 386,591.33	
	Landfill tax	1414.8	T	£ 88.34	£ 124,987.11	
	Compaction of Fill	320620.0	m3	£ 0.77	£ 246,877.40	
	Imported Topsoil	0.0	m3	£ 24.46	£ -	
	Ditch				£ -	
	Excavation of unacceptable material class U1/U2	4167.2	m3	£ 4.65	£ 19,377.67	
	Disposal of material	4167.2	m3	£ 3.39	£ 14,126.94	
	add for up to 10km	4167.2	m3/km	£ 14.94	£ 62,258.57	
	Geotextile over weak soils	7124.0	m2	£ 4.31	£ 30,704.44	
	Ponds		m3		£ -	
	Excavation of unacceptable material class U1/U2 in new watercourses	9385.0	m3	£ 7.65	£ 71,795.25	
	Disposal of material	9385.0	m3	£ 3.39	£ 31,815.15	
	add for up to 10km	9385.0	m3/km	£ 14.94	£ 140,211.90	
	Geosynthetic clay liner to ponds	9010.0	m2	£ 9.65	£ 86,946.50	
	Topsoiling 150mm thick to surfaces at 10 degrees or less to the horizontal	191531.0	m2	£ 7.17	£ 1,373,277.27	
	Completion of formation	129674.0	m2	£ 1.15	£ 149,125.10	£ **8,475,930.39**
700	PAVEMENTS					
	Type 1 unbound mixture sub-base in carriageway, hardshoulder and hardstrip - 250mm thick	31383.5	m3	£ 45.56	£ 1,429,832.26	
	Dense asphalt concrete base, 250mm thick in carriageway, hardshoulder and hardstrip.	125534.0	m2	£ 37.69	£ 4,730,748.79	
	Dense asphalt concrete binder, 60mm thick in carriageway, hardshoulder and hardstrip.	125534.0	m2	£ 13.95	£ 1,750,948.23	
	Surface course, 40mm thick in carriageway, hardshoulder and hardstrip in carriageway	125534.0	m2	£ 10.28	£ 1,290,907.97	
	Red thermoplastic Screed	7850.0	m2	£ 5.57	£ 43,724.50	
	Tack Coat to Dft clause 920	125534.0	m2	£ 0.87	£ 109,214.58	£ **9,355,376.33**
1100	KERBS, FOOTWAYS & PAVED AREAS					
	Straight Kerbs 125 x 255mm	7290.0	m	£ 18.01	£ 131,292.90	
	Foundations to Kerbs 300mm x 150mm	7290.0	m	£ 5.90	£ 43,011.00	
	Combined kerb	7290.0	m	£ 139.13	£ 1,014,257.70	
	Footway 210mm Thick, 150mm subbase, 40mm binder, 20mm surface course.	4132.0	m2	£ 28.93	£ 119,538.76	
	Tactile Pavings	8.0	m2	£ 56.00	£ 448.00	£ **1,308,548.36**
1200	TRAFFIC SIGNS AND ROADMARKINGS					
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 18 square metres but not exceeding 19 square metres on 3 posts. - ADS	16.0	no	£ 9,346.00	£ 149,536.04	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on tubular steel post. Reg signs	10.0	no	£ 555.91	£ 5,559.10	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on existing columns. Reg signs	2.0	no	£ 113.27	£ 226.54	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. Rbout flag	16.0	no	£ 927.54	£ 14,840.64	
	Lit Chevron Sign	16.0	no	£ 814.84	£ 13,037.44	
	Nonlit chevron sign	32.0	no	£ 2,366.40	£ 75,724.80	
	Permanent enhanced retro reflective traffic sign as non lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. - changeover	20.0	no	£ 505.62	£ 10,112.40	
	Proposed Road Markings	15.0	item	£ 1,600.00	£ 24,000.00	
	Road Studs	5233.3	no	£ 4.35	£ 22,765.00	£ **315,801.96**
1300	LIGHTING COLUMNS					
	Lighting Column 8m high, with bracket arm and lighting unit	94.0	no	£ 1,586.24	£ 149,106.56	£ **149,106.56**
1400	ELECTRICAL WORK FOR ROAD LIGHTING COLUMNS					
	Trenching, 300 to 450mm wide, depth not exceeding 1.5m	940.0	m	£ 18.82	£ 17,690.80	
	2 No. 100mm internal diameter UPVC duct in trench depth not exceeding 1.0 metres.	940.0	m	£ 5.00	£ 4,700.00	
	25mm2 3 core XLPE/PVC/SWA/PVC cable with copper conductors in duct.	940.0	m	£ 6.05	£ 5,687.00	
	Brick Chamber with galvanised steel cover	31.0	no	£ 881.13	£ 27,315.03	
	Feeder pillar 1111x1203mm	4.0	no	£ 1,731.45	£ 6,925.80	£ **62,318.63**
3000	LANDSCAPING AND ECOLOGY					
	Grass Seeding	18.0	ha	£ 2,302.51	£ 41,445.18	
	Trees and shrubs allowance				£ 1,000,000.00	£ 1,041,445.18
	MINOR CULVERTS					£ 67,680.18
	STRUCTURES					£ 33,606,020.63
	SUB TOTAL					£ 58,218,179.45
	ADD FOR CONTRACTOR'S OH&P (not included in above rates)	0.2				£ 8,732,726.92
	SUB TOTAL					£ 66,950,906.37
	PRELIMINARIES	0.3				£ 16,737,726.59
	SUB TOTAL					£ 83,688,632.97
	STATUTORY UNDERTAKER'S COSTS	0.1				£ 4,184,431.65
	LAND COSTS AND ASSOCIATED FEES	7.9	km	£ 1,183,700.00		£ 9,292,045.00
	ESTIMATED CONSTRUCTION COST					£ 97,165,109.61
	PREPARATION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.3)	0.1				£ 11,659,813.15
	SUPERVISION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.4)	0.1				£ 4,858,255.48
	SUB TOTAL					£ 113,683,178.25
	Optimum Bias (HM Treasury Green Book - Supplementary Guidance)	0.3				£ 36,378,617.04
	ESTIMATED TOTAL COST					£ 150,061,795.29

Hereford Transport Package
Cost Estimate - Corridor 4

SERIES	ITEM	QUANTITY	UNIT	RATE	AMOUNT	
200	SITE CLEARANCE					
	General site Clearance	51.3	ha	£ 1,923.92	£ 98,697.10	
	Take up or down and remove to tip off site Lighting Columns	20.0	no	£ 164.97	£ 3,299.40	
	Demolition of residential properties	5.0	no	£ 5,451.00	£ 27,255.00	
	Demolition of agricultural properties	4.0	no	£ 15,056.00	£ 60,224.00	
	Demolition of boundary Wall	1.0	item	£ 1,196.50	£ 1,196.50	
	Take up or down and remove to tip off site kerbs	1174.0	m	£ 4.94	£ 5,799.56	
	Take up or down and remove to tip off site signs including posts	5.0	no	£ 50.69	£ 253.45	
	Take up or down and remove to tip off site four post and rail fence	2184.0	m	£ 15.58	£ 34,026.72	
	Take up or down and remove to tip off site chamber cover and frame	6.0	no	£ 5.95	£ 35.70	
	Take up or down and remove to tip off site electric pole	11.0	no	£ 164.97	£ 1,814.67	
	Take up or down and remove to tip off site telecom pole	7.0	no	£ 164.97	£ 1,154.79	
	Take up or down and remove to tip off site hedge	3807.0	m	£ 9.48	£ 36,090.36	
	Take up or down and remove to tip off site post	15.0	no	£ 50.69	£ 760.35	
	Take up or down and remove to tip off site gully	30.0	no	£ 4.59	£ 137.70	£ **270,745.30**
300	FENCING					
	Four post and rail fencing	15276.0	m	£ 26.13	£ 399,161.88	
	Concrete Foundation	8486.7	no	£ 10.89	£ 92,419.80	
	Four post and rail fencing with sheep netting on post and wire	5635.0	m	£ 29.01	£ 163,471.35	
	Concrete Foundation	3130.6	no	£ 10.89	£ 34,091.75	£ **689,144.78**
400	VEHICLE RESTRAINT SYSTEMS AND PEDESTRIAN GUARDRAILING					
	Safety Barrier on driven posts straight or curved exceeding 120 metres radius	5436.0	m	£ 36.19	£ 196,728.84	
	Short driven posts for single sided corrugated beam	2718.0	no	£ 28.17	£ 76,566.06	
	Extra over in concrete foundations	2718.0	no	£ 37.49	£ 101,897.82	
	Metal parapet 1.0m high straight or curved exceeding 50m radius	580.0	m	£ 188.19	£ 109,150.20	
	Terminal for untensioned single sided beam	66.0	no	£ 2,193.00	£ 144,738.00	£ **629,080.92**
500	DRAINAGE					
	300mm dia. Filter Drain average 1.50m deep on type A bedding	4300.0	m	£ 194.52	£ 836,436.00	
	150mm dia. Sewer Drain average 1.50m deep on type A bedding	2136.0	m	£ 99.04	£ 211,549.44	
	Chamber 1200mm dia. 2000mm depth	86.0	no	£ 1,855.59	£ 159,580.74	
	Precast concrete road gully with grating and cover	712.0	no	£ 736.06	£ 524,074.72	
	Headwalls	31.0	no	£ 7,152.00	£ 221,712.00	
	Extra over hard material in drainage	387.0	m3	£ 27.71	£ 10,723.77	
	Sealing redundant gullies	30.0	no	£ 4.59	£ 137.70	£ **1,964,214.37**
600	EARTHWORKS					
	Excavation of Acceptable material class 5A in cutting and other excavation	51242.0	m3	£ 1.65	£ 84,549.30	
	Excavation of Acceptable material excluding class 5A in cutting and other excavation	335080.0	m3	£ 3.76	£ 1,259,900.80	
	Excavation of Uacceptable material class U1 in cutting and other excavation	83770.0	m3	£ 4.65	£ 389,530.50	
	Extra over excavation for excavation in Hard Material in cutting and other excavation	4188.5	m3	£ 36.50	£ 152,880.25	
	Deposition	335080.0	m3	£ 1.43	£ 479,164.40	
	Imported acceptable material class 1 A/B/C	83833.0	m3	£ 25.04	£ 2,099,178.32	
	extra for aggregate tax	83833.0	m3	£ 5.41	£ 453,536.53	
	Disposal of material	99968.7	m3	£ 3.39	£ 338,893.89	
	add for up to 10km	99968.7	m3/km	£ 14.94	£ 1,493,532.38	
	Landfill tax	188041.1	T	£ 2.76	£ 518,993.50	
	Landfill tax	1899.4	T	£ 88.34	£ 167,783.46	
	Compaction of Fill	418913.0	m3	£ 0.77	£ 322,563.01	
	Imported Topsoil	0.0	m3	£ 24.46	£ -	
	Ditch				£ -	
	Excavation of unacceptable material class U1/U2	3356.8	m3	£ 4.65	£ 15,608.93	
	Disposal of material	3356.8	m3	£ 3.39	£ 11,379.42	
	add for up to 10km	3356.8	m3/km	£ 14.94	£ 50,149.99	
	Geotextile over weak soils	4820.0	m2	£ 4.31	£ 20,774.20	
	Ponds		m3		£ -	
	Excavation of unacceptable material class U1/U2 in new watercourses	9950.0	m3	£ 7.65	£ 76,117.50	
	Disposal of material	9950.0	m3	£ 3.39	£ 33,730.50	
	add for up to 10km	9950.0	m3/km	£ 14.94	£ 148,653.00	
	Geosynthetic clay liner to ponds	10104.0	m2	£ 9.65	£ 97,503.60	
	Topsoiling 150mm thick to surfaces at 10 degrees or less to the horizontal	233622.0	m2	£ 7.17	£ 1,675,069.74	
	Completion of formation	132133.0	m2	£ 1.15	£ 151,952.95	£ **10,041,456.18**
700	PAVEMENTS					
	Type 1 unbound mixture sub-base in carriageway, hardshoulder and hardstrip - 250mm thick	32223.8	m3	£ 45.56	£ 1,468,114.05	
	Dense asphalt concrete base, 250mm thick in carriageway, hardshoulder and hardstrip.	128895.0	m2	£ 37.69	£ 4,857,408.08	
	Dense asphalt concrete binder, 60mm thick in carriageway, hardshoulder and hardstrip.	128895.0	m2	£ 13.95	£ 1,797,827.46	
	Surface course, 40mm thick in carriageway, hardshoulder and hardstrip in carriageway	128895.0	m2	£ 10.28	£ 1,325,470.25	
	Red thermoplastic Screed	8115.0	m2	£ 5.57	£ 45,200.55	
	Tack Coat to Dft clause 920	128895.0	m2	£ 0.87	£ 112,138.65	£ **9,606,159.04**
1100	KERBS, FOOTWAYS & PAVED AREAS					
	Straight Kerbs 125 x 255mm	7134.0	m	£ 18.01	£ 128,483.34	
	Foundations to Kerbs 300mm x 150mm	7134.0	m	£ 5.90	£ 42,090.60	
	Combined kerb	6326.0	m	£ 139.13	£ 880,136.38	
	Footway 210mm Thick, 150mm subbase, 40mm binder, 20mm surface course.	3222.0	m2	£ 28.93	£ 93,212.46	
	Tactile Pavings	16.0	m2	£ 56.00	£ 896.00	£ **1,144,818.78**
1200	TRAFFIC SIGNS AND ROADMARKINGS					
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 18 square metres but not exceeding 19 square metres on 3 posts. - ADS	16.0	no	£ 9,346.00	£ 149,536.04	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on tubular steel post. Reg signs	6.0	no	£ 555.91	£ 3,335.46	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on existing columns. Reg signs	6.0	no	£ 113.27	£ 679.62	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. Rbout flag	16.0	no	£ 927.54	£ 14,840.64	
	Lit Chevron Sign	16.0	no	£ 814.84	£ 13,037.44	
	Nonlit chevron sign	32.0	no	£ 2,366.40	£ 75,724.80	
	Permanent enhanced retro reflective traffic sign as non lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. - changeover	24.0	no	£ 505.62	£ 12,134.88	
	Proposed Road Markings	15.0	item	£ 1,600.00	£ 24,000.00	
	Road Studs	5410.0	no	£ 4.35	£ 23,533.50	£ **316,822.38**
1300	LIGHTING COLUMNS					
	Lighting Column 8m high, with bracket arm and lighting unit	94.0	no	£ 1,586.24	£ 149,106.56	£ **149,106.56**
1400	ELECTRICAL WORK FOR ROAD LIGHTING COLUMNS					
	Trenching, 300 to 450mm wide, depth not exceeding 1.5m	940.0	m	£ 18.82	£ 17,690.80	
	2 No. 100mm internal diameter UPVC duct in trench depth not exceeding 1.0 metres.	940.0	m	£ 5.00	£ 4,700.00	
	25mm2 3 core XLPE/PVC/SWA/PVC cable with copper conductors in duct.	940.0	m	£ 6.05	£ 5,687.00	
	Brick Chamber with galvanised steel cover	31.3	no	£ 881.13	£ 27,608.74	
	Feeder pillar 1111x1203mm	4.0	no	£ 1,731.45	£ 6,925.80	£ **62,612.34**
3000	LANDSCAPING AND ECOLOGY					
	Grass Seeding	23.4	ha	£ 2,302.51	£ 53,791.70	
	Trees and shrubs allowance				£ 1,000,000.00	£ 1,053,791.70
	MINOR CULVERTS					£ 119,490.48
	STRUCTURES					£ 33,224,123.75
	SUB TOTAL					£ 59,271,566.58
	ADD FOR CONTRACTOR'S OH&P (not included in above rates)	0.2				£ 8,890,734.99
	SUB TOTAL					£ 68,162,301.56
	PRELIMINARIES	0.3				£ 17,040,575.39
	SUB TOTAL					£ 85,202,876.95
	STATUTORY UNDERTAKER'S COSTS	0.1				£ 4,260,143.85
	LAND COSTS AND ASSOCIATED FEES	8.1	Km	£ 1,183,700.00		£ 9,587,970.00
	ESTIMATED CONSTRUCTION COST					£ 99,050,990.80
	PREPARATION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.3)	0.1				£ 11,886,118.90
	SUPERVISION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.4)	0.1				£ 4,952,549.54
	SUB TOTAL					£ 115,889,659.24
	Optimum Bias (HM Treasury Green Book - Supplementary Guidance)	0.3				£ 37,084,690.96
	ESTIMATED TOTAL COST					£ 152,974,350.19

HEREFORD TRANSPORT PACKAGE - HEREFORD BYPASS

COST ESTIMATE - CORRIDOR 5

SERIES	ITEM	QUANTITY	UNIT	RATE	AMOUNT	
200	**SITE CLEARANCE**					
	General site Clearance	48.000	ha	1923.92	£ 92,348.16	
	Take up or down and remove to tip off site Lighting Columns	19	no	164.97	£ 3,134.43	
	Demolition of residential properties	5	no	5451.00	£ 27,255.00	
	Demolition of boundary Wall	1	item	1196.50	£ 1,196.50	
	Take up or down and remove to tip off site kerbs	1155	m	4.94	£ 5,705.70	
	Take up or down and remove to tip off site signs including posts	13	no	50.69	£ 658.97	
	Take up or down and remove to tip off site four post and rail fence	2627	m	15.58	£ 40,928.66	
	Take up or down and remove to tip off site chamber cover and frame	7	no	5.95	£ 41.65	
	Take up or down and remove to tip off site electric pole	8	no	164.97	£ 1,319.76	
	Take up or down and remove to tip off site telecom pole	5	no	164.97	£ 824.85	
	Take up or down and remove to tip off site hedge	4712	m	9.48	£ 44,669.76	
	Take up or down and remove to tip off site post	17	no	50.69	£ 861.73	
	Take up or down and remove to tip off site gully	40	no	4.59	£ 183.60	£ **219,128.77**
300	**FENCING**					
	Four post and rail fencing	14454	m	26.13	£ 377,683.02	
	Concrete Foundation	8030	no	10.89	£ 87,446.70	
	Four post and rail fencing with sheep netting on post and wire	4561	m	29.01	£ 132,314.61	
	Concrete Foundation	2534	no	10.89	£ 27,594.05	£ **625,038.38**
400	**VEHICLE RESTRAINT SYSTEMS AND PEDESTRIAN GUARDRAILING**					
	Safety Barrier on driven posts straight or curved exceeding 120 metres radius	4890	m	36.19	£ 176,969.10	
	Short driven posts for single sided corrugated beam	2445	no	28.17	£ 68,875.65	
	Extra over in concrete foundations	2445	no	37.49	£ 91,663.05	
	Metal parapet 1.0m high straight or curved exceeding 50m radius	790	m	188.19	£ 148,670.10	
	Terminal for untensioned single sided beam	66	no	2193.00	£ 144,738.00	£ **630,915.90**
500	**DRAINAGE**					
	300mm dia. Filter Drain average 1.50m deep on type A bedding	4000	m	194.52	£ 778,080.00	
	150mm dia. Sewer Drain average 1.50m deep on type A bedding	1,800	m	99.04	£ 178,272.00	
	Chamber 1200mm dia. 2000mm depth	80	no	1855.59	£ 148,447.20	
	Precast concrete road gully with grating and cover	600	no	736.06	£ 441,636.00	
	Headwalls	26	no	7152.00	£ 185,952.00	
	Extra over hard material in drainage	360	m^3	27.71	£ 9,975.60	
	Sealing redundant gullies	40	no	4.59	£ 183.60	£ **1,742,546.40**
600	**EARTHWORKS**					
	Excavation of Acceptable material class 5A in cutting and other excavation	47,652	m^3	1.65	£ 78,625.80	
	Excavation of Acceptable material excluding class 5A in cutting and other excavation	306880	m^3	3.76	£ 1,153,868.80	
	Excavation of Unacceptable material class U1 in cutting and other excavation	76720	m^3	4.65	£ 356,748.00	
	Extra over excavation for excavation in Hard Material in cutting and other excavation	3836	m^3	36.50	£ 140,014.00	
	Deposition	306880	m^3	1.43	£ 438,838.40	
	Imported acceptable material class 1 A/B/C	111220	m^3	25.04	£ 2,784,988.80	
	extra for aggregate tax	111220	m^3	5.41	£ 601,700.20	
	Disposal of material	92919	m^3	3.39	£ 314,993.88	
	add for up to 10km	92919	m3/km	14.94	£ 1,388,203.14	
	Landfill tax	174780	T	2.76	£ 482,392.23	
	Landfill tax	1765	T	88.34	£ 155,960.07	
	Compaction of Fill	418100	m^3	0.77	£ 321,937.00	
	Imported Topsoil	0	m^3	24.46	£ -	
	Ditch				£ -	
	Excavation of unacceptable material class U1/U2	4125	m^3	4.65	£ 19,181.25	
	Disposal of material	4125	m^3	3.39	£ 13,983.75	
	add for up to 10km	4125	m3/km	14.94	£ 61,627.50	
	Geotextile	5991	m^2	4.31	£ 25,821.21	
	Ponds					
	Excavation of unacceptable material class U1/U2 in new watercourses	9760	m^3	7.65	£ 74,664.00	
	Disposal of material	9760	m^3	3.39	£ 33,086.40	
	add for up to 10km	9760	m3/km	14.94	£ 145,814.40	
	Geosynthetic clay liner to ponds	10177	m^2	9.65	£ 98,208.05	
	Topsoiling 150mm thick to surfaces at 10 degrees or less to the horizontal	209690	m^2	7.17	£ 1,503,474.91	
	Completion of formation	135231	m^2	1.15	£ 155,515.28	£ **10,349,607.07**
700	**PAVEMENTS**					
	Type 1 unbound mixture sub-base in carriageway, hardshoulder and hardstrip - 250mm thick	32946	m^3	45.56	£ 1,501,031.15	
	Dense asphalt concrete base, 250mm thick in carriageway, hardshoulder and hardstrip.	131,785	m^2	37.69	£ 4,966,317.73	
	Dense asphalt concrete binder, 60mm thick in carriageway, hardshoulder and hardstrip.	131785	m^2	13.95	£ 1,838,137.18	
	Surface course, 40mm thick in carriageway, hardshoulder and hardstrip in carriagway	131785	m^2	10.28	£ 1,355,189.08	
	Red high Friction Surfacing	7800	m^2	5.57	£ 43,446.00	
	Tack Coat to Dft clause 920	131785	m^2	0.87	£ 114,652.95	£ **9,818,774.09**
1100	**KERBS, FOOTWAYS & PAVED AREAS**					
	Straight Kerbs 125 x 255mm	6175	m	18.01	£ 111,211.75	
	Foundations to Kerbs 300mm x 150mm	6175	m	5.90	£ 36,432.50	
	Combined kerb	7057	m	139.13	£ 981,840.41	
	Footway 210mm Thick, 150mm subbase, 40mm binder, 20mm surface course.	3,438	m^2	28.93	£ 99,461.34	
	Tactile Pavings	8	m^2	56.00	£ 430.08	£ **1,229,376.08**
1200	**TRAFFIC SIGNS AND ROADMARKINGS**					
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 18 square metres but not exceeding 19 square metres on 3 posts. - ADS	16	no	9346.00	£ 149,536.04	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on tubular steel post. Reg signs	6	no	555.91	£ 3,335.46	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on existing columns. Reg signs	6	no	113.27	£ 679.62	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. Rbout flag	16	no	927.54	£ 14,840.64	
	Lit Chevron Sign	16	no	814.84	£ 13,037.44	
	Nonlit chevron sign	32	no	2366.40	£ 75,724.80	
	Permanent enhanced retro reflective traffic sign as non lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. - changeover	24	no	505.62	£ 12,134.88	
	Proposed Road Markings	15	item	1600.00	£ 24,000.00	
	Road Studs	5200	no	4.35	£ 22,620.00	£ **315,908.88**
1300	**LIGHTING COLUMNS**					
	Lighting Column 8m high, with bracket arm and lighting unit	94	no	1586.24	£ 149,106.56	£ **149,106.56**
1400	**ELECTRICAL WORK FOR ROAD LIGHTING COLUMNS**					
	Trenching, 300 to 450mm wide, depth not exceeding 1.5m	940	m	18.82	£ 17,690.80	
	2 No. 100mm internal diameter UPVC duct in trench depth not exceeding 1.0 metres.	940	m	5.00	£ 4,700.00	
	25mm2 3 core XLPE/PVC/SWA/PVC cable with copper conductors in duct.	940	m	6.05	£ 5,687.00	
	Brick Chamber with galvanised steel cover	31	no	881.13	£ 27,608.74	
	Feeder pillar 1111x1203mm	4	no	1731.45	£ 6,925.80	£ **62,612.34**
3000	**LANDSCAPING AND ECOLOGY**					
	Grass Seeding	21	ha	2302.51	£ 48,281.26	
	Trees and shrubs allowance				£ 1,000,000.00	£ **1,048,281.26**
	MINOR CULVERTS					£ **122,349.78**
	STRUCTURES					£ **31,649,350.63**
	SUB TOTAL					£ **57,962,996.14**
	ADD FOR CONTRACTOR'S OH&P (not included in above rates)	15.00%				£ **8,694,449.42**
	SUB TOTAL					£ **66,657,445.56**
	PRELIMINARIES	25.00%				£ **16,664,361.39**
	SUB TOTAL					£ **83,321,806.95**
	STATUTORY UNDERTAKER'S COSTS	5.00%				£ **4,166,090.35**
	LAND COSTS AND ASSOCIATED FEES	7.8	km	1183700.00		£ **9,232,860.00**
	ESTIMATED CONSTRUCTION COST					£ **96,720,757.29**
	PREPARATION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.3)	12.00%				£ **11,606,490.88**
	SUPERVISION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.4)	5.00%				£ **4,836,037.86**
	SUB TOTAL					£ **113,163,286.03**
	Optimism Bias (HM Treasury Green Book - Supplementary Guidance)	32.00%				£ **36,212,251.53**
	ESTIMATED TOTAL COST					£ **149,375,537.56**

HEREFORD TRANSPORT PACKAGE - HEREFORD BYPASS

COST ESTIMATE - CORRIDOR 6

SERIES	ITEM	QUANTITY	UNIT	RATE	AMOUNT	
200	**SITE CLEARANCE**					
	General site Clearance	50.000	ha	1923.92	£ 96,196.00	
	Take up or down and remove to tip off site Lighting Columns	24	no	164.97	£ 3,959.28	
	Demolition of residential properties	5	no	5451.00	£ 27,255.00	
	Demolition of agricultural properties	0	no	15056.00	£ -	
	Demolition of boundary Wall	1	item	11516.94	£ 11,516.94	
	Take up or down and remove to tip off site kerbs	894	m	4.94	£ 4,416.36	
	Take up or down and remove to tip off site signs including posts	10	no	50.69	£ 506.90	
	Take up or down and remove to tip off site four post and rail fence	2748	m	15.58	£ 42,813.84	
	Take up or down and remove to tip off site chamber cover and frame	1	no	5.95	£ 5.95	
	Take up or down and remove to tip off site electric pole	16	no	164.97	£ 2,639.52	
	Take up or down and remove to tip off site telecom pole	7	no	164.97	£ 1,154.79	
	Take up or down and remove to tip off site hedge	4978	m	9.48	£ 47,191.44	
	Take up or down and remove to tip off site post	15	no	50.69	£ 760.35	
	Take up or down and remove to tip off site gully	16	no	4.59	£ 73.44	£ **238,489.81**
300	**FENCING**					
	Four post and rail fencing	19057	m	26.13	£ 497,959.41	
	Concrete Foundation	10587	no	10.89	£ 115,294.85	
	Four post and rail fencing with sheep netting on post and wire	1316	m	29.01	£ 38,177.16	
	Concrete Foundation	731	no	10.89	£ 7,961.80	£ **659,393.22**
400	**VEHICLE RESTRAINT SYSTEMS AND PEDESTRIAN GUARDRAILING**					
	Safety Barrier on driven posts straight or curved exceeding 120 metres radius	5394	m	36.19	£ 195,208.86	
	Short driven posts for single sided corrugated beam	2697	no	28.17	£ 75,974.49	
	Extra over in concrete foundations	2697	no	37.49	£ 101,110.53	
	Metal parapet 1.0m high straight or curved exceeding 50m radius	790	m	188.19	£ 148,670.10	
	Terminal for untensioned single sided beam	66	no	2193.00	£ 144,738.00	£ **665,701.98**
500	**DRAINAGE**					
	300mm dia. Filter Drain average 1.50m deep on type A bedding	3860	m	194.52	£ 750,847.20	
	150mm dia. Sewer Drain average 1.50m deep on type A bedding	2,503	m	99.04	£ 247,897.12	
	Chamber 1200mm dia. 2000mm depth	77	no	1855.59	£ 142,880.43	
	Precast concrete road gully with grating and cover	834	no	736.06	£ 613,874.04	
	Headwalls	26	no	7152.00	£ 185,952.00	
	Extra over hard material in drainage	347	m^3	27.71	£ 9,626.45	
	Sealing redundant gullies	16	no	4.59	£ 73.44	£ **1,951,150.68**
600	**EARTHWORKS**					
	Excavation of Acceptable material class 5A in cutting and other excavation	51,264	m^3	1.65	£ 84,585.60	
	Excavation of Acceptable material excluding class 5A in cutting and other excavation	331200	m^3	3.76	£ 1,245,312.00	
	Excavation of Unacceptable material class U1 in cutting and other excavation	82800	m^3	4.65	£ 385,020.00	
	Extra over excavation for excavation in Hard Material in cutting and other excavation	4140	m^3	36.50	£ 151,110.00	
	Deposition	331200	m^3	1.43	£ 473,616.00	
	Imported acceptable material class 1 A/B/C	106580	m^3	25.04	£ 2,668,763.20	
	extra for aggregate tax	106580	m^3	5.41	£ 576,597.80	
	Disposal of material	99574	m^3	3.39	£ 337,556.71	
	add for up to 10km	99574	m3/km	14.94	£ 1,487,639.30	
	Landfill tax	187299	T	2.76	£ 516,945.69	
	Landfill tax	1892	T	88.34	£ 167,131.40	
	Compaction of Fill	437780	m^3	0.77	£ 337,090.60	
	Imported Topsoil	0	m^3	24.46	£ -	
	Ditch				£ -	
	Excavation of unacceptable material class U1/U2	5049	m^3	4.65	£ 23,477.85	
	Disposal of material	5049	m^3	3.39	£ 17,116.11	
	add for up to 10km	5049	m3/km	14.94	£ 75,432.06	
	Geotextile over weak soils	7115	m^2	4.31	£ 30,665.65	
	Ponds					
	Excavation of unacceptable material class U1/U2 in new watercourses	8880	m^3	7.65	£ 67,932.00	
	Disposal of material	8880	m^3	3.39	£ 30,103.20	
	add for up to 10km	8880	m3/km	14.94	£ 132,667.20	
	Geosynthetic clay liner to ponds	8566	m^2	9.65	£ 82,661.90	
	Topsoiling 150mm thick to surfaces at 10 degrees or less to the horizontal	229932	m^2	7.17	£ 1,648,610.05	
	Completion of formation	143045	m^2	1.15	£ 164,501.75	£ **10,704,536.06**
700	**PAVEMENTS**					
	Type 1 unbound mixture sub-base in carriageway, hardshoulder and hardstrip - 250mm thick	34938	m^3	45.56	£ 1,591,775.28	
	Dense asphalt concrete base, 250mm thick in carriageway, hardshoulder and hardstrip.	139,752	m^2	37.69	£ 5,266,554.12	
	Dense asphalt concrete binder, 60mm thick in carriageway, hardshoulder and hardstrip.	139752	m^2	13.95	£ 1,949,260.90	
	Surface course, 40mm thick in carriageway, hardshoulder and hardstrip in carriagway	139752	m^2	10.28	£ 1,437,116.40	
	Red high Friction Surfacing	8300	m^2	5.57	£ 46,231.00	
	Tack Coat to Dft clause 920	139752	m^2	0.87	£ 121,584.24	£ **10,412,521.94**
1100	**KERBS, FOOTWAYS & PAVED AREAS**					
	Straight Kerbs 125 x 255mm	8190	m	18.01	£ 147,501.90	
	Foundations to Kerbs 300mm x 150mm	8190	m	5.90	£ 48,321.00	
	Combined kerb	6937	m	139.13	£ 965,144.81	
	Footway 210mm Thick, 150mm subbase, 40mm binder, 20mm surface course.	3,285	m^2	28.93	£ 95,035.05	
	Tactile Pavings	8	m^2	56.00	£ 448.00	£ **1,256,450.76**
1200	**TRAFFIC SIGNS AND ROADMARKINGS**					
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 18 square metres but not exceeding 19 square metres on 3 posts - ADS	16	no	9346.00	£ 149,536.04	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on tubular steel post. Reg signs	10	no	555.91	£ 5,559.10	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on existing columns. Reg signs	2	no	113.27	£ 226.54	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. Rbout flag	16	no	927.54	£ 14,840.64	
	Lit Chevron Sign	16	no	814.84	£ 13,037.44	
	Nonlit chevron sign	32	no	2366.40	£ 75,724.80	
	Permanent enhanced retro reflective traffic sign as non lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. - changeover	20	no	505.62	£ 10,112.40	
	Proposed Road Markings	15	item	1600.00	£ 24,000.00	
	Road Studs	5533	no	4.35	£ 24,070.00	£ **317,106.96**
1300	**LIGHTING COLUMNS**					
	Lighting Column 8m high, with bracket arm and lighting unit	106	no	1586.24	£ 168,141.44	£ **168,141.44**
1400	**ELECTRICAL WORK FOR ROAD LIGHTING COLUMNS**					
	Trenching, 300 to 450mm wide, depth not exceeding 1.5m	1060	m	18.82	£ 19,949.20	
	2 No. 100mm internal diameter UPVC duct in trench depth not exceeding 1.0 metres.	1060	m	5.00	£ 5,300.00	
	25mm2 3 core XLPE/PVC/SWA/PVC cable with copper conductors in duct.	1060	m	6.05	£ 6,413.00	
	Brick Chamber with galvanised steel cover	35	no	881.13	£ 31,133.26	
	Feeder pillar 1111x1203mm	4	no	1731.45	£ 6,925.80	£ **69,721.26**
3000	**LANDSCAPING AND ECOLOGY**					
	Grass Seeding	23	ha	2302.51	£ 52,942.00	
	Trees and shrubs allowance				£ 1,000,000.00	£ **1,052,942.00**
	MINOR CULVERTS					£ **151,492.14**
	STRUCTURES					£ **34,270,974.83**
	SUB TOTAL					£ **61,918,623.08**
	ADD FOR CONTRACTOR'S OH&P (not included in above rates)	15.00%				£ **9,287,793.46**
	SUB TOTAL					£ **71,206,416.54**
	PRELIMINARIES	25.00%				£ **17,801,604.14**
	SUB TOTAL					£ **89,008,020.68**
	STATUTORY UNDERTAKER'S COSTS	5.00%				£ **4,450,401.03**
	LAND COSTS AND ASSOCIATED FEES	8.3	km	1183700.00		£ **9,824,710.00**
	ESTIMATED CONSTRUCTION COST					£ **103,283,131.71**
	PREPARATION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.3)	12.00%				£ **12,393,975.81**
	SUPERVISION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.4)	5.00%				£ **5,164,156.59**
	SUB TOTAL					£ **120,841,264.10**
	Optimism Bias (HM Treasury Green Book - Supplementary Guidance)	32.00%				£ **38,669,204.51**
	ESTIMATED TOTAL COST					£ **159,510,468.62**

HEREFORD TRANSPORT PACKAGE - HEREFORD BYPASS

COST ESTIMATE - CORRIDOR 7

SERIES	ITEM	QUANTITY	UNIT	RATE	AMOUNT	
200	**SITE CLEARANCE**					
	General site Clearance	52.000	ha	1923.92	£ 100,043.84	
	Take up or down and remove to tip off site Lighting Columns	24	no	164.97	£ 3,959.28	
	Demolition of residential properties	5	no	5451.00	£ 27,255.00	
	Demolition of agricultural properties	4	no	15056.00	£ 60,224.00	
	Demolition of boundary Wall	1	item	11223.44	£ 11,223.44	
	Take up or down and remove to tip off site kerbs	894	m	4.94	£ 4,416.36	
	Take up or down and remove to tip off site signs including posts	7	no	50.69	£ 354.83	
	Take up or down and remove to tip off site four post and rail fence	2375	m	15.58	£ 37,002.50	
	Take up or down and remove to tip off site chamber cover and frame	0	no	5.95	£ -	
	Take up or down and remove to tip off site electric pole	19	no	164.97	£ 3,134.43	
	Take up or down and remove to tip off site telecom pole	7	no	164.97	£ 1,154.79	
	Take up or down and remove to tip off site hedge	4660	m	9.48	£ 44,176.80	
	Take up or down and remove to tip off site post	14	no	50.69	£ 709.66	
	Take up or down and remove to tip off site gully	21	no	4.59	£ 96.39	£ **293,751.32**
300	**FENCING**					
	Four post and rail fencing	17019	m	26.13	£ 444,706.47	
	Concrete Foundation	9455	no	10.89	£ 102,964.95	
	Four post and rail fencing with sheep netting on post and wire	5956	m	29.01	£ 172,783.56	
	Concrete Foundation	3309	no	10.89	£ 36,033.80	£ **756,488.78**
400	**VEHICLE RESTRAINT SYSTEMS AND PEDESTRIAN GUARDRAILING**					
	Safety Barrier on driven posts straight or curved exceeding 120 metres radius	6078	m	36.19	£ 219,962.82	
	Short driven posts for single sided corrugated beam	3039	no	28.17	£ 85,608.63	
	Extra over in concrete foundations	3039	no	37.49	£ 113,932.11	
	Metal parapet 1.0m high straight or curved exceeding 50m radius	580	m	188.19	£ 109,150.20	
	Terminal for untensioned single sided beam	78	no	2193.00	£ 171,054.00	£ **699,707.76**
500	**DRAINAGE**					
	300mm dia. Filter Drain average 1.50m deep on type A bedding	4310	m	194.52	£ 838,381.20	
	150mm dia. Sewer Drain average 1.50m deep on type A bedding	2,648	m	99.04	£ 262,290.93	
	Chamber 1200mm dia. 2000mm depth	86	no	1855.59	£ 159,951.86	
	Precast concrete road gully with grating and cover	883	no	736.06	£ 649,777.41	
	Headwalls	30	no	7152.00	£ 214,560.00	
	Extra over hard material in drainage	388	m^3	27.71	£ 10,748.71	
	Sealing redundant gullies	21	no	4.59	£ 96.39	£ **2,135,806.50**
600	**EARTHWORKS**					
	Excavation of Acceptable material class 5A in cutting and other excavation	54,924	m^3	1.65	£ 90,624.60	
	Excavation of Acceptable material excluding class 5A in cutting and other excavation	306800	m^3	3.76	£ 1,153,568.00	
	Excavation of Unacceptable material class U1 in cutting and other excavation	76700	m^3	4.65	£ 356,655.00	
	Extra over excavation for excavation in Hard Material in cutting and other excavation	3835	m^3	36.50	£ 139,977.50	
	Deposition	306800	m^3	1.43	£ 438,724.00	
	Imported acceptable material class 1 A/B/C	114400	m^3	25.04	£ 2,864,576.00	
	extra for aggregate tax	114400	m^3	5.41	£ 618,904.00	
	Disposal of material	97334	m^3	3.39	£ 329,963.62	
	add for up to 10km	97334	m3/km	14.94	£ 1,454,175.94	
	Landfill tax	183086	T	2.76	£ 505,317.38	
	Landfill tax	1849	T	88.34	£ 163,371.90	
	Compaction of Fill	421200	m^3	0.77	£ 324,324.00	
	Imported Topsoil	0	m^3	24.46	£ -	
	Ditch				£ -	
	Excavation of unacceptable material class U1/U2	4389	m^3	4.65	£ 20,408.85	
	Disposal of material	4389	m^3	3.39	£ 14,878.71	
	add for up to 10km	4389	m3/km	14.94	£ 65,571.66	
	Geotextile	5914	m^2	4.31	£ 25,489.34	
	Ponds					
	Excavation of unacceptable material class U1/U2 in new watercourses	9100	m^3	7.65	£ 69,615.00	
	Disposal of material	9100	m^3	3.39	£ 30,849.00	
	add for up to 10km	9100	m3/km	14.94	£ 135,954.00	
	Geosynthetic clay liner to ponds	8533	m^2	9.65	£ 82,343.45	
	Topsoiling 150mm thick to surfaces at 10 degrees or less to the horizontal	228597	m^2	7.17	£ 1,639,042.88	
	Completion of formation	150960	m^2	1.15	£ 173,604.00	£ **10,697,938.82**
700	**PAVEMENTS**					
	Type 1 unbound mixture sub-base in carriageway, hardshoulder and hardstrip - 250mm thick	36918	m^3	45.56	£ 1,681,995.47	
	Dense asphalt concrete base, 250mm thick in carriageway, hardshoulder and hardstrip.	147,673	m^2	37.69	£ 5,565,057.01	
	Dense asphalt concrete binder, 60mm thick in carriageway, hardshoulder and hardstrip.	147673	m^2	13.95	£ 2,059,743.00	
	Surface course, 40mm thick in carriageway, hardshoulder and hardstrip in carriagway	147673	m^2	10.28	£ 1,518,570.68	
	Red high Friction Surfacing	8700	m^2	5.57	£ 48,459.00	
	Tack Coat to Dft clause 920	147673	m^2	0.87	£ 128,475.51	£ **11,002,300.67**
1100	**KERBS, FOOTWAYS & PAVED AREAS**					
	Straight Kerbs 125 x 255mm	8625	m	18.01	£ 155,336.25	
	Foundations to Kerbs 300mm x 150mm	8625	m	5.90	£ 50,887.50	
	Combined kerb	6267	m	139.13	£ 871,927.71	
	Footway 210mm Thick, 150mm subbase, 40mm binder, 20mm surface course.	3,279	m^2	28.93	£ 94,861.47	
	Tactile Pavings	8	m^2	56.00	£ 448.00	£ **1,173,460.93**
1200	**TRAFFIC SIGNS AND ROADMARKINGS**					
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 18 square metres but not exceeding 19 square metres on 3 posts. - ADS	16	no	9346.00	£ 149,536.04	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on tubular steel post. Reg signs	10	no	555.91	£ 5,559.10	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 0.25 square metres but not exceeding 0.5 square metres on existing columns. Reg signs	2	no	113.27	£ 226.54	
	Permanent enhanced retro reflective traffic sign as lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. Rhoul flag	16	no	927.54	£ 14,840.64	
	Lit Chevron Sign	16	no	814.84	£ 13,037.44	
	Nonlit chevron sign	32	no	2366.40	£ 75,724.80	
	Permanent enhanced retro reflective traffic sign as non lit sign unit sign face exceeding 1.0 square metres but not exceeding 2.0 square metres on tubular steel posts. - chanaeover	20	no	505.62	£ 10,112.40	
	Proposed Road Markings	15	item	1600.00	£ 24,000.00	
	Road Studs	5800	no	4.35	£ 25,230.00	£ **318,266.96**
1300	**LIGHTING COLUMNS**					
	Lighting Column 8m high, with bracket arm and lighting unit	99	no	1586.24	£ 157,037.76	£ **157,037.76**
1400	**ELECTRICAL WORK FOR ROAD LIGHTING COLUMNS**					
	Trenching, 300 to 450mm wide, depth not exceeding 1.5m	990	m	18.82	£ 18,631.80	
	2 No. 100mm internal diameter UPVC duct in trench depth not exceeding 1.0 metres.	990	m	5.00	£ 4,950.00	
	25mm2 3 core XLPE/PVC/SWA/PVC cable with copper conductors in duct.	990	m	6.05	£ 5,989.50	
	Brick Chamber with galvanised steel cover	33	no	881.13	£ 29,077.29	
	Feeder pillar 1111x1203mm	4	no	1731.45	£ 6,925.80	£ **65,574.39**
3000	**LANDSCAPING AND ECOLOGY**					
	Grass Seeding	23	ha	2302.51	£ 52,634.76	
	Trees and shrubs allowance				£ 1,000,000.00	£ **1,052,634.76**
	MINOR CULVERTS					£ **125,023.86**
	STRUCTURES					£ **35,856,169.83**
	SUB TOTAL					£ **64,334,162.35**
	ADD FOR CONTRACTOR'S OH&P (not included in above rates)	15.00%				£ **9,650,124.35**
	SUB TOTAL					£ **73,984,286.70**
	PRELIMINARIES	25.00%				£ **18,496,071.67**
	SUB TOTAL					£ **92,480,358.37**
	STATUTORY UNDERTAKER'S COSTS	5.00%				£ **4,624,017.92**
	LAND COSTS AND ASSOCIATED FEES	8.7	km	1183700.00		£ **10,298,190.00**
	ESTIMATED CONSTRUCTION COST					£ **107,402,566.29**
	PREPARATION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.3)	12.00%				£ **12,888,307.96**
	SUPERVISION COSTS (DMRB Volume 13, part 2, Chapter 7, 7.4)	5.00%				£ **5,370,128.31**
	SUB TOTAL					£ **125,661,002.56**
	Optimism Bias (HM Treasury Green Book - Supplementary Guidance)	32.00%				£ **40,211,520.82**
	ESTIMATED TOTAL COST					£ **165,872,523.38**

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