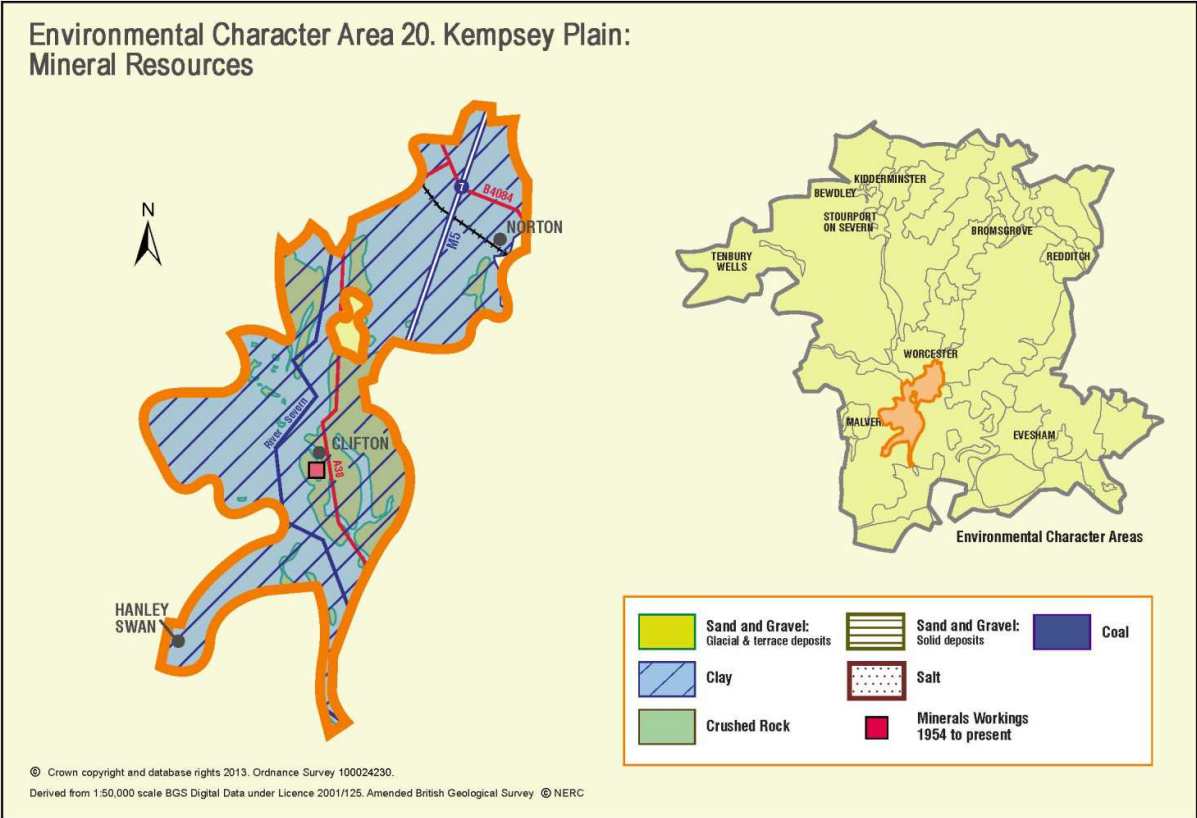


Appendix 20: Analysis of aggregate resources in ECA 20: Kempsey Plain



ECA Summary for the Fourth Stage consultation on MLP (Winter 2018):

Sand and gravel
 There are 10 resource areas identified for sand and gravel in Kempsey Plain ECA:

- Key: 2
- Significant: 1
- Compromised: 7

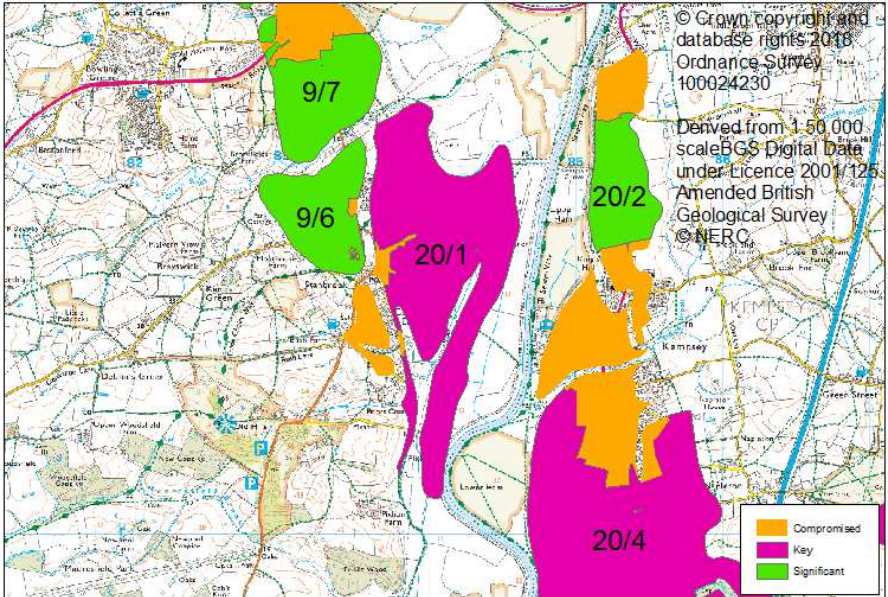
Crushed rock
 There are no resource areas identified in Kempsey Plain ECA for crushed rock.

Non-aggregates
 BGS data indicates that there are deposits of clay in this ECA.

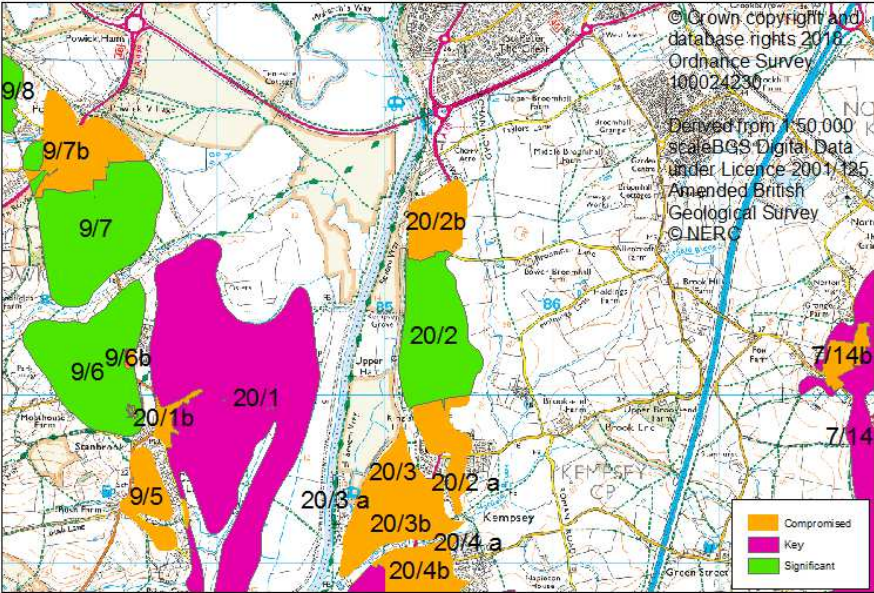
Overview of resource assessment for ECA 20

Sand and gravel resource areas:

Resource number*	Second Stage Consultation		Third Stage Consultation		Fourth Stage Consultation		
	Original estimated resource tonnage (2 tonnes/m ³)	Significance	Revised estimate of resource tonnage (1.65 tonnes/m ³)	Significance	New resource number (where resource has been split)	Revised estimate of resource tonnage (1.65 tonnes/m ³)	Result
20/1	6,900,000	Key	5,692,500	Key	20/1	5,527,500	Key
					20/1b		Compromised
20/2	1,457,000	Significant	1,202,025	Significant	20/2	843,975	Significant
					20/2b		Compromised
20/2 a	310,000	Compromised	255,750	Compromised	Not reassessed		
20/3	280,000	Compromised	264,000	Compromised			
20/3 a	840,000	Compromised	693,000	Compromised			
20/4	28,658,000	Key	23,642,850	Key	20/4	20,565,600	Key
					20/4b		Compromised
20/4 a	1,242,000	Compromised	1,024,650	Compromised	Not reassessed		

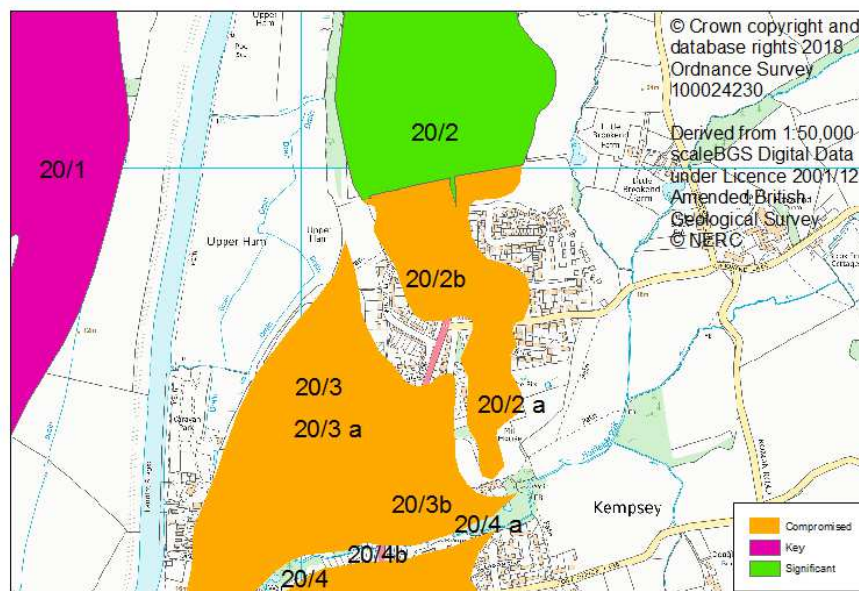
Overview	
Resource number:	20/1
Resource name:	Beauchamp Court
Resource area:	138 ha
Resource depth:	Estimated 5m
Location	
OS sheet reference:	SO 85 SW, SO 84 NW
National grid ref:	384058, 249848
 <p>© Crown copyright and database rights 2018 Ordnance Survey 100024230</p> <p>Derived from 1:50,000 scale BGS Digital Data under Licence 2001/125 Amended British Geological Survey ©NERC</p> <p>Legend: ■ Compromised ■ Key ■ Significant</p>	
Resource description:	
Resource description:	2 nd terrace (Worcester) sand and gravel. Within these river terrace deposits, boreholes indicate wide variation in the thickness of sand and gravel. Within the flood plain of the River Severn, fluvial silty and sandy clays overlie deposits of sand and gravel which rarely exceed 4m in thickness, overburden has an average thickness of 3.3m. Investigations in the district to the south of Beauchamp Court proved the 2 nd terrace to be 4-6m thick. (Estimated resource depth based on median depth of 5m)
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A medium deposit intersected by some ribbon development across the centre of the resource area.
Crude estimate of resource:	Area: 138 ha x average depth: 5m / 2 Estimated resource volume: 3,450,000m ³ Estimated resource tonnage (at 2 t/m³): 6,900,000 tonnes
Conclusion:	Significant – key resource. Use to define areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 138 ha x average depth: 5m / 2 Estimated resource volume: 3,450,000m ³ Estimated resource tonnage (at 1.65 t/m³): 5,692,500 tonnes
Conclusion:	Significant – key resource.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
This resource area has been split into areas 20/1 and 20/1b.	

Resource area 20/1		Resource area 20/1b	
Resource area:	134 ha	Commentary:	Screened out due to the following appendix A criterion: <ul style="list-style-type: none"> - Listed Buildings - Settlement boundary
Resource depth:	Estimated 5m		
Revised estimate of resource:	Area: 134 ha x average depth: 5m ÷ 2 Estimated resource volume: 3,350,000 m ³ Estimated resource tonnage (at 1.65 t/m³): 5,527,500 tonnes		
Conclusion:	Key resource	Conclusion:	Compromised

Overview	
Resource number:	20/2
Resource name:	Clerkenleap
Resource area:	47ha
Resource depth:	Estimate 3.1m
Location	
OS sheet reference:	SO 85 SE, SO 84 NE
National grid ref:	385315, 250388
	
Resource description:	
Resource description:	3 rd terrace (Holt Heath) sand and gravel. A borehole within the terrace at Kempsey recorded 0.3m of overburden on 3.1m of sand and gravel. The third terrace consists of gravel, sandy gravel and sand which is clayey or cobbly in part. (Estimated resource depth based on borehole depth of 3.1m)
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small resource area intersected by the A38, with small-scale development along the road. The deposit continues to the south where it is overlain by the village of Kempsey, this section is assessed as resource area 20/2a.
Crude estimate of resource:	Area: 47ha x average depth: 3.1m / 2 Estimated resource volume: 728,500m ³ Estimated resource tonnage (at 2 t/m³): 1,457,000 tonnes
Conclusion:	Significant. Consider in defining areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 47ha x average depth: 3.1m / 2 Estimated resource volume: 728,500m ³ Estimated resource tonnage (at 1.65 t/m³): 1,202,025 tonnes
Conclusion:	Significant.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	

This resource area has been split into areas 20/2 and 20/2b.			
Resource area 20/2		Resource area 20/2b	
Resource area:	33 ha	Commentary:	Screened out due to the following appendix A criterion: <ul style="list-style-type: none"> - Allocated site in South Worcestershire Development Plan - Listed Buildings - Settlement boundary
Resource depth:	Estimated 3.1m		
Revised estimate of resource:	Area: 33 ha x average depth: 3.1m ÷ 2 Estimated resource volume: 511,500 m ³ Estimated resource tonnage (at 1.65 t/m³): 843,975 tonnes		
Conclusion:	Significant resource	Conclusion:	Compromised

Overview	
Resource number:	20/2a
Resource name:	Clerkenleap a)
Resource area:	10ha
Resource depth:	Estimate 3.1m
Location	
OS sheet reference:	SO 85 SE, SO 84 NE
National grid ref:	385362, 249700



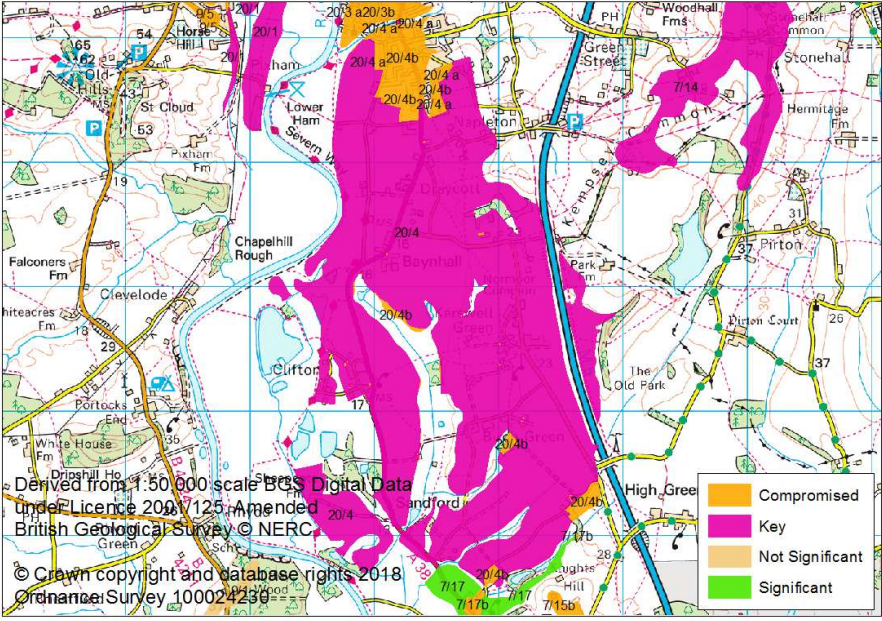
Resource description:	
Resource description:	3 rd terrace (Holt Heath) sand and gravel. A borehole within the terrace at Kempsey recorded 0.3m of overburden on 3.1m of sand and gravel. The third terrace consists of gravel, sandy gravel and sand which is clayey or cobbly in part. (Estimated resource depth based on borehole depth of 3.1m)
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small deposit intersected by the A38. The resource area is compromised by the village of Kempsey. The deposit continues to the north and this section is assessed as resource area 20/2.
Crude estimate of resource:	Area: 10ha x average depth: 3.1m / 2 Estimated resource volume: 155,000m ³

	Estimated resource tonnage (at 2 t/m³): 310,000 tonnes
Conclusion:	Compromised by development.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 10ha x average depth: 3.1m / 2 Estimated resource volume: 155,000m ³ Estimated resource tonnage (at 1.65 t/m³): 255,750 tonnes
Conclusion:	Compromised by development.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation	

Overview	
Resource number:	20/3
Resource name:	West of Kempsey
Resource area:	8 ha
Resource depth:	Estimated 4m
Location	
OS sheet reference:	SO 84 NW
National grid ref:	385058, 249334
Resource description:	
Resource description:	2 nd terrace (Worcester) sand and gravel. Within these river terrace deposits, boreholes indicate wide variation in the thickness of sand and gravel. Within the flood plain of the River Severn, fluvial silty and sandy clays overlie deposits of sand and gravel which rarely exceed 4m in thickness, overburden has an average thickness of 3.3m. (Estimated resource depth based on BGS data indicating 4m)
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	The deposit continues under the village of Kempsey, this section is assessed as a separate resource area (20/3a). Only 8 hectares of the deposit remains uncompromised by significant development but this area contains some small-scale dispersed development.
Crude estimate of resource:	Area: 8 ha x average depth: 4m / 2 Estimated resource volume: 140,000 m ³ Estimated resource tonnage (at 2 t/m³): 280,000 tonnes
Conclusion:	Compromised by development with less than 10ha of the deposit remaining.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Calculation above showed the wrong estimated resource volume. Calculation corrected below: Area: 8 ha x average depth: 4m / 2 Estimated resource volume: 160,000 m ³ Estimated resource tonnage (at 1.65 t/m³): 264,000 tonnes
Conclusion:	Compromised by development.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	

Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation

Overview	
Resource number:	20/3a
Resource name:	West of Kempsey a)
Resource area:	21 ha
Resource depth:	Estimated 4m
Location	
OS sheet reference:	SO 84 NW
National grid ref:	385058, 249334
Resource description:	
Resource description:	2 nd terrace (Worcester) sand and gravel. Within these river terrace deposits, boreholes indicate wide variation in the thickness of sand and gravel. Within the flood plain of the River Severn, fluvial silty and sandy clays overlie deposits of sand and gravel which rarely exceed 4m in thickness, overburden has an average thickness of 3.3m. (Estimated resource depth based on BGS data indicating 4m)
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	This resource area is compromised by the settlement of Kempsey. Only 8 hectares of the deposit remain uncompromised by significant development and this section is assessed separately as resource area 20/3.
Crude estimate of resource:	Area: 21 ha x average depth: 4m / 2 Estimated resource volume: 420,000 m ³ Estimated resource tonnage (at 2 t/m³): 840,000 tonnes
Conclusion:	Compromised by development.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 21 ha x average depth: 4m / 2 Estimated resource volume: 420,000 m ³ Estimated resource tonnage (at 1.65 t/m³): 693,000 tonnes
Conclusion:	Compromised by development.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation	

Overview	
Resource number:	20/4
Resource name:	South of Kempsey
Resource area:	623 ha
Resource depth:	Estimated 4.6m
Revised resource depth:	Estimated 4.1m
Location	
OS sheet reference:	SO 84 NE, SO 84 NW
National grid ref:	385593, 246648
	
Resource description:	
Resource description:	<p>2nd terrace (Worcester) and 3rd terrace (Holt Heath) sand and gravel (roughly 50% of each). Only 2 boreholes have been sunk in the area, both in the 2nd terrace, one within the built-up area of Kempsey proved 3.1m of sand and gravel beneath 0.3m of overburden and the other east of Baynhall Farm where 7.6m of sand and gravel lies beneath 0.6m of overburden. Clifton quarry in the 2nd terrace has previously been worked and the application estimated an average depth of 4m across the site.</p> <p>There are no boreholes in the 3rd terrace and no exposures recorded but the terrace generally comprises gravel, sandy gravel and sand which may be clayey or cobbly in part. The maximum known thickness of the 3rd terrace is 5.2m of sand overlying 3m of gravel (8.2m in St John's, Worcester) but between 1 and 6m is probably the common range.</p> <p>(Estimated resource depth based on mean average of: a) borehole depths (3.1m and 7.6m), b) average depth of Clifton quarry (4m) and c) median depth of 3rd terrace (3.5m). Giving 4.6m)</p>
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A large deposit with dispersed development. The deposit has previously/currently been worked at Clifton and this is not included as part of the resource area. The deposit also continues under the village of Kempsey, this section is considered separately as resource area 20/4a. The area of deposit under the M5 has not been assessed.
Crude estimate of resource:	<p>Area: 623ha x average depth: 4.6m / 2</p> <p>Estimated resource volume: 14,329,000m³</p> <p>Estimated resource tonnage (at 2 t/m³): 28,658,000 tonnes</p>

Conclusion:	Significant – key resource. Use to define areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Additional information	<p>Two sites within resource area 20/4 were proposed by the mineral operator Lafarge Tarmac to the south (28ha) and east (52ha) of the existing Clifton quarry. These sites are both within the 2nd terrace (Worcester) deposits.</p> <p>To accompany their site submission, Lafarge Tarmac provided an executive summary and accompanying maps from a "Report on Exploration Drilling of the Potential Southern and Eastern Extensions Clifton Quarry" (dated June 2014) which showed the results of site investigation over the period from 1998 to 2014 comprising a total of 68 boreholes and 18 trial pits. These revealed that river terrace sand and gravels underlie these areas, varying in thickness between 0m-7.4m with an average of 3.6m across the entire site. The southern area also contains a finer fluvial sand deposit above the sand and gravel with a range of 0m-7.2m and an average of 2.5m.</p> <p>The main (lower) sand and gravel deposit comprises a silty, sand and gravel. The sand is generally medium-fine grained and would be suitable for production of 0/4mm classified sands for concrete production once washed. The gravels are typical of the area comprising rounded clasts of 'bunter' quartzite with occasional 'erratic' rock types sourced from the Malvern hills and upper regions of the Severn. Although local variations exist, the lower sand and gravel in the southern extension is generally more gravel rich than the eastern extension.</p> <p>The upper sand in the southern area is similar to that encountered in the existing quarry. The sand is suitable for dry screening or washing for production of 0/2mm grade concrete and mortar sands.</p> <p>The report concludes that the total potential resource for the area, calculated as a saleable tonnage is between 2,293,000 tonnes and 2,855,000 tonnes, depending on stand-offs applied.</p> <p>In addition to the information in the Resource Description above, the estimated resource depth can be updated as follows: Estimated resource depth based on mean average of: a) borehole depths (3.1m and 7.6m), b) average depth of Clifton quarry (4m), c) median depth of 3rd terrace (3.5m), d) average depth of "lower" deposit across southern and eastern extension areas (3.6m), e) average depth of "upper" deposit in southern area (2.5m) = 4.1 m</p>
Revised estimate of resource:	<p>Area: 623ha x average depth: 4.1m / 2 Estimated resource volume: 12,771,500 m³ Estimated resource tonnage (at 1.65 t/m³): 21,072,975 tonnes</p>
Conclusion:	Significant – key resource.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
This resource area has been split into areas 20/4 and 20/4b	

Resource area 20/4		Resource area 20/4b	
Resource area:	608 ha	Commentary:	Screened out due to the following appendix A criterion: <ul style="list-style-type: none"> - Allocated site in South Worcestershire Development Plan - Ancient Semi-Natural Woodland - Listed Buildings - Registered Parks and Gardens - Settlement boundary - Site of Special Scientific Interest
Resource depth:	Estimated 4.1m		
Revised estimate of resource:	Area: 608 ha x average depth: 4.1m ÷ 2 Estimated resource volume: 12,464,000 m ³ Estimated resource tonnage (at 1.65 t/m³): 20,565,600 tonnes		
Conclusion:	Key resource	Conclusion:	Compromised

Overview	
Resource number:	20/4a
Resource name:	South of Kempsey a)
Resource area:	27 ha
Resource depth:	Estimated 4.6m
Revised resource depth:	Estimated 4.1m
OS sheet reference:	SO 84 NE, SO 84 NW
National grid ref:	385593, 246648
Resource description:	
Resource description:	<p>2nd terrace (Worcester) and 3rd terrace (Holt Heath) sand and gravel (roughly 50% of each). Only 2 boreholes have been sunk in the area, both in the 2nd terrace, one within the built-up area of Kempsey proved 3.1m of sand and gravel beneath 0.3m of overburden and the other east of Baynhall Farm where 7.6m of sand and gravel lies beneath 0.6m of overburden. Clifton quarry in the 2nd terrace has previously been worked and the application estimated an average depth of 4m across the site.</p> <p>There are no boreholes in the 3rd terrace and no exposures recorded but the terrace generally comprises gravel, sandy gravel and sand which may be clayey or cobbly in part. The maximum known thickness of the 3rd terrace is 5.2m of sand overlying 3m of gravel (8.2m in St John's, Worcester) but between 1 and 6m is probably the common range.</p> <p>(Estimated resource depth based on mean average of: a) borehole depths (3.1m and 7.6m), b) average depth of Clifton quarry (4m) and c) median depth of 3rd terrace (3.5m). Giving 4.6m)</p>
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	This resource area is compromised by the settlement of Kempsey. The deposit continues to the south of Kempsey village and this section is considered separately as resource area 20/4.
Crude estimate of resource:	<p>Area: 27ha x average depth: 4.6m / 2</p> <p>Estimated resource volume: 621,000m³</p> <p>Estimated resource tonnage (at 2 t/m³): 1,242,000 tonnes</p>
Conclusion:	Compromised by development.

Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Additional information	<p>Two sites within resource area 20/4 were proposed by the mineral operator Lafarge Tarmac to the south (28ha) and east (52ha) of the existing Clifton quarry. These sites are both within the 2nd terrace (Worcester) deposits.</p> <p>To accompany their site submission, Lafarge Tarmac provided an executive summary and accompanying maps from a "Report on Exploration Drilling of the Potential Southern and Eastern Extensions Clifton Quarry" (dated June 2014) which showed the results of site investigation over the period from 1998 to 2014 comprising a total of 68 boreholes and 18 trial pits. These revealed that river terrace sand and gravels underlie these areas, varying in thickness between 0m-7.4m with an average of 3.6m across the entire site. The southern area also contains a finer fluvial sand deposit above the sand and gravel with a range of 0m-7.2m and an average of 2.5m.</p> <p>The main (lower) sand and gravel deposit comprises a silty, sand and gravel. The sand is generally medium-fine grained and would be suitable for production of 0/4mm classified sands for concrete production once washed. The gravels are typical of the area comprising rounded clasts of 'bunter' quartzite with occasional 'erratic' rock types sourced from the Malvern hills and upper regions of the Severn. Although local variations exist, the lower sand and gravel in the southern extension is generally more gravel rich than the eastern extension.</p> <p>The upper sand in the southern area is similar to that encountered in the existing quarry. The sand is suitable for dry screening or washing for production of 0/2mm grade concrete and mortar sands.</p> <p>The report concludes that the total potential resource for the area, calculated as a saleable tonnage is between 2,293,000 tonnes and 2,855,000 tonnes, depending on stand-offs applied.</p> <p>In addition to the information in the Resource Description above, the estimated resource depth can be updated as follows: Estimated resource depth based on mean average of: a) borehole depths (3.1m and 7.6m), b) average depth of Clifton quarry (4m), c) median depth of 3rd terrace (3.5m), d) average depth of "lower" deposit across southern and eastern extension areas (3.6m), e) average depth of "upper" deposit in southern area (2.5m) = 4.1m</p>
Revised estimate of resource:	<p>Area: 27ha x average depth: 4.1m / 2 Estimated resource volume: 553,500m³ Estimated resource tonnage (at 1.65 t/m³): 913,275 tonnes</p>
Conclusion:	Compromised by development.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation	