Touchstone geological services ltd

Samlesbury Estate
Aggregate Mineral Resource Assessment
August 2022

Executive Summary

The site under review at Samlesbury Estate is demonstrated to contain 2,575,000 saleable tonnes of sand and gravel.

The deposit is approximately 60% sand and 40% gravel.

The sand fraction is of excellent quality in grading and composition, suitable for a range of applications under BS EN 12620 Aggregates for Concrete.

The gravel fraction comprises a significant volume greater than 20mm in size making it available for crushing and thus extending the options for high quality concrete products.

The sand and gravel deposit therefore satisfies the *compliance with specifications* objective within Policy CS1 of the adopted Core Strategy and the sand meets the *high-quality sand* objective of Policy CS3 in that Core Strategy.

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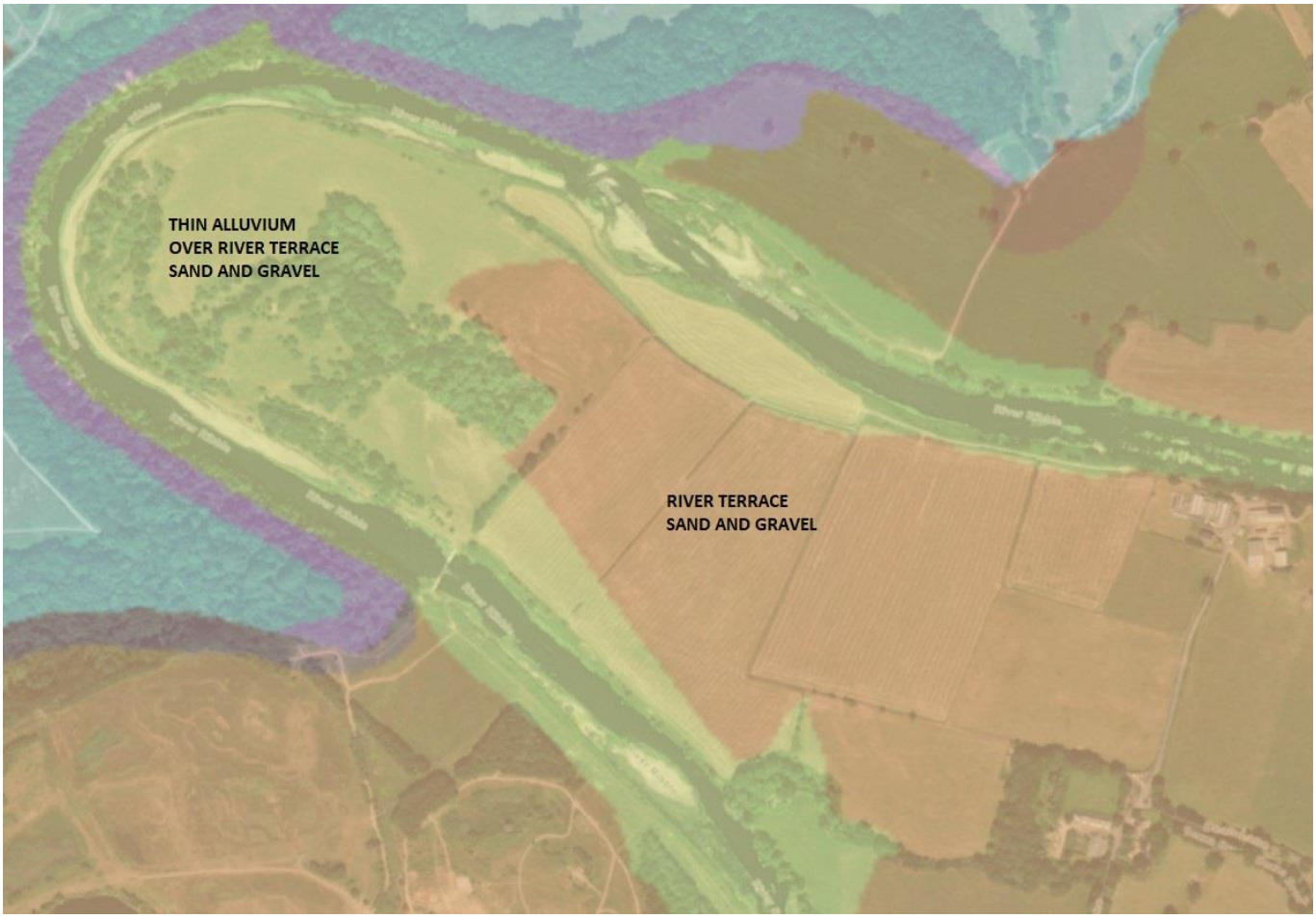
Introduction and Geology

Touchstone Geological Services Ltd (TGSL) has been approached by Harleyford Aggregates Ltd to assess potential aggregate mineral resources on part of the Samlesbury Estate, near Preston, Lancashire and to give consideration to Policy CS1 of the adopted Core Strategy.

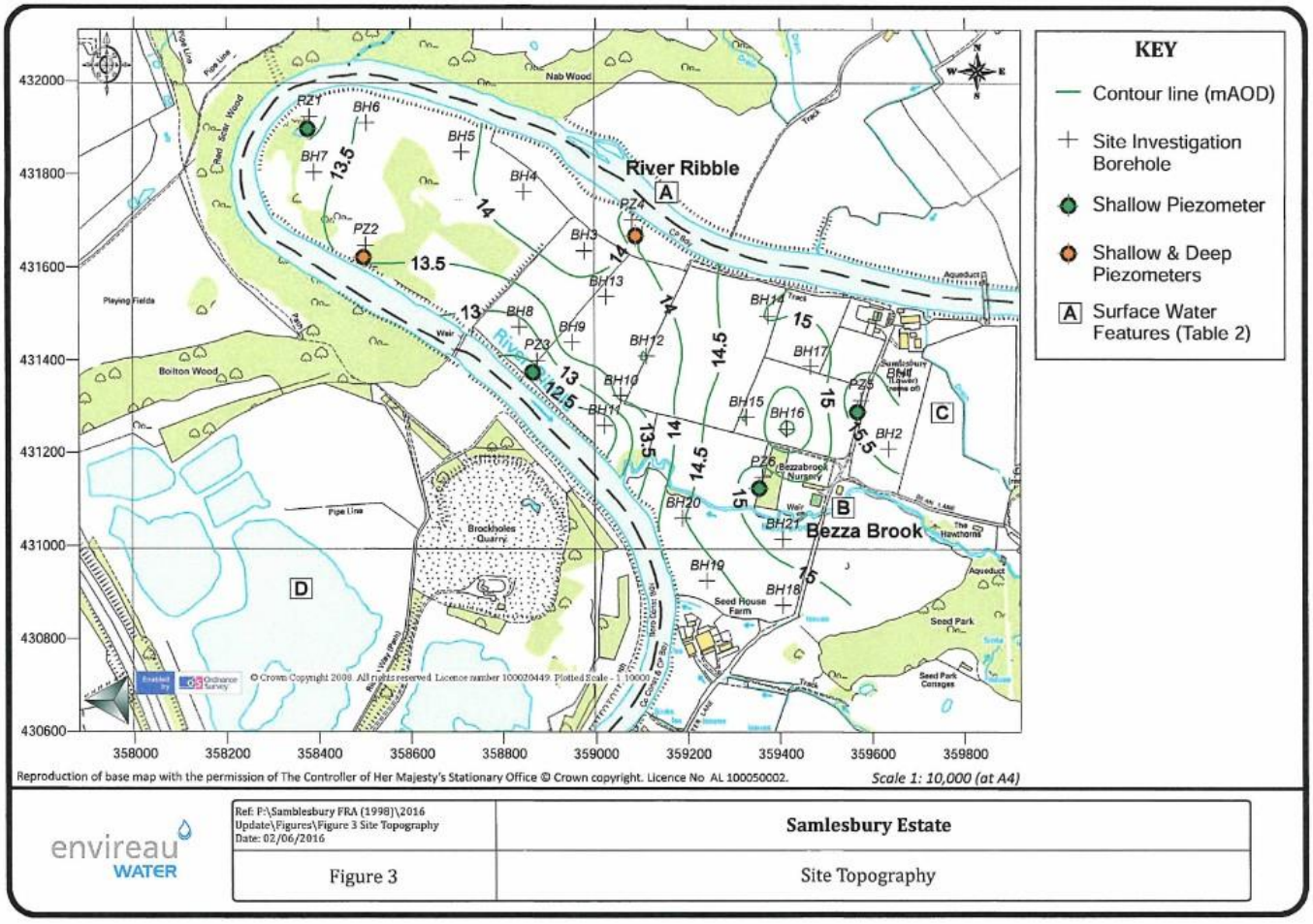
The site of interest is located approximately 5.5km east of the centre of Preston and 2km northwest of the village. The site comprises relatively flat arable land enclosed by a meander of the River Ribble.

Source: Google Maps

A review of the available published geological information (British Geological Survey on-line Geology Viewer) indicates that the site is underlain by 2nd River Terrace deposits of sand and gravel. These are exposed at the surface in central and eastern parts of the site and are covered by thin alluvium in western parts.



In 2008 a total of twenty-one 175mm diameter continuous flight auger boreholes were drilled by AJ Goff Ltd and twenty bulk samples recovered for particle size distribution (psd) analysis:



The mineral deposit was described as comprising *'generally clean, well-graded, pale coloured flint sand and rounded gravel (mainly flint derived, with some sandstone) overlain by varying thickness of clayey silty fine brown sand, and with a base of either firm brown clay or very compacted friable red sandstone.'*

Detailed borehole logs and psd results have been made available for this resource assessment.

It is understood that parts of the site were worked for sand and gravel prior to the 1970's however no information exists but for an outline of workings described by scrubland (see aerial imagery above).

Quality of the Deposit

The psd results from the 2008 exploration have been interrogated by AVGRAD, separated into the Sand and Gravel and the overlying Upper Sand:

Table 1 illustrates the nature of the raw sand and gravel split into the two fractions; it comprises an overall weighted average of **51/42/7 (%) Gravel/Sand/Silt**.

SITE NAME: Samlesbury Sand and Gravel Gradings — **TABLE 1**

			UNPROCESSED SAND (PERCENTAGE PASSING)									% GRAVEL (ABSOLUTE)					OVERALL SUMMARY			
BOREHOLE NUMBER	DEPTH (m) From	To	4.0 mm	2.8 mm	2.0 mm	1.0 mm	0.500 mm	0.250 mm	0.125 mm	0.063 mm		40+ mm	20/40[b] mm	10/20[b] mm	4/10[b] mm	O Size mm	Gravel %	Sand %	Fines %	Sand Clean's
S/01/1	2.0	3.0	100	94	88	75	53	34	25	19	*	18	20	16	14	18	50	26	6	silty
S/02/1	1.7	3.0	100	96	91	78	49	27	20	16	*	3	18	19	15	3	52	38	7	silty
S/03/1	1.7	3.0	100	95	92	79	44	16	10	8		4	10	12	11	4	33	58	5	s silty
S/03/2	3.0	4.5	100	90	81	71	52	32	23	19	*	36	14	9	10	36	33	25	6	silty
S/04/1	0.7	1.5	100	94	89	77	54	20	9	6		6	28	20	11	6	59	33	2	s silty
S/04/2	1.5	3.0	100	95	92	83	60	27	16	11	*	15	5	9	8	15	22	56	7	silty
S/04/3	3.0	4.5	100	95	93	82	57	25	16	11	*	10	23	15	8	10	46	39	5	silty
S/05/1	4.0	5.0	100	88	79	52	30	21	12	9		13	13	23	18	13	54	30	3	s silty
S/05/2	5.5	7.0	100	91	83	62	34	19	13	9		2	22	14	15	2	51	43	4	s silty
S/08/2	3.0	4.0	100	97	94	78	50	20	11	6		9	9	11	7	9	27	60	4	s silty
S/09/1	0.8	1.5	100	96	91	83	67	48	33	26	**	11	17	15	11	11	43	34	12	v silty
S/09/2	2.0	3.0	100	95	89	79	61	37	24	18	*	26	13	12	11	26	36	31	7	silty
S/09/3	4.5	6.0	100	99	96	94	90	71	39	24	**	0	7	5	5	0	17	63	20	v silty
WEIGHTED AVERAGE		-	**100**	**94**	**89**	**77**	**54**	**31**	**19**	**14**	*	**12**	**15**	**13**	**11**	**12**	**39**	**42**	**7**	silty
MAXIMUM		-	100	99	96	94	90	71	39	26	**	36	28	23	18	36	59	63	20	v silty
MINIMUM		-	100	88	79	52	30	16	9	6		0	5	5	5	0	17	25	2	s silty

NOTE: * defines an unprocessed sand grading where the fines (-63µm) content is greater than 10 %
NOTE: ** defines an unprocessed sand grading where the fines (-63µm) content is greater than 20 %

Table 2 illustrates a washed sand product grading; the sand is a very competitive medium to coarse grained sand with **48% and 21% passing the key 500 micron and 250 micron sieves** respectively. The gravel fraction possesses an excellent balance across the size ranges including a very useful oversize (20/40mm and 40mm+) that provides the option for crushing to reach specialist strength concrete markets:

SITE NAME: Samlesbury Sand and Gravel Gradings — **TABLE 2**

			PROCESSED SAND (PERCENTAGE PASSING)								% GRAVEL (ABSOLUTE)					OVERALL SUMMARY			
BOREHOLE NUMBER	DEPTH (m) From	To	4.0 mm	2.8 mm	2.0 mm	1.0 mm	0.500 mm	0.250 mm	0.125 mm	0.063 mm	40+ mm	20/40[b] mm	10/20[b] mm	4/10[b] mm	O Size mm	Gravel %	Sand %	Fines %	Sand Clean's
S/01/1	2.0	3.0	100	92	85	70	44	21	10	2	18	20	16	14	18	50	26	6	silty
S/02/1	1.7	3.0	100	95	90	74	41	15	7	2	3	18	19	15	3	52	38	7	silty
S/03/1	1.7	3.0	100	95	91	78	40	9	3	1	4	10	12	11	4	33	58	5	s silty
S/03/2	3.0	4.5	100	88	77	65	41	18	6	2	36	14	9	10	36	33	25	6	silty
S/04/1	0.7	1.5	100	94	88	76	52	16	4	1	6	28	20	11	6	59	33	2	s silty
S/04/2	1.5	3.0	100	95	91	81	56	19	7	1	15	5	9	8	15	22	56	7	silty
S/04/3	3.0	4.5	100	95	92	80	52	16	6	1	10	23	15	8	10	46	39	5	silty
S/05/1	4.0	5.0	100	87	77	47	24	14	4	1	13	13	23	18	13	54	30	3	s silty
S/05/2	5.5	7.0	100	91	82	59	29	12	6	1	2	22	14	15	2	51	43	4	s silty
S/08/2	3.0	4.0	100	97	93	77	47	16	6	1	9	9	11	7	9	27	60	4	s silty
S/09/1	0.8	1.5	100	94	89	77	57	32	12	3	11	17	15	11	11	43	34	12	v silty
S/09/2	2.0	3.0	100	94	87	75	53	24	9	2	26	13	12	11	26	36	31	7	silty
S/09/3	4.5	6.0	100	98	95	92	88	63	22	3	0	7	5	5	0	17	63	20	v silty
WEIGHTED AVERAGE		-	**100**	**93**	**88**	**73**	**48**	**21**	**8**	**2**	**12**	**15**	**13**	**11**	**12**	**39**	**42**	**7**	silty
MAXIMUM		-	100	98	95	92	88	63	22	3	36	28	23	18	36	59	63	20	v silty
MINIMUM		-	100	87	77	47	24	9	3	1	0	5	5	5	0	17	25	2	s silty

NOTE: Sand Plant simulation assumes that the amount of fines (-63µm) removed is 90 %

The following table demonstrates that the sand and gravel complies with BS EN 12620 for a 0/4 (MP) concrete sand.

FINE AGGREGATES FOR CONCRETE AND GENERAL USE : COMPLIANCE TO EN 12620 0/4(MP)					
GRADING ENVELOPE	LOWER	UPPER	RESULT	COMPLIANCE	FAILS %
8.0mm	100	100	100	PASS	-
6.3mm	95	100	100	PASS	-
4.0mm	85	100	100	PASS	-
0.500mm	30	70	48	PASS	-
0.063mm	$f_{category}$		2	f 3	-
GRADING TOLERANCES	MIN	MAX	AVE		
1.0mm tolerance 'Ave' ± 20	47	92	73	INCONSISTANT	-
0.250mm tolerance 'Ave' ± 20	9	63	21	INCONSISTANT	-
0.063mm tolerance 'Ave' ± 3	1	3	2	PASS	-

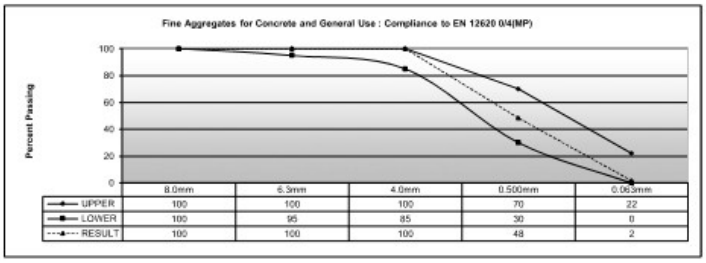


Table 3 illustrates the nature of the raw sand in the overlying Upper Sand:

SITE NAME: Samlesbury Upper Sand Gradings — **TABLE 3**

			UNPROCESSED SAND (PERCENTAGE PASSING)									% GRAVEL (ABSOLUTE)				OVERALL SUMMARY				
BOREHOLE NUMBER	DEPTH (m) From	To	4.0 mm	2.8 mm	2.0 mm	1.0 mm	0.500 mm	0.250 mm	0.125 mm	0.063 mm		40+ mm	20/40[b] mm	10/20[b] mm	4/10[b] mm	O Size mm	Gravel %	Sand %	Fines %	Sand Clean's
S/07/1	0.5	3.0	100	100	100	100	98	69	25	15	*	0	0	0	0	0	0	85	15	silty
S/07/2	3.0	4.5	100	100	100	100	99	82	42	18	*	0	0	0	0	0	0	82	18	silty
S/08/1	1.9	2.9	100	100	100	100	99	89	44	25	**	0	0	0	0	0	0	75	25	v silty
S/10/1	1.5	2.8	100	100	100	100	99	79	34	18	*	0	0	0	0	0	0	82	18	silty
WEIGHTED AVERAGE		-	**100**	**100**	**100**	**100**	**99**	**77**	**34**	**18**	*	**0**	**0**	**0**	**0**	**0**	**0**	**82**	**18**	silty
MAXIMUM		-	100	100	100	100	99	89	44	25	**	0	0	0	0	0	0	85	25	v silty
MINIMUM		-	100	100	100	100	98	69	25	15	*	0	0	0	0	0	0	75	15	silty

NOTE: * defines an unprocessed sand grading where the fines (-63µm) content is greater than 10 %
NOTE: ** defines an unprocessed sand grading where the fines (-63µm) content is greater than 20 %

Table 4 illustrates a washed sand product grading; the sand is confirmed as a fine to fine/medium grained sand with **98% and 73% passing the key 500 micron and 250 micron sieves** respectively.

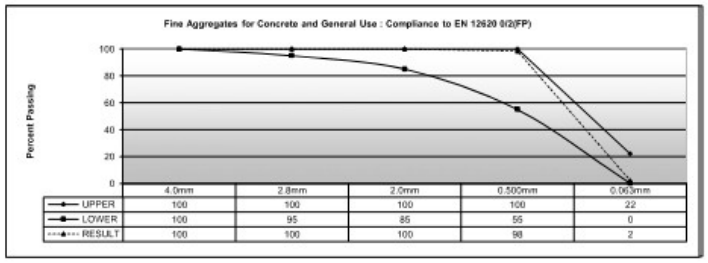
SITE NAME: Samlesbury Upper Sand Gradings — **TABLE 4**

			PROCESSED SAND (PERCENTAGE PASSING)								% GRAVEL (ABSOLUTE)				OVERALL SUMMARY				
BOREHOLE NUMBER	DEPTH (m) From	To	4.0 mm	2.8 mm	2.0 mm	1.0 mm	0.500 mm	0.250 mm	0.125 mm	0.063 mm	40+ mm	20/40[b] mm	10/20[b] mm	4/10[b] mm	O Size mm	Gravel %	Sand %	Fines %	Sand Clean's
S/07/1	0.5	3.0	100	100	100	100	98	64	13	2	0	0	0	0	0	0	85	15	silty
S/07/2	3.0	4.5	100	100	100	100	99	79	31	2	0	0	0	0	0	0	82	18	silty
S/08/1	1.9	2.9	100	100	100	100	99	86	28	3	0	0	0	0	0	0	75	25	v silty
S/10/1	1.5	2.8	100	100	100	100	99	75	21	2	0	0	0	0	0	0	82	18	silty
WEIGHTED AVERAGE		-	**100**	**100**	**100**	**100**	**98**	**73**	**21**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**82**	**18**	silty
MAXIMUM		-	100	100	100	100	99	86	31	3	0	0	0	0	0	0	85	25	v silty
MINIMUM		-	100	100	100	100	98	64	13	2	0	0	0	0	0	0	75	15	silty

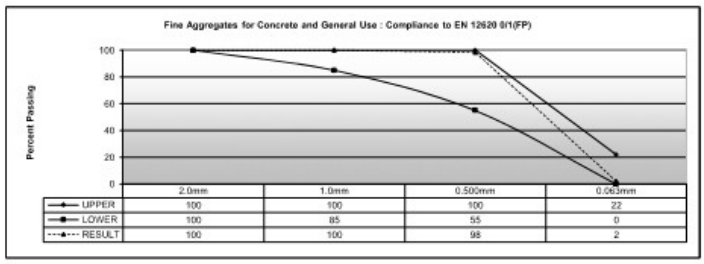
NOTE: Sand Plant simulation assumes that the amount of fines (-63µm) removed is 90 %

The following table demonstrates that the sand complies with BS EN 12620 for 0/1 (FP) and 0/2 (FP) concrete sand.

FINE AGGREGATES FOR CONCRETE AND GENERAL USE : COMPLIANCE TO EN 12620 0/2(FP)					
GRADING ENVELOPE	LOWER	UPPER	RESULT	COMPLIANCE	FAILS %
4.0mm	100	100	100	PASS	-
2.8mm	95	100	100	PASS	-
2.0mm	85	100	100	PASS	-
0.500mm	55	100	98	PASS	-
0.063mm	$f_{category}$		2	f 3	-
GRADING TOLERANCES	MIN	MAX	AVE		
1.0mm tolerance 'Ave' ± 20	100	100	100	PASS	-
0.250mm tolerance 'Ave' ± 25	64	86	73	PASS	-
0.063mm tolerance 'Ave' ± 5	2	3	2	PASS	-



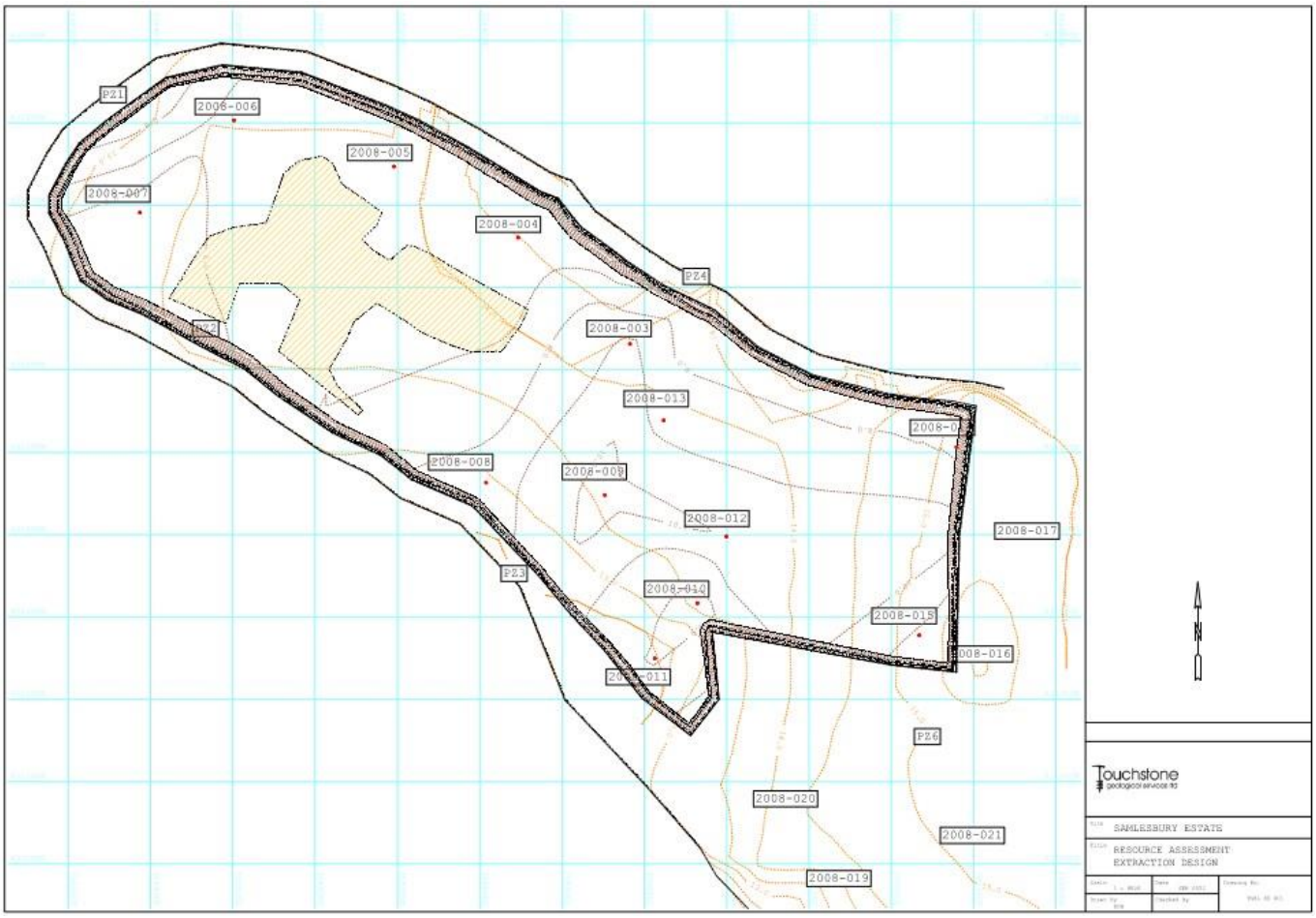
FINE AGGREGATES FOR CONCRETE AND GENERAL USE : COMPLIANCE TO EN 12620 0/1(FP)					
GRADING ENVELOPE	LOWER	UPPER	RESULT	COMPLIANCE	FAILS %
2.0mm	100	100	100	PASS	-
1.0mm	85	100	100	PASS	-
0.500mm	55	100	98	PASS	-
0.063mm	$f_{category}$		2	f 3	-
GRADING TOLERANCES	MIN	MAX	AVE		
0.250mm tolerance 'Ave' ± 25	64	86	73	PASS	-
0.063mm tolerance 'Ave' ± 5	2	3	2	PASS	-



The option exists to blend crushed sands from the sand and gravel deposit with the Upper Sand thereby increasing resources of high-quality BS EN 12620 0/4 (MP) concrete sand.

Resources

A digital topographic survey has been created from published OS mapping data to enable accurate geological and resource modelling:



The extraction batter has been set at 25m standoff from the River Ribble and with an overall slope profile of 1v in 2.5h. The brown contours represent the topography and the grey contours represent the base of mineral workings.

The Upper Sand has an assumed density of 1.6 tonnes/m³ and a waste factor of 20% has been applied.

The Sand and Gravel has an assumed density of 1.8 tonnes/m³ and a waste factor of 10% has been applied.

It is assumed that the former workings (shaded area on the image above) reached the base of deposit and as such is excluded from the resource assessment.

Digital geological and resource modelling has demonstrated the following:

Overburden: 394,000m³

Upper Sand: 675,000 saleable tonnes

Sand and Gravel: 1,900,000 saleable tonnes

Please note that although the extent of the former workings indicate the width and breadth available to reach the base of deposit this would equate to a resource removed of approximately 300,000 saleable tonnes of sand and gravel and a depth of working of 8m below the surrounding topography. The shape of the supposed extraction appears unusual and certainly not related to the geology. It may well be that only piecemeal extraction occurred, that the base of deposit was not reached, or at least not everywhere, and further resources still exist here.

The mineral quoted above is hereby classified a Measured Resource under the PERC Standard 2021*.

*PERC is the not-for-profit Pan-European Reserves and Resources Reporting Committee and the PERC Standard is the established best practice protocol and guidance for reserve and resource classification and estimation across the European Economic Area.

The PERC Standard has been adopted by all major aggregate producers in the UK and is used to underpin annual mineral returns to local and national government. PERC is recognised by all major stock exchanges.

PERC is a member of CRIRSCO, the Committee for Mineral Reserves International Reporting Standards, the internationally recognised organization for mineral reporting Codes and Standards. Reciprocal Codes and Standards include the USA, South Africa, Canada, Australasia, Brazil, Chile, Colombia, India, Turkey, Mongolia, Indonesia and Khazakhstan.

Economic Viability

In terms of estimated tonnes of sand and gravel, resources greater than 2,000,000 saleable tonnes represent a very attractive investment opportunity; that amount, in the author's experience, is usually the threshold required by operators engaged in sand and gravel mineral resource exploration and replenishment.

The excellent quality of the sand and gravel at Samlesbury Estate has been described above in terms of BS EN 12620 grading envelopes for concrete aggregates. More specifically, the medium to coarse sand grading allows for the efficient and sustainable use of cement and water to create the required specification strengths of a range of main-stay concrete products used in the built environment. Finer sand gradings equate to a much greater surface area of particles and this leads to a higher water demand and hence cement demand to meet the same specification strengths. In Cheshire for example it is common to find sand with 70% or more passing the key 500 micron sieve.

The gravel is naturally ideally sized across the 4/10mm and 10/20mm sieves for concrete aggregates.

The volume of gravel oversize (20/40mm and 40mm+) and hence the ability to introduce gravel crushings, plus the grading of the Upper Sand, adds to the economic versatility of the deposit.

The sand and gravel deposit therefore satisfies the *compliance with specifications* objective within Policy CS1 of the adopted Core Strategy and the sand meets the *high-quality sand* objective of Policy CS3 in that Core Strategy.

Eddie Bailey BSc (Hons) CGeol FGS EurGeol FIQ

Director, Touchstone Geological Services Ltd

Statement of Competence

Eddie Bailey is a Chartered Geologist and European Geologist with over 34 years UK and international experience and expertise in construction aggregate geology, including mineral exploration of all aggregate deposit types, geological resource modelling, quarry design and development, mineral reserve and resource assessment, mineral quality and economic analysis, mineral safeguarding, geodiversity, the Aggregate Levy, and project management.

Eddie graduated from Exeter University in 1989 with a 2:1 honours degree in Geology. He began his career as Assistant Geologist with English China Clays Quarries Ltd (1986-87) before joining Tarmac plc in July 1989, becoming Geological Manager – South in February 1995 and Group Head of Geology in 2004 where he was responsible for the geological teams and delivery of the geological and geotechnical workload across the UK and international businesses including Turkey, Germany, Poland, Czech Republic, Spain, Romania, France, Ireland, UAE, Oman and China. Reporting through Exco his role included setting departmental and company policy in Health and Safety - in particular geotechnics and the application of the Quarries Regulations 1999, training, and reserve and resource management to the PERC Standard. In April 2008 Eddie joined Aggregate Industries to establish a geological function in the southern half of the company before becoming Head of Geology AIUK in January 2012.

In August 2018 Eddie left AIUK to set up Touchstone Geological Services Ltd to continue to offer expert consultation and exploration services to the extractive industry, to developers, to MPAs, and other interested parties.

Eddie was a founder member of the Pan-European Reserves and Resources Reporting Committee in 2006 (PERC) and sat as Chair from 2014 to 2018; in so doing he concurrently served as representative for Europe on CRIRSCO, the Committee for Reserves and Resources International Reporting Standards.

Eddie has advised Group companies on many major Due Diligence exercises including the Tarmac-Wimpey asset swap, the AngloAmerican sale of Tarmac to Lafarge, the acquisition of Foster Yeoman, the Holcim acquisition of CEMEX Australia, the merger of Holcim and Lafarge, the NI 43-101 Report for the Hemerdon Mine Project for Tungsten West, and the acquisition of the Johnston Quarry Group by SigmaRoc Ltd. Eddie has also acted as an advisor to the Welsh Assembly on sand and gravel resources.

Eddie served on the Chartership Panel of the Geological Society from 2006 to 2018 and currently serves as a Scrutineer. He has lectured on construction aggregates and economic geology at Cardiff University and Leicester University and at numerous national and international conferences.