Rowan

Proposed Sand & Gravel Extraction Facility
Garrans, Stradbally, Co. Laois

Environmental Impact Assessment Report: Appendices (Volume 3)

Client: Pat Booth

Date: November 2020

Appendix 1.1: Aggregate Shortages (2019 Articles)

MINISTER SEAN CANNEY LAUNCHES ICF PUBLICATION ON ESSENTIAL AGGREGATES

On Wednesday, 23rd October 2019, Minister of State for Natural Resources Sean Canney TD launched Irish Concrete Federation's Publication -"Essential Aggregates: Providing for Ireland's needs to 2040"

Ireland will need to produce an estimated 1.5 billion tonnes of aggregates to meet housing and infrastructure targets set down under the Government's Project Ireland 2040 plan, according to the Irish Concrete Federation (ICF) at the launch of a major new publication.

"Essential Aggregates: Providing for Ireland's needs to 2040" is an industry led call for Government to ensure that Ireland's future supply of aggregates (crushed rock, sand and gravel) is planned, monitored and managed in a sustainable manner, to provide for Ireland's future infrastructure development. The report identifies that demand for aggregates in Ireland at 12 tonnes per capita is twice the current EU 28 average, due to Ireland's infrastructural deficit, dispersed pattern of settlement and resulting large road network. The Federation warns that scarcities of some aggregates are now emerging in the Eastern and Midland regions, due to natural shortages, a lack of forward planning and delays and other shortcomings in the planning process.

Speaking today at the launch, CEO of the Irish Concrete Federation, Gerry Farrell, said strong political leadership is called for to bring forward the first ever National Aggregates Policy as a proper response to the future infrastructure needs and demographic change underway across the country.

"*Ireland has abundant natural reserves of high-quality aggregates but their future accessibility must be planned for and protected by Government. A lack of future planning and priority in the planning process and delays in achieving prospective quarry planning permissions will result in future shortages in the supply of some types of construction aggregates in certain areas of the country. The future supply of aggregates needs to be prioritised and addressed in a planned manner if we are to reach the ambitious construction targets as laid out in Project Ireland 2040*"

"*We're grateful that Minister Seán Canney recognises the strategic importance of having access to a steady and dependable supply of local, high-quality raw materials that are necessary for the delivery of Ireland's future built environment. We look forward to working with Government to deliver a sustainable framework that promotes the identification, protection and extraction of aggregates in a sustainable manner, supportive of environmental protection and the circular economy*" Mr Farrell commented.

The ICF is calling for the development of a National Aggregates Planning Policy which would be reflected in local and regional planning policy and which would improve planning processes, including a provision to provide a direct route to An Bord Pleanála to fast-track critically important quarry planning applications. ICF stated that the current average decision-making timeframe for quarry planning applications is 76 weeks with some decisions taking in excess of 2 years, as practically all decisions are appealed to An Bord Pleanála.

It also calls for longer durations of planning authorisations for extractive developments, certainty of planning enforcement and firm and consistent public procurement policy to ensure supply to the marketplace only comes from authorised operations.

Minister of State for Natural Resources, Community Affairs and Digital Development, Sean Canney TD, said: *"The Government is focused on achieving the objectives set down in Project Ireland 2040 and as you saw in Budget 2020, we are committing the necessary funds to ensure public* *infrastructure projects are delivered that guarantee a good quality of life of all our citizens. I'm acutely aware of the key role that aggregate materials will play in the delivery of Project Ireland 2040 and we are working with all stakeholders to ensure that the planning system needs to be reformed and streamlined to allow for this. I applaud the Irish Concrete Federation for their leadership in the delivery of this report and I look forward to working with them to advance a National Aggregates Policy."*

Koen Verbruggen, Director of the Geological Survey of Ireland, commented: *"The Geological Survey Ireland is pleased to welcome this publication on planning policy for the aggregates industry. Raw material potential has recently been explicitly recognised within the 2019 Climate Action Plan as a key potential rural employer while local sources of aggregates are vital in the drive to reduce our carbon footprint and to transition towards a more sustainable society. It is extremely important that policymakers understand the current realities of aggregate production and that any deficiencies in the current planning system are addressed appropriately."*

Reference:https://www.irishconcrete.ie/2019/10/23/minister-sean-canney-launches-icf-publication-on-essential-aggregates/ (accessed August 2020)

State needs to produce '1.5bn tonnes' of aggregates for Project Ireland

Concrete trade body calls on Government to ensure aggregates supply is 'sustainable'

Thu, Oct 24, 2019, 06:00

Kevin O'Sullivan Environment & Science Editor

The Irish Concrete Federation confirms demand for aggregates in Ireland is at 12 tonnes per capita; twice the current EU 28 average. Photograph: iStock

The State will need to produce an estimated 1.5 billion tonnes of aggregates – crushed rock, sand and gravel – to meet housing and infrastructure demand arising from the Government's Project Ireland 2040 plan, according to the Irish Concrete Federation (ICF).

Following publication of a report assessing future requirements, the ICF called on the Government to ensure future supply of aggregates "is planned, monitored and managed in a sustainable manner, to provide for Ireland's future infrastructure development".

The report confirms demand for aggregates in Ireland is at 12 tonnes per capita; twice the current EU 28 average, "due to Ireland's infrastructural deficit, dispersed pattern of settlement and resulting large road network".

The ICF warned that scarcities of some aggregates were emerging in the eastern and midland regions, due to natural shortages, lack of forward planning and shortcomings in the planning process.

Its chief executive Gerry Farrell said strong political leadership was needed to bring forward a national aggregates policy as a proper response to the future infrastructure needs and demographic change across the country.

"Ireland has abundant natural reserves of high-quality aggregates but their future accessibility must be planned for and protected by Government. A lack of future planning and priority in the planning process and delays in achieving prospective quarry planning permissions will result in future shortages in the supply of some types of construction aggregates in certain areas of the country," he added.

"We look forward to working with Government to deliver a sustainable framework that promotes the identification, protection and extraction of aggregates in a sustainable manner, supportive of environmental protection and the circular economy," Mr Farrell said – local supplies reduce transport distances and reduce their carbon footprint.

Regional planning

The policy should be reflected in local and regional planning policy and include provision to provide a direct route to An Bord Pleanála "to fast-track critically important quarry planning applications".

The ICF said the average decision-making time frame for quarry planning applications was 76 weeks, with some decisions taking in excess of two years, as practically all decisions are appealed to An Bord Pleanála. Currently there are 500 large commercial quarries extracting raw materials for the construction sector.

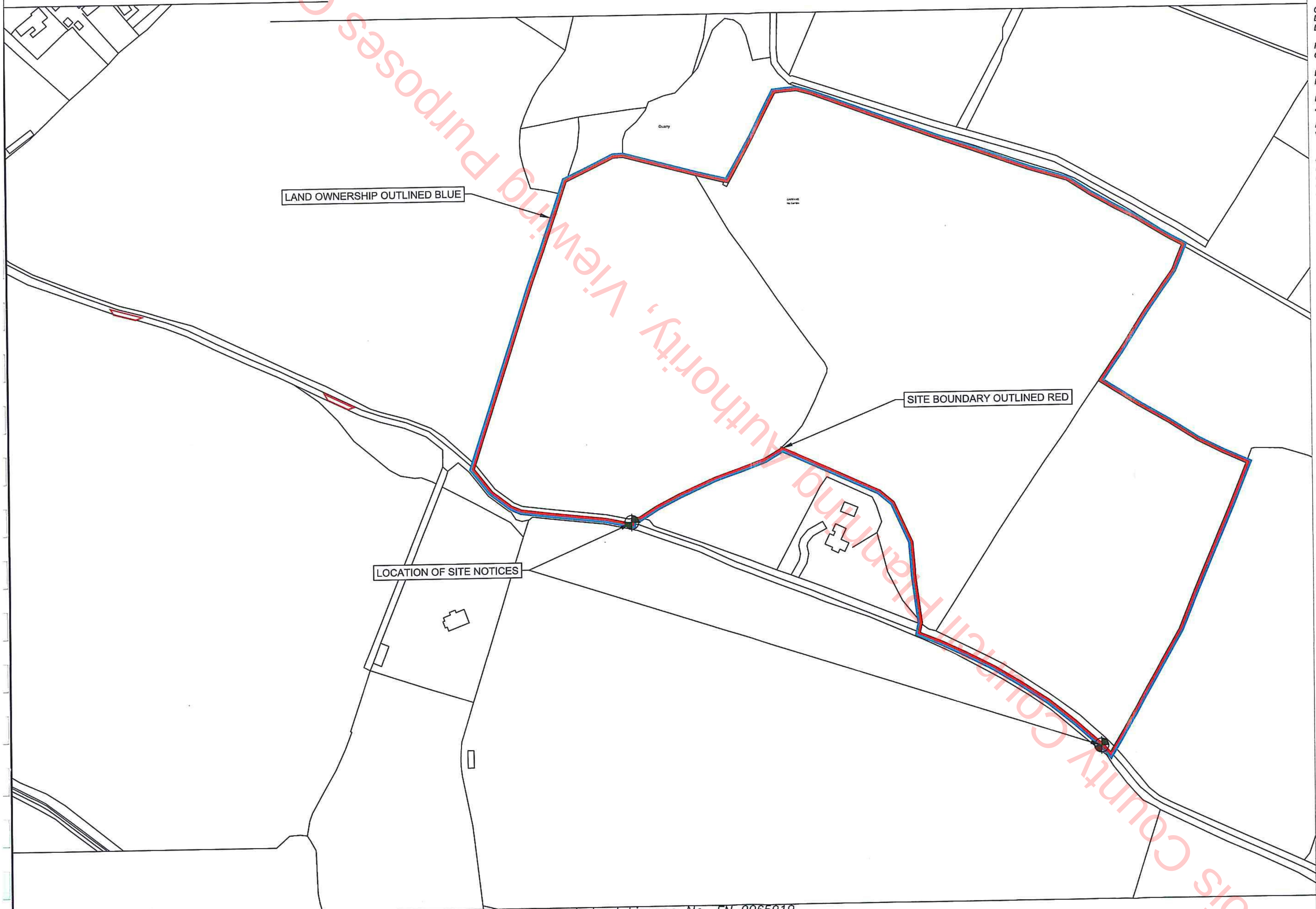
It also calls for "longer durations of planning authorisations for extractive developments, certainty of planning enforcement and firm and consistent public procurement policy to ensure supply to the marketplace only comes from authorised operations".

Speaking at an ICF event in Dublin, Koen Verbruggen, director of the Geological Survey of Ireland, welcomed the publication. "Raw material potential has recently been explicitly recognised within the 2019 Climate Action Plan as a key potential rural employer, while local sources of aggregates are vital in the drive to reduce our carbon footprint and to transition towards a more sustainable society," he added.

Minister of State for Natural Resources Seán Canney said he was aware of the key role aggregates would play in the delivery of Project Ireland 2040. The Government would work with stakeholders to ensure the planning system was "reformed and streamlined to allow for this".

Reference: https://www.irishtimes.com/business/construction/state-needs-to-produce-1-5bn-tonnes-of-aggregates-for-project-ireland-1.4060751 (accessed August 2020)

Appendix 2.1: Site Drawings



Ordnance Survey Ireland Licence No. EN 0065919
Ordnance Survey Ireland/Government of Ireland
Copyright:
==========

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

0
Description:
Digital Cartographic Model (DCM)

Publisher / Source:
Ordnance Survey Ireland (OSi)

Data Source / Reference:
PRIME2

File Format:
Autodesk AutoCAD (DWG_R2013)

File Name:
v_50088672_1.dwg

Clip Extent / Area of Interest (AOI):
LLX,LLY= 658405.3762,697326.3372
LRX,LRY= 659235.3762,697326.3372
ULX,ULY= 658405.3762,697941.3372
URX,URY= 659235.3762,697941.3372

Projection / Spatial Reference:
Projection= IRENET95_Irish_Transverse_Mercator

Centre Point Coordinates:
X,Y= 658820.3762,697633.8372

Reference Index:
Map Series | Map Sheets
1:5,000 | 3945

Data Extraction Date:
Date= 11-Oct-2019

Source Data Release:
DCLMS Release V1.121.106

Product Version:
Version= 1.3

License / Copyright:
Ordnance Survey Ireland 'Terms of Use' apply.
Please visit 'www.osi.ie/about/terms-conditions'.

© Ordnance Survey Ireland, 2019

N

PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P02	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R
ISSUE	DATE	DESCRIPTION	DRW	CRG

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

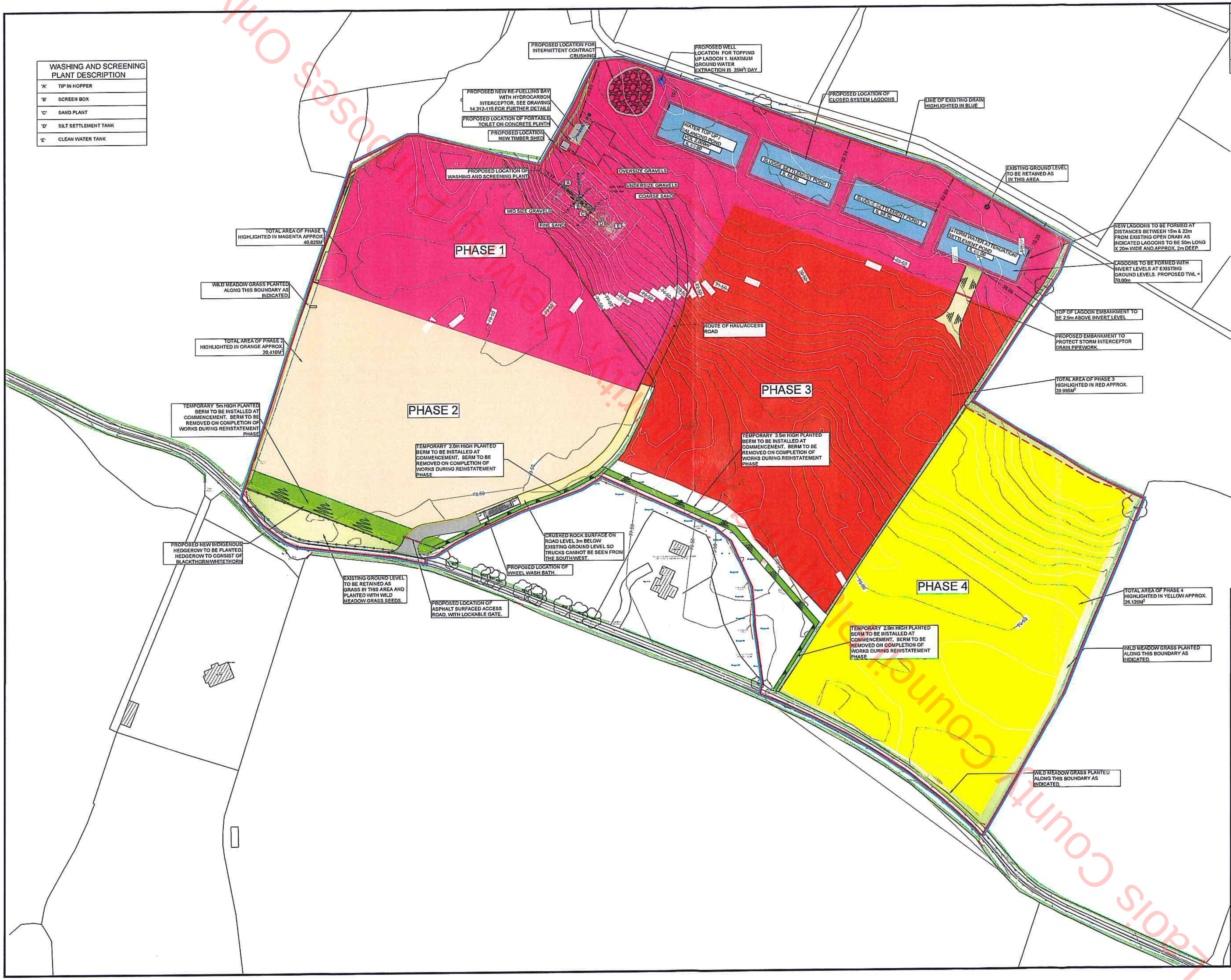
PROJECT:
PROPOSED SAND & GRAVEL PIT GARRANS, STRADBALLY, CO. LAOIS

TITLE:
SITE LOCATION PLAN

DATE: 11.10.2019
SCALE: 1:2,500@A3
DRAWING TITLE: 14.312.101
REVISION: PL01

THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION:Z:\DRAWINGS-2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\00 CURRENT



WASHING AND SCREENING PLANT DESCRIPTION

'A'	TIP IN HOPPER
'B'	SCREEN BOX
'C'	SAND PLANT
'D'	SILT SETTLEMENT TANK
'E'	CLEAN WATER TANK

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - "ASK".
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

LEGEND

EXISTING CARRAIGEWAY	☐
ASHPHALT SURFACE ACCESS ROAD	▨
CRUSHED ROCK ACCESS ROAD	▨
PROPOSED LINE OF BERM	🟩
PHASE 1	🟥
PHASE 2	▨
PHASE 3	🟥
PHASE 4	🟨
EXISTING BUILDINGS	▨
PROPOSED AREAS TO BE PLANTED WITH WILD MEADOW GRASS	▨
PROPOSED LINE OF 1.2M HIGH STOCK PROOF FENCE	-o-o-o-

AREA OF SITE - 12.84 HECTARES
AREA OF SITE - 31.73 ACRES
AREA OF SITE - 128,408m²
SITE OUTLINED IN RED
OS SHEET 3945

ISSUE	DATE	DESCRIPTION	DRW	ORG
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P07	11.09.20	REVISED AS PER TYNAN ENVIROMENTAL	B.S	J.R
P06	24.08.20	ADDITIONAL WILD MEADOW GRASS ADDED	B.S	J.R
P05	28.07.20	REVISED AS PER FEEDBACK FROM TYNAN ENVIROMENTAL	B.S	J.R
P04	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P03	31.03.20	AREAS OF INDIVIDUAL PHASES ADDED	B.S	J.R
P02	27.03.20	AREAS OF INDIVIDUAL PHASES ADDED	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

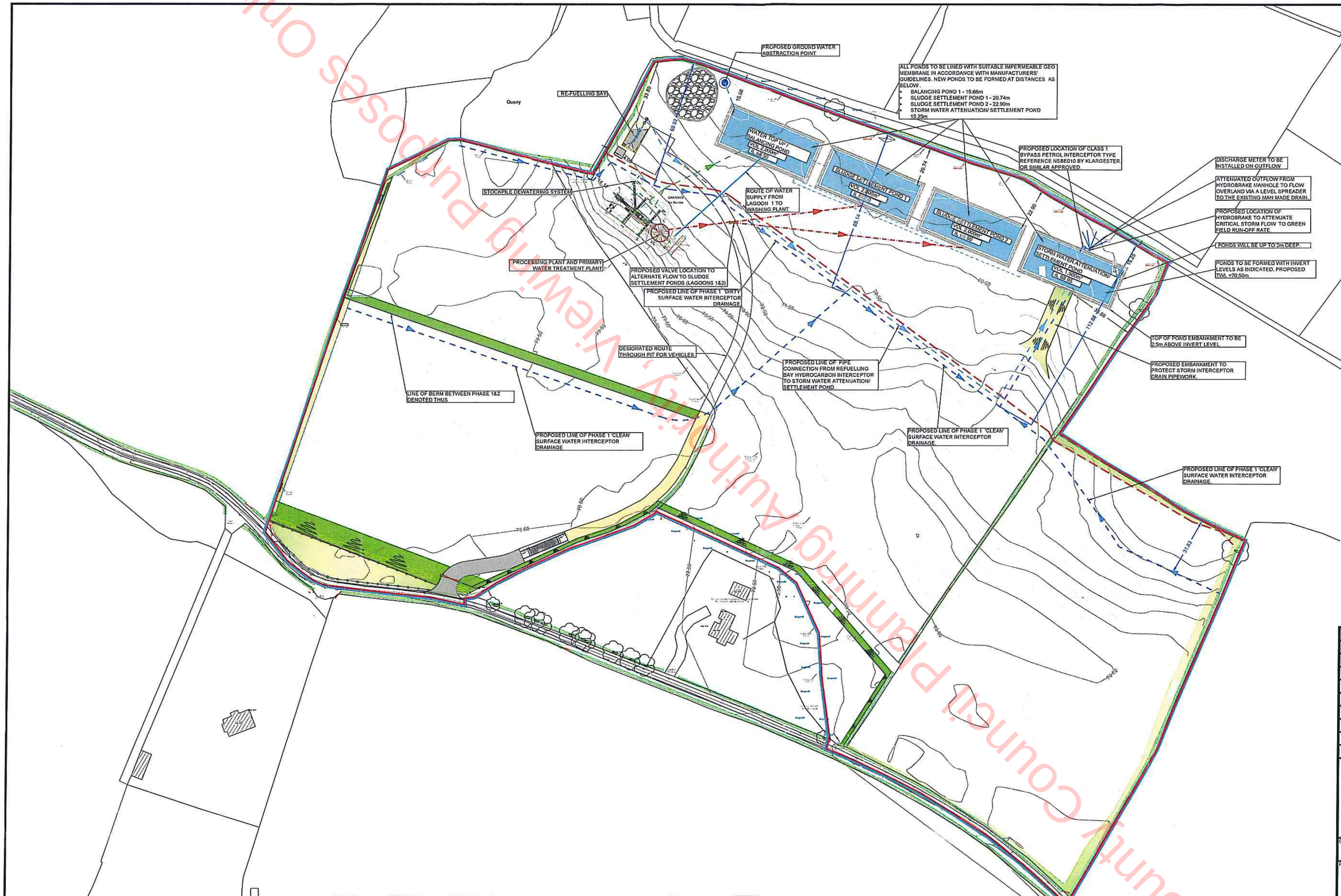
PROJECT:
PROPOSED SAND & GRAVEL PIT AT
GARRANS, STRADBALLY, CO. LAOIS

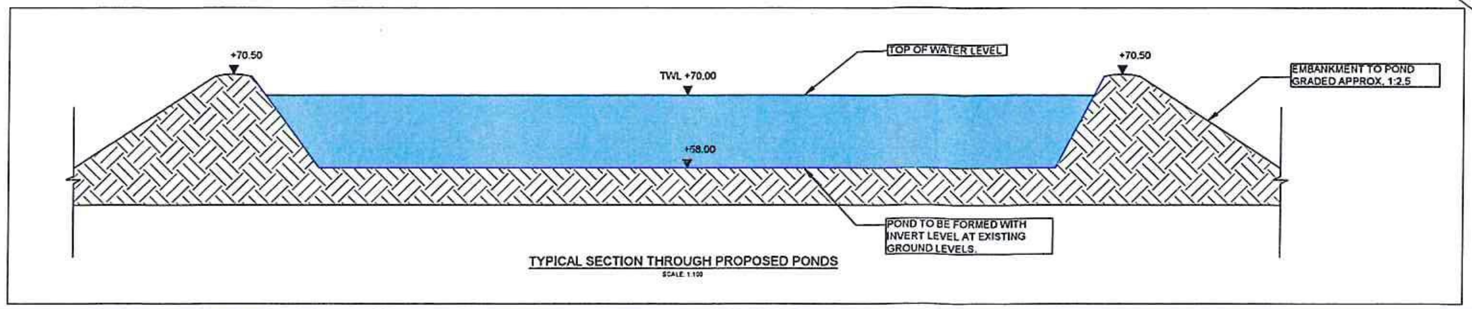
TITLE:
SITE LAYOUT MASTERPLAN WITH
PROPOSED PHASING

DATE: 15.10.2019
SCALE: 1:1,000@A1
DRAWING TITLE: 14.312.103
REVISION: PL01

THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION Z:\DRAWINGS\2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\00 CURRENT\XREFS





TYPICAL SECTION THROUGH PROPOSED PONDS

SCALE 1:100

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

LEGEND

EXISTING CARRAIGEWAY	
ASHPHALT SURFACE ACCESS ROAD	▨
CRUSHED ROCK ACCESS ROAD	▨
PROPOSED LINE OF BERM	🟩
EXISTING BUILDINGS	▨
PROPOSED AREAS TO BE PLANTED WITH WILD MEADOW GRASS	▨
ROUTE OF INTERCEPTOR DRAIN	— — —
ROUTE OF SILT WATER FROM PROCESSING PLANT	— · — · —
WATER SUPPLY TO PROCESSING PLANT	———
LINE OF CLEAN PUMPED WATER TRANSFER BETWEEN PONDS	- - - - -
PROPOSED LOCATION OF WELL	●
WATER SUPPLY TO LAGOON 1 FROM WELL	— — — —
INITIAL LINE OF EXTRACTION	— — — —
LAND DRAINAGE CONNECTION FROM THE STOCKPILE DEWATERING SYSTEM	- - - - -
SEPARATE PIPE CONNECTION FROM REFUELING BAY TO STORMWATER ATTENUATION/ SETTLEMENT POND	- - - - -

ISSUE	DATE	DESCRIPTION	DRW	CRG
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P08	16.09.20	REVISED INTERCEPTOR DRAIN AS PER TYNAN ENVIROMENTAL	B.S	J.R
P07	11.09.20	REVISED DRAINAGE RUNS AS PER TYNAN ENVIROMENTAL	B.S	J.R
P06	10.09.20	REVISED AS PER TYNAN ENVIRONMENTAL COMMENTS	B.S	J.R
P05	24.08.20	ADDITIONAL WILD MEADOW GRASS ADDED	B.S	J.R
P04	18.08.20	REVISED AS PER COMMENTS FROM REC	B.S	J.R
P03	28.07.20	REVISED AS PER FEEDBACK FROM TYNAN ENVIROMENTAL	B.S	J.R
P02	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P01	14.05.20	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

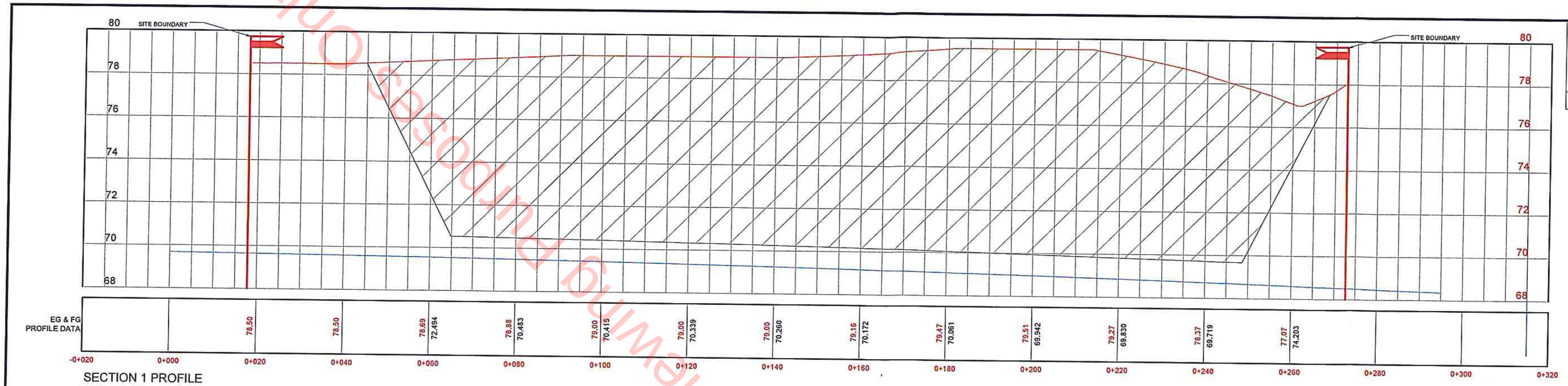
PROJECT:
PROPOSED SAND & GRAVEL PIT AT
GARRANS, STRADBALLY, CO. LAOIS

TITLE:
PROPOSED SITE DRAINAGE

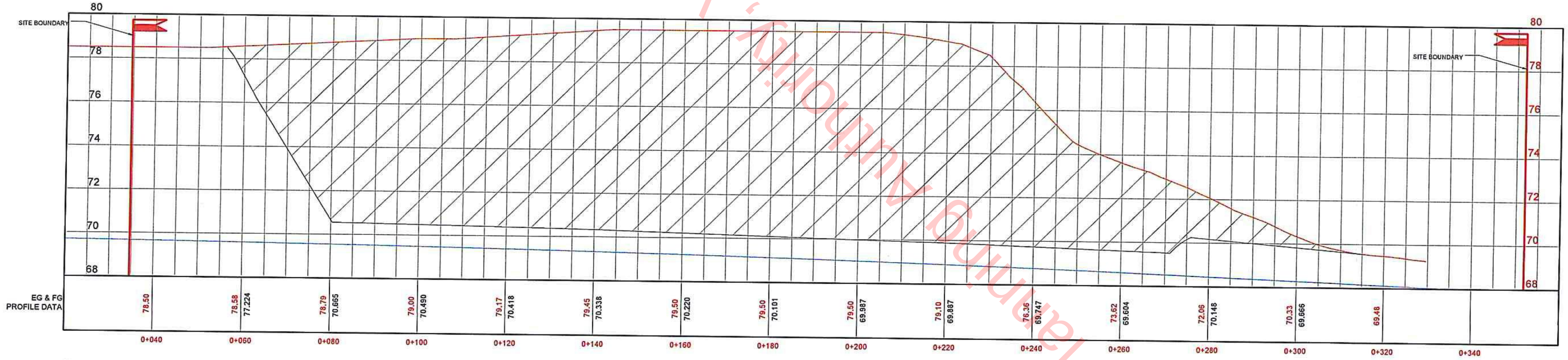
DATE: 14.05.2020
SCALE: 1:1,000@A1
DRAWING TITLE: 14.312.120
REVISION: PL01

THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

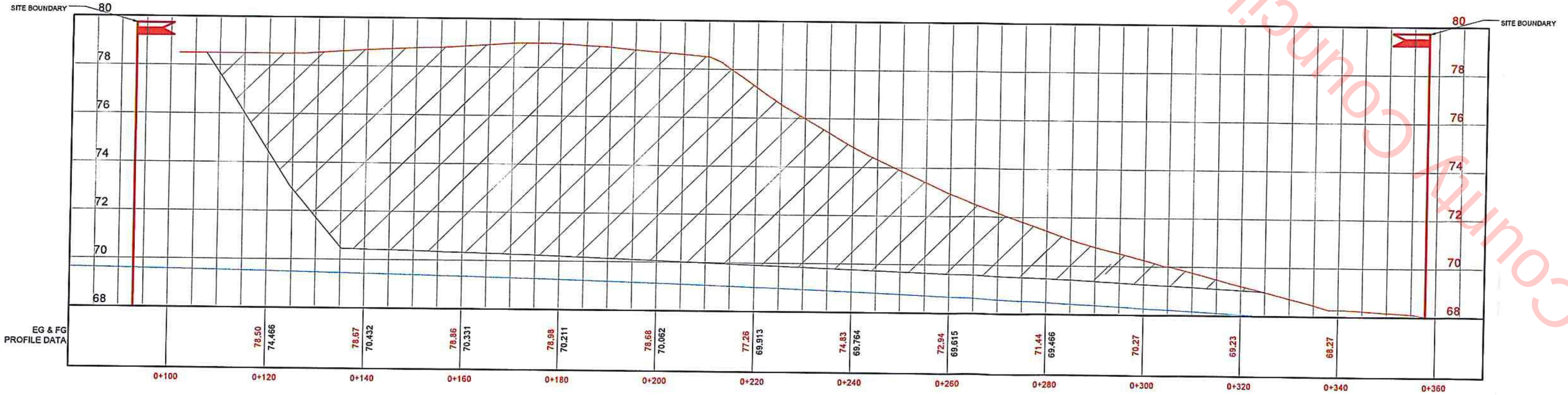
DWG LOCATION Z:\DRAWINGS\2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\00 CURRENT



SECTION 1 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100



SECTION - 2 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100



SECTION - 3 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - "ASK".
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

LEGEND

EXISTING GROUND LEVEL	—
PROPOSED FINISHED GROUNDLEVEL Min. 1m ABOVE MAX WATER LEVEL	—
Max. Ground water level +10% of seasonal variation	---
CUT	▨

ISSUE	DATE	DESCRIPTION	DRW	CRG
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P04	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P03	29.01.20	REVISED WATER TABLE LEVELS FOR DISCUSSION	B.S	J.R
P02	13.01.20	REVISED PIT LEVELS FOR DISCUSSION	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

PROJECT:
PROPOSED SAND AND GRAVEL PIT AT
GARRANS,STRADBALLY,
CO. LAOIS

TITLE:
SITE SECTIONS SHEET 1

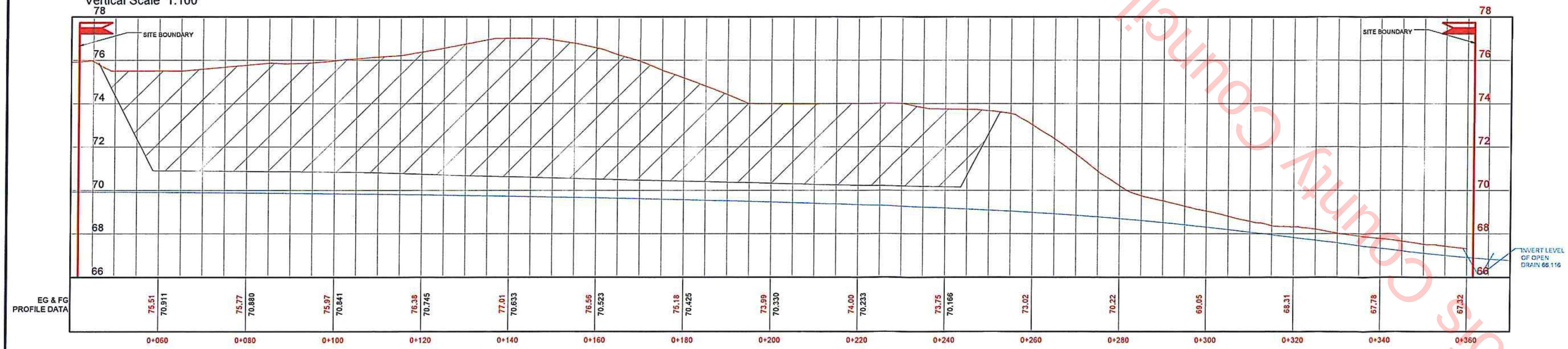
DATE: 16.10.2019
SCALE: 1:500@A1
DRAWING TITLE: 14.312.110
REVISION: PL01

THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION Z:\DRAWINGS\2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\00 CURRENT

SECTION - 4 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100

SECTION - 5 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100



SECTION - 6 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - "ASK".
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

LEGEND

EXISTING GROUND LEVEL ———
PROPOSED FINISHED GROUNDLEVEL Min. 1m ABOVE MAX WATER LEVEL ———
Max. Ground water level +10% of seasonal variation ———
CUT ▨

ISSUE	DATE	DESCRIPTION	DRW	CRG
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P05	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P04	31.03.20	LOCATIONS OF OPEN DRAINS ADDED	B.S	J.R
P03	29.01.20	REVISED WATER TABLE LEVELS FOR DISCUSSION	B.S	J.R
P02	13.01.20	REVISED PIT LEVELS FOR DISCUSSION	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

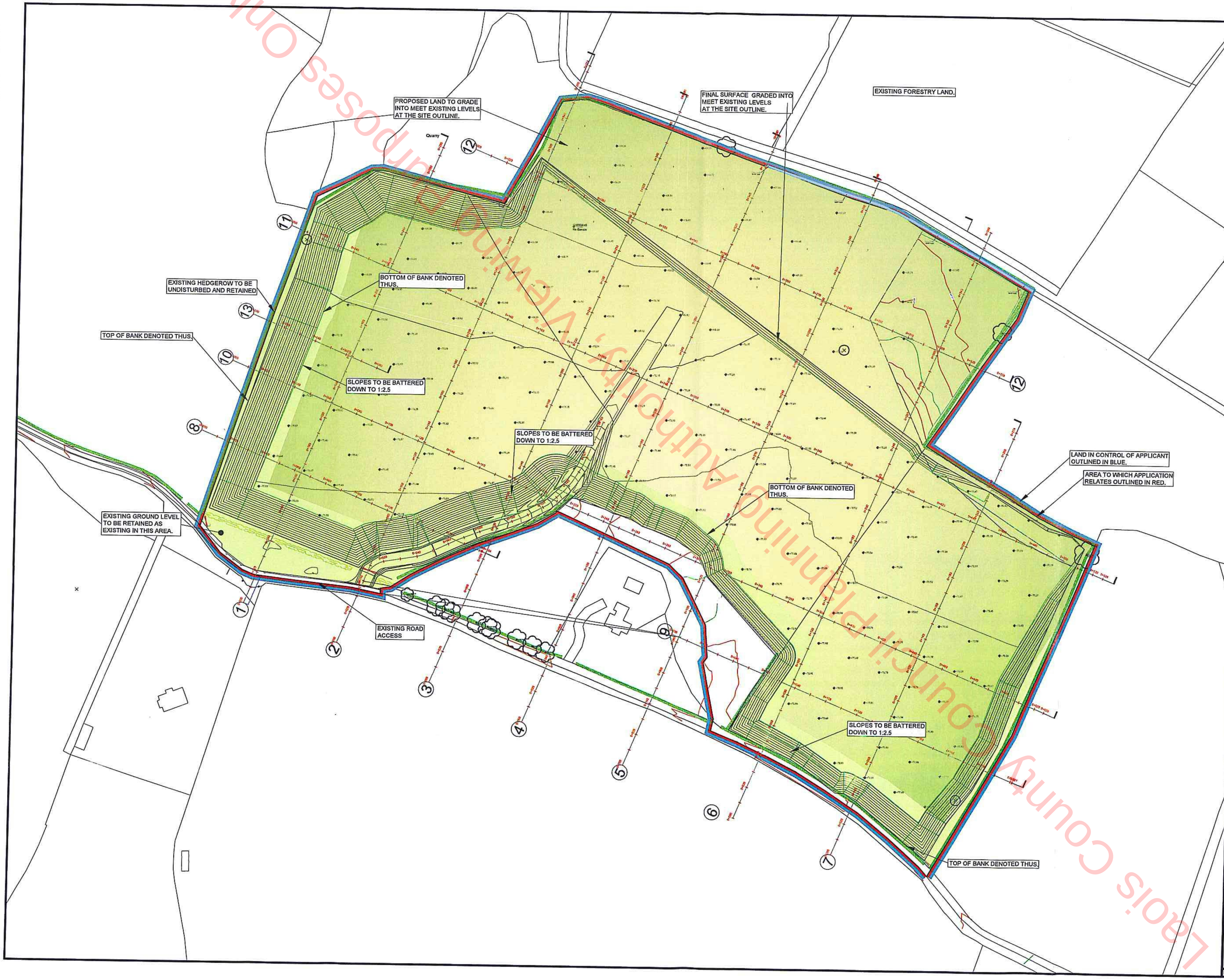
PROJECT:
PROPOSED SAND AND GRAVEL PIT AT
GARRANS,STRADBALLY,
CO. LAOIS

TITLE:
SITE SECTIONS SHEET 2

DATE: 16.10.2019
SCALE: 1:500@A1
DRAWING TITLE: 14.312.111
REVISION: PL01

THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM, ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION Z:\DRAWINGS\2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\00 CURRENT



NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS,FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

PHASE 5:

1. Re-fuelling area, timber shed & portable toilet to be removed from site.
2. Any temporary Screening berms to be used in final restoration.
3. Remaining slopes to be battered down to 1 in 2.5.
4. Remaining areas to be re-seeded with agricultural grass-seed mixture native to the local area.
5. Perimeter stockproof to be made secure.
6. Removal of monitoring points for dust & noise upon completion of works

ISSUE	DATE	DESCRIPTION	DRW	CRG
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P02	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R

Jason Redmond & Associates Consulting Engineers

Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

PROJECT:
PROPOSED SAND AND GRAVEL PIT AT
GARRANS,STRADBALLY,
CO. LAOIS

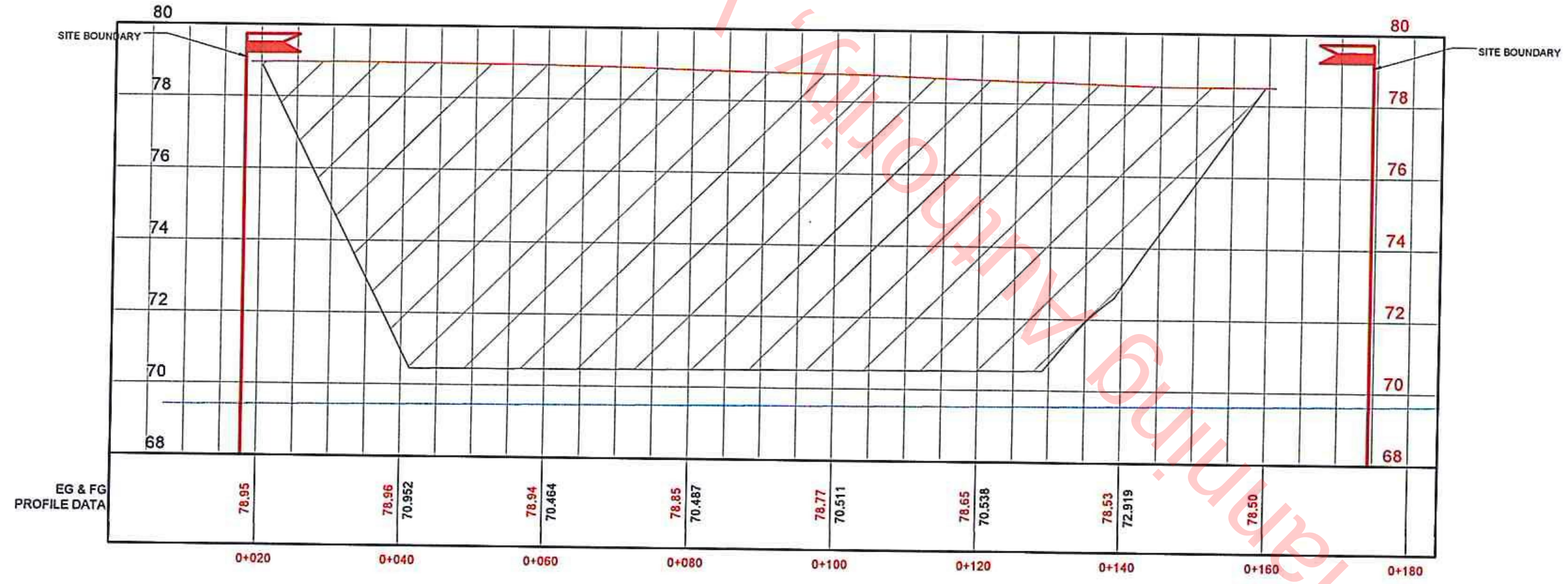
TITLE:
RESTORATION PHASE 5 SHOWING
SITE SECTION LINES

DATE: 17.10.2019
SCALE: 1:1,000@A1
DRAWING TITLE: 14.312.109
REVISION: PL01

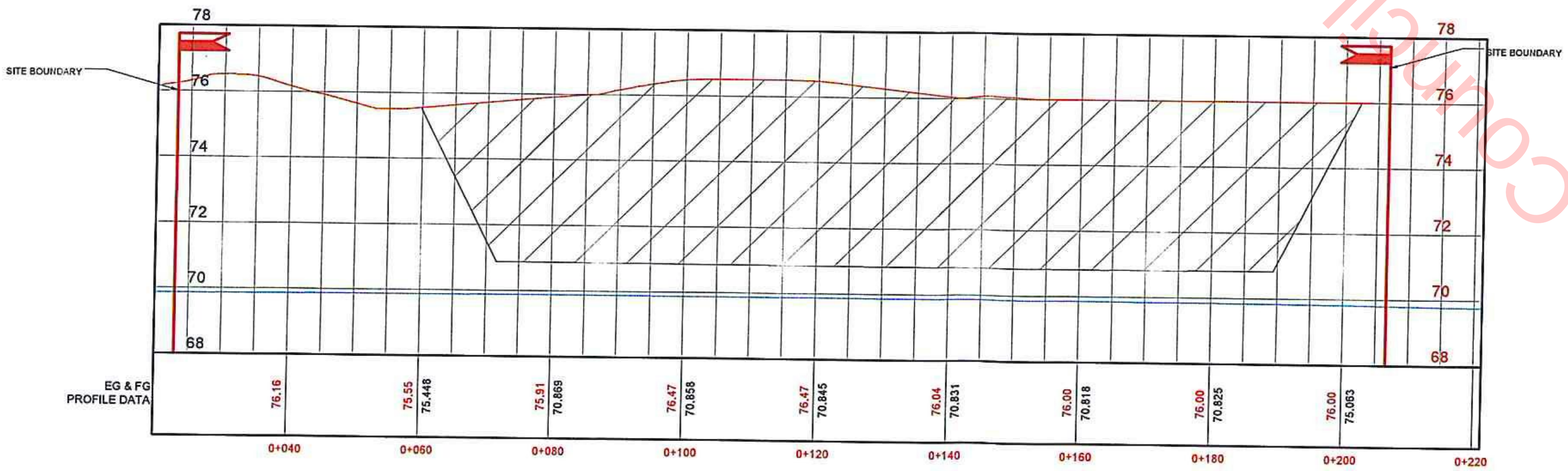
THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION:Z:\DRAWINGS\2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\00 CURRENT

SECTION -7 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100



SECTION - 8 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100



SECTION - 9 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS,FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

LEGEND

EXISTING GROUND LEVEL	—
PROPOSED FINISHED GROUNDLEVEL Min. 1m ABOVE MAX WATER LEVEL	—
Max. Ground water level +10% of seasonal variation	—
CUT	▨

ISSUE	DATE	DESCRIPTION	DRW	CHG
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P04	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P03	29.01.20	REVISED WATER TABLE LEVELS FOR DISCUSSION	B.S	J.R
P02	13.01.20	REVISED PIT LEVELS FOR DISCUSSION	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

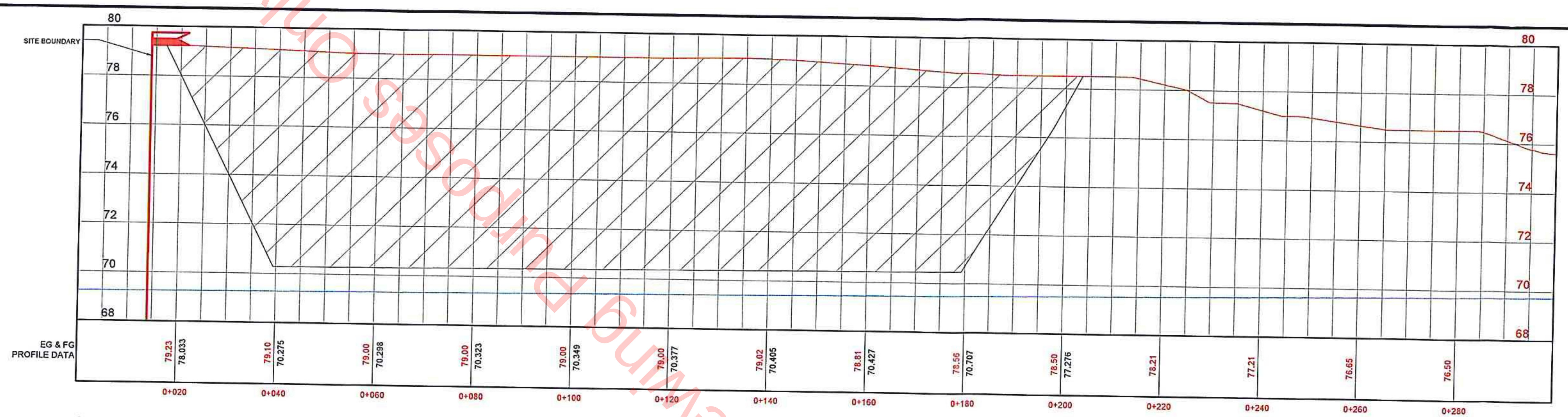
CLIENT:
PAT BOOTH

PROJECT:
PROPOSED SAND AND GRAVEL PIT AT
GARRANS,STRADBALLY,
CO. LAOIS

TITLE:
SITE SECTIONS SHEET 3

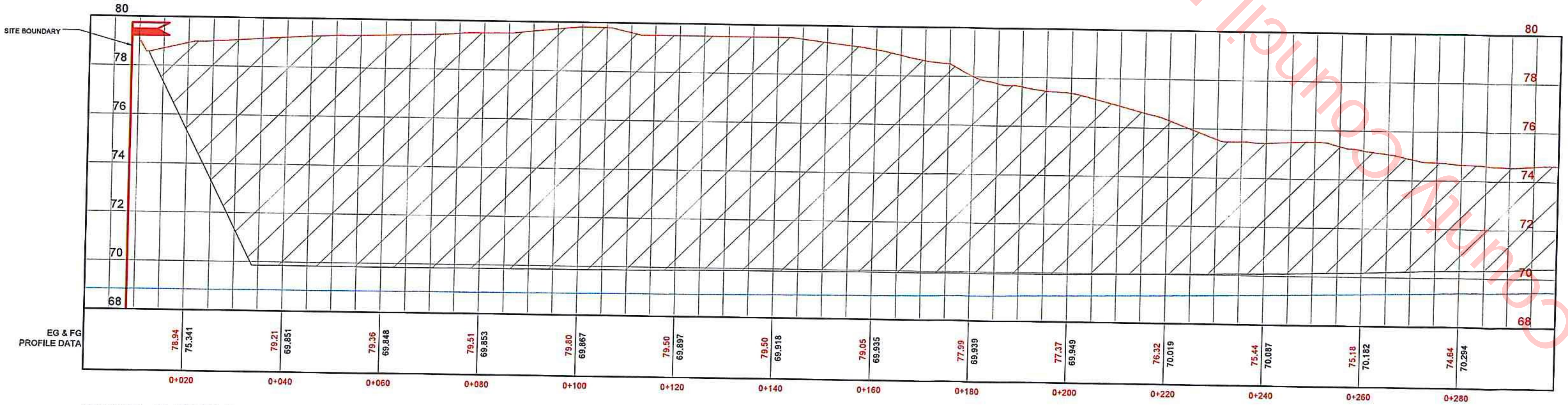
DATE: 16.10.2019
SCALE: 1:500@A1
DRAWING TITLE: 14.312.112
REVISION: PL01

DWG LOCATION Z:\DRAWINGS\2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\00 CURRENT



SECTION - 10 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100

SECTION - 10 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100



SECTION - 11 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

LEGEND

EXISTING GROUND LEVEL ―
PROPOSED FINISHED GROUNDLEVEL Min. 1m ABOVE MAX WATER LEVEL ―
Max. Ground water level +12% of seasonal variation ―
CUT ▨

PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P04	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P03	29.01.20	REVISED WATER TABLE LEVELS FOR DISCUSSION	B.S	J.R
P02	13.01.20	REVISED PIT LEVELS FOR DISCUSSION	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R
ISSUE	DATE	DESCRIPTION	DRW	ORG

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

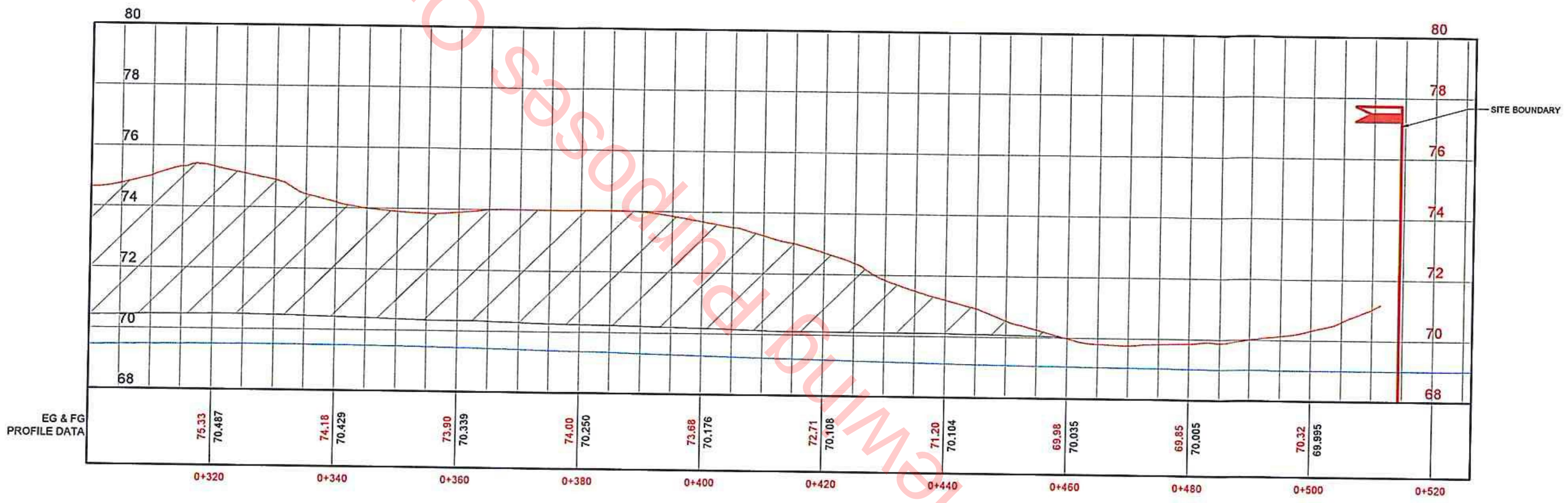
PROJECT:
PROPOSED SAND AND GRAVEL PIT AT
GARRANS,STRADBALLY,
CO. LAOIS

TITLE:
SITE SECTIONS SHEET 4

DATE: 16.10.2019
SCALE: 1:500@A1
DRAWING TITLE: 14.312.113
REVISION: PL01

THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION Z:\DRAWINGS\2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\03 CURRENT



SECTION - 11 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100

SECTION - 12 PROFILE
Horizontal Scale 1:500
Vertical Scale 1:100

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS

NOT FOR CONSTRUCTION

LEGEND

EXISTING GROUND LEVEL
PROPOSED FINISHED GROUNDLEVEL Min. 1m ABOVE MAX WATER LEVEL
Max. Ground water level +10% of seasonal variation
CUT ▨

PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P04	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P03	29.01.20	REVISED WATER TABLE LEVELS FOR DISCUSSION	B.S	J.R
P02	13.01.20	REVISED PIT LEVELS FOR DISCUSSION	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R
ISSUE	DATE	DESCRIPTION	DRW	ORG

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

PROJECT:
PROPOSED SAND AND GRAVEL PIT AT
GARRANS,STRADBALLY,
CO. LAOIS

TITLE:
SITE SECTIONS SHEET 5

DATE: 16.10.2019
SCALE: 1:500@A1
DRAWING TITLE: 14.312.114
REVISION: PL01

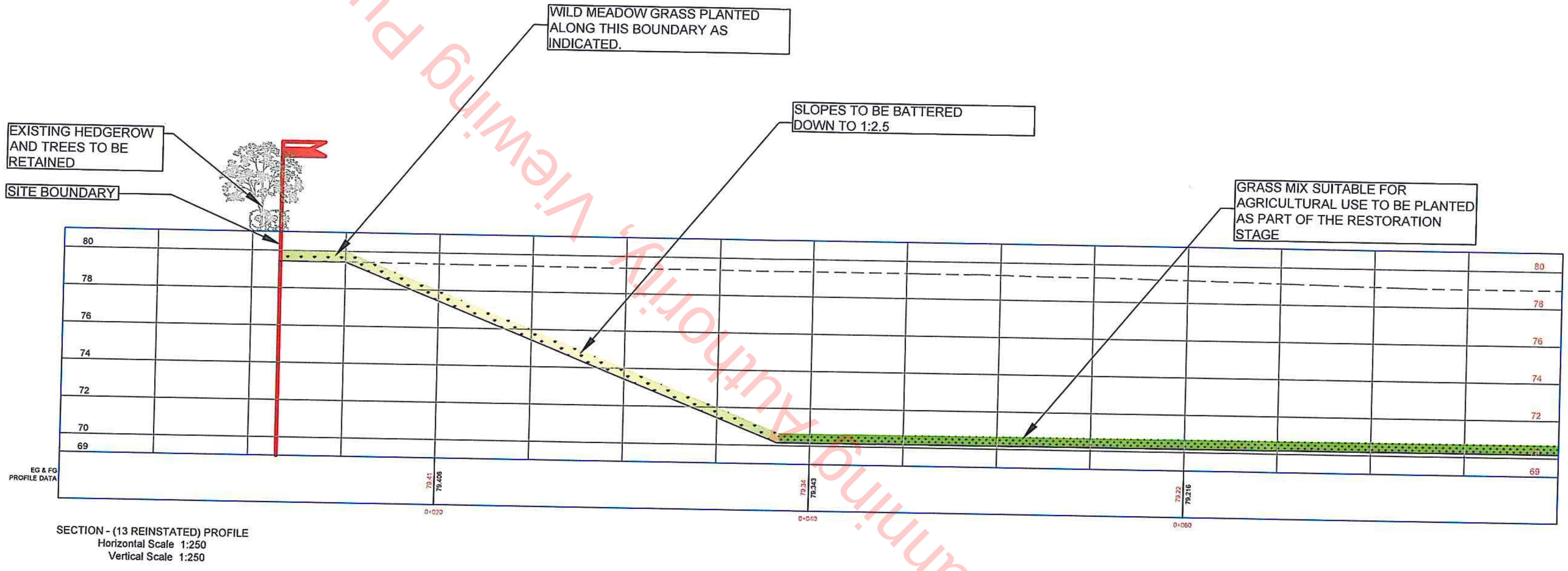
THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION Z:\DRAWINGS\2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\00 CURRENT

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION



SECTION - (13 REINSTATED) PROFILE
Horizontal Scale 1:250
Vertical Scale 1:250

ISSUE	DATE	DESCRIPTION	DRW	CHK
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P01	18.05.20	ISSUED FOR PRE PLANNING DISCUSSIONS	B.S	J.R

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

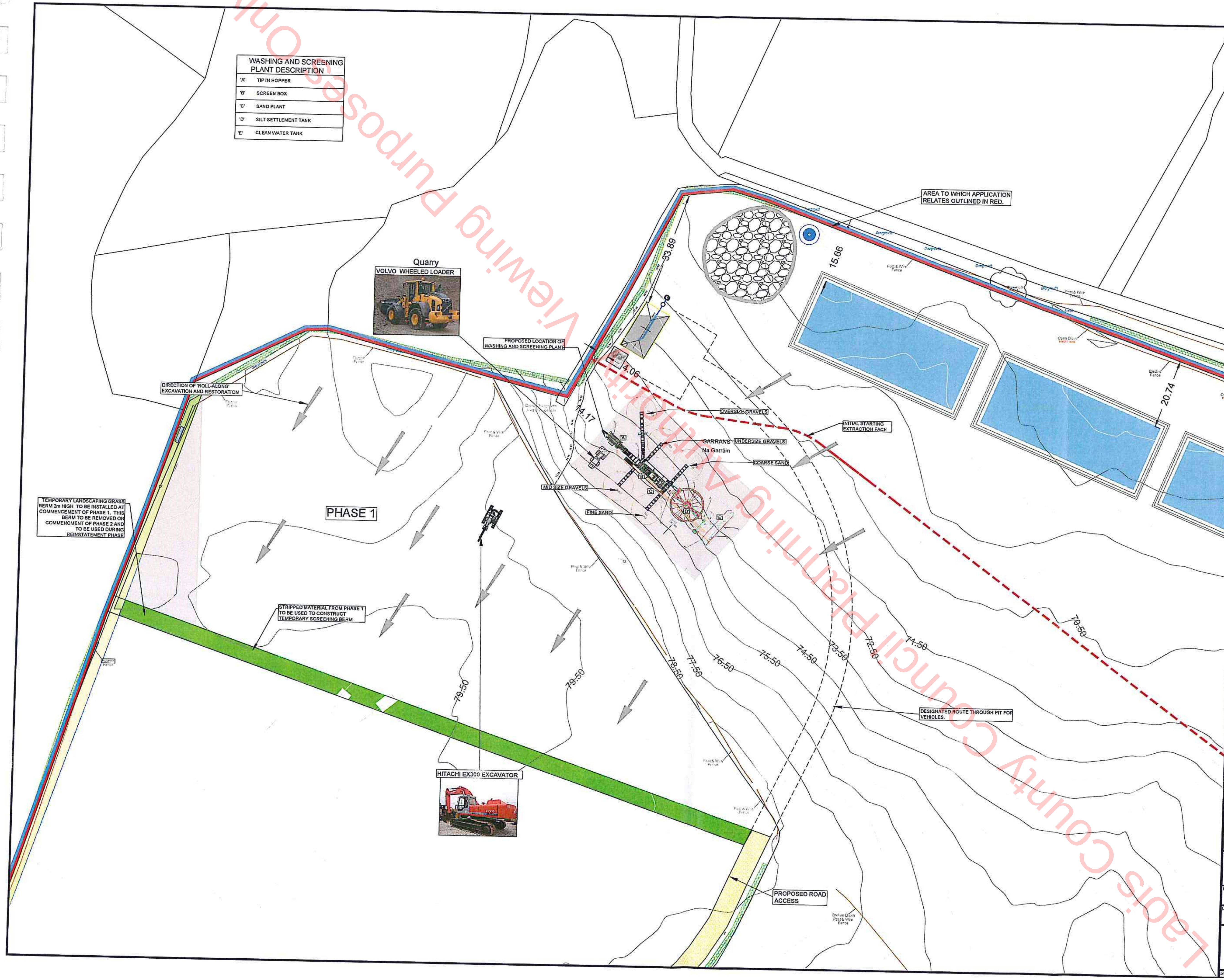
CLIENT:
PAT BOOTH

PROJECT:
PROPOSED SAND AND GRAVEL PIT AT
GARRANS,STRADBALLY,
CO. LAOIS

TITLE:
SITE SECTIONS SHEET 6

DATE: 18.05.2020
SCALE: 1:250@A3
DRAWING TITLE: 14.312.115
REVISION: PL01

THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.



WASHING AND SCREENING PLANT DESCRIPTION	
'A'	TIP IN HOPPER
'B'	SCREEN BOX
'C'	SAND PLANT
'D'	SILT SETTLEMENT TANK
'E'	CLEAN WATER TANK

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

PHASE1:

1. Topsoil and overburden stripped from Phase 1 used to construct screening berm along Southern edge of site.
2. Sand and gravel to be excavated from Phase 1 in a phased manner.
3. Excess topsoil and overburden to be stockpiled on excavated quarry floor in Phase 1 for use in 'roll-along' restoration of Phase 1 as ground becomes available

ISSUE	DATE	DESCRIPTION	DRW	ORG
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P02	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

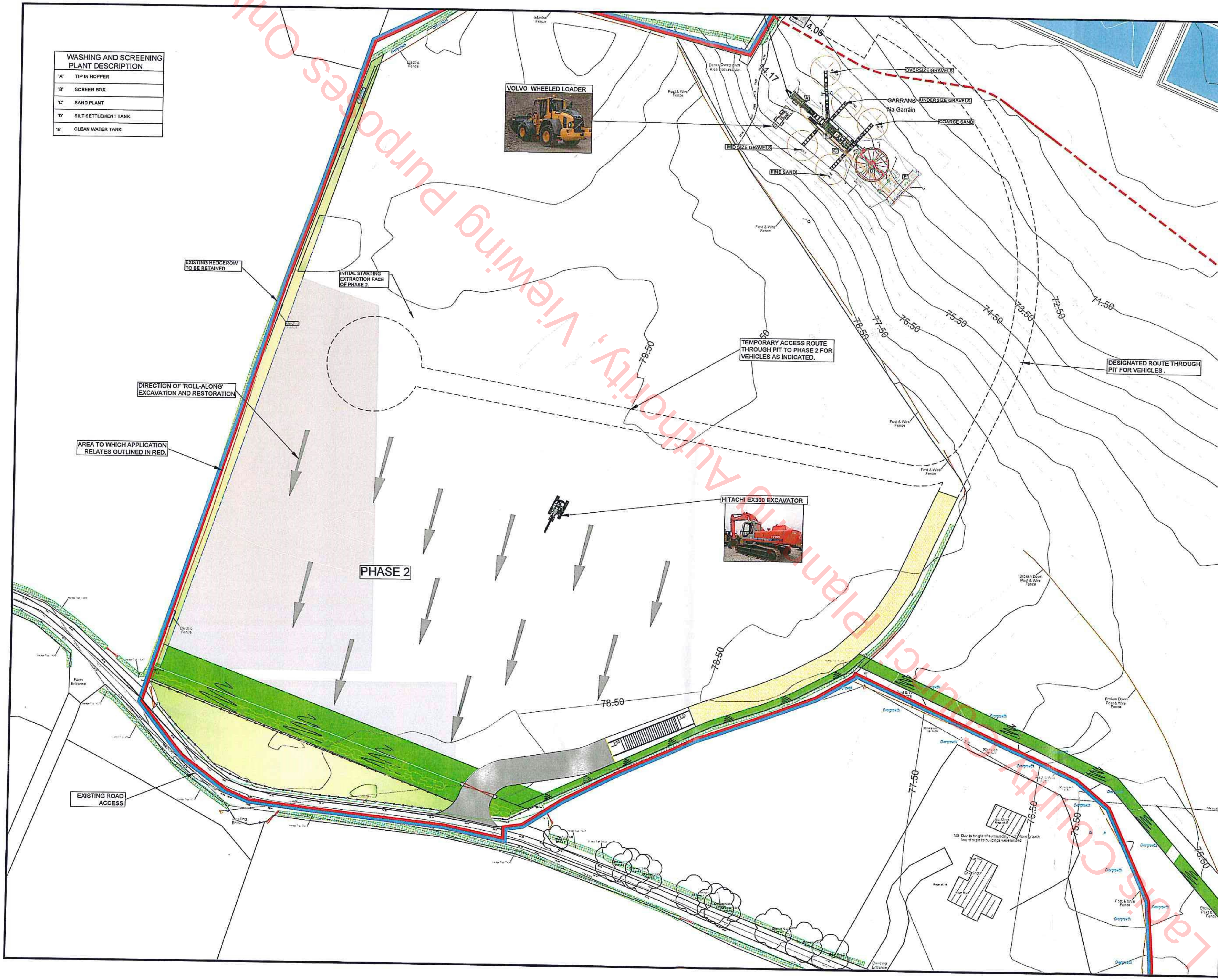
CLIENT:
PAT BOOTH

PROJECT:
PROPOSED SAND & GRAVEL PIT AT
GARRANS, STRADBALLY, CO. LAOIS

TITLE:
OPERATIONAL PLAN PHASE 1

DATE: 14.10.2019
SCALE: 1:500@A1
DRAWING TITLE: 14.312.105
REVISION: PL01

THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.



WASHING AND SCREENING PLANT DESCRIPTION	
'A'	TIP IN HOPPER
'B'	SCREEN BOX
'C'	SAND PLANT
'D'	SILT SETTLEMENT TANK
'E'	CLEAN WATER TANK

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

PHASE 2:

1. Phase 2 to be stripped of topsoil and overburden for use in restoration of Phase 1.
2. Sand and gravel to be excavated from Phase 1 in a Southerly direction following the contours of the ground.
3. Ongoing restoration to be undertaken in Phases 1 & 2 with materials stripped from Phase 3.

ISSUE	DATE	DESCRIPTION	DRW	ORG
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P02	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

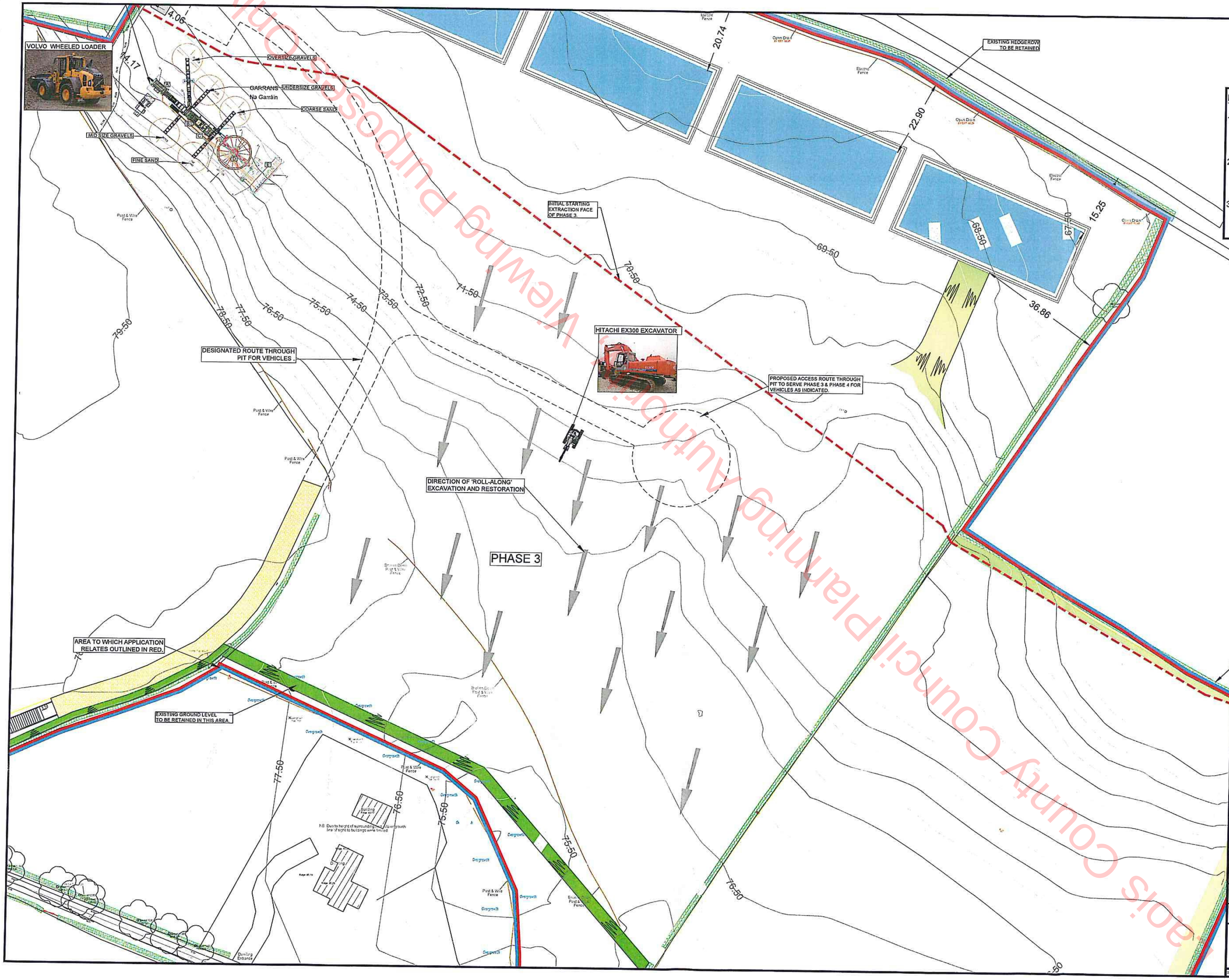
PROJECT:
PROPOSED SAND & GRAVEL PIT AT
GARRANS, STRADBALLY, CO. LAOIS

TITLE:
OPERATIONAL PLAN PHASE 2

DATE: 15.10.2019
SCALE: 1:500@A1
DRAWING TITLE: 14.312.106
REVISION: PL01

THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION Z:\DRAWINGS\2014\14.312 GARRANS PIT, STRADBALLY\01 JRASSC\00 CURRENT



NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

PHASE 3:

1. Phase 3 to be stripped of topsoil and overburden for use in restoration of Phases 1 & 2.
2. Sand and gravel to be excavated from Phase 3 in a Southerly direction following the contours of the ground.
3. Ongoing restoration to be undertaken in Phases 1 & 2 with materials stripped from Phase 3.

N

ISSUE	DATE	DESCRIPTION	DRW	ORG
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P02	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R

Jason Redmond & Associates Consulting Engineers

Civil Structural
Project Management

5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

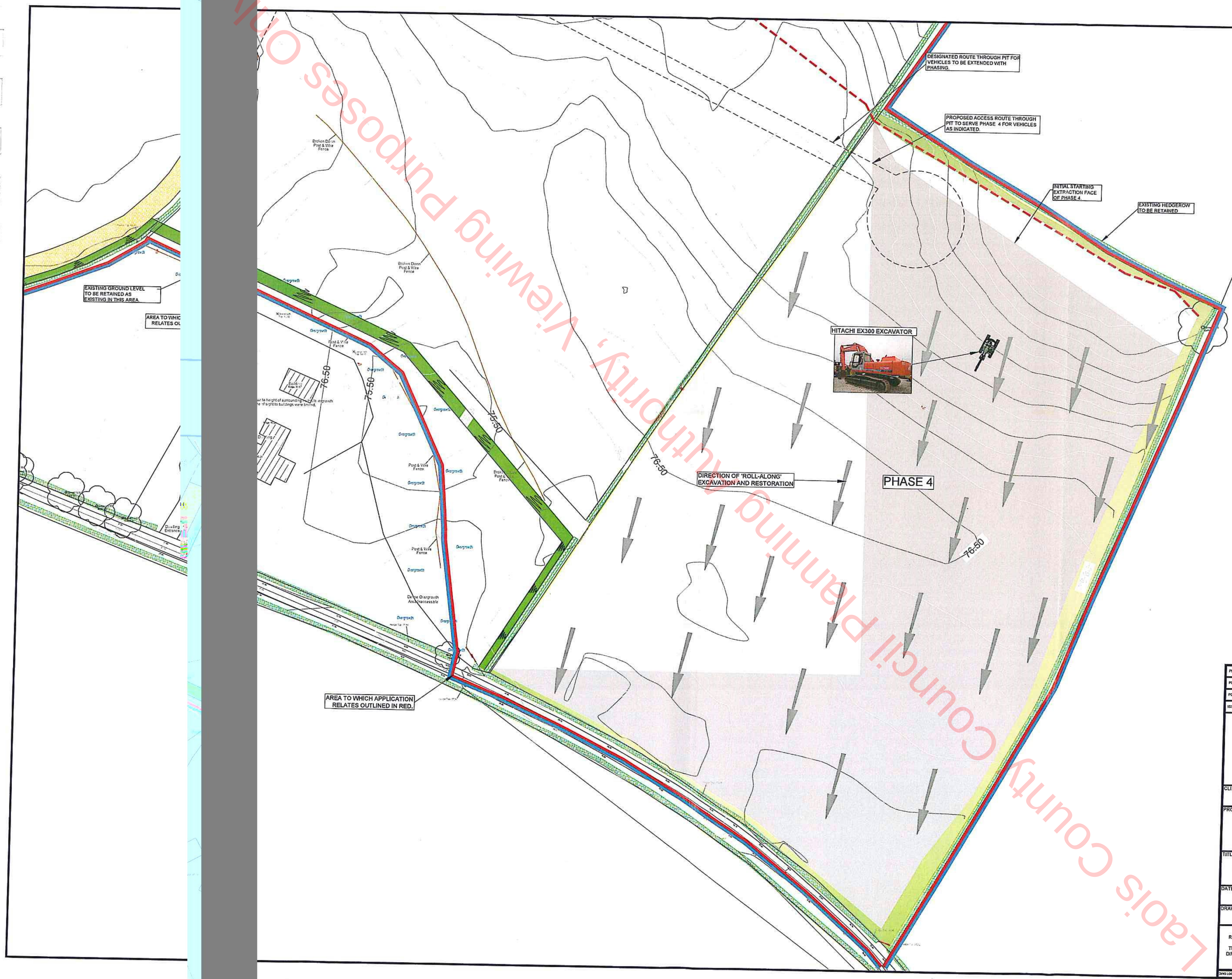
PROJECT:
PROPOSED SAND & GRAVEL PIT AT
GARRANS, STRADBALLY, CO. LAOIS

TITLE:
OPERATIONAL PLAN PHASE 3

DATE: 15.10.2019
SCALE: 1:500@A1
DRAWING TITLE: 14.312.107
REVISION: PL01

THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION Z:\DRAWINGS\2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\00 CURRENT



NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

PHASE 4:

1. Phase 4 to be stripped of topsoil and overburden for use in restoration of Phase 3.
2. Sand and gravel to be excavated from Phase 4 in a Southerly direction following the contours of the ground.
3. Ongoing restoration to be undertaken in Phases 3 with materials stripped from Phase 4.

ISSUE	DATE	DESCRIPTION	DRW	CKD
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P02	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P01	25.10.19	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

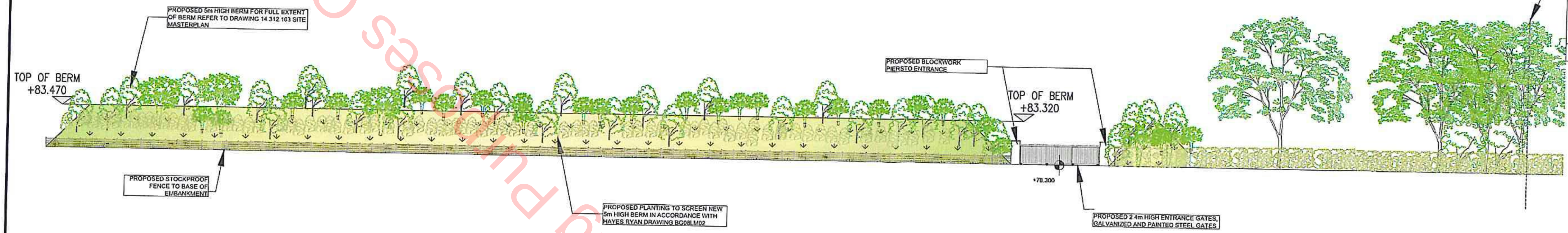
PROJECT:
PROPOSED SAND & GRAVEL PIT AT
GARRANS, STRADBALLY, CO. LAOIS

TITLE:
OPERATIONAL PLAN PHASE 4

DATE: 15.10.2019
SCALE: 1:500@A1
DRAWING TITLE: 14.312.108
REVISION: PL01

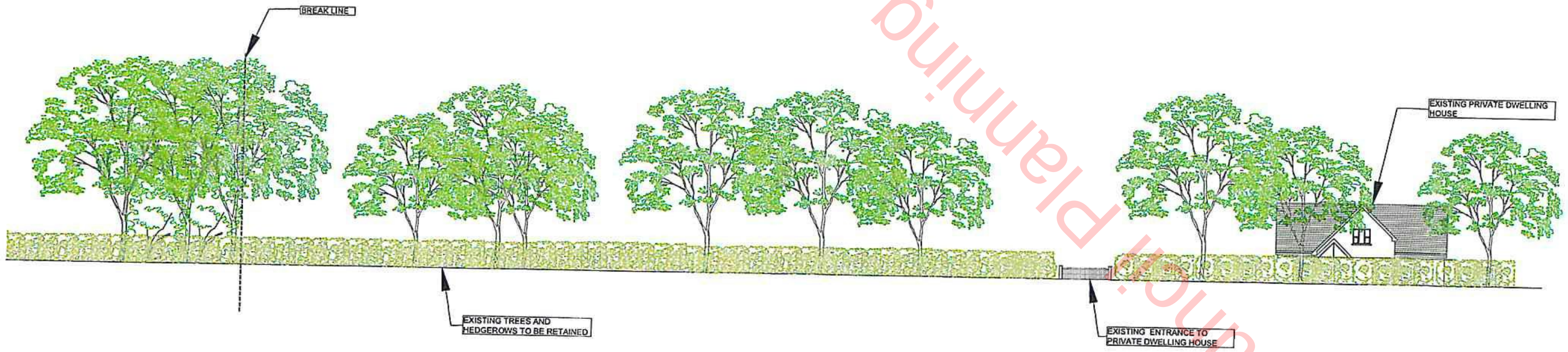
THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION Z:\DRAWINGS\2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\00 CURRENT



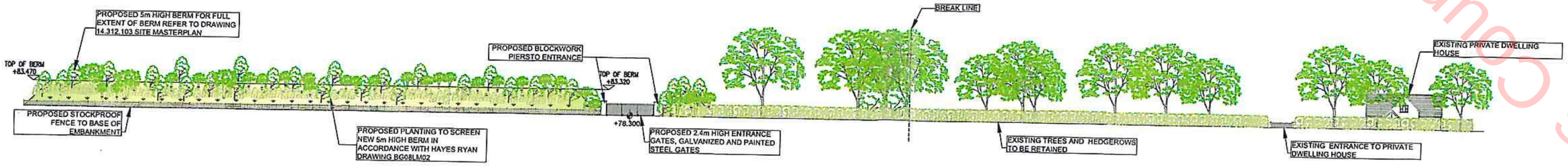
PROPOSED STREET VIEW ELEVATION OF ENTRANCE

SCALE: 1:250



PROPOSED STREET VIEW ELEVATION OF ENTRANCE

SCALE: 1:250



PROPOSED STREET VIEW ELEVATION OF ENTRANCE

SCALE: 1:500

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - "ASK".
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P01	10.09.20	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R
ISSUE	DATE	DESCRIPTION	DRW	CHKD

Jason Redmond & Associates Consulting Engineers

Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

PROJECT:
PROPOSED SAND & GRAVEL PIT AT
GARRANS, STRADBALLY, CO. LAOIS

TITLE:
PROPOSED STREET VIEW
ELEVATION

DATE:
15.10.2019

SCALE:
AS@A1

DRAWING TITLE:
14.312.200

REVISION:
PL01

THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION Z:\DRAWINGS\2014\14.312 GARRONS PIT, STRADBALLY\01 JRASSC\00 CURRENT

Appendix 2.2: Environmental Management Plan

Rowan

Pat Booth,
Garrans, Stradbally, Co. Laois

Environmental Management Plan

November 2020

This page is left intentionally blank

Report Sign Off

CLIENT REF	**BOO0001-1**		
DEVELOPMENT ADDRESS	**GARRANS, STRADBALLY, CO. LAOIS**		
REVISION	**DATE**	**ORIGNATOR**	**REVIEWER**
ISSUE TO CLIENT	06/11/20	DM	CF

Table of Contents

1. Introduction

Rowan Engineering Consultants (Rowan) Ltd. were requested by Pat Booth to draft an Environmental Management Plan (EMP) for a proposed quarry operation at Garrans, Stradbally, Co. Laois. The proposed works will consist of the following:

- Quarry activities for the extraction of and processing of sand and gravel within a c. 12ha site at Garrans;
- On site processing of the material to include extraction, washing, sizing, screening and stockpiling;
- Intermittent crushing of oversized aggregate material;
- Dispatch of the processed materials off-site on Heavy Goods Vehicles (HGVs);
- Installation of site wheel wash, refuelling area, oil interceptors, sludge settlement ponds and storm water attenuation/settlement ponds;
- Development of a, 3No. lay-bys on the local road L7939, a new site entrance and internal site access road;
- Landscaping works to include a planted berm running next to the site entrance and southern boundary of the site;
- Provision of site office, welfare facilities and all ancillary development infrastructure; and
- Final restoration of the site.

No blasting will be undertaken at the site, with site operations such as crushing, which would be required intermittently, undertaken towards the rear of the site (at the northern boundary).

1.1 Purpose and Scope of the EMP

The scope of the EMP covers the activities relating to the mobilisation, operation and restoration of the site.

The purpose of the EMP is to set out a framework for management of future activities in compliance with legislative requirements, relevant best practise and also any environmental management requirements resulting from planning permissions.

The EMP is applicable to the Client (Pat Booth) and also any sub-contractors & site staff working on the site during its operational period.

The EMP will be made available to all site personnel.

2. Location of the Proposed Facility

The site is located in the townland of Garrans, Co Laois, approximately 500m east from Garrans Cross Roads and the regional road R427. The site encompasses approximately 12 hectares and is accessed by the local road, L7939 which is running west-east, towards the R428. The land is currently greenfield, made up of fields and hedgerows used for farming activities.

The site is bound to the north by a section of Coillte owned forestry. There is history of previous quarrying activities for sand and gravel to the north west of the proposed Project, registered under Stradbally Quarries Ltd (QY05/74/1).

The site is largely bound by agricultural lands on the west, eastern and southern boundaries, with the Stradbally River is located c. 300m south of the site. There is a tributary to the Stradbally River at a distance of c. 400m north of the site.

There are a number of one-off private residences located along the R427 at Garrans Cross Road and off the surrounding local roads.

The site would be described as hummock topography, with an elevation ranging between 67 to 80m Above Ordnance Datum (AOD). There is a slope downwards towards the north and north easterly boundary of the site.

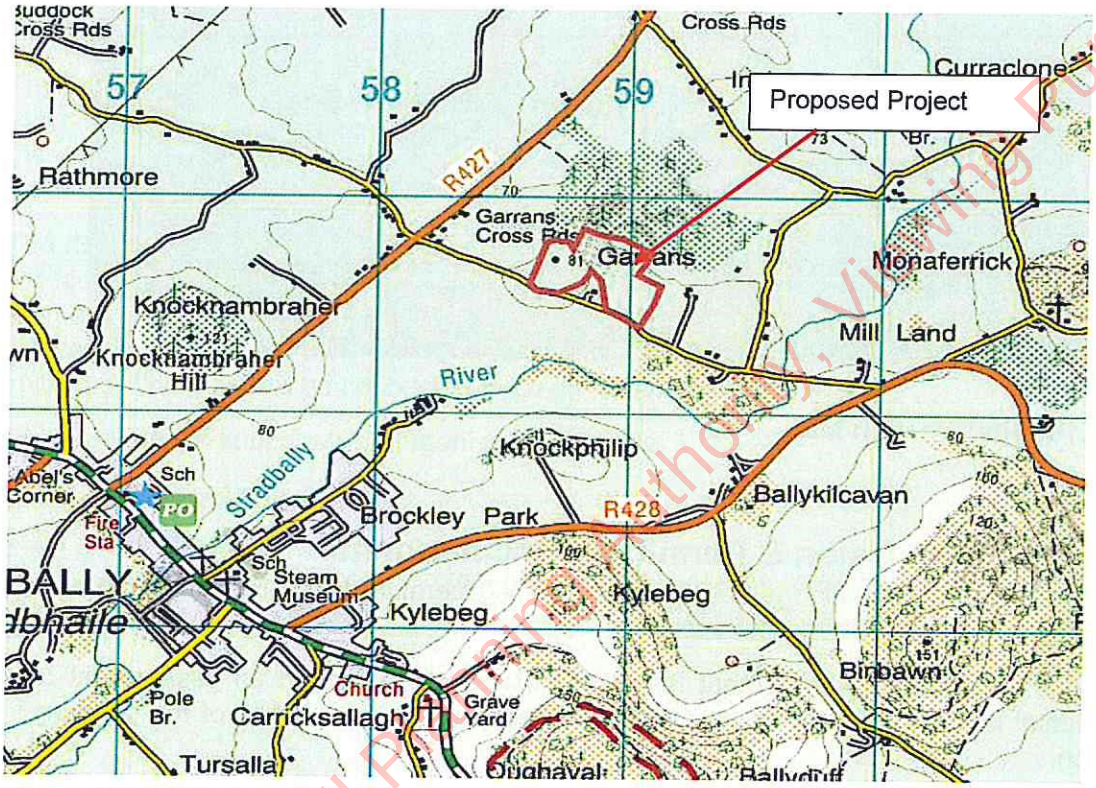


Figure 2.1a: Site Location Map

- A climate change uncertainty allowance of 10% of annual groundwater variability across the site was added to the groundwater levels.

The material extraction depths are set out in the cross sections for the site, provided in the planning application drawings

Once the topsoils and overburden have been stripped, the aggregate (sand and gravel) will be extracted with a wheeled front-end loader (30 tonne). It is envisaged that c. 200 tonnes of excavated material per day (350 tonnes at the occasional peak), will be directly fed into the hoppers of a mobile washing and screening plant (Photograph 4.1) which will be located to the north of the site, adjacent to the refuelling area.

Oversized material is tipped out of the plant at this initial stage.

Photograph 4.1: Image of a typical washing and screening plant

The acceptable material is conveyed for screening, washing and sizing within the plant. The plant will convey material into various stockpiles such as:

- Material < 4mm: 2 grades of washed sands (fine and coarse) conveyed into stockpiles; and
- Material > 4mm: other aggregate sizes conveyed into stockpiles.

The plant will be electrically powered.

The objective of the washing process for the material is two fold – 1. To meet particular standards and specifications for future processing needs and 2. To remove material such as clays, leaves and twigs.

Crushing of oversized material (larger than 20mm) will be undertaken intermittently, about once every three months, in the north west corner of the site. The mobile crushing equipment proposed for use will produce a size of aggregate which is then suitable for feeding into the washing and screening plant.

4.2.5 Water Usage at the Site

There will be no discharge of process wash waters from the site.

The plant is very efficient in that c. 80% of the process water used, will be recycled through an integrated water treatment plant (which is part of the washing and screening plant) and then entered, straight back into the process.

The proposed washing and screening plant will require 234-407 m^3 of water to facilitate the screening, sizing and washing of 200 -350 tonnes/ day.

Given that 80% (192-334 m^3) of the water is recycled straight back into the washing process, the plant only requires a 20% top-up (42-73 m^3/processed tonnage/day) of additional water.

The remaining 20% top-up process water will be provided by:

- Recycled recovered water from sludge settlement ponds.
  Silt which is settled out of the washwater from the wash plant will be pumped, with some water towards the 2No. sludge settlement ponds located on the northern boundary. The water recovered from these ponds will be recycled back into the wash plant;
- Water recovered from the stockpiled aggregate material will be collected in a pipe network and recycled back into the washing and screening plant;
- Surface water run off from the site will be collected and stored in the storm water attenuation/ settlement ponds. This will be introduced into the wash plant; and
- Groundwater abstraction from a water supply borehole, located close to the north western boundary will be introduced into the wash plant.

The breakdown of the 20% top-up process water is outlined in Table 4.2 below.

The process top-up water will be directed to a water balance pond. This pond will manage the combined water inputs and feed water into the washing and screening plant.

In addition to the 20% top-up, the water breakdown in Table 4.2 has also accounted for water usage requirements, for the wheel wash and for dust suppression.

Full details and background to the process water breakdown is provided in Chapter 8 Hydrology and Hydrogeology of the EIAR.

4.2.6 Drainage Proposal For The Site

There will be no discharge of process wash waters from the site.

There will be a surface water discharge, at an appropriate greenfield rate, from the site to the existing drain on the northern boundary (in line with existing conditions on the site).

The water management system on-site will be based on a collection and conveyance system, that is focused on capturing and storing water within the site for use in the processing stages.

This will include the recycling of process water, the collection of surface water drainage from the site and also collection from the stockpile storage areas.

The drainage proposals are as follows:

- Collected water will be retained within the site through a series of pipes and 4No. ponds located towards the northern boundary of the site at distances of c. 15-22m from the existing drain, that runs along this boundary (Refer to Figure 4.2 below).;
- The 4No. ponds are as follows:
    - Pond 1: water top up balancing pond;
    - Ponds 2 & 3: sludge settlement ponds;
    - Pond 4: storm water attenuation / settlement pond
- The 4No. ponds will be lined with a suitable impermeable membrane.
- **Pond 1**: will accept and manage the combined water inputs from each of the top up sources and feed back into the washing and screening plant.
- **Ponds 2&3:** Silty water from the washing and screening plant will discharge from the plant to the sludge settlement ponds (Ponds 2 & 3). These ponds will operate in rotation, with a retention time in excess of 24hours. This will allow for the settlement of sludge and the recovery of c. 6-12m^3 of water per day, that will be recycled back into the process, via Pond 1. The dried silt/sludge will be used in the restoration activities, alongside the stripped topsoils and overburden.
- **Pond 4:** Surface water will be collected from the working and grassed areas of the site and from the outlet of the refuelling area. This surface water will be directed to Pond 4. Following settlement, the water will be recycled into the process, via Pond 1. There will also be a discharge point located at Pond 4, towards the existing drain on the northern boundary. This outlet will be fitted with a hydrocarbon interceptor, hydrobrake and discharge meter. The discharge will be at an appropriate greenfield rate (6.35 lts/sec), in line with existing conditions on-site.
- Ponds 2&3 and Pond 4 will operate in isolation to avoid the risk of silty process water or sludge, entering Pond 4 and being discharged to the environment i.e. there will be no pipe connection between Ponds 2&3 and Pond 4.
- **Water Supply Borehole**: The water supply borehole will be connected to Pond 1. Water will be abstracted from the well as required, into Pond 1 and then onwards to the washing and screening plant. The volumes of water abstracted from the borehole will be monitored and records maintained on-site.
- **Stockpile Area:** Surface water will be collected from underneath the aggregate stockpiles and directed into Pond 1 and then back to the washing and screening plant.

Water management proposals are discussed in detail in Chapter 8 Hydrology and Hydrogeology of the EIAR.

Refer to the Drainage Drawing provided with the planning application drawings.

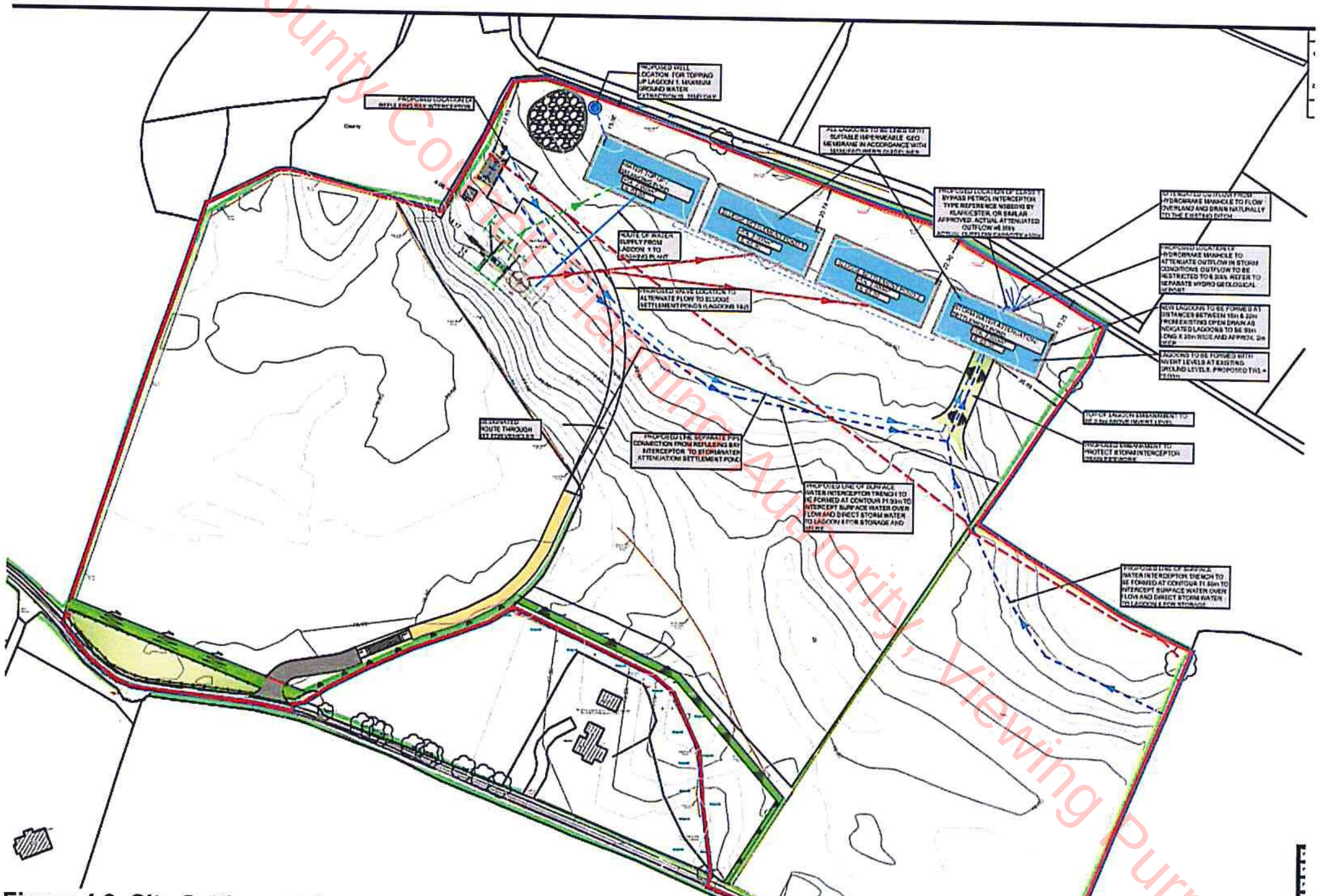


Figure 4.2: Site Settlement Ponds (surface water and sludge) (Ref: extracted from the planning drawings)

Table 4.2a: Breakdown of Water Requirements for the Site

Material Processing Rates (tonnes/day)	Full Process Water Requirement for the Wash Plant (m^3/processed tonnage/day)	Recycled Water within water treatment plant (80%) m^3/processed tonnage/day	20% Top-Up Process Water (m^3/processed tonnage/day)	Sludge Wa r Content o Sludge Pon s (m^3/process d tonnage/da	Recovered Water from Sludge Ponds (m^3/processed tonnage/day)	Material Water to Stockpile at 12% content (m^3/processed tonnage/day)	Recovered Water from Stockpile Dewatering System (m^3/processed tonnage/day)	Wheel wash and dust suppression water requirement (m^3)	Water Balance needed from surfacewater collection and groundwater abstraction (m^3/processed tonnage/day)
200	234	192	**42**	18	**6**	24	**14**	2	**24**
350	407	334	**73**	31	**12**	42	**22**	4	**42**

***Explanation**: 42 m^3 top-up – 6 m^3 recovered from sludge ponds – 14 r ^{3} from stockpile areas = 22 m^3 + 2 m^3 for wheel wash and dust suppression, results in a water balance of 24 m^3/processed tonnage/day to be ma e up from surface water and groundwater sources.*

Table 4.2b: Breakdown of Surface Water and Groundwater Requ rements for the Site

Material Processing Rates (tonnes/day)	Water Collected from Surface Water (Average)	Groundwater Abstraction	Water Balance from surfacewater collection an groundwater abstraction (m^3/processed tonnage/day)
200	15 m3/day	9 m3/day	24
350	15 m3/day	27 m3/day	42

4.2.7 Aggregate Storage and Dispatch

As the material is washed, it will be stockpiled on site depending on the grade of the material. Material will be loaded from stockpiles onto HGV's using the front-ended loader, which are installed with internal weighing systems.

The extracted aggregate will be used to primarily support the demand within the County Laois and County Kildare regions and is thereby supporting local and regional economic development and contributing towards the security of supply of local manufacturing products in the region.

An approximate breakdown of the volumes being dispatched from the site are as follows:

- 30% to Portlaoise Town;
- 20% to Stradbally;
- 20% to Portarlington;
- 20% to Athy;
- 5% to South Kildare; and
- 5% to North County Laois Area.

The material will leave the Garrans site and is generally expected to be used within a 25km radius of the site.

4.3 Site Security and Boundary Treatment

There is a post and wire fencing along the site perimeters in addition to the existing hedgerows. These will be maintained.

It is proposed that a security gate (lockable) with additional 1.6m high fencing will be installed at the site entrance.

4.4 Proposed Restoration & Landscaping (Site Decommissioning)

Following the cessation of extraction activities within each phase, restoration works for the relevant phase will commence. It is not proposed that the voided areas would be infilled.

The voided lands would be graded and sloped to meet the existing levels at the site outline.

Dried silt from the settlement ponds and the stripped topsoils and subsoils will be placed within the void.

The area will then be re-seeded with agricultural grass seed mixture native to the local area.

The perimeter fence will be stockproofed and secure.

Any monitoring points (such as dust deposition) will be removed.

To compensate for the loss of the internal hedgerow system, the Landscape Plan for the restoration phase has specified the provision of new hedgerows. In addition, the Landscape Plan, also specifies additional tree planting on the site boundaries and areas of Irish meadow/wildflower mixture planting within the site.

Figure 4.2: Proposed restoration for the site. (Ref: extracted from the planning drawings)

4.5 Working Hours

The proposed maximum working hours for the site activities subject to agreement with the planning authority are:

- Monday – Friday: 0700-2000hrs; and
- Saturday: 0800-1800hrs.

4.6 Site Facilities, Plant and Equipment

Office and welfare facilities will be provided on site.

The main plant, equipment and infrastructure on site will include the following:

- Security Gates;
- Site office, welfare facilities and car parking area;
- Oil interceptors;
- Wheelwash;
- Washing and screening plant; and
- 4No. ponds for sludge settlement and storm water attenuation/ settlement;

- Mixture of fixed and mobile equipment such as front loaders (with onboard weighing systems), extractors, dumper trucks, dozers and a mobile crusher and screener.

4.7 Site Access and Transport Routes

The site will be accessed from the local road, L7939 with a turn left *in* and turn right *out* rule implemented at the site entrance.

Heavy Goods Vehicles (HGV's) will access the site from Garrans Cross off the regional road R427 and turning left into the site. HGV's leaving the site will turn right towards the R427.

There will be no access, turning right into or left out of the site, towards the R428 and Ballykilcavan Bridge direction.

HGV's will leave the site, having passed through a wheel wash facility, to prevent dirt and debris being transported onto the local road network.

Whilst the proposed Project will not generate significant volumes of site traffic, between the proposed site entrance and the junction with the R427, 3No. lay-bys will be provided to support traffic movements on this stretch of the L7939.

4.8 Site Security

There is a post and wire fencing along the site perimeters in addition to the existing hedgerows. These will be maintained.

It is proposed that a security gate (lockable) with additional 1.6m high fencing will be installed at the site entrance.

Regular inspections of the site will be undertaken by the Pat Booth (and/or site staff) and any repairs at the site perimeters will be repaired immediately.

4.9 Roles and Responsibilities

During operation, Pat Booth will employ c. 3 people on-site. Pat Booth shall:

- Be responsible for having a site member on site to oversee all site activities;
- Be responsible for the overall management and performance of the facility;
- Be the main point of contact in the event of contact from a member of the public, local authority and/or other organisations;
- Be responsible for undertaking regular inspections of the site and site perimeter;
- Be responsible to confirming that the site activities are undertaken in adherence to:
    - EIAR and any subsequent planning permissions;
    - EMP; and
    - Legislative requirements and environmental best practise.
- Maintain all environmental records and documentation.

4.10 Record Keeping

Records relevant to environmental management shall be retained on site. These shall include:

- Environmental Inspection Checklists;
- Environmental monitoring records (i.e. dust monitoring);

- Records of any environmental incidents;
- Complaint and Corrective Action Records;
- Waste Records
    - Waste Contractor name;
    - Vehicle registration details;
    - Time & date;
    - EWC Code and waste description;
    - Weight/Volume of each load of waste leaving the site; and
    - Final destination details.

5. Environmental Management

5.1 Environmental Mitigation from the Environmental Impact Assessment Report

Construction environmental mitigation was outlined in the EIAR to avoid/reduce the potential for environmental impacts during the construction phase.

This mitigation will be implemented by Pat Booth and is detailed in Table 5.1 below.

Table 5.1: Environmental Mitigation

Chapter	Reference	Potential Environmental Impact	Description
General			An Environmental Management Plan (EMP) will be prepared setting out a framework in relation to the management of environmental issues when the proposed Project is operational. The EMP will be updated prior to the commencement of the works on site and compliance with the EMP will be mandatory.
5 – Traffic and Transport	Section 5.5	Increased traffic generation – impact on road network capacity	The Traffic and Transport Assessment concluded that, the operation of the proposed Project would not impact the capacity of the local road network. The site will be accessed & exited using the regional road R427 junction only. Site traffic will not access/exit the site using the Ballykilcavan Bridge. 3No. lay-bys will be installed on the local road L7939 in line with the drawing provided in the Traffic and Transport Assessment.
6 – Noise and Vibration	Section 6.5	Impacts on noise sensitive locations	The mitigation measures that will be implemented on site to minimise environmental impacts relating to noise, will include: • All vehicle engines will be switched off when not in use; • Plant and machinery used on-site will comply with the EC (Construction Plant and Equipment) Permissible, Noise Levels Regulations, 1988 (S.I. No. 320 of 1988); • Best practicable means will be implemented to minimise noise emissions and the site will comply with the general

Chapter	Reference	Potential Environmental Impact	Description
			recommendations of BS 5228-1 2009 and "Environmental Good Practice Site Guide' 2005 compiled by CIRIA and the UK Environmental Agency; • Care will be taken when loading & unloading vehicles to reduce or minimise potential disturbance to local residents; • Access / internal haul roads will be kept clean and maintained in a good state of repair, i.e. any potholes are filled, and large bumps removed, to avoid unwanted rattle and "body-slap" from heavy goods vehicles; • Restricted speed limits will be implemented on site to reduce the generation of noise from moving HGV's within the site; • The berms will be erected to act as acoustic barriers adjacent to the closest residences; • All existing perimeter hedge planting will be retained; • Additional vegetation planting will be provided around the perimeter of the site (Refer to the Landscape Plan for the site for full details); and • The berms will be inspected on a regular basis and maintained as necessary.
7- Soils and Geology	Section 7.6	Pollution event on local soils and geology	The following mitigation measures will be implemented on site to minimise environmental impacts: • Soil stockpiles will not be stored at elevated locations on the site; • All vehicles leaving the site will be cleaned by the wheel washing facility to prevent the spread of mud and dust on public roads; • Vehicles delivering materials with dust potential will be enclosed or covered with tarpaulin; • During prolonged dry or windy periods, any areas with the potential to generate dust will be watered, in particular areas next to the site entrance; and • Public roads will be inspected regularly for cleanliness and cleaned as necessary; and • There will be minimal storage of oils and chemicals on site. They shall be stored on bunds in a hardstanding area; • There will be no storage of fuel on-site. Refuelling of vehicles, plant and equipment will be undertaken at the designated refuelling area by a mobile fuel tanker, that will enter the site as required • Any spillages or leakages shall be cleaned up immediately and addressed in line with the requirement of the Emergency Response Procedure and Spill Protocol outlined in the EMP;

Chapter	Reference	Potential Environmental Impact	Description
			• With regard to the potential for sediment release from the site, the site will operate a collection and conveyance system on-site, that is focused on capturing and storing water within the site for use in the processing stage. Silty/sludge water from the wash plant will be managed in isolation, to surface water collected on-site, to avoid the risk of discharge to the environment. Collected waters from the site will be managed through a system of 4No. ponds that will be lined with an impermeable material and are sized to allow are appropriate retention times and settlement of sediment. (Refer to Chapter 8 Hydrology and Hydrogeology for full details). • An Emergency Response Procedure including procedures for any chemical/oil/waste leaks at the facility is in place (See Section 11 below) and all relevant personnel working at the site will be trained in its implementation.
8 – Hydrology (Flood Risk), Water Quality and Hydrogeology	Section 8.5 & 8.6	Pollution of surface and groundwaters	Refer to Table 1.0 in Appendix 1 of the EMP for surface water and groundwater mitigation measures.
9 – Air Quality	Section 9.5	Nuisance dust	The mitigation measures that will be implemented on site to minimise environmental impacts relating to dust emissions will include: • Vehicles delivering materials (to and from the site), with dust potential will be enclosed or covered with tarpaulin; • All HGV's leaving the site will directed through a wheelwash in order to prevent mud and soils being tracked onto public roads; • Restricted speed limits will be implemented on site to reduce the generation of dust from moving HGV's within the site; • All stockpiles on site will be monitored and treated with water to minimise dust emissions where required; • Hard surfaces on-site will be swept to remove any mud or aggregate build up to minimise dust emissions; • During prolonged dry or windy periods, any areas with the potential to generate dust will be watered, in particular areas next to the site entrance and at the excavation and storage locations; • Material handling and stockpiling of materials will be designed and laid out to minimise the exposure to wind; • Materials will not be moved on-site if they are too dry or when there is unusually windy or rainy weather conditions;

Chapter	Reference	Potential Environmental Impact	Description
			• Works shall be ceased during excessively high winds; • Grassed screening mounds (from the stripped top soil) close to the site entrance and along the southern boundary; • Public roads will be inspected regularly for cleanliness and cleaned as necessary. • With regard to exhaust emissions and GHG emissions: o Vehicles on the site will be not left idling for more than a few minutes; o Plant and equipment on site will be regularly maintained and records retained in this regard; and o Energy consumption & emissions data will be considered in the purchasing new plant and vehicles **Note**: See Dust Management & Monitoring Procedure below
9 – Air Quality	Section 9.6	Nuisance dust	A monthly dust monitoring programme will be implemented at the site boundaries for the duration of the site activities and records maintained on-site. The monthly measurements will be undertaken using the TA Luft/VDI 2119 Bergerhoff Method and levels shall not exceed the 350 mg/m^2/day standard. Records of the monthly measurements will be maintained on-site. **Note**: See Dust Management & Monitoring Procedure below
10 – Landscape and Visual	Section 10.6	Impacts on landscape and visual receptors.	**Avoidance** The hedgerows on the site boundary will be retained. Any damage to the existing hedgerows which form the boundary of the site will be avoided. There will be no loading of soil, excavate, spoil or any materials onto the root system of the hedgerows or any of the hedgerow trees. A root zone protection barrier will be set up and marked with signage indicating its purpose before any heavy vehicles move on site. Trees on the north west corner of the site are currently vulnerable as there is a drop away outside the site boundary and they may suffer from vibrations at the root zone. To avoid the potential loss of these trees, they will be protected from disturbance to the root system to ensure longevity, for as long as possible. In the interim, additional tree planting as per the Landscape Plan recommendations will ensure that there is substitute trees ready to strengthen this existing stand in the landscape in the long term and as a permanent aspect of the landscape pattern. All hedgerows and tree stands will be reinforced with new planting wherever the opportunity presents itself.

Chapter	Reference	Potential Environmental Impact	Description
			Fraxinus excelsior will be avoided in new planting due to the current risk this poses to the spread of the fungal disease, *Chalara fraxinea (Hymenoscyphus fraxineus)* to existing stands of ash or ash as hedgerow trees in the area.
10 – Landscape and Visual	Section 10.6	Impacts on landscape and visual receptors.	**Hedgerow Overmanagement** The hedgerow along the western boundary is key to screening the site but is currently overmanaged. It will the subject of a different maintenance approach to become a more effective screen. The excessive bramble will be removed to permit whitethorn *Crataegus monogyna*, Blackthorn, *Prunus spinosa*, existing ash *Fraxinus excelsior* and Sycamore *Acer pseudoplatanus* to emerge. There may also possibly be beech, *Fagus sylvatica* hazel *Corylus avellana* and holly *Ilex aquifolium* in the hedgerow if it is allowed to emerge. Bramble will be controlled as will grass species for a short time until the hedge re emerges. One tree shall be allowed to grow into a hedgerow tree at approximately 5m intervals. A second hedgerow to be established parallel to this to future proof the landscape pattern and strengthen screening for visual receptors along this alignment of hedgerow. This to be done with no damage to the root system of the existing hedge. As part of the iterative design process an interim construction landscape plan has been prepared and this section of hedgerow is included as part of this plan. Where the opportunity presents itself, the hedgerow will be thickened with new planting to reinforce the existing hedgerow. **Hedgerow Replacement** Where it is not possible to avoid the loss of hedgerow in the centre of the site, this is to be replaced as per the Landscape Plan at the restoration phase. This may require construction of a typical low field ditch to allow for changed drainage conditions and to attain initial height. This will also help maintain the spatial field and landscape pattern. **Historical Pattern Restoration** In mitigating the effects of excavation there is also an opportunity to restore the historical cultural landscape pattern as evidenced by the Ordnance Historical maps of Garrans in (i) Six inch colour 1837-1842 (ii)1888-1913 Black and White 25 inch maps (iii)Cassini 6 inch and (iv) Ordnance Survey historical flood plain records. The evidence in the historical maps indicates the size of the field systems and the position of the hedgerows which define them. The central hedgerow which is seen from the western boundary hedgerow is currently almost obliterated with only one or two whitethorn in evidence along its length. The position of the hedgerow is still apparent but the hedgerow itself is of very low quality. The central hedgerow towards the eastern boundary is of good condition and this will be replaced as outlined in the landscape plan. All the boundary hedgerows will be protected. The landscape plan will replace the landscape

Chapter	Reference	Potential Environmental Impact	Description
			trees lost due to field expansion during increased agricultural productivity over the years. This will replace the landscape pattern as evidenced in the Ordnance Survey maps. The tree planting will also ensure that the use of younger trees will guanantee the longevity of this landscape pattern into the future with the potential for this pattern to last in excess of two hundred and fifty years. This evidence provides the basis for replanting the original landscape patterns and ensuring that this portion of the county has reinstated an example of the field spatial pattern. This will not only help mitigate the excavation work but will have a positive impact on landscape spatial patterns.
10 – Landscape and Visual	Section 10.6	Impacts on landscape and visual receptors.	**Landscape Form** The land form which underlies the landscape pattern generated by hedgerow and trees is a fine, softly contoured undulating landscape at the macro and micro scales. Just as the greater landscape form is undulating the form at field scale is also similarly wave like in shape. It runs slightly west to north east. It will not be possible to replicate this form during the restoration phase but by softening the contours and making a less angular landform and instilling a little of the wave like pattern where possible and where materials underlying the topsoil permit, it is possible to mitigate somewhat for the loss of form. Earthworks during the restoration works shall address as much as possible, the issue of landscape form in the reinstatement and reconfiguration of the subsoil and topsoil to development a natural appearance in the topographical flow of the new landscape as it emerges.
10 – Landscape and Visual	Section 10.6	Impacts on landscape and visual receptors.	**Temporary Berms** The use of temporary berms will assist greatly with reducing visual impact at the construction and operational phases and these shall be kept in place for as long as practicable until the landscape nears restoration completion. This is especially true for the first berm near the site entrance on the south. Given that the extraction period is to be of the order of 20 years with the average extraction of 200 tonnes per day, then the berms constructed at each phase play an important role in screening. Because they will be in place for some time the visual receptors will benefit from some contouring of the berm facing the road giving it a softer less angular profile. It will appear more naturalistic and less anthropogenic and still effectively screen off the activity behind.
10 – Landscape and Visual	Section 10.6	Impacts on landscape and visual receptors.	**Landscape Maintenance and Management Plan** A Landscape Maintenance and Management Plan will detail the work to be undertaken to protect the hedgerow and hedgerow trees at the outset and the work involved with infill planting and all new planting. This Plan will be maintained over the life of the operation and subsequently until the plantings

Chapter	Reference	Potential Environmental Impact	Description
			are fully established. The Plan will involve irrigation where necessary, pruning, weeding, fertilising, trimming, removal of dead and diseased wood, hedgerow cutting, hand laying where required and general maintenance. Defects periods are established and maintenance requirements during this period are established. The mitigation measures as outlined are conducted throughout the life of the operation and its restoration. Placing each measure into its timeline according to construction, operational and restoration phases produces the following inventory; **Construction Phase** • Shaping, contouring and planting of berms • Establishing root protection barriers and avoiding any damage to hedgerow and hedgerow trees. • Commencing hedgerow maintenance especially on western boundary • Assessing individual maintenance needs for all hedgerow trees and hedgerows. • Infill planting to strengthen existing hedgerows **Operational Phase** • Continue to maintain and manage hedgerows replacing any losses • Combine maintenance irrigation with foliage dust cleaning if required. • Maintain all new plantings **Restoration Phase** • Provide for off-site removal, re-use and/or recovery of all buildings, plant, infrastructure and paved surfaces on completion of restoration activities. • Landscape form restoration. The final restoration landform will be graded at a shallow angle so as to merge in with the surrounding agricultural landscape. These mitigation measures are in accordance with the recommendations provided in the DoEHLG (2004) publication Quarries and Ancillary Activities: Guidelines for Planning Authorities. Additionally, contouring and curving of the earthworks to soften angular profiles and reduce the appearance of straight edges will simulate to some extent the natural undulating landscape. • Historical landscape pattern and spatial configuration to be restored. • The Landscape Plan will be fully implemented. • New hedgerow planting and associated soil preparation.

Chapter	Reference	Potential Environmental Impact	Description
			• A new Landscape Management Plan will be devised and implemented in the case of the existing hedgerows, during the life of the Project and for the new landscape planting, after the restoration phase. • Continue to maintain and manage the trees and hedgerow system, establish a defects period and hand over at the end of the restoration phase to ensure the permanent preservation of the landscape works.
11- Biodiversity	Section 11.12	Impacts on ecological receptors	• Prior to any works commencing on site, site personnel will be made aware of the ecological sensitivity of the treelines in the site and of the measures required to protect the biodiversity of the site and the water quality of the local aquatic receptors. They will be made familiar with the mitigation outlined in the assessment and incorporated into the EMP; • All site works will be confined to the application site. • All quarrying activities on site will follow current best practice guidelines, including the Geological Heritage Guidelines for the Extractive Industry produced by Geological Survey of Ireland and Environmental Management in the Extractive Industry produced by the EPA; • Any vegetation clearance shall be undertaken outside of bird nesting season (March to August Inclusive), or under the supervision of a suitably qualified ecologist; • All excavated topsoil shall be stored appropriately on site and retained for future reinstatement of the quarry, on a phased basis and at the end of its operational phase, to support the final restoration works. Measures will be taken to minimise sediment generation during the storage of these soils. • The exposed surfaces shall be minimised and reinstated or re-vegetated as soon as possible. • Verges of undisturbed habitat will be left around the field margins of the site. This verge must include the root protection zone of trees that are to be retained. This should be fenced off prior to the commencement of quarrying activities. The verge should be managed in accordance with traditional hay meadow practices, i.e., cutting in autumn and removing the topped grass. The maintenance of this corridor will also allow mammals to continue commuting throughout the site if required. • The fencing around the quarrying activities will be mammal proof. There should be no gaps at the bottom.

Chapter	Reference	Potential Environmental Impact	Description
11-Biodiversity	Section 11.12	Impacts on ecological receptors	**Treelines and Hedgerows** • The removal of trees, treelines and hedgerows within the site has been avoided where possible. All boundary hedgerows/treelines will be retained and protected. The hedgerow between Phase 3 & 4 operations will be removed during the course of the excavation works. • A Landscape Plan for the Operational and Restoration Phases has been developed. It outlines proposals for the protection, planting and provision of compensatory treelines/hedgerows over the lifetime of the proposed Project. • The treelines remain the most important ecological features within the site. These shall be protected from direct habitat loss though removal and indirect loss through damage through root compaction. The following applies: o There is a c.3ha area in the northern section of the site i.e. surrounding the 4No. ponds and the refuelling area which will not be stripped or excavated within, during the lifetime of the proposed Project. The 4No. ponds will be located c.15-22m from the boundary. These measures will protect the treeline along this boundary; o Any damage to the existing hedgerows which form the boundary of the site will be avoided. There will be no loading of soil, excavate, spoil or any materials onto the root system of the hedgerows or any of the hedgerow trees; o A root zone protection barrier will be set up and marked with signage indicating its purpose before any heavy vehicles move on site; o In the event that tree removal works are required during the course of site activities, these shall be guided under the advice of an arboriculturist. They will only be carried out outside of the bird nesting season or under the supervision of a suitably qualified ecologist; o If trees need to be removed, it shall be done through the soft felling method, and this will reduce the risk of harming fauna during the felling process. Soft-felling involves the whole of the tree and any large branches being cut down in sections, with each section being

Chapter	Reference	Potential Environmental Impact	Description
			carefully lowered to the ground. Once on the ground the timber will be left in-situ on the ground for a minimum of 24 hours before being chipped or removed in order for any fauna to disperse without harm. • Treelines and hedgerows shall be supplemented with suitable native species where necessary. Refer to the Landscape Plan (Appendix 10.6) for full details;
11-Biodiversity	Section 11.12	Impacts on ecological receptors	**Bats** • Prior to the removal of any tree, it shall be checked for the presence of roosting bats by a suitably qualified person. • If there are bats present, the tree will be removed when the bats are no longer using the tree, or else a derogation license will be sought from NPWS for the relocation of the bats. • Minimal lighting will be required at the site and will be focused on the main working areas only, when the site is in operation. The lighting will aim to maintain any opportunities around the site for nocturnal and crepuscular species by using timers, cowls and hoods. Lighting shall not be directed at any tree, hedgerows or woodland habitats. **Badgers** • The site will be re-surveyed for badger activity prior to the commencement of each phase of the quarrying activities. • There is a badger sett (Sett 1) located within the Phase 4 area. Extraction activities will not commence in this area of the site for a number of years. If upon review, this sett is still active, badgers will be excluded from the sett and any other setts that may be identified and considered vulnerable. • Approval to exclude and excavate the sett(s) will be sought from the NPWS prior to the commencement of any quarrying works in the relevant area. • Any setts that require to be excluded/removed shall be monitored by a suitably qualified person prior to exclusion. If the sett is shown to be a breeding sett, exclusion shall not be undertaken between December and July. • Other setts (Setts 2,3,4) close to the site may also be indirectly affected by the ground disturbance from the quarrying activities. However, the area closest to

Chapter	Reference	Potential Environmental Impact	Description
			these setts will not be quarried or stripped. This is the northern area where the refuelling area and 4No. ponds will be located. This stretch of land will act as a buffer between the site works and these setts. • Dust mitigation measures as outlined in the EMP will be followed on site at all times, e.g., the dampening of internal haul roads, surface material and stockpiles; the presence of vehicle washing facilities and the vegetation of earthen berms and screening bunds.
11-Biodiversity	Section 11.12	Impacts on ecological receptors	**Surface water and Groundwater Quality** • It is important to protect the quality of surface water and groundwater locally. The following measures must be adhered to: o There will be minimal requirement for the storage of chemicals, oils, greases and hydraulic fluids. Where required, these will bestored in bunded compounds, located away from the drain on the northern boundary; o The designated refuelling area will be located in the north west corner of the site. This area will facilitate the refuelling of mobile equipment on the site .There will be no storage of fuel at the site, with refuelling being undertaken with a mobile tanker that will access the site as needed. The refuelling area will be a concrete hardstanding area with a gully to collect any spillages. The gully will be connected to an oil interceptor. o Stockpile storage areas and the site office are located away from the drain on the northern boundary; o An effective spillage procedure will be incorporated as part of the EMP and all staff will be properly briefed. o Any waste oils or hydraulic fluids will be collected and stored in appropriate containers and disposed of offsite in an appropriate manner. o All plant and machinery shall be regularly maintained and serviced (off-site) to minimise release of hydrocarbons. o Spill kits shall be present in all plant machinery. o Oil booms and oil soakage pads shall be kept on site to deal with any accidental spillages.

Chapter	Reference	Potential Environmental Impact	Description
			○ Waste oils and hydraulic fluids should be collected in leak-proof containers and removed from site for disposal and recycling Detailed mitigation for surface water and groundwater are detailed in Appendix 1.
12- Population and Human Health	Section 12.6	Impacts on population and human health	• Vehicles delivering or exiting with materials with dust potential will be enclosed or covered with tarpaulin; • All HGV's leaving the site will directed through a wheelwash in order to prevent mud and other wastes being tracked onto public roads; • All stockpiles will be monitored and treated with water to minimise dust emissions; • Hard surfaces on-site will be swept to remove any mud or aggregate build up to minimise dust emissions; • During prolonged dry or windy periods, any areas with the potential to generate dust will be watered, in particular areas next to the site entrance; and • Public roads will be inspected regularly for cleanliness and cleaned as necessary. • A Landscape Plan has been developed for the Operational and Restoration Phases. This identifies plans for the protection, management and restoration of treelines/hedgerows at the site. In addition, the provision of planted berms will reduce the visual impact for receptors in the vicinity of the proposed Project.
13- Cultural Heritage	Section 13.5	Impacts on cultural heritage assets	As part of the site enabling works it is recommended that archaeological test trenches be undertaken to identify any potential for sub surface remains. Should any items that may have archaeological potential be encountered, all works will be immediately stopped and the archaeologist will detail and agree any potential mitigation with Laois County Council and the Department of AHRRGA. This required mitigation will then be integrated into an updated revision of the Environmental Management Plan (EMP) for the proposed Project.
14 – Waste Management	Section 14.5	Waste management impacts	Refer to Waste Management Plan below.

5.2 Environmental Management Procedures

5.2.1 Materials – Deliveries & Removal

Traffic to and from the site will include:

- 15 HGV Loads per day from the facility (assuming the peak extraction of 350 tonnes per day);
- Staff movements would consist of 2 inbound trips in the morning and 2 outbound trips in the evening; and
- A total of 6 additional trips for miscellaneous items.

Vehicles making deliveries, bringing and removing materials to/from the site will access via the regional road R427 and the junction at Garrans with local road L7939.

Site traffic will not access or exit the site, traveling east, using Ballykilcavan Bridge.

Any waste receptacles being removed from the site will be covered or enclosed.

Vehicles delivering materials or exiting with materials that have dust potential will be enclosed or covered with tarpaulin.

5.2.2 Bunding and Storage of Chemicals/Oils On-Site

Minimal volumes of chemical/oil material are expected to be retained on the site.

There will be no fuel storage on site.

The following controls shall be implemented by Pat Booth in relation to the storage of chemicals and oils on-site:

- Any oils & chemicals that may be present on-site shall be stored on bunds & one the hardstanding area;
- Bunds shall be able to contain at least 25% of the total volume of the stored products or 110% of the total volume the largest container (whichever is greater);
- Pat Booth shall confirm that bunds are maintained, inspected and emptied of their contents in a manner that prevents environmental damage;
- Storage of oils and chemicals shall be away from the drain on the northern boundary;
- Any bunds shall be checked regularly to:
    - Determine if it is necessary to drain the contents of the bund;
    - Ensure that the bund contents will not overflow the bund (Ideally the bund should be dry, as any volume occupied by liquid within the bund reduces the potential of the bund to retain the spilled contents of a tank should a spillage or leakage occur);
    - Check the condition of the bund; and
    - Confirm that any drain valves are in the closed position and locked if necessary.
- If the bund contains anything other than rainwater, then an odour and visual assessment of the bunds contents must be made before it can be discharged (via the oil interceptor on-site). It may be necessary to analyse the contents of the bund, if its identity cannot be determined following initial inspection;
- If it is determined, following the identification of the bunds contents that they are unsuitable for discharge, Pat Booth shall transfer the material into suitable, clearly labelled containers and disposed of as deemed necessary by a licenced waste contractor.

- Suitable material from the bunds (i.e. rainwater), will be discharged via the oil interceptor to the recharge pond.

5.2.3 Refuelling of Plant and Equipment On-Site

The following controls shall be implemented by Pat Booth in relation to refuelling activities on site:

- Delivery of any fuel to the facility will be in approved vehicles and tanks;
- All refuelling will be undertaken on the designated, hardstanding area at the site compound discharging to the oil interceptor;
- Refuelling shall not be undertaken when plant and equipment engines are running;
- Pat Booth will confirm that all equipment, fittings, hoses, tanks and nozzles are in good condition and free from leaks;
- All dispensing of fuel will be attended for the duration of the operation;
- A staff member will inspect the refuelling area prior to and on completion of the refuelling activity; and
- Filled and labelled spill kits will be maintained next to the refuelling area and readily available.

5.2.4 Non-Native Species Management

No non-native species have been identified on site during the site surveys.

In the event, the non-native species are identified during future excavation works, the following will apply in the control and management of these species at the site:

- **Confirm species identification**: Should Pat Booth suspect that any invasive species are occurring on site, they will verify the identification with a suitably qualified professional;
- **Confirm species distribution within the site**: A survey will be undertaken and a map produced indicating the species distribution on site. This will include any buffer zones for potential growth;
- **Confirm a Management Plan**: This plan may require the support of a specialist firm. The objective of the Plan will be to eradicate the spread of the non-native species and may require the following:
  - Cordoning off areas of the site;
  - Ensuring soils within the cordoned off area are not moved/spread within the site;
  - Treatment of soils – such as chemical, burial, excavation & off-site removal; and
  - Cleaning of machinery and equipment.
- **Monitoring:** Implementing a suitable monitoring period to confirm that the Management Plan was successful and that there are no missed plants, late geminating seeds or a reintroduction of invasive species.

6. Emissions Monitoring and Management

Refer to Appendix 3 for the Monitoring Location Map relating to emission monitoring/sampling points.

6.1.1 Dust Monitoring

Visual Inspections

Daily visual Inspections will be carried at the 4 locations (D1-D4) around the site boundary. All visual inspections will be summarised in the Weekly Environmental Inspection Checklist which is Appendix 2 of the EMP.

The visual inspections will assist in monitoring the effectiveness of dust mitigation measures.

Dust Deposition Monitoring

Dust deposition monitoring will be undertaken on a monthly basis at 4 locations on the site boundary. Refer to Monitoring Map in Appendix 3 (locations D1-D4). These locations can be adjusted as required, depending on the phasing of the site works etc.

This monitoring will be carried out using Bergerhoff dust deposition gauges.

The off site laboratory analysis of the Bergerhoff jars will be undertaken at a suitably accredited laboratory and deposition will expressed as mg/m^2/day.

The laboratory results will be compared against the "*Technical Instructions on Air Quality Control – TA Luft*" 2002 emission value for dustfall of 350 mg/m^2/day.

Where measured concentrations in deposited dust are found to exceed these baseline limits the cause/source of the excessive dust will be investigated, and any additional feasible and reasonable measures available will be implemented to reduce impact and reduce any impact to the environment and/or the local community.

Any excessive levels of dust observed by Pat Booth or measured in the dust deposition analysis will be recorded in the Complaints and Corrective Actions Records (Appendix 4). In addition they will be identified and recorded in the Weekly Environmental Inspection Checklist in Appendix 2

6.1.2 Groundwater Monitoring

Groundwater Abstraction Rates

Weekly groundwater abstraction rates will be recorded. The purpose is to validate the proposed water usage rates.

Groundwater Levels

One of the four site investigation groundwater monitoring points will be retained for operational phase groundwater level monitoring. Groundwater levels will be measured daily using an in-borehole water level monitor. The purpose is to identify whether any significant changes in groundwater level occur as a result of the presence and operation of the quarry.

Groundwater Quality

Groundwater samples from this borehole will be analysed and compared against key baseline groundwater parameters as set out in the EIAR and the relevant standards, annually. The purpose is to identify whether any significant changes in groundwater quality occur as a result of the presence and operation of the quarry.

Sampling will also be carried out in according to the provisions of any grant of permission.

Borehole Decommissioning

Boreholes not used in operational monitoring will be back filled with suitable material. The purpose is to ensure that the boreholes cannot act as preferential flow paths into the sand and gravel body and the underlying bedrock aquifer.

6.1.3 Surface Water Monitoring

Discharge Rate

Discharge rate will be recorded weekly from the discharge meter installed on the outflow. The purpose is to validate the proposed discharge rates.

Discharge Quality

Quality of the surface water discharge from the site will be monitored according to any planning conditions imposed.

Surface Water Monitoring

Water samples from the onsite man-made drain (when water occurs) and the drain downstream where permanent flow occurs, will be taken four times yearly.

These will be compared against key baseline surface water parameters as set out in this report and the relevant standards. The purpose is to identify whether any significant changes in water quality occur as a result of the presence and operation of the quarry.

7. Waste Management Plan

The overarching waste management policies for the proposed Project will be to;

- Prevent wherever possible the generation of waste;
- To reuse waste on site where applicable or transport it to a suitably licenced facility; and
- Recyclable waste fractions will be segregated at source on site and transferred to a suitably licensed facility.

7.1.1 Waste Streams

Expected waste streams for the proposed Project are detailed in Table 7.1.

Table 7.1: Expected Waste Stream

Description of Material	Management Options
Municipal waste	Waste segregation to encourage recycling will be implemented on site where possible.
Mixed recyclable waste	
Glass	
Plastics	Disposal of some elements may be required.
Waste electrical and electronic	
Waste oils, lubricants and flocculants	Waste receptacles will be provided on site

7.1.2 Waste Storage

Pat Booth shall be responsible for managing waste streams for the duration of the site operations.

Minimal waste generation is expected at the site. Regardless, a Waste Management Plan will be implemented to confirm the appropriate waste procedures are implemented on site.

Waste will be stored in in appropriate receptacle in a designated area of the site. The waste storage area will not be situated in the vicinity of the any surface water features.

7.1.3 Management of the Segregation and Storage of Wastes

Waste collected on site will be subject to the following requirements:

- Appropriate waste containers will be used to ensure that different waste types are appropriately segregated and stored at all times;
- All waste containers will be kept clean;
- All waste will be appropriately sealed or covered in order to prevent nuisance and potential emissions to air, ground and water and to prevent cross contamination of waste streams;
- Where applicable, waste will be held in containers to prevent leakage, spillage or escape of the contents under normal conditions of handling, storage and transport;
- All waste will be clearly labelled and the label will be accurate and sufficient so as to enable proper and safe handling, storage and transportation;
- General non-hazardous waste generated on-site can be stored in movable, labelled skips; and
- All transfers of waste off-site will be recorded by Pat Booth and relevant waste documentation maintained on-site.

7.1.4 Movement of Waste

All waste will be documented and weighed prior to leaving the site. All waste receptacles will be covered or enclosed when leaving the site.

All movement of waste and the use of waste contractors will be undertaken in accordance with waste legislation including the:

- Waste Management Acts 1996-2011;
- Waste Management (Collection Permit) Regulations 2007 as amended; and
- Waste Management (Facility Permit and Registration) Regulations 2007 as amended.

A copy of Waste Collection Permits, Certificates of Registrations, Waste Facility Permits and Waste Licences will be maintained on site.

If waste is being shipped abroad, a copy of the Transfrontier Shipping (TFS) notification document will be obtained from Dublin City Council (as the relevant authority for all authorities).

A receipt from the final destination of waste material will be kept as part of the on-site waste records.

8. Traffic Management

8.1 Site Entrance

Access into the proposed Project will be via traffic travelling the R427 onto the L7939. All access and egress to the site will be made via the L7939 and R427.

No traffic will enter or exit the site from the east (R428) over Ballykilcavan Bridge.

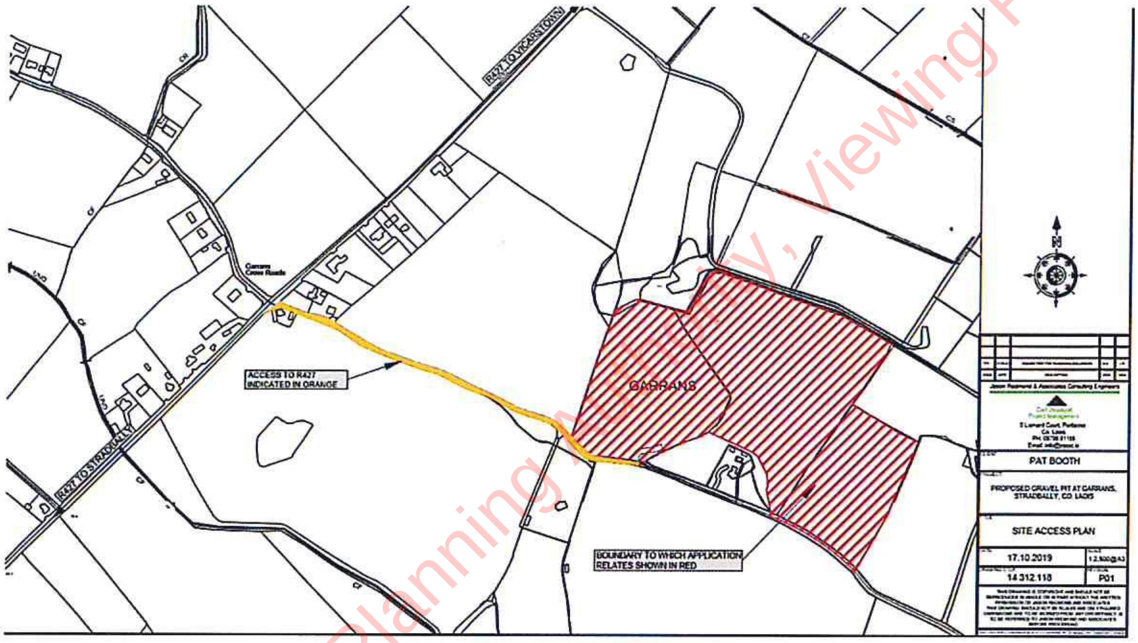


Figure 8.1: Access Route to/from the Proposed Project (Ref: extracted from planning drawings)

8.1.1 L7939 Lay-Bys

A number of locations for lay-bys were agreed for the local road L7939 and are detailed in Figure 8.2.

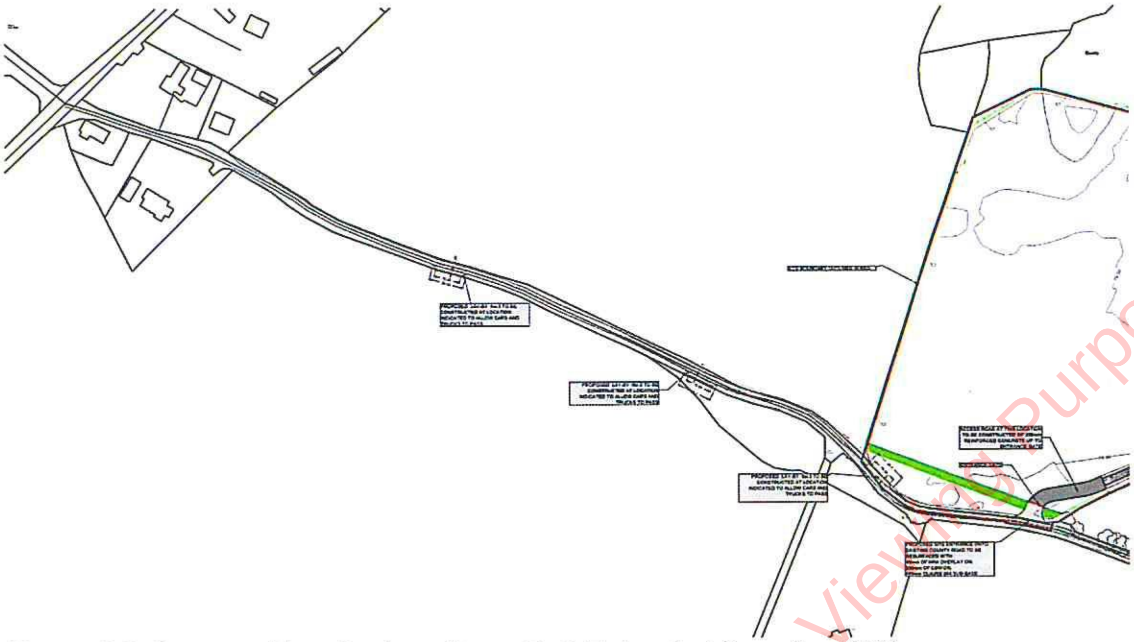


Figure 8.2: Proposed Lay-by Locations (Ref: Extracted from the TTA)

9. Site Inspection Procedure and Checklist

In addition to any environmental monitoring (i.e. dust emissions), a minimum of weekly environmental management inspections will be undertaken by Pat Booth.

These inspections will confirm that the site activities are being undertaken in accordance with the requirements of the:

- EIAR and any subsequent planning permissions;
- EMP; and
- Legislative requirements and environmental best practise.

These inspections will also provide the opportunity to highlight any areas where environmental management practices can be improved.

The checks will incorporate the following elements:

- Visual checking of mechanical plant for leaks and mechanical issues in order to minimise leakage and breakdowns on site. The purpose is to identify any need for pre-emptive maintenance, so as to avoid any accidental spillage of hydrocarbons.
- Visual checks for leakage or structural instability will be carried out and recorded at the top-up balancing, sludge settlement and storm water attenuation/settlement ponds as well as at conveyance structures. The purpose is to identify any need for pre-emptive maintenance, to avoid accidental spills of water containing suspended sediments and any associated pollutants.
- Visual checks of the hydrocarbon interceptors. The purpose is to identify any need for pre-emptive maintenance, to avoid accidental spills of water containing hydrocarbons..
- Visual checks of the closed tank integrated primary water treatment plant as well as conveyance structures.

- Visual checks of the drains and the discharge area will be carried out and recorded. The purpose is to identify the commencement of any erosion or scouring, in order to initiate mitigation measures.

A copy of the proposed checklist is provided in Appendix 2.

Any complaints, incidents or corrective actions identified during the weekly inspections will be recorded in the Complaints and Corrective Actions Records (Appendix 4).

10. Environmental Incidents and Complaints

10.1 Management of Complaints

When the site is operational, the local public will be able to make enquiries and complaints to the Site Office.

Pat Booth will record the complaint and determine if any of the issues raised are attributable to the site activities and where required, corrective actions will be implemented.

All complaints will be recorded in the Complaints and Corrective Actions Records (Appendix 4).

10.2 Environmental Incidents

In the event of an environmental incident, the Pat Booth will be notified immediately.

Where there is any indication that environmental pollution (such as release to the environment) has, or may have taken place, then Pat Booth will liaise with the appropriate Authority.

The incident and any corrective actions shall be recorded in the Complaints and Corrective Actions Records (Appendix 4).

11. Emergency Response Procedure

The purpose of the emergency response procedure (ERP) is to address an emergency situation which may originate on-site. The main scenario's which were considered to potentially occur on site were associated with:

- A spill or leakage;
- A fire; and
- Site emissions in exceedance of limit values

11.1 Emergency Spill/Leakage Protocol

The procedure for dealing with spillages and/or leakages on site is as follows:

- Pat Booth shall be notified of a spill/leakage immediately by site staff;
- Where there is any indication that environmental pollution (releases to the environment) has, or may have, taken place, then Pat Booth will liaise with the appropriate Authority as deemed required;
- If possible, the type & nature of the spilled material and the volume shall be confirmed. Any risks to human health and/or the environment shall be determined;

- Stop the source and contain the spillage;
- Limit the spillage effected area by blocking, diverting or confining the spillage;
- Smaller leaks/spillages shall be contained using a spill kit, where absorbent product will be applied to the spill and removed as soon as it has absorbed all the material. All contaminated spill kit material shall be put into a suitable waste container and labelled as to the contents, prior to collection by a licenced waste contractor;
- If a bigger spillage occurs, access to any surface water features (i.e. drain on the northern boundary) shall be blocked off to stop potential discharges. Then, staff shall clear up the spillage and dispose of the spill material to an authorised waste facility;
- If a spillage results in discharges to a surface water feature or an adverse impact on the environment occurs, the Pat Booth shall report to the appropriate authority (Laois County Council and Inland Fisheries Ireland) and agree a course of action;
- A record of the spill/leakage incident shall be retained on-site.

11.2 Fire

In the event of a fire, persons near the outbreak of the fire shall alert Pat Booth. In an emergency situation, the appropriate services will be notified.

The following information will be provided:

1. The name of the company

2. Address

Garrans, Stradbally, Co. Laois

3. Details of the Fire

Emergency contact details are:

Local Garda Station: Stradbally: +353 57 8625222

Local Fire Station: Portlaoise : +353 57 8664000

Dialling 999/112 will connect the caller with any of the emergency services.

If a fire on-site has an adverse impact on the environment, Laois County Council and Inland Fisheries Ireland (as relevant) will be notified and they shall agree a course of action.

11.3 Site emissions in exceedance of limit values

If it is ascertained that the site is not operating to the emission limit values, the following will be implemented:

Parameter	Procedure
Dust	Where measured concentrations in deposited dust are found to exceed emission limit values, the cause/source of the excessive dust will be investigated, and any additional feasible and reasonable measures available will be implemented to reduce impact and reduce any impact to the environment and/or the local community. This may include additional dampening down of stockpiles, site activities etc.

Parameter	Procedure
Surface water	The measured concentrations in the man made drain and tributary to the Stradbally River will be reviewed. Elevated concentrations or significant changes from the previous sampling period will be investigated to confirm that it is not related to site activities. Laois County Council and Inland Fisheries Ireland will be notified as required. In the event that impacts to the drain are related to site activities, actions as may be deemed necessary will be undertaken to bring parameters within limits, in consultation with the authorities.
Groundwater	Where measured concentrations are found to exceed emission limit values or there are significant changes in groundwater quality, the cause/source of the change will be investigated and any feasible and reasonable measures available will be implemented to bring the parameters/levels within limits. Laois County Council will be notified.

Any levels in exceedance of the emission limits will be recorded in the Complaints and Corrective Actions Records (Appendix 4). In addition they will be identified and recorded in the Weekly Environmental Inspection Checklist in Appendix 2.

Appendices

Mitigation Reference No.	Mitigation Principle	Description
		• Temporary bunding and diversion to the sludge-settlement ponds, which have sufficient excess capacity to store, settle and recycle the average daily process water and/or to the storm water attenuation/settlement pond, if sufficient storage exists at the time of the accident. • Reduction in outflow or stopping flow at the discharge point from the storm water attenuation/settlement ponds, in order to increase retention time, if required. • Location of the sludge management system and primary water treatment system a minimum distance of 20 m from the site man-made drain. In the case of accidental discharge from the pond, this buffer zone, which is fully vegetated, will retain sediment.
M10	Avoidance	Minimisation of exposed ground by stripping of soils only at the commencement of a quarrying phase and immediate re-seeding of the worked out phase, in order to minimise entrainment of sediment and associated pollutants in surface water run-off. Stripped soil stockpiles/berms, will be re-seeded with appropriate grassland species. Retention of a vegetated (non-stripped) buffer zone to a distance of 60 m from the man-made drain which occurs on site, in order to avoid entrainment of sediment in any surface water run-off draining directly to the drain.
M11	Avoidance	e emplacement of a flexible, reactive, surface water interceptor drainage system which will be modified to be effective for each phase of the development. It comprises separated 'clean' water and 'dirty water elements as follows: • 'Clean water' interceptor drainage, which collects clean surface water runoff from areas of the site which have not been stripped of vegetation and from re-instated areas of the site, which are fully re-vegetated. This minimises the volume of water in which pollutants could be entrained; If necessary, geotextile lining or french drains will be implemented to prevent erosion and improve conveyance. • Dirty water' interceptor drainage which collects surface water run-off from areas of the site where pollutant entrainment may occur. This includes working areas of the quarry and recently re-instated areas, where vegetation is not yet established, but excludes the bunded re-fuelling area. If necessary, geotextile lining or french drains will be implemented to prevent erosion and improve conveyance. • Conveyance of all collected drainage to the storm water attenuation/sediment settlement pond.
M12	Prevention	Combined storm water attenuation/sediment settlement pond. This comprises: • Impermeable pond(s) with sufficient storage (1,054 m^3) to attenuate the site run-off resulting critical 1 in 20 year storm rainfall event; • Retention time c. 30% in excess of that required to settle fine silt size particles and designed to maximise settlement efficiency; • Discharge of treated water to the environment actively controlled, via a flow control and a discharge meter, to the greenfield run-off rate. The discharge will occur onto an area of natural vegetation, at approximately 19 m distance upgradient of the man-made drain, in the form of a level spreader. The greenfield discharge rate is very low and unlikely to cause erosion. Erosion control measures such as rip-rap will be emplaced if commencement of erosion is observed.
M13	Reduction	Controls which will treat water polluted by suspended sediment and associated pollutants in the case of accidental spillage/overflow from the storm water attenuation pond/settlement pond: • Temporary bunding and diversion to the sludge-settlement ponds, which have excess capacity sufficient to contain a 1 in 10 year storm water run-off event. • Location of the storm water attenuation pond a minimum distance of 20 m the site man-made drain. In the case of accidental discharge from the pond, this buffer zone, which is fully vegetated, will retain sediment.
M14	Avoidance	Electric processing and integrated primary water treatment plant and use of a gravity stockpile drainage system, significantly reducing fuel usage on site. No storage of fuels on site. Extraction plant (comprising an excavator and a wheeled loader) fuelled by a mobile fuel bowser brought to site. Fuelling occurs within a designated, impermeable bunded fuelling area, provisioned with a hydrocarbon interceptor. Drainage from the re-fuelling area is isolated from the surface water system and is conveyed directly to the storm water attenuation/sediment settlement pond. Handling of fuels and oils brought to site will be in accordance with UK Guidance for Pollution Prevention (2019) and Pollution Prevention Guidance (pre 2019).

Mitigation Reference No.	Mitigation Principle	Description
		Where plant allows, environmentally considerate lubricants, such as synthetic non-toxic biodegradable hydraulic fluids, will be used. Scheduled visual checking for leaks and mechanical issues will occur, in order to minimise leakage and breakdowns on site. General servicing of site machinery takes place off-site. Storage of primary water treatment system polymer flocculant in a locked, fully watertight shed, from which no outflow of stored volume can occur.
M15	Reduction	Controls which will treat water polluted by fuels, lubricants or flocculant in the case of accidental spillage or escape are: • Spill kits, which will be stored on site. Staff will be fully trained in the correct and appropriate use, monitoring and removal of spill kits; • Shutting off of the flow control valves on the discharge point from the storm water attenuation/settlement ponds which receive site surface water drainage. Immediate subsequent removal of contents for off-site disposal with an appropriately licensed waste disposal company
M16	Avoidance	Minimisation of groundwater abstraction by combined usage of surface and groundwater resources. At the average material processing rate, groundwater abstraction comprises an average 37% of total water supply requirement, ranging from a minimum of 0% to a maximum of 68% across a year. At the occasional maximum material processing rate, groundwater abstraction ranges from an occasional 38% to 83% of total water supply requirement.
M17	Avoidance	Placement of the abstraction well at the north west corner of the site. This ensure that the zone contributing groundwater to the abstraction is contained within the site boundary (with the exception of c. 6 m across the northern boundary) and does not intersect the area contributing either of the two domestic house supplies (assumed to abstract a conservative 1 m^3/day) to the south of the site.
M18	Avoidance	Zones of Contribution (zones contributing groundwater to the abstraction) delineated for the average and occasional maximum material extraction groundwater requirements are extremely conservative. • A conservative ZOC (ZOC 1) has been delineated for the maximum (July) required groundwater abstraction rate of 17 m^3/day, for the average material processing rate. By convention, ZOCs are delineated for a continuous 'steady state' average abstraction rate over a year, which assumes maintenance of the same pumping rate throughout a year. Withdrawal of groundwater from the full extent of the ZOC will only occur if that abstraction rate is continuous throughout the year. According to best practise, a ZOC is delineated for 150% of annual average usage (i.e. 13.5 m^3/day) to provide a factor of safety. Defining the ZOC for the maximum July rate of 17 m^3/day, rather than 150% of the average annualised daily abstraction rate, therefore significantly .overestimates the extent of the area which will contribute groundwater to the borehole, by an additional factor of safety of approximately 25%. • An additional ZOC (ZOC 2) has been delineated for the intermittent maximum (July) required groundwater abstraction rate of 35 m3/day, for the occasional maximum material processing rate. This is a notional ZOC, which would only occur, if water were to be extracted at this maximum rate, throughout the year. This will not occur, since this is an intermittent processing rate. A factor of safety of the order of >50% is likely to be associated with this ZOC area. This is delineated only for the purposes of a very conservative assessment of risk to sensitive ecological receptors
M19	Avoidance	• Extraction will be to a depth of at least 1 m above the estimated highest winter groundwater level across the extraction area, to which is added a climate change uncertainty allowance of 10% of annual groundwater level variability across the site. Groundwater levels at the site decrease by 1.5 to 2 m depth seasonally. Pollutants would therefore be attenuated by a minimum depth of 1 m, increasing seasonally to approximately 3 m depth of unsaturated subsoil material, before reaching the groundwater table and associated flowpaths. There is therefore no potential for direct discharge of pollutants to the groundwater.

Introduction & Scope

This environmental inspection procedure outlines the requirements for the conduct of regular visual inspections at the Pat Booth site, Garrans, Stradbally, Co. Laois.

Regular visual inspections are performed to ensure a clean working environment is maintained and emissions from the facility are controlled.

The inspections also aim to identify potential environmental hazards in the work area and to minimise associated risks.

Responsibilities

Pat Booth

- Undertake regular visual inspections of the Site;
- Undertake and record the Weekly Check inspections (per checklist attached); and
- Implement and adhere to any required corrective actions/ control measures.

Inspection Procedure

1. Review the Weekly Checklist Form;
2. Conduct the inspection by walking around the work environment;
3. Identify any hazards and areas of non compliance against the checklist;
4. Record all findings, ensuring the Form is signed and dated and includes details of the personnel conducting the environmental inspection;
5. Any corrective actions are recorded in the Complaints and Corrective Action Record;

Appendix A

Environmental Inspection Checklist

PAT BOOTH
ENVIRONMENTAL INSPECTION CHECKLIST

Date: ______________

Person: ______________

Weather condition (precipitation, sun, wind- speed and direction)

Environmental Inspection Checklist	Comments	Corrective Actions Needed (Y/N)
	GENERAL	
Site clean and tidy – no litter, good housekeeping?		
Are there any leaks or mechanical issues with plant and equipment on-site?		
Do any corrective action records remain open?		
Site complying with emissions limit values?		
	DUST EMISSIONS	
Are site activities sprayed to minimise dust generation?		
Are dusty sections of the site sprayed with water?		
Are speed control measures being complied with		
	WATER ENVIRONMENT	
Are emission values at the monitoring points being met?		
Are there any leakage or instability issues associated with the ponds and the conveyance system on-site?		

PAT BOOTH
ENVIRONMENTAL INSPECTION CHECKLIST

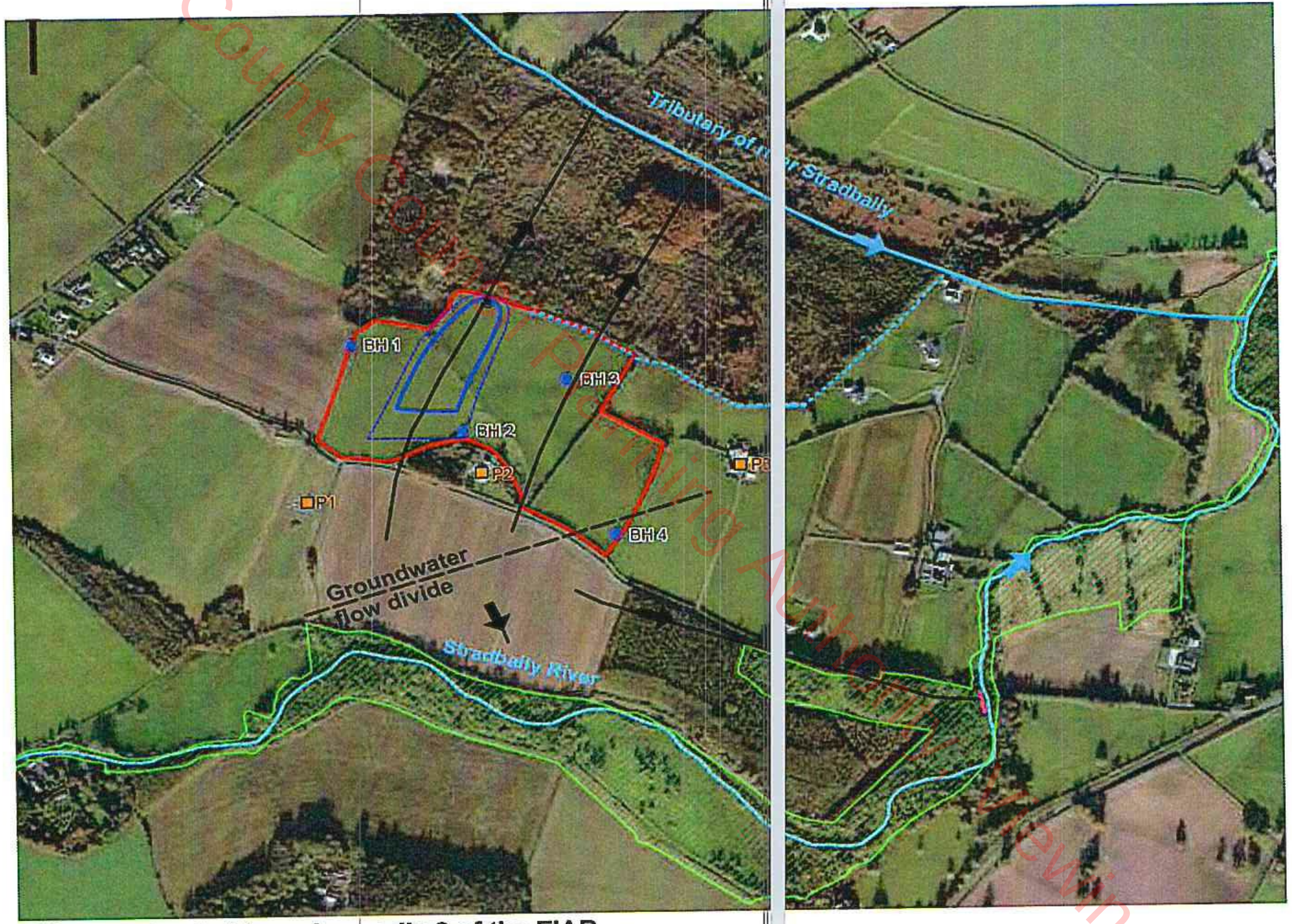
Environmental Inspection Checklist	Comments	Corrective Actions Needed (Y/N)
Is the discharge from storm water pond (Pond 4) and the discharge area before the drain, operating correctly?		
Is the water treatment system on the washing and screening plant being used and properly maintained?		
Are the drainage conveyance systems on-site operating correctly?		
Are vehicles cleaned before leaving the site?		
Are wheel washing facilities properly maintained		
Is sand and silt in the wheel washing bay regularly removed?		
Is the site entrance and surrounding public road kept clean and free of mud?		
Are the site interceptors operating correctly?		
Are the site interceptors serviced regularly?		
Is wastewater regularly removed off-site		
Is water recycled where possible for dust suppression/ wheelwash etc?		
Are there any issues with the man made drain on the northern boundary?		
NOISE		
Is the site operating within the agreed working hours?		
Is idle equipment turned off?		
Any noise mitigation measures adopted?		
WASTE MANAGEMENT		

PAT BOOTH
ENVIRONMENTAL INSPECTION CHECKLIST

Environmental Inspection Checklist	Comments	Corrective Actions Needed (Y/N)
Are wastes regularly removed off-site for recycling/ appropriate disposal?		
Are all wastes collected and disposed of by licensed contractors		
Are waste containers appropriately & clearly labelled?		

Appendix 3: Monitoring Locations Map

Dust Monitoring Locations (D1-D4)



Map – extracted from Appendix 8 of the EIAR

Groundwater Monitoring: in either BH1-BH4 (one of these will b retained during site operations)

Surfacewater Monitoring: in the tributary of the Stradbally River & drain on the northern boundary (blue dashed line)

Appendix 4: Complaints and Corrective Action Record

Complaints and Corrective Action Record

Complaints & Corrective Action Record
Reference Number : *001, 002 etc*
Date Recorded:
Identified by/how: *(complaint, site check, staff member)*
Description of the Issue
Cause of the Issue
Corrective Action to Prevent Reoccurrence: *(where possible, attach relevant evidence of closure such as photos)*
Date Corrective Action Implemented:
Signed: *(Plant Manager, staff member dealing with it)*
Signed by Site Manager:

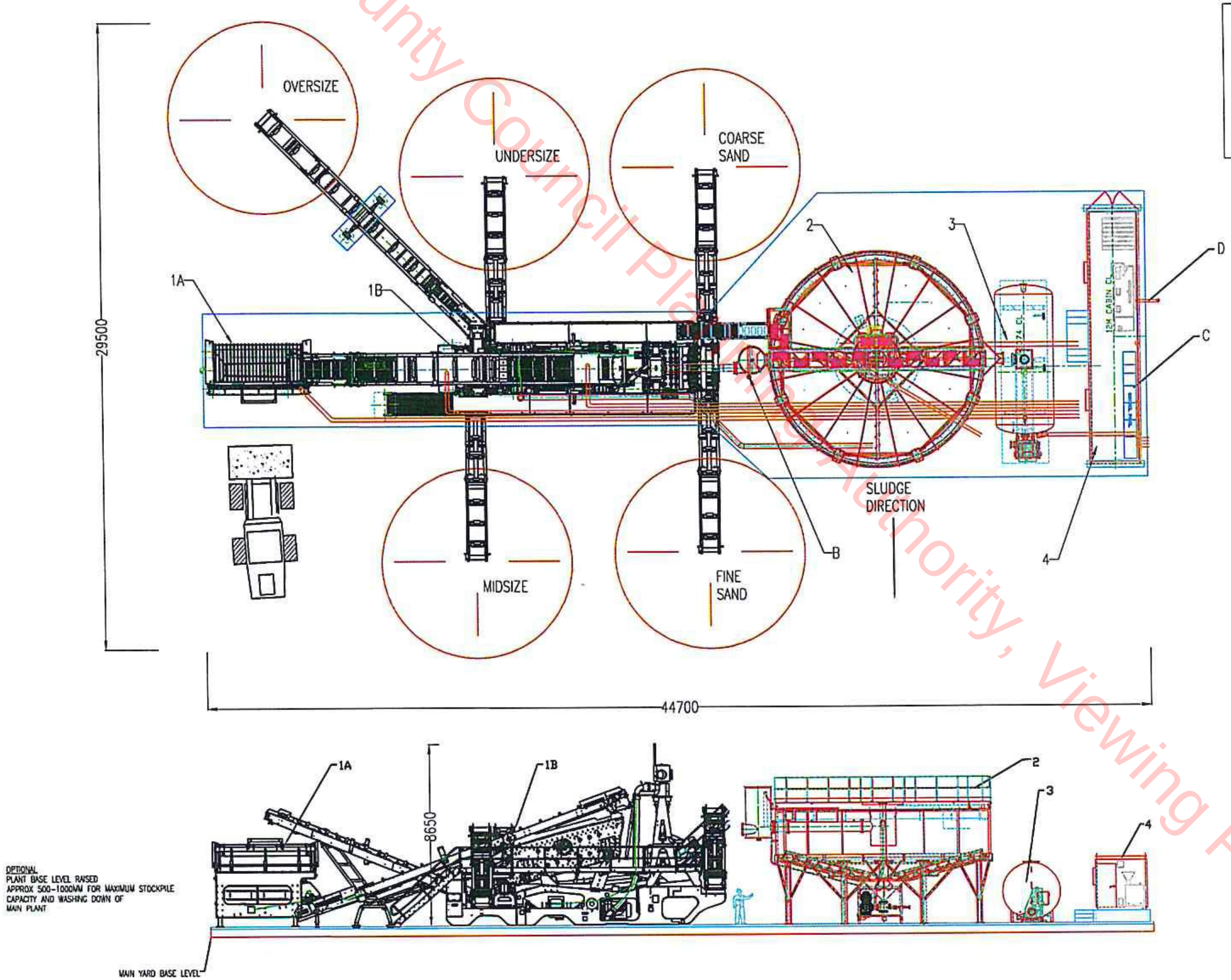
Appendix 2.3: Wash and Screening Plant Brochures

Item	Qty	Name, Designation, Material, etc.	Reference
1A	1	M14 HOPPER	CDE SUPPLY
1B	1	M2500 E5X	CDE SUPPLY
2	1	A600 AQUACYCLE	CDE SUPPLY
3	1	AS374 AQUASTORE	CDE SUPPLY
4	1	12M CONTROL CABIN C/W FLOCSTATION	CDE SUPPLY

THIRD ANGLE PROJECTION.

Rev No.	Revision Note	Date	Signature

NOTES:
CUSTOMER TO SUPPLY AND FIT THE FOLLOWING:
- A. ADEQUATE BASE FOR PLANT – CDE TO SUPPLY CIVIL DRAWINGS UPON LAYOUT APPROVAL
- B. WATER TOP UP TO PLANT
- C. POWER SUPPLY TO CDE CONTROL PANEL
- D. POTABLE WATER SUPPLY
- E. UNDERGROUND WATER & CABLE DUCTS



A NEW WORLD OF RESOURCE

Cookstown, Co. Tyrone
Northern Ireland

T:+44 288 676 7900
info@cdeglobal.com
www.cdeglobal.com

PROJECT PROPOSED CDE WASH PLANT LAYOUT	CLIENT: ONYX
DRN BY:R.HARKIN | Date: 17-Oct-19	SCALE: N/A | SHEET 1 OF 1
APP BY: | Date:	DRAWING No: PRESALES-LAYOUT-58

Appendix 5.1: Traffic and Transportation Assessment

Jason Redmond & Associates Consulting Engineers

Civil Structural Project Management

5 Lismard Court, Portlaoise, Co Laois

Ph: 057 8681155 E-mail: info@jrassc.ie www.jrassc.ie

PROJECT: Garrans Pit, Stradbally, Co Laois

PROJECT NO: 14.312

DOCUMENT TITLE: Traffic and Transportation Assessment

DOCUMENT NO: 14.312-TTA-01

Issue	Date	Description	Orig.	PE	PD	Issue Check
PL01	13.5.2020	Issued for Planning	TS	BS	JR	

Contents

Appendices

EXECUTIVE SUMMARY

Jason Redmond Associates (JRA) were appointed by Mr Pat Booth, Killone, Stradbally Co Laois to provide Civil Engineering Consultancy Services in respect of a planning application for a proposed sand and gravel pit at Garrans, Stradbally, Co Laois. Part of the brief was to advise on the Road Capacity, Road Safety, Layout and Design issues associated with a proposal to utilise existing road access.

The brief requires for JRA to produce a Traffic and Transport Assessment for the proposed development in respect of the Traffic Modelling, PICADY Analysis, Trip Generation Assignment and Distribution.

The quarry is located along the L7939 local road, approximately 0.5km from the junction between the R427 and the L7939. This access junction between the R427 and the L7939 currently is in use as a simple priority junction from the R427 local road with the L7939 local road.

This TTA report addresses the capacity issues associated with the existing junction between the R427, L7939 and the L7938 junction for vehicular traffic, both for the year of opening (2021) and for an assessment year of 6 years after the date of opening (2027). The analysis and assessment contained within this report confirms that there are no capacity concerns that would warrant refusal of the proposed scheme by Laois County Council (LCC)

The proposed normal working hours of the subject development will be 8.00am – 6.00pm Mon-Fri and 8.00am – 2.00pm Saturday. However, on occasion there may be a requirement to work beyond those times and standard quarry opening hours as per standard quarry registration would be 07:00 and 20:00 on Monday to Friday, and on Saturdays between 07:00 and 18:00.
However, in order to allow for a robust analysis of the traffic associated with the proposed extension, it is proposed that the facility will be assessed as operating on a 5-day week only. This provides for a larger number for the daily trips to the facility, and accordingly a higher trip number during the peak hours. This will therefore provide a more onerous and robust analysis on the traffic flow at the junction under analysis.

If there are no significant capacity or safety concerns associated with the increased traffic flows to the existing access, as is clearly demonstrated through the studies undertaken, then we submit that the proposed works should be granted approval.

We believe that there are no capacity or safety issues that would warrant refusal of permission by LCC.

1. INTRODUCTION

1.1 This Transportation Assessment (TA) has been prepared by Jason Redmond and Associates Consulting Engineers, and addresses traffic and access considerations of a proposed sand and gravel facility at Garrans, Stradbally, Co Laois, and specifically analyses the existing major-minor priority junction which currently allows for vehicular access to the proposed sand and gravel pit. A layout plan showing the existing junction location is included in ***Appendix A***.

1.2 The proposed location of the existing sand and gravel site is as shown marked with an asterix * in Figure 1.2 below.

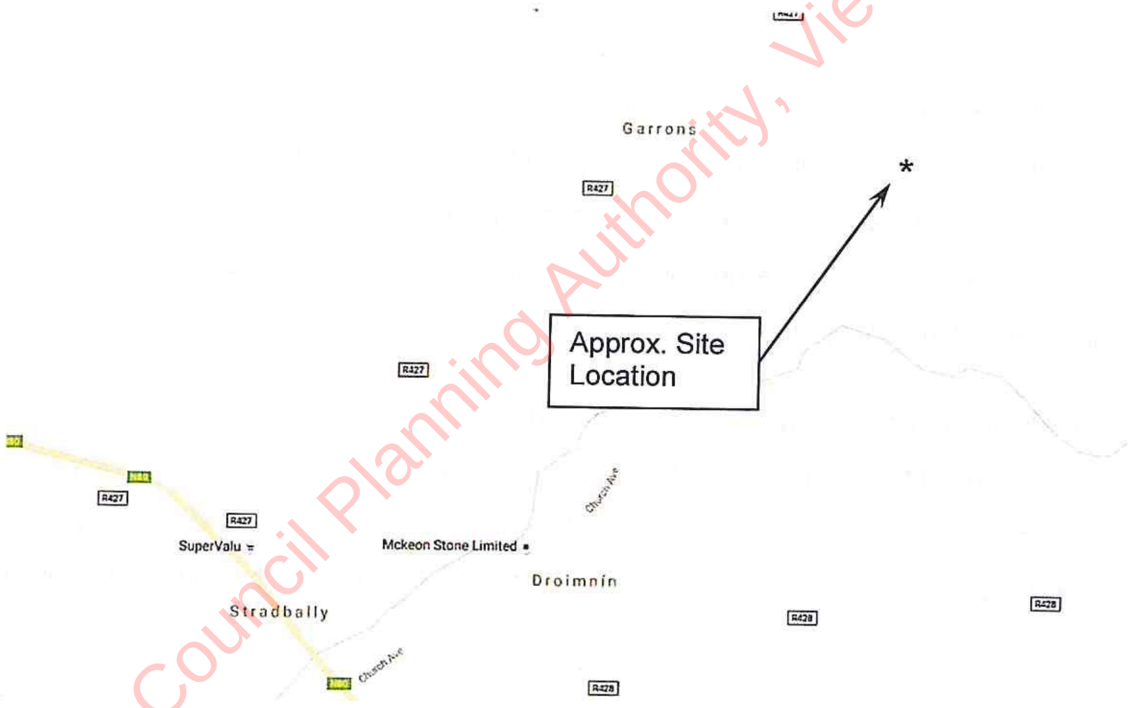


Figure 1.2 - Site Location.

1.3 In describing the Receiving Environment and the Proposed Future Environment, this report addresses the following aspects of the proposed development:

- Development Proposals.
- Modern Roads-Design Considerations.
- Multi Modal Accessibility to the Development.
- Traffic capacity/impact.

1.4 Recommendations contained within this Transportation Assessment are based on site visits, observations of operational performance of the existing road network, our experience in assessing and designing developments of this nature.

1.5 The Report has been prepared in accordance with the requirements of The Institution of Highways and Transportation "Guidelines for Traffic Impact Assessment" and the NRA's Traffic & Transport Assessment Guidelines. These are the professional Guidelines used to assess the impact of developments on public roads.

1.6 A pre-planning discussion took place with Mr Eoghan Lynch of Laois County Council (LCC) on 24th May 2018 at the early stages of the project in order to address issues of concern and in order to establish the parameters and scope for inclusion in this study. The report reflects the discussions. During this discussion, it was confirmed by LCC that the TTA should carry out an analysis on the existing junction between the R427, L7939 and L7938 local roads, to assess the impact of the proposed sand and gravel facility on the working of this existing junction. The quarry is located on the L7939 and vehicles accessing the quarry travel to it along the R427.

1.7 To update Laois County Council Requirements JRA followed up with the Roads Department and a meeting was held with the Area Engineer on site on 14th January 2020. The junction arrangements lay by locations, hardstanding details etc were discussed and a drawing prepared and submitted to the Road Department on 15th January 2020 showing the agreed locations and details.

2. RECEIVING ENVIRONMENT

2.1 The proposed access junction is located between the L7939 and the R427 at Garrans, Stradbally, Co Laois. The R427 currently operates as a 2-lane road, with 1 lane in either direction. The road is classified as a Regional Road and has an urban speed restriction of 80kph in this location.

2.2 The L7939 consists of a carriageway of overall width of typically 3.3m, which essentially allows for one-way traffic flow along the majority of the road. However, there are several areas where the road width increases locally, and these areas are currently used by existing traffic as lay-by areas to allow for one car to pull in allowing an opposing vehicle to pass safely. The low levels of existing traffic flow as noted on the local road allow this system to work quite efficiently. This road provides local access from the junction with the nearby R427. Despite the width of the road, traffic flows were noted to be of a sufficiently low figure to allow for free-flowing traffic.

2.3 There are no footpaths present on either side of the R427 road, which simply has grass verges on both side of the road. A similar situation exists along the L7939. No cyclists nor pedestrians were noted along either road during the survey.

2.4 A new traffic survey, during a 'normal' traffic period was carried out to the R427 in the vicinity of the junction with the L7939 on the 12th December 2019. This survey revealed a 2-way flow of 141 pcu's along the R427 road in the vicinity of the junction with the L7938 during the weekday AM peak commuter period (0800 to 0930), and a 2-way flow of 195 pcu's during the PM peak commuter period (1600 to 1800).

2.5 The survey also revealed a 2-way flow of 15 pcu's along the L7939 road in the vicinity of the junction with the R427 during the weekday AM peak commuter period (0800 to 0930), and a 2-way flow of 12 pcu's during the PM peak commuter period (1600 to 1800).

3.0 PROPOSED ACCESS

3.1 The proposal involves the construction of a sand and gravel pit at Garrans, Stradbally, Co Laois.

3.2 Vehicular access into the site will be made by traffic travelling via the R427 local road and then along the L7939 local road. All access/egress to the site will be made by vehicles approaching from and exiting along the R427. No traffic will enter or exit the site from the east along the L7939 as the road access is not suitable in a westerly direction. A drawing showing the vehicular access arrangement is included as ***Appendix A***.

3.3 This report concerns itself with the safe and efficient operation of the junction between the R427 and the L7939. It will be examined to ensure that the additional traffic using this junction will not result in its capacity being exceeded.

4. TRIP GENERATION, ASSIGNMENT AND DISTRIBUTION

4.1 The proposed normal working hours of the subject development will be 8.00am – 6.00pm Mon-Fri and 8.00am – 2.00 pm Saturday. However, on occasion there may be a requirement to work beyond those times and standard quarry opening hours as per standard quarry registration would be 07:00 and 20:00 on Monday to Friday, and on Saturdays between 07:00 and 18:00.

4.2 However, in order to allow for a more robust analysis of the traffic associated with the proposed extension, it is proposed that the facility will be assessed as operating on a 5-day week only. Therefore, this will provide for a larger number for the proposed daily trips to the facility, and accordingly a higher trip number during the peak hours. This will provide a more onerous and robust analysis on the traffic flow at the junction under analysis. It is proposed that the facility will operate for 50 weeks in each year.

4.3 The facility is a sand and gravel resource, and it is estimated that a volume of approximately 511,168m^3 or 1,226,803 tonnes is available for abstraction at the site. It is anticipated that the gravel pit will operate for a duration of up to 20 years.

4.4 From the above abstraction volumes, a daily average production rate of approximately 200 tonnes has been estimated for the facility. However during peak times the daily rate may increase to 350 Tonnes per day or 1,750 over a 5 day week. Materials will be exported in loads of 24 tonnes on average, and this yields 73 loads per week. Based on a 5-day week, it is estimated that there will be 15 loads per day made from the facility during peak times. As each load will involve an arrival and a departure of a truck from the site, it is therefore deemed that there will 15 haulage trips per day associated with the proposed facility. Allowing 1 HGV to equate to 2 pcu's results in an equivalent of 30pcu trips being generated by the haulage traffic. These trips would be spread out evenly over the work day to avoid congestion at the quarry. All haulage traffic will follow the route as set out on drawing 14.312-113, with all traffic accessing the site travelling along the R427 travelling from Stradbally in the south west and from Vicarstown in the North East to access the L7939, and all traffic exiting the site along the R427 towards Stradbally in the south west or Vicarstown in the North East after exiting the L7939.

4.5 It has been estimated that the facility will require 2-3 full-time staff to operate the facility at the demand levels as estimated. Staff movements will generate trips in the morning and evening peaks, and possible inter-peak times, i.e. lunchtime trips. For this assessment, 2 inbound peak hour trips in the morning peak and 2 outbound trips in the evening peak have been assumed. In a similar manner to the haulage traffic, all staff vehicle movements will follow the route as set out on drawing 14.312-113.

4.6 A total of 6nr additional trips have been assumed to occur daily for potential miscellaneous trips that may be associated with the proposed works. These miscellaneous trips will allow for site inspections and for plant/machinery and also for any meetings which may occur. It is not considered that these trips would coincide with either the morning or evening peak.

4.7 Table 4.1 below contains a summary of the total daily trips generated with the sand and gravel pit for the future assessment years.

	Arrivals	**Departures**	**Total**
Haulage Vehicles, pcu	30	30	60
Staff, pcu	2	2	4
Miscellaneous, pcu	6	6	12
Total, pcu	38	38	76

Table 4.1: Summary of Total Maximum Daily Trips (in pcu's)

4.8 Table 4.1 provides information on the total daily trips associated with the proposed development. In order to obtain the AM and PM peak hour flows from the total daily flow, it will be assumed that in this case that the peak AM and PM flow associated with the proposed quarry will amount to 12% of the daily flow, which provides for a robust assessment for the peak traffic flows. It will be assumed with the staff trips that there will be 2 inbound peak hour trips in the morning peak and 2 outbound trips in the evening peak have been assumed. The miscellaneous trips are assumed to be made out of peak hours.

This then yields the following peak flows as set out in Table 4.2.

	AM Peak		PM Peak	
	Arrivals	**Departures**	**Arrivals**	**Departures**
Haulage Vehicles	4 (30x12%)	4 (30x12%)	4 (30x12%)	4 (30x12%)
Staff	2	0	0	2
Miscellaneous	0	0	0	0
Total	6	4	4	6

Table 4.2 – Hourly Peaks Associated with Proposed Quarry (in pcu's)

4.9 For the additional traffic estimated to be arriving to the proposed development, it is assumed that there will be a 70:30 modal split between traffic travelling north east from Stradbally , and South West from Vicarstown. All the traffic will be accessing the site will arrive via the R427 road junction. These modals splits will be assumed to occur for traffic arriving during both the AM and PM peak hours.

4.10 For the additional traffic estimated to be departing from the proposed development, it is also assumed that there will be a 70:30 modal split between traffic travelling South West towards Stradbally, and North East towards Vicarstown. All the traffic exiting the site will exit via the R427 road junction. These modals splits will be assumed to occur for traffic arriving during both the AM and PM peak hours. Therefore, when the additional traffic generated by the completed development is distributed as set out above, it yields the following distribution to the public road network:

	Arrivals	
	AM Peak	**PM Peak**
Travelling SW From Vicarstown Along R427	2	1
Travelling NE From Stradbally Along R427	4	3

Table 4.3 – Distribution of Generated Traffic to Public Roads, Arrivals (in pcu's)

	Departures	
	AM Peak	**PM Peak**
Travelling NE Towards Vicarstown Along R427	1	2
Travelling SW Towards Stradbally Along R427	3	4

Table 4.4 – Distribution of Generated Traffic to Public Roads, Departures (in pcu's)

Details of the Traffic Generation characteristics used in this instance are summarised below as ***Table 4.5***.

Time Period	**Arrivals**	**Departures**	**Total**
Weekday AM Peak (08.00:09.00)	6	4	10
Weekday PM Peak (17.00:18.00)	4	6	10

Table 4.5 - Summary of Traffic Generation (in pcu's)

4.11 A comprehensive classified traffic survey was undertaken on the local roads on 12th December 2019 to establish the weekday AM commuter peak hour traffic flows and the afternoon school's peak hour traffic flow at the location of the proposed development access. The surveys were undertaken during normal school term time and in this regard, they are considered as acceptable for use in the study. Full details of the Traffic Survey data are included as ***Appendix B***.

4.12 For the assessment of junctions, the NRA TTA Guidance requires an assessment of development traffic impact to be conducted for the year of opening, and during the design year of 6 years after opening. Therefore, in this case, an assessment of the vehicular access junction capacity has been undertaken for the design year and assumed year of opening (both assessed as being 2021) and for the future design year (2027).

4.13 Traffic growth factors for future year assessments were calculated from data obtained in the NRA Project Appraisal Guidelines Unit 5.5, which provides the recommended method of predicting future year traffic growth on National Roads. Based on the tabulated 'medium growth' in the Laois Region in this document, a yearly growth factor of 1.015 is provide for the years 2021 to 2025, with a factor of 1.013 for the year 2027. Using this information, the value of the relevant growth factor to be applied to the 2021 traffic flows to estimate the flows for the year 2027 is included in Table 4.6 below.

Table 4.6 - Traffic Growth Rates, NRA Project Appraisal Guidelines

Year	**to Year**	**From Table 5.5.1:**
2021	2027	1.11

5. TRAFFIC IMPACT

5.1 In accordance with our methodology, we have followed the IHT *Guidelines for TIA,* and the NRAs Traffic and Transportation Assessment Guidelines (Sept 2007), in the assessment of the traffic impact resulting from the proposed development.

5.2 We have undertaken an access junction assessment during the year of opening (2021) and during the design year 6 years after opening (2027). For simple comparative purposes, the results for year of opening and design years of 2021 and 2027 are summarised below as Table 5.1.

5.3 JRA Consulting Engineers have assessed the site access junction using the NRA approved PICADY (**P**riority **I**ntersection **C**apacity **A**nd **D**ela**Y**) software package. PICADY produces results based on a ratio of flow to capacity (RFC) and queue length. An RFC greater than 1.00 indicates that a junction is operating at or above capacity, with 0.85 considered to be the optimum RFC value.

5.4 It should be noted that the PICADY software sets minimum values for the major and minor road widths within the design model at 6.5m and 3.3m respectively. In this situation, the major and minor road widths were noted 6.5m and 3.3m respectively.

5.5 Therefore, for the purposes of this analysis, the road widths for the major and minor roads have been assessed using the minimum dimensions as acceptable to the PICADY design software, i.e. the R427 has been modelled at 6.5m wide and the L7939 has been modelled at being 3.3m in width.

5.6 This will result in the design calculations being carried out on a less onerous situation than was found to exist on site, as the wider road widths as used within the design will have higher capacities than the narrower road widths as exist on the ground. Therefore, the results will need to be interpreted to take account of the reduced capacities that will actually exist on site.

5.7 We have appended the detailed JRA computer simulation model results (PICADY Outputs) of the junction modelling in ***Appendix C***. A summary of the results is reproduced below as ***Table 5.1***.

Table 5.1; - Proposed Priority Access Junction – Summary PICADY Results, Worst Case

	AM								PM							
	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
2020																
Stream B-AC	0.0	~1	0.00	0.00	A	0.12	A	900 % ▯	0.0	~1	0.00	0.00	A	0.27	A	900 % ▯
Stream C-AB	0.0	0.5	6.26	0.00	A				0.0	0.0	6.30	0.01	A			
2021																
Stream B-AC	0.0	~1	0.00	0.00	A	0.12	A	900 % ▯	0.0	~1	0.00	0.00	A	0.27	A	900 % ▯
Stream C-AB	0.0	0.5	6.26	0.00	A				0.0	0.5	6.30	0.01	A			
2027																
Stream B-AC	0.0	~1	0.00	0.00	A	0.12	A	900 % ▯	0.0	~1	0.00	0.00	A	0.31	A	900 % ▯
Stream C-AB	0.0	0.5	6.26	0.00	A				0.0	~1	6.32	0.01	A			

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Junction LOS and Junction Delay are demand-weighted averages.

Arm A is the R427 Local Road (West Side)
Arm B is the L7939
Arm C is the R427 Local Road (East Side)

5.8 The results of the modelling clearly show that the proposed junction will have more than adequate capacity to accommodate the worst case traffic associated with the proposed extension to the existing sand and gravel pit at Garrans, Stradbally, Co Laois. All of the RFCs are <u>way</u> below the theoretical capacity of 0.85, and no queuing whatsoever is anticipated. (The results are so favourable that we are confident that the development access could accommodate very significantly higher traffic volumes without any capacity related problems arising).

5.9 The design calculations carried out on PICADY's minimum road widths indicate that there will be a spare capacity of 98% for vehicles in the future design year 2026. It can therefore be assessed that even with talking the actual reduced road widths as exist on site, the junction will have adequate capacity to cater for the additional traffic flows as resulting from the proposed extension.

5.10 It would appear that the most significant design requirement will be the safe use of the access roads. It is proposed that the extremely low level of traffic associated with the proposed extension will result in no decrease in the current safe use of the existing road network. The traffic levels associated with the proposed development will result in an extra 6nr pcu's each way on the road during the peak hour, which results in an increase of 1vehicle per 10minutes, which is negligible.

5.11 A joint site visit with the Area Engineer for LCC on 14th January 2020 included a review of the junction of the L7939 and the R427. This junction was operating well with no improvements required.

5.12 The L7939 between the junction with the R427 and the subject site entrance were reviewed. A number of locations for Lay-bys were reviewed and agreed and a specification for the lay by build-up was agreed also- see attached map in Appendix A.

6.0 CONCLUSION

6.1 This Transportation Assessment assesses the traffic impact associated with the proposal to provide an extension to the existing sand and gravel pit at Garrans, Stradbally, Co Laois.

6.2 This Report has been prepared in accordance with the Institution of Highways and Transportation "*Guidelines for Traffic Impact Assessment*", and it provides an onerous and robust assessment of the capacity and design of the proposed access.

6.3 This report demonstrates that the existing access junction between the R427 and the L7939 will provide more than adequate capacity to cater for the maximum worst case traffic demands, in a safe and appropriate manner.

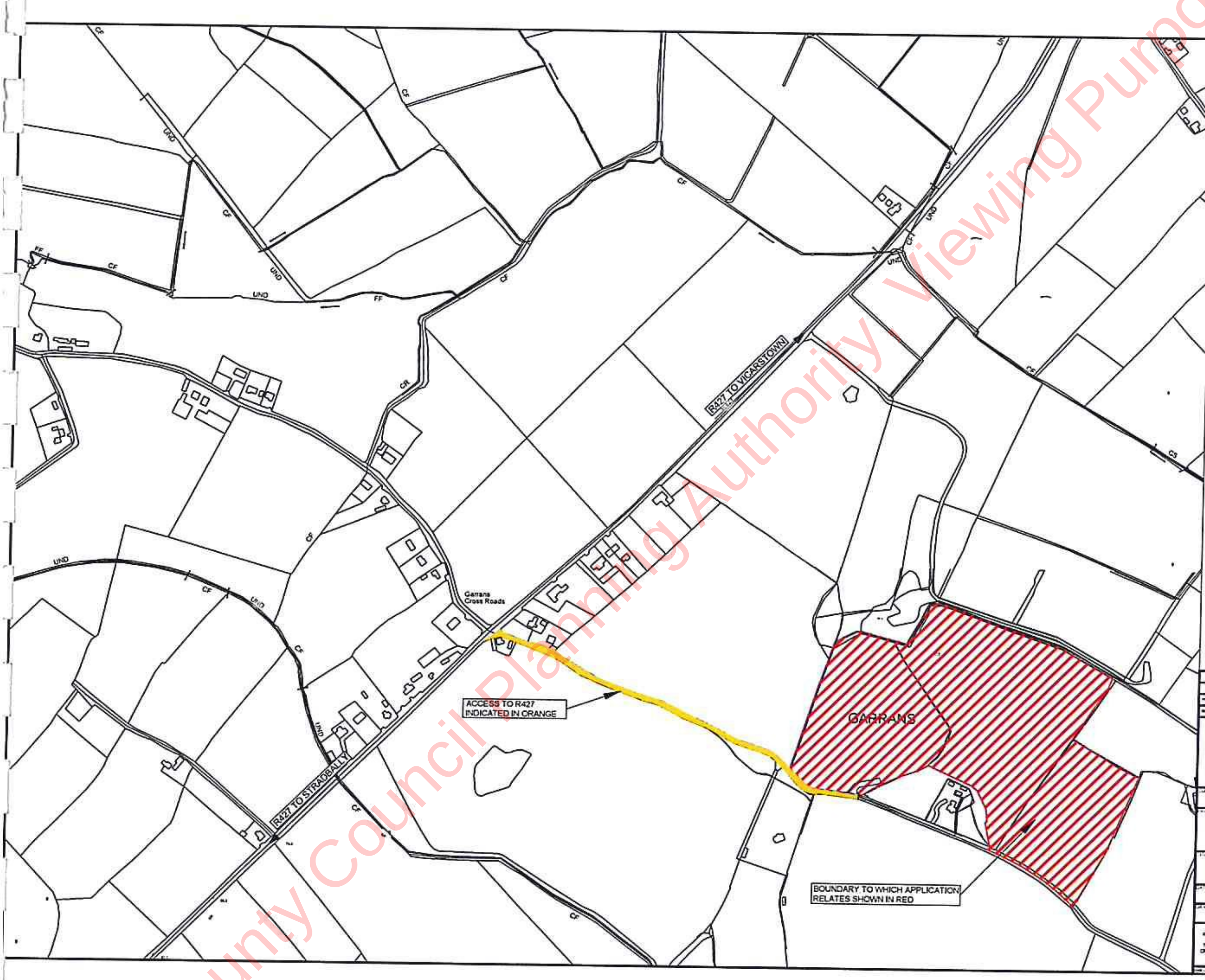
6.4 This is confirmed through the detailed analysis contained within this report which demonstrates, based on 2019 traffic survey data, that there are no capacity or queuing problems whatsoever at the site access during both the year of opening and the design years (2021 and 2027).

6.5 It is also proposed that the low level of additional traffic as associated with the proposed sand and gravel pit will have little impact on the safe operation of the existing road network in the vicinity of the pit.

6.6 It is considered that there are no significant Traffic and Road issues that prevent a positive determination of the application by the Local Authority.

Appendix A

Proposed Access Layout Drawing
Proposed Lay-By Map



NOTES

NOT FOR CONSTRUCTION

Jason Redmond & Associates Consulting Engineers

Civil Structural
Project Management
6 Lismard Court, Portlaoise
Co. Laois,
PH. 05786 61156
Email info@rassoc.ie

PAT BOOTH

PROPOSED GRAVEL PIT AT GARRANS, STRADBALLY, CO. LAOIS

SITE ACCESS PLAN

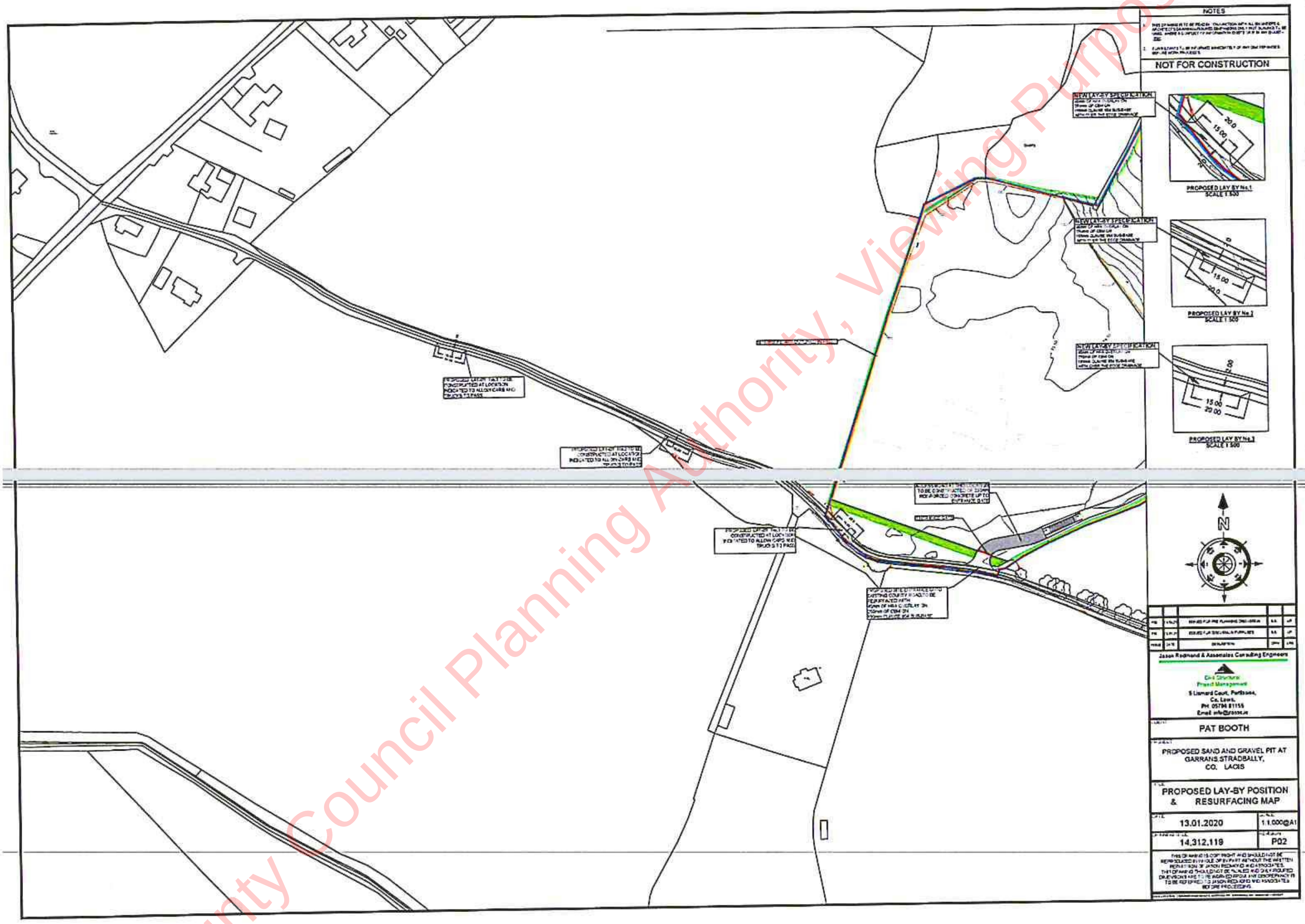
17.10.2019

1:2500@A3

14.312.118

P01

THIS DRAWING IS COPYRIGHT AND SHOULD NOT BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE WRITTEN PERMISSION OF JASON REDMOND AND ASSOCIATES. THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCIES TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.


NOTES
NOT FOR CONSTRUCTION
PROPOSED LAY BY No.1
PROPOSED LAY BY No.2
PROPOSED LAY BY No.3
20.0
15.00
N
Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH. 05786 81155
Email: info@jrace.ie
PAT BOOTH
PROPOSED SAND AND GRAVEL PIT AT
GARRANS,STRADBALLY,
CO. LAOIS
PROPOSED LAY-BY POSITION
& RESURFACING MAP
13.01.2020
1:1,000@A1
14.312.119
P02

Appendix B

Traffic Survey Data

Civil Structural
Project Management

Traffic Count Data from 12th December 2019

Carried Out By Taras Sukhanov
On Behalf Of Jason Redmond Associates
Consulting Engineers

Time Period	R 427 Toward Vicarstown		R 427 Toward Stradbally		in Garrons pit from Vicarstown		in Garrons pit from Stradbally		Out Vicarstown from Quarry		Out Stradbally from Quarry	
	Cars	HGV's	Cars	HGV's	Cars	HGV's	Cars	HGV's	Cars	HGV's	Cars	HGV's
08:00-08:15	16		9									
08:15-08:30	11		8				1		2			
08:30-08:45	7		13	1			1		1			
08:45-09:00	11	2	11								1	
09:00-09:15	14		13		2		1		1		1	
09:15-09:30	10		12		1		1				2	
	Cars	HGV's	Cars	HGV's	Cars	HGV's	Cars	HGV's	Cars	HGV's	Cars	HGV's
16:00-16:15	11		9									
16:15-16:30	17	1	8	1			1				1	
16:30-16:45	11		14	1			1		1			
16:45-17:00	9		10	1	2							
17:00-17:15	18		7								1	
17:15-17:30	6		11				1					
17:30-17:45	15		16				2					
17:45-18:00	13		12				1				1	

Appendix C

PICADY Results Output

	AM								PM							
	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
	2020															
Stream B-AC	0.0	~1	0.00	0.00	A	0.12	A	900 % ▯	0.0	~1	0.00	0.00	A	0.27	A	900 % ▯
Stream C-AB	0.0	0.5	6.26	0.00	A				0.0	0.0	6.30	0.01	A			
	2021															
Stream B-AC	0.0	~1	0.00	0.00	A	0.12	A	900 % ▯	0.0	~1	0.00	0.00	A	0.27	A	900 % ▯
Stream C-AB	0.0	0.5	6.26	0.00	A				0.0	0.5	6.30	0.01	A			
	2027															
Stream B-AC	0.0	~1	0.00	0.00	A	0.12	A	900 % ▯	0.0	~1	0.00	0.00	A	0.31	A	900 % ▯
Stream C-AB	0.0	0.5	6.26	0.00	A				0.0	~1	6.32	0.01	A			

Main Results for each time segment

16:00 - 16:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	613	0.000	0	0.0	0.0	0.000	A
C-AB	0	0	571	0.000	0	0.0	0.0	0.000	A
[illegible]	[illegible]	[illegible]			[illegible]				
A-B	0	0			0				
A-C	12	3			12				

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	613	0.000	0	0.0	0.0	0.000	A
C-AB	0.92	0.23	578	0.002	0.92	0.0	0.0	6.242	A
C-A	9	2			9				
A-B	0	0			0				
A-C	12	3			12				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	613	0.000	0	0.0	0.0	0.000	A
C-AB	0.60	0.15	578	0.001	0.60	0.0	0.0	6.237	A
C-A	9	2			9				
A-B	0	0			0				
A-C	12	3			12				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	613	0.000	0	0.0	0.0	0.000	A

8.2.2 Existing Information

Data relating to the site and environs arising from the following sources were reviewed and incorporated into the analysis, assessment and reporting:

- *Site Ground Investigations Report (3/10/2003);*
- *Site Topographic Survey (November, 2015);*
- *Geological Survey of Ireland (GSI) soils, subsoils, quaternary, bedrock geology, active extraction sites, geotechnical investigations, borehole, bedrock aquifer, sand and gravel aquifer; aggregate potential, groundwater recharge, groundwater wells and springs, surface water features, karst feature and groundwater protection area mapping and databases (www.gsi.ie and www.dccae.gov.ie)*
- *Teagasc/EPA (2004) subsoils mapping and notes;*
- *Water Framework Directive groundwater body characterisation reports (www.gsi.ie);*
- *Water Framework Directive monitoring locations, monitoring results, water bodies, catchments, status, pressures, waste water discharge, programme of measures and protected areas data (https://gis.epa.ie/EPAMaps/Water);*
- *EPA Hydrotool flow estimation and catchment characteristics data (https://gis.epa.ie/EPAMaps/Water) and hydrometric data from EPAHydroNet http://www.epa.ie/hydronet/#Water%20Levels*
- *Office of Public Works (OPW) (http://waterlevel.ie/);*
- *Met Eireann meteorological data (www.met.ie);*
- *Ordnance Survey of Ireland (OSI), GSI, Google and Bing Maps aerial photographs;*
- *OSI historic 1:10,560 and 1: 2,500 scale maps.*

8.2.3 Field Works

The following field works were carried out at and surrounding the site and the results incorporated into the analysis, assessment, and reporting.

Table 8.1: Field Works

Works	Methodology	Date/Monitoring Period
Inspection of soil, subsoil exposures and surface and groundwater features	• Location and examination of exposures, by cleaning of surface, recording with photographs and field notes. • Location of springs, seepages, drains and watercourses	19/7/2016
Intrusive site investigations, subsoil and bedrock logging in BH1, BH2, BH3 and BH4	• Site investigations and installations designed and supervised (on site/by phone) by Tynan Environmental; • Drilling carried out by Petersen Drilling Services Ltd. using a Knebel HY79 air flush hammer drill in	15 – 17/10/2018

Works	Methodology	Date/Monitoring Period
	accordance with BS 5930:2015 Code of Practice for Site Investigations • Logging of material to BS 5930:2015 Code of Practice for Ground Investigations by Petersen Drilling Ltd. or Tynan Environmental and/or validation on -site in samples by Tynan Environmental. Recording with photographs and field notes. • Samples taken at approximately 2 m interval, analysed for particle size distribution (PSD).	
Installation of standpipes in BH1, BH2, BH3 and BH4	• Installation of piezometers under supervision of Tynan Environmental, designed in response to hydrogeological conditions encountered at each borehole location. • High resolution RTK GPS survey of borehole locations to datum (m OD)	15 – 17/10/2018
Monitoring of groundwater water level in BH1, BH2, BH3 and BH4	• Borehole instrumentation using continuous pressure transducer water level monitors recording monitoring and barometric compensation monitor (Eijkelkamp) recording at 10 minute intervals. Monitors have a resolution of +/- 0.02 or +/- 0.01 m • Manual water level measurements using dipper.	17/10/2018 – 10/4/2019 (BH4 to 21/1/2019) 17/10/2018, 21/1/2019, 10/4/2019
Monitoring of groundwater in BH2	• Borehole instrumentation as above • Manual water level measurements using dipper.	2/1/2020- current 21/1/2020
Water level heights survey, summer and winter	• Survey of surface water, spring water, drain and adjacent borehole water levels heights on site and surrounds, including tributary of Stradbally river, Stradbally river and surrounds using RTK GPS, dipper and staff.	19/7/2016, 21/1/2019, 2/1/2020
Groundwater and surface water sampling and analysis	• Sampling requirements and locations specified by Tynan Environmental; • Sampling and analysis of groundwater (2 locations) and surface water (6 locations) at and surrounding the site according to best practise guidance were carried out by ELS Ltd.	13/12/2019

8.2.4 Analysis and Impact Assessment

Analysis and assessment are carried out using best practise methodology, supported by referenced publications and in accordance with and/or with reference, to existing guidance as set out above.

8.3 Project Description

The characteristics of the proposed Project which interact with and have the potential to have likely, significantly impact on the water environment are set out below. These characteristics relate primarily to the Operational Phase. Specific reference is made to commissioning and re-instatement phases, where necessary.

8.3.1 Material Extraction and Processing

Method and Depth

Material will be extracted using an excavator, with the material moved using a wheeled loader.

Extraction will be to a depth of at least 1 m above the estimated highest winter groundwater level across the extraction area, to which is added a climate change uncertainty allowance of 10% of annual groundwater level variability across the site. Material extraction depths across the site are set out in cross sections provided in Appendix 2.1.

Extraction Rate

Average daily extraction rate over a 20 year period is 203 tonnes/day (61,000 tonnes per annum).

Maximum daily abstraction rate is 350 tonnes/day. This is to allow for occasional (not greater than one month) extraction at a rate in excess of the average rate, to respond to market requirements.

A stockpile of c. 2000 tonnes (10 days processing) will be created during the commissioning phase of the quarry to buffer the requirement to increase extraction above the average so as to minimise the number of occasions on which a higher extraction rate would be required.

Extraction Phasing

A full description of the site phasing is set out in the Project Description Chapter of this EIAR. Four phases of material extraction are proposed and set out in the drawings provided in Appendix 2.1. A proportion of the site to the north (around the 4No. ponds and refuelling area) will not be quarried and the land in this area will not be stripped of vegetation.

Material Processing System

The material processing system proposed is highly efficient in terms of water usage and management. It comprises integrated processing, water treatment/recycling, stockpile and sludge dewatering and recovery, as follows and as set out in Figure 8.1 Material Processing System Diagram, below.

- Mobile washing plant which comprises feeding, screening, sand washing and stockpile conveyors (CDE CDE M2500 E5), thereafter described as the 'processing plant';
    - Material ≥4 mm is rinsed, screened and delivered by conveyor to stockpiles according to size;
    - Material<4 mm is classified in two cyclones to produce two grades of clean sands; delivered by conveyor to stockpiles according to size.
    - Water top up of a maximum of 20% of plant water requirement;
    - The plant is driven by an electricity.
- Integrated primary water treatment plant (CDE AquaCycle Thickener)

  - Overflow arising from the cyclones and washing is directed to the closed tank water treatment plant;
  - Dosed with flocculant in the deaeration chamber, then sent to the thickener settlement chamber. The < 63 micron silt/clay particles form a chain and sink to the bottom of the chamber.
  - Clarified water flows over a weir and is recycled into the screening and washing plant system resulting in at least 80% recycling of process water; Up to 90% may be recycled in some scenarios.
  - At a pre-set slurry density thickened sludge is pumped to a sludge pond, at an approximately 1:2 ratio of silt to water;
  - The plant is driven by electricity.
- Sludge Settlement Ponds (Ponds 2&3)
  - Settle thickened sludge;
  - Recovered water recycled to the process water top-up balancing pond;
- Stockpile Dewatering system
  - Conveyors place stockpiles on the stockpile dewatering system area;
  - The system comprises an impermeable under layer and outer bund, with stockpile water collection by gravity drainage,
  - Gravity drainage of material water, and any direct rainfall, is conveyed to the process top-up water balancing pond (Pond 1).

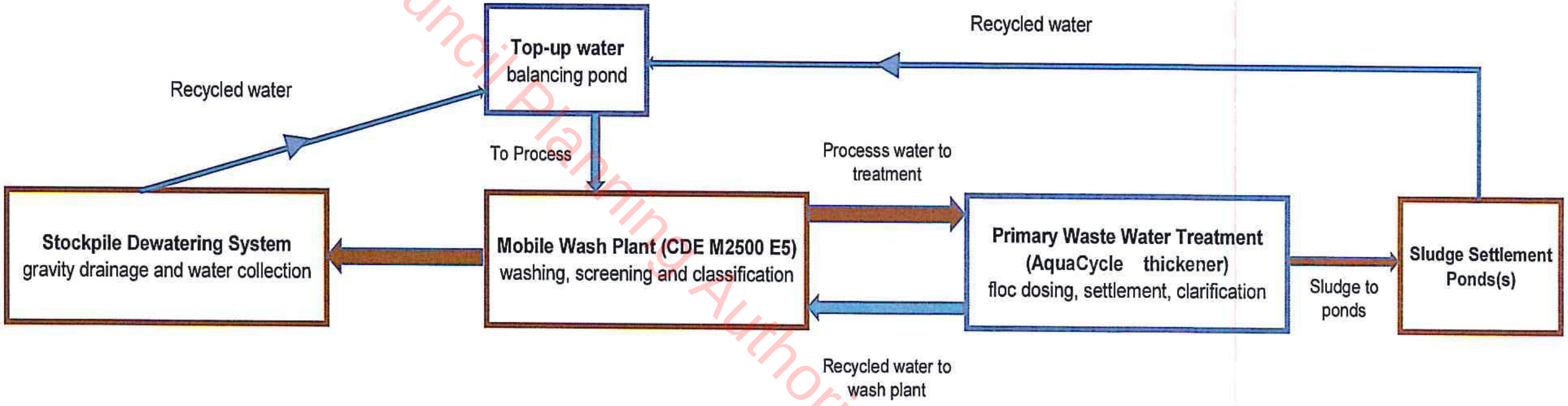
Material Processing System Water Budget

The water budget for the material processing system set out above, operating at the average and maximum processing rates, is as follows in Table 8.2.Table 8.2

Table 8.2 Material Processing System Water Budget

Process rate (tonnes/time)	Material processing rates (tonnes/day)	Full Process water requirement (m^3/processed tonnage/day)	Recycled water within process and water treatment plant ≥80% (m^3/processed tonnage/day)	Top-up water requirement to process ≤20% (m^3/processed tonnage/day)
100	203	234	192	42
	350	407	334	73

Figure 8.1: Material Processing System Diagram



8.3.2 Water Management

Process and Ancillary Water Recovery, Recycling and Usage

The site water management system entails water recovery and recycling within all stages of the process and ancillary activities, in order to minimise water usage.

In addition to material processing, ancillary site activities which involve water usage are:

- Wheel Washing, and
- Dust Suppression.

The process and ancillary water recovery, recycling and usage budget is set out in Table 8.3 below. The budget proceeds from the fact that at least 80% of the material process water requirement is fulfilled by recycling within the plant and integrated water treatment plant, as described above. Up to 90% may be recycled in some scenarios, therefore approximately 80% is a conservative estimate used for the purposes of a conservative assessment of the maximum top-up water requirement.

Assuming a requirement for approximately 20% top-up of process water, the top -up water requirement rate is 21 m^3/100 tonne processed. This equates to 42 m^3/day for the average processing rate and 73 m^3/day for the occasional maximum processing rate. The top-up volume will be provided by:

- Recycled recovered water from the sludge storage ponds, recycled in a closed system loop to the processing plant. Estimates of recovery rate are conservative at approximately 33% of sludge volume. The estimate is based on settlement rates over a 24 hour period and the suppliers experience of recovery rates at working iterations of the processing plant.
- Recycled recovered stockpile material water, recycled in a closed system loop to the processing plant. All gravity drainage is collected in the stockpile recovery system. Estimate of average recovery rate is based on expected gravity drainage rates (specific yield) (Fetter, 1994) of the bulked site material properties. See Appendix 8.4 for site material characteristics.
- Water usage, for the remaining water requirement which cannot be derived from recovery and recycling.

Table 8.3 Process and Ancillary Water Recovery, Recycling and Usage Budget

Material processing rates (tonnes/day)	Full Process water requirement (m^3/processed tonnage/day)	Recycled water within process and water treatment plant ≥80% (m^3/processed tonnage/day)	Top-up water requirement to process ≤20% (m^3/processed tonnage/day)	Sludge water content to settlement ponds (m^3/processed tonnage/day)	Recovered water from sludge ponds (m3/processed tonnage/day)	Material water to stockpile at 12% content (m^3/processed tonnage/day)	Recovered water from stockpile dewatering system (m3/processed tonnage/day)	Wheel wash and dust supression assumed unretrieved (dust suppresson 10 nozzles 1 m3/hr)	Water Usage (m3/processed tonnage/day)
203	234	192	42	18	6	24	14	2	**24**
350	407	334	73	31	12	42	22	4	**42**

Site Water Usage Supply

The daily operational water usage requirement of 24 m^3/processed tonnage/day for the average processing rate and 42 m^3/processed tonnage/day for the occasional maximum processing rate will be supplied from:

- Surface water run-off collection and storage;
- Groundwater abstraction, for the remaining water supply requirement which cannot be derived from collection of 70% of surface water run-off.

The proportion of usage of collected from each source, will depend on the seasonal availability of surface water run-off for collection and storage. Estimates of average daily surface water available for usage at the operational site and the requirement for groundwater abstraction to achieve the daily operational site water usage are set out below in Table 8.4 Surface water and Groundwater usage supply.

Surface Water Supply

Surface water availability includes adjustment for losses while in storage. A rate of usage of 70% of site surface water run-off is assumed.

Average surface water usage is, therefore, 15 m^3/day. Surface water available for usage is estimated to vary from a minimum of 7 m^3/day in July to 26 m^3/day in October.

The plant initial processing run will have a water requirement of 234 m^3/processed tonnage. This initial run will be supplied from the same sources as the operational phase water. That is to say, surface water run-off water will be collected and stored in advance and topped up with stored groundwater abstraction. The water management system will be commissioned in advance of the process being started, in order that sufficient collection and storage of surface water can occur.

Climate Change Allowance in Surface Water Supply

Average usage from surface water over the summer period (April – September) is 10 m^3/day. Climate change projections predict an increase in the number of dry days ranging from 15% to 40% (Nolan, 2015). Storage of 40 days of summer period surface water usage, that is 400 m^3, will be retained continuously in storage on site. This is generated from storm water run-off.

The frequencies of heavy precipitation events are projected to increase across the whole year, but show notable increases (approximately 20%) during the winter and autumn months (Nolan and McKinstry, 2019). Current guidance (OPW, 2009) is addition of 20% to flood flows.

The potential increase in winter run-off has not been factored into available winter surface water run-off supply, in order to be conservative in this regard. There is therefore likely to be additional surface water available during winter and autumn months.

A 20% increase has, however, been factored into required storm water attenuation storage calculations, to provide a factor of safety relating to climate change.

Groundwater Abstraction

The characteristics of the groundwater abstraction are as follows:

- At the average material extraction rate, the estimated requirement for groundwater supply is an annual average of 9 m³/day. Supply requirement will range from 1 m³/day in January to a maximum of 17 m³/day in July. Occasional material extraction at the maximum proposed extraction rate, would require an intermittent groundwater supply rate ranging from 19 m³/day in January to a maximum of 35 m³/day in July.
- The hydrogeological characteristics of the sand and gravel deposit, that is the transmissivity, storage and groundwater level fluctuations indicate that these abstraction rates can readily be achieved. Significantly higher sustainable yields are likely to be available from this deposit. (See Section Currently 4.1 Site Hydrogeology, below).
- A water supply borehole extending to c. 5 m below the average water level, located close to the north western boundary of the site, will provide the supply.

Zones of Contribution to Groundwater Abstraction

Zones of Contribution to the borehole have been delineated for the groundwater abstraction. The Zone of Contribution (ZOC) is the extent of area which supplies groundwater to an abstraction borehole, pumping at a given daily abstraction rate, on an annual basis. The cone of depression of the abstraction (that is, the area of reduced groundwater levels) is smaller than, and fully contained within, the ZOC area. See Appendix 8.1, Figure 5 for extents.

Zone of Contribution Delineation Methodology

The hydrogeological investigations and ZOC delineations have been carried out according to the principles and methodologies set out in DELG/EPA/GSI (1999) Groundwater Protection Schemes, the GSI/EPA/IGI training course on Groundwater Source Protection Zone (SPZ) Delineation, as well as EPA (2011) *Advice Note No. 7: Source Protection and Catchment Management to Protect Groundwater Sources.*

Groundwater Abstraction Rate

At the average material extraction rate (c. 200 tonnes/day), the estimated requirement for groundwater supply is an annual average of 9 m³/day. Supply requirement will range from 1 m³/day in January to a maximum of 17 m³/day in July.

Occasional material extraction at the maximum proposed extraction rate (350 tonnes/day), would require an intermittent groundwater supply rate ranging from 19 m³/day in January to a maximum of 35 m³/day in July (See Table 8.4, above for details of monthly groundwater usage).

ZOCs have been delineated for the following abstraction rates:

- A conservative ZOC (ZOC 1) has been delineated for the maximum (July) required groundwater abstraction rate of 17 m^3/day, for the 200 tonnes/day processing rate. By convention, ZOCs are delineated for a continuous 'steady state' average abstraction rate over a year, which assumes maintenance of the same pumping rate throughout a year. Withdrawal of groundwater from the full extent of the ZOC will only occur if that abstraction rate is continuous throughout the year.
  According to best practise, a ZOC is delineated for 150% of annual average usage (i.e. 9 m^3/day * 150% = 13.5 m^3/day) to provide a factor of safety. Defining the ZOC for the maximum July rate of 17 m^3/day, rather than 150% of the average annualised daily abstraction rate, therefore significantly overestimates the extent of the area which will contribute groundwater to the borehole, by an additional factor of safety of approximately 25%.

- An additional ZOC (ZOC 2) has been delineated for the intermittent maximum (July) required groundwater abstraction rate of 35 m^3/day, for the occasional 350 tonnes/day processing rate. This is a notional ZOC, which would only occur, if water were to be extracted at this maximum rate, throughout the year. This will not occur, since this is an intermittent processing rate. A factor of safety of the order of >50% is likely to be associated with this ZOC area. This is delineated only for the purposes of a very conservative assessment of risk to sensitive ecological receptors.

Supply Borehole Characteristics

The abstraction will comprise one borehole, located at the north west boundary of the site. Likely depth is approximately 10 m total depth below ground level, to ensure is 5 m in the saturated zone (below average groundwater level). A variable rate submersible pump will be installed in the borehole and the abstraction rate will be metered.

Conceptual Model of Groundwater Flow

The detailed conceptual model of groundwater flow derived from site investigations and all other available groundwater data is set out in this Chapter. The approximately 10 m depth abstraction borehole will penetrate a glacio-fluvial sand and gravel deposit, which is estimated to be up to 20 m deep in this area. Groundwater flow to the borehole is from the south south-west, towards the north north-east. Groundwater gradient is estimated to be 0.004. Saturated zone transmissivity in the borehole, based on average surrounding borehole hydraulic conductivity is estimated to be 122.5 m2/day (See Appendix 8.6 details). Groundwater vulnerability is naturally extreme, as defined by the Geological Survey of Ireland (GSI).

Recharge and Water Balance

The term 'recharge' refers to the amount of water replenishing the groundwater flow system. The estimation recharge rate is critical in ZOC delineation, as it will dictate the size of the zone of contribution to the required abstraction. The recharge rate is estimated to be an annual average of 398 mm/year, as set out in Section Currently 8.4.13 Groundwater Recharge Rate and Site Water Balance, below.

The water balance calculation requires that the annual recharge volume over the area contributing to the abstraction (the ZOC) equals the annual abstraction volume. ZOC areas are therefore as follows:

- ZOC 1: An area of 0.0155 km^2 (1.55 ha) is required to supply sufficient recharge for a continuous annual abstraction (at the July rate) of 17 m^3/day.
- ZOC 2 : An area of 0.032 km^2 (3.2 ha) is required to supply sufficient recharge for a continuous annual abstraction (at the intermittent July rate) of 35 m^3/day.

ZOC Boundaries

ZOC boundaries are based upon a combination of analytical equations and data derived from hydrogeological site investigations. ZOC boundaries are as follows:

- ZOC 1
  The eastern and western boundaries of the ZOC are based on groundwater flow lines, derived from measured groundwater gradients and other hydrogeological site investigations. They are also consistent with estimates of maximum half-width estimated using the uniform flow equation maximum half width calculation (Todd D.K., 1980 in Groundwater Hydrology) (See Appendix 8.6 for calculations);
  The downgradient boundary at 6 m north of the borehole is based on the uniform flow equation (Todd D.K., 1980 in Groundwater Hydrology);
  The south south-eastern, upgradient boundary is based on the water balance.
- ZOC 2
  The eastern and western boundaries of the ZOC are based on groundwater flow lines, derived from measured groundwater gradients and other hydrogeological site investigations. They are also consistent with estimates of maximum half-width estimated using the uniform flow equation maximum half width calculation (Todd D.K., 1980 in Groundwater Hydrology) (See Appendix 8.6 for calculations);
  The downgradient boundary at 11 m north of the borehole is based on the uniform flow equation (Todd D.K., 1980 in Groundwater Hydrology);
  The south south-eastern, upgradient boundary is based on the water balance.

Climate Change Allowance in Groundwater Supply and ZOC Delineations

The hydrogeological characteristics of the site indicate that the proposed yields are sustainable under projected climate change conditions (See Section Currently 8.4.13. Hydrogeological response to Climate Change, below)

The extremely conservative ZOC delineations allow a large factor of safety (of the order of 25% and >50%) with respect to the area contributing groundwater supply to the borehole. This factor of safety will allow for any sand and gravel groundwater system responses to changes in meteorological parameters projected under climate change. (See Currently 8.4.13. Hydrogeological response to Climate Change, below).

The frequencies of heavy precipitation events are projected to increase across the whole year, but show notable increases (approximately 20%) during the winter and autumn months (Nolan and McKinstry, 2019). Current guidance (OPW, 2009) is addition of 20% to flood flows.

The potential increase in winter flows has not been factored into available winter surface water run-off supply, in order to be conservative in this regard. There is therefore likely to be additional surface water available during winter and autumn months, in which case lower groundwater abstraction rates may be required.

Table 8.4 Surface Water and Groundwater Supply

Daily Water Balance Parameter (m³/day)	Average	Month											
		January	February	March	April	May	June	July	August	September	October	November	December
Site average daily site run-off volume from permeable area of 12.76 ha (m³/day)	25	33	18	21	16	19	19	16	28	22	39	31	33
Site average daily site run-off volume from hardstanding areas of 0.08 ha and including evaporative losses (m³/day)	0	1	1	0	-1	-2	-2	-2	-1	0	1	2	2
Total site average daily run-off (m³/day)	25	35	19	22	15	17	17	14	27	22	40	33	35
Collected volume at 70% of site average daily run-off (m³/day)	17	24	13	15	12	13	13	12	20	16	27	22	23
Evaporation losses from storage/attenuation pond (m³/day)	2	0.5	0.9	1.7	2.4	3.7	4.2	4.3	3.3	2.2	1.2	0.5	0.4
Surface water available for process usage (m³/day)	**15**	**23**	**12**	**13**	**9**	**10**	**9**	**7**	**16**	**13**	**26**	**21**	**23**
Groundwater abstraction requirement at average (203 tonnes/day) material processing rate (m³/day)	**9**	**1**	**12**	**11**	**15**	**14**	**15**	**17**	**8**	**11**	**0**	**3**	**1**

Daily Water Balance Parameter (m^3/day)	Average	Month											
		January	February	March	April	May	June	July	August	September	October	November	December
Groundwater abstraction requirement at occasional maximum (305 tonnes/day) material processing rate (m^3/day)	27	19	30	29	33	32	33	35	26	29	16	21	19

Surface Water Run-off Collection, Conveyance and Storage

See Figure 8.2 below, for a schematic of the full water management system.

Average Daily Surface water run-off

Estimates of daily site run-off rates per month for the developed site are set out in Table 8.4 Surface water and groundwater usage supply above. Average daily run-off is seasonal and varies from a minimum of 16 m³/day in July, to a maximum of 38 m³/day in October.

Storm water run-off

Site storm water run-off rates and volumes from the 12.84 ha developed site have been estimated for the 1 in 20 year storm for storm durations of 15 minutes to 48 hours, using the rational equation method. This is appropriate for the 20 year proposed life of the quarry. Met Eireann estimations of point rainfall frequencies (www.met.ie and Fitzgerald D.L., 2007), which provide rainfall depths at sliding durations for specified return periods for the site location, were used.

Climate Change Allowance for Storm water run-off

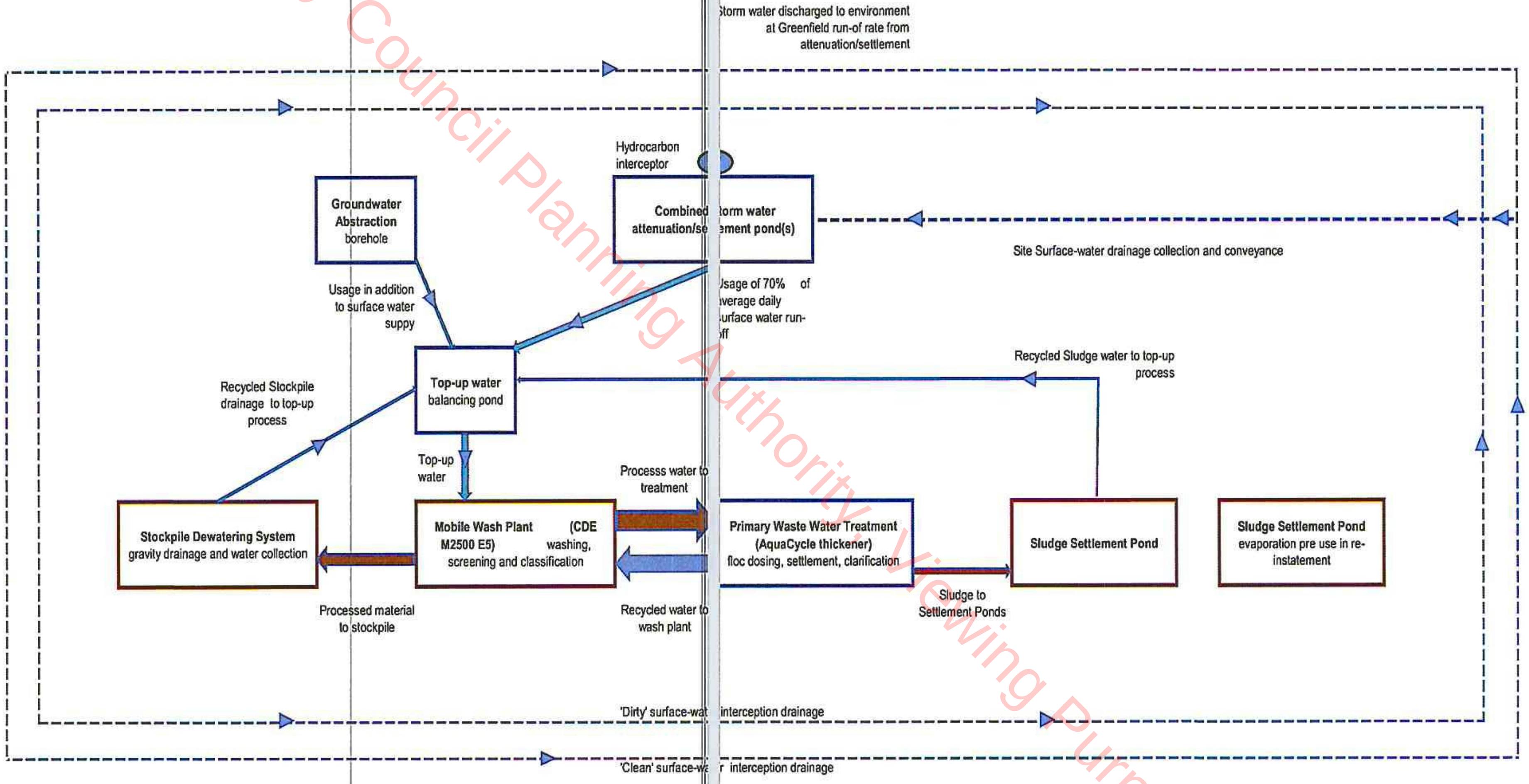
Climate change projections are that rainfall is projected to increase during winter and autumn (Nolan, 2019, 2017, 2015, Gleeson, 2013). A climate change allowance of 20% has been added to the rainfall depth used to calculate storm water run-off rates in accordance with OPW (2009) Assessment of Potential Future Scenarios For Flood Risk Management - Draft Guidance (See Appendix 8.2 for calculations).

The rational method is used to estimate storm water run-off is extremely conservative and is reported as yielding flood peaks typically twice as large as Flood Studies Report methods (Cawley and Cunnane, 2003), therefore is therefore an additional factor of safety in storm water attenuation storage designs based upon it.

Collection and conveyance

The collection and conveyance system is a flexible, reactive system, which will be modified to be effective for each phase of the development. It comprises the following elements:

Figure 8.2: Site Water Management System



- 'Clean water' interceptor drainage, which collects clean surface water runoff from areas of the site which have not been stripped of vegetation and from re-instated areas of the site, which are fully re-vegetated.
  This minimises the volume of water in which pollutants could be entrained; If necessary, geotextile lining or french drains will be implemented to prevent erosion and improve conveyance.
- Dirty water' interceptor drainage which collects surface water run-off from areas of the site where pollutant entrainment may occur. This includes working areas of the quarry and recently re-instated areas, where vegetation is not yet established, but excludes the bunded re-fuelling area. If necessary, erosion control measures will be implemented.
- Collection from a small area of shed roof;
- Conveyance of all collected drainage to the storm water attenuation/sediment settlement pond (Pond 4).

Storage

Total storage volume of 1500 m^3 in impermeable combined storm water attenuation/sediment settlement pond(s) is designed to attenuated both storm water run-off and store retained water to provide process water during dry periods. This comprises:

- Storm water attenuation storage

  Storm water from the critical 20 year return period storm with climate change allowance (and lower return period storms), is attenuated and discharged at the greenfield run-off rate for that return period storm of 0.0092 m^3/s. See Appendix 8.2 details and calculations. The maximum storage required for the critical storm is 1054 m^3.

- Retention in storage of process water, for projected climate change increase in dry-weather days. Storage of 40 days of average summer period surface water usage (May – September at 10 m^3/day) that is a total of 400 m^3· is retained continuously in storage on site. This contains a significant margin of safety for climate change designed to mitigate against projected increases in dry periods (largest for summer,) with likely values ranging from 12% to 40% (See Section currently 8.4.1 Climate Change Projections, below). This stored water is collected initially during the commissioning phase and maintained by storm water.

Water usage rate from the storage will be controlled via a flexible pumping regime and a discharge/rate meter.

A top-up water balancing pond, of volume (2000 m^3) is located before the processing plant, in order to balance the combined inflows from the usage sources: the storm water attenuation/sediment settlement pond, groundwater abstraction. the recycled water from the stockpile dewatering system and sludge settlement ponds.

Discharge to the Environment

Discharge to the environment from the storm water attenuation/sediment settlement pond (Pond 4) (for volumes in excess of the retained 40 day storage) will be actively controlled, via a flow control and a discharge meter to the pre-development greenfield run-off rate of 6.35 l/s (See Section 8.4.5. and Appendix 8.2). See the Drainage Layout Map in Appendix 2.1.

The discharge will occur onto an area of natural vegetation, at approximately 19 m distance upgradient of the man-made drain, in the form of a level spreader. The greenfield discharge rate is very low and unlikely to cause erosion. Erosion control measures such as rip-rap will be emplaced if commencement of erosion is observed.

Grey and Foul Waste Water

Sanitary and comfort facilities are self contained. These comprise:

- Provision of a 'portaloo' toilet and hand wash facilities on site; managed under contract with an approved waste collector;
- Provision of bottled water to site staff.

There is no discharge of foul or grey water from sanitary or comfort facilities to ground, or the water environment, at the site. A management contract with an approved waste collector will be put in place for removal and replacement of the infrastructure and its contained waste.

Sludge Management

The sludge management system comprises two sludge settlement ponds (Ponds 2 & 3), lined with an impermeable membrane, operating in rotation, each with the same design specification and operated as follows:

- Two settlement ponds, each lined with an impermeable membrane, each with volume of 2,000 m^3, comprising 2 m depth by 1000 m^2 area;
- One pond receiving a maximum sludge volume of 31 m^3/day. The design results in a retention time significantly in excess of 24 hrs. It allows a progressive settlement of sludge at a rate that generates 6 – 12 m^3/day of water which can be recycled back into the processing system, while allowing a freeboard in excess of 0.5 m;
- The second drying pond containing sludge, drying by evaporation, before removal of the dried sludge for re-instatement;
- Switching of drying pond function to receiving pond function, after removal of dried sludge.

Water Pollution Controls

Pollution Source Controls

Controls which will prevent pollution at source by suspended sediments and associated pollutants (such as ammonia, nitrogen or organic matter released from excavated subsoils), and hydrocarbons and foul/grey water organic wastes are as follows:

Closed system treatment and recycling of at least 80% of silt laden process water, within the processing plant and closed tank integrated primary water treatment plant. This reduces the volume of water containing suspended sediment exiting the processing plant by 80% and thus significantly reduces the volume of 'dirty' water requiring conveyance to, and treatment in, open sediment settlement ponds.

- No discharge of untreated or treated process water to the water environment. Process water which leaves the process in processed material and in sludge is recycled back into the process and is not discharged to the water environment. This is achieved via the:
- Stockpile dewatering system, comprising collection of all stockpile drainage and any direct rainwater, followed by direct, closed recycling into the process top-up water balancing pond. This avoids entrainment of stockpile material in surface water run-off.
- Recycling of available water from sludge settlement ponds and recycling into the process top-up water balancing pond (see sludge management, above.
- Minimisation of exposed ground by stripping of soils only at the commencement of a quarrying phase and immediate re-seeding of the worked out phase, in order to minimise entrainment of sediment and associated pollutants in surface water run-off. Stripped soil stockpiles/berms, will be re-seeded with appropriate grassland species.
- Retention of a vegetated (non-stripped) buffer zone to a minimum distance of 60 m distance upgradient from the man-made drain which occurs on site, in order to avoid entrainment of sediment in any surface water run-off draining directly to the drain. This will act as a buffer for any pollutants entrained in surface water run-off from any other part of the site.
- Stripped soil stockpiles will be located at the southern end of the site, at the maximum available distance from the man-made drain and a minimum of 60 m from the drain. Stripped soil stockpiles/berms, will be immediately re-seeded with appropriate grassland species.
- 'Clean' water interceptor drainage system collecting surface water run-off from vegetated, non working areas of the site, in order to avoid entrainment of suspended sediments and other potential pollutants including hydrocarbons in drainage water. This reduces the volume of 'dirty' water requiring treatment;
- Electric processing and integrated primary water treatment plant and gravity stockpile drainage system, significantly reducing fuel usage on site and therefore the risk of hydrocarbon spillage.

- No storage of fuels on site. Extraction plant (comprising an excavator and a wheeled loader) fuelled by a mobile fuel bowser brought to site. Fuelling occurs within a designated, impermeable bunded fuelling area, provisioned with a hydrocarbon interceptor. It is positioned so as to retain approximately 3 m of unsaturated material above the maximum predicted groundwater level. Drainage from the re-fuelling area is isolated from the surface water system and is conveyed directly to the storm water attenuation/sediment settlement pond; Handling of fuels and oils brought to site will be in accordance with UK Guidance for Pollution Prevention (2019) and Pollution Prevention Guidance (pre 2019).
- Where plant allows, environmentally considerate lubricants, such as synthetic non-toxic biodegradable hydraulic fluids, will be used.
- Scheduled visual checking for leaks and mechanical issues will occur, in order to minimise leakage and breakdowns on site. General servicing of site machinery takes place off-site.
- Storage of primary water treatment system polymer flocculant in a locked, fully watertight shed, from which no outflow of stored volume can occur.
- No discharge of foul or grey water from sanitary or comfort facilities to ground, or the water environment, at the site. Provision of a 'portaloo' toilet on site with a management contract with an approved waste collector.
- The site Environmental Management Plan (EMP), which sets out all environmental controls, including inter alia:
    - Correct site management procedures,
    - Monitoring and maintenance methods, schedules and recording
    - Accident responses.

All staff will be trained to understand their roles and responsibilities as set out in the EMP.

Pollution Treatment Controls

Controls which will treat water polluted by suspended sediment (and associated pollutants) or accidental spills of hydrocarbon or flocculant are as follows:

- Closed system treatment and recycling of at least 80% of material process water within the processing plant and integrated primary water treatment plant.
- Sediment Settlement Pond(s)
  Settlement pond(s) will be used to treat suspended solids and any associated pollutants (such as ammonia, nitrogen or organic matter), flocculant and hydrocarbons (CIRIA C532, 2001) entrained in site surface water drainage.
- Pond design and function will be as follows:
    - Site surface water drainage waters ('clean' and 'dirty') are conveyed to the combined storm water attenuation/sediment settlement pond;

- The pond(s), which is lined with an impermeable membrane, is designed to act as a wet pond which treats storm water from the 1 in 20 year event, as appropriate to the 20 year proposed life of the quarry. The pond(s) will have a total storage volume of 1,500 m3, with a depth of 1.55 m, including a freeboard of 0.5 m. The storage volume comprises 1,054 m3 storage for storm water and 400 m3 continuous storage of surface water, to be used as process water top-up during dry weather periods;
- Shape is rectangular, approximately 20m x 50 m, to maximise settlement efficiency along the length from inflow to outflow point;
- Retention time required to settle fine silt, in a pond of 1.5 m depth is 19 hours (CIRIA C648, 2006). Wet required pond minimum treatment volume (CIRIA 2000 in Butler et al, 2011) is 506 m3. The pond volume is significantly in excess of this and also allows for a retention time of 24 hrs, in accordance with Environmental Protection Agency (2006);
- Regular maintenance of the settlement pond will occur. Wet silt will be moved to the sludge management pond. If a pollutant spill has occurred, the pond will be emptied and sediment removed immediately after and sent to a licensed waste management facility;
- Periodic review of the efficacy of the pond system will occur, with addition of a second pond to the system if required suspended sediment limits are not being met.
- Regular checks for pond leakage or structural instability will be carried out and the results recorded.

Accidental Pollution Treatment Controls

The EMP, accident response methods, roles and responsibilities are the basis of the accident responses to be implemented by site staff.

Controls which will treat water polluted by hydrocarbons or flocculant in the case of accidental spillage or escape are:

- Spill kits, which will be stored on site. Staff will be fully trained in the correct and appropriate use, monitoring and removal of spill kits;
- Shutting off of the flow control valves on the discharge point from the storm water attenuation/settlement ponds which receive site surface water drainage. Immediate subsequent removal of contents for off-site disposal with an appropriately licensed waste disposal company.

Controls which will treat water polluted by suspended sediment and associated nutrients in the case of accidental spillage or breakdown of the integrated primary water treatment system are:

- Temporary bunding and diversion to the sludge-settlement ponds, which have sufficient excess capacity to store, settle and recycle the average daily process water and/or to the storm water attenuation/settlement pond, if sufficient storage exists at the time of the accident.
- Reducing outflow or stopping flow at the discharge point from the storm water attenuation/settlement ponds, in order to increase retention time, if required.

8.3.3 Re-instatement

Reinstatement of land will be carried out on a phased basis, on completion of the preceding phase. The material available for re-instatement is estimated from available site investigations results as comprising:

- 22,440 m^3 silt size material recovered from sludge;
- 28,150 m^3 top-soil recovered during stripping and stored

This will result in a depth of re-instatement of approximately (0.18 m silt+ 0.22m topsoil) across the site.

8.4 Existing Environment

8.4.1 Meteorological Setting

Current Average Hydro-Climatic Conditions

Understanding hydrogeology and hydrology requires an understanding of general meteorological patterns across the area. Average annual rainfall in the 1km surrounding the site is 821 mm/year (Met Eireann 1 km square rainfall grid 1981-2010 and Walsh S., 2012)). Average annual evapotranspiration is 362 mm/year (Met Eireann). Average annual effective rainfall, that is, rainfall available for run-off and groundwater recharge in the vicinity of the site, is therefore 468 mm/year (Met Eireann and GSI Groundwater Recharge map, 2019).

Monthly meteorological data from Met Eireann sources closest to the site and which is considered indicative of conditions at the site is set out in Table 8.5 below. The Athy rainfall station, which records number of rain days, is located at a distance of 10 km east south-east. Oakpark synoptic station, which records evaporation, is located 25 km to the south east. Monthly rainfall amounts have a seasonal pattern as does open-water evaporation. Average number of rain days has a less marked seasonal pattern.

Climate Change Projections

Regional climate projections have been modelled on a 4 to 6 km grid scale, for the mid 21st century, in Ireland by inter alia Nolan et al (2017), Nolan (2015), Nolan and McKinstry (2019) and Gleeson et al (2013). Relevant projections are summarised below.

Rainfall is projected to increase during winter and autumn and decrease during summer and over the full year (Nolan, 2019, 2017, 2015, Gleeson, 2013).

- The frequencies of heavy precipitation events are projected to increase across the whole year, but show notable increases (approximately 20%) during the winter and autumn months (Nolan and McKinstry, 2019) by mid-century.
- Drier conditions are projected to be more pronounced in the summer, with likely reductions in rainfall ranging from 0% to 13% and from 3% to 20% for the medium- to low-emission and high-emission scenarios respectively, by mid-century (modelled 20 year period 2014 – 2060) (Nolan, 2015).
- The number of extended dry periods (defined as at least 5 consecutive days for which the daily precipitation is less than 1 mm) is also projected to increase substantially by mid-century over the full year and during autumn and summer. The projected increases in dry periods are largest for summer, with likely values ranging from 12% to 40% for both the medium- to low-emission and high-emission scenarios by mid-century (Nolan, 2015).

Projections for mid-century indicate an increase of 1–1.6°C in mean annual temperatures, with the largest increases seen in the east of the country (Nolan, 2015). Temperature projections show a clear west-to-east temperature gradient, with the largest increase seen in the east (Nolan and McKinstry, 2019).

Projections for evaporation and evapotranspiration have not been explicitly modelled, as they are a function of these and additional meteorological and soil parameters.

Table 8.5 Current Average Hydro-Climatic Conditions

Month	January	February	Marc	April	May	June	July	August	September	October	November	December	Average Annual
1 km grid long term average 1981-2010													
Average monthly rainfall (mm)	83	59	[illegible]	56	60	60	56	74	65	92	79	82	830
Pro-ratad monthly actual evapotranspiration (AE) (mm)	30	30	[illegible]	30	30	30	30	30	30	30	30	30	362
Athy Rainfall Station (6414) 2010-2019													
Average monthly rainfall (mm)	71	73	[illegible]	41	52	70	55	64	68	82	85	97	814
Average number of rain days (0.2 mm +) (mm)	13	11	[illegible]	9	11	10	11	11	11	12	13	15	138
Oakpark Synoptic Station (375) 2017-2019													
Average monthly rainfall (mm)	80	57	[illegible]	56	60	61	59	72	70	93	86	84	840
Average monthy (open water) evaporation (E) (mm)	16	26	[illegible]	74	114	129	130	100	68	36	16	14	773
Average monthly potential evapotranspiration (PE) (mm)	13	19	[illegible]	51	81	93	97	73	49	26	12	11	558

8.4.2 Topography and Landform Setting

The regional setting of the site is the western edge of the lowlands surrounding the River Barrow and its floodplain 6 km to the east. Topography at the site averages 75 m O.D. The land rises to the west south west and towards the northern edge of the Castlecomer Plateau and to a height of 340 m O.D. at Fossey Mountain at a distance of c. 10 km. These uplands are the catchment divide between the Barrow river catchment to the east, in which the site is located and the Nore river catchment to the west.

The site and surrounds are located in an area of hummocky topography, resulting from glacial deposition of sediments from melting ice, which extend up to 4 km south west, west and north of the site and approximately 1 km south and east. These glacial landforms comprise sediments which overlie the bedrock beneath. The landforms are predominantly deglacial hummocky sands and gravels, with discrete elongate sub-aqueous esker ridges running through the area (Geological Survey Ireland (2013) Quaternary Geology Map of Ireland).

The hummocky sands and gravel sediments are classified as glaciofluvial sands and gravels of Carboniferous limestone petrology. The esker sediments are classified as basic esker sands and gravels. (Primary source is Teagasc, 2006; 134% additional area of potential granular sediments in county Laois derived from GSI, 2000 (Draft)).

Flatter, lower lying areas around the Stradbally River and its tributaries are composed of alluvial soils and subsoils.

8.4.3 Regional Water Balance

The natural water balance for the region of hummocky sand and gravel and esker glacial deposits surrounding the site is dominated by groundwater recharge, with low rates of surface water run-off occurring.

The average annual water balance for the area surrounding the site is tabulated below. The water balance is derived from meteorological data (Met Eireann) and from effective rainfall and groundwater recharge data (Geological Survey of Ireland, 2018 and Hunter Williams et al, 2013). Effective rainfall is rainfall available for run-off and groundwater recharge. It is noted that the recharge mapping displayed on www.gsi.ie has not been updated to reflect updated mapping of the extents of glacio-fluvial sand and gravel subsoils in Co. Laois, by the Geological Survey of Ireland. The recharge co-efficient tabulated here, takes account of these most recent subsoil mapping results and is derived using the Geological Survey of Ireland recharge calculation method (Hunter Williams et al, 2013).

Table 8.6 Annual average regional water balance

Water Balance Inputs and Outputs	Average Annual (mm)
Rainfall (Met Eireann 1 km grid 1981-2010) (mm)	830
Pro-ratad monthly actual evapotranspiration (AE) Met Eireann in GSI/Hunter Williams *et al* (2013) (mm)	362
Effective Rainfall (ER) (mm)	468
Groundwater recharge (85% of ER) (mm)	398
Surface water run-off (15% of ER) (mm)	70

8.4.4 Hydrology (Surface Water) Regional Setting

Surface Watercourses and Catchments

The site is located in the South Eastern River Basin District, in the Barrow WFD Catchment/Hydrometric Area (No. 14). It is located in the Stradbally river sub-catchment. The Stradbally river is a tributary of the River Barrow and has a regional flow direction north eastward towards the River Barrow.

The Stradbally river flows eastwards at a distance of approximately 300 m south of the site, then turns to flow north at a distance of approximately 600 m east of the site (See Appendix 8.1, Figure 1). The Stradbally river has a total length of 9.48 km, is a 4th order river and flows into the Barrow river at a distance of 5 km downstream of the site. A small (unnamed on any map series) tributary of the Stradbally river flows predominantly north-west to south-east to the north of the site and joins the Stradbally river approximately 1.25 km north east of the site. A man-made drain, commencing approximately half way along the northern site boundary, runs eastwards, then northwards to connect with that tributary at approximately 0.75 km downstream of the site. The man-made drain has intermittent seasonal flow and therefore creates a seasonal connection between the site and the Stradbally river, located 1.25 km downstream of the site. Two hydrometric stations are located close to the site on the Stradbally river, EPA Station 14044 Stradbally 3.24 km upstream of, and OPW 14007 Derrybrock 2.76 km downstream of where the

LEGEND:

🟥	Site Boundary
▭	Surface water Catchment Boundary
—	Surface watercourses
▲	Upstrean and downstream WFD Monitoring
★	Hydrometric Stations (OPW and EPA)

Title: Figure 1 Regional Hydrology

Drawing No: 135_1

Project: EIAR Proposed Quarry, Garrons, Co. Laois

Stage: Final Water

Client: Pat Booth

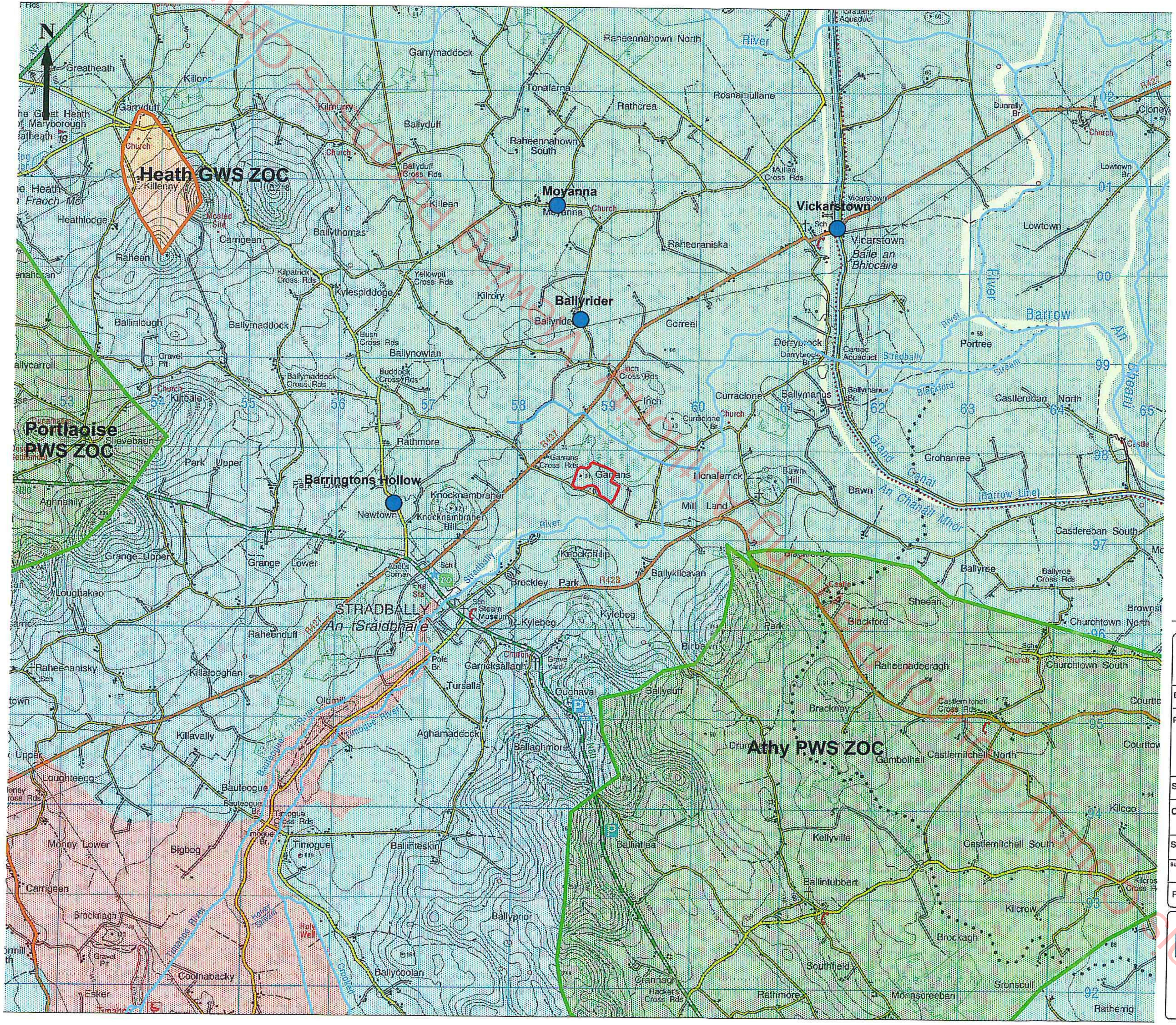
Scale: 1:40,000 @ A3

surveyed	drawn	checked	date
	ST	ST	23/6/2020

Revisions: Rev. 0

TYNAN ENVIRONMENTAL
environmental and hydrogeological consulting

7 Hillcrest Park
Strandhill, Co. Sligo
T +353 71 9128395
F +353 71 9128395
stynan@tynanenvironmental.com
www.tynanenvironmental.com



LEGEND:

🟥 Site Boundary

— Surface watercourses

▨ Regionally Important Karst Limestone Bedrock Aquifer and Bagnelstown Upper GWB

▨ Locally Importnat Gravel Aquifer and Timahoe GWB

🟩 Publiic water supply ZOC

🟧 Group Water Scheme ZOC

● Settlement with Group Water Scheme

Irish Public Sector Data (Geological Survey, EPA) licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence

Title: Figure 2 Regional Hydrogeology and Water Supplies

Drawing No: 135_1

Project: EIAR Proposed Quarry, Garrons, Co. Laois

Stage: Final Water

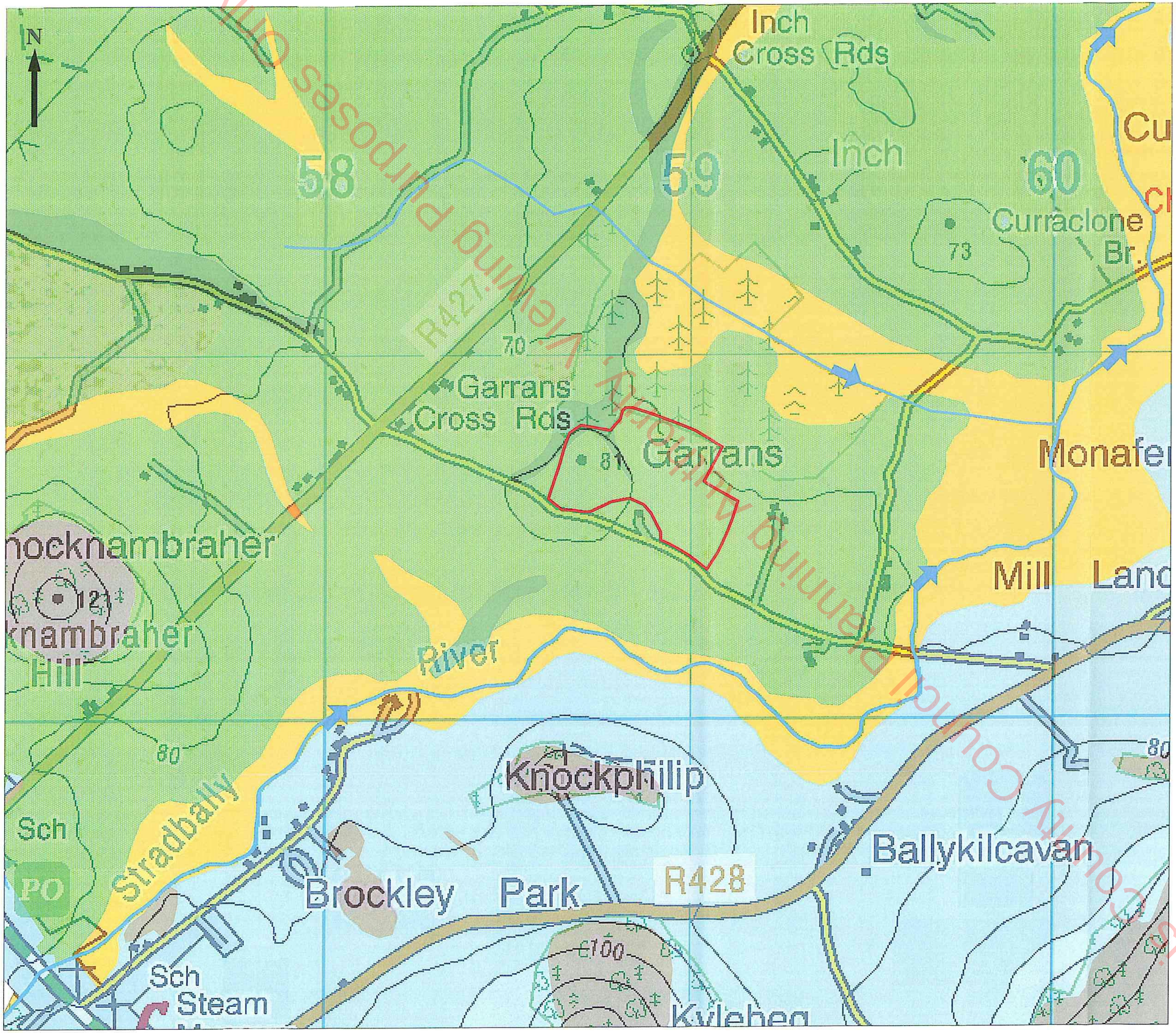
Client: Pat Booth.

Scale: 1:40,000 @ A3

surveyed	drawn	checked	date
	ST	ST	23/6/2020

Revisions: Rev. 0

TYNAN ENVIRONMENTAL
environmental and hydrogeological consulting
7 Hillcrest Park
Strandhill, Co. Sligo
T +353 71 9128395
F +353 71 9128395
stynan@tynanenvironmental.com
www.tynanenvironmental.com



LEGEND:

🟥 Site Boundary

Surface watercourses

Subsoils

- 🟨 Alluvium
- 🟩 Basic Esker Sands & Gravels (Glaciofluvial)
- ▨ Limestone Sands & Gravels (Glaciofluvial)
- ⬜ Karst Limestone Bedrock exposure
- 🟦 Till derived from limestone bedrock

Irish Public Sector Data (Geological Survey, EPA) licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence

Title:
Figure 3 Subsoils

Drawing No: 135_3

Project:
EIAR Proposed Quarry,
Garrons, Co. Laois

Stage: Final Water

Client: Pat Booth.

Scale: 1:10,000 @ A3

surveyed	drawn	checked	date
	ST	ST	23/6/2020

Revisions: Rev. 0

TYNAN ENVIRONMENTAL
environmental and hydrogeological consulting

7 Hillcrest Park
Strandhill, Co. Sligo

T +353 71 9128395
F +353 71 9128395

stynan@tynanenvironmental.com
www.tynanenvironmental.com

LEGEND:

🟥	Site Boundary
—	Surface watercourses
- - -	Man-made drain
▲	WFD monitoring location
■	Study surface water sampling points
▨	River Barrow and River Nore SAC

Irish Public Sector Data (Geological Survey, EPA) licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence

Title:	Figure 4 Surface Water and Hydrology Site and Environs		
Drawing No:	135_4		
Project:	EIAR Proposed Quarry, Garrons, Co. Laois		
Stage:	Final Water		
Client:	Pat Booth		
Scale:	1:6,000 @ A3		
surveyed	drawn ST	checked ST	date 23/6/2020
Revisions:	Rev. 0		

TYNAN ENVIRONMENTAL
environmental and hydrogeological consulting

7 Hillcrest Park
Strandhill, Co. Sligo
T +353 71 9128395
F +353 71 9128395
stynan@tynanenvironmental.com
www.tynanenvironmental.com

LEGEND:

🟥	Site Boundary
─	Surface watercourses
┄	Man-made drain
▨	River Barrow and River Nore SAC
─	Zone of groundwater springs
◉	Groundwater monitoring borehole
⬚	ZOC 2 (Notional)
☐	ZOC 1 (Maximum average abstraction)
◉	Proposed Abstraction Borehole
🟧	Adjacent Properties
─	Groundwater Flow Direction

Irish Public Sector Data (Geological Survey, EPA) licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence

Title: Figure 5 Groundwater & Hydrogeology
Site and Environs

Drawing No: 135_5

Project:
EIAR Proposed Quarry,
Garrons, Co. Laois

Stage: Final Water

Client: Pat Booth

Scale: 1:6,000 @ A3

surveyed	drawn	checked	date
	ST	ST	23/6/2020

Revisions: Rev. 0

TYNAN ENVIRONMENTAL
environmental and hydrogeological consulting
7 Hillcrest Park
Strandhill, Co. Sligo
T +353 71 9128395
F +353 71 9128395
stynan@tynanenvironmental.com
www.tynanenvironmental.com

Appendix 8.2: Surface Water Run-off and Storage Calculation

Greenfield Run-off Calculations
Storm Water Storage Calculations

STORM WATER ATTENUATION STORAGE VOLUME

Return Period (yrs): 20
Pervious area (ha): 12.76
Impervious area (ha): 0.08

(Hours)	Duration (min)	Duration (sec)	Depth (mm)	Depth (m)	Depth (m) +20% CC Allowance	Intensity (m/hr)	Effective rainfall intensity (m/hr)	Discharge (m^3/s)	Volume (m^3)	Greenfield Runoff (m^3)	Required Storage (m^3)
	5	300	10.3	0.0103	0.01236	0.1236	0.0309	1.1021	330.6	3.3	327.3
	10	600	14.4	0.0144	0.01728	0.0864	0.0216	0.7704	462.2	6.6	455.6
	15	900	17	0.017	0.0204	0.0680	0.0170	0.6063	545.7	9.9	535.8
	30	1800	20.1	0.0201	0.02412	0.0402	0.0101	0.3585	645.2	19.9	625.3
1	60	3600	23.7	0.0237	0.02844	0.0237	0.0059	0.2113	760.8	39.8	721.0
2	120	7200	28	0.028	0.0336	0.0140	0.0035	0.1248	898.8	79.5	819.3
3	180	10800	30.9	0.0309	0.03708	0.0103	0.0026	0.0918	991.9	119.3	872.6
4	240	14400	33.1	0.0331	0.03972	0.0083	0.0021	0.0738	1062.5	159.0	903.5
6	360	21600	36.6	0.0366	0.04392	0.0061	0.0015	0.0544	1174.9	238.5	936.4
8	480	28800	40.3	0.0403	0.04836	0.0050	0.0013	0.0449	1293.6	318.0	975.6
10	600	36000	43.2	0.0432	0.05184	0.0043	0.0011	0.0385	1386.7	397.5	989.2
12	720	43200	47.7	0.0477	0.05724	0.0040	0.0010	0.0354	1531.2	477.0	**1054.2**
24	1440	86400	51.1	0.0511	0.06132	0.0021	0.0005	0.0190	1640.3	954.0	686.3
								Maximum Required Storage (m^3)			**1054.2**

GREENFIELD RUN-OFF RATES : QBAR and Increased Return Periods

Site: **134_Garrons, Co. Laois**

QBAR: Institute of Hydrology 124 (1994) 3 Parameter Equation Rural QBAR = 0.00108(0.0
*AREA)^0.89*SAAR^1.17*SPR^2.17

Type	Location	AREA (ha)	SAAR	SPR	QBAR (m3/s/50 ha)	QBAR (l/s/50 ha)	QBAR (l/s/area)
Greenfield	Arbitrary 50 ha	50.00	830	0.15	0.024714194	24.71419446	24.71419446
Greenfield	1 ha	1.00					**0.494283889**
Greenfield	Site Area	12.84					**6.346605138**

Flood Growth Factors Ireland East*	Storm Return Period (years)	Site Run-off (l/s)	Site Run-off (m^3/s)
	2.3 (QBAR)	6.346605138	0.006346605
1.38	10	8.75831509	0.008758315
1.45	20	9.20257745	0.009202577
1.74	50	11.04309294	0.011043093

***Cawley and Cunnane (2013) interpolated for T = 20**

Appendix 8.3: Certificates of Analysis

els

ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

ISO 17025
INAB
ACCREDITED
TESTING
DETAILED IN SCOPE REG NO.111T

		Report Number	**171682 - 1**
		Sample Number	171682/001
		Date of Receipt	13/12/2019
		Date Started	13/12/2019
Tel No		**Received or Collected**	ELS-Sampled
Customer PO	requested	**Date of Report**	23/01/2020
Project No.	QN009847	**Sample Type**	Surface Waters
Customer Ref	SW4	**Condition on receipt**	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
BOD									
	BOD		EW001	1.0		2.0	mg/L	INAB	
Coliforms									
	Total Coliforms	*	Default-N	0		218	MPN/100ml	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		10	mg/L		
Dissolved Oxygen (Site Test)									
	Dissolved Oxygen (Site Test)		EW043S	0		10	mg/L		
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		0.009	mg/l N	INAB	
	Ammonium as NH4 (calc)		EW175	0.006		0.011	mg/l NH4	INAB	
	Chloride mg/L		EW175	1.0		13	mg/L	INAB	
Gallery Plus-Suite A-Dissolved									
	Ammonia as N-Dissolved		EW175	0.0050		0.013	mg/l N	INAB	
	Colour-Dissolved (True)		EW175	2.00		9.53	PtCo	INAB	
	Nitrate as N-Dissolved		EW175	0.15		5.1	mg/l N	INAB	
	Nitrite as N-Dissolved		EW175	0.005		<0.005	mg/l N	INAB	
	Phosphate (Ortho/MRP) as P-Dissolved		EW175	0.005		0.015	mg/l P	INAB	
	Total Oxidised Nitrogen (TON) as N-Dissolved		EW175	0.15		5.1	mg/l N	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH-C8 to C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L		
Inorganic Nitrogen-Dissolved (CalcGallery)									
	Inorganic Nitrogen-Dissolved (CalcGallery)		EW175	0.161		5.110	mg/l N		
Metals-Trace									
	Total Hardness (Calc)		EW188	3.0		378.0	mg/L CaCO3		
	Manganese		EW188	1.0		2.1	ug/L	INAB	
	Calcium		EW188	0.1		141.4	mg/L		
	Magnesium		EW188	0.3		6.0	mg/L	INAB	
Micro-Faecal Coliforms (Sub 6)									
	Faecal Coliforms	*	Default	1		180	cfu/100ml	YES	

Signed : Rachel Walsh 23/01/2020

Rachel Walsh-Technical Manager

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test
7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised

els

ENVIRONMENTAL LABORATORY SERVICES

EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

ISO 17025
INAB
ACCREDITED
TESTING
DETAILED IN SCOPE REG NO.111T

Report Number 171682 - 1
Sample Number 171682/001
Date of Receipt 13/12/2019
Date Started 13/12/2019

Tel No
Customer PO requested
Project No. QN009847
Customer Ref SW4

Received or Collected ELS-Sampled
Date of Report 23/01/2020
Sample Type Surface Waters
Condition on receipt Satisfactory

CERTIFICATE OF ANALYSIS

TEST ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Suspended Solids								
Suspended Solids		EW013	5		8	mg/L	INAB	
Temperature (Site)								
Temperature (Site)		GLP10	0.0		7.7	Deg C		
Titralab								
pH		EW153	0.0		7.9	pH Units	INAB	
Conductivity @20 DegC		EW153	25		582	uscm-1@20	INAB	
Alkalinity Total (R2 pH4.5)		EW153	10		217	mg/L CaCO3	INAB	
Total Dissolved Solids (TDS)								
Total Dissolved Solids (TDS)		EW046	15		397	mg/L	INAB	
Total Organic Carbon (TOC)								
Total Organic Carbon (TOC)		EW123	0.25		4.81	mg/L	INAB	
Turbidity								
Turbidity		EW136	0.1		0.2	NTU	INAB	

Signed : Rachel Walsh 23/01/2020

Rachel Walsh-Technical Manager

NOTES

1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test
7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised

els
ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

ISO 17025
INAB
ACCREDITED
TESTING
DETAILED IN SCOPE REG NO.111T

Tel No		**Report Number**	**171682 - 1**
Customer PO	requested	**Sample Number**	171682/002
Project No.	QN009847	**Date of Receipt**	13/12/2019
Customer Ref	SW1	**Date Started**	13/12/2019
		Received or Collected	ELS-Sampled
		Date of Report	23/01/2020
		Sample Type	Surface Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
BOD									
	BOD		EW001	1.0		<1.0	mg/L	INAB	
Coliforms									
	Total Coliforms	*	Default-N	0		1733	MPN/100ml	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		12	mg/L		
Dissolved Oxygen (Site Test)									
	Dissolved Oxygen (Site Test)		EW043S	0		10	mg/L		
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		0.023	mg/l N	INAB	
	Ammonium as NH4 (calc)		EW175	0.006		0.029	mg/l NH4	INAB	
	Chloride mg/L		EW175	1.0		19	mg/L	INAB	
Gallery Plus-Suite A-Dissolved									
	Ammonia as N-Dissolved		EW175	0.0050		0.025	mg/l N	INAB	
	Colour-Dissolved (True)		EW175	2.00		26.20	PtCo	INAB	
	Nitrate as N-Dissolved		EW175	0.15		4.9	mg/l N	INAB	
	Nitrite as N-Dissolved		EW175	0.005		0.011	mg/l N	INAB	
	Phosphate (Ortho/MRP) as P-Dissolved		EW175	0.005		0.035	mg/l P	INAB	
	Total Oxidised Nitrogen (TON) as N-Dissolved		EW175	0.15		4.9	mg/l N	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH-C8 to C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L		
Inorganic Nitrogen-Dissolved (CalcGallery)									
	Inorganic Nitrogen-Dissolved (CalcGallery)		EW175	0.161		4.934	mg/l N		
Metals-Trace									
	Total Hardness (Calc)		EW188	3.0		285.9	mg/L CaCO3	INAB	
	Manganese		EW188	1.0		31	ug/L	INAB	
	Calcium		EW188	0.1		103.7	mg/L		
	Magnesium		EW188	0.3		6.5	mg/L	INAB	
Micro-Faecal Coliforms (Sub 6)									
	Faecal Coliforms	*	Default	1		520	cfu/100ml	YES	

Rachel Walsh

Signed : ______________________________ 23/01/2020

Rachel Walsh-Technical Manager

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test
7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised

els ENVIRONMENTAL LABORATORY SERVICES
ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

ISO 17025
INAB
ACCREDITED
TESTING
DETAILED IN SCOPE REG NO.111T

Tel No		**Report Number**	**171682 - 1**
Customer PO	requested	**Sample Number**	171682/002
Project No.	QN009847	**Date of Receipt**	13/12/2019
Customer Ref	SW1	**Date Started**	13/12/2019
		Received or Collected	ELS-Sampled
		Date of Report	23/01/2020
		Sample Type	Surface Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Suspended Solids									
	Suspended Solids		EW013	5		6	mg/L	INAB	
Temperature (Site)									
	Temperature (Site)		GLP10	0.0		6.6	Deg C		
Titralab									
	pH		EW153	0.0		8.0	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		474	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		231	mg/L CaCO3	INAB	
Total Dissolved Solids (TDS)									
	Total Dissolved Solids (TDS)		EW046	15		303	mg/L	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		5.35	mg/L	INAB	
Turbidity									
	Turbidity		EW136	0.1		3.5	NTU	INAB	

Signed : Rachel Walsh 23/01/2020

Rachel Walsh-Technical Manager

NOTES

1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.

2.SPEC= Allowable limit or parametric value

3.OOS=Result which is outside specification highlighted as OOS-A

4.LOQ=Limit of Quantification or lowest value that can be reported

5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited

6."*" Indicates sub-contract test

7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised

els
ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

ISO 17025
INAB
ACCREDITED
TESTING
DETAILED IN SCOPE REG NO.111T

		Report Number	**171682 - 1**
		Sample Number	171682/003
		Date of Receipt	13/12/2019
		Date Started	13/12/2019
Tel No		**Received or Collected**	ELS-Sampled
Customer PO	requested	**Date of Report**	23/01/2020
Project No.	QN009847	**Sample Type**	Surface Waters
Customer Ref	SW5	**Condition on receipt**	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
BOD									
	BOD		EW001	1.0		1.5	mg/L	INAB	
Coliforms									
	Total Coliforms	*	Default-N	0		579	MPN/100ml	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		11	mg/L		
Dissolved Oxygen (Site Test)									
	Dissolved Oxygen (Site Test)		EW043S	0		11	mg/L		
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		0.006	mg/l N	INAB	
	Ammonium as NH4 (calc)		EW175	0.006		0.008	mg/l NH4	INAB	
	Chloride mg/L		EW175	1.0		24	mg/L	INAB	
Gallery Plus-Suite A-Dissolved									
	Ammonia as N-Dissolved		EW175	0.0050		0.015	mg/l N	INAB	
	Colour-Dissolved (True)		EW175	2.00		15.70	PtCo	INAB	
	Nitrate as N-Dissolved		EW175	0.15		6.4	mg/l N	INAB	
	Nitrite as N-Dissolved		EW175	0.005		<0.005	mg/l N	INAB	
	Phosphate (Ortho/MRP) as P-Dissolved		EW175	0.005		0.024	mg/l P	INAB	
	Total Oxidised Nitrogen (TON) as N-Dissolved		EW175	0.15		6.5	mg/l N	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH-C8 to C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L		
Inorganic Nitrogen-Dissolved (CalcGallery)									
	Inorganic Nitrogen-Dissolved (CalcGallery)		EW175	0.161		6.469	mg/l N		
Metals-Trace									
	Total Hardness (Calc)		EW188	3.0		426.2	mg/L CaCO3		
	Manganese		EW188	1.0		30	ug/L	INAB	
	Calcium		EW188	0.1		151.9	mg/L		
	Magnesium		EW188	0.3		11.4	mg/L	INAB	
Micro-Faecal Coliforms (Sub 6)									
	Faecal Coliforms	*	Default	1		140	cfu/100ml	YES	

Signed : Rachel Walsh 23/01/2020

Rachel Walsh-Technical Manager

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test
7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised

els
ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

ISO 17025
INAB
ACCREDITED
TESTING
DETAILED IN SCOPE REG NO.111T

		Report Number	**171682 - 1**
		Sample Number	171682/003
		Date of Receipt	13/12/2019
		Date Started	13/12/2019
Tel No		**Received or Collected**	ELS-Sampled
Customer PO	requested	**Date of Report**	23/01/2020
Project No.	QN009847	**Sample Type**	Surface Waters
Customer Ref	SW5	**Condition on receipt**	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Suspended Solids									
	Suspended Solids		EW013	5		<5	mg/L	INAB	
Temperature (Site)									
	Temperature (Site)		GLP10	0.0		7.3	Deg C		
Titralab									
	pH		EW153	0.0		8.0	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		650	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		234	mg/L CaCO3	INAB	
Total Dissolved Solids (TDS)									
	Total Dissolved Solids (TDS)		EW046	15		377	mg/L	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		4.69	mg/L	INAB	
Turbidity									
	Turbidity		EW136	0.1		0.6	NTU	INAB	

Signed : Rachel Walsh 23/01/2020

Rachel Walsh-Technical Manager

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test
7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised

els

ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

INAB ISO 17025 ACCREDITED TESTING
DETAILED IN SCOPE REG NO.111T

Tel No		**Report Number**	**171682 - 1**
Customer PO	requested	**Sample Number**	171682/004
Project No.	QN009847	**Date of Receipt**	13/12/2019
Customer Ref	SW6	**Date Started**	13/12/2019
		Received or Collected	ELS-Sampled
		Date of Report	23/01/2020
		Sample Type	Surface Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
BOD									
	BOD		EW001	1.0		<1.0	mg/L	INAB	
Coliforms									
	Total Coliforms	*	Default-N	0		1300	MPN/100ml	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		10	mg/L		
Dissolved Oxygen (Site Test)									
	Dissolved Oxygen (Site Test)		EW043S	0		10	mg/L		
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		0.005	mg/l N	INAB	
	Ammonium as NH4 (calc)		EW175	0.006		0.006	mg/l NH4	INAB	
	Chloride mg/L		EW175	1.0		24	mg/L	INAB	
Gallery Plus-Suite A-Dissolved									
	Ammonia as N-Dissolved		EW175	0.0050		0.037	mg/l N	INAB	
	Colour-Dissolved (True)		EW175	2.00		14.20	PtCo	INAB	
	Nitrate as N-Dissolved		EW175	0.15		6.2	mg/l N	INAB	
	Nitrite as N-Dissolved		EW175	0.005		0.006	mg/l N	INAB	
	Phosphate (Ortho/MRP) as P-Dissolved		EW175	0.005		0.023	mg/l P	INAB	
	Total Oxidised Nitrogen (TON) as N-Dissolved		EW175	0.15		6.2	mg/l N	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH-C8 to C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L		
Inorganic Nitrogen-Dissolved (CalcGallery)									
	Inorganic Nitrogen-Dissolved (CalcGallery)		EW175	0.161		6.195	mg/l N		
Metals-Trace									
	Total Hardness (Calc)		EW188	3.0		424.8	mg/L CaCO3		
	Manganese		EW188	1.0		34	ug/L	INAB	
	Calcium		EW188	0.1		151.2	mg/L		
	Magnesium		EW188	0.3		11.5	mg/L	INAB	
Micro-Faecal Coliforms (Sub 6)									
	Faecal Coliforms	*	Default	1		880	cfu/100ml	YES	

Signed : Rachel Walsh 23/01/2020

Rachel Walsh-Technical Manager

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test
7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised

els
ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

ISO 17025
INAB
ACCREDITED
TESTING
DETAILED IN SCOPE REG NO.111T

Report Number	**171682 - 1**
Sample Number	171682/004
Date of Receipt	13/12/2019
Date Started	13/12/2019
Received or Collected	ELS-Sampled
Date of Report	23/01/2020
Sample Type	Surface Waters
Condition on receipt	Satisfactory

Tel No	
Customer PO	requested
Project No.	QN009847
Customer Ref	SW6

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Suspended Solids									
	Suspended Solids		EW013	5		<5	mg/L	INAB	
Temperature (Site)									
	Temperature (Site)		GLP10	0.0		7.6	Deg C		
Titralab									
	pH		EW153	0.0		8.1	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		649	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		239	mg/L CaCO3	INAB	
Total Dissolved Solids (TDS)									
	Total Dissolved Solids (TDS)		EW046	15		374	mg/L	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		4.86	mg/L	INAB	
Turbidity									
	Turbidity		EW136	0.1		0.7	NTU	INAB	

Signed : Rachel Walsh 23/01/2020

Rachel Walsh-Technical Manager

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test
7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised

ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

INAB ACCREDITED TESTING ISO 17025
DETAILED IN SCOPE REG NO.111T

		Report Number	**171682 - 1**
		Sample Number	171682/005
		Date of Receipt	13/12/2019
		Date Started	13/12/2019
Tel No		**Received or Collected**	ELS-Sampled
Customer PO	requested	**Date of Report**	23/01/2020
Project No.	QN009847	**Sample Type**	Surface Waters
Customer Ref	SW2	**Condition on receipt**	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
BOD									
	BOD		EW001	1.0		1.6	mg/L	INAB	
Coliforms									
	Total Coliforms	*	Default-N	0		2420	MPN/100ml	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		12	mg/L		
Dissolved Oxygen (Site Test)									
	Dissolved Oxygen (Site Test)		EW043S	0		10	mg/L		
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		<0.005	mg/l N	INAB	
	Ammonium as NH4 (calc)		EW175	0.006		<0.006	mg/l NH4	INAB	
	Chloride mg/L		EW175	1.0		20	mg/L	INAB	
Gallery Plus-Suite A-Dissolved									
	Ammonia as N-Dissolved		EW175	0.0050		0.022	mg/l N	INAB	
	Colour-Dissolved (True)		EW175	2.00		25.07	PtCo	INAB	
	Nitrate as N-Dissolved		EW175	0.15		4.1	mg/l N	INAB	
	Nitrite as N-Dissolved		EW175	0.005		0.167	mg/l N	INAB	
	Phosphate (Ortho/MRP) as P-Dissolved		EW175	0.005		0.046	mg/l P	INAB	
	Total Oxidised Nitrogen (TON) as N-Dissolved		EW175	0.15		4.1	mg/l N	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH-C8 to C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L		
Inorganic Nitrogen-Dissolved (CalcGallery)									
	Inorganic Nitrogen-Dissolved (CalcGallery)		EW175	0.161		4.278	mg/l N		
Metals-Trace									
	Total Hardness (Calc)		EW188	3.0		291.7	mg/L CaCO3	INAB	
	Manganese		EW188	1.0		29	ug/L	INAB	
	Calcium		EW188	0.1		106.0	mg/L		
	Magnesium		EW188	0.3		6.5	mg/L	INAB	
Micro-Faecal Coliforms (Sub 6)									
	Faecal Coliforms	*	Default	1		510	cfu/100ml	YES	

Signed : Rachel Walsh 23/01/2020

Rachel Walsh-Technical Manager

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test
7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised

ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

INAB ISO 17025 ACCREDITED TESTING
DETAILED IN SCOPE REG NO.111T

		Report Number	**171682 - 1**
		Sample Number	171682/005
		Date of Receipt	13/12/2019
		Date Started	13/12/2019
Tel No		**Received or Collected**	ELS-Sampled
Customer PO	requested	**Date of Report**	23/01/2020
Project No.	QN009847	**Sample Type**	Surface Waters
Customer Ref	SW2	**Condition on receipt**	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Suspended Solids									
	Suspended Solids		EW013	5		8	mg/L	INAB	
Temperature (Site)									
	Temperature (Site)		GLP10	0.0		7.3	Deg C		
Titralab									
	pH		EW153	0.0		8.1	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		486	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		238	mg/L CaCO3	INAB	
Total Dissolved Solids (TDS)									
	Total Dissolved Solids (TDS)		EW046	15		282	mg/L	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		5.11	mg/L	INAB	
Turbidity									
	Turbidity		EW136	0.1		2.9	NTU	INAB	

Signed : Rachel Walsh 23/01/2020

Rachel Walsh-Technical Manager

NOTES

1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test
7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised

els
ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.elsltd.com
email:info@elsltd.com

ISO 17025
INAB
ACCREDITED
TESTING
DETAILED IN SCOPE REG NO.111T

		Report Number	**171682 - 1**
		Sample Number	171682/006
		Date of Receipt	13/12/2019
		Date Started	13/12/2019
Tel No		**Received or Collected**	ELS-Sampled
Customer PO	requested	**Date of Report**	23/01/2020
Project No.	QN009847	**Sample Type**	Surface Waters
Customer Ref	SW3	**Condition on receipt**	Satisfactory

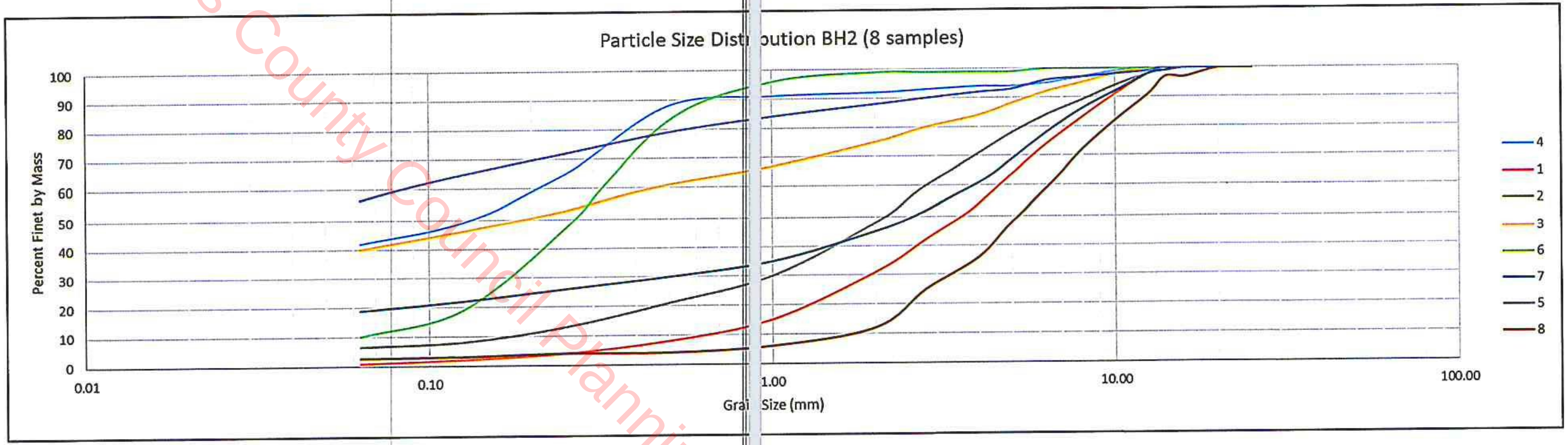
CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
BOD									
	BOD		EW001	1.0		1.7	mg/L	INAB	
Coliforms									
	Total Coliforms	*	Default-N	0		1733	MPN/100ml	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		11	mg/L		
Dissolved Oxygen (Site Test)									
	Dissolved Oxygen (Site Test)		EW043S	0		10	mg/L		
Gallery Plus-Suite A									
	Ammonia as N		EW175	0.005		<0.005	mg/l N	INAB	
	Ammonium as NH4 (calc)		EW175	0.006		<0.006	mg/l NH4	INAB	
	Chloride mg/L		EW175	1.0		21	mg/L	INAB	
Gallery Plus-Suite A-Dissolved									
	Ammonia as N-Dissolved		EW175	0.0050		0.024	mg/l N	INAB	
	Colour-Dissolved (True)		EW175	2.00		22.06	PtCo	INAB	
	Nitrate as N-Dissolved		EW175	0.15		4.6	mg/l N	INAB	
	Nitrite as N-Dissolved		EW175	0.005		0.009	mg/l N	INAB	
	Phosphate (Ortho/MRP) as P-Dissolved		EW175	0.005		0.028	mg/l P	INAB	
	Total Oxidised Nitrogen (TON) as N-Dissolved		EW175	0.15		4.7	mg/l N	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH-C8 to C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L		
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
Inorganic Nitrogen-Dissolved (CalcGallery)									
	Inorganic Nitrogen-Dissolved (CalcGallery)		EW175	0.161		4.678	mg/l N		
Metals-Trace									
	Total Hardness (Calc)		EW188	3.0		350.7	mg/L CaCO3		
	Manganese		EW188	1.0		27	ug/L	INAB	
	Calcium		EW188	0.1		125.8	mg/L		
	Magnesium		EW188	0.3		8.8	mg/L	INAB	
Micro-Faecal Coliforms (Sub 6)									
	Faecal Coliforms	*	Default	1		300	cfu/100ml	YES	

Signed : Rachel Walsh 23/01/2020

Rachel Walsh-Technical Manager

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test
7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised

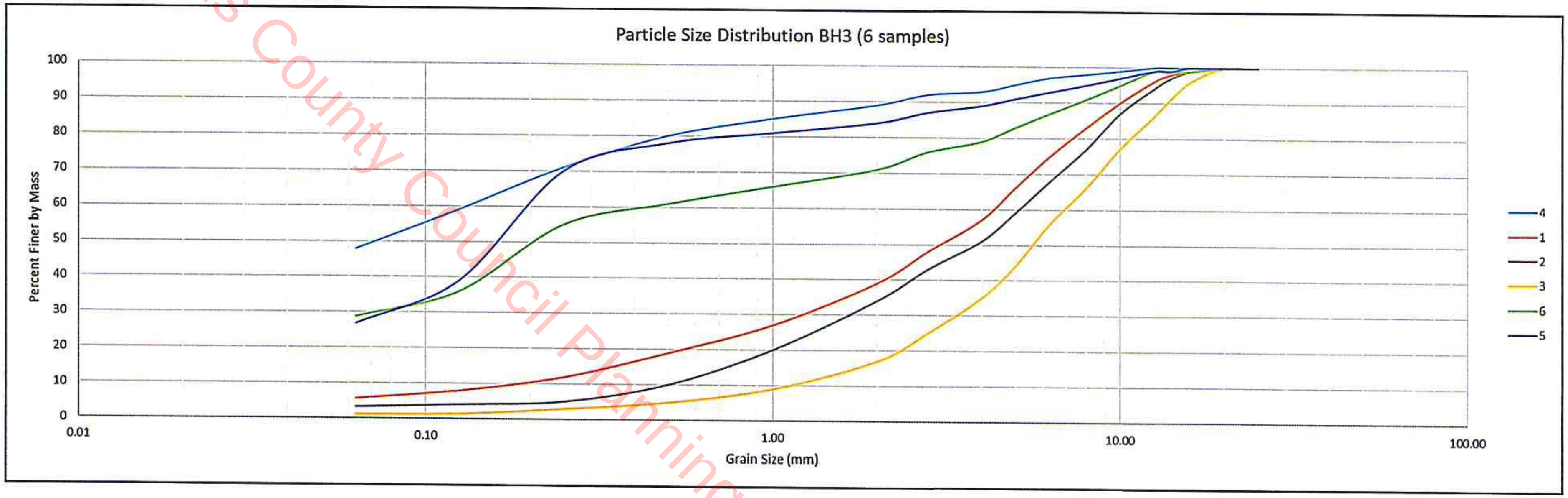


Borehole **BH2**

Method: Shepherd (in Fetter, 1988)

Coefficients: Textually immature Channel deposits C 450 1.65

Sample	1	2	3	4	5	6	7	8	Mean Hydraulic Conductivity K (m/day)	Average horizontal K (m/day) bGWL (saturated)	Average T (m2/d) bGWL (saturated)
d50 (mm)	2.8	2.2	1	0.11	0.06	0.27	0.063	5.2	1.46325		
K (ft/day)	2460.4994	1652.7605	450	11.789909	4.700287	51.875551	4.700287471	6833.104	662.3322847		
K (m/day) (Khm)	749.96022	503.76141	137.16	3.5935642	1.432647	15.811668	1.432647621	2082.730099	**201.8788804**		
bm	1.5	2.5	2.2	3.3		1.8	4.2	1			
b	20	20	20	20	2	20	20	20			
Khm*bm/b	56.247017	62.970177	15.0876	0.5929381	0.214897	1.4230501	0.300856	104.136505		**20.29264105**	**223.219052**



Borehole **BH3**

Method: Shepherd (in Fetter, 1988)

Coefficients: Texturally immature Channel deposits C 450 J 1.65

Sample	1	2	3	4	5	6	Mean Hydraulic Conductivity K (m/day)	Average horizontal K (m/day) bGWL (saturated)	Average T (m2/d) bGWL (saturated)
d50 (mm)	2	2.9	4.8	0.07	0.57	0.11	1.741666667		
K (ft/day)	1412.2514	2607.1692	5987.7072	5.5927355	177.99427	11.789909	1700.417443		
K (m/day) (Kmh)	430.45422	794.66516	1825.0532	1.7046658	54.252654	3.5935642	**518.2872366**		
bm	1.5	2.9	3.1	3	1.8	1.4			
b	20	20	20	20	20	20			
Khm*bm/b	32.284066	115.22645	282.88324	0.2556999	4.8827389	0.2515495		**72.06830685**	**720.6830685**

petersen drilling services ltd. on behalf of **Pat Booth**

Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test												
		No	Type	Insitu test	From (m)	To (m)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
0.00	Firm sandy TOPSOIL		RO		0.00	20.00	0000		100	brown												11.20
0.30	Medium dense brown silty SAND																					
0.60	Dense brown greyish sandy coarse GRAVEL with frequent cobbles and boulders																					
6.30	Medium dense brown SAND with occasional silt layers																					
7.80	Medium dense brown gravelly silty SAND																					
10.50	Soft to firm brown becoming grey slightly sandy SILT																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0950			
Finish time (hhmm)	**Hole (m)**	**Water (m)**	**Casing (m)**
1555	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer
C	140.00	0.00	20.00							
RO	154.00	0.00	20.00				DTH	115	Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
1225	6.30	6.30	Very Slow	0.00	0.00	0.00	0.00	11.00

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks
		General; mobilisation to site

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00

Drilling Crew Details		CSCS No
Support Operative	john whyte	
Lead Driller	stephan petersen	
Site category	Green	
Project Engineer	Suzanne Tynan	
Lead Driller's signature		

Project Title

Garrons Pit, Stradbally

Weather	Fine	Project No	23/18
Date	15/10/2018	Day	Monday
Rig type	knebel hy79	Borehole Number	
Inclination	Orientation	BH 1	
Sheet	1 of 2	Completed	Y

AGS

Produced by KeyLogbook

petersen drilling services ltd. on behalf of **Pa Booth**

Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test											
		No	Type	Insitu test	From (m)	To (m)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
17.10	Medium dense grey gravelly SAND																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0950			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1555	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
1350	17.10	17.10	Medium	11.20	11.20	11.20	11.20	N/S

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks

SPT . Numb	pd1	Calibration Date	18/09/2017
SPT R d Type	2 3/8 Regular	SPT Energy Ratio	0.00

Drillin Crew Details		CSCS No
Supp t Operative	john whyte	
Lead iller	stephan petersen	
Site c egory	Green	
Projec Engineer	Suzanne Tynan	
Lead iller's signature		

Project Title

Garrons Pit, Stradbally

Weather	Fine	Project No	23/18
Date	15/10/2018	Day	Monday
Rig type	knebel hy79	Borehole Number	
Inclination	Orientation	BH 1	
Sheet	2 of 2	Completed	Y

AGS

Produced by KeyLogbook

petersen drilling services ltd. on behalf of **Pat Booth** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test											
		No	Type	Insitu test	From (m)	To (m)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
0.00	Firm sandy TOPSOIL		RO		0.00	21.00	0000		100	grey												11.00
0.50	Dense brown greyish sandy GRAVEL with frequent cobbles and boulders																					
4.50	Loose becoming Medium dense brown SAND																					
7.70	Soft to firm brown becoming grey very silty CLAY																					
11.00	Firm brown greyish silty sandy CLAY																					
15.80	Dense brown greyish very sandy very clayey GRAVEL																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0815			
Finish time (hhmm)	**Hole (m)**	**Water (m)**	**Casing (m)**
1300	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer
C	140.00	0.00	21.00							
RO	154.00	0.00	21.00				DTH	115	Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
0800	8.00	8.00	Very Slow	0.00	0.00	0.00	0.00	8.50

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00

Drilling Crew Details		CSCS No
Support Operative	john whyte	
Lead Driller	stephan petersen	
Site category	Green	
Project Engineer	Suzanne Tynan	
Lead Driller's signature		

Project Title

Garrons Pit, Stradbally

Weather	Variable	Project No	23/18
Date	16/10/2018	Day	Tuesday
Rig type	knebel hy79	Borehole Number	
Inclination	Orientation	BH 2	
Sheet	1 of 2	Completed	Y

AGS

Produced by KeyLogbook

petersen drilling services ltd. on behalf of **Pa Booth** Rotary Drilling Log

Keynetix

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
20.00	Medium strong grey LIMESTONE weathered																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0815			
Finish time (hhmm)	**Hole (m)**	**Water (m)**	**Casing (m)**
1300	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
1200	20.00	20.00	Medium	11.00	11.00	0.00	0.00	N/S

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks

SPT I. Numb	pd1	Calibration Date	18/09/2017
SPT R d Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drillin Crew Details		CSCS No	
Suppc t Operative	john whyte		
Lead I iller	stephan petersen		
Site c egory	Green		
Projec Engineer	Suzanne Tynan		
Lead I iller's signature			

Project Title

Garrons Pit, Stradbally

Weather	Variable	Project No	23/18
Date	16/10/2018	Day	Tuesday
Rig type	knebel hy79	Borehole Number	
Inclination	Orientation	BH 2	
Sheet	2 of 2	Completed	Y

Produced by KeyLogbook

AGS

petersen drilling services ltd. on behalf of **Pat Booth** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test											
		No	Type	Insitu test	From (m)	To (m)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
0.00	Firm sandy TOPSOIL		RO		0.00	16.00	0000		100	grey												0.00
0.50	Medium dense grey brownish sandy GRAVEL																					
2.50	Dense grey sandy coarse GRAVEL with frequent cobbles and boulders																					
3.30	Dense brown reddish sandy coarse GRAVEL with frequent cobbles and boulders																					
3.70	Dense brown greyish sandy coarse GRAVEL with frequent cobbles and boulders																					
4.30	Firm grey very silty sandy CLAY																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
1205			
Finish time (hhmm)	**Hole (m)**	**Water (m)**	**Casing (m)**
1750	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer
C	140.00	0.00	16.00							
RO	154.00	0.00	16.00				DTH	115	Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
1420	3.50	3.50	Very Slow	0.00	0.00	0.00	0.00	4.50

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details		CSCS No	
Support Operative	john whyte		
Lead Driller	stephan petersen		
Site category	Green		
Project Engineer	Suzanne Tynan		
Lead Driller's signature			

Project Title

Garrons Pit, Stradbally

Weather	Variable	Project No	23/18
Date	16/10/2018	Day	Tuesday
Rig type	knebel hy79	Borehole Number	
Inclination	Orientation	BH 3	
Sheet	1 of 2	Completed	Y

AGS

Produced by KeyLogbook

petersen drilling services ltd. on behalf of **Pa Booth** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
9.50	Medium dense brown very silty SAND																					
11.80	LIMESTONE BOULDER																					
13.20	Soft to firm grey silty gravelly CLAY																					
15.00	Medium strong grey LIMESTONE weathered																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
1205			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1750	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
1420	9.50	9.50	Slow	0.00	0.00	0.00	0.00	13.50
1635	15.00	15.00	Very fast	3.50	3.50	0.00	0.00	N/S

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks

SPT I . Numb	pd1	Calibration Date	18/09/2017
SPT R d Type	2 3/8 Regular	SPT Energy Ratio	0.00

Drillin Crew Details		CSCS No
Supp t Operative	john whyte	
Lead I iller	stephan petersen	
Site c egory	Green	
Projec Engineer	Suzanne Tynan	
Lead I iller's signature		

Project Title

Garrons Pit, Stradbally

Weather	Variable	Project No	23/18
Date	16/10/2018	Day	Tuesday
Rig type	knebel hy79	Borehole Number	
Inclination	Orientation	BH 3	
Sheet	2 of 2	Completed	Y

AGS

Produced by KeyLogbook

petersen drilling services ltd. on behalf of **Pat Booth** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test											
		No	Type	Insitu test	From (m)	To (m)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
0.00	Firm sandy TOPSOIL		RO		0.00	17.30	0000		100	grey												9.20
0.50	Medium dense brown SAND																					
4.90	Soft to firm brown becoming grey sandy slightly gravelly SILT																					
10.50	Firm grey silty slightly sandy gravelly CLAY																					
14.10	Medium dense grey sandy clayey GRAVEL																					
15.90	Medium strong grey LIMESTONE weathered																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0745			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1535	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer
C	140.00	0.00	17.30							
RO	154.00	0.00	17.30				DTH	115	Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
0905	3.00	3.00	Very Slow	0.00	0.00	0.00	0.00	6.00
1005	15.90	15.90	Medium	0.00	0.00	0.00	0.00	N/S

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details		CSCS No	
Support Operative	john whyte		
Lead Driller	stephan petersen		
Site category	Green		
Project Engineer	Suzanne Tynan		
Lead Driller's signature			

Project Title

Garrons Pit, Stradbally

Weather	Fine	Project No	23/18
Date	17/10/2018	Day	Wednesday
Rig type	knebel hy79	Borehole Number	
Inclination	Orientation	BH 4	
Sheet	1 of 2	Completed	Y

AGS

Produced by KeyLogbook

petersen drilling services ltd. on behalf of **Pa Booth** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
17.00	Strong dark grey LIMESTONE																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0745			

Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1535	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks

SPT I Numb	pd1	Calibration Date	18/09/2017
SPT R d Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drillin Crew Details		CSCS No	
Suppc t Operative	john whyte		
Lead I iller	stephan petersen		
Site c egory	Green		
Projec Engineer	Suzanne Tynan		
Lead I iller's signature			

Project Title

Garrons Pit, Stradbally

Weather	Fine	Project No	23/18
Date	17/10/2018	Day	Wednesday
Rig type	knebel hy79	Borehole Number	
Inclination	Orientation	BH 4	
Sheet	2 of 2	Completed	Y

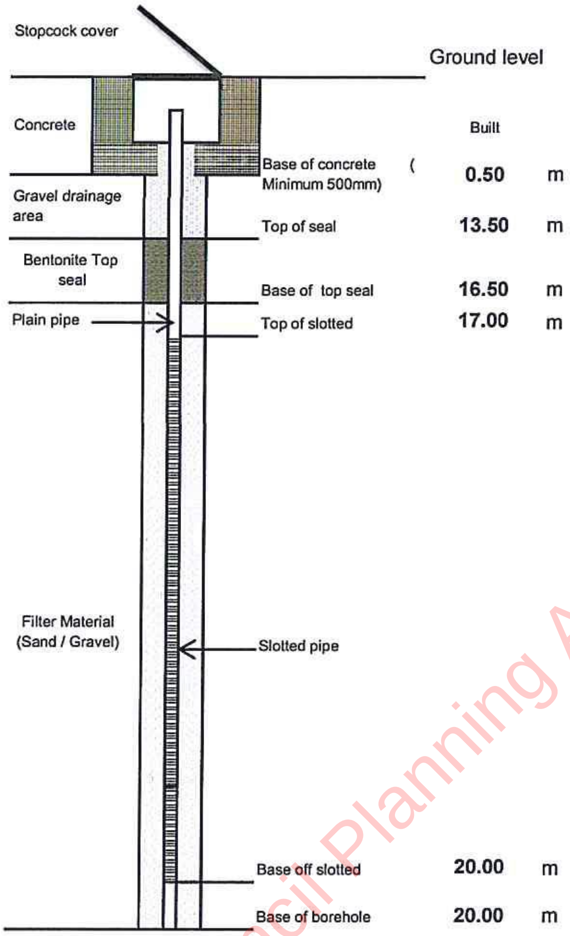
Produced by KeyLogbook

AGS

petersen drilling services

Summary of Standpipe Installation

Schematic Diagram
(not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	154	mm
Slot size	1	mm
Geosock	Yes	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	11.20	m
Time of Initial reading	1555	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	13.50	0.50
Borehole seal top	16.50	13.50
Filter zone	20.00	16.50
Plain pipe	17.00	GL
Slotted zone	20.00	17.00
Base of borehole	20.00	

Remarks

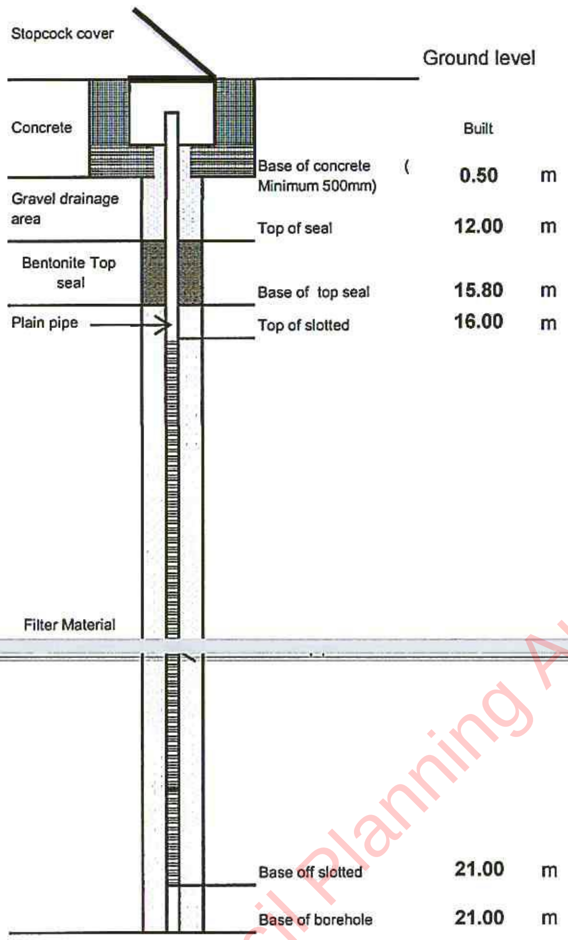
Rig type	knebel hy79	**Project Title**			
Drilling Crew Details		Garrons Pit, Stradbally			
Support Operative	john whyte				
Lead Driller	stephan petersen	**Project No**		23/18	
Site category	Green	**Day**	Monday	**Date**	October 15, 2018
Engineer	Suzanne Tynan			**Borehole Number**	
Lead Driller's signature				**BH 1**	

Produced by KeyLogbook

petersen drilling services

Summary of Standpipe Installation

Schematic Diagram
(not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	154	mm
Slot size	1	mm
Geosock	Yes	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	11.00	m
Time of Initial reading	1255	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	12.00	0.50
Borehole seal top	15.80	12.00
Filter zone	21.00	15.80
[illegible]	[illegible]	[illegible]
Slotted zone	21.00	16.00
Base of borehole	21.00	

Remarks

Rig type	knebel hy79	**Project Title**		
Drilling Crew Details		Garrons Pit, Stradbally		
Support Operative	john whyte			
Lead Driller	stephan petersen	**Project No**	23/18	
Site category	Green	**Day** Tuesday	**Date**	October 16, 2018
Engineer	Suzanne Tynan		**Borehole Number**	
Lead Driller's signature			**BH 2**	

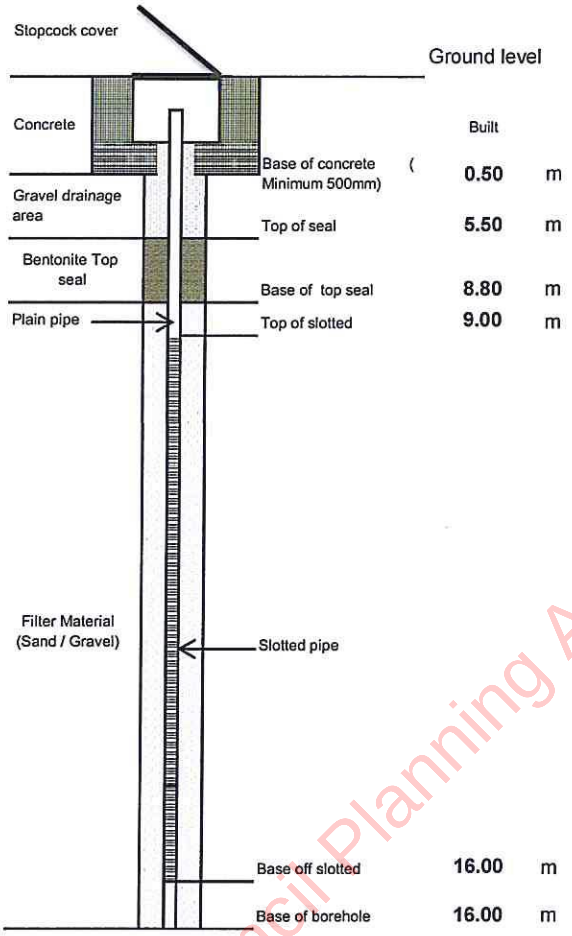
AGS

Produced by KeyLogbook

petersen drilling services

Summary of Standpipe Installation

Schematic Diagram
(not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	154	mm
Slot size	1	mm
Geosock	Yes	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	3.50	m
Time of Initial reading	1640	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	5.50	0.50
Borehole seal top	8.80	5.50
Filter zone	16.00	8.80
Plain pipe	9.00	GL
Slotted zone	16.00	9.00
Base of borehole	16.00	

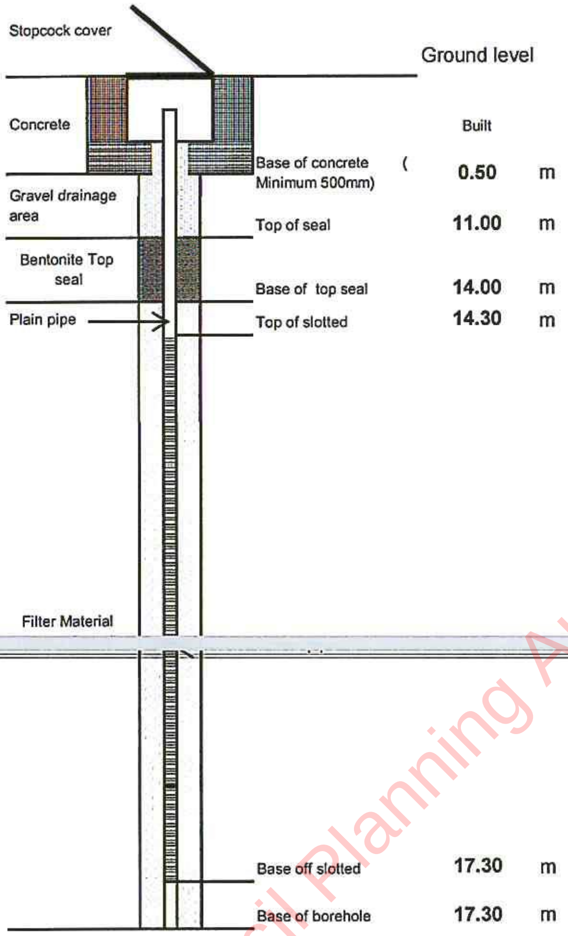
Remarks

Rig type	knebel hy79	**Project Title**			
Drilling Crew Details		Garrons Pit, Stradbally			
Support Operative	john whyte				
Lead Driller	stephan petersen	**Project No**		23/18	
Site category	Green	**Day**	Tuesday	**Date**	October 16, 2018
Engineer	Suzanne Tynan			**Borehole Number**	
Lead Driller's signature				**BH 3**	

petersen drilling services

Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	154	mm
Slot size	1	mm
Geosock	Yes	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	9.20	m
Time of Initial reading	1210	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	11.00	0.50
Borehole seal top	14.00	11.00
Filter zone	17.30	14.00
[illegible]	[illegible]	[illegible]
Slotted zone	17.30	14.30
Base of borehole	17.30	

Remarks

Rig type	knebel hy79
Drilling Crew Details	
Support Operative	john whyte
Lead Driller	stephan petersen
Site category	Green
Engineer	Suzanne Tynan
Lead Driller's signature	

Project Title

Garrons Pit, Stradbally

Project No		23/18	
Day	Wednesday	**Date**	October 17, 2018

Borehole Number

BH 4

AGS

Produced by KeyLogbook

GROUND INVESTIGATION REPORT

Client; Mr. Terence O'Shaughnessy, Stradbally, Co.Laois

performed by;

Land Surveying Services
Date: October 3, 2003

Confidential Report

Report Date: 22/10/2003

Page 1 of 3

HIGHWAY TESTING
LABORATORY LTD.

Test Report ID: 03/329

Grading Analysis Test Report

(tested in accordance with B.S. 812: Part 103.1: 1985)

Client: Steve Boyd
Material: Sand
Quarry Location: Co. Laois

Ht Ref.: SBoyd03329
Date Rec.: 06/10/2003
Date Tested: 09/10/2003

Grading Analysis Results (% Passing)

B.S. Test Sieve Size	TPA	TPB
75mm	100.0	100.0
50mm	97.8	100.0
37.5mm	91.5	100.0
28mm	83.1	100.0
20mm	73.1	100.0
14mm	65.2	97.7
10mm	58.3	95.0
6.3mm	50.7	89.8
5mm	47.5	87.2
3.35mm	41.4	83.5
2.36mm	35.4	80.5
1.18mm	23.0	71.3
600µm	12.5	54.6
425µm	8.1	38.4
300µm	5.3	20.5
150µm	2.8	4.4
75µm	2.1	2.9

95%
25%
25%
12½

Table 1: Grading Analysis of 2 No. Samples of Sand.

Remarks:

1. Gradings determined by Wet Sieve Analysis.

Authorised Signature. Michael F

Michael Finn
Quality Manager

Date: 22/10/03

Preamble

On Friday October 3, 2003 Land Surveying Services visited the lands of Mr. Terence O'Shaughnessy at his request to perform Trial Pits to determine soil types and to quantify volume of in-situ material available for possible quarrying on the land as designated by Mr. O'Shaughnessy (Ordinance Survey Plot No. 227686_2_1 dated 5 September 2003 attached).

Mr. O'Shaughnessy had arranged for a Hitachi EX120 Hydraulic Excavator to be present on the site. The area of land in qestion is approximately 25 acres or 10 hectares (100,000 square metres) in area. The land is agricultural grassed pasture, dry in nature and slopes uniformly from an Ordinance Level of 66.5m AOD at the stream along the North Eastern Boundary to a level of 79.7m AOD at it's peak, a difference of 13.2m in elevation.

Mr. O'Shaughnessy indicated that we were to use the level of the stream bed, 66.5m AOD as the bottom limit of any envisaged quarry excavation for volume calculation purposes.

Contour Survey

Land Surveying Services performed a detailed contour survey of Mr. O'Shaughnessy's land to 0.5m contour accuracy on the slopes and to 0.1m accuracy in the flatter areas. Information obtained was plotted on the Contour Drawing enclosed.

Trial Pits

Four (4) Trial Pits were excavated , A through D at the locations as indicated on our contour drawing The results are shown below in tabular format. Samples of the Gravel and Sand found in Trial Pits "A" and "B" were taken for Gradation Analysis

Results Obtained ***Excavator Hitachi EX120 -12 tonne***

Trial Pit	Material Description	Depth (m)	Ground Water
"A"	Topsoil	0 to 0.3m	*None Observed*
	Subsoil	0.3m to 0.8m	*None Observed*
	Natural Rounded Gravel	0.8m to 1.6m	*None Observed*
	Coarse Natural Sand	1.6m to 3m	*None Observed*
"B"	Topsoil	0 to 0.3m	*None Observed*
	Subsoil	0.3m to 0.7m	*None Observed*
	Natural Rounded Gravel	0.7m to 0.9m	*None Observed*
	Medium to Fine Natural Sand	0.9m to 3m	*None Observed*
"D"	Topsoil	0 to 0.2m	*None Observed*
	Alluvial Silt	0.3m to 0.7m	*None Observed*
	Coarse Natural Sand	0.7m to 2.4m	*Water at 1.5m*
			Pit abandoned at 2.4m
C	Topsoil	0 to 0.3m	*None Observed*
	Subsoil	0.3m to 0.8m	*None Observed*
	Natural Rounded Gravel	0.8m to 1.1m	*None Observed*
	Medium to Fine Natural Sand	1.1m to 3m	*None Observed*

Trial Pit Observations

The Gravel and Sand observed appeared to occur in definite veins or layers and was clean in nature and free of mud. The material was not cohesive. The ground was un-disturbed and did not show any signs of previous excavation or backfilling work. The sample taken from Trial Pit "A" was a mixture of Gravel and Sand, whilst that taken from Trial Pit "B" was mainly Sand.

Attached please find a Gradation Analysis Report and Particle Size Distribution Curves for material sampled from Trial Pit "A" and Trial Pit "B" as performed by Highway Testing Laboratory Ltd. to B.S. 812: Part 103.1: 1985 by the Wet Sieve Analysis Method.

All material Sampled passed the 75mm sieve and in particular the Sample taken from Trial Pit "B" which was sandy in nature all passed the 20mm sieve.

Trial Pit Conclusions

The excavated material found in-situ below the overburden layers of topsoil and subsoil can be classified as either sand or gravel, and is suitable for use as structural fill, anf if screened or crushed as necessary would be saleable as common quarry products e.g. graded gravels and sand. The materials sampled were not tested for pH, Carbonate Content or Unit Weights.

A suggested commercial value for the in-situ natural un-crushed and un-screened sand and gravel

Volumetric Analysis

Using an area of 100,000 square metres and discounting the top meter of ground as overburden and using a level of 66.5m AOD as the bottom limit of excavation as advised, we estimate a volume of approximately five hundred and sixty five thousand (565,000) cubic meters of material available for excavation on the land area designated to us by Mr. Terence O'Shaughnessy.

*

Attachments

Laboratory Test Results - Highway Testing Laboratory Ltd. dated October 22, 2003
Ordinance Survey Plot Ref. No. 227686_2_1 dated September 5, 2003
Contour Survey Drawing dated September 26, 2003

Disclaimer

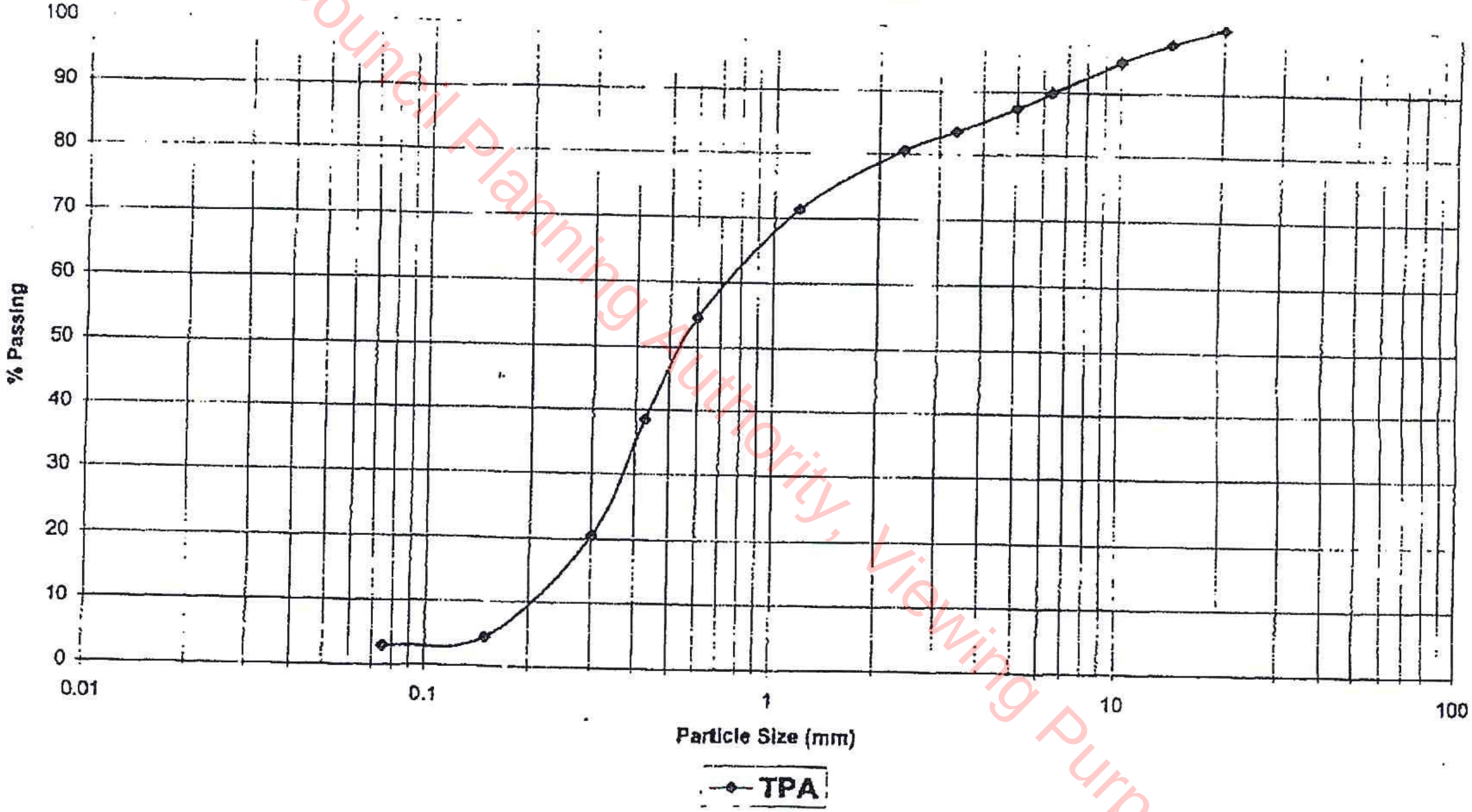
This report is confidential and has been prepared for the sole and exclusive use of Mr. Terence O'Shaughnessy for informational purposes only. It may not be duplicated or re-used by any other persons or companies without the written permission of Land Surveying Services. Applicable Permits and/or Permissions from the relevant Authorities should be sought prior to any excavations. Please note that Land Surveying Services are not, or, do not purport to be Geologists, Chemists, Archaeologists, Quantity Surveyors, Planners, Auctioneers or Valuers. All analyses and conclusions made are based on subjective observations and samples obtained from Trial Pits A, B, C and D only. Trial Pit locations were selected randomly and without prejudice. Weather conditions were dry and calm on the day of the test, and the land was traversible by a four wheel drive road legal vehicle.

Prepared by; Colm Boyd **Date ;** 28/10/03.

Colm Boyd
Land Surveying Services

Particle Size Distribution Curve

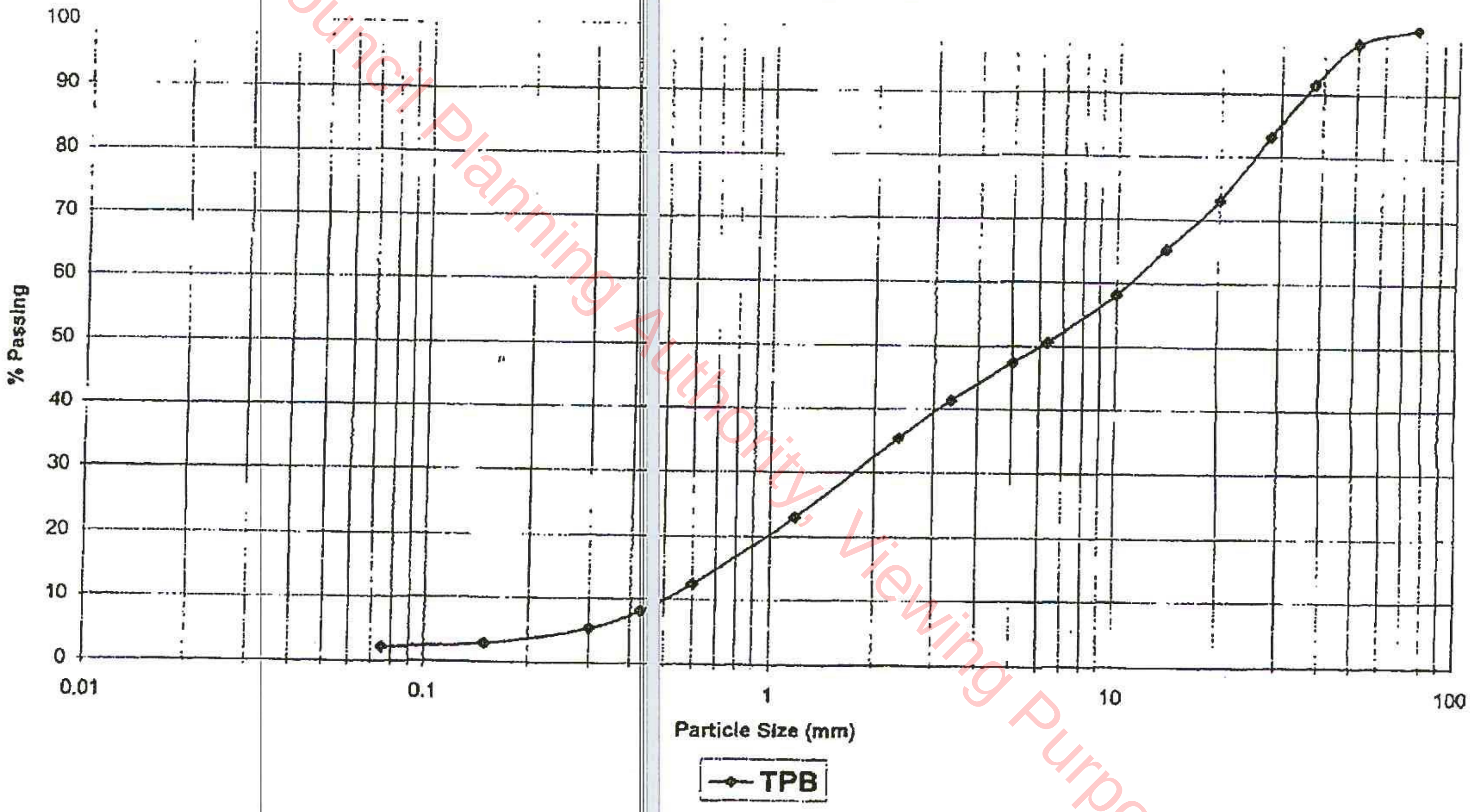
Sample Ref.: SBoyd03329/1.2



This report applies only to the items tested
and shall not be reproduced except in full,
without the approval of the testing laboratory.

Particle Size Distribution Curve

Sample Ref.: SBoyd03329/2.2



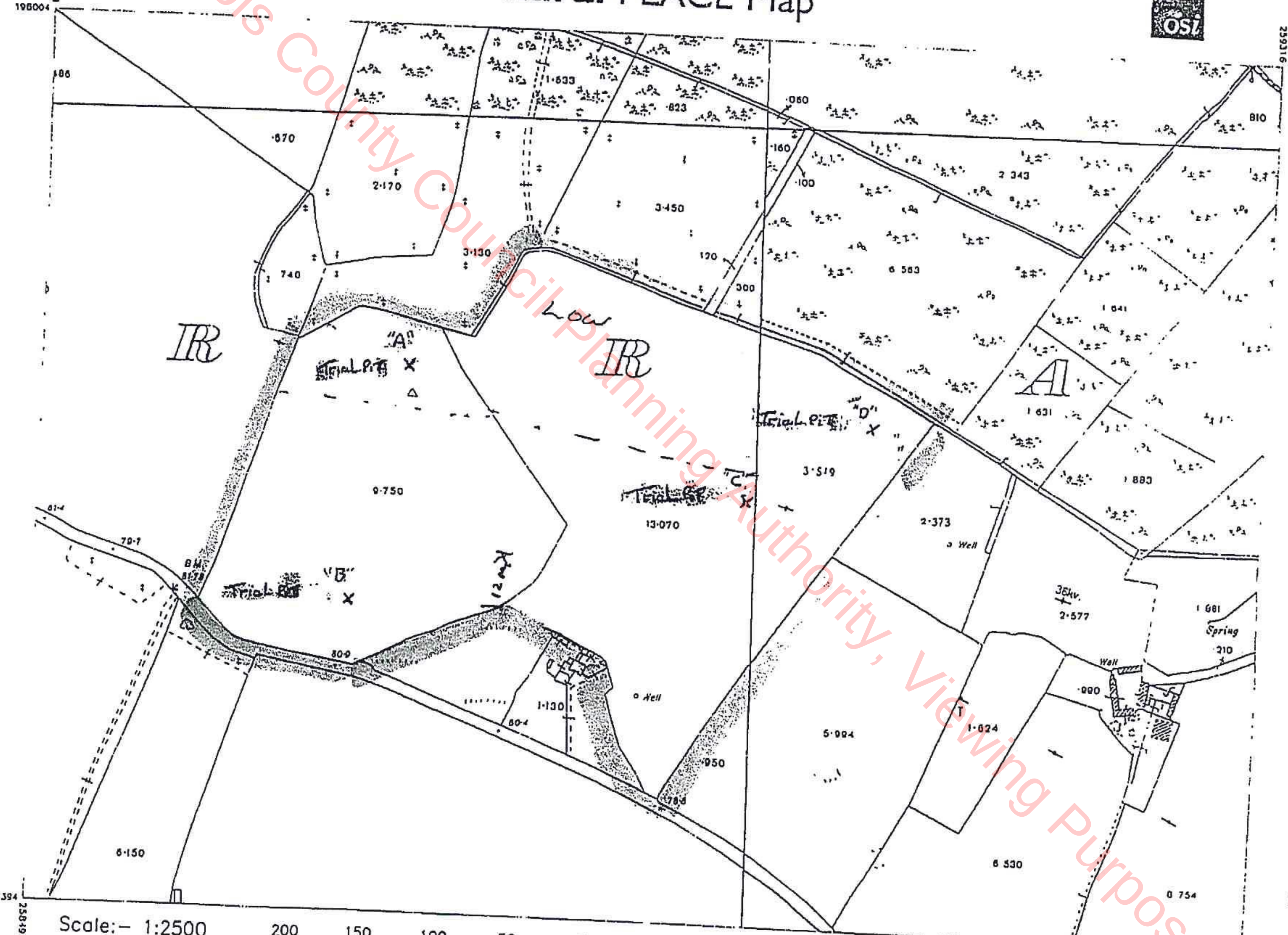
Surveyed 1907
Revised 1960 - 1983
Levelled 1907

Rural PLACE Map

DESCRIPTION

MAP SCALES

25inch
LS014-11 LS014-15
LS014-10 LS014-14



Scale:- 1:2500
Scála:- 1:2500

200 150 100 50 0 200 Metres
500 250 0 500 Feet

REDUCED COPY - DO NOT SCALE

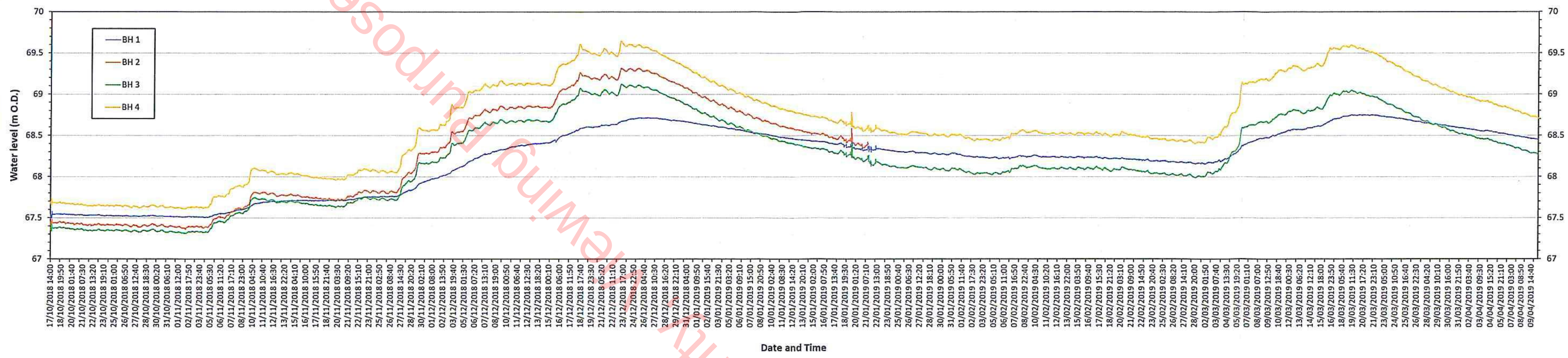
Plot Ref. No. 227686_2_1
Plot Date 05-SEP-2003

Ordnance Survey Ireland

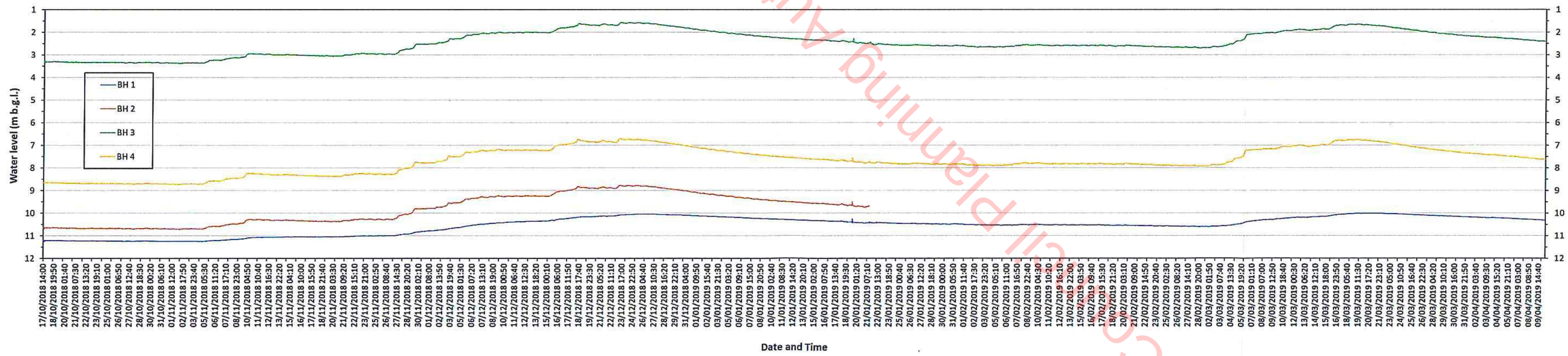
Arna thiomsú agus arna fhoilsiú ag Suirbhéireacht Ordanáis Éireann, Páirc an Fhionnuisce, Baile Átha Cliath 8, Éire
Compiled and published by Ordnance Survey Ireland, Phoenix Park, Dublin 8, Ireland.

Appendix 8.5: Groundwater Levels and Plots

Plot 1 Groundwater Levels October 2018 to April 2019 at BHs 1-4 (m O.D.)



Plot 2 Groundwater Levels October 2018 to April 2019 at BHs 1-4 (m b.g.l.)



Selected Recorded Groundwater Levels

ID	Location	Easting ING	Northing ING	Date	Water level (m O.D.)	Ground level (m O.D.)	Hydrological conditions
WL1	Trial Pit A (locn. uncertain, approx. water level)	258729	197777	03/10/2015	<74.85	77.85	Winter (early)
WL2	Trial Pit B (locn. uncertain, approx. water level)	258733	197606	03/10/2015	<75.75	78.75	Winter (early)
WL3	Trial Pit C (locn. uncertain, approx. water level)	258997	197690	03/10/2015	<68.65	71.65	Winter (early)
WL4	Trial Pit D (locn. uncertain, approx. water level)	259043	197743	03/10/2015	66.49	67.9	Winter (early)
WL5	Drain (approximate water level)	259082	197743	13/07/2016	66.17	65.99	Summer
WL6	Stradbally river south	259000	197142	19/07/2016	68.038	67.8	Summer (baseflow)
WL7	Stradbally river east	259622	197253	19/07/2016	64.969	64.828	Summer (baseflow)
WL8	Tributary Stradbally river north west of site	258800	198340	19/07/2016	66.22	66.129	Summer (baseflow)
WL9	Coillte quarry (approx. water level)	258759	197845	??/07/2015	<66.02	69.02	Summer (baseflow)
WL10	Site drain 10 m east of start	258940	197814	19/07/2016	<66.53	66.53	Summer (baseflow)

ID	Location	Easting ING	Northing ING	Date	Water level (m O.D.)	Ground level (m O.D.)	Hydrological conditions
WL11	Drain downstream of site (also historic 6" map)	259339	197660	19/07/2016	<65.08	65.08	Summer (baseflow)

Easting ING	Northing ING	Date	Water level (m O.D.)	Location
258664	197765	3/1/2020	68.49	BH1
258834	197618	3/1/2020	69.058	BH2
258989	197707	3/1/2020	68.89	BH3
259064	197444	3/1/2020	69.36	BH4
259339	197660	3/1/2020	65	WL11 drain downstream of site
259622	197253	3/1/2020	65.52	WL 7 Stradbally River East below wier 0.3m height
259228	197544	3/1/2020	68.678	BH5 Cattle Supply Well
258936	197813	3/1/2020	66.93	WL 10 in site drain at start
259000	197142	3/1/2020	69	WL 6 Stradbally River South
259079	197748	3/1/2020	66.21	WL 5 site drain NE corner of site

Appendix 8.6: Groundwater Abstraction Zone of Contribution Delineation

ZOC Boundary Estimation Calculations

Transmissivity Estimate at supply borehole

K m/d (Average BH1, BH2 saturated zone)	24.5
Saturated depth (b)	5
Transmissivity (m^2/d)	122.5

Uniform Flow Eqn (confined) Downgradient Distance (Todd D.K., 1980 Groundwater Hydrology)

Distance = Q/2πKbi

Borehole Supply	Q (m^3/d)	T (m^2/d)	i	DGD (m)
Occasional maximum abstraction rate	35	122.5	0.004	11
Average maximum abstraction rate	17	122.5	0.004	6

Uniform Flow Eqn (confined) Maximum Half Width calculation (Todd D.K., 1980 Groundwater Hydrology)

Distance = +/- Q/2Kbi Unconfined conditions met.

Borehole Supply	Q (m^3/d)	T (m^2/d)	i	Max Half Width (m)
Occasional maximum abstraction rate	35	122.5	0.004	36
Average maximum abstraction rate	17	122.5	0.004	17

Appendix 8.7: Flood Risk Assessment

Stage 1 and Stage 2 Flood Risk Assessment

Project: Proposed Sand and Gravel Quarry above the groundwater table at Garrons, Co. Laois.

Client: Pat Booth

Date: 13/8/2020

Author: Suzanne Tynan BSc. MSc.(Env Sci) MSc.(Hydro) PGeo. EurGeol.

Submitted to:
Rowan Consulting Engineering Ltd.,
Trim,
Co. Meath.

TYNAN ENVIRONMENTAL
environmental and hydrogeological consulting

7 Hillcrest Park
Strandhill, Co. Sligo
T +353 71 9128395
F +353 71 9128395
info@tynanenvironmental.com
www.tynanenvironmental.com

1 INTRODUCTION

1.1 Assessment Brief

Tynan Environmental was requested Rowan Engineering Consultants Ltd. to carry out a site specific Stage 1 and Stage 2 Flood Risk Assessment, on behalf of their client, for a proposed greenfield quarry development at Garrons, Co. Laois.

This work is carried out in accordance with best practise and specifically in accordance with the provisions of OPW (2009) *The Planning System and Flood Risk Management – Guidelines for Planning Authorities*.

1.2 Statement of Authority

Suzanne Tynan, principal of Tynan Environmental, is a hydrogeologist and hydrologist with twenty-two years' experience in the area of hydrology and hydrogeology. Suzanne holds an MSc. in Hydrology and Water Resources Management (Department of Civil and Environmental Engineering, Imperial College, London), an MSc. in Environmental Science (School of Natural Sciences, Trinity College, Dublin) and a BSc, in Geology and Botany (School of Sciences, University College Dublin) and has held research fellowship and researcher positions at Trinity College Dublin. She has PGeo (Professional Geologist) chartered status from the Institute of Geologists of Ireland (IGI) and from the European Federation of Geologists (EurGeol). Suzanne is a board member of the Institute of Geologists of Ireland, a member of the working group which wrote the Institute of Geologists of Ireland (2013) *Guidelines for the Preparation of Soils Geology and Hydrogeology Chapters of Environmental Impact Statements* and is currently on the working grouping updating this guidance to concur with recent legislative changes. She was a member of the Water Framework Directive National Groundwater Working Group sub-group writing guidance on groundwater dependent ecosystems. Suzanne has been an invited speaker on combined groundwater and surface water flooding at conferences and EI technical lectures.

Suzanne has significant technical and project management experience in the area of assessment, mitigation and management of the relationship between projects and the water environment. This includes experience in the areas of EIAR, flood risk assessment and hydro-ecology (the study of the interaction between water systems and dependant ecology) and design of avoidance and mitigation measures for infrastructure located in or adjacent to water environments. Suzanne has carried out supporting hydrogeology/hydrology for EIAR and Natura Impact Statements for numerous types of surface water and groundwater dependent Natura 2000 qualifying interest habitats, for proposed developments including roads, quarries, housing developments, groundwater abstraction, marina, gas pipeline, windfarm and drainage projects. These have been carried out on behalf of both government and private clients. This work includes the design of a national methodology for screening the impacts of drainage maintenance schemes on groundwater dependent Natura 2000 sites on behalf of OPW and assessment of the risks associated with mine dewatering in large open cast mines in Poland, in collaboration with the Polish Environment Agency. Current and recent major hydrogeological/hydrological and flood risk assessments include two projects funded by OPW in support of characterisation and remediation of 2015 groundwater flooding in Co. Sligo, combined groundwater surface-water flood risk modelling and NIS works for a road and local authority housing development on behalf of Limerick County Council, assessment of the risk of fluvial and/or groundwater flooding at sites for proposed school, hospital, waste transfer station, road, quarry and land reclamation sites. These projects include the development of integrated surface water and groundwater management systems. Work has also included the modelling of the impacts of climate change on flooding in the Thames Valley, at the British Geological Survey.

Design and implementation of site works, analysis and report writing were carried out by Suzanne Tynan of Tynan Environmental, apart from the works provided by external contributors listed below.

1.3 External Contributors

- Jason Redmond and Associates provided:
  - Site topographic survey;
  - Material excavation and re-instatement quantities;
  - Extraction phasing layout and layout element areas;

  - Design and layout of sludge settlement ponds and pre-process water supply balancing pond.
- Petersen Drilling Services Ltd. carried out drilling and installation of piezometers according to BS 5930:2015 Code of Practice for Site Investigations;
- James Fisher Testing Services (Ireland) Ltd (UKAS accredited) carried out material analysis according to Particle Size Distribution-EN 933 Part 1: 2012 Cl 7.1&7.2 Washing & Sieving Method
- The report and figures contain Irish Public Sector Data (Geological Survey) licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence.

1.4 Site Works

Site walkovers and site investigations to support hydrological, hydrogeological and flood risk analysis and reporting were carried out on 19/7/2016, 15 – 17/10/2018, 21/1/2019, 10/4/2019 and 2/1/2020.

1.5 Development Description

1.5.1 Location

The proposed development site (the site) is located in the townland of Garrons, Co. Laois. The site is a greenfiled site, bounded to the south by an 'other' class road, which meets the R427 Regional road c. 0.5 km to the west of the site boundary. It comprises worked agricultural land, bounded on all sides by privately owned agricultural land. The garden of one private domestic dwelling adjoins the site at the southern boundary.

1.5.2 Development Method and Depth

Material will be extracted by dry excavation using an excavator, with the material moved using a wheeled loader.

Extraction will be to a depth of at least 1 m above the estimated highest winter groundwater level across the extraction area, to which is added a climate change uncertainty allowance of 10% of annual groundwater level variability across the site (See accompanying Environmental Impact Assessment Report (EIAR) Chapter 8 Hydrology and Hydrogeology and Cross Section prepared for the site and submitted with the planning application drawings).

1.5.3 Extraction Rate

Proposed average daily extraction rate over a 20 year period is 203 tonnes/day (61,000 tonnes per annum).

Maximum daily abstraction rate will be set at 350 tonnes/day. This is to allow for occasional (not greater than one month) extraction at a rate in excess of the average rate, to respond to market requirements.

1.5.4 Extraction Phasing

Four phases of material extraction are proposed and set out in EIAR and planning application drawings.

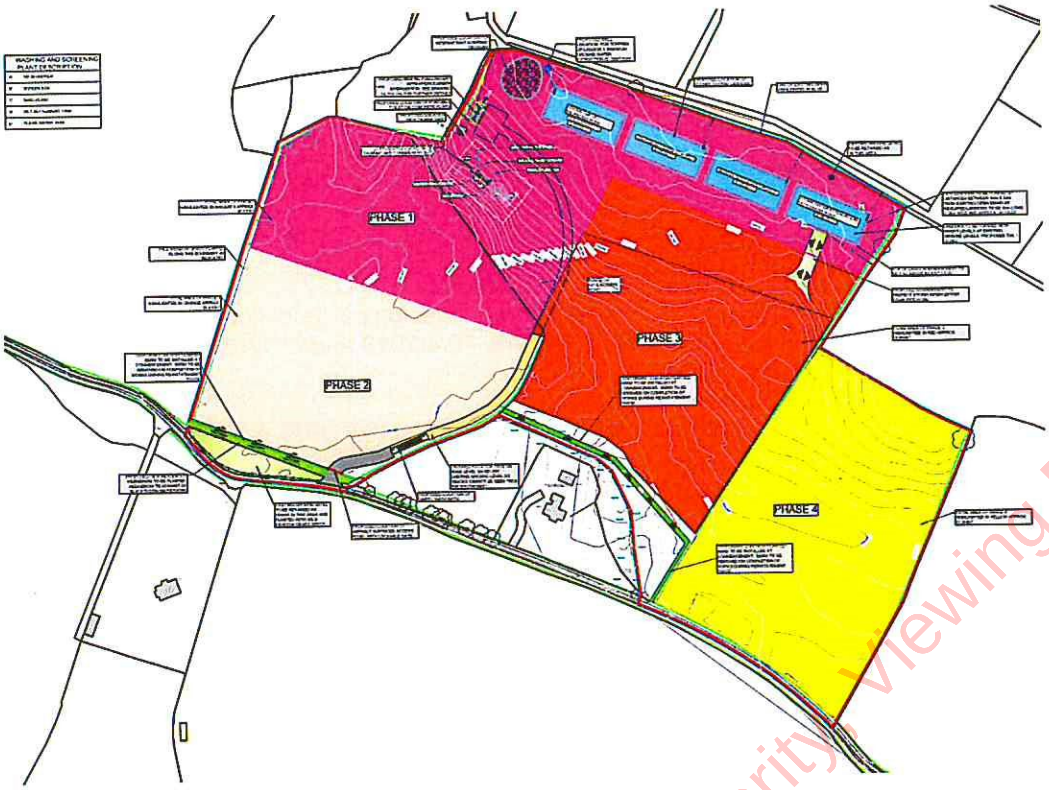


Figure 1: Site Layout Plan (Ref: extracted from the planning drawings)

The overall area of the site is c.12.84 hectares / 128,408m². The four phases incorporate the following areas:

- Phase 1 (Pink): c. 40,825 m²
- Phase 2 (Orange): c. 20,410 m²
- Phase 3 (Red): c. 29,995 m²
- Phase 4 (Yellow): c. 27,250 m²

A twenty year planning permission is requested.

1.5.5 *Material Processing*

The material processing system proposed comprises integrated processing, water treatment/recycling, stockpile and sludge dewatering and recovery. The system is highly efficient in terms of water usage and management.

1.5.6 *Re-instatement*

Reinstatement of land will be carried out on a phased basis, on completion of the preceding phase. The material available for re-instatement is estimated from available site investigations results as comprising:

- 22,440 m³ silt size material recovered from sludge;
- 28,150 m³ top-soil recovered during stripping and stored

This will result in a depth of re-instatement of approximately (0.18 m silt+ 0.22m topsoil) across the site.

1.6 Development Water Management

The development water management system comprises systems for both process and surface water run-off management and follows the principles of a SUDS drainage train. It entails water recovery and recycling at source within all stages of the process and ancillary activities, as well as storage and discharge at the green-field run-off rate.

1.6.1 Process Water Management

Process water is recycled within a closed tank system treatment of a least 80% of process water, within the primary water treatment plant (CDE AquaCycle Thickener) and subsequent closed, direct recycling back to the integrated processing plant (screening, sand washing and stockpile conveyors in a CDE M2500 E5).

1.6.2 Surface Water Management

See **Diagram 1** Site Water Management System below, for a schematic of the full water management system.

Average Daily Surface water run-off

Average daily run-off is seasonal and varies from a minimum of 14 m³/day in July, to a maximum of 40 m³/day in October.

Storm water run-off

Site storm water run-off rates and volumes from the 12.84 ha developed site have been estimated for the 1 in 20 year storm for storm durations of 15 minutes to 48 hours, using the rational equation method. This is appropriate for the 20 year proposed life of the quarry. Met Eireann estimations of point rainfall frequencies (www.met.ie and Fitzgerald D.L., 2007), which provide rainfall depths at sliding durations for specified return periods for the site location, were used.

Climate Change Allowance for Storm water run-off

Climate change projections are that rainfall is projected to increase during winter and autumn (Nolan, 2019, 2017, 2015, Gleeson, 2013). A climate change allowance of 20% has been added to the rainfall depth used to calculate storm water run-off rates in accordance with OPW (2009) *Assessment of Potential Future Scenarios For Flood Risk Management - Draft Guidance* (See **Appendix 1** for calculations).

The rational method is used to estimate storm water run-off is extremely conservative and is reported as yielding flood peaks typically twice as large as Flood Studies Report methods (Cawley and Cunnane, 2003), therefore is therefore an additional factor of safety in storm water attenuation storage designs based upon it.

Collection and conveyance

The collection and conveyance system is a flexible, reactive system, which will be modified to be effective for each phase of the development. It comprises the following elements:

- 'Clean water' interceptor drainage, which collects clean surface water runoff from areas of the site which have not been stripped of vegetation and from re-instated areas of the site, which are fully re-vegetated. This minimises the volume of water in which pollutants could be entrained; If necessary, geotextile lining or french drains will be implemented to prevent erosion and improve conveyance.
- Dirty water' interceptor drainage which collects surface water run-off from areas of the site where pollutant entrainment may occur. This includes working areas of the quarry and recently re-instated areas, where vegetation is not yet established, but excludes the bunded re-fuelling area. If necessary, geotextile lining or french drains will be implemented to prevent erosion and improve conveyance.
- Collection from a small area of shed roof;
- Conveyance of all collected drainage to the storm water attenuation/sediment settlement pond (s).

Storage

Total storage volume of 1500 m³ in impermeable combined storm water attenuation/sediment settlement pond(s) is designed to attenuated both storm water run-off and store retained water to provide process water during dry periods. This comprises:

- Storm water attenuation storage
  Storm water from the critical 20 year return period storm with climate change allowance (and lower return period storms), is attenuated and discharged at the greenfield run-off rate for that return period storm of 0.0092 m³/s. See **Appendix 1** for details and calculations. The maximum storage required for the critical storm is 1054 m³.

- Retention in storage of process water, for projected climate change increase in dry-weather days. Storage of 40 days of average summer period surface water usage (May – September at 10 m³/day) that is a total of 400 m³, is retained continuously in storage on site. This contains a significant margin of safety for climate change designed to mitigate against projected increases in dry periods (largest for summer,) with likely values ranging from 12% to 40% (Nolan, 2015). This stored water is collected initially during the commissioning phase and maintained by storm water.

Water usage rate from the storage will be controlled via a flexible pumping regime and a discharge/rate meter.

A top-up water balancing pond, of volume (2000m³) is located before the processing plant, in order to balance the combined inflows from the two usage sources of the storm water attenuation/sediment settlement pond and groundwater abstraction and the recycled water from the stockpile dewatering system and sludge settlement pond.

Discharge to the environment

Discharge to the environment from the lined combined storm water attenuation/sediment settlement pod (for volumes in excess of the retained 40 day storage) will be actively controlled, via a flow control and a discharge meter to the greenfield run-off rate of 6.35 l/s. See **Appendix 1** for greenfield run-off calculations.

The discharge will occur onto an area of natural vegetation, at approximately 19 m distance upgradient of the man-made drain, in the form of a level spreader. The greenfield discharge rate is very low and unlikely to cause erosion. Erosion control measures such as rip-rap will be emplaced if commencement of erosion is observed.

No alterations to the man-made drain will occur, therefore the intermittent, seasonal pathway from the site, to the tributary of the Stradbally river and the Stradbally River is retained. The drain and its banks are protected by the retention of a minimum 20 m wide buffer zone of the natural vegetation, in which no quarrying or related activities will occur.

1.6.3 Climate Change Projections

Regional climate projections have been modelled on a 4 to 6 km grid scale, for the mid 21st century, in Ireland by *inter alia* Nolan *et al* (2017), Nolan (2015), Nolan and McKinstry (2019) and Gleeson *et al* (2013). Relevant projections are summarised below.

Rainfall is projected to increase during winter and autumn and decrease during summer and over the full year (Nolan, 2019, 2017, 2015, Gleeson, 2013).

- The frequencies of heavy precipitation events are projected to increase across the whole year, but show notable increases (approximately 20%) during the winter and autumn months (Nolan and McKinstry, 2019) by mid-century.
- Drier conditions are projected to be more pronounced in the summer, with likely reductions in rainfall ranging from 0% to 13% and from 3% to 20% for the medium- to low-emission and high-emission scenarios respectively, by mid-century (modelled 20 year period 2014 – 2060) (Nolan, 2015).
- The number of extended dry periods (defined as at least 5 consecutive days for which the daily precipitation is less than 1 mm) is also projected to increase substantially by mid-century over the full year and during

autumn and summer. The projected increases in dry periods are largest for summer, with likely values ranging from 12% to 40% for both the medium- to low-emission and high-emission scenarios by mid-century (Nolan, 2015).

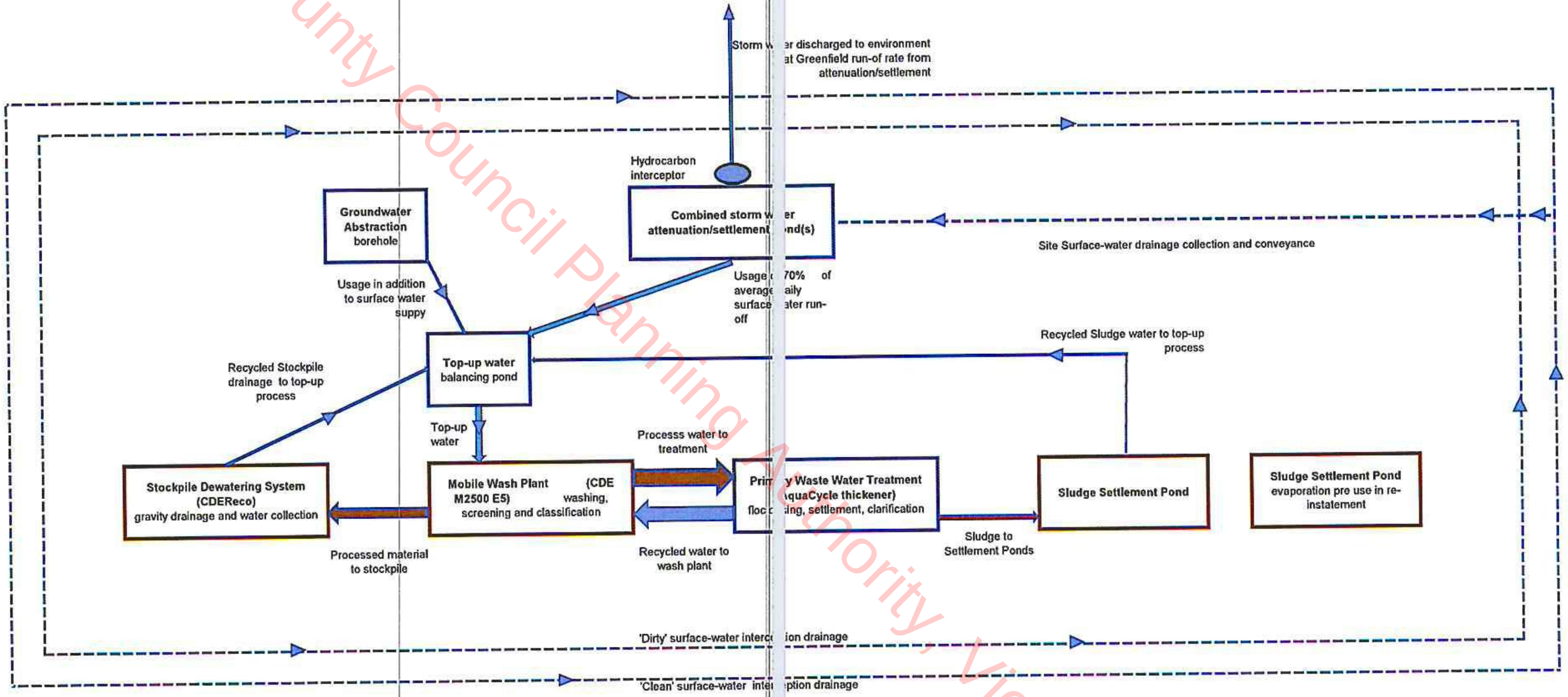
Projections for mid-century indicate an increase of 1–1.6°C in mean annual temperatures, with the largest increases seen in the east of the country (Nolan, 2015). Temperature projections show a clear west-to-east temperature gradient, with the largest increase seen in the east (Nolan and McKinstry, 2019).

Projections for evaporation and evapotranspiration have not been explicitly modelled, as they are a function of these and additional meteorological and soil parameters.

1.7 Development Vulnerability Classification

The development is considered to have a Vulnerability Class (OPW, 2009) of 'less vulnerable development'.

Diagram 1 Site Water Management System



2 FLOOD RISK ASSESSMENT METHODOLOGY

2.1 *Best Practise Methodology*

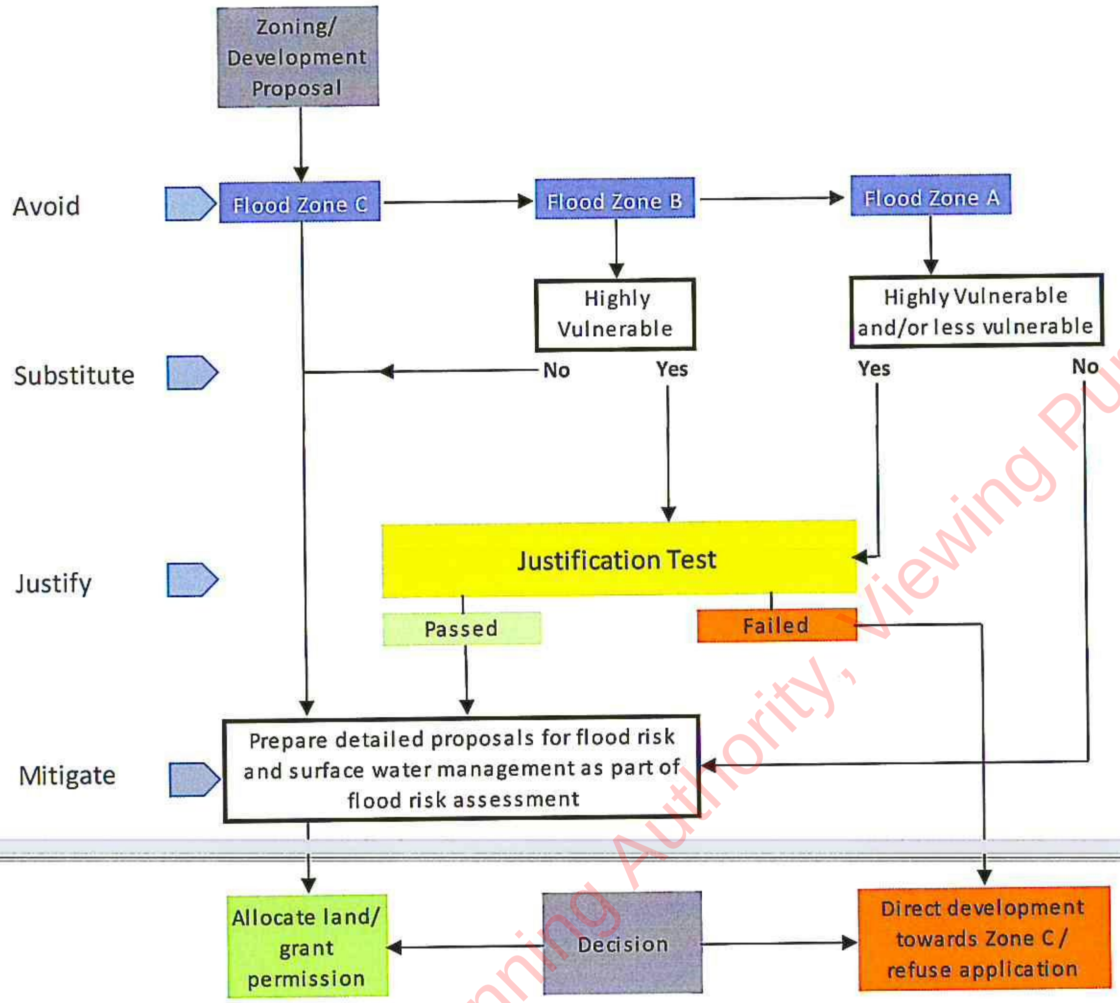
The Planning System and Flood Risk Management – Guidelines for Planning Authorities (OPW, 2009) sets out the current best practise methodology for flood risk assessment and management.

The guidance adopts a staged approach to flood risk assessment (FRA), advising the carrying out of only those stages of appraisal and assessment such as are needed for the purposes of decision making. The stages are:

- Stage 1 Flood risk identification;
- Stage 2 Initial flood risk assessment, carried out where Stage 1 identifies a requirement;
- Stage 3 Detailed Flood risk assessment, carried out where Stage 2 identifies a requirement.

This staged approach is carried out within the framework of the sequential approach planning mechanism, which is applied by the planning authority to flood risk planning and management, as follows:

Sequential Approach



Site specific flood risk assessment must be carried out by those proposing the development, in areas where flood risk has been identified.

Flood risk assessment at the site specific level, is required to be carried out to a level of detail which depends on the level of risk and the scale of the development. The scope of the flood risk assessment depends on the type and scale of development and the sensitivity of the area. Where the requirement is identified in Stage 2, detailed flood risk assessment is carried out. It normally involves some form of mathematical modelling of systems that embraces the source-pathway-receptor model.

The key outputs from a detailed site-specific FRA should, in general, include:

- Plans, showing:
  - The site and development proposal and it's relationship with watercourses and structures which may influence local hydraulics.
- Surveys, of:
  - Site levels and cross sections relating relevant development levels to sources of flooding and likely flood water levels.
- Assessments, of:

- All potential sources of flooding;
- Flood alleviation measures already in place;
- The potential impact of flooding on the site;
- How the layout and form of the development can reduce those impacts, including arrangements for safe access and egress;
- Proposals for surface water management according to sustainable drainage principles;
- The effectiveness and impacts of any necessary mitigation measures;
- The residuals risks to the site after the construction of any necessary measures and the means of managing those risks;

A successful FRA is characterised by:

- Assessing existing flood risk in terms of the likelihood of flooding and resultant consequences; and
- Assessing the potential, post – development risks having regard to the design of mitigation and compensation measures.

Flood Zone delineation is a key element of the FRA output and flood zones are defined according to probability of occurrence as set out in the following table.

Flood Zone	Probability of Flooding
A	High Probability: Greater than 1% AEP (or 1 in 100 year) probability flooding.
B	Moderate probability: Between 1% and 0.1% AEP (or 1 in 1000 year) probability of flooding
C	Low Probability Less than 0.1% AEP (or 1 in 1000 year) probability of flooding.

2.2 Site Works

Site walkovers and site investigations to support hydrological, hydrogeological and flood risk analysis and reporting were carried out on 19/7/2016, 15 – 17/10/2018, 21/1/2019, 10/4/2019 and 2/1/2020.

2.3 Application of Best Practise Methodology to the Proposed Development Site

This document contains a Stage 1 (Initial) and Stage 2 (Preliminary) Flood Risk Assessment. This approach is considered to achieve the requirements of the OPW (2009) guidance, which advises the carrying out of only those stages of appraisal and assessment such as are needed for the purposes of decision making. This is based specifically on the:

- Nature, small scale and low vulnerability to flooding of the proposed development;

The resulting flood risk assessment is considered robust and fit for the purposes of decision making.

3 STAGE 1 FLOOD RISK IDENTIFICATION

An assessment of existing information has been carried out. The existing information assessed included sources of information quoted in *Appendix A* of OPW (2009), where they exist and are appropriate to the type and scale of the proposed development and the location of the site.

3.1 Coastal Flooding

The site is located at a distance of 70 km from the sea and no risk of coastal flooding was identified during the Preliminary Flood Risk Mapping (PFRA) or subsequent Flood Risk Management Plan phases of flood risk assessment by OPW and its project partners.

3.2 Fluvial Flooding

The site is located in a sub-catchment of the Barrow River catchment, which falls within Flood Risk Management Plan Unit of Management UOM14 Barrow River Basin. It is located in the WFD South Eastern River Basin District, in the Barrow WFD Catchment/Hydrometric Area (No. 14). The site is located in the Stradbally river sub-catchment.

The Stradbally river has a regional flow direction broadly north eastward towards the River Barrow. The Stradbally river flows eastwards at a distance of approximately 0.3 km south of the site, then turns to flow north at a distance of approximately 0.65 km m east of the site. The Stradbally river has a total length of 9.48 km, is a 4th order river and flows into the Barrow River at a distance of 5 km downstream of the site. A small (unnamed on any map series) tributary of the Stradbally river flows predominantly north-west to south-east c. 0.4 km to the north of the site and joins the Stradbally river approximately 1.25 km north east of the site. The last 400 m of this tributary, and the Stradbally River are OPW Drainage District channels. A man-made drain, commencing approximately half-way along the [illegible] site boundary, runs eastwards, then northwards to connect with that tributary at approximately 0.75 km downstream of the site. The man-made drain has intermittent seasonal flow and therefore creates a seasonal connection between the site and the Stradbally river, located 1.25 km downstream of the site.

CFRAMs assessment and mapping has been carried out for the Barrow River and the stretch of the Stradbally River The maximum extent of the high-end future scenario flooding (low, medium and high probabilities) are set out in **Figure 1.** This maximum extent upstream is located at a distance of c.3.5 km downstream of the site, via the site drain, the tributary of the Stradbally river and the Stradbally River. The River Stradbally itself was not selected as an AFA, therefore no CFRAMS modelling of flood extents was carried out.

PFRAM mapping (www.myplan.ie on 31/12/2019) indicates the extents of fluvial flooding in the Stradbally river mapped during the preliminary assessment. See **Figure 2** for extents. The extent of the flooding in the Stradbally river and its tributary is at a distance ranging from 0.31 km (south) to 0.0.65 km (east) from the site boundary. Additionally, the site ranges from 7 – 11 m above the Stradbally River. There is therefore no risk of flooding to the site from the River Stradbally or its tributary.

No recorded Past Flood Events occur at or within the vicinity of the site. The closest are at a distance of 4 km immediately north and south of Ballyroe.

3.3 Pluvial Flooding

No risk of pluvial flooding is identified at the site on the PFRAM mapping. See **Figure 2**. Some small areas of pluvial risk are estimated to occur to the north and north-east of the site.

An area of benefitting lands is delineated to the north and north east of the site boundary.

3.4 Conclusions of Stage 1 Flood Risk Identification

Flood risk from fluvial, pluvial and coastal flooding were assessed during the Stage 1 assessment.

No risk of coastal or pluvial flooding was identified.

In accordance with the precautionary principle, risk associated with small areas of pluvial flood risk estimated to occur to the north and north east will be further assessed.

4 STAGE 2 INITIAL FLOOD RISK ASSESSMENT

4.1 Meteorological Setting and Water Balance

4.1.1 Current Average Hydro-Climatic Conditions

Average annual rainfall in the 1km surrounding the site is 821 mm/year (Met Eireann 1 km square rainfall grid 1981-2010 and Walsh S., 2012)). Average annual evapotranspiration is 362 mm/year (Met Eireann). Average annual effective rainfall, that is, rainfall available for run-off and groundwater recharge in the vicinity of the site, is therefore 468 mm/year (Met Eireann and GSI Groundwater Recharge map, 2019).

4.1.2 Water Balance

The natural water balance for the region of hummocky sand and gravel and esker glacial deposits surrounding the site is dominated by groundwater recharge, with low rates of surface water run-off occurring.

The average annual water balance for the area surrounding the site is tabulated in Table 1, below. The water balance is derived from meteorological data (Met Eireann) and from effective rainfall and groundwater recharge data (Geological Survey of Ireland, 2018 and Hunter Williams *et al*, 2013). Effective rainfall is rainfall available for run-off and groundwater recharge. It is noted that the recharge mapping displayed on www.gsi.ie has not been updated to reflect updated mapping of the extents of glacio-fluvial sand and gravel subsoils in Co. Laois, by the Geological Survey of Ireland. The recharge co-efficient tabulated here, takes account of these most recent subsoil mapping results and is derived using the Geological Survey of Ireland recharge calculation method (Hunter Williams *et al*, 2013).

Table 1 Annual average regional water balance

Water Balance Inputs and Outputs	**Average Annual (mm)**
Rainfall (Met Eireann 1 km grid 1981-2010) (mm)	830
Pro-ratad monthly actual evapotranspiration (AE) Met Eireann in GSI/Hunter Williams *et al* (2013) (mm)	362
Effective Rainfall (ER) (mm)	468
Groundwater recharge (85% of ER) (mm)	398
Surface water run-off (15% of ER) (mm)	70

4.2 Hydrological Setting

4.2.1 Site Soils and Subsoils

The site and immediate surrounds are located in an area of hummocky topography, resulting from glacial deposition of sediments from melting ice, which extend up to 4 km south west, west and north of the site and approximately 1 km south and east. The hummocky sands and gravel sediments are classified as glaciofluvial sands and gravels of Carboniferous limestone petrology. The esker sediments are classified as basic esker sands and gravels. (GSI, Aggregate Potential Mapping (2016) - Primary source is Teagasc, 2006; 134% additional area of potential granular sediments in county Laois derived from GSI, 2000 (Draft)). This mapping is the most recent update of the Teagasc (2006) mapping, which re-classified the Till derived from limestones subsoil in this area as hummocky sand and gravel deposits. Mapping indicates that these deposits are overlain by basic deep well drained mineral soils.

Site investigations carried out for the purposes of the accompanying EIAR within the site boundary comprised:

- 4 No. trial pits in October 2003 and
- 4 No. boreholes in October 2018.

The four trial pits excavated to depths of 3 m exposed 0.7 to 0.8 m of sandy soil overlying layered, well sorted, high permeability sands and gravels. The four boreholes encountered 15 to 20 m depth of layered, fine to coarse, well sorted sands and gravels, with one silt or clay dominated horizon, within the profile. (Details of the site investigations, trial pit and borehole log descriptions, particle size distribution (PSD) curves and hydraulic conductivity estimates are set out in Appendix 8.4 of Chapter 8 Hydrology and Hydrogeology of the EIAR).

Mean hydraulic conductivity (K) of the profile sediments in three boreholes ranges from 190 m/day to 518 m/day. These are very high K values, consistent with glaciofluvial sand and gravel deposits elsewhere (Tedd *et al* (2012) and Kilmuckridge GWB, Wexford, *WFD Summary of Initial Characterisation*). This K value will result in very high infiltration rates.

4.2.2 Site Surface Water Run-off Characteristics

Average daily run-off is seasonal and varies from a minimum of 16 m³/day in July, to a maximum of 34 m³/day in October. Monthly run-off is derived from the site water balance, based on an average partitioning of effective rainfall into 15% surface water runoff and 85% groundwater recharge based on site characteristics (Geological Survey of Ireland, 2018 and Hunter Williams *et al*, 2013). The actual evapotranspiration parameter has been pro-ratad from the annual average. This is not considered to introduce unreasonable uncertainty into the estimates, due to the high permeability characteristics of the soils at the site and the effect of their associated field capacity on summer actual evapotranspiration rates

Site greenfield run-off rate for specific return period storms has been estimated using the Institute of Hydrology IH24 method for small rural catchments (Institute of Hydrology, 1994) and Cawley and Cunnane (2003) growth factors. QBAR or mean annual flood flow (approximately 2.3 year return period) is 6.35 l/s. See **Appendix 1** for calculations. Average and storm run-off rates are very low and result from the presence of deep well drained soils overlying permeable glaciofluvial sands and gravel deposits.

4.2.3 Off-site Soils and Subsoils

Alluvial subsoils and soils are mapped on both banks of the unnamed tributary of the Stradbally river and the Stradbally River (Teagasc, 2006 and Geological Survey of Ireland, 2016 www.gsi.ie). These soils/subsoils are mapped as occurring at distance ranging from 0.1 km to 0.3 km north and north east of the site boundary and are described as having low permeability (Geological Survey of Ireland, 2016 www.gsi.ie). Poorly drained mineral soils are mapped as overlying the sands and gravel sediments north of the site boundary.

These areas of poorly drained mineral soils and alluvium, correspond broadly to the area designated as Benefitting Lands (OPW).

4.2.4 *Site Drainage Photos*

Photo 1 Site view towards south west from BH1 (10/4/2019)

Photo 2 Site view towards west (10/4/2019)

Photo 3 Site view towards east south-east (10/4/2019)

Photo 4 Site view towards north east (10/4/2019)

Photo 5 Man-made drain (dry) on site looking down-drain (south east) from start of drain (dry) (19/7/2016)

Photo 7 Man-made drain (containing water) on site looking down-drain (south east) (21/1/2020)

4.2.5 *Topographic Gradients of Site and Surrounds*

Topographic gradients at the site are predominantly from south to north. Maximum height at the site is approximately 87 m O.D. along the southern boundary, falling to a minimum of 68 m OD in the north eastern corner of the site. Ground height reduces to c. 66 m O.D. at the tributary of the Stradbally river, to the north of the site.

4.3 Historic and Predicted Flood Extents

4.3.1 Flood Defences

No flood defences exist.

4.3.2 Historic Flooding

A walkover of the site was conducted with the site landowner and the owner of adjacent agricultural lands. No flooding has been observed at the site or in adjacent lands to the west, north, north east, east or south. The land is predominantly tilled for crops, due to its high drainage.

4.3.3 OPW Flood Risk Management Plans (FRMP) Modelled Flood Extents

No risk of pluvial flooding is identified at the site on the PFRAM mapping (See **Figure 2**). This is consistent with the presence of well drained, very high permeability soils and subsoils at the site.

An area pluvial risk is estimated to occur 0.1 km to the north north-east of the site. This area occurs within an area of alluvial soils, within the area of benefiting lands. This area is located at a height of approximately 2 [illegible] below the minimum height at the site.

A number of small (<10 m area) points are noted within a disused sand pit, within the adjacent Coillte plantation to the north west of the site. These are considered very unlikely to occur, due to the presence of high permeability sand and gravel soils and subsoils exposed at the disused quarry. Equally a small area <10 m is mapped as occurring to the east of the site. This has never been observed by the landowner. Its absence is consistent with the presence of underlying sand and gravel subsoils, confirmed during ploughing by the landowner. These small areas are therefore not considered to occur.

4.4 Pre-Development Flood Risk Assessment

4.4.1 Source-Pathway-Receptor Model

The pluvial flood area comprises the source.
Pathway is overland flow.
The site comprises the flood receptor.

4.4.2 Risk to On-site Receptors

Impact of Pre-Development Flooding on the Proposed Development

The impact of pre-development flooding, is set out here in accordance with OPW (2009);

- There will be no impact on the proposed development resulting from resulting from an extreme event pluvial flood. The development is a minimum of 0.1 km outside of the extreme event extents, that is, in Flood Zone C.
- Any increased flooding associated with uncertainty in climate change increases in rainfall, will not extend onto the site. This is due to the topographic gradient being towards the tributary of the Stradbally river and the 2 m difference in height between the lowest site boundary and the area containing the pluvial flood.

There will therefore be no economic, social or environmental consequences to on-site receptors resulting from pre-development flood levels.

4.5 Post-Development Flood Risk Assessment

4.5.1 Risk to On-site Receptors

Impact of Post Development Flooding on the Proposed Development

There will be no changes to post-development flood risk resulting from the proposed development, as it is entirely located in Flood Zone C.

The level of flood risk therefore remains the same as for the pre-development scenarios.

There will therefore be no economic, social or environmental consequences to on-site receptors resulting from post-development flood levels.

4.5.2 Risk to Off-site Receptors

Impact of Post Development Flooding on Pluvial Flood Risk

Surface water management at the site (as set out in detail in Section *1.5 Water Development Management*, above) is designed to minimise impact on the hydrology of the surrounding area. The development results in a total of 0.08 ha of impervious area and retention of 12.76 ha of pervious area. The increase in surface water run-off associated with this impervious area is imperceptible. Storm water drainage is collected and discharged at pre-development surface water run-off rate.

There will therefore be no additional risk of pluvial flooding associated with the presence of the proposed development.

Impact of Post Development Flooding on Fluvial Flood Risk in the Stradbally River

The site is intermittently connected with the Stradbally River via the site man-made drain and the tributary of the Stradbally River.

Surface water management at the site, is designed to minimise impact on the hydrology of the surrounding area. The man-made drain is retained and protected, in order to maintain the natural hydrological linkages. The development results in a total of 0.08 ha of impervious area and retention of 12.76 ha of pervious area. The increase in surface water run-off associated with this impervious area is imperceptible. Storm water drainage is collected and discharged to the man-made drain at the pre-development surface water run-off rate. This design mimics the natural hydrological regime.

There will therefore be no additional risk of downstream fluvial flooding associated with the presence of the proposed development.

4.6 Drainage

4.6.1 Surface Water Management and the Incorporation of SuDs principles

The surface water management strategy and design, set out in Section *1.5 Water Development Management*, above, has been developed in accordance with the principles set out in the Greater Dublin Strategic Drainage Study (2005) and Capita Symonds (2008).

The principles employed in this design include:

- Minimisation at source of development related surface water run-off volume, through the minimisation of hard paving area. The development results in a total of 0.08 ha of impervious area and retention of 12.76 ha of pervious area. The increase in surface water run-off associated with this impervious area is imperceptible.
- Minimisation of site water losses and usage by integrated process water treatment and recycling;
- Conveyance of 'clean' and 'dirty' water in separated interceptor drainage, to minimise the entrainment of pollutants subsequently requiring treatment;
- Storage and retention of storm water run-off on site in order to effect settlement of pollutants and to allow discharged to the environment at the pre-development greenfield run-off rate.

4.6.2 Wastewater Drainage Proposals

Sanitary and comfort facilities are self-contained. These comprise:

- Provision of a 'portaloo' toilet and hand wash facility on site; managed under contract with an approved waste collector;
- Provision of bottled water to site staff.

There is no discharge of foul or grey water from sanitary or comfort facilities to ground, or the surface water environment, at the site. A management contract with an approved waste collector will be put in place for removal and replacement of the infrastructure and its contained waste.

4.7 Mitigation Measures and Flood Defences

The approach to location and design of the development has resulted in no requirement for mitigation measures, beyond those incorporated as 'avoidance' during the design process.

4.8 Impact of Residual Flooding on the Proposed Development

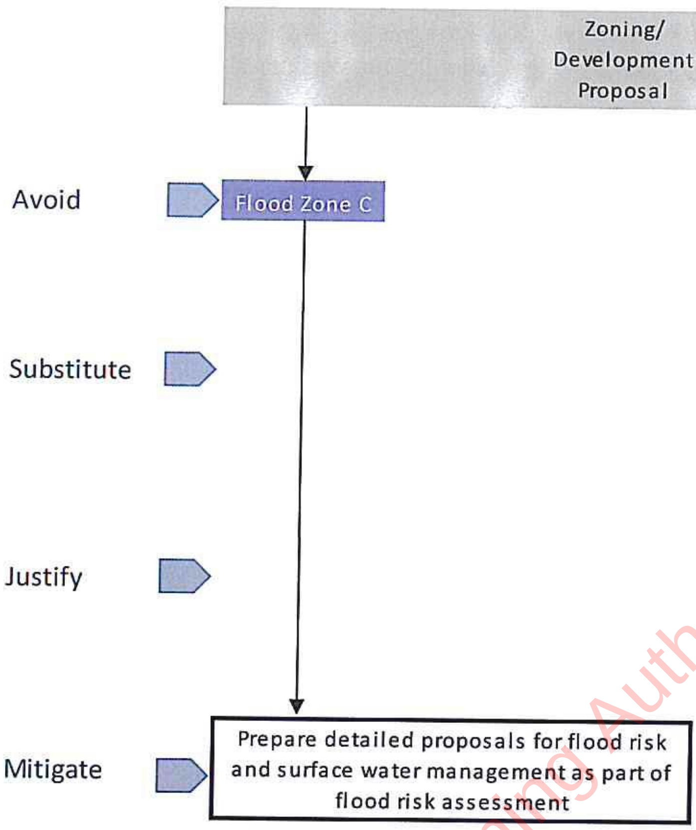
No flood defences are required since the development is not located in any flood zones. There is therefore no requirement to assess residual flood risk, which is defined as the risk associated with exceedance of flood defences.

4.9 Changes to Flood Storage

There will be no reduction in flood storage, due to avoidance of any development in any flood zones.

5 SEQUENTIAL APPROACH

The sequential approach has been used in determining the location and design of the currently proposed development. The sequence which has been followed is set out below:



6 REFERENCES

Capita Symonds (2008) *Good Practice Guidance on Controlling the Effects of Surface Mineral Working on the Water Environment.* Report to the Department of Communities and Local Government and to the Mineral Industry Research Organisation.

Cawley, T. and Cunnane, C., 2003. Comment on Estimation of Greenfield run-off rates. Irish National Hydrology Conference, Athlone.

Geological Survey of Ireland, Groundwater Databases. www.gsi.ie/mapping/.

Gleeson, E., McGrath R., Treanor M., 2013. Ireland's climate: The Road Ahead. Met Éireann, Dublin, Ireland.

Greater Dublin Strategic Drainage Study, 2005. Regional Drainage Policies Technical Document, Volume 2.

Hunter Williams, N.H., Misstear B.D.R, Daly, D. and Lee, M. 2013. Development of a national groundwater recharge map for the Republic of Ireland, Quarterly Journal of Engineering Geology and Hydrogeology, 46, 493-506.

OPW, 2009. *The Planning System and Flood Risk Management – Guidelines for Planning Authorities.*

Nolan, P., O'Sullivan, J., & McGrath, R. (2017). Impacts of climate change on mid-twenty-first-century rainfall in Ireland: a high-resolution regional climate model ensemble approach. International Journal of Climatology.

Nolan, P., 2015. *Ensemble of Regional Climate Model Projections for Ireland. EPA climate change research report No. 159.* EPA: Wexford.

Nolan, P. and McKinstry, A. (2019) Regional Climate Model predictions for Ireland. Proceedings of the International Association of Hydrogeologists – Irish Group 39th Annual Groundwater Conference - Groundwater Drought, Floods and Climate Change.

OPW (2009) *Assessment of Potential Future Scenarios For Flood Risk Management - Draft Guidance*.

Tedd, K.M., Misstear, B.D.R., Coxon, C., Daly, D. and Hunter Williams, N.H. 2012. Hydrogeological insights from groundwater level hydrographs in SE Ireland. Quarterly Journal of Engineering Geology and Hydrogeology 2012, v.45; p19-30.

Walsh S., 2012: *A Summary of Climate Averages 1981-2010 for Ireland, Climatological Note No.14*, Met Éireann, Dublin.

Teagasc/EPA, 2004. Digital maps and accompanying documentation: *EPA Soil and Subsoil Mapping Project – Summary Methodology Description for Subsoils, Land Cover, Habitat and Soils Mapping/Modelling.* Publ. Teagasc.

FIGURES

Figure 1 Flood Extents and Related Information (Source: OPW www.floodi fo.ie)

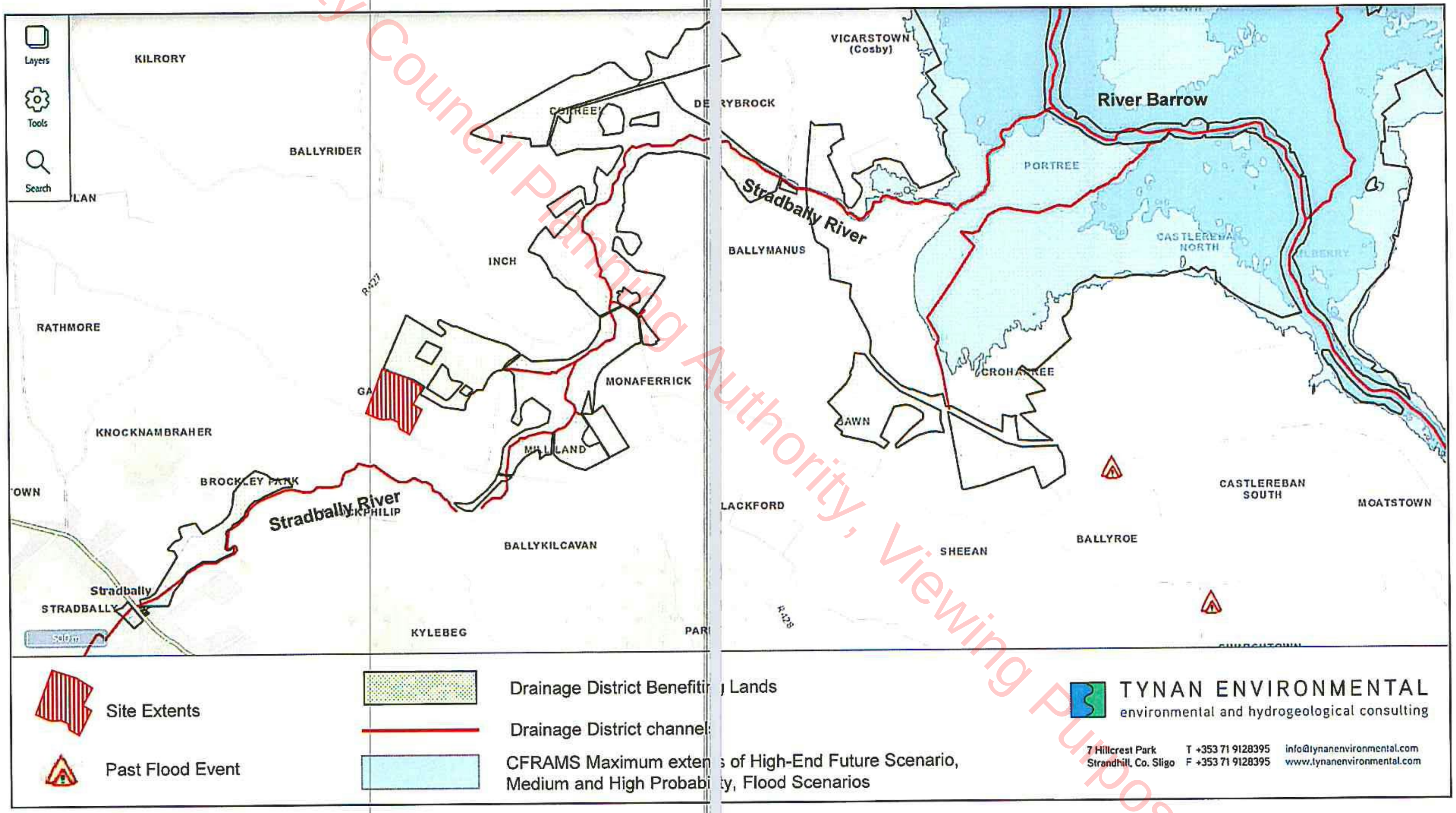
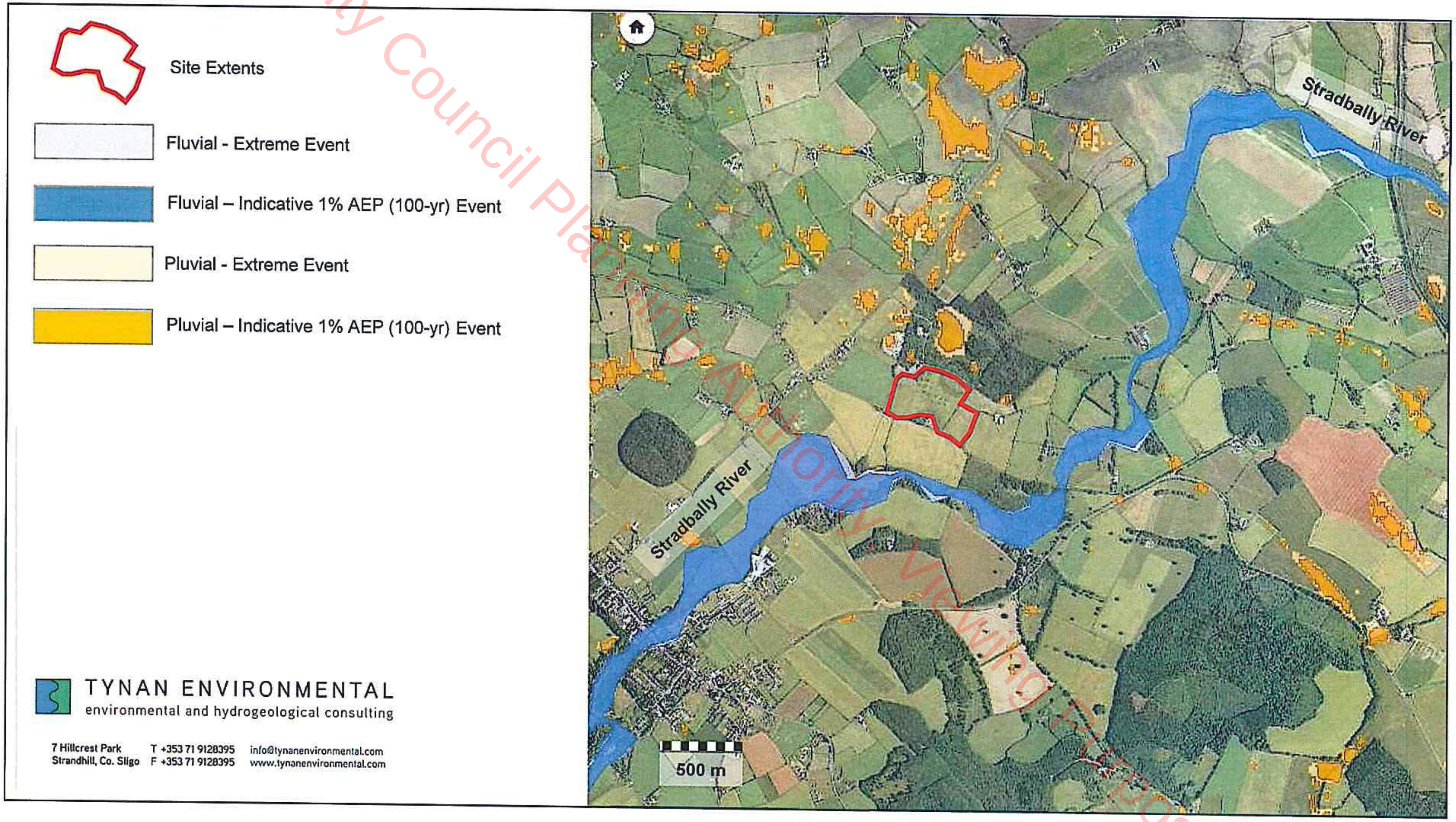
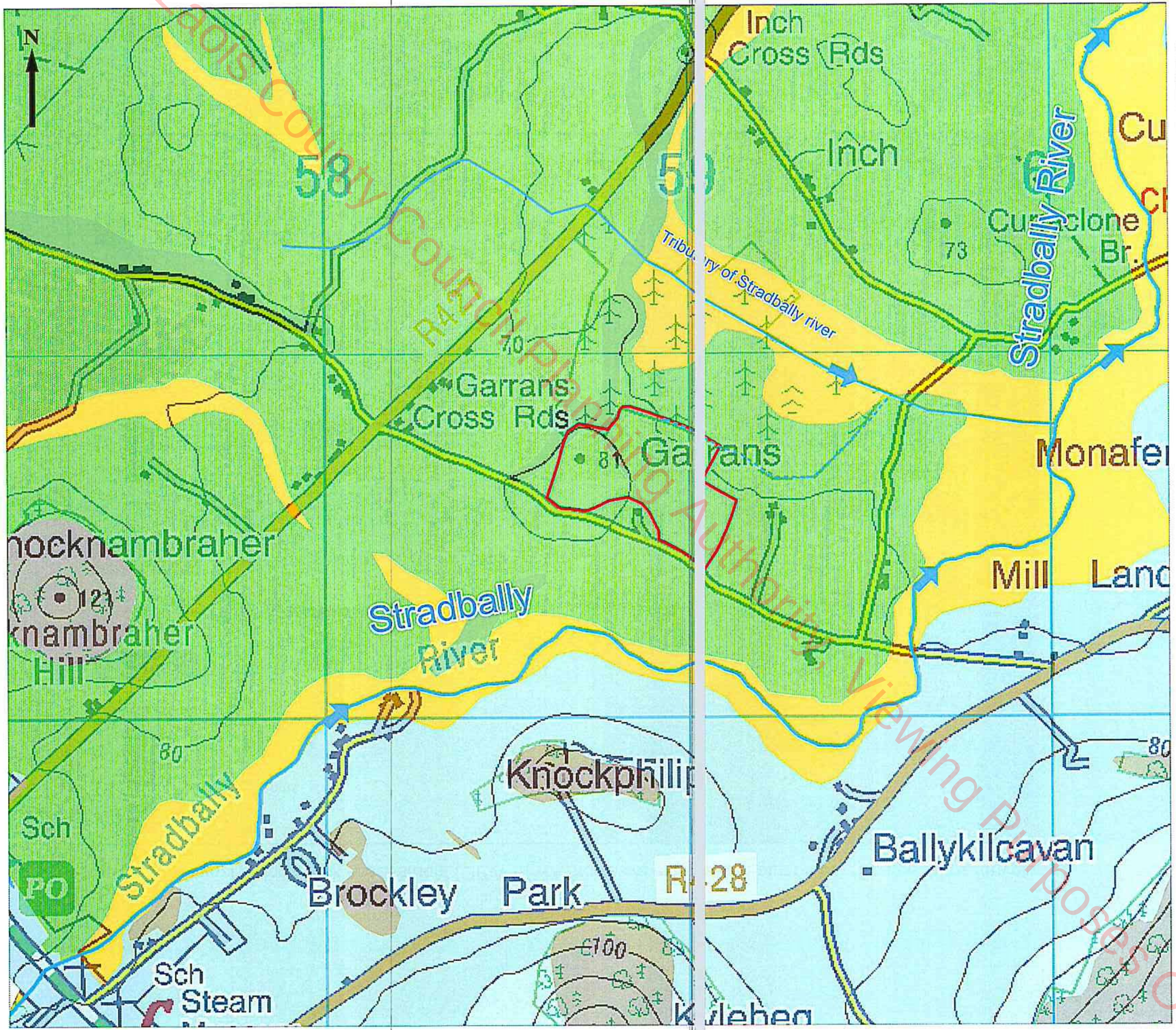


Figure 2 Preliminary Flood Risk Assessment (OPW PFRA Indicative extents and outcomes) (Source: https://myplan.ie)





LEGEND:

- 🟥 Site Boundary
- Surface watercourses
- ------ Man-made drain

Subsoils/Soils

- 🟨 Alluvium
- 🟩 Basic Esker Sands & Gravels (Glaciofluvial)
- 🟩 Limestone Sands & Gravels (Glaciofluvial)
- ▨ Karst Limestone Bedrock exposure
- 🟦 Till derived from limestone bedrock

Title: Figure 3 Subsoils/Soils

Drawing No: 135_3

Project: EIAR Proposed Quarry, Garrons, Co. Laois

Stage: Flood Risk Assessment

Client: Booth Concrete Ltd.

Scale: 1:10,000 @ A3

surveyed	drawn	checked	date
	ST	ST	1/7/2020

Revisions: Rev. 0

TYNAN ENVIRONMENTAL
environmental and hydrogeological consulting
7 Hillcrest Park
Strandhill, Co. Sligo
T +353 71 9128395
F +353 71 9128395
stynan@tynanenvironmental.com
www.tynanenvironmental.com

APPENDIX 1

Surface Water Run-off and Storage Calculation

- Greenfield Run-off Calculations
- Storm Water Storage Calculations

GREENFIELD RUN-OFF RATES : QBAR and Increased Return Pe iods

Site: **134_Garrons, Co. Laois**

QBAR: Institute of Hydrology 124 (1994) 3 Parameter Equation Rural QBAR = 0.0(108(0.01 *AREA)^0.89*SAAR^1.17*SPR^2.17

Type	Location	AREA (ha)	SAAR	SPR	QBAR (m3/s/50 ha)	QBAR (l/s/50 ha)	QBAR (l/s/area)
Greenfield	Arbitrary 50 ha	50.00	830	0.15	0.024714194	24.71419446	24.71419446
Greenfield	1 ha	1.00					**0.494283889**
Greenfield	Site Area	12.84					**6.346605138**

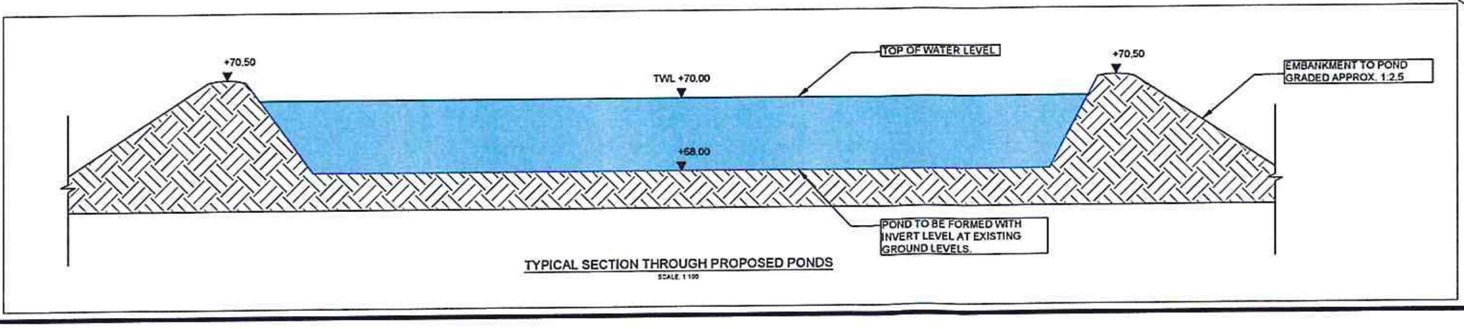
Flood Growth Factors Ireland East*	Storm Return Period (years)	Site Run-off (l/s)	Site Run-off (m^3/s)
	2.3 (QBAR)	6.346605138	0.006346605
1.38	10	8.75831509	0.008758315
1.45	20	9.20257745	0.009202577
1.74	50	11.04309294	0.011043093

***Cawley and Cunnane (2013) interpolated for T = 20**

STORM WATER ATTENUATION STORAGE VOLUME

Return Period (yrs): 20
Pervious area (ha): 12.76
Impervious area (ha): 0.08

(Hours)	Duration (min)	Duration (sec)	Depth (mm)	Depth (m)	Depth (m) +20% CC Allowance	Intensity (m/hr)	Effective rainfall intensity (m/hr)	Discharge (m^3/s)	Volume (m^3)	Greenfield Runoff (m^3)	Required Storage (m^3)
	5	300	10.3	0.0103	0.01236	0.1236	0.0309	1.1021	330.6	3.3	327.3
	10	600	14.4	0.0144	0.01728	0.0864	0.0216	0.7704	462.2	6.6	455.6
	15	900	17	0.017	0.0204	0.0680	0.0170	0.6063	545.7	9.9	535.8
	30	1800	20.1	0.0201	0.02412	0.0402	0.0101	0.3585	645.2	19.9	625.3
1	60	3600	23.7	0.0237	0.02844	0.0237	0.0059	0.2113	760.8	39.8	721.0
2	120	7200	28	0.028	0.0336	0.0140	0.0035	0.1248	898.8	79.5	819.3
3	180	10800	30.9	0.0309	0.03708	0.0103	0.0026	0.0918	991.9	119.3	872.6
4	240	14400	33.1	0.0331	0.03972	0.0083	0.0021	0.0738	1062.5	159.0	903.5
6	360	21600	36.6	0.0366	0.04392	0.0061	0.0015	0.0544	1174.9	238.5	936.4
8	480	28800	40.3	0.0403	0.04836	0.0050	0.0013	0.0449	1293.6	318.0	975.6
10	600	36000	43.2	0.0432	0.05184	0.0043	0.0011	0.0385	1386.7	397.5	989.2
12	720	43200	47.7	0.0477	0.05724	0.0040	0.0010	0.0354	1531.2	477.0	**1054.2**
24	1440	86400	51.1	0.0511	0.06132	0.0021	0.0005	0.0190	1640.3	954.0	686.3
								Maximum Required Storage (m^3)			**1054.2**



TYPICAL SECTION THROUGH PROPOSED PONDS

SCALE 1:100

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED, WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

NOT FOR CONSTRUCTION

LEGEND

EXISTING CARRAIGEWAY	
ASHPHALT SURFACE ACCESS ROAD	▨
CRUSHED ROCK ACCESS ROAD	▨
PROPOSED LINE OF BERM	🟩
EXISTING BUILDINGS	▨
PROPOSED AREAS TO BE PLANTED WITH WILD MEADOW GRASS	▨
ROUTE OF INTERCEPTOR DRAIN	- - -
ROUTE OF SILT WATER FROM PROCESSING PLANT	— · — · —
WATER SUPPLY TO PROCESSING PLANT	———
LINE OF CLEAN PUMPED WATER TRANSFER BETWEEN PONDS	- - - - -
PROPOSED LOCATION OF WELL	●
WATER SUPPLY TO LAGOON 1 FROM WELL	- - - -
INITIAL LINE OF EXTRACTION	- - - -
LAND DRAINAGE CONNECTION FROM THE STOCKPILE DEWATERING SYSTEM	- - - - -
SEPARATE PIPE CONNECTION FROM REFUELING BAY TO STORMWATER ATTENUATION/ SETTLEMENT POND	- - - - -

N

ISSUE	DATE	DESCRIPTION	DRW	CHG
PL01	12.11.20	ISSUED FOR PLANNING PURPOSES	B.S	J.R
P08	16.09.20	REVISED INTERCEPTOR DRAIN AS PER TYNAN ENVIROMENTAL	B.S	J.R
P07	11.09.20	REVISED DRAINAGE RUNS AS PER TYNAN ENVIROMENTAL	B.S	J.R
P06	10.09.20	REVISED AS PER TYNAN ENVIRONMENTAL COMMENTS	B.S	J.R
P05	24.08.20	ADDITIONAL WILD MEADOW GRASS ADDED	B.S	J.R
P04	18.08.20	REVISED AS PER COMMENTS FROM REC	B.S	J.R
P03	28.07.20	REVISED AS PER FEEDBACK FROM TYNAN ENVIROMENTAL	B.S	J.R
P02	18.05.20	ISSUED FOR PRE PLANNING DISCUSSION	B.S	J.R
P01	14.05.20	ISSUED FOR DISCUSSION PURPOSES	B.S	J.R

Jason Redmond & Associates Consulting Engineers
Civil Structural
Project Management
5 Lismard Court, Portlaoise,
Co. Laois.
PH: 05786 81155
Email: info@jrassc.ie

CLIENT:
PAT BOOTH

PROJECT:
PROPOSED SAND & GRAVEL PIT AT
GARRANS, STRADBALLY, CO. LAOIS

TITLE:
PROPOSED SITE DRAINAGE

DATE: 14.05.2020
SCALE: 1:1,000@A1
DRAWING TITLE: 14.312.120
REVISION: PL01

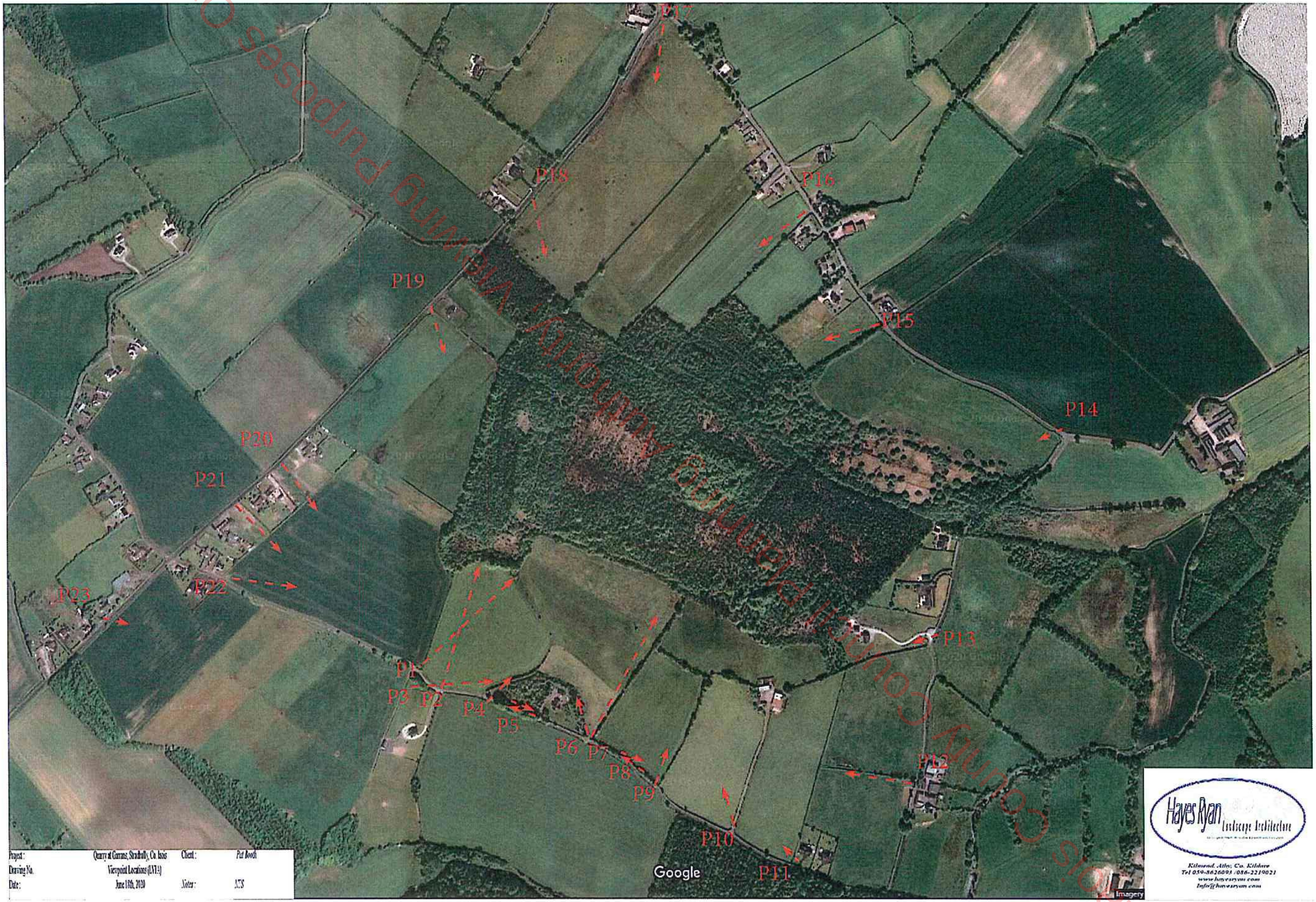
THIS DRAWING SHOULD NOT BE SCALED AND ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. ANY DISCREPANCY IS TO BE REFERRED TO JASON REDMOND AND ASSOCIATES BEFORE PROCEEDING.

DWG LOCATION Z:\DRAWINGS\2014\14.313 GARRANS PIT, STRADBALLY\01 JRASSC\00 CURRENT

Appendix 10.1: Site Viewpoint Location Map

Project :	Quarry at Garrans, Stradbally, Co. laois	Client :	Pat Booth
Drawing No.	Site Location (LVIA)		
Date :	June 18th, 2020	Notes :	NTS

Hayes Ryan Landscape Architecture
Kilmead, Athy, Co. Kildare
Tel 059-8626093 /086-2219021
www.hayesryan.com
Info@hayesryan.com



Project :	Quarry at Garrans, Stradbally, Co. laois	Client :	Pat Booth
Drawing No.	Viewpoint Locations (LVIA)		
Date :	June 18th, 2020	Notes :	NTS

Hayes Ryan Landscape Architecture

Kilmead, Athy, Co. Kildare
Tel 059-8626093 /086-2219021
www.hayesryan.com
Info@hayesryan.com

Appendix 10.2: Site Viewpoint Survey (Photographs)

Appendix 2 Viewpoint Survey

Viewpoint P1 Summer

Viewpoint P1 Winter

Viewpoint P2 Summer

Viewpoint P2 Winter

Viewpoint P3 Summer

Viewpoint P3 Winter

Viewpoint P4 Summer

Viewpoint P4 Winter

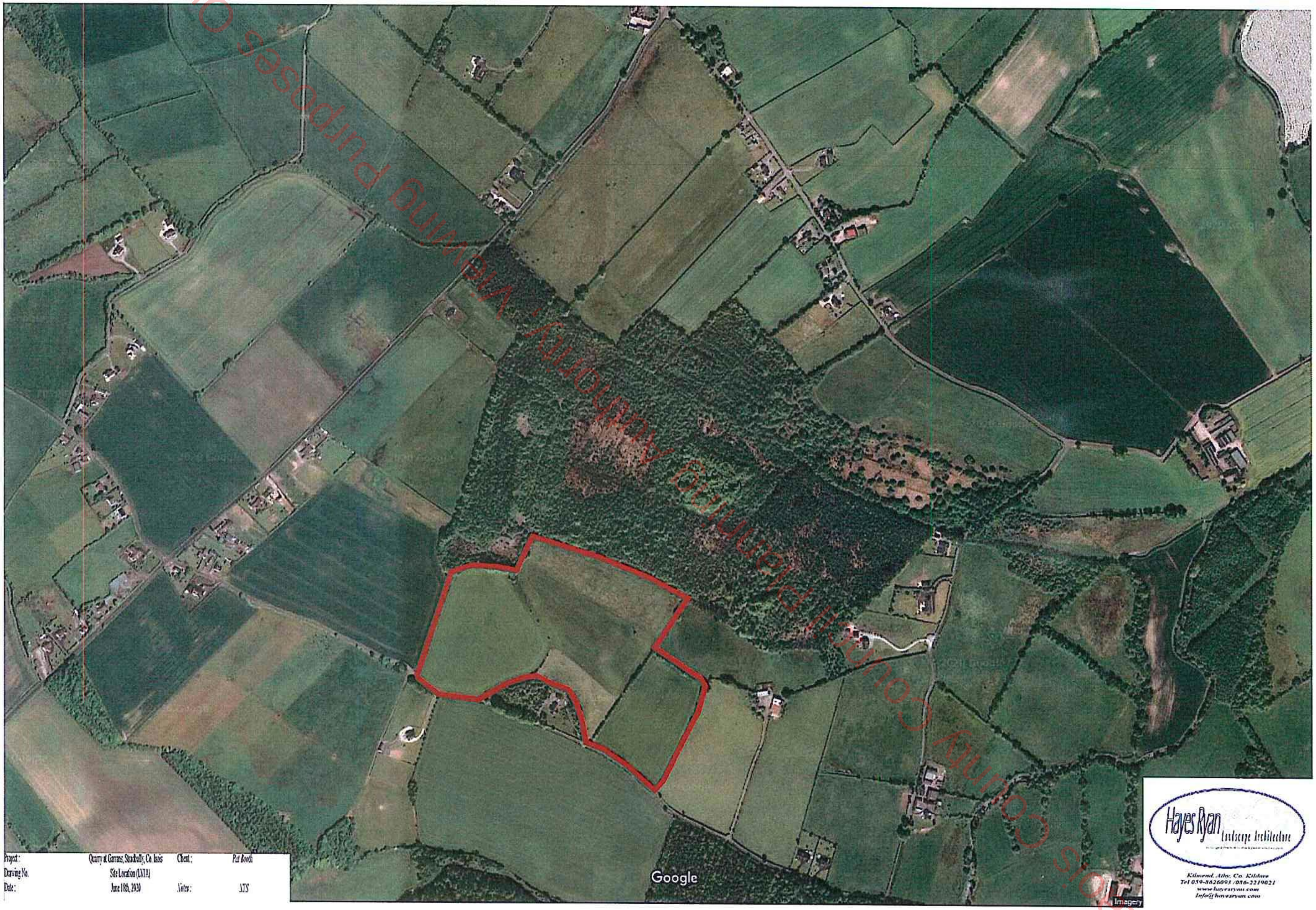
Viewpoint P5 Summer Foliage

Viewpoint P5 Winter Foliage

Viewpoint P6 Summer

Viewpoint P7

Appendix 10.1: Site Viewpoint Location Map



Project :	Quarry at Garrans, Stradbally, Co. laois	Client :	Pat Booth
Drawing No.	Site Location (LVIA)		
Date :	June 18th, 2020	Notes :	NTS

Hayes Ryan Landscape Architecture

Kilmead, Athy, Co. Kildare
Tel 059-8626093 /086-2219021
www.hayesryan.com
Info@hayesryan.com

Project :	Quarry at Garrans, Stradbally, Co. laois	Client :	Pat Booth
Drawing No.	Viewpoint Locations (LVIA)		
Date :	June 18th, 2020	Notes :	NTS

Hayes Ryan Landscape Architecture

Kilmead, Athy, Co. Kildare
Tel 059-8626093 /086-2219021
www.hayesryan.com
Info@hayesryan.com

Appendix 10.2: Site Viewpoint Survey (Photographs)

Appendix 2 Viewpoint Survey

Viewpoint P1 Summer

Viewpoint P1 Winter

Viewpoint P2 Summer

Viewpoint P2 Winter

Viewpoint P3 Summer

Viewpoint P3 Winter

Viewpoint P4 Summer

Viewpoint P4 Winter

Viewpoint P5 Summer Foliage

Viewpoint P5 Winter Foliage

Viewpoint P6 Summer

Viewpoint P7

Viewpoint P8 Summer

Viewpoint P8 Winter foliage

Viewpoint P9

Viewpoint P 10 Summer

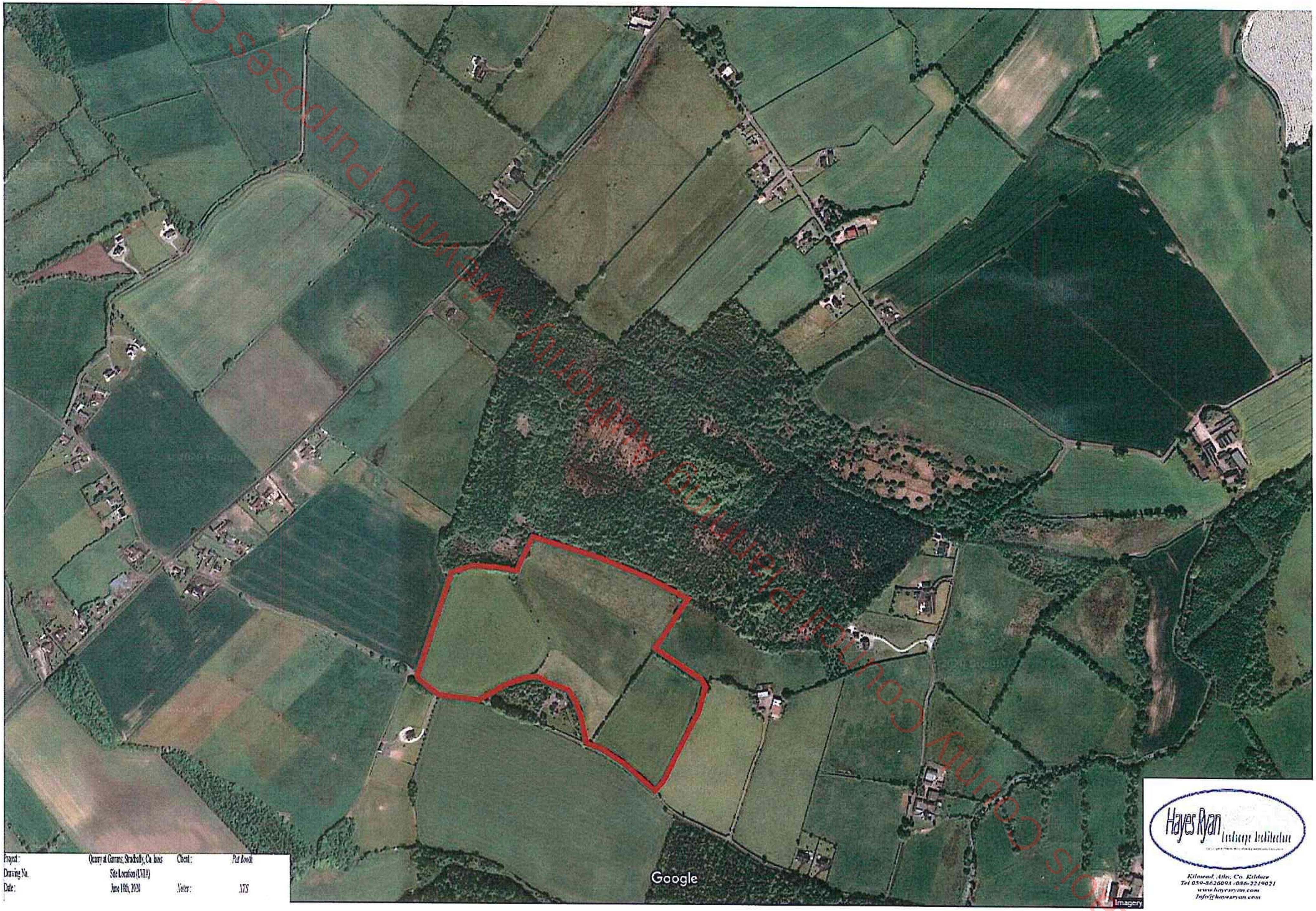
Viewpoint P 10 Winter

Viewpoint P 11

Figure 11 Hedgerows are typically neat and well maintained in the area

Figure 12 Mature tree stands are generous and established hedgerows are typical of the local landscape around Garrans.

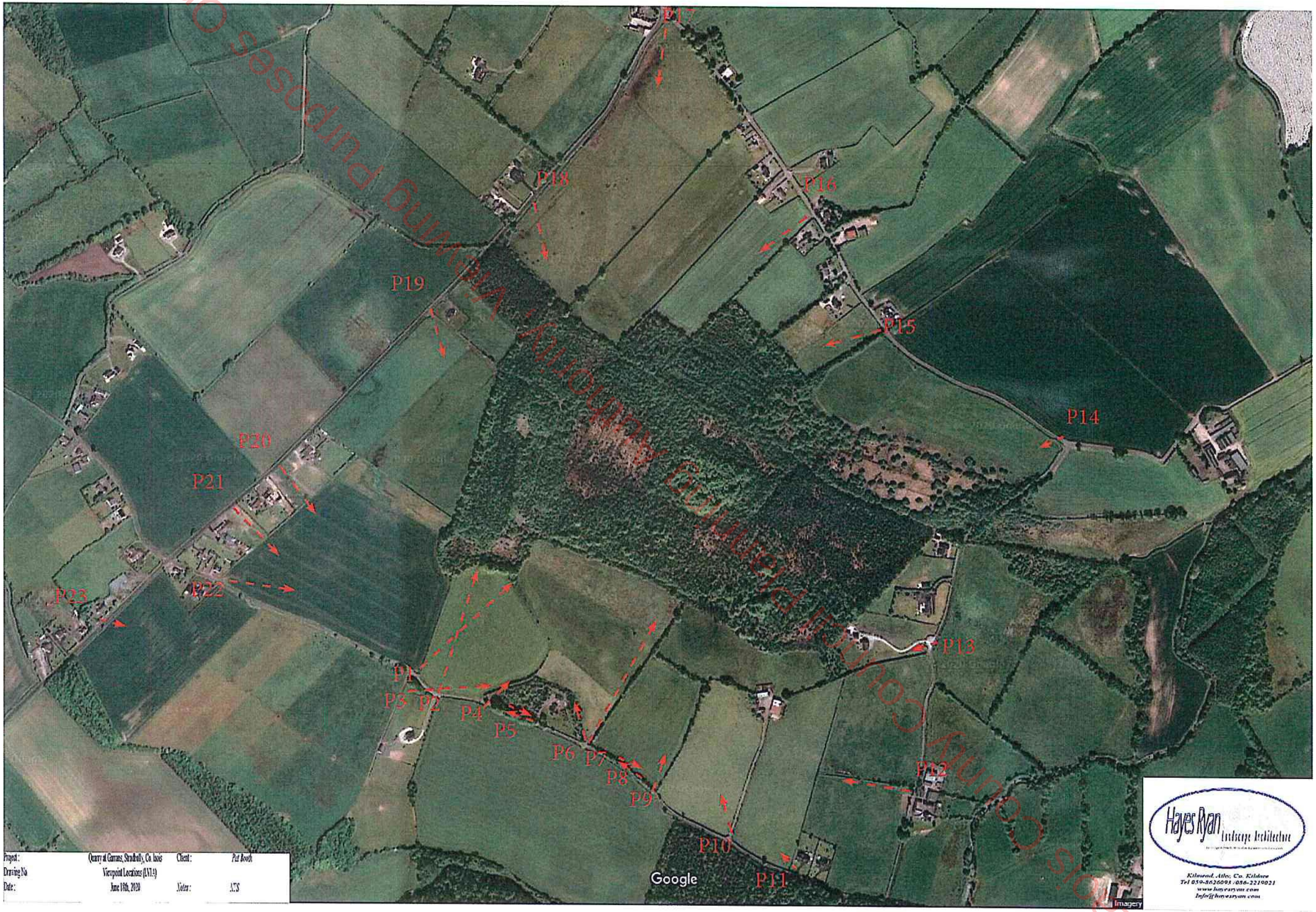
Appendix 10.1: Site Viewpoint Location Map



Project :	Quarry at Garrans, Stradbally, Co. laois	Client :	Pat Booth
Drawing No.	Site Location (LVIA)		
Date :	June 18th, 2020	Notes :	NTS

Hayes Ryan Landscape Architecture

Kilmead, Athy, Co. Kildare
Tel 059-8626093 /086-2219021
www.hayesryan.com
Info@hayesryan.com



Project :	Quarry at Garrans, Stradbally, Co. laois	Client :	Pat Booth
Drawing No	Viewpoint Locations (LVIA)		
Date :	June 18th, 2020	Notes :	N.T.S

Hayes Ryan
Landscape Architecture
Kilmead, Athy, Co. Kildare
Tel 059-8626093 /086-2219021
www.hayesryan.com
Info@hayesryan.com

Appendix 10.2: Site Viewpoint Survey (Photographs)

Appendix 2 Viewpoint Survey

Viewpoint P1 Summer

Viewpoint P1 Winter

Viewpoint P2 Summer

Viewpoint P2 Winter

Viewpoint P3 Summer

Viewpoint P3 Winter

Viewpoint P4 Summer

Viewpoint P4 Winter

Viewpoint P5 Summer Foliage

Viewpoint P5 Winter Foliage

Viewpoint P6 Summer

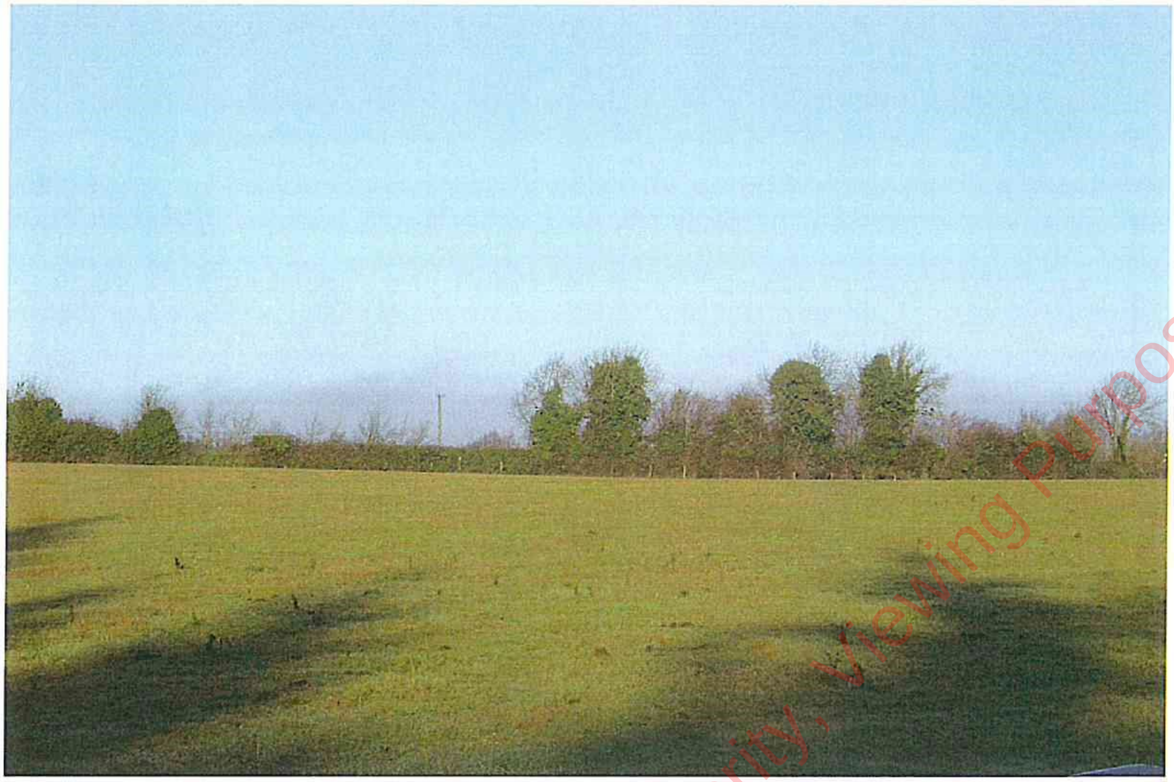
Viewpoint P7

Viewpoint P8 Summer

Viewpoint P8 Winter foliage

Viewpoint P9

Viewpoint P 10 Summer



Viewpoint P 10 Winter

Viewpoint P 11

Viewpoint P 12

Viewpoint P 13

Viewpoint P 14

Viewpoint P 15

Appendix 3 General photographic landscape survey

Figure 1 View towards applicant site from Garrons Cross Road in winter.

This, the approach to the site, has no glimpse of the applicant site at this point.

Figure 2 Good mature tree stand to fore of the applicant site, good winter screening.

Figure 3. Characteristic road side trees and hedgerow in full leaf to fore of applicant site.

Figure 4 Excellent species mixture is evident in all the hedgerows in the area. Here, Privet, ***Ligustrum sps.*** Holly, ***Ilex sps.*** Beech ***Fagus sps.*** form dense and effective screening.

Figure 5 Excellent species mixture is evident in winter and screening is equally as effective. Here beech, *Fagus sps*. is combined with evergreen yew, *Taxus sps.*

Figure 6 Excellent height is apparent on the site boundaries supplying effective screening.

Figure 7. The hedgerow network provides superb screening even in winter.

Figure 8. The hedgerow network is species rich and diverse in summer, giving excellent screening in full leaf.

Figure 9 Hedgerows are typically neat and well maintained in the area

Figure 10 There are good layers of hedgerow all throughout the area.

Figure 11 Hedgerows are typically neat and well maintained in the area

Figure 12 Mature tree stands are generous and established hedgerows are typical of the local landscape around Garrans.

Figure 13 Important hedgerow both for spatial pattern and screening. This hedgerow on the western boundary is overmanaged . This boundary is essential for maintaining a sense of landscape pattern and to establish screening. Controlling bramble and allowing whitethorn to thicken up with one tree species at five metre intervals, will improve the quality of this hedgerow.

Figure 14 Mature tree stand along the north western corner of the site is an important feature of this landscape type. The characteristics of lowland agricultural landscape with long views to nearby hills, across the applicant site are evident in this image.

Figure 15 The north western corner of the site. By retaining these boundary trees for as long as possible, planting young substitute trees, the landscape pattern will be maintained.

Figure 16 The landscape viewed from within the site. The residence within the hedgerow and tree group has some screening from the applicant site

Figure 17 Remnants of a hedgerow defining the field pattern on site. There are just a few *Crataegus* remaining.The hedgerow seen here running north.

Figure 18 Remnants of the same hedgerow running in a southerly direction. The rear of this dwelling and its surrounding hedge and tree planting appear on all historical landscape maps.

Figure 19 Underlying landform and remnants of the original field pattern.

Figure 20 Hedgerows can be strengthened and planted to ensure good screening is always provided and the landscape pattern is reinforced.

Figure 21 Mature boundary hedgerows and the local hedgerow network ensure very effective screening of the applicant site.

Figure 22 Double hedgerow and similar hedges in the locality adding layers of vegetation and screening to the landscape.

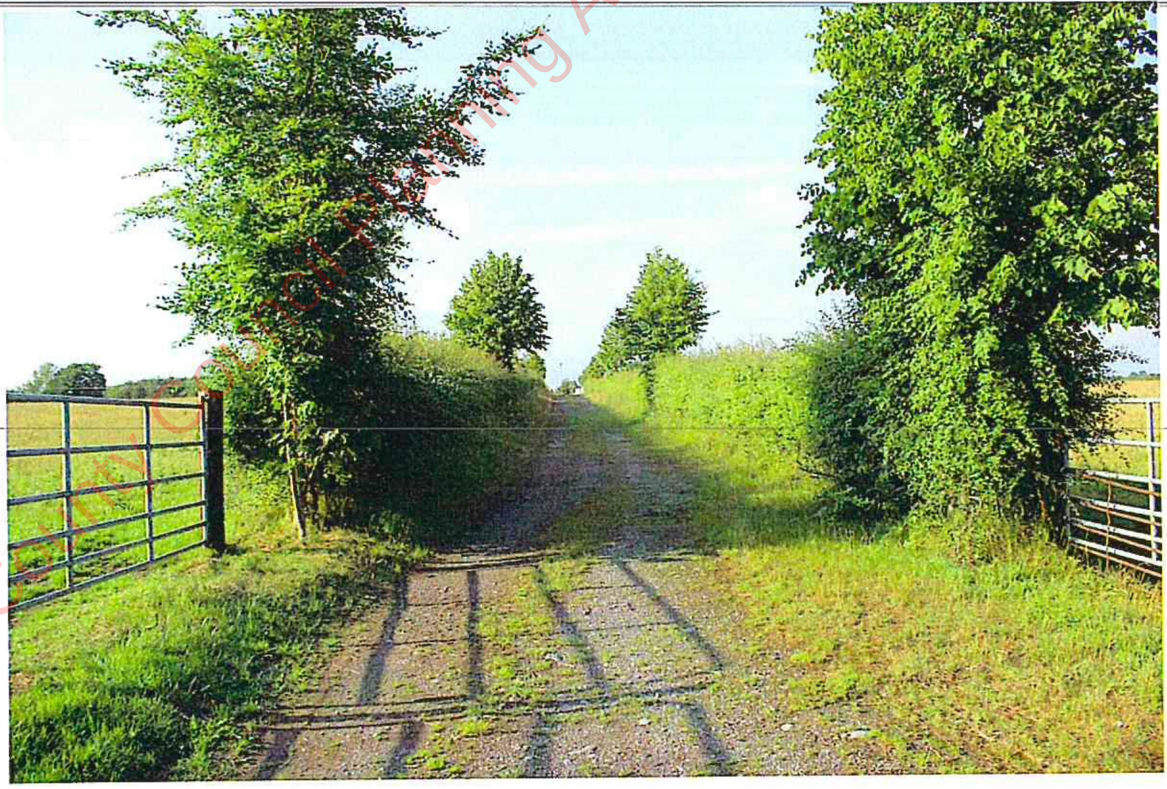


Figure 23 Double hedge in summer adds wonderful layers to the landscape

Figure 24 Boundary hedgerow with trees on the eastern side of the site, winter appearance.

Figure 25 Hedgerow with trees on the eastern side of the site in summer foliage.

Figure 26 Long views across the applicant site will not be disrupted in the long term by the presence of the quarry or the restored landscape. Summer.

Figure 27. Long views to topographical elevations across the applicant site. Winter appearance

Figure 28 Soft slope and afforsetation towards lower lying fields in the vacinity of the applicant site.

Figure 29 Wave like undulations at field scale in the adjacent field system

Figure 30 The undulating nature of the landform at field scale, is most evident during the winter months

Figure 31 The landform backing onto a tree stand and woodland in the north western corner. The forestry, tree and woodland system combine to screen the site from the north.

Figure 32 Traditional farm clusters surrounded in hedgerows, tree planting and woodland back drops are characteristic of the landscape typology.

Figure 33 Undulating rolling landform, hedgerows, trees and woodland plantations are characteristic of the area.

Figure 34 The site is well concealed from the greater landscape by a combination of undulating landscape and hills and generous mature woodlands nd hedgerows. This view from the site towards south east.

Figure 35 The rolling and wooded landscape in the area of Garrans is peppered with small stone bridges over the River Stradbally

Figure 36 Adjacent fields with wave like undulations are characteristic of the winter landscape.

Figure 37 More dramatic undulations at field scale towards north west of adjoining field system.

Figure 38 Wave undulation in winter crop cover adjacent field system.

Figure 39 Full hedgerows along R427, Stradbally Road

Appendix 10.4: Historical Landscape (Old Maps)

Appendix 4 Historical Landscapes

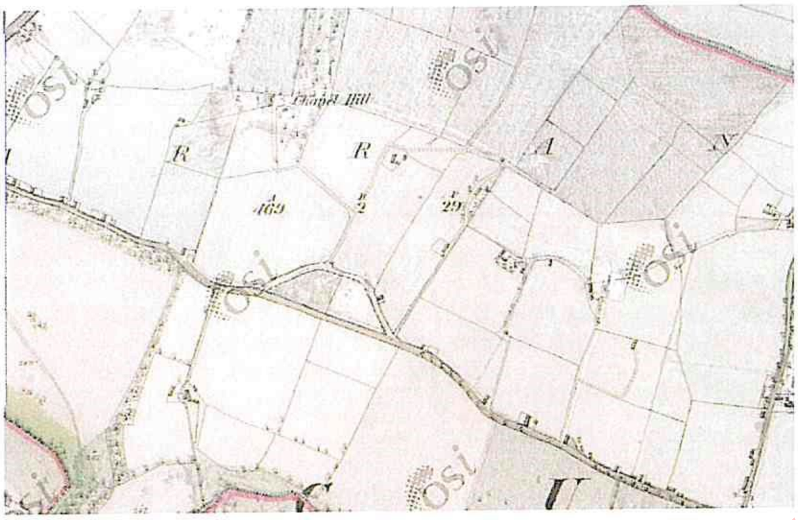


Figure 1 Ordnance Survey Historical 6 inch colour 1837-1842

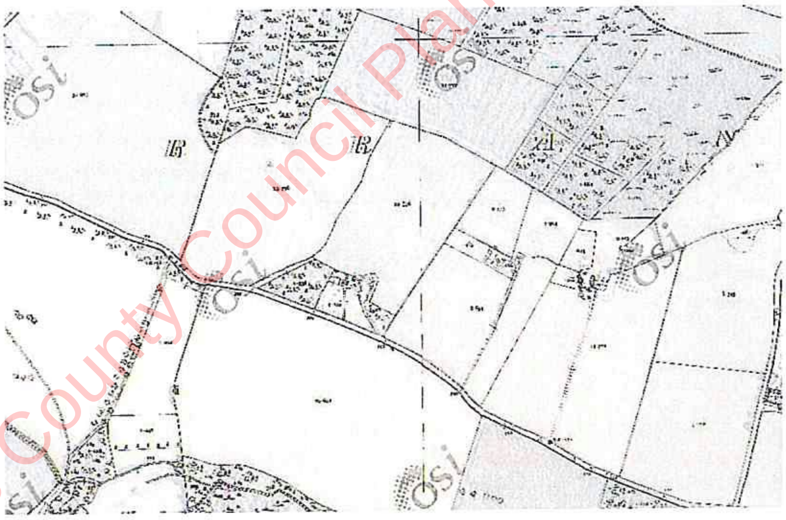


Figure 2 Ordnance Survey Historical 25 inch 1837 -1913

Figure 3 Ordnance Survey 1830's Historic Flood Plains Locations

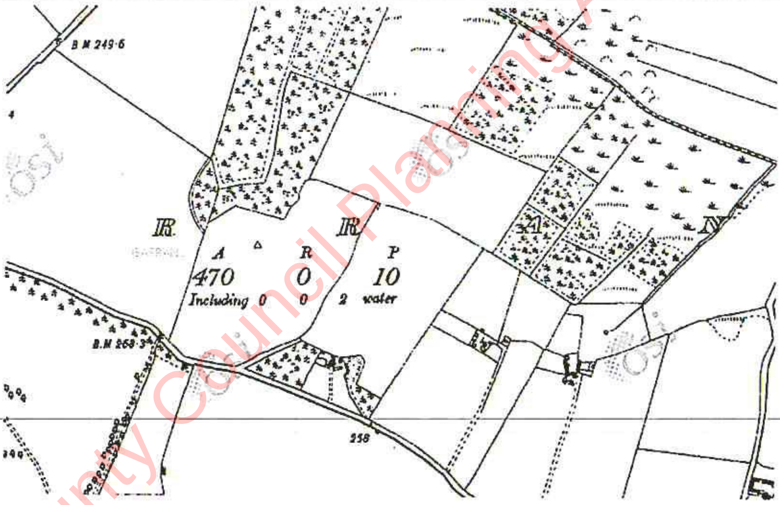


Figure 4 Ordnance Survey Historical Maps 6 inch Cassini

Appendix 10.5: LCA Views (Details from Laois County Development Plan 2017-2023)

Appendix 5 LCC Landscape Character Assessment and Views and Prospects

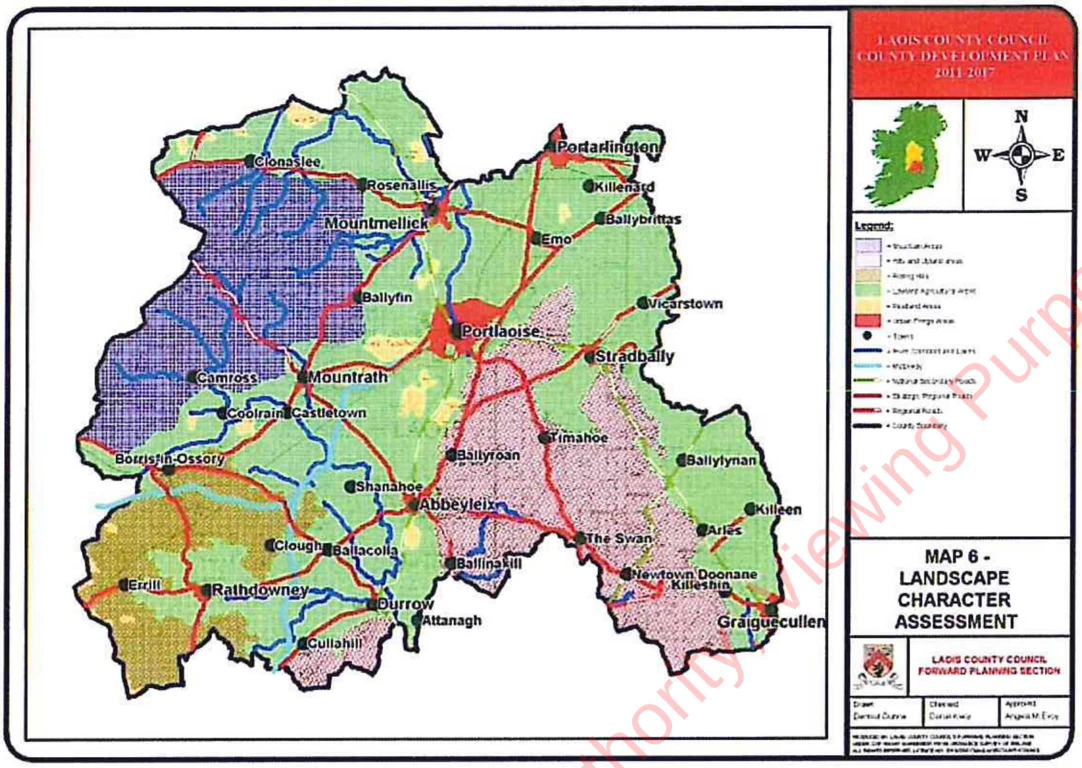


Figure 1. Landscape Character Assessment

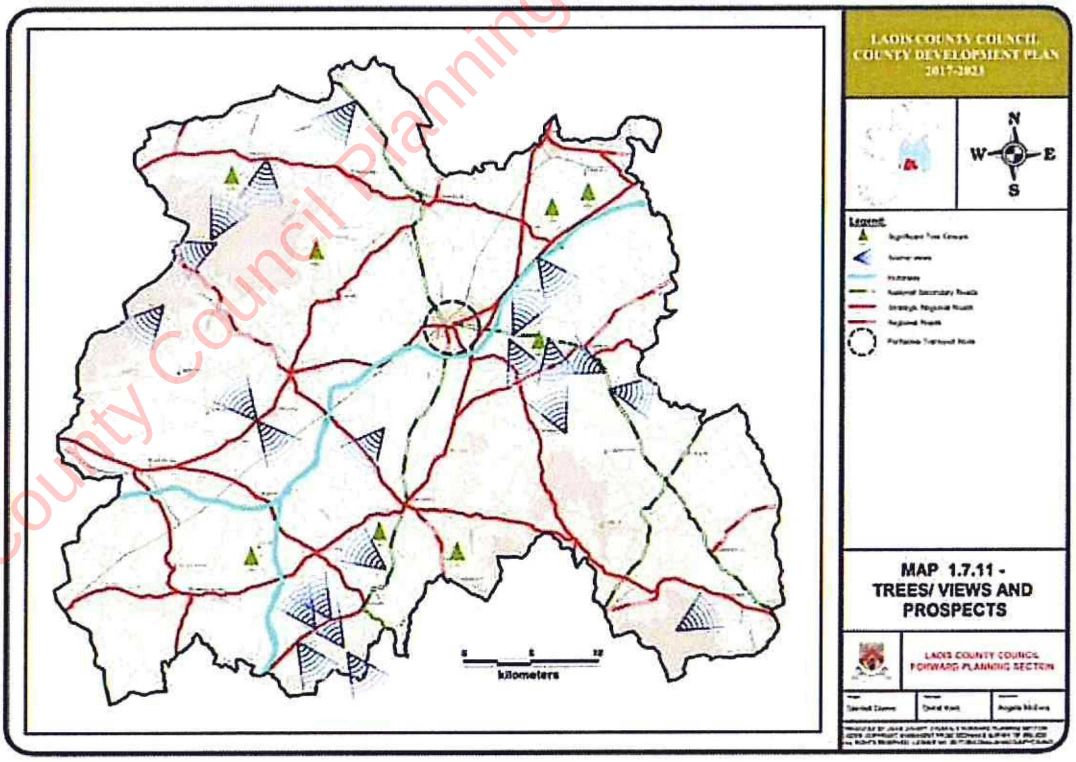


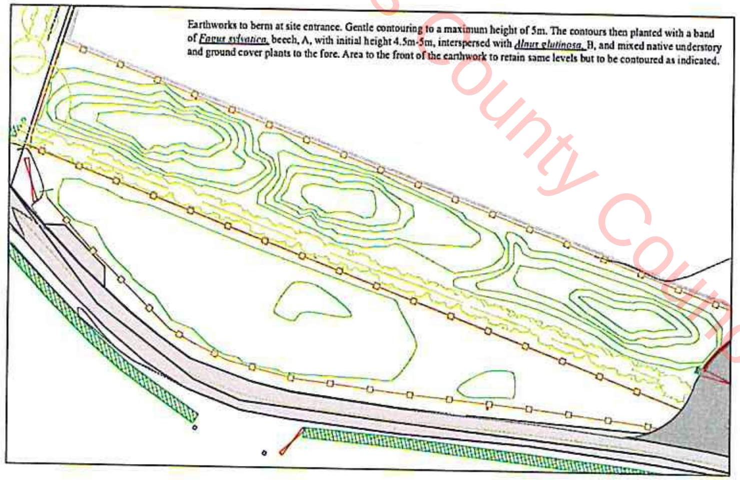
Figure 2. Location of views and Prospects

Appendix 10.6: Landscape Plans

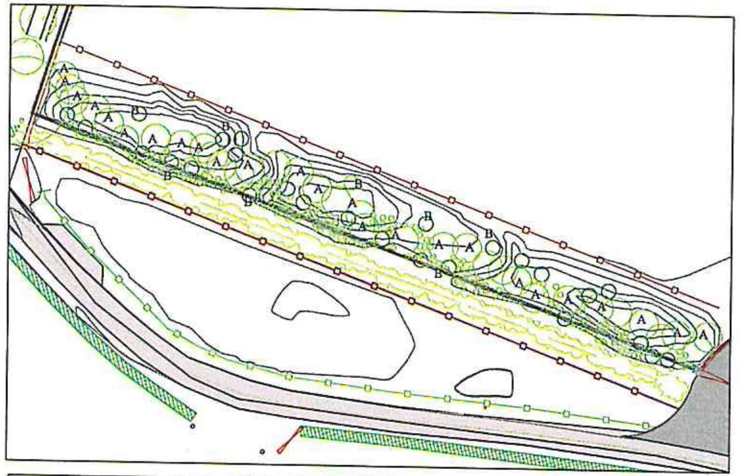
Interim and Restoration Phases

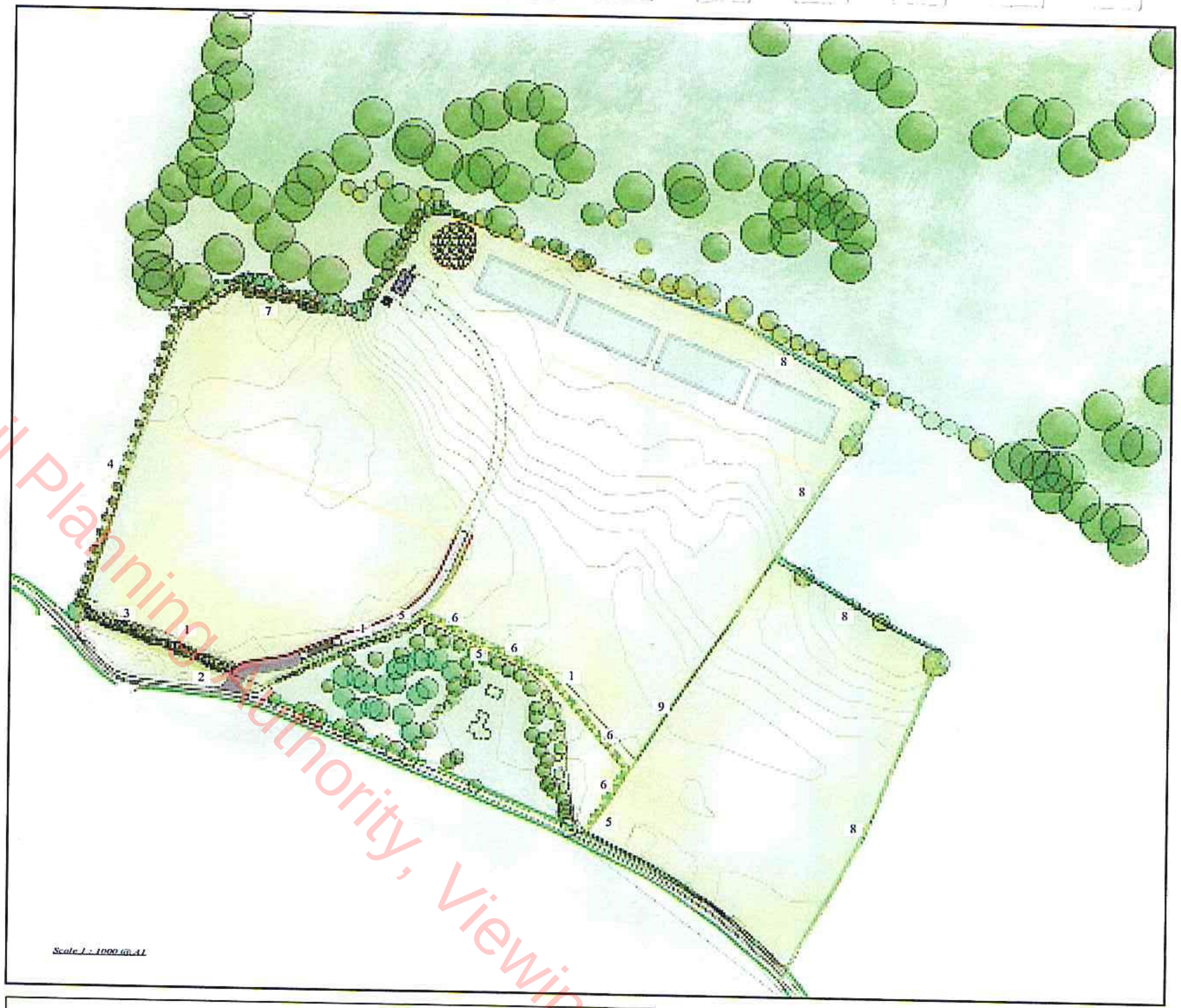
Interim Landscape Plan

Construction and Operational Phase



Earthworks to berm at site entrance. Gentle contouring to a maximum height of 5m. The contours then planted with a band of *Fagus sylvatica*, beech, A, with initial height 4.5m-5m, interspersed with *Alnus glutinosa*, B, and mixed native understory and ground cover plants to the fore. Area to the front of the earthwork to retain same levels but to be contoured as indicated.





LEGEND

1.Screening from temporary berms reinforced with good planting.

2.Main berm providing screening to be contoured to a height of 5m giving a pleasant appearance to the earthworks reminiscent of surrounding landscape. Contours arising from landscape at 1m height difference, with variations in distance between contours.

3. Planting on contoured berm to add additional height to the screening. 18-20 cm rb. Fagus sylvatica to add an additional 4.5-5m height to the berm contours and these plants to be distributed naturally along the contours. *Alnus glutinosa* 150 cm ht br. to be distributed throughout the planting here. Alnus grows at 1m per annum, generating nitrogen at the root system and providing shelter for adjacent plants and excellent screening. Understory plants to entirely cover remainder of mounds facing the road. *Corylus avellana* 120 cm ht br. *Ilex aquifolium* 3 L. *Taxus bacatta* 60 cm rb. at 300mm centres with any remaining bare soil planted with *Hedera helix 'Hibernica'* 9 cm liner.

4. Western hedgerow to be allowed to regenerate with naturally emerging trees like ash, sycamore, beech or roan at 5-10 m intervals.These to be pruned with a single leader and clear stem. Bramble and weed species to be removed with stumps being treated with careful application of brushwood killer. The brushwood killer to be glyphosate based and applied with all caution for adjacent plant materials and health and safety. As the plant life emerges from the hedge, gaps to be infilled with *Crataegus monogyna* 120cm ht.br. and tops clipped in first season of growth to allow whitethorn to thicken up. A small ditch to be formed parallel to the western hedgerow and this to be planted parallel to the western boundary with a hedgerow mix; 60% *Crataegus monogyna* 120 cm ht br. in staggered rows at 300mm centres, interspersed with 10 % *Ilex aquifolium*, 2L . 10% *Prunus spinosa* 60-90 cm ht.br and 20 % *Corylus avellana* 120 cm ht br. Whitethorn to be clipped down after first growing season to allow the hedge to thicken. New hedgerow

5. Existing hedgerow to be protected as berm is formed and no excess soil or heavy material or machinery to encroach on the hedgerow root system or below the plant drip line.

6.Temporary berm to be planted with *Alnus glutinosa* 8-10 cm gr. br, *Sorbus acuparia* 8-10 cm gr. br, *Viburnum opulus* 2L, *Betula pendula* 8-10 cm gr. br, *Fagus sylvatica* 8-10 cm gr. br, *Corylus avellana* 120cm ht.br, *Acer campestre*, 120 cm ht. *Quercus petraea* 8-10 cm gr. br.

7. Additional Beech 7 no. 12-14 cm gr br/rb to be planted at this part of the boundary. Existing trees to be protected.

8. Eastern boundary hedgerow, roadside hedgerow and northern hedgerows to be protected with no loading on or encroachment of the root zone of the hedgerow or hedgerow trees. With no excavation of the north western boundary, the priority protection of the root zone is from loading of equipment or materials.

9. Mid field hedgerow to be preserved for as long as possible until excavation of this phase

Hayes Ryan Landscape Architecture

www.hayesryan.com
Kilmead, Athy, Co. Kildare,
info@hayesryan.com
086 2219021
Tel 01- 6875095

Project : Pat Booth, Garrons, Stradbally, Co. Laois
Drawing : Interim Landscape Plan
Drawing No. BG08LM02
Drawn By : GH
Date : 12/8/'20
Scale : 1 : 1000 @A1

Landscape Plan

LEGEND

1. Historical field pattern restoration according to OS 25inch 1888-1913 map.

2. Historical field pattern restoration according to OS 25 inch 1837-1842

3. Softening of angular landform to generate natural contours sympathetic with surrounding topography.

4. Repair and maintenance to hedgerows in situ prior to operations. All hedgerows to be trimmed, pruned and layed as appropriate. Hedgerow trees to be shaped and all dead and diseased wood to be removed. Any gaps to be subject to infill planting.

5. Hedgerow to be reinstated with new hedgerow to replace preexisting hedgerow. Slight topographical undulations adjacent to hedgerow and hedgerow to be lifted onto a ditch to ensure good growing conditions

6. New hedgerow to generate field pattern with slight topographical differentiation and hedgerow to be planted on to raised ditch.
Planting Specification : Plants selected according to BS 3936 1:1992
New Hedgerows
A mixed double row native hedgerow consisting of the following plants planted at 300mm staggered centres to consist of:
60% Crataegus monogyna br ht. 90-120cm
20% Prunus spinosa br ht. 60-90cm
5% Viburnum opulus br ht. 60-90cm
10% Ilex aquifolium 5L ht.40-60cm
5% Euonymus europaeus br ht. 60-90cm
Quercus petraea planted at 10m intervals 12-14 cm gr.br.

7. Tree planting to complete historical pattern and to soften contours to new lowered fields. Planting to also reinforce the tree planting to the forsetry on the northwestern boundary. Recycle where possible trees planted on the berms during the construction and operational stage by root balling best samples. Tree planting and establishment according to BS 8545 2014 - from nursery stock to independence in landscape.

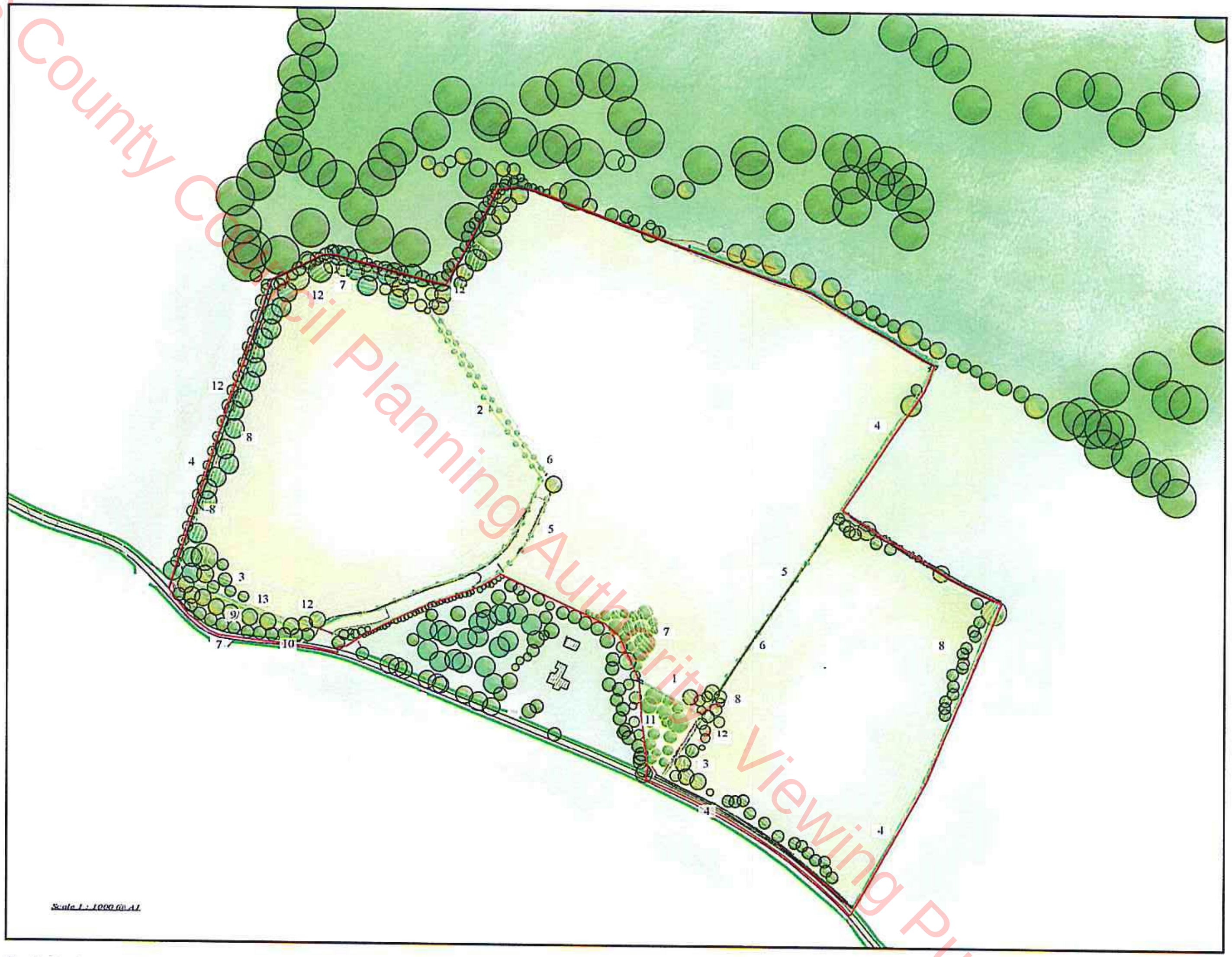
8. Mixed Tree Planting
Tree Specifications
Fagus sylvatica 12-14 cm gr br.
Quercus petraea 10-12 cm gr br
Quercus robur 10-12 cm gr br
Alnus glutinosa 10-12 cm gr br
Sorbus acuparia 10-12 cm gr br
Ilex aquifolium 3L containerised
Corylus avellana 120 cm ht.br (understory)
9. Beech 4.5-5m height
Fagus sylvatica 18-20 cm gr rb

10.Taxus bacatta 60cm ht rb confined to roadside boundary

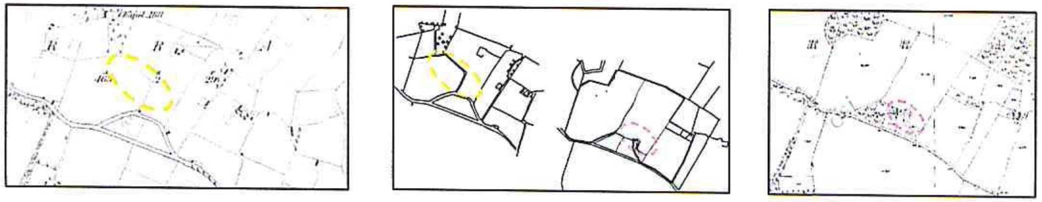
11. Taxodium distichum 5L, Alnus glutinosa 10-12 cm gr. br/rb, where planting conditions prove damp.

12. New planting to be irrigated by establishing a dripline irrigation system or setting up an alternative irrigation system for first two years post planting.

13. Irish meadow mixture or Wildflower mix no 2 or Farm pollinator mix seeded to contours and adjacent to planting.



Historical Landscape patterns extracted from OS 25 inch 1888-1913 and 1837-1842 (nts)



Project : Pat Booth, Garrons, Stradbally, Co. Laois
Drawing : Landscape Plan Post Restoration
Drawing No. BG08LM01
Drawn By : GH
Date : 12/8/'20
Scale : 1 : 1000 @A1

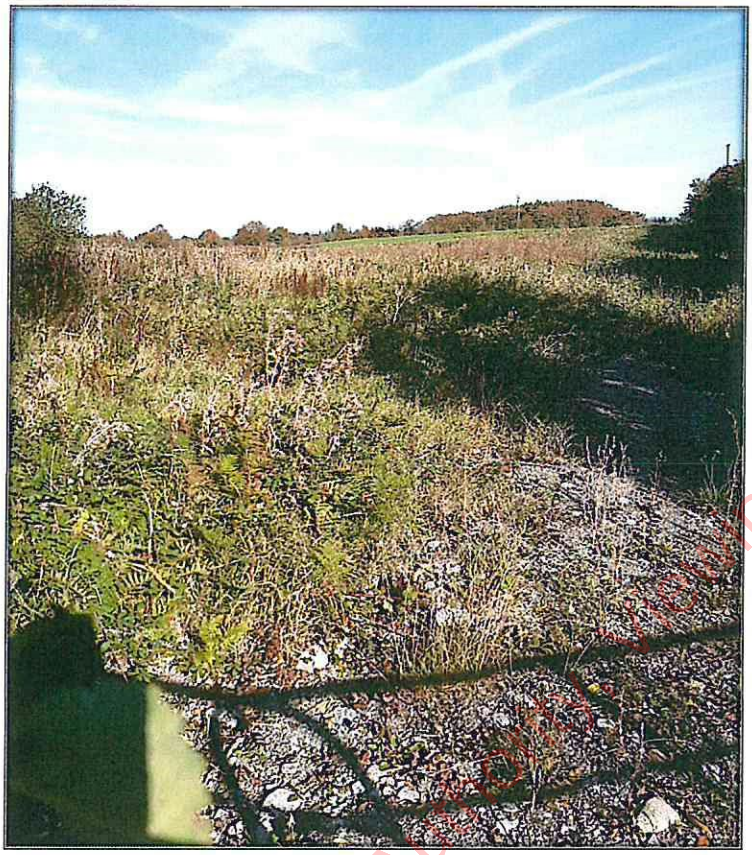
Hayes Ryan Landscape Architecture

Species List

Common Name	Scientific Name
Alder	*Alnus glutinosa*
Ash	*Fraxinus excelsior*
Beech	*Fagus sylvatica*
Bindweed	*Convolvulus arvensis*
Blackthorn	*Prunus spinosa*
Bracken	*Pteridium aquilinum*
Bramble	*Rubus fruticosus agg.*
Broad plantain	*Plantago major*
Broadleaved Dock	*Rumex obtusifolius*
Cocksfoot grass	*Dactylis glomerata*
Cleavers	*Gallium aparine*
Coltsfoot	*Tussilago farfara*
Common hogweed	*Heracleum sphondylium*
Corn flower	*Centaurea cyanus*
Cow parsley	*Anthriscus sylvestris*
Creeping buttercup	*Ranunculus repens*
Creeping thistle	*Cirsium arvense*
Dandelion	*Taraxacum officinale*
Dog rose	*Rosa canina*
Elder	*Sambucus nigra*
False oat grass	*Arrhenatherum elatius*
Fescue	*Festuca sp.*
Fools watercress	*Apium nodiflorum*
Fumitory	*Fumaria muralis*
Germander speedwell	*Veronica chamaedrys*
Ground ivy	*Glechoma hederacea*
Hairy bittercress	*Cardamine hirsuta*
Hawthorn	*Crataegus monogyna*
Hazel	*Corylus avellana*
Herb Robert	*Geranium robertianum*
Hoary willowherb	*Epilobium parviflorum*
Holly	*Ilex aquifolium*
Horsetail	*Equisetum arvense*
Ivy	*Hedera helix*
Knapweed	*Centaurea nigra*
Lilac	*Syringa vulgaris*
Meadow grass	*Poa annua*
Gorse	*Ulex europaeus*
Guelder rose	*Viburnum opulus*
Mugwort	*Artemisia vulgaris*
Nettle	*Urtica diocia*
Pedunculate oak	*Quercus robur*
Pignut	*Conopodium majus*
Poppy	*Papaver rhoeas*
Prickly sowthistle	*Sonchus asper*
Privet	*Ligustrum vulgare*
Red clover	*Trifolium pratense*
Red leg	*Polygonum persicaria*
Ribwort plantain	*Pantago lanceolate*
Rye grass	*Lolium perenne*
Rosebay willowherb	*Epilobium angustifolium*
Scarlett pimpernel	*Anagallis arvensis*
Shepard's purse	*Capsella bursa-pastoris*
Silver birch	*Betula pendula*
Snowberry	*Symphoricarpos albus*
Smooth hawksbeard	*Crepis capillaris*
Sowthistle	*Sonchus arvensis*
Spindle	*Euonymus europaeus*
Spear thistle	*Cirsium vulgare*
Sycamore	*Acer pseudoplantatus*

Sunflower	*Helianthus annuus*
Traveller's joy	*Clematis vitalba*
Tufted vetch	*Vicia cracca*
Vetches	*Vicia sp.*
White mustard	*Sinapis alba*
Willow	*Salix sp.*
Yarrow	*Achillea millefolium*

Appendix 11.2: Site Photographs



View into the Site from the Road

Appendix 11.3: Mammal Report

A Mammal Assessment of Garrons Pit, Stradbally, County Laois

Brian Keeley B.Sc. (Hons) in Zool. December 2019

TABLE OF CONTENTS

Introduction

Most of Ireland's mammals enjoy protection under the Wildlife Act (1976) and the more recent updating of this legislation (Wildlife (Amendment) Act 2000, S.I. No. 94 of 1997, S.I. No. 378 of 2005, European Communities (Natural Habitats) (Amendment) Regulations, 2005). In conjunction with the enactment of the Habitats Directive into Irish legislation, all native mustelid species and bat species are protected with further protection given to otters and lesser horseshoe bats. Lesser horseshoe bats are not found in County Kildare or the neighbouring county (Wicklow).

Bats account for nine of Ireland's terrestrial mammal species, approximately one quarter of the species of the Irish land mass. All of the species found to date and indeed all bat species that may remain undetected up to the present are afforded legal protection under Irish and EU legislation and agreements (Wildlife Act (1976), Wildlife (Amendment)

Act (2000), S.I. No. 94 of 1997 and S.I. No. 378 OF 2005 implementing the EU Habitats Directive, Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animal) and the Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats).

A speedy and productive means of determining the mammal fauna within a site is to walk the entire site concerned, paying particular attention to all hedgerow, woodland, watercourses, fence lines, paths etc. to locate mammal signs.

Determining the fauna of the surrounding area may involve a much greater level of assessment if the aim of the survey is to catalogue all mammals in all townlands but this is too detailed for the aim of creating mitigation for most developments except where the species under consideration are particularly elusive or specialised and leave few signs. The survey undertaken within the site of the proposed quarry at Garrons, Stradbally allows a targeting of mitigation measures to the appropriate or most efficient sites to prevent accidental death or injury in and to assist in providing mitigation for losses brought about in feeding and commuting.

Excavation and extraction create sequential changes to a site that usually lead to considerable landmass loss, vegetation loss and a change from a green site to a greater level of exposed stone.

Many mammals that have legal protection may be placed at risk from this including bats, badgers, otters, pine martens, red squirrels and hares to name but a few. While larger mammals such as badgers and otters may be monitored and protected once their presence is noted, bats pose a greater challenge due to their life cycle, small size, secretive and nocturnal habits and their choice of resting places ranging from ground level (or subterranean) up to treetops. In the current site, felling of trees creates potential risks to bats.

In relation to badgers, the clearance of hedgerow or scrub poses the risk of the removal of the badgers' home burrow and the associated burrows (all of which are known as setts) that are used seasonally or occasionally throughout the year. In winter, this is

especially risky if the sett is not identified before hedgerow removal operations, as this is the time when badger cubs are born. In the classification used in this report, setts are considered to fall into four categories, which are best elaborated by long-term studies but can be interpreted to a relatively good accuracy in terms of status based on basic observations.

The basic sett type within which badgers are typically present throughout the year is the main sett. This is almost always the sett within which cubs are born. Bedding outside the entrance to these setts often identifies their use as such and paw prints and dung pits or latrines nearby also assist in their categorisation. There are typically a number of entrances to a main sett, some of which may be disused. Paths leading from the main sett are often very easy to trace for some distance.

Annexe setts are similar in construction to main setts and are typically accessed by a number of entrances. They are often discernibly connected to a main sett by well-worn paths, which is within 150 metres of the annexe sett.

Badgers do not necessarily use this type of sett throughout the year and they may be inactive at the time of any short-term study. Subsidiary setts are again not always active throughout the year. There may be a number of entrances to the sett and they are not clearly associated with any other sett.

The last type of sett, the outlier sett, may only have one entrance and has no path leading to it. This type of sett is only sporadically used and may even be in areas subject to flooding or seasonally unsuitable to badger use. These setts may be overlooked if they have remained inactive for several weeks.

Setts may be under threat from the operation of a quarry if they are adjacent to the excavation activity or are affected by the increased human activity. Setts outside of this land take area may also be threatened with damage from the normal activities of the heavy plant equipment required for extraction. For example, if a badger sett entrance were located outside of the land take of the project but led to a system of tunnels that lay under the working area of the heavy plant, there is a clear risk that the tunnels would be

crushed under the repeated movement of equipment. These tunnels may occasionally go as deep as two metres underground (or deeper) but are also liable to surface to shallower depth to avoid rocky substrate or water.

Thus, badger setts may be affected by the immediate impact upon them from the excavation and removal of the soil within which they are established or by the indirect destruction of tunnels that lie under the commuting corridor of equipment within the quarry.

Otters have a higher level of protection than badgers and all other mammals within the zone of influence of the proposed quarry if present as they are an Annex II species under the Habitats Directive and must be considered during the planning. This report will deal with bats, badgers and otters and any other mammal species encountered. Otters are not considered a likelihood within the site but evidence of their presence was sought nonetheless. Mitigation is proposed for the preparatory phase and also the operational phase of the quarry for ground mammals and bats.

Materials and Methods

Badgers, Otters and Other Protected Species of Ground mammal

Equipment employed:

Maps of proposed quarry, Huawei Smartphone, Nikon 10 x 50 binoculars Google Maps.

Badger presence was determined by:

1) the identification of setts or structures likely to be setts (some animal burrows may require further checking to rule out (or confirm) as badger setts). 2) badger tracks (digging and paw prints and badger dung and hairs)

The ground mammal fauna (including arboreal species such as squirrel) was sought during a survey undertaken on 12th November 2019. All hedgerow drains and streams, tree cover, soil and stone banks, obvious mounds or depressions and gorse within the survey band (the quarry area and adjoining areas) were examined for the presence of

badger setts or other animal burrows. Any identified setts are typically considered in terms of the number of entrances, signs of activity, location relative to the development and the likelihood of alternative setts in the vicinity.

Otter presence was sought at hedgerow and wet areas.

All other mammal signs were sought on the ground including tracks, paw prints and chewed cones.

Survey constraints

The ground mammal survey was carried out in November 2019, a period when wild vegetation is in decline and mammal signs are generally evident.

Badger surveys are intended to be undertaken in winter when the die-back allows for ease of detection of entrances to setts or other burrows. November is the first such suitable period for such surveys. Thus, this assessment provides good information on ground mammals within the site.

Bats

Equipment employed:

Map of Garrons, Stradbally
Huawei Smartphone 6 with digital camera
This assessment included a visual inspection from ground level of trees and shrubs and scrub within the site and adjacent areas in November 2019. No activity survey as undertaken.

Survey constraints

Conditions for surveying were not suited to the detection of bat activity as temperatures dropped below zero on the night of 13th November 2019. These conditions were not adequate for bat feeding activity. There was a breeze approaching a wind on the night morning of survey and the night-time survey was deemed unlikely to provide a representative assessment of bat activity.

Results For Ground Mammals

Species of mammal noted at Garrons, Stradbally

Badger	*Meles meles*
Rabbit	*Oryctolagus cuniculus*
Wood mouse	*Apodemus sylvaticus*
Fox	*Vulpes vulpes*

One badger sett was confirmed from the site (see Figure 1 and point (1)) while there is a second sett within lands behind the proposed site (Figure 1 (2)) where there has been some excavations previously. There is a third potential sett (Figure 1 (3)) which is most probably a rabbit burrow within the site and finally a probable sett (Figure 1(4)) close to the only other definite badger sett (i.e. Figure 1(2)) outside of the proposal but potentially affected by excavations should they reach the edge of the site in this area.

The sett within the site has two entrances, neither of which showed activity at the time of survey. However, this was a dry period and it is difficult at such times to identify badger activity into and out of a sett without more intensive targeted assessment.

The more active sett lies within the surrounding lands and there were clear tracks leading from here both to the north and south of the sett.

A burrow at the northern perimeter is most probably a rabbit burrow while there is a probable sett opening out on to a relatively steep slope and under a rotting log.

Results For Bats

There are a small number of trees with roost potential on the perimeter of the site. This includes a pedunculate oak and a small number of beech and a fallen oak (outside of the site but adjoining the perimeter. There was no clear evidence of bat occupancy within the trees examined. This was based on an evaluation from ground level only.

Potential Impacts On Ground Mammals

1. Badger sett loss

There is one definite badger sett within the site that will be removed as part of the clearance procedures for the quarry.

2. Interference with commuting badgers and other mammals

Badger movement will be altered by the presence of the quarry and there will be a loss of foraging within the quarry area. This may lead to an alteration of badger movement but is unlikely to cause a loss of the badger social group from the area.

Mitigation For Ground Mammals

1. Licensed exclusion of the badger sett within the land take

Approval to exclude and excavate the sett within the land take shall be sought from the National Parks and Wildlife Service. The sett shall be monitored by a suitably qualified ecologist prior to exclusion. If the sett is shown to be a breeding sett, exclusion shall not be undertaken between December and July.

Potential Impacts On Bats

1. **Loss of roost sites**
2. **Death or injury during tree felling and clearance**
3. **Loss of feeding**
4. **Interruption to commuting**

1. Loss of roost sites

There is potential for roost loss through tree removal. If undertaken without proper measures, this would lead to injury or death of protected bats.

2. Death or injury during tree felling and clearance

While no tree roosts were noted, these are difficult to rule out. If undertaken during the nesting season, this would lead to bird fatalities while it would create a risk to bats of death if undertaken when present at any time of year.

3. Loss of feeding

The removal of hedgerow and mature trees removes feeding opportunities for both bats and birds. There will be a loss of a small number of mature trees and areas of scrub.

Mitigation For Bats

1. Examination of all trees earmarked for removal for the presence of bats

2. Provision of bat boxes for bats within the surrounding area

3 Lighting must be kept away from any bat boxes and good feeding potential

1. Examination of all trees earmarked for removal for presence of bats.

All mature trees proposed for removal or tree surgery shall be examined for the presence of bats by a bat specialist prior to any procedures that will lead to their complete removal or the removal of mature limbs or parts of limbs that may possess suitable splits or cavities for roost sites for bats.

Should any tree be noted to be a roost site for bats, the tree shall require a derogation issued by NPWS to allow the planned destruction of a protected structure. A programme of measures shall be designed and approved by NPWS and implemented under the guidance of a bat specialist. This may include additional bat boxes or other features for alternative roost sites as well as a schedule of the timing of felling and the specific procedure required to prevent injury or death to bats.

2. Provision of bat boxes for bats within the surrounding area

It is proposed that 4 Schwegler 2F bat boxes are erected on trees (that will be retained) within and adjoining the land take, 2 with Double Front Panel and 2 x 2FN

bat boxes. All boxes should be no less than 3 metres from the ground, mainly in southerly directions and away from lighting, clear of dense branches or scrub and away from busy roads. The boxes may be installed at a maximum of three to any one tree but this should only be done where a tree is substantial in girth and boxes are not crowded together.

3 Lighting must be kept away from any bat boxes and good feeding potential

Lighting must be kept from any vegetation intended to provide shelter for fauna and the canopy of any mature trees that are retained within the site. Lighting should not exceed 3 lux along any hedgerow or mature trees to allow for bat feeding and commuting. No bat boxes or other roost sites shall be intentionally or inadvertently illuminated.

Appendices

Badger evidence within and adjoining the site

1. Two entrance sett within the hedgerow on the eastern perimeter of the site
2. One entrance sett outside of the site within an exposed slope which appears to have been quarried previously
3. Single entrance burrow along the northern boundary of the site
4. Probable inactive sett under fallen tree at the top of a slope outside of the site

Trees with good bat roost potential
(a) Beech trees (b) Pedunculate oak (c) Fallen oak tree

Badger sett within the site
Middle line – sett entrances
Track around sett (bottom left) Burrow at northern end of the site (bottom right)

Potential sett under fallen tree and active sett outside of the proposed land take

Rabbit burrows behind the proposed quarry in a former quarried area

Badger tracks through the site

Tree roost potential within and around the site
(top) Pedunculate oak within the northern hedge (right), beech trees middle and right
(bottom) Fallen oak to the northern perimeter (outside of the site)

Archaeological Monuments Adjacent to the Proposed Project

Cultural Monument	Townland	Distance to Proposed Project	RMP
Mass House	Garrons	60m	LA 014056
Enclosure	Garrons	470m	LA 14088
Enclosure	Garrons	500m	LA 014089
Enclosure	Knockphilip	685m	LA 014041
House	Ballykilcavan	650M	LA014-099002-

LA014-056----

Class: Mass-house

Townland: GARRANS

Unlocated seventeenth century Mass House with townland, described in the History of Queens County as a place where Fr. Roger Moore, popish priest of Moyann, Oghmalt, Tymogue , Corclone and Fossy who resided at Garrans and the site of his Mass-house in this townland is still pointed out at a place called Chapel Hill, where in all probability Mass had been offered up in the open air before the Mass-house came into being. He was ordained a priest at Liege in 1662, and became P.P. ten years later (O'Hanlon and O'Leary 1914, vol. 2, 593).

Pre-development testing by Dominic Delany under licence no. 93E0051, at a potential archaeological site took place over a three-day period in April. The site is located in a forested area which was being cleared in advance of replanting. The first edition of the OS 6-inch map for Co. Laois (1841, Sheet No. 14) has the name 'Chapel Hill' at the south end of the forest. There is also a large L-shaped building shown here. This was pinpointed as the possible location of the late 17th-century Mass-house at Garrans, which is mentioned in the historical record. A spread of redeposited soil and crushed building material was located during trial trenching at the site. This feature covered an area measuring approximately 18m north-south x 6m-10m east-west and it had an average depth of 0.15m. The finds from this disturbed context consisted mainly of sherds of 18th/19th-century pottery. This feature undoubtedly represents the site of the L-shaped building. The nature of the surviving evidence indicates that this structure was demolished and the building materials removed, probably prior to planting in the late 19th century. There was no evidence to suggest that this was the site of the chapel.

LA014-089----

Class: Enclosure

Townland: GARRANS

Aerial photograph (GB90.BL.18) shows cropmark of a circular enclosure with an incomplete rectilinear annexe, both defined by a fosse. First recorded as a positive cropmark in July 1990. Although this coincides with a patch of trees on the OS 6-inch map (and also the First Edition), it does appear archaeological. However, it may represent demesne landscaping.

LA014-041----

Class: Enclosure

Townland: KNOCKPHILIP

Marked on the 1841 edition of the OS 6-inch map as a circular 'fort' (max. diam. c. 50m). Situated in undulating countryside. No visible surface remains.

LA014-088----

Class: Enclosure

Townland: GARRANS

Aerial photograph (GB90.BL.16) shows cropmark of an incomplete enclosure defined by a fosse. First recorded as a positive cropmark in July 1990. Enclosure cut by modern road. Rather faint image; could be a natural feature. Note gravel working in adjacent field on OSI 2005 orthophotos.

LA014-099002-

Class: House - 17th century

Townland: BALLYKILCAVAN

Ballykilcavan House possibly built on site of or in close proximity to the medieval castle (LA014-099----) of Ballykilcavan which was granted to Robert Hartpole in 1576. The house stands on a low rise of ground S of the Stradbally River. An architectural fragment (LA014-099001-) from the castle lies on the ground in the back garden of the house. Around 1639 the lands and castle of Ballykilcavan were acquired by Oliver Walsh who commenced the building of a house (LA014-099002-) on the site of the medieval castle (pers. comm. David Walsh-Kemmis). The first house built by OliverWalsh may have been a fortified house as this was the type of building being constructed in Laois during the first half of the seventeenth century. Today there is no evidence of any fortifications in the upstanding remains of Ballykilcavan House. There are at least three clear building phases visible in the present Ballykilcavan House. The dating of the first phase is uncertain as the building is covered in render and has been altered over the centuries. It is possible that the early 17th century house built by Oliver Walsh c. 1639 is represented by the two projecting flanking towers (Ferguson 2015, 138). However there is no clear evidence of any fortifications in these wings. Alternatively this part of the house may date from the late 17th or early 18th century rather than the first half of the 17th century. The plan layout with projecting flanking towers can also be compared to early 18th century houses such as Linsfort Castle, Co. Donegal which was built in 1720 (Craig 1976, 66).

The 1641 deposition of Oliver Walsh records that he recently built a house on his lands in Co. Laois shortly before the outbreak of the rebellion in 1641. In his deposition he states that, 'he hath bene at the Chardge of above one hundred pounds (as he conceiveth) upon parte of his said Lands in the Queenes County, where he dwelled by buildinge, ditchinge, & other improvements, and nowe receaveth noe benefitte thereby by occasion of this Rebellion' (TCD, 1641 Depositions Project, online transcript January 1970 [http://1641.tcd.ie/deposition.php?depID] accessed Wednesday 11 November 2015 12:30). Maurice Craig (1976, 122) compared Ballykilcavan House to Landestown House, Co. Kildare which dates from the first half of the 18th century. According to Bence-Jones (1988, 23) Ballykilcavan House was 'a 2 storey early or mid-C18 house; entrance front of 7 bays with an open-bed pediment and advanced end bays, rather similar to the min block of Landenstown, Co. Kildare'. The present house was described by the National Inventory of Architectural Heritage as following; 'Detached seven-bay two-storey house with dormer attic, built c.1740, with gable to centre and projecting end bays. Extended, c.1975, with two-storey projecting bay added to left, two-storey range added to right and two-storey return to rear. Double-pitched and hipped slate and replacement fibre-cement tile roof with skylight to rear on a circular plan with lead-sheeted plinth; rolled lead ridge tiles; nap rendered chimneystacks; cast-iron rainwater goods on brackets. Rendered painted walls. Square-headed window openings with limestone sills and six-over-six timber sash windows. Limestone pedimented doorcase to door opening with glazed timber panelled door. Entrance/Stair Hall with Portland stone-flagged floor; carved timber staircase with scrolled handrail; decorative plaster ceiling, c.1790; Dining Room with alcove having flanking pilasters; Drawing Room with white marble fireplace; Rococo plaster frieze; decorative plaster ceiling to landing to first floor. House is set back from road in own grounds; landscaped grounds to site; tarmacadam drive and forecourt to approach. Group of detached outbuildings to site, one with three-bay pedimented advanced bay having round-headed openings to first floor'. www.buildingsofireland.ie The Irish Historic Houses Association recently described Ballykilcavan House as following; 'Ballykilcavan is a charming house of about 1680, in wooded parkland just east of Stradbally. The estate was acquired by Oliver Walsh in 1639 and the house was probably built by his son, another Oliver, who died in 1697. The house has full-height wings like flanking towers at the corners of the entrance front while similar towers on the rear of the house are now hidden by later extensions. These towers were a feature of fortified houses of the seventeenth century and lingered on into the early eighteenth century as decorative features. The house is comprised of a ground floor (unusually at ground level), an upper floor and an attic storey, where the dormer windows have been replaced by skylights. It has been altered and extended many times over the centuries but many rooms retrain their late-seventeenth century dimensions though the decoration is later. In the 18th century Ballykilcavan was given a more Georgian aspect with a 'floating' pediment-gable, a fine cut-stone doorcase and sash windows with thin glazing bars. There is good 1730s plasterwork on the hall ceiling, and even finer work above the staircase and landing. The landing is actually the house's finest room and originally extended from front to back as a gallery before the main staircase was installed. The first prominent member of the family was Hunt Walsh, who commanded the 28th of Foot at the siege of Quebec and became a general. He was awarded a valuable estate in Prince Edward Island in a lottery of lands after the Seven Years' War before succeeding his uncle at Ballykilcavan and becoming MP for Maryborough. General Walsh is likely to have commissioned the magnificent 18th century U-shaped stable block. The next owner was the general's brother Raphael, Dean of Dromore, who began an ambitious remodelling of the house. He planned a new front at the rear with a classical cornice and parapet, and a suite of south-facing rooms. Unfortunately, work was disrupted by the 1798 Rebellion and Dean Walsh only completed half the building vertically, leaving the remainder blank'. The proposed development dies not include any architectural monuments listed in the Buildings of Ireland database. A number of structures are located in the wider vicinity of the development. The closest of these is 670m distance this site also includes the remains of a tudor house recorded as an archaeological monument and in the buildings of Ireland register (Register number 12801410).

Appendix 13.2: Photographic Plates

Plate 1: Looking northeast over the east of the study area

Plate 2: Looking west over the central section of the study area

Plate 3: Looking east over the study area

Plate 4: Looking north towards the site of the mass chapel

Plate 5: Looking south over the western extent of the study area

Plate 6: Looking east over the site