Housing Land Assessment

Murieston Road
Murieston
Livingston
West Lothian

Prepared by

Clarendon Planning and Development Ltd

On behalf of

BDW Trading Ltd and H&J Russell

April 2015

Contents

Section 1- Introduction

1.1
The purpose of this report is to provide an overview of the **deliverability and effectiveness of existing housing land supply in West Lothian,** with regard to opportunities for future growth and in particular as a **basis for supporting the application for planning permission at Murieston.**

1.2
The requirement upon Local Authorities to maintain a generous land supply at all times, including a minimum 5 year effective housing land supply, is firmly established in national planning policy. Housing land deliverability is critical in terms of meeting demand and its importance is elaborated upon within *Scottish Planning Policy (SPP) (Scottish Government, June 2014)* and the *National Planning Framework 3 (Scottish Government, June 2014)*, which is reflected at regional level by the approved *SESplan (June 2013)* and *SESplan Supplementary Guidance on Housing Land* (October 2014) and at local level by the *West Lothian Local Plan (adopted 2009)*. Specific guidance on the assessment of sites, in terms of deeming their 'effectiveness', is contained with *Planning Advice Note (PAN) 2/2010 'Affordable Housing and Housing Land Audits' (Scottish Government, 2010)*.

1.3
The South East Scotland Strategic Development Plan ("SESplan") identifies a housing land requirement for the SESplan area from 2009 – 2019 of 74,835 houses and for the period from 2019 – 2024 of 32,710 houses. SESplan also identifies the scale of the likely housing requirement between 2024 and 2032 as a further 48,000 houses. SESplan requires each of the constituent local authorities to maintain a 5 year effective housing land supply ***at all times*** within its own area. SESplan also authorises the grant of Planning Permission for non-allocated sites in order to maintain a 5 year effective housing land supply subject to satisfying certain specific criteria.

1.4
SESplan Supplementary Guidance on Housing Land sets out the agreed housing land requirements for all constituent local authorities and is based upon the approved SESplan Housing Need and Demand Assessment (HNDA). Whilst the HNDA is currently being reviewed as part of the initial stages of SESplan No.2, the existing HNDA is the only assessment which has been thoroughly tested and approved by the Government.

1.5
Given this position, the approved SESplan Supplementary Guidance and housing land requirement contained therein comprises the correct basis by which to assess West Lothian's housing land requirement.

Section 2- Approach & Methodology

2.1
Clarendon have utilised the latest available agreed Housing Land Audit (West Lothian HLA 2014) as a basis for **assessing effective housing sites within West Lothian which should provide for a minimum 5 year minimum supply**, as per national, strategic and local planning policy.

2.2
The supply is **assessed against the approved SESplan requirement for West Lothian as set out in approved SESplan Supplementary Guidance on Housing Land which is based upon the agreed SESplan Housing Needs and Demand Assessment (HNDA)**. This enables an analysis to be undertaken of the 5 year effective land supply.

2.3
Prior to approval of SESplan Supplementary Guidance on Housing Land, Scottish Ministers had requested an amendment to the proposed version to ensure that housing land requirements for both the 2009-19 and 2019-24 periods are met in full.

2.4
A recent issue has been raised by East Lothian Council (via their revised Interim Planning Guidance, December 2014) questioning the need to meet the requirements for both periods in full. This is based upon revisions to Scottish Planning Policy in June 2014, which post-dated the Government's approval of SESplan Supplementary Guidance by a matter of days. This is based on an amendment to wording relating to the requirements for Strategic Development Plans.

2.5
The 2010 version of Scottish Planning Policy states, *"the strategic development plan should also identify how much of the housing land requirement should be met by site allocations in the local development plan that are capable of development by the end of year 7"* (Paragraph 72).

2.6
The revised (June 2014) Scottish Planning Policy states, *"strategic development plans should set out the housing supply target and the housing land requirement for the plan area, each local authority area, and each functional housing market area. They should also state the amount and broad locations of land which should be allocated in local development plans to meet the housing land requirement up to year 12 from the expected year of plan approval, making sure that the requirement for each housing market area is met in full."* (Paragraph 118).

2.7
In essence, East Lothian argue that revised SPP supercedes SESplan SG and that local authorities should not meet the interim Year 7 (i.e. 2019) targets. However, this argument is flawed in that the revisions to SPP are aimed at the requirements for 'strategic development plans', i.e. for new SDP's going forward and not the only very recently approved strategic guidance that preceded the SPP revision - it was not the Government's intention to make the SESplan Supplementary Guidance obsolete (days after approving).

2.8
It is therefore considered that all SESplan local authorities must adhere to the approved SESplan and associated Supplementary Guidance and meet the requirements for both periods in full with the 5 year effective land supply based upon requirements for both specific periods.

2.6
Based on the above approach, the realistic deliverability of the effective land supply can be established with any shortfall identified versus the strategic housing land requirement.

Section 3- Effective Land Supply Appraisal

Housing Land Requirement

3.1
The *SESplan Housing Need and Demand Assessment (HNDA)* provides a region-wide assessment with a requirement from 2009 to 2019 for 74,835 houses, equating to an annual completion requirement of 7,483 houses across the region and an initial 5 year land supply requirement to enable 37,415 completions. A housing demand forecast for each local authority area is provided in the SESplan HNDA which confirms that the average need/demand for new housing in West Lothian in the period 2009-19 is 11,420 units (Table E5 on Page 76 of SESplan HNDA).

3.2
SESplan Supplementary Guidance Table 3.1 reflects the HNDA demand figure with a housing land requirement for 11,420 units within the period 2009-19 with an additional 6,590 units required in the period 2019-24. As noted above, this agreed housing land requirement should form the basis of calculating a 5 year effective land supply requirement.

3.3
Taking first the achieved completions within **West Lothian** for the period 2009-14, as detailed within Housing Land Audits 2010-2014, the following unit numbers can be deducted from the net requirement:-

- 2009/10 543 units
- 2010/11 530 units
- 2011/12 229 units
- 2012/13 523 units
- 2013/14 615 units

- Total 2,440 units

3.4
Based on the 2009-19 SESplan SG Requirement of 11,420 units, this results in an **outstanding requirement for 8,980 units in the period 2014-19**, which equates to an annual average of 1,786 units to meet this target. The **5 year effective land supply target is therefore also 8,890 units for West Lothian**.

3.5
Even if the overall 2009-24 strategic housing land requirement was utilised without the interim 2019 target, the net requirement would be 15,570 units (18,010 target - 2,440 completions in the period to 2024 equating to a 5 year effective land supply target of 7,785 units (15,570/10 = 1,557 x 5). However, for the reasons set out in Section 2, SESplan requires both 2019 and 2024 targets to be achieved and therefore the higher figure set out in Paragraph 3.4 should be utilised.

Housing Land Supply 2009-19

3.6
West Lothian HLA 2014 programmed completions for the period 2014-2019 comprise the following:-

- 2014/15 722 units
- 2015/16 1,062 units
- 2016/17 1,109 units
- 2017/18 1,087 units
- 2018/19 819 units

- Total 4,799 units

Based on the 'net' SESplan SG requirement for West Lothian of 8,980 units outlined in Section 3, this results in a **shortfall of 4,181 units in the period to 2019 (i.e. just 53% of requirement is met)**.

5 Year Effective Land Supply 2014-2019

3.7
In terms of the national planning policy requirement of maintaining a minimum 5 year effective land supply at all times, the existing land supply shortfall reflects the 2009-19 SESplan period, i.e.

West Lothian (approved SG requirement)

- 5 Year 'Net' Requirement: 8,980 units or 1,796 per annum (see Section 3)
- 5 Year Supply: 4,799 units (W.Lothian 2014 HLA)
- **Shortfall of 4,181 units**
- **Effective Land Supply: 53% or 2.7 years**

3.8
This assessment confirms the **severe land supply shortage position within West Lothian.**

3.9
Again, for comparison only, if setting aside the interim 2019 SESplan target and utilising the net 2014-24 SESplan requirement as a base, the following would apply:-

- 10 Year 'Net' Requirement: 15,570 units or 1,557 per annum equating to 5 year requirement of 7,785 units (see Section 3)
- 5 Year Supply: 4,799 units (W.Lothian 2014 HLA)
- Shortfall of 2,986 units
- Effective Land Supply: 62% or 3 years

3.10
It is therefore clear that, whether the 2019 interim target is applied (as it should be) or not, there is a substantial effective land supply shortfall.

Emerging Local Development Plan Supply

3.11
West Lothian Council published their Local Development Plan Main Issues Report in August 2014. This includes options with preferred and alternative housing sites, following an assessment of sites put forward via a Call for Sites excercise in 2011.

3.12
In total, all identified preferred and alternative housing sites comprise 4,039 units. This includes small sites and much larger sites so, clearly, not all of the units could be achieved within the LDP period to 2024 (and clearly only a small proportion could be implemented by 2019 based on current LDP adoption timescales of late 2016/early 2017). This also assumes that both identified preferred and alternative sites would come forward via the LDP.

3.13
Given that LDP sites could only feasibly contribute from 2017/18 onwards, i.e. 2 years of the current 5 year effective land supply period, there is a very limited prospect of LDP sites bridging the effective land supply shortfall.

Rolling Effective Land Supply

3.14
Appendix 1 provides a **rolling Effective Land Supply assessment for the whole 2009-24 SDP period** for which a land requirment has been set. This utilises 2014 HLA programming, extended programming of HLA sites to 2024 and inclusion of an estimated LDP sites allowance from 2017 onwards (based on the SESplan SG Table 3.2 which sets out additional allowance of 2,130 units for West Lothian in the period to 2024 - this equates to 50% of all LDP MIR preferred and alternative site capacity).

3.15
Table 3 of Appendix 1 identifies total housing output on an annual basis between 2009-24 based upon programmed and estimated supply. This illustrates that the SDP average annual requirement is met in only 1 of the 15 years.

3.16
Table 4a illustrates that even with adding in this generous LDP site allowance, the 5 year effective land supply (from 2014) remains deficient (95%).

3.17
Table 4b and Table 4c also include the LDP sites allowance and highlights that only 69% of the 2009-19 SDP requirement and 64% of the 2019-24 SDP requirement would be met.

3.18
Table 5 demonstrates that at no point in the 2009-24 period would a 5 year effective land supply be maintained.

3.19
Overall, the assessment (with a generous LDP sites allowance which includes an additional 300 units per annum from 2017/18 onwards), demonstrates that **early approval of new sites is urgently required.**

Spatial Strategy & New Allocations

3.20
As noted, the LDP MIR identifies preferred and alternative sites with scope for a total of 4,039 units across West Lothian. The majority are within the SESplan-approved **West Lothian Strategic Development Area**, which has a broad definition but mainly focuses on the M8 corridor.

3.21
The now superceded 2004 Structure Plan identified Core Development Areas to meet requirements to 2015, including Armadale (1,000 units minimum), Livingston/Almond Valley (3,000 units minimum) and Winchburgh/East Broxburn/Uphall (3,000 units minimum). These releases were reflected within the 2009 adopted West Lothian Local Plan which included site capacities in excess of these minimum requirements to allow for future growth. **Table 1** below confirms progress to date (2014 HLA) and it can be seen that only 412 of the required 7,000 units are expected to be completed by 2015, i.e. 6%.

Table 1 - West Lothian CDA Completions

CDA	Complete	Prog to 2015	Total to 2015	5 Yr Effective
Armadale	152	57	209	**593**
Liv'ston (2 areas)	0	54	54	**859**
Winch/ Brox (2 areas)	55	94	149	**903**
Total	**207**	**205**	**412**	**2,355**

3.22
This indicates that, in terms of new LDP allocations and site brought forward through applications under SESplan Policy 7, a range of deliverable sites, which can be phased to allow for early completions should be considered.

Section 4 - Summary

- **National, strategic and local planning policy require a 5 year effective housing land supply to be available at all times**

- **The approved SESplan HNDA and adopted SESplan Supplementary Guidance provides a housing land requirement for West Lothian demand of 11,420 units in the period 2009-19 and a further 6,590 units in the period 2019-24 - the requirements for both periods are to be met in full**

- **Allowing for completions to date (as per the 2014 Housing Land Audit), there remains a net requirement between 2014-19 of 8,980 units (which also equates to the 5 year effective housing land requirement)**

- **Based upon the 2014 Housing Land Audit, there is a programmed effective land supply of 4,799 units and therefore a shortfall of 4,181 units in the period to 2019, i.e. an effective land supply of just 53% or 2.7 years**

- **The 2014 LDP MIR identified potential preferred and alternative housing sites for just over 4,000 units but contributions from LDP sites is not expected until 2017 at the earliest, i.e. just 2 years of the pre-2019 or effective land supply period**

- **Appendix 1 provides a rolling assessment of Effective Land Supply throughout the 2009-24 period and adds an estimated allowance from LDP sites (based upon the additional SESplan allowance to be accommodated by 2024) - this assessment illustrates that a 5 year effective land supply will not be achieved for any 5 year period between 2009-24 and less than 70% of 2019 and 2024 SESplan targets will be achieved**

- **West Lothian's spatial strategy has focused on large-scale Core Development Areas but these limited number of major housing sites have been slow to provide completions with just 6% of the previous Structure Plan requirement to 2015 likely to be met**

- **West Lothian's timescales for production of their LDP means that a post-public consultation Proposed Plan will not be available until late 2015 with adoption in late 2016 / early 2017 with completions from LDP sites from 2017/18 onwards at best**

- **Given land supply targets will not be achieved via the LDP, West Lothian Council must grant permission to effective, deliverable sites now based upon SESplan Policy 7**

Appendix 1 - West Lothian Rolling Effective Land Supply Assessment (Part 1)

APPENDIX 1

Assessment of Housing Land Requirement and Effective Supply | West Lothian Local Authority Area | Based upon 2014 Housing Land Audit

Table 1 – Housing Land Requirement

SESplan Housing Land Requirement 2009-19:	**11420**
(SESplan Supplementary Guidance October 2014)	
Annual average equivalent:	**1142**
SESplan Housing Land Requirement 2019-24:	**6590**
(SESplan Supplementary Guidance October 2014)	
Annual average equivalent:	**1318**

Table 2 – Past Completions

09-10	10-11	11-12	12-13	13-14	Av.
543	530	229	523	615	**488**

(West Lothian LDP MIR Housing Land Study & 2014 HLA)

Table 3 – Housing Land Supply Assessment SDP Period 2009-24 (based on existing 2014 HLA)

LDP Period (DPS No.7)									LDP1	LDP2	LDP3	LDP4	LDP5	LDP6	LDP7
	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
W.Lothian Completions (2011 HLA & WLC)	543	530	229	523	615										
W.Lothian Effective Supply (2014 HLA)						722	1062	1109	1087	819	560	463			
W.Lothian Post-7r Supply (2014 HLA – Projections Rolled Forward)													426	404	382
W.Lothian LDP Sites (Estimated) (SESplan SG additional allowance of 2130 units within period to 2024)									304	304	304	304	304	304	304
W.Lothian – Total Supply	**543**	**530**	**229**	**523**	**615**	**722**	**1062**	**1109**	**1391**	**1123**	**864**	**767**	**730**	**708**	**686**
Annual Strategic Req.*	**1142**	**1142**	**1142**	**1142**	**1142**	**1142**	**1142**	**1142**	**1142**	**1142**	**1318**	**1318**	**1318**	**1318**	**1318**
*see Table 1															
Surplus/Shortfall	-599	-612	-913	-619	-527	-420	-80	-33	249	-19	-454	-551	-588	-610	-632

Appendix 1 - West Lothian Rolling Effective Land Supply Assessment (Part 2)

Table 4a – 5 Year Effective Land Supply

LDP Total 5 Yr Supply:	**5407**
LDP 5 yr ELS Target:	5710
Surplus/Deficit:	**-303**
	95%

Table 4b – SDP Year 7 Target (2019)

Total Supply to 2019:	**7847**
SDP 2019 Target:	11420
Surplus/Deficit:	**-3573**
	69%

Table 4c – SDP Year 12 Target (2024)

Total Supply to 2024:	**11602**
SDP 2024 Target:	18010
Surplus/Deficit:	**-6408**
	64%

Table 5

SDP Period:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
5 Year Effective Land Supply	**2009/10-2013/14**	**2010/11-2014/15**	**2011/12-2015/16**	**2012/13-2016/17**	**2013/14-2017/18**	**2014/15-2018/19**	**2015/16-2019/20**	**2016/17-2020/21**	**2017/18-2021/22**	**2018/19-2022/23**	**2019/20-2023/24**
Programmed Completions	**2440**	**2619**	**3151**	**4031**	**4899**	**5407**	**5549**	**5254**	**4875**	**4192**	**3755**
Effective Land Supply Target	5710	5710	5710	5710	5710	5710	5886	6062	6238	6414	6590
ELS Target pa (average)	1142	1142	1142	1142	1142	1142	1177	1212	1248	1283	1318
% ELS achieved	43%	46%	55%	71%	86%	95%	94%	87%	78%	65%	57%
Years ELS	2.14	2.29	2.76	3.53	4.29	4.73	4.71	4.33	3.91	3.27	2.85

Alan Motion Tree Consulting Ltd
Chartered Forester, Arboricultural Consultant

Tree Survey
and
Arboricultural Constraints

MURIESTON, LIVINGSTON

For

BDW TRADING LTD AND H & J RUSSELL

Institute of Chartered Foresters
Registered Consultant

[redacted]

GENERAL INTRODUCTION AND SUMMARY

This tree survey has been carried out for BDW Trading Ltd and H & J Russell, in relation to proposed development on land at Murieston, Livingston. It relates to 131 trees within the survey boundary shown on the plans appended to the report. Small trees of less than 15cm stem diameter, and areas of undergrowth are described in general terms, but are not recorded in detail. The survey has been carried out in accordance with BS5837:2012 "Trees in relation to design, demolition and construction – Recommendations."

STANDARD CONDITIONS RELATING TO TREE SURVEY INFORMATION

1. Unless otherwise stated, tree surveys are undertaken from ground level using established visual assessment methodology. The inspection is designed to determine, as far as possible, the following:
    a. The presence of fungal disease in the root, stem, or branch structure that may give rise to a risk of structural failure of part or all of the tree;
    b. The presence of structural defects, such as root heave, cavities, weak forks, hazard beams, included bark, cracks, and the like, that may give rise to a risk of structural failure of part or all of the tree;
    c. The presence of soil disturbance, excavations, infilling, compaction, or other changes in the surrounding environment, such as adjacent tree removal or erection of new structures, that may give rise to a risk of structural failure of part or all of the tree;
    d. The presence of the foregoing or any other factor not specifically referred to, which may give rise to a decline or death of the tree.
    e. The presence of surrounding structures, roads, footpaths, utilities, boundaries and the like where growth of the tree may present a hazard or nuisance.
2. Where further investigation is required, either by climbing or the use of specialised decay detection equipment, this will be identified in the report.
3. The findings and recommendations contained within this report are valid for a period of twelve months. Trees are living organisms subject to change - it is strongly recommended that they are inspected at regular intervals for reasons of safety.

4. Whilst every effort has been made to detect defects within the trees inspected, no guarantee can be given as to the absolute safety or otherwise of any individual tree. Extreme climatic conditions can cause damage to apparently healthy trees.
5. The findings and recommendations contained within this report are based on the current site conditions. The construction of roads, buildings, service wayleaves, removal of shelter, and alterations to established soil moisture conditions can all have a detrimental effect on the health and stability of retained trees. Accordingly, a re-inspection of retained trees is recommended on completion of any development operations.
6. This report has been prepared for the sole use of BDW Trading Ltd And H & J Russell and their appointed agents. Any third party referring to this report or relying on information contained within it does so entirely at their own risk.

SITE DESCRIPTION

The site is located at Westfield Farm on the eastern edge of Murieston, lying to the south of Livingston. The site is bordered on the east by Murieston Road and to the north by the Shotts-Edinburgh railway line. The areas surveyed include an avenue of beech trees lining the approach to Westfield Farm steading and an area of plantation woodland lying immediately to the north of the access road. In both of these areas the trees have been recorded individually (tagged 2602 - 2730). Standing dead wood was not tagged or included in the survey. Further areas of secondary woodland established on the former mine works were also surveyed but are described in general terms as compartments W1 - W4. The surrounding fields are grazed by cattle and horses. The open areas between the woodlands are recovering semi-improved/improved grassland. There is network of informal paths through the woodland and grassland areas that are clearly well-used, particularly by horse-riders. The area immediately to the west of the woodlands is temporarily fenced off as a paddock.

Avenue/Access Track

Tree numbers 2601 - 2655 form an avenue of beech trees located on the original approach to the farm. The trees were clearly hedgerow trees in a hawthorn/holly hedge bordering either side of the track. This approach is no longer the main access to the farm which is now taken from Brucefield Park West to the west of the farm buildings. The access appears to be used only for stock management purposes. The avenue does not appear on the first edition OS map

(publication date 1854 - 1875) but is shown on the second edition map (1895) suggesting that the trees are probably 130-150 years old (see historic maps in appendix 1). The majority of trees have structural defects and /or significant decay and many have suffered extensive storm damage and failure or partial failure. Dieback and decline is evident in most trees. 26 of the remaining trees were recorded as C category and while their retention in the short-term is compatible with the current low-level use of the access track, any increase in use of the track will render many as U category. Of the B category trees minor defects and dieback were noted in most, rendering them unsuitable for retention with an alternative use of the site without extensive remedial works. There is a high potential for bat roosts and nesting birds in the avenue trees due to the large number of cavities in the upper stems and crowns. The hedgerow (collectively tagged as 2604) is remnant only, with some holly and hawthorn bushes still present, particularly in the western end of the site, but has not been maintained as a hedge for many years. *Cryptococcus fagisuga* (beech scale) was observed on many of the beech trees, with infestations particularly bad on tree numbers 2608 and 2643. The fields on either side of the track are at lower levels than the track, restricting the rooting zones of the trees. Erosion and poaching from stock in the areas below the tree canopies is an issue throughout the length of the avenue in the fields on both sides.

Tree numbers 2656 - 2658 are located within the field to the north of the avenue. The trees are all that remains of a previous shelterbelt that divided the fields (see historic maps in appendix 1). The trees are in declining condition and a further dead beech tree is still present on site as standing deadwood. The area is used as a feeding station for stock and serious compaction and erosion is having a detrimental effect on tree health.

Plantation

Tree numbers 2665 - 2704 are all located in an area immediately to the north west of the entrance. The pattern of planting and species composition suggests that this area was planted as a mixed broadleaved woodland but many of the trees are in decline and many more have been lost as evidenced by the amount of standing and fallen deadwood on the site (standing deadwood has not been tagged). There are serious drainage issues on the site which are having a detrimental effect on tree health, particularly in the central and southern parts of the woodland (bordering the access track). Many of the trees are stag-headed and several are almost dead. The trees along the eastern boundary are in better condition as this area is better drained. The eastern boundary (bordering Murieston Road) is mostly hazel, clearly planted as

a hedge but not maintained for many years. Historic maps show that the site was a former mine workings and a raised ridge (possibly the route of a former tramway) lined with beech trees starts in this areas and continues into W1.

The remaining trees on the site are present as secondary woodland and are described in general terms as follows (refer to attached map):

W1

This is secondary ash woodland with a large birch component. The average dbh of the ash is approximately 30cm while that of the birch is approximately 20cm. The woodland is unmanaged and in need of thinning. The trees are generally etiolated and of poor form. The ground flora is dominated by nettles and bramble, indicating that the site has previously been disturbed. There are some larger beech and oak trees located in the west of the compartment on either side of the main path through the site which have been surveyed individually (2705 - 2709).

The site is bordered to the west by a remnant hawthorn hedge. A group of 3 trees is located on the boundary that have also been surveyed individually (2710 -2712) are growing from some rubble. Japanese knotweed is also establishing within this area.

A number of individual trees have been tagged in the meadow to the north of W1 (tree numbers 2713 - 2722). One of these, tree number 2722, a birch, is partially windblown.

W2

W2 is also an area of secondary woodland dominated by pioneer species (ash, willow and birch) with a few oaks and beech on the drier areas. The trees are a similar size and age to those in W1. Ground conditions within this compartment are very wet and windthrow and movement in root plates was observed throughout the compartment. The trees are generally of poor form and most of the ash are multi-stemmed and/or in declining condition. Ash regeneration is prolific throughout the compartment. There are a few large multi-stemmed oaks within the woodland which appear to be lapsed coppice stools pre-dating the development of the site as a mine workings. The larger roadside trees in this compartment were tagged and surveyed individually (tree numbers 2723 - 2728). These trees are mostly mature oaks which

again appear to pre-date the mine workings. They are generally in good condition and some of the better trees on the site.

The land rises steeply to the road in the northern part of the site from the northern meadow. The woodland here is dominated by willow. The trees are shallow-rooted and windthrow is evident within the stand.

There are two mature oaks located in the northern meadow (2729 and 2730). These are large open grown trees with full crowns. The trees are both good examples of their species. Bark stripping by horses has caused minor damage to the buttress roots of both trees.

The Edinburgh- Shotts railway line forms the northern boundary to the site. Trees (predominantly willow) from the railway line overhang into the site along the length of the railway but appear to be regularly coppiced.

W3

W3 is an area of birch/willow secondary woodland in poor condition. Again, poor drainage is an issue throughout the compartment which is having a detrimental effect on tree health and stability. This area of woodland appears to be younger than W1 and W2 (less than 30 years). Ground flora is dominated by aggressive species such as bramble and nettle suggesting previous disturbance.

The drier ground at the northern end of the compartment adjoining compartment 4 supports a copse of mature hawthorn which is fenced within the paddock area. Poaching and erosion from horses has caused some damage to the ground within this area.

W4

W4 is an area of mature/over-mature multi-stemmed willow growing from the abutments of a former tramway. The trees are generally in declining condition. Some semi-mature beech trees are located along the western edge of the abutments just outwith the development site. The ground conditions suggest that stability may be an issue with these trees as they mature. There is some ash and beech regeneration throughout W4.

STATUTORY PROTECTION

The position with regards to statutory protection of trees has not been confirmed. No work should be undertaken without confirming the position with the local planning authority.

TREE SURVEY AND ANALYSIS

A visual assessment has been carried out from the ground level of 131 trees within the site. The location of the trees is plotted on the attached Tree Survey Plan, and their condition and recommended remedial works are recorded in detail in the schedule attached at page 14 of this document. This records relevant details in accordance with the recommendations contained in BS 5837:2012, and includes:

- Tree number (Tree tag number where used, or plan reference number)
- Tree species (common name)
- Stem diameter at breast height (1.5m above ground level)
- Canopy spread in metres (average)
- Tree height (estimate in metres)
- Crown height (clearance to lowest branches in metres)
- Tree Condition Category
- General condition (good, fair, poor, dead)
- Age (Young, middle-aged, mature, over-mature, veteran)
- Whether single or multi-stemmed
- Comments and observations on the overall health and condition of the tree, highlighting any problems or defects
- Recommended remedial works, where necessary.

Where appropriate, recommendations have been made on necessary remedial action such as tree surgery or felling. This is specified where there is likely to be significant risk to safety or tree health, or to abate a nuisance. The recommendations are general in nature and do not constitute a detailed work specification. Specifications, where required, can be provided to accord with the guidance and recommendations contained in BS3998:2010, “Tree work – Recommendations.”

The trees have been tagged with round 4-digit tags ranging from 2601-2730.

Trees and groups have been categorised in accordance with the guidelines contained in BS 5837 as follows:

26 Category A

54 Category B,

51 Category C

0 Category U.

For details of the tree categorisation, refer to the table on page 13. Categorisation is carried out without reference to the proposed development or site alterations, and is based solely on tree health, condition, safe life expectancy, and amenity value. The presence of trees and their quality is only one factor in the design and planning process, and the retention of good quality, healthy trees may be inappropriate in the context of wider planning and development considerations.

CONSTRAINTS POSED BY EXISTING TREES

In order to minimise the risk of long-term damage to trees from construction operations, particular care is required to protect trees from physical damage. Significant damage can be caused to root systems by ground level changes; soil compaction; contamination from oils and cement; and changes in soil moisture content. For these reasons, BS 5837:2012 '*Trees in relation to design, demolition and construction – Recommendations*' sets out a minimum recommended Root Protection Area (RPA) in m^2 based on the stem diameter of the tree. The RPA represents the below-ground constraints presented by trees within the proposed development area and must be taken into account in the design process. Whilst BS5837 recommends specifying the RPA as a circle, for practical purposes this report uses the equivalent square area centred on the stem of the tree. The RPA may be adjusted where restrictions to normal rooting patterns suggest that root growth will be minimal (*e.g.* adjacent to walls, sealed surfaces, watercourses, or existing utility trenches).

Above-ground constraints include ultimate tree height and canopy spread which will affect both physical presence and daylight availability to any proposed structures. Species characteristics, such as evergreen or dense foliage, potential for branch drop, fruit fall, *etc*, will all have an

influence on the potential for development of the site. Other factors that may need to be taken into account will include easements for underground and above-ground apparatus; road safety and visibility; or the proposed end use of space adjacent to retained trees.

ARBORICULTURAL IMPACT ASSESSMENT

No detailed design layouts have been considered as part of this report. As noted within the description, the trees along the access track (2601-2655) are in poor condition, and it is unlikely that they could be successfully or safely retained within any future development. If the avenue feature is to be retained it would require removal of the C Category trees, in conjunction with a minimum 20m stand-off distance to any occupied spaces (roads, gardens, buildings). The woodland areas should be retained to maintain a visual buffer between the site and Murieston Road.

The development of the proposed northern access, as shown in the Murieston Development: Access Appraisal (Jacobs) 2014 (appendix B), would necessitate the removal of three trees tagged 2723 – 2725 in the tree survey. All three trees are mature downy birch. The trees, as shown below, are unremarkable trees and all have defects and/or are in declining condition. The removal of these trees will not adversely affect the remaining surrounding trees.

Tree numbers 2723-2725 at the proposed access point viewed from Murieston Road

The visibility splay to the north is largely unaffected by the remaining mature trees. Some low growing natural regeneration and understory overhangs into the visibility splay and would require removal.

In addition to the removal of 2723-2715, the proposed location of the road is likely to result in the removal of section of woodland area W2. The access road would also cut through an open glade in the woodland, minimising tree removal. W2 is an area of recently established secondary woodland of mainly willow, birch and ash with some oak. The development of the road access as shown would result in the removal of several willow and ash and one semi-mature oak. The trees affected are generally of poor form and most of the ash are multi-stemmed and/or in declining condition. Drainage in this area is poor and many of the trees have stability issues. The removal of these trees is unlikely to have a significant effect on the amenity value of the site.

Two further trees, tagged 2715 (ash) and 2718 (oak), would require removal to accommodate the required visibility splay to the south of the proposed access. 2716 (oak) is likely to be affected by the removal of 2715 and 2718, rendering it unstable and should also be removed. All three trees are multi-stemmed specimens with defects. The trees are all located on the southern boundary of a meadow. The removal of the three trees would have a minor impact on the amenity value of the site when viewed from Murieston Road. The loss of trees could readily be compensated for through new planting, located farther back from the road into the meadow area. New planting would strengthen the roadside boundary woodland and create separation between the proposed housing development and the woodland, in keeping with the woodland settings of the surrounding housing developments.

A further few young trees, too small to have been included in the survey will also require removing.

Visibility splay to the south from the centre of the proposed access road showing tree numbers 2715- 2719 in the background.

TREE PROTECTION PLAN

The Tree Protection Plan indicates appropriate Construction Exclusion Zones, which are based on the recommended Root Protection Areas and other identified constraints, including daylight shading, tree species, vigour, amenity values, and specific ground conditions which are likely to influence the rooting environment.

The Tree Protection Plan indicates the location of all proposed structures and hard surfacing, and the location of the required Construction Exclusion Zone (CEZ) around trees proposed for retention. Trees recommended for retention must be protected barriers and/or ground protection prior to commencement of any development works, including demolition. Barriers should consist of a scaffold framework in accordance with Figure 2 of BS 5837:2012, comprising a vertical and horizontal framework, well braced to resist impacts, with vertical tubes spaced at a maximum interval of 3 m. Onto this, weld mesh panels should be securely fixed with wire or scaffold clamps. Heras Fencing may be used providing that the panels are joined together with a minimum of two anti-tamper couplings, and that panels are braced on the inside of the CEZ with stabiliser struts in accordance with Figure 3 of BS5837:2012.

There should be no movement of machinery, stockpiling of materials, excavations (including service runs), or changes in existing ground levels within the Construction Exclusion Zone throughout the duration of the construction works. Where service runs must pass through the protected area, excavations should be dug by hand, and all tree roots encountered that are greater than 25mm diameter should be retained intact. Cables, pipes and ducts should be fed below roots, and trenches should be backfilled as soon as possible to prevent desiccation of roots.

BS 5837:2012 Tree Categorisation

TREES FOR REMOVAL				
Category and definition	**Criteria**			**Identification on plan**
Category U Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years	• Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other U Category trees (e.g. where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning) • Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline • Trees infected with pathogens of significance to the health and/or safety of other trees nearby, or very low quality trees suppressing adjacent trees of better quality NOTE : *Category U trees can have existing or potential conservation value which it might be desirable to preserve*.			**Red**
TREES TO BE CONSIDERED FOR RETENTION				
Category and definition	**Criteria – Subcategories**			**Identification on plan**
	1 Mainly arboricultural values	**2 Mainly landscape values**	**3 Mainly cultural values, including conservation**	
Category A **Trees of high quality** with an estimated remaining life expectancy of 40 years	Trees that are particularly good examples of their species, especially if rare or unusual, or essential components of groups, or of formal or semi-formal arboricultural features (e.g. the dominant and/or principal trees within an avenue)	Trees, groups or woodlands of particular visual importance as arboricultural features and/or landscape features.	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (e.g. veteran trees or wood-pasture)	**Green**
Category B **Trees of moderate quality** with an estimated remaining life expectancy of at least 20 years	Trees that might be included in Category A, but are downgraded because of impaired condition (*e.g.* presence of significant though remediable defects including unsympathetic past management and storm damage), such that they are unlikely to be suitable for retention beyond 40 years; or trees lacking the special quality necessary to merit the Category A designation	Trees present in numbers, usually as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality.	Trees with material conservation or other cultural value	**Blue**
Category C **Trees of low quality** with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150mm	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories	Trees present in groups or woodlands, but without this conferring on them a greater collective landscape value; and/or trees offering low or only temporary/transient landscape benefits	Trees with no material conservation or other cultural value	**Grey**

Tree Survey Schedule

Tag No	Species	DBH	Canopy	Ht	C.Ht	BS Cat	Condition	Age	Stems	Comments	Recommendations
2601	Beech	0.60	4	14	1	C1	Poor	M	1	Restricted rooting due to ground conditions. Cavity/decay affecting main fork. Storm damage. Major dead wood (>50mm dia).	Will not tolerate disturbance. Unsuitable for retention within any development.
2602	Beech	0.70	1	5	3	C1	Poor	M	1	Restricted rooting due to ground conditions. Significant cavity/decay in stem. Crown has collapsed as result of storm damage.	
2603	Beech	0.50	1	7	1	C1	Poor	M	1	Restricted rooting due to ground conditions. Significant cavity/decay in stem. Storm damage. Crown has collapsed as a result of storm damage	Will not tolerate disturbance. Unsuitable for retention within any development.
2604	Hawthorn	0.20	2	<5	3	B1	Fair	M	M	Restricted rooting due to ground conditions. Group of hawthorn and holly. Remnant hedgerow.	
2605	Beech	0.60	6	16	1	B1	Fair	M	1	Restricted rooting due to ground conditions. Bark staining, spotting, exudation. Minor cavity/decay in stem. Branch stubs from past pruning/storm damage.	
2606	Beech	0.65	4	18	2	B1	Fair	M	1	Restricted rooting due to ground conditions. Bark staining, spotting, exudation. Canopy 1-sided. Branch stubs from past pruning/storm damage.	
2607	Beech	0.50	3	14		B1	Fair	M	1	Restricted rooting due to ground conditions. Canopy suppressed.	
2608	Beech	0.60	3	8	1	C1	Poor	M	1	Restricted rooting due to ground conditions. Significant cavity/decay in stem. Storm damage. Scale insect. Crown has collapsed as result of storm damage	Will not tolerate disturbance. Unsuitable for retention within any development.
2609	Beech	0.65	3	17	6	B1	Fair	M	1	Restricted rooting due to ground conditions. Minor cavity/decay in stem. Low vigour, poor shoot extension, thin foliage.	

Tree Survey Schedule

Tag No	Species	DBH	Canopy	Ht	C.Ht	BS Cat	Condition	Age	Stems	Comments	Recommendations
2610	Beech	0.60	5	18	3	A1	Good	M	1	Restricted rooting due to ground conditions. Minor cavity/decay in stem.	
2611	Beech	0.80	2	13	3	A1	Good	M	1	Restricted rooting due to ground conditions. Longitudinal crack in main stem. Significant cavity/decay in stem. Storm damage.	
2612	Beech	0.70	3	18	3	A1	Good	M	1	Restricted rooting due to ground conditions. Longitudinal crack in main stem. Minor cavity/decay in stem. Canopy 1-sided. Storm damage. Major limb lost through storm damage	
2613	Beech	0.60	3	14	1	C1	Poor	M	1	Restricted rooting due to ground conditions. Significant cavity/decay in stem. Low vigour, poor shoot extension, thin foliage. Kretzchmaria.	Will not tolerate disturbance. Unsuitable for retention within any development.
2614	Beech	0.75	4	16		B1	Fair	M	1	Restricted rooting due to ground conditions. Low vigour, poor shoot extension, thin foliage. Minor cavity/decay in main scaffold limb.	
2615	Beech	0.80	4	16	1	B1	Good	M	1	Restricted rooting due to ground conditions. Minor dead wood (<50mm dia).	
2616	Beech	0.55	2	15	3	A1	Good	M	1	Excavations/level changes in root zone. Minor cavity/decay in stem. Low vigour, poor shoot extension, thin foliage. Minor dead wood (<50mm dia).	
2617	Common lime	0.75	3	15	1	C1	Poor	M	1	Excavations/level changes in root zone. Minor cavity/decay in stem. Stem wound, exposed timber remains sound. Low vigour, poor shoot extension, thin foliage. Minor crown dieback.	
2618	Beech	0.65	3	14	1	C1	Poor	M	1	Excavations/level changes in root zone. Minor cavity/decay in stem. Longitudinal crack in main stem. Significant cavity/decay in main scaffold limb. Low vigour, poor shoot extension, thin foliage.	Will not tolerate disturbance. Unsuitable for retention within any development.

Tree Survey Schedule

Tag No	Species	DBH	Canopy	Ht	C.Ht	BS Cat	Condition	Age	Stems	Comments	Recommendations
2619	Ash	0.40	2	14	1	B1	Fair	M-A	1	Minor cavity/decay in stem. Low vigour, poor shoot extension, thin foliage.	
2620	Beech	0.75	5	10	3	C1	Poor	M	1	Excavations/level changes in root zone. Significant cavity/decay in stem. Storm damage. Significant dieback, stag-headed. Kretzchmaria.	Will not tolerate disturbance. Unsuitable for retention within any development.
2621	Beech	0.70	4	17	3	B1	Good	M	1	Excavations/level changes in root zone. Longitudinal crack in main stem. Minor cavity/decay in stem. Low vigour, poor shoot extension, thin foliage. Minor crown dieback.	
2622	Beech	0.80	3	15	3	B1	Good	M	1	Excavations/level changes in root zone. Minor cavity/decay in stem. Minor cavity/decay in main scaffold limb.	
2623	Beech	0.70	4	17	2	B1	Good	M	1	Excavations/level changes in root zone. Minor cavity/decay in stem. Low vigour, poor shoot extension, thin foliage. Minor dead wood (<50mm dia).	
2624	Beech	1.05	8	18	2	B1	Fair	M	1	Excavations/level changes in root zone. Minor cavity/decay in stem. Branch stubs from past pruning/storm damage. Significant cavity/decay in main scaffold limb.	
2625	Beech	0.65	2	14	3	C1	Poor	M	1	Excavations/level changes in root zone. Significant cavity/decay in stem. Storm damage.	Will not tolerate disturbance. Unsuitable for retention within any development.
2626	Beech	0.75	4	16	3	C1	Poor	M	1	Excavations/level changes in root zone. Significant cavity/decay in stem. Significant dieback, stag-headed. Significant cavity/decay in main scaffold limb.	Will not tolerate disturbance. Unsuitable for retention within any development.
2627	Beech	0.60	3	12	2	C1	Poor	M	1	Excavations/level changes in root zone. Significant cavity/decay in stem. Significant dieback, stag-headed.	Will not tolerate disturbance. Unsuitable for retention within any development.

Tree Survey Schedule

Tag No	Species	DBH	Canopy	Ht	C.Ht	BS Cat	Condition	Age	Stems	Comments	Recommendations
2628	Beech	0.50	3	16	2	B1	Good	M	1	Excavations/level changes in root zone. Stem wound, exposed timber remains sound. Canopy suppressed.	
2629	Beech	0.50	2	14	4	A1	Good	M	1	Restricted rooting due to ground conditions. Minor cavity/decay in stem. Canopy suppressed. Minor crown dieback.	
2630	Beech	0.65	4	16	1	C1	Poor	M	1	Excavations/level changes in root zone. Significant cavity/decay in stem. Kretzchmaria.	Will not tolerate disturbance. Unsuitable for retention within any development.
2631	Beech	0.50	3	12	1	C1	Good	M	1	Excavations/level changes in root zone. Minor cavity/decay in stem. Canopy suppressed.	
2632	Silver birch	0.30	2	16	2	A1	Good	M-A	M	Group of 5 birch trees	
2633	Beech	0.50	3	16	2	C1	Poor	M	1	Significant decay in buttress. Bark necrosis. Low vigour, poor shoot extension, thin foliage.	Will not tolerate disturbance. Unsuitable for retention within any development.
2634	Beech	0.50	4	16	2	B1	Good	M	1	Minor cavity/decay in stem.	
2635	Beech	0.60	4	15	3	B1	Fair	M	1	Excavations/level changes in root zone. Bark staining, spotting, exudation. Canopy 1-sided.	
2636	Beech	0.70	5	18	2	B1	Good	M	1	Excavations/level changes in root zone. Minor cavity/decay in stem.	
2637	Beech	0.60	4	17	2	C1	Poor	M	1	Bark necrosis. Stem wound, exposed timber remains sound. Canopy 1-sided.	Will not tolerate disturbance. Unsuitable for retention within any development.
2638	Beech	0.65	5	17	3	C1	Poor	M	1	Significant decay in buttress. Minor crown dieback.	Will not tolerate disturbance. Unsuitable for retention within any development.
2639	Beech	0.55	4	10	3	C1	Poor	M	1	Significant decay in buttress. Significant cavity/decay in stem. Storm damage.	Fell.

Tree Survey Schedule

Tag No	Species	DBH	Canopy	Ht	C.Ht	BS Cat	Condition	Age	Stems	Comments	Recommendations
2640	Beech	0.60	2	15	5	C1	Poor	M	1	Significant cavity/decay in stem. Storm damage. Significant dieback, stag-headed. High potential for wildlife interest	Will not tolerate disturbance. Unsuitable for retention within any development. Check for nest/roost sites.
2641	Beech	0.40	3	10	4	C1	Poor	M	1	Significant cavity/decay in stem. Bark necrosis. Significant dieback, stag-headed. High potential for wildlife interest	Will not tolerate disturbance. Unsuitable for retention within any development. Check for nest/roost sites.
2642	Beech	0.55	5	12	3	C1	Fair	M	1	Longitudinal crack in main stem. Minor cavity/decay in stem. Minor crown dieback. Low vigour, poor shoot extension, thin foliage.	
2643	Beech	0.55	5	17	4	B1	Fair	M	1	Significant cavity/decay in main scaffold limb. Scale insect.	
2644	Beech	0.50	3	16	2	B1	Fair	M	1	Excavations/level changes in root zone. Stem wound, exposed timber remains sound. Branches affecting adjacent structure.	
2645	Beech	0.70	4	17	6	C1	Poor	M	1	Significant decay in buttress. Significant cavity/decay in stem. Significant dieback, stag-headed. Storm damage.	Will not tolerate disturbance. Unsuitable for retention within any development.
2646	Beech	0.60	5	14	3	B1	Fair	M	1	Minor decay in buttress. Stem lean. Canopy 1-sided.	
2647	Beech	0.45	3	13	3	C1	Poor	M	1	Excavations/level changes in root zone. Minor cavity/decay in stem. Stem wound, exposed timber remains sound. Low vigour, poor shoot extension, thin foliage.	Will not tolerate disturbance. Unsuitable for retention within any development.
2648	Beech	0.55	3	15	2	B1	Fair	M	1	Minor decay in buttress. Bark necrosis.	
2649	Beech	0.50	3	16	2	B1	Good	M	1	Excavations/level changes in root zone. Minor cavity/decay in stem. Branch stubs from past pruning/storm damage.	
2650	Beech	0.65	5	15	1	C1	Poor	M	1	Decay fungus present. Longitudinal crack in main stem. Minor cavity/decay in stem.	Will not tolerate disturbance. Unsuitable for retention within any development.

Tree Survey Schedule

Tag No	Species	DBH	Canopy	Ht	C.Ht	BS Cat	Condition	Age	Stems	Comments	Recommendations
2651	Beech	0.55	3	17	2	B1	Good	M	1	Minor decay in buttress. Minor cavity/decay in stem. Included bark, weak fork in main scaffold limb. Minor cavity/decay in main scaffold limb.	
2652	Beech	0.65	5	15	3	B1	Good	M	1	Excavations/level changes in root zone. Minor cavity/decay in stem. Minor crown dieback.	
2653	Beech	0.65	5	16	2	C1	Poor	M	1	Minor decay in buttress. Significant cavity/decay in stem.	Will not tolerate disturbance. Unsuitable for retention within any development.
2654	Beech	0.70	3	16	6	C1	Poor	O-M	1	Significant decay in buttress. Significant cavity/decay in stem. Storm damage. Kretzchmaria.	Fell.
2655	Beech	0.60	4	17	3	C1	Poor	O-M	1	Significant decay in buttress. Significant cavity/decay in stem. Significant dieback, stag-headed.	Will not tolerate disturbance. Unsuitable for retention within any development.
2656	Beech	0.90	3	17	3	C1	Poor	M	1	Excavations/level changes in root zone. Bark necrosis. Significant cavity/decay in stem. Significant dieback, stag-headed.	
2657	Beech	0.70	3	18	3	B1	Good	M	1	Excavations/level changes in root zone.	
2658	Flowering cherry	0.60	4	10	2	C1	Poor	M	1	Excavations/level changes in root zone. Significant dieback, stag-headed.	
2659	Beech	0.70	3	17	2	C1	Poor	M	1	Significant decay in buttress. Significant cavity/decay in stem. Stem wound, exposed timber remains sound. Low vigour, poor shoot extension, thin foliage.	
2660	Beech	0.50	2	14	1	C1	Poor	M	1	Excavations/level changes in root zone. Significant cavity/decay in stem. Significant dieback, stag-headed.	
2661	Beech	0.45	2	14	3	B1	Good	M	1	Excavations/level changes in root zone. Minor crown dieback.	
2662	Beech	0.55	3	17	6	C1	Poor	M	1	Excavations/level changes in root zone. Significant dieback, stag-headed.	

Tree Survey Schedule

Tag No	Species	DBH	Canopy	Ht	C.Ht	BS Cat	Condition	Age	Stems	Comments	Recommendations
2663	Beech	0.55	3	18	3	C1	Poor	M	1	Minor decay in buttress. Significant cavity/decay in stem.	
2664	Beech	0.40	3	14	3	B1	Fair	M-A	1	Excavations/level changes in root zone. Minor cavity/decay in main scaffold limb.	
2665	Oak	0.65	4	15	3	B1	Dead	M	1	Restricted rooting due to ground conditions. Ivy growth obscuring detailed assessment. Minor crown dieback.	
2666	Oak	0.50	8	11	3	A1	Good	M	1	Stem lean. Canopy 1-sided.	
2667	Oak	0.50	2	18	6	C1	Poor	M	1	Significant dieback, stag-headed.	
2668	Oak	0.30	2	14	6	C1	Poor	M	1	Significant dieback, stag-headed.	
2669	Silver birch	0.50	2	16	3	A1	Good	M	1		
2670	Beech	0.40	2	14	3	C1	Poor	Y-M	1	Significant decay in buttress. Significant cavity/decay in stem. Significant dieback, stag-headed. Armillaria.	
2671	Oak	0.40	3	18	3	B1	Good	Y-M	1	Low vigour, poor shoot extension, thin foliage. Minor crown dieback.	
2672	Beech	0.40	2	14	6	C1	Fair	Y-M	1	Canopy suppressed. Low vigour, poor shoot extension, thin foliage.	
2673	Oak	0.80	3	20	2	A1	Good	M	1	Minor dead wood (<50mm dia).	
2674	Beech	0.45	3	10	3	A1	Good	Y-M	1	Canopy suppressed. Canopy 1-sided.	
2675	Beech	0.50	3	14	3	C1	Poor	Y-M	1	Decay fungus present. Minor cavity/decay in stem.	
2676	Oak	0.60	5	18	3	B1	Fair	M	1	Stem lean. Low vigour, poor shoot extension, thin foliage. Minor crown dieback.	
2677	Ash	0.30	2	12	3	A1	Good	Y	1		
2678	Oak	0.40	4	16	3	A1	Good	Y-M	1	Stem lean. Canopy suppressed. Canopy 1-sided.	
2679	Oak	0.50	3	18	2	B1	Good	Y-M	1	Canopy suppressed. Canopy 1-sided.	
2680	Oak	0.50	2	16	3	A1	Good	Y-M	1		
2681	Oak	0.50	2	16	3	A1	Good	Y-M	1	Storm damage.	
2682	Oak	0.45	3	12	2	A1	Good	Y-M	1	Poor crown structure. Minor dead wood (<50mm dia). Overhanging road.	Tip back secondary branch growth to remove conflict with adjacent structure.

Tree Survey Schedule

Tag No	Species	DBH	Canopy	Ht	C.Ht	BS Cat	Condition	Age	Stems	Comments	Recommendations
2682	Oak	0.40	2	9	2	C1	Fair	M-A	1	Stem lean. Poor crown structure. Stem badly twisted	
2683	Oak	0.30	2	12	3	A1	Good	Y	1	Storm damage.	
2684	Beech	0.40	2	12	3	C1	Poor	M	1	Movement/instability in root plate. Significant cavity/decay in stem. Significant cavity/decay in main scaffold limb. Significant dieback, stag-headed.	
2685	Beech	0.60	1	14	3	C1	Poor	M	1	Bark necrosis. Significant cavity/decay in stem. Significant dieback, stag-headed. Almost dead	
2686	Beech	0.95	5	18	3	C1	Poor	O-M	1	Minor decay in buttress. Bark necrosis. Minor cavity/decay in stem. Significant cavity/decay in main scaffold limb. Major dead wood (>50mm dia).	
2687	Oak	0.40	2	18	3	A1	Good	Y-M	1		
2688	Beech	0.35	1	10	3	C1	Poor	M	1	Restricted rooting due to ground conditions. Minor cavity/decay in stem. Included bark, compression fork. Significant dieback, stag-headed. Canopy suppressed.	
2689	Beech	0.55	3	20	4	B1	Fair	M	1	Minor crown dieback. Major dead wood (>50mm dia).	
2690	Beech	0.55	3	18	2	B1	Fair	M	1	Included bark, compression fork. Included bark, weak fork in main scaffold limb.	
2691	Beech	0.50	4	18	5	B1	Good	M	1	Canopy suppressed. Minor dead wood (<50mm dia).	
2692	Beech	0.50	5	18	3	C1	Fair	M	1	Significant decay in buttress. Included bark, compression fork. Canopy suppressed.	
2693	Beech	0.45	4	16	3	B1	Fair	M	1	Minor decay in buttress. Bark necrosis. Minor crown dieback.	
2694	Oak	0.45	1	<5	2	C1	Poor	M	1	Storm damage. Snapped at 4m	
2695	Oak	0.40	3	13	2	C1	Fair	Y-M	1	Minor decay in buttress. Storm damage.	
2696	Oak	0.80	6	22	3	A1	Good	M	1	Stem lean. Canopy suppressed. Included bark, weak fork in main scaffold limb.	

Tree Survey Schedule

Tag No	Species	DBH	Canopy	Ht	C.Ht	BS Cat	Condition	Age	Stems	Comments	Recommendations
2697	Beech	0.50	3	18	3	C1	Poor	M	1	Decay fungus present. Significant dieback, stag-headed. Kretzchmaria.	
2698	Beech	0.35	4	12	2	B1	Fair	M-A	1	Stem lean. Canopy suppressed. Poor crown structure.	
2699	Silver birch	0.35	2	16	3	B1	Fair	M	1	Low vigour, poor shoot extension, thin foliage.	
2700	Ash	0.45	3	20	3	B1	Fair	Y-M	1	Storm damage.	
2701	Oak	0.45	3	16	2	B1	Fair	M	1	Significant dieback, stag-headed.	
2702	Oak	0.50	5	20	3	B1	Fair	M	1	Low vigour, poor shoot extension, thin foliage. Major dead wood (>50mm dia).	
2703	Beech	0.60	4	18	1	C1	Poor	M	1	Significant cavity/decay in stem. Minor cavity/decay in main scaffold limb. Major limb shearing from stem	
2704	Beech	0.70	6	22	3	C1	Poor	M	1	Stem lean. Significant cavity/decay in stem. Storm damage. Stem has sheared at inclusion	
2705	Beech	0.45	4	17		C1	Fair	M-A	1	Minor decay in buttress. Stem wound, exposed timber remains sound.	
2706	Beech	1.20	7	18	3	B1	Fair	O-M	M	Minor decay in buttress. Included bark, compression fork. Minor cavity/decay in stem. Canopy 1-sided. Canopy suppressed. Pair of multi-stemmed co-dependant beech with shared root plate.	
2707	Oak	0.40	3	16	3	B1	Good	Y-M	1	Stem wound, exposed timber remains sound. Canopy suppressed. Damage to bark from horses	
2708	Oak	0.45	3	14	3	B1	Good	M-A	1	Stem lean. Minor cavity/decay in stem. Poor crown structure. Canopy suppressed.	
2709	Oak	0.60	3	14	3	A1	Fair	M	1	Stem lean. Minor cavity/decay in stem. Canopy suppressed. Minor dead wood (<50mm dia).	

Tree Survey Schedule

Tag No	Species	DBH	Canopy	Ht	C.Ht	BS Cat	Condition	Age	Stems	Comments	Recommendations
2710	Grey willow	0.65	3	16	2	B1	Fair	M	M	Included bark, compression fork. Minor cavity/decay in stem. Minor crown dieback. Low vigour, poor shoot extension, thin foliage. Growing with a birch tree dbh 20cm	
2711	Sycamore	0.70	4	16	2	B1	Good	M-A	1	Included bark, compression fork.	
2712	Silver birch	0.25	3	10	3	B1	Good	Y-M	1	Canopy suppressed.	
2713	Ash	0.45	4	15	2	A1	Good	Y-M	1		
2714	Ash	0.35	3	14	2	B1	Fair	M-A	1	Minor cavity/decay in stem. Minor crown dieback.	
2715	Ash	0.60	3	12	3	B1	Fair	M-A	M	Included bark, compression fork. Minor cavity/decay in stem. Minor crown dieback.	
2716	Oak	0.50	2	14	3	B1	Good	Y-M	M	Low vigour, poor shoot extension, thin foliage.	
2717	Oak	0.70	5	16	3	B1	Fair	M	1	Excessive epicormic growth. Minor dead wood (<50mm dia). Minor crown dieback.	
2718	Oak	0.80	3	18	2	B1	Good	M	M	Included bark, compression fork. Minor crown dieback. Minor dead wood (<50mm dia).	
2719	Oak	0.40	2	17	3	B1	Good	Y-M	1	Canopy suppressed.	
2720	Ash	0.25	3	16	3	B1	Fair	M-A	1	Group of 3 ash with ash canker	
2721	Oak	0.30	3	12	1	A1	Good	M-A	1	Stem lean.	
2722	Downy birch	0.30	2	8	1	C1	Poor	M	1	Movement/instability in root plate. Significant cavity/decay in stem. Partially windblown	
2723	Downy birch	0.45	4	16	3	B1	Good	M	M	Included bark, compression fork.	
2724	Downy birch	0.35	2	17	6	B1	Fair	M	1	Stem lean. Minor cavity/decay in stem. Low vigour, poor shoot extension, thin foliage.	
2725	Downy birch	0.35	2	14	3	C1	Poor	M	M	Included bark, compression fork. Stem lean. Low vigour, poor shoot extension, thin foliage. Minor crown dieback.	
2726	Oak	0.50	3	18	3	A1	Good	M	M	Minor dead wood (<50mm dia). Minor crown dieback.	
2727	Oak	0.65	5	18	4	A1	Good	M	1		

Tree Survey Schedule

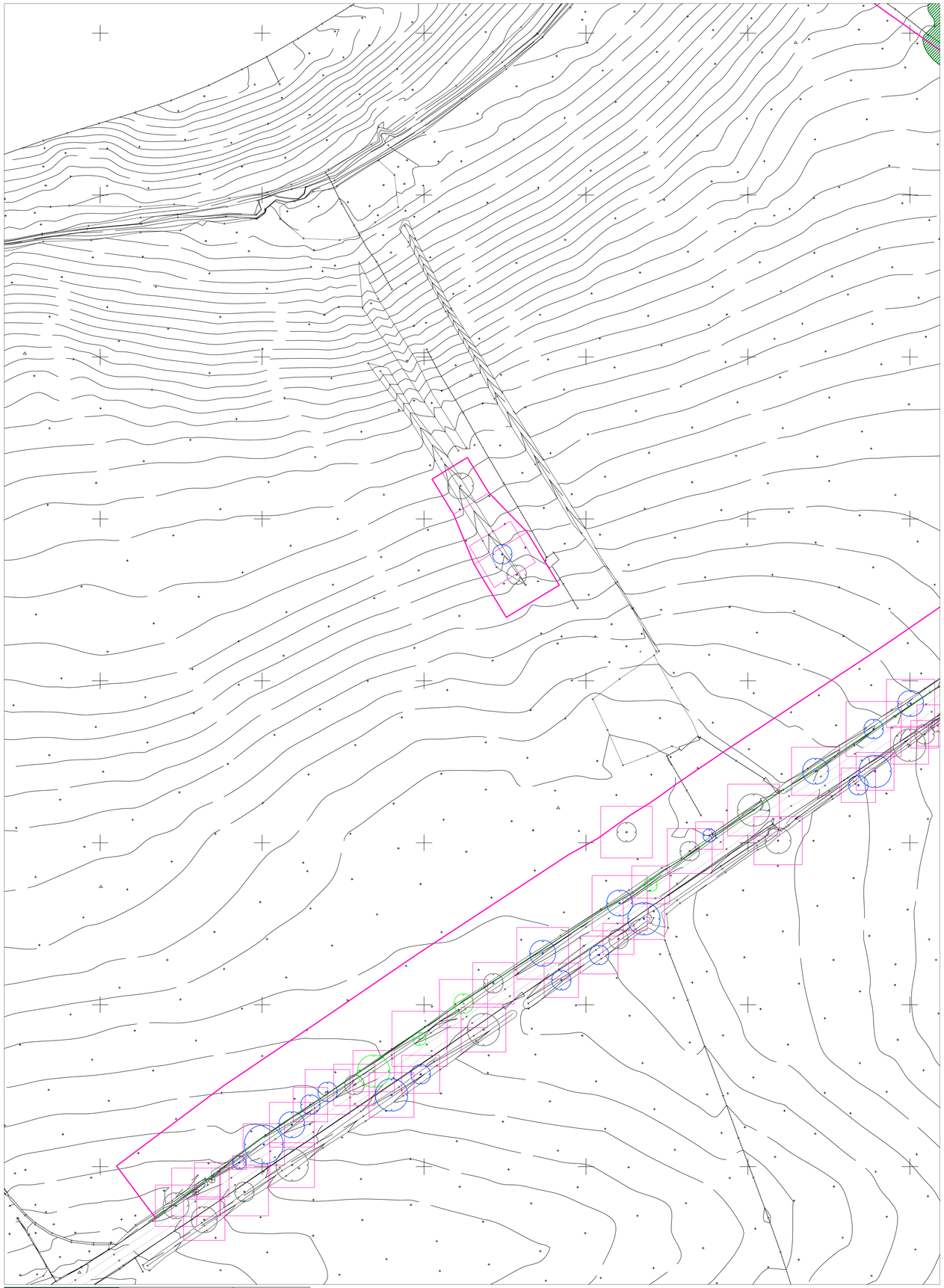
Tag No	Species	DBH	Canopy	Ht	C.Ht	BS Cat	Condition	Age	Stems	Comments	Recommendations
2728	Oak	1.25	5	20	2	A1	Good	M	M	Minor crown dieback. Minor dead wood (<50mm dia).	
2729	Oak	1.10	3	16	2	A1	Good	M	M	Minor crown dieback. Minor dead wood (<50mm dia). Bark stripping from horses	
2730	Oak	0.90	5	18	2	A1	Good	M	M	Minor dead wood (<50mm dia). Minor crown dieback.	

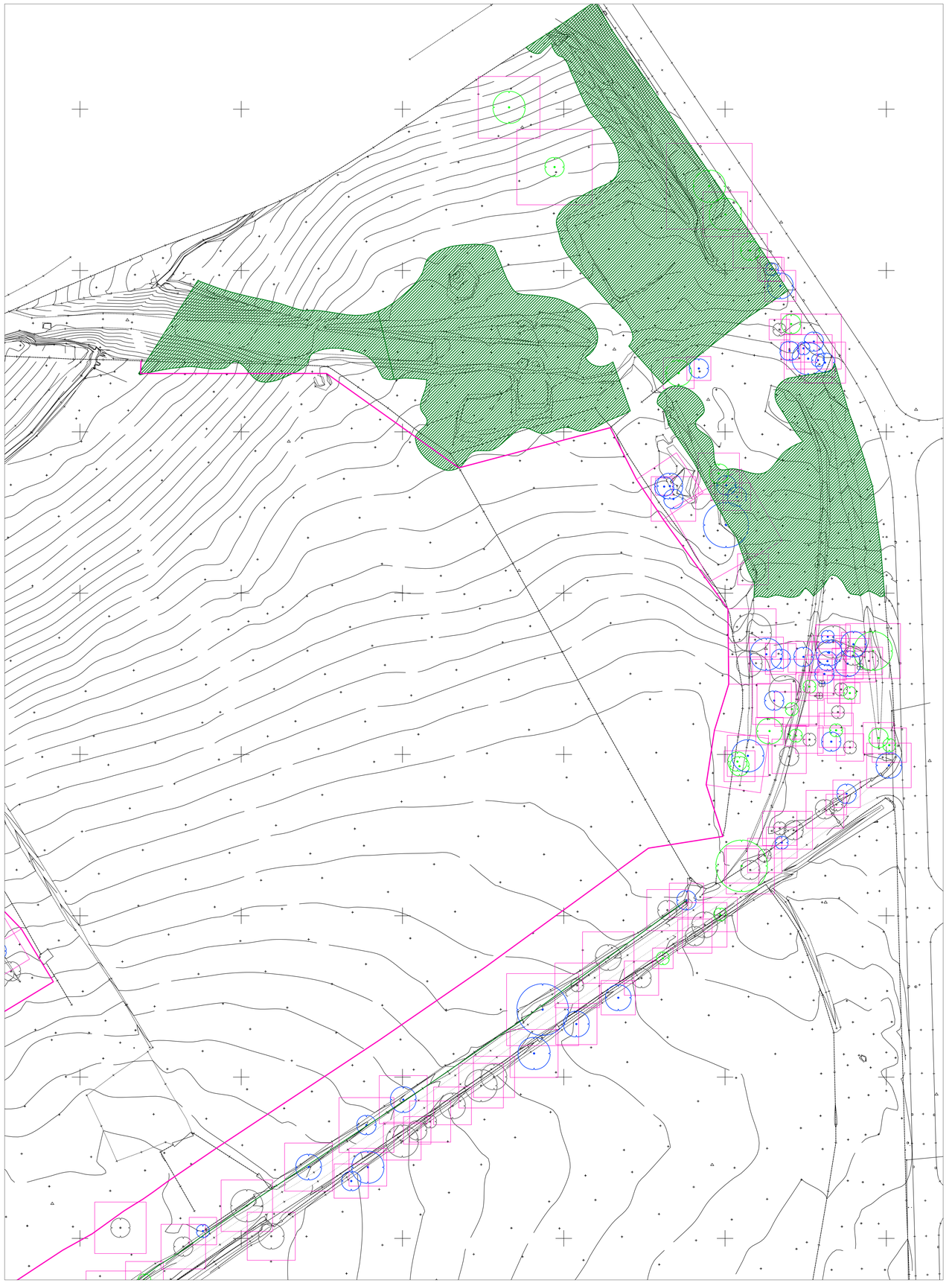
NOTE: Recommendations given in the foregoing schedule do not constitute a detailed tree work specification. This schedule should not be used for tendering or instructing tree surgery operations. A detailed Tree Works Specification can be provided in accordance with BS3998:2010, "Tree Work – Recommendations" where required.

Tree Survey Schedule

KEY TO TREE SURVEY SCHEDULE

No	Number as shown on survey plan (refers to tree tags where used)
Species	Common name
DBH	Stem Diameter at Breast Height, measured at 1.5m above ground level. Diameter measured in 0.05m bands and ***rounded up*** to next 0.05m.
Canopy	Average canopy radius in metres (survey drawing shows actual canopy radius at 4 cardinal points).
Ht	Approximate tree height in metres
C Ht	Crown height, indicating clearance from ground level to lowest branches, measured in metres
BS Cat	British Standard 5837:2012 tree categorisation
Condition	General overall description of condition: Good, Fair, Poor, Dead
Age	Age class (Young, Middle-Aged, Mature, Over-Mature, Veteran)
Stems	Single (1) or multiple (M) stems from below 1.5m, used to determine the appropriate Root Protection Area.
Comments	Comments on any observed defects within the root zone or affecting visible buttress root system; on the main stem up to and including the point of the first main fork; and affecting main scaffold branch system or secondary branch structure. Will be left blank where no defects are noted and growth characteristics are normal
Recommendations	Description of any recommended remedial tree work operations to be carried out in accordance with BS 3998:2010, and following the specifications identified in the Arboricultural Association Specification for Tree Works. Will be left blank where no work is required





Alan Motion Tree Consulting Ltd
Chartered Forester, Arboricultural Consultant

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Education Capacity Appraisal Addendum

In Support of

Land west of Murieston Road, Murieston, West Lothian

Prepared by

Clarendon Planning & Development Ltd

on behalf of

BDW Trading Ltd and H&J Russell

November 2015

CLARENDON
PLANNING AND
DEVELOPMENT

Introduction

The following tables and charts have incorporated the most recent figures released by West Lothian Council relating to projected school roll and capacity figures, seen in Appendix 2 of the 2012 Base School Forecast. In relation to St.Margaret's RC Academy, the projected capacity accords with both adopted Local Plan and Council SPG in terms of planned extensions.

The original Education Capacity Appraisal assessed the impact of a 200 unit housing development on catchment schools. This Addendum assesses the impact of a reduced proposal for 100-120 units, as per email correspondence to the Council on 18th September 2015.

Bellsquarry Primary School

Based on an initial consultation response from WLC Education on 27th August 2015, it is understood that one additional classroom could be accommodated at Bellsquarry Primary School. The capacity of this additional classroom could be between 25 (P1 max class size and preferred target size) to 33 (as stated in the consultation response). As such, the impact of the proposal taking into account an additional classroom of both 25 and 33 pupil capacity is assessed with findings confirming:

- A 100 unit development utilising a 25 capacity classroom would exceed capacity by just 1 pupil (in 2023)
- A 120 unit development utilising a 25 capacity classroom would exceed capacity by 7 pupils (in 2023)
- Both 100 unit and 120 unit options utilising a 33 capacity classroom could be accommodated

The PPP proposal for approximately 100-120 housing units is therefore considered feasible within the context of the Council's projections.

St Ninian's RC Primary School

Significant capacity exists at St Ninian's RC Primary School and the proposed development can be accommodated within the existing infrastructure.

The James Young High School

The James Young High School has a declining school roll and the proposed development can be accommodated within the existing infrastructure.

St Margaret's RC Academy

The school roll is rising at St Margaret's RC Academy but education capacity exists in the context of the Council's planned extensions and the proposed development can be accommodated with the provision of developer contributions as set out in the Council's SPG.

Conclusion

Based on the most recent education figures produced by West Lothian Council as Education Authority, our projections show capacity exists within all four catchment area schools for the proposed development of 100-120 residential units.

Bellsquarry Primary School

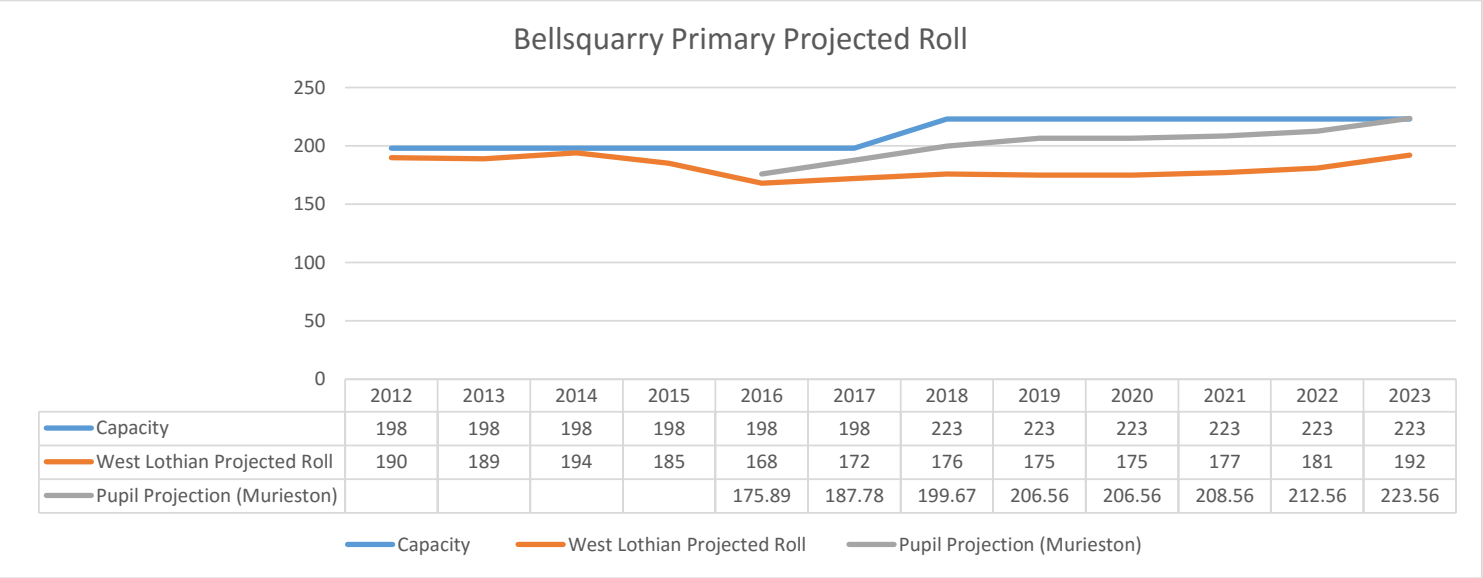
Assuming Committed Capacity of 198 & 223 (1 Committed Classroom = 25)

TABLE 1A - 100 unit option (25/year)

Year	Committed Sites P1-P7 Roll	Capacity	Murieston Road Houses	Pupils*	Total Committed & Murieston Road	Cumulative Change
2015	185	198	0	0.00	**185**	0
2016	168	198	25	7.89	**176**	8
2017	172	223	25	7.89	**188**	16
2018	176	223	25	7.89	**200**	24
2019	175	223	25	7.89	**207**	32
2020	175	223	0	0.00	**207**	32
2021	177	223	0	0.00	**209**	32
2022	181	223	0	0.00	**213**	32
2023	192	223	0	0.00	**224**	32

*Utilising WLC Child Product Ratio of 0.3156

FIGURE 1B - 100 unit (25/year)



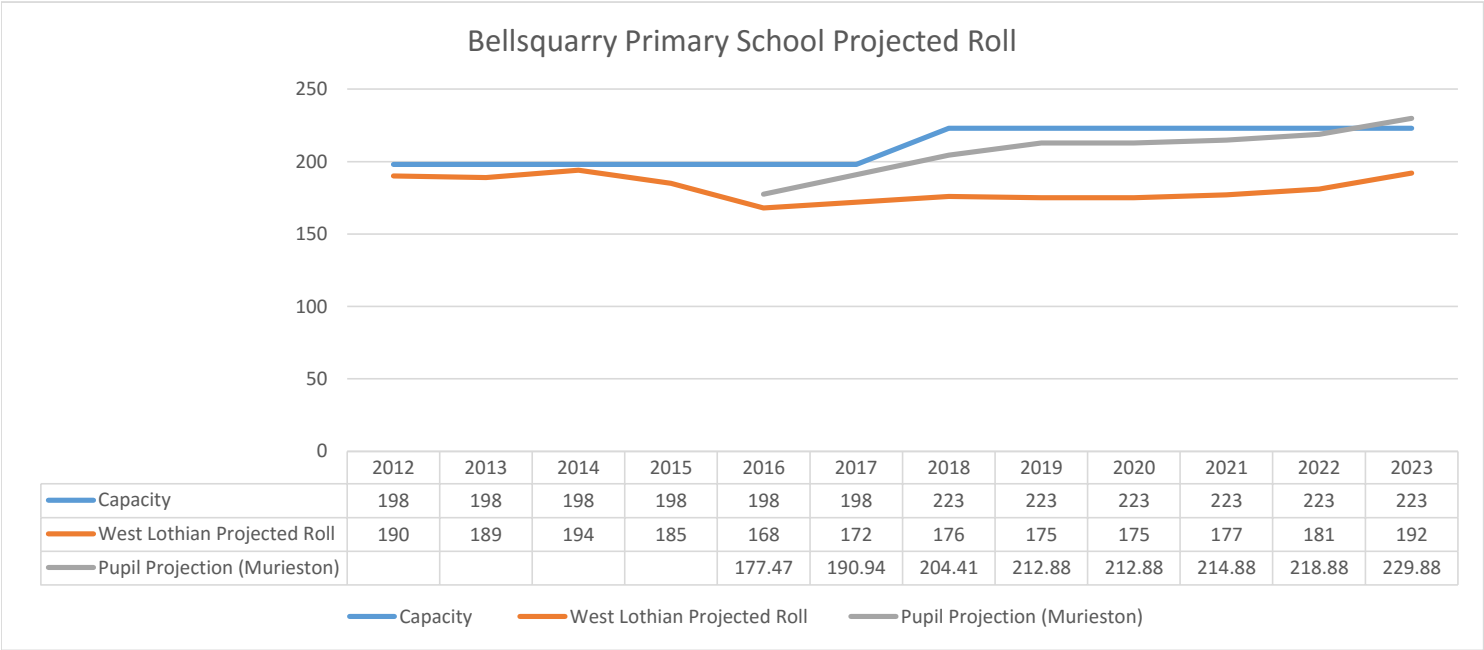
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Capacity	198	198	198	198	198	198	223	223	223	223	223	223
West Lothian Projected Roll	190	189	194	185	168	172	176	175	175	177	181	192
Pupil Projection (Murieston)					175.89	187.78	199.67	206.56	206.56	208.56	212.56	223.56

TABLE 2A - 120 unit option (30/year)

Year	Committed Sites P1-P7 Roll	Capacity	Murieston Road Houses	Pupils*	Total Committed & Murieston Road	Cumulative Change
2015	185	198	0	0.00	185	0
2016	168	198	30	9.47	177	9
2017	172	223	30	9.47	191	19
2018	176	223	30	9.47	204	28
2019	175	223	30	9.47	213	38
2020	175	223	0	0.00	213	38
2021	177	223	0	0.00	215	38
2022	181	223	0	0.00	219	38
2023	192	223	0	0.00	230	38

*Utilising WLC Child Product Ratio of 0.3156

FIGURE 2B - 120 units (30/year)



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Capacity	198	198	198	198	198	198	223	223	223	223	223	223
West Lothian Projected Roll	190	189	194	185	168	172	176	175	175	177	181	192
Pupil Projection (Murieston)					177.47	190.94	204.41	212.88	212.88	214.88	218.88	229.88

Bellsquarry Primary School

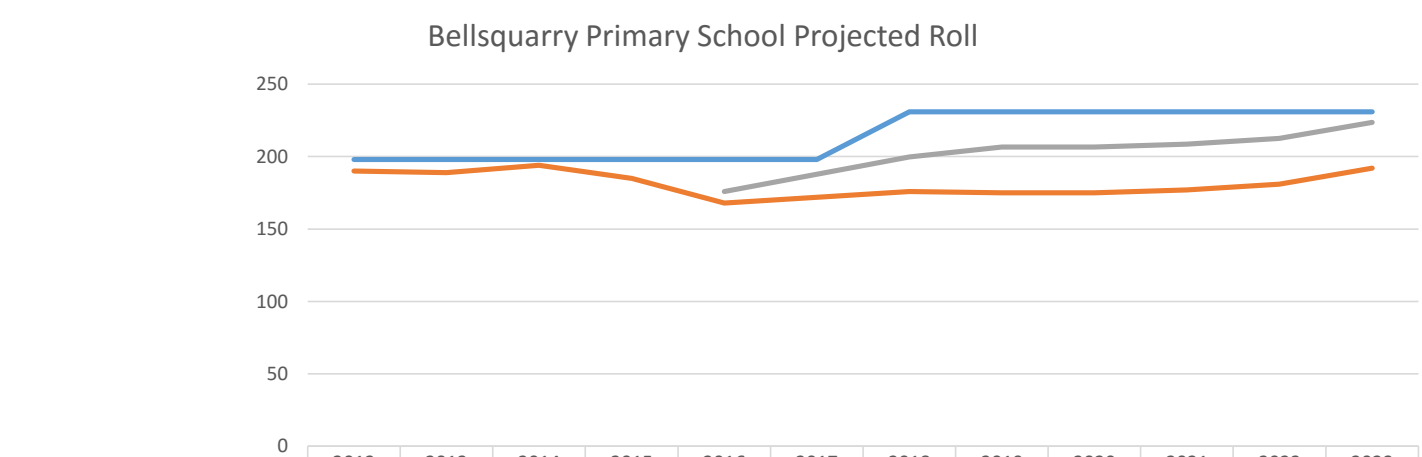
Assuming Committed Capacity of 198 & 231 (1 Committed Classroom = 33)

TABLE 3A - 100 unit option (25/year)

Year	Committed Sites P1-P7 Roll	Capacity	Murieston Road Houses	Pupils*	Total Committed & Murieston Road	Cumulative Change
2015	185	198	0	0.00	**185**	0
2016	168	198	25	7.89	**176**	8
2017	172	231	25	7.89	**188**	16
2018	176	231	25	7.89	**200**	24
2019	175	231	25	7.89	**207**	32
2020	175	231	0	0.00	**207**	32
2021	177	231	0	0.00	**209**	32
2022	181	231	0	0.00	**213**	32
2023	192	231	0	0.00	**224**	32

*Utilising WLC Child Product Ratio of 0.3156

FIGURE 3B - 100 units (25/year)



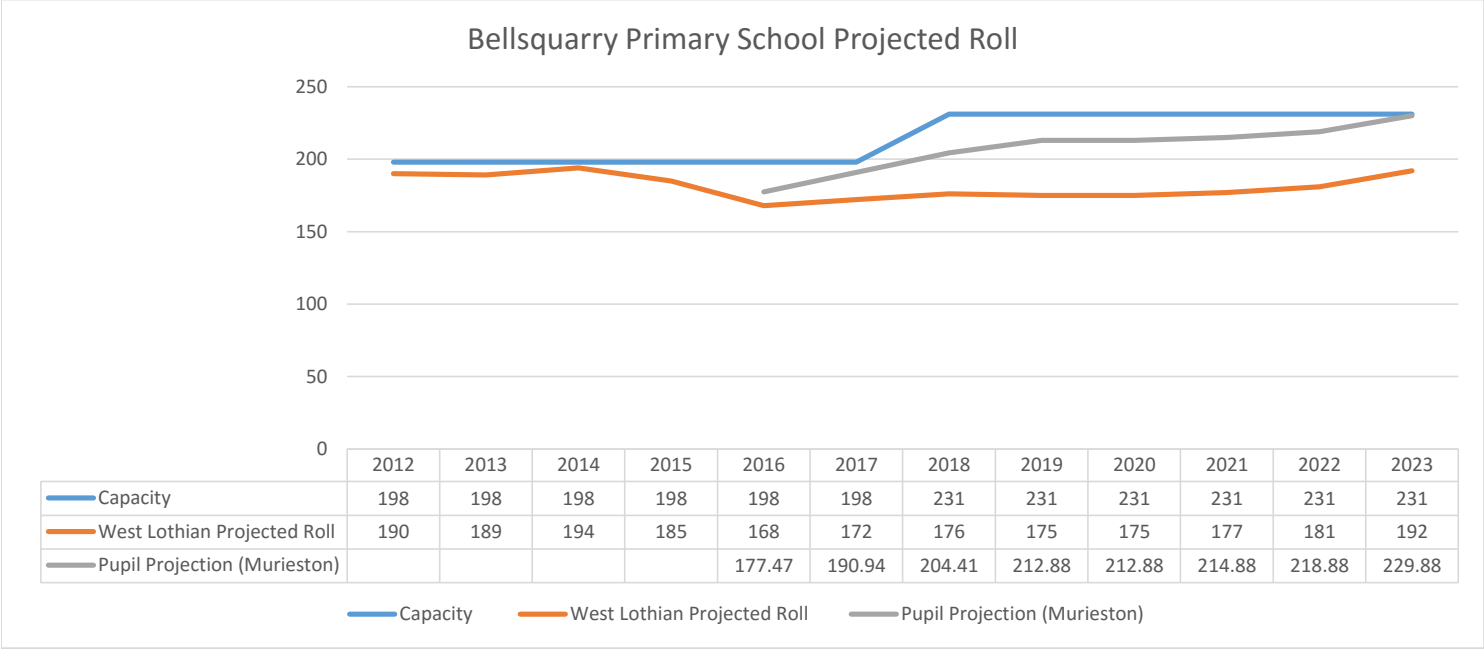
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Capacity	198	198	198	198	198	198	231	231	231	231	231	231
West Lothian Projected Roll	190	189	194	185	168	172	176	175	175	177	181	192
Pupil Projection (Murieston)					175.89	187.78	199.67	206.56	206.56	208.56	212.56	223.56

TABLE 4A - 120 unit option (30/year)

Year	Committed Sites P1-P7 Roll	Capacity	Murieston Road Houses	Pupils*	Total Committed & Murieston Road	Cumulative Change
2015	185	198	0	0.00	**185**	0
2016	168	198	30	9.47	**177**	9
2017	172	231	30	9.47	**191**	19
2018	176	231	30	9.47	**204**	28
2019	175	231	30	9.47	**213**	38
2020	175	231	0	0.00	**213**	38
2021	177	231	0	0.00	**215**	38
2022	181	231	0	0.00	**219**	38
2023	192	231	0	0.00	**230**	38

*Utilising WLC Child Product Ratio of 0.3156

FIGURE 4B - 120 units (30/year)



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Capacity	198	198	198	198	198	198	231	231	231	231	231	231
West Lothian Projected Roll	190	189	194	185	168	172	176	175	175	177	181	192
Pupil Projection (Murieston)					177.47	190.94	204.41	212.88	212.88	214.88	218.88	229.88

St Ninian's RC Primary

TABLE 5A - 100 unit option (25/year)

Year	Committed Sites P1-P7 Roll	Capacity	Murieston Road Houses	Pupils*	Total Committed & Murieston Road	Cumulative Change
2015	229	387	0	0.00	**229**	0
2016	223	387	25	2.32	**225**	2
2017	219	387	25	2.32	**224**	5
2018	212	387	25	2.32	**219**	7
2019	204	387	25	2.32	**213**	9
2020	195	387	0	0.00	**204**	9
2021	192	387	0	0.00	**201**	9
2022	193	387	0	0.00	**202**	9
2023	196	387	0	0.00	**205**	9

*Utilising WLC Child Product Ratio of 0.0927

FIGURE 5B - 100 unit option (25/year)

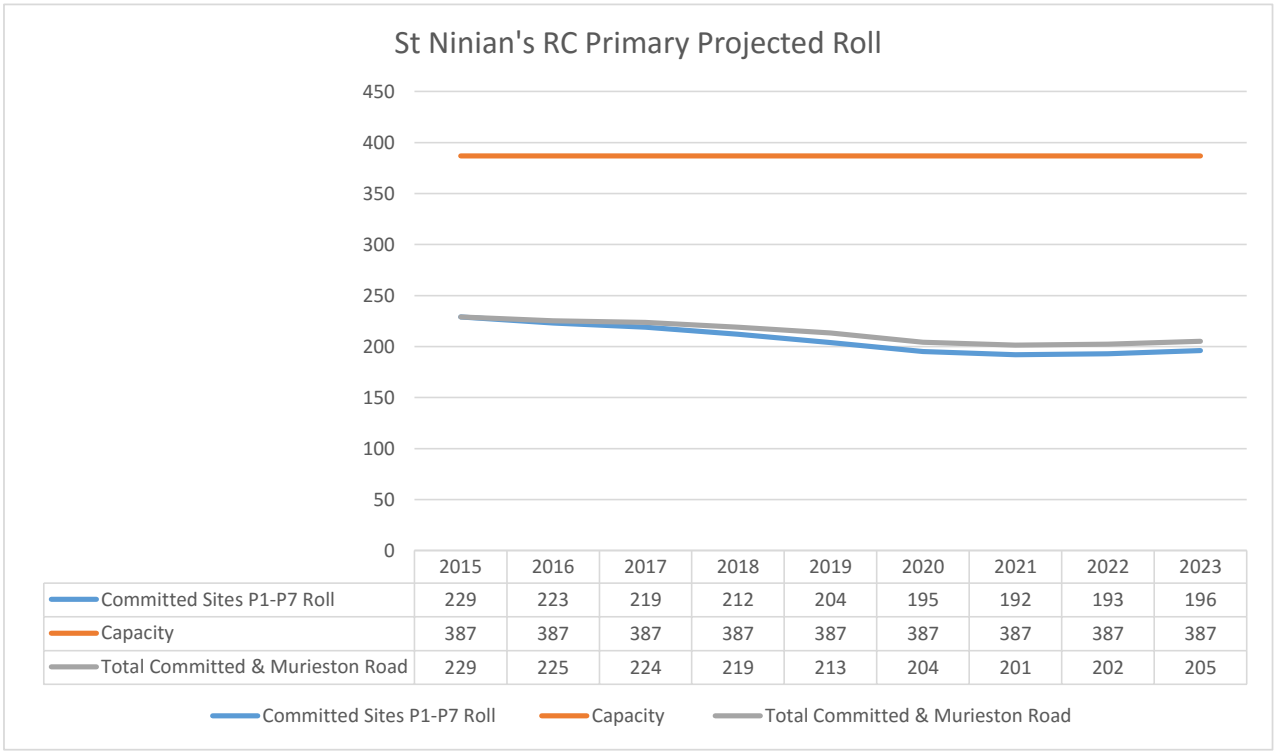
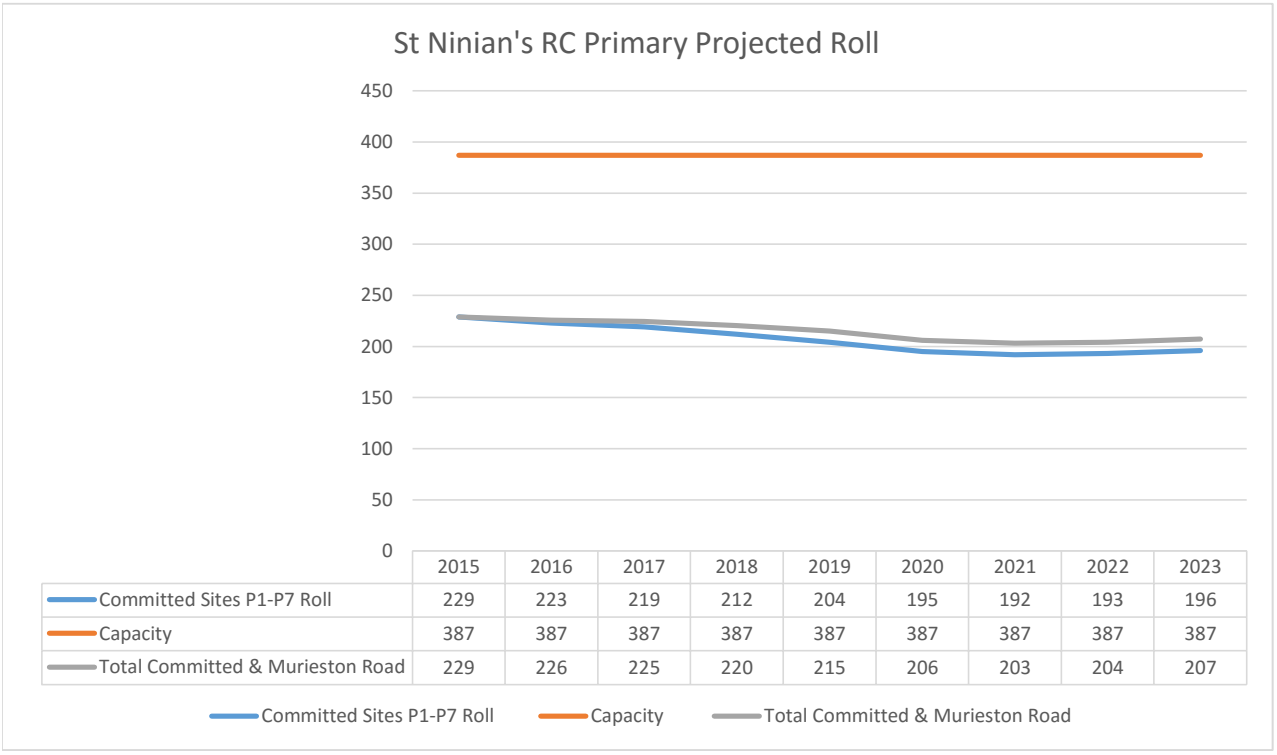


TABLE 6A - 120 unit option (30/year)

Year	Committed Sites P1-P7 Roll	Capacity	Murieston Road Houses	Pupils*	Total Committed & Murieston Road	Cumulative Change
2015	229	387	0	0.00	**229**	0
2016	223	387	30	2.78	**226**	3
2017	219	387	30	2.78	**225**	6
2018	212	387	30	2.78	**220**	8
2019	204	387	30	2.78	**215**	11
2020	195	387	0	0.00	**206**	11
2021	192	387	0	0.00	**203**	11
2022	193	387	0	0.00	**204**	11
2023	196	387	0	0.00	**207**	11

*Utilising WLC Child Product Ratio of 0.0927

FIGURE 6B - 120 unit option (30/year)



The James Young High School

TABLE 7A - 100 unit option (25/year)

Year	Committed Sites S1-S6 Roll	Capacity	Murieston Road Houses	Pupils*	Total Committed & Murieston Road	Cumulative Change
2015	1115	1210	0	0.00	**1115**	0
2016	1094	1210	25	4.27	**1098**	4
2017	1059	1210	25	4.27	**1068**	9
2018	1029	1210	25	4.27	**1042**	13
2019	1015	1210	25	4.27	**1032**	17
2020	1015	1210	0	0.00	**1032**	17
2021	1014	1210	0	0.00	**1031**	17
2022	974	1210	0	0.00	**991**	17
2023	918	1210	0	0.00	**935**	17

*Utilising WLC Child Product Ratio of 0.1706

FIGURE 7B - 100 unit option (25/year)

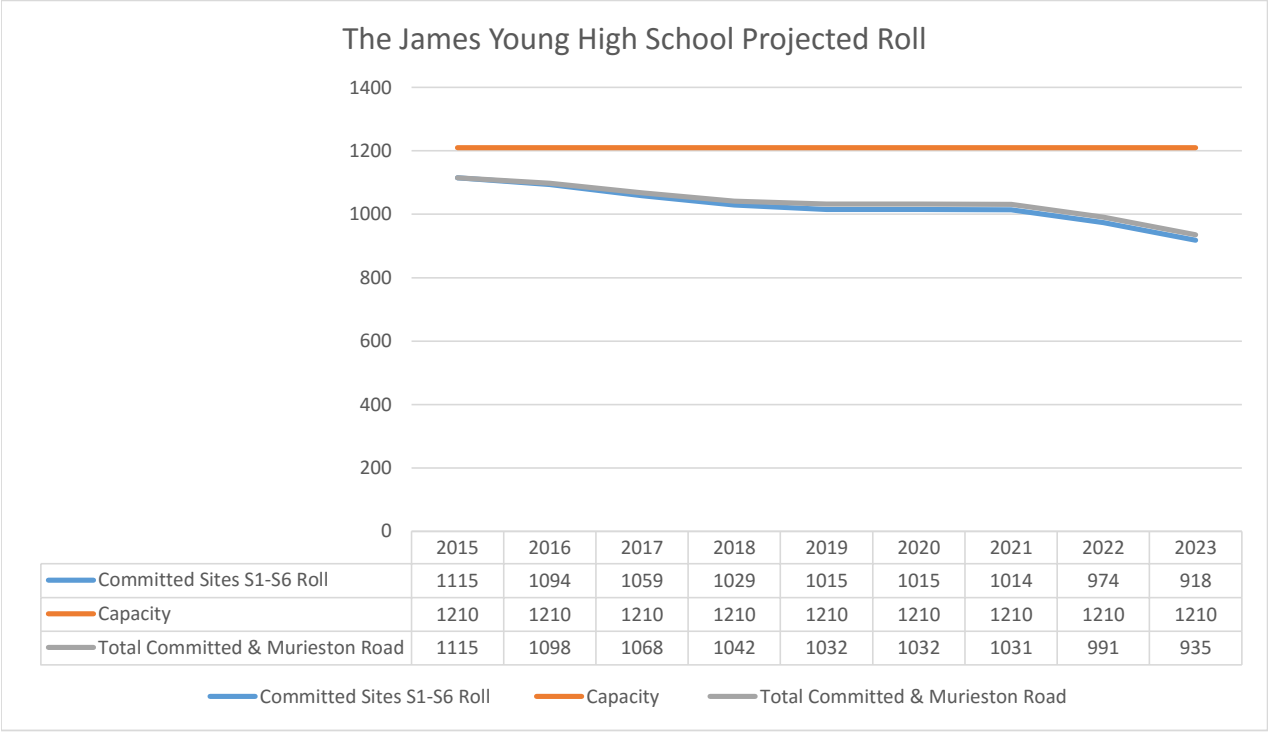
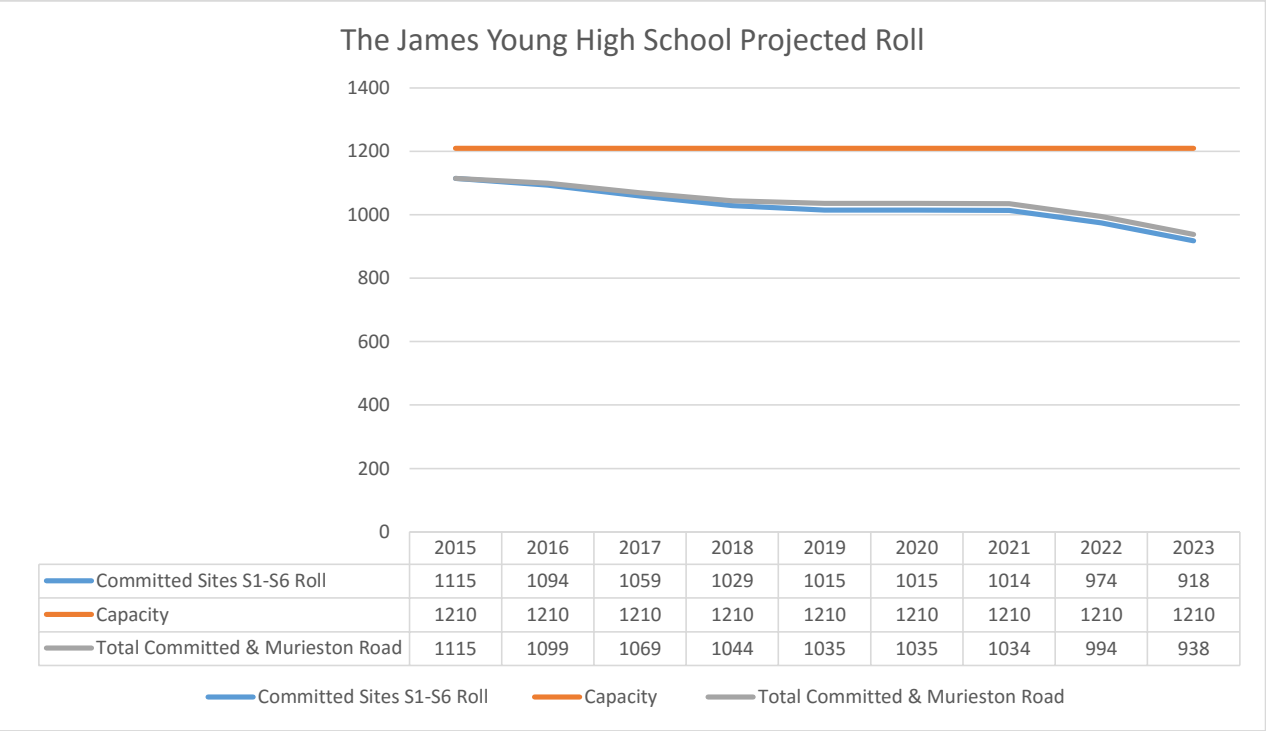


TABLE 8A - 120 unit option (30/year)

Year	Committed Sites S1-S6 Roll	Capacity	Murieston Road Houses	Pupils*	Total Committed & Murieston Road	Cumulative Change
2015	1115	1210	0	0.00	**1115**	0
2016	1094	1210	30	5.12	**1099**	5
2017	1059	1210	30	5.12	**1069**	10
2018	1029	1210	30	5.12	**1044**	15
2019	1015	1210	30	5.12	**1035**	20
2020	1015	1210	0	0.00	**1035**	20
2021	1014	1210	0	0.00	**1034**	20
2022	974	1210	0	0.00	**994**	20
2023	918	1210	0	0.00	**938**	20

*Utilising WLC Child Product Ratio of 0.1706

FIGURE 8B - 120 unit option (30/year)



St Margaret's RC Academy

TABLE 9A - 100 unit option (25/year)

Year	Committed Sites S1-S6 Roll	Capacity	Murieston Road Houses	Pupils*	Total Committed & Murieston Road	Cumulative Change
2015	1128	1100	0	0.00	**1115**	0
2016	1160	1210	25	1.49	**1161**	1
2017	1154	1210	25	1.49	**1157**	3
2018	1167	1320	25	1.49	**1171**	4
2019	1205	1320	25	1.49	**1211**	6
2020	1218	1320	0	0.00	**1224**	6
2021	1244	1320	0	0.00	**1250**	6
2022	1270	1320	0	0.00	**1276**	6
2023	1305	1320	0	0.00	**1311**	6

*Utilising WLC Child Product Ratio of 0.0597

FIGURE 9B - 100 unit option (25/year)

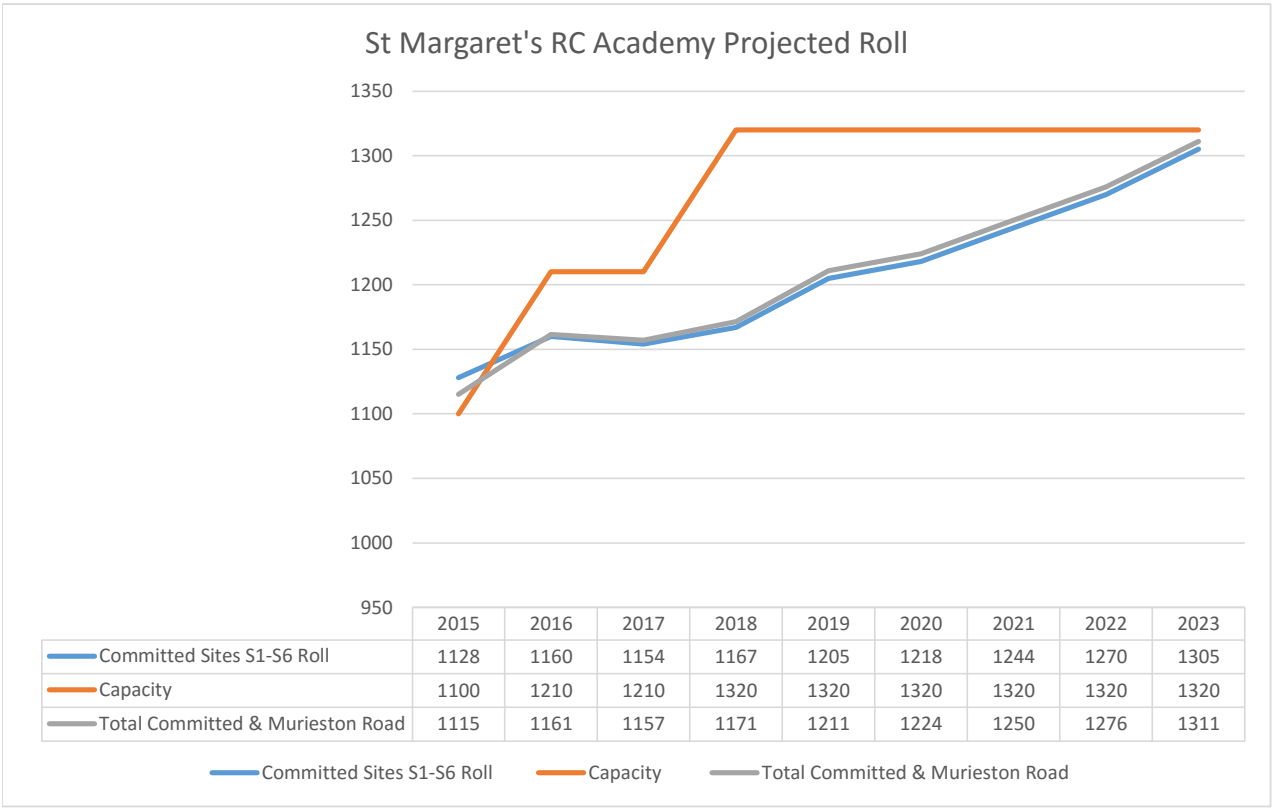
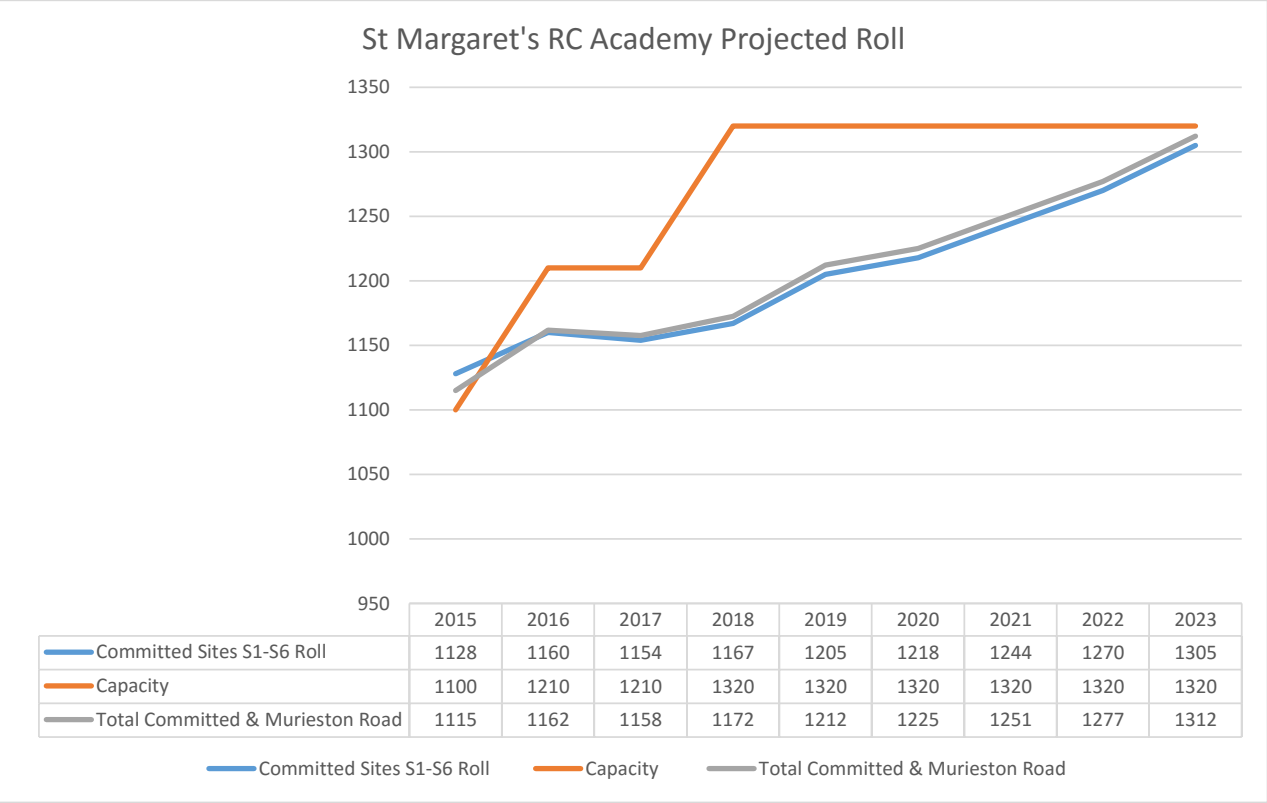


TABLE 10A - 120 unit option (30/year)

Year	Committed Sites S1-S6 Roll	Capacity	Murieston Road Houses	Pupils*	Total Committed & Murieston Road	Cumulative Change
2015	1128	1100	0	0.00	**1115**	0
2016	1160	1210	30	1.79	**1162**	2
2017	1154	1210	30	1.79	**1158**	4
2018	1167	1320	30	1.79	**1172**	5
2019	1205	1320	30	1.79	**1212**	7
2020	1218	1320	0	0.00	**1225**	7
2021	1244	1320	0	0.00	**1251**	7
2022	1270	1320	0	0.00	**1277**	7
2023	1305	1320	0	0.00	**1312**	7

*Utilising WLC Child Product Ratio of 0.0597

FIGURE 10B - 120 unit option (30/year)



Kaya Consulting Limited

BDW Trading Limited and H&J Russell

Proposed Development at Murieston, Livingston

Flood Risk Assessment

15 July 2014

[redacted]

T [redacted]

Document Information and History

Project:	Proposed Development at Murieston, Livingston
Client:	BDW Trading Ltd and H&J Russell
Client Representative:	Ross Manson, Clarendon Planning
Kaya Consulting Job Number:	KC785
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Project Director:	[redacted]
Author	[redacted]

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V2.0	10.10.2014	Final Report	M Stewart		

[redacted]

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1 Introduction

Kaya Consulting Ltd. was commissioned by BDW Trading Ltd and H&J Russell though Clarendon Planning and Development Limited to undertake a flood risk assessment at a proposed development site in the Murieston area of Livingston.

The site is located on a sloping greenfield ground on the edge of Murieston area of Livingston. There are a number of water features within and close to the site boundary, including an unnamed watercourse / field drain close to the northern boundary of the site, and a small pond near the south-west corner of the site. The site currently drains north and east. A flood risk assessment would need to consider risk from the watercourses, surface water runoff from adjacent land and groundwater.

The flood risk assessment is in support of a Planning Application in Principle.

The scope of work includes the following:

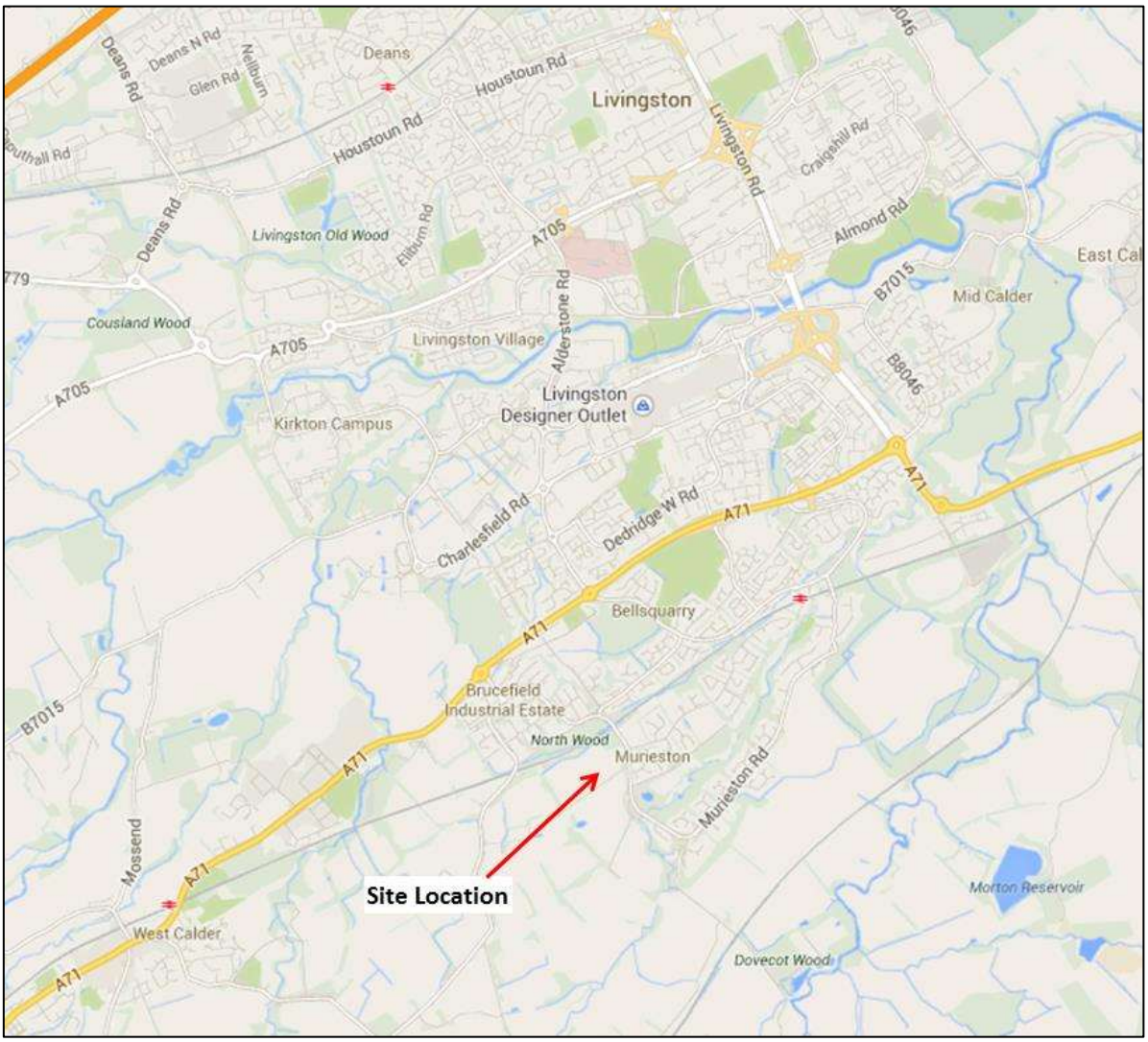
- Walkover site visit, including identification of key water features on site.
- Contact local council flooding officers with a view to obtain any relevant information related to the site including historical flood records.
- Assessment of flooding risk from open watercourses. This will be based on definition of catchment areas, simple calculations and LiDAR topographical data, if available.
- Assessment of flooding risk from surface water runoff from adjacent land.
- Assessment of risk from groundwater, based on readily available data.
- Overview of site drainage options and calculation of greenfield runoff rates.
- Development of outline SuDS drainage strategy, based on discharging attenuated surface water runoff to the open watercourse within the site.
- Identification of work required for a full flood risk assessment at the detailed design stage.
- Flood Risk Assessment report suitable for submission with planning application in principle.

Information made available to Kaya Consulting Ltd for the study includes the following:

- Location plan;
- Topographical survey of the site; and
- Outline development layout (Masterplan).

A general location map of the site is shown in Figure 1. The work carried out to assess the flooding risk of the site and main findings of the study are summarised in the following sections.

Figure 1: General site location



2 Legislative and Policy Aspects

2.1 National Planning Policy

The current version of the Scottish Planning Policy (SPP) was published in June 2014 and replaces the previous version which was published in February 2010. The SPP sets out national planning policies which reflect Scottish Government's priorities for operation of the planning system and for the development and use of land. It relates to:

- the preparation of development plans;
- the design of development, from initial concept through to delivery; and
- the determination of planning applications and appeals.

The National Planning Framework (NPF) provides a statutory framework for Scotland's long term spatial development and sets out the Scottish Government's spatial development priorities for the next 20 to 30 years. The SPP sets out the policy that will help to deliver the objectives of the NPF.

Some extracts from the SPP are listed below:

Policy Principles

255. The planning system should promote:

- *a precautionary approach to flood risk from all sources, including coastal, water course*
- *(fluvial), surface water (pluvial), groundwater, reservoirs and drainage systems (sewers and*
- *culverts), taking account of the predicted effects of climate change;*
- *flood avoidance: by safeguarding flood storage and conveying capacity, and locating*
- *development away from functional flood plains and medium to high risk areas;*
- *flood reduction: assessing flood risk and, where appropriate, undertaking natural and*
- *structural flood management measures, including flood protection, restoring natural features*
- *and characteristics, enhancing flood storage capacity, avoiding the construction of new*
- *culverts and opening existing culverts where possible; and*
- *avoidance of increased surface water flooding through requirements for Sustainable*
- *Drainage Systems (SuDS) and minimising the area of impermeable surface.*

256. To achieve this, the planning system should prevent development which would have a significant probability of being affected by flooding or would increase the probability of flooding elsewhere. Piecemeal reduction of the functional floodplain should be avoided given the cumulative effects of reducing storage capacity.

257. Alterations and small-scale extensions to existing buildings are outwith the scope of this policy, provided that they would not have a significant effect on the storage capacity of the functional floodplain or local flooding problems.

Key Documents

- *Flood Risk Management (Scotland) Act 2009105*
- *Updated Planning Advice Note on Flooding*
- *Delivering Sustainable Flood Risk Management106 (Scottish Government, 2011).*
- *Surface Water Management Planning Guidance107 (Scottish Government, 2013).*

Delivery

258. Planning authorities should have regard to the probability of flooding from all sources and take flood risk into account when preparing development plans and determining planning applications. The calculated probability of flooding should be regarded as a best estimate and not a precise forecast. Authorities should avoid giving any indication that a grant of planning permission implies the absence of flood risk.

259. Developers should take into account flood risk and the ability of future occupiers to insure development before committing themselves to a site or project, as applicants and occupiers have ultimate responsibility for safeguarding their property.

Development Planning

260. Plans should use strategic flood risk assessment (SFRA) to inform choices about the location of development and policies for flood risk management. They should have regard to the flood maps prepared by Scottish Environment Protection Agency (SEPA), and take account of finalised and approved Flood Risk Management Strategies and Plans and River Basin Management Plans.

261. Strategic and local development plans should address any significant cross boundary flooding issues. This may include identifying major areas of the flood plain and storage capacity which should be protected from inappropriate development, major flood protection scheme requirements or proposals, and relevant drainage capacity issues.

262. Local development plans should protect land with the potential to contribute to managing flood risk, for instance through natural flood management, managed coastal realignment, washland or green infrastructure creation, or as part of a scheme to manage flood risk.

263. Local development plans should use the following flood risk framework to guide development. This sets out three categories of coastal and watercourse flood risk, together with guidance on surface water flooding, and the appropriate planning approach for each (the annual probabilities referred to in the framework relate to the land at the time a plan is being prepared or a planning application is made):

- ***Little or No Risk*** *– annual probability of coastal or watercourse flooding is less than 0.1% (1:1000 years)*
  - *No constraints due to coastal or watercourse flooding.*
- ***Low to Medium Risk*** *– annual probability of coastal or watercourse flooding is between 0.1% and 0.5% (1:1000 to 1:200 years)*
  - *Suitable for most development. A flood risk assessment may be required at the upper end of the probability range (i.e. close to 0.5%), and for essential infrastructure and the most vulnerable uses. Water resistant materials and construction may be required.*
  - *Generally not suitable for civil infrastructure. Where civil infrastructure must be located in these areas or is being substantially extended, it should be designed to be capable of remaining operational and accessible during extreme flood events.*
- ***Medium to High Risk*** *– annual probability of coastal or watercourse flooding is greater than 0.5% (1:200 years)*
  - *May be suitable for:*
    - *residential, institutional, commercial and industrial development within built-up areas provided flood protection measures to the appropriate standard already exist and are maintained, are under construction, or are a planned measure in a current flood risk management plan;*
    - *essential infrastructure within built-up areas, designed and constructed to remain operational during floods and not impede water flow;*
    - *some recreational, sport, amenity and nature conservation uses, provided appropriate evacuation procedures are in place; and*
    - *job-related accommodation, e.g. for caretakers or operational staff.*
  - *Generally not suitable for:*

- *civil infrastructure and the most vulnerable uses;*
- *additional development in undeveloped and sparsely developed areas, unless a location is essential for operational reasons, e.g. for navigation and water-based recreation, agriculture, transport or utilities infrastructure (which should be designed and constructed to be operational during floods and not impede water flow), and an alternative, lower risk location is not available; and*
- *new caravan and camping sites.*

- *Where built development is permitted, measures to protect against or manage flood risk will be required and any loss of flood storage capacity mitigated to achieve a neutral or better outcome.*
- *Water-resistant materials and construction should be used where appropriate. Elevated buildings on structures such as stilts are unlikely to be acceptable.*

Surface Water Flooding

- *Infrastructure and buildings should generally be designed to be free from surface water flooding in rainfall events where the annual probability of occurrence is greater than 0.5% (1:200 years).*
- *Surface water drainage measures should have a neutral or better effect on the risk of flooding both on and off the site, taking account of rain falling on the site and run-off from adjacent areas.*

Development Management

264. It is not possible to plan for development solely according to the calculated probability of flooding. In applying the risk framework to proposed development, the following should therefore be taken into account:

- *the characteristics of the site;*
- *the design and use of the proposed development;*
- *the size of the area likely to flood;*
- *depth of flood water, likely flow rate and path, and rate of rise and duration;*
- *the vulnerability and risk of wave action for coastal sites;*
- *committed and existing flood protection methods: extent, standard and maintenance regime;*
- *the effects of climate change, including an allowance for freeboard;*
- *surface water run-off from adjoining land;*
- *culverted watercourses, drains and field drainage;*
- *cumulative effects, especially the loss of storage capacity;*
- *cross-boundary effects and the need for consultation with adjacent authorities;*
- *effects of flood on access including by emergency services; and*
- *effects of flood on proposed open spaces including gardens.*

265. Land raising should only be considered in exceptional circumstances, where it is shown to have a neutral or better impact on flood risk outside the raised area. Compensatory storage may be required.

266. The flood risk framework set out above should be applied to development management decisions. Flood Risk Assessments (FRA) should be required for development in the medium to high category of flood risk, and may be required in the low to medium category in the circumstances described in the framework above, or where other factors indicate heightened risk. FRA will generally be required for applications within areas identified at high or medium likelihood of flooding/flood risk in SEPA's flood maps.

267. Drainage Assessments, proportionate to the development proposal and covering both surface and foul water, will be required for areas where drainage is already constrained or otherwise problematic, or if there would be off-site effects.

268. Proposed arrangements for SuDS should be adequate for the development and appropriate long-term maintenance arrangements should be put in place.

2.2 National Indicative River and Coastal Flood Map (Scotland)

The SEPA third generation flood map shows the likely extent of flooding for high, medium and low likelihood for fluvial, pluvial (surface water) flows and tidal waters. Consultation of the map shows that the site is outside of any mapped fluvial floodplains in the area. However, the maps show part of the north-east corner of the site lying within the surface water flood map (pluvial flood map). The maps suggest flooding upstream of the old railway line culvert within the site. SEPA maps are indicative, and for sites close to or partially within the flood extent a detailed site specific assessment is required to determine flooding risk more accurately.

2.3 SEPA Technical Flood Risk Guidance

The latest version of SEPA 'Technical Flood Risk Guidance for Stakeholders' would need to be consulted when undertaking flood risk assessments (current version is 8, February 2014). This technical guidance document is intended to outline methodologies that may be appropriate for hydrological and hydraulic modelling and sets out what information SEPA requires to be submitted as part of a Flood Risk Assessment.

SEPA Policy 41 sets out roles and responsibilities of SEPA and Planning Authorities.

2.4 Flood Risk Management (Scotland) Act 2009

The Flood Risk Management (Scotland) Act 2009 came into force on 26 November 2009. The Act repealed the Flood Prevention (Scotland) Act 1961 and introduces a more sustainable and streamlined approach to flood risk management, suited to present and future needs and to the impact of climate change. It encourages a more joined up and coordinated process to manage flood risk at a national and local level.

The Act brings a new approach to flood risk management including a framework for coordination and cooperation between all organisations involved in flood risk management, new responsibilities for SEPA, Scottish Water and local authorities in relation to flood risk management, a revised and streamlined process for flood protection schemes, new methods to enable stakeholders and the public to contribute to managing flood risk; and SEPA to act as a single enforcement authority for the safe operation of Scotland's reservoirs.

2.5 Controlled Activities Regulations

The Water Environment (Controlled Activities) (Scotland) Amended Regulations 2013 (CAR) brings new controls for discharges, abstractions, impoundments and engineering works in or near inland waters. Any such work requires authorisation (licence) from the Scottish Environment Protection Agency (SEPA) who are responsible for the implementation of the Act. The Regulations include a requirement that surface water discharge must not result in pollution of the water environment. It also makes Sustainable Drainage Systems (SuDS) a requirement for new development, with the exception of runoff from a single dwelling and discharges to coastal waters.

2.6 Climate Change

The SPP states that "*planning system should promote a precautionary approach to flood risk from all sources, including coastal, water course (fluvial), surface water (pluvial), groundwater, reservoirs and drainage systems (sewers and culverts), taking account of the predicted effects of climate change.*"

One of the sustainable policy principles within the National Planning Framework is supporting climate change mitigation and adaptation including taking account of flood risk.

SEPA recommend a 20% increase in peak flow for the 0.5% AEP (1:200) event, in accordance with DEFRA (Department of Environment, Food and Rural Affairs) and recent Scottish Government research. Although the 2009 climate change predictions (UKCP09) provides information on spatial variations, for current studies a 20% increase in peak flows is assumed.

It is recommended that any site drainage design considers future estimates of increased precipitation and follows an adaptive approach.

3 Site Location and Description

The proposed development is a greenfield site in the Murieston area of Livingston, West Lothian, Figure 2. The site is currently in grassed fields, Photo 1.

The site is bounded to the west by fields and a narrow band of trees. To the south the site is bounded by an access road to Westfield Farm and beyond the road are more fields. The site is bounded to the north-east by a B-class road and existing developments beyond. A railway line runs along the northern boundary of the site, separated from the site by an area of trees.

The site slopes north and north-east from a high point at the south-western boundary of the site. Ground levels in this area are at around 183 m AOD (Above Ordnance Datum), with the lowest point at the north-east corner of the site at approximately 158 m AOD. The site topography is shown in Figure 3, with 0.5 m contours produced from the site topographical survey.

From a review of historical maps of the area it is clear that there was a small limestone quarry at the north-eastern corner of the site (Westfield Mine). The mine is visible as an operational mine in Ordnance Survey maps of 1908. It is shown closed in the 1940s, although the 1940s maps show a number of ponds within the site towards the north-east corner. These ponds are no longer water features within the site and all that remains of the mine is raised ground at the north-eastern corner that represents a railway embankment that used to take a spur off the main railway to the mine site.

An unnamed stream flows along the northern boundary of the site and separates the site from the narrow tree belt running along the railway. The stream is around 1 to 1.5 m wide through the site and it flows parallel to the railway line. A minor tributary enters the stream from under the railway line near to the mid-point of the site (Figure 2) and a small ditch enters the stream at the north-east corner of the site. The ditch receives runoff from the eastern part of the site. The unnamed stream leaves the site through a brick arched culvert under Murieston Road, Photo 2. The arch was measured in the field to be 1.2 m wide and 1.45 m high, Photo 3. Within the site the stream passes under the old railway embankment by way of a 0.9 m high and 1.5 m wide arched culvert, Figure 3.

The Third Generation SEPA Indicative Flood Map of the site shows part of the north-east corner of the site lying within the surface water flood map (pluvial flood map). The maps suggest flooding upstream of the old railway line culvert within the site.

West Lothian Council's flooding officer was contacted to obtain any relevant information regarding historical flooding at the site. The flooding officer had no records of historical flooding at the site and the council held no information on the culverted watercourse downstream of the site.

Figure 2: Site Location

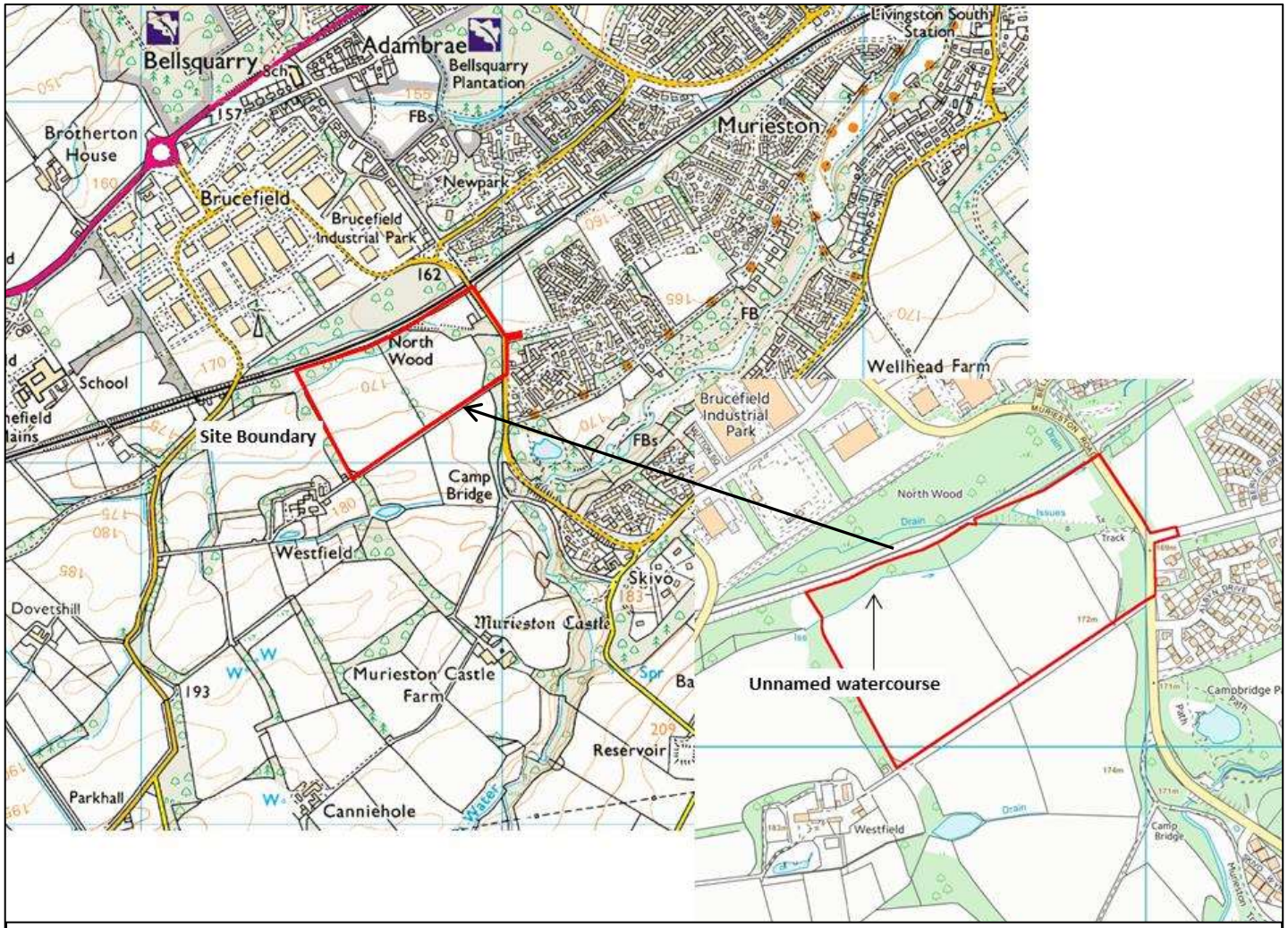


Figure 3: Site Topography and Surface Flow Pathways

Plate 1: View of site from south-east corner

Plate 2: View of unnamed stream downstream of site from Murieston Road culvert

Plate 3: Culvert under Murieston Road

4 Hydrological Analysis

The hydrological assessment makes estimates of;

- Design flows for Unnamed Stream; and
- Greenfield runoff rate.

4.1 Estimation of design flows for Unnamed Stream

The catchment area for the unnamed stream is difficult to determine as there are a number of man-made land drains affecting flow paths upstream of the site. Based on the Flood Estimation Handbook (FEH) CD-Rom Version 3 the catchment is calculated to be 0.59 km^2. However, following a site visit and inspection of the upstream catchment, it appears that the catchment of unnamed stream could be as much as 1.05 km^2, with the catchment area is shown in Figure 4. As the headwaters are impacted by a number of man-made drains and road crossings, there may be significant attenuation in the upstream areas, so design flows based on the full 1.05 km^2 catchment are likely to be conservative (high).

Key catchment characteristics are shown in Table 1.

Table 1: FEH CD-Rom Version 3 Catchment characteristics for Unnamed Stream at site

Parameter	Value
Easting (m)	304450
Northing (m)	664350
AREA (km^2)	1.05[a]
ALTBAR (m)	181
ASPBAR (^{o})	3
ASPVAR	0.73
BFIHOST	0.312
DPLBAR	2.3[a]
DPSBAR	26.1[a]
FARL	1
LDP	1.57
PROPWET	0.49
SAAR (mm)	885
SAAR4170 (mm)	910
SPRHOST	39.7
URBCONC1990	-
URBEXT1990	0
URBLOC1990	-

A Edited from FEH CD-Rom values

For small ungauged watercourses, the FEH recommends that return period flows are estimated based on standard rainfall-runoff methods. For the purpose of this assessment we have considered the FEH Rainfall-Runoff method and Institute of Hydrology (IH) small catchment method (Report 124) with FSR scaling factors. The results for each method are provided in Table 2.

Table 2: Return period flow estimates for Unnamed Stream at site

Method	Q_{200} (m^3/s)	Q_{200} + climate change (m^3/s)
[a]FEH Rainfall-Runoff	2.1	2.5
[b]IH124	1.8	2.1

a Design storm duration 3.9 hours, Design storm depth = 59.1 mm
b SAAR = 885 mm, SOIL = 0.45 (ISOIL4), Urban Correction = 1

To be conservative, the 200 year design flow for Unnamed Stream is estimated to be 2.1 m^3/s, based on the FEH Rainfall-Runoff method, which produced the highest design flow in Table 2.

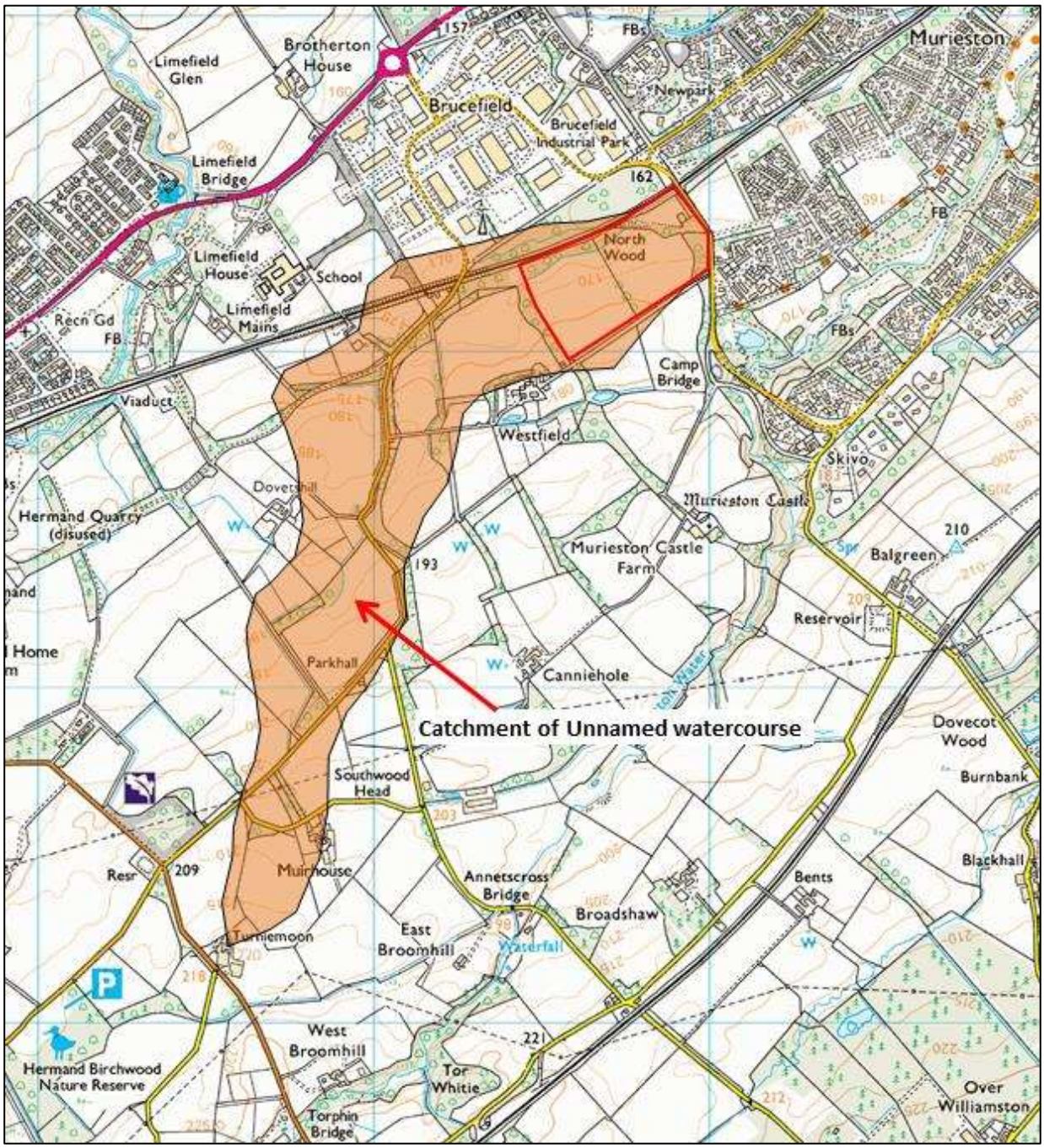
Scottish Government guidelines suggest that the magnitude of extreme flood events will increase by around 20% in the next 50 to 75 years. Estimates of 1 in 200 year flow + 20% are also provided in Table 2.

4.2 Estimation of greenfield runoff rate for site

The development site is greenfield. The total site area is around 15 ha.

Greenfield runoff rates for the existing site were estimated using the Institute of Hydrology (IH) small catchment method (IH124). The IH124 gave a 2-year greenfield runoff rate of around 5.3 l/s/ha. This is based on SAAR value of 885 mm and soil type 4 (i.e. SOIL=0.45). It should be noted that some councils may require site drainage systems to be designed for lower 2-year runoff rates, e.g. 5 l/s/ha. Requirements for West Lothian Council should be discussed and agreed with the council.

Figure 4: Unnamed Stream Catchment Area



5 Flood Risk Assessment

This chapter assesses risk of flooding from:

- Unnamed Stream;
- Surface water runoff from adjacent land;
- Groundwater;
- Ponds at disused mine site;
- Site drainage; and
- Site access.

5.1 Flood risk from Unnamed Stream

5.1.1 Mathematical modelling of Unnamed Stream

An Unnamed Stream flows west to east along the northern boundary of the site. A HEC-RAS model of the stream was developed based on the available topographical survey through the site. The survey did not provide details of the channel sections through the site. However, given the site topography and the slope of land from south to north, a detailed model was not considered to be required to provide an indication of the floodplain extent within the site.

Twelve cross-sections were extracted from existing topographical survey through the site, as shown in Figure 5. The model was then extended to the culvert under Murieston Road. The culvert under the disused railway was included in the model, based on details obtained within the site survey. Dimensions of the culvert under Murieston Road were based on site observations.

The model was run with a Manning's n of 0.045 for the channel and 0.085 for the banks and floodplain areas.

The model was run in steady state, with the downstream boundary set as a normal depth boundary with slope of 0.007 (equivalent to surveyed slope of the stream) and upstream boundary set at the 200 year flow for the stream.

Predicted water levels within the site for 200 year and 200 year + climate change conditions are shown in Table 3. A long profile is provided in Figure 5 and key cross-sections are shown in Appendix 1.

The model results indicated that the culvert under the disused railway embankment within the site was under-sized for the 200 year flow, with the model predicting surcharging at the upstream end of the culvert under 200 year flow conditions. In contrast the culvert under Murieston Road was able to pass the 200 year and 200 year + climate change flows without surcharging.

Under 200 year conditions, flows were predicted to go out of bank along much of the length of the watercourse. Given the local topography flooding was predicted in a narrow strip adjacent to the channel only, as shown in Figure 6. Although the 200 year + climate change flow predicted higher flood levels along the channel, this increase in water level makes little difference to the areal extent of flooding as ground levels rise away from the channel.

Table 3: Predicted flood levels in Unnamed Stream

Cross-section	Peak flood level, Q_{200} (m AOD)	Peak flood level, Q_{200} + climate change (m AOD)
xs1	163.88	163.94
xs2	163.38	163.44
xs3	162.99	163.04
xs4	162.35	162.40
xs5	161.48	161.54
xs6	160.62	160.66
xs7	159.72	160.18
xs8	159.70	160.18
xs9	159.69	160.18
xs10	158.39	158.41
xs11	157.98	158.04
xs12	157.58	157.75
xs13	157.09	157.13
xs14	156.76	156.81

5.1.2 Model Sensitivity Analysis

A model sensitivity analysis provides an illustration of the effects of changing key model parameters on the important model outputs (in our case flood levels). By re-running the model, changing one input parameter at a time, the effect of that input on the model results can be isolated. Repeating this process to account for several model parameters of interest within the range of their possible input values, gives a sensitivity analysis that, when compared with the model assumptions and knowledge of realistic inputs, can provide an indication of the uncertainty associated with the model predictions.

The sensitivity analysis considers changes in Manning's n roughness coefficient, increasing flow, the model downstream boundary condition and culvert blockage. Results from these runs were compared to the 'Base Case' 200 year flow model run and are tabulated in Table 5.

Table 4: Model sensitivity runs

Scenario no.	Change to model
1	Manning's n increased by 20%
2	Manning's n decreased by 20%
3	Increase flow by 20%
4	Downstream boundary slope decreased by factor of 5
5	Culverts Blocked 50%
6	Culverts Blocked 95%

Varying Manning's n by 20% resulted in maximum change in flood levels of around 0.12 m, indicating that the Manning's friction values have a limited effect on model results.

Increase in flow by 20% increased flood levels around 0.02 – 0.5 m within the modelled reach.

A decrease in the downstream slope by a factor of 5 increased the flood levels by 1.2 m at the downstream boundary. Flood levels at other sections were not affected.

Blockage of 50% to both structures (railway embankment culvert and Murieston Road culvert) resulted in around 3.1 m increase in predicted water levels upstream of the railway embankment and around 2 m upstream of Murieston Road. Overtopping is predicted at the railway embankment. A 95% blockage scenario was also undertaken. The results of 95% blockage indicated that the flood levels would rise around 5.3 m at the railway embankment and 7.4 m at Murieston Road Bridge. Both structures are predicted to overtop. Under extreme cases water level would rise to approximately 165 m AOD, which is approximately 0.2 m higher than the lowest level on Murieston Road.

Figure 5: Model Cross-section Locations

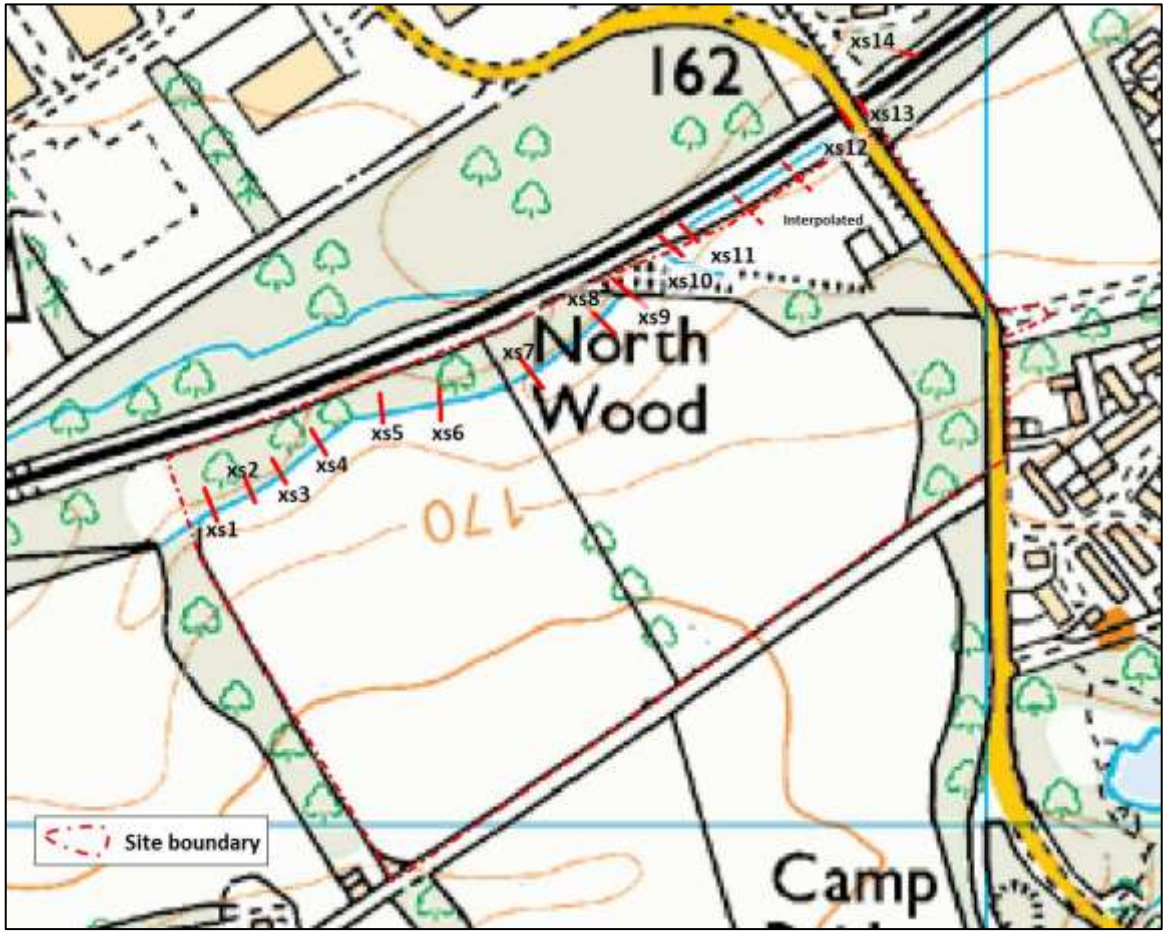


Figure 6: Long profile showing predicted 200 year flood level

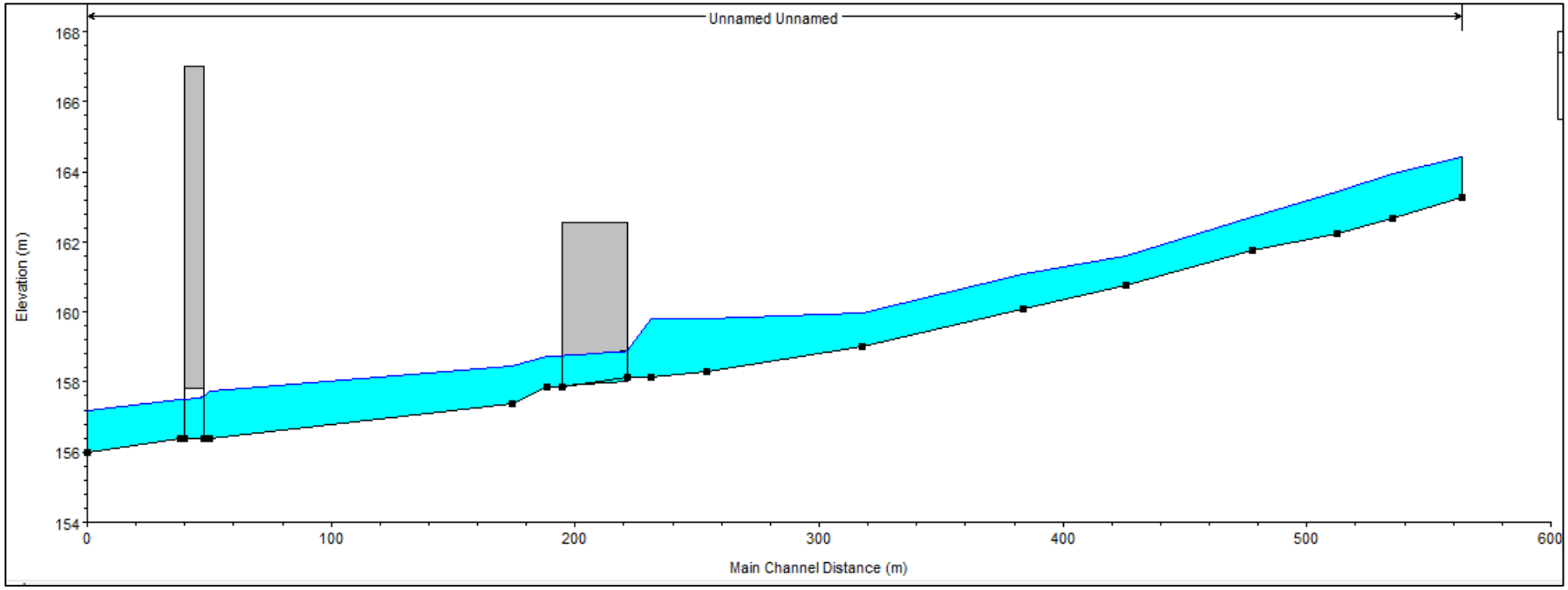


Figure 7: Indicative floodplain map for 200 year flood extent

Table 5: Results of Sensitivity Analysis

		Difference from Base Case (m)					
Cross-section	Peak flood level, Q_{200} (m AOD)	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
xs1	163.88	+0.06	-0.06	+0.06	0	-0.03	+1.12
xs2	163.38	+0.06	-0.08	+0.06	0	+0.04	+1.62
xs3	162.99	+0.07	-0.12	+0.05	0	-0.11	+2.01
xs4	162.35	+0.03	-0.03	+0.05	0	+0.45	+2.65
xs5	161.48	+0.10	-0.10	+0.06	0	+1.32	+3.52
xs6	160.62	0	-0.02	+0.04	0	+2.18	+4.38
xs7	159.72	+0.03	-0.02	+0.46	0	+3.08	+5.28
xs8	159.70	0	-0.01	+0.48	0	+3.10	+5.3
xs9	159.69	0	0	+0.49	0	+3.11	+5.31
xs10	158.39	+0.07	-0.04	+0.02	0	+1.20	+6.61
xs11	157.98	0	-0.06	+0.06	0	+1.61	+7.02
xs12	157.58	+0.01	0	+0.17	0	+2.01	+7.42
xs13	157.09	+0.05	-0.06	+0.04	0	0	0
xs14	156.76	+0.05	-0.06	+0.05	+0.27	0	0

5.1.3 Summary of Flood Risk from Unnamed Stream

The 200 year floodplain of the unnamed stream is shown in Figure 7. Based on SPP, no development should take place within this floodplain area, including the SuDS pond. We would also recommend that development is kept at least 5 m from the bank of the watercourse (to be discussed and agreed with the planning authority) to provide access for channel maintenance.

There are two culverts impacting flows within the site.

There is a relatively large culvert under Murieston Road at the downstream end of the site. Calculations indicated that this culvert was appropriately sized for the 200 year flow within the channel. However, if the culvert were blocked calculations showed that flood levels could rise significantly upstream of the culvert as the spill level for the culvert is some 10 m above the invert of the culvert. The culvert has no screen at present and during the detailed design stage we would suggest that the potential of installing a screen at the upstream end of the culvert is considered.

There is a second smaller culvert within the site, passing under an old railway embankment. The culvert is predicted to be surcharged under 200 year flow conditions. If this culvert were to be blocked flood waters could pond to around 3 m deep before overtopping the embankment. We would suggest that consideration is made for the removal of this culvert and the opening of the channel within the site. This would remove a potential flooding risk associated with blockage of this culvert. Calculations would have to be made to show that removing the culvert would not increase downstream flows.

Discussion should be held with the council related to ground levels and finished floor levels within the developed site. A key constraint will be the overtopping levels of the culverts within the site and ideally finished floor level would be set above the level of Murieston Road. However, given the small upstream catchment of the burn and if a trash screen is installed at the Murieston Road culvert, lower floor levels may be permitted within the site. This can be considered further at the detailed planning stage. However, at this stage it should be assumed that minimum Finished Floor Levels of properties should be above 165 m AOD.

There is a minor field drain along the north-eastern edge of the site (Figure 3). The ditch drains the eastern edge of the site. We would suggest that the drain is retained as it provides access to the lowest part of Murieston Road (164.8 m AOD) for flood waters within the site to escape.

Overall there are some flood management issues to be considered during the detailed planning stage (e.g., removal of minor culvert, trash screen for Murieston Road culvert and consideration of finished ground levels in the site). However, most of the site is not affected by these issues and flooding is not considered to be a significant issue limiting development of this site.

5.2 Flood risk from surface water runoff from adjacent land

The site rises to a local high point in the south-west corner of the site. The land to the south is higher and there is potential for some surface water entering the site from the south. However, access road to Westfield Farm which forms the southern boundary of the site slopes north-east and would intercept

any flows from the site. Flood waters flowing downs the road could enter the south-east corner of the site which is lower than the access road.

Land along the western boundary slopes down north and the risk of substantial surface water entering the site from the west is low.

The railway intercepts any flood waters from the north.

Murieston Road forming the eastern boundary of the site is higher and there is potential for excess water on the road to enter the site. The road slopes down to a low point a short distance south of the north-east corner of the site. This is the area from which excess surface water on the road could spill onto the site.

5.3 Flood risk from groundwater

The site slopes from south to north towards unnamed stream. There are no springs identified on Ordnance Survey maps and given the slope of the site there is not expected to be a significant risk of flooding from groundwater. However, as there is a disused railway embankment near the north-east corner of the site it is possible that the embankment affects local surface and subsurface flow pathways (i.e., compacted land under and around the embankment) resulting in poor drainage or locally raised groundwater levels to the west of the embankment. There was no evidence of this during the site visit; hence, the risk is expected to be low. Historical maps also indicate ponds in the north-east part of the site; remnants from historical mining activity within the north-east of the site (see Section 5.5).

The risk from ground water is not expected to be significant, but groundwater levels should be assessed as part of site investigation works and if a shallow groundwater table is encountered, appropriate design measures should be taken.

5.4 Flood risk from local sewer network

A review of the Scottish Water service drawings of the area indicated that there are no combined or other sewers located close to the site boundary. As a result, the site is not considered to be at risk of flooding from surcharging Scottish Water system.

5.5 Flood risk from site drainage

Design of the site drainage system is not part of this assessment. However, an outline drainage strategy for the site is provided in Section 6. As the site is greenfield, development will increase surface water runoff from the site. As a result, runoff will need to be controlled and attenuated before discharge.

5.6 Flood risk associated with ponds at disused mine site

As outlined in Section 3, the Westfield Mine was located in the north-east corner of the site, in the early 1900s. The mine site has been reclaimed; however, historical maps of the area showed the presence of ponds associated with the mine site. These ponds appear to have been surface features even after the end of mining operations. At present, the ponds are no longer visible and appear to have been infilled. However, it is not clear if these features have any sub-surface connections to old mining workings, or if they could accumulate water following rainfall. As the catchment areas of the ponds are located within the site boundary, the catchments will be incorporated within the site drainage system. However, we would recommend that an assessment of the ponds and old mine workings is undertaken as part of site investigations during detailed design.

5.7 Flood risk for site access

The location of the site access is not known at present, but we assume it will be from the east from Murieston Road. The road slopes generally to the north along the site boundary. There is not thought to be a significant risk of ponding of flood waters on the road (except at the low point), and the road is not predicted to lie within the floodplain of any watercourse. Irrespective of this care should be taken in the design of the site access so that it does not act as a flood flow pathway for surface water on the main road to enter the site and flow towards properties.

6 Outline Drainage Strategy

As the current proposals are for a Planning Application in Principle, outline drainage proposals are presented to provide evidence that the site will be able to be effectively drained consistent with Planning Policies. Further work will be required to produce final drainage plans suitable for submission with a detailed planning application.

6.1 Current Onsite Drainage

The site is currently a greenfield site. Surface flow pathways within the site, based on the site topographical survey are shown in Figure 6. At present, the entire site drains to the unnamed stream flowing along the northern boundary of the site.

Greenfield runoff rates for the site were calculated in Section 4.2.

6.2 Outline Surface Water Drainage Proposals

6.2.1 SuDS pond and surface water flow attenuation

The most obvious drainage option would be to attenuate surface water runoff from the whole site in a SuDS pond located toward the north-eastern corner of the site. We would suggest that SuDS ponds are designed to attenuate surface water runoff for events up to and including 200 year event to the 2 year runoff rate. Based on the current (total) site area draining to Unnamed Stream (Figure 6) the 2-year greenfield rate for the site would be 15 ha x 5.3L/s/ha = 79.5 L/s), unless an alternative flow rates can be agreed with the council. Lower flows will be necessary if a smaller site area is developed.

A conservative estimate of the pond size was made based on the following assumptions:

- Around 60% of the site will be impermeable and 40% permeable post-development;
- pond is 1 m deep; and
- the pond will have a 3.5 m buffer zone around it for maintenance access.

As a result, the area of the pond was estimated to be around 8,000 m^2 and the volume around 8,000 m^3. These figures will be refined during detailed design stage.

SuDS ponds should not be developed within the floodplain of the Unnamed Stream.

Appropriate SuDS measures to address water treatment requirements should be provided consistent with the requirements of the local council, SEPA and SUDS design manual. For development more than 50 houses, runoff from roofs and roads would need to pass through two stages of treatment. The SuDS pond would be considered as one stage of treatment, so a further stage of treatment would be required upstream of the SuDS pond, e.g., filter trenches alongside roads or permeable paving in driveways, or similar.

Further work is required at the detailed planning stage. However, due to the site topography, proximity to Unnamed Stream and available land on site for SuDS, it is clear that an acceptable site drainage

system will be able to be developed at the site. Hence, for the requirements of Planning in Principle there is confidence that the site can be effectively drained.

6.2.2 Surface water flow pathways

The site is located on sloping land and as a result there is a risk of surface water flooding within the site from runoff generated within the site boundaries (see Section 5.2). Hence, care will need to be taken when designing the site layout to take account of the sloping land. The site layout should be designed in a manner that provides flow pathways that route excess surface water (e.g., in the case of blockage of the site drainage system or rainfall events in excess of the design condition) through the site without ponding or flooding the properties.

6.2.3 Opening of culverted section of unnamed stream

The unnamed stream passes under a disused railway embankment in the north-east corner of the site. The culvert is a 1.5 m wide and 0.9 m high brick arch. SEPA has a policy of promoting the de-culverting of watercourses for flood risk management and environmental reasons. In addition, the removal of the culvert would also reduce the risk of blockage related flooding within the site and would have benefits in terms of long-term flood management within the site.

The flood modelling study undertaken for this assessment indicated that the culvert is able to pass the estimated 200 year flow with some surcharging. In the worst case of full blockage flood waters would back up behind the embankment to a level of around 163 m AOD, before overtopping the embankment. In the worst case flood depths could reach 5m upstream of the embankment. Such a situation would clearly constitute a significant flooding risk at the site. Hence, we would suggest that the option of the removal of embankment and culverted section of the unnamed stream is considered in more detail at the detailed planning stage. Detailed modelling of the post-development scenario would need to be undertaken to show that removing the culvert would not result in an increase in flows being passed downstream; however, results presented in this report would suggest that as the culvert is sized for the 200 year flow in unnamed stream that its removal would not affect downstream flood risk.

7 Summary and Conclusions

This report described a flood risk assessment for a proposed development site in the Murieston area of Livingston, West Lothian. The report also provides an outline drainage strategy for the site. This report is in support of a Planning Application in Principle.

The site generally slopes from south to north towards an Unnamed Stream. Calculations indicate that low-lying areas adjacent to the stream lie within the 200 year floodplain of the watercourse. No development should take place within the floodplain of the watercourse. Overall there are some flood management issues to be considered during the detailed planning stage (e.g., removal of minor culvert, trash screen for Murieston Road culvert and consideration of finished ground levels in the site), but flooding is not considered to be a significant issue limiting development of this site.

The site is not considered to be at significant risk of flooding from surface water runoff from adjacent land or groundwater. However, there is potential for some surface water to enter the site from the south and possibly east and this will need to be taken into account at the detailed planning stage.

An outline drainage strategy is proposed for the site. Further work is required at the detailed planning stage. However, due to the site topography, proximity to Unnamed Stream and available land on site for SuDS, it is clear that an acceptable site drainage system will be able to be developed at the site. Hence, for the requirements of Planning in Principle there is confidence that the site can be effectively drained.

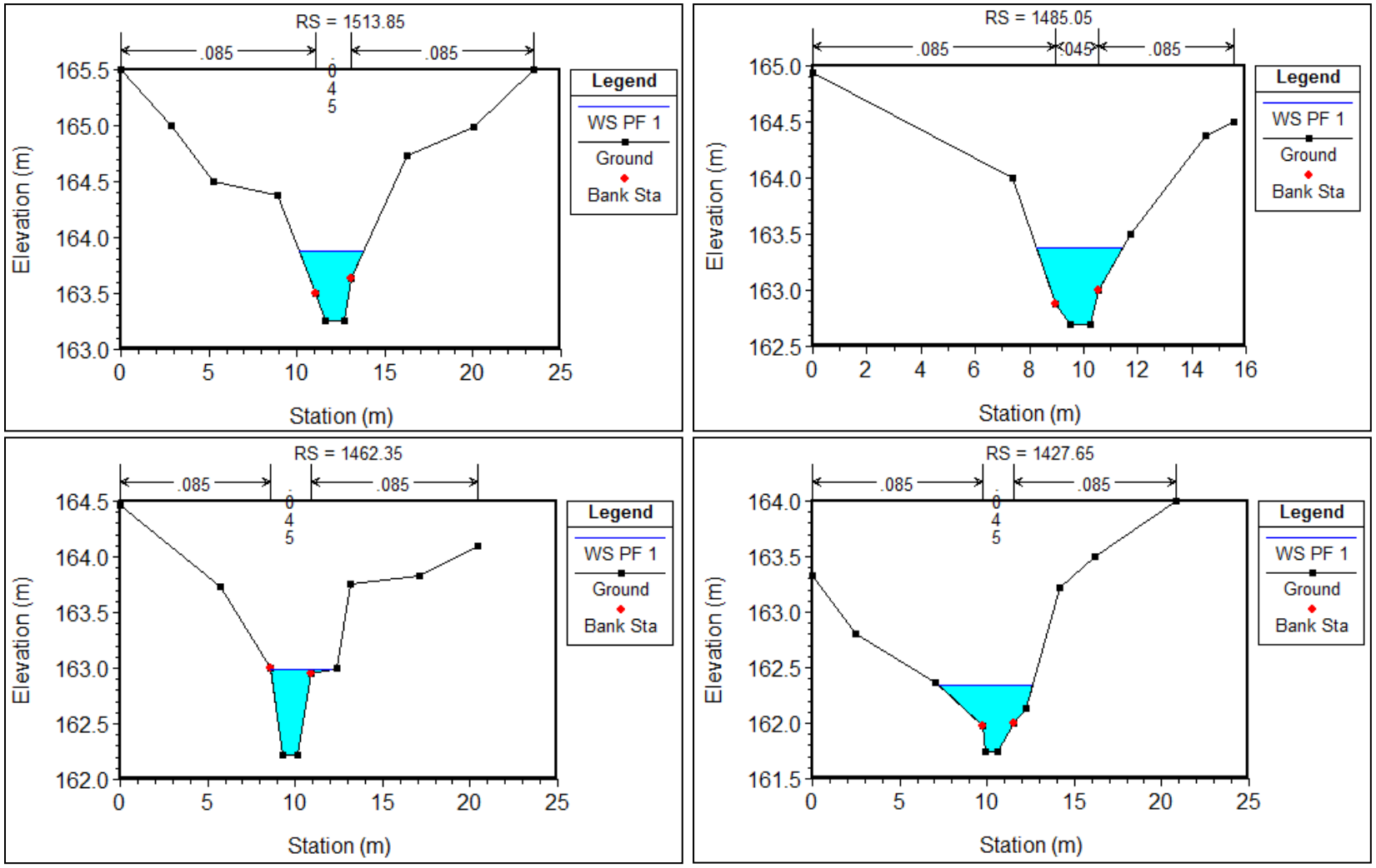
The site is located on sloping land and as a result there is a risk of surface water flooding within the site from runoff generated within the site boundaries. Hence, care will need to be taken when designing the site layout to take account of the sloping land. The site layout should be designed in a manner that provides flow pathways that route excess surface water (e.g., in the case of blockage of the site drainage system or rainfall events in excess of the design condition) through the site without ponding or flooding the property.

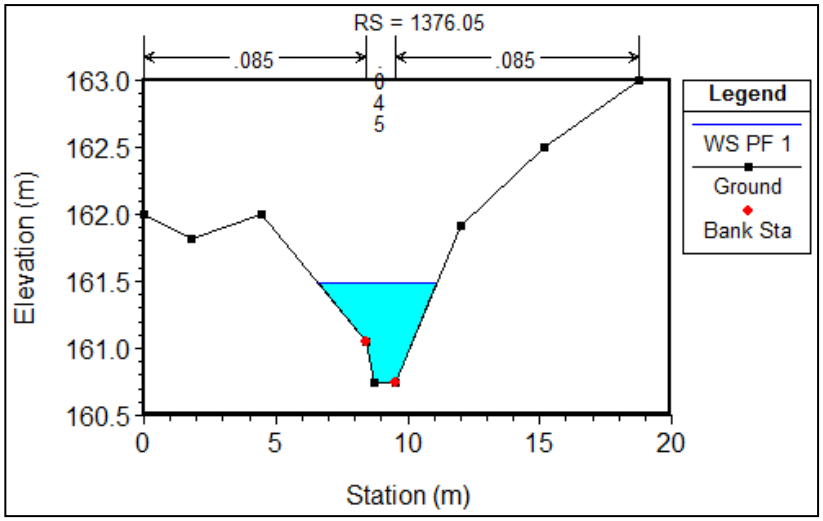
There was an operational mine with associated pond features within the north-east corner of the site. No water features are visible at present, but we would recommend that an assessment of the ponds and old mine workings is undertaken as part of site investigations during detailed design.

It is good practice to design finished floor levels an appropriate height above surrounding ground levels and arrange finished ground levels sloping away from buildings.

It should be noted that risk of flooding can be reduced but not totally eliminated, given the potential for events exceeding design conditions to occur and uncertainties associated with hydrological estimates

Appendix 1: Model cross-sections

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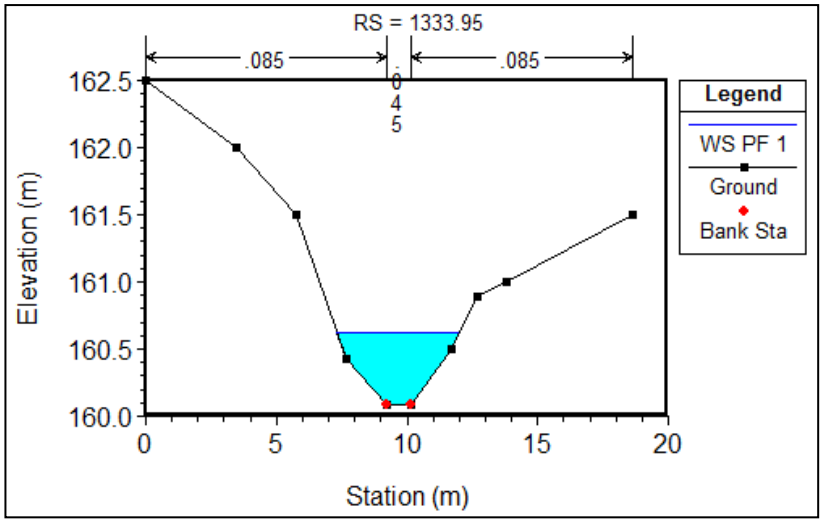
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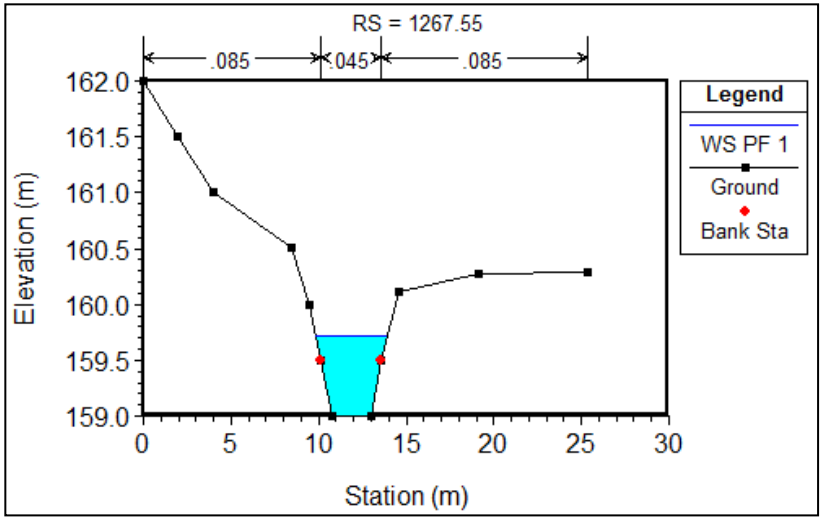
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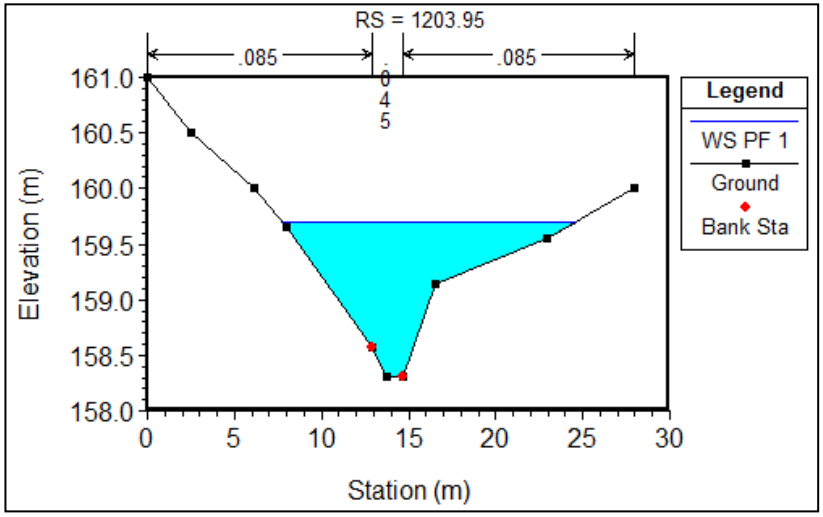
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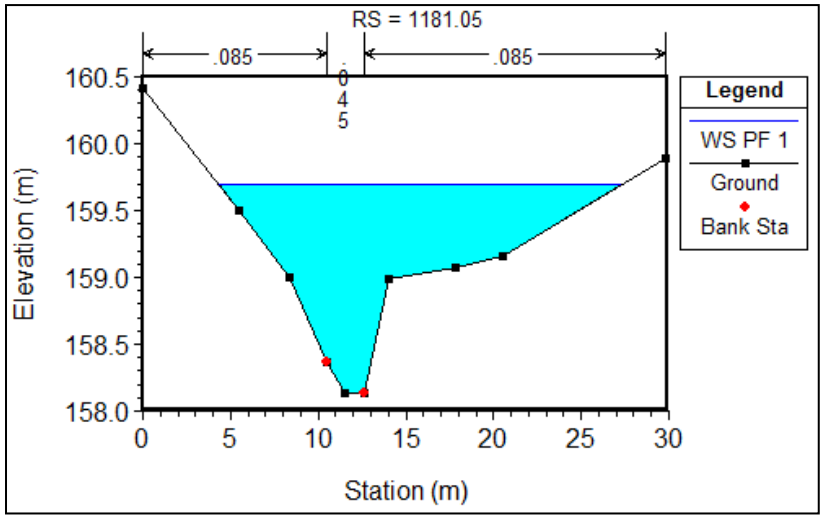
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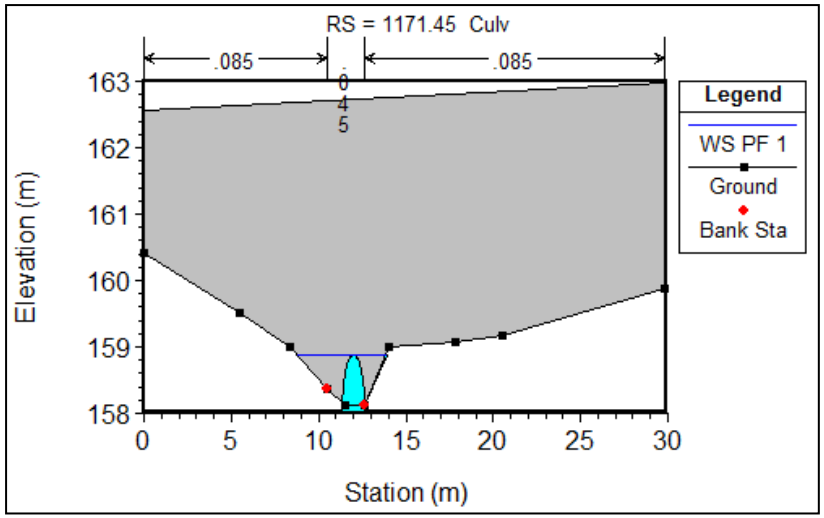
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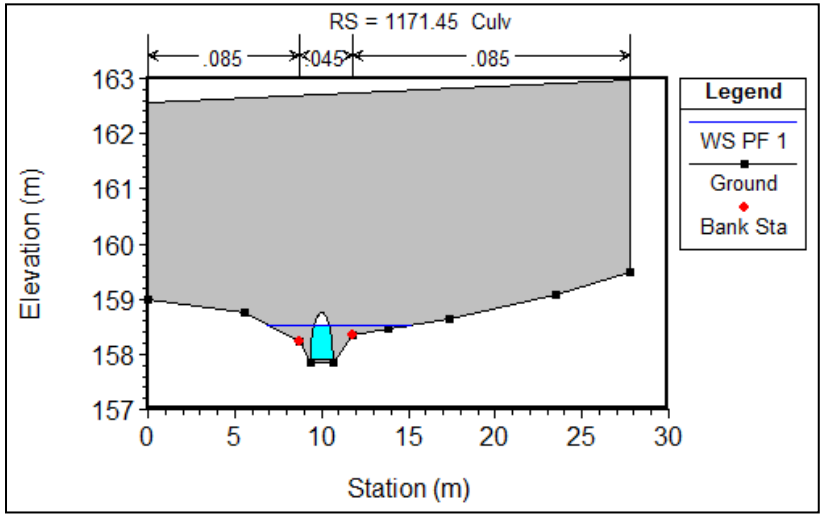
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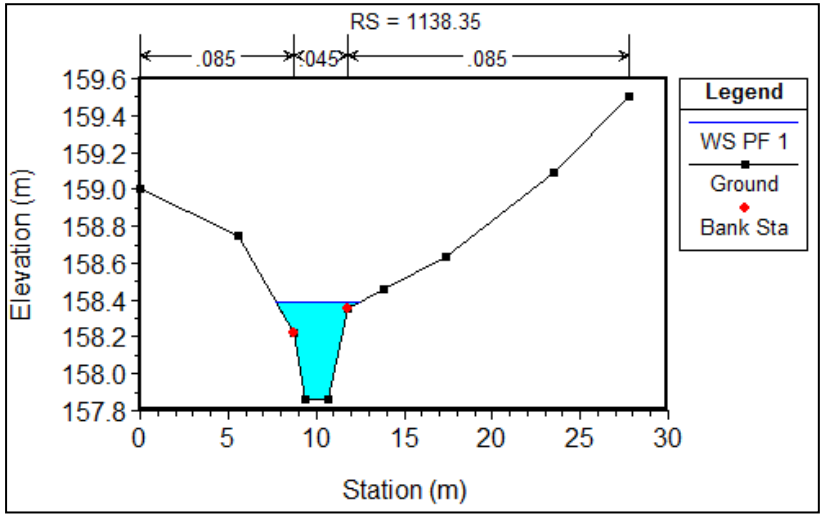
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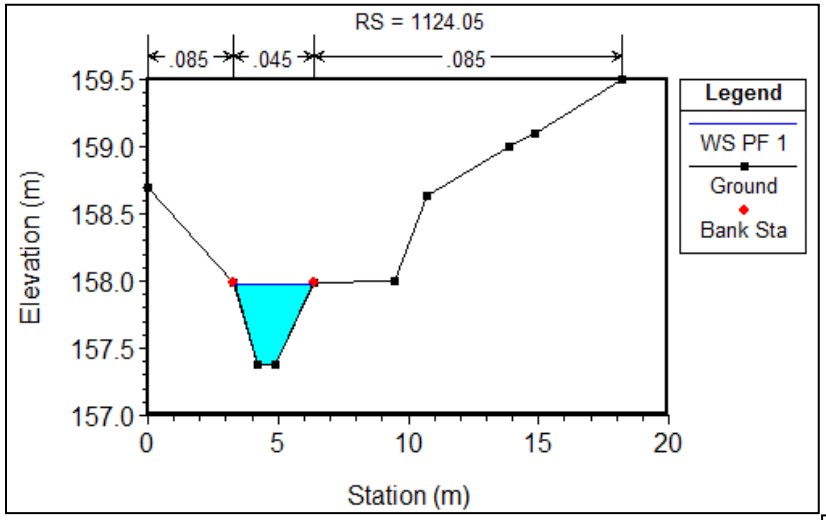
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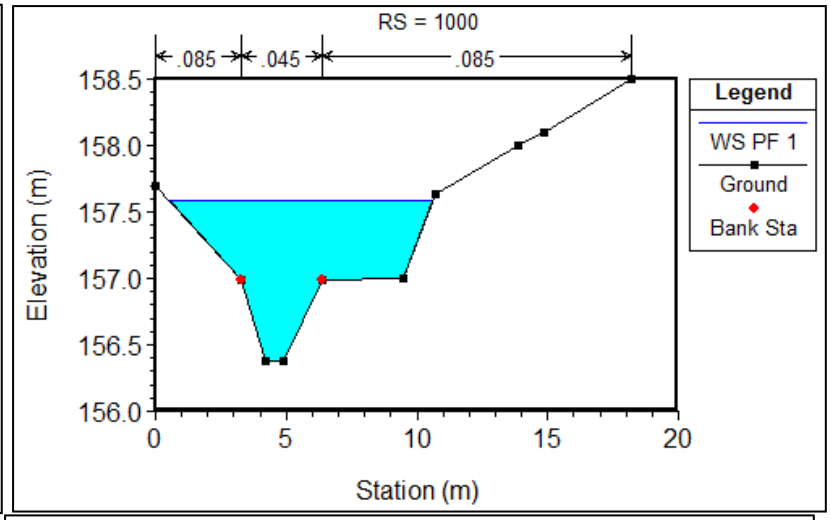
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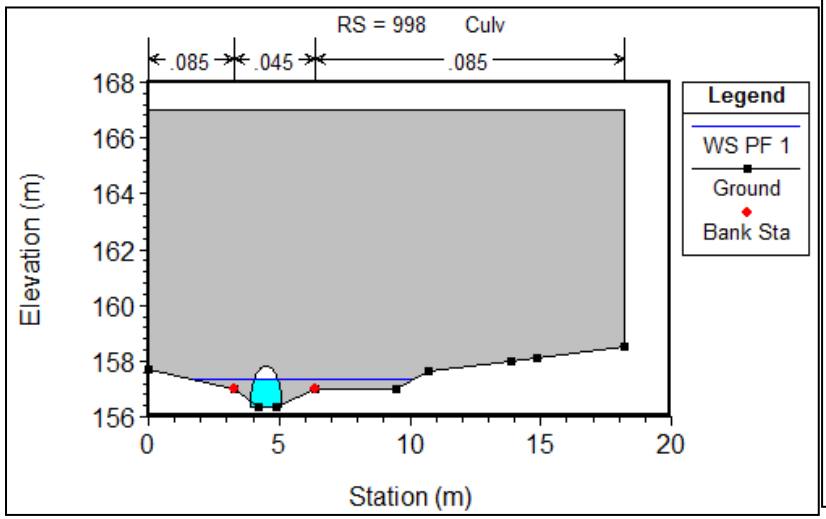
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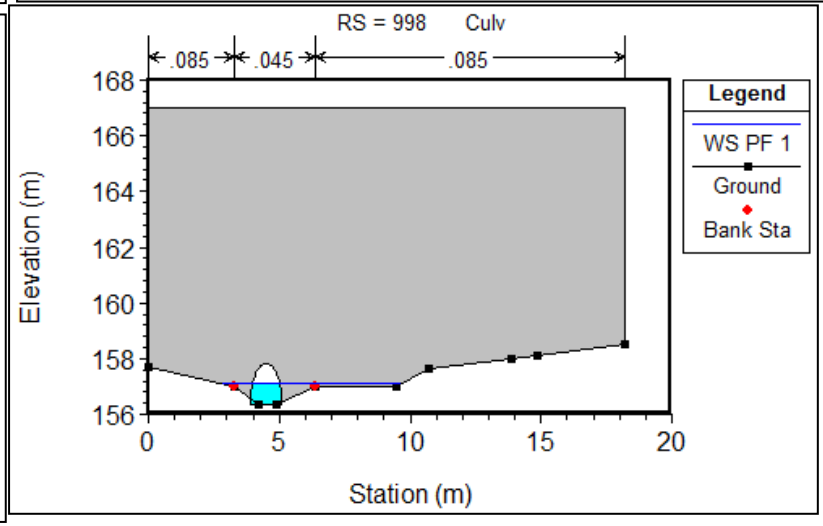
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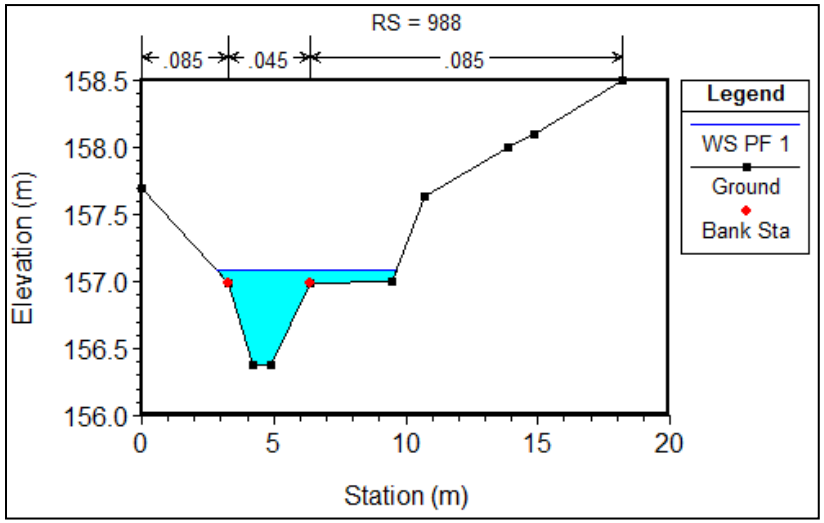
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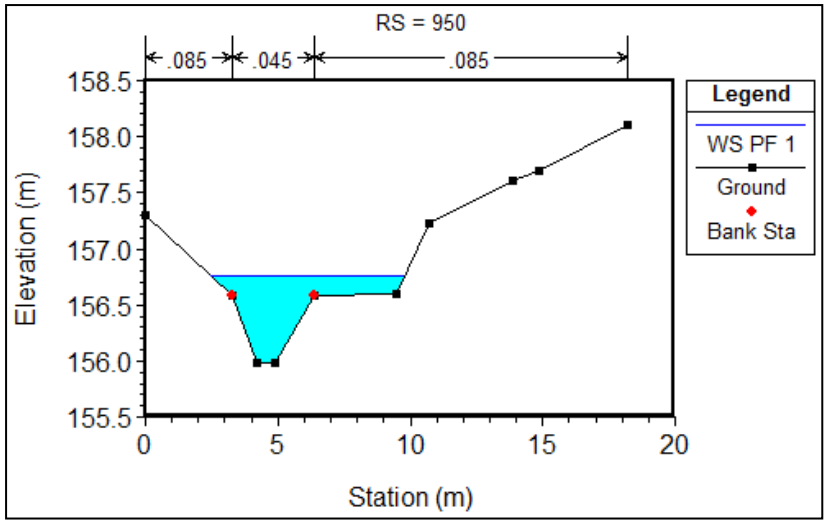
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