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STRACHUR SAWMILL,
STRACHUR
FLOOD RISK ASSESSMENT REPORT
FOR
JACK THOMSON

Report No.	1623-200	**Version:**	FINAL
Revision:	1	**Issue Date:**	17th December 2015
Authors	DA		

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FLOOD RISK ASSESSMENT REPORT
FOR
JACK THOMSON

SITE SUMMARY INFORMATION

Name of Site:	Strachur Sawmill, Strachur
Ordnance Survey Grid Reference:	NN 1009 0029
Site Address:	Sawmill, Balliemeanoch, Strachur, Argyll and Bute PA27 8DW
Local Authority:	Argyll and Bute Council
Current Site Use:	Vacant ground (overgrown woodland)
Proposed Site Use:	Commercial Office and associated car parking
Area (hectares):	1.45ha approx.
On site buildings:	No
Type of Investigation:	Level 3 Flood Risk Assessment

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1 INTRODUCTION

1.1 BACKGROUND

The development of a site at the former Sawmill, Balliemeanoch, Strachur, Argyll and Bute is currently under consideration. The River Cur forms the northern boundary to the site and flows generally from east to west adjacent to the northern extent of the proposed site. The proposed building location within the site is closer to the southern site boundary.

In order to meet the requirements of the Planning process, Terrenus Land & Water Ltd was appointed by the Client, Mr Jack Thomson to undertake a flood risk assessment of the site.

1.2 OBJECTIVES OF INVESTIGATION

The principal aim of the assessment is to develop an understanding of the flood risk to the site and to model the fluvial flood risk from the River Cur to the proposed development. Consideration of feasible mitigation measures if required also forms part of the investigation.

1.3 SCOPE OF STUDY

The following tasks were undertaken during the course of this investigation:

- Collation of data;
- Site walkover inspection;
- Assessment of data;
- Analysis of flood effects; and
- Production of an Interpretative Report.

The flood risk analysis uses modified Flood Estimation Handbook data, together with the MIKE11 (HD75+FEH) software modelling tool. This hydrodynamic software provides a fully dynamic solution for open channel flow.

1.4 PROPOSED SITE END-USE

It is understood that the development of the site will involve the construction of a small commercial office and associated car parking.

1.5 LIMITATIONS OF REPORT

Terrenus Land & Water Ltd. has prepared this report for the sole use of the Client, in accordance with generally accepted consulting practice and for the intended purpose as stated in the related contract agreement. No other warranty, expressed or implied, is made as to the professional advice included in this report. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from Terrenus Land & Water Ltd; a charge may be levied against such approval.

To the best of our knowledge, information contained in this report is accurate at the date of issue. There may be conditions pertaining at the site not disclosed by the study, which might have a bearing on the recommendations provided if such conditions were known. We have, however, used our professional judgement in attempting to limit this during the assessment.

It is important therefore that these implications be clearly recognised when the findings of this study are being interpreted. In addition, this should be borne in mind if this report is used without further confirmatory investigation after a significant delay.

2 SITE DETAILS

2.1 DATA SOURCES

The following data sources were consulted during the course of the Flood Risk Assessment:

- Data provided by Client including site boundary and outline layout;
- Site survey and cross sections as supplied by Phoenix Surveys (Scotland) Ltd;
- Current Topographic Maps;
- Available additional information.

2.2 SITE LOCATION AND DESCRIPTION

The following site description is based on a walkover inspection undertaken on the 28th November 2015. A photographic record of the visit is included in the appendix to this report.

A site survey was supplied by Phoenix Surveys (Scotland) Ltd and forms the basis of the understanding of the site topography. This survey was augmented with additional available information and measurements taken during the site walkover. The site lies within the grounds of the former Sawmill at Balliemeanoch, Strachur. The area to be developed is situated in the south-western corner of the grounds.

The site covers an area of approximately 1.45ha, and forms an irregular shaped plot of land bound to the west by the A815 and to the north by the River Cur. The eastern site boundary runs from the southern bank of the River Cur, following around the northern extent of an existing maintenance shed and down along the site access road. The southern site boundary is marked by the site access road.

The site is currently occupied by woodland and overgrown shrubs in winter die-back. A number of surface water pathways were noted to cross the site generally from west to east. The main drainage pathway was noted to originate from vehicle ruts from the lumber storage area. The lumber storage area was largely empty at the time of the walkover and lies within the site but between the western wooded portion and the adjoining vehicle staging area. The vehicle staging area is currently in use by P. McKerral & Co Ltd of Campbelltown for their haulage operations.

The northern site boundary has historically been artificially bunded in places to prevent flooding from the River Cur. Observations made during the site walkover inspection noted several locations where small drainage channels have been cut into the bank of the River Cur to assist in the drainage of localised nuisance flooding from surface water ponding. The largest of these modifications to the bank is found at the northern end of the maintenance sheds at the northern end of the site.

The A815 Road Bridge is immediately adjacent to the north-western corner of the site and has a span of approximately 11 meters. There is a stone parapet that is 1 meter high and s short 200mm drop to the base of the soffit. This gives the bridge an opening of approximately 3.5 meters from base of soffit to bed level (33.9m OD). The upstream section of the bridge has stone and concrete wing walls to help divert water through the bridge as it is not aligned perpendicular to the flow of the main channel.

A review of the site survey indicates the presence of a low lying shallow basin near to the southwestern corner of the site, adjacent to the site access road. This area is currently drained by the drainage ditch that runs down the western site boundary to the River Cur. Survey levels in this area indicate the basin to lie around 36.4m OD to 36.9m OD. This low lying area could provide a potential overland flow pathway from the site to the drainage ditch. In the event of the drainage ditch being full, the overland flow pathway could potentially overtop the site access road and the A815, before heading west and downstream of the site.

The site layout is shown on Drawing 1623-200-001, which is included in the Appendix.

2.3 SITE NEIGHBOURS

As the site lies within the larger grounds of the former Sawmill at Balliemeanoch, Strachur the immediate site neighbours are the buildings and work areas currently occupied by P. McKerral & Co Ltd of Campbelltown. The haulage company is using the grounds and buildings for their lumber haulage operations. Within the grounds there are lumber stockpiles, a weighbridge, a transport staging area and the maintenance shed, which includes a small office. This area lies to the east of the site and shares a common access track with the site.

To the north, west and south of the site the land use is dominated by pastoral grazing. The A815 runs parallel to the western site boundary.

Balliemeanoch Breaks Bed and Breakfast is situated approximately 500meters northeast of the site.

2.4 HYDROLOGY AND DRAINAGE

Current drainage within the site will flow in a north-westerly direction, with flow across the site from east to west and a general fall towards the River Cur in the north. Weather conditions at the time of the site walkover were wet, giving rise to areas of standing water, waterlogged soils and nuisance flooding within the site, particularly around the lumber storage and transport staging areas. Several small drainage channels were observed to assist in the clearance of the nuisance flooding and ponding particularly around the northern site boundary, draining directly into the River Cur.

Runoff from the roof of the maintenance shed appears to be conveyed from the site via pipes leading to a direct discharge into the River Cur, some localised site drainage around the maintenance shed was also noted.

The Scottish Environment Protection Agency (SEPA) provides River and Coastal Flood Map for Scotland. These 'Flood Maps' show potential flooding from coastal, rivers (fluvial) and surface water (pluvial) sources, where data is available water velocity and depth information is included. The maps also provide a breakdown of flood likelihood in broad agreement with the Scottish Planning Policy Risk Framework.

A review of the map suggests that the site lies within the functional flood plain of the River Cur. There is evidence of some surface water flooding in and around the warehouse / site maintenance sheds in the immediate vicinity to the site.

SEPA makes the following statement about the Flood Map:

> *"The river flood map was developed using a nationally consistent approach to producing flood hazard information, such as depth of water and speed of flow arising from river flooding. It is based on a two dimensional flood modelling method applied across Scotland to all catchments greater than 3km^2. The river flood map includes hydraulic structures and defences such as bridges, culverts and flood storage areas where appropriate information was available.*

and

> *The surface water flood map combines information on rainfall and sewer model outputs. It incorporates data from a national surface water study, a regional surface water study with increased resolution in selected areas and a Scottish Water sewer flooding assessment."*

The flood map should be treated with caution and SEPA makes the following general comment:

> *"The flood maps are designed to provide a community level assessment of flooding and its impacts. They model flooding at a national scale. As with any approach of this scale, there are limitations and assumptions made to enable modelling and a consistent approach to be applied across Scotland. Limitations arise from the data used to create the maps, the modelling*

techniques applied and the ability to incorporate datasets from local studies into a national approach."

Additional background details of the SEPA flood map can be found on the SEPA website: http://www.sepa.org.uk/flooding/flood_maps.aspx

3 FLOOD RISK ASSESSMENT

3.1 GENERAL

Flooding occurs when the amount of water arriving on land exceeds the capacity of the land to discharge that water (by infiltration, overland flow, groundwater rise or a failed drainage system). It can occur on any level or near-level areas of land but the main concern in inland areas is with land adjacent to watercourses (fluvial flooding) and the possibility of overland flow (surface water flooding).

3.2 OVERLAND FLOW & LOCAL DRAINAGE

Within the site itself the drainage is likely to be via overland flow and via existing drainage infrastructure to the River Cur. Nuisance flooding from ponding is present throughout the site, particularly within the areas of the lumber storage and the vehicle staging areas. Road drainage and boundary drainage around the site is managed via the use of drainage ditches.

Road drainage ditches from the A815 around the site entrance were noted and culverts beneath the A815 were present. The size and condition of these culverts was not possible to determine at the time of the site walkover. Any failure of the existing drainage infrastructure within the site will result in ponding and localised nuisance flooding, which will ultimately lead to overland flow towards the River Cur to the north. Failure of the existing infrastructure is considered likely as it does not appear to be well maintained and was generally found to be in a poor condition.

The proposed development of the site will reduce infiltration rates and increase the potential for overland flow; however, the implementation of appropriate SuDS measures could reduce runoff from the site. The placement of any SuDS measures will be required to be out-with functional flood plain of the River Cur. Discharge of any SuDS measures may require SEPA approval and licensing under the Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR).

3.3 GROUNDWATER RISE

Given the local geology and landform the risk of groundwater rise in the area is considered to be insignificant.

3.4 FLUVIAL FLOOD RISK MODEL SETUP

3.4.1 General

Due to the nature of the flood risk assessment the risk model runs along the centre line of the River Cur from upstream of the site to beyond the A815 Road Bridge; a reach of approximately 470m. The model is inclusive of the natural flood plain of the watercourse as well as any topographical and hydraulic features that would affect the modelling result. All features have been identified during the site walkover and by the review of the available maps and survey data.

The sections of the watercourse modelled are shown on Drawing 1623-200-001 included in the Appendix.

The model length was established to be long enough to avoid any adverse effects on the water flow from any significant features along the watercourse. Cross sections through the River Cur were obtained from Phoenix Surveys (Scotland) Ltd and used in conjunction with the site survey to construct the model.

The site boundary lies between chainage 230m (Section 4) and chainage 360m (Section 5) and is represented by 2 of the ten cross sections used in the model. These sections give a reach along the northern site boundary of approximately 250m. The upstream River Cur bed level (at chainage 230m) is at 34.9m OD, while the final downstream section relative to the site (chainage 360) is recorded at 33.9m OD Thus a fall of about 1m is anticipated over the section of the model relative to the site.

With respect to the overall model setup, the upstream River Cur bed (at chainage 0m) is recorded at 36.3m OD, while the final downstream section (at chainage 470m) is recorded at 34.0m OD. Thus a fall of about 2.3m is anticipated over the entire reach of the modelled section resulting in an overall bed slope of 0.005m/m.

In order to fully analyse the water course, runs were carried out at a variety of Manning numbers and peak flow rates. Blockage scenarios for the A815 Road Bridge were also considered, as detailed below in Section 3.4.2.

A long section profile of the modelled reach and the cross sections from the model are shown on Figure 2, contained within the Appendix.

3.4.2 Structures

An important feature for the modelling of all structures with the hydrodynamic software used is that they must impose a constriction to the flow. That is, an inlet and an outlet loss must be present over the structure and the structure's geometry definition (with respect to flow-area) must be smaller than both the up and downstream cross sections for all levels defined in the structure.

The only structure associated with the River Cur is the A815 Road Bridge, which is present in close proximity to the north-western corner of the site. The A815 Road Bridge is located within the model at chainage 370m and is a single span road bridge with a stone parapet and a concrete base. The soffit of the bridge underlies the bridge surface by approximately 200-250mm. The bridge sits obliquely to the main direction of flow and has concrete and stone wing walls on the upstream face. The main opening is approximately 11.7 meters wide and 4m high. The bed level of the River Cur at the bridge has been surveyed at 33.9m OD and the road surface is at 38.9m OD. The bridge was constructed in 1960.

At the time of the site walkover inspection, there was a large mature tree that had fallen into the river immediately upstream of the structure. This could have the potential to cause a blockage at the bridge. Any potential blockage of the bridge is likely to have a minimal effect on the peak flood water level due to the width and height of the bridge opening. It is estimated that the tree could represent a blockage of approximately 5-8%. Two blockage scenarios were applied to the model to simulate blockage at the bridge through a reduction in the cross sectional area of the bridge opening, these were:

- A conservative blockage estimate of 10%; and
- A more onerous blockage estimate of 20%.

3.4.3 Downstream River Boundary

The location of the downstream boundary is approximately 190m downstream of the A815 Road Bridge and has been placed sufficiently far downstream to be remote from the site and the influence of any structures. The downstream boundary conditions for the site have been set in hydrodynamic mode with an open boundary. The Hydrodynamic (HD) Module has been applied to the boundary and is defined by the Time series (TS). The Q-h relationship at the downstream boundary is computed using a Manning's value of 0.04 and a bed slope of 0.002.

3.5 RIVER FLOW

Relevant direct gauging station data is not available for the site. Rainfall records and catchment descriptors have been obtained from the Flood Estimation Handbook (FEH) CD ROM Version 3. Flow rates have been calculated using the FEH rainfall runoff methodology and others as noted following:

- FEH (2007) QMED (Index Flood) calculation;
- Improved FEH estimate of QMED (2008);
- IHR 124 calculation;
- FEH revitalised flood hydrograph method (ReFH) Version2; and
- MIKE 11 Rainfall Runoff method.

A summary of the possible peak design flows for the River Cur is provided in Table 1 in the Appendix.

Taking into consideration the differing methods of flow calculation the 0.5% probability (1 in 200 year) peak flow for the River Cur at the site is estimated to be in the order of 101.7m^3/s (the design storm peak flow for the fluvial assessment).

3.6 CLIMATE CHANGE ALLOWANCE

The Scottish Executive guidance 'UKCIP02 Update (2003)' suggests that peak river flows may increase by between 15% and 20% in Scotland by the mid 2080's due to global climate change. The recently published UK Climate Projections (UKCP09) support the above percentage increase and therefore is in line with the current SEPA guidelines for the whole of Scotland.

A comparative model run with an additional allowance of 20% has been added to the estimated 0.5% probability flood event. This comparative flow will represent the flooding regime at the site under conditions brought about by global climate change. Increasing the design flow for the River Cur to 122m^3/s.

3.7 MODEL RESULTS UNDER EXISTING GROUND CONDITIONS

Using standard hydrodynamic software modelling techniques for open channel flow, information between cross sections is interpolated through the Mike 11 hydrodynamic software and the watercourse flood levels calculated accordingly.

The water flow analysis assumes a generally conservative estimate of watercourse bed and banking roughness (Manning 'n' of 0.04). Further analysis of the watercourse was undertaken with a variety of roughness coefficients (Manning's 'n' of between 0.035 and 0.045) and this indicates that the watercourse is not unduly sensitive to such changes.

Table 2, contained within the appendix to this report, shows the variation between the different Manning's 'n' values used under existing ground conditions. Table 2 also shows the peak water levels under existing ground conditions for varying flood hydrographs.

As with all fluvial flood models, uncertainties remain regarding the channel roughness that affects the relationship between flow rate and water level. The analysis must, therefore, be regarded as approximate.

3.7.1 Peak Water Level

Peak flood levels based on the existing ground conditions for the 1 in 200 year event are shown on Table 2 in the appendix. As noted in Table 2 the peak water levels for both the 1 in 200 year and the 1 in 200 year plus 20% Global Climate Change are similar. In the vicinity of the site the peak water

level falls from a high of 37.46m OD at the upstream end to a low of 37.18m OD immediately upstream of the road bridge.

Blockage scenarios for the A815 Road Bridge had no impact on peak water levels. The model indicates that the opening is sufficiently large enough to accommodate both the 1 in 200 year and the 1 in 200 year plus 20% Global Climate Change flows with both a 10% and 20% reduction in area.

Peak flood water levels within the site will be primarily controlled by the flow rate and volume of water travelling down the River Cur, the structures do not pose a significant enough constriction to flow to have an impact on the site.

The area of inundation associated with the River Cur under peak storm conditions is shown on Drawing 1623-200-002 in the Appendix.

Peak flood water levels indicate that during the 1 in 200 year event, there is the potential for overland flow to occur at the south-western corner of the site at the junction with the A815 and the site access road. Flood depths are not likely to exceed 200mm. the potential overland flood routing pathway is shown on Drawing 1623-200-002 in the Appendix.

4 DISCUSSION AND RECOMMENDATIONS

4.1 GENERAL

For new developments the acceptable risk of flooding should take into account various factors including risk to human health and the direct and indirect financial losses relating to flooding.

The assessment indicates that the risk to the site from groundwater rise is low.

The assessment indicates that the risk to the site from overland flow due to direct rainfall runoff and failure of existing drainage is also low. Shallow nuisance flooding from ponding may occur, but is not anticipated to achieve any significant depth.

With respect to the Scottish Planning Policy, the fluvial model indicates that the majority of the site is at Medium to High risk of fluvial flooding from the River Cur, as shown on Drawing 1623-200-002.

The assessment indicates that the risk to the site from overland flow, as a result of flood routing is Medium to High. The indicative flood routing directional arrows, as shown on Drawing 1623-200-002, show the potential pathway of slow moving flood waters to pass through the site and out onto the A815 via the site access road at the site entrance. Flow rates would be low and shallow sheet flow would occur.

It is understood that Sustainable Drainage System (SuDS) design to manage stormwater runoff from the proposed development areas will be undertaken and will likely involve discharge into the River Cur. Appropriate SuDS measures may include permeable pavement surfaces for car parking areas and detention of roof run-off prior to discharge into the River Cur.

4.2 DEVELOPMENT AND POSSIBLE MITIGATION MEASURES

It is understood that the proposed development will be restricted to the southwestern corner of the site, where the flood depths are at their lowest.

As the site lies within the functional flood plain of the River Cur it is recommended that the site installs, operates and maintains a suitable early warning system for flood events. Recommended options would include the following:

- Installation, operation and maintenance of a water level sensor and siren at the upstream extent of the site, to provide forewarning of rising water levels; and
- Installation, monitoring and maintenance of a connection to the SEPA Flood Warning system.

In addition to the above, it is also recommended that the building be commercial property (Offices) be elevated so as to protect the fabric of the building and its contents from the effects of flooding. Final floor levels for the development should be set at a minimum of 600mm above the peak flood water levels associated with the 1 in 200 year plus 20% uplift for global climatic change event. Recommended options that may be suitable for use are:

- Elevation of the building via the construction of blockwork which would allow the passage of flood waters through the area beneath the building; or
- Elevation of the building via the use of stilts.

In order to provide safe emergency access and egress from the site, it is recommended that the site access road be re-profiled to a minimum level of 37.5m OD throughout the site and 37.2m OD at the site entrance off the A815. This would ensure that the flood water depth does not exceed 300mm across the access point. To assist in the conveyance of the flood water through the site and maintain the existing flood routing pathways, a swale should be incorporated to convey flood waters to the west and across the A815 form the lower lying site access at the south-western corner of the site.

4.3 PHYSICAL WORKS ASSOCIATED WITH THE EXISTING WATERCOURSE

In relation to flood risk and sedimentation control, the Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR) is likely to be required as part of the development phase of the works. It is recommended that discussions between the appointed contractor and SEPA are held with respect to CAR at their earliest convenience.

Controlled activities would include any permanent works in close proximity to the River Cur, as well as any potential SuDS outfalls within the development footprint.

4.4 EFFECTS ON SITE NEIGHBOURS

It is not anticipated that there be any effect on site neighbours as a result of the proposed development.

The proposed implementation of appropriate SuDS measures will attenuate rainfall runoff from the site and will reduce the peak storm flow of the River Cur. The overall risk of flooding at the site and further downstream following the development of the site will therefore be reduced, albeit marginally.

4.5 OVERALL FLOOD RISK ASSESSMENT CONCLUSION

The Scottish Planning Policy notes that new developments should be free from significant flood risk from any source and that such development should not:

- materially increase the probability of flooding elsewhere;
- add to the area of land which requires protection by flood prevention measures;
- affect the ability of the functional flood plain to attenuate the effects of flooding by storing flood water;
- interfere detrimentally with the flow of water in the flood plain; or
- compromise options for future river management.

The development of the site for commercial purposes is feasible with careful design and planning. The installation, monitoring and maintenance of the proposed early warning systems, in conjunction with the elevated building and landscaping would ensure that the risk from flooding at the site is mitigated and managed appropriately.

-oo000oo-

Terrenus Land & Water Ltd wishes to thank Mr Jack Johnson for the opportunity to prepare this report and trust that it meets with your requirements. However, should you wish to discuss the contents of the report then please do not hesitate to contact the undersigned.

Signed for and on behalf of

Terrenus Land & Water Ltd

Douglas Aitken

Associate Director

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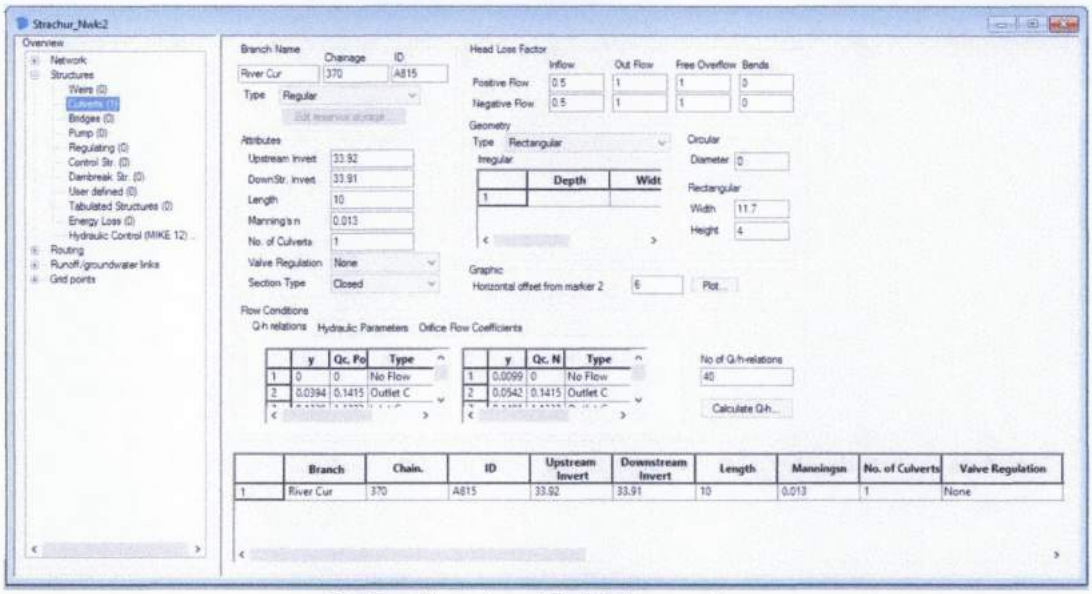
FOR
JACK THOMSON

FIGURES

Figure 2 – Model Sections



Bridge Structure Model Parameters.

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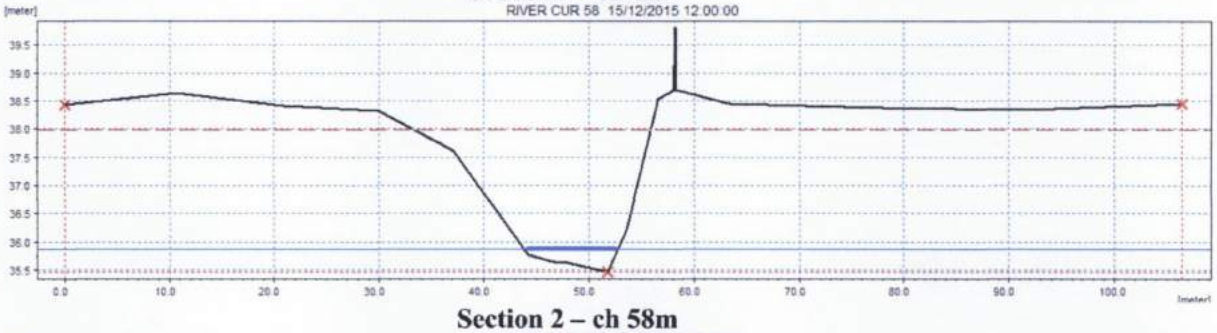
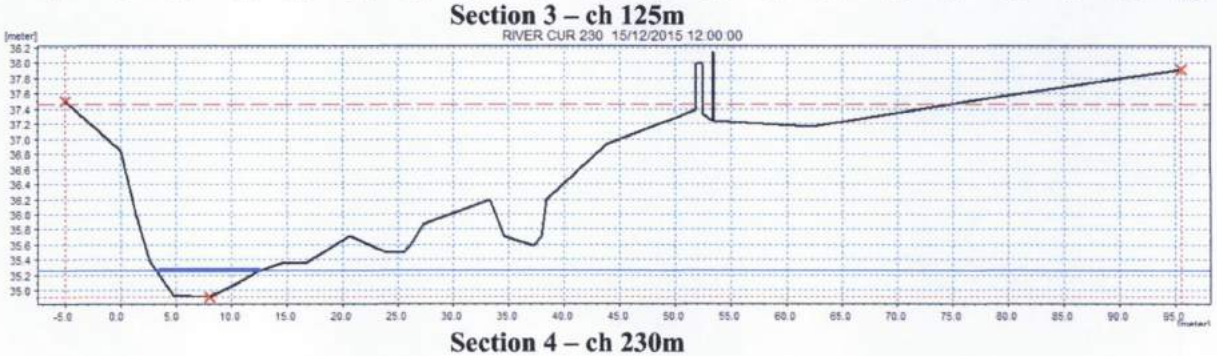
Figure 2 – Model Sections

Section1 – ch 0m



Section 2 – ch 58m

Section 3 – ch 125m



Section 4 – ch 230m

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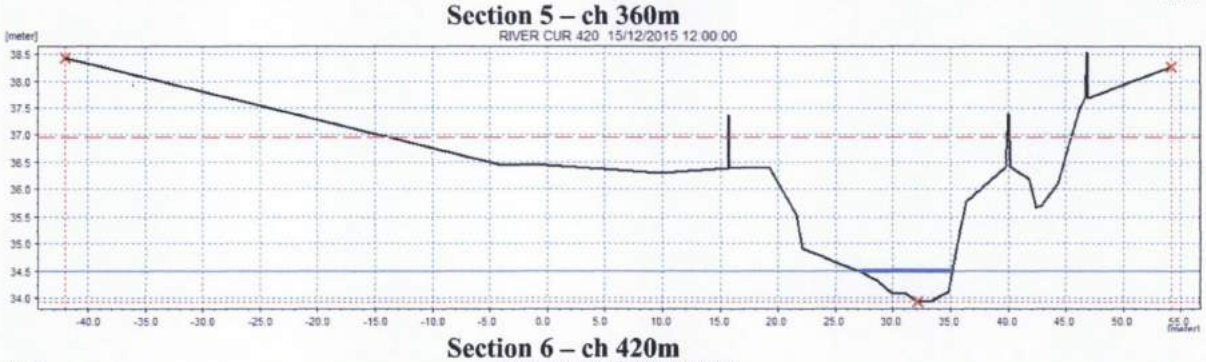
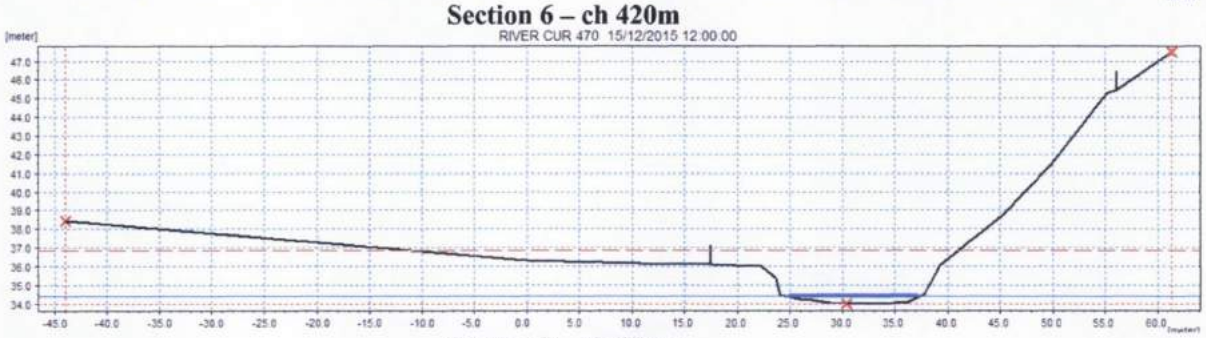
Figure 2 – Model Sections

Section 5 – ch 360m



Section 6 – ch 420m



Section 7 – ch 470m

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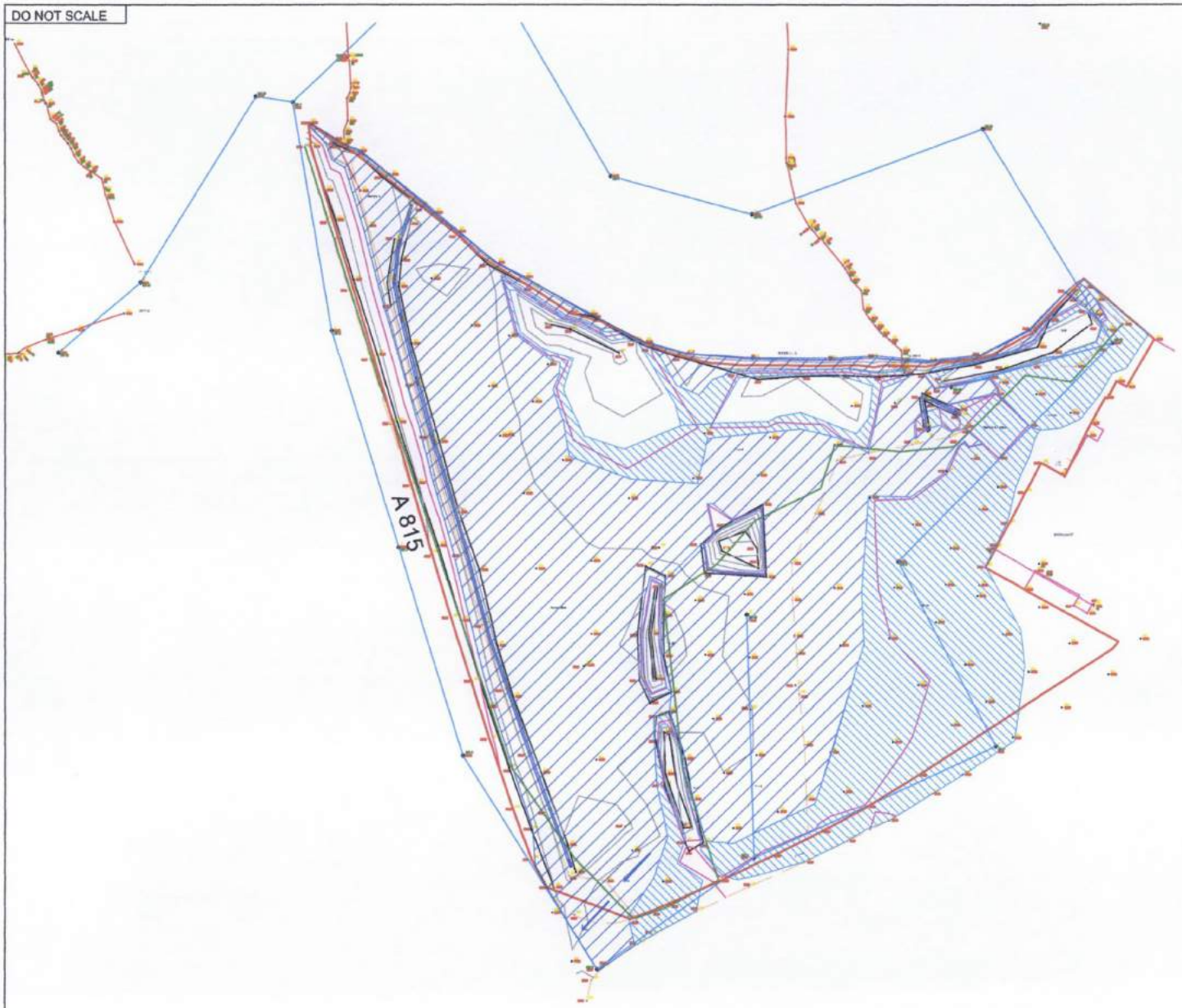
DRAWINGS

DO NOT SCALE



LEGEND

: 1 IN 200 YEAR FLOOD EXTENT

: 1 IN 200 YEAR PLUS 20% GCC FLOOD EXTENT

: INDICATIVE OVERLAND FLOW PATHWAY ARROW

Rev	Description	By	App	Date

terrenus land&water

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Stanley Boulevard, Hamilton, G72 0BN
Tel - 01698 532 533

Client: JACK THOMSON

Project: STRACHUR SAWMILL, STRACHUR FLOOD RISK ASSESSMENT

Drawing title: FLOOD EXTENT PLAN

Drawn	Checked	Approved
DA	WH	WH

Date: 17/12/15

Scale: NTS

1623-200-002

ORIGINAL A3

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TABLES

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Table 1 - Summary of Peak Flow Volumes

		All flow volumes are expressed in m^3/s						
		FEH QMED (using 2007 methodology)	FEH QMED (using 2008 methodology)	IHR 124 Rural (Catchments <25km^2)	IHR 124 Urban (Catchments <25km^2)	ReFH 2	Rainfall Runoff Methodology (MIKE)	Estimated Peak Flow (using Mike)
River Cur	200 year	134.3	137.3	119.1	119.1	105.0	101.7	101.70
	200 year plus potential Global Climate Change (GCC) of 20%	161.20	164.78	142.97	142.97	126.01	122.09	122.04

Note: FEH CD-ROM 3 Dataset used

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Table 2 - FRA Model Outputs

			Peak Water Level (mOD) for Existing Ground Levels						
	Section number	Cross Section with chainage (m)	1 in 200 yr (101.7m3/s) at Mannings of 0.035	1 in 200 yr (101.7m3/s) at Mannings of 0.04	1 in 200 yr (101.7m3/s) at Mannings of 0.05	1 in 200 yr (101.7m3/s) at Mannings of 0.04 with 20% blockage of A815 Road Bridge	1 in 200 yr plus 20% GCC (122m3/s) at Mannings of 0.04	Approximate Level of river bank adjacent to site (mOD)	Comments
River Cur	1	0	38.22	**38.35**	38.48	38.35	38.56	39.7	
	2	58	37.84	**37.99**	38.12	37.99	38.21	38.65	
	3	125	37.41	**37.52**	37.62	37.52	37.72	38.81	
	4	230*	37.31	**37.46**	37.55	37.46	37.72	37.5	Upstream of site
	5	360*	36.96	**37.18**	37.27	37.18	37.47	36.93	Site
	6	420	36.92	**36.95**	36.98	36.95	37.14	36.40	Upstream of A815
	7	470	36.84	**36.84**	36.84	36.84	37.03	36.02	

Legend: denotes where peak water level exceed

* Cross-sections affecting Site

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PHOTOGRAPHIC PLATES

Plate 1 – View north across the southern site boundary from the Sawmill access road.

Plate 2 – View north along western site boundary (A815) towards Strachur.

Plate 3 – View south showing drainage ditches around the site access.

Plate 4 – View north of local drainage ditches surrounding site access.

Plate 5 – View south along western site boundary from the approximate centre of the site.

Plate 6 – View north along western site boundary from the approximate centre of the site.

Plate 7 – View west through centre of the site, surface water runoff draining through the site.

Plate 8 – View west of internal site drainage connection with western boundary ditches.

Plate 9 – Northern connection of drainage ditch with the River Cur.

Plate 10 – View of the A815 Road Bridge over the River Cur, north of the site.

Plate 11 – Fallen mature tree at the A815 road bridge (upstream side).

Plate 12 – View southeast looking upstream along the River Cur.

Plate 13 – View west from A815 Road Bridge of the River Cur (downstream).

Plate 14 – View northwest looking across the A815 towards the downstream fields.

Plate 15 – View north across adjacent wood stockpiling area, site to the left.

Plate 16 – Looking northeast towards the sawmill buildings across the transport staging area.

Plate 17 – Drainage from the transport staging area conveying runoff to the River Cur.

Plate 18 – River Cur embankment cut through, upstream of the site.

Plate 19 – Panorama looking north across site access, southern boundary and western boundary.

Plate 20 – Panorama looking north along eastern site boundary along lumber storage areas adjacent to transport staging area.

Plate 21 – Panorama looking south through the southern portion of the site, view taken looking towards site access.

Plate 22 – Panorama taken from A815 looking southeast across western site boundary and through centre of the site.