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FLOOD RISK ASSESSMENT

For

The Huntroyde Estate

And

Clitheroe Auction Mart Co Ltd

And

Mr John Taylor, Ms Sarah Howard and Ms Samantha Howard

October 2012

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WADDOW VIEW
CLITHEROE

Flood Risk Assessment

October 2012

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EXECUTIVE SUMMARY

This report was commissioned by The Huntroyde Estate, Clitheroe Auction Mart Co Ltd and Mr John Taylor, Ms Sarah Howard and Ms Samantha Howard referred to hereafter as 'the client' to support a planning application for the construction of a residential development complete with estate roads, external works, footpaths, car parking, external lighting, landscaping, boundary walls, fencing, external services and drainage.

The site is in an area identified as having a 'low' probability of flooding on the Environment Agency Flood Map and is located in Flood Zone 1. NPPF requires that planning applications for development proposals of 1 hectare or greater in Flood Zone 1 should be accompanied by a Flood Risk Assessment. The residential nature of the development proposals means the classification of the site is 'more vulnerable' from NPPF Table 2.

The Flood Risk Assessment has reviewed all sources of flood risk to both the proposed development and to the existing adjacent development as a result of the proposals, including; fluvial, tidal, pluvial, groundwater, sewers and flooding from artificial sources. An Internet based search for flooding events did not recall any historical flooding in the immediate site area.

The small watercourse crossing site was hydraulically modelled to confirm it posed no flood risk to the development area in accordance with the Environment Agency's requirements.

In light of the relatively low flood risk from all of the sources reviewed the principle focus of the Flood Risk Assessment is on the effective management of surface water drainage.

The primary option for surface water disposal is via infiltration, if discharge of the surface water via infiltration is not viable and discharge is proposed to the watercourse bisecting site then flows will need to be restricted to the mean annual flood, QBar, calculated to be 33.1l/s.

Foul water flows are to be discharged to the combined public sewer crossing the southern corner of site.

This report has been prepared in consultation with the Environment Agency and incorporates their comments where possible.

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Specialist Software

- Flood Estimation Handbook FEH CD-ROM (v.3.0) – *Determination of Catchment Descriptors and depths of rainfall*
- HEC-RAS (v.4.1) – *Watercourse 1-D Modelling*
- MicroDrainage WinDES (v.12.6.1) – *Calculation of Greenfield run-off rates IH124/ICP-SUDS, rates of rainall and stormwater storage estimates*

Abbreviations & Acronyms

AEP	Annual Exceedance Probability	NGR	National Grid Reference
BGL	Below Ground Level	NPPF	National Planning Policy Framework
BGS	British Geological Survey	NSRI	National Soils Research Institute
CC	Climate Change	OS	Ordnance Survey
EA	Environment Agency	QSE	Quick Storage Estimate
FEH	Flood Estimation Handbook	RVBC	Ribble Valley Borough Council
FRA	Flood Risk Assessment	SFRA	Strategic Flood Risk Assessment
FZ	Flood Zone	SuDS	Sustainable Urban Drainage Systems
Ha	Hectare	TWL	Top Water Level
LLFA	Lead Local Flood Authority	UKCIP	United Kingdom Climate Impacts Programme
LPA	Local Planning Authority	UU	United Utilities
mAOD	Metres Above Ordnance Datum		

1.0 INTRODUCTION

1.1 Planning Policy Context

1.1.1 All forms of flooding and their impact on the natural and built environment are material planning considerations. NPPF sets out the Government's objectives for the planning system, and how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change.

1.1.2 Government policy with respect to development in flood risk areas is contained within the National Planning Policy Framework (NPPF).

1.1.3 NPPF requires that planning applications for development proposals of 1 hectare or greater in Flood Zone 1 should be accompanied by a Flood Risk Assessment.

1.2 Site Context

1.2.1 This report was commissioned by the client to support an outline planning application for the construction of a residential development complete with estate roads, external works, footpaths, car parking, external lighting, landscaping, boundary walls, fencing, external services and drainage.

1.3 Consultation

1.3.1 The preparation of this report has been undertaken in consultation with the Environment Agency (EA).

1.3.2 The Local Planning Authority (LPA), Ribble Valley Borough Council (RVBC), will make the final decision with regard to any planning permission, RVBC also act as the Lead Local Flood Authority (LLFA). NPPF advises that the LPA should consult with the Environment Agency who will provide advice and guidance on flood issues at a strategic level and in relation to planning applications.

1.3.3 The EA were contacted to discuss the nature and extent of information to be provided within the Flood Risk Assessment (FRA) and the methodology and scope of the River Modelling exercise contained within. In addition background knowledge of flood risk specific to the site was requested, however there is no record of historical flooding within the immediate site area on record with the EA (correspondence is included in Appendix D).

2.0 EXISTING SITE SITUATION

2.1 Location

2.1.1 The site is located just off Milton Avenue, Clitheroe. The Ordnance Survey National Grid Reference (OS NGR) for the site is 374096 (Easting), 442181 (Northing) and the nearest postcode is BB7 2HX. The site location plan is shown in Appendix A.

2.1.2 The site is predominantly undeveloped; it is accessed via Milton Avenue, Back Commons (runs along a portion of the southern boundary) and Waddington Road (to the northern corner of the site). It is currently open grassed fields, levels slope gently from northwest to southeast. Existing mature trees line the eastern site border, and hedgerows line the northern, southern and western borders.

2.1.3 There is an existing derelict building located along the northern boundary. The surrounding area is predominantly residential to the north and south, fields to the west and a public car park to the east. A small stream bisects the site emerging from a culvert around the mid-point of the south eastern boundary and running north-northeast. A railway line is shown 100m south of site.

2.2 Existing and Historical Land Use

2.2.1 The site is undeveloped, with the exception of the small derelict barn structure located along the northern boundary. The total site area is approximately 9.2ha and is considered to be 100% pervious. The photograph (below) in Figure 1 is a view north west from the northern boundary.

2.3 Topography

2.3.1 A topographical survey of the site has been undertaken and is included in Appendix B. The site generally slopes from the northwest to the southeast; levels range from approximately 80.5mAOD to 71.5mAOD.

Figure 1: Photograph of site
View northwest from the middle of the northern boundary

3.0 DEVELOPMENT PROPOSALS

3.1 Nature of the development

3.1.1 The proposed development comprises the construction of a residential development complete with estate roads, external works, footpaths, car parking, external lighting, landscaping, boundary walls, fencing, external services and drainage.

3.1.2 The outline proposals are for approximately 345 dwellings, a copy of the proposed planning layout drawing is included in Appendix C.

3.1.3 There is considered to be no existing impermeable area, the proposed impermeable area of the development is approximately 2.76 hectares, 30% of the total site area.

4.0 SOURCES OF FLOOD RISK

4.1 Fluvial Flood Risk

4.1.1 Information relating to the flood risk at the site has been obtained from the Environment Agency's (EA) website and online Flood Map, an extract of which is shown in Figure 2 (below).

4.1.2 Examination of the Flood Map shows that the site is located within an area classified as Flood Zone 1 and is not considered to be at significant risk of flooding from Rivers or the Sea, Appendix D shows the online flood map and statement in full.

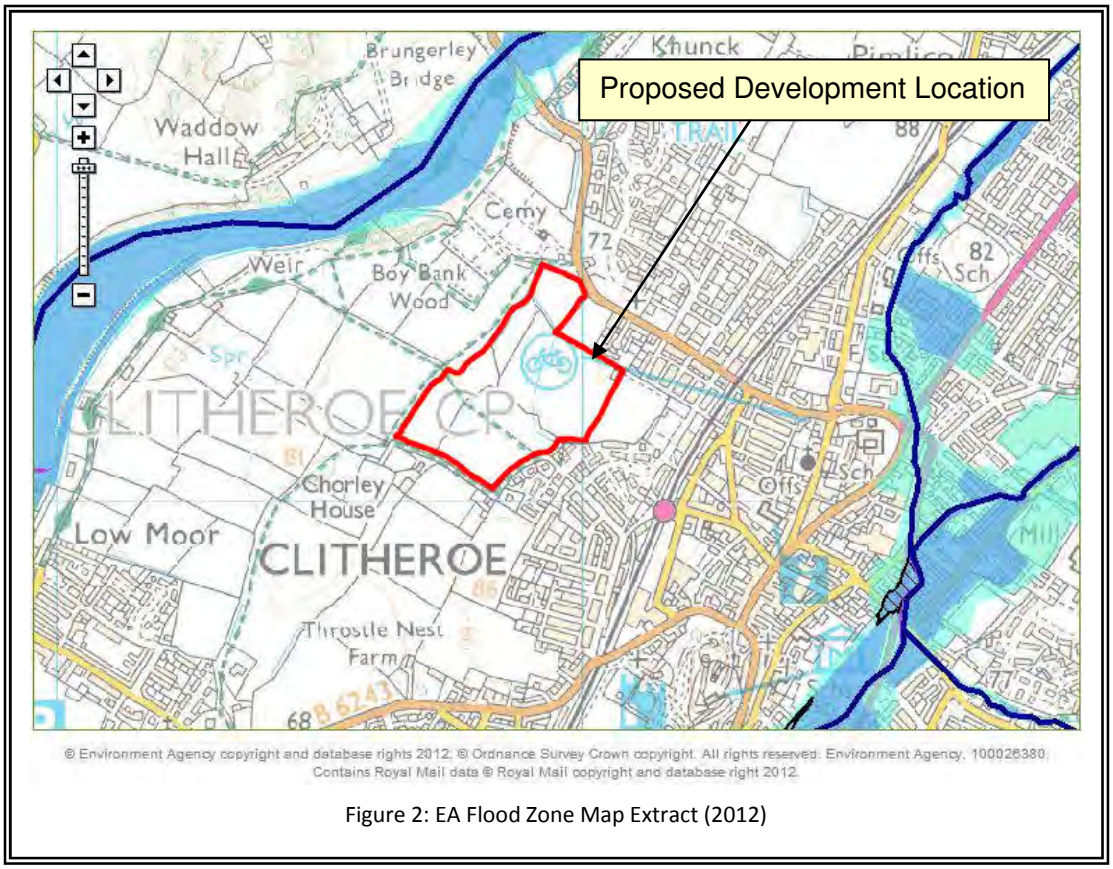

Figure 2: EA Flood Zone Map Extract (2012)

4.1.3 Historic maps suggest a watercourse that flowed along the eastern boundary, then the southern boundary before heading offsite in a west/northwest direction; however there was no evidence of a watercourse above ground along the eastern boundary. The watercourse is understood to still run below ground (culverted) along the southern boundary.

4.1.4 The watercourse appears to be fed by a public surface water sewer (UUW asset) at UUW node ref. 1104 (900mm dia. pipe).

4.1.5 The culvert (c.900mm dia.) discharges in to an open channel around the mid-point of the south eastern boundary. A photograph of the outfall is shown in Figure 3.

4.1.6 The open channel watercourse flows west then north bisecting the development area (there are two existing culverted sections to allow access between fields.

Figure 3: Photograph of site
View east from the mid-point along the south eastern boundary

4.1.6 The EA confirmed they do not possess hydraulic modelling data for the 'ordinary' watercourse crossing site, therefore it was considered necessary to undertake a river modelling exercise to determine the floodplain extent for a variety of storm events. The method and scope of the modelling exercise was agreed with the EA and full details of the exercise are included in Section 5.0.

4.2 Tidal Flood Risk

4.2.1 Due to the distance from the coast and estuarine waterways the risk of flooding from tidal sources is considered very low.

4.3 Artificial Sources of Flood Risk

4.3.1 Due to the site location relative to any artificial bodies of water such as reservoirs or canals the risk of flooding from this source is considered low.

4.4 Pluvial Flood Risk

4.4.1 Intense rainfall that is unable to soak into the ground or enter drainage systems can run-off land and result in flooding. Local topography and the land use can have a strong influence on the direction and depth of flow. Large catchment areas are particularly prone to this type of flooding. The volume and rate of overland flow from land can be exacerbated if development increases the percentage of impermeable area.

4.4.2 The topography of the development and surrounding area means there is little likelihood of significant flows impacting on the proposed development or on land and property adjacent to the development. The only flows that are likely to be present on site are from direct rainfall on areas of hardstanding.

4.4.3 Any overland flows generated by the proposed development must be directed away from the adjacent existing residential properties on the boundaries; safe avenues of overland flow away from the proposed dwellings are advised.

4.5 Groundwater Flood Risk

4.5.1 In general terms groundwater flooding can occur from three main sources: - raised water tables, seepage and percolation and groundwater recovery or rebound.

4.5.2 If ground water levels are naturally close to the surface then this can present a flood risk during times of intense rainfall.

4.5.3 At present there are no reported problems with groundwater flooding.

4.5.4 Seepage and percolation occur where embankments above ground level hold water. In these cases water travels through the embankment material and emerges on the opposite side of the embankment.

4.5.5 Due to the high levels of the proposed development area relative to the watercourse the likelihood of flooding from this source is low.

4.5.6 Groundwater recovery / rebound occurs where the water table has been artificially depressed by abstraction. When the abstraction stops the water table makes a recovery to its original level. There is the potential for groundwater flooding in low lying areas where groundwater levels have been depressed below their pre-pumping conditions, where these were at or close to ground level.

4.5.7 As with the seepage scenario the likelihood of flooding from this source is low.

4.6 Sewer Flood Risk

4.6.1 There are no known public sewer systems within the vicinity of site or private surface water systems that have given rise to flooding issues.

4.6.2 There is a 675mm diameter combined public sewer crossing the site from around the mid-point along the south eastern boundary off Back Commons (UU MH Ref.9002) to the southern corner of site (UU MH Ref.8001). This system will need to be catered for within the proposed planning layout either in terms of an easement strip or a diversion; ideally under public highway to allow appropriate access to prevent blockages and minimise flood risk.

4.6.3 In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and waste water known as ‘combined sewers’. Foul water flooding often occurs in areas prone to overland flow and can result when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away. It can also occur when the sewer becomes blocked or is

of inadequate capacity, this could lead to there being a high risk of internal property flooding with contaminated water.

4.7 Strategic Flood Risk Assessment (SFRA) Information

4.7.1 The SFRA also indicates the site is not located within Flood Zones 2 or 3a and there are no specific risks to the site area indicated within the SFRA.

4.8 Historical and Anecdotal Flooding Information

4.8.1 An Internet based search for flooding events did not recall any historical flooding in the immediate site area. Pre-development enquiries with the EA also failed to highlight any historical flooding events specific to the development site.

4.8.2 Discussion with the Highway Department has highlighted some existing highway flooding issues off Milton Avenue; however these are considered a nuisance rather than a significant issue to the development. There may be an opportunity to provide some assistance in terms of flood alleviation to this area of highway but options will need to be evaluated during the detailed design of the drainage systems required to serve site.

4.9 Flood Risk Vulnerability Classification and Flood Zone Compatibility

4.9.1 The development is residential in its nature and as such is classified as 'more vulnerable' in *Table 1: Flood Risk Vulnerability Classification* within the Technical Guidance to the National Planning Policy Framework, *Table 2: Flood Risk Vulnerability and Flood Zone 'Compatibility'* within NPPF confirms that this type of land use is appropriate for Flood Zone 1.

4.10 Residual Risks

4.10.1 The development is accessible for emergency access and egress during times of extreme flooding as the flood plain does not extend into the proposed residential development.

4.10.2 The development and its drainage systems should be designed to cope with intense storm events up to and including the 100 year return period rainfall event with an allowance for Climate Change (CC). If an extreme rainfall event exceeds the design criteria for the drainage system it is likely that there will be some overland flows that are unable to enter the system, it is important that these potential overland flows are catered for within the proposed planning layout in the event that the capacity of the drainage system is exceeded.

4.10.3 Any overland flows generated by the proposed development must be directed away from the adjacent existing residential properties on the boundaries; safe avenues of overland flow away from the proposed dwellings are advised.

4.10.4 As with any drainage system blockages within either the foul or surface water system have the potential to cause flooding or disruption. It is important that should any drainage systems not be offered for adoption to either the Water Company or the Local Authority then an appropriate maintenance regime be scheduled with an appropriate management company for these private drainage systems.

5.0 FLUVIAL FLOOD MODELLING

5.1 Hydrological Modelling

5.1.1 This study has considered the; 1 in 1 year, 1 in 100 year, 1 in 100 year + 20% allowance for climate change and the 1 in 1000 year flood flows along the brook.

5.1.2 A small land drain running along the north western field boundary connects into the watercourse and for completeness has been included within the model.

5.1.3 Catchment descriptors were obtained from the FEH CD-ROM for the catchment upstream of the site. A catchment map and the catchment descriptors are provided in Appendix G. In addition to the natural catchment there are known to be public surface water sewers connecting into the watercourse; the catchment from these sewers has been determined and added to the natural catchment to determine the total flow estimates.

5.1.4 The Revitalised FEH Rainfall Run-Off Method (ReFEH) was applied based on catchment descriptors. These are considered to represent conservative flow estimates (i.e. adopts the precautionary approach). The flows from the areas of hard-standing, roof areas and roads were determined by applying the rainfall characteristics from the FEH CD-ROM. The peak flow estimates are shown in Table 5.1 below; full details are shown in Appendix H.

Return Period (years)	Flow Ref.	Flow Estimate (m^3/s)
1 in 1	Q1	0.0724
1 in 100	Q100	0.2248
1 in 100 + 20% (CC)	Q100+20%CC	0.2896
1 in 1000	Q1000	0.3963

Table 5.1: Watercourse – ReFEH Flow Estimates

Return Period (years)	Flow Ref.	Flow Estimate (m^3/s)
1 in 1	Q1	0.0177
1 in 100	Q100	0.0423
1 in 100 + 20% (CC)	Q100+20%CC	0.0508
1 in 1000	Q1000	0.0618

Table 5.2: Land Drain – ReFEH Flow Estimates

5.2 Hydraulic Modelling

5.2.1 A steady state 1 dimensional model of the brook was developed using HEC-RAS v4.1 which solves the Energy Equation using the Standard Step Method.

5.2.2 A topographical survey of the site was undertaken and cross sections through the brook and adjacent land were recorded at approximately 10 metre centres upstream and downstream of the site in order to generate stable numerical solutions.

5.2.3 A schematic view of the modelled reach, profile and cross sections are shown in Appendix J.

5.2.4 Roughness coefficient allocation was based on information obtained during a site walkover survey in October 2011. The brook channel is relatively clean, with weeds and stones lower stages with more ineffective slopes and sections. As such the channel was assigned a roughness Manning's n value of 0.045. Beyond the main channel a Manning's n value of 0.045 has been applied.

5.2.5 The upstream and downstream boundary conditions were assumed normal depth, based on the average gradient through the study area the gradients are as follows: -

River Reach	Gradient (1 in x)	S
1 (watercourse)	308	0.003
2 (land drain)	146	0.007
3 (watercourse)	1012	0.001

Table 5.3: HEC-RAS Boundary Conditions

5.2.6 The hydraulic modelling results including; a schematic plan, a longitudinal profile, cross sections (indicating Top Water Levels (TWL) for all of the aforementioned storm events) are included in Appendix J.

5.2.7 The results indicate that an insignificant amount out of main channel flooding would occur; the extent of this flooding is indicated on the Flood Plain Plan in Appendix K.

5.2.8 There is no requirement to set minimum Finished Floor Levels (FFL) as the proposed development is located outside of the floodplain, however it is advised that FFL be set ideally 600mm above the adjacent Q100 (1%AEP) TWL.

5.3 Compensatory Flood Storage

5.3.1 There is no requirement for compensatory flood storage as there is no intention to raise the existing ground levels within the flood plain extents and the proposed development is located outside of the flood plain extent.

6.0 SURFACE WATER MANAGEMENT

6.1 Pre-development Surface Water Run-off

6.1.1 For the purposes of determining the existing rate of surface water run-off the site is considered to be Greenfield. The total area of the site is 9.20ha (hectares), 100% pervious.

6.1.2 The existing greenfield run-off rates have been calculated to be 28.8l/s for the annual return period storm event and 68.9l/s for the 1 in 100yr return period storm event using the IH124/ICP-SUDS Greenfield Run-off method, based on the catchment characteristics of the site obtained from the FEH CD-ROM (v3.0).

6.1.3 The mean annual flood, QBar is calculated to be 33.1l/s.

6.1.4 The approximate volume of surface water run-off generated by the 100 year return period storm event is 217.6m^3; with rainfall based on the FEH rainfall data for the 6hr duration winter profile storm.

6.2 Post-development (unrestricted) Surface Water Run-off

6.2.1 The proposed impermeable area will be approximately 30% of the total development area (8.328ha), this equates to approximately 2.76 hectares.

6.2.2 Based on a rainfall rate of 50mm/hr (BRegs: Part H) the unrestricted run-off rate would be 383.3l/s.

6.2.3 Based on a rainfall rate of 10.2mm/hr (WinDES /FEH Data – 6hr winter peak rainfall intensity) the annual unrestricted run-off rate would be 78.2l/s.

6.2.4 The post-development surface water run-off volume for the 1 in 100 year return period event with a 30% allowance for Climate Change is 279.0m^3.

6.2.5 The proposed impermeable area will generate significantly greater run-off than the existing total site area; if flows cannot be discharged via infiltration then they should be restricted to Greenfield run-off rates to compensate for the increase in run-off volume.

6.3 Sustainable Drainage Systems (SuDS)

6.3.1 In accordance with NPPF, Sustainable Drainage Systems (SuDS) should be specified wherever possible to manage surface water. This in turn reduces the burden downstream on both watercourses and sewerage systems.

6.3.2 SuDS have the ability to address three core objectives; water quantity, water quality and amenity value. With the appropriate system specified, all three core objectives can be satisfied. Where possible, peak surface water discharge rates to watercourses and sewers should be reduced.

6.3.3 Preference should always be given to SuDS over the traditional methods of buried sewers wherever possible and practical. Runoff from car parking areas and roads could be conveyed

through swales, permeable pavements, bio-retention areas and petrol interceptors to provide a degree of treatment before flows are carried to public sewers.

6.3.4 Opportunities should be taken to provide soft landscaping where at all possible on site to assist in minimising surface water run-off. Added benefits include biodiversity and visual enhancements.

6.3.5 The exact type of SuDS will be determined at the detailed design stage.

6.4 Methods of Surface Water Management

6.4.1 There are three methods that have been reviewed for the management and discharge of surface water detailed below; these could be applied individually or collectively to form a complete strategy. The order of priority for the method of drainage is listed below.

- Discharge via infiltration
- Discharge to watercourse
- Discharge to public sewerage system

6.5 Discharge via Infiltration

6.5.1 Any impermeable areas that can drain to soakaway or an alternative method of infiltration would significantly improve the sustainability of the surface water system and would help to minimise the amount of attenuation and storm water storage required.

6.5.2 The British Geology Survey (BGS) 1:50 000 scale bedrock geology description: Clitheroe Limestone Formation And Hodder Mudstone Formation (Undifferentiated) - Mudstone. Sedimentary Bedrock formed approximately 334 to 344 million years ago in the Carboniferous Period. Local environment previously dominated by shallow carbonate seas. The 1:50 000 scale superficial deposits description: Till, Devensian - Diamicton. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by ice age conditions.

6.5.3 The National Soil Resources Institute (NSRI) indicates that the nature of the soil is likely to be; slowly permeable, seasonally wet, acid loamy and clayey soils. Drainage is considered likely to be impeded.

6.5.4 Based upon the infiltration constraints identified above it is unlikely that infiltration drainage will be a suitable method of surface water discharge for the proposed development; however, infiltration should not be discounted as a complete or partial drainage solution until testing has been carried out in accordance with BRE365 to determine whether any infiltration solution can be applied in an specific areas of site thought to be most suitable.

6.5.5 If initial testing indicates infiltration may be viable then soakaway testing should be undertaken in specific locations where the use of soakaways is most likely, this is dependent upon the proposed planning layout and should be completed prior to the detailed design.

6.5.6 If it is ultimately proposed that the surface water arising from the proposed development is discharged via one or more infiltration solutions such as soakaways then the design standard will be no flooding for storm events up to and including the 100 year return period storm event in accordance with the 'The Suds Manual' (2007). The resultant storage volume depends on the infiltration rate and contributing impermeable area for each specific soakaway; this will be determined at the detailed design stage.

6.6 Discharge to a Watercourse

6.6.1 Due to the watercourse bisecting site this is the obvious method of discharging surface water flows generated by the proposed development.

6.6.2 The watercourse and land drain that connects to the watercourse should be of sufficient depth to allow a suitable outfall with the necessary cover to any attenuation system.

6.6.3 As an increase in the impermeable area is proposed (as the site is currently Greenfield) there will be an increase in the resultant volume of surface water run-off being generated compared to the pre-development scenario. This increase in surface water volume means that a discharge rate of Qbar should be applied to the surface water flows.

6.6.4 As a connection is proposed to a watercourse it is an EA requirement that the surface water drainage proposals cater for the 100 year return period storm event with a 30% allowance for climate change.

6.6.5 The storage requirement for the 1 in 1 year return period storm event with a restricted discharge rate of 33.1l/s is approximately between 165m^3 and 377m^3.

6.6.6 The storage requirement for the 1 in 100 year return period storm event plus 30% allowance for Climate Change with a restricted discharge rate of 33.1l/s is approximately between 1670m^3 and 2671m^3.

6.7 Discharge to a Public Sewer

6.7.1 There is a 675mm diameter combined public sewer crossing the site from around the mid-point along the south eastern boundary off Back Commons (UU MH Ref.9002) to the southern corner of site (UU MH Ref.8001). There is no intention of discharging surface water flows to the public sewer system in light of the close proximity to the watercourse.

6.8 Climate Change

6.8.1 There are indications that the climate in the UK is changing significantly and it is widely believed that the nature of climate change will vary greatly by region. Current expert opinion indicates the likelihood that future climate change would produce more frequent short duration and high intensity rainfall events with the addition of more frequent periods of long duration rainfall.

6.8.2 Table 5 in the NPPF Technical Guidance states that the recommended national precautionary sensitivity ranges for increase of peak rainfall intensity is 30% until 2115. It is widely believed that the impact of climate change means there is likely to be a long term increase in the average sea levels, with an expectation that sea levels will rise gradually.

6.8.3 An increase in flood water levels means that future flooding events will occur more frequently and will have a greater impact.

6.8.4 Any increase in the level of flood risk to the proposed development from climate change is likely to be related to the increase in rainfall intensity and duration and its impact upon the surface water drainage system.

7.0 FOUL WATER MANAGEMENT

7.1 There are no existing foul water flows generated by the site.

7.2 There is a 675mm diameter combined public sewer crossing the site from around the mid-point along the south eastern boundary off Back Commons (UU MH Ref.9002) to the southern corner of site (UU MH Ref.8001). This would provide a point of connection for the foul water flows generated by the development; however the feasibility of making a connection would depend on levels. It may be necessary to provide a foul water pumping station to serve site and pump via a rising main back up to the system crossing site; this will need to be determined at the design stage.

7.3 Based on the detailed proposals for the construction of 345 residential properties the approximate peak foul water flows generated by the development are approximately 16.0l/s. This is based on 4000 litres per dwelling per 24 hours; the guidance contained within Sewers for Adoption 7th Edition (SfA).

8.0 SUMMARY AND CONCLUSIONS

8.1 This report was commissioned by the client to support a planning application for the construction of a residential development complete with estate roads, external works, footpaths, car parking, external lighting, landscaping, boundary walls, fencing, external services and drainage.

8.2 The site is in an area identified as having a 'low' probability of flooding on the Environment Agency Flood Map and is located in Flood Zone 1.

8.3 NPPF requires that planning applications for development proposals of 1 hectare or greater in Flood Zone 1 should be accompanied by a Flood Risk Assessment.

8.4 The residential nature of the development proposals means the classification of the site is 'more vulnerable' from NPPF Table 2.

8.5 The Flood Risk Assessment (FRA) has reviewed all sources of flood risk to both the proposed development and to the existing adjacent development as a result of the proposals, including; fluvial, tidal, pluvial, groundwater, sewers and flooding from artificial sources.

8.6 An Internet based search for flooding events did not recall any historical flooding in the immediate site area. The pre-development enquiries with the EA also failed to highlight any historical flooding events specific to the development site.

8.7 In light of the relatively low flood risk from all of the sources reviewed the principle focus of the FRA is on the effective management of surface water drainage.

8.8 It is proposed for surface water to be discharged to ground via soakaways if feasible; however it is more likely that a practical solution will be to discharge to the watercourse crossing site.

8.9 The Greenfield run-off rates have been calculated using the IH124/ICP-SUDS method based on the catchment characteristics of the site obtained from the FEH CD-ROM (v3.0). The mean annual peak rate of run-off QBar is calculated to be 33.1l/s.

8.10 The storage requirement for the 1 in 1 year return period storm event with a restricted discharge rate of 33.1l/s is approximately between 165m^3 and 377m^3.

8.11 The storage requirement for the 1 in 100 year return period storm event plus 30% allowance for Climate Change with a restricted discharge rate of 33.1l/s is approximately between 1670m^3 and 2671m^3.

8.12 It is proposed that the foul water be discharged to the combined public sewer crossing the southern corner of site.

8.13 The development is accessible for emergency access and egress during times of extreme flooding as the flood plain does not extend into the area proposed for residential development.

8.14 The development and its drainage systems should be designed to cope with intense storm events up to and including the 100 year return period rainfall event with an allowance for Climate Change (CC). If an extreme rainfall event exceeds the design criteria for the drainage system it is

likely that there will be some overland flows that are unable to enter the system, it is important that these potential overland flows are catered for within the proposed planning layout in the event that the capacity of the drainage system is exceeded.

8.15 As with any drainage system blockages within either the foul or surface water system have the potential to cause flooding or disruption. It is important that should any drainage systems not be offered for adoption to either the Water Company or the Local Authority then an appropriate maintenance regime be scheduled with an appropriate management company for these private drainage systems.

8.16 The Flood Risk Assessment is considered to be commensurate with the development proposals and in summary, the development can be considered appropriate for Flood Zone 1 in accordance with the NPPF.

9.0 RECOMMENDATIONS

9.1 The development and its drainage systems should be designed to cope with intense storm events up to and including the 100 year return period rainfall event with an allowance for Climate Change (CC).

9.2 Opportunities should be taken to provide soft landscaping where at all possible on site to assist in minimising surface water run-off. Added benefits include biodiversity and visual enhancements.

9.3 If an infiltration drainage solution cannot be provided for the surface water system proposed to serve the development, then discharge of surface water to the watercourse crossing site should be restricted to a maximum rate of QBar, calculated to be 33.1l/s.

9.4 It is important that should any drainage systems not be offered for adoption to either the Water Company or the Local Authority then an appropriate maintenance regime be scheduled with an appropriate management company for these private drainage systems.

9.5 Any overland flows generated by the proposed development must be directed away from any neighbouring development; safe avenues of overland flow away from the proposed dwellings are advised.

9.6 Foul water flows are to be discharged to the combined public sewer crossing the southern corner of the site; a pumped solution may be required to serve the whole development area.

BIBLIOGRAPHY & REFERENCES

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CIRIA 609: Sustainable drainage systems. Hydraulic, structural and water quality advice (2004).
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CIRIA 644: Building Greener (2007).
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Technical Guidance to the National Planning Policy Guidance, CLG (2012).

Drawing references

Planning Layout – Illustrative Masterplan: Waddow View, Clitheroe – 11-021-1002 (MCK Associates Ltd)
Topographical Land Survey – 0911/Topo Rev A – (Geomatic Surveys Ltd)

Web-based references

Bingmaps – http://www.bing.com/Maps/
British Geological Survey – http://www.bgs.ac.uk/opengeoscience/home.html
Ribble Valley Borough Council – http://www.ribblevalley.gov.uk/
Chronology of British Hydrological Events – www.dundee.ac.uk/
CIRIA – http://www.ciria.org/
Cranfield University – http://www.landis.org.uk/soilscapes/
Environment Agency – www.environment-agency.gov.uk/
FloodProBE – http://www.floodprobe.eu/
Flood Forum – http://www.floodforum.org.uk/
Flood London – http://www.floodlondon.com/
Flood Resilience Group – http://www.floodresiliencegroup.org/frg/
Google Maps – http://maps.google.co.uk/
London Resilience – http://www.londonprepared.gov.uk/
Streetmap – http://www.streetmap.co.uk/
United Utilities – http://www.unitedutilities.com/
US Army Corps of Engineers – http://www.hec.usace.army.mil/software/hec-ras/
Watertight International – http://www.watertightinternational.com/

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APPENDIX A: LOCATION PLAN

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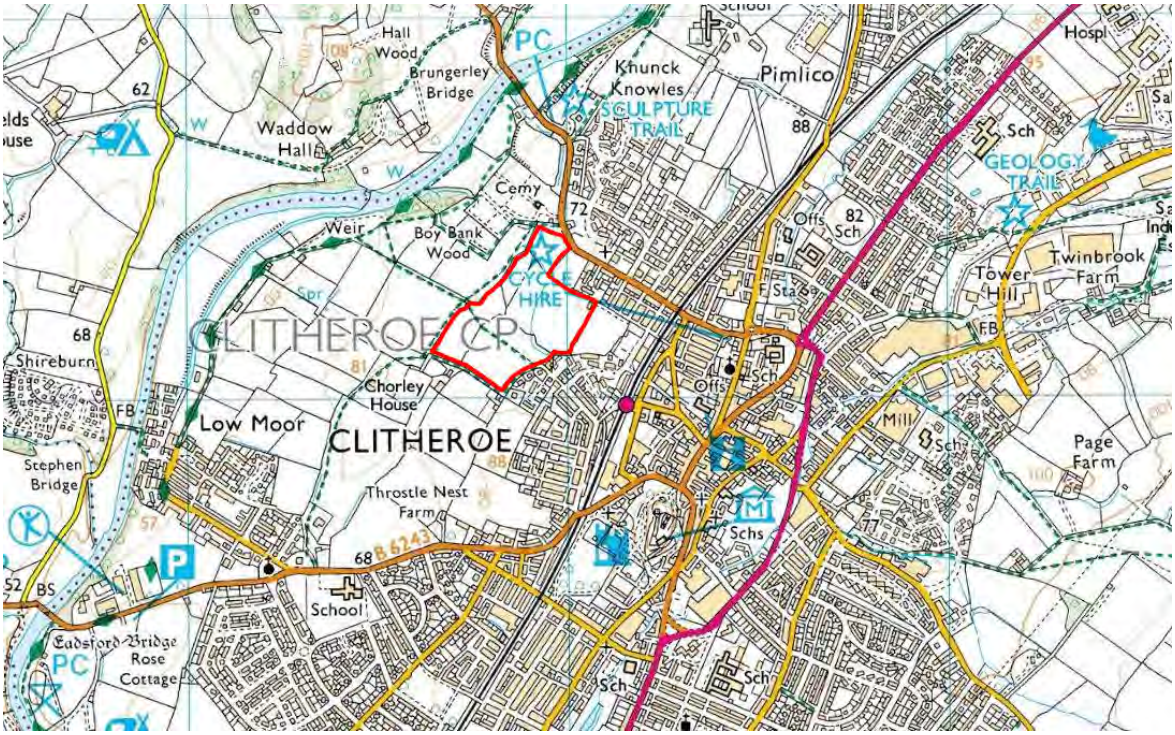
LOCATION PLAN
WADDOW VIEW, CLITHEROE



OS X (Eastings)	374096
OS Y (Northings)	442181
Nearest Post Code	BB7 2HX
Lat (WGS84)	N53:52:31 (53.875177)
Long (WGS84)	W2:23:44 (-2.395478)
LR	SD740421
mX	-266663
mY	7112013

APPENDIX B: TOPOGRAPHIC SURVEY

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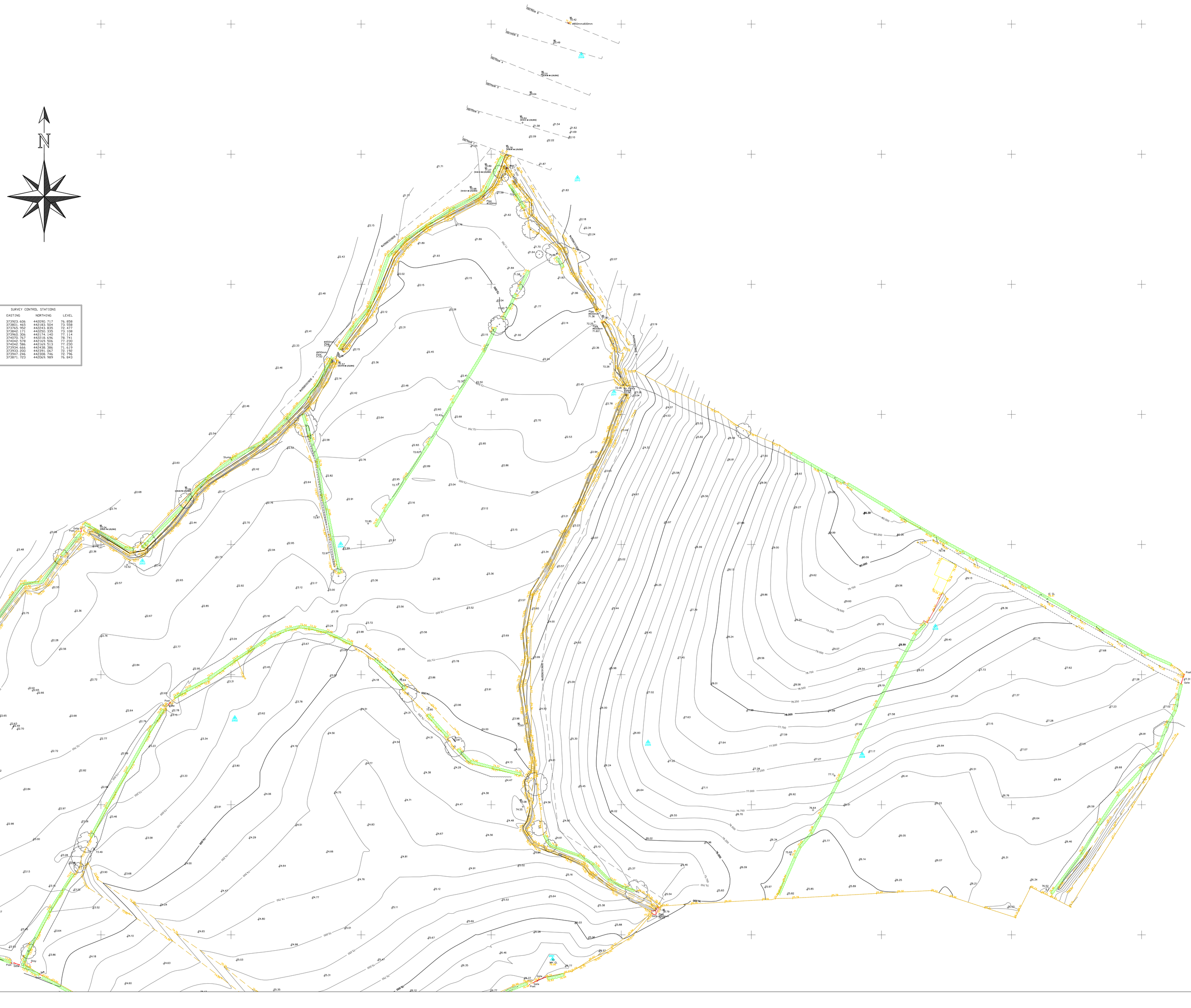

SURVEY CONTROL STATIONS

STN	EASTING	NORTHING	LEVEL
2001	373923. 606	442090. 717	76. 858
2002	373801. 465	442183. 504	73. 558
2003	373765. 952	442243. 835	72. 477
2004	373842. 171	442250. 335	73. 108
2005	373960. 306	442174. 140	77. 114
2006	374070. 767	442218. 696	78. 741
2007	374042. 578	442169. 506	77. 230
2008	374042. 586	442169. 513	77. 230
2009	373934. 666	442438. 386	71. 619
2010	373933. 200	442391. 067	72. 192
2011	373947. 246	442308. 746	72. 796
2012	373871. 723	442069. 989	76. 843

LEGEND

CONTROL STATIONS	△
MANHOLE	▭ MH CL 31.20
BUSH	
TREE	
DROP KERB	— — — — —
EMBANKMENT	TOP BANK BOTTOM BANK
OVERHEAD ELECTRICITY LINE	— · — · —
OVERHEAD TELEPHONE LINE	—— - - —— - - ——
FOOTPATH	— — — — —
FENCE	|——|——
HEDGE	
FOLIAGE	
DITCH	═ ═ ═
VERGE	— — — — —
EXISTING BUILDING	▭
MAIN CONTOUR	50.00
CONTOUR	49.50
SW SEWER	— - —— - —— - —
FW SEWER	— — — — —

AV	Air Valve
BH	Borehole
BD	Bollard
BM	Bench Mark
BS	Bus Stop
BT	BT Inspection Chamber
BL	Bed Level
CATV	Cable TV Cover
CL	Cover Level
C/L	Chain Link Fence
CP	Catch Pit
CPS	Concrete Paving Slab
ECB	Electricity Control Box
EH	Building Eaves Level
ER	Earthing Rod
FB	Flower Bed
FH	Fire Hydrant
FL	Floor Level
GH	Greenhouse
GP	Gate Post
GR	Grate
GV	Gas Valve
G	Gully
IC	Inspection Chamber
IL	Invert Level
KO	Kerb Outlet
JB	Junction Box
LP	Lamp Post
MH	Man Hole
MK	Marker Post
MS	Mile Stone Marker
NP	Street Name Plate
O/H	Overhead
P	Post
PB	Post Box
PI	Pipe
PM	Parking Meter
P/R	Post & Rail Fence
P/W	Post & Wire Fence
PYL	Electricity Pylon
RE	Rodding Eye
RH	Building Ridge Level
RSJ	Reinforced Steel Joist
R/W	Retaining Wall
RWP	Rainwater Pipe
SC	Stop Cock
SL	Soffit Level
SP	Sign Post
ST	Stop Tap
SV	Stop Valve
SY	Stay Wire
TOW	Top Of Wall Level
TH	Trial Hole
TL	Traffic Light
TP	Telegraph Pole
UTL	Unable To Lift
WM	Water Meter
WL	Water Level
VH	Building Valley Level

Disclaimer

Man Entry to sewers has not been undertaken. Depths, Pipesizes etc are measured from the ground. All sewers and inverts to be checked prior to any works commencing on site. Geomatic Surveys Limited are not resposible for manholes, services, information not surveyed which may have an impact on site development.

Boundaries shown are physical and may not represent legally conveyed ownership

Tree species have only been identified using basic identification techniques. For precise tree species identification, it is recommended that a qualified aboroculturist is used prior to tree removal.

REV	DATE	DESCRIPTION	BY	APP.
A	08.03.12	Culvert Pipe sizes and Openings confirmed on the drawing.	DCW	

Sheet Layout

Sheet 1
Sheet 2

Survey Information

The Survey is related to Ordnance Survey National Grid and Datum, using GPS.

Geomatic Surveys Ltd
LAND SURVEYORS AND CONSULTING ENGINEERS
Bank House, The Paddock
Wilmslow Road
Handforth
Cheshire
SK9 3HQ
Tel/Fax:– 01625 521405
Email: info@geomaticsurveys.co.uk
Web: www.geomaticsurveys.co.uk

Client

BETTS ASSOCIATES

Project Title

WADDOW VIEW
BACK COMMONS
CLITHEROE

Drawing Title

TOPOGRAPHICAL SURVEY

Drawn	Checked	Surveyed Date
DCW	IRH	23/02/2012
Date	**Scale**	**Sheet No.**
27/02/2012	1:500 @ A0	SHEET 1 OF 2
Drg. No.		**Rev**
0911/Topo		A

SURVEY CONTROL STATIONS			
STN	EASTING	NORTHING	LEVEL
2001	373923.606	442090.717	76.858
2002	373801.465	442183.504	73.558
2003	373765.952	442243.835	72.477
2004	373842.171	442250.335	73.108
2005	373960.306	442174.140	77.114
2006	374070.767	442218.696	78.741
2007	374042.578	442169.506	77.230
2008	374042.586	442169.513	77.230
2009	373934.666	442438.386	71.619
2010	373933.200	442391.067	72.192
2011	373947.246	442308.746	72.796
2012	373871.723	442069.989	76.843

LEGEND

CONTROL STATIONS
MANHOLE
BUSH
TREE
DROP KERB
EMBANKMENT (TOP BANK / BOTTOM BANK)
OVERHEAD ELECTRICITY LINE
OVERHEAD TELEPHONE LINE
FOOTPATH
FENCE
HEDGE
FOLIAGE
DITCH
VERGE
EXISTING BUILDING
MAIN CONTOUR (50.00)
CONTOUR (49.50)
SW SEWER
FW SEWER

AV	Air Valve
BH	Borehole
BD	Bollard
BM	Bench Mark
BS	Bus Stop
BT	BT Inspection Chamber
BL	Bed Level
CATV	Cable TV Cover
CL	Cover Level
C/L	Chain Link Fence
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GV	Gas Valve
G	Gully
IC	Inspection Chamber
IL	Invert Level
KO	Kerb Outlet
JB	Junction Box
LP	Lamp Post
MH	Man Hole
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MS	Mile Stone Marker
NP	Street Name Plate
O/H	Overhead
P	Post
PB	Post Box
PI	Pipe
PM	Parking Meter
P/R	Post & Rail Fence
P/W	Post & Wire Fence
PYL	Electricity Pylon
RE	Rodding Eye
RH	Building Ridge Level
RSJ	Reinforced Steel Joist
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SC	Stop Cock
SL	Soffit Level
SP	Sign Post
ST	Stop Tap
SV	Stop Valve
SY	Stay Wire
TOW	Top Of Wall Level
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TP	Telegraph Pole
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A	08.03.12	Culvert Pipe sizes and Openings confirmed on the drawing.	DCW	

Sheet Layout

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Client

BETTS ASSOCIATES

Project Title

WADDOW VIEW
BACK COMMONS
CLITHEROE

Drawing Title

TOPOGRAPHICAL SURVEY

Drawn	Checked	Surveyed Date
DCW	IRH	23/02/2012
Date	Scale	Sheet No.
27/02/2012	1:500 @ A0	SHEET 2 OF 2
Drg. No.	0911/Topo	Rev. A

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APPENDIX C: PROPOSED PLANNING LAYOUT

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Illustrative masterplan

Waddow View
Clitheroe

Layout narration

1. New primary entrance with carefully designed landscape features create an inviting access point.
2. Carefully spaced outward facing feature blocks, overlooking a landscaped amenity area creating an attractive setting along Kirkmoor Road. On street parking restricted providing an uncluttered frontages at the gateway into the development.
3. Low density blocks fronting Kirkmoor Road, building lines respected and boundary treatments carefully selected to help assimilate the buildings into the landscape setting. Existing hedgerow maintained.
4. Small hard landscaped court with soft edges.
5. Primary nodal area creates impact upon arrival. Formal open space encapsulated by strong blocks. Orientation and type critical to the success of this area. Dual aspect gateway blocks frame routes in every direction and visually permeable boundary treatments softened by landscaping promote a legible well defined area.
6. Rural setting with hedge lined streets, careful consideration to vista terminations at the open space area.
7. Outward facing blocks, well spaced creating a soft edge overlooking the openspace areas.
8. Attractive landscape feature and setting which highlights important pedestrian/cycle routes.
9. Street follows a route which forms an integral part of and interacts with the building form, open space areas and landscape features. This principle of interaction along this important route creates an interesting and noteworthy journey through the development.
10. Prominent blocks with mass, character and a suitable street presence to stand at the head of these important vistas. Frontage parking minimised creating uncluttered views of this important area.
11. Well connected and accessible open space area. Perception changes depending on which approach route is taken, achieved by carefully manipulating vistas, pinch points, block massing and positioning. Attractive and distinctive landscaping and street furniture adds further to this effect.
12. Careful positioning and orientation of blocks around this attractive amenity area. Existing water feature retained and enhanced.
13. Irregular varied streets 'nuts and bolts' approach, careful consideration given to parking arrangements. Soft edges and tree planting will help create an attractive and inviting environment. Pedestrian, priority area which help prevent 'rat running'.
14. Bus only barrier allowing bus only access to the northern part of the development.

Key

- Focal building/s
- Landmark building/s
- Primary vista enforcing desire routes
- Potential/existing footpath Cycle/links connections
- Existing Footpath/cycle routes to wider area
- New pedestrian/ cycle link
- Hard landcaped pedestrian priority street.
- Crèche
- Bus street only connection.

mck associates limited
architecture | building surveying | urban design

Job no: 11-021-1002 • Scale: 1/1000 • Sheet Size: A1 • Date: May 2012 • Revision: B • Drawn: M.King

Note this layout plan is for indicative purposes only for the outline planning application

APPENDIX D: EA FLOODING INFORMATION & CORRESPONDENCE

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Environment Agency

Enter a postcode or place name: Clitheroe, Lancashire Go

Other topics for this area... Risk of Flooding from Rivers and Sea

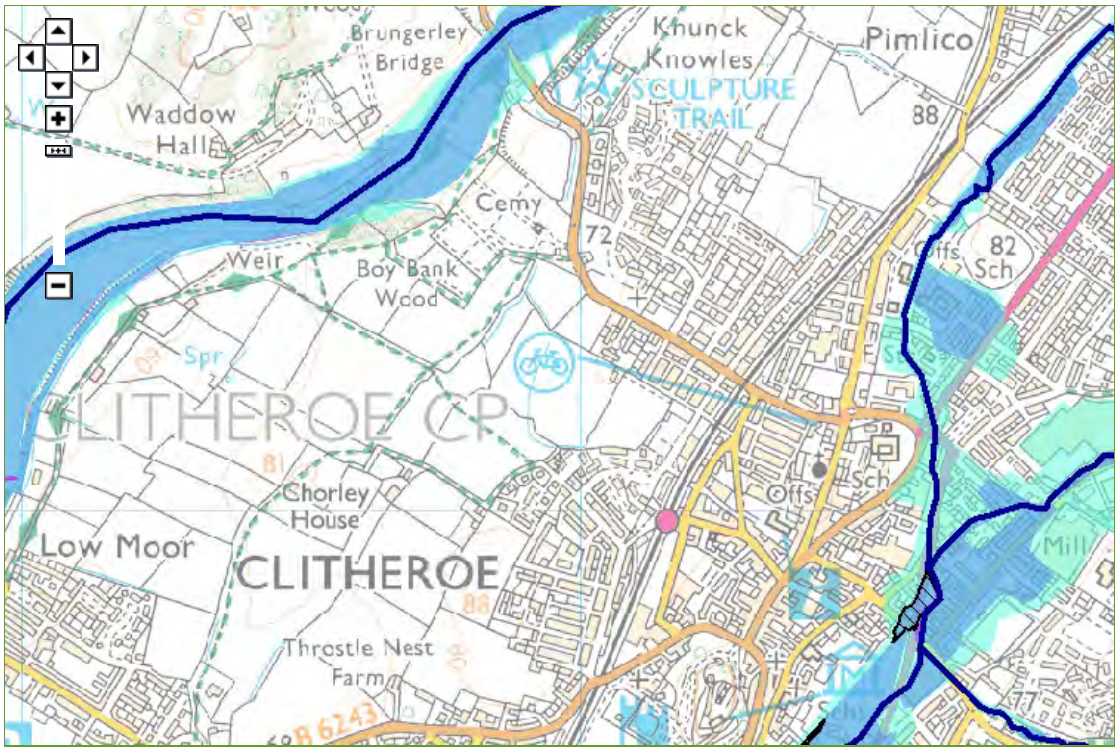
Risk of Flooding from Rivers and Sea

Map legend

Click on the map to see what is the Risk of Flooding at a particular location.

- Flood Maps
  - Flooding from rivers or sea without defences
  - Extent of extreme flood
  - Flood defences
  - Areas benefiting from flood defences
  - Main rivers

X: 373,966;Y: 442,241 at scale 1:10,000 Data search Text only version



Flood Map – Information Warnings

Manchester Ship Canal

Flood Mapping of the Manchester Ship Canal in Trafford, Salford and Warrington may be subject to revision as a result of representations. For further information please contact the Environment Agency on 03708 506 506.
Users of the Flood Zone Map should be aware that we have received a Judicial review challenge to the mapping of the Manchester Ship Canal at Trafford, Salford and Warrington on the ground that the preparation of the map is flawed In respect of our consideration of the role of the sluice gates in preventing flooding.
We are defending the challenge and believe and are advised that it is ill-founded. Nevertheless, pending determination of the challenge, users of the map need to consider whether the existence of the Challenge, and the basis of it, affects the weight they judge may be given to the zoning of the Manchester Ship Canal within the Flood Map.

More about flooding:

Understanding the flood map

A more detailed explanation to help you understand the flood map shown above.

Current flood warnings

We provide flood warnings online 24 hours a day. Find out the current flood warning status in your local area.

Flood map - your questions answered

Answers to commonly asked questions about the flood map.

Environment Agency

Interactive Maps

Flood Risk for X:373962, Y:442235

Be prepared

We do not have an assessment of flood risk for the area which you have selected. This may be because the area selected is outside the floodplain. It could also be because we have been unable to assess the likelihood of flooding for this area because we did not have sufficient information (this applies to fewer than 1% of the properties in England and Wales in the flood outline)

For a fuller explanation of flood likelihood, click here.

Be aware:

Our maps only cover flooding from rivers and the sea. Flooding can occur at any time and in any place from sources such as rising ground water levels, burst water mains, road drains, run-off from hillsides, sewer overflows etc.
Click here to find out more.
To find out how to be prepared for all types of flooding go to our Floodline pages or call Floodline on tel: 0845 988 1188.
The information on the likelihood of flooding is not intended to be used by people applying for planning permission for new developments. To find out how the Flood Map can help when planning a new development, click here.

Author: The Environment Agency | WIYBYSUPPORT@environment-agency.gov.uk
Last updated: 28th March 2012

C1/SEA/14/CW/RN/RN/08/L01

18th January 2012

BETTS ASSOCIATES
CONSULTING ENGINEERS

Mr C. Worswick
Environment Agency
Sent via e-mail [colin.worswick@environment-agency.gov.uk]

Dear Colin,

WADDOW VIEW, CLITHEROE
RIVER MODELLING METHODOLOGY

I am writing to propose a methodology for the modelling of an unnamed ordinary watercourse running through our clients proposed development.

Development Proposals
The preliminary development proposals are attached and are residential in nature. The river modelling exercise is proposed to determine accurately the floodplain extents and in turn the allowable development extents and/or the flood risk mitigation deemed necessary. The river modelling will be the principle component of the future FRA.

Watercourse Data & Investigation
The EA have advised that they do not have modelling data for this brook and I would be pleased if you could confirm that this is still the case. The reason the modelling is proposed is due to the fact that the possible flood plain extent from the unnamed watercourse is not currently known.

We will have the brook surveyed in detail (including cross sections at 10m intervals) and a standard site-wide topographic survey undertaken to allow the river model to be constructed.

Watercourse Modelling Proposals
We use HEC-RAS in conjunction with the FEH catchment data to model the watercourse. The analysis will look at a variety of standard elements including climate change sensitivity. The resultant output from this model will inform the next stage of the proposal.

I would be pleased if you could confirm that you find the proposals outlined acceptable in principle.

I trust you will find the above of assistance, however, if you have any queries or require further information please do not hesitate to contact me.

Yours sincerely,

Richard Nicholas
Associate
BETTS ASSOCIATES

Enc.

Cc. Jane Dickman (Dickman Associates)

Old Marsh Farm Barns
Welsh Road, Sealand
Flintshire CH5 2LY
Telephone: 01244 288 178
Fax: 01244 288 516

www.betts-associates.co.uk

APPENDIX E: FEH CATCHMENT DATA & DESCRIPTORS

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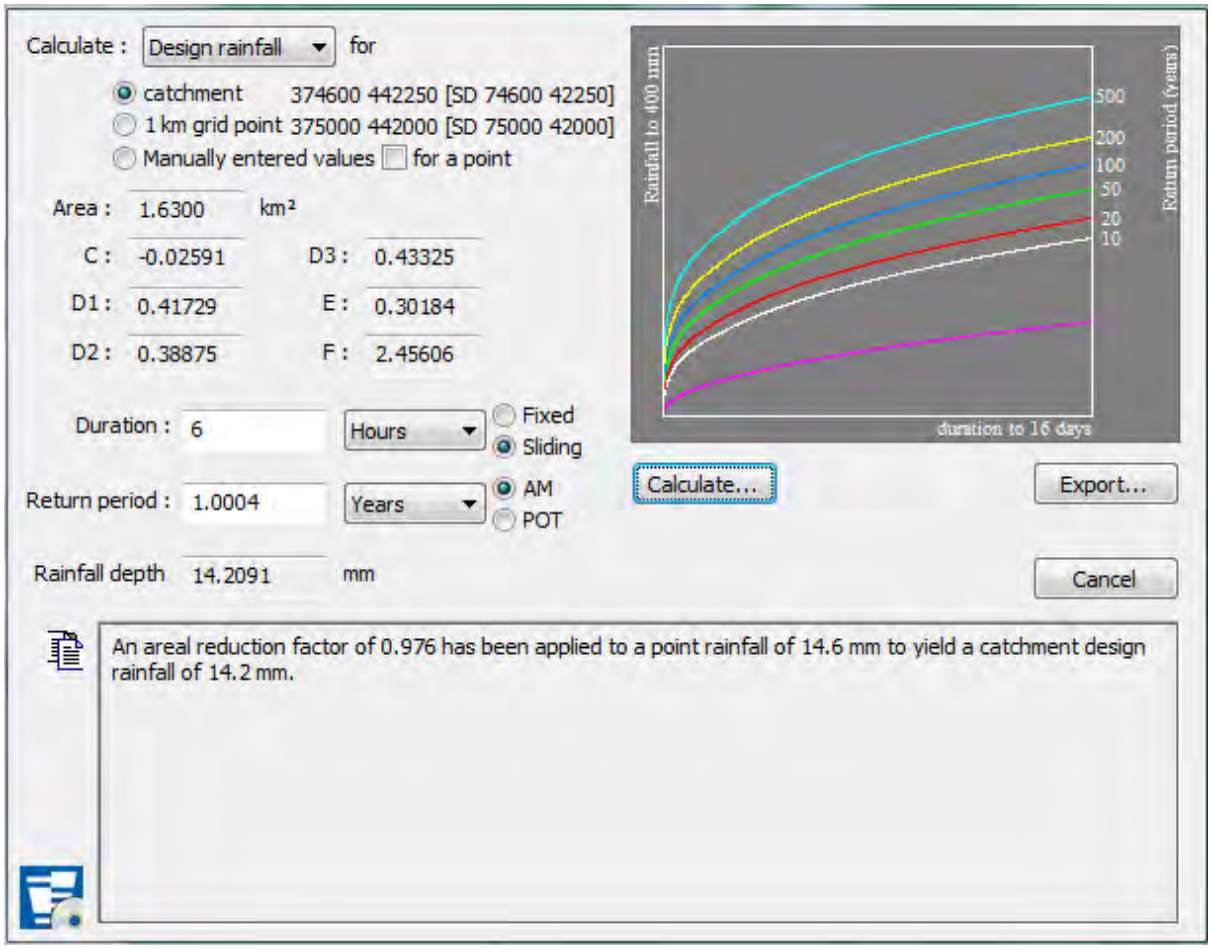
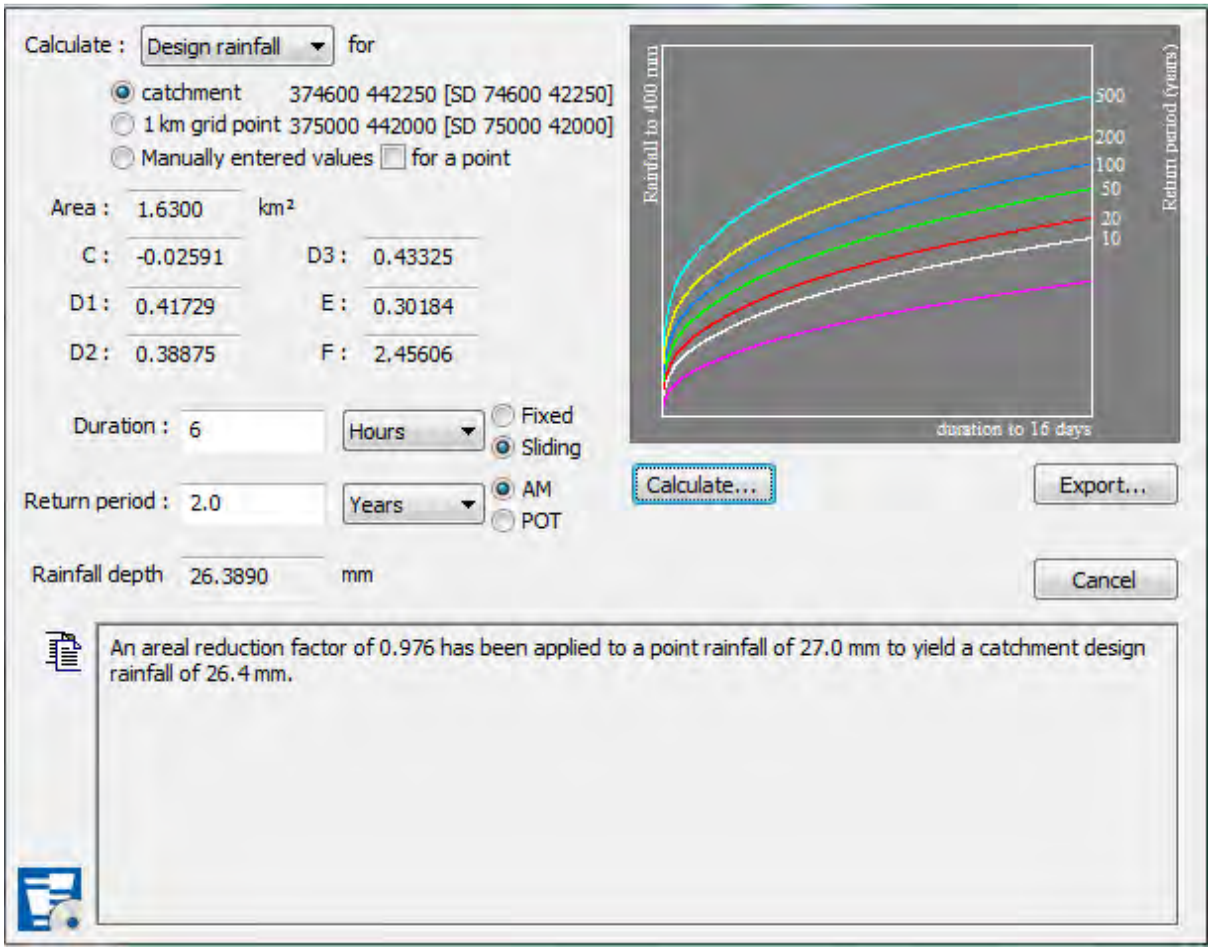
VERSION	FEH CD-ROM	Version	3	exported at	14:59:28	GMT	Fri	30-Mar-12	
CATCHMENT	GB	374600	442250	SD 74600 42250					
AREA	1.63								
ALTBAR	98								
ASPBAR	283								
ASPVAR	0.36								
BFIHOST	0.434								
DPLBAR	1.83								
DPSBAR	39.9								
FARL	0.995								
LDP	3.33								
PROPWET	0.6								
RMED-1H	10.4								
RMED-1D	42.4								
RMED-2D	58.8								
SAAR	1222								
SAAR4170	1158								
SPRHOST	30.35								
URBCONC1990	0.449								
URBEXT1990	0.0429								
URBLOC1990	0.395								
C	-0.02591								
D1	0.41729								
D2	0.38875								
D3	0.43325								
E	0.30184								
F	2.45606								
C(1 km)	-0.025								
D1(1 km)	0.406								
D2(1 km)	0.39								
D3(1 km)	0.43								
E(1 km)	0.3								
F(1 km)	2.46								

DESIGN RAINFALL DEPTHS





Calculate : Design rainfall for

catchment 374600 442250 [SD 74600 42250]
1 km grid point 375000 442000 [SD 75000 42000]
Manually entered values for a point

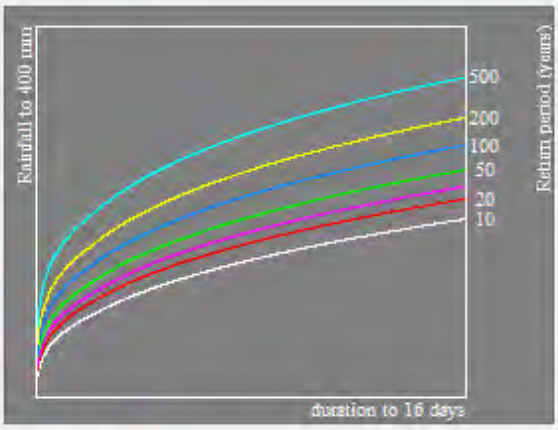
Area : 1.6300 km²

C : -0.02591 D3 : 0.43325
D1 : 0.41729 E : 0.30184
D2 : 0.38875 F : 2.45606

Duration : 6 Hours Fixed Sliding

Return period : 30.0 Years AM POT

Rainfall depth 57.0391 mm



Calculate... Export... Cancel

An areal reduction factor of 0.976 has been applied to a point rainfall of 58.4 mm to yield a catchment design rainfall of 57.0 mm.

Calculate : Design rainfall for

catchment 374600 442250 [SD 74600 42250]
1 km grid point 375000 442000 [SD 75000 42000]
Manually entered values for a point

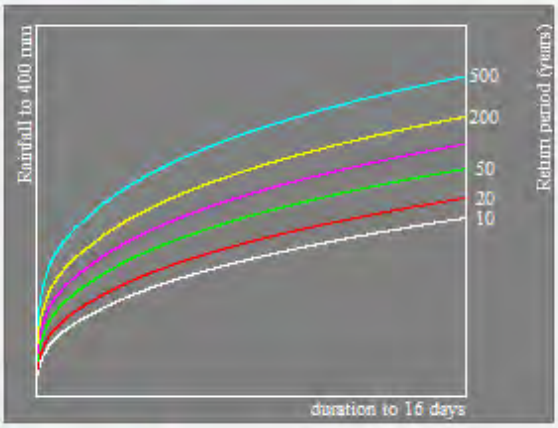
Area : 1.6300 km²

C : -0.02591 D3 : 0.43325
D1 : 0.41729 E : 0.30184
D2 : 0.38875 F : 2.45606

Duration : 6 Hours Fixed Sliding

Return period : 100.0 Years AM POT

Rainfall depth 77.8112 mm



Calculate... Export... Cancel

An areal reduction factor of 0.976 has been applied to a point rainfall of 79.7 mm to yield a catchment design rainfall of 77.8 mm.

APPENDIX F: SURFACE WATER RUN-OFF CALCULATIONS

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ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.304
Area (ha)	9.200	Urban	0.000
SAAR (mm)	1222	Region Number	Region 10

Results l/s

QBAR Rural	33.1
QBAR Urban	33.1
Q1 year	28.8
Q1 year	28.8
Q30 years	56.1
Q100 years	68.9

APPENDIX G: STORMWATER STORAGE ESTIMATES

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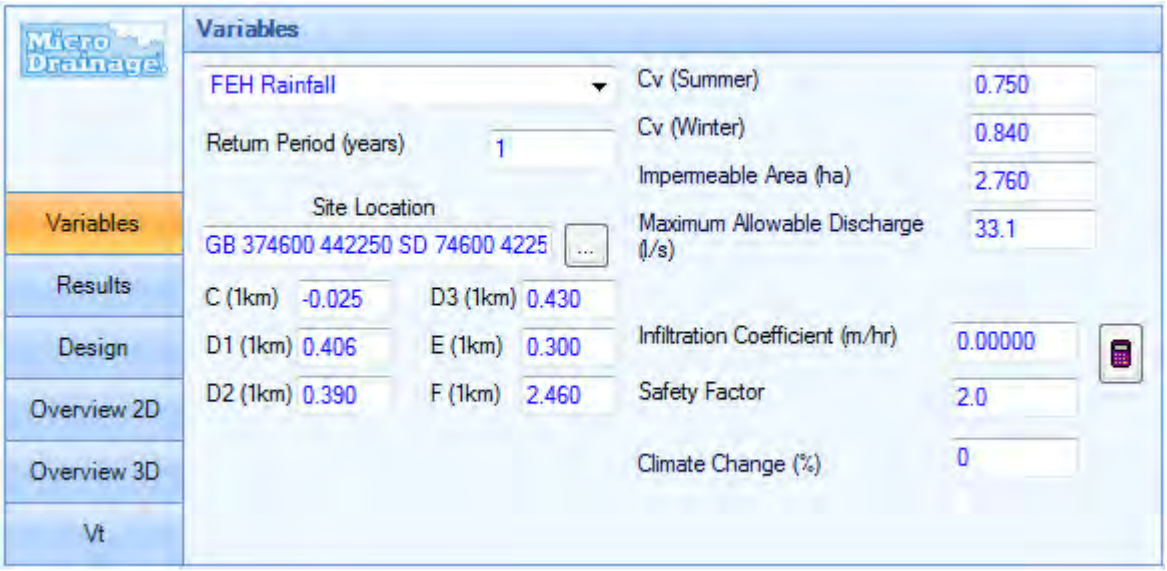
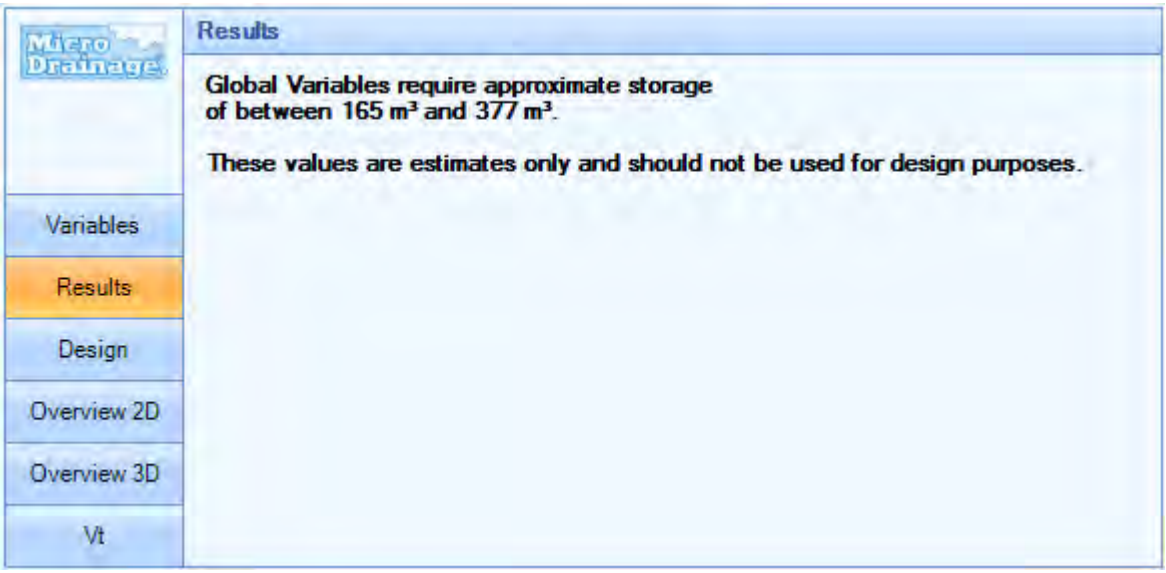
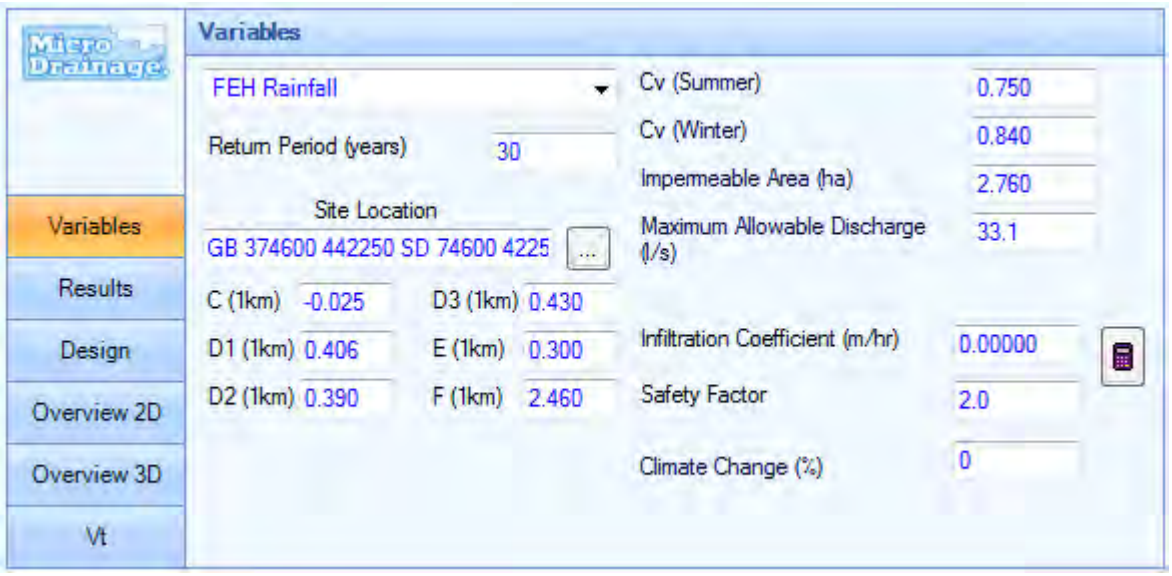
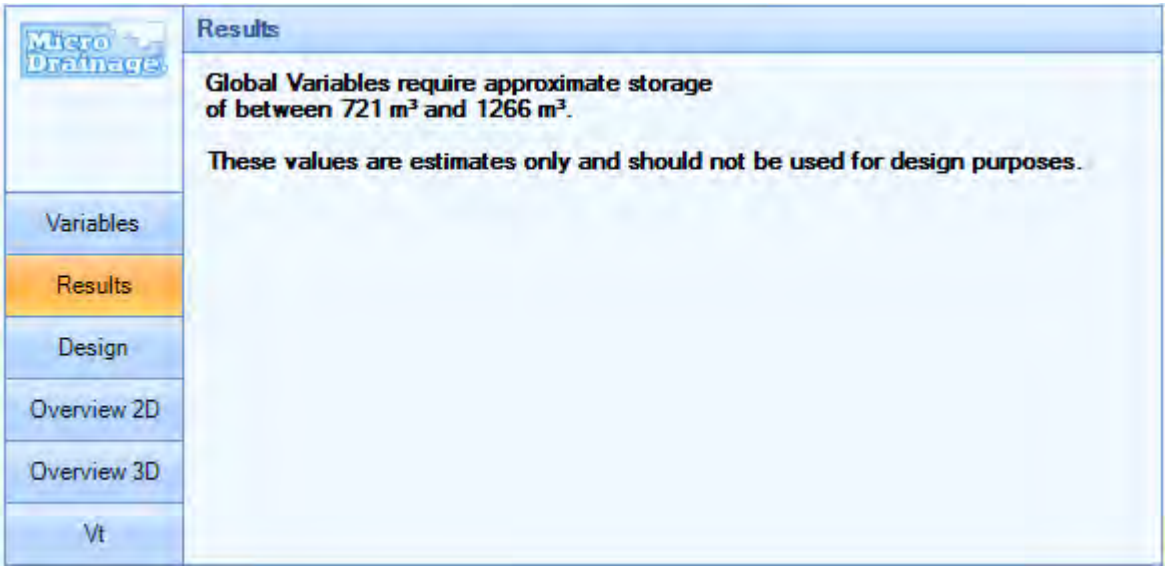
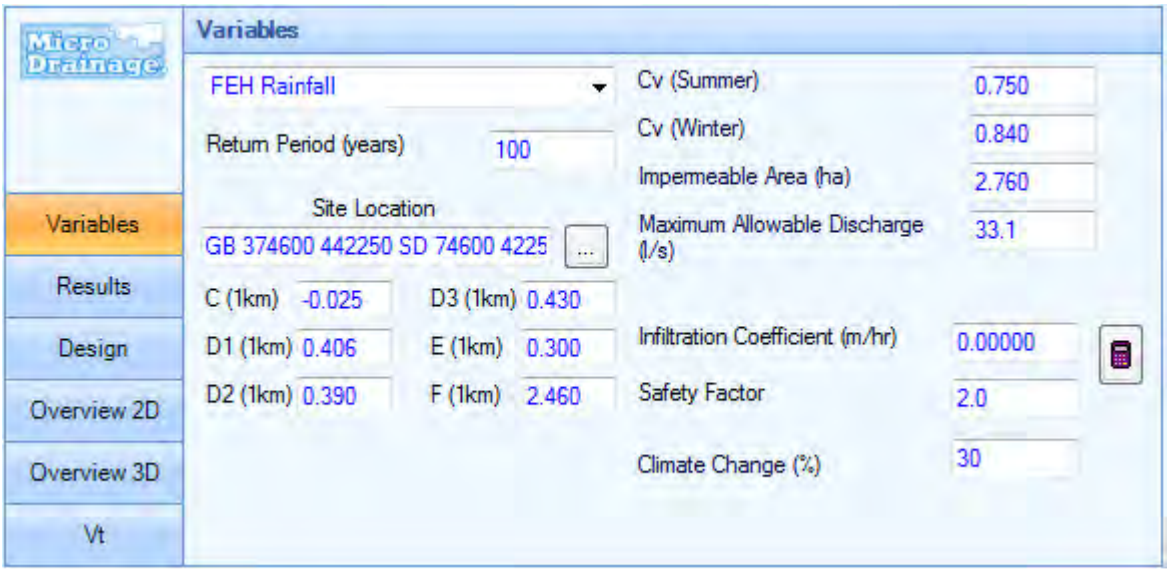
STORMWATER STORAGE ESTIMATES

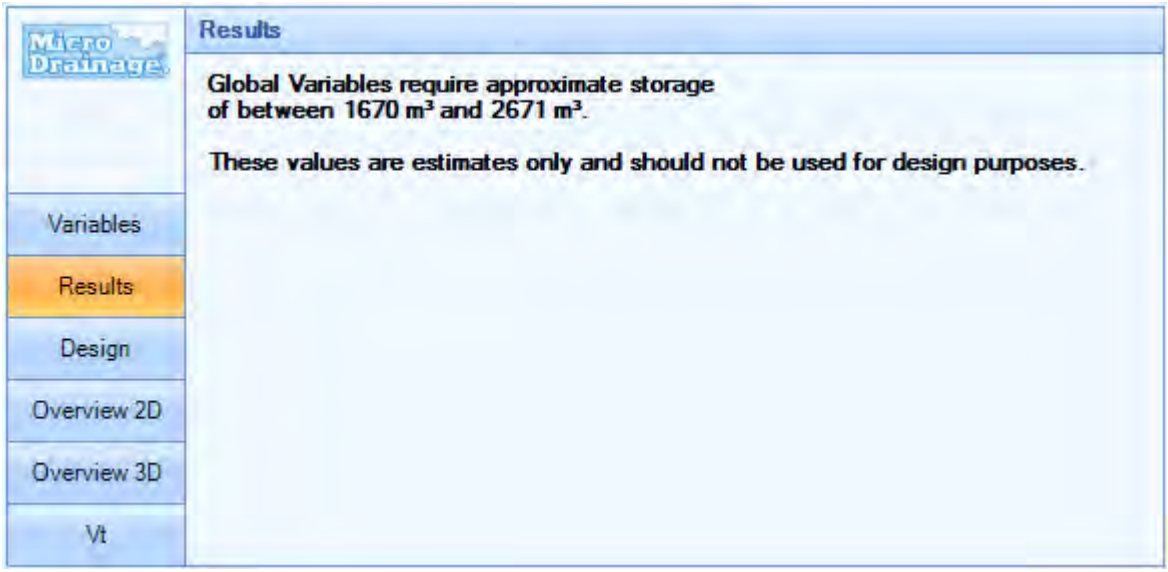





Variables
FEH Rainfall
Return Period (years) 30
Site Location
GB 374600 442250 SD 74600 4225
C (1km) -0.025
D1 (1km) 0.406
D2 (1km) 0.390
D3 (1km) 0.430
E (1km) 0.300
F (1km) 2.460
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 2.760
Maximum Allowable Discharge (l/s) 33.1
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 0
Variables
Results
Design
Overview 2D
Overview 3D
Vt


Results
Global Variables require approximate storage of between 721 m³ and 1266 m³.
These values are estimates only and should not be used for design purposes.
Variables
Results
Design
Overview 2D
Overview 3D
Vt


Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FEH Rainfall
Return Period (years) 100
Site Location
GB 374600 442250 SD 74600 4225
...
C (1km) -0.025
D3 (1km) 0.430
D1 (1km) 0.406
E (1km) 0.300
D2 (1km) 0.390
F (1km) 2.460
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 2.760
Maximum Allowable Discharge (l/s) 33.1
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 30


Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage of between 1670 m³ and 2671 m³.
These values are estimates only and should not be used for design purposes.

APPENDIX H: ReFH FLOW ESTIMATES

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BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS

JOB NO: SEA/14 MADE BY: RDN
DATE: 10.04.2012 CHECKED BY:
SHEET NO: 1 REV: A

JOB TITLE: WADDOW VIEW, CLITHEROE

FLOW RATES FOR MEC-RAS MODEL.

Primary Watercourse

Urban Area Imp Catchment = 21630 Sqm (2.163) ha

Peak Rainfall			
	1/yr	10.2 mm/hr	Q_1 = 61.3 l/s
	100yr	33.0 mm/hr	Q_{100} = 198.3 l/s
[*30% CC]	100+30%*	42.9 mm/hr	Q_{100+CC} = 257.8 l/s
	1000yr	59.5 mm/hr	Q_{1000} = 357.5 l/s

Greenfield Area Catchment = 35436 Sqm (3.544 ha)

SAAR = 1222 mm / SPR = 30.35

Q_1 = 11.1 l/s
Q_{100} = 26.5 l/s
† Q_{100+CC} = 31.8 l/s
Q_{1000} = 38.8 l/s

[† 20% CC]

Total Flow (peak) rates: Urban & Greenfield

Q_1 = 72.4 l/s	0.0724
Q_{100} = 224.8 l/s	0.2248
Q_{100+CC} = 289.6 l/s	0.2896
Q_{1000} = 396.3 l/s	0.3963

Secondary tributary

Greenfield Area Catchment = 56578 Sqm (5.652) ha

Total Flow (peak) rates:

Q_1 = 17.7 l/s	0.0177
Q_{100} = 42.3 l/s	0.0423
† Q_{100+CC} = 50.8 l/s	0.0508
Q_{1000} = 61.8 l/s	0.0618

[† 20% CC]

TEL: FAX:
EMAIL: enquiries@betts-associates.co.uk

ACE

The Institution of Structural Engineers

APPENDIX I: CROSS-SECTIONS THROUGH THE WATERCOURSE

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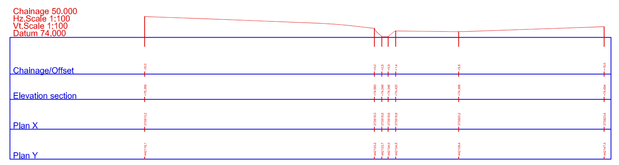

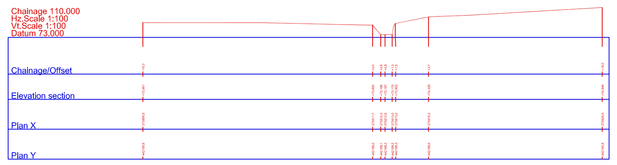

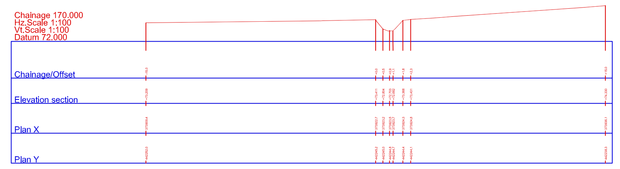

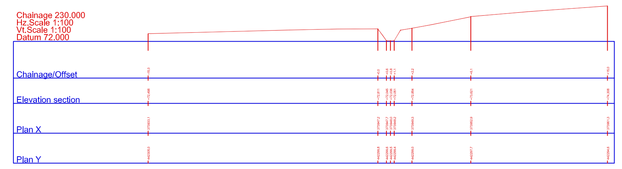

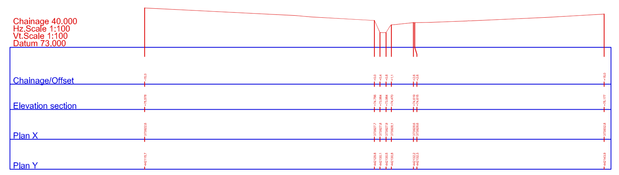

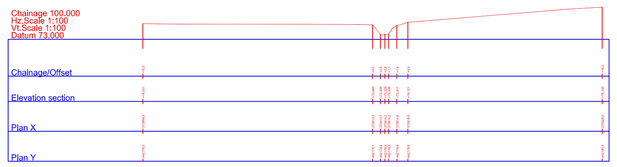

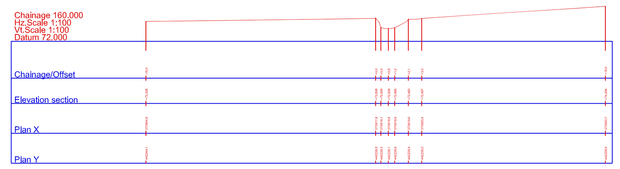

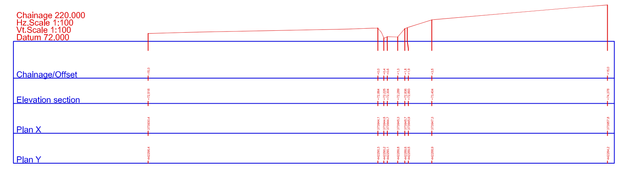

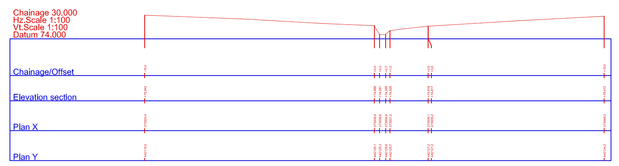

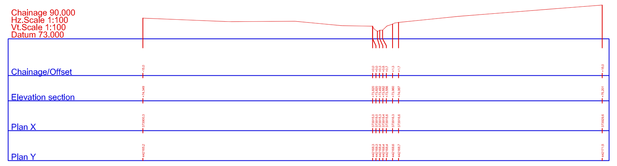

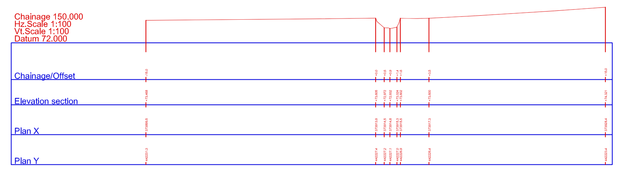

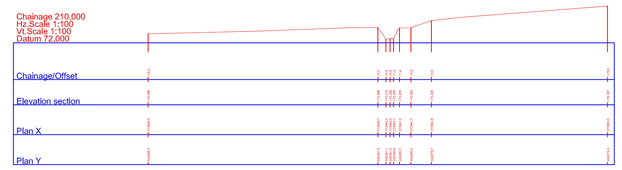

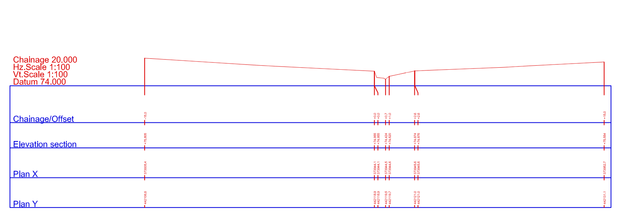

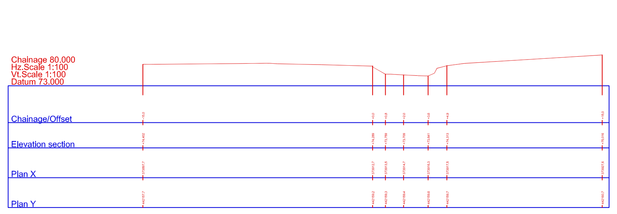

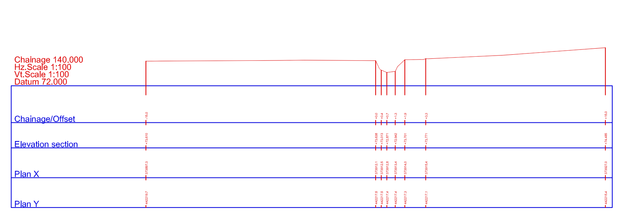

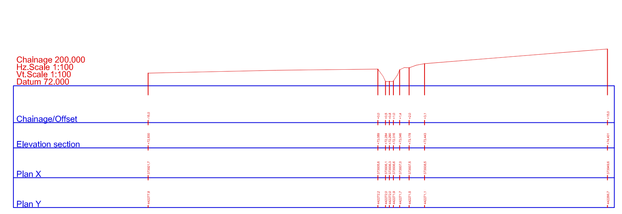

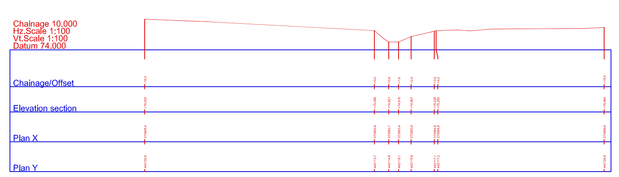

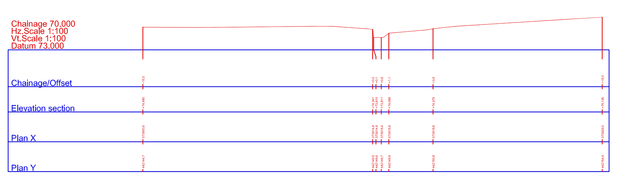

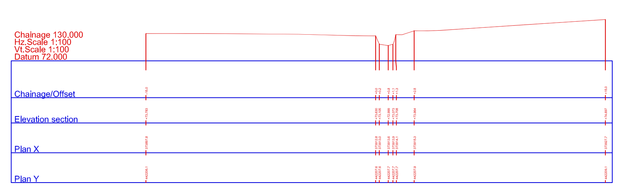

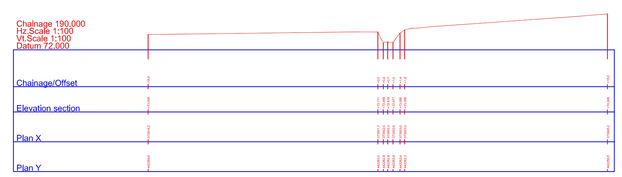

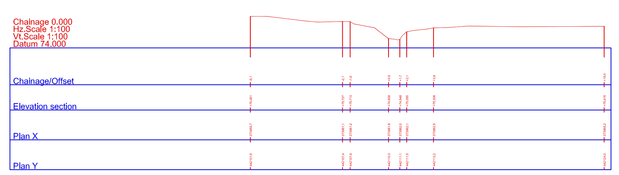

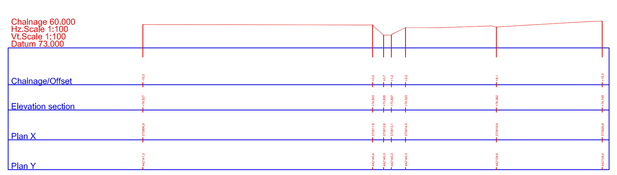

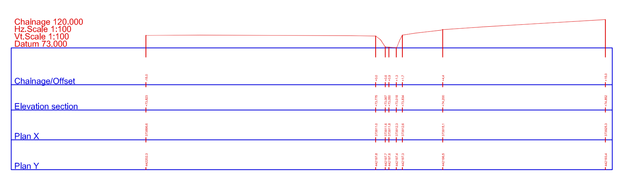

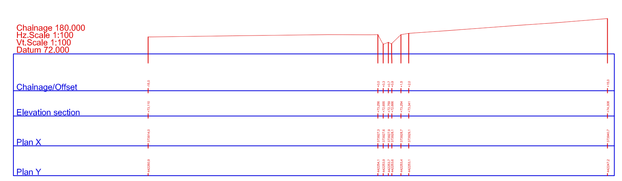

WATERCOURSE 1

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REV	DATE	DESCRIPTION	BY	APP.

Sheet Layout

Sheet 1

Survey Information
All levels are related to Ordnance Survey Datum.
Refer to Topographical Survey for details.

Geomatic Surveys Ltd
LAND SURVEYORS AND CONSULTING ENGINEERS
Bank House, The Paddock
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Client

BETTS ASSOCIATES

Project Title

WADDOW VIEW
BACK COMMONS
CLITHEROE

Drawing Title

SECTIONS

Drawn	Checked	Surveyed Date
DCW	IRH	24/02/2012
Date	Scale	Sheet No.
28/02/2012	1:200 @ A0	SHEET 1 OF 3
Drg. No		Rev
0911/Sections		

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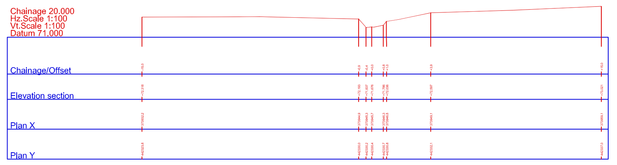

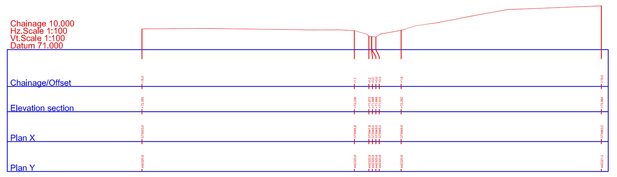

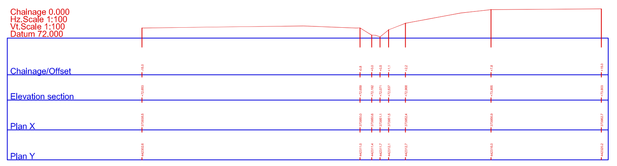

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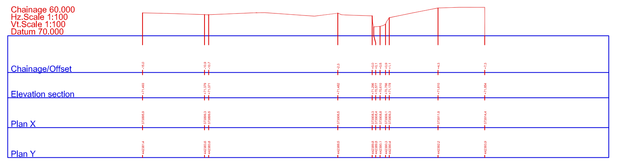

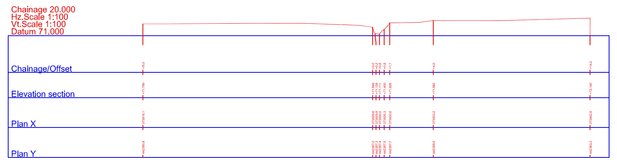

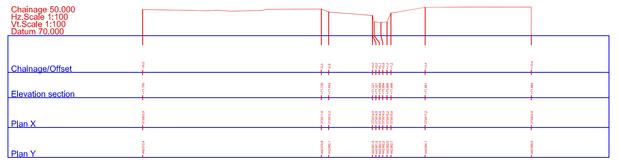

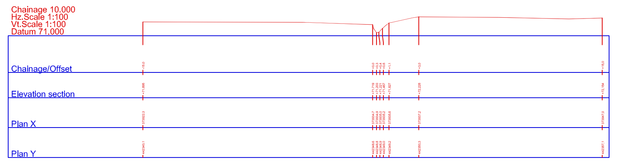

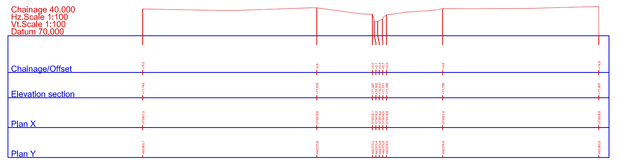

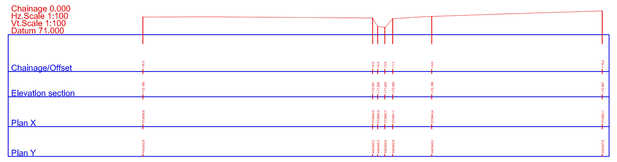

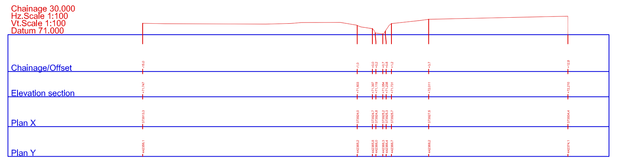

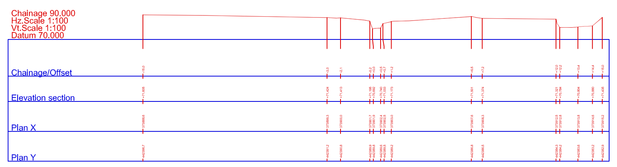

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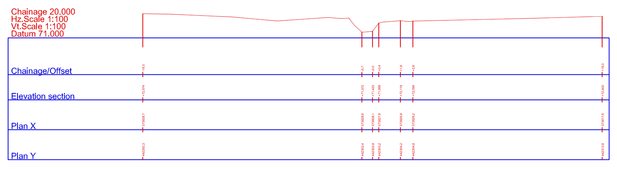

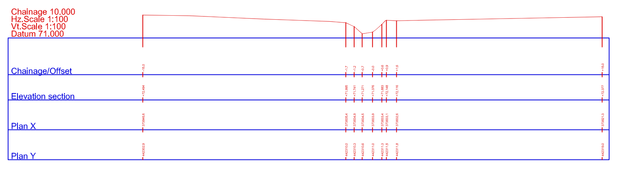

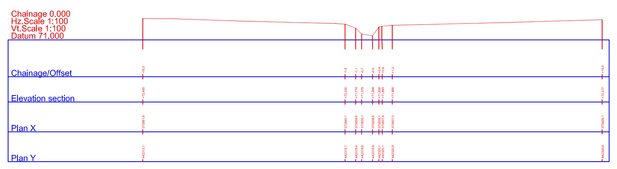

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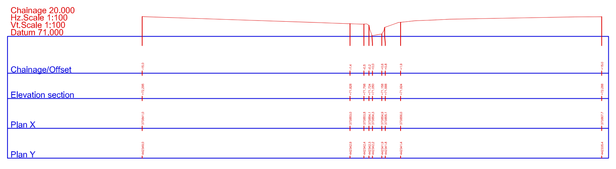

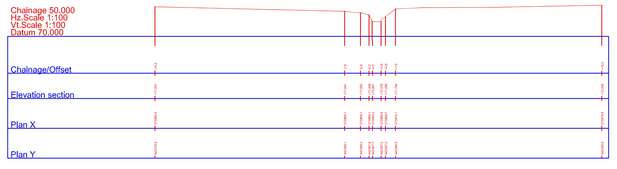

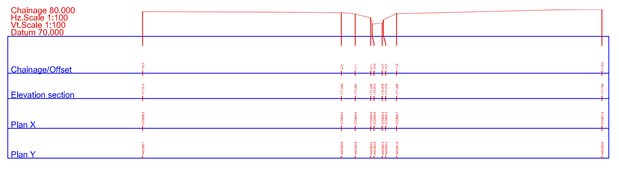

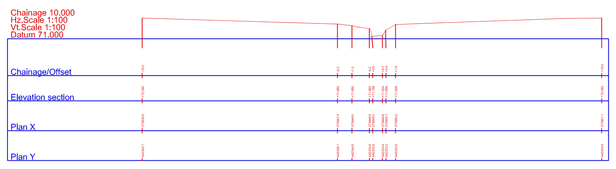

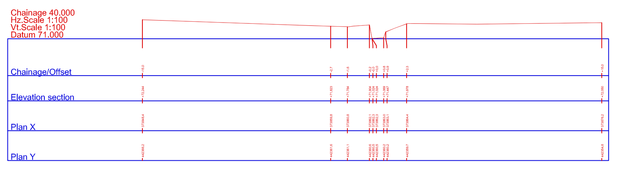

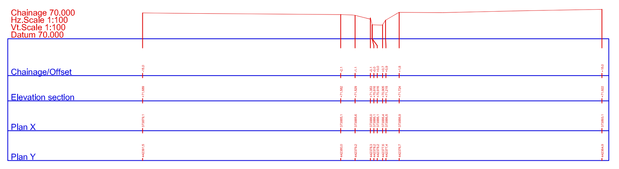

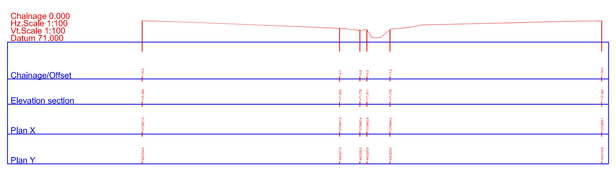

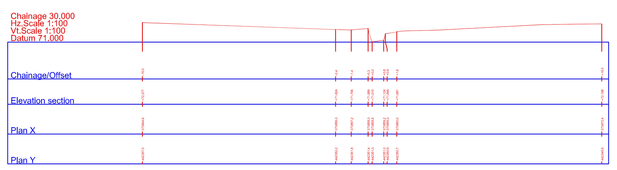

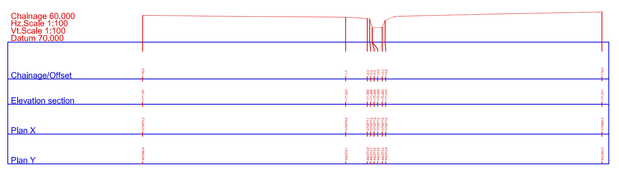

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Web: www.geomaticsurveys.co.uk

Client

BETTS ASSOCIATES

Project Title

WADDOW VIEW
BACK COMMONS
CLITHEROE

Drawing Title

SECTIONS

Drawn	Checked	Surveyed Date
DCW	IRH	24/02/2012
Date	Scale	Sheet No.
28/02/2012	1:200 @ A0	SHEET 2 OF 3
Drg. No.		Rev
0911/Sections		

Section 6
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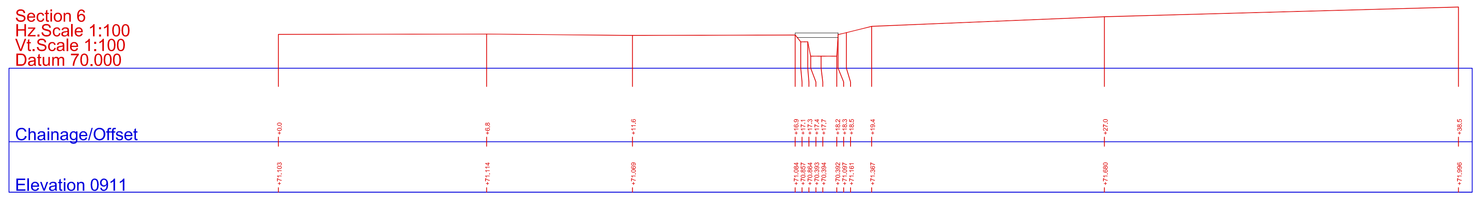
Vt.Scale 1:100
Datum 70.000



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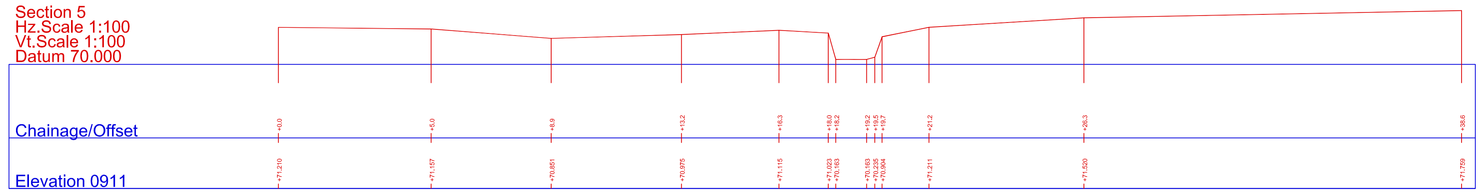
Vt.Scale 1:100
Datum 70.000



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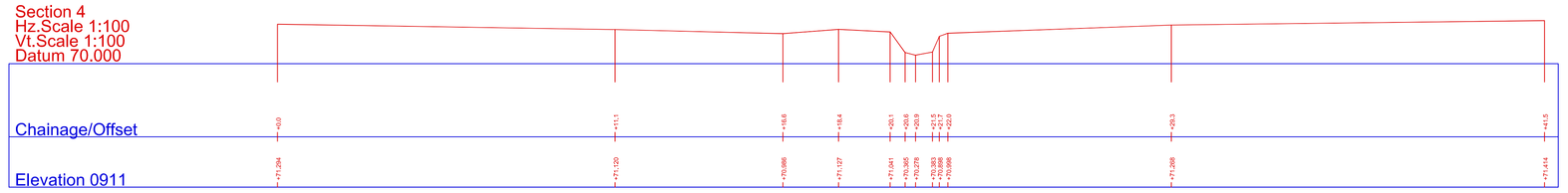
Vt.Scale 1:100
Datum 70.000



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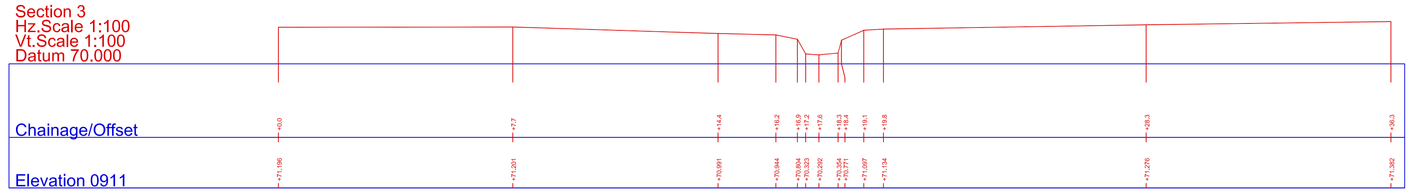
Vt.Scale 1:100
Datum 70.000



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Vt.Scale 1:100
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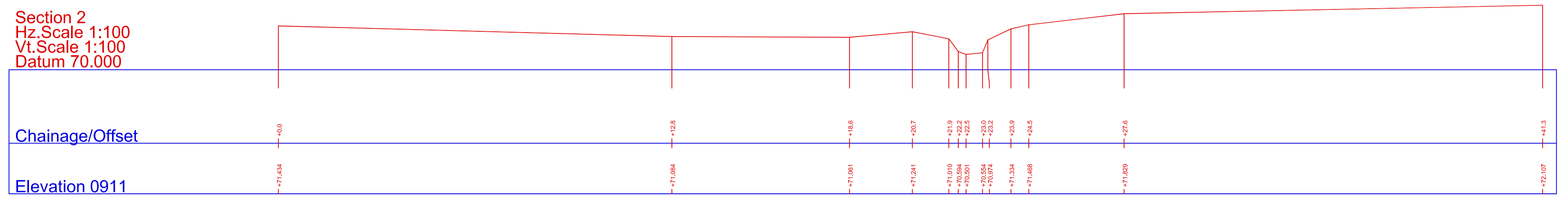

Section 1
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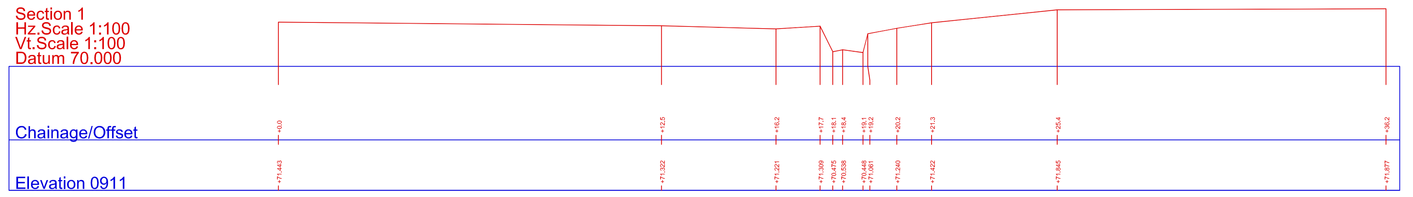
Vt.Scale 1:100
Datum 70.000



WATERCOURSE 5 cont..

Disclaimer

All dimensions to be checked on site prior to any works commencing.
Any descrepancies must be reported back to Geomatic Surveys Limited immediately.
Although every effort has been made to ensure the accuracy of the information contained within the drawing, Geomatic Surveys Limited are not responsible for inaccurate or missing information which may have an impact on the development of the site.

REV	DATE	DESCRIPTION	BY	APP.
A	08.03.12	Downstream culvert for section 6 amended to show concrete encased steel beam.	DCW	

Sheet Layout

Sheet 1

Survey Information
All levels are related to Ordnance Survey Datum. Refer to Topographical Survey for details.

Geomatic Surveys Ltd
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Client
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Project Title
WADDOW VIEW
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SECTIONS

Drawn	Checked	Surveyed Date
DCW	IRH	24/02/2012
Date	Scale	Sheet No.
28/02/2012	1:200 @ A0	SHEET 3 OF 3
Drg. No.		Rev
0911/Sections		A

APPENDIX J: HEC-RAS SCHEMATIC PLAN, PROFILE AND CROSS-SECTIONS

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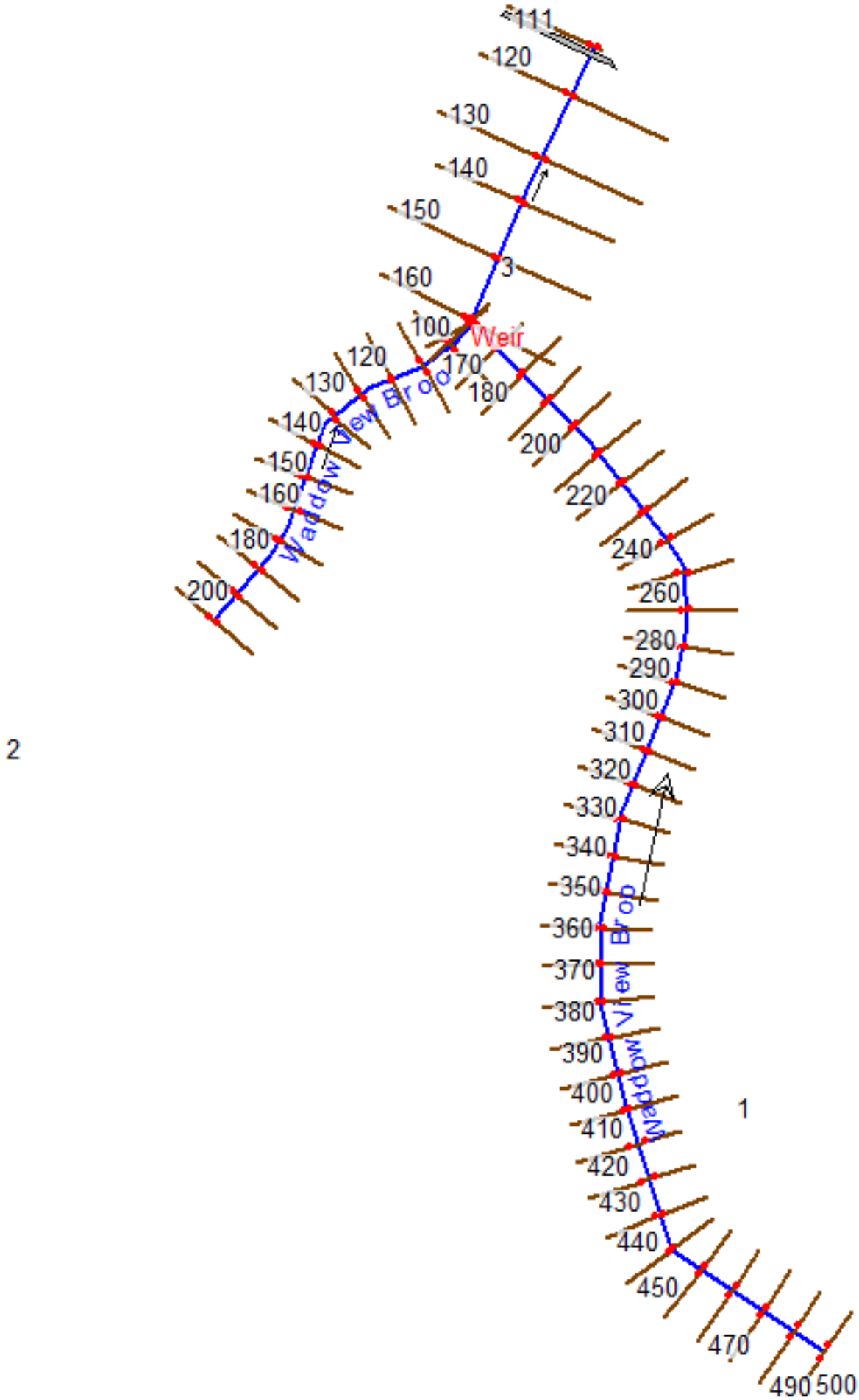
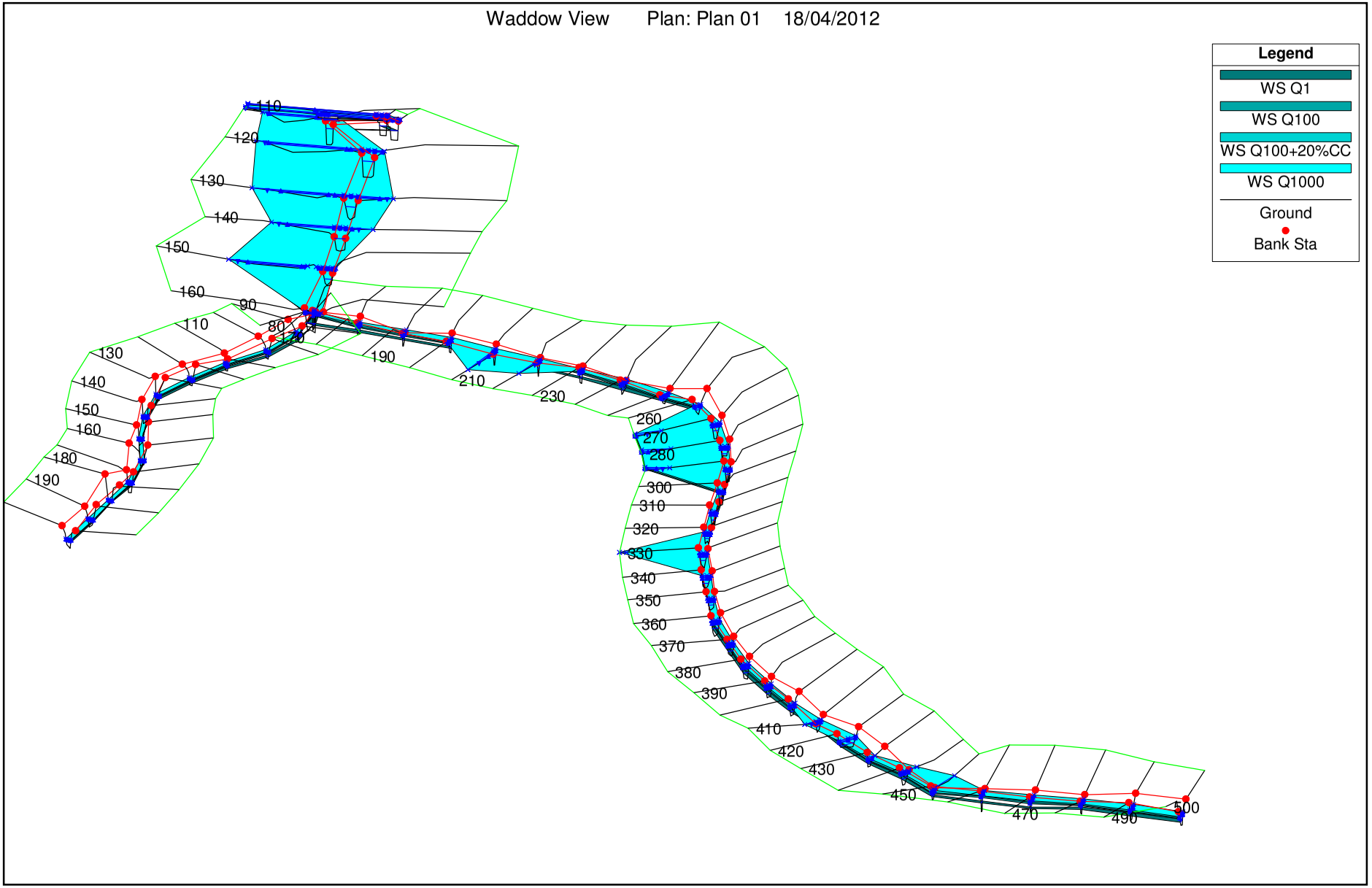

111
120
130
140
150
3
160
100
Weir
170
180
200
220
240
260
280
290
300
310
320
330
340
350
360
370
380
390
400
410
420
430
440
450
470
490
500
120
130
140
150
160
180
200
Waddow View Brook
View Brook Waddow
1
2


Waddow View Plan: Plan 01 18/04/2012
Legend
WS Q1
WS Q100
WS Q100+20%CC
WS Q1000
Ground
Bank Sta
110
120
130
140
150
160
90
80
70
190
210
230
260
270
280
300
310
320
330
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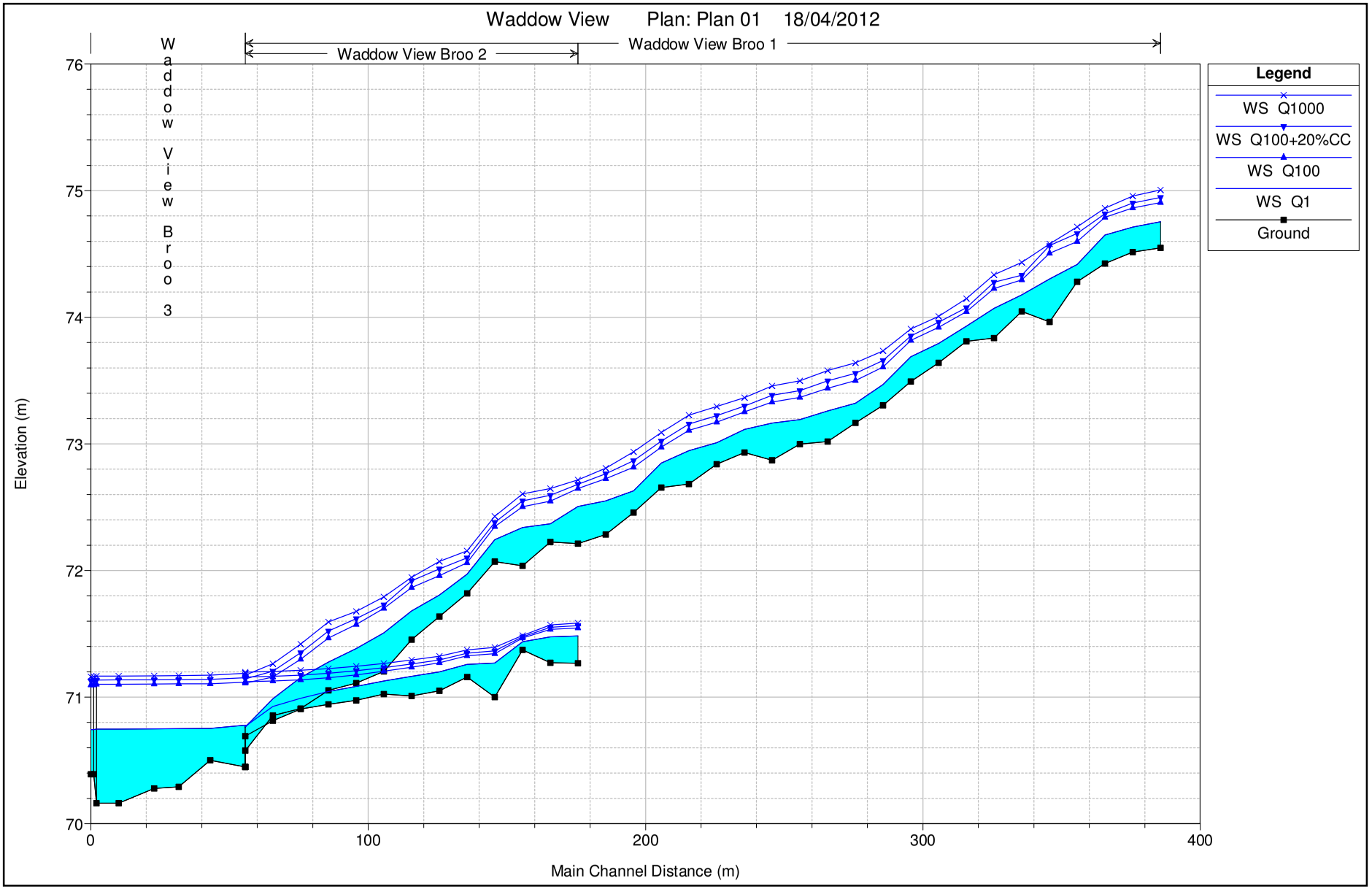
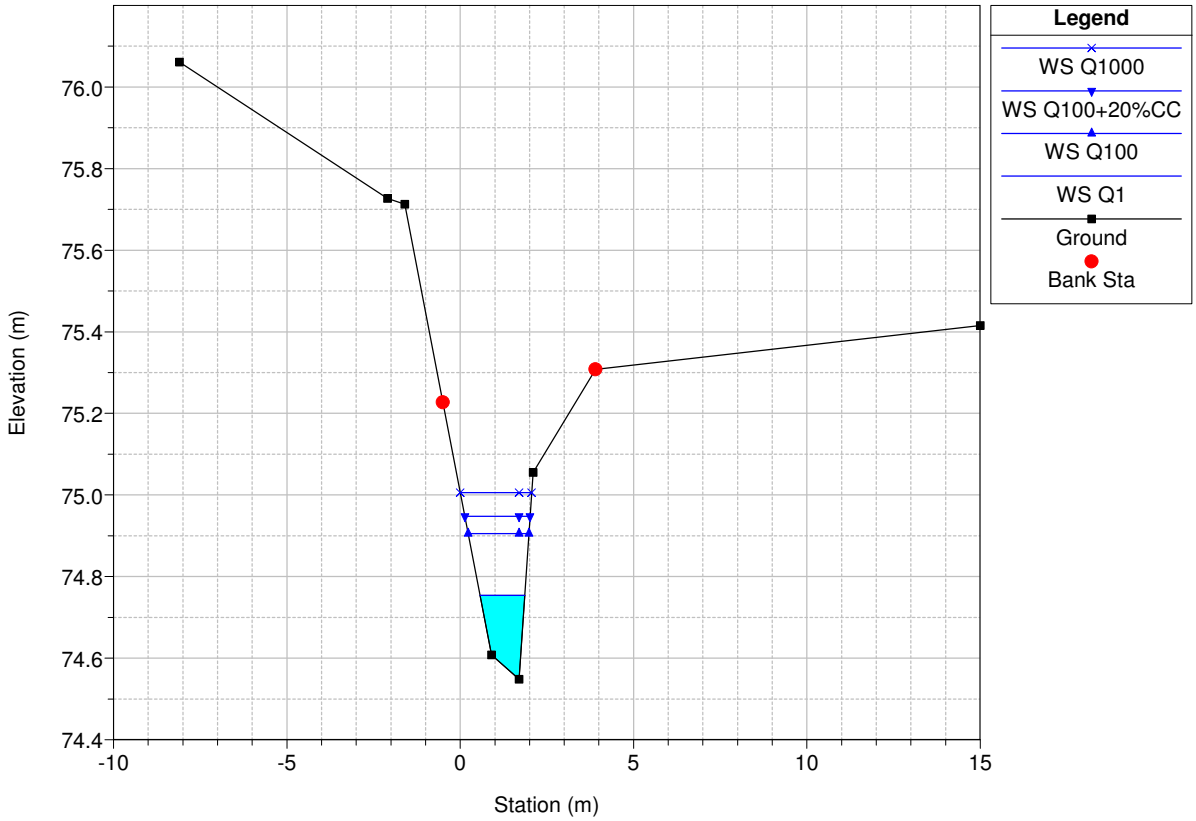
130
140
150
160
180
190


Waddow View Plan: Plan 01 18/04/2012
Waddow View Broo 2
Waddow View Broo 1
Waddow View Broo 3
Legend
WS Q1000
WS Q100+20%CC
WS Q100
WS Q1
Ground
Elevation (m)
Main Channel Distance (m)
76
75
74
73
72
71
70
0
100
200
300
400

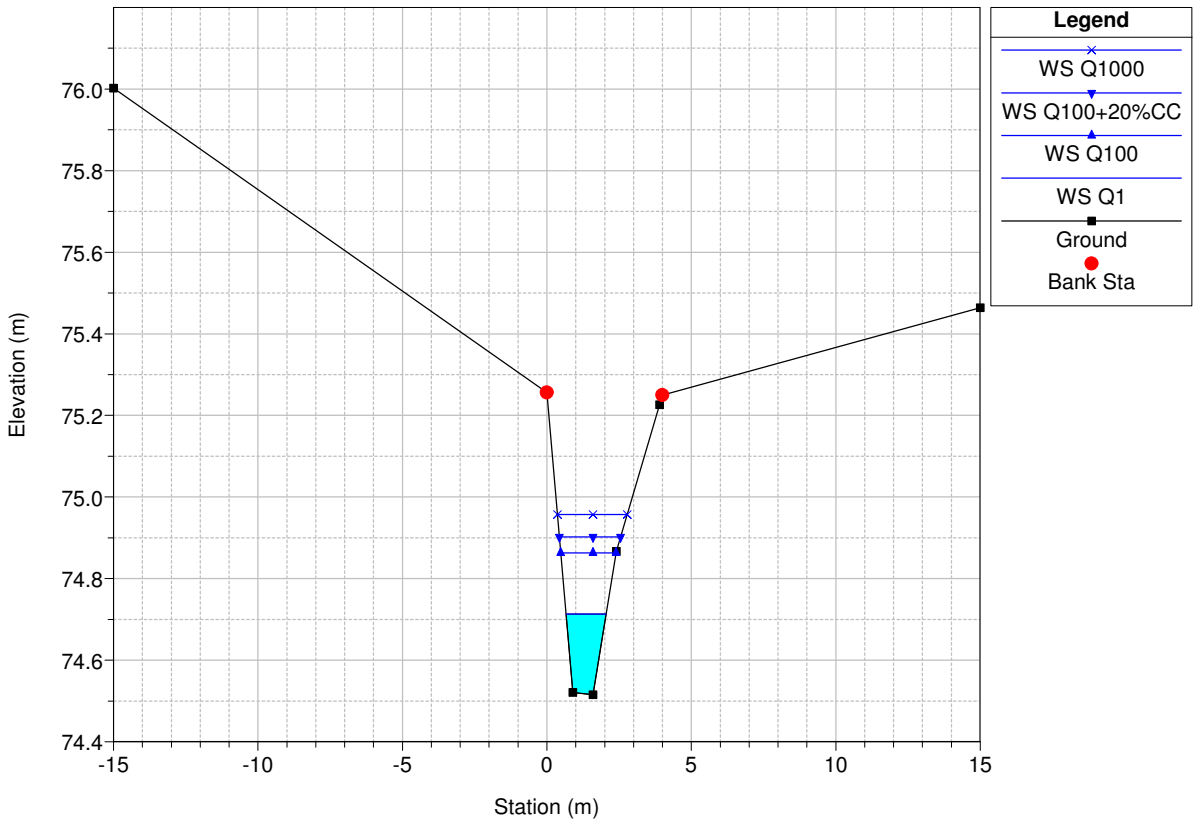
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 500 (W1-CH0)



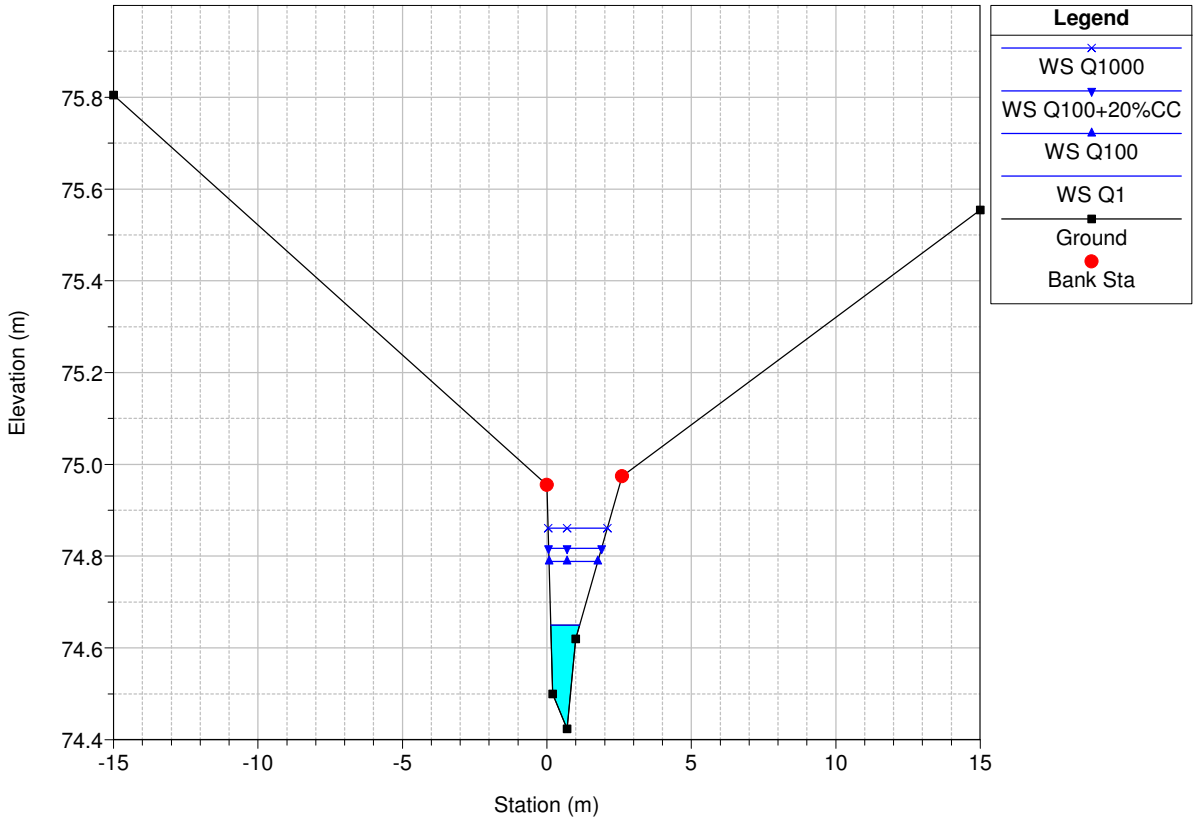
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 490 (W1-CH10)



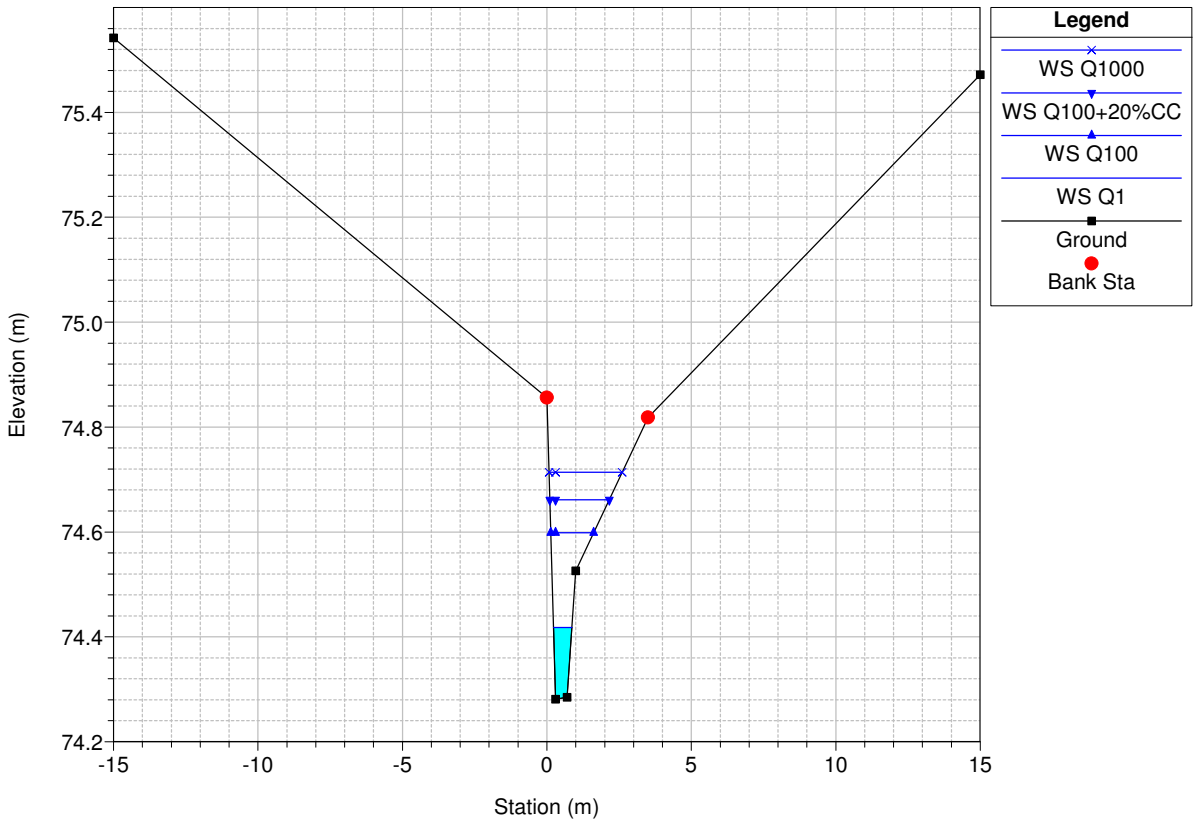
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 480 (W1-20)



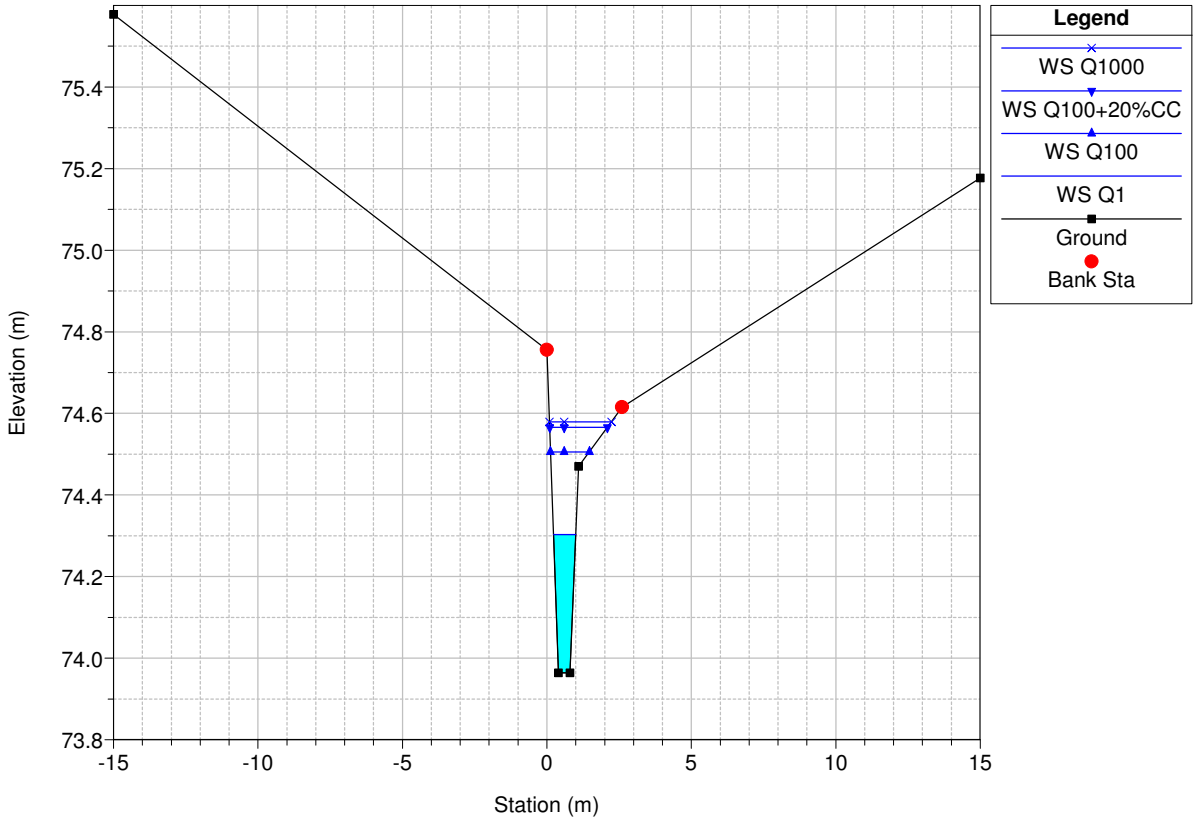
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 470 (W1-30)



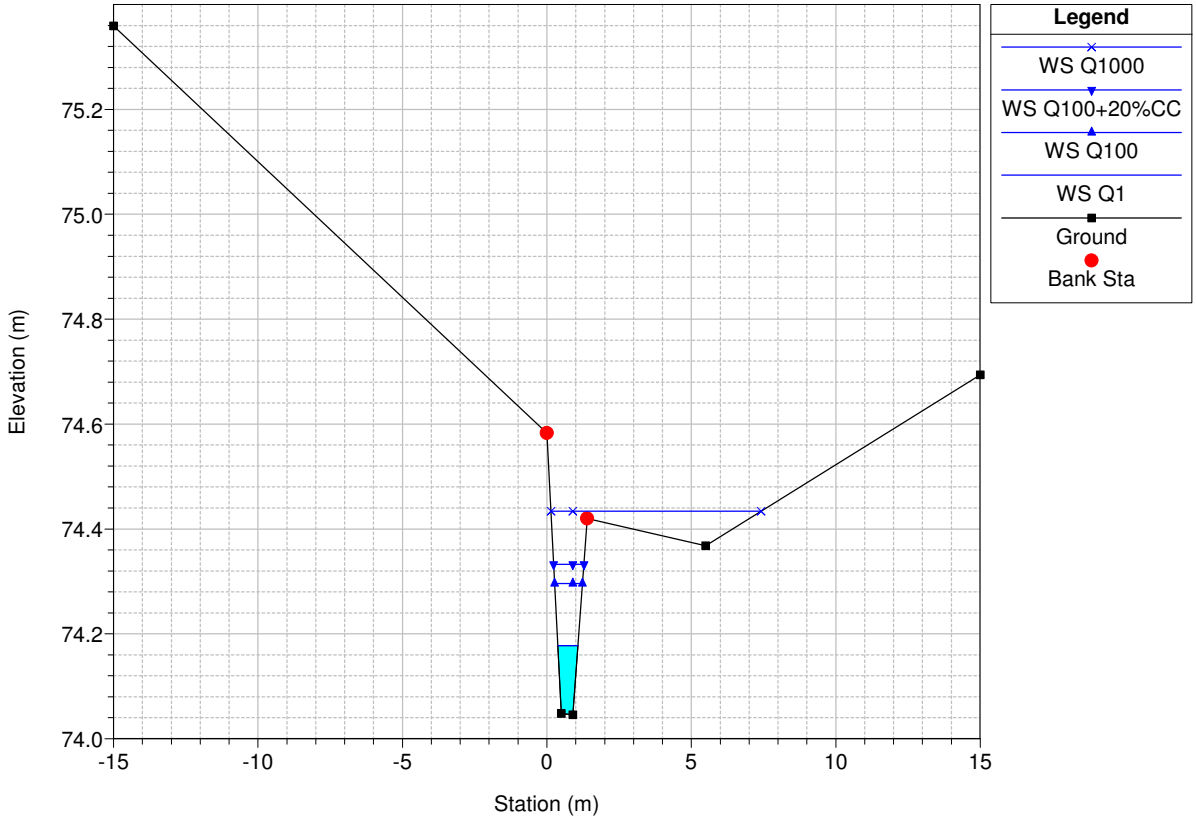
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 460 (W1-40)



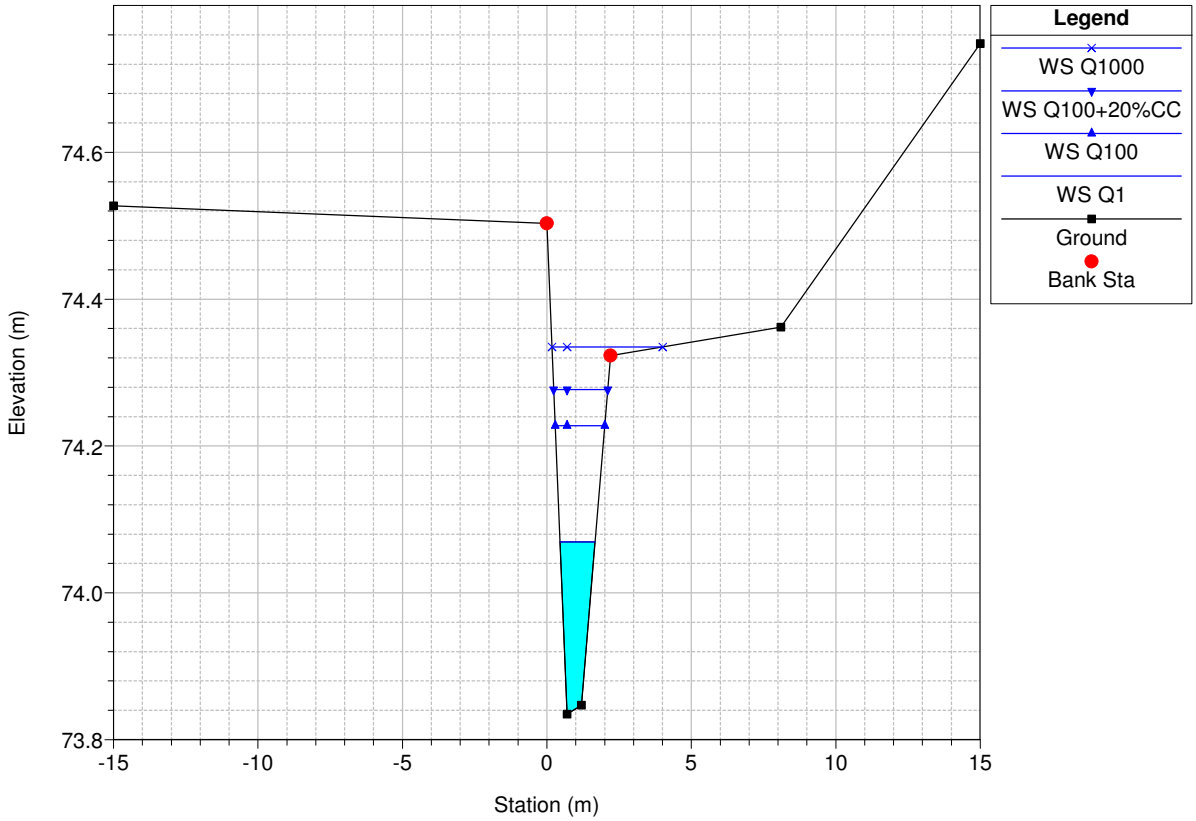
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 450 (W1-50)



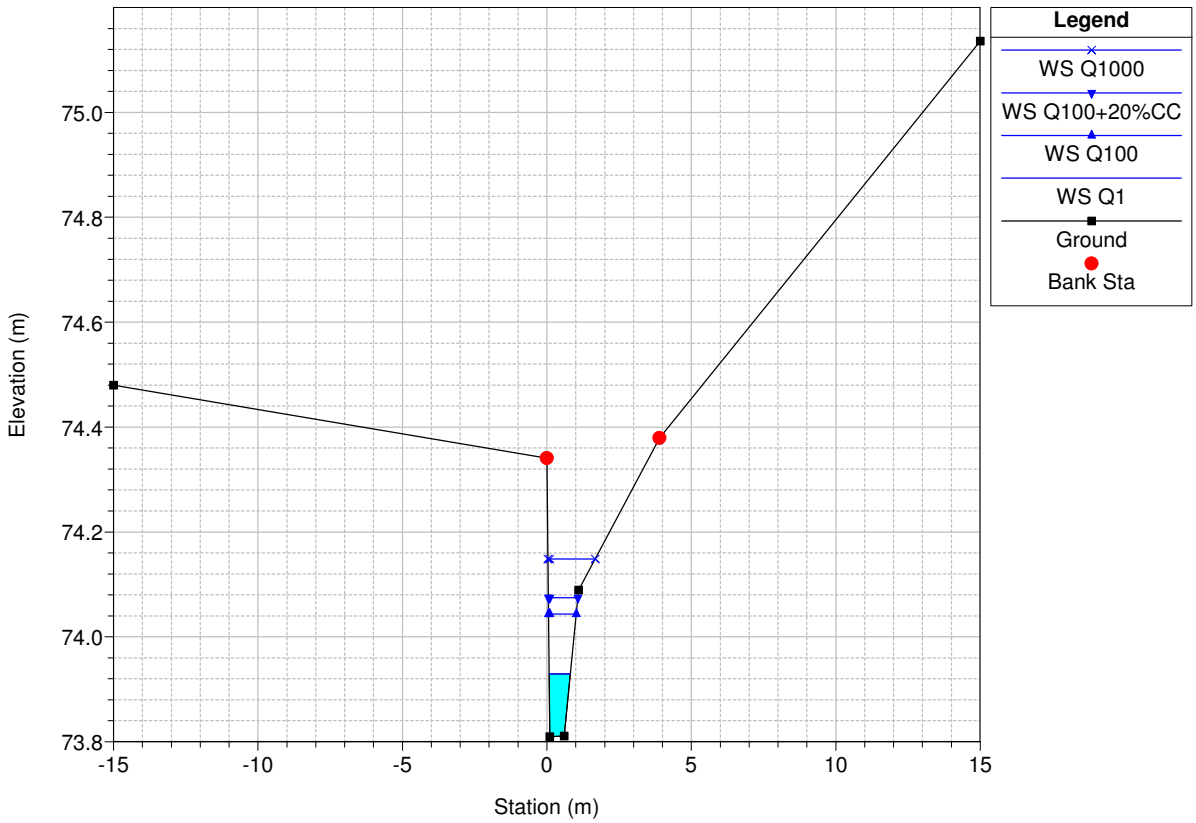
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 440 (W1-60)



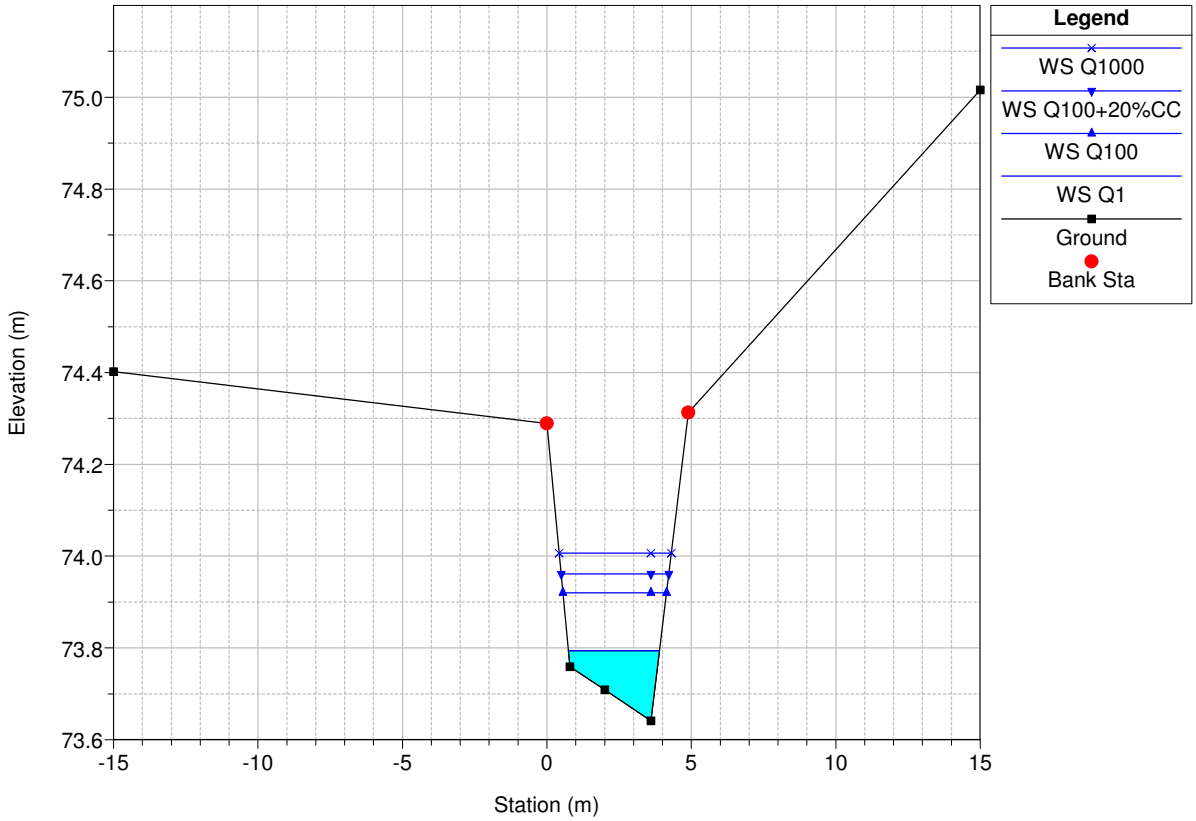
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 430 (W1-70)



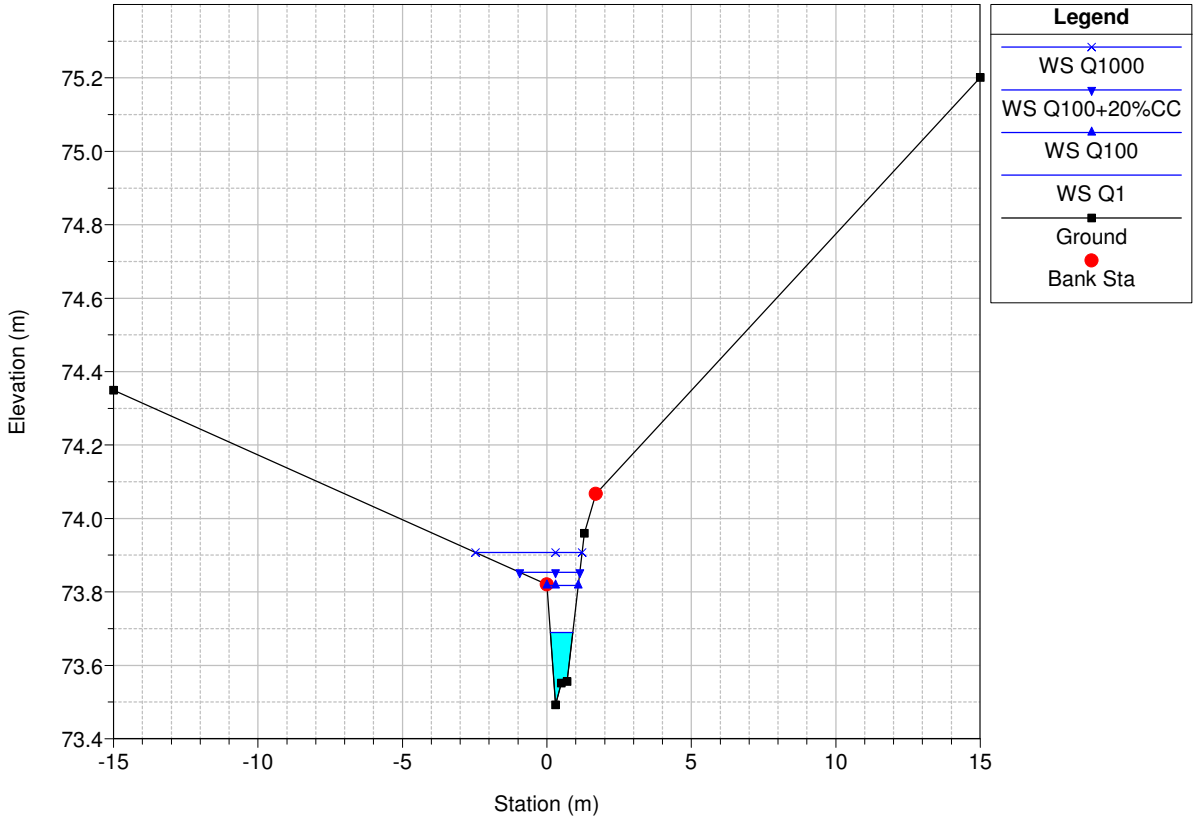
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 420 (W1-80)



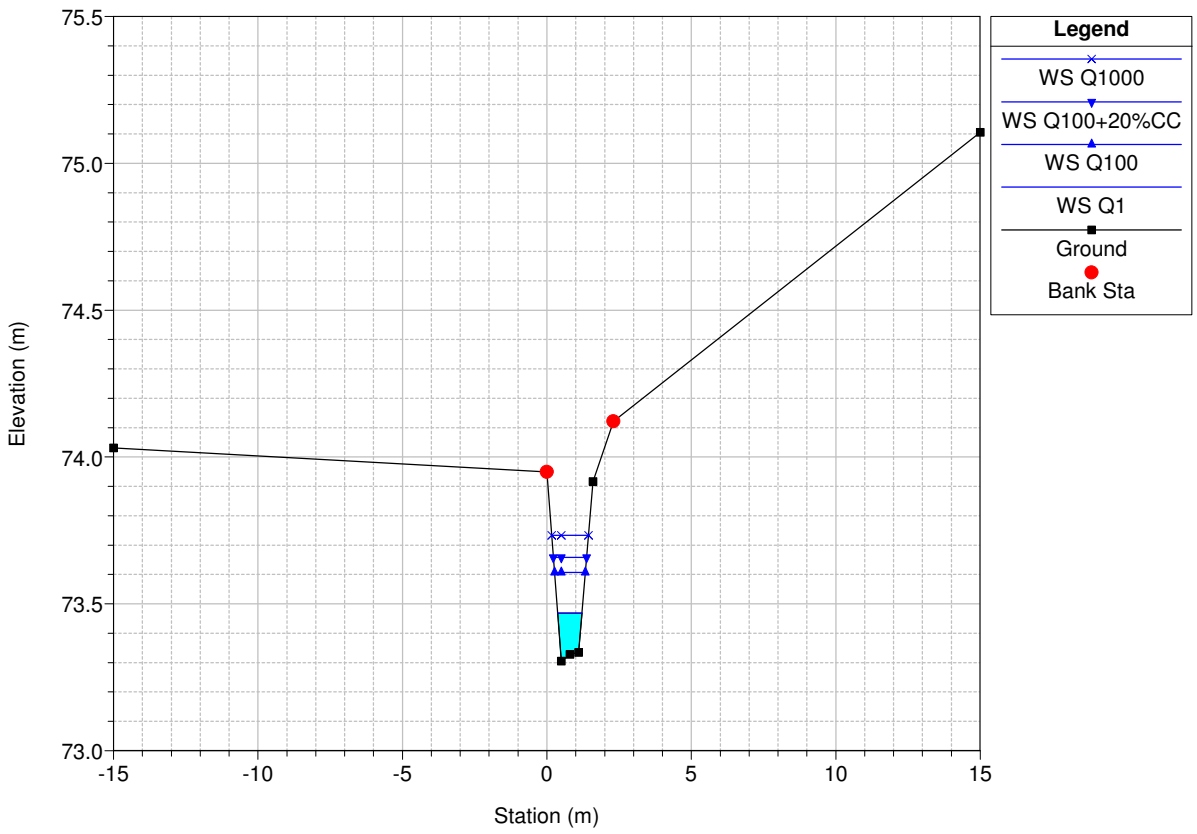
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 410 (W1-90)



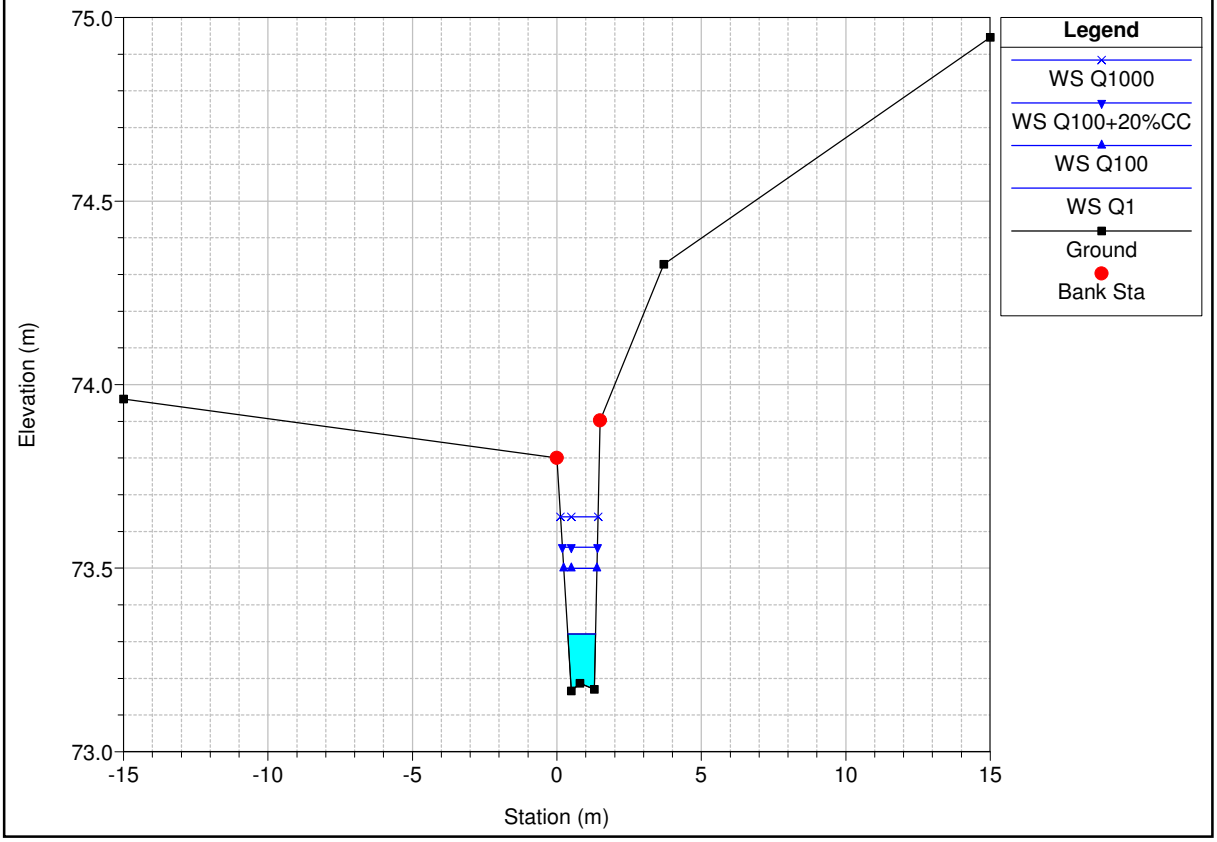
Waddow View Plan: Plan 01 18/04/2012

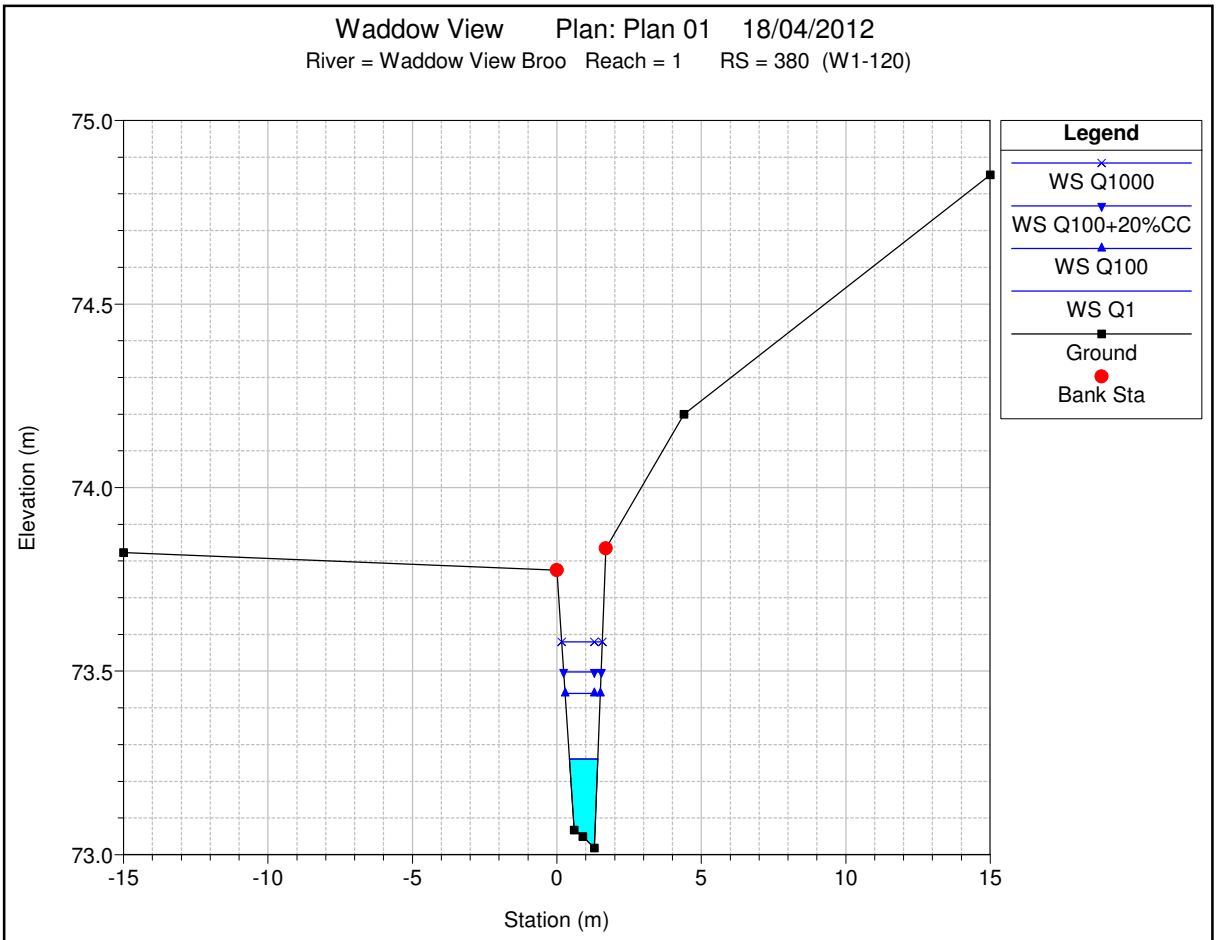
River = Waddow View Broo Reach = 1 RS = 400 (W1-100)



Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 390 (W1-110)

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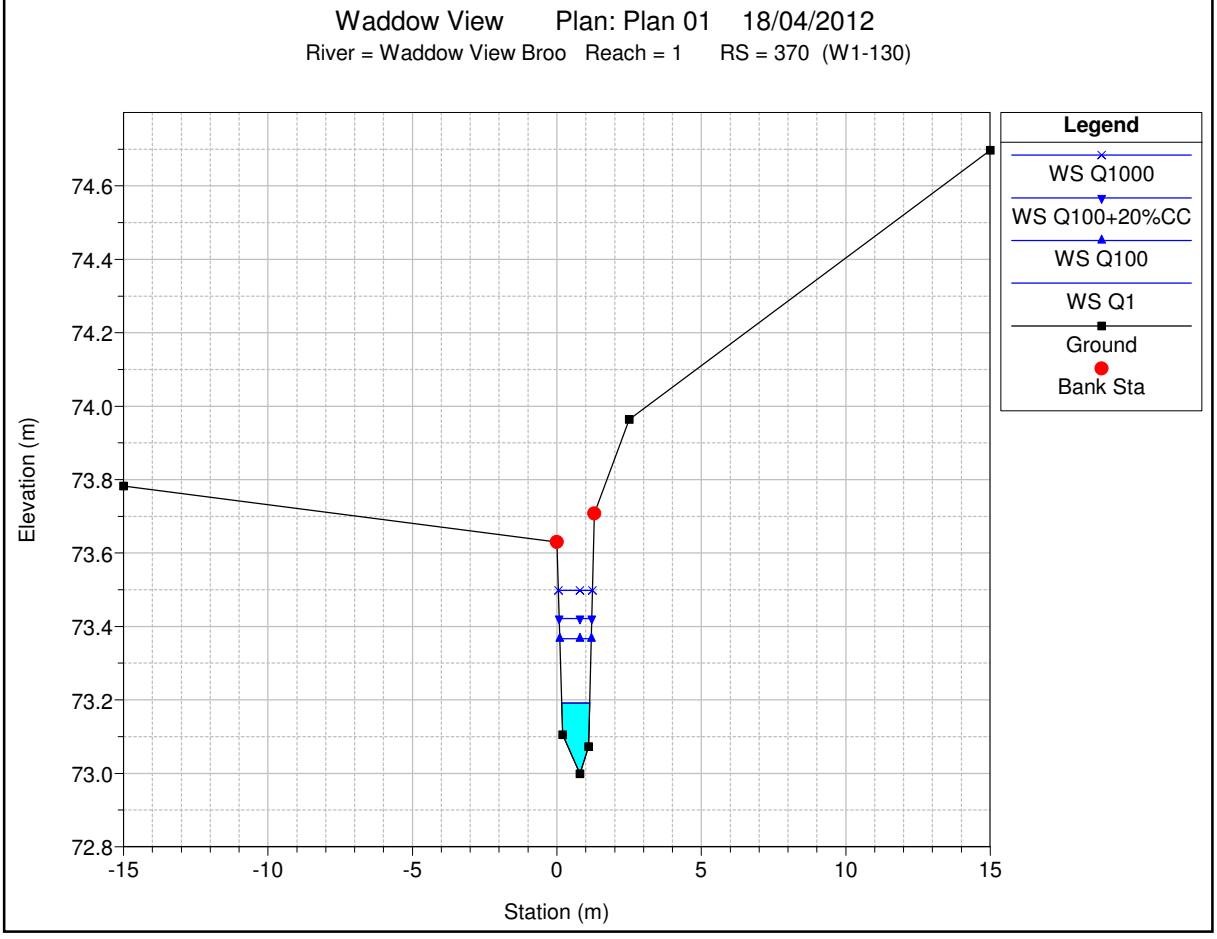
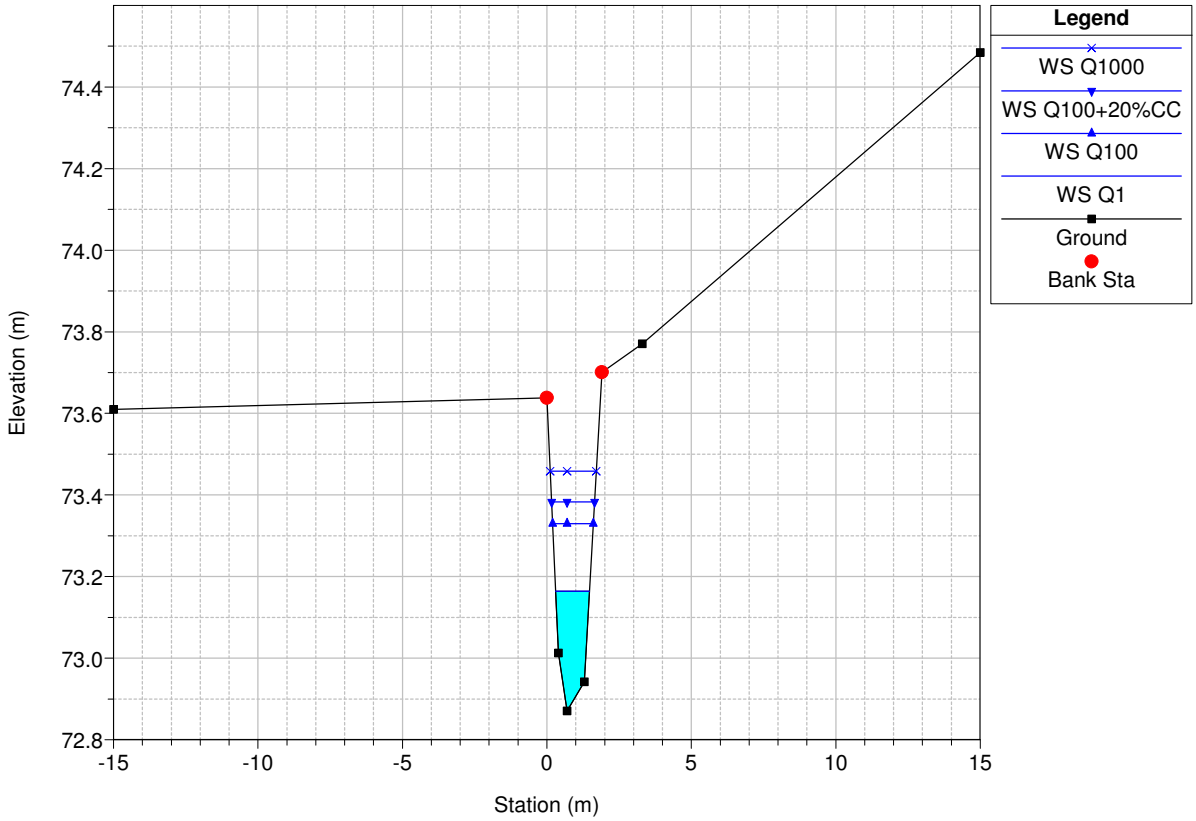
River = Waddow View Broo Reach = 1 RS = 380 (W1-120)
Legend
WS Q1000
WS Q100+20%CC
WS Q100
WS Q1
Ground
Bank Sta
Elevation (m)
Station (m)
75.0
74.5
74.0
73.5
73.0
-15
-10
-5
0
5
10
15


Waddow View Plan: Plan 01 18/04/2012
River = Waddow View Broo Reach = 1 RS = 370 (W1-130)
Legend
WS Q1000
WS Q100+20%CC
WS Q100
WS Q1
Ground
Bank Sta
Elevation (m)
Station (m)
74.6
74.4
74.2
74.0
73.8
73.6
73.4
73.2
73.0
72.8
-15
-10
-5
0
5
10
15

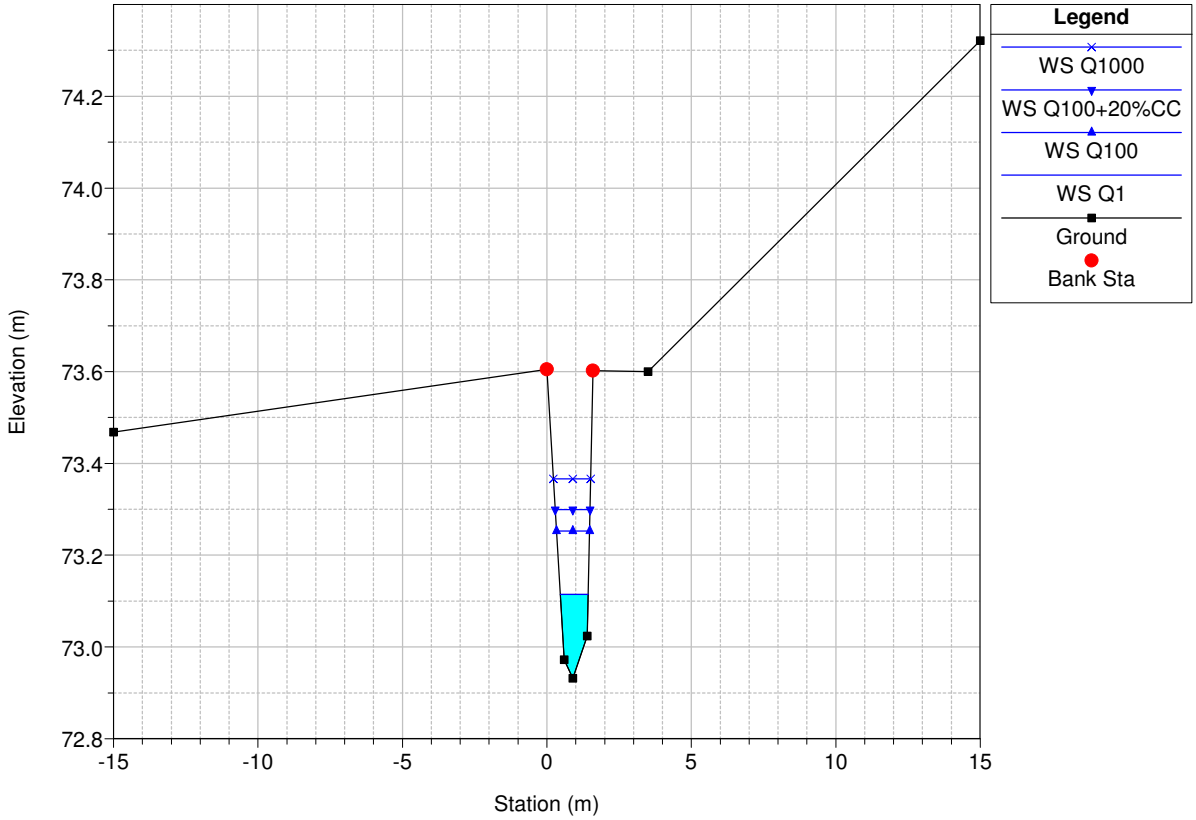
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 360 (W1-140)



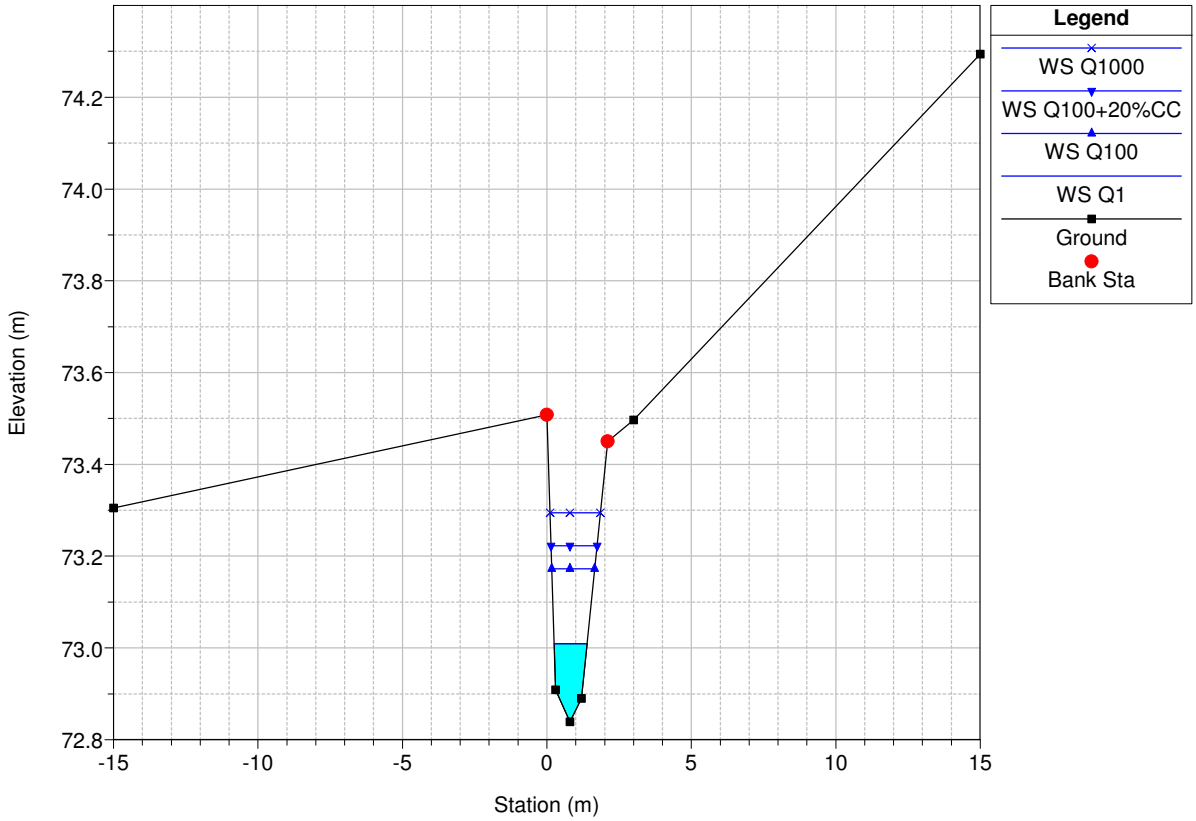
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 350 (W1-150)



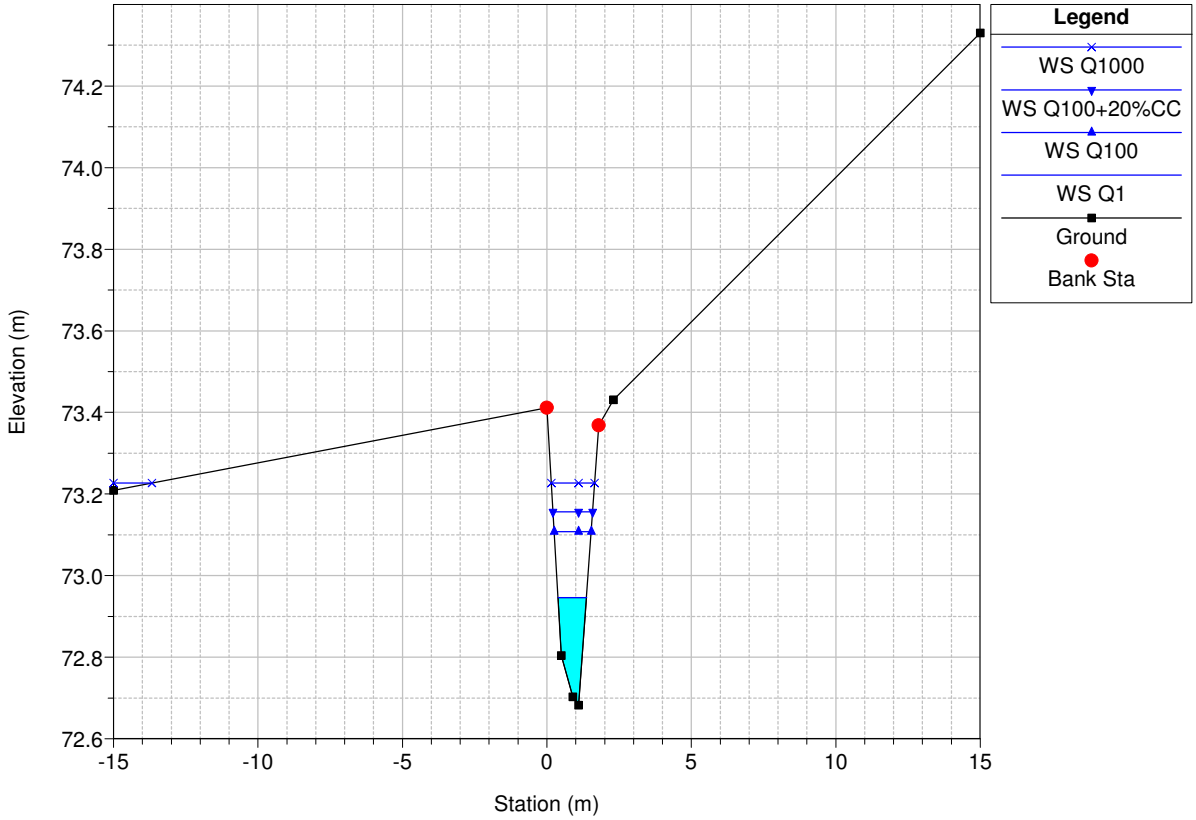
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 340 (W1-160)



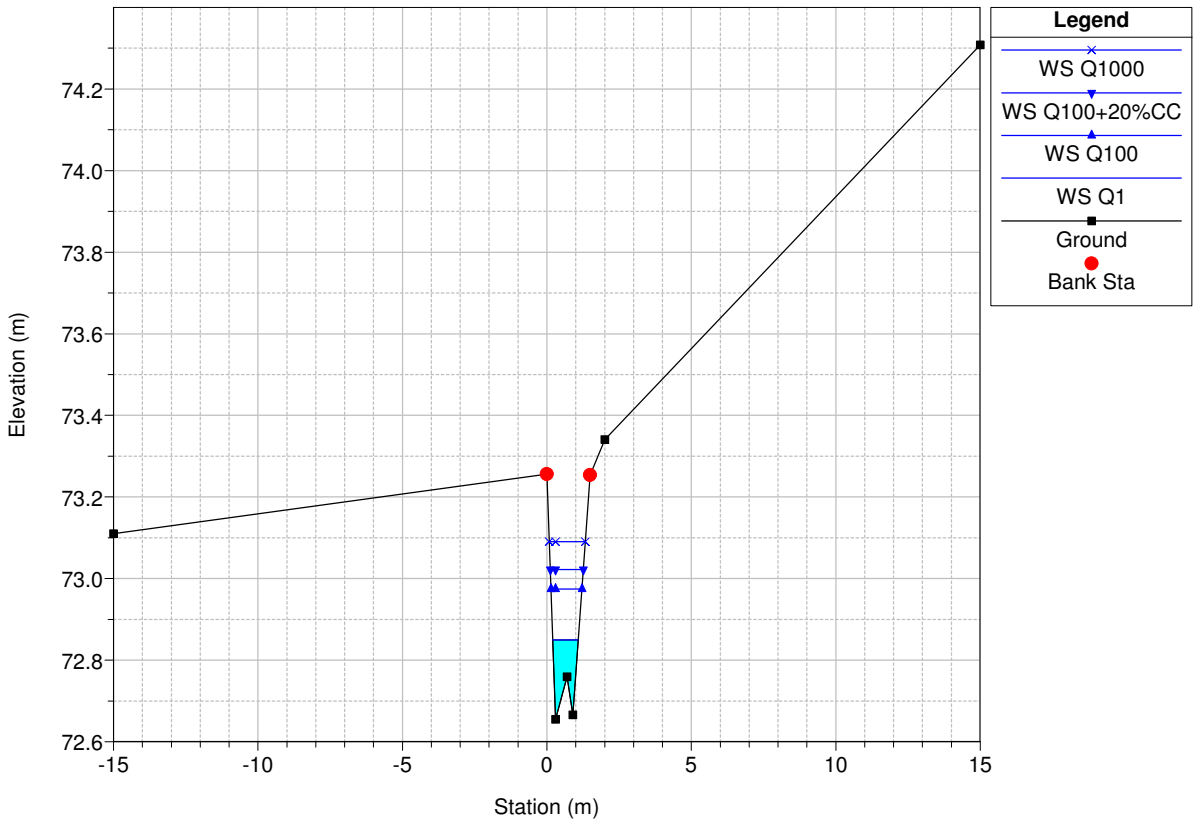
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 330 (W1-150)



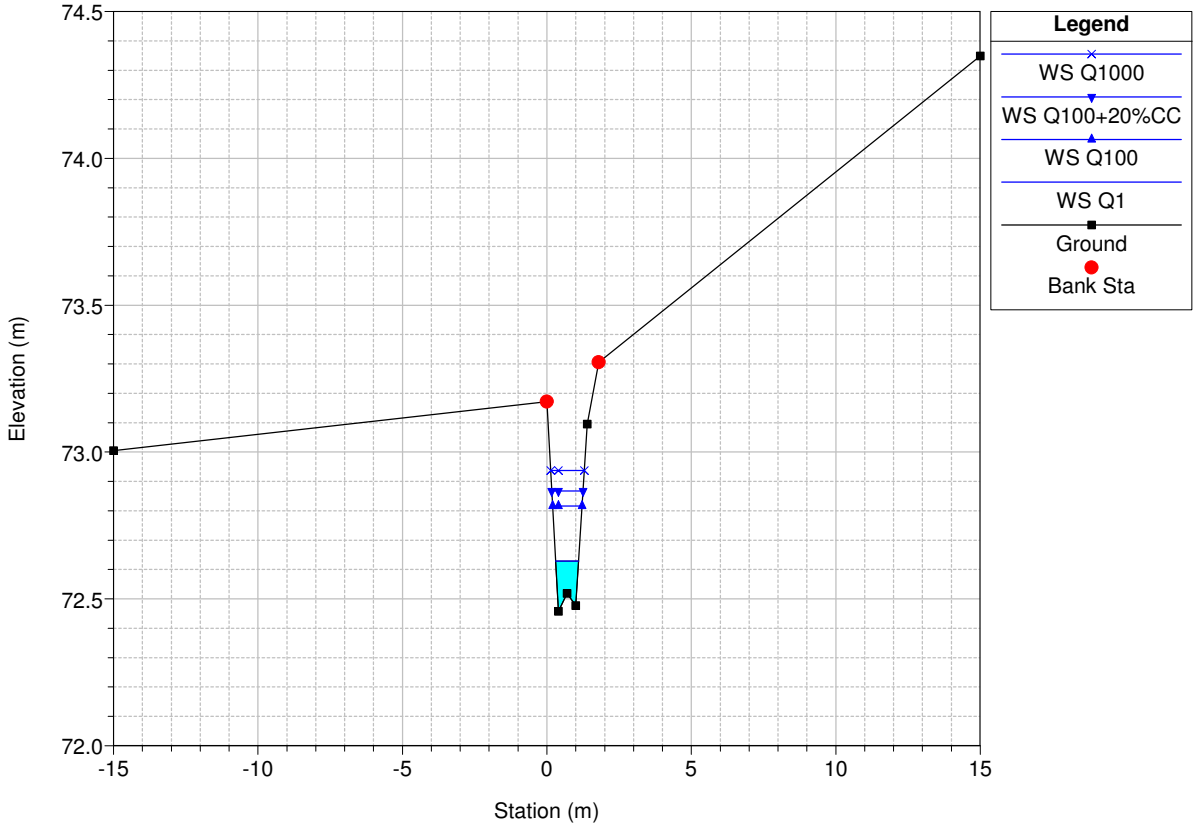
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 320 (W1-180)



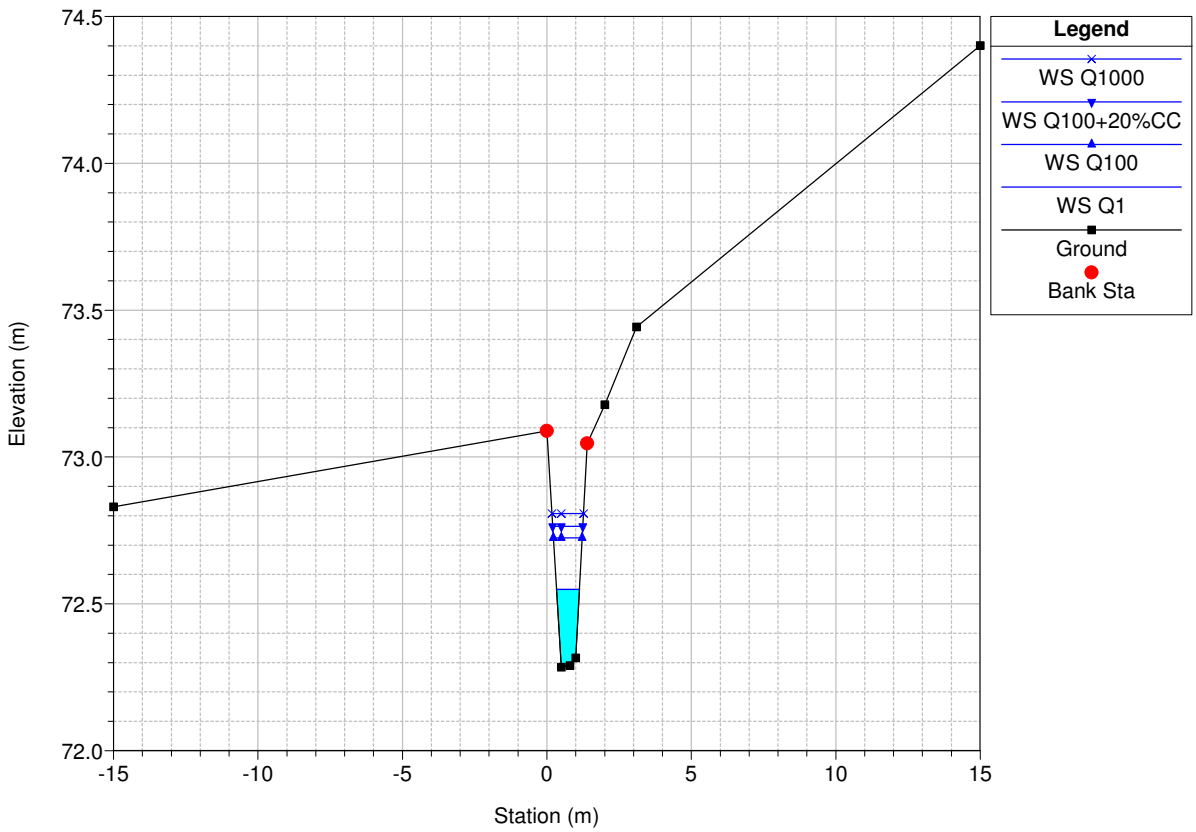
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 310 (W1-190)



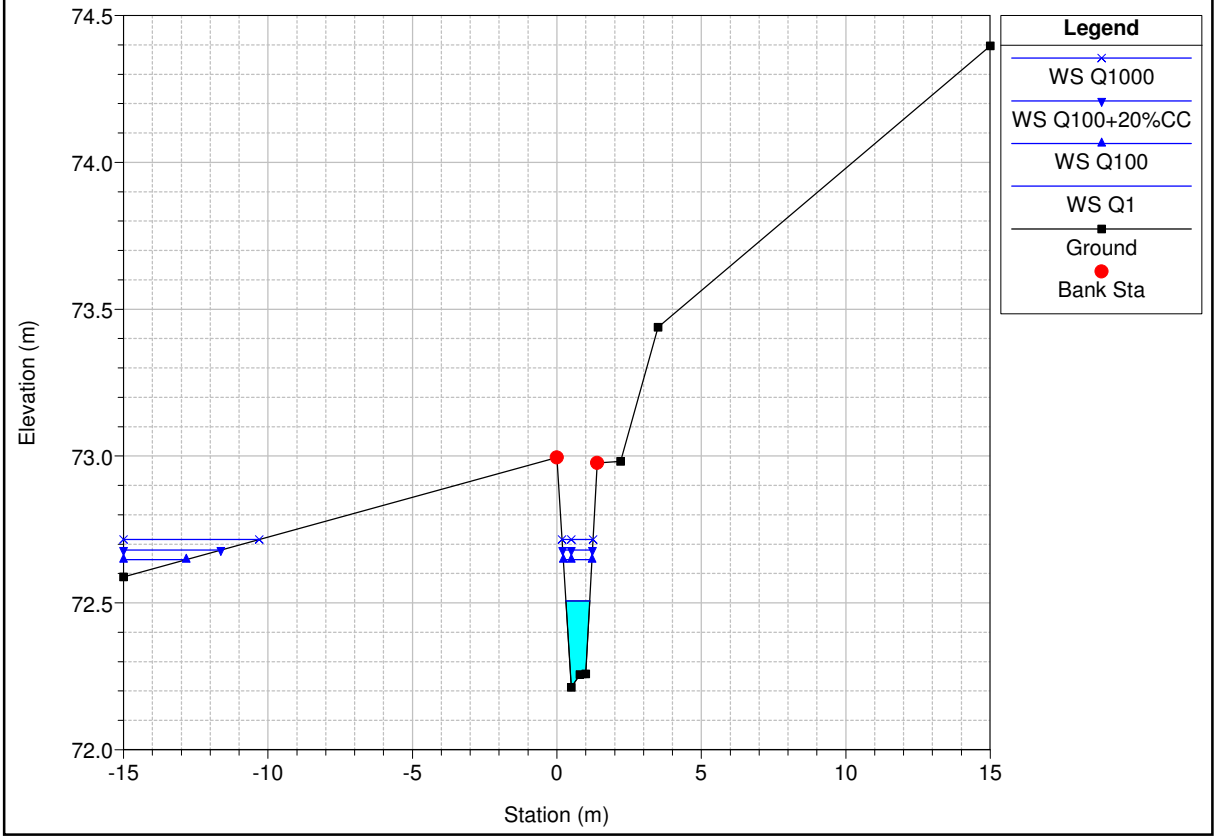
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 300 (W1-200)



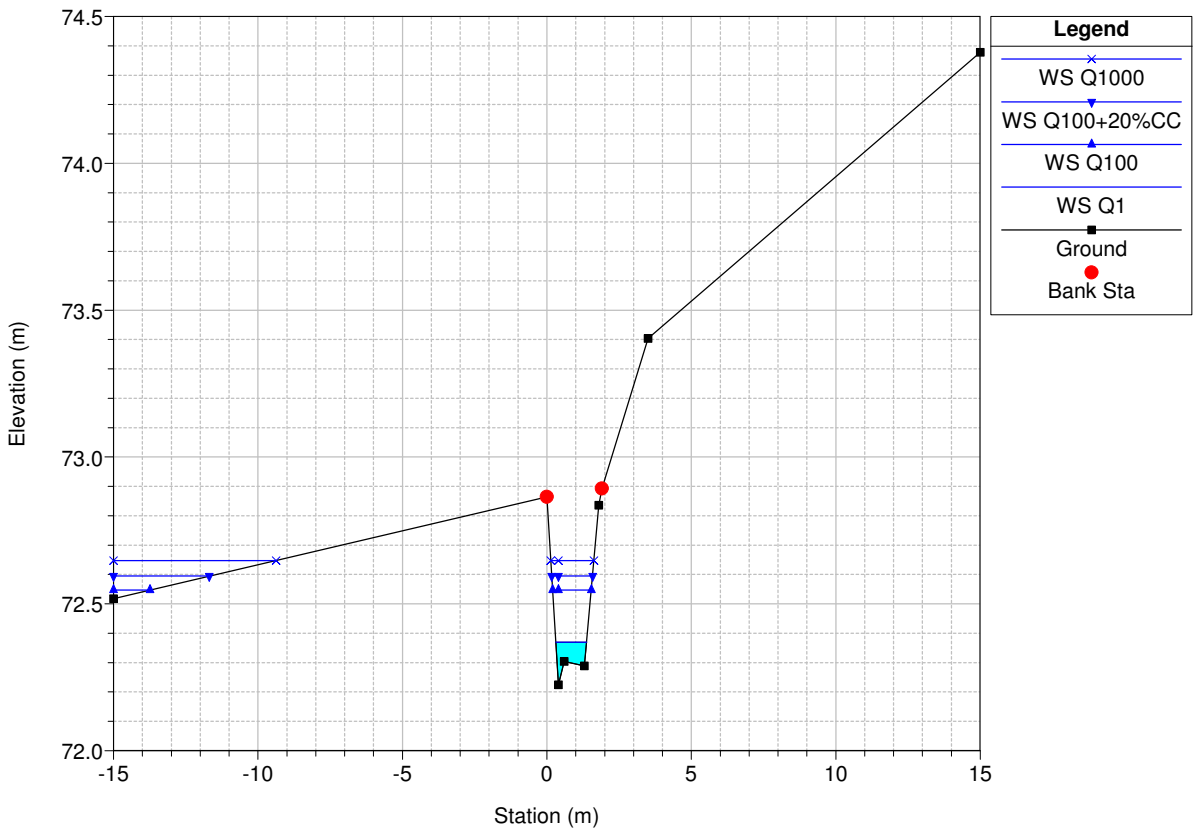
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 290 (W1-210)



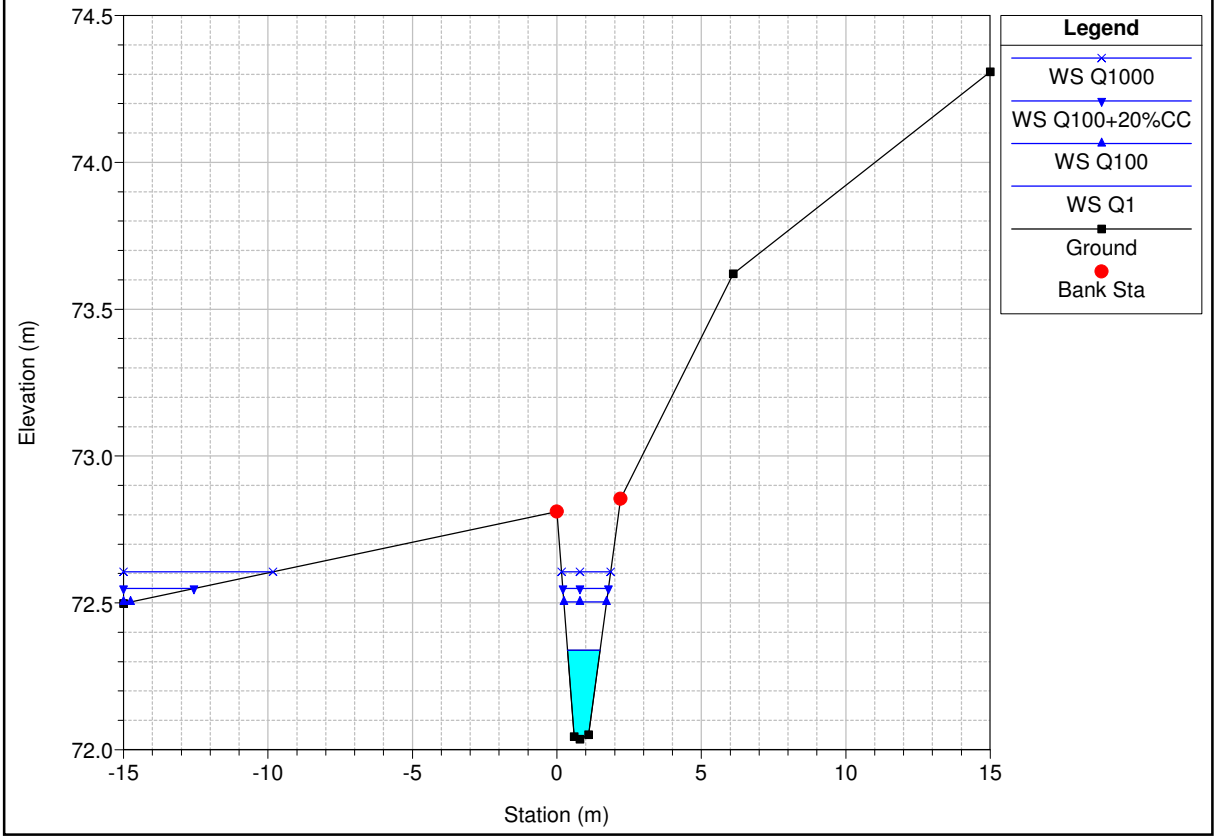
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 280 (W1-220)



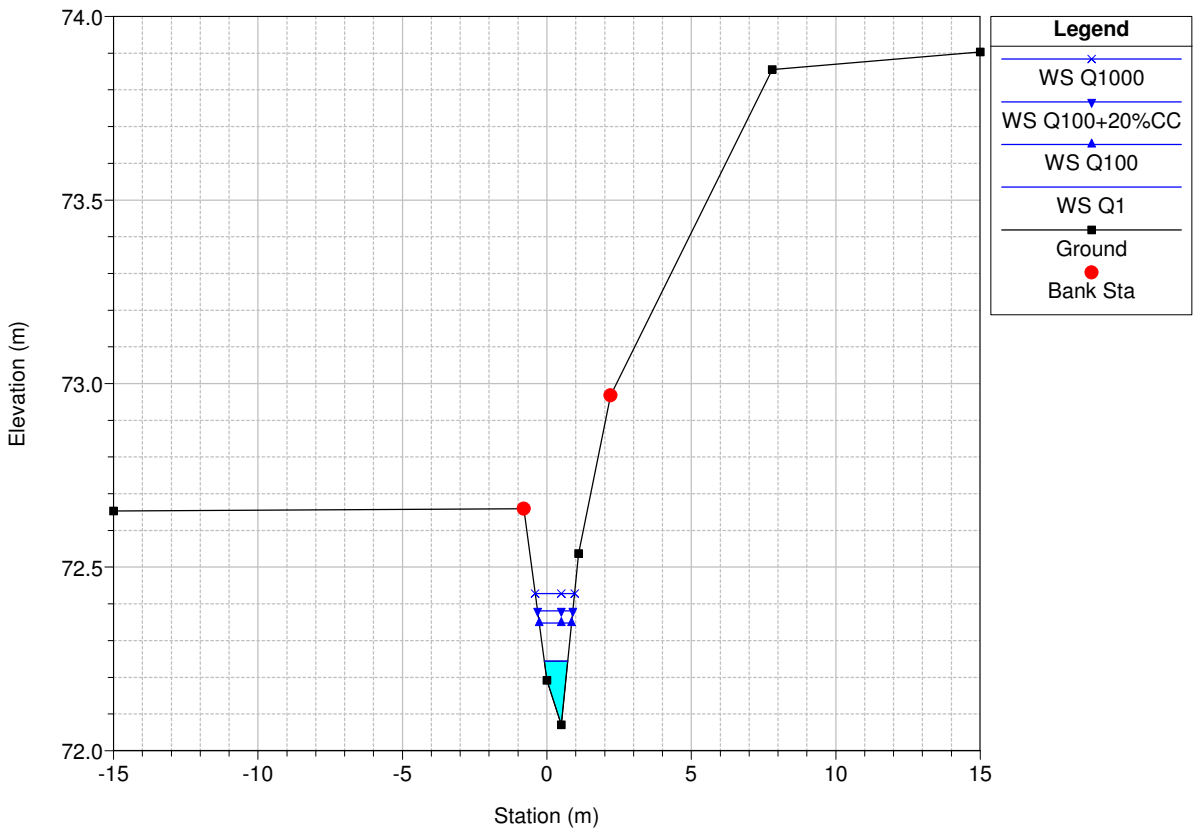
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 270 (W1-230)



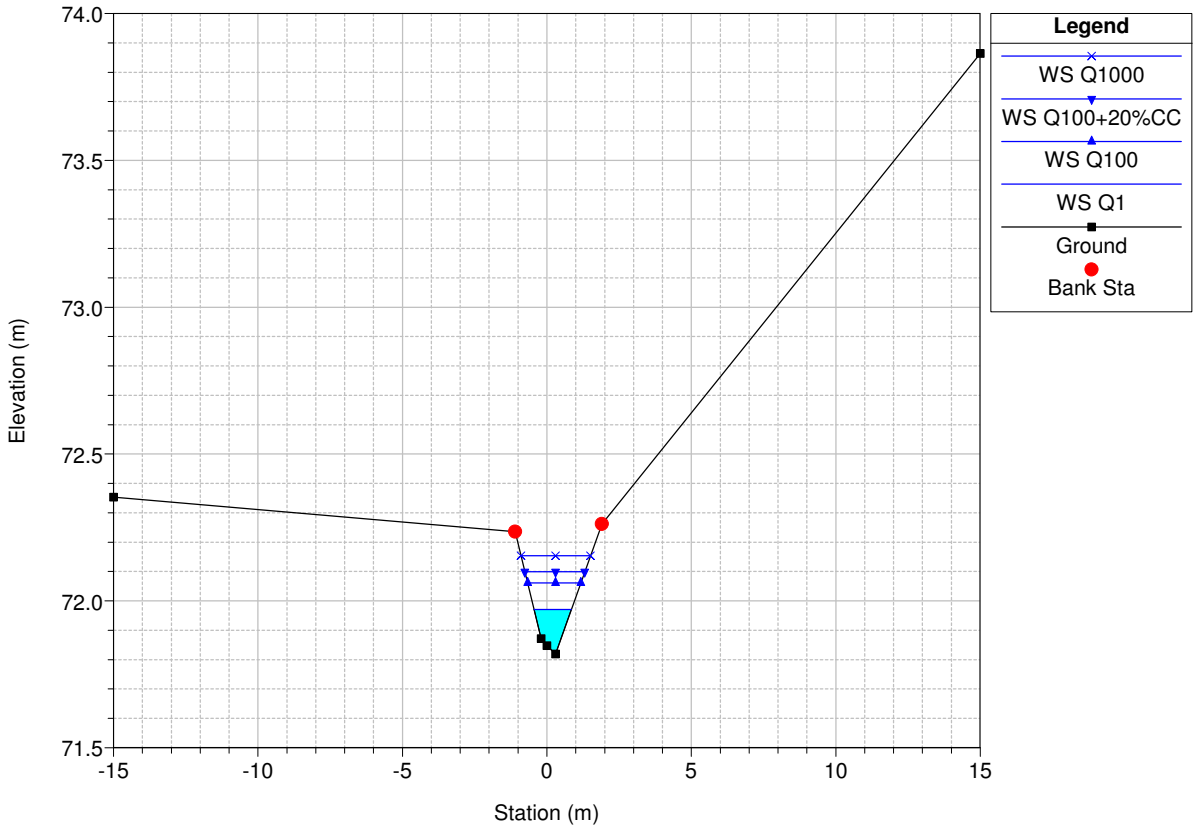
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 260 (W2-0)



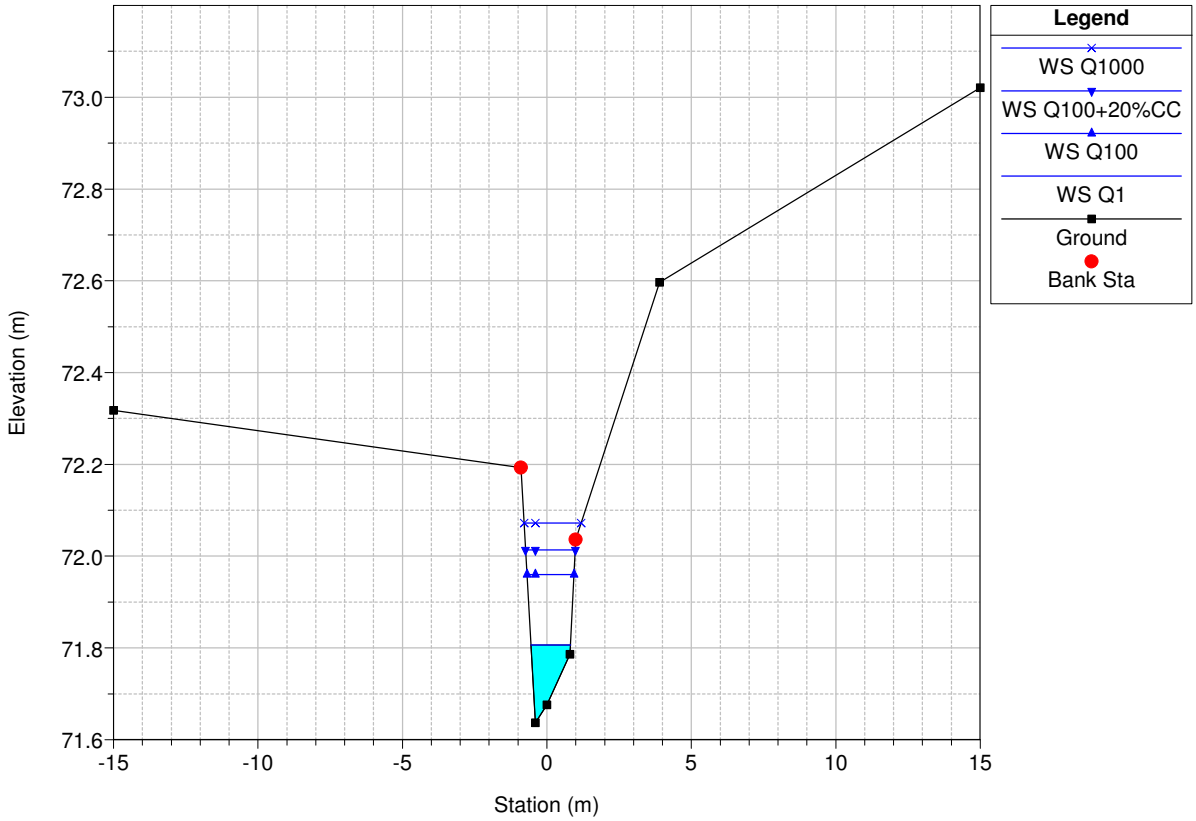
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 250 (W2-10)



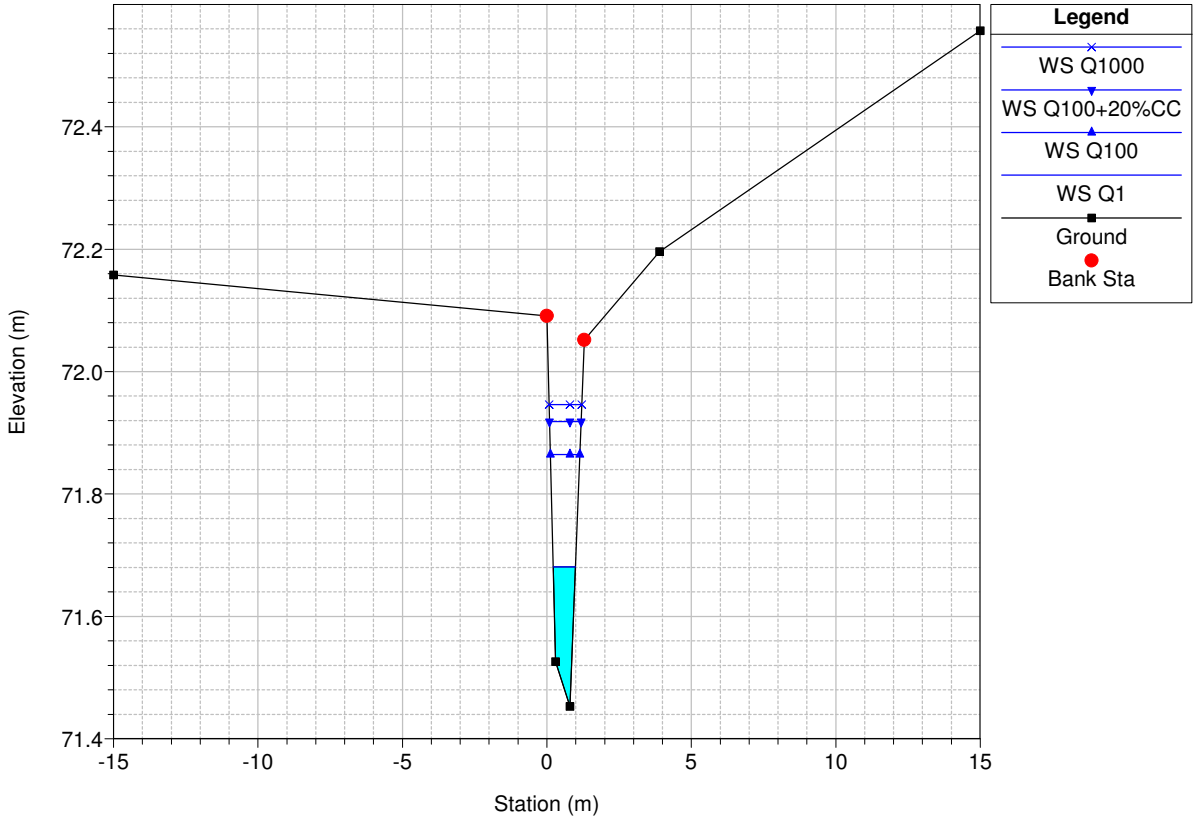
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 240 (W2-20)



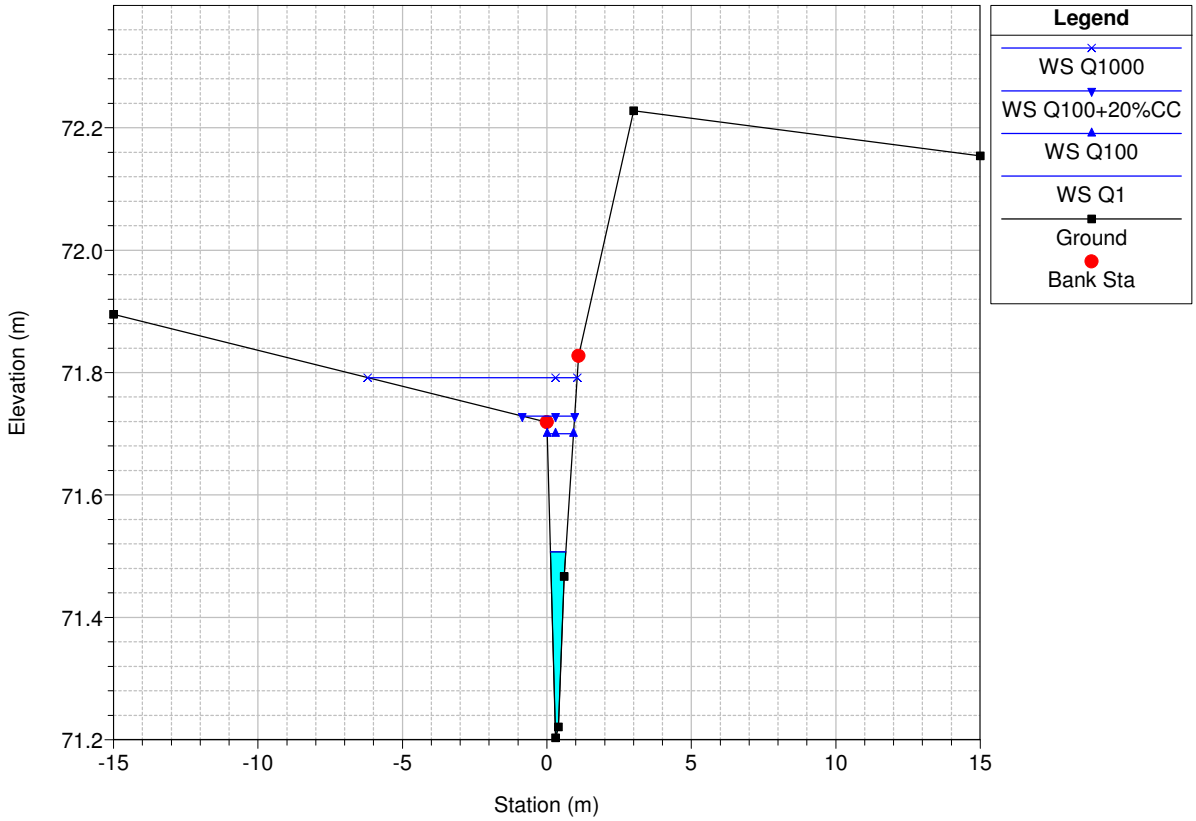
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 230 (W3-0)



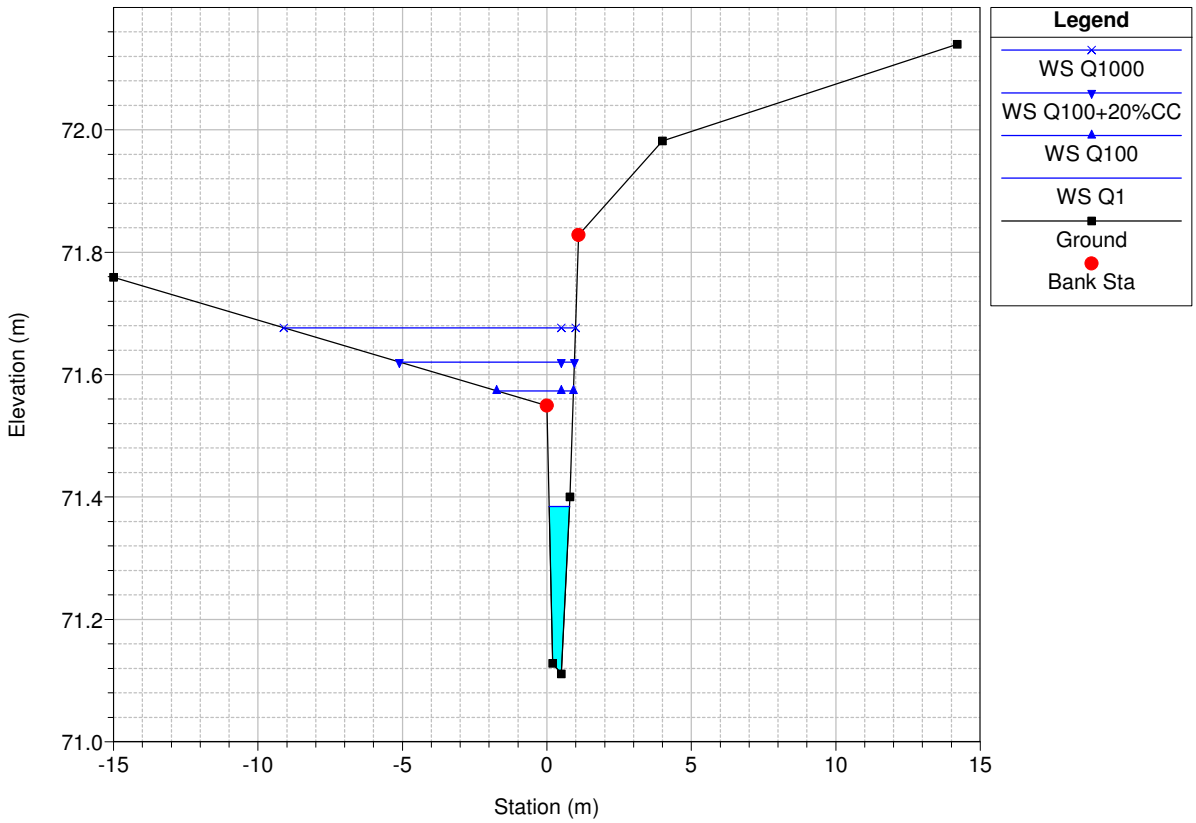
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 220 (W3-10)



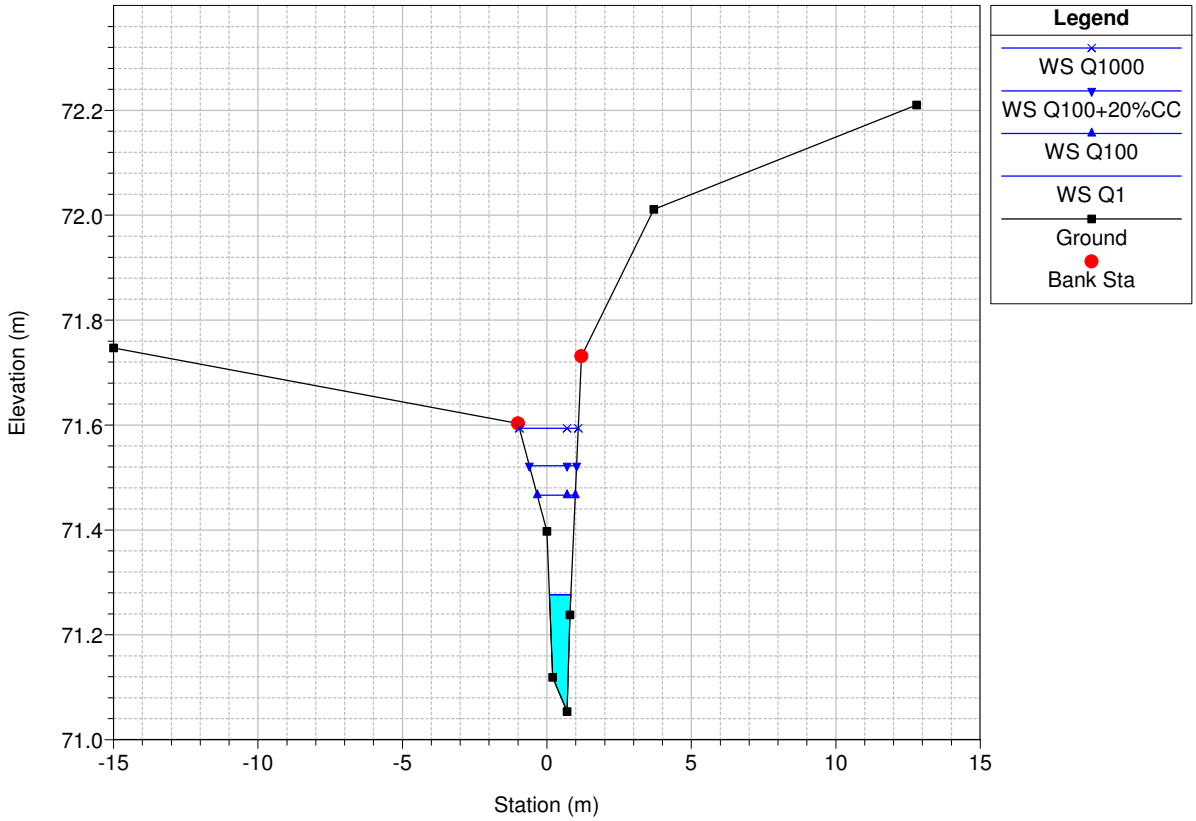
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 210 (W3-20)



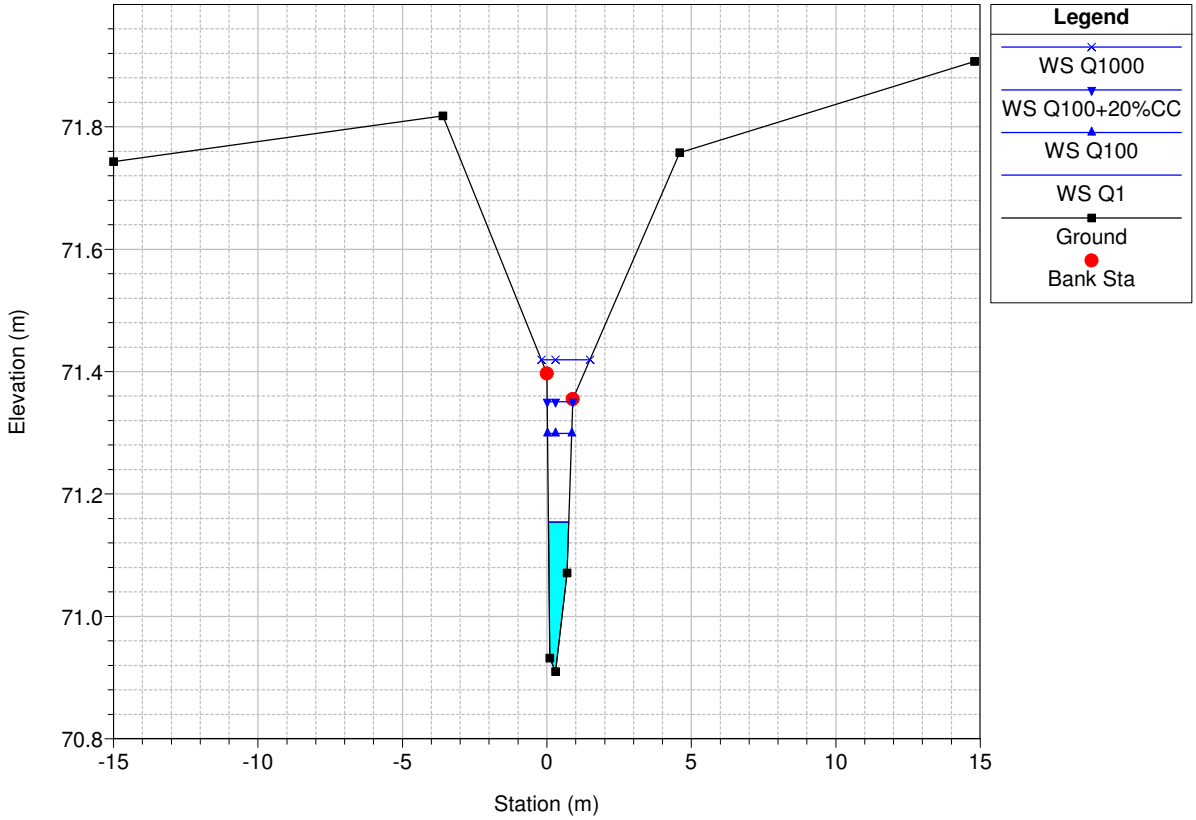
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 200 (W3-30)



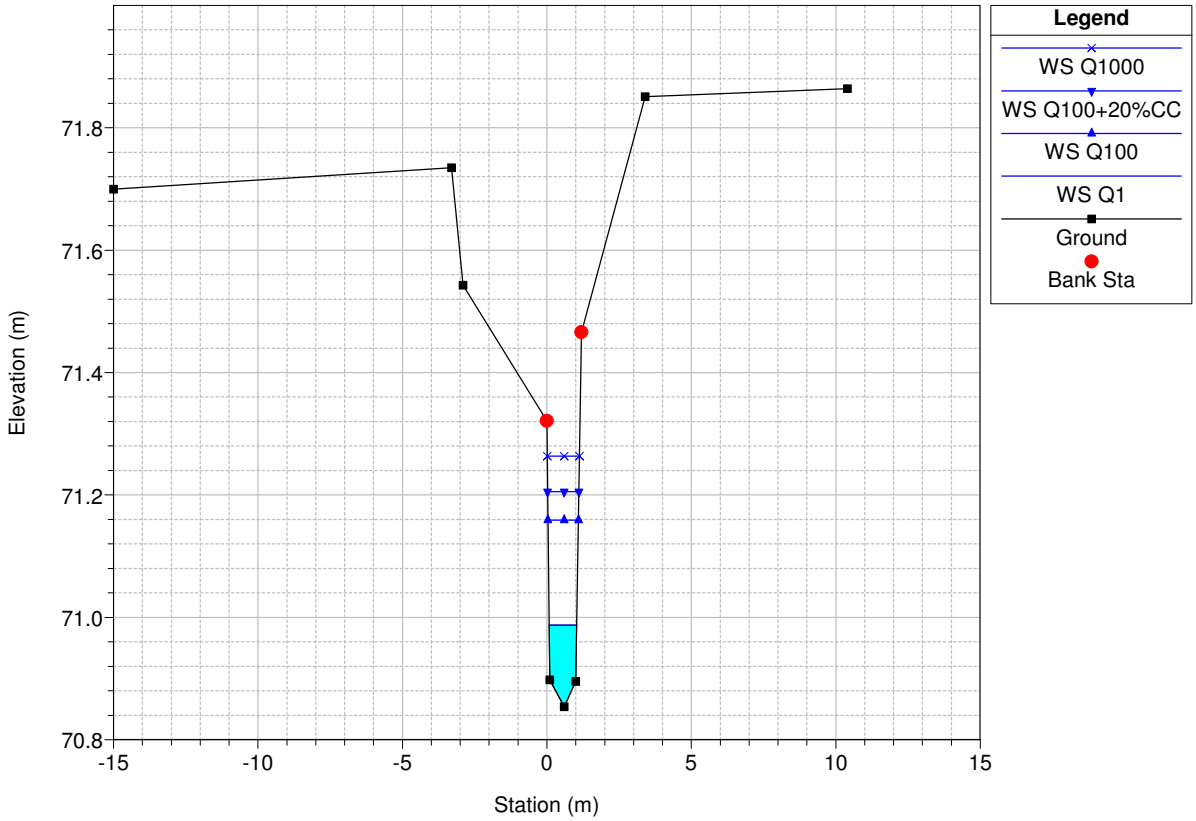
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 190 (W3-40)



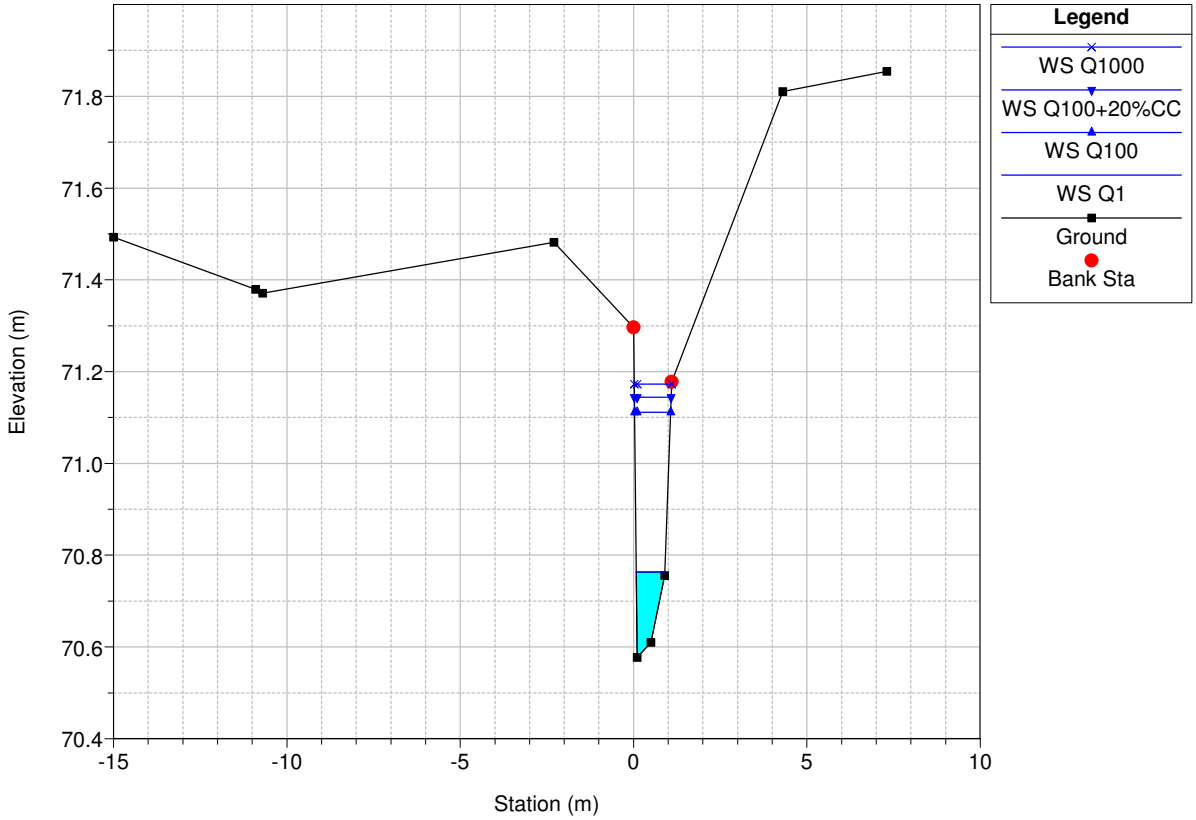
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 180 (W3-50)



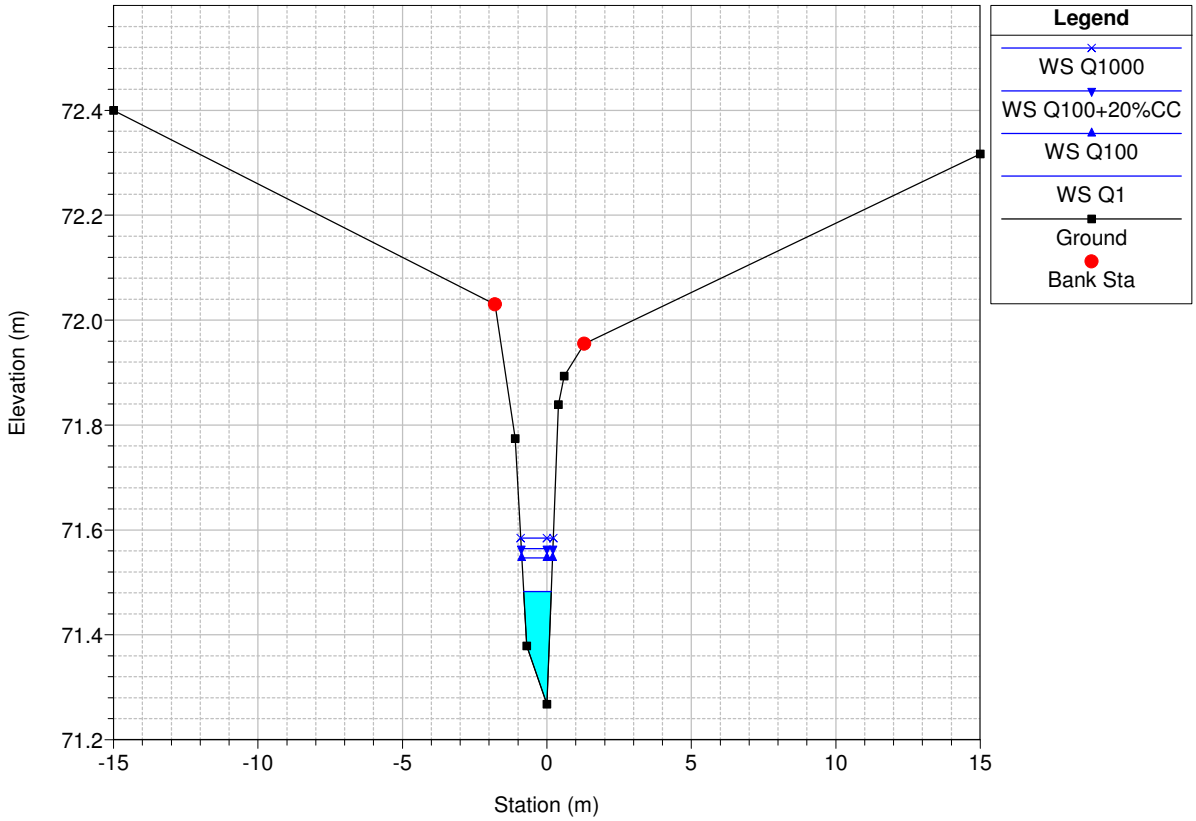
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 1 RS = 170 (W3-60)



Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 2 RS = 200 (W4-CH20)



Waddow View Plan: Plan 01 18/04/2012

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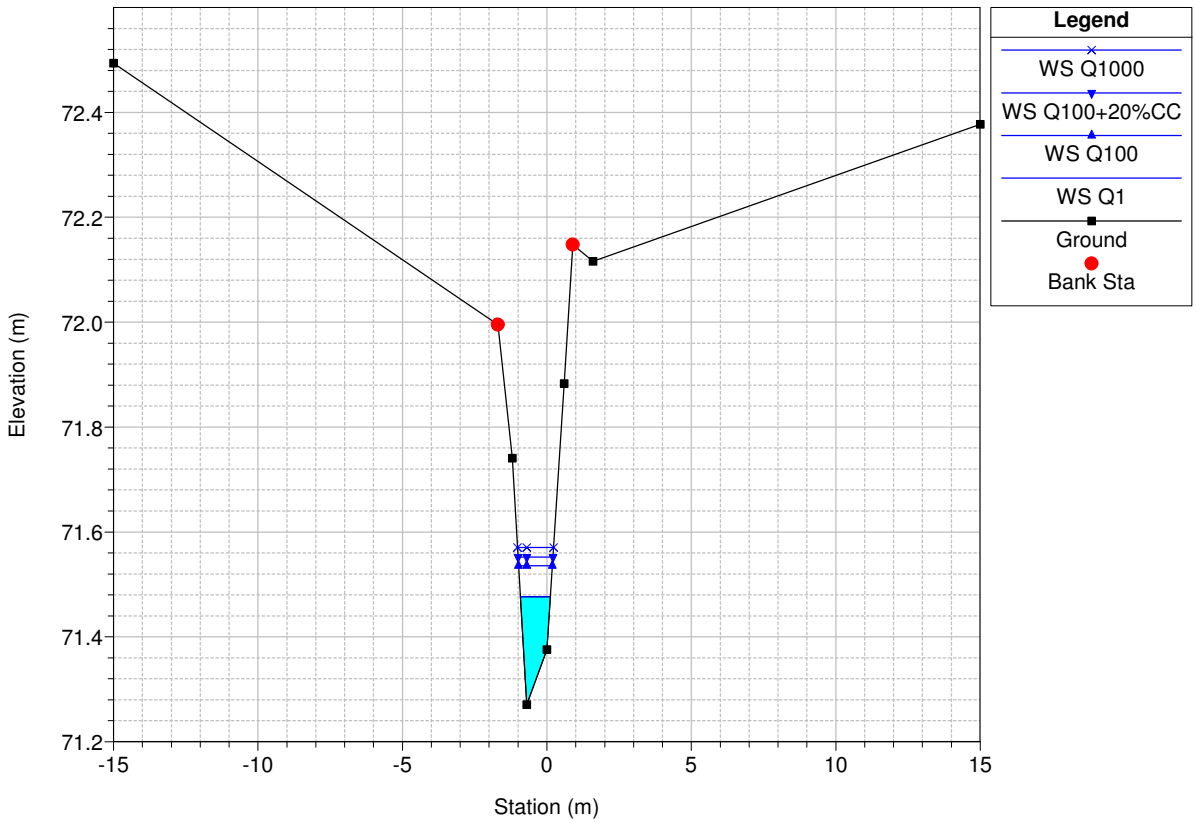
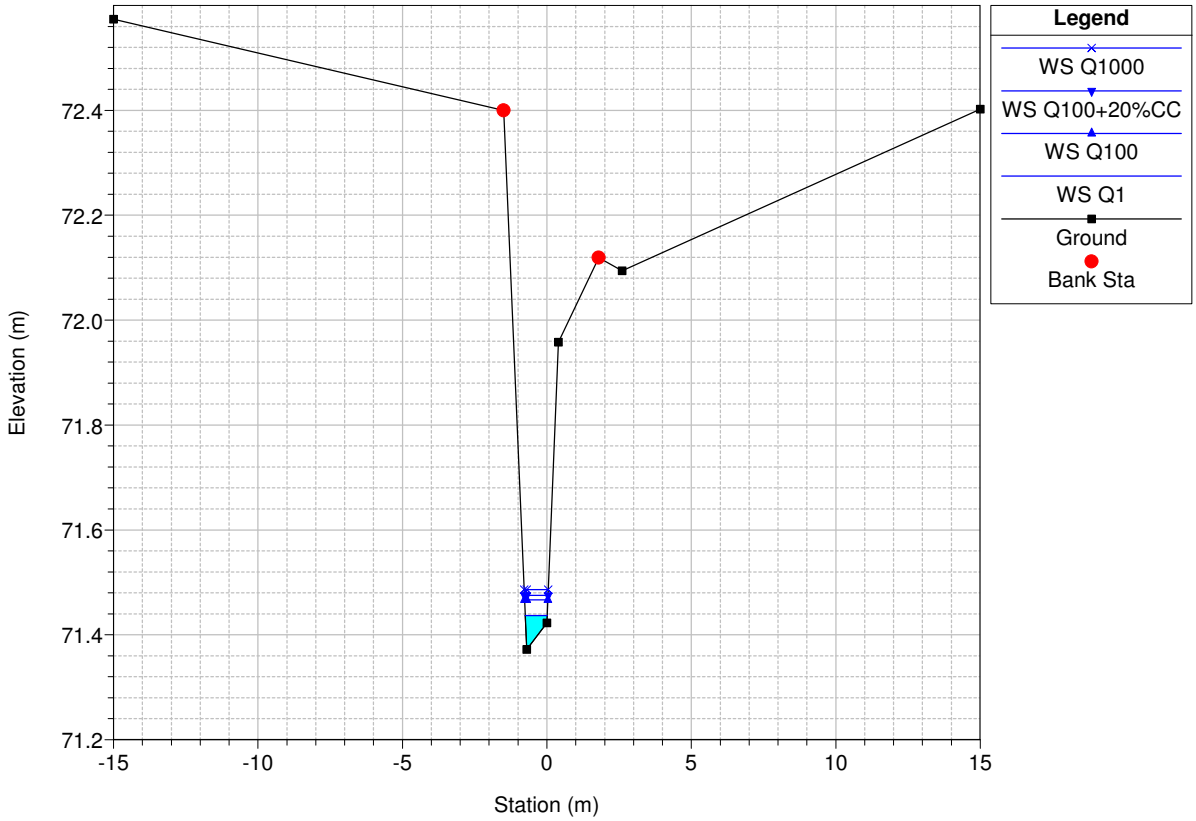


Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 2 RS = 180 (W4-CH0)



Waddow View Plan: Plan 01 18/04/2012

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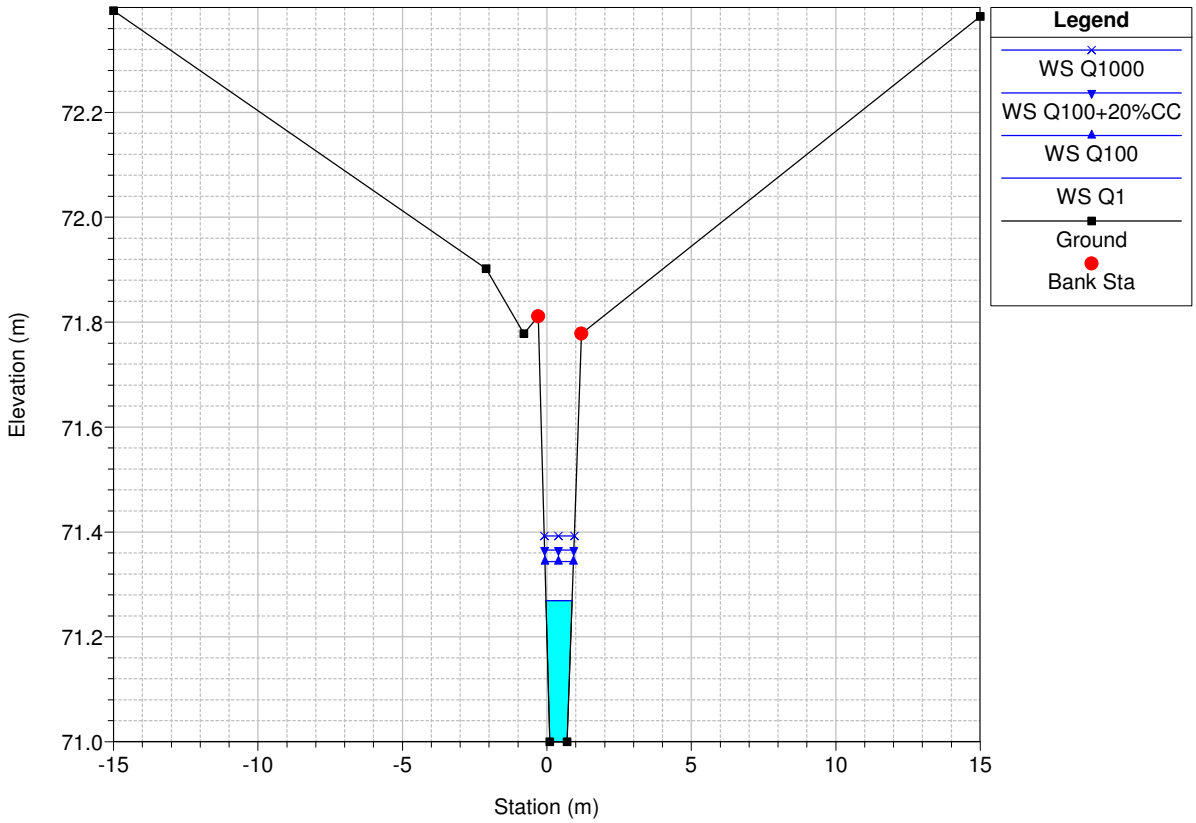

Waddow View Plan: Plan 01 18/04/2012

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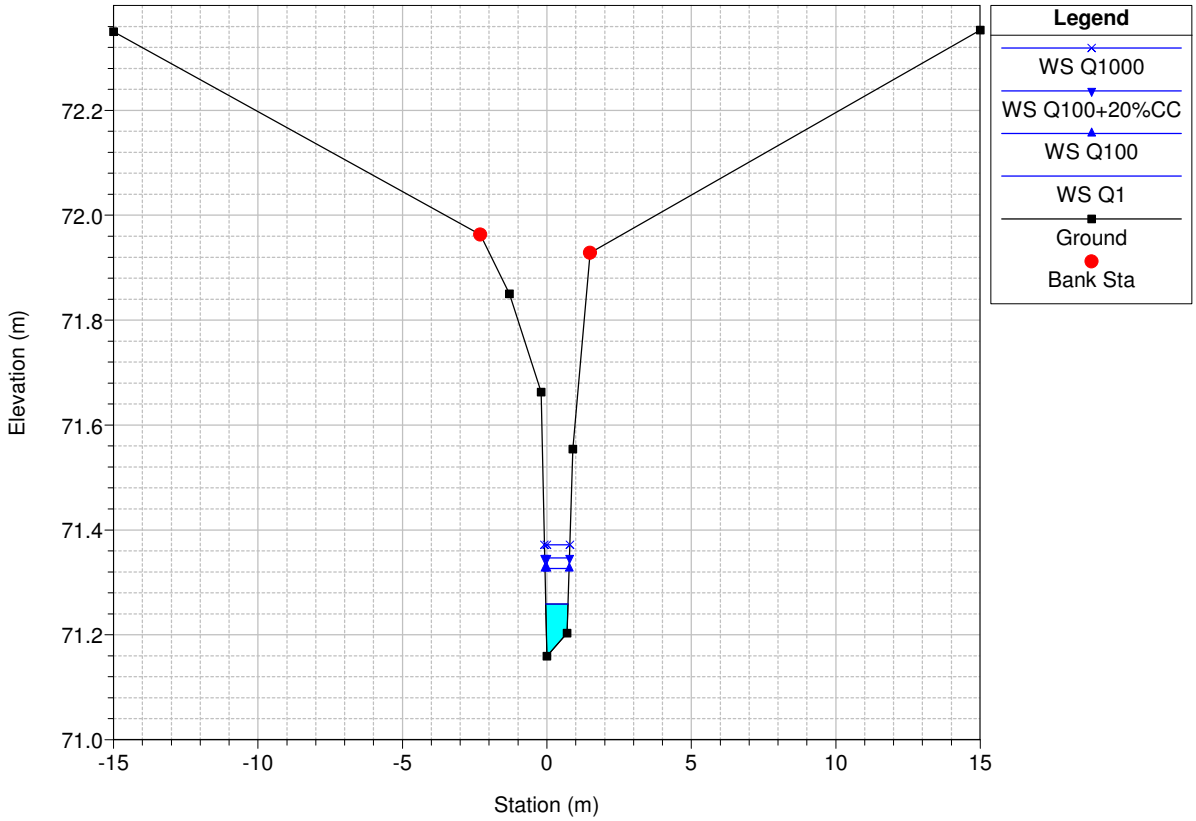

Waddow View Plan: Plan 01 18/04/2012

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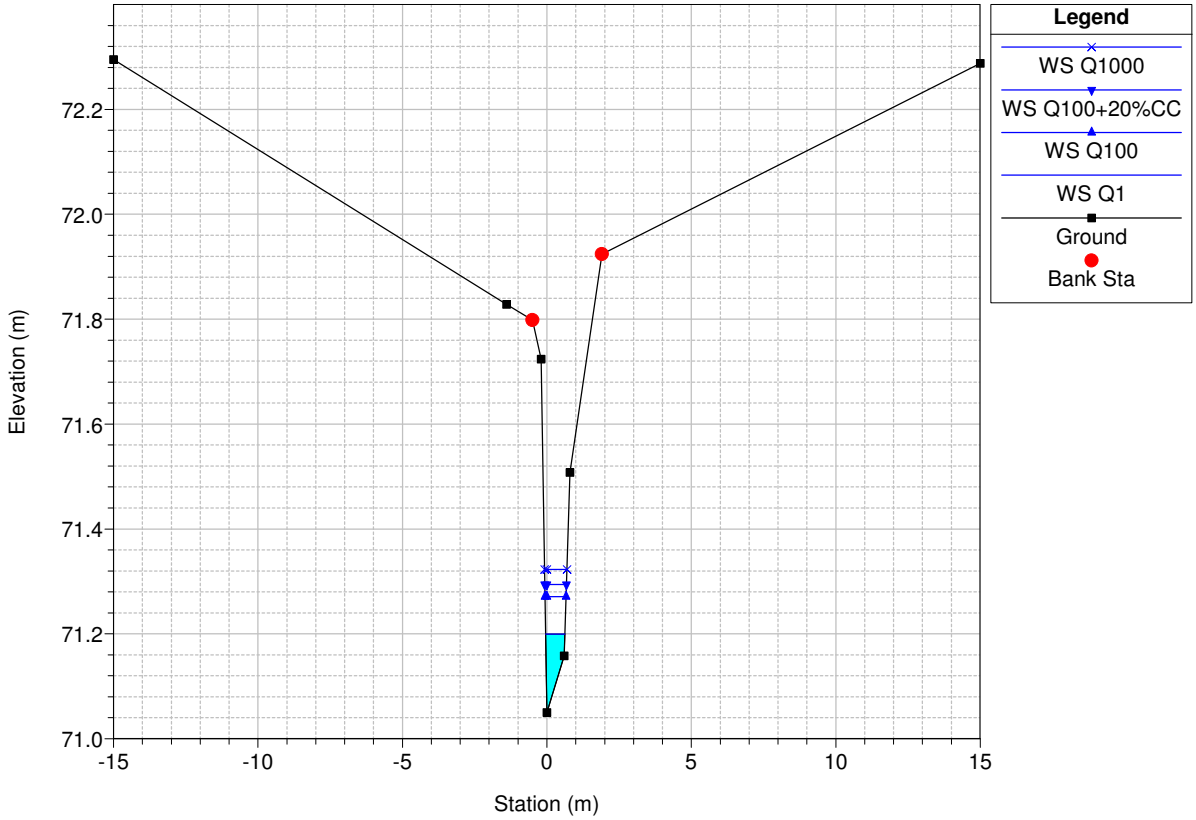

Waddow View Plan: Plan 01 18/04/2012

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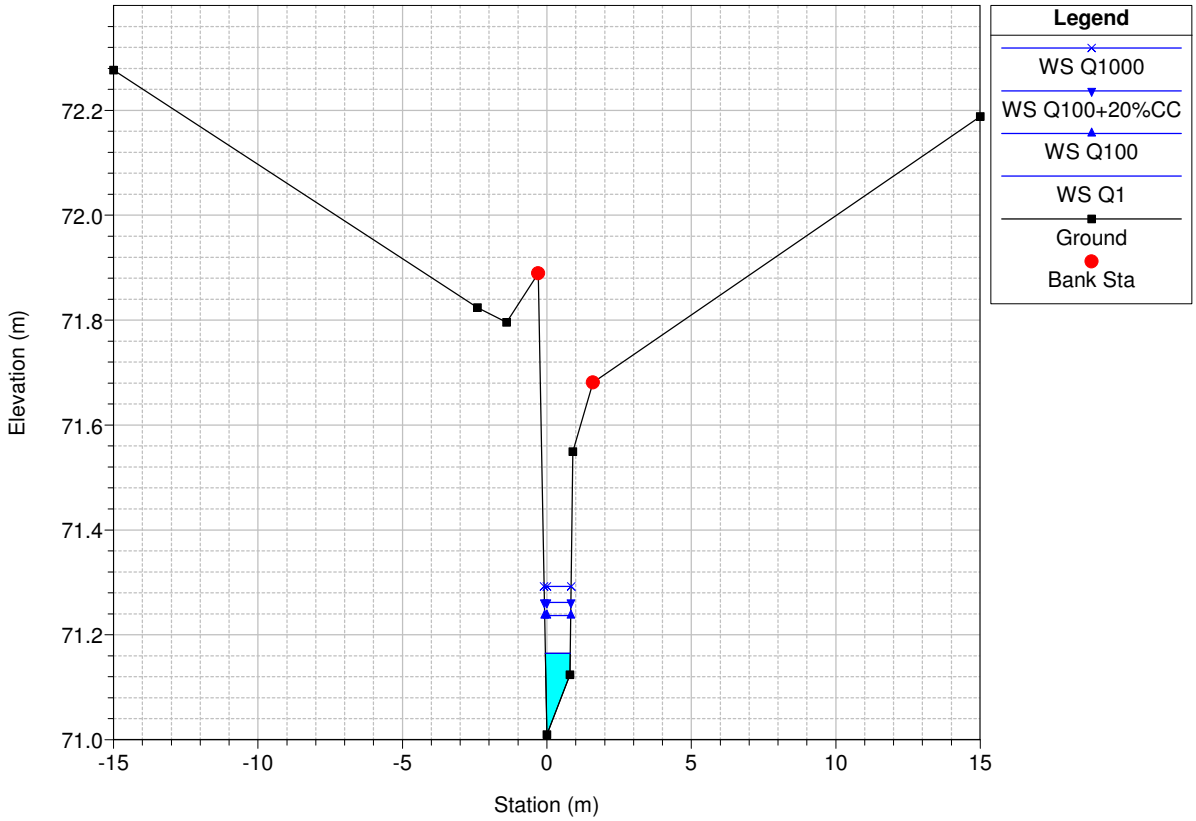

Waddow View Plan: Plan 01 18/04/2012

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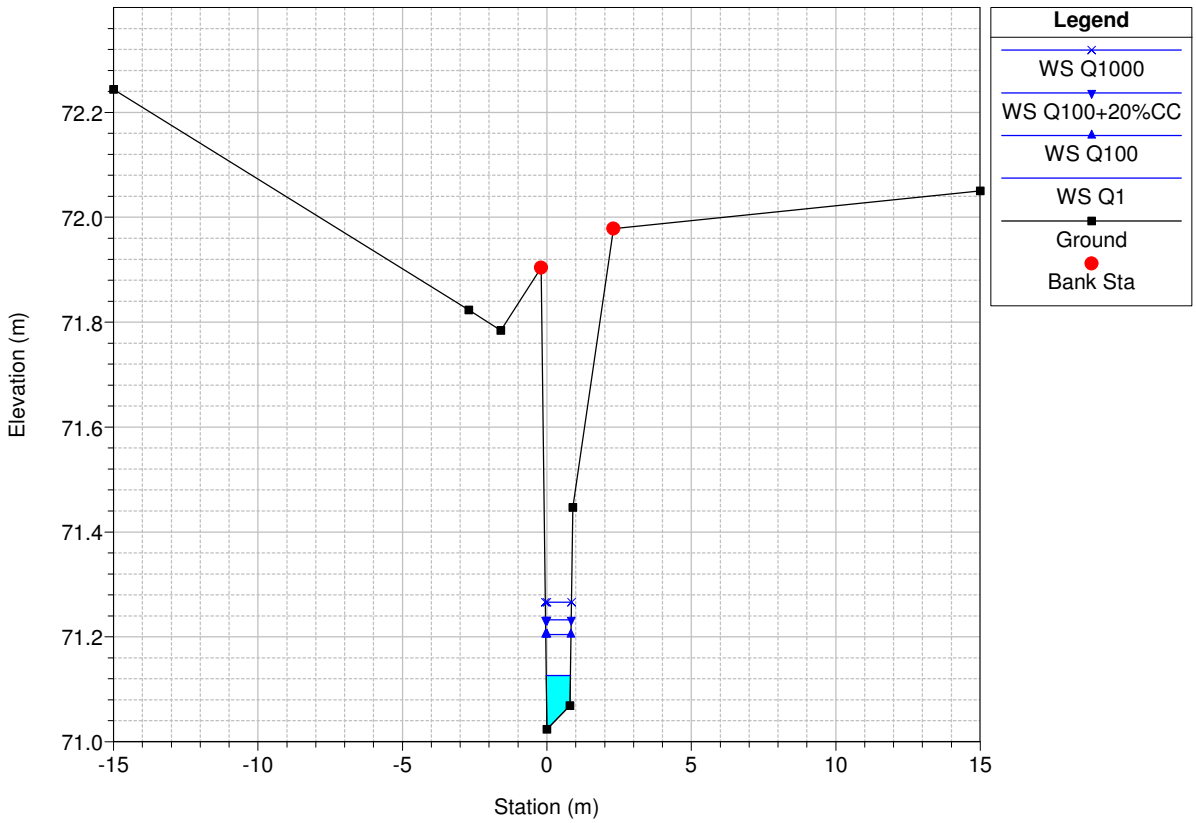

Waddow View Plan: Plan 01 18/04/2012

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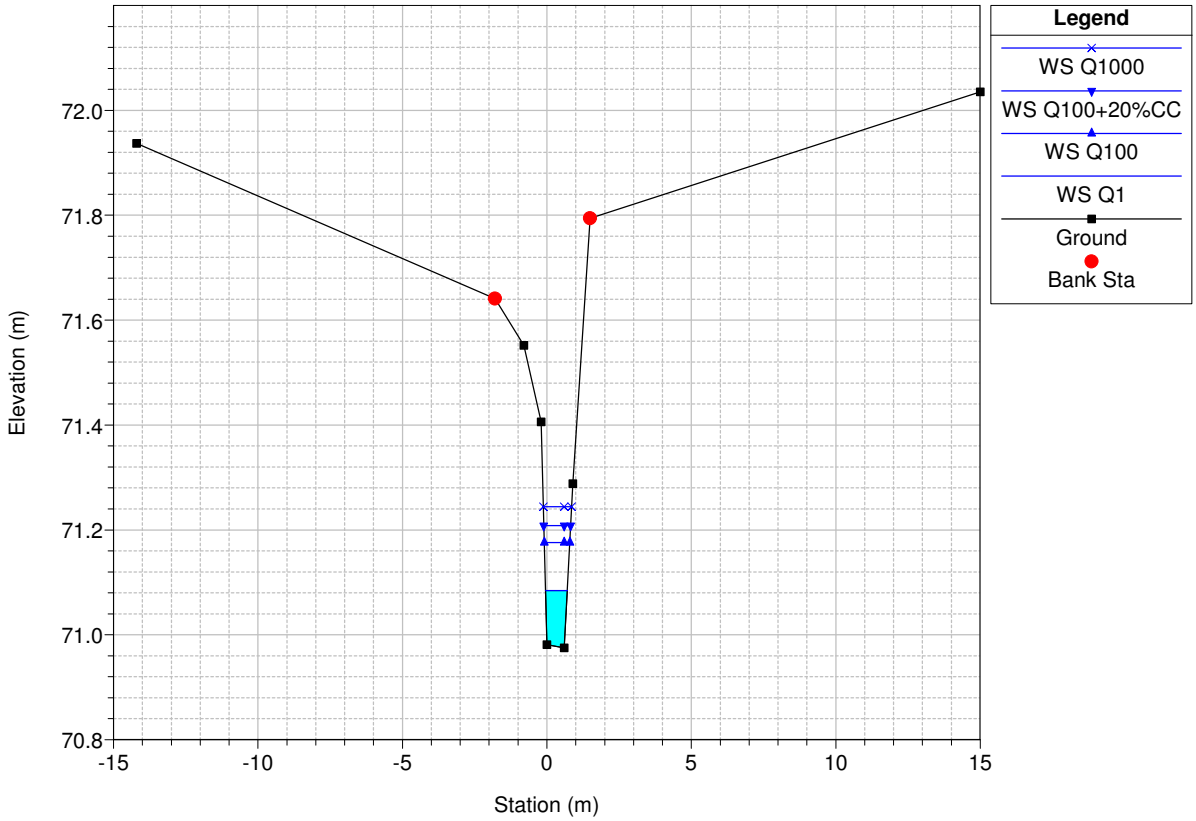

Waddow View Plan: Plan 01 18/04/2012

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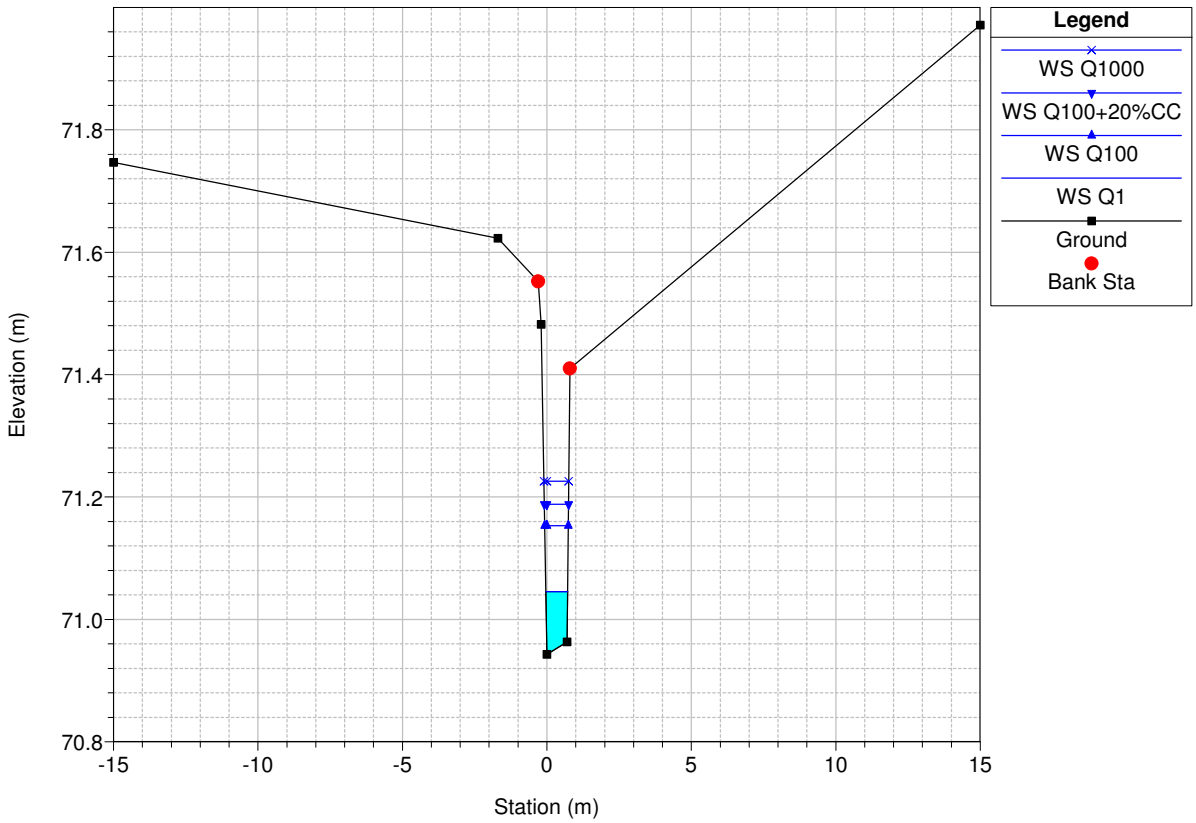

Waddow View Plan: Plan 01 18/04/2012

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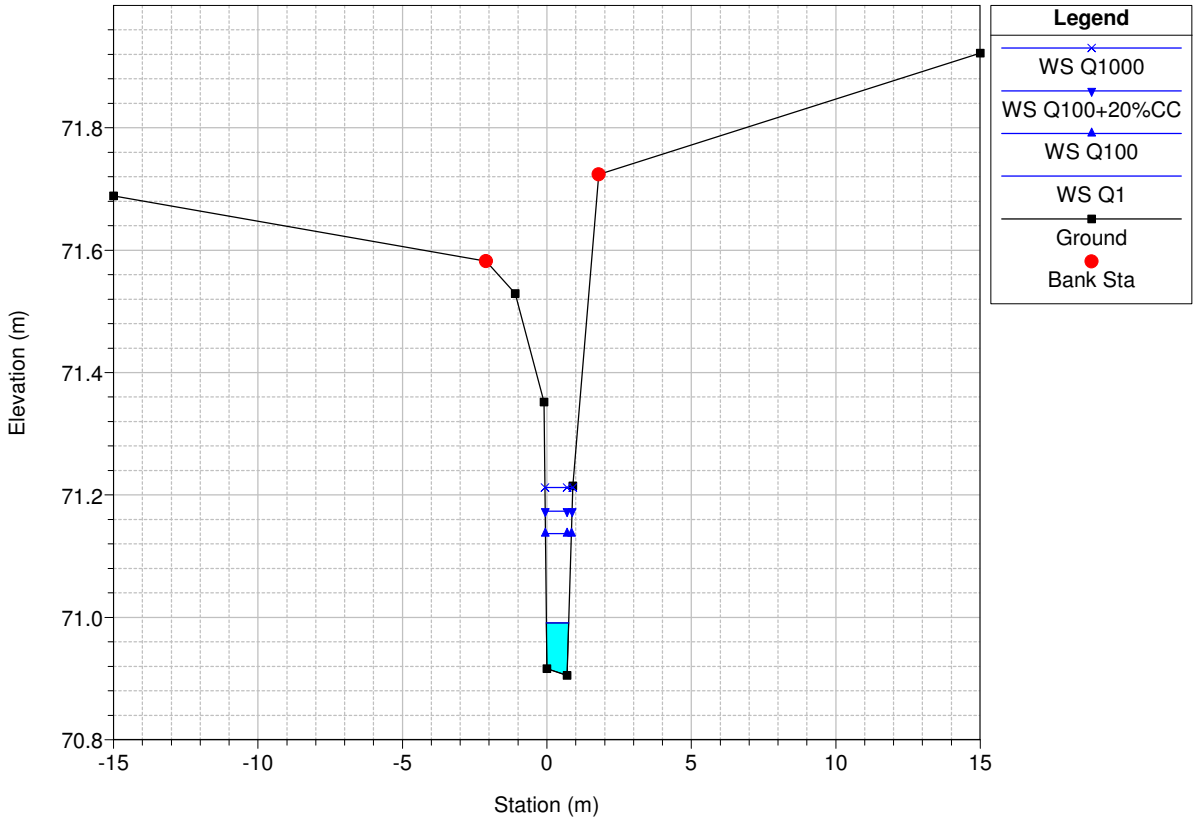

Waddow View Plan: Plan 01 18/04/2012

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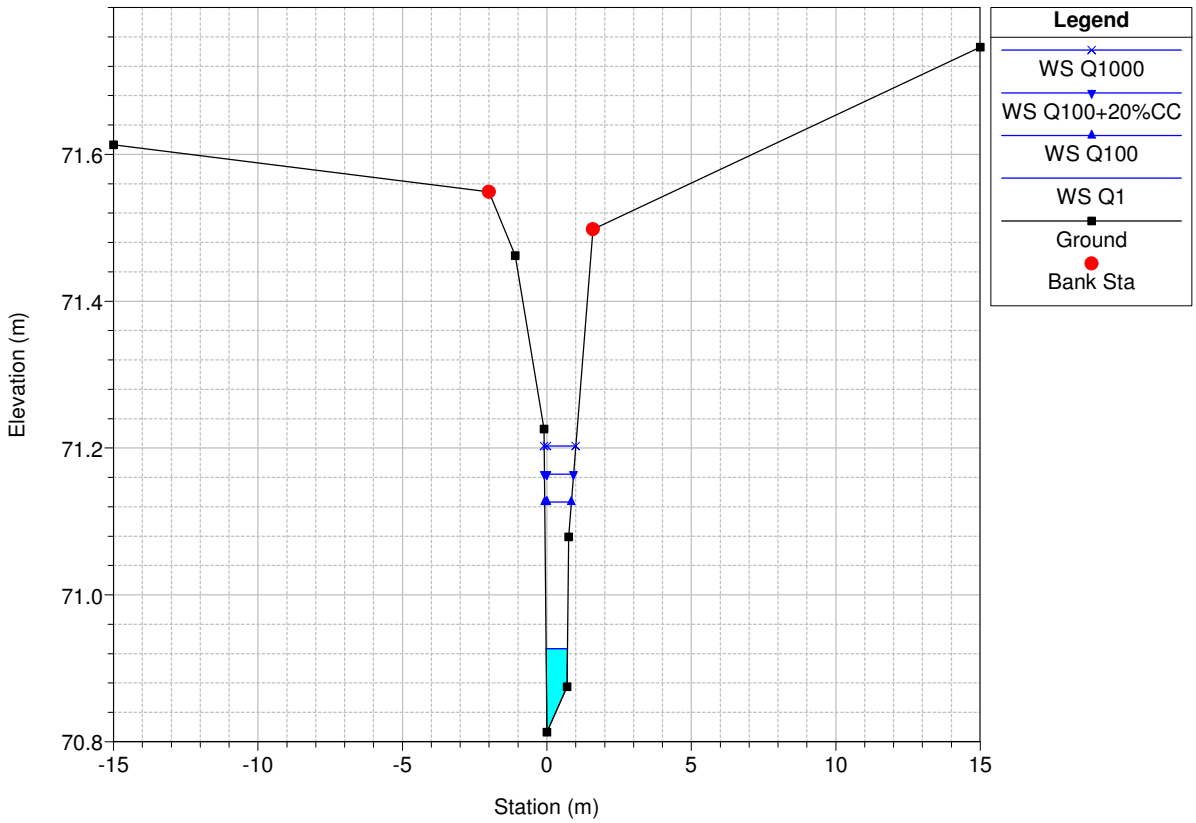
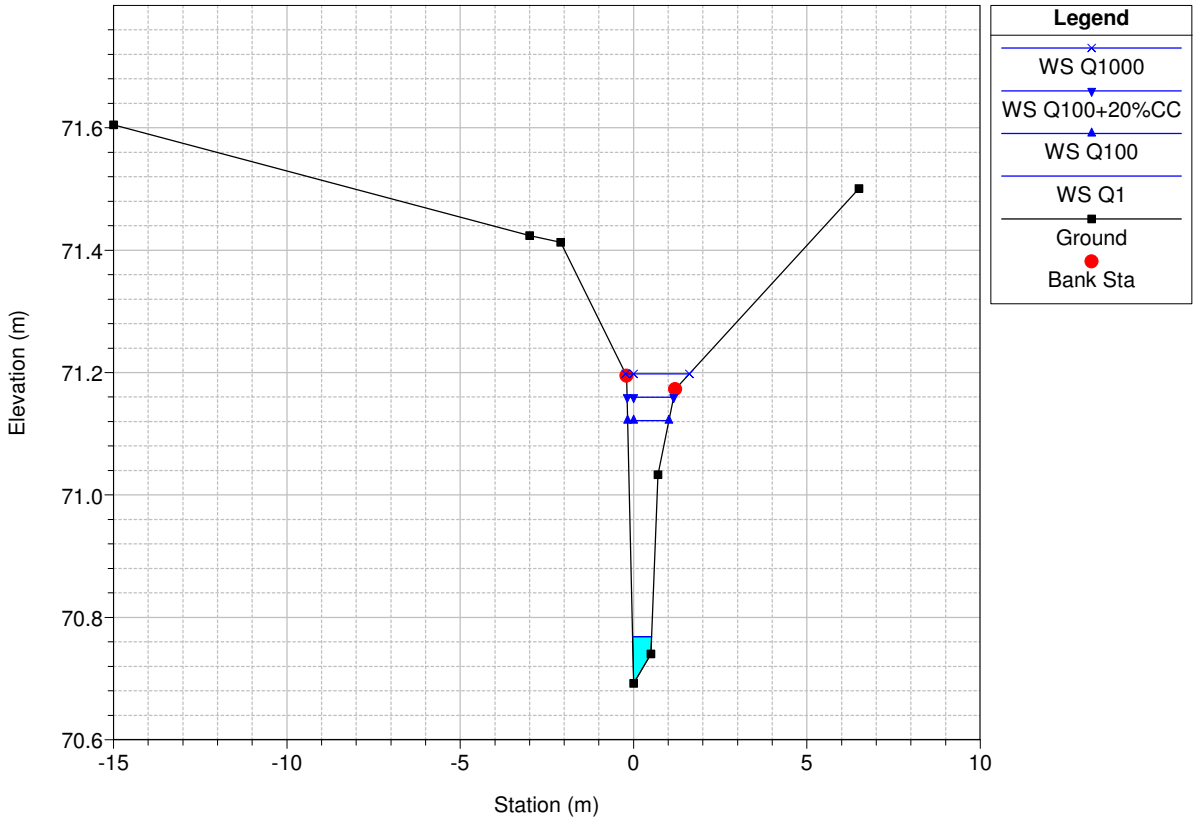


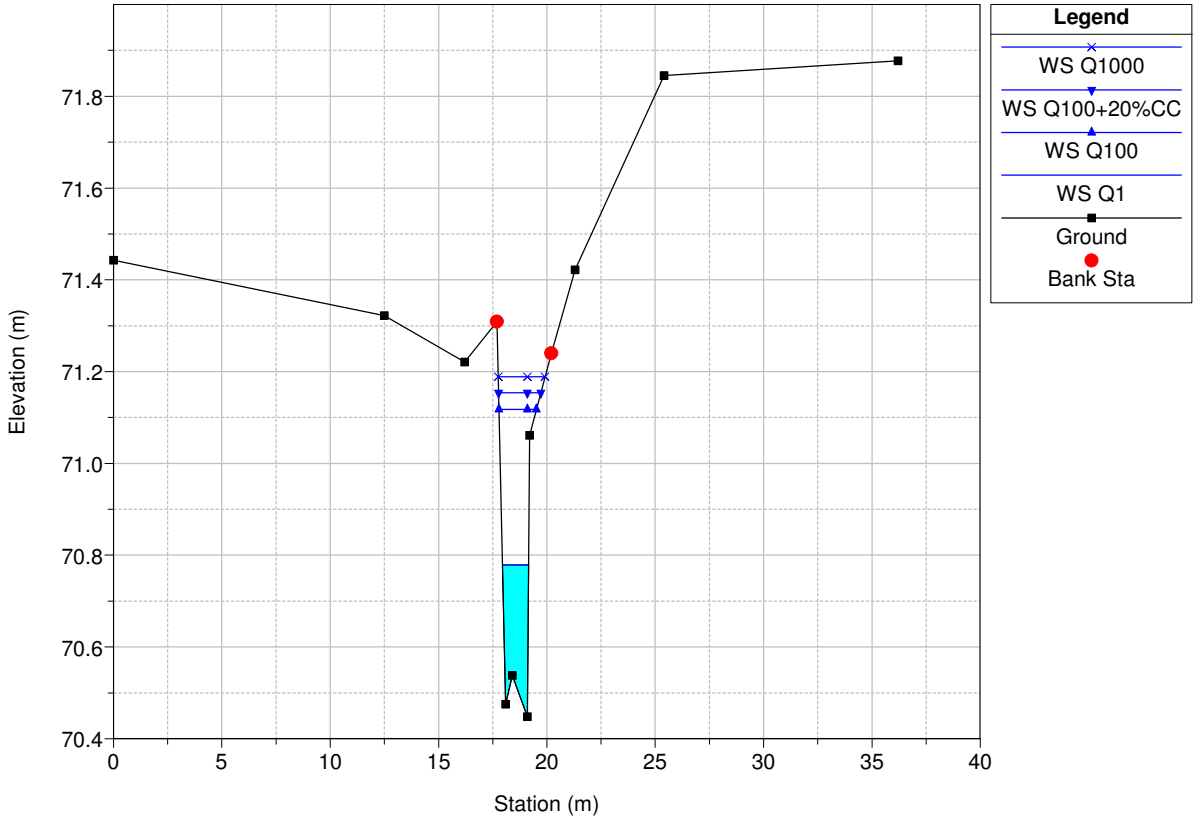
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 2 RS = 80 (W5a-CH90)



Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 3 RS = 160 (W5b-S1)



Waddow View Plan: Plan 01 18/04/2012

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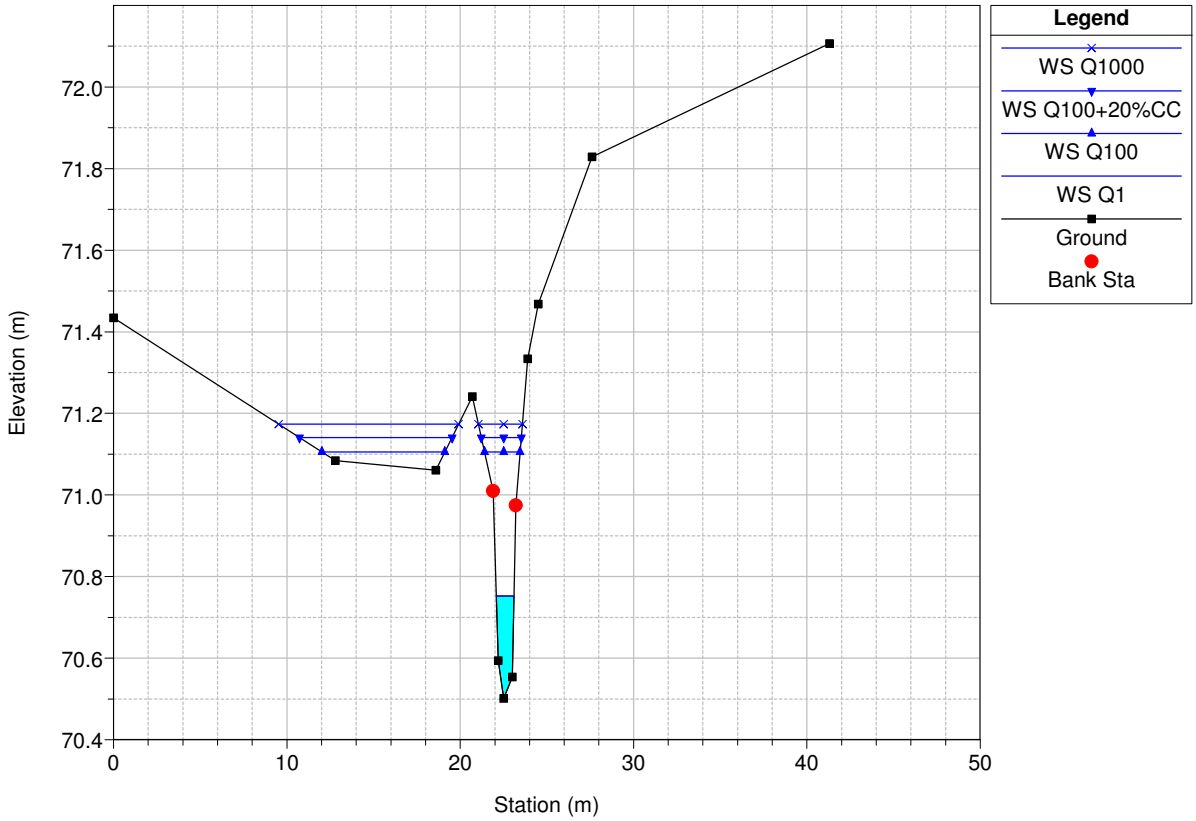
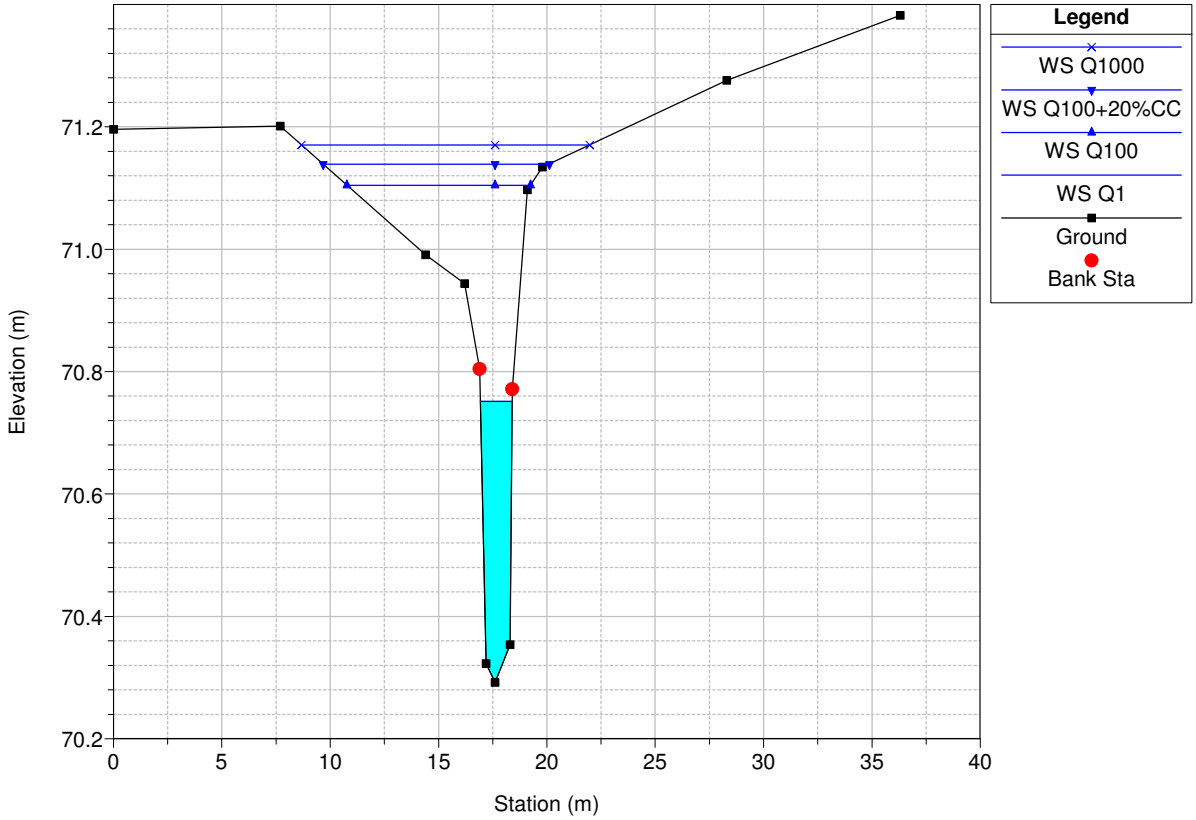


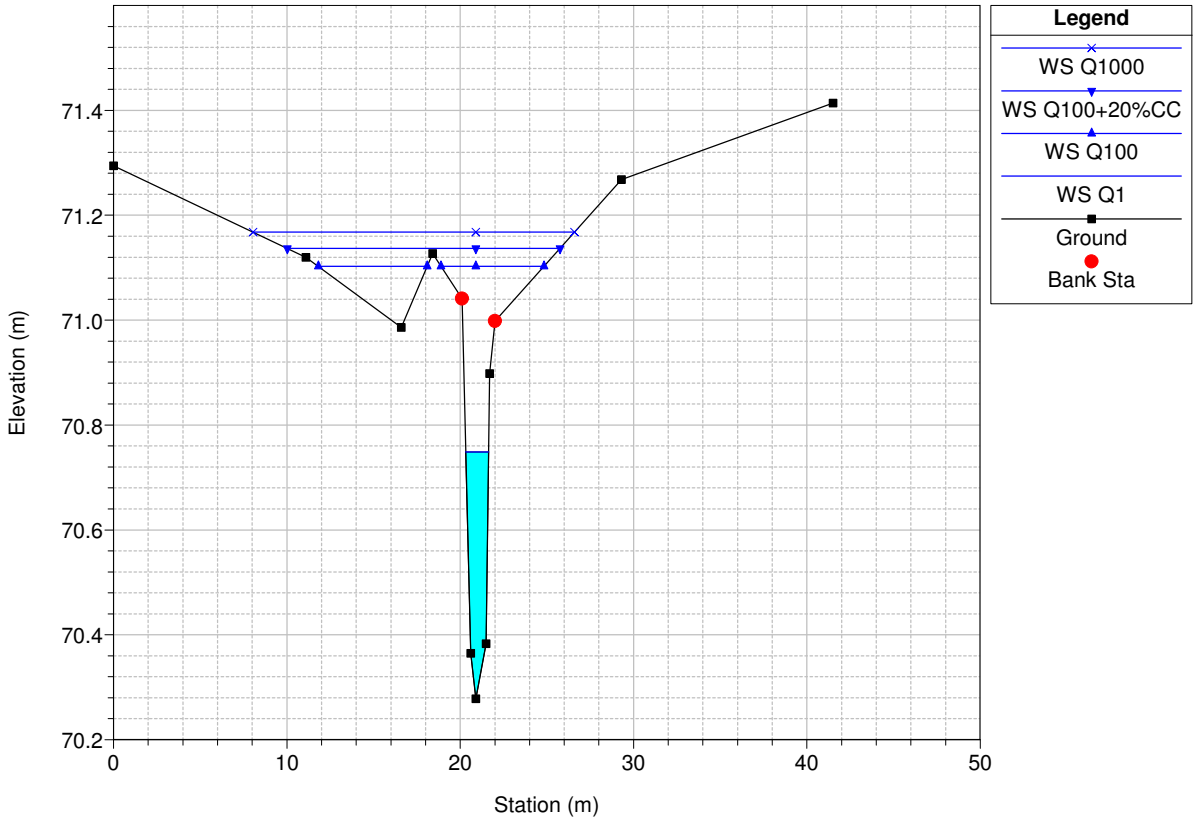
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 3 RS = 140 (W5b-S3)



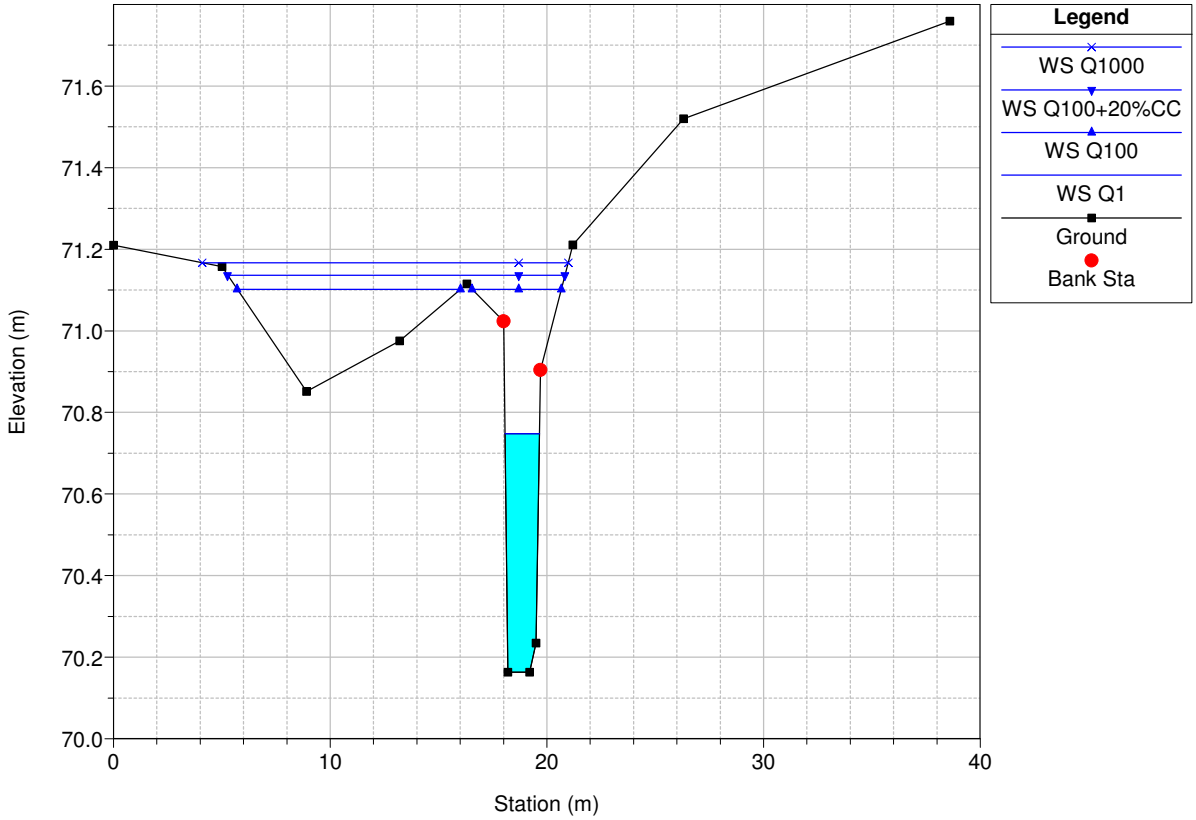
Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 3 RS = 130 (W5b-S4)



Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 3 RS = 120 (W5b-S5)



Waddow View Plan: Plan 01 18/04/2012

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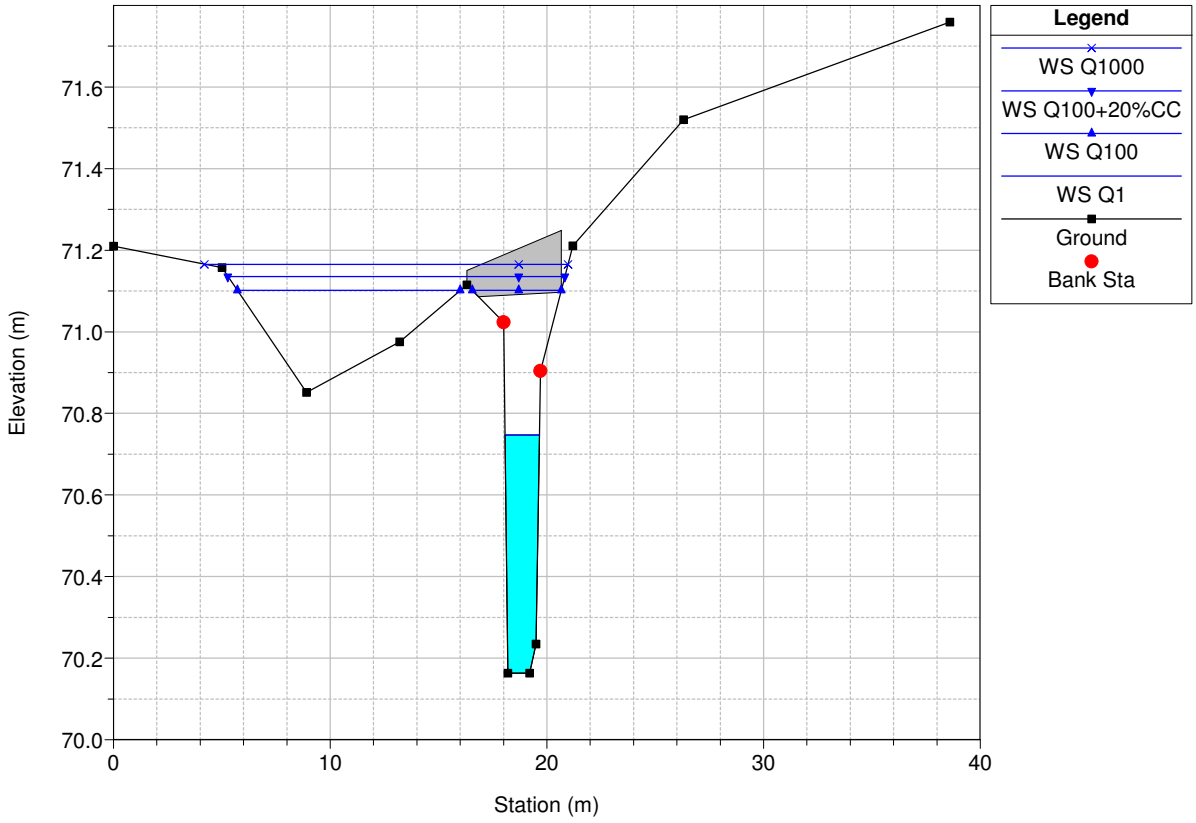

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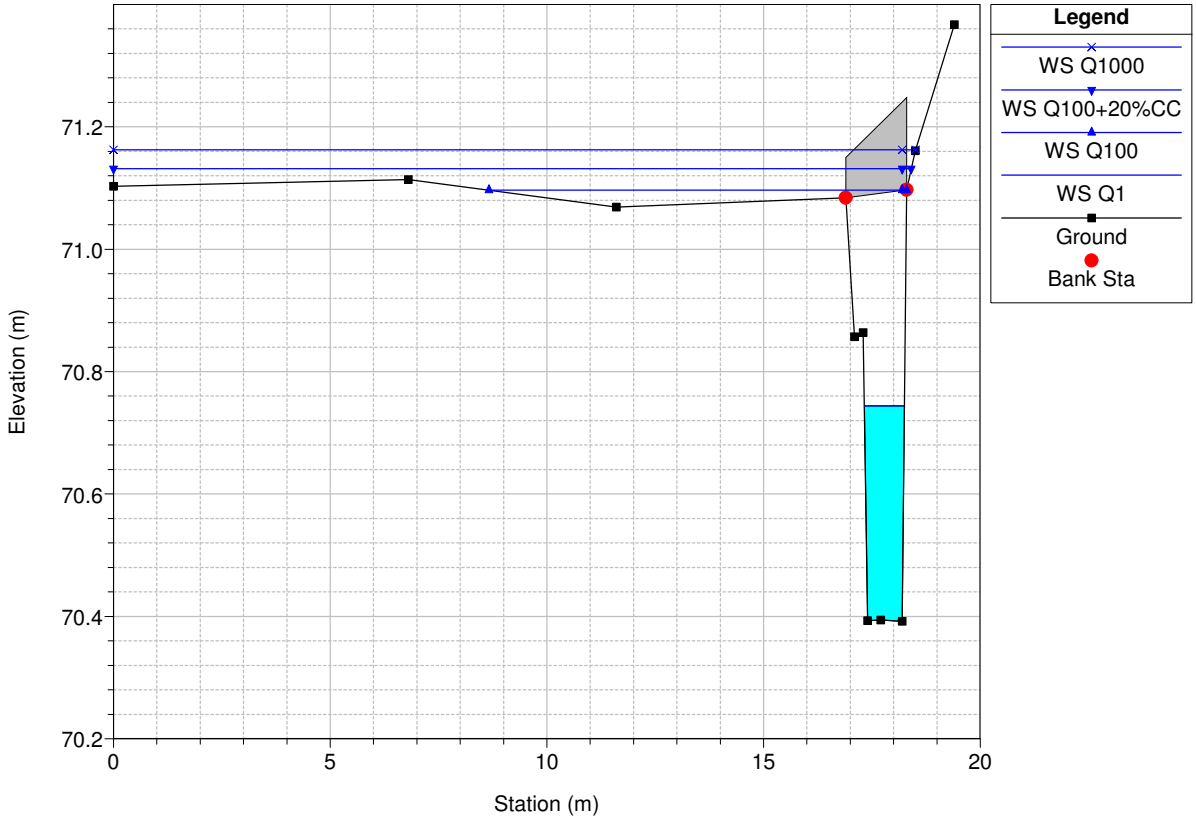
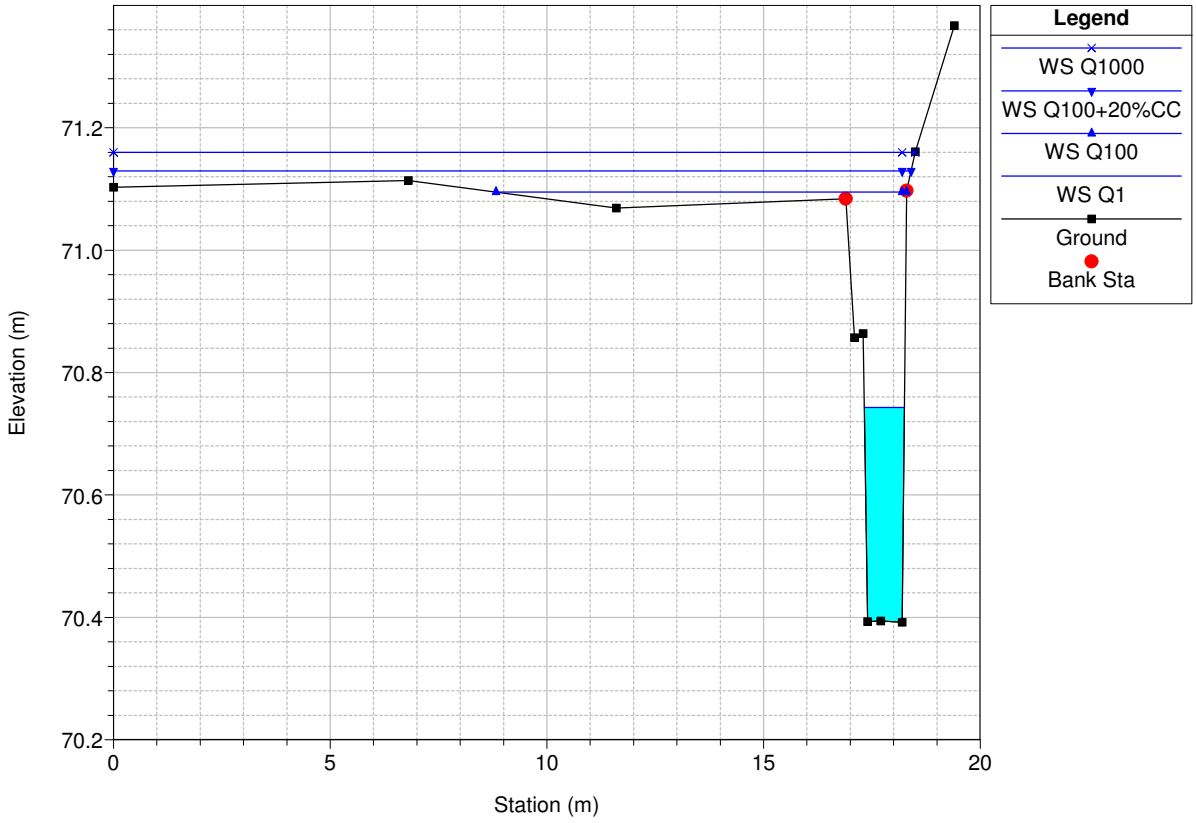


Waddow View Plan: Plan 01 18/04/2012

River = Waddow View Broo Reach = 3 RS = 110 (W5b-S6)



APPENDIX K: FLOOD PLAIN PLAN

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DO NOT SCALE

SURVEY CONTROL STATIONS

STN	EASTING	NORTHING	LEVEL
2001	373923.606	442090.717	76.858
2002	373801.465	442183.504	73.558
2003	373765.952	442243.835	72.477
2004	373842.171	442250.335	73.108
2005	373960.306	442174.140	77.114
2006	374070.767	442218.696	78.741
2007	374042.578	442169.506	77.230
2008	374042.586	442169.513	77.230
2009	373934.666	442438.386	71.619
2010	373933.200	442391.067	72.192
2011	373947.246	442308.746	72.796
2012	373871.723	442069.989	76.843

N

LEGEND

0.1%AEP (1in1000yr EVENT) FLOODING EXTENTS

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

THE HUNTROYDE ESTATE
AND
CLITHEROE AUCTION MART

PROJECT: WADDOW VIEW CLITHEROE

TITLE: FLOOD PLAIN PLAN

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
APRIL 2012	A1	RDN	RA

PROJECT No:	DRAWING No:	REV:
SEA14	100	P1

APPENDIX L: UNITED UTILITIES SEWER RECORDS

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United Utilites Water PLC
Property Searches
Stephen's Way
Goose Green
Wigan
WN3 6PJ

DX 719690 Wigan 8

Telephone 0870 751 0101

Fax Number 0870 7510102

Property.searches@uuplc.co.uk

Your Ref:
Our Ref: 08/ 821325
Date: 22/08/2011

BETTS ASSOCIATES LTD
OLD MARSH FARM BARNS
WELSH ROAD

SEALAND
CH5 2LY

FAO: R NICHOLAS

Dear Sirs

Location: CHEWS FARM CLITHEROE

I acknowledge with thanks your request dated 22/08/11 for information on the location of our services.

Please find enclosed plans showing the approximate position of our apparatus known to be in the vicinity of this site.
I attach General Condition Information sheets, which details contact numbers for additional services (i.e. new supplies, connections, diversions) which we are unable to deal with at this office. In addition you should ensure they are made available to anyone carrying out any works which may affect our apparatus.

I trust the above meets with you requirements and look forward to hearing from you should you need anything further.

Please note from Friday 30th September 2011 we will no longer be providing a mapping service for any Electricity Assets. This service will be through ENW Ltd, 304 Bridgewater Place, Birchwood Park, Warrington, WA3 6XG Tel: 0800 048 1820 (Option 4) or E Mail: http://www.enwl.co.uk.

If you have any queries regarding this matter please telephone us on 0870 7510101.

Yours Faithfully,

S McManus

Sue McManus
Operations Manager
Property Searches

From 1st October 2011 ownership of private sewers and lateral drains will change in accordance with The Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011.
The results of this request do not reflect these changes.
For further information please visit; http://www.unitedutilities.com/privatesewers.aspx

United Utilities Water PLC
Registered in England & Wales No. 2366678
Registered Office: Haweswater House,
Lingley Mere Business Park, Lingley Green Avenue,
Great Sankey, Warrington, WA5 3LP

TERMS AND CONDITIONS - WASTERWATER & WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUW apparatus) of United Utilities Water PLC ("UUW").

TERMS AND CONDITIONS:

1. This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.

2. This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.

3. In particular, the position and depth of any UUW apparatus shown on the Map are approximate only. UUW strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUW apparatus. The exact location, positions and depths should be obtained by excavation trial holes.

4. The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.

5. The position and depth of UUW apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been ade subsequent to issue and prior to any works being carried out.

6. This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUW apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.

7. No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUW apparatus by reason of the actual position and/or depths of UUW apparatus being different from those shown on the Map and any information supplied with it.

8. If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.

9. This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUW from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

Conditions and information regarding wastewater network

These general conditions and precautions apply to the wastewater network of United Utilities.

Please ensure that a copy of these conditions is passed to your representative and contractor on site.

1. United Utilities provides the approximate locations of its sewers according to its records. These records are not necessarily accurate or complete nor do they normally show the positions of every sewer culvert or drain, private connections from properties to the public sewers or the particulars of any private system. No person or company shall be relieved from liability for any damage caused by reason of the actual positions and/or depths being different from those indicated. The records do indicate the position of the nearest known public sewer from which the likely length of private connections can be estimated together with the need for any off site drainage rights or easements.

2. Special requirements relative to our sewers may be indicated. United Utilities employees or its contractors will visit any site at reasonable notice to assist in the location of its underground sewers and advise any precautions that may be required to obviate any damage. To arrange a visit or for further information regarding new supplies, connections, diversions, costing, or any notification required under these General Conditions, please call us on **0845 746 2200**.

3. Where public sewers are within a site which is to be developed and do not take any drainage from outside the area, they are from an operational viewpoint redundant. The developer must identify all redundant sewers affected by the development and apply to United Utilities in writing for these sewers to be formally closed. The developer shall bear all related costs of the physical abandonment work.

4. Public sewers within the site that are still live outside the area, will be subject to a "Restricted Building zone". This would normally be a surface area equivalent to the depth of the sewer measured from the centre line of the sewer on either side. No construction will be permitted within that zone. The developer should also note that deep and wide rooted trees must not be planted in close proximity to live sewers. Access to public sewers must be maintained at all times and no interference to manholes will be permitted during construction work.

5. Where there is a public sewer along the line of a proposed development/building, arrangements shall be made by the developer at his cost to divert the sewer around the development. Where this is not possible and as a last resort, a "Building Over Agreement" will need to be completed under section 18 of the Building Act 1984. The developer shall design building foundations to ensure that no additional loading is transferred to the sewer and submit such details both to the Local Authority's Building Control Officer and to United Utilities for approval/acceptance. United Utilities on a rechargeable basis would normally undertake all aspects of design work associated with the diversion of any part of the operational wastewater network.

6. Where there is a non-main river watercourse/culvert passing through the site, the landowner has the responsibility of a riparian owner for the watercourse/culvert and is responsible for the maintenance of the fabric of the culvert and for all works involved in maintaining the unrestricted flow through it. Building over the watercourse/culvert is not recommended. The developer must contact the local authority before any works are carried out on the watercourse/culvert. Where it is necessary to discharge surface water from the site into the watercourse/culvert the developer shall make an assessment of the available capacity of the watercourse/culvert (based on a 1 in 50 year event) and ensure that the additional flow to be discharged into the watercourse/culvert will not cause any flooding. In appropriate cases, flooding may be prevented by on-site storage. The developer shall submit the relevant details required to substantiate his development proposals. Details of any outfall proposed shall also be submitted to the Environment Agency, PO Box 12, Richard Fairclough House, Knutsford Road, Warrington, Cheshire, WA4 1HT for their approval.

7. Where there is a main river watercourse/culvert passing through the site, the developer shall submit all proposals affecting the river to the Environment Agency at the address stated in paragraph 6 for approval/acceptance.

8. Your attention is drawn also to the following:

- **Private drains or sewers which may be within the site.** United Utilities has no duty to keep records of private drains and sewers, and there are no comprehensive records kept elsewhere. Local Authority Building Control Officers may have records of recent developments and they or the developer may be able to provide information in this respect.

- **Applications to make connections to the public sewer.** The developer must write to United Utilities requesting an application form that must be duly completed and returned. No works on the public sewer shall be carried out until a letter of consent is received from United Utilities.

- **Sewers for adoption.** If an agreement for the adoption of sewers under Section 104 of the Water Industry Act 1991 is being contemplated, a submission in accordance with "Sewers for Adoption", Fifth Edition, published by the Water Research Centre (2001) Plc, Henley Road, Medmenham, PO Box 16, Marlow, Buckinghamshire, SL7 2HD will be required, taking into consideration any departures from the general guide stipulated by United Utilities.

- **Further consultation with United Utilities.** Developers wishing to seek advice or clarification regarding sewer record information provided should contact United Utilities to arrange an appointment. A consultation fee may be charged, details of which will be made available at the time of making an appointment.

9. Combined sewers, foul sewers, surface water sewers, and pumped mains. These are shown separately in a range of colours or markings to distinguish them on our drawings, which are extracts from the statutory regional sewer map. A legend and key is provided on each extract for general use, although not all types of sewer will be shown on every extract.

   Combined sewers shown coloured red carry both surface water and foul sewage, especially in areas where there is no separate surface water sewerage system.

   Foul sewers coloured brown may also carry surface water and there may be no separate surface water system indicated in the immediate area. Both combined and foul sewers carry wastewater to our treatment works before it can safely be returned to the environment.

   Surface water sewers coloured blue on our drawings are intended only to carry uncontaminated surface water (e.g. rainfall from roofs, etc) and they usually discharge into local watercourses. It is important for the protection of the environment and water quality that only uncontaminated surface water is connected to the surface water sewers. Improper connections to surface water sewers from sink wastes, washing machines and other domestic use of water can cause significant pollution of watercourses.

   Pumped mains, rising mains and sludge mains will all be subject to pumping pressures and are neither suitable nor available for making new connections.

   Highway drains, when included, show as blue and black dashed lines. Highway drains are not assets belonging to United Utilities and are the responsibility of local authorities.

10. For information regarding future proposals for construction of company apparatus please write to United Utilities, PO Box 453, Warrington, WA5 3QN.

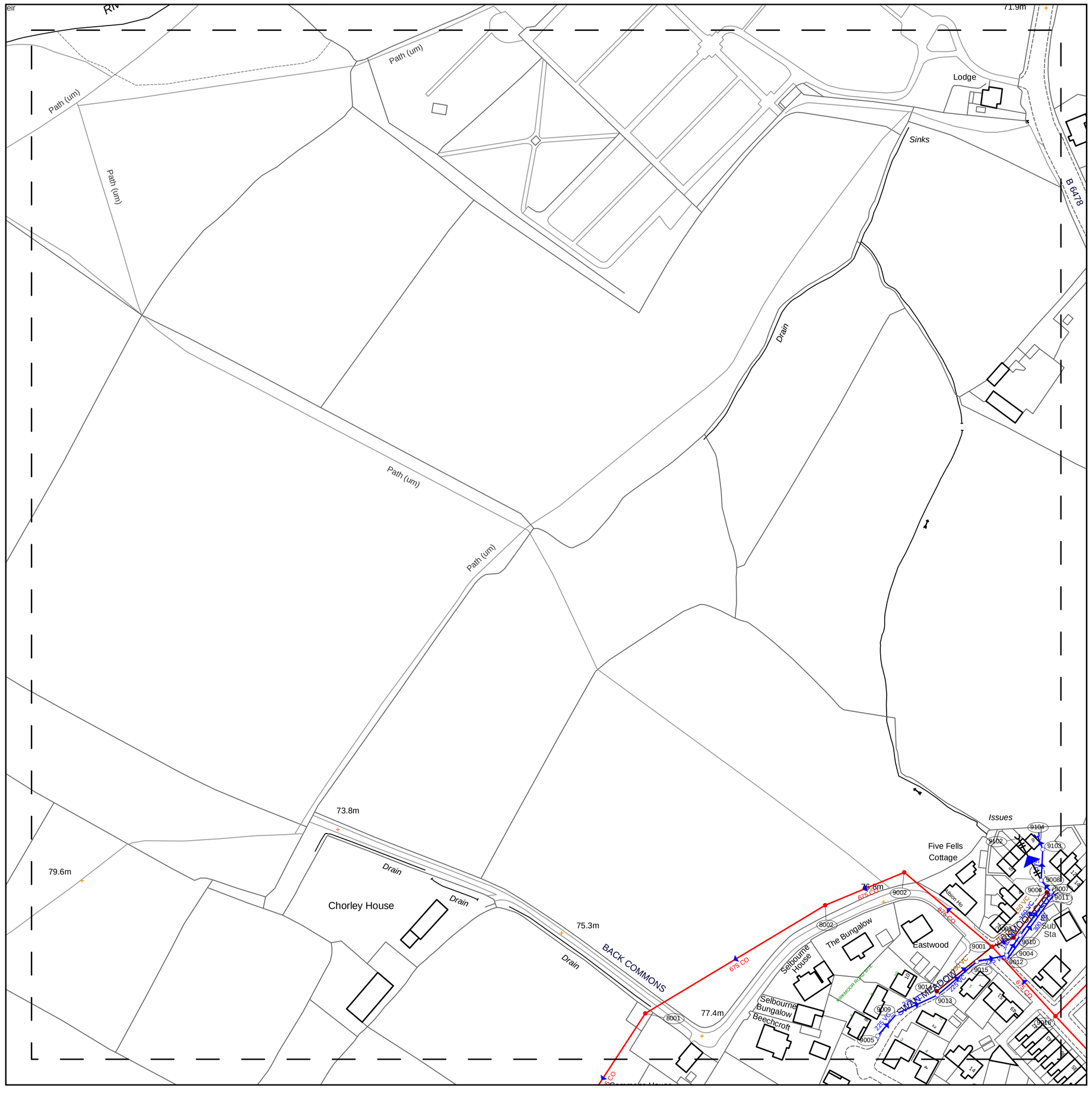
11. For information regarding easements, deeds, grants or wayleaves please write to United Utilities Property Solutions, Coniston Buildings, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington WA5 3UU (**Tel: 01925 463 654**).

United Utilities

United Utilities Water PLC
Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington WA5 3LP
www.unitedutilities.com

Registered in England and Wales Registered Number 2366678

01/07/UUNW/DC/1997a



OS Sheet No: SD7342SE

Scale 1:1250 Date: 22-Aug-2011

Printed by: Rob Payne

Refno	Cover	Func	Type	Invert	Size.x	Size.y	Shape	Matl	Grad	Length
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8002		C	M		675		C	CO		101.89
9001	77.19	C	M	73.39	675		C	CO		55.91
9002		C	M		675		C	CO		41.61
9003		F	M		150		C	VC		11.29
9004		S	M		150		C	VC		11.74
9005		S	M		225		C	VC		14.19
9006		F	M		150		C	VC		27.26
9007		S	M		375		C			7.46
9008		S	M		375		C			15.05
9009		S	M		225		C	VC		21.75
9010		S	M		150		C	VC		25.83
9011		S	G		300		C	VC		1.89
9012		S	G		300		C	VC		38.45
9013		S	M		225		C	VC		25.09
9014		F	M		150		C	VC		34.51
9015		S	M		225		C	VC		14.78
9016	77.65	C	M		675		C	CO		45.64
9102		S	F							
9103		S	M		375		C			6.78
9104		S	F							

WASTE WATER SYMBOLOGY

Note - ALL flow direction arrows are BLUE - colour not significant

NODE TABLE ABBREVIATIONS

MANHOLE FUNCTION

F	Foul	T	Transition
S	Surface	O	Overflow
C	Combined	U	Unspecified

MANHOLE / NODE TYPE

M	Manhole	Z	Ghost in Rising Main
J	Junction	C	Cascade
L	Lamphole	Y	Gulley
H	Hatchbox	E	Ejector
R	Rodding Eye	O	Oil Injector
F	Outfall	I	Inlet
V	Combined Sewer Overflow	B	Hydrobrake
		T	Vent Column
P	Pumping Station	X	Valve
S	Soakaway	U	Unspecified
D	Dual Function Manhole	Q	Expediency Node
		G	Ghost (to allow pipe bends)
W	Treatment Works		

SEWER SHAPE

C	Circular	T	Trapezoidal
E	Egg	A	Arch
O	Oval	B	Barrel
F	Flat Top	H	Horseshoe
R	Rectangular	U	Unspecified
S	Square		

SEWER MATERIAL

AC	Asbestos Cement
BR	Brick
CI	Cast Iron
SI	Spun (Grey) Iron
CO	Concrete
CS	Concrete Segments (Bolted)
CS	Concrete Segments (Unbolted)
CC	Concrete Box Culvert
DI	Ductile Iron
GR	Glass Reinforced Concrete
GR	Glass Reinforced Plastic
PS	Plastic / Steel Composite
PV	Polyvinyl Chloride
PE	Polythene
RP	Reinforced Plastic Matrix
ST	Steel
VC	Vitrified Clay (All Clayware)
PP	Polypropylene
PF	Pitch Fibre
MA	Masonry - In Regular Courses
MA	Masonry - Randomly Coursed
U	Unspecified

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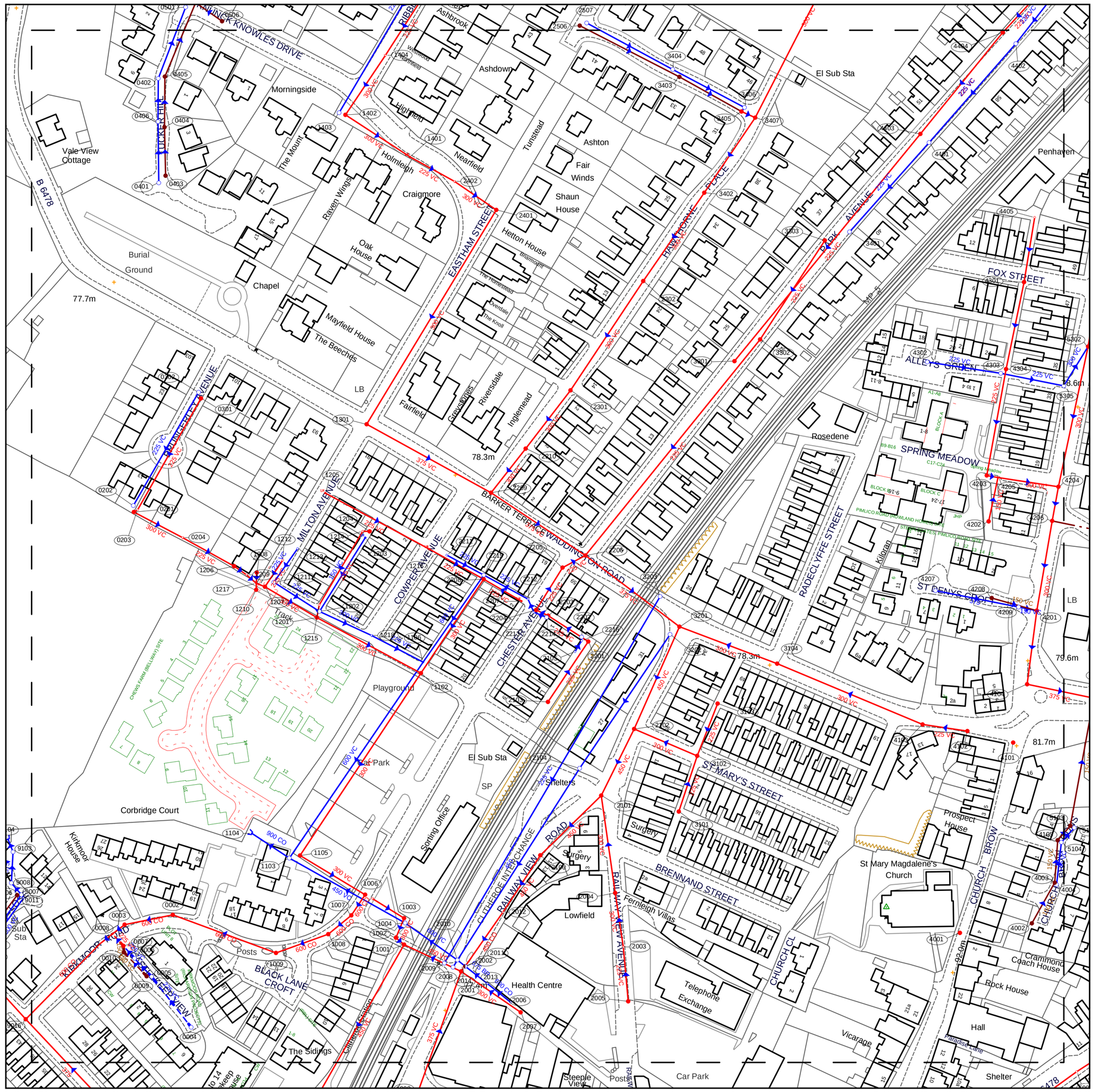
Scale 1:1250 Date: 22-Aug-2011
21 Nodes
Sheet 1 of 1

United Utilities
SEWER RECORDS



OS Sheet No: SD7442SW

Scale 1:1250 Date: 22-Aug-2011

Printed by: Rob Payne

Refno	Cover	Func	Type	Invert	Size.x	Size.y	Shape	Matl	Grad	Length
0002		C	M		600		C	CO		23.82
0003		C	M		600		C	CO		7.39
0004		S	M		225		C	VC		31.08
0005		S	M		225		C	VC		12.1
0006		S	M		225		C	VC		8.15
0007		C	M		225		C	VC		7.86
0008		F	J		600		C	CO		58.96
0009		F	M		150		C	VC		15.98
0010		F	M		150		C	VC		3.13
0201	81.07	C	M	77.77	300		C	VC	58	26.61
0202	81.05	S	M							
0203		C	G		225		C	VC		2.11
0204		C	Q	77.31	225		C	VC	62	28.57
0301	81.38	C	M	78.77	225		C	VC		62.08
0302	81.39	S	M	79.73	225		C	VC	66	63.32
0401		S	M							29.65
0402		S	M							37.01
0403		F	M							23.49
0404		F	M							24.51
0405		F	M							38.78
0406		S	M							20.9
1001	75.89	C	M	74.69	450		C	VC		89.41
1002	76.18	C	M	74.92	300		C	VC	86	5.15
1003	76.54	C	M	75.07	300		C	VC	79	10.26
1004	76.54	S	M	74.89	450		C	VC	494	64.26
1005		F	Q	75.39	300		C	VC	60	18.01
1006		C	M		600		C	CO		12
1007		C	M		600		C	CO		14.43
1008		C	M		600		C	CO		26.88
1009		C	M		600		C	CO		53.27
1102	77.13	C	M	75.82	300		C	VC	265	105.92
1103	76.95	S	M	74.73	900		C	CO		21.88
1104		S	F							
1105	77.11	C	M	75.39	300		C	VC	123	36.8
1106		S	J		600		C	VC		114.9
1201	78.23	C	M		300		C	VC		57.11
1202	78.19	S	M	77.07	300		C	VC		27.75
1203		S	L	77.73	150		C	VC	67	42.03
1204	78.69	C	M	76.99	225		C	VC		3.37
1205		C	L	78.58	225		C	VC		57.22
1206	79.19	C	M	76.8	225		C	VC		7.28
1207	78.82	C	M	76.57	300		C	VC		29.25
1208		C	M		300			VC		5.24
1209		C	Q		300		C	VC		6.32
1210		C	M		300			VC		3.1
1211	78.81	S	M	77.29	225		C	VC	131	26.19
1212		C	G		225		C	VC		15.5
1213		S	G		225		C	VC		19.93
1214		C	G		225		C	VC		41.46
1215		C	G		225		C	VC		6.19
1216		C	L		225		C	VC		30.05
1217		C	J		300		C	VC		4.5
1218		S	Q		225		C	VC		28.14
1301	79.91	C	M	77.06	375		C	VC	65	68.76
1401		C	L	80.21	225		C	VC	92	24.71
1402	83.46	C	M	80.62	300		C	VC	91	37.17
1403		S	M							
1404		C	Q	80.77	300		C	VC	267	34.71
2001	76.89	C	M	74.81	450		C	VC	277	30.5
2002	76.9	S	D	75.14	610		C	BR		4.84
2003		C	Q	76.15	300		C	VC	66	26.43
2004	77.32	C	M	75.73	300		C	VC	74	47.65
2005	78.23	C	M	76.55	225		C	VC	66	26.43
2006		S	G		600		C	CO		14.46
2007	77.06	C	M	75.38	300		C	VC	67	35
2008		S	M							
2009		S	M							
2010	76.69	S	M		450		C			4.06
2010	76.69	S	M		600		C	VC		31.05
2011	76.9	F	D	74.81	450		C	CO	-127	1.27
2012		C	Q	74.9	450		C	CO	456	31.91
2013		S	Q		675		C	BR		13.57
2014		F	Q	74.82	450		C	VC	-196	1.96

Refno	Cover	Func	Type	Invert	Size.x	Size.y	Shape	Matl	Grad	Length
2101	77.65	C	M	75.07	450		C	VC	517	41.33
2102	77.94	C	M	75.21	450		C	VC	300	35.96
2103	77.25	C	M	76.39	225		C	VC	73	35.14
2104	77.22	S	M		450		C			110.1
2105		S	G		150			VC		6.15
2106	77.34	C	M	74.97	450		C	VC	471	32.98
2201	77.31	C	M	76.15	225		C	VC	51	23.08
2202	77.3	S	M							
2203	77.02	C	M	75.68	225		C	VC	-5	6.45
2204	77.96	C	M	76.97	225		C	VC	23	24.15
2205	77.03	C	M	75.88	225		C	VC	78	12.52
2206	76.94	C	M	75.69	375		C	VC	168	57.12
2207		C	L	76.29	225		C	VC	302	21.13
2208	77.45	C	M	76.2	300		C	VC	152	54.75
2209	77.78	C	M	75.98	375		C	VC	196	54.85
2210	78.09	C	M	76.34	300		C	VC	80	27.15
2211		S	G		225		C	VC		20.34
2212		S	G		225		C	VC		24.38
2213		S	G		225		C	VC		6.95
2214		S	M		225		C	VC		6.68
2215	77.43	S	M	75.28	600		C	VC		51.37
2216		S	G		150		C	VC		1.86
2301	78.42	C	M	76.8	300		C	VC	81	35.6
2302	79.05	C	M	77.09	300		C	VC	235	63.58
2401	82.07	C	M	79.66	300		C	VC	47	121.28
2402		C	Q	79.94	300		C	VC	94	24.52
3101	78.36	C	M	76.93	225		C	VC	105	28.39
3102	78.5	C	M	76.64	300		C	VC	29	33.19
3103	78.31	C	M	76.96	225		C	VC	91	27.2
3104	78.69	C	M	76.9	300		C	VC	32	50.6
3201	77.03	C	M	75.32	450		C	VC	602	54.18
3202		S	M							78.23
3203		S	M		225		C	VC		205.99
3301	78.88	C	M							
3302	79.08	C	M	77.44	225		C	VC	78	134.55
3303	80.17	C	M		225		C	VC		57.26
3401	80.26	S	M							
3402	79.98	C	M	77.28	300		C	VC	306	51.98
3403		F	M		300			VC		34.4
3404		S	M		300			VC		39.33
3405		C	M		300			VC		7.28
3406		S	M		300			VC		2.44
3407		C	M		300		C	VC		43.93
4001		C	M							
4002		F	M		150		C	VC		22.59
4003		F	M		150		C	VC		20.56
4004	83.99	S	M	82.16	150		C	VC	159	20.65
4101		C	M							
4102	81.98	C	M	79.83	225		C	VC	18	21.93
4103	81.15	C	M	78.56	300		C	VC	47	76.33
4104	80.32	C	M	76.32	375		C	VC	91	32.9
4105		F	M		150		C	VC		9.34
4201	79.49	C	M	76.4	300		C	VC	719	35.94
4202	79.51	C	M	78.04	150		C	VC		21.72
4203	79.25	C	M	77.07	300		C	VC		5.49
4204	79.02	C	M	76.53	300		C	VC		16.82
4205		C	J		300		C	VC		29.63
4206		C	M		300		C	VC		44.08
4207	80.12	S	M	78.24	375		C		111	40.99
4208	79.92	F	M	77.91	150		C	VC		22.68
4209	79.74	S	M	77.87	150		C	VC		9.01
4301	79.62	C	M		225		C	VC		42.99
4302		S	M		225		C	VC		36.02
4303		S	M		225		C	VC		31.1
4304		C	M		225		C	VC		52.35
4401	80.54	S	M	79.19	225		C	VC	121	57.91
4402	81.08	S	M	79.8	225		C	VC	108	63.73
4403	80.6	C	M	78.8	225		C	VC	134	142.17
4404	81.15	C	M	79.58	225		C	VC	83	63.29
4405		C	G		225			VC		31.79
5104	84.27	S	M	81.97	225		C	VC	72	9.42
5305		S	M		300		C	VC		22.38

WASTE WATER SYMBOLOGY

Note - ALL flow direction arrows are BLUE - colour not significant

NODE TABLE ABBREVIATIONS

MANHOLE FUNCTION

F Foul
S Surface
C Combined
T Transition
O Overflow
U Unspecified

MANHOLE / NODE TYPE

M Manhole
J Junction
L Lamphole
H Hatchbox
R Rodding Eye
F Outfall
V Combined Sewer Overflow
P Pumping Station
S Soakaway
D Dual Function Manhole
W Treatment Works
Z Ghost in Rising Main
C Cascade
Y Gulley
E Ejector
O Oil Injector
I Inlet
B Hydrobrake
T Vent Column
X Valve
U Unspecified
Q Expediency Node
G Ghost (to allow pipe bends)

SEWER SHAPE

C Circular
E Egg
O Oval
F Flat Top
R Rectangular
S Square
T Trapezoidal
A Arch
B Barrel
H Horseshoe
U Unspecified

SEWER MATERIAL

AC Asbestos Cement
BR Brick
CI Cast Iron
SI Spun (Grey) Iron
CO Concrete
CS Concrete Segments (Bolted)
CS Concrete Segments (Unbolted)
CC Concrete Box Culvert
DI Ductile Iron
GR Glass Reinforced Concrete
GR Glass Reinforced Plastic
PS Plastic / Steel Composite
PV Polyvinyl Chloride
PE Polythene
RP Reinforced Plastic Matrix
ST Steel
VC Vitrified Clay (All Clayware)
PP Polypropylene
PF Pitch Fibre
MA Masonry - In Regular Courses
MA Masonry - Randomly Coursed
U Unspecified

OS Sheet No: SD7442SW
Scale 1:1250 Date: 22-Aug-2011
145 Nodes
Sheet 1 of 1

United Utilities
SEWER RECORDS

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APPENDIX M: NPPF EXTRACTS

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Table 1: Flood zones

(Note: These flood zones refer to the probability of river and sea flooding, ignoring the presence of defences)

Zone 1 - low probability

Definition
This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).

Appropriate uses
All uses of land are appropriate in this zone.

Flood risk assessment requirements
For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment. This need only be brief unless the factors above or other local considerations require particular attention.

Policy aims
In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems[2].

Zone 2 - medium probability

Definition
This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Appropriate uses
Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are *only* appropriate in this zone if the Exception Test is passed.

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims
In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.

Zone 3a - high probability

Definition
This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Appropriate uses
The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone.

The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims
In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;

- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b - the functional floodplain

Definition
This zone comprises land where water *has* to flow or be stored in times of flood.

Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

Appropriate uses
Only the water-compatible uses and the essential infrastructure listed in table 2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows; and
- not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims
In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land with a lower probability of flooding.

Table 2: Flood risk vulnerability classification

Essential infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
- Wind turbines.

Highly vulnerable

- Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use[3].
- Installations requiring hazardous substances consent[4]. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure")[5].

More vulnerable

- Hospitals.
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste[6].
- Sites used for holiday or short-let caravans and camping, *subject to a specific warning and evacuation plan.*[7]

Less vulnerable

- Police, ambulance and fire stations which are *not* required to be operational during flooding.
- Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in "more vulnerable", and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do *not* need to remain operational during times of flood.
- Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

Water-compatible development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, *subject to a specific warning and evacuation plan.*

APPENDIX N: PHOTOGRAPHS

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APPENDIX O: NOTES OF LIMITATION

The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our l conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information.

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