Lewisham Estate

78-90 Old Canterbury Road
Lewisham

Flood Management Report

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1 EXECUTIVE SUMMARY

This document is a flood management report for the proposed development located at 78-90 Old Canterbury Road, Lewisham. The flooding includes:-

- The Hawthorne Canal main drain; and
- The localised overland flow from the upstream catchment.

The site is legally described as Lot 11 in DP 774322 and Lots 6-8 in DP 977044.

Lewisham Estates P/L in conjunction with Planning Ingenuity P/L are proposing a concept plan for a Major Project comprising a mixed use development for residential, commercial and retail land uses with associated car parking facilities and public domain improvements.

The Concept Plan is for buildings ranging in height from 4 to 9 storeys. Public domain improvements include the creation of new streets, open space areas and pedestrian access points.

The proposed development is illustrated in the ground floor level plan below.



This report is a response to Council's comments as stipulated in Council's response letter reference P3570.750-02 to the Planning Application MP08_0195 (dated 26/09/2011), in relation to the flooding affectation on the site, both from the Hawthorne Canal and from the localised overland flow in Old Canterbury Road.

The report responds to the Council comments as follows (refer to Section 3.4.2 of this report for an extract of Council's letter):-

1. An independent assessment of flooding from the Hawthorne Canal Catchment has now been undertaken as requested by Council and is detailed in the following sections of this report;

2. The site survey by Stratasurv (Drawing No. 159301 Rev F) has now been updated to AHD and is included in the appendices for reference as Revision J;

3. The report has been revised to address the requirements of the NSW Floodplain Development Manual (2005) in relation to flood hazard and flood risk from the Hawthorne Canal and the localised overland flooding from Old Canterbury Road;

4. An assessment of the Probable Maximum Flood (PMF) has now been undertaken and is detailed in the following sections of this report;

5. The additional assessment carried out in this revision indicates that the proposed redirection of overland flows from Old Canterbury Road will eliminate all flooding of Old Canterbury Road for all storms up to and including the 20-year ARI storm event due to the increase in pipe size and the provision of additional inlet gully pits in Old Canterbury Road itself. It is also noted that the redirection of flows will alleviate the flooding in Brown Street and the adjoining sites;

6. The redirection of overland flows from the low point in Old Canterbury Road have been revised and are directed onto Hudson Street which will carry the flows in a 100-year ARI storm event;

7. The overland flows from Brown Street are redirected around the proposed Cul-De-Sac at RL10.80 where the basement ramp actually rises to RL12.20 before it grades down into the basement. As such, no overland flows will enter the basement from Brown Street; and

8. The trunk main diversion is now located under the proposed road which is completely within the site boundary.

The proposed development has been revised to incorporate the results of the Hawthorne Canal Catchment flood study. The study has taken into account the requirements of Council and the DGR in relation to blockages in the culvert under Longport Street and the impact of Climate Change on the flooding behaviour.

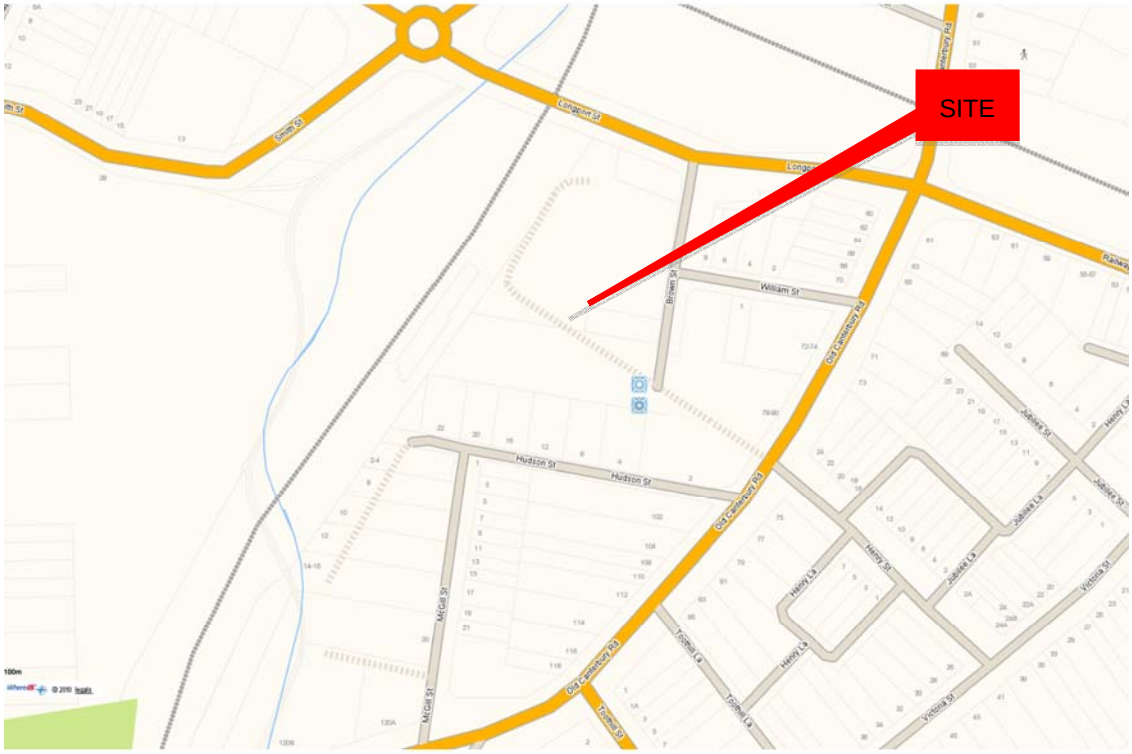
The Flood Planning Level (FPL) adopted for the proposed development (RL12.20) achieves 0.5m above the 100-year ARI flood level including 30% increase in rainfall peak and volume, sea level rise and 50% blockage in the Longport Street Culvert as summarised in the following table.

Table 1 Flood Level & FPL Summary Table

Plan	**100-yr ARI**	**100-yr ARI (50% culvert blockage)**	**100-yr ARI (30% increase in rainfall)**	**100-yr ARI (50% culvert blockage & 30% increase in rainfall**
Flood Level (mAHD) Canal Section 500.86	9.59	11.00	10.57	11.70
FPL	10.09	11.50	11.07	12.20

The FPL of 12.20mAHD applies for all the ground floor levels of the proposed buildings and the entrance to the basement car park. These design parameters have been designed in conjunction with the architectural drawings.

2 SITE LOCATION



The site is a large block of land legally described as Lot 11 in DP 774322 and Lots 6-8 in DP 977044 in the suburb of Lewisham. The site falls in the Local Government Area of Marrickville Council.

The site is bounded by the Goods Railway Corridor to the West, Hudson Street to the South, Old Canterbury Road to the East and Longport Street to the North. The site is currently fully developed with old warehouses and bitumen/concrete areas.

The site has an irregular shape and is characterised by a gentle natural gradient from East to West.

The railway line separates the site from the Hawthorne Canal located further to the West. The upstream catchment area east of the site is drained into the Canal via a trunk main traversing the site from a low point in Old Canterbury Road, through the low point in Brown Street and into the Canal downstream of Lonport Street.

3 FLOOD STUDY

3.1 Reference Documents

The following documents have been reviewed and used to prepare the stormwater strategy and this section of the report:-

1. Architectural drawings ref. 815 Prepared by Tony Owen & Partners;
2. Survey drawing ref. 1593-DT01 prepared by StrataSurv revision G dated 04.06.2009;
3. Australian Rainfall & Runoff (AR&R) dated 1997 by the Institution of Engineers, Australia;
4. The Floodplain Development Manual Revision 2005 by the NSW Government;
5. Marrickville Council response letter to the Planning Application ref. P3570.750-02 dated 23 December 2010;
6. Marrickville Council response letter to the Planning Application ref. P3570.750-02 dated 26 September 2011;
7. Marrickville Council Draft DCP Part 2 Section 2.22 “Flood Management”;
8. Hawthorne Canal Flood Assessment report by Meinhardt ref. 3473 revision B dated 29 July 2010;
9. Marrickville Council Stormwater and On-Site Detention Code (19 February 1999); and
10. Stormwater Asset plans received from Council.

3.2 Glossary

Annual Exceedance Probability (AEP)

The chance of a flood of a given or a larger size occurring in any one year, usually expressed as a percentage.

Australian Height Datum (AHD)

A common national surface level datum approximately corresponding to mean sea level.

Average Recurrence Interval (ARI)

The long term average number of years between the occurrence of a flood as big as or larger than the selected event.

Catchment

The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.

Flood

Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse.

Flood Liable Land or Flood Prone Land

Land susceptible to flooding by the PMF.

Flood Planning Levels (FPLs)

Are the combinations of flood levels and freeboards selected for floodplain risk management purposes.

Freeboard

Is a factor of safety typically used in relation to the setting of floor levels.

Habitable Room

In industrial or commercial situation: an area used for offices or to store valuable possessions susceptible to damage in the event of a flood.

Peak Discharge

The maximum discharge occurring during a flood event.

Probable Maximum Flood

PMF is the largest flood that could conceivably occur at a location, usually estimated from probable maximum precipitation.

Probable Maximum Precipitation

PMP is the greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year.

Runoff

The amount of rainfall which actually ends up as stream flow.

3.3 Development Description

The proposed mixed-use development comprises residential, commercial and retail uses, an underground carpark basement and public domain improvements.

3.4 Authorities Requirements

3.4.1 Sydney Water Corporation

(Extract from Sydney Water Corporation letter dated 20 December 2010)

Stormwater

Building over or under Sydney Water's stormwater assets is not permitted. For Sydney Water to support the proposal, a one metre offset is required between any new structures and Sydney Water's assets.

The developer proposes to adjust (make redundant) a section of Sydney Water's Hawthorne Canal stormwater system. For Sydney Water to support this adjustment, we require the entire section of redundant asset be removed with a new maintenance pit constructed in its place to terminate the adjustment.

The developer will need to engage a Water Servicing Coordinator to submit on their behalf an asset adjustment application with Sydney Water. Sydney Water will not consent to the termination of the existing drainage easement until all demolition/construction works required under the approved adjustment application have been completed.

3.4.2 Marrickville Council

(Extract from Marrickville Council letter P3570.750-02 dated 23 December 2010)

Key issue 15 of the of the Director-General's Requirements is an assessment of any flood risk on the site in consideration of the NSW Floodplain Development Manual (2005) including the potential effects of climate change, sea level rise and an increase in rainfall fall intensity.

The NSW Floodplain Development Manual (2005) provides a framework to ensure the sustainable use of floodplain environments. The primary objective of the policy is to reduce the impact of flooding and flood liability, to reduce private and public losses from floods and to ensure that any new development is compatible with the flood hazard of the site and does not create additional flooding problems in the area.

This key issue has not been adequately addressed. The Environment Assessment report comments that the site is not flood prone with no investigation or analysis.

Although the site is not currently zoned as flood prone land (as Council has not undertaken a flood study of the Hawthorn Canal Catchment), it is very likely that the site is at risk of flooding as the Hawthorne Canal runs adjacent to the site west of the railway line. The site is located towards the bottom of a 300 Ha catchment which has had its natural overland flow path blocked by the construction of the Longport Street Rail Bridge. The Longport Rail Bridge forms a barrier to the north of the site blocking the overland flow of stormwater in excess of the capacity of the Hawthorne Canal as it passes under Longport Street. During extreme storms the culvert under Longport Street will be susceptible to blockage further exacerbating the potential for flooding of the site.

The site also is traversed by a Council 900mm stormwater pipe which enters the site at a low point in Old Canterbury Road (adjacent to the Old Canterbury Road/Henry Street intersection). The stormwater pipe continues to Brown Street where it converts to a 1200 diameter Sydney Water pipe which re-enters the site at Brown Street. The development proposes to block the existing overland flow path through site from Old Canterbury Road and to divert the pipe down the new Hudson Street. This has been proposed without any assessment of the resultant flood levels on Old Canterbury Road or the increased flood risk this may cause to residential properties opposite the site on Old Canterbury Road.

A flood study needs to be undertaken that fully investigates the potential for flooding from the Hawthorn Canal and from overland flows from the low point on Old Canterbury Road (near Henry Street);

(Extract from Marrickville Council letter P3570.750-02 dated 26 September 2011)

Additional Engineering Comments on the Preferred Project Report for 78-90 Old Canterbury Road, Lewisham (MP08_0195)

Flooding:

The Flood Management Report by Cardno ITC is unsatisfactory for the following reasons:

1. No independent assessment of flooding from the Hawthorne Canal Catchment was undertaken. Cardno ITC relied upon the Hawthorne Canal Flood Assessment report by Meinhardt dated 29 July 2010 submitted as part of the redevelopment of the former Allied Mills Site in Summer Hill. This report has no status and has been superseded by a Flooding Report by Civil Certification. The current Flooding Report for the Allied Mills Site includes some assessment of the potential blockages to the drainage system and climate change scenarios as required by the Department of Planning. As a result of this new study the estimated 1 in 100 year flood levels from the Hawthorne Canal have increased. For example at section 270 (which aligns approximately with the location of the underground carpark) the 1 in 100 year flood level of RL 8.76m AHD established by the Meinhardt report has increased to 10.57m AHD in the new Civil Certification report. It should be noted that this new flood level of 10.57m AHD is 870mm higher than the level of the proposed entry to the underground carpark;

2. The site survey by Stratasurv (Drawing No. 159301 Rev F) relied upon by Cardno ITC to determine flood levels and in the design of overland flow paths is not to Australian Height Datum (AHD). The survey was compared to Council's ALS data, survey from the adjacent Allied Mills Site, Council survey at Henry Street and an adjacent site survey at 73 Old Canterbury Road and it appears that Stratasurv survey levels are 400mm higher than AHD levels;

3. The Cardno ITC Flood Management report does comply with the NSW Floodplain Development Manual (2005) as required by DGR No. 15. In particular in terms of flood hazard categorisation and the assessment of flood risk for both the mainstream flooding from the Hawthorne Canal and the local overland flooding from both Old Canterbury Road and Brown Street.

4. No assessment of The Probable Maximum Flood (PMF) has been undertaken;

5. The proposed redirection of overland flows from Old Canterbury Road will result in an increased frequency of flooding of Old Canterbury Road during lower Average Recurrence Interval (ARI) storms due to the level at which ponding begins to overflow the development site has been increased from RL 12.61m to RL 12.73m;

6. Overland flows from the Old Canterbury Road low point have been redirected around the site and discharged onto railway land in the location of the future "light rail" station. This may lead to frequent flooding of the "light rail" station and will need to be approved by State Rail;

7. The overland flows from Brown Street are redirected and discharge directly at the entrance of the basement carpark which will result in the flooding of the basement carpark; and

8. The existing Council pipe from the low point in Old Canterbury Road proposed to be upgraded and relocated around the site as detailed on Cardno ITC Drawing No. N09612-DA-H02 encroaches upon State Rail Property along the western boundary. This encroachment will need to be approved by State Rail.

As a result of the above issues and deficiencies with the flood report by Cardno ITC a new flood study will need to be submitted which provides the following information:

- The study shall determine the nature and extent of the existing flooding on the site for a full range of events up to the Probable Maximum Flood (PMF) in accordance with the NSW Floodplain Development Manual (2005);
- The study shall also include the potential effects of climate change, sea level rise and an increase in rainfall fall intensity as required by the DGR;
- The study shall investigate the potential for the culvert under Longport Street being blocked during extreme storms. In investigating the potential for blockage the study shall have regard to recent studies under taken by Wollongong Council after the 1998 Floods which found that for culverts with an opening of less than 6m the degree of blockage tended to be high with 58% being totally blocked and current research being undertaken by Australian Rainfall and Runoff (AR&R-Blockage of Hydraulic Structures November 2009);
- The study shall also provide Hazard Categories for the site and the surrounding area;
- The study shall recommend suitable Flood Planning Level(s) for the site with suitable freeboard having regard to the risk management principals consistent with Floodplain Development Manual and the likelihood of the blockage of the Longport Street culvert;
- Investigate if the proposed underground carpark is compatible with the flood risk/hazard for the site and if specific flood evacuation plans/warning systems are required or to be implemented;
- Recommend where possible suitable works to reduce the flood risk to an acceptable level;
- The development should not detrimentally increase the potential flood affection on other properties either individually or in combination with the cumulative impact of the development that is likely to occur in the surrounding area; and
- Due to the complexity of the Catchment with multiple overland flow paths combining and interacting it is recommended that a flood study that utilises a fully dynamic 1D/2D computer model be used and the following information be provided and mapped (This is consistent with the requirements of Sydney Water with regard to its comments on the adjacent Allied Mills Site):
  - i) water surface contours (including the 100year flood and PMF extents);
  - ii) velocity vectors;
  - iii) velocity and depth product contours;
  - iv) delineation of flood risk precincts; and
  - v) Show both existing and proposed flood profiles for the full range of events for the total development.

3.5 Hawthorne Canal

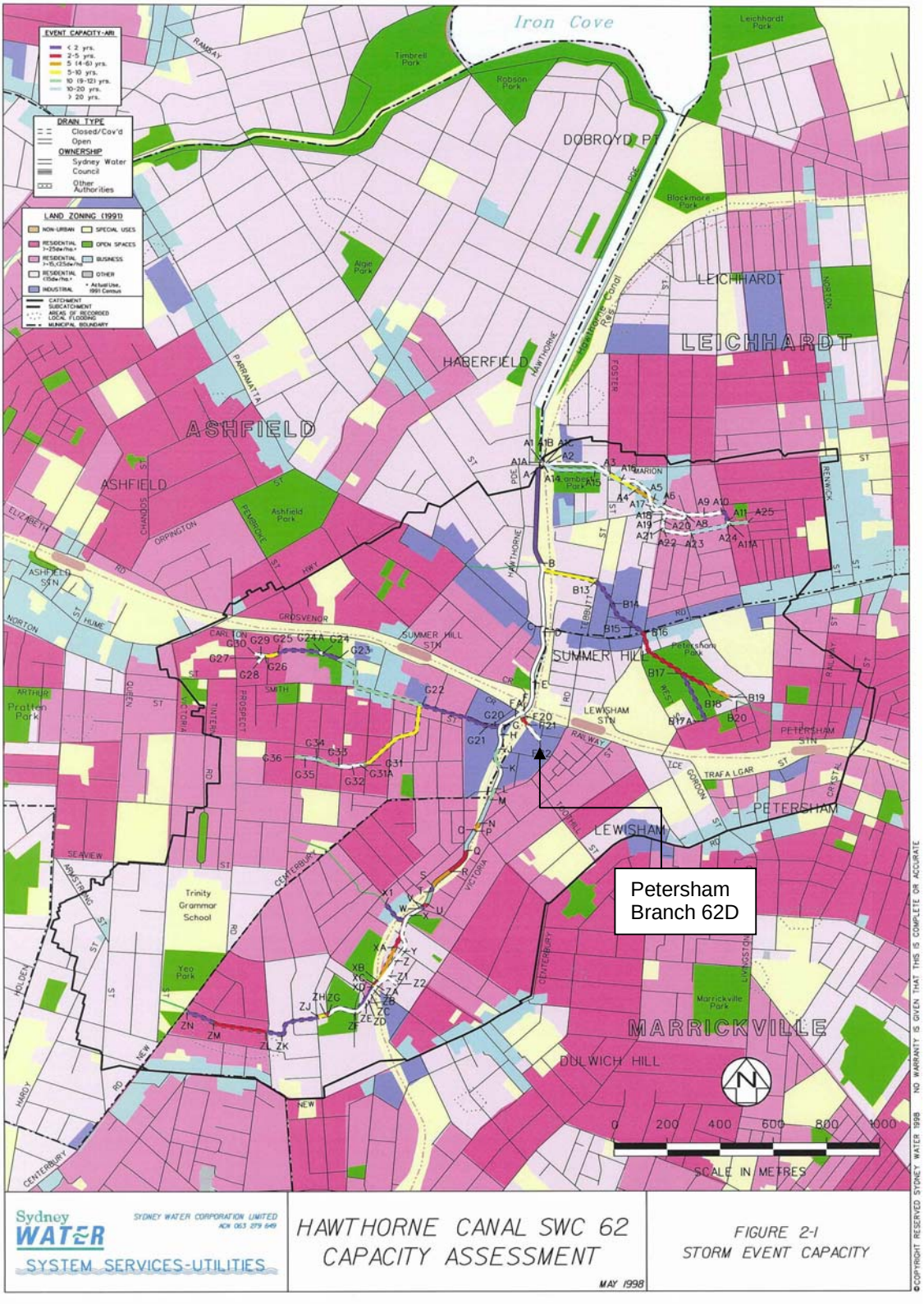
The Hawthorne Canal is a main drain running west of the railway and draining a catchment area of 300ha approximately. The canal is owned and managed by Sydney Water Corporation (SWC) and is identified as SWC62.

The canal travels under the Summer Hill Four Mills site and runs under the Longport Street bridge and Longport Rail bridge, before it continues further downstream and discharges into the Iron Cove Bay.

SWC have carried out a capacity assessment on the canal, which identifies if the canal is open or covered and determines the preliminary capacity of each section of the canal.

The assessment indicates that the canal adjacent to the site is open and has a capacity that exceeds the 20-year ARI storm event.

A copy of the plan showing the details of the canal and its capacity is included below for reference.



Meinhardt Infrastructure & Environment Pty Ltd (Meinhardt) have also carried out a flood assessment on the Hawthorne Canal under a separate commission for the Flour Mills site. This assessment

covered the hydrological simulations for the catchment upstream of the Flour Mills site (294.7ha) and the hydraulic simulations within and in the vicinity of the site.

Cardno ITC have been commissioned by Lewisham Estates P/L to carry out an independent assessment of the canal as requested by Marrickville Council.

The hydraulic simulations adopted in the flood study use a 1D flood model to determine the flood levels in the canal and the adjoining overbank areas. Although Council has requested a fully dynamic 1D/2D model to be carried out, Cardno ITC commission is only for a 1D model at this stage and is consistent with the flood study carried out for the Allied Mills site.

3.5.1 Hydrology

The hydrological assessment has been carried out using DRAINS software. The peak flood discharge from the upstream catchment is determined for the 20-year ARI, 100-year ARI storm event and the PMF as requested by Council.

An increase in peak rainfall and storm volume of 10%, 20% and 30% is also included for the 100-year ARI storm event to account for Climate Change considerations as per DECCW 2007. This has been undertaken as part of a sensitivity analysis for the 100-year ARI storm event in order to determine the impacts of Climate Change on the flooding behaviour upstream of the Longport Street culvert (refer to Section F6 of the Floodplain Development Manual).

The upstream catchment is mainly residential. The only industrial areas are the Lewisham Estates Site and the Allied Mills Site, which are proposed to be converted into residential. An impervious fraction of 0.8 has been adopted across the catchment (i.e. 80% impervious).

The following DRAINS software data were used:

Paved area initial loss	1mm
Grassed area initial loss	5mm
Paved surface retardance coefficient (n)	0.013
Grassed surface retardance coefficient (n)	0.2
Soil group type	3.0 (slow infiltration)
Antecedent moisture content	3.0 (rather wet conditions)

The rainfall data used in the hydrological simulations extends to 6 hours period.

The table below shows the sub-catchments used in the study along the summarised results of the hydrological simulations.

Table 2 Peak Discharge Flows from Catchments

SUB-CATCHMENT		Q (m^3/s)					
Name	**Area (ha)**	**20-yr ARI**	**100-yr ARI**	**PMP**	**100-yr ARI+10%**	**100-yr ARI+20%**	**100-yr ARI+30%**
C.C2	4.2	1.962	2.42	8.309	2.648	2.86	3.076
C.A	27.7	11.916	14.682	53.337	16.037	17.278	18.531
C.B	73.4	31.317	38.57	140.764	42.114	45.36	48.634
C.B1	28.3	11.401	14.532	53.526	15.854	17.08	18.301
C.C	48	20.141	25.066	91.407	27.333	29.466	31.588
C.D	10.4	4.3	5.396	19.745	5.889	6.34	6.795
C.C3	2.2	1.118	1.35	4.45	1.47	1.619	1.761
C.C1	65.3	27.931	34.408	125.308	37.532	40.475	43.402
C.D1	17.6	7.625	9.4	34.016	10.258	11.054	11.857
C.E	21.9	10.005	12.352	43.193	13.506	14.549	15.633

The overall Hawthorne Canal Catchment upstream of the site is 299ha. Refer to the catchment plan included in the appendices for the distribution of the catchments and the nodes noted in the table above.

The maximum flows in the links are summarised in the following table.

Table 3 Peak Discharge Flows in Hydrology Links

LINK	Q (m^3/s)					
Name	20-yr ARI	100-yr ARI	PMP	100-yr ARI+10%	100-yr ARI+20%	100-yr ARI+30%
OF C2.C1	1.962	2.42	8.309	2.648	2.86	3.076
OF A.B	11.916	14.682	53.337	16.037	17.278	18.531
OF B.C	38.361	50.264	156.491	56.198	61.858	66.67
OF B.B1	11.401	14.532	53.526	15.854	17.08	18.301
OF C.D	62.536	81.599	269.206	90.361	99.243	107.498
OF D.E	67.048	88.035	292.1	97.498	107	115.548
OF C3.C1	1.118	1.35	4.45	1.47	1.619	1.761
OF C1.C	29.015	36.057	125.308	39.365	42.483	45.586
OF D1.D	7.625	9.4	34.016	10.258	11.054	11.857

The values in the tables above are used in the hydraulic simulations as steady flows.

3.5.2 Hydraulics

A 1D 'HECRAS' model was configured to simulate the Hawthorne Canal and to determine the flood levels across the site and to plot the water surface profile. The data included in the HECRAS model was extrapolated from Digital Terrain Model (DTM) created from the ALS (Airborne Laser Survey) received from Marrickville Council. Cross sections at 25m intervals were extrapolated and exported into the HECRAS model as well.

The flood peak discharges derived from the DRAINS model were used to model the flows in the Steady Mode.

Manning's roughness coefficient of 0.013 was adopted for the main canal, with the banks having a higher roughness of 0.08.

850 metres of the canal have been included in the HECRAS model. Section 25 is the most downstream section located approximately 150m downstream of the Parramatta Road bridge. Longport Street is located at Section 455.

The Canal is an open concrete channel upstream of the Longport Street and up to Section 600 where is goes under the Allied Mills site and the rail corridor. For the purpose of this flood study, the section of the canal upstream of Section 600 has been modelled very roughly because of its insignificance to the results of this flood study.

For the purpose of the flood study, five (5) runs were performed to assess the impact of the blockages on the flooding situation within the site boundaries. In summary, the runs are as follows:-

- Plan 01 – Existing Site Conditions: this run simulates the existing site conditions with a nominal 0.2m depth blockage in the Longport Street culvert;
- Plan 01A – Existing Site Conditions with 50% of the cross sectional area of the Longport Street culvert blocked;
- Plan 01B – Existing Site Conditions similar to Plan 01 with a sea level rise of 0.9m prediction in 2100;
- Plan 02 – Proposed Site Conditions with the Lewisham Estates proposed project included in the model; and
- Plan 02A – Proposed Site Conditions with the Lewisham Estates proposed project included and 50% cross sectional area of the culvert blocked.

3.5.3 Plan 01 – Existing Site Conditions

Cross sections at 25 metres intervals have been extrapolated from the ALS survey provided by the Council and included in the geometry file of HECRAS. The ALS survey provided the cross sectional profile of the Hawthorne Canal along with the site levels beyond the top of the banks.

The upstream and the downstream culverts have also been included in the geometry file along with the road surface profile of Longport Street from the detailed survey by StrataSurv.

The peak flood discharge values derived from DRAINS are included in the Steady Flow mode of HECRAS to simulate the 20, 100 & PMF flood events. An increase in rainfall of 10%, 20% and 30% is applied to the 100-year ARI storm event and simulated to determine the impact of the Climate Change on the flood levels in the Canal.

A nominal blockage depth of 0.2m is applied to the Longport Street culverts to simulate the accumulation of silt and debris.

The boundary conditions set for the modelling are as follows:-

1. Normal Depth downstream of the site for the subcritical flow conditions. Normal depth of 0.16% is adopted for the downstream boundary condition;

2. Once the subcritical regime is simulated, the flood levels at the upstream sections are included in the model as “Known WS” for the mixed flow simulations; and

3. Predicted King Tide levels of 2.345m AHD for the downstream sections only for the simulation that takes into account the rise in sea levels of 0.9m by 2100 (i.e. Plan 01B).

3.5.4 Plan 01A – Existing Site Conditions with Culvert Blockages

Plan 02 is similar to Plan 01 with a blockage factor of 50% to the Longport Street culvert cross sectional areas added to the geometry file of the model in accordance with current industry practice.

This plan is prepared to simulate the impact of the downstream culvert blockage on the flood levels upstream of the culvert.

This was achieved by incorporating the obstructions as follows:-

Table 4 Culvert Obstructions in Plans 01A & 02A

Section	Description	Depth Blocked (m)	Cross Sectional Area (m^2)	Cross Sectional Area blocked (m^2)
455	Longport Street culvert	1.73	12.55	6.275

3.5.5 Plan 01B – Existing Site Conditions including rise in sea level by 2100

In Plan 01B, the flows through the Hawthorne Canal are simulated with a downstream tailwater level of 2.345m AHD.

The tailwater level is based on the maximum King Tide level recorded at Fort Denison in Sydney at 1.445m AHD. An increase in sea level of 0.9m by 2100 is added to the King Tide level in the simulations.

Although the rise in Sea Level is projected to be 0.9m in 2100 above Mean Sea Level, the approach to use a Sea Level rise above the King Tide level adopted in this study is more conservative.

3.5.6 Plan 02 – Proposed Site Conditions

In Plan 02, the geometry file is modified to include levees on the western boundary of the Lewisham Estates site to prevent the floodwaters reaching beyond the boundary of the site. Although levees will not be constructed at that location, the purpose of the levees in the simulations is to determine if the

reduction in flood storage area on the Lewisham Estates site will create an impact on the flooding behaviour if the water is confined to the Goods Rail corridor.

3.5.7 Plan 02A – Proposed Site Conditions with Culvert Blockages

This plan is similar to Plan 02 with the similar blockage factor applied to the Longport Street culvert as per Plan 01A.

The importance of this plan is to compare with Plan 01A as to the effect of the Lewisham Estates project on the flood behaviour when the culvert if partially blocked (50% ratio).

3.5.8 Results

The Lewisham Estates site falls within the model sections 500.86 & 600. Section 500.86 is immediately upstream of the Longport Culvert.

A summary of the results for key sections is included in the following table.

Table 5 Hydraulic Simulations Results for Key Canal Sections

Canal Section	Storm Event	Plan	Q Total (m3/s)	W.S. Elev (m)
600	20-yr ARI	P01-EXG	38.36	7.67
600	20-yr ARI	P01A-EXG 50% bl	38.36	10.38
600	20-yr ARI	P01B-EXG 2100	38.36	7.67
600	20-yr ARI	P02-PROP	38.36	7.67
600	20-yr ARI	P02A-PROP 50% bl	38.36	10.38
600	100-yr ARI	P01-EXG	50.26	9.78
600	100-yr ARI	P01A-EXG 50% bl	50.26	11.11
600	100-yr ARI	P01B-EXG 2100	50.26	9.78
600	100-yr ARI	P02-PROP	50.26	9.78
600	100-yr ARI	P02A-PROP 50% bl	50.26	11.11
600	PMF	P01-EXG	156.49	14.39
600	PMF	P01A-EXG 50% bl	156.49	14.79
600	PMF	P01B-EXG 2100	156.49	14.39
600	PMF	P02-PROP	156.49	14.39
600	PMF	P02A-PROP 50% bl	156.49	14.79
600	100-yr ARI + 10%	P01-EXG	56.2	10.2
600	100-yr ARI + 10%	P01A-EXG 50% bl	56.2	11.38
600	100-yr ARI + 10%	P01B-EXG 2100	56.2	10.2
600	100-yr ARI + 10%	P02-PROP	56.2	10.2
600	100-yr ARI + 10%	P02A-PROP 50% bl	56.2	11.38
600	100-yr ARI + 20%	P01-EXG	61.86	10.53
600	100-yr ARI + 20%	P01A-EXG 50% bl	61.86	11.63
600	100-yr ARI + 20%	P01B-EXG 2100	61.86	10.53
600	100-yr ARI + 20%	P02-PROP	61.86	10.53
600	100-yr ARI + 20%	P02A-PROP 50% bl	61.86	11.63
600	100-yr ARI + 30%	P01-EXG	66.67	10.81
600	100-yr ARI + 30%	P01A-EXG 50% bl	66.67	11.86
600	100-yr ARI + 30%	P01B-EXG 2100	66.67	10.81
600	100-yr ARI + 30%	P02-PROP	66.67	10.81
600	100-yr ARI + 30%	P02A-PROP 50% bl	66.67	11.86

Canal Section	Storm Event	Plan	Q Total (m3/s)	W.S. Elev (m)
575.04	20-yr ARI	P01-EXG	38.36	7.2
575.04	20-yr ARI	P01A-EXG 50% bl	38.36	10.36
575.04	20-yr ARI	P01B-EXG 2100	38.36	7.2
575.04	20-yr ARI	P02-PROP	38.36	7.2
575.04	20-yr ARI	P02A-PROP 50% bl	38.36	10.36
575.04	100-yr ARI	P01-EXG	50.26	9.71
575.04	100-yr ARI	P01A-EXG 50% bl	50.26	11.09
575.04	100-yr ARI	P01B-EXG 2100	50.26	9.71
575.04	100-yr ARI	P02-PROP	50.26	9.71
575.04	100-yr ARI	P02A-PROP 50% bl	50.26	11.09
575.04	PMF	P01-EXG	156.49	14.39
575.04	PMF	P01A-EXG 50% bl	156.49	14.79
575.04	PMF	P01B-EXG 2100	156.49	14.39
575.04	PMF	P02-PROP	156.49	14.39
575.04	PMF	P02A-PROP 50% bl	156.49	14.79
575.04	100-yr ARI + 10%	P01-EXG	56.2	10.14
575.04	100-yr ARI + 10%	P01A-EXG 50% bl	56.2	11.36
575.04	100-yr ARI + 10%	P01B-EXG 2100	56.2	10.14
575.04	100-yr ARI + 10%	P02-PROP	56.2	10.14
575.04	100-yr ARI + 10%	P02A-PROP 50% bl	56.2	11.36
575.04	100-yr ARI + 20%	P01-EXG	61.86	10.48
575.04	100-yr ARI + 20%	P01A-EXG 50% bl	61.86	11.62
575.04	100-yr ARI + 20%	P01B-EXG 2100	61.86	10.48
575.04	100-yr ARI + 20%	P02-PROP	61.86	10.48
575.04	100-yr ARI + 20%	P02A-PROP 50% bl	61.86	11.62
575.04	100-yr ARI + 30%	P01-EXG	66.67	10.76
575.04	100-yr ARI + 30%	P01A-EXG 50% bl	66.67	11.84
575.04	100-yr ARI + 30%	P01B-EXG 2100	66.67	10.76
575.04	100-yr ARI + 30%	P02-PROP	66.67	10.76
575.04	100-yr ARI + 30%	P02A-PROP 50% bl	66.67	11.84
550.11	20-yr ARI	P01-EXG	62.54	7.2
550.11	20-yr ARI	P01A-EXG 50% bl	62.54	10.27
550.11	20-yr ARI	P01B-EXG 2100	62.54	7.2
550.11	20-yr ARI	P02-PROP	62.54	7.2
550.11	20-yr ARI	P02A-PROP 50% bl	62.54	10.27
550.11	100-yr ARI	P01-EXG	81.6	9.52
550.11	100-yr ARI	P01A-EXG 50% bl	81.6	10.98
550.11	100-yr ARI	P01B-EXG 2100	81.6	9.52
550.11	100-yr ARI	P02-PROP	81.6	9.52
550.11	100-yr ARI	P02A-PROP 50% bl	81.6	10.98
550.11	PMF	P01-EXG	269.21	13.9
550.11	PMF	P01A-EXG 50% bl	269.21	14.37
550.11	PMF	P01B-EXG 2100	269.21	13.9

Canal Section	Storm Event	Plan	Q Total (m3/s)	W.S. Elev (m)
550.11	PMF	P02-PROP	269.21	13.9
550.11	PMF	P02A-PROP 50% bl	269.21	14.37
550.11	100-yr ARI + 10%	P01-EXG	90.36	9.92
550.11	100-yr ARI + 10%	P01A-EXG 50% bl	90.36	11.24
550.11	100-yr ARI + 10%	P01B-EXG 2100	90.36	9.92
550.11	100-yr ARI + 10%	P02-PROP	90.36	9.92
550.11	100-yr ARI + 10%	P02A-PROP 50% bl	90.36	11.24
550.11	100-yr ARI + 20%	P01-EXG	99.24	10.25
550.11	100-yr ARI + 20%	P01A-EXG 50% bl	99.24	11.49
550.11	100-yr ARI + 20%	P01B-EXG 2100	99.24	10.25
550.11	100-yr ARI + 20%	P02-PROP	99.24	10.25
550.11	100-yr ARI + 20%	P02A-PROP 50% bl	99.24	11.49
550.11	100-yr ARI + 30%	P01-EXG	107.5	10.51
550.11	100-yr ARI + 30%	P01A-EXG 50% bl	107.5	11.7
550.11	100-yr ARI + 30%	P01B-EXG 2100	107.5	10.51
550.11	100-yr ARI + 30%	P02-PROP	107.5	10.51
550.11	100-yr ARI + 30%	P02A-PROP 50% bl	107.5	11.7
524.97	20-yr ARI	P01-EXG	62.54	7.24
524.97	20-yr ARI	P01A-EXG 50% bl	62.54	10.28
524.97	20-yr ARI	P01B-EXG 2100	62.54	7.24
524.97	20-yr ARI	P02-PROP	62.54	7.24
524.97	20-yr ARI	P02A-PROP 50% bl	62.54	10.28
524.97	100-yr ARI	P01-EXG	81.6	9.54
524.97	100-yr ARI	P01A-EXG 50% bl	81.6	10.97
524.97	100-yr ARI	P01B-EXG 2100	81.6	9.54
524.97	100-yr ARI	P02-PROP	81.6	9.54
524.97	100-yr ARI	P02A-PROP 50% bl	81.6	10.97
524.97	PMF	P01-EXG	269.21	13.87
524.97	PMF	P01A-EXG 50% bl	269.21	14.35
524.97	PMF	P01B-EXG 2100	269.21	13.87
524.97	PMF	P02-PROP	269.21	13.87
524.97	PMF	P02A-PROP 50% bl	269.21	14.35
524.97	100-yr ARI + 10%	P01-EXG	90.36	9.95
524.97	100-yr ARI + 10%	P01A-EXG 50% bl	90.36	11.23
524.97	100-yr ARI + 10%	P01B-EXG 2100	90.36	9.95
524.97	100-yr ARI + 10%	P02-PROP	90.36	9.95
524.97	100-yr ARI + 10%	P02A-PROP 50% bl	90.36	11.23
524.97	100-yr ARI + 20%	P01-EXG	99.24	10.27
524.97	100-yr ARI + 20%	P01A-EXG 50% bl	99.24	11.47
524.97	100-yr ARI + 20%	P01B-EXG 2100	99.24	10.27
524.97	100-yr ARI + 20%	P02-PROP	99.24	10.27
524.97	100-yr ARI + 20%	P02A-PROP 50% bl	99.24	11.47
524.97	100-yr ARI + 30%	P01-EXG	107.5	10.52
524.97	100-yr ARI + 30%	P01A-EXG 50% bl	107.5	11.68

Canal Section	Storm Event	Plan	Q Total (m3/s)	W.S. Elev (m)
524.97	100-yr ARI + 30%	P01B-EXG 2100	107.5	10.52
524.97	100-yr ARI + 30%	P02-PROP	107.5	10.52
524.97	100-yr ARI + 30%	P02A-PROP 50% bl	107.5	11.68
500.86	20-yr ARI	P01-EXG	62.54	7.4
500.86	20-yr ARI	P01A-EXG 50% bl	62.54	10.29
500.86	20-yr ARI	P01B-EXG 2100	62.54	7.4
500.86	20-yr ARI	P02-PROP	62.54	7.4
500.86	20-yr ARI	P02A-PROP 50% bl	62.54	10.29
500.86	100-yr ARI	P01-EXG	81.6	9.59
500.86	100-yr ARI	P01A-EXG 50% bl	81.6	11
500.86	100-yr ARI	P01B-EXG 2100	81.6	9.59
500.86	100-yr ARI	P02-PROP	81.6	9.59
500.86	100-yr ARI	P02A-PROP 50% bl	81.6	11
500.86	PMF	P01-EXG	269.21	13.88
500.86	PMF	P01A-EXG 50% bl	269.21	14.35
500.86	PMF	P01B-EXG 2100	269.21	13.88
500.86	PMF	P02-PROP	269.21	13.88
500.86	PMF	P02A-PROP 50% bl	269.21	14.35
500.86	100-yr ARI + 10%	P01-EXG	90.36	9.99
500.86	100-yr ARI + 10%	P01A-EXG 50% bl	90.36	11.25
500.86	100-yr ARI + 10%	P01B-EXG 2100	90.36	9.99
500.86	100-yr ARI + 10%	P02-PROP	90.36	9.99
500.86	100-yr ARI + 10%	P02A-PROP 50% bl	90.36	11.25
500.86	100-yr ARI + 20%	P01-EXG	99.24	10.31
500.86	100-yr ARI + 20%	P01A-EXG 50% bl	99.24	11.49
500.86	100-yr ARI + 20%	P01B-EXG 2100	99.24	10.31
500.86	100-yr ARI + 20%	P02-PROP	99.24	10.31
500.86	100-yr ARI + 20%	P02A-PROP 50% bl	99.24	11.49
500.86	100-yr ARI + 30%	P01-EXG	107.5	10.57
500.86	100-yr ARI + 30%	P01A-EXG 50% bl	107.5	11.7[(1)]
500.86	100-yr ARI + 30%	P01B-EXG 2100	107.5	10.57
500.86	100-yr ARI + 30%	P02-PROP	107.5	10.57
500.86	100-yr ARI + 30%	P02A-PROP 50% bl	107.5	11.7[(1)]
455			Culvert	
425	20-yr ARI	P01-EXG	67.05	5.87
425	20-yr ARI	P01A-EXG 50% bl	67.05	5.87
425	20-yr ARI	P01B-EXG 2100	67.05	5.87
425	20-yr ARI	P02-PROP	67.05	5.87
425	20-yr ARI	P02A-PROP 50% bl	67.05	5.87
425	100-yr ARI	P01-EXG	88.04	6.59
425	100-yr ARI	P01A-EXG 50% bl	88.04	6.59
425	100-yr ARI	P01B-EXG 2100	88.04	6.59

Canal Section	Storm Event	Plan	Q Total (m3/s)	W.S. Elev (m)
425	100-yr ARI	P02-PROP	88.04	6.59
425	100-yr ARI	P02A-PROP 50% bl	88.04	6.59
425	PMF	P01-EXG	292.1	9.36
425	PMF	P01A-EXG 50% bl	292.1	9.36
425	PMF	P01B-EXG 2100	292.1	9.36
425	PMF	P02-PROP	292.1	9.36
425	PMF	P02A-PROP 50% bl	292.1	9.36
425	100-yr ARI + 10%	P01-EXG	97.5	6.81
425	100-yr ARI + 10%	P01A-EXG 50% bl	97.5	6.81
425	100-yr ARI + 10%	P01B-EXG 2100	97.5	6.81
425	100-yr ARI + 10%	P02-PROP	97.5	6.81
425	100-yr ARI + 10%	P02A-PROP 50% bl	97.5	6.81
425	100-yr ARI + 20%	P01-EXG	107	7.01
425	100-yr ARI + 20%	P01A-EXG 50% bl	107	7.01
425	100-yr ARI + 20%	P01B-EXG 2100	107	7.01
425	100-yr ARI + 20%	P02-PROP	107	7.01
425	100-yr ARI + 20%	P02A-PROP 50% bl	107	7.01
425	100-yr ARI + 30%	P01-EXG	115.55	7.19
425	100-yr ARI + 30%	P01A-EXG 50% bl	115.55	7.19
425	100-yr ARI + 30%	P01B-EXG 2100	115.55	7.19
425	100-yr ARI + 30%	P02-PROP	115.55	7.19
425	100-yr ARI + 30%	P02A-PROP 50% bl	115.55	7.19

(1) Level adopted as basis for the FPL. It represents the 100-year ARI flood level upstream of the Longport Street culvert on the basis of 50% blockage ratio and 30% increase in rainfall peak and storm volume.

A review of the results indicates the following:-

- The flood levels upstream of Longport Street are very sensitive to the culvert blockage. A 50% blockage creates a rise of approximately 1.4m just upstream of the culvert for extreme storm event such as the 100-yr ARI, 0.5m for the rare storm events such as the PMF and almost 3m for the minor storm events (i.e. 20-yr ARI);

- The predicted rise in sea level of 0.9m by 2100 does not have an impact of the flood levels upstream and downstream of the culvert. This indicates that the canal will not be inundated by the predicted sea level rise;

- The impact of Climate Change through the increase in peak rainfall and storm volume has a significant impact of the flood levels in the Canal. The flood levels have increased by approximately 1m upstream and 0.6m downstream of the culvert with an increase in peak rainfall of 30% in the 100-yr ARI Storm event (worst case scenario);

- The proposed Lewisham Estates Development does not have an impact on the flood levels of the Hawthorne Canal. This is due mainly to the levels of the rail corridor and the levels of the Lewisham Estates site and due to the fact that the flood waters can also be carried by the rail corridor culvert under Longport Street; and

- The PMF will inundate the Lewisham Estates site. The flood level in the PMF event vary between 13.9m and 14.39 at the downstream and the upstream ends of the site respectively.

The detailed results are included in the appendices for reference.

3.6 Discussion

3.6.1 Flood Planning & Controls

With the exception of a small area at the north western corner, the Lewisham Estates site is not affected by the 100-year ARI (refer to the flood extents plan in the appendices). The proposed levels of the development are such that the site is completed flood free in a 100-year ARI storm event. The site is therefore outside the flood planning area of the Hawthorne Canal.

The development does not increase the flood levels in its vicinity and as such should not increase the flood hazard or risk to other properties. The results of the hydraulic modeling of the Hawthorne Canal indicate that the Lewisham Estate site does not have an effect on the flooding behaviour. The comparison of plans 01 & 02 and plans 01A & 02A respectively clearly indicates that by preventing the flood water from entering the Lewisham site, the flood levels across the canal have not changed for the minor, the major and the extreme storm events. There is no upstream afflux created by this restriction which indicates that the loss of flood storage in the Lewisham site is negligible. This is due to the fact that the flows can escape through the railway culvert when the water overtops the canal banks and reaches the railway levels.

The Flood Planning Level (FPL) adopted for the proposed development is RL12.20. This level across the development achieves 0.5m above the 100-year ARI flood level including 30% increase in rainfall peak and volume, sea level rise and including the allowance for 50% blockage in the Longport Street Culvert as detailed in Table 5 above. This strategy allows the site to be flood free for all storms up to and including the 100-year ARI storm event and provides the development with a conservative safety factor above the current 100-year ARI flood level. This exceeds Council's requirements for 0.5m freeboard above the 100-year ARI storm event.

The site is inundated by the PMF event and is classified as Flood Prone Land. The Department of Planning has provided a "Guideline on Development Controls on Low Flood Risk Areas – Floodplain Development Manual". The guideline stipulates that no development controls should apply for residential developments in low flood risk areas.

Marrickville Council's draft DCP sets some controls for land uses on flood prone land as follows:-

- A site emergency response flood plan must be prepared in case of a PMF flood;
- Adequate flood warning systems, signage and exists must be available to allow safe and orderly evacuation without increased reliance upon the State Emergency Services (SES) or other authorized emergency personnel; and
- Reliable access for pedestrians or vehicles must be provided from the building, commencing at a level equal to the lowest habitable floor level to an area of refuge above the PMF.

The proposed development should also consider suitable building materials up to the PMF flood level. All electrical services associated with the development should be adequately flood proofed or raised above the PMF flood level.

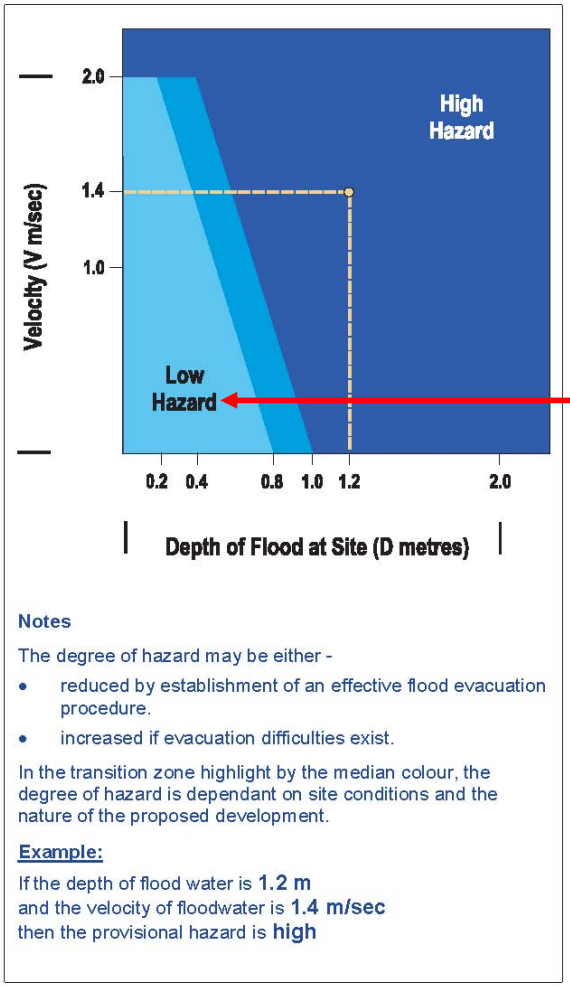
It should be noted that the PMF event is not generally considered for planning purposes but its impact is assessed for Continuing Flood Risk on the site.

3.6.2 Hydraulic and Hazard Categorisation

Based on the results of the flood study, the Lewisham site would be classified as located within a flood fringe area. Raising, filling or creating a levee at the western boundary of the site (west of the proposed road) will not impact the flood levels within the Hawthorne Canal by more than 0.1m and will not increase the flows downstream by more than 10% as required in the Floodplain Development Manual.

In the 100-year ARI storm event, as previously outlined in the report, there is a minor area affected by flooding in the existing site conditions. The maximum depth of floodwaters in that area is 0.50m and the velocity of the floodwaters is 0.26m/s. Figure L2 of the Floodplain Development Manual provides a provisional degree of hazard based on these parameters as shown below. The flooding hazard in a 100-year ARI storm event falls within the light blue colour (Low Hazard). (Refer to output table from

HECRAS model under Appendices for velocity and depth values in the right overbank area of Canal Section 500.86).



100-yr ARI - LOW HAZARD

FIGURE L2 - Provisional Hydraulic Hazard Categories

3.7 Local Overland Flow

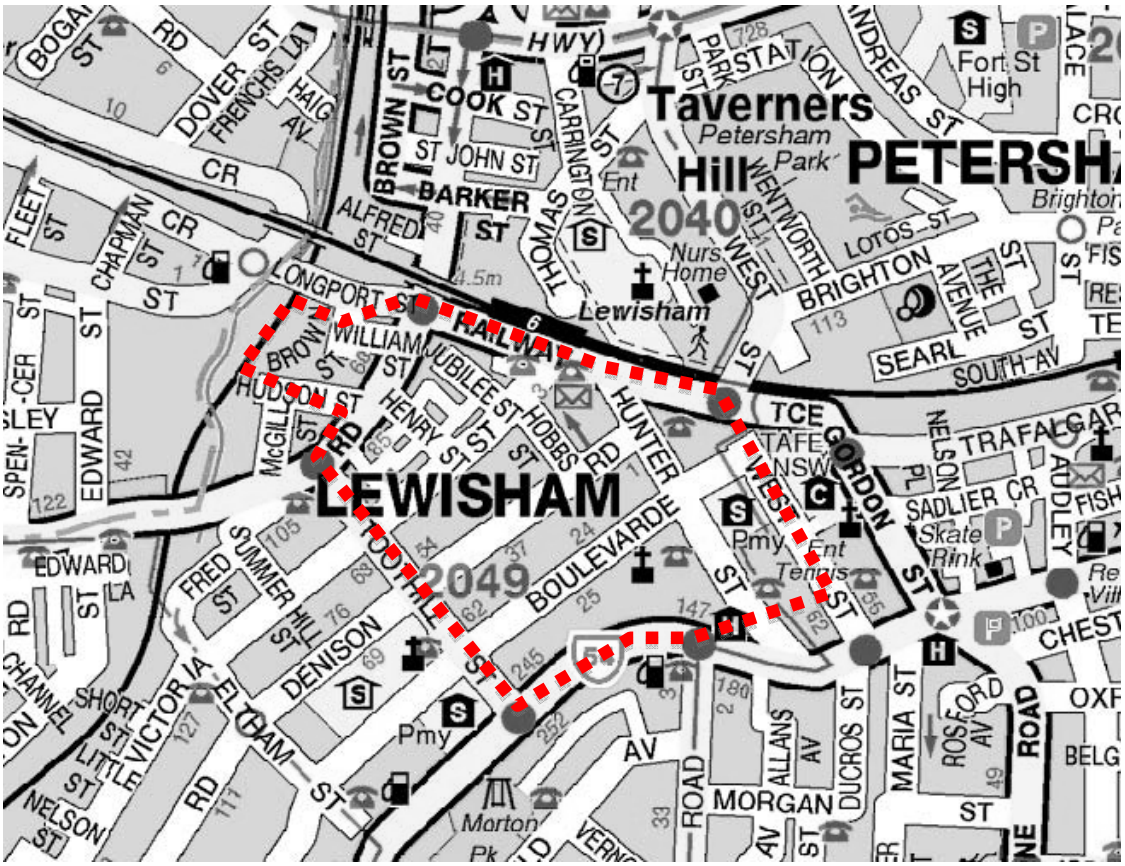
3.7.1 General

The site is located at the downhill end of the local catchment, draining into the main Hawthorne Canal through the trunk main known as the “Petersham Branch 62D”

The trunk main is a 900mm pipe owned by Marrickville Council. The pipe enters the site from the low point in Old Canterbury Road to the East (opposite Henry Street). The trunk main drains the low point in Brown Street and re-enters the site as 1200mm pipe owned by Sydney Water Corporation.

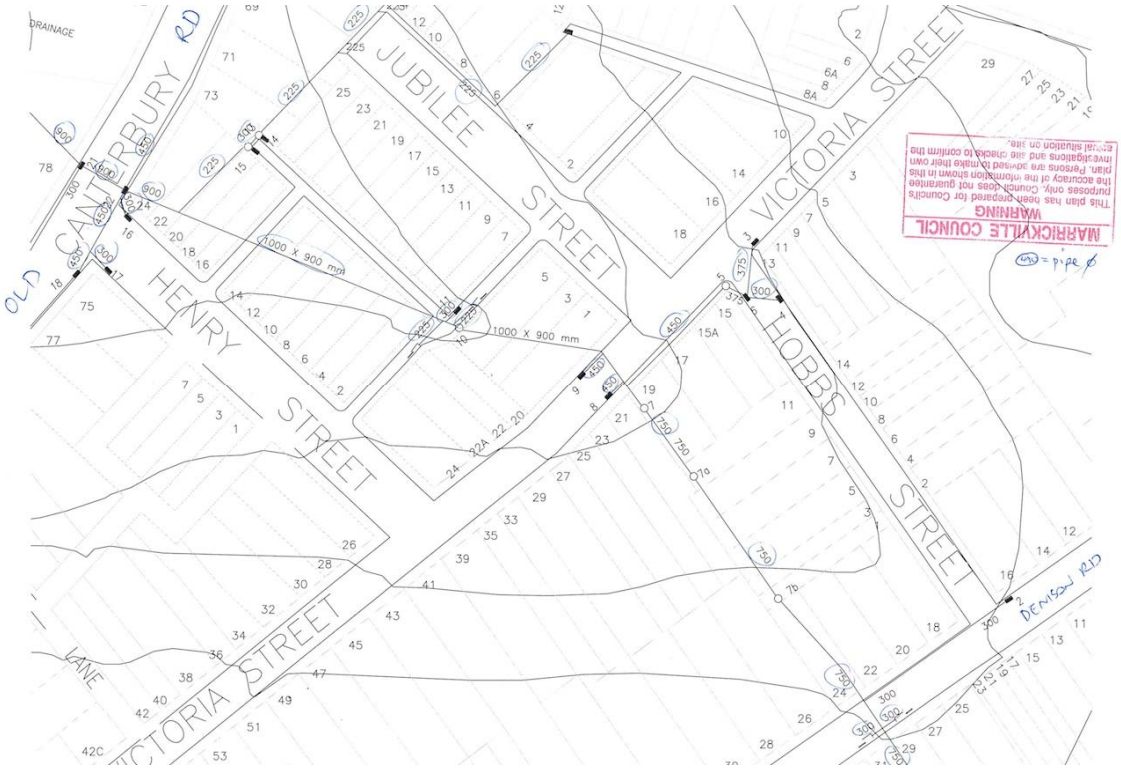
The trunk main connects to the canal downstream of the Longport Street Bridge at Node F (refer to SWC Capacity Assessment Plan above).

The trunk main drains a catchment area of 19.7ha extending up to Canterbury Road to the East, Toothill Street to the South, the Goods Railway Corridor to the West, and Railway Terrace and West Street to the North. A copy of the catchment extent is included below.



The catchment is predominately residential. An impervious fraction of 80% has been assigned to the catchment surface coverage percentage.

Council has provided a copy of the in-ground drainage network servicing the catchment. A copy is included below for reference.



Details of the 900mm/1200mm pipes traversing the site have been sourced from the flood assessment done by Meinhardt. These details have been included in a “DRAINS” model, assembled to assess the capacity of the in-ground drainage network and to determine the overland flow through the site.

Two separate models were assembled. The first model replicates the existing site conditions as per the revised survey plan by StrataSurv. This model considers the overland flow through the site. However, from Brown Street onwards the existing warehouse building is a barrier to the overland flow. The low-lying area in Brown Street becomes inundated until water is able to escape through the bitumen driveway further to the North.

The second model is for the proposed diversion of the trunk main around the proposed mixed-use development. This model considers the blocking of the existing overland flow in Old Canterbury Road and the provision of a new overfland flowpath to the South closer to Hudson Street. However, in this scenario, the flooding in Brown Street is alleviated because the majority of the runoff from the upstream catchment is diverted around the site in a new trunk main with a larger capacity.

The DRAINS model is confined to the upstream pit in Denison Road to the East and to the downstream connection with the canal.

The 100-year ARI flood level determined by Hawthorne Canal flood study has been adopted as the tailwater level for the in-ground network.

3.7.2 Existing Conditions

The simulations carried out in the existing scenario indicate that the trunk main traversing the site does not have the capacity to drain the 100-year ARI flows generated by the catchment. The pipe capacity is limited to 3.3m^3/s.

An additional 3.1m^3/s travels overland from Old Canterbury Road towards Brown Street through the gate servicing the bitumen open space on the site. The 10m wide driveway leading into the site has a level of RL:12.11 approximately (refer survey plan by StrataSurv).

The existing warehouse building wraps around Brown Street and blocks the overland flow, which is exacerbated by the additional overland flows from William Street and Longport Street.

The overland flow can only escape through the driveway from Brown Street further to the North. The driveway entry is approximately 1.5m higher than the lower point in Brown Street. This means that Brown Street and the adjoining properties will become inundated before water can escape through the site.

The 8m wide driveway leading into the site is located on a slope and has existing reduced levels that vary between RL:11.90 at the downstream end and RL:12.52 at the upstream end.

The existing overland flowpath has been simulated using HECRAS as well to determine the flood levels on Old Canterbury Road and through the Lewisham Estates site. The existing warehouse buildings are modelled as blockages or levees depending on their location and size.

The results of the DRAINS and the HECRAS models and the extent of the inundation in the existing conditions is shown in the appendices for reference.

3.7.3 Proposed Site Conditions

In the proposed site conditions, the existing trunk main through the site is diverted around the site from the low point in Old Canterbury Road. The proposed trunk main is larger in size to increase its capacity. It is also proposed to increase the pipe size under Old Canterbury Road as this will substantially increase the capacity of the in-ground drainage and will reduce the frequency of flooding in Old Canterbury Road.

Additional kerb inlet pits are also provided in Old Canterbury Road to increase the capacity of the system to convey the overland flow in the trunk main.

A failsafe overland flowpath is provided at the southern end of the development to convey the overland flow when the pipe capacity is exceeded because the existing overland flow path between Old Canterbury Road and Brown Street is removed by the proposed development.

In this case, the flooding in Brown Street is alleviated because the majority of the upstream catchment runoff is diverted away from Brown Street and into a purpose built overland flowpath between Hudson Street and the proposed development. It should also be noted that the proposed development considers raising the lower end of Brown Street from the intersection of William Street, which should alleviate the flooding associated with the existing low lying area at the end of Brown Street.

A new stormwater main is proposed to convey the runoff from the rest of the catchment draining into Brown Street. A failsafe overland flowpath is also provided within the proposed development to carry the overland flow in excess of the pipe capacity.

Another DRAINS model was assembled to reflect these changes and a new HECRAS model is also prepared to determine the extent of the flooding in Old Canterbury Road.

The results of the simulations indicate that the flow through the proposed 1500mm trunk main has increased to 4.9m^3/s and the overland flow is reduced to 1.82m^3/s. The detailed results of the DRAINS simulations are included in the appendices.

An 8m wide overland flow path is proposed south of the low point in Old Canterbury Road. The level in Old Canterbury Road is RL:12.23m.

The results of the simulations indicate that for the lower range of storm events, the in-ground drainage system is capable of conveying all the flows without flooding occurring in Old Canterbury Road. The details of DRAINS model for the 20-yr ARI storm event indicate this result (refer to results for overflow route O1.04). The likelihood of flooding in Old Canterbury Road is substantially reduced meaning that the frequency of flooding is substantially reduced and confined to the large to extreme storm events.

The 100-yr ARI flood level in Old Canterbury Road is increased by 140mm from 12.42mAHD for the existing conditions to 12.56mAHD for the proposed conditions. This result is due to the elevated start level of the overland flowpath. Although this result is not favourable, this flood level should have any adverse impact on the adjoining and the upstream properties on Old Canterbury Road due to the fact that the levels of these properties are higher than the flood level. Reference should be made to the survey plan included in the appendices and the following photos of the adjoining properties showing the properties protected by solid fence walls and steps to the internal habitable areas.

The flooding extent in the proposed site conditions and the proposed overland flowpath is included in the appendices.



Photo of No.77 Old Canterbury Road



Photo of No.75 Old Canterbury Road

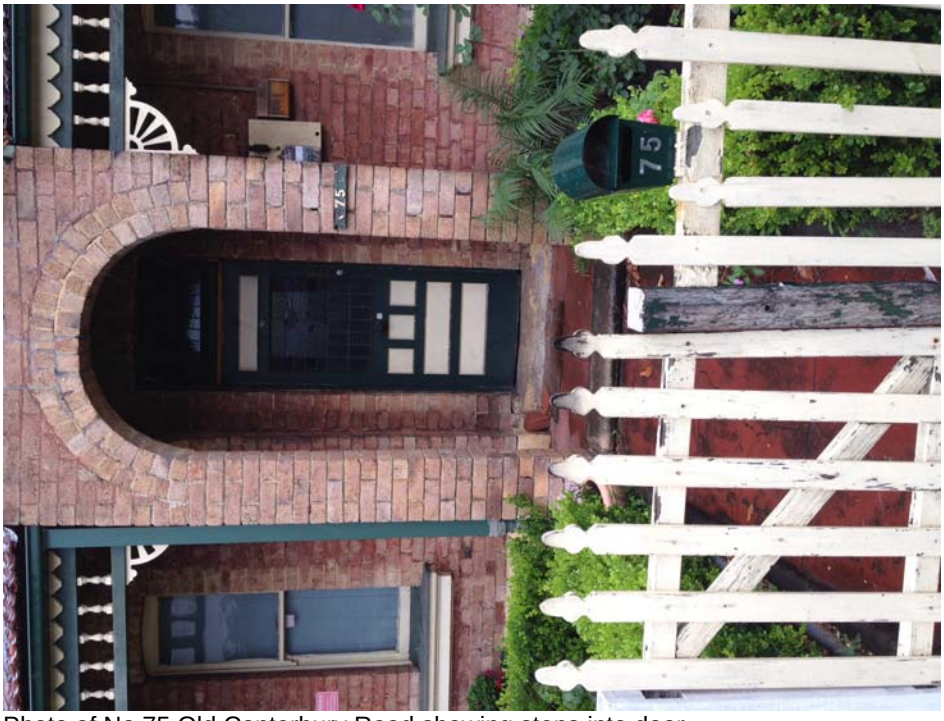


Photo of No.75 Old Canterbury Road showing steps into door



Photo of No.24 Henry Street

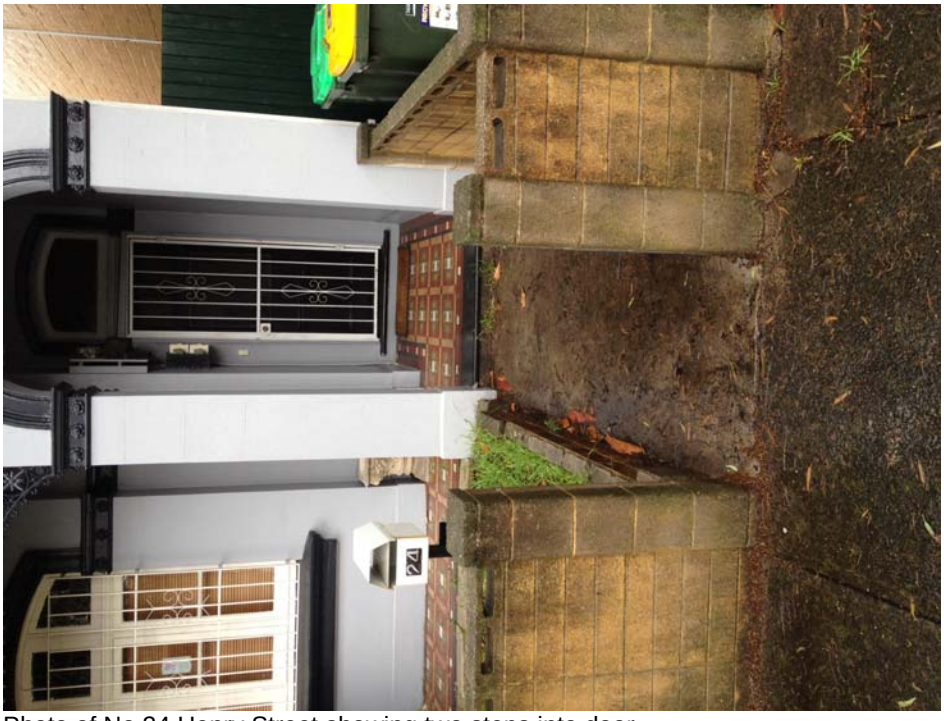


Photo of No.24 Henry Street showing two steps into door



Photo of No.73 Old Canterbury Road



Photo of 71 Old Canterbury Road

In conclusion, the proposed development does not increase the flooding in the vicinity upstream of Old Canterbury Road because of the following mitigation measures:

1. Divert the trunk main around the site;
2. Increase the size of the trunk main to 1200mm/1500mm;
3. Increase the number of inlet pits in Old Canterbury Road;

4. Provide an overland flow route south of the proposed building;
5. Raise the level of the lower end of Brown Street; and
6. Provide an overland flow route from Brown Street through the proposed development.

APPENDIX 1

Rainfall Data

IFD Table for Marrickville Council

Intensity Frequency Duration (IFD) Rainfall Data

Marrickville

2 year	*50 year*
I_1 *hr : 40.0*	I_1 *hr : 85.0*
I_{12} *hr : 8.0*	I_{12} *hr : 16.0*
I_{72} *hr : 2.5*	I_{72} *hr : 5.0*

AVERAGE RECURRENCE INTERVAL (ARI) years

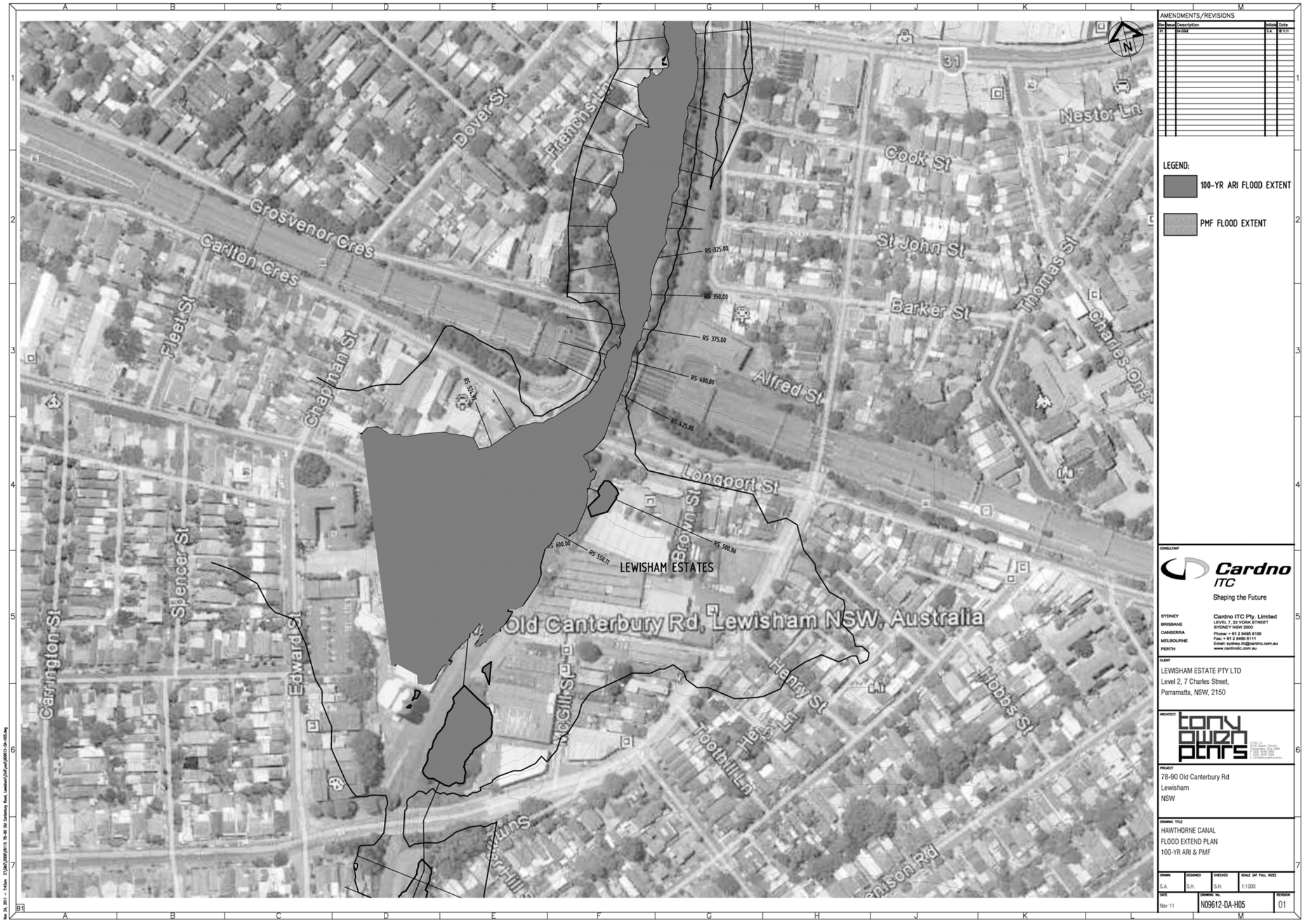
TIME	2	5	10	20	50	100
5 mins	126.5	160.8	180.4	206.6	240.6	266.3
6 mins	118.7	151.3	170	194.8	227.1	251.6
7 mins	112.1	143.3	161.2	184.9	215.8	239.3
8 mins	106.6	136.4	153.6	176.4	206.1	228.7
9 mins	101.7	130.5	147.1	169	197.6	219.4
10 mins	97.5	125.2	141.3	162.5	190.1	211.2
12 mins	90.3	116.3	131.4	151.3	177.4	197.2
14 mins	84.3	109	123.3	142.1	166.8	185.6
15 mins	81.8	105.8	119.7	138.1	162.2	180.5
16 mins	79.4	102.8	116.5	134.4	157.9	175.8
18 mins	75.1	97.5	110.6	127.7	150.3	167.4
20 mins	71.4	92.9	105.5	121.9	143.6	160.1
25 mins	64	83.6	95.1	110.2	130	145.1
30 mins	58.3	76.4	87.1	101.1	119.5	133.5
40 mins	50.1	66	75.5	87.8	104.1	116.6
50 mins	44.3	58.7	67.3	78.4	93.2	104.6
1 hours	40	53.2	61.1	71.4	85	95.5
1.5 hrs	31	41	47.1	54.9	65.2	73.1
2 hours	25.7	34	38.9	45.3	53.8	60.3
3 hours	19.8	26	29.7	34.5	40.9	45.8
4.5 hrs	15.2	19.9	22.7	26.3	31.1	34.7
6 hours	12.6	16.4	18.7	21.7	25.6	28.5
9 hours	9.6	12.6	14.3	16.5	19.4	21.7
12 hours	8	10.4	11.8	13.6	16	17.8
15 hours	7	9.1	10.3	11.9	14	15.6
18 hours	6.2	8.1	9.2	10.6	12.5	13.9
24 hours	5.2	6.8	7.7	8.9	10.5	11.7
30 hours	4.5	5.9	6.7	7.7	9.1	10.1
36 hours	4	5.2	5.9	6.9	8.1	9
48 hours	3.3	4.3	4.9	5.7	6.7	7.4
72 hours	2.5	3.2	3.7	4.3	5	5.6

Co-efficient G : 0.00 F_2 : 4.29 F_{50} : 15.80

APPENDIX 2

Hawthorne Canal

Flood Extent Plan


Dover St
Francis Ln
Nestor Ln
Cook St
Grosvenor Cres
Carlton Cres
St John St
Barker St
Thomas St
Charles One
Fleet St
Chapman St
Alfred St
RS 325.00
RS 350.00
RS 375.00
RS 400.00
RS 425.00
RS 450.00
Longport St
Brown St
RS 500.86
RS 550.11
RS 600.00
LEWISHAM ESTATES
Old Canterbury Rd, Lewisham NSW, Australia
Carrington St
Spencer St
Edward St
McGill St
Henry St
Hobbs St
Foothills Dr
Sunnyhills Dr
Jamison Rd
AMENDMENTS/REVISIONS
LEGEND:
100-YR ARI FLOOD EXTENT
PMF FLOOD EXTENT
Cardno ITC
Shaping the Future
Cardno ITC Pty. Limited
LEVEL 7, 33 YORK STREET
SYDNEY NSW 2000
Phone: + 61 2 9495 8100
Fax: + 61 2 9495 8111
Email: sydney.itc@cardno.com.au
www.cardnoitc.com.au
LEWISHAM ESTATE PTY LTD
Level 2, 7 Charles Street,
Parramatta, NSW, 2150
tony owen ptnrs
78-90 Old Canterbury Rd
Lewisham
NSW
HAWTHORNE CANAL
FLOOD EXTEND PLAN
100-YR ARI & PMF
S.A.
S.H.
S.H.
1:1000
Nov '11
N09612-DA-H05
01

APPENDIX 3

DRAINS Model Results – Hawthorne Canal

20-year ARI, 100-year ARI & PMF

Including the increase in rainfall peak by 10%, 20% & 30% for the 100-year ARI storm event

20-yr ARI Storm Event

DRAINS results prepared 15 November, 2011 from Version 2011.17

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C.C2	1.962	1.856	0.122	6.74	34.77	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C.A	11.916	11.426	0.563	9.57	49.31	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C.B	31.317	30.068	1.435	9.97	51.4	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C.B1	11.401	10.969	0.496	11.21	57.81	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C.C	20.141	19.354	0.903	10.32	53.2	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C.D	4.3	4.132	0.192	10.64	54.84	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C.C3	1.118	1.046	0.083	5.05	26.03	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C.C1	27.931	26.798	1.301	9.86	50.84	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C.D1	7.625	7.301	0.373	9.26	47.73	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C.E	10.005	9.496	0.586	7.36	37.93	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF C2.C1	1.962	1.962	0.362	0.099	0.15	23.85	1.48	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
OF A.B	11.916	17.896	0.329	0.23	0.67	49.99	2.91	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
OF B.C	38.361	41.411	0.301	0.23	1.55	49.99	6.74	AR&R 20 year, 1 hour storm, average 71 mm/h, Zone 1
OF B.B1	11.401	21.421	0.341	0.23	0.8	49.99	3.48	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
OF C.D	62.536	63.278	0.292	0.23	2.37	49.99	10.29	AR&R 20 year, 1 hour storm, average 71 mm/h, Zone 1
OF D.E	67.048	68.212	0.28	0.23	2.55	49.99	11.1	AR&R 20 year, 1 hour storm, average 71 mm/h, Zone 1
OF C3.C1	1.118	1.118	0.453	0.072	0.11	18.46	1.49	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
OF C1.C	29.015	29.015	0.314	0.23	1.09	49.99	4.72	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
OF D1.D	7.625	8.604	0.352	0.185	0.39	40.91	2.11	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1

CONTINUITY CHECK for AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chang (cu.m)	Difference %
C2	1739.29	1739.29	0	0
A	11399.79	11399.79	0	0
B	53192.38	53192.38	0	0
B1	11609.56	11609.56	0	0
C	102431.15	102431.16	0	0
D	113951.7	113951.68	0	0
C3	914	914	0	0
C1	29516.32	29516.32	0	0
D1	7249.05	7249.05	0	0
E	123009.39	123009.39	0	0

Run Log for 09115 run at 15:08:53 on 15/11/2011

100-yr ARI Storm Event

DRAINS results prepared 15 November, 2011 from Version 2011.17

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C.C2	2.42	2.264	0.197	6.04	31.13	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C.A	14.682	13.948	0.925	8.56	44.15	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C.B	38.57	36.708	2.346	8.93	46.02	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C.B1	14.532	13.883	0.818	10.04	51.76	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C.C	25.066	23.873	1.503	9.24	47.63	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C.D	5.396	5.148	0.313	9.52	49.1	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C.C3	1.35	1.241	0.138	4.52	23.31	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C.C1	34.408	32.715	2.133	8.83	45.52	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C.D1	9.4	8.912	0.615	8.29	42.73	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C.E	12.352	11.584	0.968	6.59	33.96	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF C2.C1	2.42	2.42	10.84	0.109	0.17	25.82	1.54	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
OF A.B	14.682	24.037	9.846	0.23	0.9	49.99	3.91	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
OF B.C	50.264	54.874	9.005	0.23	2.05	49.99	8.93	AR&R 100 year, 1 hour storm, average 95 mm/h, Zone 1
OF B.B1	14.532	27.53	10.198	0.23	1.03	49.99	4.48	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
OF C.D	81.599	82.667	8.74	0.23	3.09	49.99	13.45	AR&R 100 year, 1 hour storm, average 95 mm/h, Zone 1
OF D.E	88.035	89.843	8.397	0.23	3.36	49.99	14.61	AR&R 100 year, 1 hour storm, average 95 mm/h, Zone 1
OF C3.C1	1.35	1.35	13.55	0.078	0.12	19.54	1.58	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
OF C1.C	36.057	36.057	9.388	0.23	1.35	49.99	5.87	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
OF D1.D	9.4	10.61	10.538	0.201	0.45	44.14	2.22	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1

CONTINUITY CHECK for AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chang (cu.m)	Difference %
C2	2348.39	2348.39	0	0
A	15427.55	15427.55	0	0
B	72014.67	72014.66	0	0
B1	15730.54	15730.54	0	0
C	138665.11	138665.2	0	0
D	154257.27	154257.25	0	0
C3	1233.29	1233.29	0	0
C1	39940.07	39940.07	0	0
D1	9808.01	9808.01	0	0
E	166494.63	166494.63	0	0

Run Log for 09115 run at 15:10:04 on 15/11/2011

PMF Event

DRAINS results prepared 15 November, 2011 from Version 2011.17								
SUB-CATCHMENT DETAILS								
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm	
	Flow Q	Max Q	Max Q	Tc	Tc	Tc		
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)		
C.C2	8.309	7.825	1.151	3.33	17.19	0.04	PMP 15mins	
C.A	53.337	51.039	5.468	4.73	24.38	0.04	PMP 15mins	
C.B	140.764	134.908	13.931	4.93	25.41	0.04	PMP 15mins	
C.B1	53.526	51.121	4.816	5.54	28.58	0.04	PMP 15mins	
C.C	91.407	87.027	8.773	5.1	26.3	0.04	PMP 15mins	
C.D	19.745	18.83	1.833	5.26	27.11	0.04	PMP 15mins	
C.C3	4.45	4.099	0.773	2.5	12.87	0.04	PMP 15mins	
C.C1	125.308	120.098	12.394	4.88	25.13	0.04	PMP 15mins	
C.D1	34.016	32.495	3.619	4.58	23.6	0.04	PMP 15mins	
C.E	43.193	40.802	5.688	3.64	18.75	0.04	PMP 15mins	
OVERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF C2.C1	8.309	8.309	10.84	0.18	0.38	40.01	2.13	PMP 15mins
OF A.B	53.337	78.097	9.846	0.23	2.92	49.99	12.7	PMP 15mins
OF B.C	156.491	171.786	9.005	0.23	6.43	49.99	27.94	PMP 30mins
OF B.B1	53.526	102.094	10.198	0.23	3.82	49.99	16.61	PMP 15mins
OF C.D	269.206	272.882	8.74	0.23	10.21	49.99	44.39	PMP 45mins
OF D.E	292.1	297.481	8.397	0.23	11.13	49.99	48.39	PMP 45mins
OF C3.C1	4.45	4.45	13.55	0.127	0.27	29.41	2.16	PMP 15mins
OF C1.C	125.308	125.308	9.388	0.23	4.69	49.99	20.38	PMP 15mins
OF D1.D	34.016	39.56	10.538	0.23	1.48	49.99	6.44	PMP 15mins
CONTINUITY CHECK for PMP 15mins								
Node	Inflow	Outflow	Storage Chanc	Difference				
	(cu.m)	(cu.m)	(cu.m)	%				
C2	6562.19	6562.19	0	0				
A	43228.4	43228.4	0	0				
B	201893.89	201893.8	0	0				
B1	44136.52	44136.52	0	0				
C	388671.22	388671.16	0	0				
D	432364.41	432364.41	0	0				
C3	3440.68	3440.68	0	0				
C1	111893.03	111893.02	0	0				
D1	27470.91	27470.91	0	0				
E	466575.5	466575.5	0	0				
Run Log for 09115 run at 15:18:19 on 15/11/2011								

100-yr ARI Storm Event (10% Increase in peak rainfall)

DRAINS results prepared 15 November, 2011 from Version 2011.17

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C.C2	2.648	2.469	0.226	5.85	30.16	0.07	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
C.A	16.037	15.184	1.075	8.3	42.77	0.07	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
C.B	42.114	39.954	2.723	8.65	44.58	0.07	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
C.B1	15.854	15.12	0.926	9.73	50.14	0.07	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
C.C	27.333	25.981	1.705	8.95	46.14	0.07	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
C.D	5.889	5.602	0.362	9.23	47.57	0.07	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
C.C3	1.47	1.343	0.16	4.38	22.58	0.07	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
C.C1	37.532	35.61	2.422	8.55	44.1	0.07	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
C.D1	10.258	9.703	0.699	8.03	41.4	0.07	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
C.E	13.506	12.627	1.108	6.38	32.9	0.07	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF C2.C1	2.648	2.648	10.84	0.113	0.18	26.54	1.59	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
OF A.B	16.037	27.028	9.846	0.23	1.01	49.99	4.4	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
OF B.C	56.198	61.4	9.005	0.23	2.3	49.99	9.99	AR&R 100 year, 1 hour storm, average 105 mm/h, Zone 1 (10%)
OF B.B1	15.854	30.559	10.198	0.23	1.14	49.99	4.97	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
OF C.D	90.361	91.545	8.74	0.23	3.42	49.99	14.89	AR&R 100 year, 1 hour storm, average 105 mm/h, Zone 1 (10%)
OF D.E	97.498	99.52	8.397	0.23	3.72	49.99	16.19	AR&R 100 year, 1 hour storm, average 105 mm/h, Zone 1 (10%)
OF C3.C1	1.47	1.47	13.55	0.08	0.13	20.08	1.62	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
OF C1.C	39.365	39.365	9.388	0.23	1.47	49.99	6.4	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)
OF D1.D	10.258	11.553	10.538	0.208	0.47	45.58	2.27	AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)

CONTINUITY CHECK for AR&R 100 year, 25 minutes storm, average 157 mm/h, Zone 1 (10%)

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chang (cu.m)	Difference %
C2	2558.59	2558.59	0	0
A	16817.49	16817.49	0	0
B	78501.97	78501.96	0	0
B1	17145.4	17145.4	0	0
C	151138.73	151138.7	0	0
D	168132.75	168132.8	0	0
C3	1343.48	1343.48	0	0
C1	43526.09	43526.07	0	0
D1	10688.39	10688.39	0	0
E	181466.33	181466.33	0	0

Run Log for 09115 run at 15:47:31 on 15/11/2011

100-yr ARI Storm Event (20% Increase in peak rainfall)

DRAINS results prepared 15 November, 2011 from Version 2011.17

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C.C2	2.86	2.658	0.255	5.69	29.35	0.07	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
C.A	17.278	16.325	1.202	8.08	41.63	0.07	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
C.B	45.36	42.949	3.039	8.42	43.39	0.07	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
C.B1	17.08	16.246	1.052	9.47	48.8	0.07	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
C.C	29.466	27.925	1.943	8.71	44.91	0.07	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
C.D	6.34	6.02	0.403	8.98	46.3	0.07	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
C.C3	1.619	1.464	0.202	4.96	25.57	0.08	AR&R 100 year, 1 hour storm, average 115 mm/h, Zone 1 (20%)
C.C1	40.475	38.281	2.767	8.32	42.92	0.07	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
C.D1	11.054	10.434	0.782	7.82	40.29	0.07	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
C.E	14.549	13.591	1.209	6.21	32.02	0.07	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF C2.C1	2.86	2.86	10.84	0.116	0.19	27.26	1.63	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
OF A.B	17.278	29.81	9.846	0.23	1.12	49.99	4.85	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
OF B.C	61.858	67.551	9.005	0.23	2.53	49.99	10.99	AR&R 100 year, 1 hour storm, average 115 mm/h, Zone 1 (20%)
OF B.B1	17.08	33.532	10.198	0.23	1.25	49.99	5.45	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
OF C.D	99.243	100.458	8.74	0.23	3.76	49.99	16.34	AR&R 100 year, 1 hour storm, average 115 mm/h, Zone 1 (20%)
OF D.E	107	109.299	8.397	0.23	4.09	49.99	17.78	AR&R 100 year, 1 hour storm, average 115 mm/h, Zone 1 (20%)
OF C3.C1	1.619	1.619	13.55	0.084	0.14	20.79	1.65	AR&R 100 year, 1 hour storm, average 115 mm/h, Zone 1 (20%)
OF C1.C	42.483	42.483	9.388	0.23	1.59	49.99	6.91	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)
OF D1.D	11.054	12.423	10.538	0.213	0.5	46.66	2.33	AR&R 100 year, 25 minutes storm, average 168 mm/h, Zone 1 (20%)

CONTINUITY CHECK for AR&R 100 year, 1 hour storm, average 115 mm/h, Zone 1 (20%)

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chang (cu.m)	Difference %
C2	4587.49	4587.49	0	0
A	30215.38	30215.38	0	0
B	141112.44	141112.48	0	0
B1	30846.79	30846.79	0	0
C	271667.09	271667.13	0	0
D	302208.06	302208.09	0	0
C3	2405.07	2405.07	0	0
C1	78215.65	78215.66	0	0
D1	19201.8	19201.8	0	0
E	326121.75	326121.75	0	0

Run Log for 09115 run at 15:54:13 on 15/11/2011

100-yr ARI Storm Event (30% Increase in peak rainfall)

DRAINS results prepared 15 November, 2011 from Version 2011.17

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C.C2	3.076	2.849	0.286	5.55	28.62	0.06	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
C.A	18.531	17.473	1.334	7.87	40.59	0.06	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
C.B	48.634	45.962	3.371	8.21	42.3	0.06	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
C.B1	18.301	17.378	1.164	9.23	47.58	0.06	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
C.C	31.588	29.88	2.154	8.49	43.78	0.06	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
C.D	6.795	6.441	0.446	8.76	45.14	0.06	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
C.C3	1.761	1.578	0.201	5.35	27.6	0.08	AR&R 100 year, 1.5 hours storm, average 95 mm/h, Zone 1 (30%)
C.C1	43.402	40.968	3.07	8.12	41.84	0.06	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
C.D1	11.857	11.168	0.869	7.62	39.28	0.06	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
C.E	15.633	14.562	1.351	6.06	31.22	0.06	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF C2.C1	3.076	3.076	10.84	0.12	0.2	27.98	1.66	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
OF A.B	18.531	32.311	9.846	0.23	1.21	49.99	5.26	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
OF B.C	66.67	72.855	9.005	0.23	2.73	49.99	11.85	AR&R 100 year, 1 hour storm, average 124 mm/h, Zone 1 (30%)
OF B.B1	18.301	36.269	10.198	0.23	1.36	49.99	5.9	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
OF C.D	107.498	108.772	8.74	0.23	4.07	49.99	17.69	AR&R 100 year, 1 hour storm, average 124 mm/h, Zone 1 (30%)
OF D.E	115.548	118.003	8.397	0.23	4.41	49.99	19.2	AR&R 100 year, 1 hour storm, average 124 mm/h, Zone 1 (30%)
OF C3.C1	1.761	1.761	13.55	0.087	0.15	21.33	1.7	AR&R 100 year, 1.5 hours storm, average 95 mm/h, Zone 1 (30%)
OF C1.C	45.586	45.586	9.388	0.23	1.71	49.99	7.42	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)
OF D1.D	11.857	13.299	10.538	0.22	0.52	47.91	2.36	AR&R 100 year, 25 minutes storm, average 179 mm/h, Zone 1 (30%)

CONTINUITY CHECK for AR&R 100 year, 1.5 hours storm, average 95 mm/h, Zone 1 (30%)

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chang (cu.m)	Difference %
C2	5709.97	5709.97	0	0
A	37622.38	37622.38	0	0
B	175719.28	175719.33	0	0
B1	38416.45	38416.45	0	0
C	338286	338286.09	0	0
D	376313.72	376313.63	0	0
C3	2992.57	2992.57	0	0
C1	97388.27	97388.27	0	0
D1	23907.33	23907.33	0	0
E	406080	406080	0	0

Run Log for 09115 run at 16:04:48 on 15/11/2011

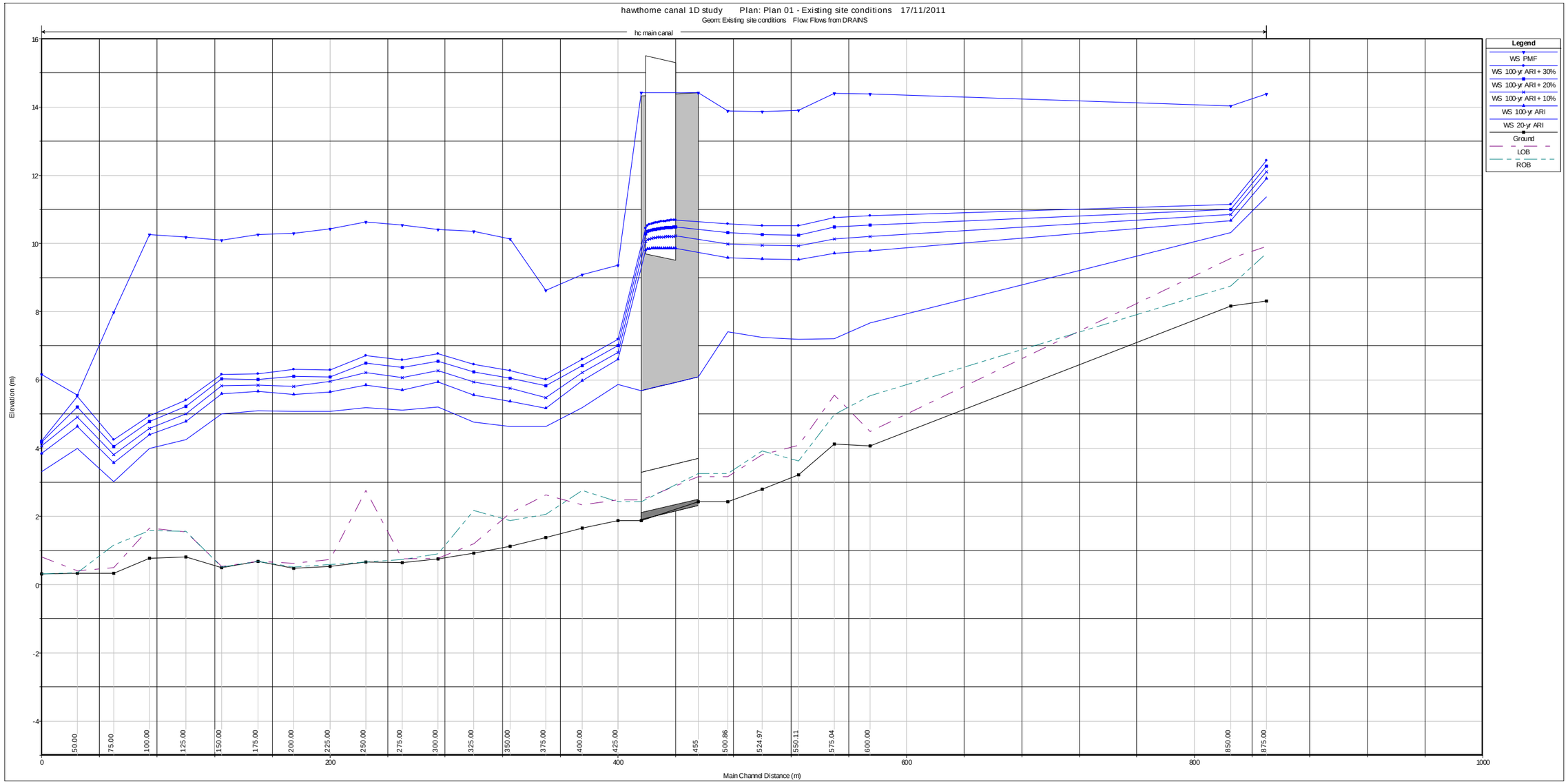
APPENDIX 4

HECRAS Model Results – Hawthorne Canal

20-year ARI, 100-year ARI & PMF for Plans 01, 01A, 01B, 02 & 02A

Including the increase in rainfall peak by 10%, 20% & 30% for the 100-year ARI storm event

Plan 01

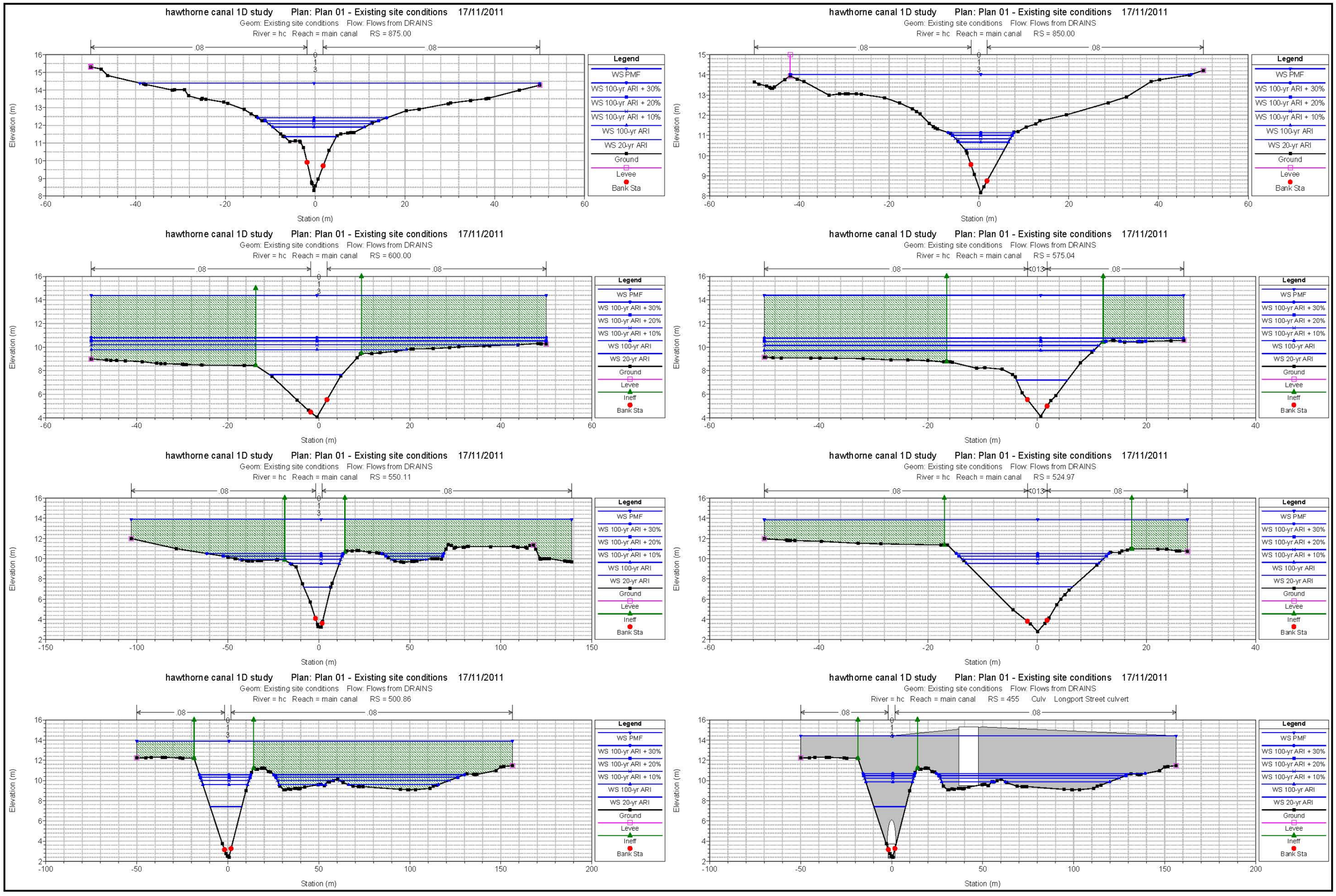

hawthorne canal 1D study Plan: Plan 01 - Existing site conditions 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS
hc main canal
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
LOB
ROB
Elevation (m)
16
14
12
10
8
6
4
2
0
-2
-4
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
300.00
325.00
350.00
375.00
400.00
425.00
455
500.86
524.97
550.11
575.04
600.00
850.00
875.00
0
200
400
600
800
1000
Main Channel Distance (m)

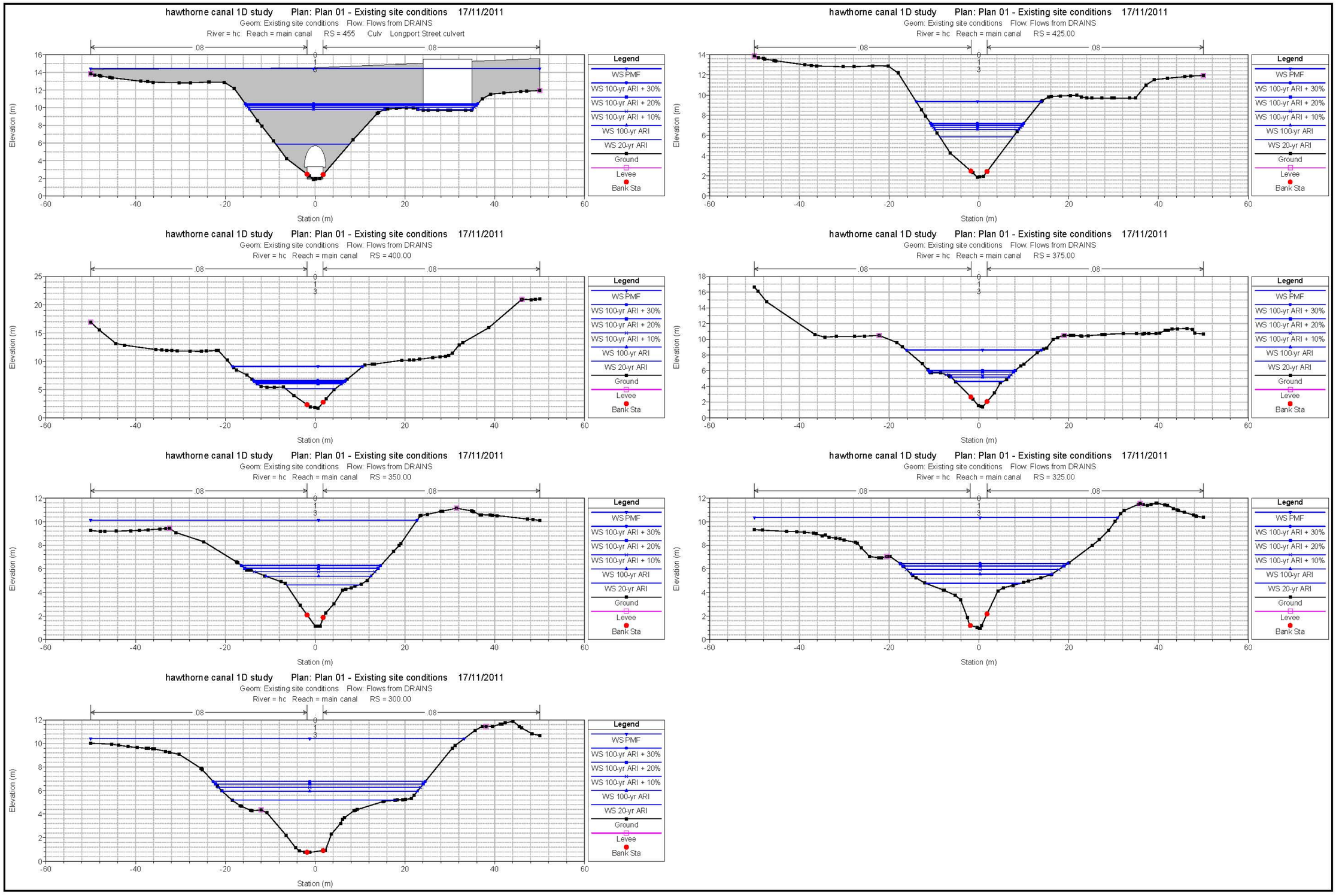
HEC-RAS Plan: P01-EXG River: hc Reach: main canal

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Vel Left	Vel Right
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)
main canal	875.00	20-yr ARI	38.36	8.31	11.36	11.36	12.34	0.001577	4.46	12.43	11.64	0.94	0.24	0.38
main canal	875.00	100-yr ARI	50.26	8.31	11.90	11.90	12.89	0.001246	4.56	21.21	20.43	0.86	0.33	0.31
main canal	875.00	PMF	156.49	8.31	14.39	14.39	15.31	0.000721	5.27	146.48	89.05	0.73	0.42	0.44
main canal	875.00	100-yr ARI + 10%	56.20	8.31	12.10	12.10	13.11	0.001192	4.66	25.50	22.84	0.85	0.36	0.33
main canal	875.00	100-yr ARI + 20%	61.86	8.31	12.26	12.26	13.31	0.001174	4.79	29.36	25.22	0.85	0.39	0.35
main canal	875.00	100-yr ARI + 30%	66.67	8.31	12.43	12.43	13.47	0.001112	4.82	33.94	28.71	0.84	0.38	0.36
main canal	850.00	20-yr ARI	38.36	8.17	10.32	10.90	12.19	0.004152	6.23	9.34	8.91	1.57	0.35	0.65
main canal	850.00	100-yr ARI	50.26	8.17	10.67	11.29	12.73	0.003592	6.60	12.82	11.11	1.51	0.40	0.69
main canal	850.00	PMF	156.49	8.17	14.03	13.67	14.87	0.000570	5.12	160.65	89.40	0.71	0.40	0.43
main canal	850.00	100-yr ARI + 10%	56.20	8.17	10.85	11.65	12.95	0.003299	6.70	14.89	12.28	1.46	0.43	0.70
main canal	850.00	100-yr ARI + 20%	61.86	8.17	11.01	11.72	13.15	0.003076	6.80	16.96	13.37	1.43	0.45	0.71
main canal	850.00	100-yr ARI + 30%	66.67	8.17	11.14	11.86	13.31	0.002916	6.87	18.82	14.63	1.41	0.45	0.72
main canal	600.00	20-yr ARI	38.36	4.06	7.67	6.73	8.06	0.000399	2.97	28.88	15.99	0.54	0.33	0.23
main canal	600.00	100-yr ARI	50.26	4.06	9.78	7.12	9.94	0.000092	2.02	72.90	69.29	0.28	0.25	0.18
main canal	600.00	PMF	156.49	4.06	14.39	9.63	14.65	0.000077	2.82	179.95	100.00	0.29	0.42	0.36
main canal	600.00	100-yr ARI + 10%	56.20	4.06	10.20	7.30	10.36	0.000085	2.04	82.58	93.75	0.28	0.26	0.19
main canal	600.00	100-yr ARI + 20%	61.86	4.06	10.53	7.47	10.69	0.000081	2.08	90.31	100.00	0.27	0.27	0.21
main canal	600.00	100-yr ARI + 30%	66.67	4.06	10.81	7.57	10.97	0.000079	2.12	96.68	100.00	0.27	0.28	0.22
main canal	575.04	20-yr ARI	38.36	4.13	7.20	6.97	8.00	0.001069	4.09	14.87	9.34	0.83	0.33	0.40
main canal	575.04	100-yr ARI	50.26	4.13	9.71	7.39	9.93	0.000131	2.29	62.61	60.33	0.33	0.20	0.22
main canal	575.04	PMF	156.49	4.13	14.39	10.10	14.64	0.000081	2.80	196.11	76.81	0.29	0.37	0.36
main canal	575.04	100-yr ARI + 10%	56.20	4.13	10.14	7.58	10.35	0.000116	2.28	74.28	61.25	0.31	0.22	0.22
main canal	575.04	100-yr ARI + 20%	61.86	4.13	10.48	7.74	10.69	0.000109	2.30	83.81	67.17	0.31	0.23	0.22
main canal	575.04	100-yr ARI + 30%	66.67	4.13	10.76	7.91	10.96	0.000103	2.31	91.87	76.81	0.30	0.24	0.23
main canal	550.11	20-yr ARI	62.54	3.22	7.20	6.49	7.98	0.000570	4.14	31.56	14.92	0.68	0.36	0.38
main canal	550.11	100-yr ARI	81.60	3.22	9.52	7.04	9.91	0.000163	3.05	77.80	26.98	0.40	0.26	0.27
main canal	550.11	PMF	269.21	3.22	13.90	11.02	14.60	0.000179	4.60	219.99	242.05	0.45	0.54	0.51
main canal	550.11	100-yr ARI + 10%	90.36	3.22	9.92	7.26	10.33	0.000157	3.12	89.52	74.93	0.39	0.25	0.28
main canal	550.11	100-yr ARI + 20%	99.24	3.22	10.25	7.49	10.66	0.000153	3.19	99.74	96.43	0.39	0.27	0.29
main canal	550.11	100-yr ARI + 30%	107.50	3.22	10.51	7.71	10.94	0.000153	3.27	108.09	108.99	0.39	0.29	0.30
main canal	524.97	20-yr ARI	62.54	2.79	7.24	6.37	7.94	0.000522	3.94	33.53	15.23	0.64	0.39	0.32
main canal	524.97	100-yr ARI	81.60	2.79	9.54	6.91	9.90	0.000157	2.94	78.99	24.24	0.38	0.30	0.26
main canal	524.97	PMF	269.21	2.79	13.87	10.56	14.59	0.000192	4.63	217.59	77.49	0.45	0.54	0.50
main canal	524.97	100-yr ARI + 10%	90.36	2.79	9.95	7.15	10.31	0.000150	3.00	89.11	25.78	0.37	0.31	0.27
main canal	524.97	100-yr ARI + 20%	99.24	2.79	10.27	7.37	10.65	0.000151	3.10	97.54	27.00	0.38	0.32	0.28
main canal	524.97	100-yr ARI + 30%	107.50	2.79	10.52	7.58	10.93	0.000154	3.21	104.61	27.97	0.38	0.33	0.29
main canal	500.86	20-yr ARI	62.54	2.42	7.40	5.78	7.86	0.000257	3.21	45.94	17.37	0.47	0.31	0.28
main canal	500.86	100-yr ARI	81.60	2.42	9.59	6.32	9.87	0.000104	2.63	91.69	98.02	0.32	0.26	0.24
main canal	500.86	PMF	269.21	2.42	13.88	9.99	14.58	0.000158	4.50	222.95	206.35	0.43	0.49	0.48
main canal	500.86	100-yr ARI + 10%	90.36	2.42	9.99	6.55	10.29	0.000102	2.72	101.87	117.01	0.32	0.27	0.25
main canal	500.86	100-yr ARI + 20%	99.24	2.42	10.31	6.77	10.63	0.000105	2.83	110.37	126.95	0.33	0.28	0.26
main canal	500.86	100-yr ARI + 30%	107.50	2.42	10.57	6.97	10.91	0.000108	2.94	117.47	132.86	0.33	0.29	0.27
main canal	455		Culvert											
main canal	425.00	20-yr ARI	67.05	1.88	5.87	5.19	6.65	0.000557	4.22	37.10	16.39	0.69	0.42	0.38
main canal	425.00	100-yr ARI	88.04	1.88	6.59	5.73	7.46	0.000508	4.52	49.72	18.71	0.68	0.46	0.42
main canal	425.00	PMF	292.10	1.88	9.36	9.36	12.08	0.000927	8.40	114.22	27.85	0.99	0.85	0.78
main canal	425.00	100-yr ARI + 10%	97.50	1.88	6.81	5.96	7.76	0.000524	4.74	53.84	19.43	0.70	0.48	0.44
main canal	425.00	100-yr ARI + 20%	107.00	1.88	7.01	6.18	8.04	0.000540	4.95	57.86	20.11	0.71	0.50	0.46
main canal	425.00	100-yr ARI + 30%	115.55	1.88	7.19	6.36	8.28	0.000554	5.13	61.37	20.69	0.73	0.52	0.47
main canal	400.00	20-yr ARI	67.05	1.65	5.20	5.20	6.57	0.001289	5.41	21.86	11.21	0.97	0.53	0.41
main canal	400.00	100-yr ARI	88.04	1.65	5.98	5.98	7.39	0.001011	5.55	34.31	18.60	0.89	0.44	0.43
main canal	400.00	PMF	292.10	1.65	9.09	9.37	12.03	0.001151	8.71	108.00	29.04	1.05	0.90	0.76
main canal	400.00	100-yr ARI + 10%	97.50	1.65	6.21	6.21	7.69	0.000997	5.72	38.66	19.32	0.89	0.48	0.45
main canal	400.00	100-yr ARI + 20%	107.00	1.65	6.42	6.42	7.97	0.000991	5.89	42.80	19.96	0.90	0.52	0.47
main canal	400.00	100-yr ARI + 30%	115.55	1.65	6.60	6.60	8.21	0.000986	6.04	46.51	20.52	0.90	0.54	0.49
main canal	375.00	20-yr ARI	67.05	1.39	4.64	5.06	6.49	0.001994	6.22	18.11	10.69	1.18	0.51	0.56
main canal	375.00	100-yr ARI	88.04	1.39	5.18	5.63	7.29	0.001846	6.72	24.46	12.86	1.17	0.57	0.59
main canal	375.00	PMF	292.10	1.39	8.63	9.41	11.96	0.001344	9.20	101.99	30.19	1.13	0.88	0.85
main canal	375.00	100-yr ARI + 10%	97.50	1.39	5.48	6.03	7.59	0.001665	6.76	28.52	14.43	1.13	0.56	0.61
main canal	375.00	100-yr ARI + 20%	107.00	1.39	5.83	6.23	7.89	0.001442	6.69	34.30	18.69	1.07	0.46	0.61
main canal	375.00	100-yr ARI + 30%	115.55	1.39	6.02	6.43	8.13	0.001410	6.82	37.85	19.29	1.06	0.50	0.63
main canal	350.00	20-yr ARI	67.05	1.12	4.64	4.63	5.94	0.001222	5.30	25.37	16.15	0.95	0.47	0.41
main canal	350.00	100-yr ARI	88.04	1.12	5.37	5.31	6.68	0.000971	5.42	39.81	23.35	0.87	0.41	0.47
main canal	350.00	PMF	292.10	1.12	10.13	8.48	11.16	0.000375	5.72	249.99	72.72	0.62	0.45	0.61
main canal	350.00	100-yr ARI + 10%	97.50	1.12	5.76	5.57	6.97	0.000818	5.30	49.58	26.88	0.81	0.40	0.48
main canal	350.00	100-yr ARI + 20%	107.00	1.12	6.05	5.79	7.25	0.000757	5.32	57.88	29.78	0.79	0.40	0.50
main canal	350.00	100-yr ARI + 30%	115.55	1.12	6.28	6.05	7.47	0.000723	5.37	64.70	31.01	0.78	0.42	0.51
main canal	325.00	20-yr ARI	67.05	0.93	4.77	4.40	5.85	0.000844	4.78	28.40	21.17	0.81	0.34	0.27
main canal	325.00	100-yr ARI	88.04	0.93	5.55	5.25	6.57	0.000654	4.81	49.04	31.34	0.74	0.39	0.30
main canal	325.00	PMF	292.10	0.93	10.36	8.24	11.05	0.000249	4.90	313.82	80.95	0.52	0.42	0.50
main canal	325.00	100-yr ARI + 10%	97.50	0.93	5.94	5.50	6.87	0.000551	4.68	61.81	33.92	0.69	0.40	0.33
main canal	325.00	100-yr ARI + 20%	107.00	0.93	6.24	5.73	7.14	0.000508	4.68	72.23	35.90	0.67	0.41	0.35
main canal	325.00	100-yr ARI + 30%	115.55	0.93	6.46	5.90	7.37	0.000491	4.74	80.31	37.42	0.66	0.42	0.37
main canal	300.00	20-yr ARI	67.05	0.76	5.20	3.69	5.65	0.000266	3.35	67.64	36.79	0.51	0.31	0.22
main canal	300.00	100-yr ARI	88.04	0.76	5.94	4.12	6.39	0.000233	3.48	98.27	43.47	0.49	0.33	0.25
main canal	300.00	PMF	292.10	0.76	10.42	7.51	11.02	0.000178	4.63	355.51	83.25	0.48	0.38	0.45
main canal	300.00	100-yr ARI + 10%	97.50	0.76	6.28	4.35	6.71	0.000215	3.49	113.13	45.04	0.48	0.34	0.27
main canal	300.00	100-yr ARI + 20%	107.00	0.76	6.55	4.92	7.00	0.000208	3.55	125.90	46.31	0.47	0.35	0.29
main canal	300.00	100-yr ARI + 30%	115.55	0.76	6.77	5.08	7.22	0.000206	3.62	136.02	47.29	0.47	0.36	0.30
main canal	275.00	20-yr ARI	67.05	0.65	5.11	3.66	5.64	0.000288	3.52	55.84	29.44	0.53	0.31	0.24
main canal	275.00	100-yr ARI	88.04	0.65	5.71	4.21	6.36	0.000308	3.96	77.23	43.79	0.56	0.25	0.29
main canal	275.00	PMF	292.10	0.65	10.54	8.04	10.96	0.000131	4.04	420.32	85.98	0.41	0.37	0.41
main canal	275.00	100-yr ARI + 10%	97.50	0.65	6.08	4.37	6.69	0.000275	3.92	94.03	48.14	0.54	0.25	0.31
main canal	275.00	100-yr ARI + 20%	107.00	0.65	6.37	4.88	6.97	0.000262	3.96	108.55	52.75	0.53	0.25	0.32
main canal	275.00	100-yr ARI + 30%	115.55	0.65	6.59	5.11	7.20	0.000257	4.02	120.77	56.70	0.53	0.26	0.33

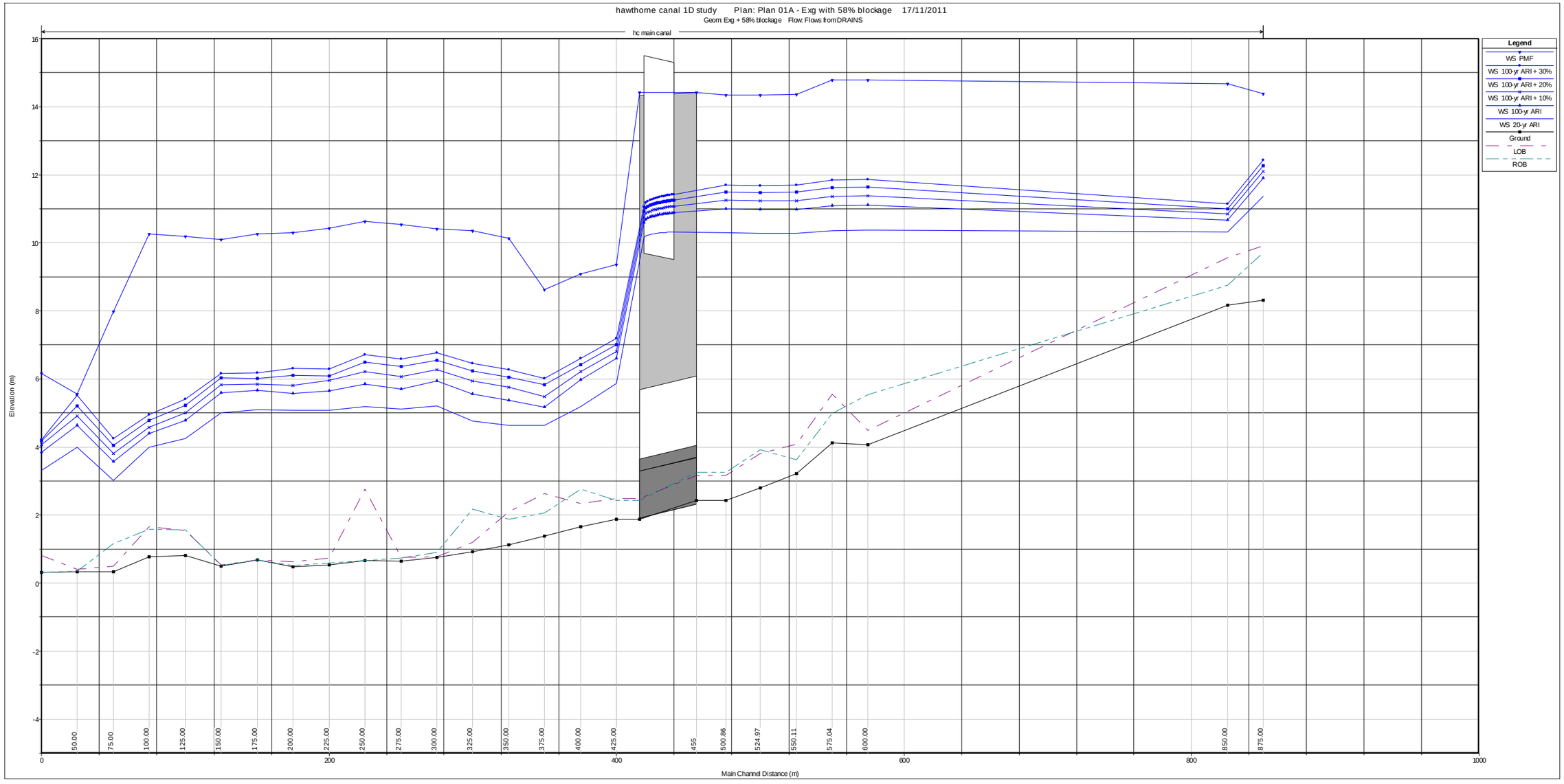
HEC-RAS Plan: P01-EXG River: hc Reach: main canal (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Vel Left	Vel Right
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)
main canal	250.00	20-yr ARI	67.05	0.67	5.19	3.63	5.59	0.000403	3.32	63.15	30.36	0.53	0.17	0.42
main canal	250.00	100-yr ARI	88.04	0.67	5.86	4.06	6.29	0.000371	3.53	87.29	42.80	0.52	0.18	0.45
main canal	250.00	PMF	292.10	0.67	10.64	7.62	10.91	0.000148	3.57	431.01	83.71	0.37	0.39	0.47
main canal	250.00	100-yr ARI + 10%	97.50	0.67	6.21	4.37	6.62	0.000334	3.51	103.53	49.48	0.50	0.20	0.46
main canal	250.00	100-yr ARI + 20%	107.00	0.67	6.50	4.60	6.91	0.000316	3.54	118.54	54.83	0.49	0.21	0.46
main canal	250.00	100-yr ARI + 30%	115.55	0.67	6.72	5.05	7.13	0.000306	3.59	131.28	58.85	0.49	0.22	0.47
main canal	225.00	20-yr ARI	67.05	0.53	5.08	3.59	5.57	0.000271	3.43	56.41	25.25	0.52	0.31	0.28
main canal	225.00	100-yr ARI	88.04	0.53	5.65	4.13	6.26	0.000292	3.86	71.90	29.08	0.55	0.33	0.33
main canal	225.00	PMF	292.10	0.53	10.43	8.05	10.89	0.000143	4.21	396.16	83.50	0.43	0.40	0.40
main canal	225.00	100-yr ARI + 10%	97.50	0.53	5.96	4.38	6.59	0.000288	3.98	81.16	32.43	0.55	0.32	0.35
main canal	225.00	100-yr ARI + 20%	107.00	0.53	6.10	4.68	6.86	0.000329	4.33	87.24	46.59	0.59	0.24	0.38
main canal	225.00	100-yr ARI + 30%	115.55	0.53	6.30	4.68	7.09	0.000328	4.43	97.17	51.37	0.59	0.24	0.39
main canal	200.00	20-yr ARI	67.05	0.48	5.08	3.56	5.56	0.000259	3.39	54.11	20.81	0.51	0.32	0.30
main canal	200.00	100-yr ARI	88.04	0.48	5.58	4.12	6.25	0.000312	3.99	65.81	27.31	0.57	0.32	0.35
main canal	200.00	PMF	292.10	0.48	10.31	8.09	10.88	0.000165	4.51	347.84	69.26	0.46	0.44	0.39
main canal	200.00	100-yr ARI + 10%	97.50	0.48	5.82	4.35	6.57	0.000331	4.23	76.23	40.99	0.59	0.26	0.37
main canal	200.00	100-yr ARI + 20%	107.00	0.48	6.10	4.57	6.85	0.000315	4.28	87.97	42.44	0.58	0.28	0.38
main canal	200.00	100-yr ARI + 30%	115.55	0.48	6.31	4.77	7.07	0.000311	4.36	96.97	43.48	0.58	0.30	0.39
main canal	175.00	20-yr ARI	67.05	0.68	5.09	3.54	5.55	0.000264	3.36	57.00	20.31	0.51	0.33	0.34
main canal	175.00	100-yr ARI	88.04	0.68	5.66	4.09	6.26	0.000294	3.85	69.46	23.41	0.55	0.36	0.38
main canal	175.00	PMF	292.10	0.68	10.26	8.13	10.87	0.000180	4.65	330.49	64.25	0.48	0.45	0.43
main canal	175.00	100-yr ARI + 10%	97.50	0.68	5.85	4.32	6.55	0.000325	4.14	74.46	28.17	0.58	0.33	0.41
main canal	175.00	100-yr ARI + 20%	107.00	0.68	6.01	4.53	6.83	0.000364	4.48	80.11	38.29	0.62	0.28	0.44
main canal	175.00	100-yr ARI + 30%	115.55	0.68	6.17	4.72	7.05	0.000377	4.65	86.49	41.28	0.63	0.29	0.46
main canal	150.00	20-yr ARI	67.05	0.50	5.01	3.51	5.53	0.000278	3.49	50.88	20.58	0.53	0.29	0.31
main canal	150.00	100-yr ARI	88.04	0.50	5.59	4.00	6.25	0.000302	3.95	63.43	22.50	0.56	0.35	0.36
main canal	150.00	PMF	292.10	0.50	10.10	8.39	10.85	0.000206	4.98	306.48	66.30	0.51	0.44	0.44
main canal	150.00	100-yr ARI + 10%	97.50	0.50	5.83	4.46	6.54	0.000312	4.14	68.82	23.28	0.57	0.37	0.37
main canal	150.00	100-yr ARI + 20%	107.00	0.50	6.04	4.69	6.81	0.000324	4.33	73.82	23.98	0.59	0.39	0.39
main canal	150.00	100-yr ARI + 30%	115.55	0.50	6.16	4.91	7.04	0.000355	4.60	76.85	26.79	0.62	0.37	0.41
main canal	125.00	20-yr ARI	67.05	0.82	4.24	4.24	5.45	0.001194	5.27	29.51	16.67	0.97	0.54	0.49
main canal	125.00	100-yr ARI	88.04	0.82	4.78	4.78	6.16	0.001129	5.71	39.09	19.15	0.97	0.58	0.54
main canal	125.00	PMF	292.10	0.82	10.19	8.81	10.80	0.000227	4.74	367.39	100.00	0.51	0.45	0.37
main canal	125.00	100-yr ARI + 10%	97.50	0.82	5.00	5.00	6.45	0.001108	5.89	43.41	20.17	0.97	0.60	0.56
main canal	125.00	100-yr ARI + 20%	107.00	0.82	5.23	5.23	6.72	0.001063	6.00	48.27	21.10	0.96	0.62	0.58
main canal	125.00	100-yr ARI + 30%	115.55	0.82	5.40	5.40	6.96	0.001057	6.16	51.95	21.71	0.96	0.64	0.59
main canal	100.00	20-yr ARI	67.05	0.77	3.99	4.20	5.40	0.001591	5.69	27.32	16.64	1.09	0.59	0.53
main canal	100.00	100-yr ARI	88.04	0.77	4.40	4.70	6.10	0.001636	6.33	34.48	17.95	1.13	0.69	0.59
main canal	100.00	PMF	292.10	0.77	10.26	8.90	10.76	0.000201	4.43	395.53	100.00	0.47	0.43	0.38
main canal	100.00	100-yr ARI + 10%	97.50	0.77	4.59	4.90	6.38	0.001627	6.55	37.87	18.53	1.14	0.72	0.62
main canal	100.00	100-yr ARI + 20%	107.00	0.77	4.78	5.10	6.65	0.001594	6.73	41.50	19.14	1.13	0.75	0.64
main canal	100.00	100-yr ARI + 30%	115.55	0.77	4.95	5.27	6.89	0.001558	6.86	44.87	19.69	1.13	0.77	0.65
main canal	75.00	20-yr ARI	67.05	0.33	3.01	3.66	5.26	0.002625	6.93	17.52	11.49	1.41	0.66	0.56
main canal	75.00	100-yr ARI	88.04	0.33	3.56	4.22	5.98	0.002209	7.26	24.39	13.45	1.33	0.70	0.61
main canal	75.00	PMF	292.10	0.33	7.99	7.99	10.55	0.000841	8.17	152.37	65.38	0.96	0.49	0.74
main canal	75.00	100-yr ARI + 10%	97.50	0.33	3.80	4.46	6.27	0.002062	7.38	27.69	14.30	1.30	0.72	0.63
main canal	75.00	100-yr ARI + 20%	107.00	0.33	4.04	4.68	6.55	0.001921	7.47	31.22	15.16	1.27	0.73	0.64
main canal	75.00	100-yr ARI + 30%	115.55	0.33	4.25	4.88	6.78	0.001815	7.55	34.47	15.90	1.25	0.73	0.65
main canal	50.00	20-yr ARI	67.05	0.34	4.00	3.13	4.63	0.000474	3.97	49.36	21.93	0.66	0.35	0.45
main canal	50.00	100-yr ARI	88.04	0.34	4.64	3.65	5.36	0.000451	4.31	64.46	25.29	0.66	0.38	0.48
main canal	50.00	PMF	292.10	0.34	5.55	7.04	10.30	0.002403	11.31	89.59	29.89	1.58	1.02	1.23
main canal	50.00	100-yr ARI + 10%	97.50	0.34	4.91	3.87	5.66	0.000440	4.43	71.50	26.66	0.66	0.40	0.49
main canal	50.00	100-yr ARI + 20%	107.00	0.34	5.21	4.09	5.97	0.000419	4.51	79.57	28.14	0.65	0.40	0.50
main canal	50.00	100-yr ARI + 30%	115.55	0.34	5.51	4.27	6.27	0.000386	4.51	88.49	29.70	0.63	0.41	0.49
main canal	25.00	20-yr ARI	67.05	0.31	3.31	3.31	4.55	0.001228	5.37	29.30	15.54	1.00	0.43	0.60
main canal	25.00	100-yr ARI	88.04	0.31	3.84	3.84	5.27	0.001157	5.83	38.12	17.40	1.00	0.49	0.65
main canal	25.00	PMF	292.10	0.31	6.16	7.40	9.96	0.001768	10.15	121.94	66.79	1.35	0.55	1.08
main canal	25.00	100-yr ARI + 10%	97.50	0.31	4.07	4.07	5.57	0.001133	6.01	42.06	18.14	1.00	0.51	0.66
main canal	25.00	100-yr ARI + 20%	107.00	0.31	4.17	4.17	5.86	0.001232	6.39	43.97	18.50	1.05	0.54	0.70
main canal	25.00	100-yr ARI + 30%	115.55	0.31	4.22	4.22	6.14	0.001375	6.80	44.88	18.98	1.11	0.56	0.75


hawthorne canal 1D study Plan: Plan 01 - Existing site conditions 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS
River = hc Reach = main canal RS = 875.00
River = hc Reach = main canal RS = 850.00
River = hc Reach = main canal RS = 600.00
River = hc Reach = main canal RS = 575.04
River = hc Reach = main canal RS = 550.11
River = hc Reach = main canal RS = 524.97
River = hc Reach = main canal RS = 500.86
River = hc Reach = main canal RS = 455 Culv Longport Street culvert
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta


hawthorne canal 1D study Plan: Plan 01 - Existing site conditions 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS
River = hc Reach = main canal RS = 455 Culv Longport Street culvert
River = hc Reach = main canal RS = 425.00
River = hc Reach = main canal RS = 400.00
River = hc Reach = main canal RS = 375.00
River = hc Reach = main canal RS = 350.00
River = hc Reach = main canal RS = 325.00
River = hc Reach = main canal RS = 300.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta

Plan 01A

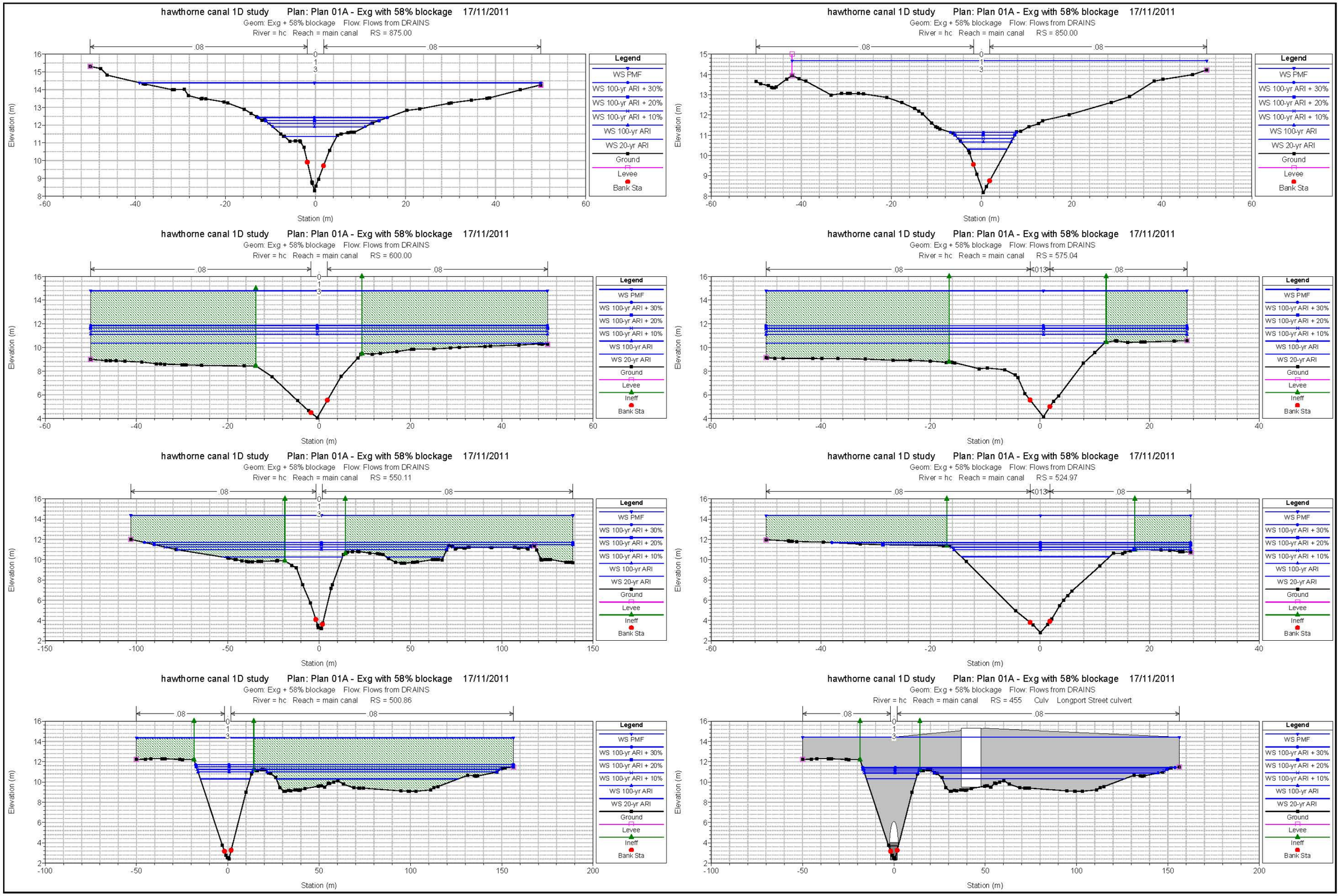

hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
hc main canal
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
LOB
ROB
Elevation (m)
16
14
12
10
8
6
4
2
0
-2
-4
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
300.00
325.00
350.00
375.00
400.00
425.00
455
500.86
524.97
550.11
575.04
600.00
850.00
875.00
0
200
400
600
800
1000
Main Channel Distance (m)

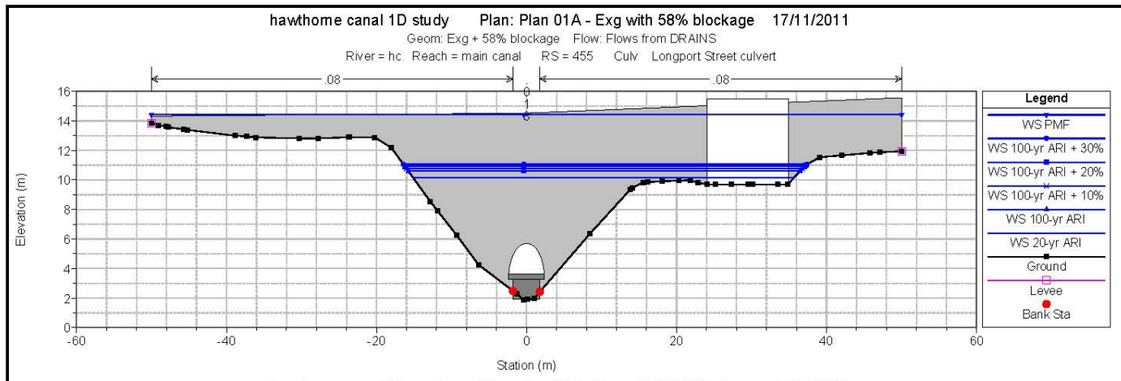
HEC-RAS Plan: P01A-EXG 58% bl River: hc Reach: main canal

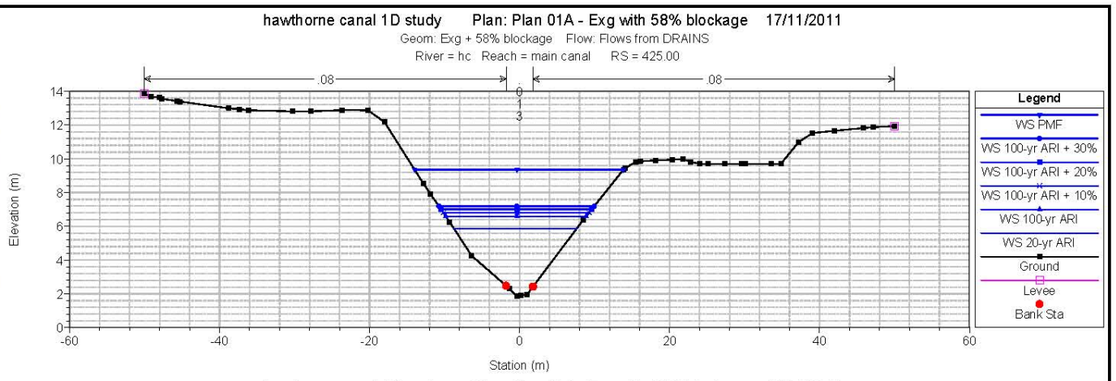
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
main canal	875.00	20-yr ARI	38.36	8.31	11.36	11.36	12.34	0.001577	4.46	12.43	11.64	0.94
main canal	875.00	100-yr ARI	50.26	8.31	11.90	11.90	12.89	0.001246	4.56	21.21	20.43	0.86
main canal	875.00	PMF	156.49	8.31	14.39	14.39	15.31	0.000721	5.27	146.48	89.05	0.73
main canal	875.00	100-yr ARI + 10%	56.20	8.31	12.10	12.10	13.11	0.001192	4.66	25.50	22.84	0.85
main canal	875.00	100-yr ARI + 20%	61.86	8.31	12.26	12.26	13.31	0.001174	4.79	29.36	25.22	0.85
main canal	875.00	100-yr ARI + 30%	66.67	8.31	12.43	12.43	13.47	0.001112	4.82	33.94	28.71	0.84
main canal	850.00	20-yr ARI	38.36	8.17	10.32	10.90	12.19	0.004152	6.23	9.34	8.91	1.57
main canal	850.00	100-yr ARI	50.26	8.17	10.67	11.29	12.73	0.003592	6.60	12.82	11.11	1.51
main canal	850.00	PMF	156.49	8.17	14.68	13.67	15.11	0.000292	3.95	220.22	92.05	0.52
main canal	850.00	100-yr ARI + 10%	56.20	8.17	10.85	11.65	12.95	0.003299	6.70	14.89	12.28	1.46
main canal	850.00	100-yr ARI + 20%	61.86	8.17	11.01	11.72	13.15	0.003076	6.80	16.96	13.37	1.43
main canal	850.00	100-yr ARI + 30%	66.67	8.17	11.14	11.86	13.31	0.002916	6.87	18.82	14.63	1.41
main canal	600.00	20-yr ARI	38.36	4.06	10.38	6.73	10.45	0.000035	1.34	86.75	100.00	0.18
main canal	600.00	100-yr ARI	50.26	4.06	11.11	7.12	11.19	0.000037	1.50	103.75	100.00	0.19
main canal	600.00	PMF	156.49	4.06	14.79	9.63	15.02	0.000066	2.69	189.16	100.00	0.27
main canal	600.00	100-yr ARI + 10%	56.20	4.06	11.38	7.30	11.47	0.000040	1.59	109.98	100.00	0.20
main canal	600.00	100-yr ARI + 20%	61.86	4.06	11.63	7.47	11.73	0.000042	1.67	115.92	100.00	0.20
main canal	600.00	100-yr ARI + 30%	66.67	4.06	11.86	7.57	11.96	0.000043	1.73	121.11	100.00	0.21
main canal	575.04	20-yr ARI	38.36	4.13	10.36	6.97	10.44	0.000046	1.47	80.38	61.72	0.20
main canal	575.04	100-yr ARI	50.26	4.13	11.09	7.39	11.19	0.000047	1.61	101.43	76.81	0.20
main canal	575.04	PMF	156.49	4.13	14.79	10.10	15.02	0.000069	2.65	207.54	76.81	0.27
main canal	575.04	100-yr ARI + 10%	56.20	4.13	11.36	7.58	11.47	0.000049	1.69	109.14	76.81	0.21
main canal	575.04	100-yr ARI + 20%	61.86	4.13	11.62	7.74	11.73	0.000050	1.76	116.51	76.81	0.21
main canal	575.04	100-yr ARI + 30%	66.67	4.13	11.84	7.91	11.96	0.000051	1.81	122.95	76.81	0.22
main canal	550.11	20-yr ARI	62.54	3.22	10.27	6.49	10.43	0.000060	2.00	100.40	97.40	0.24
main canal	550.11	100-yr ARI	81.60	3.22	10.98	7.04	11.18	0.000067	2.26	123.47	147.47	0.26
main canal	550.11	PMF	269.21	3.22	14.37	11.02	14.97	0.000150	4.32	235.51	242.05	0.42
main canal	550.11	100-yr ARI + 10%	90.36	3.22	11.24	7.26	11.45	0.000071	2.38	132.06	197.16	0.27
main canal	550.11	100-yr ARI + 20%	99.24	3.22	11.49	7.49	11.72	0.000075	2.49	140.19	229.31	0.28
main canal	550.11	100-yr ARI + 30%	107.50	3.22	11.70	7.71	11.95	0.000078	2.59	147.22	234.58	0.29
main canal	524.97	20-yr ARI	62.54	2.79	10.28	6.37	10.43	0.000060	1.95	97.86	27.04	0.24
main canal	524.97	100-yr ARI	81.60	2.79	10.97	6.91	11.18	0.000071	2.27	118.43	42.91	0.26
main canal	524.97	PMF	269.21	2.79	14.35	10.56	14.97	0.000159	4.34	233.96	77.49	0.42
main canal	524.97	100-yr ARI + 10%	90.36	2.79	11.23	7.15	11.45	0.000076	2.40	126.92	43.65	0.27
main canal	524.97	100-yr ARI + 20%	99.24	2.79	11.47	7.37	11.71	0.000081	2.52	135.09	56.20	0.28
main canal	524.97	100-yr ARI + 30%	107.50	2.79	11.68	7.58	11.94	0.000084	2.63	142.36	65.47	0.29
main canal	500.86	20-yr ARI	62.54	2.42	10.29	5.78	10.42	0.000042	1.79	109.94	126.63	0.21
main canal	500.86	100-yr ARI	81.60	2.42	11.00	6.32	11.16	0.000051	2.08	129.86	155.79	0.23
main canal	500.86	PMF	269.21	2.42	14.35	9.98	14.96	0.000133	4.24	238.32	206.35	0.40
main canal	500.86	100-yr ARI + 10%	90.36	2.42	11.25	6.55	11.44	0.000055	2.22	137.64	166.09	0.24
main canal	500.86	100-yr ARI + 20%	99.24	2.42	11.49	6.77	11.70	0.000059	2.35	145.18	173.56	0.25
main canal	500.86	100-yr ARI + 30%	107.50	2.42	11.70	6.97	11.93	0.000063	2.46	151.83	173.95	0.26
main canal	455		Culvert									
main canal	425.00	20-yr ARI	67.05	1.88	5.87	5.19	6.65	0.000557	4.22	37.10	16.39	0.69
main canal	425.00	100-yr ARI	88.04	1.88	6.59	5.73	7.46	0.000508	4.52	49.72	18.71	0.68
main canal	425.00	PMF	292.10	1.88	9.36	9.36	12.08	0.000927	8.40	114.22	27.85	0.99
main canal	425.00	100-yr ARI + 10%	97.50	1.88	6.81	5.96	7.76	0.000524	4.74	53.84	19.43	0.70
main canal	425.00	100-yr ARI + 20%	107.00	1.88	7.01	6.18	8.04	0.000540	4.95	57.86	20.11	0.71
main canal	425.00	100-yr ARI + 30%	115.55	1.88	7.19	6.36	8.28	0.000554	5.13	61.37	20.69	0.73
main canal	400.00	20-yr ARI	67.05	1.65	5.20	5.20	6.57	0.001289	5.41	21.86	11.21	0.97
main canal	400.00	100-yr ARI	88.04	1.65	5.98	5.98	7.39	0.001011	5.55	34.31	18.60	0.89
main canal	400.00	PMF	292.10	1.65	9.09	9.37	12.03	0.001151	8.71	108.00	29.04	1.05
main canal	400.00	100-yr ARI + 10%	97.50	1.65	6.21	6.21	7.69	0.000997	5.72	38.66	19.32	0.89
main canal	400.00	100-yr ARI + 20%	107.00	1.65	6.42	6.42	7.97	0.000991	5.89	42.80	19.96	0.90
main canal	400.00	100-yr ARI + 30%	115.55	1.65	6.60	6.60	8.21	0.000986	6.04	46.51	20.52	0.90
main canal	375.00	20-yr ARI	67.05	1.39	4.64	5.06	6.49	0.001994	6.22	18.11	10.69	1.18
main canal	375.00	100-yr ARI	88.04	1.39	5.18	5.63	7.29	0.001846	6.72	24.46	12.86	1.17
main canal	375.00	PMF	292.10	1.39	8.63	9.41	11.96	0.001344	9.20	101.99	30.19	1.13
main canal	375.00	100-yr ARI + 10%	97.50	1.39	5.48	6.03	7.59	0.001665	6.76	28.52	14.43	1.13
main canal	375.00	100-yr ARI + 20%	107.00	1.39	5.83	6.23	7.89	0.001442	6.69	34.30	18.69	1.07
main canal	375.00	100-yr ARI + 30%	115.55	1.39	6.02	6.43	8.13	0.001410	6.82	37.85	19.29	1.06
main canal	350.00	20-yr ARI	67.05	1.12	4.64	4.63	5.94	0.001222	5.30	25.37	16.15	0.95
main canal	350.00	100-yr ARI	88.04	1.12	5.37	5.31	6.68	0.000971	5.42	39.81	23.35	0.87
main canal	350.00	PMF	292.10	1.12	10.13	8.48	11.16	0.000375	5.72	249.99	72.72	0.62
main canal	350.00	100-yr ARI + 10%	97.50	1.12	5.76	5.57	6.97	0.000818	5.30	49.58	26.88	0.81
main canal	350.00	100-yr ARI + 20%	107.00	1.12	6.05	5.79	7.25	0.000757	5.32	57.88	29.78	0.79
main canal	350.00	100-yr ARI + 30%	115.55	1.12	6.28	6.05	7.47	0.000723	5.37	64.70	31.01	0.78
main canal	325.00	20-yr ARI	67.05	0.93	4.77	4.40	5.85	0.000844	4.78	28.40	21.17	0.81
main canal	325.00	100-yr ARI	88.04	0.93	5.55	5.25	6.57	0.000654	4.81	49.04	31.34	0.74
main canal	325.00	PMF	292.10	0.93	10.36	8.24	11.05	0.000249	4.90	313.82	80.95	0.52
main canal	325.00	100-yr ARI + 10%	97.50	0.93	5.94	5.50	6.87	0.000551	4.68	61.81	33.92	0.69
main canal	325.00	100-yr ARI + 20%	107.00	0.93	6.24	5.73	7.14	0.000508	4.68	72.23	35.90	0.67
main canal	325.00	100-yr ARI + 30%	115.55	0.93	6.46	5.90	7.37	0.000491	4.74	80.31	37.42	0.66
main canal	300.00	20-yr ARI	67.05	0.76	5.20	3.69	5.65	0.000266	3.35	67.64	36.79	0.51
main canal	300.00	100-yr ARI	88.04	0.76	5.94	4.12	6.39	0.000233	3.48	98.27	43.47	0.49
main canal	300.00	PMF	292.10	0.76	10.42	7.51	11.02	0.000178	4.63	355.51	83.25	0.48
main canal	300.00	100-yr ARI + 10%	97.50	0.76	6.28	4.35	6.71	0.000215	3.49	113.13	45.04	0.48

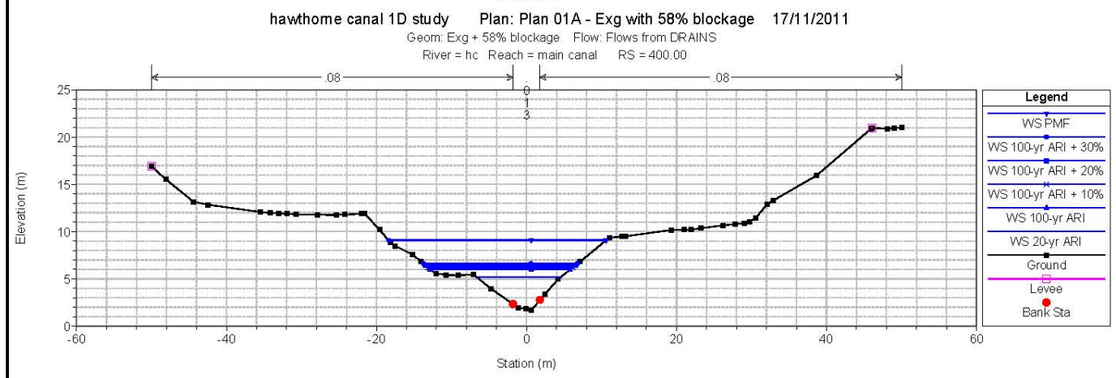
HEC-RAS Plan: P01A-EXG 58% bl River: hc Reach: main canal (Continued)

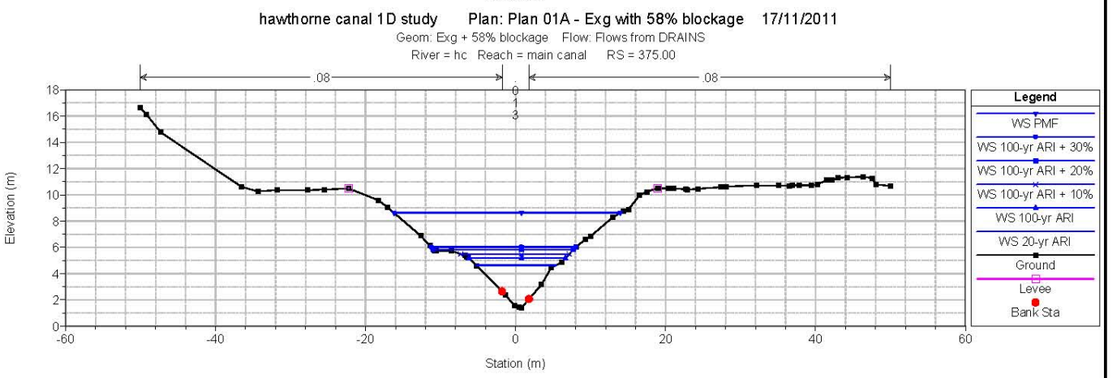
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
main canal	300.00	100-yr ARI + 20%	107.00	0.76	6.55	4.92	7.00	0.000208	3.55	125.90	46.31	0.47
main canal	300.00	100-yr ARI + 30%	115.55	0.76	6.77	5.08	7.22	0.000206	3.62	136.02	47.29	0.47
main canal	275.00	20-yr ARI	67.05	0.65	5.11	3.66	5.64	0.000288	3.52	55.84	29.44	0.53
main canal	275.00	100-yr ARI	88.04	0.65	5.71	4.21	6.36	0.000308	3.96	77.23	43.79	0.56
main canal	275.00	PMF	292.10	0.65	10.54	8.04	10.96	0.000131	4.04	420.32	85.98	0.41
main canal	275.00	100-yr ARI + 10%	97.50	0.65	6.08	4.37	6.69	0.000275	3.92	94.03	48.14	0.54
main canal	275.00	100-yr ARI + 20%	107.00	0.65	6.37	4.88	6.97	0.000262	3.96	108.55	52.75	0.53
main canal	275.00	100-yr ARI + 30%	115.55	0.65	6.59	5.11	7.20	0.000257	4.02	120.77	56.70	0.53
main canal	250.00	20-yr ARI	67.05	0.67	5.19	3.63	5.59	0.000403	3.32	63.15	30.36	0.53
main canal	250.00	100-yr ARI	88.04	0.67	5.86	4.06	6.29	0.000371	3.53	87.29	42.80	0.52
main canal	250.00	PMF	292.10	0.67	10.64	7.62	10.91	0.000148	3.57	431.01	83.71	0.37
main canal	250.00	100-yr ARI + 10%	97.50	0.67	6.21	4.37	6.62	0.000334	3.51	103.53	49.48	0.50
main canal	250.00	100-yr ARI + 20%	107.00	0.67	6.50	4.60	6.91	0.000316	3.54	118.54	54.83	0.49
main canal	250.00	100-yr ARI + 30%	115.55	0.67	6.72	5.05	7.13	0.000306	3.59	131.28	58.85	0.49
main canal	225.00	20-yr ARI	67.05	0.53	5.08	3.59	5.57	0.000271	3.43	56.41	25.25	0.52
main canal	225.00	100-yr ARI	88.04	0.53	5.65	4.13	6.26	0.000292	3.86	71.90	29.08	0.55
main canal	225.00	PMF	292.10	0.53	10.43	8.05	10.89	0.000143	4.21	396.16	83.50	0.43
main canal	225.00	100-yr ARI + 10%	97.50	0.53	5.96	4.38	6.59	0.000288	3.98	81.16	32.43	0.55
main canal	225.00	100-yr ARI + 20%	107.00	0.53	6.10	4.68	6.86	0.000329	4.33	87.24	46.59	0.59
main canal	225.00	100-yr ARI + 30%	115.55	0.53	6.30	4.68	7.09	0.000328	4.43	97.17	51.37	0.59
main canal	200.00	20-yr ARI	67.05	0.48	5.08	3.56	5.56	0.000259	3.39	54.11	20.81	0.51
main canal	200.00	100-yr ARI	88.04	0.48	5.58	4.12	6.25	0.000312	3.99	65.81	27.31	0.57
main canal	200.00	PMF	292.10	0.48	10.31	8.09	10.88	0.000165	4.51	347.84	69.26	0.46
main canal	200.00	100-yr ARI + 10%	97.50	0.48	5.82	4.35	6.57	0.000331	4.23	76.23	40.99	0.59
main canal	200.00	100-yr ARI + 20%	107.00	0.48	6.10	4.57	6.85	0.000315	4.28	87.97	42.44	0.58
main canal	200.00	100-yr ARI + 30%	115.55	0.48	6.31	4.77	7.07	0.000311	4.36	96.97	43.48	0.58
main canal	175.00	20-yr ARI	67.05	0.68	5.09	3.54	5.55	0.000264	3.36	57.00	20.31	0.51
main canal	175.00	100-yr ARI	88.04	0.68	5.66	4.09	6.26	0.000294	3.85	69.46	23.41	0.55
main canal	175.00	PMF	292.10	0.68	10.26	8.13	10.87	0.000180	4.65	330.49	64.25	0.48
main canal	175.00	100-yr ARI + 10%	97.50	0.68	5.85	4.32	6.55	0.000325	4.14	74.46	28.17	0.58
main canal	175.00	100-yr ARI + 20%	107.00	0.68	6.01	4.53	6.83	0.000364	4.48	80.11	38.29	0.62
main canal	175.00	100-yr ARI + 30%	115.55	0.68	6.17	4.72	7.05	0.000377	4.65	86.49	41.28	0.63
main canal	150.00	20-yr ARI	67.05	0.50	5.01	3.51	5.53	0.000278	3.49	50.88	20.58	0.53
main canal	150.00	100-yr ARI	88.04	0.50	5.59	4.00	6.25	0.000302	3.95	63.43	22.50	0.56
main canal	150.00	PMF	292.10	0.50	10.10	8.39	10.85	0.000206	4.98	306.48	66.30	0.51
main canal	150.00	100-yr ARI + 10%	97.50	0.50	5.83	4.46	6.54	0.000312	4.14	68.82	23.28	0.57
main canal	150.00	100-yr ARI + 20%	107.00	0.50	6.04	4.69	6.81	0.000324	4.33	73.82	23.98	0.59
main canal	150.00	100-yr ARI + 30%	115.55	0.50	6.16	4.91	7.04	0.000355	4.60	76.85	26.79	0.62
main canal	125.00	20-yr ARI	67.05	0.82	4.24	4.24	5.45	0.001194	5.27	29.51	16.67	0.97
main canal	125.00	100-yr ARI	88.04	0.82	4.78	4.78	6.16	0.001129	5.71	39.09	19.15	0.97
main canal	125.00	PMF	292.10	0.82	10.19	8.81	10.80	0.000227	4.74	367.39	100.00	0.51
main canal	125.00	100-yr ARI + 10%	97.50	0.82	5.00	5.00	6.45	0.001108	5.89	43.41	20.17	0.97
main canal	125.00	100-yr ARI + 20%	107.00	0.82	5.23	5.23	6.72	0.001063	6.00	48.27	21.10	0.96
main canal	125.00	100-yr ARI + 30%	115.55	0.82	5.40	5.40	6.96	0.001057	6.16	51.95	21.71	0.96
main canal	100.00	20-yr ARI	67.05	0.77	3.99	4.20	5.40	0.001591	5.69	27.32	16.64	1.09
main canal	100.00	100-yr ARI	88.04	0.77	4.40	4.70	6.10	0.001636	6.33	34.48	17.95	1.13
main canal	100.00	PMF	292.10	0.77	10.26	8.90	10.76	0.000201	4.43	395.53	100.00	0.47
main canal	100.00	100-yr ARI + 10%	97.50	0.77	4.59	4.90	6.38	0.001627	6.55	37.87	18.53	1.14
main canal	100.00	100-yr ARI + 20%	107.00	0.77	4.78	5.10	6.65	0.001594	6.73	41.50	19.14	1.13
main canal	100.00	100-yr ARI + 30%	115.55	0.77	4.95	5.27	6.89	0.001558	6.86	44.87	19.69	1.13
main canal	75.00	20-yr ARI	67.05	0.33	3.01	3.66	5.26	0.002625	6.93	17.52	11.49	1.41
main canal	75.00	100-yr ARI	88.04	0.33	3.56	4.22	5.98	0.002209	7.26	24.39	13.45	1.33
main canal	75.00	PMF	292.10	0.33	7.99	7.99	10.55	0.000841	8.17	152.37	65.38	0.96
main canal	75.00	100-yr ARI + 10%	97.50	0.33	3.80	4.46	6.27	0.002062	7.38	27.69	14.30	1.30
main canal	75.00	100-yr ARI + 20%	107.00	0.33	4.04	4.68	6.55	0.001921	7.47	31.22	15.16	1.27
main canal	75.00	100-yr ARI + 30%	115.55	0.33	4.25	4.88	6.78	0.001815	7.55	34.47	15.90	1.25
main canal	50.00	20-yr ARI	67.05	0.34	4.00	3.13	4.63	0.000474	3.97	49.36	21.93	0.66
main canal	50.00	100-yr ARI	88.04	0.34	4.64	3.65	5.36	0.000451	4.31	64.46	25.29	0.66
main canal	50.00	PMF	292.10	0.34	5.55	7.04	10.30	0.002403	11.31	89.59	29.89	1.58
main canal	50.00	100-yr ARI + 10%	97.50	0.34	4.91	3.87	5.66	0.000440	4.43	71.50	26.66	0.66
main canal	50.00	100-yr ARI + 20%	107.00	0.34	5.21	4.09	5.97	0.000419	4.51	79.57	28.14	0.65
main canal	50.00	100-yr ARI + 30%	115.55	0.34	5.51	4.27	6.27	0.000386	4.51	88.49	29.70	0.63
main canal	25.00	20-yr ARI	67.05	0.31	3.31	3.31	4.55	0.001228	5.37	29.30	15.54	1.00
main canal	25.00	100-yr ARI	88.04	0.31	3.84	3.84	5.27	0.001157	5.83	38.12	17.40	1.00
main canal	25.00	PMF	292.10	0.31	6.16	7.40	9.96	0.001768	10.15	121.94	66.79	1.35
main canal	25.00	100-yr ARI + 10%	97.50	0.31	4.07	4.07	5.57	0.001133	6.01	42.06	18.14	1.00
main canal	25.00	100-yr ARI + 20%	107.00	0.31	4.17	4.17	5.86	0.001232	6.39	43.97	18.50	1.05
main canal	25.00	100-yr ARI + 30%	115.55	0.31	4.22	4.22	6.14	0.001375	6.80	44.88	18.98	1.11

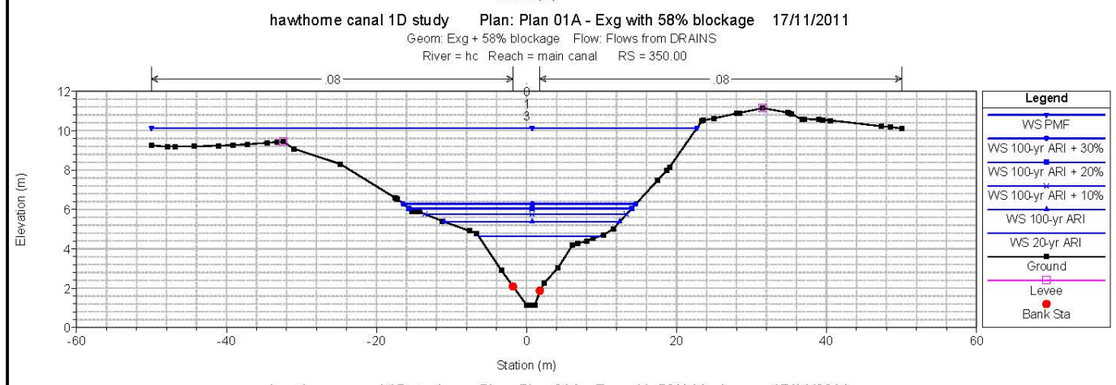

hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 875.00
hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 850.00
hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 600.00
hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 575.04
hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 550.11
hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 524.97
hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 500.86
hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 455 Culv Longport Street culvert
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta

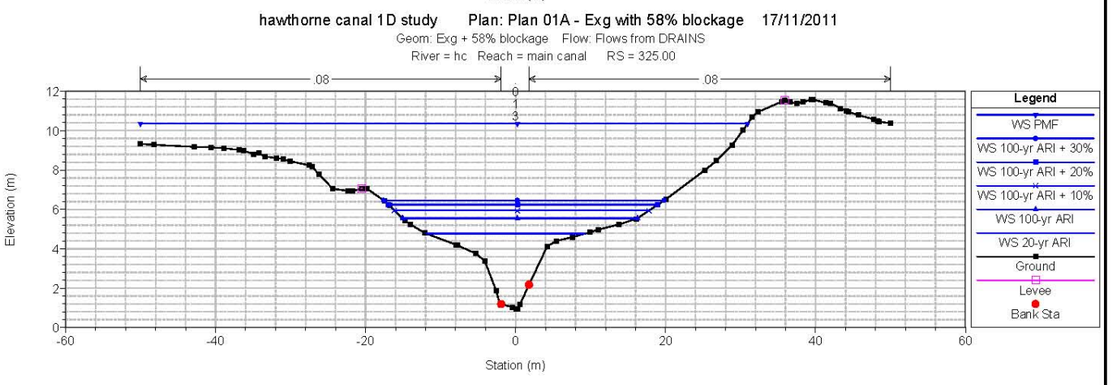

hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 455 Culv Longport Street culvert
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta

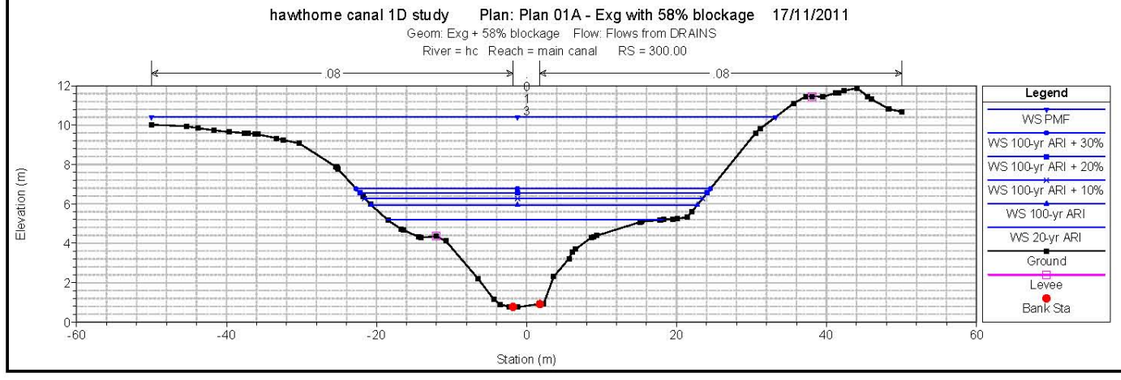

hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 425.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta


hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 400.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta

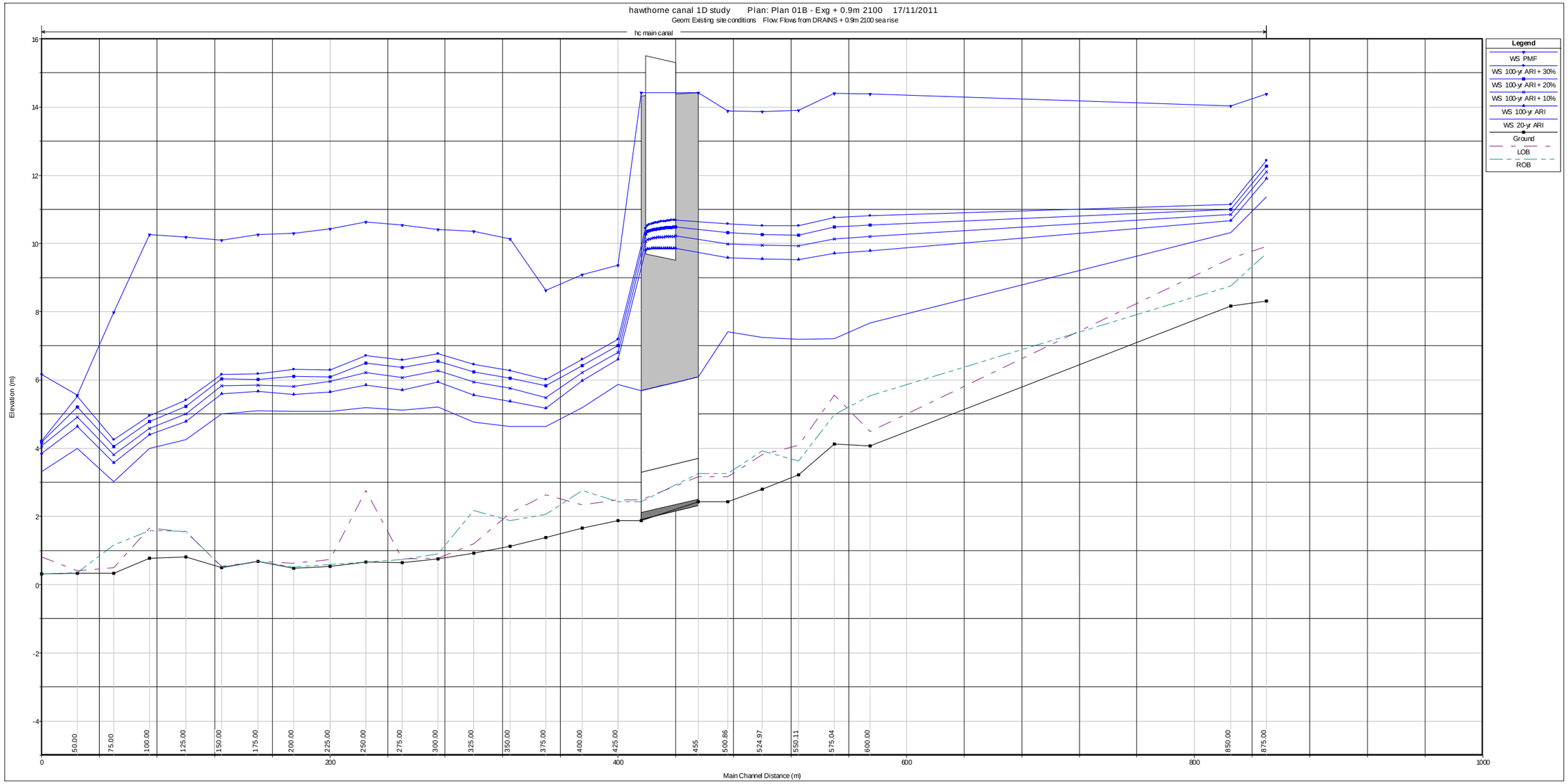

hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 375.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta


hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 350.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta


hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 325.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta


hawthorne canal 1D study Plan: Plan 01A - Exg with 58% blockage 17/11/2011
Geom: Exg + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 300.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta

Plan 01B

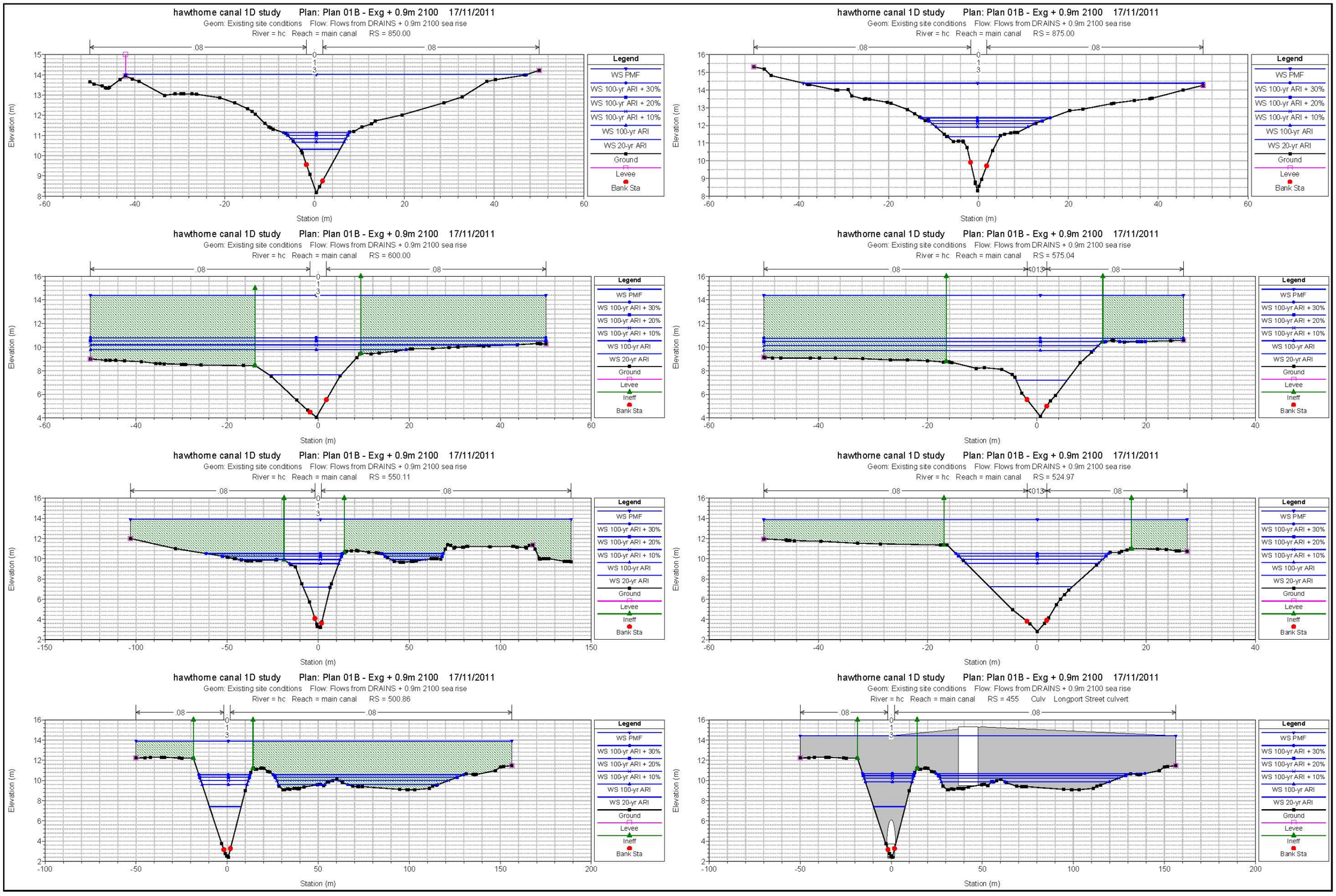

hawthorne canal 1D study Plan: Plan 01B - Exg + 0.9m 2100 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS + 0.9m 2100 sea rise
hc main canal
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
LOB
ROB
Elevation (m)
Main Channel Distance (m)

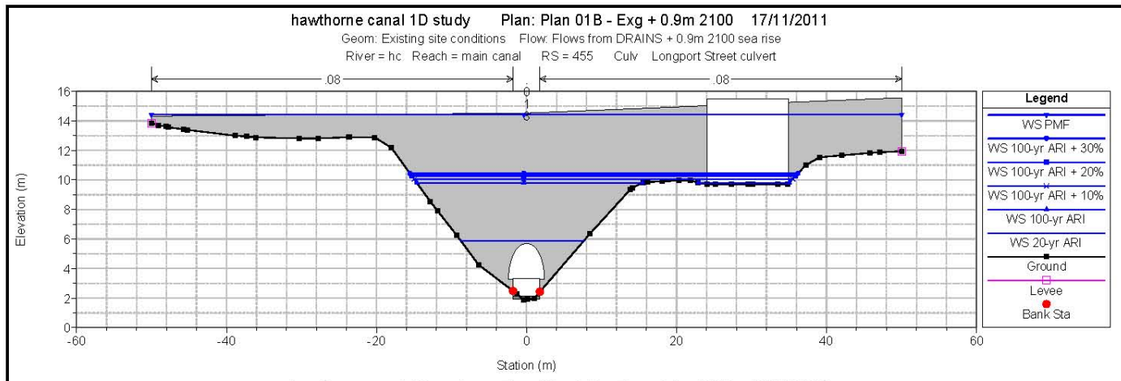
HEC-RAS Plan: P01B-EXG 2100 River: hc Reach: main canal

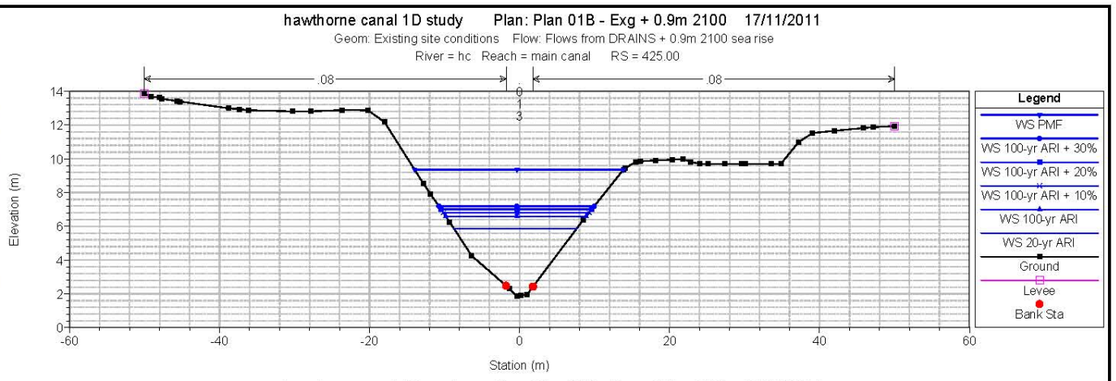
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
main canal	875.00	20-yr ARI	38.36	8.31	11.36	11.36	12.34	0.001577	4.46	12.43	11.64	0.94
main canal	875.00	100-yr ARI	50.26	8.31	11.90	11.90	12.89	0.001246	4.56	21.21	20.43	0.86
main canal	875.00	PMF	156.49	8.31	14.39	14.39	15.31	0.000721	5.27	146.48	89.05	0.73
main canal	875.00	100-yr ARI + 10%	56.20	8.31	12.10	12.10	13.11	0.001192	4.66	25.50	22.84	0.85
main canal	875.00	100-yr ARI + 20%	61.86	8.31	12.26	12.26	13.31	0.001174	4.79	29.36	25.22	0.85
main canal	875.00	100-yr ARI + 30%	66.67	8.31	12.43	12.43	13.47	0.001112	4.82	33.94	28.71	0.84
main canal	850.00	20-yr ARI	38.36	8.17	10.32	10.90	12.19	0.004152	6.23	9.34	8.91	1.57
main canal	850.00	100-yr ARI	50.26	8.17	10.67	11.29	12.73	0.003592	6.60	12.82	11.11	1.51
main canal	850.00	PMF	156.49	8.17	14.03	13.67	14.87	0.000570	5.12	160.65	89.40	0.71
main canal	850.00	100-yr ARI + 10%	56.20	8.17	10.85	11.65	12.95	0.003299	6.70	14.89	12.28	1.46
main canal	850.00	100-yr ARI + 20%	61.86	8.17	11.01	11.72	13.15	0.003076	6.80	16.96	13.37	1.43
main canal	850.00	100-yr ARI + 30%	66.67	8.17	11.14	11.86	13.31	0.002916	6.87	18.82	14.63	1.41
main canal	600.00	20-yr ARI	38.36	4.06	7.67	6.73	8.06	0.000399	2.97	28.88	15.99	0.54
main canal	600.00	100-yr ARI	50.26	4.06	9.78	7.12	9.94	0.000092	2.02	72.90	69.29	0.28
main canal	600.00	PMF	156.49	4.06	14.39	9.63	14.65	0.000077	2.82	179.95	100.00	0.29
main canal	600.00	100-yr ARI + 10%	56.20	4.06	10.20	7.30	10.36	0.000085	2.04	82.58	93.75	0.28
main canal	600.00	100-yr ARI + 20%	61.86	4.06	10.53	7.47	10.69	0.000081	2.08	90.31	100.00	0.27
main canal	600.00	100-yr ARI + 30%	66.67	4.06	10.81	7.57	10.97	0.000079	2.12	96.68	100.00	0.27
main canal	575.04	20-yr ARI	38.36	4.13	7.20	6.97	8.00	0.001069	4.09	14.87	9.34	0.83
main canal	575.04	100-yr ARI	50.26	4.13	9.71	7.39	9.93	0.000131	2.29	62.61	60.33	0.33
main canal	575.04	PMF	156.49	4.13	14.39	10.10	14.64	0.000081	2.80	196.11	76.81	0.29
main canal	575.04	100-yr ARI + 10%	56.20	4.13	10.14	7.58	10.35	0.000116	2.28	74.28	61.25	0.31
main canal	575.04	100-yr ARI + 20%	61.86	4.13	10.48	7.74	10.69	0.000109	2.30	83.81	67.17	0.31
main canal	575.04	100-yr ARI + 30%	66.67	4.13	10.76	7.91	10.96	0.000103	2.31	91.87	76.81	0.30
main canal	550.11	20-yr ARI	62.54	3.22	7.20	6.49	7.98	0.000570	4.14	31.56	14.92	0.68
main canal	550.11	100-yr ARI	81.60	3.22	9.52	7.04	9.91	0.000163	3.05	77.80	26.98	0.40
main canal	550.11	PMF	269.21	3.22	13.90	11.02	14.60	0.000179	4.60	219.99	242.05	0.45
main canal	550.11	100-yr ARI + 10%	90.36	3.22	9.92	7.26	10.33	0.000157	3.12	89.52	74.93	0.39
main canal	550.11	100-yr ARI + 20%	99.24	3.22	10.25	7.49	10.66	0.000153	3.19	99.74	96.43	0.39
main canal	550.11	100-yr ARI + 30%	107.50	3.22	10.51	7.71	10.94	0.000153	3.27	108.09	108.99	0.39
main canal	524.97	20-yr ARI	62.54	2.79	7.24	6.37	7.94	0.000522	3.94	33.53	15.23	0.64
main canal	524.97	100-yr ARI	81.60	2.79	9.54	6.91	9.90	0.000157	2.94	78.99	24.24	0.38
main canal	524.97	PMF	269.21	2.79	13.87	10.56	14.59	0.000192	4.63	217.59	77.49	0.45
main canal	524.97	100-yr ARI + 10%	90.36	2.79	9.95	7.15	10.31	0.000150	3.00	89.11	25.78	0.37
main canal	524.97	100-yr ARI + 20%	99.24	2.79	10.27	7.37	10.65	0.000151	3.10	97.54	27.00	0.38
main canal	524.97	100-yr ARI + 30%	107.50	2.79	10.52	7.58	10.93	0.000154	3.21	104.61	27.97	0.38
main canal	500.86	20-yr ARI	62.54	2.42	7.40	5.78	7.86	0.000257	3.21	45.94	17.37	0.47
main canal	500.86	100-yr ARI	81.60	2.42	9.59	6.32	9.87	0.000104	2.63	91.69	98.02	0.32
main canal	500.86	PMF	269.21	2.42	13.88	9.99	14.58	0.000158	4.50	222.95	206.35	0.43
main canal	500.86	100-yr ARI + 10%	90.36	2.42	9.99	6.55	10.29	0.000102	2.72	101.87	117.01	0.32
main canal	500.86	100-yr ARI + 20%	99.24	2.42	10.31	6.77	10.63	0.000105	2.83	110.37	126.95	0.33
main canal	500.86	100-yr ARI + 30%	107.50	2.42	10.57	6.97	10.91	0.000108	2.94	117.47	132.86	0.33
main canal	455		Culvert									
main canal	425.00	20-yr ARI	67.05	1.88	5.87	5.19	6.65	0.000557	4.22	37.10	16.39	0.69
main canal	425.00	100-yr ARI	88.04	1.88	6.59	5.73	7.46	0.000508	4.52	49.72	18.71	0.68
main canal	425.00	PMF	292.10	1.88	9.36	9.36	12.08	0.000927	8.40	114.22	27.85	0.99
main canal	425.00	100-yr ARI + 10%	97.50	1.88	6.81	5.96	7.76	0.000524	4.74	53.84	19.43	0.70
main canal	425.00	100-yr ARI + 20%	107.00	1.88	7.01	6.18	8.04	0.000540	4.95	57.86	20.11	0.71
main canal	425.00	100-yr ARI + 30%	115.55	1.88	7.19	6.36	8.28	0.000554	5.13	61.37	20.69	0.73
main canal	400.00	20-yr ARI	67.05	1.65	5.20	5.20	6.57	0.001289	5.41	21.86	11.21	0.97
main canal	400.00	100-yr ARI	88.04	1.65	5.98	5.98	7.39	0.001011	5.55	34.31	18.60	0.89
main canal	400.00	PMF	292.10	1.65	9.09	9.37	12.03	0.001151	8.71	108.00	29.04	1.05
main canal	400.00	100-yr ARI + 10%	97.50	1.65	6.21	6.21	7.69	0.000997	5.72	38.66	19.32	0.89
main canal	400.00	100-yr ARI + 20%	107.00	1.65	6.42	6.42	7.97	0.000991	5.89	42.80	19.96	0.90
main canal	400.00	100-yr ARI + 30%	115.55	1.65	6.60	6.60	8.21	0.000986	6.04	46.51	20.52	0.90
main canal	375.00	20-yr ARI	67.05	1.39	4.64	5.06	6.49	0.001994	6.22	18.11	10.69	1.18
main canal	375.00	100-yr ARI	88.04	1.39	5.18	5.63	7.29	0.001846	6.72	24.46	12.86	1.17
main canal	375.00	PMF	292.10	1.39	8.63	9.41	11.96	0.001344	9.20	101.99	30.19	1.13
main canal	375.00	100-yr ARI + 10%	97.50	1.39	5.48	6.03	7.59	0.001665	6.76	28.52	14.43	1.13
main canal	375.00	100-yr ARI + 20%	107.00	1.39	5.83	6.23	7.89	0.001442	6.69	34.30	18.69	1.07
main canal	375.00	100-yr ARI + 30%	115.55	1.39	6.02	6.43	8.13	0.001410	6.82	37.85	19.29	1.06
main canal	350.00	20-yr ARI	67.05	1.12	4.64	4.63	5.94	0.001222	5.30	25.37	16.15	0.95
main canal	350.00	100-yr ARI	88.04	1.12	5.37	5.31	6.68	0.000971	5.42	39.81	23.35	0.87
main canal	350.00	PMF	292.10	1.12	10.13	8.48	11.16	0.000375	5.72	249.99	72.72	0.62
main canal	350.00	100-yr ARI + 10%	97.50	1.12	5.76	5.57	6.97	0.000818	5.30	49.58	26.88	0.81
main canal	350.00	100-yr ARI + 20%	107.00	1.12	6.05	5.79	7.25	0.000757	5.32	57.88	29.78	0.79
main canal	350.00	100-yr ARI + 30%	115.55	1.12	6.28	6.05	7.47	0.000723	5.37	64.70	31.01	0.78
main canal	325.00	20-yr ARI	67.05	0.93	4.77	4.40	5.85	0.000844	4.78	28.40	21.17	0.81
main canal	325.00	100-yr ARI	88.04	0.93	5.55	5.25	6.57	0.000654	4.81	49.04	31.34	0.74
main canal	325.00	PMF	292.10	0.93	10.36	8.24	11.05	0.000249	4.90	313.82	80.95	0.52
main canal	325.00	100-yr ARI + 10%	97.50	0.93	5.94	5.50	6.87	0.000551	4.68	61.81	33.92	0.69
main canal	325.00	100-yr ARI + 20%	107.00	0.93	6.24	5.73	7.14	0.000508	4.68	72.23	35.90	0.67
main canal	325.00	100-yr ARI + 30%	115.55	0.93	6.46	5.90	7.37	0.000491	4.74	80.31	37.42	0.66
main canal	300.00	20-yr ARI	67.05	0.76	5.20	3.69	5.65	0.000266	3.35	67.64	36.79	0.51
main canal	300.00	100-yr ARI	88.04	0.76	5.94	4.12	6.39	0.000233	3.48	98.27	43.47	0.49
main canal	300.00	PMF	292.10	0.76	10.42	7.51	11.02	0.000178	4.63	355.51	83.25	0.48
main canal	300.00	100-yr ARI + 10%	97.50	0.76	6.28	4.35	6.71	0.000215	3.49	113.13	45.04	0.48

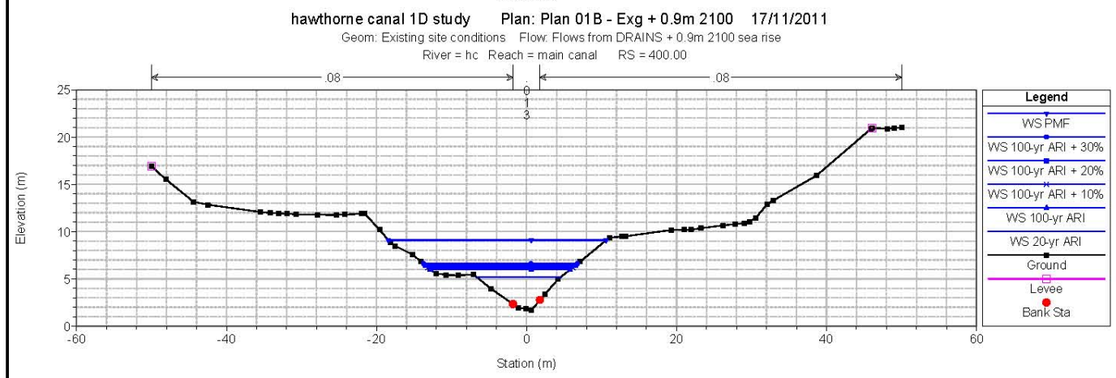
HEC-RAS Plan: P01B-EXG 2100 River: hc Reach: main canal (Continued)

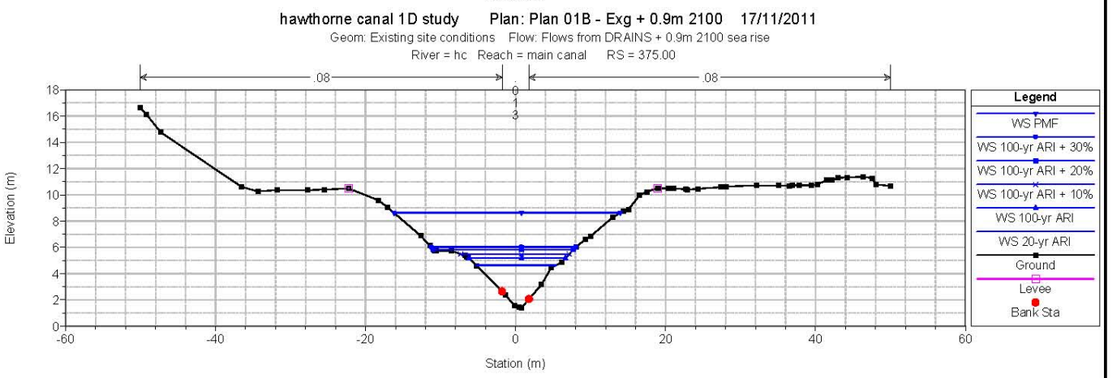
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
main canal	300.00	100-yr ARI + 20%	107.00	0.76	6.55	4.92	7.00	0.000208	3.55	125.90	46.31	0.47
main canal	300.00	100-yr ARI + 30%	115.55	0.76	6.77	5.08	7.22	0.000206	3.62	136.02	47.29	0.47
main canal	275.00	20-yr ARI	67.05	0.65	5.11	3.66	5.64	0.000288	3.52	55.84	29.44	0.53
main canal	275.00	100-yr ARI	88.04	0.65	5.71	4.21	6.36	0.000308	3.96	77.23	43.79	0.56
main canal	275.00	PMF	292.10	0.65	10.54	8.04	10.96	0.000131	4.04	420.32	85.98	0.41
main canal	275.00	100-yr ARI + 10%	97.50	0.65	6.08	4.37	6.69	0.000275	3.92	94.03	48.14	0.54
main canal	275.00	100-yr ARI + 20%	107.00	0.65	6.37	4.88	6.97	0.000262	3.96	108.55	52.75	0.53
main canal	275.00	100-yr ARI + 30%	115.55	0.65	6.59	5.11	7.20	0.000257	4.02	120.77	56.70	0.53
main canal	250.00	20-yr ARI	67.05	0.67	5.19	3.63	5.59	0.000403	3.32	63.15	30.36	0.53
main canal	250.00	100-yr ARI	88.04	0.67	5.86	4.06	6.29	0.000371	3.53	87.29	42.80	0.52
main canal	250.00	PMF	292.10	0.67	10.64	7.62	10.91	0.000148	3.57	431.01	83.71	0.37
main canal	250.00	100-yr ARI + 10%	97.50	0.67	6.21	4.37	6.62	0.000334	3.51	103.53	49.48	0.50
main canal	250.00	100-yr ARI + 20%	107.00	0.67	6.50	4.60	6.91	0.000316	3.54	118.54	54.83	0.49
main canal	250.00	100-yr ARI + 30%	115.55	0.67	6.72	5.05	7.13	0.000306	3.59	131.28	58.85	0.49
main canal	225.00	20-yr ARI	67.05	0.53	5.08	3.59	5.57	0.000271	3.43	56.41	25.25	0.52
main canal	225.00	100-yr ARI	88.04	0.53	5.65	4.13	6.26	0.000292	3.86	71.90	29.08	0.55
main canal	225.00	PMF	292.10	0.53	10.43	8.05	10.89	0.000143	4.21	396.16	83.50	0.43
main canal	225.00	100-yr ARI + 10%	97.50	0.53	5.96	4.38	6.59	0.000288	3.98	81.16	32.43	0.55
main canal	225.00	100-yr ARI + 20%	107.00	0.53	6.10	4.68	6.86	0.000329	4.33	87.24	46.59	0.59
main canal	225.00	100-yr ARI + 30%	115.55	0.53	6.30	4.68	7.09	0.000328	4.43	97.17	51.37	0.59
main canal	200.00	20-yr ARI	67.05	0.48	5.08	3.56	5.56	0.000259	3.39	54.11	20.81	0.51
main canal	200.00	100-yr ARI	88.04	0.48	5.58	4.12	6.25	0.000312	3.99	65.81	27.31	0.57
main canal	200.00	PMF	292.10	0.48	10.31	8.09	10.88	0.000165	4.51	347.84	69.26	0.46
main canal	200.00	100-yr ARI + 10%	97.50	0.48	5.82	4.35	6.57	0.000331	4.23	76.23	40.99	0.59
main canal	200.00	100-yr ARI + 20%	107.00	0.48	6.10	4.57	6.85	0.000315	4.28	87.97	42.44	0.58
main canal	200.00	100-yr ARI + 30%	115.55	0.48	6.31	4.77	7.07	0.000311	4.36	96.97	43.48	0.58
main canal	175.00	20-yr ARI	67.05	0.68	5.09	3.54	5.55	0.000264	3.36	57.00	20.31	0.51
main canal	175.00	100-yr ARI	88.04	0.68	5.66	4.09	6.26	0.000294	3.85	69.46	23.41	0.55
main canal	175.00	PMF	292.10	0.68	10.26	8.13	10.87	0.000180	4.65	330.49	64.25	0.48
main canal	175.00	100-yr ARI + 10%	97.50	0.68	5.85	4.32	6.55	0.000325	4.14	74.46	28.17	0.58
main canal	175.00	100-yr ARI + 20%	107.00	0.68	6.01	4.53	6.83	0.000364	4.48	80.11	38.29	0.62
main canal	175.00	100-yr ARI + 30%	115.55	0.68	6.17	4.72	7.05	0.000377	4.65	86.49	41.28	0.63
main canal	150.00	20-yr ARI	67.05	0.50	5.01	3.51	5.53	0.000278	3.49	50.88	20.58	0.53
main canal	150.00	100-yr ARI	88.04	0.50	5.59	4.00	6.25	0.000302	3.95	63.43	22.50	0.56
main canal	150.00	PMF	292.10	0.50	10.10	8.39	10.85	0.000206	4.98	306.48	66.30	0.51
main canal	150.00	100-yr ARI + 10%	97.50	0.50	5.83	4.46	6.54	0.000312	4.14	68.82	23.28	0.57
main canal	150.00	100-yr ARI + 20%	107.00	0.50	6.04	4.69	6.81	0.000324	4.33	73.82	23.98	0.59
main canal	150.00	100-yr ARI + 30%	115.55	0.50	6.16	4.91	7.04	0.000355	4.60	76.85	26.79	0.62
main canal	125.00	20-yr ARI	67.05	0.82	4.24	4.24	5.45	0.001194	5.27	29.51	16.67	0.97
main canal	125.00	100-yr ARI	88.04	0.82	4.78	4.78	6.16	0.001129	5.71	39.09	19.15	0.97
main canal	125.00	PMF	292.10	0.82	10.19	8.81	10.80	0.000227	4.74	367.39	100.00	0.51
main canal	125.00	100-yr ARI + 10%	97.50	0.82	5.00	5.00	6.45	0.001108	5.89	43.41	20.17	0.97
main canal	125.00	100-yr ARI + 20%	107.00	0.82	5.23	5.23	6.72	0.001063	6.00	48.27	21.10	0.96
main canal	125.00	100-yr ARI + 30%	115.55	0.82	5.40	5.40	6.96	0.001057	6.16	51.95	21.71	0.96
main canal	100.00	20-yr ARI	67.05	0.77	3.99	4.20	5.40	0.001591	5.69	27.32	16.64	1.09
main canal	100.00	100-yr ARI	88.04	0.77	4.40	4.70	6.10	0.001636	6.33	34.48	17.95	1.13
main canal	100.00	PMF	292.10	0.77	10.26	8.90	10.76	0.000201	4.43	395.53	100.00	0.47
main canal	100.00	100-yr ARI + 10%	97.50	0.77	4.59	4.90	6.38	0.001627	6.55	37.87	18.53	1.14
main canal	100.00	100-yr ARI + 20%	107.00	0.77	4.78	5.10	6.65	0.001594	6.73	41.50	19.14	1.13
main canal	100.00	100-yr ARI + 30%	115.55	0.77	4.95	5.27	6.89	0.001558	6.86	44.87	19.69	1.13
main canal	75.00	20-yr ARI	67.05	0.33	3.01	3.66	5.26	0.002625	6.93	17.52	11.49	1.41
main canal	75.00	100-yr ARI	88.04	0.33	3.56	4.22	5.98	0.002209	7.26	24.39	13.45	1.33
main canal	75.00	PMF	292.10	0.33	7.99	7.99	10.55	0.000841	8.17	152.37	65.38	0.96
main canal	75.00	100-yr ARI + 10%	97.50	0.33	3.80	4.46	6.27	0.002062	7.38	27.69	14.30	1.30
main canal	75.00	100-yr ARI + 20%	107.00	0.33	4.04	4.68	6.55	0.001921	7.47	31.22	15.16	1.27
main canal	75.00	100-yr ARI + 30%	115.55	0.33	4.25	4.88	6.78	0.001815	7.55	34.47	15.90	1.25
main canal	50.00	20-yr ARI	67.05	0.34	4.00	3.13	4.63	0.000474	3.97	49.36	21.93	0.66
main canal	50.00	100-yr ARI	88.04	0.34	4.64	3.65	5.36	0.000451	4.31	64.46	25.29	0.66
main canal	50.00	PMF	292.10	0.34	5.55	7.04	10.30	0.002403	11.31	89.59	29.89	1.58
main canal	50.00	100-yr ARI + 10%	97.50	0.34	4.91	3.87	5.66	0.000440	4.43	71.50	26.66	0.66
main canal	50.00	100-yr ARI + 20%	107.00	0.34	5.21	4.09	5.97	0.000419	4.51	79.57	28.14	0.65
main canal	50.00	100-yr ARI + 30%	115.55	0.34	5.51	4.27	6.27	0.000386	4.51	88.49	29.70	0.63
main canal	25.00	20-yr ARI	67.05	0.31	3.31	3.31	4.55	0.001228	5.37	29.30	15.54	1.00
main canal	25.00	100-yr ARI	88.04	0.31	3.84	3.84	5.27	0.001157	5.83	38.12	17.40	1.00
main canal	25.00	PMF	292.10	0.31	6.16	7.40	9.96	0.001768	10.15	121.94	66.79	1.35
main canal	25.00	100-yr ARI + 10%	97.50	0.31	4.07	4.07	5.57	0.001133	6.01	42.06	18.14	1.00
main canal	25.00	100-yr ARI + 20%	107.00	0.31	4.17	4.17	5.86	0.001232	6.39	43.97	18.50	1.05
main canal	25.00	100-yr ARI + 30%	115.55	0.31	4.22	4.22	6.14	0.001375	6.80	44.88	18.98	1.11

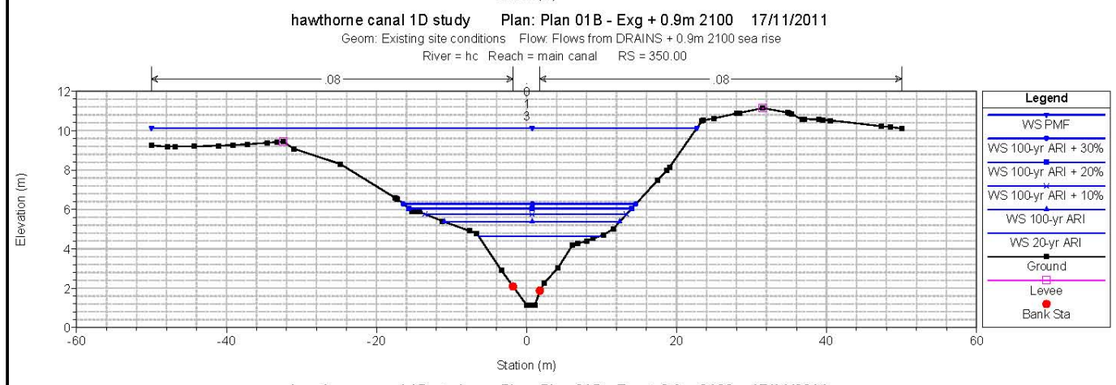

hawthorne canal 1D study Plan: Plan 01B - Exg + 0.9m 2100 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS + 0.9m 2100 sea rise
River = hc Reach = main canal RS = 850.00
River = hc Reach = main canal RS = 875.00
River = hc Reach = main canal RS = 600.00
River = hc Reach = main canal RS = 575.04
River = hc Reach = main canal RS = 550.11
River = hc Reach = main canal RS = 524.97
River = hc Reach = main canal RS = 500.86
River = hc Reach = main canal RS = 455 Culv Longport Street culvert
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta

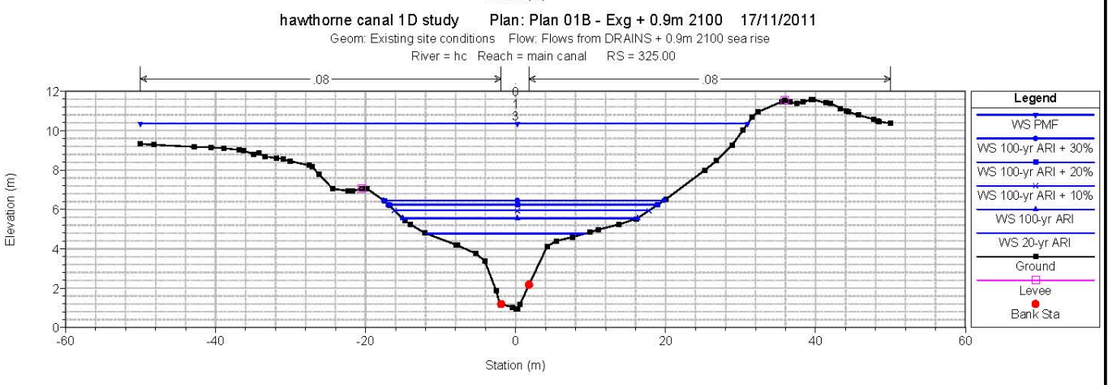

hawthorne canal 1D study Plan: Plan 01B - Exg + 0.9m 2100 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS + 0.9m 2100 sea rise
River = hc Reach = main canal RS = 455 Culv Longport Street culvert
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta

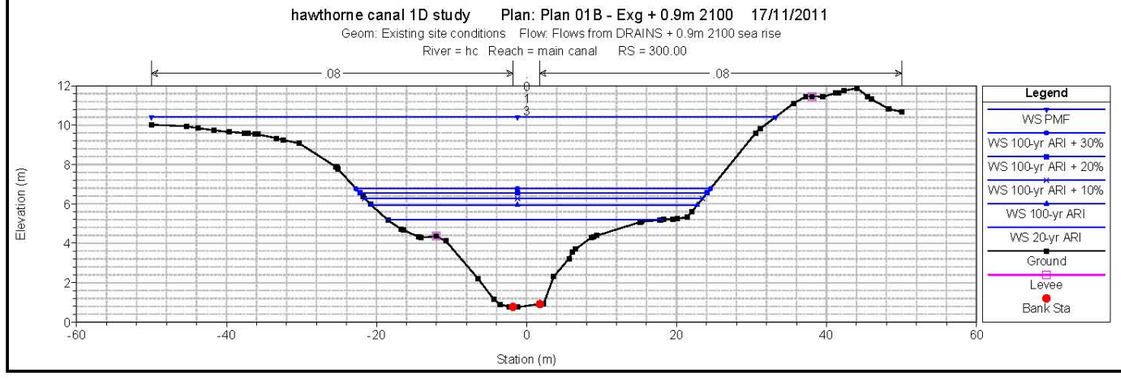

hawthorne canal 1D study Plan: Plan 01B - Exg + 0.9m 2100 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS + 0.9m 2100 sea rise
River = hc Reach = main canal RS = 425.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta


hawthorne canal 1D study Plan: Plan 01B - Exg + 0.9m 2100 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS + 0.9m 2100 sea rise
River = hc Reach = main canal RS = 400.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta

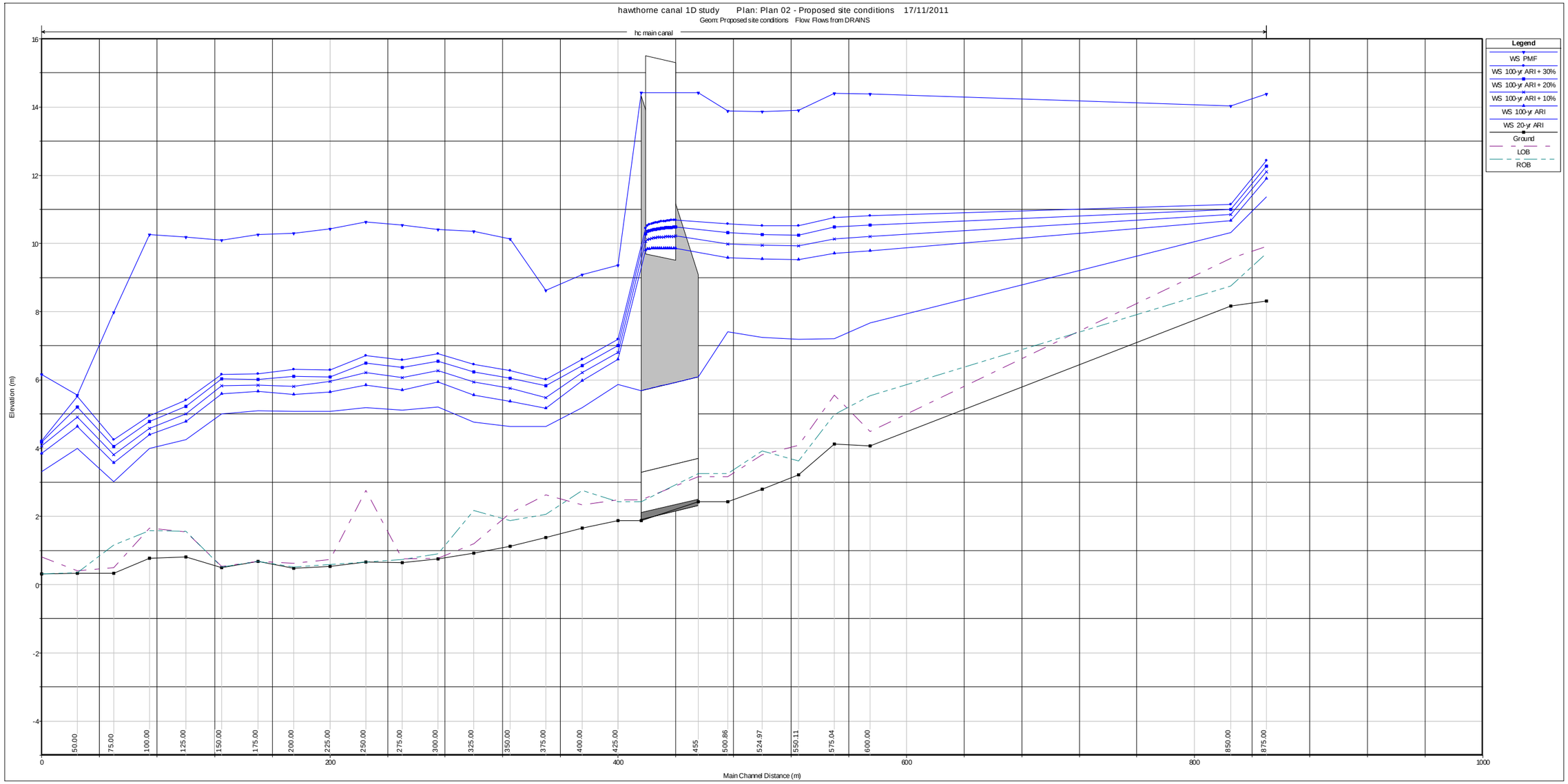

hawthorne canal 1D study Plan: Plan 01B - Exg + 0.9m 2100 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS + 0.9m 2100 sea rise
River = hc Reach = main canal RS = 375.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta


hawthorne canal 1D study Plan: Plan 01B - Exg + 0.9m 2100 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS + 0.9m 2100 sea rise
River = hc Reach = main canal RS = 350.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta


hawthorne canal 1D study Plan: Plan 01B - Exg + 0.9m 2100 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS + 0.9m 2100 sea rise
River = hc Reach = main canal RS = 325.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta


hawthorne canal 1D study Plan: Plan 01B - Exg + 0.9m 2100 17/11/2011
Geom: Existing site conditions Flow: Flows from DRAINS + 0.9m 2100 sea rise
River = hc Reach = main canal RS = 300.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta

Plan 02

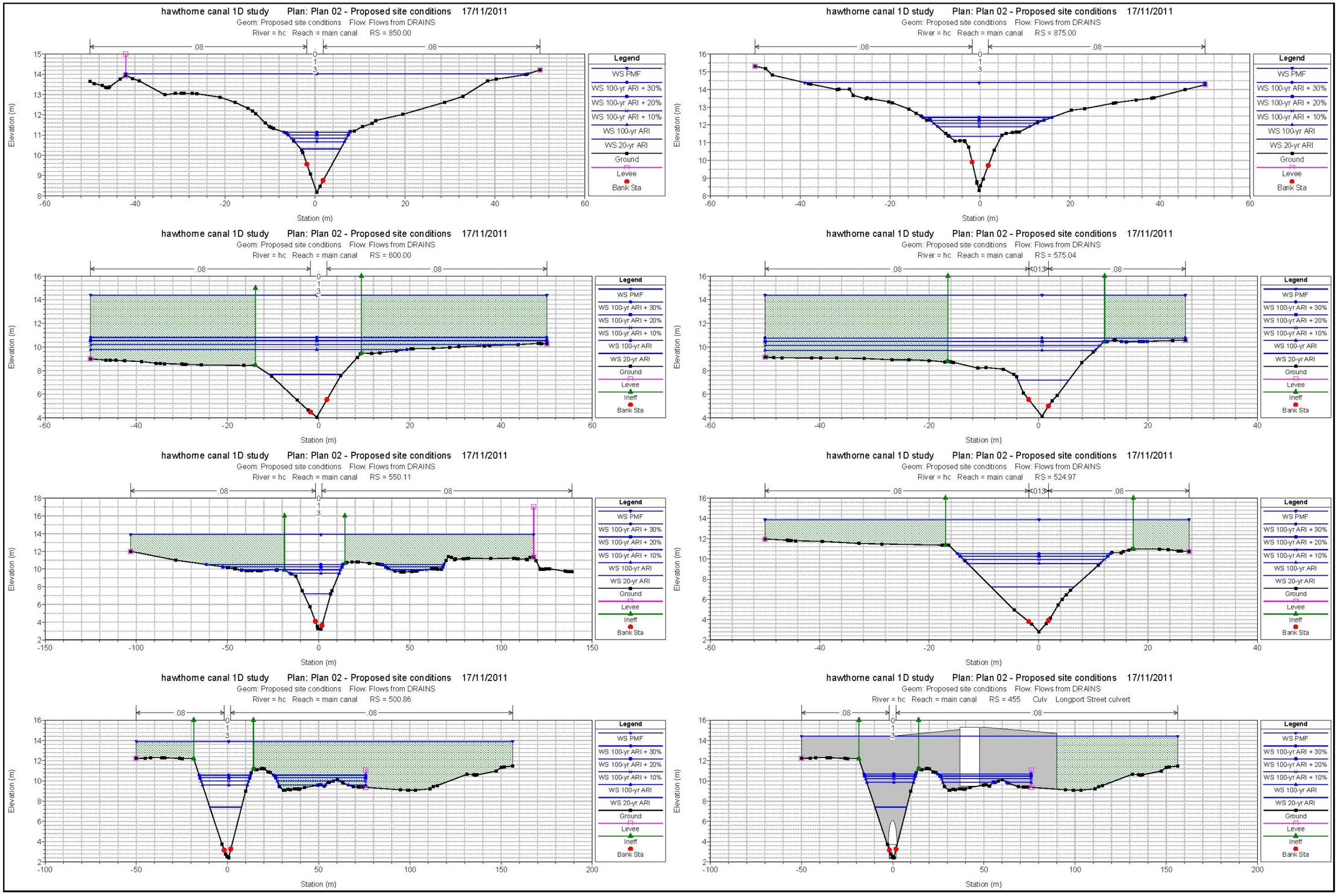

hawthorne canal 1D study Plan: Plan 02 - Proposed site conditions 17/11/2011
Geom: Proposed site conditions Flow: Flows from DRAINS
hc main canal
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
LOB
ROB
Elevation (m)
16
14
12
10
8
6
4
2
0
-2
-4
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
300.00
325.00
350.00
375.00
400.00
425.00
455
500.86
524.97
550.11
575.04
600.00
850.00
875.00
0
200
400
600
800
1000
Main Channel Distance (m)

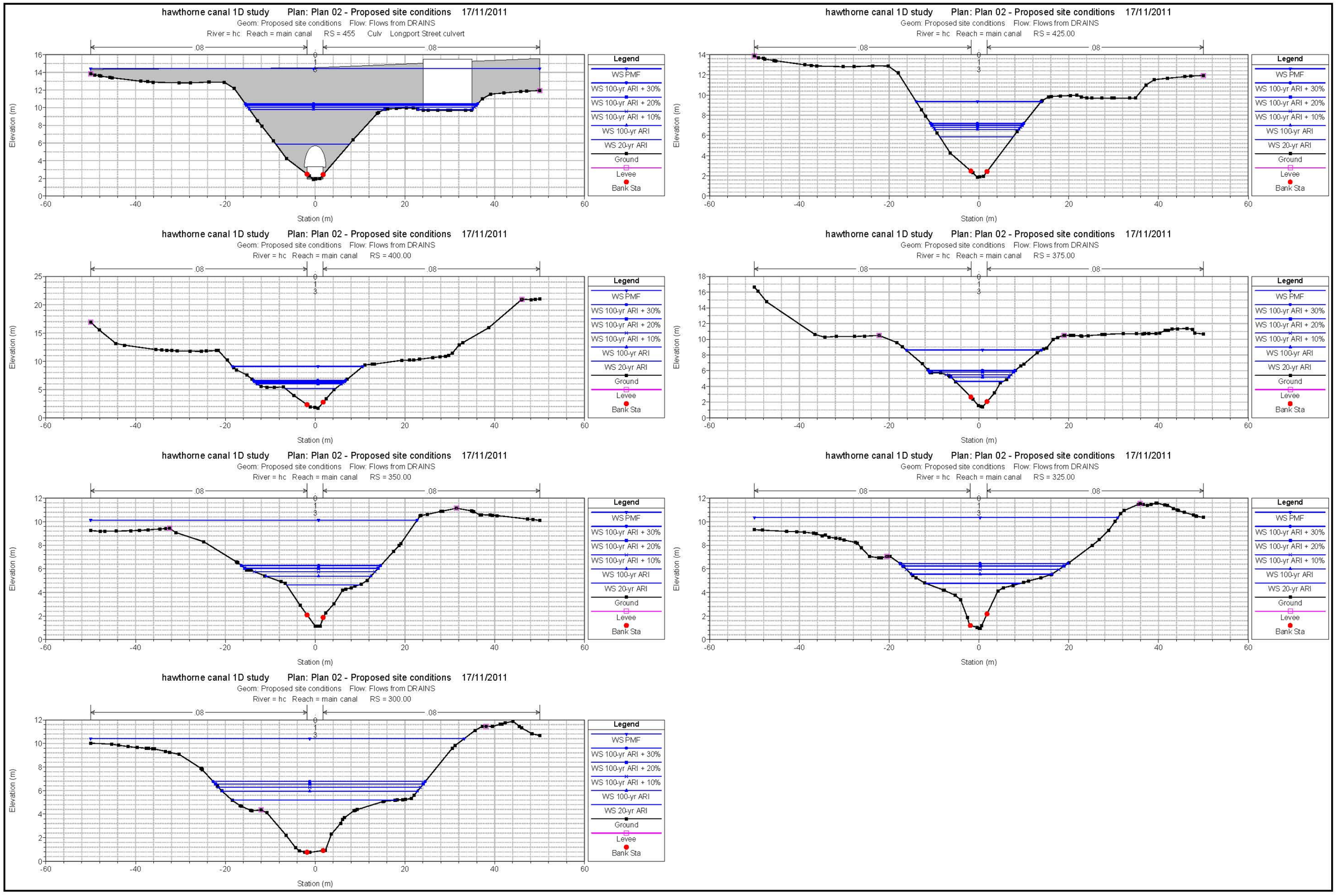
HEC-RAS Plan: P02-PROP River: hc Reach: main canal

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
main canal	875.00	20-yr ARI	38.36	8.31	11.36	11.36	12.34	0.001577	4.46	12.43	11.64	0.94
main canal	875.00	100-yr ARI	50.26	8.31	11.90	11.90	12.89	0.001246	4.56	21.21	20.43	0.86
main canal	875.00	PMF	156.49	8.31	14.39	14.39	15.31	0.000721	5.27	146.48	89.05	0.73
main canal	875.00	100-yr ARI + 10%	56.20	8.31	12.10	12.10	13.11	0.001192	4.66	25.50	22.84	0.85
main canal	875.00	100-yr ARI + 20%	61.86	8.31	12.26	12.26	13.31	0.001174	4.79	29.36	25.22	0.85
main canal	875.00	100-yr ARI + 30%	66.67	8.31	12.43	12.43	13.47	0.001112	4.82	33.94	28.71	0.84
main canal	850.00	20-yr ARI	38.36	8.17	10.32	10.90	12.19	0.004152	6.23	9.34	8.91	1.57
main canal	850.00	100-yr ARI	50.26	8.17	10.67	11.29	12.73	0.003592	6.60	12.82	11.11	1.51
main canal	850.00	PMF	156.49	8.17	14.03	13.67	14.87	0.000570	5.12	160.65	89.40	0.71
main canal	850.00	100-yr ARI + 10%	56.20	8.17	10.85	11.65	12.95	0.003299	6.70	14.89	12.28	1.46
main canal	850.00	100-yr ARI + 20%	61.86	8.17	11.01	11.72	13.15	0.003076	6.80	16.96	13.37	1.43
main canal	850.00	100-yr ARI + 30%	66.67	8.17	11.14	11.86	13.31	0.002916	6.87	18.82	14.63	1.41
main canal	600.00	20-yr ARI	38.36	4.06	7.67	6.73	8.06	0.000399	2.97	28.88	15.99	0.54
main canal	600.00	100-yr ARI	50.26	4.06	9.78	7.12	9.94	0.000092	2.02	72.90	69.29	0.28
main canal	600.00	PMF	156.49	4.06	14.39	9.63	14.65	0.000077	2.82	179.95	100.00	0.29
main canal	600.00	100-yr ARI + 10%	56.20	4.06	10.20	7.30	10.36	0.000085	2.04	82.58	93.75	0.28
main canal	600.00	100-yr ARI + 20%	61.86	4.06	10.53	7.47	10.69	0.000081	2.08	90.31	100.00	0.27
main canal	600.00	100-yr ARI + 30%	66.67	4.06	10.81	7.57	10.97	0.000079	2.12	96.68	100.00	0.27
main canal	575.04	20-yr ARI	38.36	4.13	7.20	6.97	8.00	0.001069	4.09	14.87	9.34	0.83
main canal	575.04	100-yr ARI	50.26	4.13	9.71	7.39	9.93	0.000131	2.29	62.61	60.33	0.33
main canal	575.04	PMF	156.49	4.13	14.39	10.10	14.64	0.000081	2.80	196.11	76.81	0.29
main canal	575.04	100-yr ARI + 10%	56.20	4.13	10.14	7.58	10.35	0.000116	2.28	74.28	61.25	0.31
main canal	575.04	100-yr ARI + 20%	61.86	4.13	10.48	7.74	10.69	0.000109	2.30	83.81	67.17	0.31
main canal	575.04	100-yr ARI + 30%	66.67	4.13	10.76	7.91	10.96	0.000103	2.31	91.87	76.81	0.30
main canal	550.11	20-yr ARI	62.54	3.22	7.20	6.49	7.98	0.000570	4.14	31.56	14.92	0.68
main canal	550.11	100-yr ARI	81.60	3.22	9.52	7.04	9.91	0.000163	3.05	77.80	26.98	0.40
main canal	550.11	PMF	269.21	3.22	13.90	11.02	14.60	0.000179	4.60	219.99	221.00	0.45
main canal	550.11	100-yr ARI + 10%	90.36	3.22	9.92	7.26	10.33	0.000157	3.12	89.52	74.93	0.39
main canal	550.11	100-yr ARI + 20%	99.24	3.22	10.25	7.49	10.66	0.000153	3.19	99.74	96.43	0.39
main canal	550.11	100-yr ARI + 30%	107.50	3.22	10.51	7.71	10.94	0.000153	3.27	108.09	108.98	0.39
main canal	524.97	20-yr ARI	62.54	2.79	7.24	6.37	7.94	0.000522	3.94	33.53	15.23	0.64
main canal	524.97	100-yr ARI	81.60	2.79	9.54	6.91	9.90	0.000157	2.94	78.99	24.24	0.38
main canal	524.97	PMF	269.21	2.79	13.87	10.56	14.59	0.000192	4.63	217.59	77.49	0.45
main canal	524.97	100-yr ARI + 10%	90.36	2.79	9.95	7.15	10.31	0.000150	3.00	89.11	25.78	0.37
main canal	524.97	100-yr ARI + 20%	99.24	2.79	10.27	7.37	10.65	0.000151	3.10	97.54	27.00	0.38
main canal	524.97	100-yr ARI + 30%	107.50	2.79	10.52	7.58	10.93	0.000154	3.21	104.61	27.97	0.38
main canal	500.86	20-yr ARI	62.54	2.42	7.40	5.78	7.86	0.000257	3.21	45.94	17.37	0.47
main canal	500.86	100-yr ARI	81.60	2.42	9.59	6.32	9.87	0.000104	2.63	91.69	58.26	0.32
main canal	500.86	PMF	269.21	2.42	13.88	9.99	14.58	0.000158	4.50	222.95	206.35	0.43
main canal	500.86	100-yr ARI + 10%	90.36	2.42	9.99	6.55	10.29	0.000102	2.72	101.87	71.33	0.32
main canal	500.86	100-yr ARI + 20%	99.24	2.42	10.31	6.77	10.63	0.000105	2.83	110.37	76.57	0.33
main canal	500.86	100-yr ARI + 30%	107.50	2.42	10.57	6.97	10.91	0.000108	2.94	117.47	78.68	0.33
main canal	455		Culvert									
main canal	425.00	20-yr ARI	67.05	1.88	5.87	5.19	6.65	0.000557	4.22	37.10	16.39	0.69
main canal	425.00	100-yr ARI	88.04	1.88	6.59	5.73	7.46	0.000508	4.52	49.72	18.71	0.68
main canal	425.00	PMF	292.10	1.88	9.36	9.36	12.08	0.000927	8.40	114.22	27.85	0.99
main canal	425.00	100-yr ARI + 10%	97.50	1.88	6.81	5.96	7.76	0.000524	4.74	53.84	19.43	0.70
main canal	425.00	100-yr ARI + 20%	107.00	1.88	7.01	6.18	8.04	0.000540	4.95	57.86	20.11	0.71
main canal	425.00	100-yr ARI + 30%	115.55	1.88	7.19	6.36	8.28	0.000554	5.13	61.37	20.69	0.73
main canal	400.00	20-yr ARI	67.05	1.65	5.20	5.20	6.57	0.001289	5.41	21.86	11.21	0.97
main canal	400.00	100-yr ARI	88.04	1.65	5.98	5.98	7.39	0.001011	5.55	34.31	18.60	0.89
main canal	400.00	PMF	292.10	1.65	9.09	9.37	12.03	0.001151	8.71	108.00	29.04	1.05
main canal	400.00	100-yr ARI + 10%	97.50	1.65	6.21	6.21	7.69	0.000997	5.72	38.66	19.32	0.89
main canal	400.00	100-yr ARI + 20%	107.00	1.65	6.42	6.42	7.97	0.000991	5.89	42.80	19.96	0.90
main canal	400.00	100-yr ARI + 30%	115.55	1.65	6.60	6.60	8.21	0.000986	6.04	46.51	20.52	0.90
main canal	375.00	20-yr ARI	67.05	1.39	4.64	5.06	6.49	0.001994	6.22	18.11	10.69	1.18
main canal	375.00	100-yr ARI	88.04	1.39	5.18	5.63	7.29	0.001846	6.72	24.46	12.86	1.17
main canal	375.00	PMF	292.10	1.39	8.63	9.41	11.96	0.001344	9.20	101.99	30.19	1.13
main canal	375.00	100-yr ARI + 10%	97.50	1.39	5.48	6.03	7.59	0.001665	6.76	28.52	14.43	1.13
main canal	375.00	100-yr ARI + 20%	107.00	1.39	5.83	6.23	7.89	0.001442	6.69	34.30	18.69	1.07
main canal	375.00	100-yr ARI + 30%	115.55	1.39	6.02	6.43	8.13	0.001410	6.82	37.85	19.29	1.06
main canal	350.00	20-yr ARI	67.05	1.12	4.64	4.63	5.94	0.001222	5.30	25.37	16.15	0.95
main canal	350.00	100-yr ARI	88.04	1.12	5.37	5.31	6.68	0.000971	5.42	39.81	23.35	0.87
main canal	350.00	PMF	292.10	1.12	10.13	8.48	11.16	0.000375	5.72	249.99	72.72	0.62
main canal	350.00	100-yr ARI + 10%	97.50	1.12	5.76	5.57	6.97	0.000818	5.30	49.58	26.88	0.81
main canal	350.00	100-yr ARI + 20%	107.00	1.12	6.05	5.79	7.25	0.000757	5.32	57.88	29.78	0.79
main canal	350.00	100-yr ARI + 30%	115.55	1.12	6.28	6.05	7.47	0.000723	5.37	64.70	31.01	0.78
main canal	325.00	20-yr ARI	67.05	0.93	4.77	4.40	5.85	0.000844	4.78	28.40	21.17	0.81
main canal	325.00	100-yr ARI	88.04	0.93	5.55	5.25	6.57	0.000654	4.81	49.04	31.34	0.74
main canal	325.00	PMF	292.10	0.93	10.36	8.24	11.05	0.000249	4.90	313.82	80.95	0.52
main canal	325.00	100-yr ARI + 10%	97.50	0.93	5.94	5.50	6.87	0.000551	4.68	61.81	33.92	0.69
main canal	325.00	100-yr ARI + 20%	107.00	0.93	6.24	5.73	7.14	0.000508	4.68	72.23	35.90	0.67
main canal	325.00	100-yr ARI + 30%	115.55	0.93	6.46	5.90	7.37	0.000491	4.74	80.31	37.42	0.66
main canal	300.00	20-yr ARI	67.05	0.76	5.20	3.69	5.65	0.000266	3.35	67.64	36.79	0.51
main canal	300.00	100-yr ARI	88.04	0.76	5.94	4.12	6.39	0.000233	3.48	98.27	43.47	0.49
main canal	300.00	PMF	292.10	0.76	10.42	7.51	11.02	0.000178	4.63	355.51	83.25	0.48
main canal	300.00	100-yr ARI + 10%	97.50	0.76	6.28	4.35	6.71	0.000215	3.49	113.13	45.04	0.48

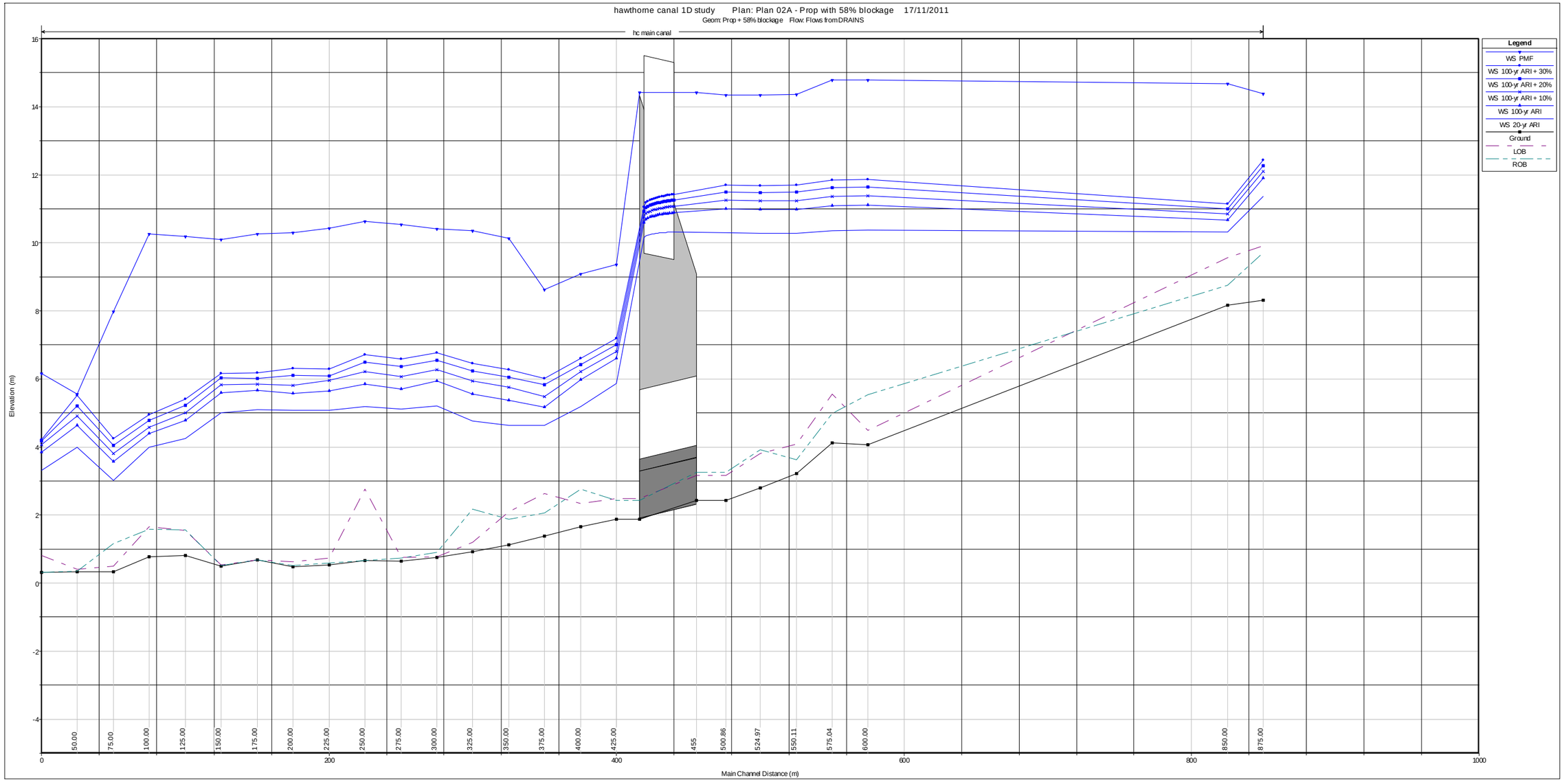
HEC-RAS Plan: P02-PROP River: hc Reach: main canal (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
main canal	300.00	100-yr ARI + 20%	107.00	0.76	6.55	4.92	7.00	0.000208	3.55	125.90	46.31	0.47
main canal	300.00	100-yr ARI + 30%	115.55	0.76	6.77	5.08	7.22	0.000206	3.62	136.02	47.29	0.47
main canal	275.00	20-yr ARI	67.05	0.65	5.11	3.66	5.64	0.000288	3.52	55.84	29.44	0.53
main canal	275.00	100-yr ARI	88.04	0.65	5.71	4.21	6.36	0.000308	3.96	77.23	43.79	0.56
main canal	275.00	PMF	292.10	0.65	10.54	8.04	10.96	0.000131	4.04	420.32	85.98	0.41
main canal	275.00	100-yr ARI + 10%	97.50	0.65	6.08	4.37	6.69	0.000275	3.92	94.03	48.14	0.54
main canal	275.00	100-yr ARI + 20%	107.00	0.65	6.37	4.88	6.97	0.000262	3.96	108.55	52.75	0.53
main canal	275.00	100-yr ARI + 30%	115.55	0.65	6.59	5.11	7.20	0.000257	4.02	120.77	56.70	0.53
main canal	250.00	20-yr ARI	67.05	0.67	5.19	3.63	5.59	0.000403	3.32	63.15	30.36	0.53
main canal	250.00	100-yr ARI	88.04	0.67	5.86	4.06	6.29	0.000371	3.53	87.29	42.80	0.52
main canal	250.00	PMF	292.10	0.67	10.64	7.62	10.91	0.000148	3.57	431.01	83.71	0.37
main canal	250.00	100-yr ARI + 10%	97.50	0.67	6.21	4.37	6.62	0.000334	3.51	103.53	49.48	0.50
main canal	250.00	100-yr ARI + 20%	107.00	0.67	6.50	4.60	6.91	0.000316	3.54	118.54	54.83	0.49
main canal	250.00	100-yr ARI + 30%	115.55	0.67	6.72	5.05	7.13	0.000306	3.59	131.28	58.85	0.49
main canal	225.00	20-yr ARI	67.05	0.53	5.08	3.59	5.57	0.000271	3.43	56.41	25.25	0.52
main canal	225.00	100-yr ARI	88.04	0.53	5.65	4.13	6.26	0.000292	3.86	71.90	29.08	0.55
main canal	225.00	PMF	292.10	0.53	10.43	8.05	10.89	0.000143	4.21	396.16	83.50	0.43
main canal	225.00	100-yr ARI + 10%	97.50	0.53	5.96	4.38	6.59	0.000288	3.98	81.16	32.43	0.55
main canal	225.00	100-yr ARI + 20%	107.00	0.53	6.10	4.68	6.86	0.000329	4.33	87.24	46.59	0.59
main canal	225.00	100-yr ARI + 30%	115.55	0.53	6.30	4.68	7.09	0.000328	4.43	97.17	51.37	0.59
main canal	200.00	20-yr ARI	67.05	0.48	5.08	3.56	5.56	0.000259	3.39	54.11	20.81	0.51
main canal	200.00	100-yr ARI	88.04	0.48	5.58	4.12	6.25	0.000312	3.99	65.81	27.31	0.57
main canal	200.00	PMF	292.10	0.48	10.31	8.09	10.88	0.000165	4.51	347.84	69.26	0.46
main canal	200.00	100-yr ARI + 10%	97.50	0.48	5.82	4.35	6.57	0.000331	4.23	76.23	40.99	0.59
main canal	200.00	100-yr ARI + 20%	107.00	0.48	6.10	4.57	6.85	0.000315	4.28	87.97	42.44	0.58
main canal	200.00	100-yr ARI + 30%	115.55	0.48	6.31	4.77	7.07	0.000311	4.36	96.97	43.48	0.58
main canal	175.00	20-yr ARI	67.05	0.68	5.09	3.54	5.55	0.000264	3.36	57.00	20.31	0.51
main canal	175.00	100-yr ARI	88.04	0.68	5.66	4.09	6.26	0.000294	3.85	69.46	23.41	0.55
main canal	175.00	PMF	292.10	0.68	10.26	8.13	10.87	0.000180	4.65	330.49	64.25	0.48
main canal	175.00	100-yr ARI + 10%	97.50	0.68	5.85	4.32	6.55	0.000325	4.14	74.46	28.17	0.58
main canal	175.00	100-yr ARI + 20%	107.00	0.68	6.01	4.53	6.83	0.000364	4.48	80.11	38.29	0.62
main canal	175.00	100-yr ARI + 30%	115.55	0.68	6.17	4.72	7.05	0.000377	4.65	86.49	41.28	0.63
main canal	150.00	20-yr ARI	67.05	0.50	5.01	3.51	5.53	0.000278	3.49	50.88	20.58	0.53
main canal	150.00	100-yr ARI	88.04	0.50	5.59	4.00	6.25	0.000302	3.95	63.43	22.50	0.56
main canal	150.00	PMF	292.10	0.50	10.10	8.39	10.85	0.000206	4.98	306.48	66.30	0.51
main canal	150.00	100-yr ARI + 10%	97.50	0.50	5.83	4.46	6.54	0.000312	4.14	68.82	23.28	0.57
main canal	150.00	100-yr ARI + 20%	107.00	0.50	6.04	4.69	6.81	0.000324	4.33	73.82	23.98	0.59
main canal	150.00	100-yr ARI + 30%	115.55	0.50	6.16	4.91	7.04	0.000355	4.60	76.85	26.79	0.62
main canal	125.00	20-yr ARI	67.05	0.82	4.24	4.24	5.45	0.001194	5.27	29.51	16.67	0.97
main canal	125.00	100-yr ARI	88.04	0.82	4.78	4.78	6.16	0.001129	5.71	39.09	19.15	0.97
main canal	125.00	PMF	292.10	0.82	10.19	8.81	10.80	0.000227	4.74	367.39	100.00	0.51
main canal	125.00	100-yr ARI + 10%	97.50	0.82	5.00	5.00	6.45	0.001108	5.89	43.41	20.17	0.97
main canal	125.00	100-yr ARI + 20%	107.00	0.82	5.23	5.23	6.72	0.001063	6.00	48.27	21.10	0.96
main canal	125.00	100-yr ARI + 30%	115.55	0.82	5.40	5.40	6.96	0.001057	6.16	51.95	21.71	0.96
main canal	100.00	20-yr ARI	67.05	0.77	3.99	4.20	5.40	0.001591	5.69	27.32	16.64	1.09
main canal	100.00	100-yr ARI	88.04	0.77	4.40	4.70	6.10	0.001636	6.33	34.48	17.95	1.13
main canal	100.00	PMF	292.10	0.77	10.26	8.90	10.76	0.000201	4.43	395.53	100.00	0.47
main canal	100.00	100-yr ARI + 10%	97.50	0.77	4.59	4.90	6.38	0.001627	6.55	37.87	18.53	1.14
main canal	100.00	100-yr ARI + 20%	107.00	0.77	4.78	5.10	6.65	0.001594	6.73	41.50	19.14	1.13
main canal	100.00	100-yr ARI + 30%	115.55	0.77	4.95	5.27	6.89	0.001558	6.86	44.87	19.69	1.13
main canal	75.00	20-yr ARI	67.05	0.33	3.01	3.66	5.26	0.002625	6.93	17.52	11.49	1.41
main canal	75.00	100-yr ARI	88.04	0.33	3.56	4.22	5.98	0.002209	7.26	24.39	13.45	1.33
main canal	75.00	PMF	292.10	0.33	7.99	7.99	10.55	0.000841	8.17	152.37	65.38	0.96
main canal	75.00	100-yr ARI + 10%	97.50	0.33	3.80	4.46	6.27	0.002062	7.38	27.69	14.30	1.30
main canal	75.00	100-yr ARI + 20%	107.00	0.33	4.04	4.68	6.55	0.001921	7.47	31.22	15.16	1.27
main canal	75.00	100-yr ARI + 30%	115.55	0.33	4.25	4.88	6.78	0.001815	7.55	34.47	15.90	1.25
main canal	50.00	20-yr ARI	67.05	0.34	4.00	3.13	4.63	0.000474	3.97	49.36	21.93	0.66
main canal	50.00	100-yr ARI	88.04	0.34	4.64	3.65	5.36	0.000451	4.31	64.46	25.29	0.66
main canal	50.00	PMF	292.10	0.34	5.55	7.04	10.30	0.002403	11.31	89.59	29.89	1.58
main canal	50.00	100-yr ARI + 10%	97.50	0.34	4.91	3.87	5.66	0.000440	4.43	71.50	26.66	0.66
main canal	50.00	100-yr ARI + 20%	107.00	0.34	5.21	4.09	5.97	0.000419	4.51	79.57	28.14	0.65
main canal	50.00	100-yr ARI + 30%	115.55	0.34	5.51	4.27	6.27	0.000386	4.51	88.49	29.70	0.63
main canal	25.00	20-yr ARI	67.05	0.31	3.31	3.31	4.55	0.001228	5.37	29.30	15.54	1.00
main canal	25.00	100-yr ARI	88.04	0.31	3.84	3.84	5.27	0.001157	5.83	38.12	17.40	1.00
main canal	25.00	PMF	292.10	0.31	6.16	7.40	9.96	0.001768	10.15	121.94	66.79	1.35
main canal	25.00	100-yr ARI + 10%	97.50	0.31	4.07	4.07	5.57	0.001133	6.01	42.06	18.14	1.00
main canal	25.00	100-yr ARI + 20%	107.00	0.31	4.17	4.17	5.86	0.001232	6.39	43.97	18.50	1.05
main canal	25.00	100-yr ARI + 30%	115.55	0.31	4.22	4.22	6.14	0.001375	6.80	44.88	18.98	1.11


hawthorne canal 1D study Plan: Plan 02 - Proposed site conditions 17/11/2011
Geom: Proposed site conditions Flow: Flows from DRAINS
River = hc Reach = main canal RS = 850.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta
hawthorne canal 1D study Plan: Plan 02 - Proposed site conditions 17/11/2011
Geom: Proposed site conditions Flow: Flows from DRAINS
River = hc Reach = main canal RS = 875.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta
hawthorne canal 1D study Plan: Plan 02 - Proposed site conditions 17/11/2011
Geom: Proposed site conditions Flow: Flows from DRAINS
River = hc Reach = main canal RS = 600.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta
hawthorne canal 1D study Plan: Plan 02 - Proposed site conditions 17/11/2011
Geom: Proposed site conditions Flow: Flows from DRAINS
River = hc Reach = main canal RS = 575.04
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta
hawthorne canal 1D study Plan: Plan 02 - Proposed site conditions 17/11/2011
Geom: Proposed site conditions Flow: Flows from DRAINS
River = hc Reach = main canal RS = 550.11
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta
hawthorne canal 1D study Plan: Plan 02 - Proposed site conditions 17/11/2011
Geom: Proposed site conditions Flow: Flows from DRAINS
River = hc Reach = main canal RS = 524.97
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta
hawthorne canal 1D study Plan: Plan 02 - Proposed site conditions 17/11/2011
Geom: Proposed site conditions Flow: Flows from DRAINS
River = hc Reach = main canal RS = 500.86
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta
hawthorne canal 1D study Plan: Plan 02 - Proposed site conditions 17/11/2011
Geom: Proposed site conditions Flow: Flows from DRAINS
River = hc Reach = main canal RS = 455 Culv Longport Street culvert
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta


hawthorne canal 1D study Plan: Plan 02 - Proposed site conditions 17/11/2011
Geom: Proposed site conditions Flow: Flows from DRAINS
River = hc Reach = main canal RS = 455 Culv Longport Street culvert
River = hc Reach = main canal RS = 425.00
River = hc Reach = main canal RS = 400.00
River = hc Reach = main canal RS = 375.00
River = hc Reach = main canal RS = 350.00
River = hc Reach = main canal RS = 325.00
River = hc Reach = main canal RS = 300.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta

Plan 02A

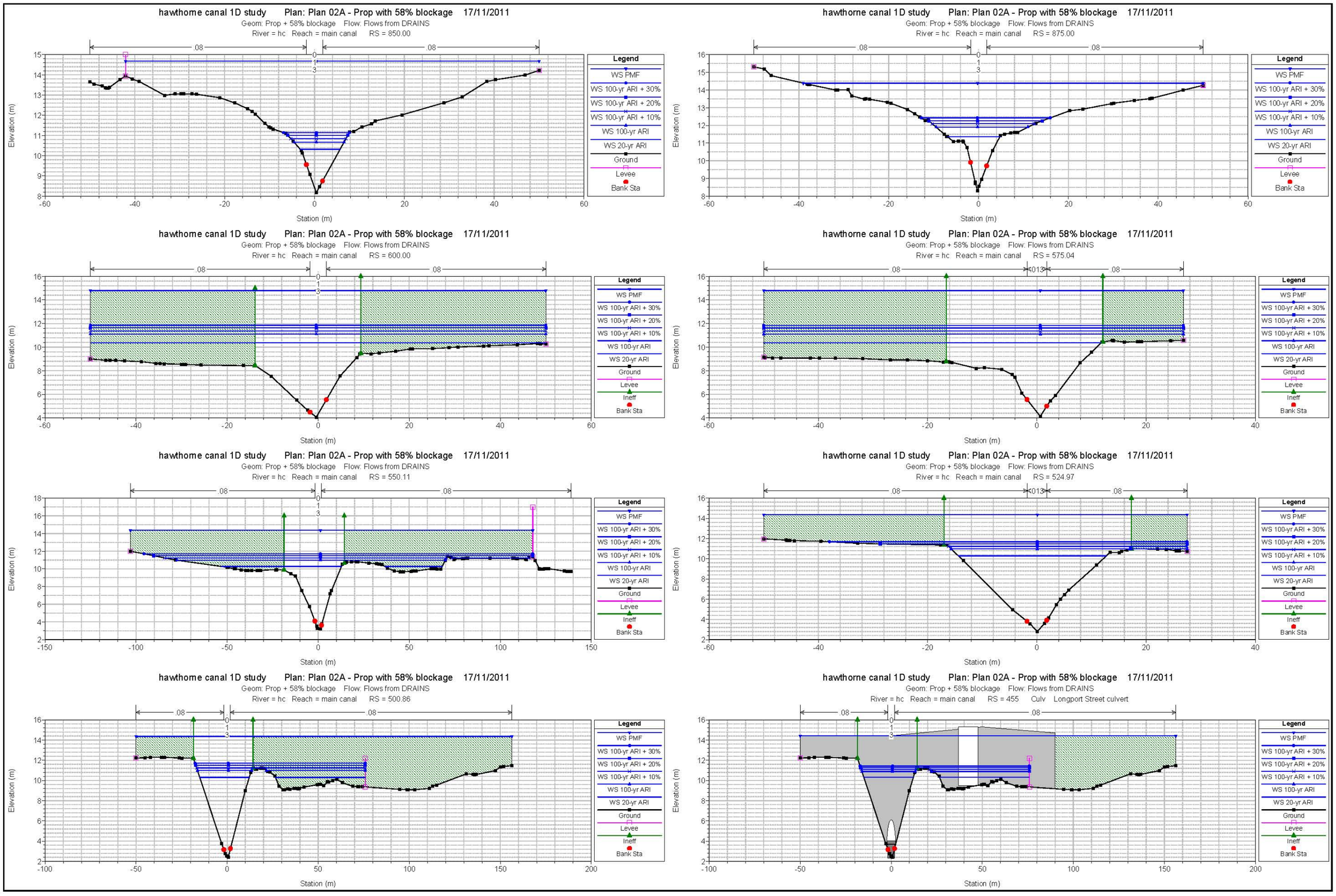

hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
hc main canal
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
LOB
ROB
Elevation (m)
16
14
12
10
8
6
4
2
0
-2
-4
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
300.00
325.00
350.00
375.00
400.00
425.00
455
500.86
524.97
550.11
575.04
600.00
850.00
875.00
0
200
400
600
800
1000
Main Channel Distance (m)

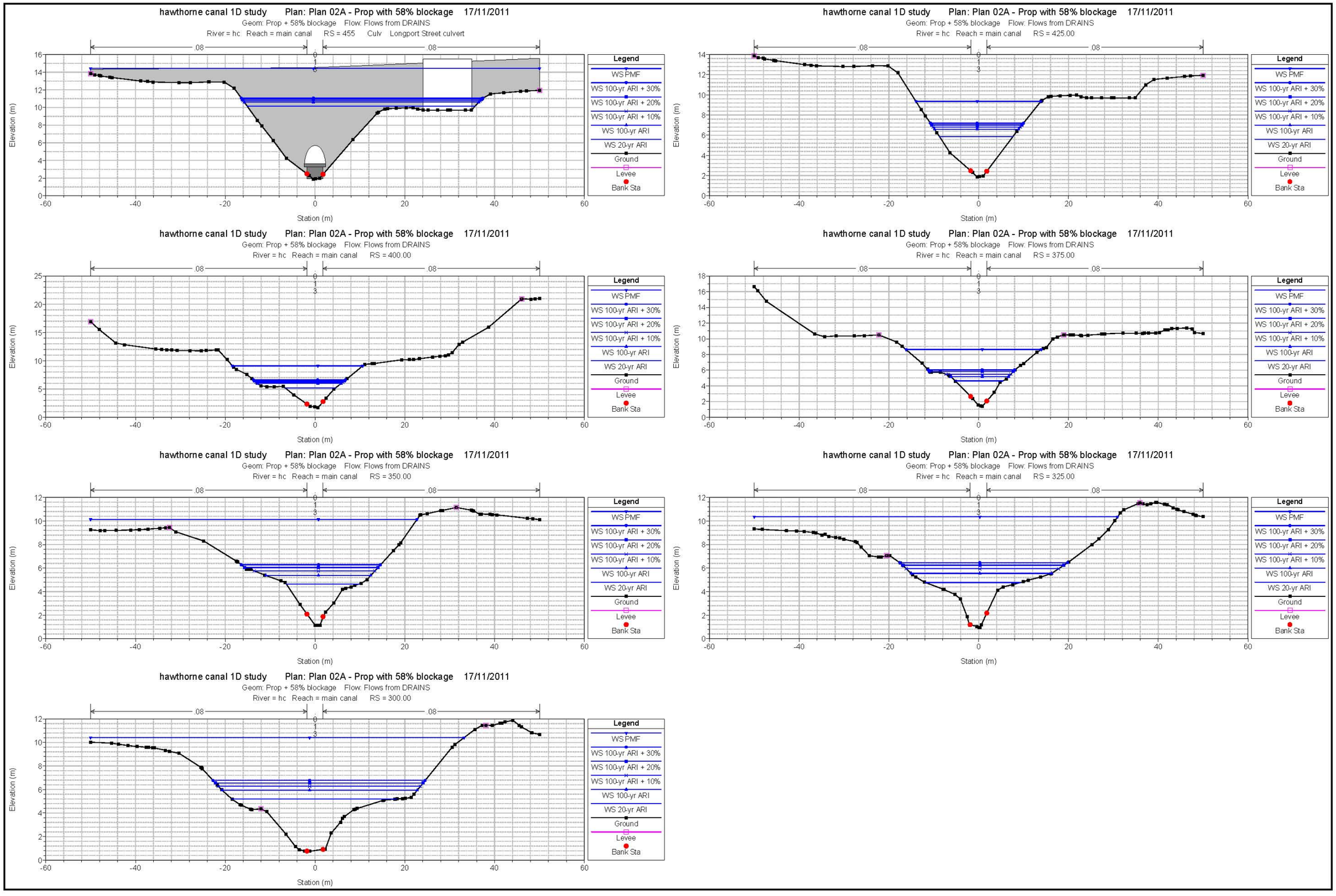
HEC-RAS Plan: P02A-PROP 58% bl River: hc Reach: main canal

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
main canal	875.00	20-yr ARI	38.36	8.31	11.36	11.36	12.34	0.001577	4.46	12.43	11.64	0.94
main canal	875.00	100-yr ARI	50.26	8.31	11.90	11.90	12.89	0.001246	4.56	21.21	20.43	0.86
main canal	875.00	PMF	156.49	8.31	14.39	14.39	15.31	0.000721	5.27	146.48	89.05	0.73
main canal	875.00	100-yr ARI + 10%	56.20	8.31	12.10	12.10	13.11	0.001192	4.66	25.50	22.84	0.85
main canal	875.00	100-yr ARI + 20%	61.86	8.31	12.26	12.26	13.31	0.001174	4.79	29.36	25.22	0.85
main canal	875.00	100-yr ARI + 30%	66.67	8.31	12.43	12.43	13.47	0.001112	4.82	33.94	28.71	0.84
main canal	850.00	20-yr ARI	38.36	8.17	10.32	10.90	12.19	0.004152	6.23	9.34	8.91	1.57
main canal	850.00	100-yr ARI	50.26	8.17	10.67	11.29	12.73	0.003592	6.60	12.82	11.11	1.51
main canal	850.00	PMF	156.49	8.17	14.68	13.67	15.11	0.000292	3.95	220.22	92.05	0.52
main canal	850.00	100-yr ARI + 10%	56.20	8.17	10.85	11.65	12.95	0.003299	6.70	14.89	12.28	1.46
main canal	850.00	100-yr ARI + 20%	61.86	8.17	11.01	11.72	13.15	0.003076	6.80	16.96	13.37	1.43
main canal	850.00	100-yr ARI + 30%	66.67	8.17	11.14	11.86	13.31	0.002916	6.87	18.82	14.63	1.41
main canal	600.00	20-yr ARI	38.36	4.06	10.38	6.73	10.45	0.000035	1.34	86.75	100.00	0.18
main canal	600.00	100-yr ARI	50.26	4.06	11.11	7.12	11.19	0.000037	1.50	103.75	100.00	0.19
main canal	600.00	PMF	156.49	4.06	14.79	9.63	15.02	0.000066	2.69	189.16	100.00	0.27
main canal	600.00	100-yr ARI + 10%	56.20	4.06	11.38	7.30	11.47	0.000040	1.59	109.98	100.00	0.20
main canal	600.00	100-yr ARI + 20%	61.86	4.06	11.63	7.47	11.73	0.000042	1.67	115.92	100.00	0.20
main canal	600.00	100-yr ARI + 30%	66.67	4.06	11.86	7.57	11.96	0.000043	1.73	121.11	100.00	0.21
main canal	575.04	20-yr ARI	38.36	4.13	10.36	6.97	10.44	0.000046	1.47	80.38	61.72	0.20
main canal	575.04	100-yr ARI	50.26	4.13	11.09	7.39	11.19	0.000047	1.61	101.43	76.81	0.20
main canal	575.04	PMF	156.49	4.13	14.79	10.10	15.02	0.000069	2.65	207.54	76.81	0.27
main canal	575.04	100-yr ARI + 10%	56.20	4.13	11.36	7.58	11.47	0.000049	1.69	109.14	76.81	0.21
main canal	575.04	100-yr ARI + 20%	61.86	4.13	11.62	7.74	11.73	0.000050	1.76	116.51	76.81	0.21
main canal	575.04	100-yr ARI + 30%	66.67	4.13	11.84	7.91	11.96	0.000051	1.81	122.95	76.81	0.22
main canal	550.11	20-yr ARI	62.54	3.22	10.27	6.49	10.43	0.000060	2.00	100.40	97.40	0.24
main canal	550.11	100-yr ARI	81.60	3.22	10.98	7.04	11.18	0.000067	2.26	123.47	147.47	0.26
main canal	550.11	PMF	269.21	3.22	14.37	11.02	14.97	0.000150	4.32	235.51	221.00	0.42
main canal	550.11	100-yr ARI + 10%	90.36	3.22	11.24	7.26	11.45	0.000071	2.38	132.06	197.16	0.27
main canal	550.11	100-yr ARI + 20%	99.24	3.22	11.49	7.49	11.72	0.000075	2.49	140.19	208.26	0.28
main canal	550.11	100-yr ARI + 30%	107.50	3.22	11.70	7.71	11.95	0.000078	2.59	147.22	213.53	0.29
main canal	524.97	20-yr ARI	62.54	2.79	10.28	6.37	10.43	0.000060	1.95	97.86	27.04	0.24
main canal	524.97	100-yr ARI	81.60	2.79	10.97	6.91	11.18	0.000071	2.27	118.43	42.91	0.26
main canal	524.97	PMF	269.21	2.79	14.35	10.56	14.97	0.000159	4.34	233.96	77.49	0.42
main canal	524.97	100-yr ARI + 10%	90.36	2.79	11.23	7.15	11.45	0.000076	2.40	126.92	43.65	0.27
main canal	524.97	100-yr ARI + 20%	99.24	2.79	11.47	7.37	11.71	0.000081	2.52	135.09	56.20	0.28
main canal	524.97	100-yr ARI + 30%	107.50	2.79	11.68	7.58	11.94	0.000084	2.63	142.36	65.47	0.29
main canal	500.86	20-yr ARI	62.54	2.42	10.29	5.78	10.42	0.000042	1.79	109.94	76.48	0.21
main canal	500.86	100-yr ARI	81.60	2.42	11.00	6.32	11.16	0.000051	2.08	129.86	84.29	0.23
main canal	500.86	PMF	269.21	2.42	14.35	9.99	14.96	0.000133	4.24	238.32	206.35	0.40
main canal	500.86	100-yr ARI + 10%	90.36	2.42	11.25	6.55	11.44	0.000055	2.22	137.63	92.67	0.24
main canal	500.86	100-yr ARI + 20%	99.24	2.42	11.49	6.77	11.70	0.000059	2.35	145.18	93.11	0.25
main canal	500.86	100-yr ARI + 30%	107.50	2.42	11.70	6.97	11.93	0.000063	2.46	151.83	93.50	0.26
main canal	455		Culvert									
main canal	425.00	20-yr ARI	67.05	1.88	5.87	5.19	6.65	0.000557	4.22	37.10	16.39	0.69
main canal	425.00	100-yr ARI	88.04	1.88	6.59	5.73	7.46	0.000508	4.52	49.72	18.71	0.68
main canal	425.00	PMF	292.10	1.88	9.36	9.36	12.08	0.000927	8.40	114.22	27.85	0.99
main canal	425.00	100-yr ARI + 10%	97.50	1.88	6.81	5.96	7.76	0.000524	4.74	53.84	19.43	0.70
main canal	425.00	100-yr ARI + 20%	107.00	1.88	7.01	6.18	8.04	0.000540	4.95	57.86	20.11	0.71
main canal	425.00	100-yr ARI + 30%	115.55	1.88	7.19	6.36	8.28	0.000554	5.13	61.37	20.69	0.73
main canal	400.00	20-yr ARI	67.05	1.65	5.20	5.20	6.57	0.001289	5.41	21.86	11.21	0.97
main canal	400.00	100-yr ARI	88.04	1.65	5.98	5.98	7.39	0.001011	5.55	34.31	18.60	0.89
main canal	400.00	PMF	292.10	1.65	9.09	9.37	12.03	0.001151	8.71	108.00	29.04	1.05
main canal	400.00	100-yr ARI + 10%	97.50	1.65	6.21	6.21	7.69	0.000997	5.72	38.66	19.32	0.89
main canal	400.00	100-yr ARI + 20%	107.00	1.65	6.42	6.42	7.97	0.000991	5.89	42.80	19.96	0.90
main canal	400.00	100-yr ARI + 30%	115.55	1.65	6.60	6.60	8.21	0.000986	6.04	46.51	20.52	0.90
main canal	375.00	20-yr ARI	67.05	1.39	4.64	5.06	6.49	0.001994	6.22	18.11	10.69	1.18
main canal	375.00	100-yr ARI	88.04	1.39	5.18	5.63	7.29	0.001846	6.72	24.46	12.86	1.17
main canal	375.00	PMF	292.10	1.39	8.63	9.41	11.96	0.001344	9.20	101.99	30.19	1.13
main canal	375.00	100-yr ARI + 10%	97.50	1.39	5.48	6.03	7.59	0.001665	6.76	28.52	14.43	1.13
main canal	375.00	100-yr ARI + 20%	107.00	1.39	5.83	6.23	7.89	0.001442	6.69	34.30	18.69	1.07
main canal	375.00	100-yr ARI + 30%	115.55	1.39	6.02	6.43	8.13	0.001410	6.82	37.85	19.29	1.06
main canal	350.00	20-yr ARI	67.05	1.12	4.64	4.63	5.94	0.001222	5.30	25.37	16.15	0.95
main canal	350.00	100-yr ARI	88.04	1.12	5.37	5.31	6.68	0.000971	5.42	39.81	23.35	0.87
main canal	350.00	PMF	292.10	1.12	10.13	8.48	11.16	0.000375	5.72	249.99	72.72	0.62
main canal	350.00	100-yr ARI + 10%	97.50	1.12	5.76	5.57	6.97	0.000818	5.30	49.58	26.88	0.81
main canal	350.00	100-yr ARI + 20%	107.00	1.12	6.05	5.79	7.25	0.000757	5.32	57.88	29.78	0.79
main canal	350.00	100-yr ARI + 30%	115.55	1.12	6.28	6.05	7.47	0.000723	5.37	64.70	31.01	0.78
main canal	325.00	20-yr ARI	67.05	0.93	4.77	4.40	5.85	0.000844	4.78	28.40	21.17	0.81
main canal	325.00	100-yr ARI	88.04	0.93	5.55	5.25	6.57	0.000654	4.81	49.04	31.34	0.74
main canal	325.00	PMF	292.10	0.93	10.36	8.24	11.05	0.000249	4.90	313.82	80.95	0.52
main canal	325.00	100-yr ARI + 10%	97.50	0.93	5.94	5.50	6.87	0.000551	4.68	61.81	33.92	0.69
main canal	325.00	100-yr ARI + 20%	107.00	0.93	6.24	5.73	7.14	0.000508	4.68	72.23	35.90	0.67
main canal	325.00	100-yr ARI + 30%	115.55	0.93	6.46	5.90	7.37	0.000491	4.74	80.31	37.42	0.66
main canal	300.00	20-yr ARI	67.05	0.76	5.20	3.69	5.65	0.000266	3.35	67.64	36.79	0.51
main canal	300.00	100-yr ARI	88.04	0.76	5.94	4.12	6.39	0.000233	3.48	98.27	43.47	0.49
main canal	300.00	PMF	292.10	0.76	10.42	7.51	11.02	0.000178	4.63	355.51	83.25	0.48
main canal	300.00	100-yr ARI + 10%	97.50	0.76	6.28	4.35	6.71	0.000215	3.49	113.13	45.04	0.48

HEC-RAS Plan: P02A-PROP 58% bl River: hc Reach: main canal (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
main canal	300.00	100-yr ARI + 20%	107.00	0.76	6.55	4.92	7.00	0.000208	3.55	125.90	46.31	0.47
main canal	300.00	100-yr ARI + 30%	115.55	0.76	6.77	5.08	7.22	0.000206	3.62	136.02	47.29	0.47
main canal	275.00	20-yr ARI	67.05	0.65	5.11	3.66	5.64	0.000288	3.52	55.84	29.44	0.53
main canal	275.00	100-yr ARI	88.04	0.65	5.71	4.21	6.36	0.000308	3.96	77.23	43.79	0.56
main canal	275.00	PMF	292.10	0.65	10.54	8.04	10.96	0.000131	4.04	420.32	85.98	0.41
main canal	275.00	100-yr ARI + 10%	97.50	0.65	6.08	4.37	6.69	0.000275	3.92	94.03	48.14	0.54
main canal	275.00	100-yr ARI + 20%	107.00	0.65	6.37	4.88	6.97	0.000262	3.96	108.55	52.75	0.53
main canal	275.00	100-yr ARI + 30%	115.55	0.65	6.59	5.11	7.20	0.000257	4.02	120.77	56.70	0.53
main canal	250.00	20-yr ARI	67.05	0.67	5.19	3.63	5.59	0.000403	3.32	63.15	30.36	0.53
main canal	250.00	100-yr ARI	88.04	0.67	5.86	4.06	6.29	0.000371	3.53	87.29	42.80	0.52
main canal	250.00	PMF	292.10	0.67	10.64	7.62	10.91	0.000148	3.57	431.01	83.71	0.37
main canal	250.00	100-yr ARI + 10%	97.50	0.67	6.21	4.37	6.62	0.000334	3.51	103.53	49.48	0.50
main canal	250.00	100-yr ARI + 20%	107.00	0.67	6.50	4.60	6.91	0.000316	3.54	118.54	54.83	0.49
main canal	250.00	100-yr ARI + 30%	115.55	0.67	6.72	5.05	7.13	0.000306	3.59	131.28	58.85	0.49
main canal	225.00	20-yr ARI	67.05	0.53	5.08	3.59	5.57	0.000271	3.43	56.41	25.25	0.52
main canal	225.00	100-yr ARI	88.04	0.53	5.65	4.13	6.26	0.000292	3.86	71.90	29.08	0.55
main canal	225.00	PMF	292.10	0.53	10.43	8.05	10.89	0.000143	4.21	396.16	83.50	0.43
main canal	225.00	100-yr ARI + 10%	97.50	0.53	5.96	4.38	6.59	0.000288	3.98	81.16	32.43	0.55
main canal	225.00	100-yr ARI + 20%	107.00	0.53	6.10	4.68	6.86	0.000329	4.33	87.24	46.59	0.59
main canal	225.00	100-yr ARI + 30%	115.55	0.53	6.30	4.68	7.09	0.000328	4.43	97.17	51.37	0.59
main canal	200.00	20-yr ARI	67.05	0.48	5.08	3.56	5.56	0.000259	3.39	54.11	20.81	0.51
main canal	200.00	100-yr ARI	88.04	0.48	5.58	4.12	6.25	0.000312	3.99	65.81	27.31	0.57
main canal	200.00	PMF	292.10	0.48	10.31	8.09	10.88	0.000165	4.51	347.84	69.26	0.46
main canal	200.00	100-yr ARI + 10%	97.50	0.48	5.82	4.35	6.57	0.000331	4.23	76.23	40.99	0.59
main canal	200.00	100-yr ARI + 20%	107.00	0.48	6.10	4.57	6.85	0.000315	4.28	87.97	42.44	0.58
main canal	200.00	100-yr ARI + 30%	115.55	0.48	6.31	4.77	7.07	0.000311	4.36	96.97	43.48	0.58
main canal	175.00	20-yr ARI	67.05	0.68	5.09	3.54	5.55	0.000264	3.36	57.00	20.31	0.51
main canal	175.00	100-yr ARI	88.04	0.68	5.66	4.09	6.26	0.000294	3.85	69.46	23.41	0.55
main canal	175.00	PMF	292.10	0.68	10.26	8.13	10.87	0.000180	4.65	330.49	64.25	0.48
main canal	175.00	100-yr ARI + 10%	97.50	0.68	5.85	4.32	6.55	0.000325	4.14	74.46	28.17	0.58
main canal	175.00	100-yr ARI + 20%	107.00	0.68	6.01	4.53	6.83	0.000364	4.48	80.11	38.29	0.62
main canal	175.00	100-yr ARI + 30%	115.55	0.68	6.17	4.72	7.05	0.000377	4.65	86.49	41.28	0.63
main canal	150.00	20-yr ARI	67.05	0.50	5.01	3.51	5.53	0.000278	3.49	50.88	20.58	0.53
main canal	150.00	100-yr ARI	88.04	0.50	5.59	4.00	6.25	0.000302	3.95	63.43	22.50	0.56
main canal	150.00	PMF	292.10	0.50	10.10	8.39	10.85	0.000206	4.98	306.48	66.30	0.51
main canal	150.00	100-yr ARI + 10%	97.50	0.50	5.83	4.46	6.54	0.000312	4.14	68.82	23.28	0.57
main canal	150.00	100-yr ARI + 20%	107.00	0.50	6.04	4.69	6.81	0.000324	4.33	73.82	23.98	0.59
main canal	150.00	100-yr ARI + 30%	115.55	0.50	6.16	4.91	7.04	0.000355	4.60	76.85	26.79	0.62
main canal	125.00	20-yr ARI	67.05	0.82	4.24	4.24	5.45	0.001194	5.27	29.51	16.67	0.97
main canal	125.00	100-yr ARI	88.04	0.82	4.78	4.78	6.16	0.001129	5.71	39.09	19.15	0.97
main canal	125.00	PMF	292.10	0.82	10.19	8.81	10.80	0.000227	4.74	367.39	100.00	0.51
main canal	125.00	100-yr ARI + 10%	97.50	0.82	5.00	5.00	6.45	0.001108	5.89	43.41	20.17	0.97
main canal	125.00	100-yr ARI + 20%	107.00	0.82	5.23	5.23	6.72	0.001063	6.00	48.27	21.10	0.96
main canal	125.00	100-yr ARI + 30%	115.55	0.82	5.40	5.40	6.96	0.001057	6.16	51.95	21.71	0.96
main canal	100.00	20-yr ARI	67.05	0.77	3.99	4.20	5.40	0.001591	5.69	27.32	16.64	1.09
main canal	100.00	100-yr ARI	88.04	0.77	4.40	4.70	6.10	0.001636	6.33	34.48	17.95	1.13
main canal	100.00	PMF	292.10	0.77	10.26	8.90	10.76	0.000201	4.43	395.53	100.00	0.47
main canal	100.00	100-yr ARI + 10%	97.50	0.77	4.59	4.90	6.38	0.001627	6.55	37.87	18.53	1.14
main canal	100.00	100-yr ARI + 20%	107.00	0.77	4.78	5.10	6.65	0.001594	6.73	41.50	19.14	1.13
main canal	100.00	100-yr ARI + 30%	115.55	0.77	4.95	5.27	6.89	0.001558	6.86	44.87	19.69	1.13
main canal	75.00	20-yr ARI	67.05	0.33	3.01	3.66	5.26	0.002625	6.93	17.52	11.49	1.41
main canal	75.00	100-yr ARI	88.04	0.33	3.56	4.22	5.98	0.002209	7.26	24.39	13.45	1.33
main canal	75.00	PMF	292.10	0.33	7.99	7.99	10.55	0.000841	8.17	152.37	65.38	0.96
main canal	75.00	100-yr ARI + 10%	97.50	0.33	3.80	4.46	6.27	0.002062	7.38	27.69	14.30	1.30
main canal	75.00	100-yr ARI + 20%	107.00	0.33	4.04	4.68	6.55	0.001921	7.47	31.22	15.16	1.27
main canal	75.00	100-yr ARI + 30%	115.55	0.33	4.25	4.88	6.78	0.001815	7.55	34.47	15.90	1.25
main canal	50.00	20-yr ARI	67.05	0.34	4.00	3.13	4.63	0.000474	3.97	49.36	21.93	0.66
main canal	50.00	100-yr ARI	88.04	0.34	4.64	3.65	5.36	0.000451	4.31	64.46	25.29	0.66
main canal	50.00	PMF	292.10	0.34	5.55	7.04	10.30	0.002403	11.31	89.59	29.89	1.58
main canal	50.00	100-yr ARI + 10%	97.50	0.34	4.91	3.87	5.66	0.000440	4.43	71.50	26.66	0.66
main canal	50.00	100-yr ARI + 20%	107.00	0.34	5.21	4.09	5.97	0.000419	4.51	79.57	28.14	0.65
main canal	50.00	100-yr ARI + 30%	115.55	0.34	5.51	4.27	6.27	0.000386	4.51	88.49	29.70	0.63
main canal	25.00	20-yr ARI	67.05	0.31	3.31	3.31	4.55	0.001228	5.37	29.30	15.54	1.00
main canal	25.00	100-yr ARI	88.04	0.31	3.84	3.84	5.27	0.001157	5.83	38.12	17.40	1.00
main canal	25.00	PMF	292.10	0.31	6.16	7.40	9.96	0.001768	10.15	121.94	66.79	1.35
main canal	25.00	100-yr ARI + 10%	97.50	0.31	4.07	4.07	5.57	0.001133	6.01	42.06	18.14	1.00
main canal	25.00	100-yr ARI + 20%	107.00	0.31	4.17	4.17	5.86	0.001232	6.39	43.97	18.50	1.05
main canal	25.00	100-yr ARI + 30%	115.55	0.31	4.22	4.22	6.14	0.001375	6.80	44.88	18.98	1.11


hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 850.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 875.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 600.00
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 575.04
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 550.11
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 524.97
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 500.86
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 455 Culv Longport Street culvert
Elevation (m)
Station (m)
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Ineff
Bank Sta


hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 455 Culv Longport Street culvert
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 425.00
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 400.00
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 375.00
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 350.00
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 325.00
hawthorne canal 1D study Plan: Plan 02A - Prop with 58% blockage 17/11/2011
Geom: Prop + 58% blockage Flow: Flows from DRAINS
River = hc Reach = main canal RS = 300.00
Elevation (m)
Station (m)
.08
.08
Legend
WS PMF
WS 100-yr ARI + 30%
WS 100-yr ARI + 20%
WS 100-yr ARI + 10%
WS 100-yr ARI
WS 20-yr ARI
Ground
Levee
Bank Sta

APPENDIX 5

Flood Extent Plan – Overland Flow

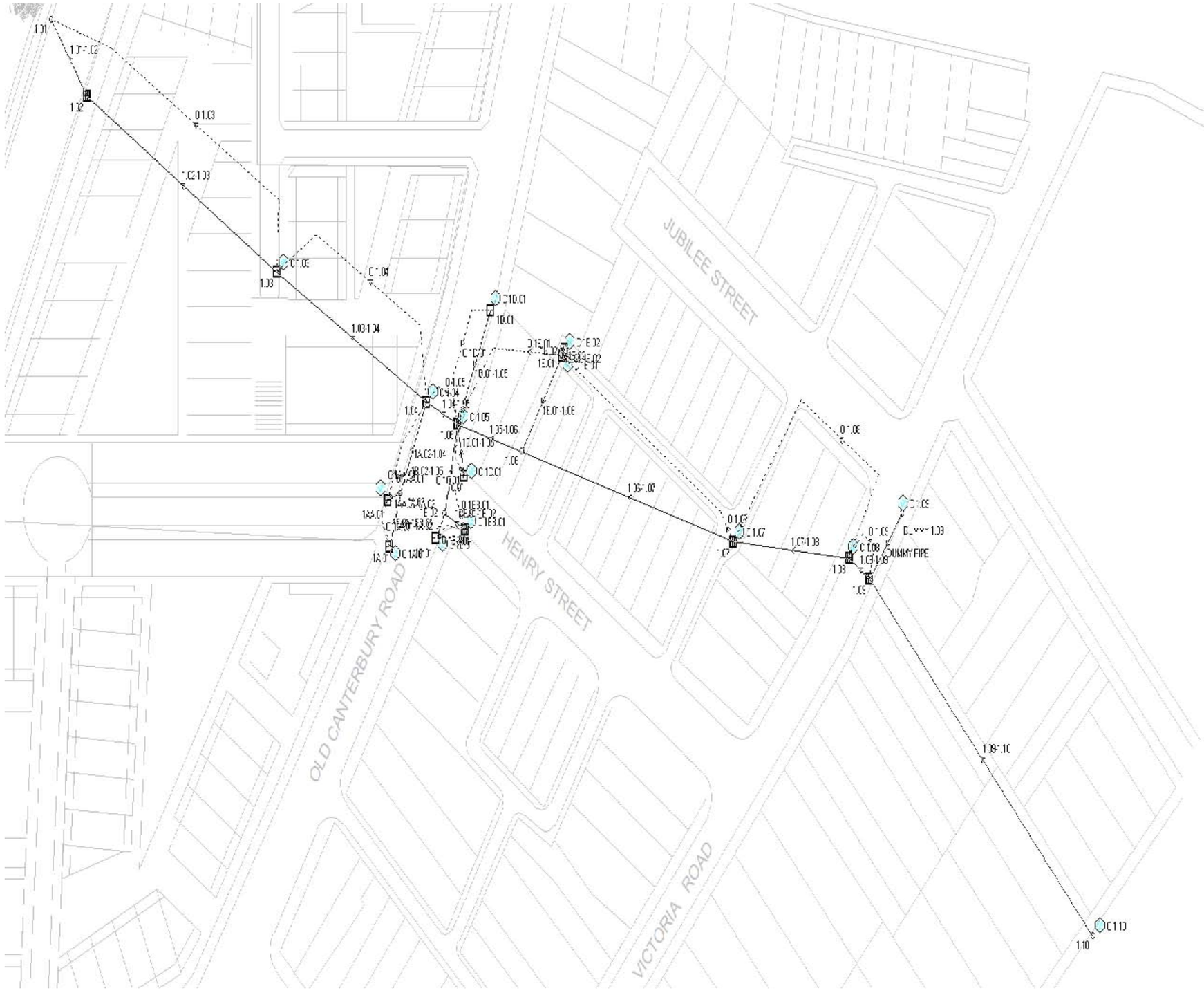
Existing Site Conditions


Alfred St
Longport St
Smith St
78 Old Canterbury Rd, Lewisham NSW, Aus
McGill St
Henry St
Toothill Ln
N
AMENDMENTS/REVISIONS
Rev
Issue
Description
Initials
Date
01
SA ISSUE
S.A.
16.11.11
CONSULTANT
Cardno ITC
Shaping the Future
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BRISBANE
CANBERRA
MELBOURNE
PERTH
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PROJECT
78-90 Old Canterbury Rd
Lewisham
NSW
DRAWING TITLE
LOCAL CATCHMENT OVERLAND FLOWPATH
FLOOD EXTEND PLAN
100-YR ARI
DRAWN
S.A.
DESIGNED
S.H.
CHECKED
S.H.
SCALE (AT FULL SIZE)
1:500
DATE
Nov '11
DRAWING No.
N09612-DA-H06
REVISION
01

APPENDIX 6

DRAINS Model Results – Overland Flow

Existing Site Conditions


JUBILEE STREET
HENRY STREET
OLD CANTERBURY ROAD
VICTORIA ROAD
DUMMY PIPE

PIT / NODE DETAILS			Version 10														
Name	Type	Family	Size	Ponding	Pressure	Surface	Max Pond	Base	Blocking	x	y	Bolt-down	id	Part Full	Inflow		
				Volume	Change	Elev (m)	Depth (m)	Inflow	Factor			lid		Shock Loss	Hydrograph		
				(cu.m)	Coeff. Ku			(cu.m/s)									
1AA.01	Sag	NSW Dept. of H	RM10 2.4 m lintel	10	0.5	13.24	0.15	0	0.5	144.866	3.808	No	9	1 x Ku	No		
1A.02	Node					13.47		0		149.028	5.202		60				
1.04	Sag	NSW Dept. of H	RM10 2.4 m lintel	20	1.5	12.42	0.19	0	0.5	157.558	24.737	No	5	1 x Ku	No		
1.03	Sag	NSW Dept. of H	RM10 2.4 m lintel	10	0	10.37	0.15	0	0.5	108.707	52.294	No	6	1 x Ku	No		
1.02	OnGrade	NSW Dept. of H	RM7		0.5	9.8		0	0.2	46.711	89.723	Yes	7	1 x Ku	No		
1.01	Node					9.6		0		34.907	106.166		39				
1A.01	OnGrade	NSW Dept. of H	RM10 2.4 m lintel		0.5	13.58		0	0.2	145.569	-6.125	No	10	1 x Ku	No		
1B.01	Sag	NSW Dept. of H	RM10 2.4 m lintel	10	0.5	13.05	0.15	0	0.5	160.728	-4.368	No	12	1 x Ku	No		
1B.02	Node					13.1		0		163.514	0.892		74				
1.05	Sag	NSW Dept. of H	RM10 2.4 m lintel	15	1.7	12.54	0.1	0	0.5	167.856	20.02	No	4	1 x Ku	No		
1BB.01	Sag	NSW Dept. of H	RM10 2.4 m lintel	10	0.5	12.87	0.15	0	0.5	170.33	-2.496	No	13	1 x Ku	No		
1C.01	Sag	NSW Dept. of H	RM10 2.4 m lintel	15	0.5	12.74	0.15	0	0.5	169.823	9.013	No	14	1 x Ku	No		
1D.01	OnGrade	Manual	kerb inlet all inflows 0.5cums		0.5	12.89		0	0.2	178.473	44.123	No	16	1 x Ku	No		
1E.02	Sag	NSW Dept. of H	RM10 2.4 m lintel	10	0.5	13.35	0.15	0	0.5	202.614	35.946	No	19	1 x Ku	No		
1E.01	Sag	NSW Dept. of H	RM10 2.4 m lintel	10	2.5	13.3	0.15	0	0.5	201.804	34.496	No	18	1 x Ku	No		
1.06	Node					13		0		188.758	14.139		81				
1.1	Node					20		0		375.295	-88.987		259				
1.09	Sag	NSW Dept. of H	RM10 2.4 m lintel	10	0.7	15.5	0.15	0	0.5	302.447	-12.988	Yes	2	1 x Ku	No		
1.08	Sag	NSW Dept. of H	RM10 2.4 m lintel	10	0.5	15.4	0.15	0	0.5	295.702	-8.613	No	1	1 x Ku	No		
1.07	Sag	Manual	kerb inlet all inflows 0.5cums	15	0.5	14	0.15	0	0.5	257.847	-5.086	No	3	1 x Ku	No		
DUMMY 1.09	Node					15.6		0		312.996	0.955		286				

SUB-CATCHMENT DETAILS																	
Name	Pit or	Total	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp	Paved	Grass	Supp
	Node	Area	Area	Area	Area	Time	Time	Time	Length	Length	Length	Slope(%)	Slope	Slope	Rough	Rough	Rough
		(ha)	%	%	%	(min)	(min)	(min)	(m)	(m)	(m)	%	%	%			
C 1AA.01	1AA.01	0.01	80	20	0	5	0	0	20	20	0.1	3	3	1	0.013	0.2	0.013
C 1.04	1.04	0.133	80	20	0	5	0	0	98	98	0.1	2.4	2.4	1	0.013	0.2	0.013
C 1.03	1.03	0.873	80	20	0	5	0	0	116	116	0.1	1.5	1.5	1	0.013	0.2	0.013
C 1A.01	1A.01	0.0774	80	20	0	5	0	0	85	85	0.1	3	3	1	0.013	0.2	0.013
C 1B.01	1B.01	0.74	80	20	0	5	0	0	151	151	0.1	5.3	5.3	1	0.013	0.2	0.013
C 1.05	1.05	0.191	80	20	0	5	0	0	68.8	68.8	0.1	4.9	4.9	1	0.013	0.2	0.013
C 1BB.01	1BB.01	0.617	80	20	0	5	0	0	132	132	0.1	5.3	5.3	1	0.013	0.2	0.013
C 1C.01	1C.01	0.057	80	20	0	5	0	0	74	74	0.1	5	5	1	0.013	0.2	0.013
C 1D.01	1D.01	0.34	80	20	0	5	0	0	83	83	0.1	5	5	1	0.013	0.2	0.013
C 1E.02	1E.02	1.04	80	20	0	5	0	0	172	172	0.1	5.2	5.2	1	0.013	0.2	0.013
C 1E.01	1E.01	0.2	80	20	0	5	0	0	71.6	71.6	0.1	5.6	5.6	1	0.013	0.2	0.013
C 1.10	1.1	8.18	80	20	0	5	0	0	340	340	0.1	5.35	5.35	1	0.013	0.2	0.013
C 1.08	1.08	0.035	80	20	0	5	0	0	53	53	0.1	2	2	1	0.013	0.2	0.013
C 1.07	1.07	0.296	80	20	0	5	0	0	56	56	0.1	5.35	5.35	1	0.013	0.2	0.013
C 1.09	DUMMY 1.09	3.98	80	20	0	5	0	0	238	238	0.1	5.6	5.6	1	0.013	0.2	0.013

PIPE DETAILS																
Name	From	To	Length	U/S IL	D/S IL	Slope	Type	Dia	I.D.	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg	Rl	Chg
			(m)	(m)	(m)	(%)		(mm)	(mm)						(m)	(m)	(m)
1AA.01-1A.02	1AA.01	1A.02	4.40577	12.34	12.296	1	Concrete, under roads	300	300	0.013	Existing	1	1AA.01	0			
1A.02-1.04	1A.02	1.04	21.0704	12.266	11.52	3.54	Concrete, under roads	300	300	0.013	Existing	1	1A.02	0			
1.03-1.04	1.04	1.03	55.6957	7.085	4.209	5.16	Concrete, under roads	900	900	0.013	Existing	1	1.04	0			
1.02-1.03	1.03	1.02	71.9131	4.156	2.792	1.9	Concrete, under roads	1200	1200	0.013	Existing	1	1.03	0			
1.01-1.02	1.02	1.01	20.1	2.792	2.017	3.86	Concrete, under roads	1200	1200	0.013	Existing	1	1.02	0			
1A.01-1A.02	1A.01	1A.02	11.8603	12.68	12.296	3.24	Concrete, under roads	300	300	0.013	Existing	1	1A.01	0			
1B.01-1BB.01	1B.01	1B.02	5.96491	12	11.894	1.78	Concrete, under roads	450	450	0.013	Existing	1	1B.01	0			
1B.02-1.05	1B.02	1.05	19.4095	11.864	11.49	1.93	Concrete, under roads	450	450	0.013	Existing	1	1B.02	0			
1.04-1.05	1.05	1.04	11.2473	7.677	7.115	5	Concrete, under roads	900	900	0.013	Existing	1	1.05	0			
1BB.01-1B.02	1BB.01	1B.02	7.61907	11.97	11.894	1	Concrete, under roads	300	300	0.013	Existing	1	1BB.01	0			
1C.01-1.05	1C.01	1.05	11.1029	11.84	11.64	1.8	Concrete, under roads	300	300	0.013	Existing	1	1C.01	0			
1D.01-1.05	1D.01	1.05	26.1544	11.84	11.49	1.34	Concrete, under roads	450	450	0.013	Existing	1	1D.01	0			
1E.01-1E.02	1E.02	1E.01	1.64884	12.45	12.434	0.97	Concrete, under roads	300	300	0.013	Existing	1	1E.02	0			
1E.01-1.06	1E.01	1.06	23.9669	12.404	11.206	5	Concrete, under roads	225	225	0.013	Existing	1	1E.01	0			
1.05-1.06	1.06	1.05	21.5544	8.785	7.707	5	Concrete, under roads	900	900	0.013	Existing	1	1.06	0			
1.09-1.10	1.1	1.09	94.4	18.473	13.753	5	Concrete, under roads	750	750	0.013	Existing	1	1.1	0			
1.08-1.09	1.09	1.08	7.98335	13.723	13.324	5	Box Culverts	1W x 0.9H		0.012	Existing	1	1.09	0			
1.07-1.08	1.08	1.07	37.7541	13.294	11.406	5	Box Culverts	1W x 0.9H		0.012	Existing	1	1.08	0			
1.06-1.07	1.07	1.06	71.2205	11.376	7.815	5	Box Culverts	1W x 0.9H		0.012	Existing	1	1.07	0			
DUMMY PIPE	DUMMY 1.09	1.09	10	13.953	13.753	2	Concrete, under roads	750	750	0.013	Existing	1	DUMMY 1.09	0			

OVERFLOW ROUTE DETAILS													
Name	From	To	Travel	Spill	Crest	Weir	Cross	Safe Depth	SafeDepth	Safe	Bed	D/S Area	id
			Time	Level	Length	Coeff. C	Section	Major Storms	Minor Storms	DxV	Slope	Contributing	
			(min)	(m)	(m)			(m)	(m)	(sq.m/sec)	(%)	%	
O 1AA.01	1AA.01	1.04	2				8 m wide road (half section)	0.3	0.15	0.4	3.7	0	185
O 1.04	1.04	1.03	5				Dummy used to model flow across road low points	0.2	0.05	0.6	4.5	0	206
O 1.03	1.03	1.01	5				Dummy used to model flow across road low points	0.2	0.05	0.6	1.1	0	208
O 1A.01	1A.01	1AA.01	1				8 m wide road (half section)	0.3	0.15	0.4	3.9	0	183
O 1B.01	1B.01	1BB.01	1				8 m wide road (half section)	0.3	0.15	0.4	1.9	0	192
O 1.05	1.05	1.04	1				Dummy used to model flow across road low points	0.2	0.05	0.6	2.7	0	181
O 1BB.01	1BB.01	1C.01	1				Dummy used to model flow across road low points	0.2	0.05	0.6	2.8	0	195
O 1C.01	1C.01	1.05	1				8 m wide road (half section)	0.3	0.15	0.4	1.9	0	200
O 1D.01	1D.01	1.05	2				8 m wide road (half section)	0.3	0.15	0.4	1.5	0	157
O 1E.02	1E.02	1E.01	1				Dummy used to model flow across road low points	0.2	0.05	0.6	13.7	0	152
O 1E.01	1E.01	1.05	5				Dummy used to model flow across road low points	0.2	0.05	0.6	2.3	0	154
O 1.09	1.09	1.08	1				Dummy used to model flow across road low points	0.2	0.05	0.6	3.4	0	146
O 1.08	1.08	1.07	5				8 m wide road (half section)	0.3	0.15	0.4	2	0	148
O 1.07	1.07	1E.01	5				8 m wide road (half section)	0.3	0.15	0.4	1.1	0	150

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PIT / NODE DETAILS — Version 8

Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivii (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
1AA.01	12.41	13.26	0.005	0.5	0.83	0	Inlet Capacity
1A.02	12.36		0				
1.04	10.58	12.61	2.009	17.1	1.84	1.842	Inlet Capacity
1.03	6.56	10.52	2.03	8.6	3.81	1.88	Inlet Capacity
1.02	6		0		3.8		None
1.01	5.6		1.88				
1A.01	12.81		0.037		0.77	0	None
1B.01	13.07	13.2	0.343	8.6	-0.02	0.227	Outlet System
1B.02	13.05		0				
1.05	13.03	12.64	2.194	12.9	-0.49	1.978	Outlet System
1BB.01	13.04	13.02	0.516	8.6	-0.17	0.502	Outlet System
1C.01	12.89	12.89	0.528	12.9	-0.15	0.526	Outlet System
1D.01	12.94		0.167		-0.05	0.199	Outlet System
1E.02	13.49	13.5	0.475	8.6	-0.14	0.47	Outlet System
1E.01	13.48	13.45	1.802	8.6	-0.18	1.643	Outlet System
1.06	13.8		0				
1.1	24.49		3.396				
1.09	16.3	15.5	0	0	-0.8	0	Outlet System
1.08	15.92	15.55	0.017	8.6	-0.52	0.3	Outlet System
1.07	14.86	14.15	0.439	12.9	-0.86	1.283	Outlet System
DUMMY 1.	16.52		1.768				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C 1AA.01	0.005	0.004	0.001	6.35	6.96	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1.04	0.062	0.056	0.007	8.75	19.32	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1.03	0.39	0.359	0.036	9.78	24.62	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1A.01	0.037	0.033	0.005	8.22	16.59	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1B.01	0.343	0.31	0.038	8.83	19.75	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1.05	0.096	0.083	0.014	7.45	12.62	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1BB.01	0.29	0.26	0.034	8.53	18.22	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1C.01	0.028	0.025	0.004	7.54	13.1	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1D.01	0.167	0.146	0.023	7.72	14.03	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1E.02	0.475	0.432	0.049	9.17	21.48	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1E.01	0.101	0.087	0.015	7.41	12.41	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1.10	3.396	3.17	0.259	11.22	32.05	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1.08	0.017	0.015	0.002	7.74	14.11	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1.07	0.153	0.129	0.024	7.11	10.86	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
C 1.09	1.768	1.631	0.158	9.95	25.52	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
1AA.01-1A	0.005	0.44	12.405	12.364	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1A.02-1.04	0.042	2.09	12.364	11.618	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1.03-1.04	3.346	5.26	8.46	6.562	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1.02-1.03	3.463	3.06	6.562	5.997	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1.01-1.02	3.463	3.06	5.869	5.6	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1A.01-1A.0	0.037	1.95	12.774	12.39	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1B.01-1BB	0.133	0.83	13.055	13.048	AR&R 20 year, 1.5 hours storm, average 55 mm/h, Zone 1
1B.02-1.05	0.279	1.75	13.048	13.028	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1.04-1.05	3.16	4.97	10.913	10.576	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1BB.01-1B	0.123	1.74	13.048	13.048	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1C.01-1.05	0.108	1.53	12.89	13.028	AR&R 20 year, 1.5 hours storm, average 55 mm/h, Zone 1
1D.01-1.05	0.139	0.88	13.021	13.028	AR&R 20 year, 10 minutes storm, average 162 mm/h, Zone 1
1E.01-1E.0	0.083	1.17	13.483	13.484	AR&R 20 year, 2 hours storm, average 45.3 mm/h, Zone 1
1E.01-1.06	0.111	2.78	13.796	13.805	AR&R 20 year, 10 minutes storm, average 162 mm/h, Zone 1
1.05-1.06	3.457	5.43	13.805	13.028	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1.09-1.10	3.301	7.47	24.494	16.3	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1.08-1.09	4.947	5.5	16.153	15.919	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1.07-1.08	4.648	5.16	15.834	14.858	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
1.06-1.07	3.475	3.86	14.832	13.805	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
DUMMY PI	1.763	3.99	16.516	16.3	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
O 1AA.01	0	0	0.458	0	0	0	0	
O 1.04	1.842	1.842	0.543	0.082	0.16	20.43	1.95	AR&R 20 year, 1 hour storm, average 71 mm/h, Zone 1
O 1.03	1.88	1.88	0.268	0.111	0.13	26.18	1.16	AR&R 20 year, 1 hour storm, average 71 mm/h, Zone 1
O 1A.01	0	0	0.47	0	0	0	0	
O 1B.01	0.227	0.227	0.328	0.134	0.2	3.1	1.47	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1.05	1.978	1.978	0.421	0.094	0.16	22.77	1.65	AR&R 20 year, 1 hour storm, average 71 mm/h, Zone 1
O 1BB.01	0.502	0.502	0.428	0.053	0.06	14.69	1.14	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1C.01	0.526	0.526	0.328	0.177	0.28	5.34	1.59	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1D.01	0.199	0.199	0.291	0.134	0.17	3.1	1.29	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1E.02	0.47	0.47	0.948	0.038	0.08	11.63	1.97	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1E.01	1.643	1.643	0.388	0.09	0.13	22.05	1.47	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1.09	0	0	0.472	0	0	0	0	
O 1.08	0.3	0.3	0.336	0.145	0.23	3.46	1.58	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1.07	1.283	1.283	0.249	0.238	0.43	6.4	1.81	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1

DRAINS results prepared 18 November, 2011 from Version 2011.17

PIT / NODE DETAILS — Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
1AA.01	12.42	13.26	0.008	0.7	0.82	0	Inlet Capacity
1A.02	12.37		0				
1.04	11	12.61	3.411	17.1	1.42	3.244	Inlet Capacity
1.03	7.26	10.52	3.49	8.6	3.11	3.323	Inlet Capacity
1.02	6.73		0		3.07		None
1.01	6.36		3.323				
1A.01	12.83		0.046		0.75	0.001	Inlet Capacity
1B.01	13.24	13.2	0.423	8.6	-0.19	0.415	Outlet System
1B.02	13.26		0				
1.05	13.27	12.64	3.435	12.9	-0.73	3.373	Outlet System
1BB.01	13.08	13.02	0.772	8.6	-0.21	0.778	Outlet System
1C.01	12.89	12.89	0.811	12.9	-0.15	0.809	Outlet System
1D.01	12.96		0.208		-0.07	0.274	Outlet System
1E.02	13.49	13.5	0.586	8.6	-0.14	0.583	Outlet System
1E.01	13.49	13.45	2.926	8.6	-0.19	2.72	Outlet System
1.06	14.13		0				
1.1	29.88		4.271				
1.09	17.24	15.5	0	0	-1.74	0	Outlet System
1.08	16.75	15.55	0.021	8.6	-1.35	0.622	Outlet System
1.07	15.29	14.15	0.793	12.9	-1.29	2.326	Outlet System
DUMMY 1.09	17.57		2.18				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C 1AA.01	0.007	0.005	0.001	6.21	6.24	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.04	0.076	0.067	0.01	8.36	17.3	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.03	0.481	0.434	0.059	9.28	22.04	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1A.01	0.046	0.04	0.007	7.88	14.86	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1B.01	0.423	0.374	0.057	8.43	17.68	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.05	0.119	0.099	0.02	7.19	11.3	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1BB.01	0.358	0.313	0.05	8.16	16.31	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1C.01	0.035	0.03	0.006	7.28	11.73	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1D.01	0.208	0.176	0.033	7.44	12.57	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1E.02	0.586	0.522	0.077	8.73	19.23	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1E.01	0.125	0.104	0.021	7.16	11.12	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.10	4.271	3.931	0.428	10.57	28.7	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.08	0.021	0.018	0.003	7.45	12.64	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.07	0.187	0.155	0.032	6.89	9.72	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.09	2.18	1.973	0.261	9.43	22.85	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
1AA.01-1A.02	0.007	0.49	12.417	12.375	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1A.02-1.04	0.051	2.21	12.375	11.629	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1.03-1.04	3.233	5.08	9.028	7.259	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1.02-1.03	3.349	2.96	7.259	6.731	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1.01-1.02	3.349	2.96	6.579	6.36	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1A.01-1A.02	0.045	2.06	12.784	12.4	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1B.01-1BB.01	0.125	0.78	13.261	13.261	AR&R 100 year, 3 hours storm, average 45.8 mm/h, Zone 1
1B.02-1.05	0.249	1.57	13.261	13.266	AR&R 100 year, 3 hours storm, average 45.8 mm/h, Zone 1
1.04-1.05	3.022	4.75	11.313	11.002	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1BB.01-1B.02	0.12	1.7	13.255	13.261	AR&R 100 year, 6 hours storm, average 28.5 mm/h, Zone 1
1C.01-1.05	0.105	1.49	12.89	13.266	AR&R 100 year, 10 minutes storm, average 211 mm/h, Zone 1
1D.01-1.05	0.165	1.04	13.247	13.266	AR&R 100 year, 10 minutes storm, average 211 mm/h, Zone 1
1E.01-1E.02	0.083	1.17	13.488	13.489	AR&R 100 year, 3 hours storm, average 45.8 mm/h, Zone 1
1E.01-1.06	0.112	2.81	14.11	14.128	AR&R 100 year, 10 minutes storm, average 211 mm/h, Zone 1
1.05-1.06	3.643	5.73	14.128	13.266	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1.09-1.10	4.128	9.34	29.877	17.236	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1.08-1.09	6.172	6.86	17.118	16.754	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1.07-1.08	5.552	6.17	16.686	15.292	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1.06-1.07	3.672	4.08	15.269	14.128	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
DUMMY PIPE	2.174	4.92	17.568	17.236	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1

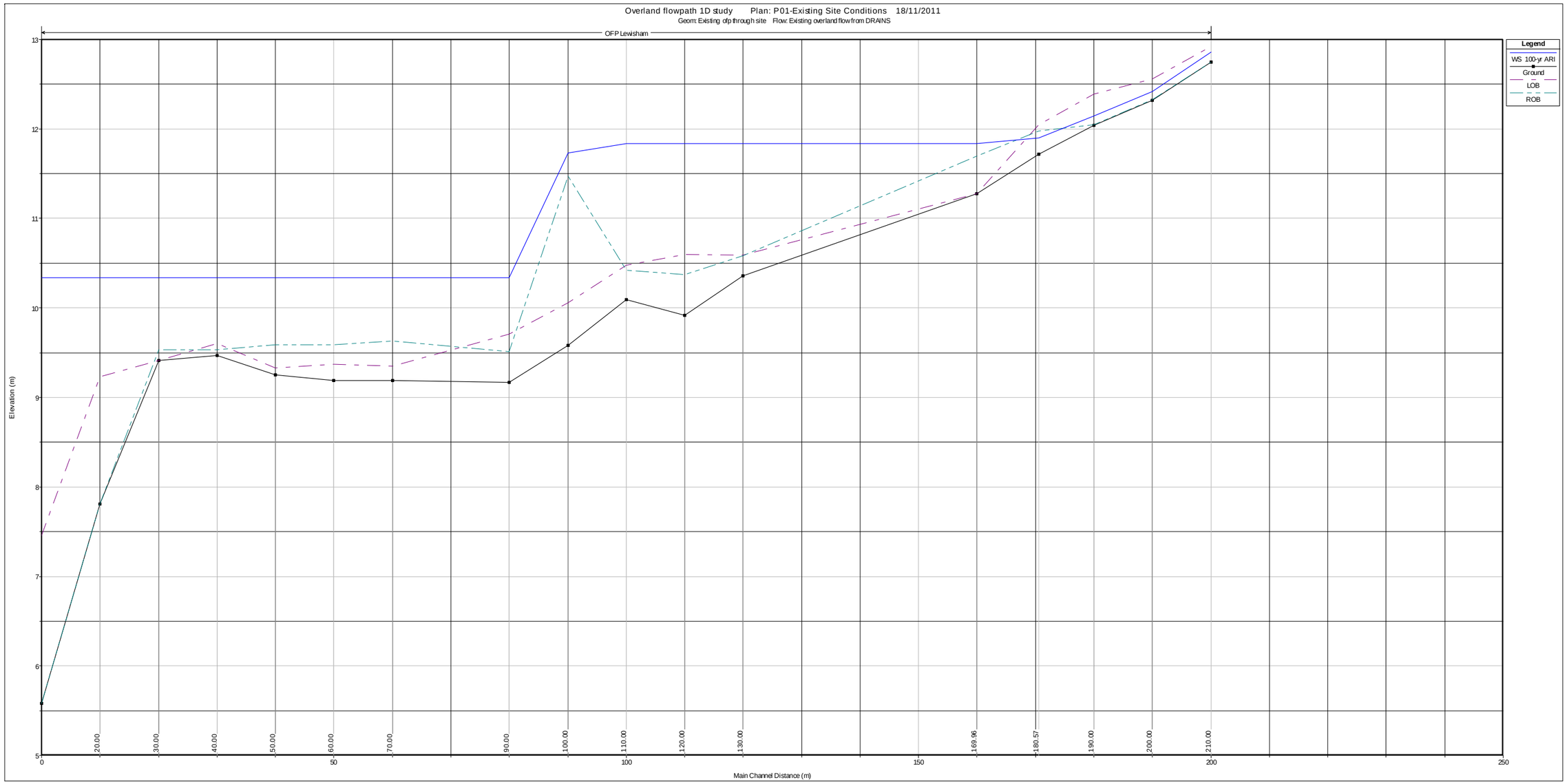
OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
O 1AA.01	0	0	0.742	0	0	0	0	
O 1.04	3.244	3.244	13.008	0.104	0.24	24.74	2.27	AR&R 100 year, 1 hour storm, average 95 mm/h, Zone 1
O 1.03	3.323	3.323	8.039	0.14	0.19	31.93	1.36	AR&R 100 year, 1 hour storm, average 95 mm/h, Zone 1
O 1A.01	0.001	0.001	0.722	0.019	0.01	0.16	0.68	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1B.01	0.415	0.415	0.966	0.166	0.25	4.8	1.5	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1.05	3.373	3.373	12.595	0.117	0.22	27.44	1.89	AR&R 100 year, 1 hour storm, average 95 mm/h, Zone 1
O 1BB.01	0.778	0.778	12.826	0.063	0.08	16.66	1.31	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1C.01	0.809	0.809	0.966	0.197	0.36	6.33	1.81	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1D.01	0.274	0.274	1.073	0.147	0.2	3.53	1.39	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1E.02	0.583	0.583	9.749	0.042	0.09	12.35	2.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1E.01	2.72	2.72	11.625	0.111	0.19	26.18	1.69	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1.09	0	0	14.134	0	0	0	0	
O 1.08	0.622	0.622	0.991	0.183	0.31	5.65	1.7	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1.07	2.326	2.326	1.162	0.286	0.65	6.4	2.28	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1

APPENDIX 7

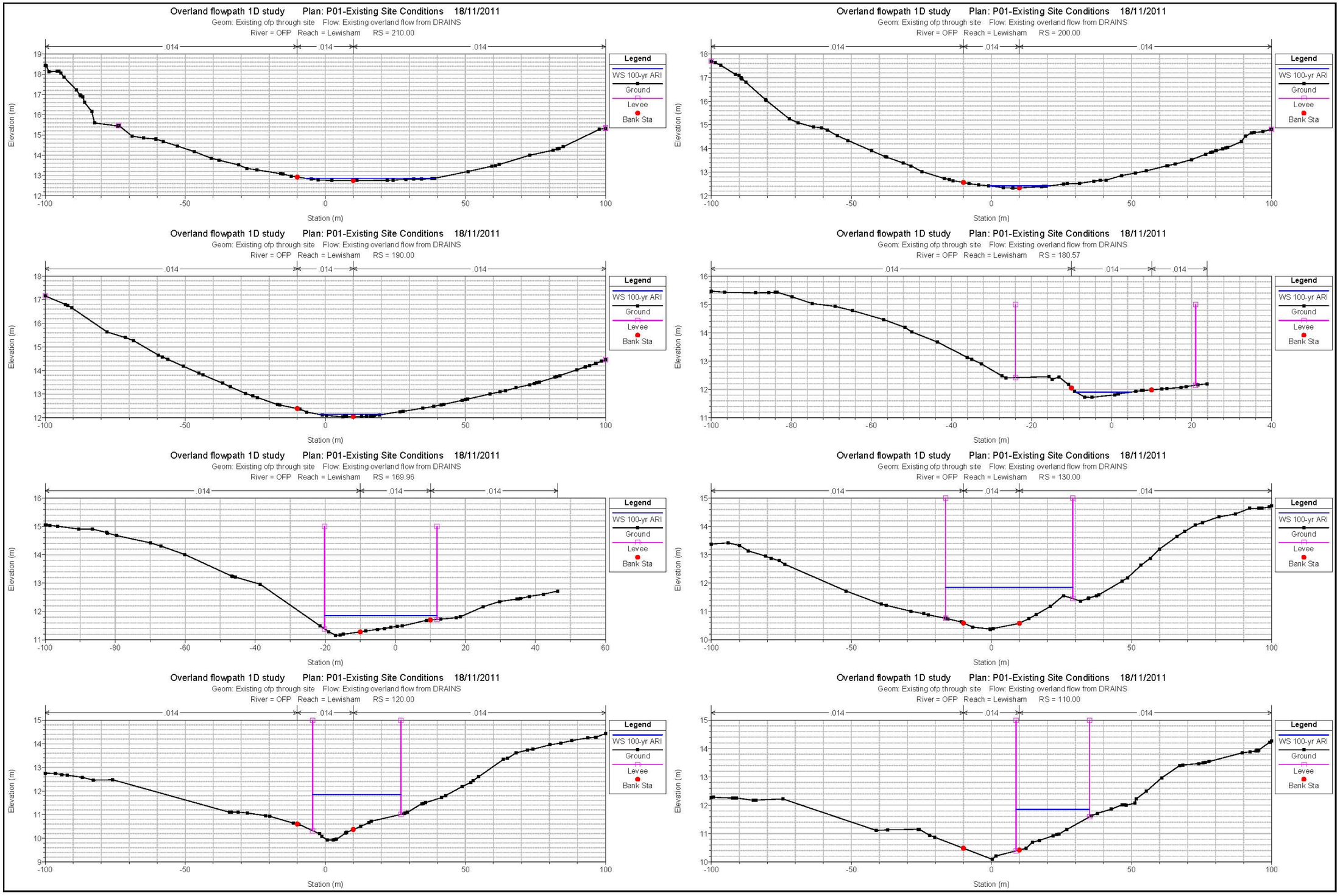
HECRAS Model Results – Overland Flow

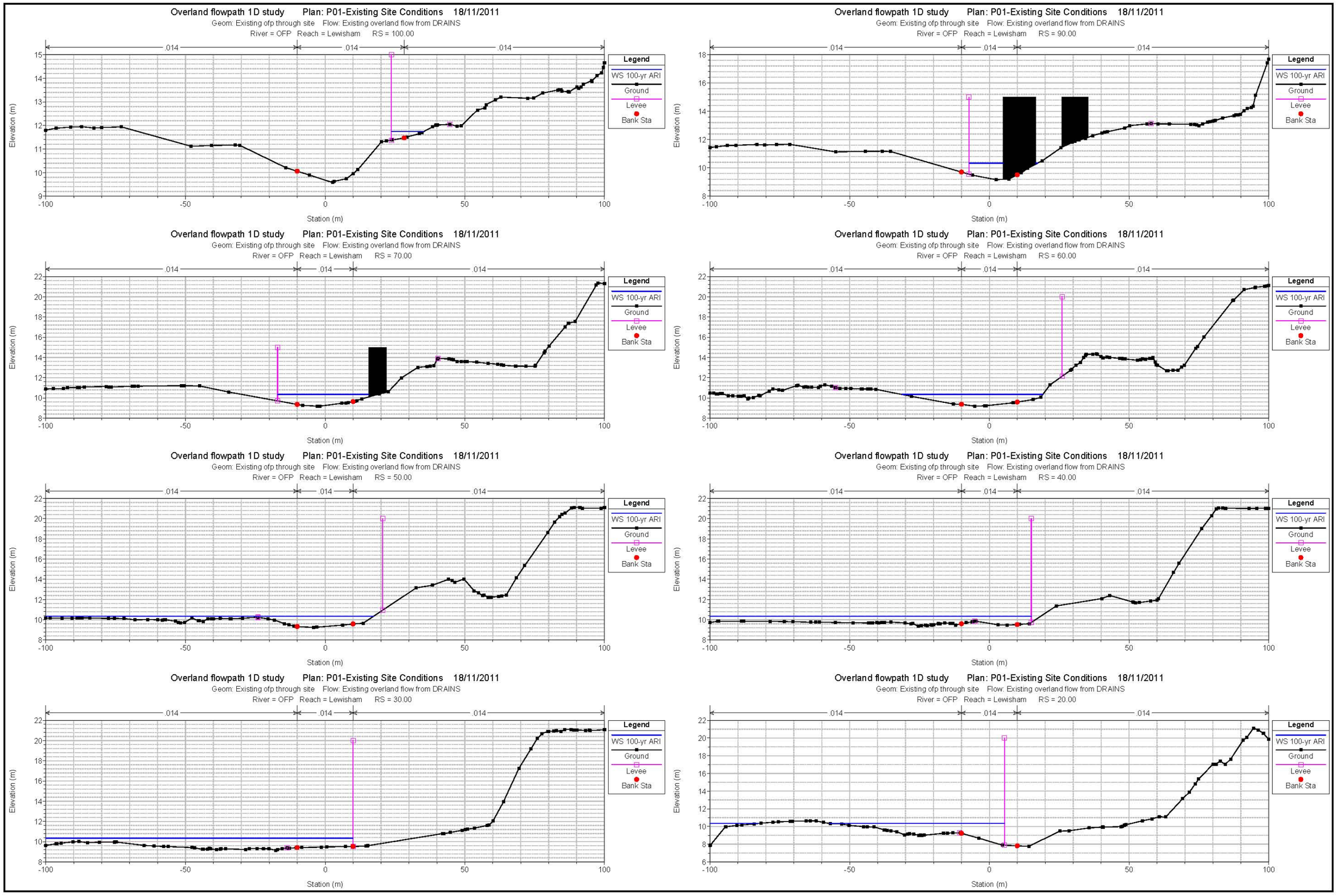
Existing Site Conditions

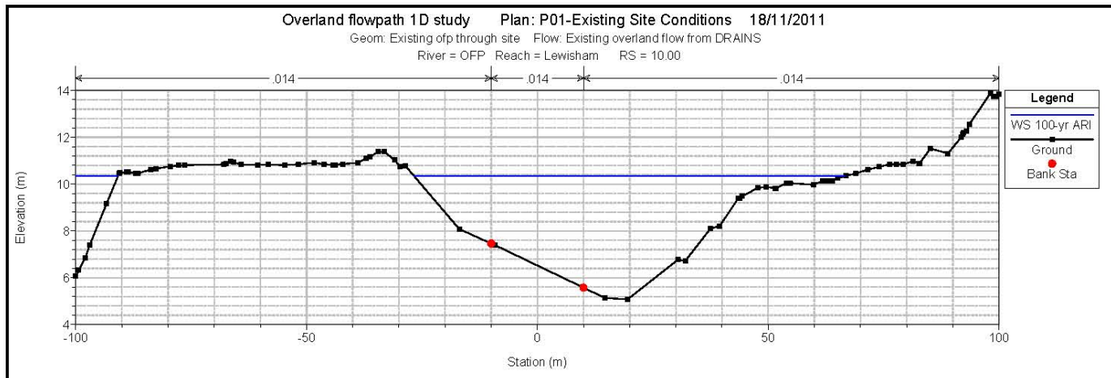

Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
OFP Lewisham
Legend
WS 100-yr ARI
Ground
LOB
ROB
Elevation (m)
13
12
11
10
9
8
7
6
5
0
50
100
150
200
250
20.00
30.00
40.00
50.00
60.00
70.00
90.00
100.00
110.00
120.00
130.00
169.96
180.57
190.00
200.00
210.00
Main Channel Distance (m)

HEC-RAS Plan: P01EXG River: OFP Reach: Lewisham Profile: 100-yr ARI

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Lewisham	210.00	100-yr ARI	3.30	12.75	12.86	12.86	12.90	0.004183	0.93	3.78	46.27	0.99
Lewisham	200.00	100-yr ARI	3.30	12.32	12.42	12.49	12.77	0.055935	2.78	1.28	21.68	3.44
Lewisham	190.00	100-yr ARI	3.30	12.04	12.15	12.21	12.35	0.026505	2.02	1.64	22.96	2.40
Lewisham	180.57	100-yr ARI	3.30	11.72	11.90	11.98	12.16	0.018980	2.23	1.48	13.71	2.17
Lewisham	169.96	100-yr ARI	3.30	11.28	11.85	11.44	11.85	0.000030	0.20	14.06	32.10	0.11
Lewisham	130.00	100-yr ARI	3.30	10.36	11.85	10.61	11.85	0.000001	0.08	49.42	45.40	0.02
Lewisham	120.00	100-yr ARI	3.30	9.92	11.85	10.26	11.85	0.000001	0.08	44.14	31.50	0.02
Lewisham	110.00	100-yr ARI	3.30	10.09	11.85	10.83	11.85	0.000005	0.12	23.71	26.20	0.03
Lewisham	100.00	100-yr ARI	3.30	9.58	11.74	11.74	11.84	0.002510	1.58	2.47	11.57	0.90
Lewisham	90.00	100-yr ARI	3.30	9.17	10.34	9.51	10.34	0.000017	0.27	12.35	12.78	0.08
Lewisham	70.00	100-yr ARI	3.30	9.19	10.34	9.44	10.34	0.000003	0.13	28.47	32.50	0.04
Lewisham	60.00	100-yr ARI	3.30	9.19	10.34	9.45	10.34	0.000002	0.11	36.48	50.46	0.03
Lewisham	50.00	100-yr ARI	3.30	9.25	10.34	9.49	10.34	0.000002	0.10	50.38	117.28	0.03
Lewisham	40.00	100-yr ARI	3.30	9.47	10.34	9.71	10.34	0.000001	0.05	72.69	115.00	0.02
Lewisham	30.00	100-yr ARI	3.30	9.41	10.34	9.39	10.34	0.000000	0.04	87.43	110.00	0.01
Lewisham	20.00	100-yr ARI	3.30	7.81	10.34	8.43	10.34	0.000000	0.06	73.94	79.79	0.01
Lewisham	10.00	100-yr ARI	3.30	5.58	10.34	5.41	10.34	0.000000	0.02	263.49	102.43	0.00


Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 210.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 200.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 190.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 180.57
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 169.96
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 130.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 120.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 110.00
.014
Legend
WS 100-yr ARI
Ground
Levee
Bank Sta
Elevation (m)
Station (m)


Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 100.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 90.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 70.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 60.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 50.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 40.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 30.00
Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 20.00
.014
Elevation (m)
Station (m)
Legend
WS 100-yr ARI
Ground
Levee
Bank Sta


Overland flowpath 1D study Plan: P01-Existing Site Conditions 18/11/2011
Geom: Existing ofp through site Flow: Existing overland flow from DRAINS
River = OFP Reach = Lewisham RS = 10.00
.014
.014
.014
Elevation (m)
Station (m)
14
12
10
8
6
4
-100
-50
0
50
100
Legend
WS 100-yr ARI
Ground
Bank Sta

APPENDIX 8

Flood Extent Plan – Overland Flow

Proposed Site Conditions

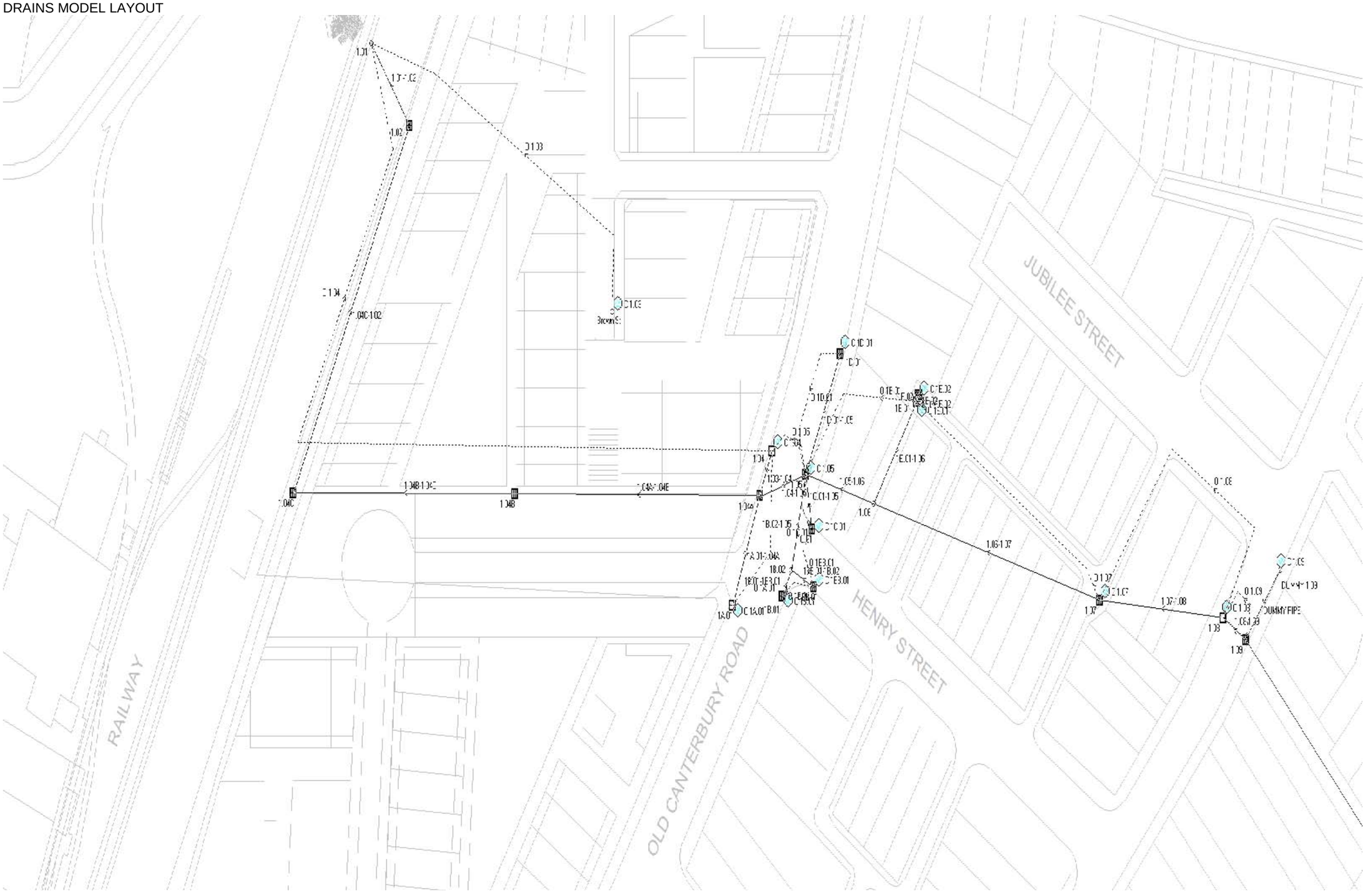

SMITH STREET
LONGPORT STREET
RAILWAY TERRACE
JUBILEE STREET
HENRY STREET
RAILWAY
BOUNDARY
EXISTING DEVELOPMENT SUBJECT TO SEPARATE APPROVAL
AMENDMENTS/REVISIONS
Rev
Issue
Description
Initials
Date
01
DA ISSUE
S.A.
16.11.11
02
REVISED DA ISSUE
S.A.
16.11.11
CONSULTANT
Cardno ITC
Shaping the Future
SYDNEY
BRISBANE
CANBERRA
MELBOURNE
PERTH
Cardno ITC Pty. Limited
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Fax: + 61 2 9499 8111
CLIENT
LEWISHAM ESTATE PTY LTD
Level 2, 7 Charles Street,
Parramatta, NSW, 2150
ARCHITECT
tony owen ptnrs
PROJECT
78–90 Old Canterbury Rd
Lewisham
NSW
DRAWING TITLE
OVERLAND FLOW PATH
PROPOSED FLOOD EXTEND PLAN
100–YR ARI
DRAWN
S.A.
DESIGNED
S.H.
CHECKED
S.H.
SCALE (AT FULL SIZE)
1:500
DATE
Nov '11
DRAWING No.
N09612–DA–H07
REVISION
02

APPENDIX 9

DRAINS Model Results – Overland Flow

Proposed Site Conditions

DRAINS MODEL LAYOUT



PIT / NODE DETAILS			Version 10														
Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph		
1.04	Sag	Manual	kerb inlet all inflows 0.5cums	30	2	12.42	0.21	0	0.5	157.558	24.737	No	5	1 x Ku	No		
1.04A	OnGrade	NSW Dept of Housing RM10 Inlet, 3% crossfall, all grades	RM10 2.4 m lintel		1.5	12.71		0	0.2	153.869	15.868	No	9	1 x Ku	No		
1.04B	OnGrade	NSW Dept of Housing RM7 Inlet, 3% crossfall, 1% grade	RM7		0.5	11.9		0	0.2	78.837	16.159	Yes	334396	1 x Ku	No		
1.04C	OnGrade	NSW Dept of Housing RM7 Inlet, 3% crossfall, 1% grade	RM7		2.5	11.28		0	0.2	11.269	16.314	Yes	334395	1 x Ku	No		
1.02	OnGrade	NSW Dept of Housing RM7 Inlet, 3% crossfall, 1% grade	RM7		2.5	9.8		0	0.2	46.711	89.723	Yes	7	1 x Ku	No		
1.01	Node					9.6		0		34.907	106.166		39				
1A.01	OnGrade	NSW Dept of Housing RM10 Inlet, 3% crossfall, all grades	RM10 2.4 m lintel		0.5	13.58		0	0.2	145.569	-6.125	No	10	1 x Ku	No		
1B.01	Sag	NSW Dept of Housing RM10 Inlet, 3% crossfall, all grades	RM10 2.4 m lintel	10	0.5	13.05	0.15	0	0.5	160.728	-4.368	No	12	1 x Ku	No		
1B.02	Node					13.1		0		163.514	0.892		74				
1.05	Sag	Manual	kerb inlet all inflows 0.5cums	30	1.7	12.54	0.2	0	0.5	167.856	20.02	No	4	1 x Ku	No		
1BB.01	Sag	NSW Dept of Housing RM10 Inlet, 3% crossfall, all grades	RM10 2.4 m lintel	10	0.5	12.87	0.15	0	0.5	170.33	-2.496	No	13	1 x Ku	No		
1C.01	Sag	NSW Dept of Housing RM10 Inlet, 3% crossfall, all grades	RM10 2.4 m lintel	15	0.5	12.74	0.15	0	0.5	169.823	9.013	No	14	1 x Ku	No		
1D.01	OnGrade	Manual	kerb inlet all inflows 0.5cums		0.5	12.89		0	0.2	178.473	44.123	No	16	1 x Ku	No		
1E.02	Sag	NSW Dept of Housing RM10 Inlet, 3% crossfall, all grades	RM10 2.4 m lintel	10	0.5	13.35	0.15	0	0.5	202.614	35.946	No	19	1 x Ku	No		
1E.01	Sag	NSW Dept of Housing RM10 Inlet, 3% crossfall, all grades	RM10 2.4 m lintel	10	2.5	13.3	0.15	0	0.5	201.804	34.496	No	18	1 x Ku	No		
1.06	Node					13		0		188.758	14.139		81				
1.1	Node					20		0		375.295	-88.987		259				
1.09	Sag	NSW Dept of Housing RM10 Inlet, 3% crossfall, all grades	RM10 2.4 m lintel	10	0.7	15.5	0.15	0	0.5	302.447	-12.988	Yes	2	1 x Ku	No		
1.08	Sag	NSW Dept of Housing RM10 Inlet, 3% crossfall, all grades	RM10 2.4 m lintel	10	0.5	15.4	0.15	0	0.5	295.702	-8.613	No	1	1 x Ku	No		
1.07	Sag	Manual	kerb inlet all inflows 0.5cums	15	0.5	14	0.15	0	0.5	257.847	-5.086	No	3	1 x Ku	No		
DUMMY 1.	Node					15.6		0		312.996	0.955		286				
Brown St	Node					10.37		0		108.68	52.495		334403				

DETENTION BASIN DETAILS														
Name	Elev	Surf. Area	Init Vol. (cu.m)	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Leng	id

SUB-CATCHMENT DETAILS																	
Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough
C 1.04	1.04	0.133	80	20	0	5	0	0	98	98	0.1	2.4	2.4	1	0.013	0.2	0.013
C 1A.01	1A.01	0.0774	80	20	0	5	0	0	85	85	0.1	3	3	1	0.013	0.2	0.013
C 1B.01	1B.01	0.74	80	20	0	5	0	0	151	151	0.1	5.3	5.3	1	0.013	0.2	0.013
C 1.05	1.05	0.191	80	20	0	5	0	0	68.8	68.8	0.1	4.9	4.9	1	0.013	0.2	0.013
C 1BB.01	1BB.01	0.617	80	20	0	5	0	0	132	132	0.1	5.3	5.3	1	0.013	0.2	0.013
C 1C.01	1C.01	0.057	80	20	0	5	0	0	74	74	0.1	5	5	1	0.013	0.2	0.013
C 1D.01	1D.01	0.34	80	20	0	5	0	0	83	83	0.1	5	5	1	0.013	0.2	0.013
C 1E.02	1E.02	1.04	80	20	0	5	0	0	172	172	0.1	5.2	5.2	1	0.013	0.2	0.013
C 1E.01	1E.01	0.2	80	20	0	5	0	0	71.6	71.6	0.1	5.6	5.6	1	0.013	0.2	0.013
C 1.10	1.1	8.18	80	20	0	5	0	0	340	340	0.1	5.35	5.35	1	0.013	0.2	0.013
C 1.08	1.08	0.035	80	20	0	5	0	0	53	53	0.1	2	2	1	0.013	0.2	0.013
C 1.07	1.07	0.296	80	20	0	5	0	0	56	56	0.1	5.35	5.35	1	0.013	0.2	0.013
C 1.09	DUMMY 1.	3.98	80	20	0	5	0	0	238	238	0.1	5.6	5.6	1	0.013	0.2	0.013
C 1.03	Brown St	0.873	80	20	0	5	0	0	116	116	0.1	1.5	1.5	1	0.013	0.2	0.013

PIPE DETAILS																
Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)
1.03-1.04	1.04	1.04A	14.4	7.085	6.797	2	Concrete, u	900	900	0.013	Existing	1	1.04	0			
1.04A-1.04	1.04A	1.04B	80	6.767	5.167	2	Concrete, u	1500	1524	0.013	NewFixed	1	1.04A	0			
1.04B-1.04	1.04B	1.04C	62	5.137	3.897	2	Concrete, u	1500	1524	0.013	NewFixed	1	1.04B	0			
1.04C-1.02	1.04C	1.02	100.2	3.867	2.792	1.07	Concrete, u	1500	1524	0.013	NewFixed	1	1.04C	0			
1.01-1.02	1.01	1.02	20.1	2.792	2.017	3.86	Concrete, u	1200	1200	0.013	Existing	1	1.02	0			
1A.01-1.04	1A.01	1.04A	28	12.68	11.773	3.24	Concrete, u	300	300	0.013	Existing	1	1A.01	0			
1B.01-1BB	1B.01	1B.02	5.96491	12	11.894	1.78	Concrete, u	450	450	0.013	Existing	1	1B.01	0			
1B.02-1.05	1B.02	1.05	19.4095	11.864	11.49	1.93	Concrete, u	450	450	0.013	Existing	1	1B.02	0			
1.04-1.05	1.05	1.04A	11.2473	7.34	7.115	2	Concrete, u	1200	1200	0.013	NewFixed	1	1.05	0			
1BB.01-1B	1BB.01	1B.02	7.61907	11.97	11.894	1	Concrete, u	300	300	0.013	Existing	1	1BB.01	0			
1C.01-1.05	1C.01	1.05	11.1029	11.84	11.64	1.8	Concrete, u	300	300	0.013	Existing	1	1C.01	0			
1D.01-1.05	1D.01	1.05	26.1544	11.84	11.49	1.34	Concrete, u	450	450	0.013	Existing	1	1D.01	0			
1E.01-1E.0	1E.02	1E.01	1.64884	12.45	12.434	0.97	Concrete, u	300	300	0.013	Existing	1	1E.02	0			
1E.01-1.06	1E.01	1.06	23.9669	12.404	11.206	5	Concrete, u	225	225	0.013	Existing	1	1E.01	0			
1.05-1.06	1.06	1.05	21.5544	8.785	7.707	5	Concrete, u	900	900	0.013	Existing	1	1.06	0			
1.09-1.10	1.1	1.09	94.4	18.473	13.753	5	Concrete, u	750	750	0.013	Existing	1	1.1	0			
1.08-1.09	1.09	1.08	7.98335	13.723	13.324	5	Box Culver	1Wx 0.9H		0.012	Existing	1	1.09	0			
1.07-1.08	1.08	1.07	37.7541	13.294	11.406	5	Box Culver	1Wx 0.9H		0.012	Existing	1	1.08	0			
1.06-1.07	1.07	1.06	71.2205	11.376	7.815	5	Box Culver	1Wx 0.9H		0.012	Existing	1	1.07	0			
DUMMY PI	DUMMY 1.	1.09	10	13.953	13.753	2	Concrete, u	750	750	0.013	Existing	1	DUMMY 1.	0			

OVERFLOW ROUTE DETAILS													
Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storr (m)	SafeDepth Minor Storr (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id
O 1.04	1.04	1.01	5				Dummy use	0.2	0.05	0.6	1	0	206
O 1A.01	1A.01	1.04	1				8 m wide rc	0.3	0.15	0.4	3.9	0	183
O 1B.01	1B.01	1BB.01	1				8 m wide rc	0.3	0.15	0.4	1.9	0	192
O 1.05	1.05	1.04	1				Dummy use	0.2	0.05	0.6	2.7	0	181
O 1BB.01	1BB.01	1C.01	1				Dummy use	0.2	0.05	0.6	2.8	0	195
O 1C.01	1C.01	1.05	1				8 m wide rc	0.3	0.15	0.4	1.9	0	200
O 1D.01	1D.01	1.05	2				8 m wide rc	0.3	0.15	0.4	1.5	0	157
O 1E.02	1E.02	1E.01	1				Dummy use	0.2	0.05	0.6	13.7	0	152
O 1E.01	1E.01	1.05	5				Dummy use	0.2	0.05	0.6	2.3	0	154
O 1.09	1.09	1.08	1				Dummy use	0.2	0.05	0.6	3.4	0	146
O 1.08	1.08	1.07	5				8 m wide rc	0.3	0.15	0.4	2	0	148
O 1.07	1.07	1E.01	5				8 m wide rc	0.3	0.15	0.4	1.1	0	150
O 1.03	Brown St	1.01	5				Dummy use	0.2	0.05	0.6	1.1	0	208

DRAINS results prepared 18 November, 2011 from Version 2011.17								
PIT / NODE DETAILS				Version 8				
Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivii (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint	
1.04	10.73	12.43	0.062	0.8	1.69	0	Inlet Capacity	
1.04A	10.73		0		1.98		None	
1.04B	9.87		0		2.03		None	
1.04C	9.44		0		1.84		None	
1.02	8.16		0		1.64		None	
1.01	5.6		0.39					
1A.01	12.81		0.037		0.77	0	None	
1B.01	12.56	13.2	0.343	8.6	0.49	0.227	Inlet Capacity	
1B.02	12.53		0					
1.05	12.4	12.72	1.599	20.6	0.14	0	Inlet Capacity	
1BB.01	12.71	13.02	0.516	8.6	0.16	0.385	Inlet Capacity	
1C.01	12.75	12.89	0.413	12.9	-0.01	0.295	Outlet System	
1D.01	12.45		0.167		0.44	0	None	
1E.02	13.44	13.5	0.475	8.6	-0.09	0.425	Outlet System	
1E.01	13.44	13.45	1.721	8.6	-0.14	1.519	Outlet System	
1.06	13.22		0					
1.1	24.06		3.396					
1.09	15.98	15.5	0	0	-0.48	0	Outlet System	
1.08	15.54	15.51	0.017	4.5	-0.14	0	Outlet System	
1.07	14.32	14.15	0.153	12.9	-0.32	1.26	Outlet System	
DUMMY 1.09	16.18		1.768					
SUB-CATCHMENT DETAILS								
Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm	
C 1.04	0.062	0.056	0.007	8.75	19.32	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1A.01	0.037	0.033	0.005	8.22	16.59	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1B.01	0.343	0.31	0.038	8.83	19.75	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1.05	0.096	0.083	0.014	7.45	12.62	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1BB.01	0.29	0.26	0.034	8.53	18.22	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1C.01	0.028	0.025	0.004	7.54	13.1	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1D.01	0.167	0.146	0.023	7.72	14.03	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1E.02	0.475	0.432	0.049	9.17	21.48	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1E.01	0.101	0.087	0.015	7.41	12.41	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1.10	3.396	3.17	0.259	11.22	32.05	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1.08	0.017	0.015	0.002	7.74	14.11	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1.07	0.153	0.129	0.024	7.11	10.86	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1.09	1.768	1.631	0.158	9.95	25.52	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
C 1.03	0.39	0.359	0.036	9.78	24.62	0.08	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1	
PIPE DETAILS								
Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm			
1.03-1.04	0.375	0.59	10.73	10.729	AR&R 20 year, 10 minutes storm, average 162 mm/h, Zone 1			
1.04A-1.04B	4.806	2.63	10.204	9.873	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1.04B-1.04C	4.769	2.61	9.699	9.442	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1.04C-1.02	4.763	2.61	8.571	8.156	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1.01-1.02	4.762	4.21	5.899	5.6	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1A.01-1.04A	0.037	1.95	12.774	11.867	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1B.01-1BB.01	0.125	0.79	12.543	12.533	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1B.02-1.05	0.259	1.63	12.533	12.405	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1.04-1.05	4.81	4.25	10.893	10.729	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1BB.01-1B.02	0.124	1.75	12.643	12.533	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1C.01-1.05	0.122	1.72	12.689	12.405	AR&R 20 year, 45 minutes storm, average 83 mm/h, Zone 1			
1D.01-1.05	0.167	1.05	12.432	12.405	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1E.01-1E.02	0.083	1.17	13.437	13.435	AR&R 20 year, 2 hours storm, average 45.3 mm/h, Zone 1			
1E.01-1.06	0.108	2.72	13.347	13.22	AR&R 20 year, 1.5 hours storm, average 55 mm/h, Zone 1			
1.05-1.06	3.756	5.9	13.22	12.405	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1.09-1.10	3.284	7.43	24.058	15.975	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1.08-1.09	4.892	5.44	15.772	15.541	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1.07-1.08	4.872	5.41	15.406	14.32	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
1.06-1.07	4.098	4.55	14.28	13.22	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
DUMMY PIPE	1.772	4.01	16.183	15.975	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1			
OVERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
O 1.04	0	0	0.256	0	0	0	0	
O 1A.01	0	0	0.47	0	0	0	0	
O 1B.01	0.227	0.227	0.328	0.134	0.2	3.1	1.47	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1.05	0	0	0.421	0	0	0	0	
O 1BB.01	0.385	0.385	0.428	0.048	0.05	13.61	1.06	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1C.01	0.295	0.295	0.328	0.146	0.22	3.49	1.54	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1D.01	0	0	0.291	0	0	0	0	
O 1E.02	0.425	0.425	0.948	0.036	0.07	11.27	1.95	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1E.01	1.519	1.519	0.388	0.088	0.13	21.51	1.44	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1.09	0	0	0.472	0	0	0	0	
O 1.08	0	0	0.336	0	0	0	0	
O 1.07	1.26	1.26	0.249	0.236	0.43	6.4	1.8	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1
O 1.03	0.39	0.39	0.268	0.058	0.04	15.58	0.77	AR&R 20 year, 25 minutes storm, average 110 mm/h, Zone 1

DRAINS results prepared 18 November, 2011 from Version 2011.17

PIT / NODE DETAILS				Version 8			
Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivi (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
1.04	12.45	12.63	3.237	25.7	-0.03	1.818	Outlet System
1.04A	11.82		0		0.89		None
1.04B	10.91		0		0.99		None
1.04C	10.45		0		0.83		None
1.02	9.09		0		0.71		None
1.01	6.36		1.992				
1A.01	12.83		0.046		0.75	0.001	Inlet Capacity
1B.01	12.86	13.2	0.423	8.6	0.19	0.307	Inlet Capacity
1B.02	12.84		0				
1.05	12.75	12.74	3.549	25.7	-0.21	3.208	Outlet System
1BB.01	12.91	13.02	0.666	8.6	-0.04	0.536	Outlet System
1C.01	12.81	12.89	0.57	12.9	-0.07	0.488	Outlet System
1D.01	12.85		0.208		0.04	0	None
1E.02	13.46	13.5	0.586	8.6	-0.11	0.564	Outlet System
1E.01	13.46	13.45	3.313	8.6	-0.16	3.133	Outlet System
1.06	13.42		0				
1.1	29.38		4.271				
1.09	16.61	15.5	0	0	-1.11	0	Outlet System
1.08	16.05	15.55	0.021	8.6	-0.65	0.361	Outlet System
1.07	14.35	14.15	0.538	12.9	-0.35	2.663	Outlet System
DUMMY 1.	16.96		2.18				

SUB-CATCHMENT DETAILS							
Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C 1.04	0.076	0.067	0.01	8.36	17.3	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1A.01	0.046	0.04	0.007	7.88	14.86	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1B.01	0.423	0.374	0.057	8.43	17.68	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.05	0.119	0.099	0.02	7.19	11.3	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1BB.01	0.358	0.313	0.05	8.16	16.31	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1C.01	0.035	0.03	0.006	7.28	11.73	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1D.01	0.208	0.176	0.033	7.44	12.57	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1E.02	0.586	0.522	0.077	8.73	19.23	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1E.01	0.125	0.104	0.021	7.16	11.12	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.10	4.271	3.931	0.428	10.57	28.7	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.08	0.021	0.018	0.003	7.45	12.64	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.07	0.187	0.155	0.032	6.89	9.72	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.09	2.18	1.973	0.261	9.43	22.85	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
C 1.03	0.481	0.434	0.059	9.28	22.04	0.07	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1

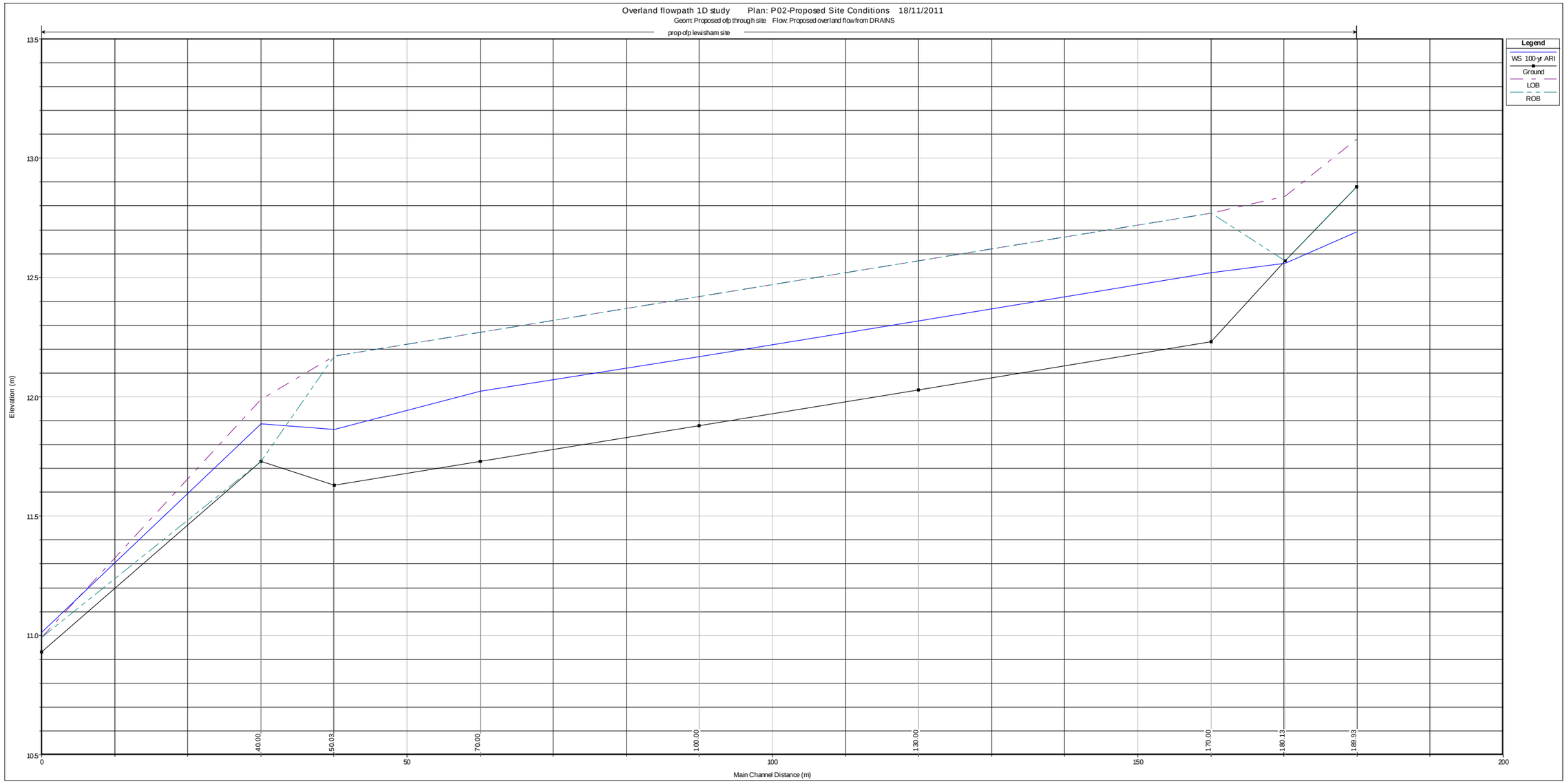
PIPE DETAILS					
Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
1.03-1.04	1.5	2.36	11.971	11.823	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1.04A-1.04	5.053	2.77	11.267	10.913	AR&R 100 year, 45 minutes storm, average 110 mm/h, Zone 1
1.04B-1.04	4.926	2.7	10.728	10.454	AR&R 100 year, 45 minutes storm, average 110 mm/h, Zone 1
1.04C-1.02	4.918	2.7	9.528	9.086	AR&R 100 year, 1 hour storm, average 95 mm/h, Zone 1
1.01-1.02	4.918	4.35	6.678	6.36	AR&R 100 year, 1 hour storm, average 95 mm/h, Zone 1
1A.01-1.04	0.045	2.06	12.784	11.877	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1B.01-1BB	0.157	0.99	12.845	12.836	AR&R 100 year, 1.5 hours storm, average 73 mm/h, Zone 1
1B.02-1.05	0.322	2.02	12.836	12.748	AR&R 100 year, 1.5 hours storm, average 73 mm/h, Zone 1
1.04-1.05	4.666	4.13	11.913	11.823	AR&R 100 year, 10 minutes storm, average 211 mm/h, Zone 1
1BB.01-1B	0.143	2.03	12.88	12.836	AR&R 100 year, 1.5 hours storm, average 73 mm/h, Zone 1
1C.01-1.05	0.119	1.68	12.799	12.748	AR&R 100 year, 3 hours storm, average 45.8 mm/h, Zone 1
1D.01-1.05	0.209	1.32	12.834	12.748	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1E.01-1E.0	0.083	1.17	13.459	13.459	AR&R 100 year, 3 hours storm, average 45.8 mm/h, Zone 1
1E.01-1.06	0.112	2.82	13.443	13.421	AR&R 100 year, 10 minutes storm, average 211 mm/h, Zone 1
1.05-1.06	3.785	5.95	13.421	12.748	AR&R 100 year, 10 minutes storm, average 211 mm/h, Zone 1
1.09-1.10	4.142	9.38	29.381	16.611	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1.08-1.09	6.209	6.9	16.422	16.05	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1.07-1.08	5.87	6.52	15.923	14.35	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
1.06-1.07	4.157	4.62	14.316	13.421	AR&R 100 year, 10 minutes storm, average 211 mm/h, Zone 1
DUMMY PI	2.177	4.93	16.958	16.611	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1

OVERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
O 1.04	1.818	1.818	7.665	0.112	0.12	26.36	1.11	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1A.01	0.001	0.001	0.722	0.019	0.01	0.16	0.68	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1B.01	0.307	0.307	0.966	0.147	0.23	3.53	1.56	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1.05	3.208	3.208	12.595	0.115	0.21	26.9	1.88	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1BB.01	0.536	0.536	12.826	0.054	0.06	14.87	1.18	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1C.01	0.488	0.488	0.966	0.173	0.27	5.17	1.56	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1D.01	0	0	1.073	0	0	0	0	
O 1E.02	0.564	0.564	9.749	0.041	0.09	12.17	2.08	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1E.01	3.133	3.133	11.625	0.117	0.21	27.44	1.76	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1.09	0	0	14.134	0	0	0	0	
O 1.08	0.361	0.361	0.991	0.158	0.24	4.28	1.51	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1.07	2.663	2.663	1.162	0.3	0.72	6.4	2.4	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1
O 1.03	0.481	0.481	8.039	0.063	0.05	16.66	0.81	AR&R 100 year, 25 minutes storm, average 145 mm/h, Zone 1

APPENDIX 10

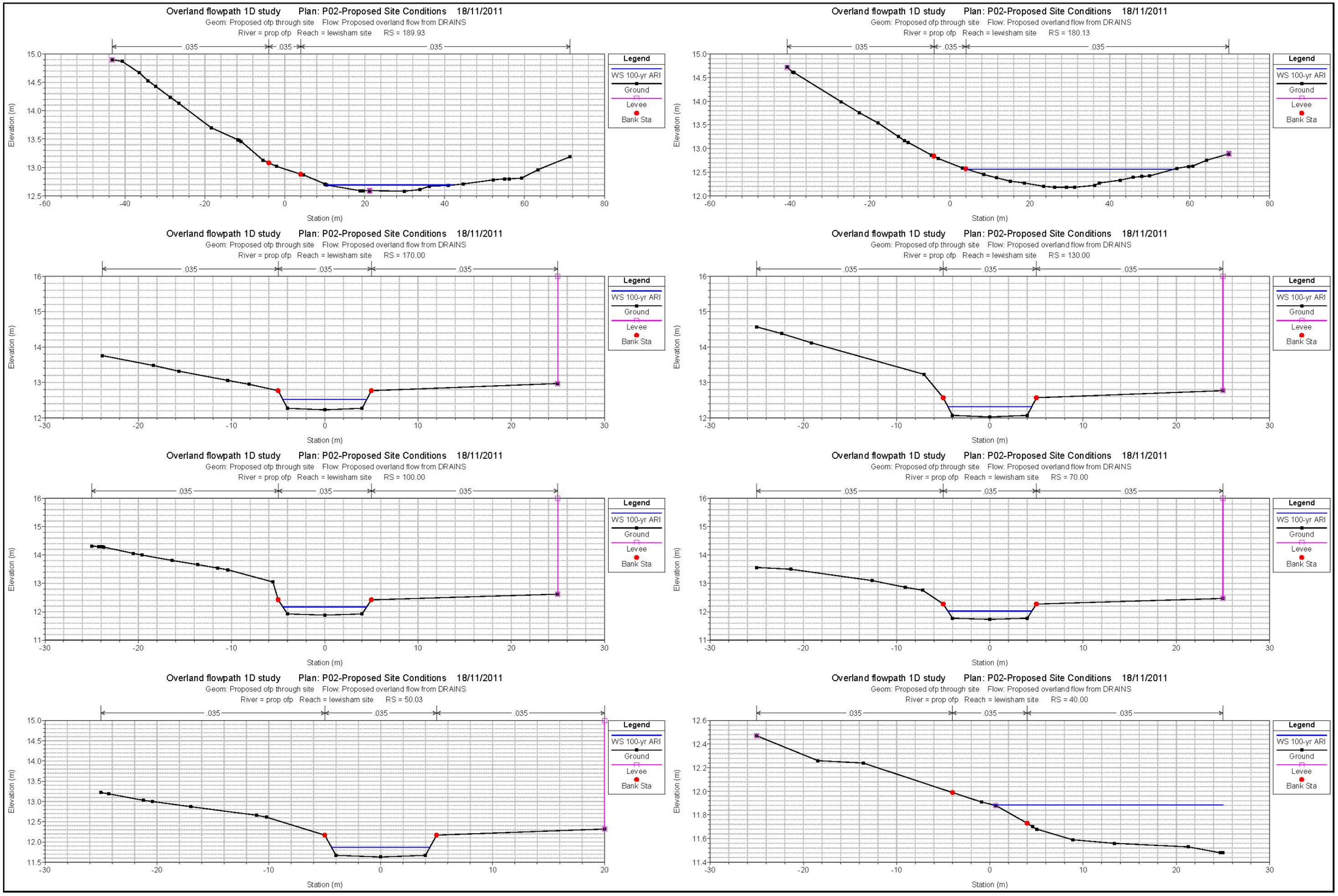
HECRAS Model Results – Overland Flow

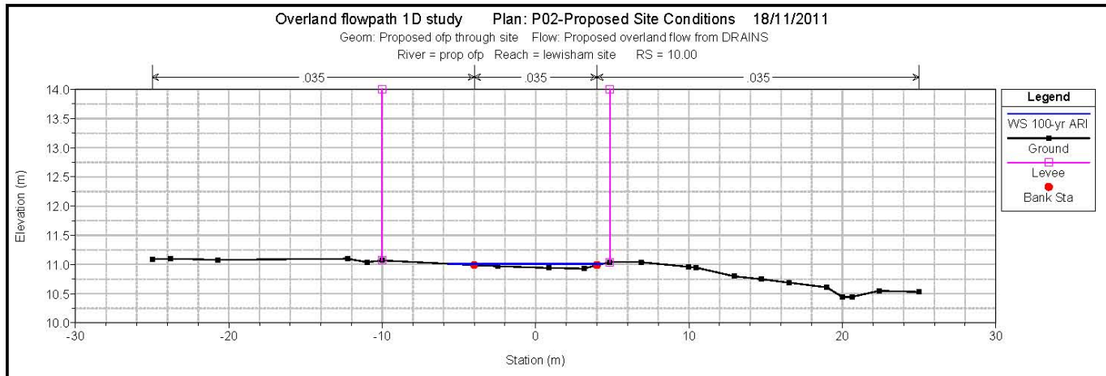
Proposed Site Conditions


Overland flowpath 1D study Plan: P02-Proposed Site Conditions 18/11/2011
Geom: Proposed ofp through site Flow: Proposed overland flow from DRAINS
prop ofp lewisham site
Legend
WS 100-yr ARI
Ground
LOB
ROB
Elevation (m)
13.5
13.0
12.5
12.0
11.5
11.0
10.5
0
50
100
150
200
40.00
50.03
70.00
100.00
130.00
170.00
180.13
189.93
Main Channel Distance (m)

HEC-RAS Plan: P02PROP River: prop ofp Reach: lewisham site Profile: 100-yr ARI

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
lewisham site	189.93	100-yr ARI	1.82	12.88	12.69	12.69	12.73	0.032352		2.14	31.69	0.00
lewisham site	180.13	100-yr ARI	1.82	12.57	12.56	12.31	12.56	0.000193		12.08	51.53	0.00
lewisham site	170.00	100-yr ARI	1.82	12.23	12.52	12.42	12.55	0.004930	0.80	2.28	9.00	0.51
lewisham site	130.00	100-yr ARI	1.82	12.03	12.32	12.22	12.35	0.005053	0.80	2.27	8.99	0.51
lewisham site	100.00	100-yr ARI	1.82	11.88	12.17	12.07	12.20	0.004955	0.80	2.28	9.00	0.51
lewisham site	70.00	100-yr ARI	1.82	11.73	12.02	11.92	12.06	0.004674	0.78	2.32	9.02	0.49
lewisham site	50.03	100-yr ARI	1.82	11.63	11.86	11.82	11.92	0.011012	1.03	1.77	8.77	0.73
lewisham site	40.00	100-yr ARI	1.82	11.73	11.89	11.89	11.89	0.000417	0.10	6.95	24.68	0.12
lewisham site	10.00	100-yr ARI	1.82	10.93	11.01	11.11	11.77	0.831184	3.88	0.48	10.06	5.17


Overland flowpath 1D study Plan: P02-Proposed Site Conditions 18/11/2011
Geom: Proposed ofp through site Flow: Proposed overland flow from DRAINS
River = prop ofp Reach = lewisham site RS = 189.93
Overland flowpath 1D study Plan: P02-Proposed Site Conditions 18/11/2011
Geom: Proposed ofp through site Flow: Proposed overland flow from DRAINS
River = prop ofp Reach = lewisham site RS = 180.13
Overland flowpath 1D study Plan: P02-Proposed Site Conditions 18/11/2011
Geom: Proposed ofp through site Flow: Proposed overland flow from DRAINS
River = prop ofp Reach = lewisham site RS = 170.00
Overland flowpath 1D study Plan: P02-Proposed Site Conditions 18/11/2011
Geom: Proposed ofp through site Flow: Proposed overland flow from DRAINS
River = prop ofp Reach = lewisham site RS = 130.00
Overland flowpath 1D study Plan: P02-Proposed Site Conditions 18/11/2011
Geom: Proposed ofp through site Flow: Proposed overland flow from DRAINS
River = prop ofp Reach = lewisham site RS = 100.00
Overland flowpath 1D study Plan: P02-Proposed Site Conditions 18/11/2011
Geom: Proposed ofp through site Flow: Proposed overland flow from DRAINS
River = prop ofp Reach = lewisham site RS = 70.00
Overland flowpath 1D study Plan: P02-Proposed Site Conditions 18/11/2011
Geom: Proposed ofp through site Flow: Proposed overland flow from DRAINS
River = prop ofp Reach = lewisham site RS = 50.03
Overland flowpath 1D study Plan: P02-Proposed Site Conditions 18/11/2011
Geom: Proposed ofp through site Flow: Proposed overland flow from DRAINS
River = prop ofp Reach = lewisham site RS = 40.00
.035
Elevation (m)
Station (m)
Legend
WS 100-yr ARI
Ground
Levee
Bank Sta


Overland flowpath 1D study Plan: P02-Proposed Site Conditions 18/11/2011
Geom: Proposed ofp through site Flow: Proposed overland flow from DRAINS
River = prop ofp Reach = lewisham site RS = 10.00
.035
.035
.035
Elevation (m)
Station (m)
Legend
WS 100-yr ARI
Ground
Levee
Bank Sta

APPENDIX 11

Catchment Plan

Hawthorne Canal


AMENDMENTS/REVISIONS
LEGEND
LEWISHAM ESTATE PTY LTD
Level 2, 7 Charles Street,
Parramatta, NSW, 2150
78-90 Old Canterbury Rd
Lewisham
NSW
HAWTHORNE CANAL
CATCHMENT PLAN
N09612-DA-R03
01

APPENDIX 12

Survey Plan

NOTES

- BOUNDARY DIMENSIONS AND AREAS HAVE BEEN COMPILED FROM THE DEPOSITED PLAN.
- RELATIONSHIP OF IMPROVEMENTS AND DETAIL TO BOUNDARIES IS DIAGRAMMATIC AND IF CRITICAL SHOULD BE CONFIRMED BY A FURTHER BOUNDARY SURVEY.
- NO SERVICE SEARCH HAS BEEN UNDERTAKEN. ONLY THOSE SERVICES WITHIN THE PROPERTY VISIBLE AT THE TIME OF SURVEY HAVE BEEN LOCATED.
- THIS DRAWING REMAINS THE COPYRIGHT OF STRATASURV P/L AND CANNOT BE REPRODUCED OR ALTERED WITHOUT PRIOR WRITTEN CONSENT.
- DIMENSIONS SHALL NOT BE OBTAINED BY SCALING THE DETAIL FROM THE DRAWING.
- ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.
- KERB LEVELS ARE TOP OF KERB UNLESS OTHERWISE SHOWN.

TYPICAL TUNNEL PROFILE
(NOT TO SCALE)

LEGEND:

- SEWER VENT
- GAS METER
- WATER METER
- HYDRANT
- SIGNAL BOX
- STANDARD TELECOMMUNICATION PIT
- Ø- TRUNK Ø, H- HEIGHT, S- SPREAD
- POWER POLE
- TRAFFIC LIGHT
- SIGN POST
- BOLLARD
- GULLY PIT
- IL INVERT LEVEL RL
- OL OBVERT LEVEL RL
- TW12.36 TOP OF WALL RL

DIAGRAM 1

The areas of the sites are as shown by (deed dimensions), the current address & registered owners below: -

11/774322	78-90 Old Canterbury Road	Callmask P/L.	12210m²
6,7 & 8/977044	vacant	Lewisham Estate P/L	919.2m²
1/226469	60 Old Canterbury Rd.	E.A. Whittaker.	167.5m²
2/226469	62 Old Canterbury Rd.	Lewisham Estate P/L.	160.9m²
3/226469	64 Old Canterbury Rd.	M.I. Rea	161.2m²
4/226469	66 Old Canterbury Rd.	A.Lee	160.3m²
5/226469	68 Old Canterbury Rd.	B.J. Milton.	159.4m²
5/977044	70 Old Canterbury Rd.	T.R.Barron	191.3m²
1/215127	(2a) Longport St.	J.G.C.Chee	208.7m²
2/215127	(2b) Longport St.	C.Scaturro	208.7m²
17/977044 & 1/734142.	4 Longport St.	C. & V. Scaturro	306m²
1/67926	6 Longport St.	V. & C. Scaturro.	397.5m²
William St & Brown St. (proposed closed)			1463m²

SCALE 1:400

FOR CONTINUATION SEE DIAGRAM 1

CLIENT DETAILS	REV	DATE	DETAILS			
DEMAIN DEVELOPERS	J	15.11.11	ADDITIONAL DETAIL ADDED (STORMWATER CHANNEL)	N/A	WW	PS
	I	25.10.11	DATUM ACCURACY REVISED TO AHD VALUE 2011	N/A	WW	PS
	H	18.06.10	DRAINAGE PIT LEVELS ADDED	JK	WW	PS
	G	04.06.09	ADJOING ROOF DETAIL AND ELEVATIONS ADDED	JM	WW	PS
	REV	DATE	REVISION DETAILS	SURV	DWN	CHK

DATE OF SURVEY	AUG.'03
ORIGIN OF RL'S	SSM 81797 RL:15.5
DATUM	AHD 2011
CONTOUR INTERVAL	N/A
CAD REF FILE:	1593DT01jt.dwg

PROJECT: 78-90 OLD CANTERBURY ROAD LEWISHAM

STRATASURV
REGISTERED SURVEYORS
DEVELOPMENT CONSTRUCTION STRATA
Sydney · Melbourne · Brisbane · Dural · Tweed Coast
TEL: 97151133 FAX: 97151144
EMAIL: surveyors@stratasurv.com.au

DRAWING TITLE: PLAN SHOWING DETAIL & LEVELS FOR LOTS 11DP 774322, 6-8 DP 977044

DRAWING NUMBER	SCALE	REVISION
1593DT01 SHEET 1 OF 3	1:400@A1	J