Northside West Clinic Private Hospital

23-27 Lytton Street, Wentworthville

Stage 2 Development

Local Flood Impact Assessment
Report No.SY150080-150310

Rev. A 16th March 2015

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1.0 INTRODUCTION & BACKGROUND

Erilyan Pty Ltd is proposing to construct, as Stage 2 of the overall site development, a new building over the existing southern car park at the private hospital located at 23-27 Lytton Street, Wentworthville on behalf of Northside West Clinic.

The overall 6,655m^2 site abuts the Finlayson Creek stormwater drainage reserve at the rear of the property with frontage to Lytton Street and is known as Lot 1 in DP787784.

The existing building complex contains the following floor levels:

- Lower ground floor - FFL19.25m AHD
- Ground floor ranges from - FFL 20.67m AHD to FFL 22.1m AHD
- Stage 1 building additions currently under construction constitutes an elevated building first floor with FFLs ranging from RL 26.025m AHD to RL 27.50m AHD constructed over the pre-existing building and portion of the northern car park

The proposed new Stage 2 building, designated as the *Rehabilitation Unit*, constitutes a ground floor with upper two storeys and three underground car park basements with the following proposed finished floor levels:

- Floor Level 2 FFL 31.00m AHD
- Floor Level 1 FFL 27.50m AHD
- Ground Floor FFL 23.50m AHD
- Basement 1 FFL 20.50m AHD
- Basement 2 FFL 17.50m AHD
- Basement 3 FFL 14.50m AHD

It is understood from the previous advice received from Holroyd City Council's Senior Drainage Engineer, Mr. Mark Evens, that the flooding regime at the site constitutes overland sheet flow flooding emanating from Lytton Street road reserve during the designated design storm events (Q_{100} ARI), and that mainstream flooding, emanating from Finlayson Creek channel and waterway, does not impose flooding constraints upon the development.

Council has previously confirmed that the site has been identified and categorised within the area of the "Preliminary Finlaysons Creek Overland Flood Study – 2012" (prepared by Lyall & Associates) as being subject to flood related development controls within a defined flood risk precinct ostensibly as a result of the above local overland flooding.

Under a previous Stage 1 development proposal a detailed flood impact study for the designated deign flood (Q_{100}) was previously completed and presented in Acor Consultants' *Local Flood Impact Assessment Report No, SY140045-140515 Rev.B* dated 15th May 2014 (refer full copy in Appendix A).

In the stage 1 Flood Report it was determined by calibration against Council's current flood map information that a portion of overland flood flow from within the Lytton Street road reserve breached the subject site frontage at two distinct locations being the southern car park and northern car park entries generally as follows:

- Southern car park Q_{100} flood inflow $0.5m^3/s$ to $1.0m^3/s$
- Northern car park Q_{100} flood inflow $0.25m^3/s$ to $0.5m^3/s$

ACOR Consultants Pty Ltd (ACOR) has been engaged as part of the Stage 2 development application process to assess the flood impacts of and upon the proposed development and to prepare a concept flood management strategy for the development.

In the process of assessing the flood impacts and constraints at the site it was necessary to consider the impacts and constraints from the assessed inflows entering the site off Lytton Street road reserve with designated flood levels (as presented in Appendix A).

The primary objective of this assessment is to adopt the Stage 1 Flood study results for the approved Stage 1 development which is currently under construction, and then to assess this against the Stage 2 development proposal and current Council development controls in the context of:

1. Impacts of the proposed development upon the existing flood regime and
2. Impact of the flooding upon the proposed development design and configuration and
3. Preparation of a concept strategy plan for flood management at the site

2.0 METHODOLOGY

In order to assess the local flood impacts for the Stage 2 development proposal the following general methodology was applied:

1. Attend site to familiarise with the status of the Stage 1 building works and the general flood area in the vicinity of the proposed Stage 2 building i.e. southern car park area, and to visually identify the prevailing hydraulic constraints and hydraulic boundaries relating to the Stage 2 development proposal
2. Adopt the previously accepted HEC-RAS model flood regime outputs (Appendix A) for the Stage 1 development proposal as the base line against which the impacts of the Stage 2 development are to be assessed
3. Review the available survey plan and proposed Stage 2 development plan to identify the Stage 2 flood flow controls and flow paths and to determine an appropriate flood management strategy consistent with the development proposal and floodplain management principles
4. Review the Stage 2 post-development flood characteristics in the light of the proposed development
5. Prepare a concept flood management strategy to maintain the baseline HEC-RAS flood regime

Noting importantly, that the current Stage 1 works located downstream of the proposed Stage 2 development area will have no material impact upon the Stage 2 flood regime and therefore the Stage 1 northern car park flood regime is taken as unchanged for Stage 2; subject of course to the caveat that the Stage 2 development does not induce greater flood flow into the downstream Stage 1 area.

3.0 FLOOD REGIME

3.1 Background & Pre-Development Flood Data

Local catchment overland flooding for the Q_{100} designated design flood (i.e. with a 1% annual exceedance probability) at the site has been previously investigated and assessed by Holroyd City Council and appropriate flood levels have been prescribed by Council (refer Appendix A)

The flood modelling indicates that, during the Q_{100} designated design flood, flows are generally restricted to overbank flows emanating from the Lytton Street road reserve corridor, which generally contains the bulk of the 'major' flows from the upstream catchment within the public road reserve.

Limited overbank flood flow, velocities, and depths occur through the site as follows (refer Appendix A):

- Pre-development flood depths over southern car park area range from 40mm to 170mm.
- Pre-development flood velocities over southern car park range from 0.39m/s to 1.00m/s.
- Pre-development flood hazard over southern car park range from 0.02 m^2/s to 0.17 m^2/s.

3.2 Post-Development Flood Characteristics

It is noted from the flood model results, the survey plan, and the Stage 1 construction plans that the Stage 2 pre-development flood extents currently remain contained within the southern car park area.

The provision of a Lytton Street frontage levee and grated trench drain bypass system (refer Appendix B) will:

i) Provide the prescribed 500mm freeboard to the habitable rooms and 150mm freeboard to basements from the adjacent flood water level will not obstruct or hinder the existing flows

ii) Ensure that the pre-development flood flow emanating from Lytton Street road reserve continues to pass through the site to the downstream receiving Finlayson Creek drainage reserve as surface discharge flow

The flood water bypass drainage system will be designed to capture and transport the existing flood inflow to the southern car park area (i.e. maximum 1.0m^3/s) around the proposed building and with surface surcharge release at the rear or the new building and into the existing drainage reserve.

A sensitivity analysis of the proposed flood flow bypass system, using DRAINS hydraulic modelling, reveals that the bypass system retains potential capacity to convey twice the designated design flow; this additional hydraulic capacity will facilitate allowances for blockages and events in excess of the designated event when designed.

3.3 Flood Level Constraints

Appendix A presents the baseline HEC-RAS modelling results which indicate that the flood levels are related to general sheet flow through the southern car park to a nominal average depth of 100mm.

Therefore the flood level constraints are adopted as that the particular HEC-RAS flood level immediately adjacent to the respective point of the proposed building being considered.

It is important to note that these pre-development flood levels constitute flow levels over the car park pavements with average flow depths of approximately 100mm therefore adoption of a 500mm freeboard to such localised overland sheet flow would in our opinion be excessive and unwarranted, particularly given that application of such a 'standardised' freeboard would equate to nearly twice the actual maximum flood depth.

We consequently believe that, commensurate with the local flood characteristics, a reasonable flood protection freeboard of 200mm above the Q_{100} local flood level could be adopted at the development site; nevertheless, adoption of the Council prescribed flood protection freeboard of 500mm will facilitate the flood protection objectives without creating impact upon the flood regime as is shown in Appendix A.

4.0 APPLIED FLOOD CRITERIA

From the compilation and assessment of the available data, adoption of the previously calibrated HEC-RAS hydraulic modelling and Stage 1 flood regime for the site the following fundamental flood design criteria applies to the proposed Stage 2 development.

The identified flood regime has been assessed primarily for the potential impacts related to the Council defined local Q_{100} design floods as the designated design criteria.

In determining the flood management criteria it was confirmed that the local flood regime defined the static flood parameters (critical flood depth) and the dynamic flood parameters (flow depth & velocity) rather than the mainstream flooding within Finlayson Creek.

4.1 Prescribed Flood Levels

The designated design local 1% AEP (Q_{100}) flood levels relevant to the Stage 2 site area, as determined for Stage 1 with top water flood levels as scheduled for two defined flood scenarios in Table 1 below (refer also Appendix A).

For the purposes of this Stage 2 flood impact assessment, the worst case flood flow scenario has been adopted for the Lytton Street overbank flow of 1.0m^3/s into the site northern car park.

TABLE 1 – Stage 2 Designated Design Flood Levels

HEC-RAS Stream Chainage (m)*	Q_{100} Top Water Level Peak Flow 0.5m3/s	Q_{100} Top Water Level Peak Flow 1.0m3/s
78.56	22.87m AHD	22.91m AHD
76.90	22.68 m AHD	22.75 m AHD
74.90	22.63 m AHD	22.69m AHD
69.03	22.23 m AHD	22.27m AHD
64.71	22.02 m AHD	22.05m AHD
61.58	21.85 m AHD	21.88m AHD

* Stream flow chainages as determined in Stage 1 flood report in Appendix A

4.2 Floor & Pavement Levels

- Proposed habitable floor levels shall be protected from inundation in the designated design event to a level no lower than the adjacent designated flood level plus a freeboard clearance of 500mm
- Proposed non-habitable floor levels, basement car park levels, shall be protected from inundation in the designated design event to a level no lower than the adjacent designated flood level plus a minimum freeboard clearance of 150mm
- For flood events in excess of the designated design event emergency flood flow relief is to be provided in the form of a letterbox opening to the Basement Level 1 floor at the rear (i.e. north-western corner) of the building which will spill out onto the adjacent existing lower pavement area thence to Finlayson Creek drainage reserve

4.3 Building Components

- All proposed rooms below the flood level criteria to have flood compatible building components; noting that the proposed basements and ground floor are to be protected from inundation during the designated flood to the prescribed freeboard clearance levels (see above) by a proposed perimeter levee and flood bypass drainage system (refer Appendix B)

4.4 Structural Soundness

- This aspect of the detailed design can in our opinion be readily accommodated within the proposed reinforced concrete structure
- The Q_{100} designated design flood has been identified as primarily shallow depth surface flow emanating from overflow flood water entering the property from the Lytton Street road reserve and thence bypassing the proposed building via a proposed diversion drain.
- Flood waters for the designated design event will therefore bypass and remain clear of the new building and will not, as a consequence, present any structural loads to the building

4.5 Flood Impacts

The flood impacts of the proposed development need to be controlled to ensure that the development will not increase flood effects related to the Q_{100} designated design storm, having particular regard to floodplain storage, flood flow depths and velocities, and cumulative impacts as follows:

- Loss of floodplain storage volume

  There is no identified floodplain storage loss attributable to the Q_{100} designated local flood event since:

  a. The site remains within a defined waterway created by the overbank flows emanating from Lytton Street road reserve and not within the flood fringe zone

  b. The proposed bypass drainage system will, as a minimum, maintain the pre-development design flood flow through the site and as a consequence also maintain the pre-development flood flow along the Lytton Street road reserve

  c. The flood regime external of the site is therefore unaffected by the proposed flood levee and bypass system proposed for the Stage 2 development

- Changes in existing flood levels and velocities

  The flood velocities and levels associated with the Q_{100} designated local flood regime through the Lytton Street road reserve remains unchanged from the pre-development characteristics due to the effective capture and transporting the overbank flood flow through the site within the proposed bypass drainage system, thus maintaining the pre-development flood flow relief afforded to the adjacent road reserve of Lytton Street.

- The cumulative impact of multiple potential developments in the floodplain

  The dynamic flooding constraints of flood flows and velocities and the water level and flood storage volume impacts emanating from the local flooding events are defined by the local flood regime as prescribed by Council and modelled in the previous Stage 1 flood report (Appendix A).

  In our opinion the flood flows to and through the site are relatively small at less than $1.0m^3/sec$, and being overland overbank flows emanating from the Lytton Street road reserve 'major' design flows.

  Therefore we believe that the consideration of cumulative impact/s would be negligible and controlled for any future developments, within Council's current policies and controls.

  Coupled with this it would be a reasonable expectation that flood waters entering the site from Lytton Street road reserve would remain controlled under Councils' development policies via the proposed bypass drainage system.

4.6 Evacuation & Flood Response Planning

- Evacuation requirements of the site should be commensurate with the flood related risks and incorporated into an emergency response plan for the facility
- Risk of flooding of the building in floods exceeding the Q_{100} local designated design flood and the associated flood responses should be addressed in a site specific flood emergency response plan prepared during the construction certificate phase of the project
- For flood events in excess of the designated design event, such a flood emergency response plan would be implemented to cover procedures and protocols to cover, amongst other things, aspects of flood intelligence, flood warning systems, roles and responsibilities for operational responses, safety, welfare, and recovery

4.7 Management & Design

- The storage of goods above the designated design flood level is achievable within the proposed floor areas as a result of the proposed flood management measures
- No storage of uncontrolled hazardous materials is permitted below the design flood level which could be released and may cause pollution or safety hazard during a Q_{100} flood event
- Emergency flood flows entering the building basement in events exceeding the designated design flood will be provided with a flow relief path and mechanism within Basement Level 1 at the rear of the building which is above natural ground level
- The flood emergency response plan previously mentioned will incorporate actions to limit the risk exposure of hazardous materials pollution of the flood plain in an event beyond the designated Q_{100} flood storm inclusive of storage of materials within the building basement levels

APPENDIX A

Acor Consultants

Local Flood Impact Assessment Report

No, SY140045-140515 Rev.B of 15th May 2014

(Covering Stage 1)

Proposed Additions to Northside West Clinic Private Hospital

23-27 Lytton Street, Wentworthville

Local Flood Impact Assessment
Report No.SY140045-140515

Rev. B 15th May 2014

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1.0 INTRODUCTION & BACKGROUND

Erilyan Pty Ltd is proposing to construct an additional floor level above the existing private hospital at 23-27 Lytton Street, Wentworthville on behalf of Northside West Clinic.

The 6,655m^2 site abuts the Finlayson Creek stormwater drainage reserve at the rear of the property with frontage to Lytton Street and is known as Lot 1 in DP787784.

The existing building contains the following floor levels:

- Lower ground floor - FFL19.25m AHD
- Ground floor ranges from - FFL 20.67m AHD to FFL 22.1m AHD

The proposed building addition constitutes a new First floor with FFL ranging from – FFL 26.025m AHD to FFL 27.50m AHD

It is understood from advice received from Holroyd City Council's Senior Drainage Engineer, Mr. Mark Evens, that the flooding regime at the site constitutes overland sheet flow flooding emanating from Lytton Street road reserve during the designated design storm events (Q_{100} ARI), and that mainstream flooding, emanating from Finlayson Creek channel and waterway, does not impose flooding constraints upon the development.

Council, in a letter to Mr Zack Ashbuy, dated 6 February 2014 (refer Appendix A), confirm that the site has been identified and categorised within the area of the "Preliminary Finlaysons Creek Overland Flood Study – 2012" (prepared by Lyall & Associates) and as being subject to flood related development controls within a defined flood risk precinct ostensibly as a result of the above local overland flooding.

ACOR Consultants Pty Ltd (ACOR) has been engaged as part of the development application process to assess the flood impacts of and upon the proposed development and to prepare a concept flood management strategy plan for the development.

In the process of assessing the flood impacts and constraints at the site it was necessary to consider the impacts and constraints from the assessed inflows entering the site off Lytton Street road reserve with designated flood levels as presented in the abovementioned Council's letter (Appendix A).

The primary objective of this assessment is to review the available information on flooding at the site, prepare a calibrated HEC-RAS flood model for the site, and to assess this against the development proposal and Council development controls in the context of:

1. Impacts of the proposed development upon the existing flood regimes and
2. Impact of the flooding upon the proposed development design and configuration and
3. Preparation of a concept strategy plan for flood management at the site

METHODOLOGY

In order to properly assess the local flood impacts the following general methodology was applied:

1. Attend Council to discuss the available flood modelling results and attend site to familiarise with the flood area and building and to visually identify the prevailing hydraulic constraints and hydraulic boundaries
2. Review the available survey plan to identify the flood flow regime and flow paths and to determine the most appropriate flood flow cross section control centreline for future hydraulic modelling adopting HEC-RAS software
3. Prepare HEC-RAS flood modelling for the two separate identified flow paths, being the northern car park flood zone and the southern car park flood zone (Appendix B)
4. Adopt and transpose the defined designated design (Q_{100}) flood levels prescribed by Holroyd Council based upon the previous TUFLOW hydraulic flood modelling (Appendix A) onto the HEC-RAS flood plan to facilitate calibration of the HEC-RAS modelling; noting that known errors in the TUFLOW modelling ground level interpolation were omitted from the calibration
5. Run the HEC-RAS modelling for various peak flow rates in order to achieve a defined 'design' peak flow rate that conforms to the above TUFLOW modelling flood level results and therefore achieves a calibrated HEC-RAS model with the following key parameters:
    a. An upstream inflow flood level to match or exceed the defined TUFLOW flood level within Lytton Street road reserve immediately adjacent to the identified overflow points (driveways) into the site; noting that the road reserve overflow inflow rate (m^3/sec) are otherwise undefineable
    b. HEC-RAS modelled flood levels within the site to match or exceed the defined TUFLOW flood level within the car park areas of the site
    c. A sensitivity HEC-RAS model of reach car park area adopting a flow rate double the value determined to match the TUFLOW modelling results to check the sensitivity of impacts upon the site flooding from increased design flows
    d. Identification of all discrete hydraulic control points observed within the site, that the TUFLOW modelling may have inherently omitted, and incorporation of the associated impacts of these controls upon the HEC-RAS flood model results as part of the model calibration process
6. From the calibrated HEC-RAS modelling determine the 'design' site flood flow i) levels, ii) water depths, iii) velocities, and iv) velocity-depth products throughout the north and south car park areas
7. Review of HEC-RAS model results in the light of the survey plan details and preparation of a concept flood management strategy plan to suit the HEC-RAS flood levels in accordance with Holroyd Council's design requirements (refer Appendix A)

APPLIED FLOOD CRITERIA

From the compilation and assessment of the available data, preparation of calibrated HEC-RAS hydraulic modelling for the site and review of the available information covering the survey data and local flooding regime, the following fundamental flood design criteria applies to the proposed development.

The identified flood regime has been assessed primarily for the potential impacts related to the Council defined local Q_{100} design floods as the designated design criteria.

In determining the flood management criteria it was found that the local flood regime defined the static flood parameters (critical flood depth) and the dynamic flood parameters (flow depth & velocity).

Prescribed Flood Levels

The designated design local 1% AEP flood levels relevant to the site as determined by Holroyd Council using previous TUFLOW hydraulic modelling (refer Appendix A) for actual locations A through L, with top water flood levels are as follows:

At location A	22.5 m AHD	Lytton Street frontage southern car park
At location B(i)	22.0 m AHD	Southern car park front of site
At location B(ii)	22.0 m AHD	Lytton Street frontage northern car park
At location C	21.5 m AHD	Southern car park
At location D	21.0 m AHD	Southern car park
At location E	20.5 m AHD	Southern car park
At location F	20.0 m AHD	Southern car park
At location G	19.5 m AHD	Southern car park
At location H	19.0 m AHD	Southern car park rear of site
At location I	20.0 m AHD	Northern car park rear of site
At location J	20.5 m AHD	Northern car park
At location K	21.0 m AHD	Northern car park
At location L	21.5 m AHD	Northern car park front of site

Floor & Pavement Levels

- Proposed habitable floor levels shall be established at a level no lower than the adjacent designated flood level plus a freeboard clearance of 500mm
- Existing habitable floor levels shall be protected from inundation to a level no lower than the adjacent designated flood level plus a freeboard clearance of 500mm
- Proposed non-habitable floor levels shall be established at a level no lower than the adjacent designated flood level plus a freeboard clearance of 150mm
- Existing non-habitable floor levels shall be protected from inundation to a level no lower than the adjacent designated flood level plus a freeboard clearance of 150mm

Building Components

- All existing rooms and proposed additional rooms below the flood level criteria to have flood compatible building components; noting that the existing lower ground and ground floors are to be protected from inundation by the designated flood to the prescribed freeboard clearance levels (see above) by a proposed perimeter levee (refer Appendix E)

Structural Soundness

- This aspect of the detailed design can in our opinion be readily accommodated within the proposed structure which is essentially a additional upper floor set at FFL RL26.025m AHD to RL27.50m AHD which is 4m to 5m above the worst case designated local flood level (RL22.0m AHD)
- The designated flood has been identified as primarily shallow sheet-flow, overflow flood water entering the property from the Lytton Street road reserve and passing through the existing car parks areas to the north and south clear of the existing building and therefore does not present any dynamic loading

Flood Impacts

The flood impacts of the development need to be controlled to ensure that the development will not increase flood effects related to the Q_{100} designated design storm, having particular regard to floodplain storage, flood flow depths and velocities, and cumulative impacts:

- **Loss of floodplain storage volume**

  There is no identified floodplain storage loss attributable to the Q_{100} designated local flood event since the flood regime within the site is unaffected by the proposed flood levee

- **Changes in existing flood levels and velocities**

  The flood velocities and levels associated with the Q_{100} designated local flood regime remains unchanged from the pre-development characteristics due to the effective containment of these flood flows within the existing car park areas and adjacent road reserve of Lytton Street.

- **The cumulative impact of multiple potential developments in the floodplain**

  The dynamic flooding constraints of flood flows and velocities and the water level and flood storage volume impacts emanating from the local flooding events are defined by the local flood regime prescribed by Council and modelled in this report.

  In our opinion the flood flows to and through the site are relatively small, being overland flows emanating from the Lytton Street road reserve “mainstream” flows, therefore we believe that the consideration of cumulative impact/s would be negligible and controlled for any future developments, within Council’s current policies and controls.

  Coupled with this it would be a reasonable expectation that flood waters entering the site from Lytton Street road reserve, via the breaching overflows entering the site frontage,

would remain controlled under Councils' development policies and thus limited to current flow rates as a maximum.

Evacuation & Flood Response Planning

- Evacuation requirements of the site should be commensurate with the flood related risks and incorporated into the current emergency plan for the facility
- Risk of flooding of the building in floods exceeding the Q_{100} local designated design flood and the associated flood responses should be addressed in a site specific flood emergency response plan prepared during the construction certificate phase of the project noting that this would also be incorporated into the above emergency plan

Management & Design

- The storage of goods above the flood levels is achievable within the existing and proposed floor areas
- No storage of uncontrolled hazardous materials is permitted below the design flood level which could be released and may cause pollution or safety hazard during a Q_{100} flood event
- The flood emergency response plan mentioned above will incorporate actions to limit the risk exposure of hazardous materials pollution of the flood plain in an event beyond the designated Q_{100} flood storm

2.0 FLOOD REGIME

2.1 Background & Available Flood Data

Local catchment overland flooding for the Q_{100} designated design flood (i.e. with a 1% annual exceedance probability) at the site has been previously investigated and assessed by Holroyd City Council and appropriate flood levels have been prescribed by Council (refer Appendix A)

The flood modelling indicates that, during the Q_{100} designated design flood, flows are generally restricted to the overflows emanating from the Lytton Street road reserve corridor, which generally contains the bulk of the flood flows from the upstream catchment within the public road reserve, with limited flood flow, velocities, and depths occurring through the site as follows:

Flood Depths (refer Appendix C & Appendix D)

- Flood depths over northern car park area 30mm to 230mm

  Noting that the maximum depth of 230mm occurs at an isolated point at the rear corner of the site

- Flood depths over southern car park area 40mm to 170mm

Noting that the maximum depth of 200mm occurs at an isolated point at the frontage to Lytton Street

Flood Velocities (refer Appendix C & Appendix D)

- Flood velocities over northern car park area 0.16 m/s to 0.74 m/s
- Flood velocities over southern car park area 0.39 m/s to 1.00 m/s

Flood Hydraulic Hazards (refer Appendix C & Appendix D)

- Flood hazard over northern car park area 0.03 m^2/s to 0.06 m^2/s
- Flood hazard over northern car park area 0.02 m^2/s to 0.17 m^2/s

2.2 Flood Characteristics

It is noted from the flood model results and the survey plan that the flood extents remain contained within the car park areas and do not reach the building. Therefore the provision of a perimeter levee to provide the prescribed 500mm freeboard to the adjacent flood water level will not obstruct or hinder the existing flows.

2.3 Flood Level Constraints

Appendix C and Appendix D present the detailed HEC-RAS modelling results which indicate that the flood levels are related to general sheet flow through the car parks to a nominal average depth of 95mm (northern car park) and 100mm (southern car park).

Therefore the flood level constraints are adopted as that HEC-RAS flood level immediately adjacent to the respective point of the building being considered.

It is important to note that these flood levels constitute flow levels over the car park pavements with average flow depths of less than 100mm therefore adoption of a 500mm freeboard to such localised overland sheet flow would in our opinion be excessive and unwarranted particularly given that application of such a standardised freeboard would equate to nearly twice the actual maximum flood depth.

We consequently believe that, commensurate with the local flood characteristics, a reasonable flood protection freeboard of 200mm above the Q_{100} local flood level should be adopted at the development site.

Nevertheless, adoption of the Council prescribed flood protection freeboard of 500mm will facilitate the flood protection objectives without creating impact upon the flood regime as is shown in Appendix E.

APPENDIX A

Holroyd City Council Letter of 6/2/2014

Designated Q_{100} Local Flood levels

and Flood Design Constraints

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Engineering Services

Our Reference: PR-513-23-0
Contact: R Sario
Telephone: 9840 9874

6 February 2013

Zack Ashby
104/30 Atchison Street
ST LEONARDS NSW 2065

Dear Sir/Madam

FLOOD LEVELS AT No 23-27 LYTTON STREET, WENTWORTHVILLE BEING LOTS 1 IN DP 787784

I refer to your request dated 29 January 2014 requesting flood information at the above property.

The above property is shown to be affected by the 1% Annual Exceedance Probability (AEP) flood, according to the information available to Council from "Preliminary Finlaysons Creek Overland Flood Study" prepared by Lyall & Associates in December 2012.

The 1% AEP flood level refers to a flood which has a 1% chance of being equalled or exceeded in any one year. It should be noted that a flood could occur that is more severe than the 1% AEP flood at any time.

The maximum 1% AEP flood level relevant to the subject property has been determined (see the attached plan) to Australian Height Datum (AHD), as follows:

1.	At location A	-	22.5 mAHD
2.	At location B	-	22.0 mAHD
3.	At location C	-	21.5 mAHD
4.	At location D	-	21.0 mAHD
5.	At location E	-	20.5 mAHD
6.	At location F	-	20.0 mAHD
7.	At location G	-	19.5 mAHD
8.	At location H	-	19.0 mAHD
9.	At location I	-	20.0 mAHD
10.	At location J	-	20.5 mAHD
11.	At location K	-	21.0 mAHD
12.	At location L	-	21.5 mAHD

The subject property has been identified as stormwater flood affected lot. Council is of the opinion that a Complying Development Certificate on this property cannot be issued.

This letter does not give or imply an approval to satisfy the Development Standards for Flood Control lots under SEPP (Exempt & Complying Development) 2008.

Minimum habitable floor levels (buildings, commercial, industrial, etc.) shall be 0.5m above the flood level at the upstream side of the structure. Minimum non-habitable floor levels (garages, laundry, sheds, etc.) shall be 0.15m above the flood level at the upstream side of the structure. Interpolation between flood levels is allowed.

The relationship between these levels and the ground surface, may be determined by a survey of the property undertaken by a Registered Surveyor.

It should be noted that where the development or redevelopment of the property is proposed, reference should be made to the relevant Development Control Plan with regard to flooding and drainage issues. Please include a copy of this letter and map with any Development Application that you may lodge with Council for the subject site.

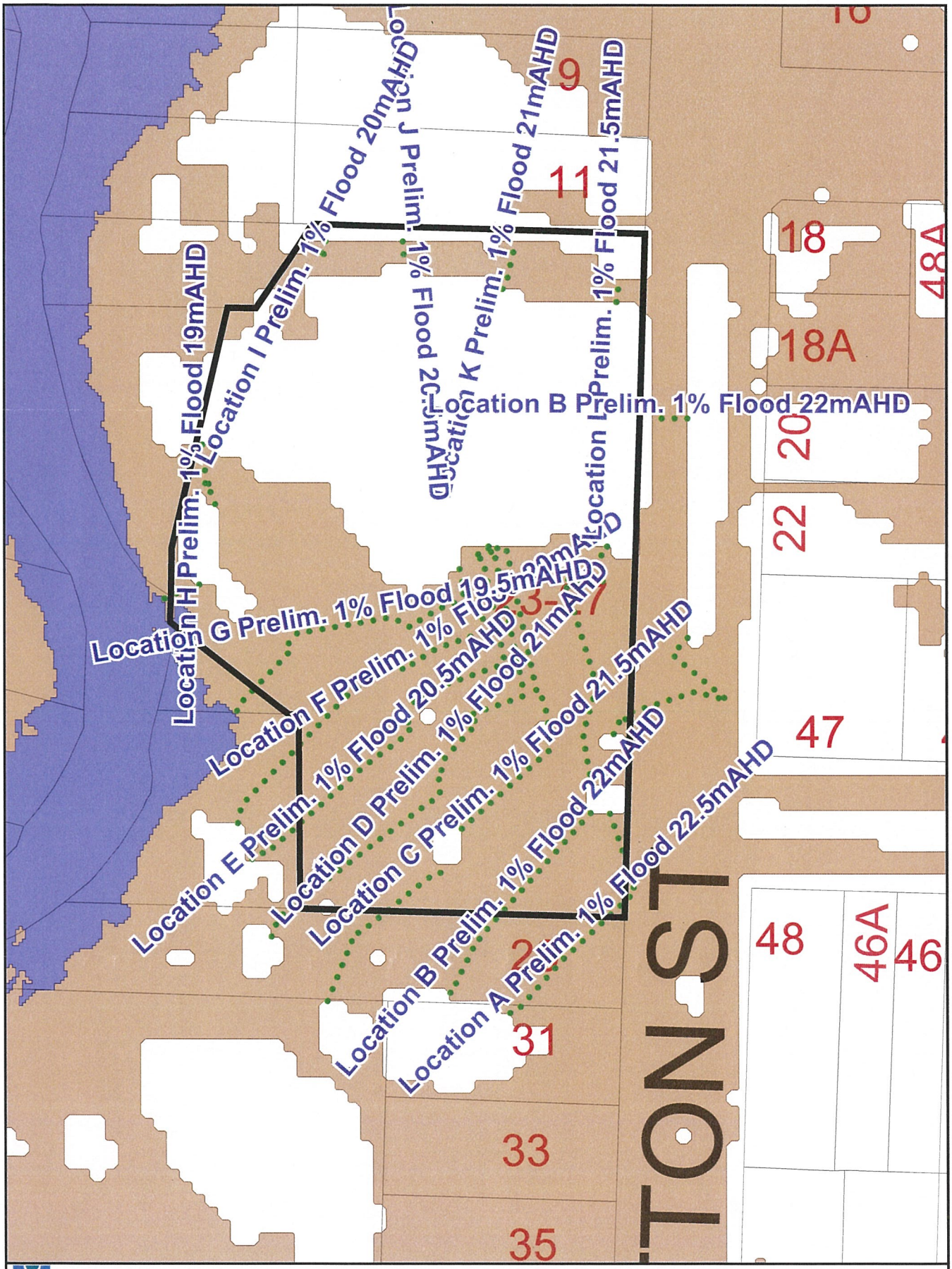
Flood levels are not static due to changing circumstances (eg, revision of the flood model) and accordingly the above flood level is only valid for six months from the above date.

If you have any questions, please do not hesitate to contact Council's Drainage Engineers, Mr. Mark Evens on 9840 9870 or Mr. Rolyn Sario on 9840 9874.

Yours faithfully

Merv Ismay
GENERAL MANAGER

Per:
MANAGER TECHNICAL SERVICES



Holroyd City
a place for everyone

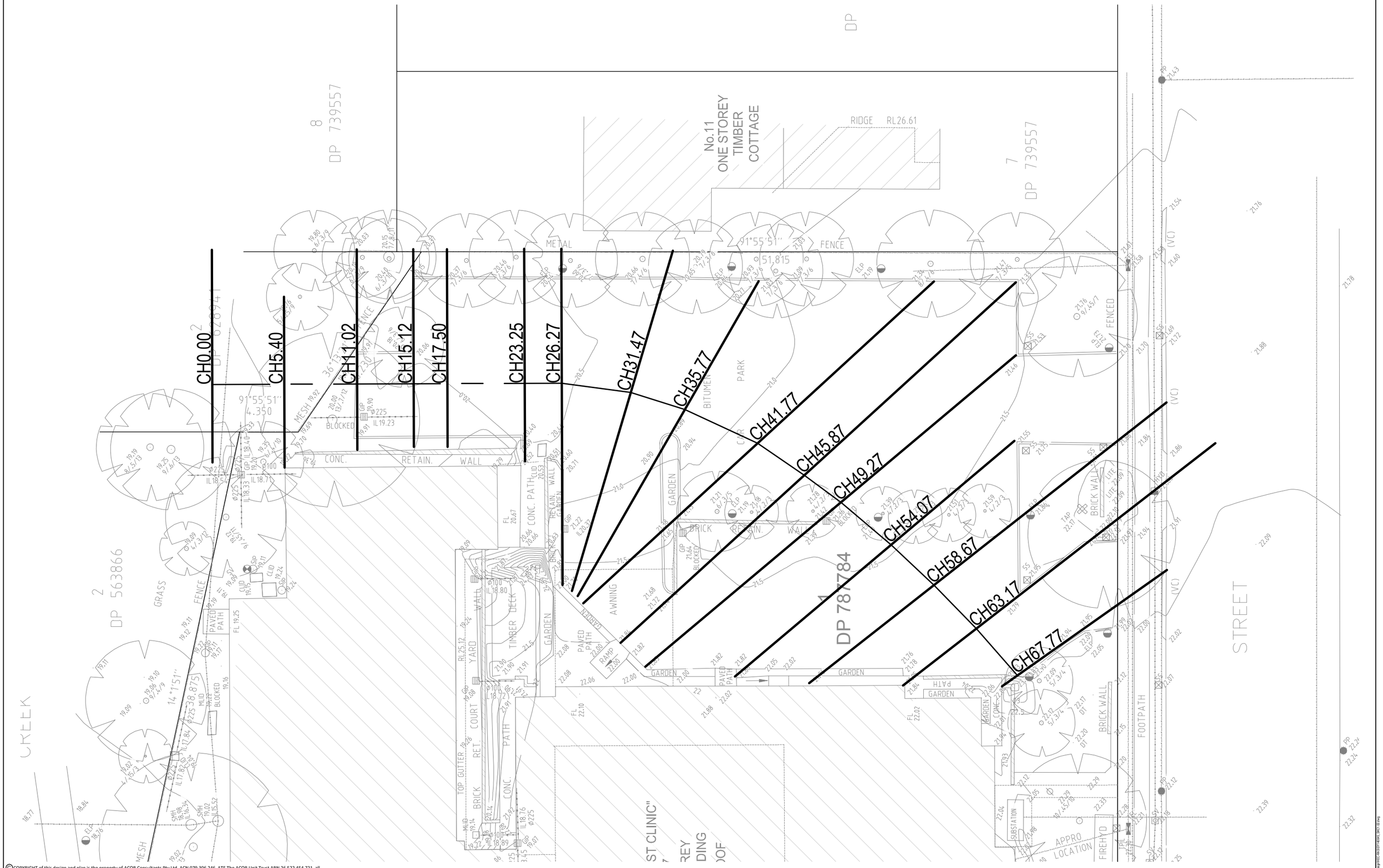
Date: 30:01:2014

Scale 1:800

APPENDIX B

North Reach & South Reach

HEC-RAS Cross Section and Flow Path Plan



This drawing has been assigned an electronic code that signifies the drawing has been checked and approved by:

Issue	Description	Date	Drawn	Approved
A	ISSUED FOR INFORMATION	15.05.14	JDC	RGE

North

Client
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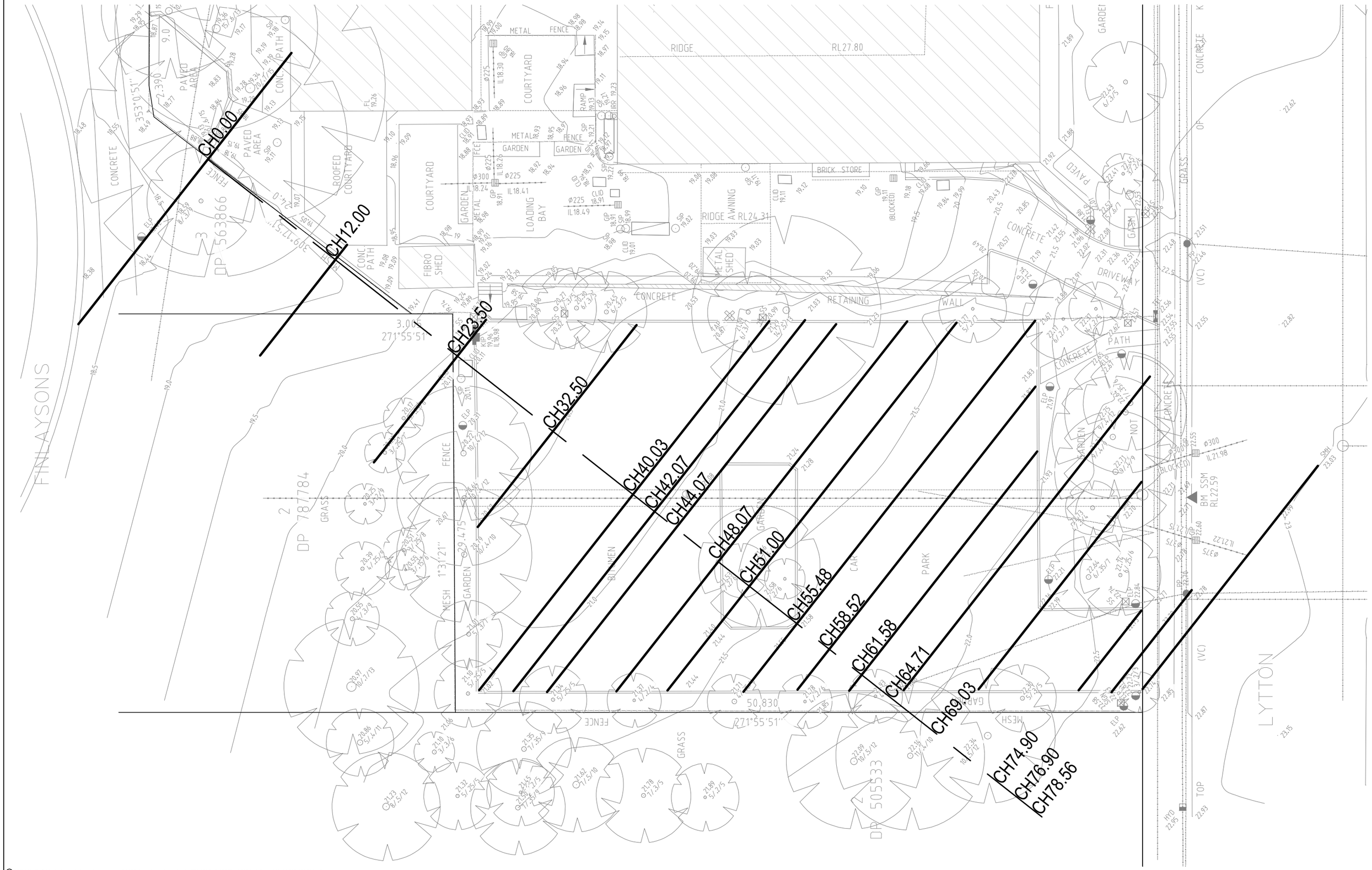
ENGINEERS | MANAGERS | INFRASTRUCTURE PLANNERS | DEVELOPMENT CONSULTANTS

Project
FLOOD IMPACT ASSESSMENT
NORTHSIDE WEST CLINIC
23-27 LYTTON STREET
WENTWORTHVILLE, NSW, 2145

Drawing Title
HEC-RAS SECTIONS PLAN SHEET
SOUTH STREAM

Drawn	Date	Scale	A3	Q.A. Check	Date
JDC	MAY 2014	1:500			
Designed	Project No.			Dwg. No.	Issue
JDC	SY140045			SKC1.01	A



This drawing has been assigned an electronic code that signifies the drawing has been checked and approved by:

Issue	Description	Date	Drawn	Approved
A	ISSUED FOR INFORMATION	15.05.14	JDC	RGE

0 1cm at full size 5cm 10cm

North

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FLOOD IMPACT ASSESSMENT
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WENTWORTHVILLE, NSW, 2145

Drawing Title
HEC-RAS SECTIONS PLAN SHEET
SOUTH STREAM

Drawn	Date	Scale A3	Q.A. Check	Date
JDC	MAY 2014	1:500		
Designed	Project No.		Dwg. No.	Issue
JDC	SY140045		SKC1.01	A

P:\SY140045\05Design\HEC-RAS\SY140045_SKC1.01.dwg
May 15, 2014 - 10:34am

APPENDIX C

North Reach - Northern Car Park

Pre-Development HEC-RAS Model Results

LYTTON STREET WENTWORTHVILLE

NORTH REACH FLOOD IMPACT ASSESSMENT HEC-EAS MODEL (Through North Car Park Area)

PRE-DEVELOPMENT WITH HEC-RAS MODEL RESULTS CALIBRATED TO MATCH TUFLOW MODELLING FLOOD LEVELS

River Station Cross Section Chainage[1] (m)	TuFlow Flood TWL Approximate m AHD	Peak Flow[2] Approx (m3/s)	Minimum Elevation (m)	W.S. Elevation (m)	E.G. Slope (m/m)	Water Depth (m)	Velocity Peak (m/s)	Vel x Depth (m2/s)	Top Width of Flow (m)	Difference[3] TuFlow Vs HEC-RAS (m)
67.770	22.0	0.25	21.94	22.00	0.009	0.06	0.60	0.04	14.69	0.00
63.18		0.25	21.79	21.90	0.001	0.11	0.34	0.04	13.40	
63.17		0.25	21.79	21.88	0.006	0.09	0.68	0.06	7.81	
58.67		0.25	21.71	21.81	0.006	0.1	0.64	0.06	9.21	
54.07	21.5	0.25	21.47	21.54	0.007	0.07	0.60	0.04	11.55	0.04
49.27		0.25	21.39	21.45	0.008	0.06	0.51	0.03	18.64	
45.87		0.25	21.29	21.33	0.012	0.04	0.51	0.02	25.34	
41.77		0.25	21.13	21.16	0.013	0.03	0.52	0.02	25.80	
35.77		0.25	20.75	20.84	0.006	0.09	0.66	0.06	8.37	
31.47		0.25	20.61	20.73	0.006	0.12	0.74	0.09	6.13	
26.27		0.25	20.43	20.52	0.004	0.09	0.53	0.05	9.76	
26.27	20.5	0.25	20.43	20.52	0.006	0.09	0.66	0.06	8.59	0.02
23.25		0.25	20.20	20.27	0.007	0.07	0.60	0.04	11.40	
17.50	20.0	0.25	20.00	20.15	0.000	0.15	0.23	0.03	11.40	0.15 [4]
15.12		0.25	20.06	20.15	0.001	0.09	0.34	0.03	11.40	
15.12		0.25	20.06	20.13	0.006	0.07	0.74	0.05	6.00	
11.02		0.25	19.90	20.13	0.000	0.23	0.16	0.04	11.70	
11.02	End Kerb[4]	0.25	20.06	20.11	0.007	0.05	0.66	0.03	9.13	
5.40	19.5	0.25	19.22	19.38	0.030	0.16	0.88	0.14	3.66	-0.12
0.00		0.25	19.10	19.24	0.006	0.14	0.77	0.11	5.31	

Notes:

1. Start HEC-RAS chainage 67.77 boundary condition upstream given at TWL 22.00 as per TuFlow modelling results (refer Figure 1 Holroyd Council Flood report)
2. Peak flow determined to match upstream reach boundary condition TWL for HEC-RAS chainage 67.77 as above
3. TuFlow model flood water level results extracted from Figure 1 Holroyd Council Flood Report
4. End kerb controls discharge water levels to allow for trapped low point over topping to reserve at rear of site to effect HEC-RAS chainage 17.5

LYTTON STREET WENTWORTHVILLE

NORTH REACH FLOOD IMPACT ASSESSMENT HEC-EAS MODEL (Through North Car Park Area)

PRE-DEVELOPMENT WITH HEC-RAS MODEL RESULTS CALIBRATED TO MATCH TUFLOW MODELLING FLOOD LEVELS

River Station Cross Section Chainage[1] (m)	TuFlow Flood TWL Approximate m AHD	Peak Flow[2] Approx (m3/s)	Minimum Elevation (m)	W.S. Elevation (m)	E.G. Slope (m/m)	Water Depth (m)	Velocity Peak (m/s)	Vel x Depth (m2/s)	Top Width of Flow (m)	Difference[3] TuFlow Vs HEC-RAS (m)
67.770	22.0	0.50	21.94	22.02	0.006	0.08	0.69	0.06	15.00	0.02
63.18		0.50	21.79	21.94	0.001	0.15	0.39	0.06	18.31	
63.17		0.50	21.79	21.92	0.006	0.13	0.75	0.10	11.49	
58.67		0.50	21.71	21.83	0.006	0.12	0.73	0.09	12.87	
54.07	21.5	0.50	21.47	21.57	0.006	0.1	0.70	0.07	14.47	0.07
49.27		0.50	21.39	21.47	0.007	0.08	0.63	0.05	21.94	
45.87		0.50	21.29	21.34	0.007	0.05	0.57	0.03	26.30	
41.77		0.50	21.13	21.18	0.007	0.05	0.58	0.03	25.80	
35.77		0.50	20.75	20.87	0.006	0.12	0.76	0.09	11.04	
31.47		0.50	20.61	20.77	0.006	0.16	0.81	0.13	9.08	
26.27		0.50	20.43	20.55	0.004	0.12	0.65	0.08	11.39	
26.27	20.5	0.50	20.43	20.54	0.006	0.11	0.77	0.08	10.50	0.04
23.25		0.50	20.20	20.30	0.005	0.1	0.70	0.07	11.40	
17.50	20.0	0.50	20.00	20.20	0.001	0.2	0.41	0.08	11.07	0.20[4]
15.12		0.50	20.06	20.20	0.001	0.14	0.39	0.05	11.40	
15.12		0.50	20.06	20.16	0.005	0.1	0.93	0.09	6.00	
11.02		0.50	19.90	20.16	0.000	0.26	0.27	0.07	13.89	
11.02	End Kerb[4]	0.50	20.06	20.13	0.006	0.07	0.78	0.05	10.21	
5.40	19.5	0.50	19.22	19.42	0.028	0.2	1.02	0.20	4.81	-0.08
0.00		0.50	19.10	19.28	0.005	0.18	0.91	0.16	6.67	

Notes:

1. Start HEC-RAS chainage 67.77 boundary condition upstream given at TWL 22.00 as per TuFlow modelling results (refer Figure 1 Holroyd Council Flood report)
2. Peak flow determined to match upstream reach boundary condition TWL for HEC-RAS chainage 67.77 as above
3. TuFlow model flood water level results extracted from Figure 1 Holroyd Council Flood Report
4. End kerb controls discharge water levels to allow for trapped low point over topping to reserve at rear of site to effect HEC-RAS chainage 17.5

APPENDIX D

South Reach - Southern Car Park

Pre-Development HEC-RAS Model Results

NORTHSIDE WEST CLINIC - 23-27 LYTTON STREET WENTWORTHVILLE

SOUTH REACH FLOOD IMPACT ASSESSMENT HEC-RAS MODEL (Through Southern Car Park Area)

PRE-DEVELOPMENT WITH HEC-RAS MODEL RESULTS CALIBRATED TO MATCH TUFLOW MODELLING FLOOD LEVELS

River Station Cross Section Chainage[1] (m)	TuFlow[3] Flood TWL Approximate m AHD	Peak Flow[2] Approx (m3/s)	Minimum Elevation (m)	W.S. Elevation (m)	E.G. Slope (m/m)	Water Depth (m)	Velocity Peak (m/s)	Vel x Depth (m2/s)	Top Width of Flow (m)	Difference[3] TuFlow Vs HEC-RAS (m)
78.56		0.5	22.74	22.87	0.0061	0.13	0.77	0.10	11.20	
76.90	22.50	0.5	22.48	22.68	0.0004	0.20	0.39	0.08	8.14	0.18
74.90		0.5	22.46	22.63	0.0051	0.17	1.00	0.17	5.02	
69.03		0.5	22.14	22.23	0.0054	0.09	0.87	0.08	7.50	
64.71	22.00	0.5	21.87	22.02	0.0064	0.15	0.68	0.10	16.00	0.02
61.58		0.5	21.75	21.85	0.0066	0.10	0.67	0.07	17.07	
58.52		0.5	21.65	21.75	0.0063	0.10	0.68	0.07	15.71	
55.48		0.5	21.55	21.64	0.0037	0.09	0.48	0.04	25.70	
55.48		0.5	21.55	21.63	0.0069	0.08	0.60	0.05	23.40	
51.00	21.50	0.5	21.4	21.49	0.0060	0.09	0.72	0.06	13.10	-0.01
48.07		0.5	21.24	21.31	0.0061	0.07	0.68	0.05	15.49	
44.07		0.5	21.08	21.12	0.0055	0.04	0.50	0.02	31.71	
44.07		0.5	21.08	21.12	0.0054	0.04	0.49	0.02	31.83	
42.07	21.00	0.5	20.97	21.02	0.0066	0.05	0.60	0.03	22.12	0.02
40.03		0.5	20.85	20.90	0.0066	0.05	0.67	0.03	17.35	
32.50	20.50	0.5	20.48	20.55	0.0061	0.07	0.70	0.05	14.59	0.05
23.50	20.00 End kerb[4]	0.5	19.96	20.12	0.0056	0.16	0.86	0.14	6.37	0.12
12.00		0.5	18.97	19.09	0.0052	0.12	0.87	0.10	7.33	
0.00		0.5	18.35	18.51	0.0053	0.16	0.76	0.12	10.55	

Notes:

1. Start HEC-RAS chainage 78.56 boundary condition upstream to suit TuFlow modelling results (refer Figure 1 Holroyd Council Flood report)
2. Peak flow determined to match upstream reach boundary condition TWL for HEC-RAS chainage 78.56 as above
3. TuFlow model flood water level results extracted from Figure 1 Holroyd Council Flood Report
4. End kerb controls discharge water levels to allow for trapped low point over topping to reserve at rear of site to effect HEC-RAS chainage 23.50

NORTHSIDE WEST CLINIC - 23-27 LYTTON STREET WENTWORTHVILLE

SOUTH REACH FLOOD IMPACT ASSESSMENT HEC-RAS MODEL (Through Southern Car Park Area)

PRE-DEVELOPMENT WITH HEC-RAS MODEL RESULTS CALIBRATED TO MATCH TUFLOW MODELLING FLOOD LEVELS

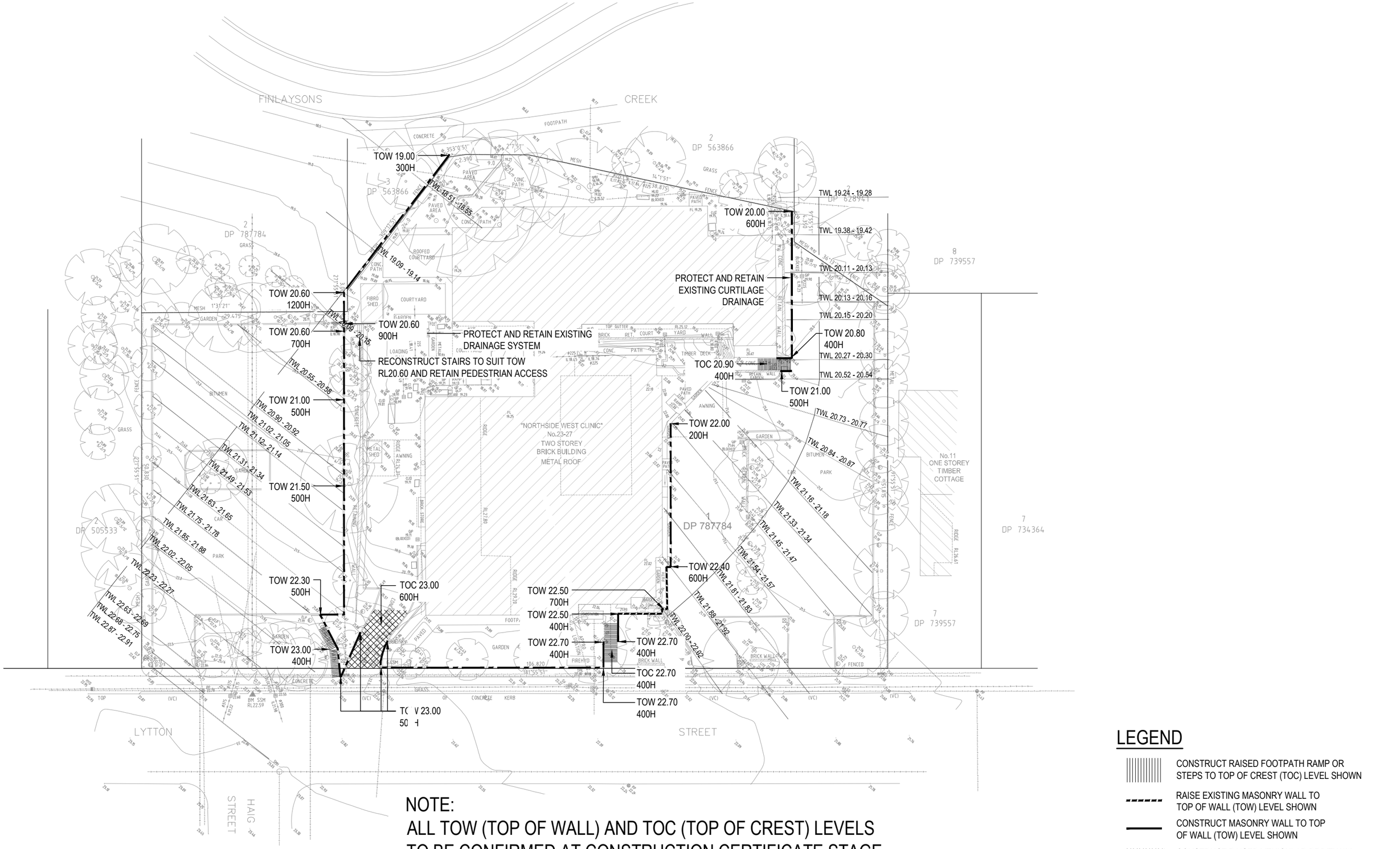
River Station Cross Section Chainage[1] (m)	TuFlow[3] Flood TWL Approximate m AHD	Peak Flow[2] Approx (m3/s)	Minimum Elevation (m)	W.S. Elevation (m)	E.G. Slope (m/m)	Water Depth (m)	Velocity Peak (m/s)	Vel x Depth (m2/s)	Top Width of Flow (m)	Difference[3] TuFlow Vs HEC-RAS (m)
78.56		1.00	22.74	22.91	0.0053	0.17	0.90	0.15	13.99	
76.90	22.50	1.00	22.48	22.75	0.0005	0.27	0.51	0.14	9.24	0.25
74.90		1.00	22.46	22.69	0.0046	0.23	1.16	0.27	6.45	
69.03		1.00	22.14	22.27	0.0047	0.13	1.10	0.14	7.50	
64.71	22.00	1.00	21.87	22.05	0.0054	0.18	0.85	0.15	16.00	0.05
61.58		1.00	21.75	21.88	0.0057	0.13	0.81	0.11	19.17	
58.52		1.00	21.65	21.78	0.0054	0.13	0.76	0.10	21.08	
55.48		1.00	21.55	21.66	0.0034	0.11	0.56	0.06	32.41	
55.48		1.00	21.55	21.65	0.0060	0.10	0.69	0.07	29.57	
51.00	21.50	1.00	21.4	21.53	0.0056	0.13	0.78	0.10	20.59	0.03
48.07		1.00	21.24	21.34	0.0055	0.10	0.80	0.08	18.85	
44.07		1.00	21.08	21.14	0.0063	0.06	0.66	0.04	34.29	
44.07		1.00	21.08	21.14	0.0062	0.06	0.66	0.04	34.38	
42.07	21.00	1.00	20.97	21.05	0.0059	0.08	0.72	0.06	26.55	0.05
40.03		1.00	20.85	20.92	0.0054	0.07	0.81	0.06	18.73	
32.50	20.50	1.00	20.48	20.58	0.0054	0.10	0.83	0.08	17.16	0.08
23.50	20.00 End kerb[4]	1.00	19.96	20.17	0.0051	0.21	1.01	0.21	9.82	0.17
12.00		1.00	18.97	19.14	0.0046	0.17	1.06	0.18	8.24	
0.00		1.00	18.35	18.55	0.0050	0.20	0.96	0.19	10.93	

Notes:

1. Start HEC-RAS chainage 78.56 boundary condition upstream to suit TuFlow modelling results (refer Figure 1 Holroyd Council Flood report)
2. Peak flow determined to match upstream reach boundary condition TWL for HEC-RAS chainage 78.56 as above
3. TuFlow model flood water level results extracted from Figure 1 Holroyd Council Flood Report
4. End kerb controls discharge water levels to allow for trapped low point over topping to reserve at rear of site to effect HEC-RAS chainage 23.50

APPENDIX E

Concept Flood Management Strategy Plan



NOTE:
ALL TOW (TOP OF WALL) AND TOC (TOP OF CREST) LEVELS
TO BE CONFIRMED AT CONSTRUCTION CERTIFICATE STAGE

LEGEND

- CONSTRUCT RAISED FOOTPATH RAMP OR STEPS TO TOP OF CREST (TOC) LEVEL SHOWN
- RAISE EXISTING MASONRY WALL TO TOP OF WALL (TOW) LEVEL SHOWN
- CONSTRUCT MASONRY WALL TO TOP OF WALL (TOW) LEVEL SHOWN
- CONSTRUCT RAISED VEHICULAR DRIVEWAY RAMP TO TOP OF CREST (TOC) LEVEL SHOWN

This drawing has been assigned an electronic code that signifies the drawing has been checked and approved by:

Issue	Description	Date	Drawn	Approved
A	ISSUED FOR INFORMATION	15.05.14	JDC	RGE

North

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Project
FLOOD IMPACT ASSESSMENT
NORTHSIDE WEST CLINIC
23-27 LYTTON STREET
WENTWORTHVILLE, NSW, 2145

Drawing Title
CONCEPT FLOOD MANAGEMENT STRATEGY PLAN

Drawn	Date	Scale	A3	Q.A. Check	Date
JDC	MAY 2014	1:500			
Designed	Project No.			Dwg. No.	Issue
JDC	SY140045			SKC1.01	A

May 13, 2014 - 4:07pm P:\SY\140045\Drawings\Flood\SKC1.01.dwg

APPENDIX B

Stage 2 Development

Proposed Flood Management Strategy Plan

PRIMARY SURCHARGE PIT.
CONSTRUCT 1200x1200 SURFACE
SURCHARGE PIT 'BP2'

BP2

IL19.85

90 PE

IL19.50

HEADWALL DISCHARGE
TO INTERNAL GUTTER
CONFIRM ON SITE

IL19.85

CONSTRUCT Ø90 PE
BLEED-PIPE TO PIT BP2
GENERALLY AS SHOWN

CONSTRUCT Ø750 RCP
DIVERSION DRAIN -
REFER LONG SECTION

EMERGENCY FLOOD DISCHARGE OUTLET
IN NORTHERN WALL OF BASEMENT LEVEL
1 AT RL 20.400 - NOMINAL 3000W X 200H
LETTERBOX OPENING IN WALL

"NORTHSIDE WEST CLINIC"
No.23-27
TWO STOREY
BRICK BUILDING
METAL ROOF

STAGE 1

1
DP 787784

2
DP 505533

A
C1.02

BASEMENT
FFL 20.500

750 RCP

DRIVEWAY

CONSTRUCT DRIVEWAY
WITH FLOOD LEVEE
MOUNT AT RL23.200

FFL 23.50

TOW MIN
RL23.00

TOC 23.00
600H

TOP OF WALL MIN
RL 23.20

IL 21.00

TDIL
22.40

RL 23.0

TOW 23.00
500H

BP1

GL 22.9

GL 22.8

TDIL 22.50

INSTALL FLOOD DIVERSION 300
WIDE GRATED TRENCH DRAIN TO
BOUNDARY GENERALLY AS SHOWN

CONSTRUCT SPECIAL 1200x1200
SURFACE INLET PIT 'BP1'

This drawing has been assigned an electronic code that signifies the drawing has been checked and approved by:

Issue	Description	Date	Drawn	Approved
A	FLOOD STUDY	19.03.15	KBM	RGE

North

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Project
NORTHSIDE WEST CLINIC
STAGE 2 - FLOOD MANAGEMENT WORKS
23-27 LYTTON STREET
WENTWORTHVILL, NSW, 2145

Drawing Title
DRAINAGE LAYOUT PLAN

Drawn	Date	Scale A3	Q.A. Check	Date
KBM	MARCH 2015	1:250		
Designed	Project No.		Dwg. No.	Issue
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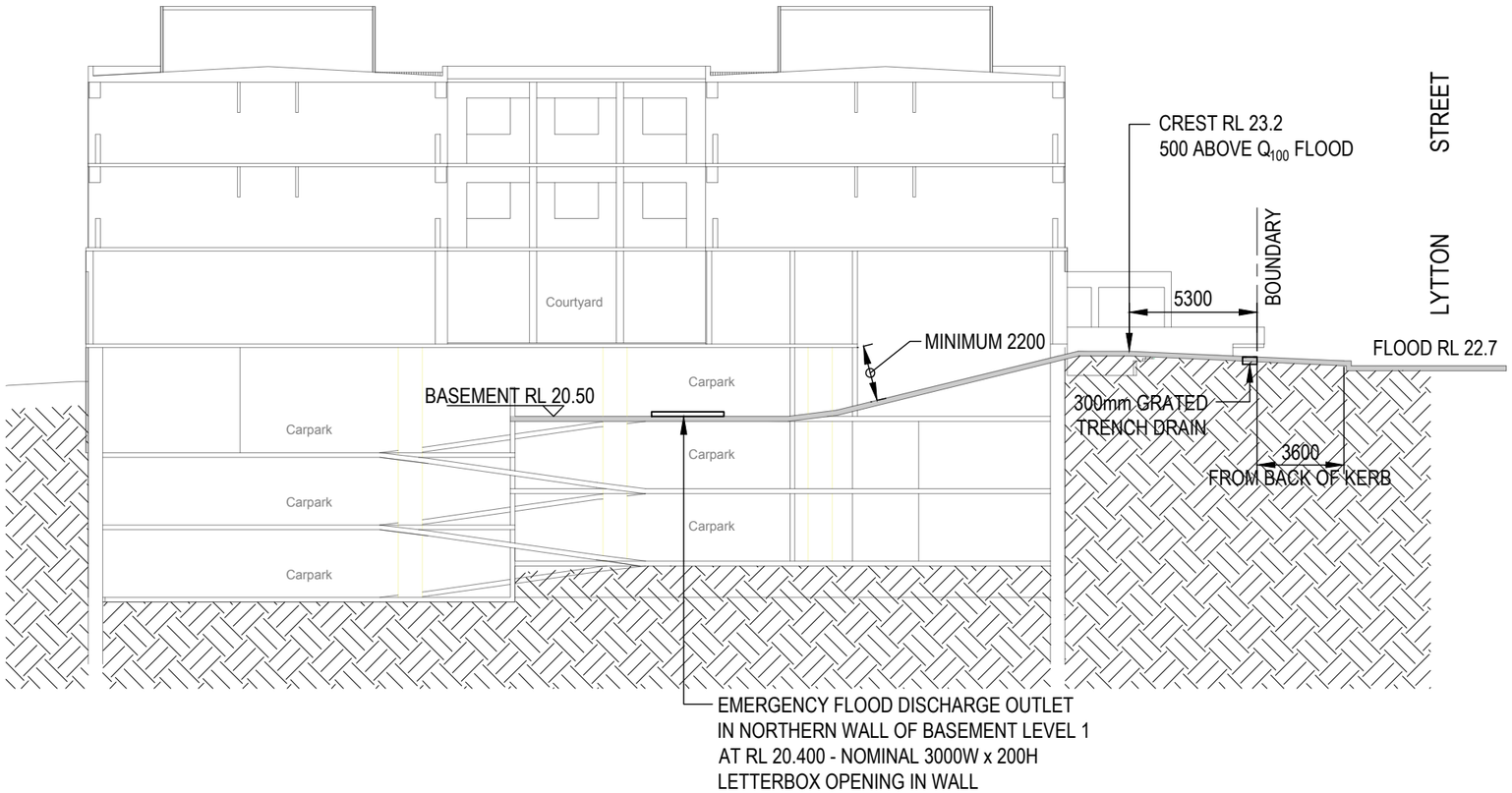
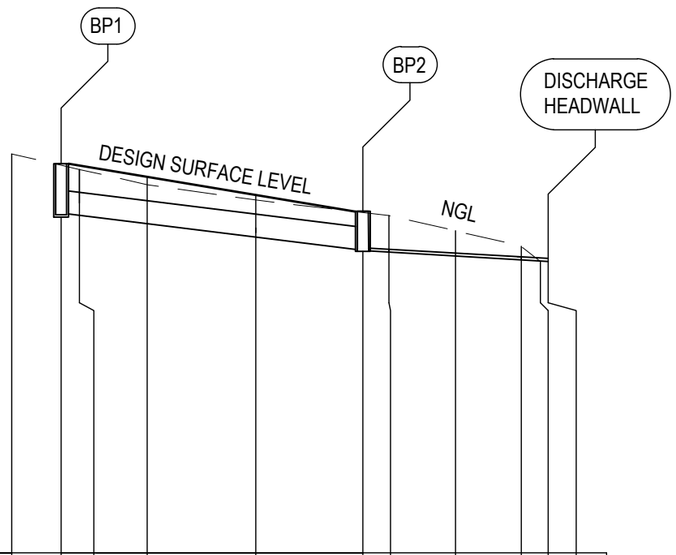
Mar 19, 15 - 1:49pm





DATUM 10.0

SURFACE LEVEL	23.0	22.65	22.5	22.0	21.5		21.0	20.5	20.0	19.5
INVERT LEVEL		21.00				19.5				19.5
CHAINAGE		0.0				49.2				78.0

SCALE 1:500 HORIZONTAL
SCALE 1:100 VERTICAL

This drawing has been assigned an electronic code that signifies the drawing has been checked and approved by:

North

Issue	Description	Date	Drawn	Approved
A	FLOOD STUDY	19.03.15	KBM	RGE

0 1cm at full size 5cm 10cm

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Project
NORTHSIDE WEST CLINIC
STAGE 2 - FLOOD MANAGEMENT WORKS
23-27 LYTTON STREET
WENTWORTHVILL, NSW, 2145

Drawing Title
DRIVEWAY LONGITUDINAL SECTION AND
DRAINAGE LONGITUDINAL SECTION

Drawn	Date	Scale A3	Q.A. Check	Date
KBM	MARCH 2015	AS SHOWN		
Designed	Project No.		Dwg. No.	Issue
RGE	SY150080		SKC1.02	A

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Mar 19, 2015 - 4:39pm