Project No: 2018-053
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FLOOD STUDY REPORT

Proposed Torrens Title Subdivision and new Dwelling House

at

15 Alto Avenue, Seaforth

for

Matt Deeran

Report Prepared By:

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1 Overview

1.1 Purpose

This report has been commissioned at the request of Matt Deeran to determine the localised flooding impacts of an overland flow path from Councils Stormwater Drainage system that traverses through the development site.

1.2 Proposed Development

The proposed development involves the construction of two new two storey residential dwellings and Torrens title subdivision of one lot into two.

1.3 Scope of Report

The scope of this report is as follows:

- Obtain information from the local council such as contoured catchment maps, existing drainage infrastructure and hydrological data.
- Undertake hydrological calculations to determine the 1% AEP catchment flow rate draining through the development site.
- Undertake hydraulic modelling of the overland flow path to determine the extent of 1% AEP storm inundation within the vicinity of the site.
- Determine the impact the proposed development will have on the overland flow path and vice versa.
- Determine the minimum finished level of the proposed residential dwellings in accordance with Manly Council's Engineering Design Specification – Auspec One.

2 Site Conditions and Hydrology

2.1 Site and Drainage Characteristics

The development site has an existing Council 825mm diameter reinforced concrete pipe within an easement to drain water 1.83 wide that traverses through the site in a north to south direction. The Council easement and drainage pipe is located within the proposed vacant lot to be created as part of the proposed development.

The development also includes the construction of a new dwelling house and detached garage and studio with the Council easement and drainage pipe dissecting the proposed structures.

2.2 Topography

The majority of the development site is gently sloping of approximately 5% grade that falls across the site in a north to south direction.

2.3 Catchment Flows

The catchment flows draining through the site can be seen in the Catchment Map (Refer to Annexure A). The rational method was used to calculate the catchment flows.

Catchment Flow

Catchment Area = 8.43 ha
Time in Concentration Tc = 17 min
Coefficient of Runoff = 0.883
Rainfall Intensity I_{100} = 175 mm/hr

$$Q = \frac{CIA}{360} = \frac{0.883 \times 175 \times 8.43}{360} = \mathbf{3.62\ m3/s}$$

Existing 825mm diameter Crappie Capacity @ 5.0% grade = **3.5 m3/s**

Total Catchment Overland Flow

Assume a 50% Blockage factor to the Council 825mm diameter pipe;

Therefore, Total $Q = 3.62 - \frac{3.5}{2} = \mathbf{1.87\ m3/s}$

3 Flood Assessment

3.1 Flood Assessment Methodology

The hydraulic computer software HEC-RAS River Analysis System Version 4.1.0 was used to model the overland flow path.

The determination of the overland flow cross-section profiles was derived from the following:

- Site Survey Job Ref. 16123Sheet 2 of 2 Rev A dated 30.03.2017by Survey Plus
- Contour map by Northern Beaches Council Online Mapping Tool
- Ground Floor Plan Job No. CC00 Dwg No. 02 Rev C dated April 2018 by Classic Country Cottages

3.2 Modelled Cross-Sections

Eight cross-section profiles was used to model the overland flow path starting upstream at the northern boundary of the development site and terminating at the downstream boundary approximately 15 metres south.

The proposed new dwelling house on proposed Lot 1 has been designed as a suspended slab to minimise obstruction to the overland flow path.

3.3 Mannings ‘n’ Channel Roughness Coefficients

Mannings ‘n’ friction coefficient values were derived from chapter 14 of the Australian Rainfall and Runoff manual. The manning’s ‘n’ values used in the hydraulic modelling was as follows:

- Short Grasses - 0.035
- Concrete – 0.012

4 Hydraulic Modelling Results

4.1 Summary of Results

The location of cross-sections used to model the overland flow path for the pre-development and post-development scenarios is represented on the 1% AEP Overland Flow Path Inundation Plan – Drawing No. 2018053Pre and 2018053Post respectively in Annexure B. The HEC-RAS output summary data can also be found in Annexure C.

The 1% AEP catchment flow rate draining through the site is Q = 3.62 m3/s. The existing 825mm diameter Council pipe has a capacity of 3.5 m3/s. A 50% blockage factor to the pipe capacity was adopted and therefore the residual overland flow rate used in the modelling of the overland flow path for the 1% AEP storm event was Q = 1.87 m3/s.

A comparison of the flood level results for the 1% AEP storm event pre-development and post-development scenarios can be found in Table 4.1.

Design Chainage	Pre-Development 1% AEP Storm Flood Level	Post-Development 1% AEP Storm Flood Level	Change in Flood Level
(m)	(m)	(m)	(m)
15.0	86.06	86.06	0.00
13.5	85.98	85.99	+ 0.01
10.0	85.69	85.70	+ 0.01
7.4	85.48	85.48	0.00
5.0	85.25	85.26	+ 0.01
0.0	84.86	84.86	0.00

***Table 4.1** – Pre Development & Post Development 1% AEP Overland Flow Flood Levels*

In accordance with Manly Council's Engineering Design Specification – Auspec One, the finished floor level of the new dwelling on proposed Lot 1 adjacent an overland flow path is required to be a minimum 0.3 metres above the 1% AEP flood level as shown in Table 4.2.

Design Chainage	Minimum Channel Base Invert Level	100 year ARI Top Water Level	Minimum Finished Floor Level	Velocity Depth Product
(m)	(m)	(m)	(m)	(m2/s)
15.0	85.89	86.06	-	0.19
13.5	85.82	85.99	86.29	0.24
10.0	85.50	85.70	86.00	0.39
7.4	85.30	85.48	85.78	0.34
5.0	85.10	85.26	85.56	0.31
3.35	84.92	85.10	85.40	0.36
1.65	84.80	84.99	85.29	0.34
0.0	84.74	84.86	-	0.23

***Table 4.2** – 1% AEP Overland Flow Levels and Minimum Finished Floor Levels*

4.2 Conclusion

In conclusion, the HEC-RAS model demonstrates that the majority of the overland flow path inundation area for the 1% AEP storm draining through the site will travel between the proposed new dwelling house and studio/garage fronting Alto Avenue.

As a result of the proposed development there will be negligible changes to the flood levels and therefore will not have a detrimental impact on the adjoining properties.

The flood levels through the site occur as an inclined plane generally parallel to the existing natural contours of the land. The depth of flooding occurring within the site ranges between 0.14 - 0.20 metres. The channel velocity at all cross sections along the flow path is less than 2.0 m/s.

The provisional hazard category for the development site is considered to be a Low Hazard by using the hydraulic hazard categorisation graph found in the NSW Government Flood Plain Management Manual.

4.3 Recommendations

As a result of the hydraulic modelling undertaken at the site for the proposed development the following recommendations are proposed:

1. The proposed finished ground floor level of the main residence shall not less than RL 86.29, which provides a minimum 300 mm freeboard above the 1% AE flood level.

2. The proposed finished floor level of the studio shall be no lower than RL 86.29.

3. The proposed garage shall have a finished floor level not less than RL 85.78.

4. All structures below the 1% AEP flood level plus a 300mm freeboard shall be constructed with flood compatible building components in accordance with Annexure C.

5. The supports of any structure shall be designed by a qualified structural engineer to withstand the forces of floodwaters, debris and buoyancy up to the 1% AEP flood level plus a 300mm freeboard.

Disclaimer - This flood study report is intended for the purposes of constructing a proposed residential dwelling house as depicted in the Ground Floor Plan Job No. CC00 Dwg No. 02 Rev C dated April 2018 by Classic Country Cottages ONLY and cannot be used for the purposes of planning other developments on the subject property or for proposed developments on neighbouring properties.

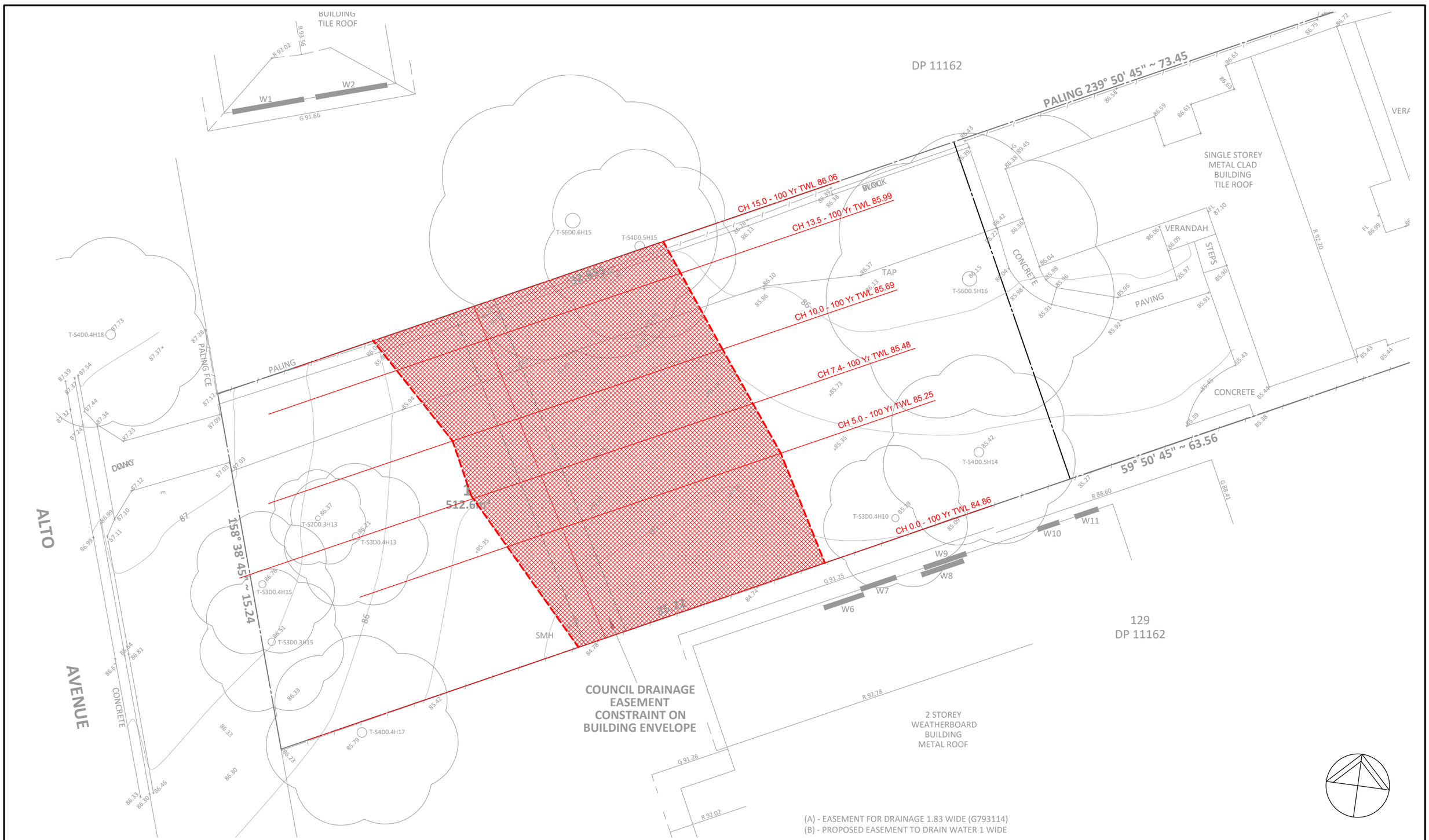
ANNEXURE A

Catchment Map


CATCHMENT
AREA = 8.43 Ha
BANTRY RESERVE
JUDITH STREET
KIRKWOOD STREET
BURNT STREET
WATERVIEW STREET
RESERVE STREET
ALTO AVENUE
WAKEHURST PARKWAY
Stormwater
SPP43048
SPP43047
SPP43075
SPP43046
SPI42764
375mm
SPP43044
SPP43045
SPP43043
SPI42761
375mm
SPP43042
SPP43074
SPP43041
SPP43040
SPP43039
SPP43037
SPP43038
SPP43073
SPP43036
SPP43072
SPP43035
SPI42753
600mm
SPP43069
SPP43071
SPP43068
SPP43034
SPP43065
SPP43066
SPP43033
SPP43070
SPP43064
SPP43063
SPP43032
SPP43031
SPP43030
SPI42748
600mm
SPP43061
SPP43062
SPP43029
SPP43028
SPP43027
SPI42745
825mm
SPP43026
SPP43025
SPP43024
SPP43057
SPP43097
SPP43095
SPP43096
SPI42812
Not Applicable
SPP43112
SPP43094
SPP43093
SPI42810
375mm
SPP43092
SPI42809
375mm
SPP43091
SPP43090
SPP43110
SPP42002
SPP42003
SPP42099
SPP42100
SPP42103
SPP42101
SPP42102
SPP42104
SPP42105
SPP42135
SPP42013
SPP42096
SPP41852
Map Data © Northern Beaches Council. Image © Jacobs & Aerometrex.
60m

Annexure B

Pre-Development 1% AEP Storm Overland Flow Path Inundation Plan



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PROJECT TITLE: NEW DWELLING HOUSE
15 ALTO AVENUE
SEAFORTH NSW

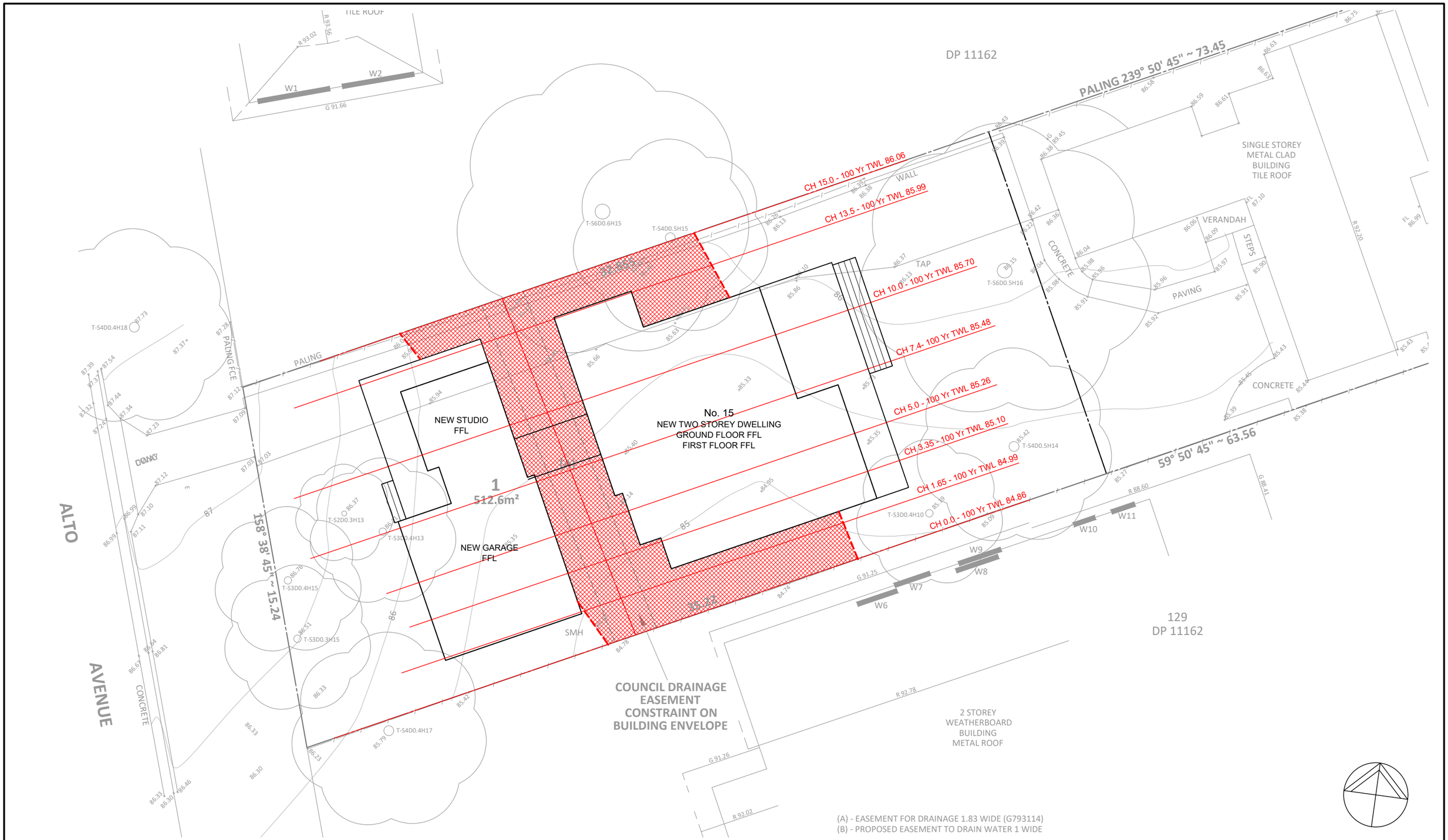
DRAWING TITLE: PRE-DEVELOPMENT
OVERLAND FLOWPATH
FLOOD EXTENTS

DRAWN: A.L	APPROVED BY: ANDREW LAM MIEAust B.E. Civil (Hons)		
DATE: 03.09.2018			
JOB No: 2018-053	DWG NO: OF1	no. IN SET 2	

No.	REVISION / ISSUE DESCRIPTION	DATE

Annexure C

Post-Development 1% AEP Storm Overland Flow Path Inundation Plan



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DRAWING TITLE: POST-DEVELOPMENT
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DRAWN: A.L
DATE: 03.09.2018
JOB No: 2018-053
APPROVED BY: ANDREW LAM MIEAust B.E. Civil (Hons)
DWG NO: OF2
no. IN SET: 2

No.	REVISION / ISSUE DESCRIPTION	DATE

ANNEXURE D

Pre-Development HEC-RAS Output Data

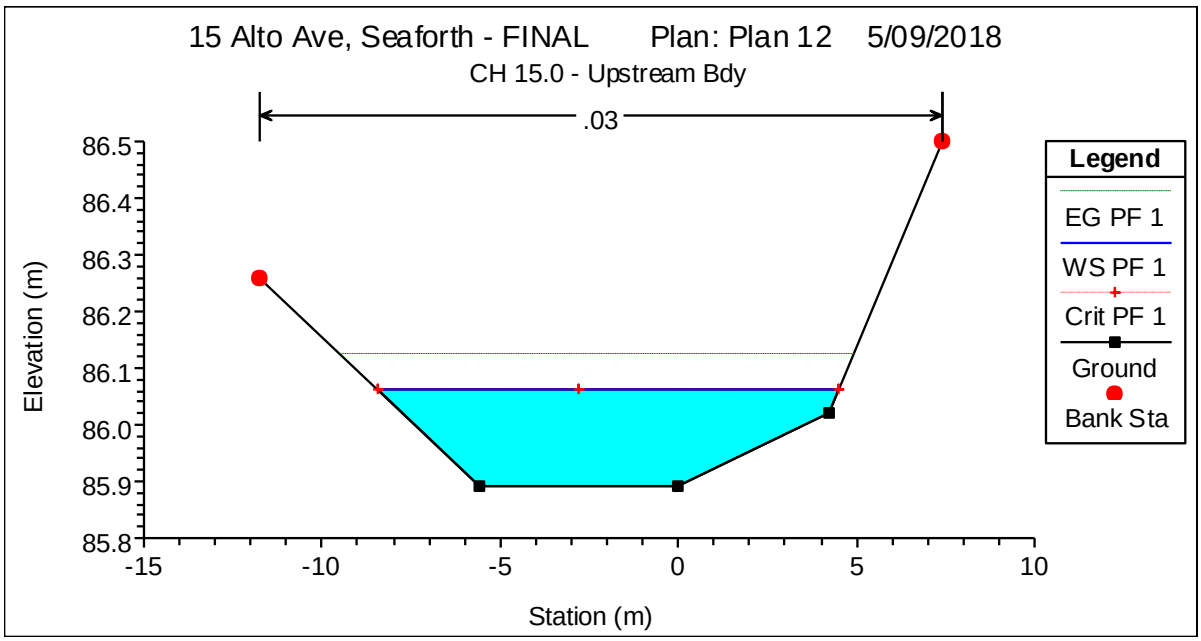

Figure D1 – Pre-Development HEC-RAS Cross-Section 15.0

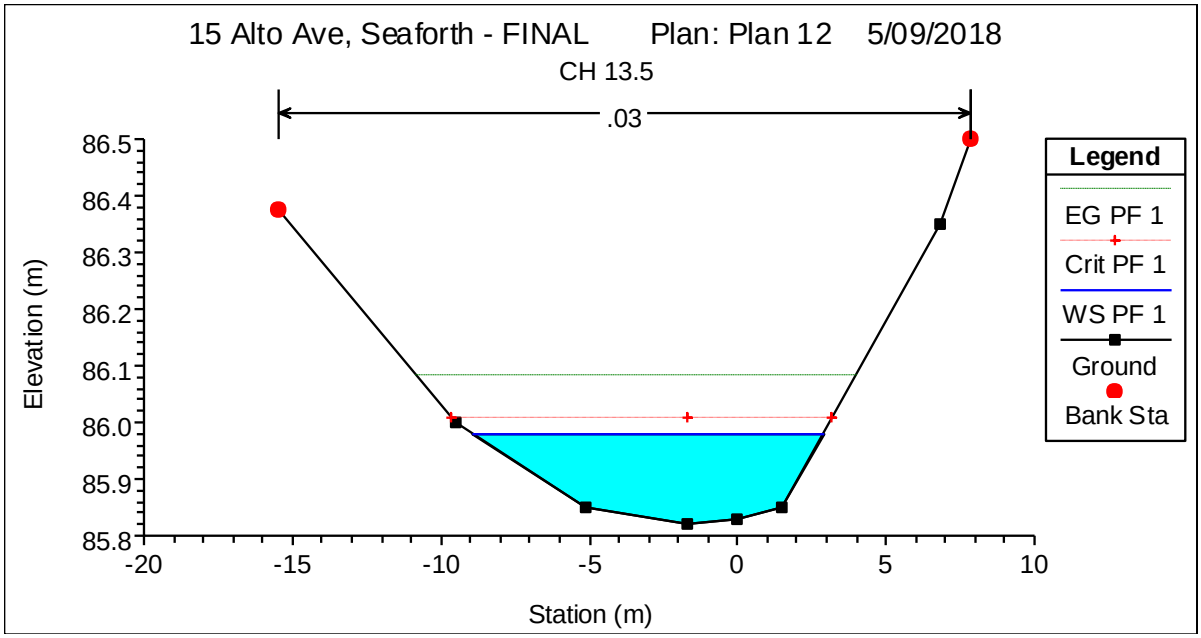

Figure D2 – Pre-Development HEC-RAS Cross-Section 13.5

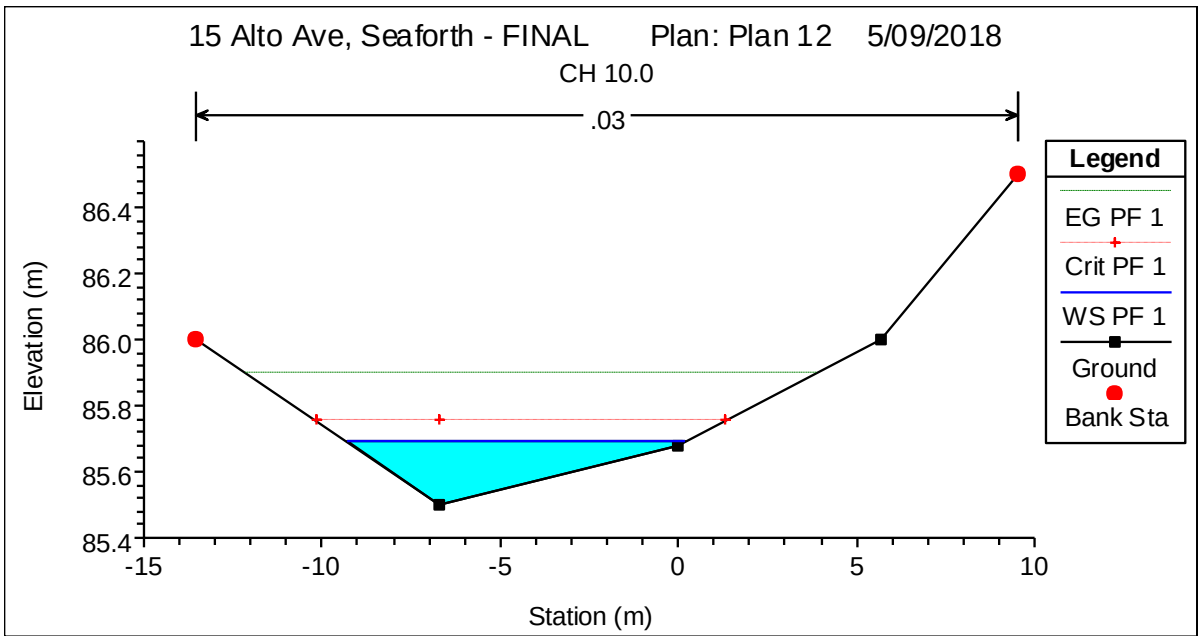

Figure D3 – Pre-Development HEC-RAS Cross-Section 10.0

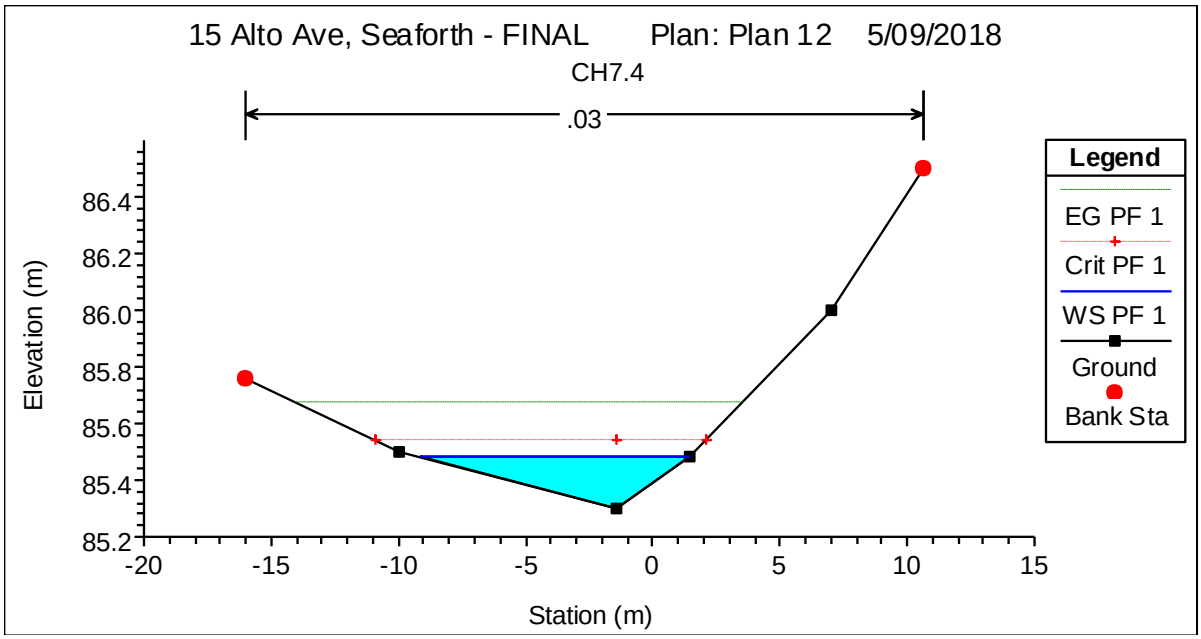

Figure D4 – Pre-Development HEC-RAS Cross-Section 7.4

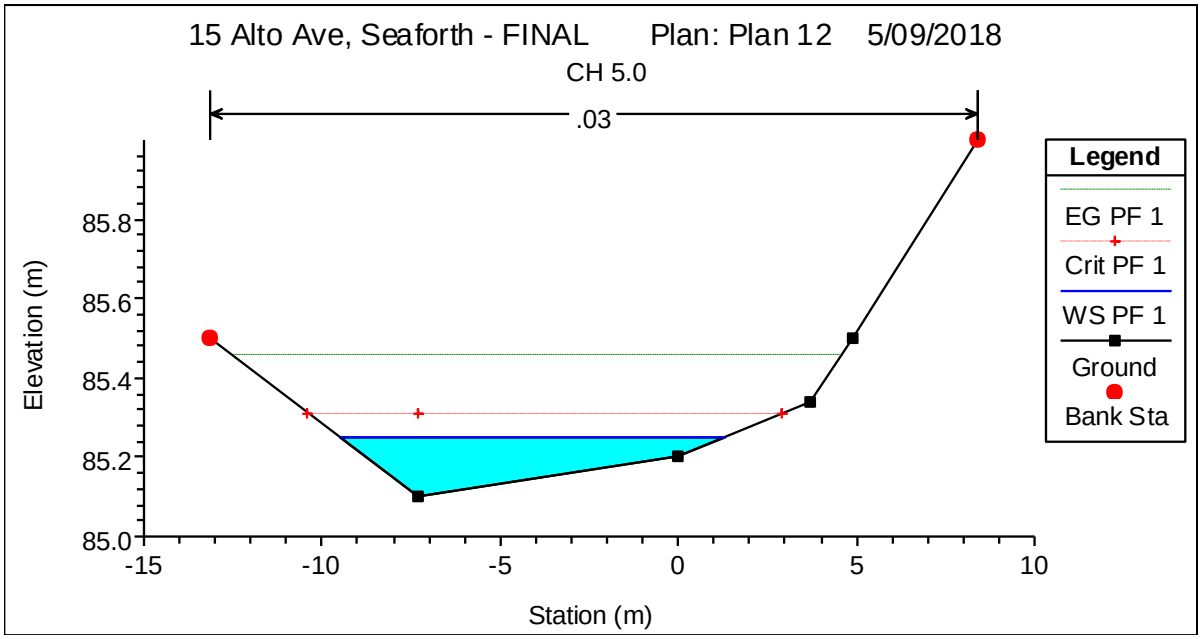

Figure D5 – Pre-Development HEC-RAS Cross-Section 5.0

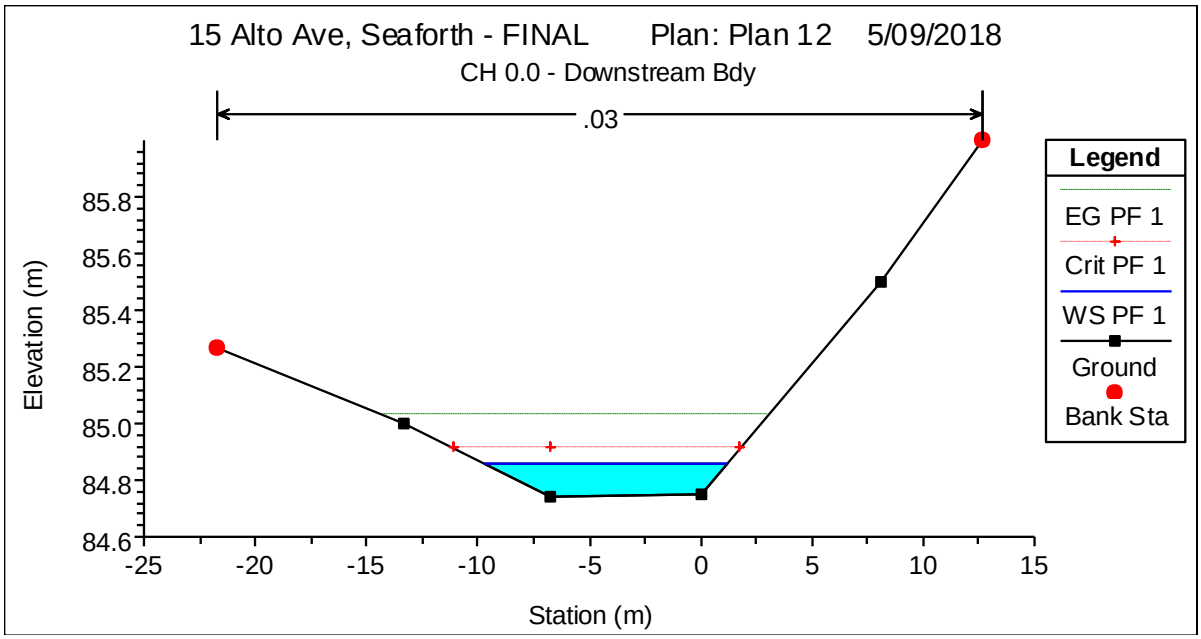

Figure D6 – Pre-Development HEC-RAS Cross-Section 0.0

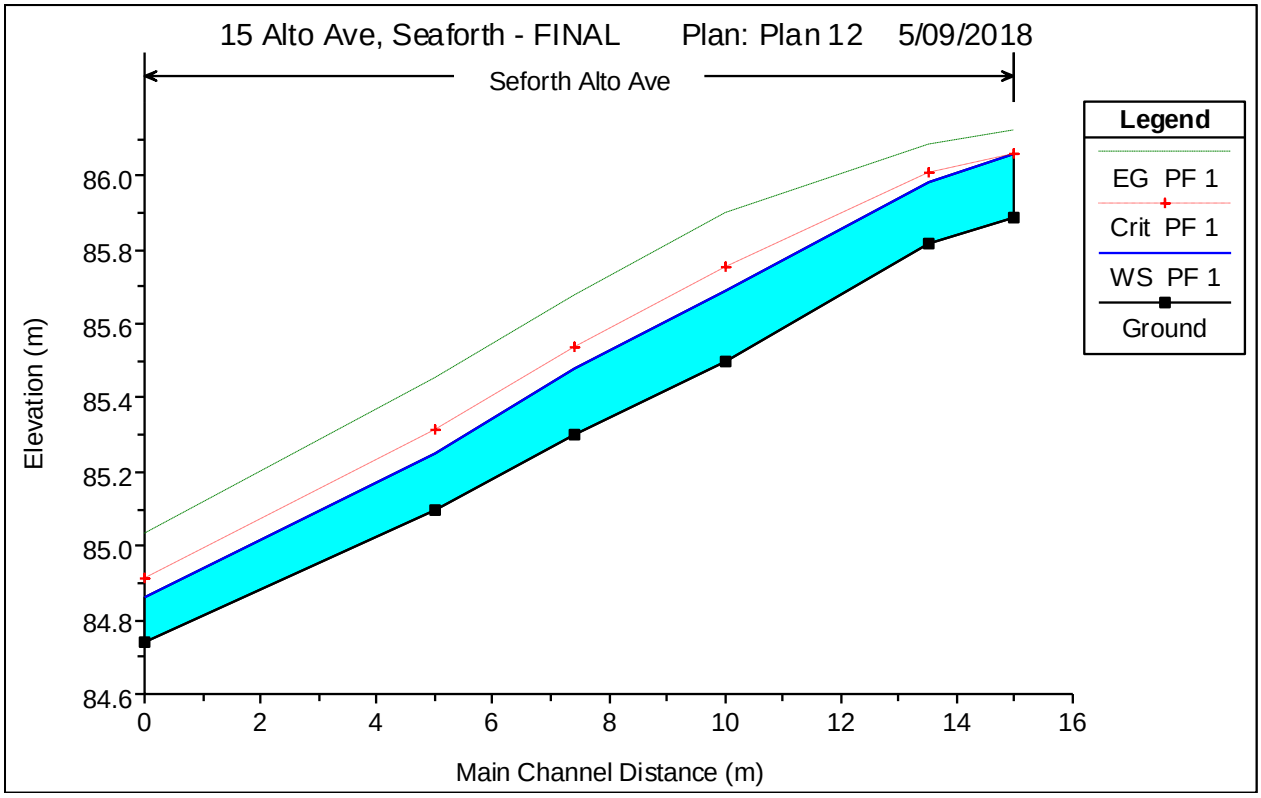

Figure D7 – Pre-Development HEC-RAS Longsection

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)	
Alto Ave	15.0	PF 1	1.87	85.89	86.06	86.06	86.13	0.017694	1.13	1.66	12.95	1.00
Alto Ave	13.5	PF 1	1.87	85.82	85.98	86.01	86.08	0.034039	1.42	1.32	11.84	1.36
Alto Ave	10.0	PF 1	1.87	85.50	85.69	85.75	85.90	0.081395	2.01	0.93	9.51	2.06
Alto Ave	7.4	PF 1	1.87	85.30	85.48	85.54	85.68	0.085532	1.96	0.96	10.62	2.08
Alto Ave	5.0	PF 1	1.87	85.10	85.25	85.31	85.46	0.096628	2.01	0.93	10.83	2.20
Alto Ave	0.0	PF 1	1.87	84.74	84.86	84.91	85.03	0.071871	1.84	1.02	10.94	1.92

Figure D8 – Pre-Development HEC-RAS Results Summary Table

ANNEXURE E

Post-Development HEC-RAS Output Data

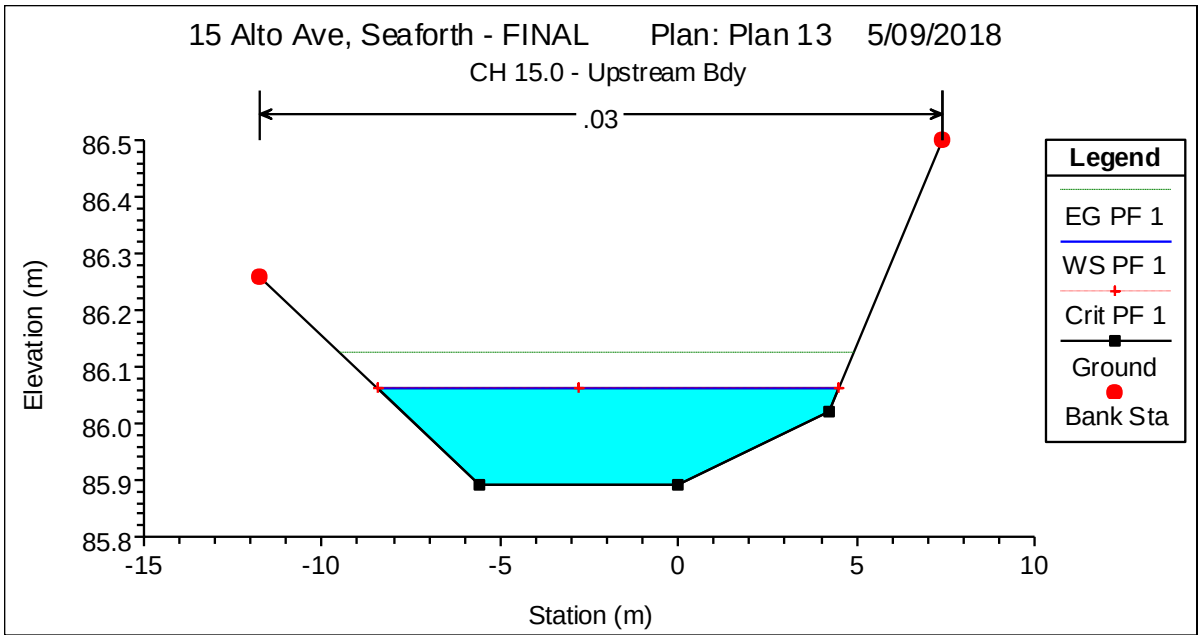

Figure E1 – Post-Development HEC-RAS Cross-Section 15.0

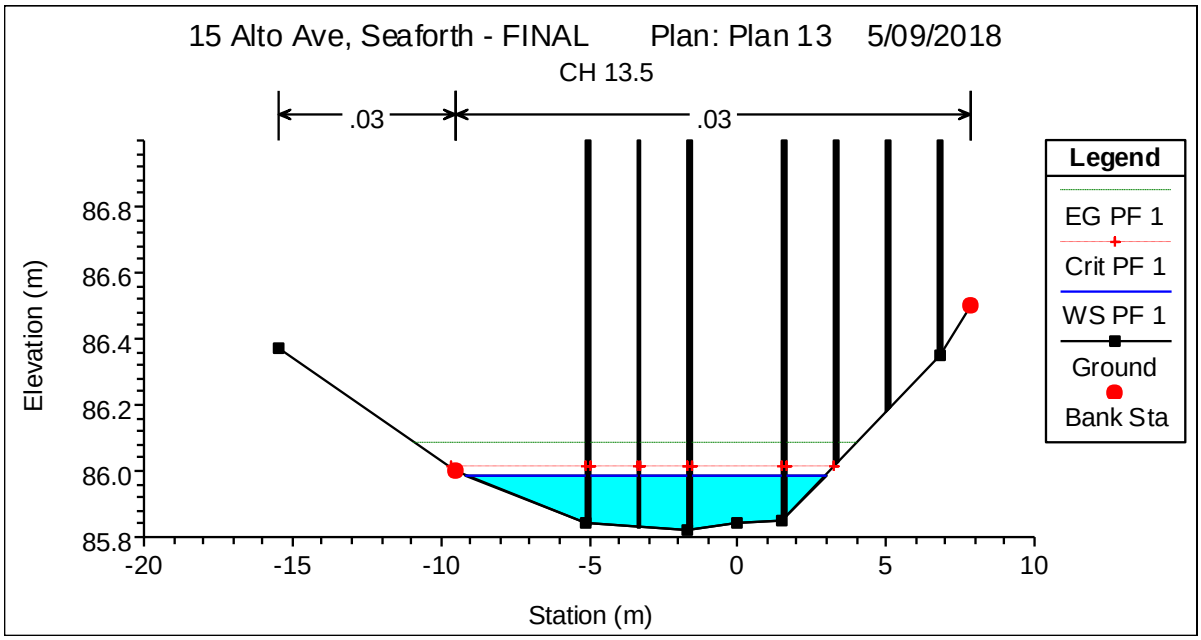

Figure E2 – Post-Development HEC-RAS Cross-Section 13.5

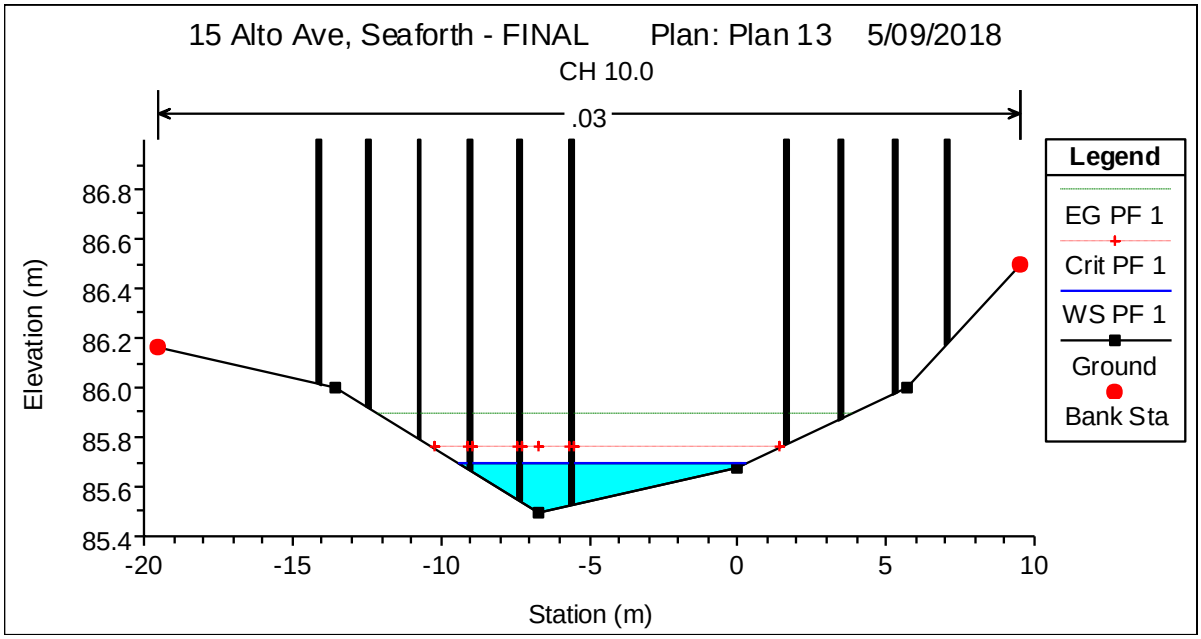

Figure E3 – Post-Development HEC-RAS Cross-Section 10.0

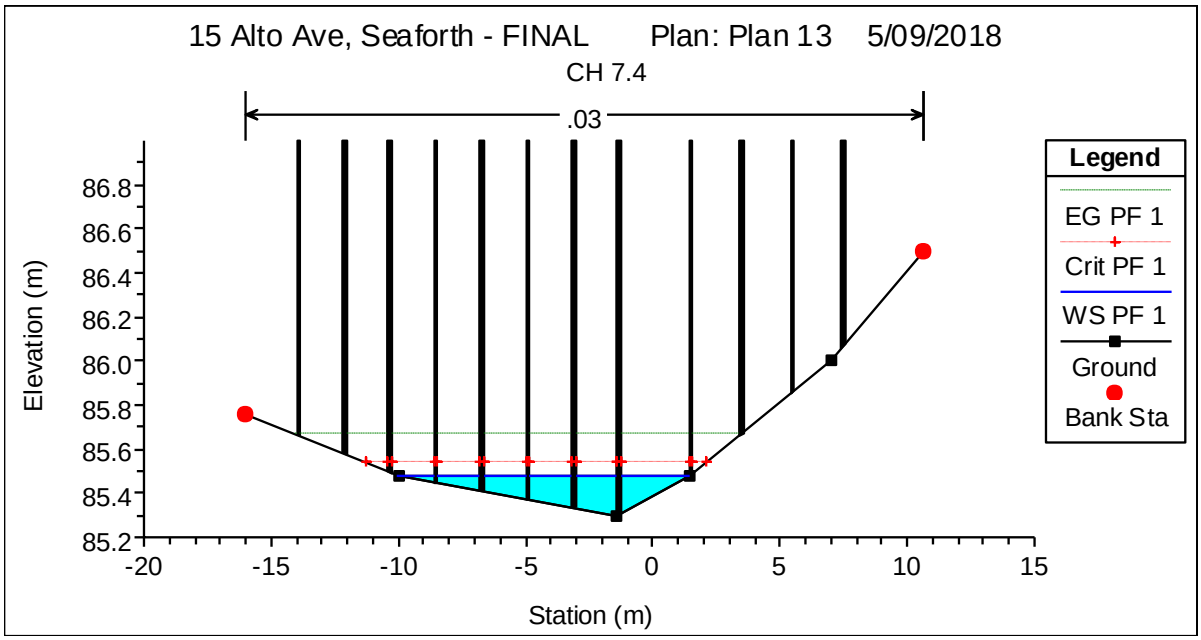

Figure E4 – Post-Development HEC-RAS Cross-Section 7.4

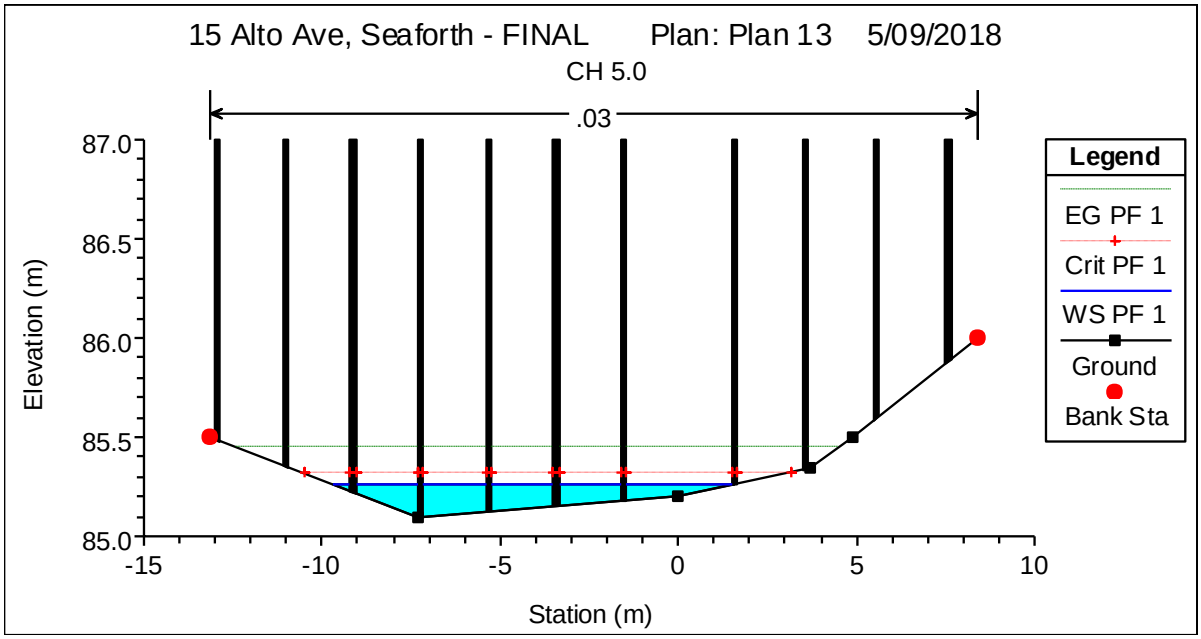

Figure E5 – Post-Development HEC-RAS Cross-Section 5.0

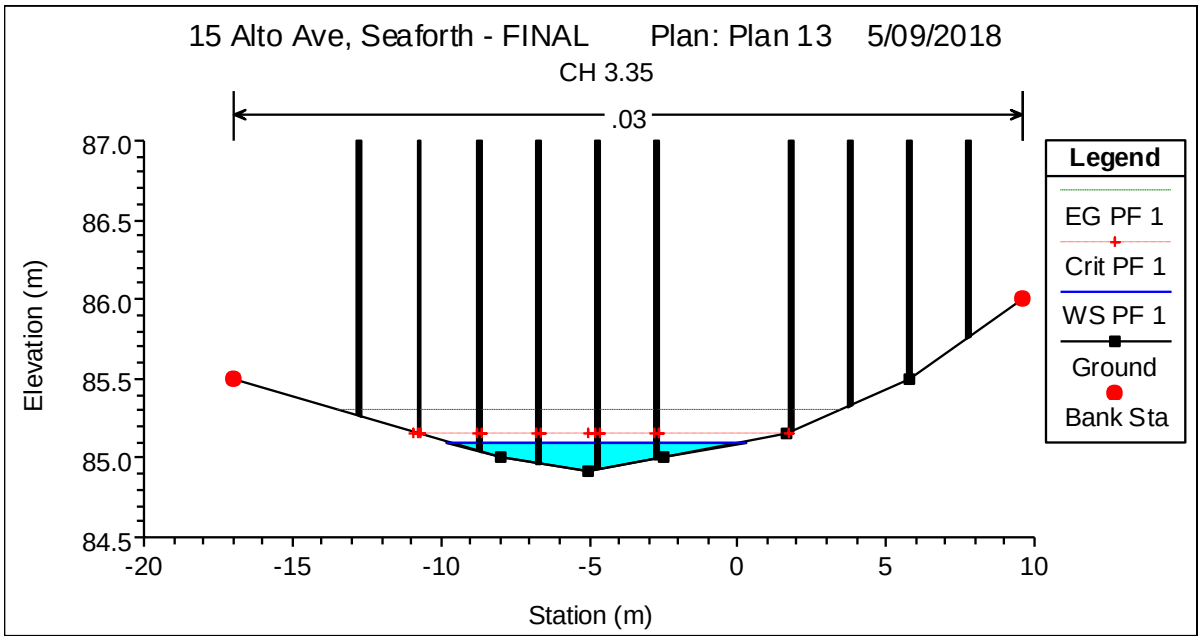

Figure E6 – Post-Development HEC-RAS Cross-Section 3.35

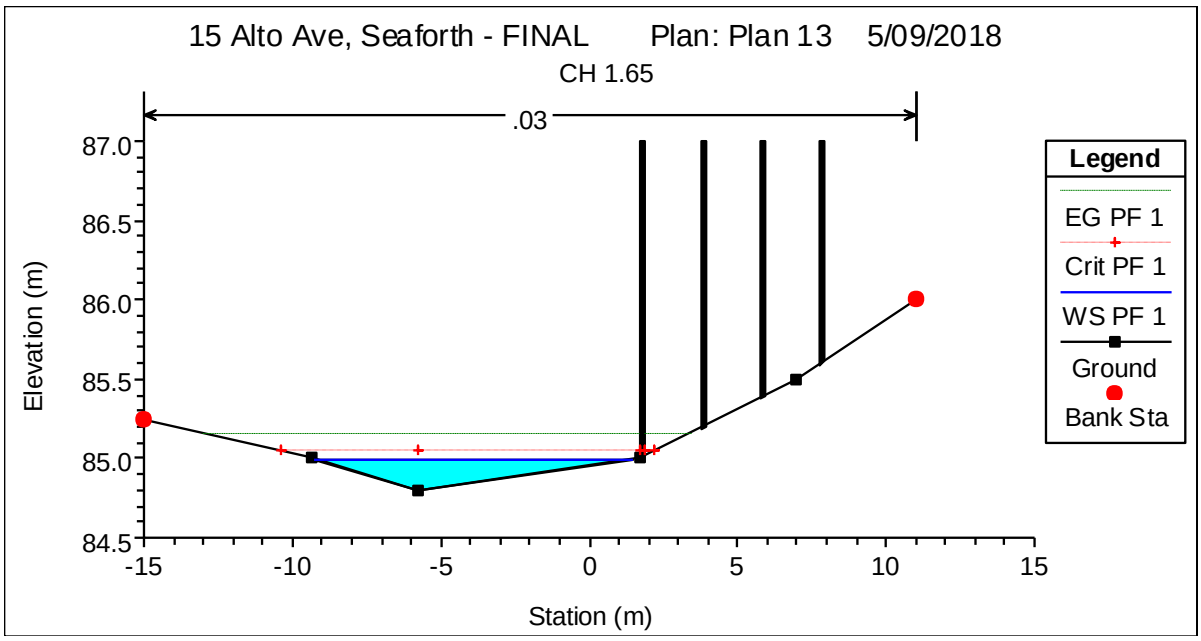

Figure E7 – Post-Development HEC-RAS Cross-Section 1.65

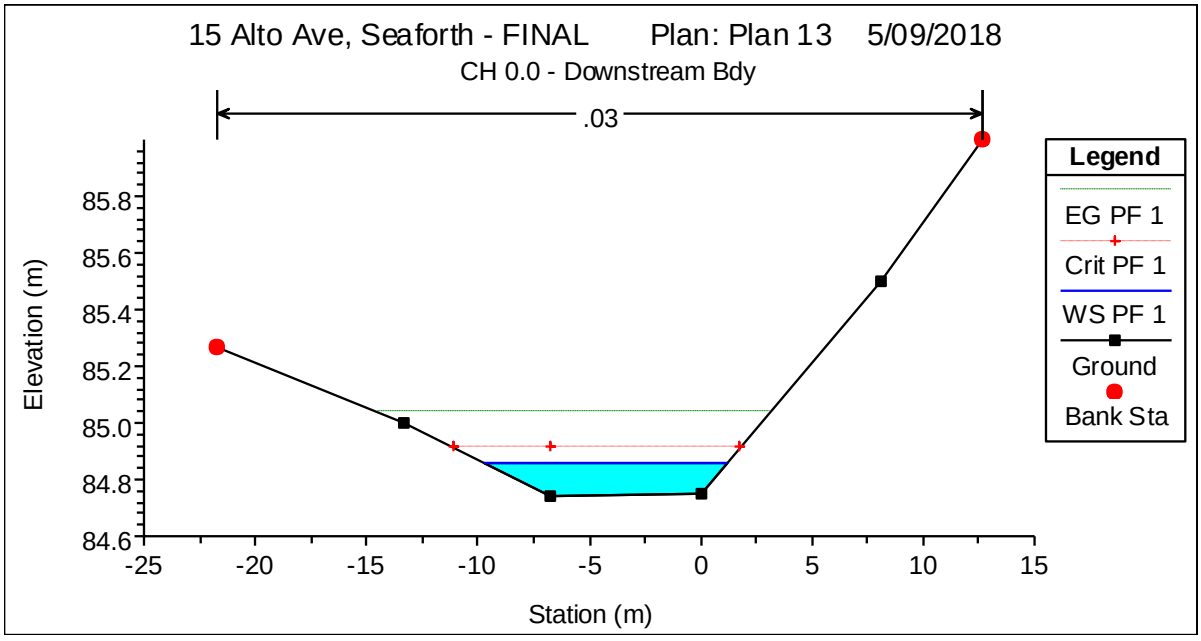

Figure E8 – Post-Development HEC-RAS Cross-Section 0.0

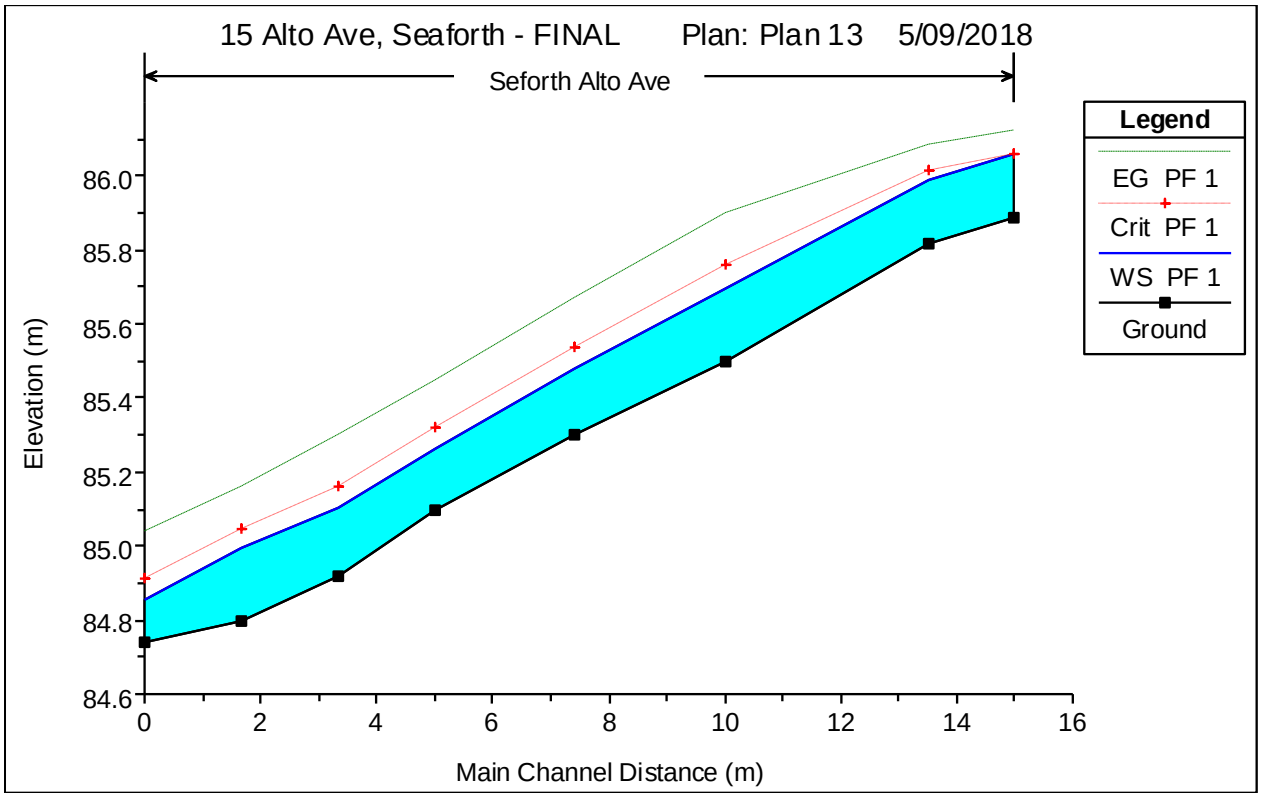

Figure E9 – Post-Development HEC-RAS Longsection

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)	
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Alto Ave	13.5	PF 1	1.87	85.82	85.99	86.01	86.09	0.035145	1.39	1.34	11.59	1.30
Alto Ave	10.0	PF 1	1.87	85.50	85.70	85.76	85.90	0.081699	1.98	0.95	9.29	1.98
Alto Ave	7.4	PF 1	1.87	85.30	85.48	85.54	85.67	0.090137	1.91	0.98	10.70	2.01
Alto Ave	5.0	PF 1	1.87	85.10	85.26	85.32	85.45	0.090014	1.93	0.97	10.42	2.02
Alto Ave	3.35	PF 1	1.87	84.92	85.10	85.16	85.30	0.089403	1.99	0.94	9.52	2.03
Alto Ave	1.65	PF 1	1.87	84.80	84.99	85.04	85.16	0.067269	1.81	1.03	10.71	1.87
Alto Ave	0.0	PF 1	1.87	84.74	84.86	84.91	85.04	0.076883	1.88	1.00	10.86	1.98

Figure E10 – Post-Development HEC-RAS Results Summary Table