14 februari 2019

Rosersberg

Uppdatering hydraulisk modellering av bäck

2019-01-25

Marco Alicera

Scope

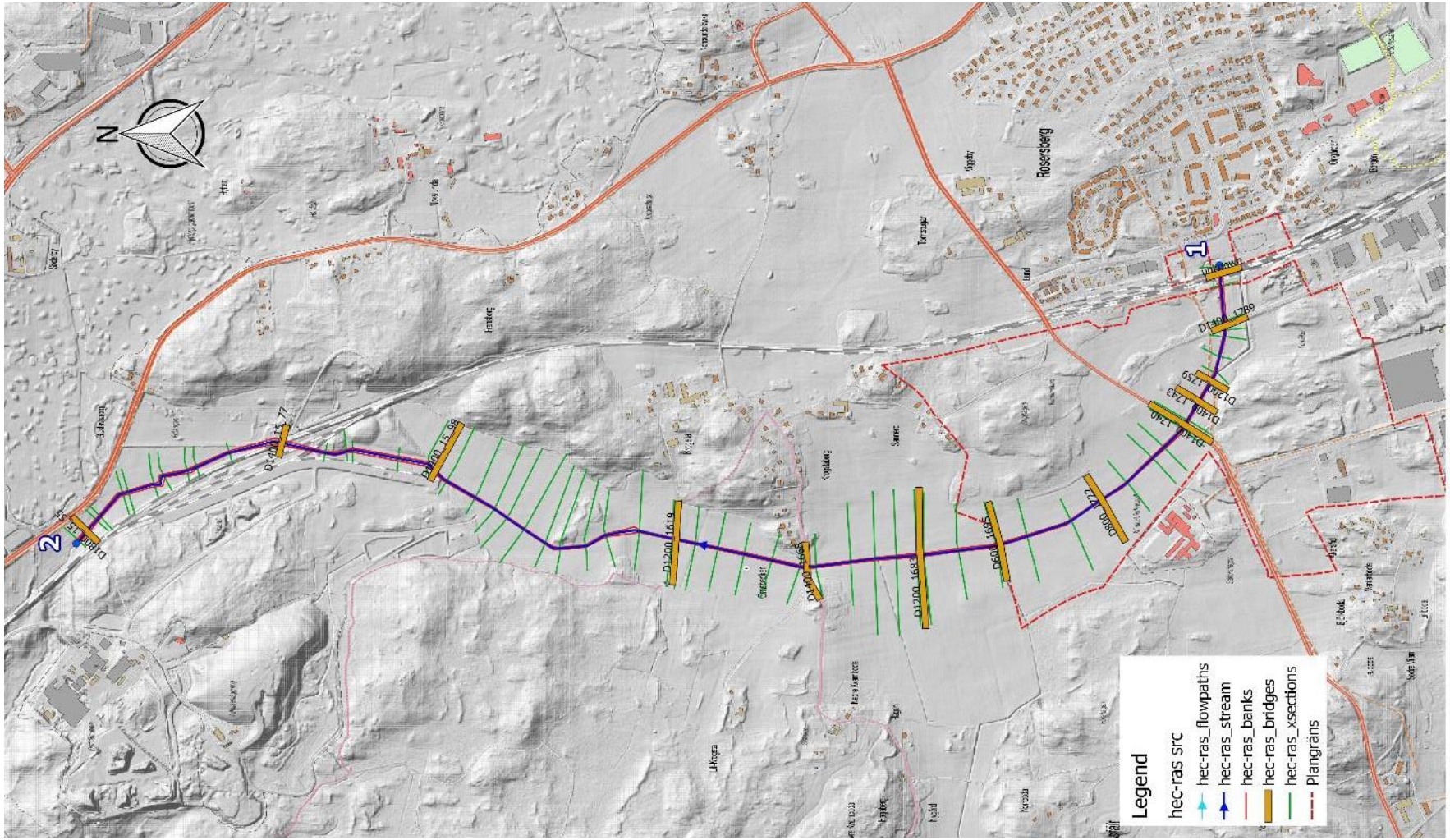
- Updating the results of the previous calculations regarding the high water levels in the stream due to some new conditions

- Flood related with climate-adjusted rains with 100 years of return period

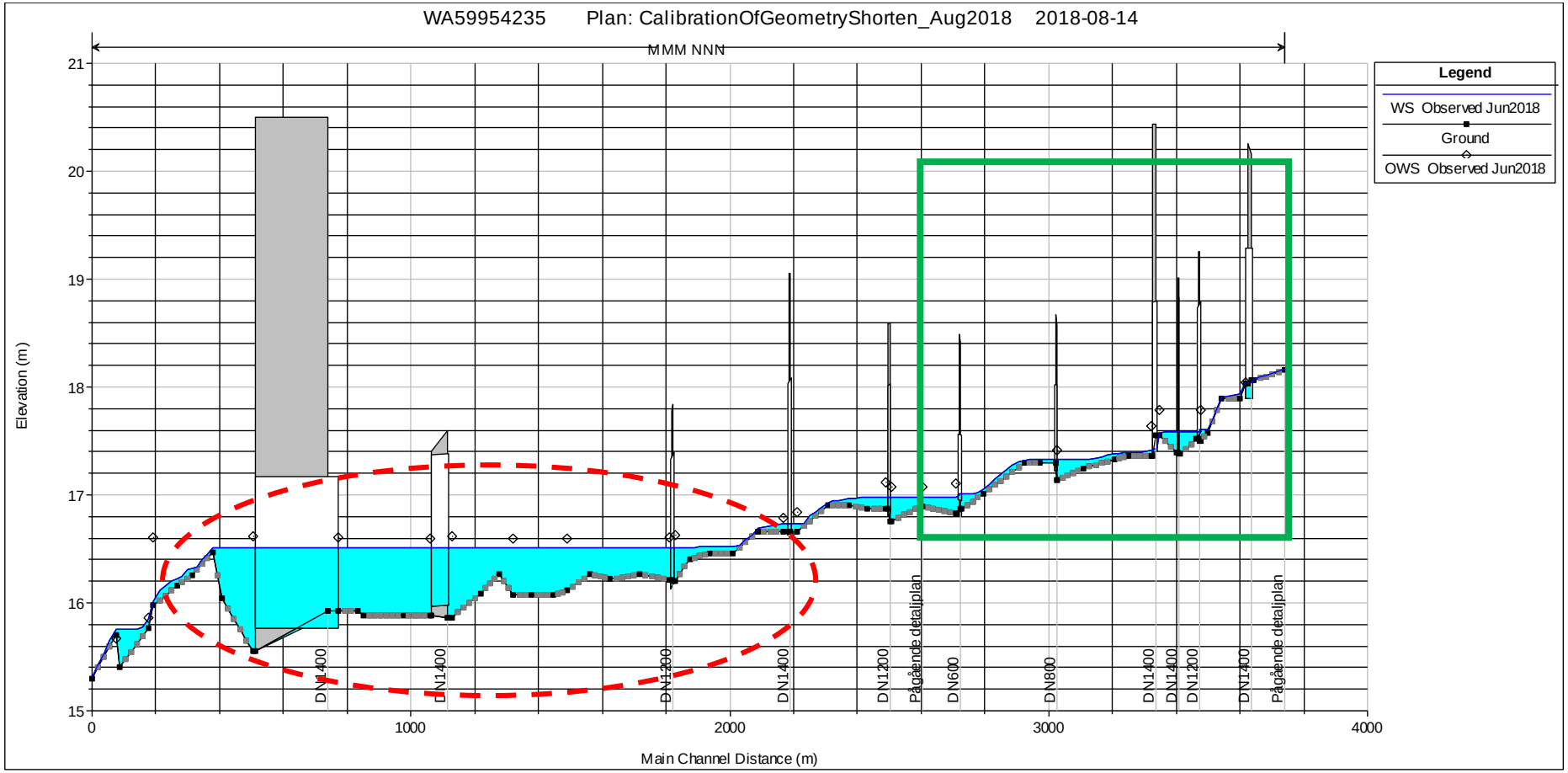
- Previous scope
  - Steg 1: Nulägesanalys
  - Skyfallsmodellering och Hydraulisk Modellering av Bäck (WSP, Aug 2018)

Previous report

Previous Report
Modellering av bäcken



Previous Report
Modellering av bäcken



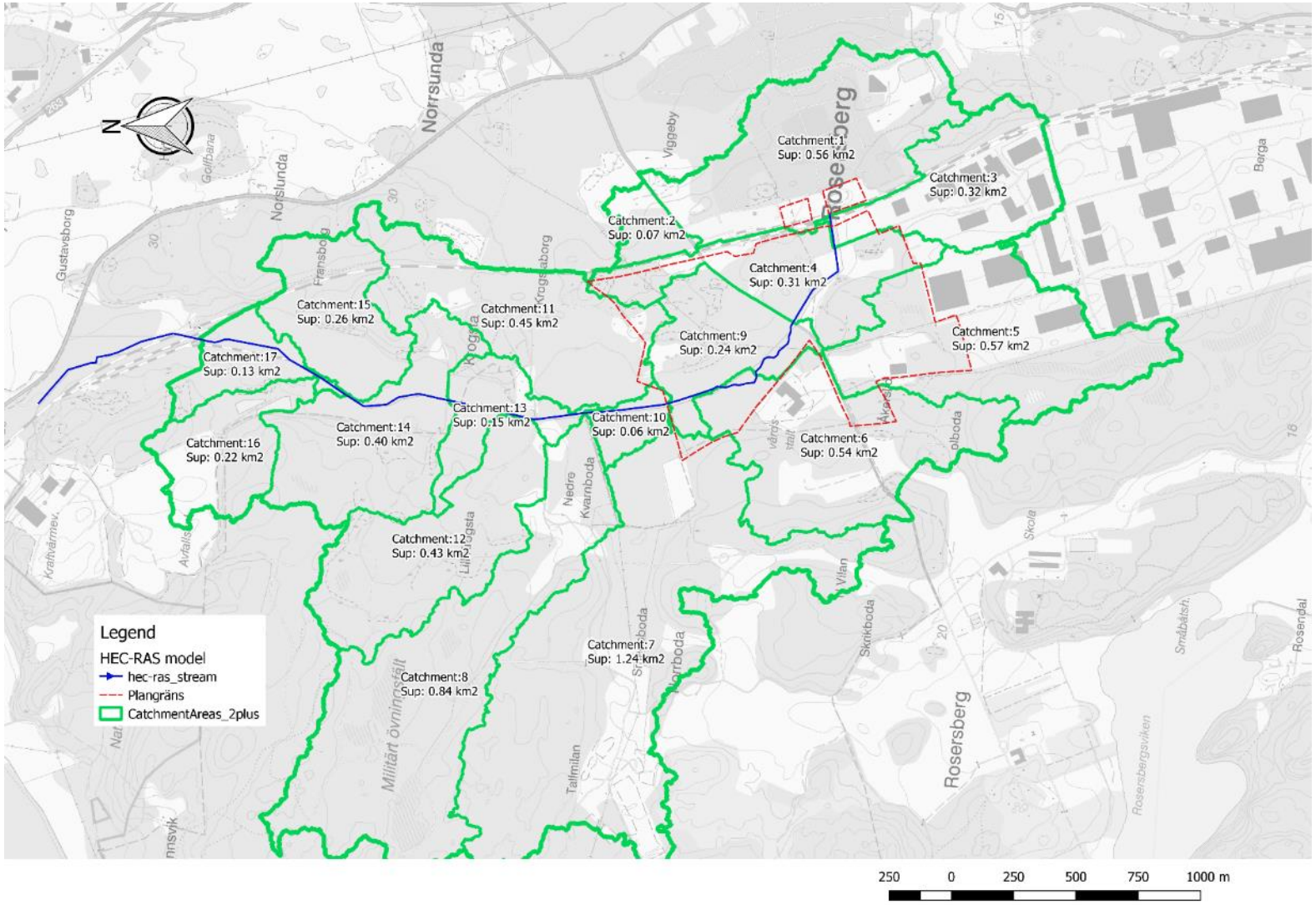
Previous Report
Inflöden/tillrinning

- Nuläget beskrivs genom att redovisa vattennivåer längs bäcken för två scenarier:
  - Medelflöde (MQ), stationärt, konstant flöde i bäcken
  - 100-årsflöde (HQ100), icke stationärt flöde, klimatfaktor 1,25

- Inflöden vid 100-årsregn
  - Flöden beräknades för olika regnvaraktigheter för att hitta dimensionerande situation för bäcken, maximala vattennivåer

tid (min) / T (år)	10	20	40	60	120	240	360
100	36.7 mm	48.5 mm	60.7 mm	68.2 mm	81.6 mm	96.2 mm	105.7 mm

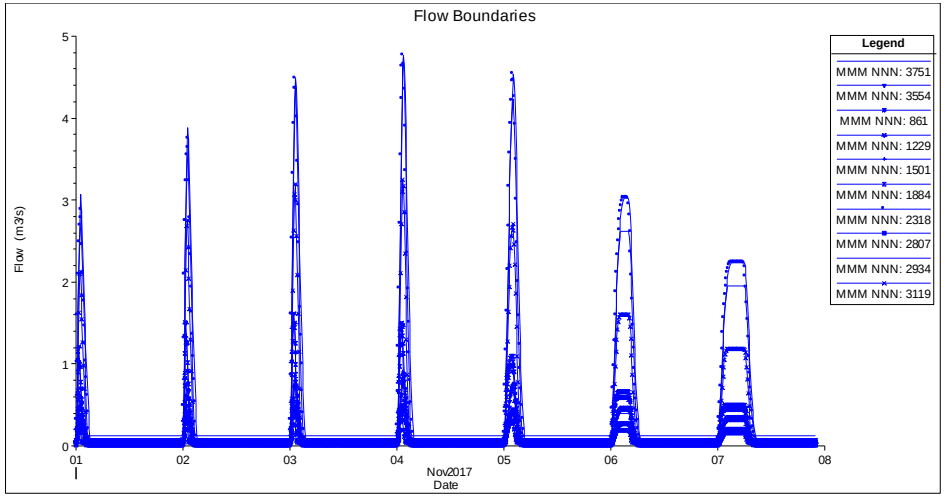
Previous Report
Delavrinningsområden



Previous report
Inflöden till bäcken

Tvärsektion i modell	Q Max (m^3/s)	Vol (10^3*m^3)
3751	4.7	258
3554	0.8	74
3119	3.3	126
2934	0.8	37
2807	0.5	28
2318	4.8	242
1884	1.5	68
1501	0.9	55
1229	1.6	65
861	0.5	36

Inflöden till planområdet från olika delavrinningsområden



Updated calculations

Basis of the updated calculations

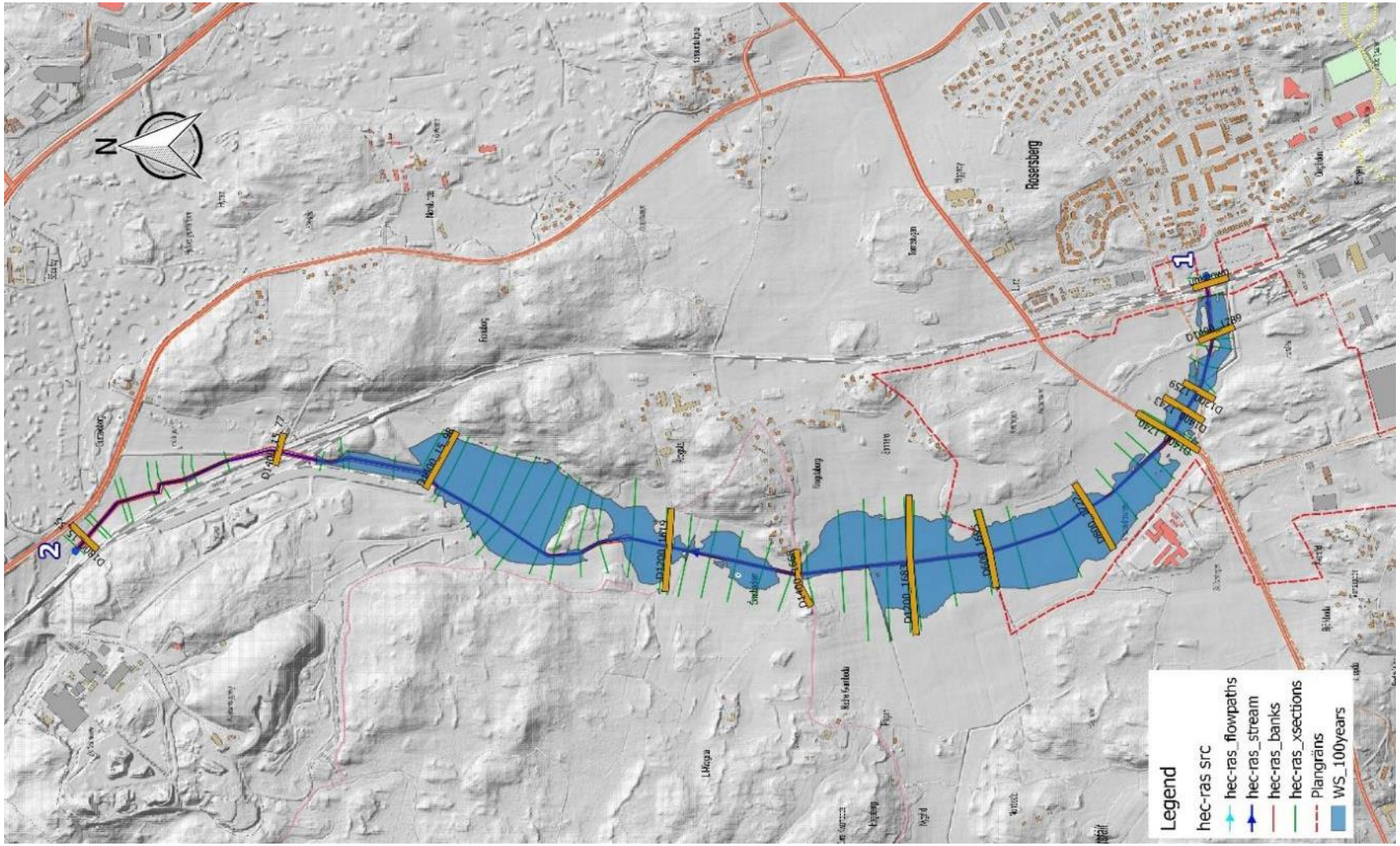
- Changes due to the project
  - The development plan of the area (Autocad file L31_p_27 WSP.dwg)
  - The description of the new cross sections at the project area (Rosersbergsbäcken - Princip för utformning av parkstråk)
  - A new and higher runoff coefficient for the development area (input from VA discipline)

- Review of the original model

Basis of the updated calculations
Reviewed hydraulic model

- Software from HEC-RAS 5.0.5 to 5.0.6 (instabilities)
- Extensions of the cross sections to cover some flood areas not covered before
- Three minor culverts (stations 2509, 2730 and 3036) were removed
- The stretch downstream the railway culvert (station 515) is free of obstructions or beaver dams

Basis of the updated calculations
Reviewed hydraulic model



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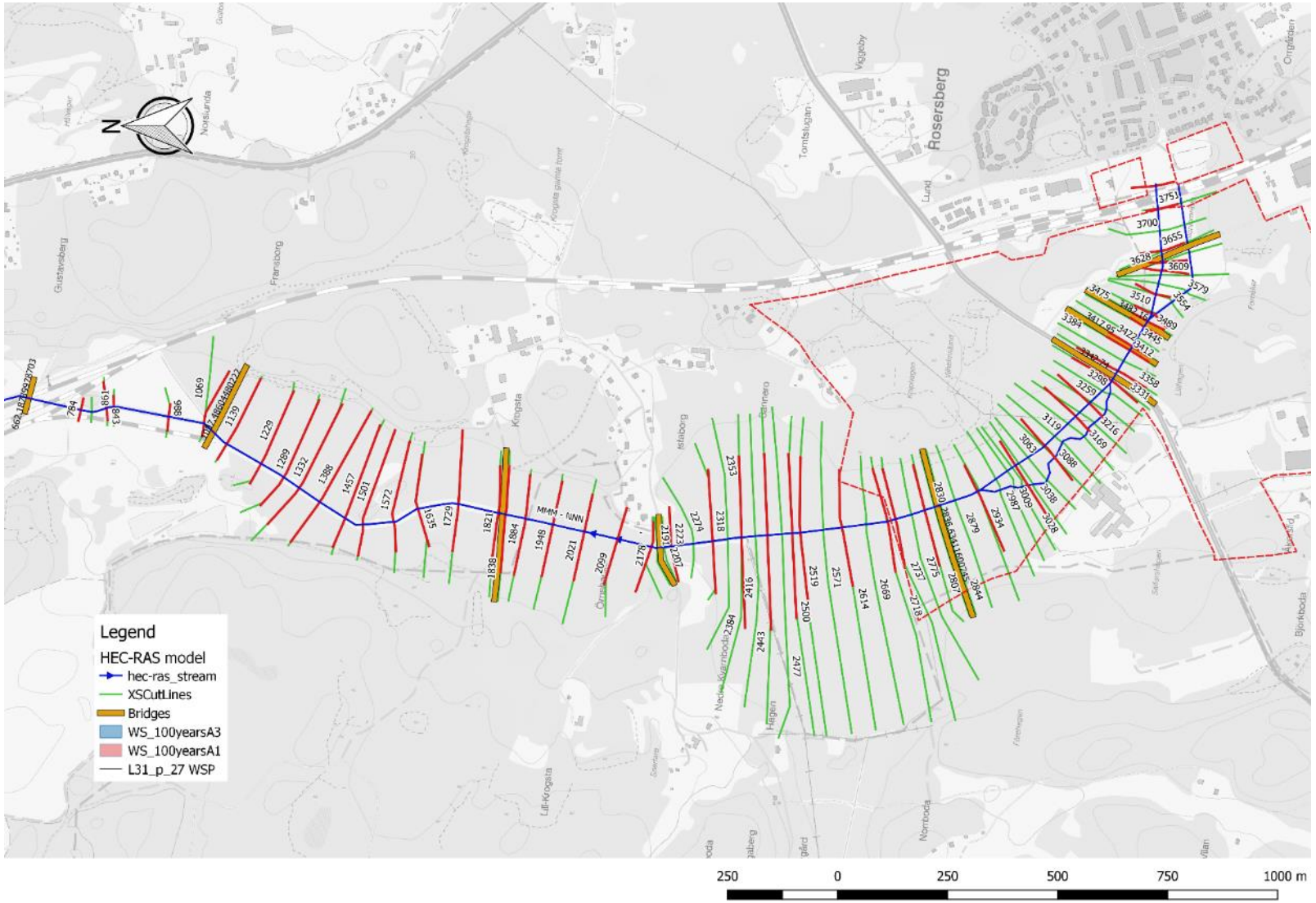

Basis of the updated calculations
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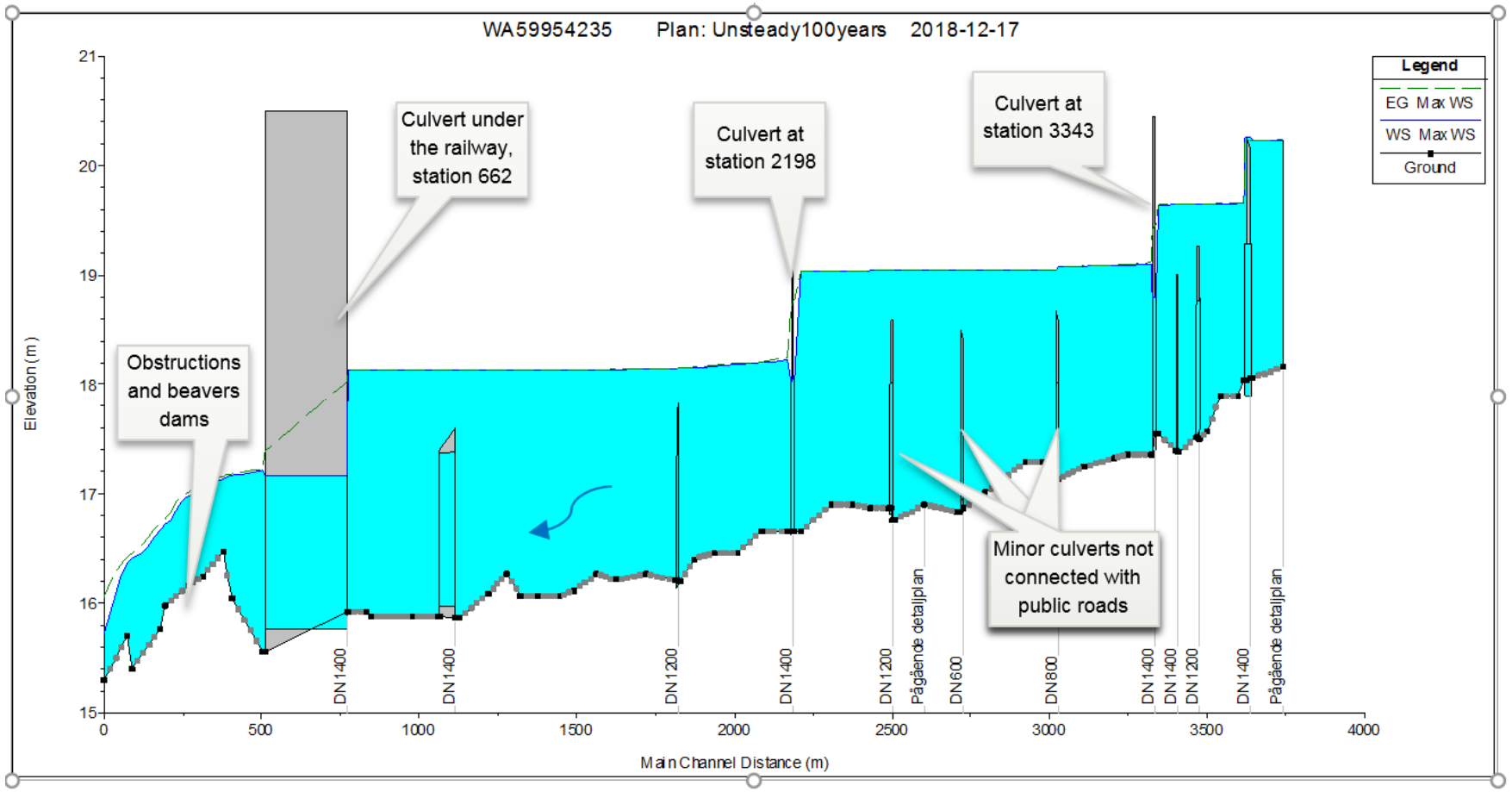

Basis of the updated calculations
Changes due to the project

- The developed areas were incorporated as blocks or permanent obstructions over the natural terrain
- A new bridge or crossing at the section 2837
- Landscape proposal for the ditch within the project area
- Change of the land use and in the runoff coefficient (C)

Basis of the updated calculations
Changes due to the project - developed areas as blocks

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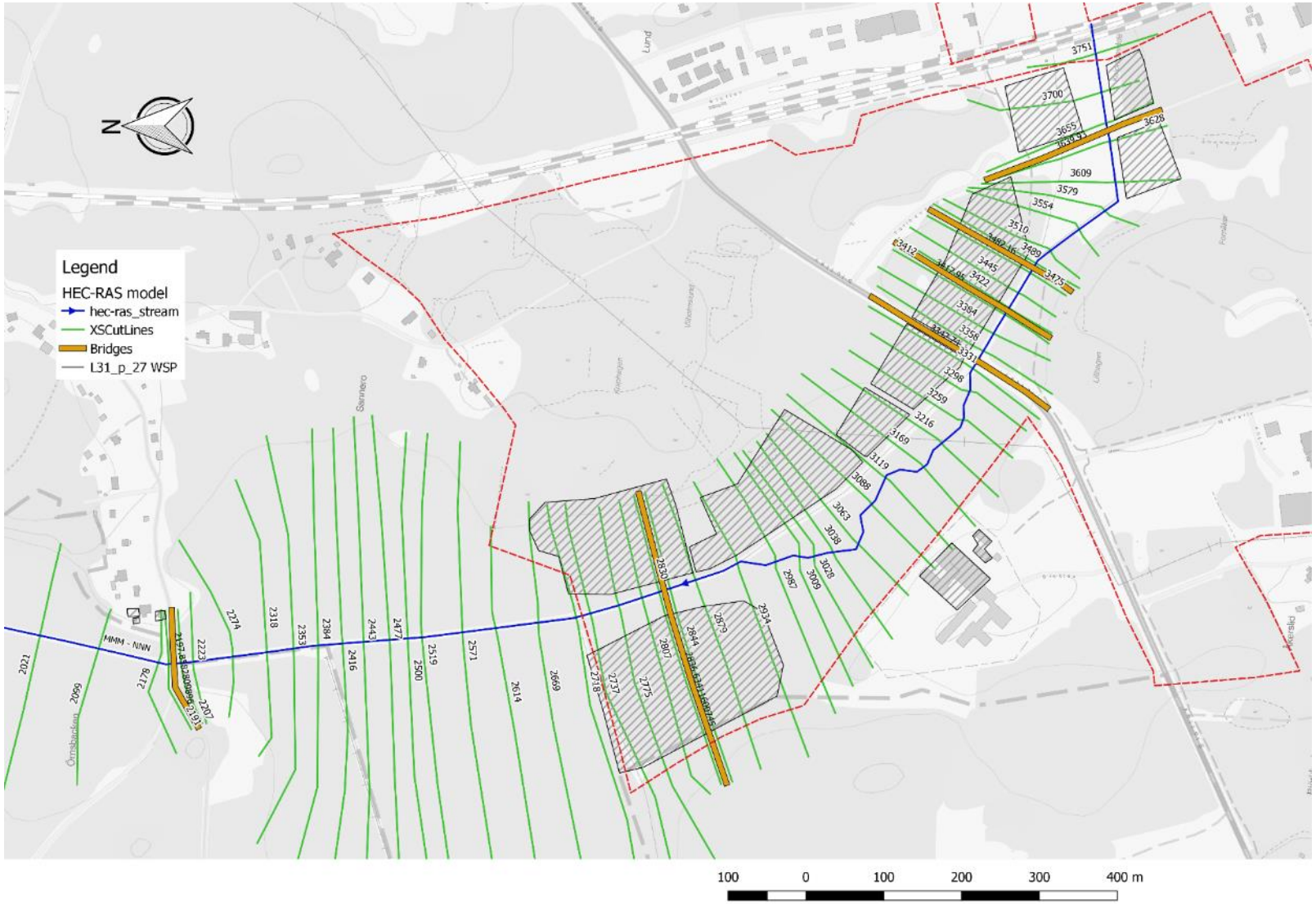

Basis of the updated calculations
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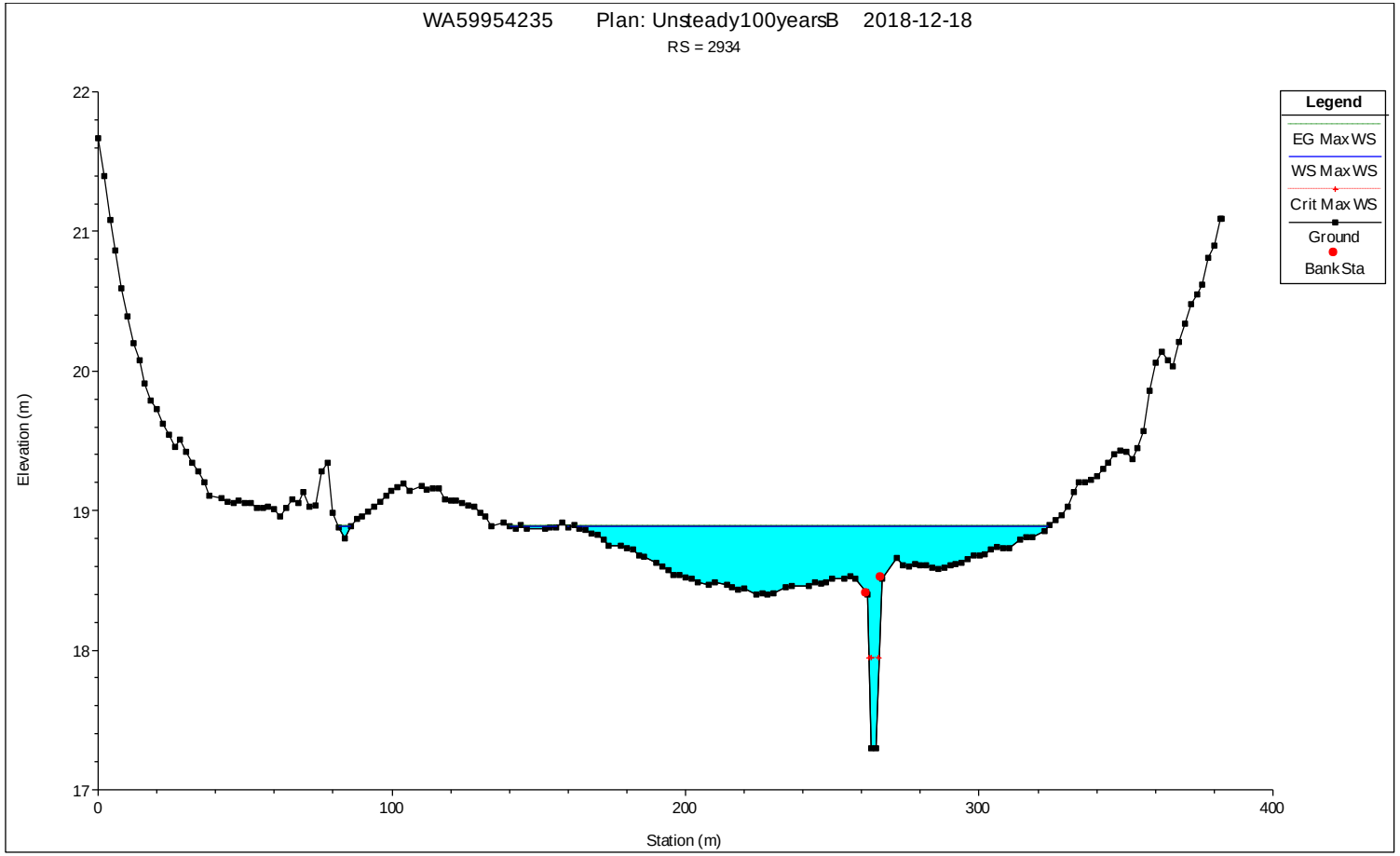

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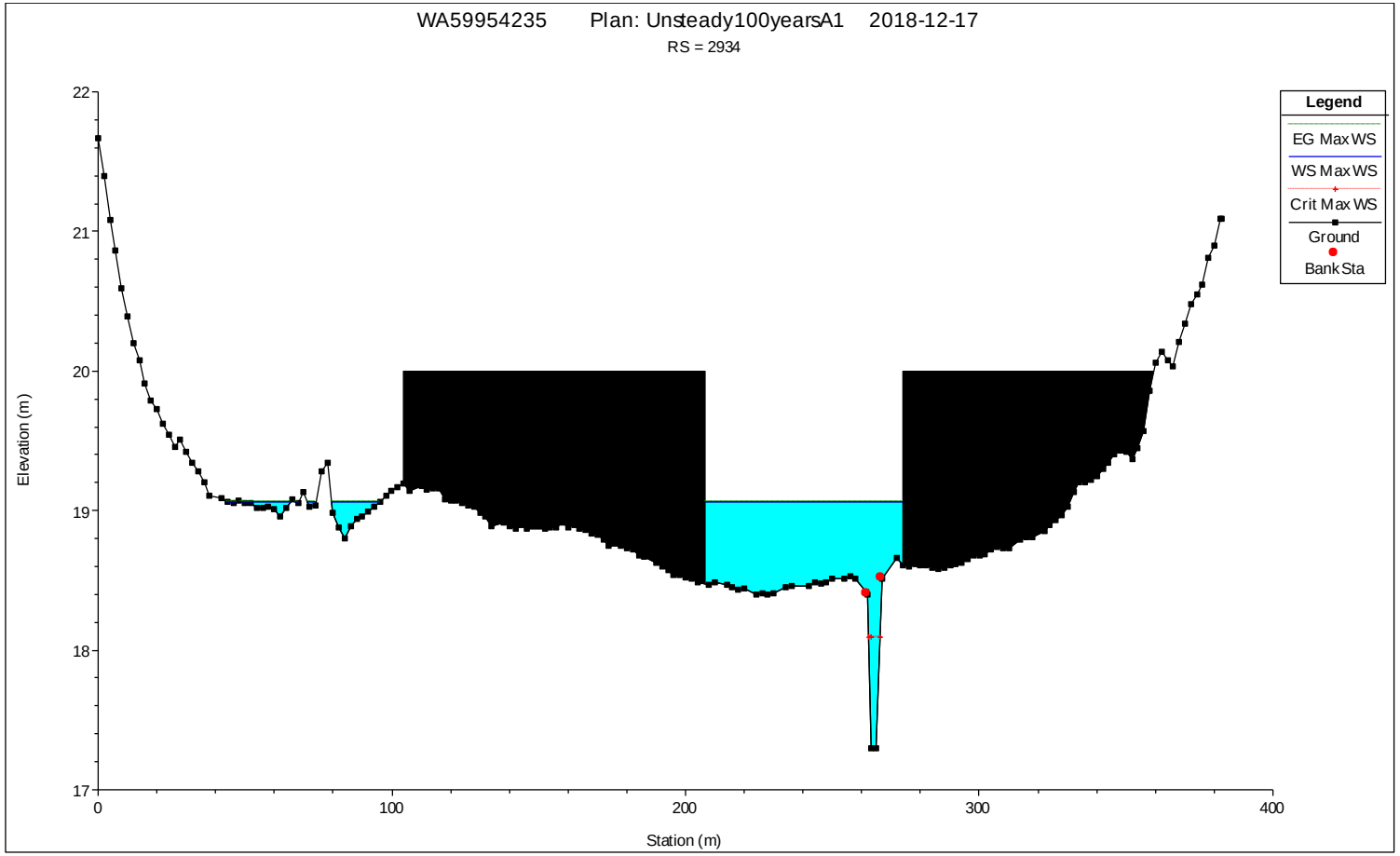
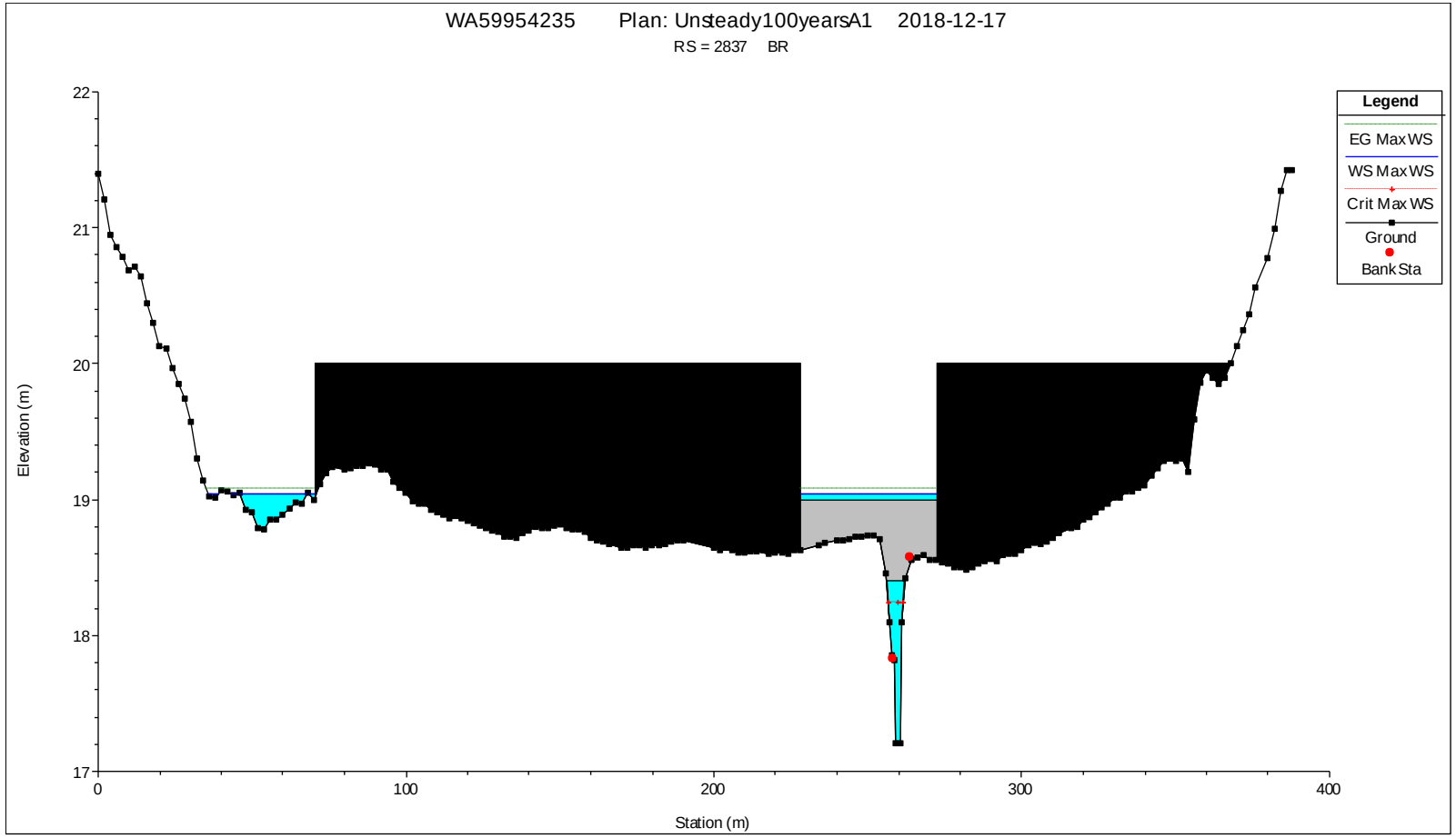


Basis of the updated calculations
Changes due to the project – New bridge



Basis of the updated calculations
Changes due to the project - Landscape

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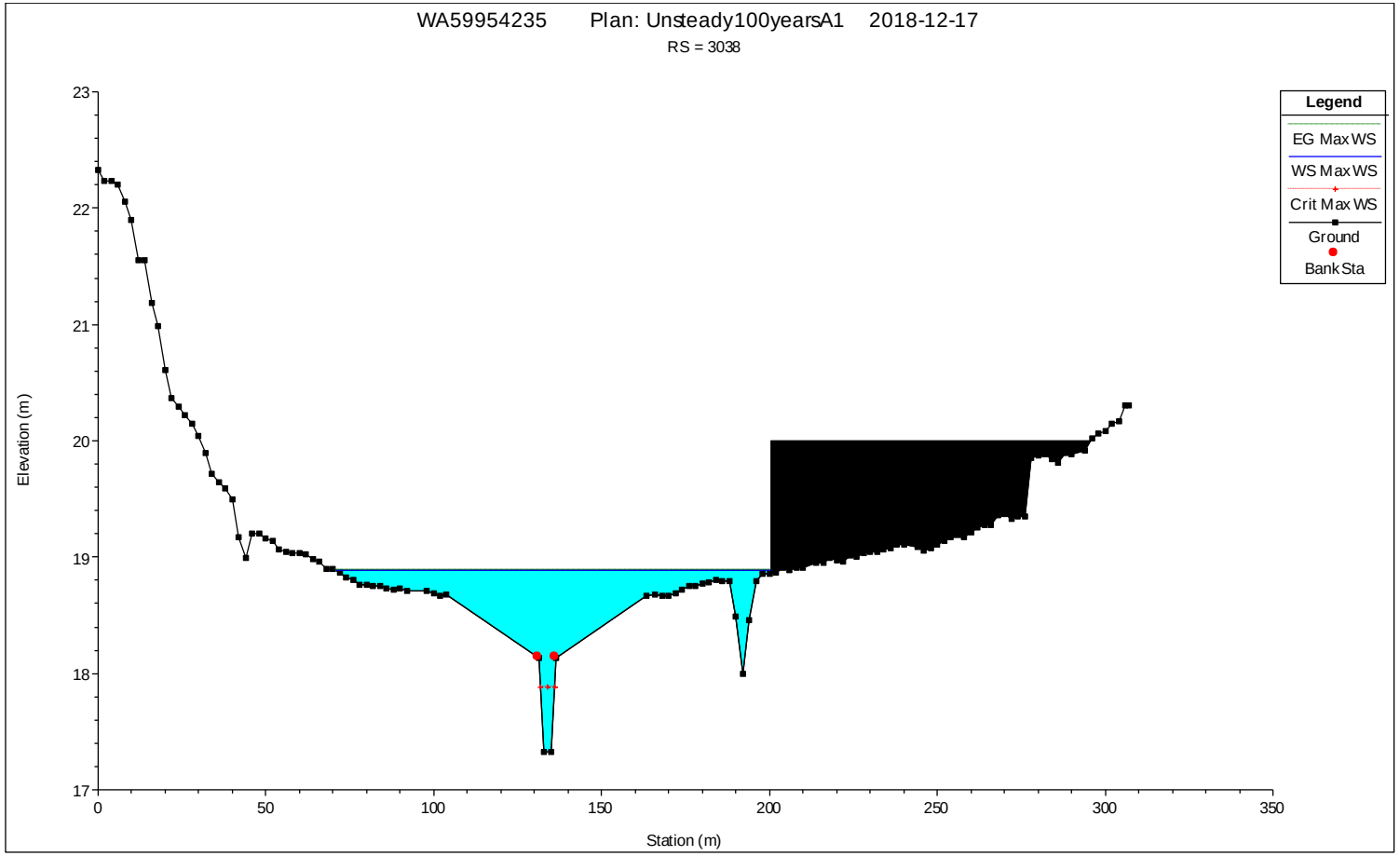
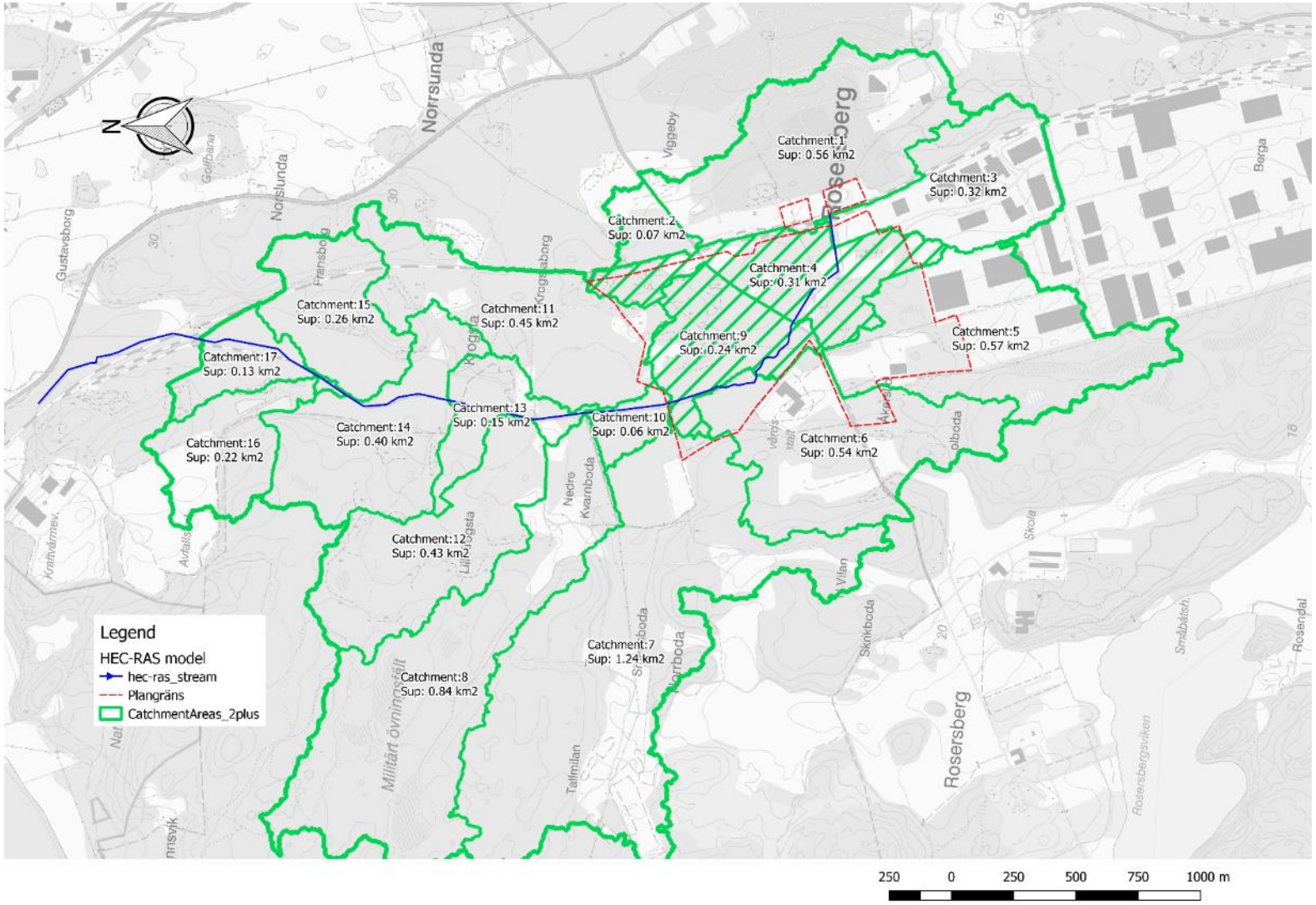


Basis of the updated calculations
Changes due to the project - land use



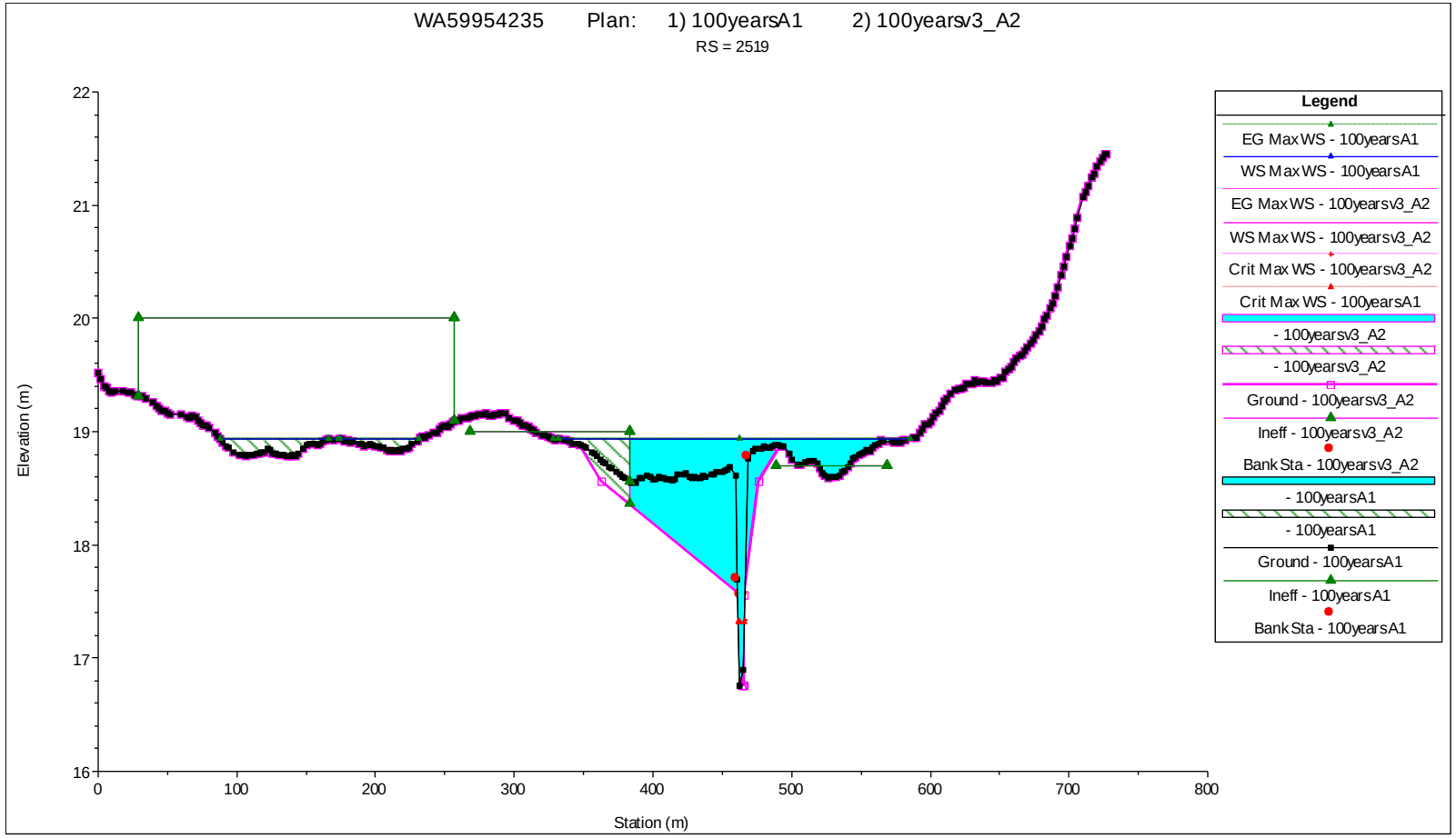
Basis of the updated calculations
Changes due to the project - land use

Delavrinningsområde	Area (ha)	Original C	New C
4	31	0.21	0.46
9	24	0.16	0.46

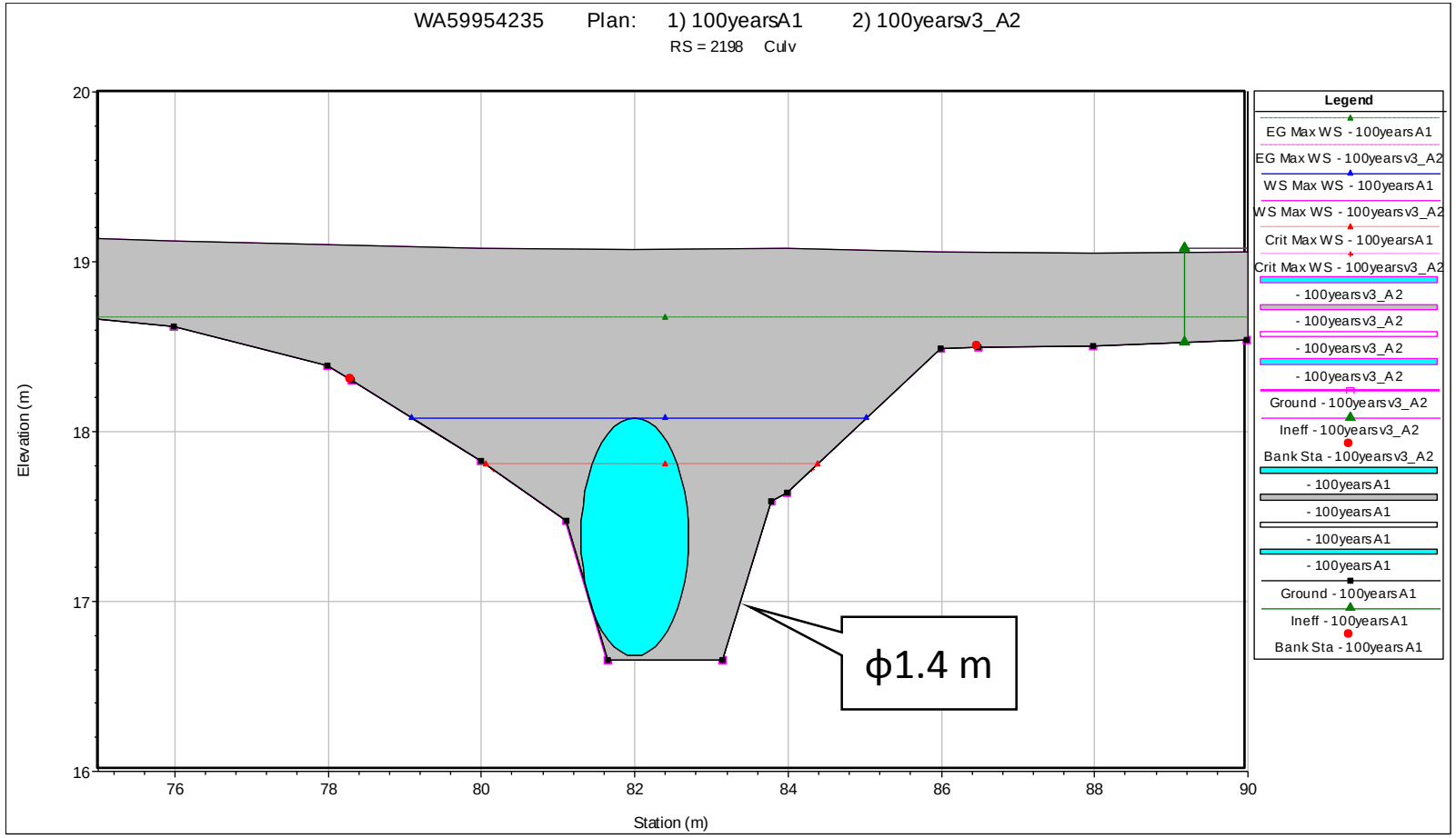
Basis of the updated calculations
Flood mitigation measures

- Flood mitigation measure 1: a wider ditch for larger storage upstream station 2200
- Flood mitigation measure 2: a larger culvert at station 2198

Basis of the updated calculations
Flood mitigation measure 1: a wider ditch



Basis of the updated calculations
Flood mitigation measure 2: larger culvert (RS 2198)



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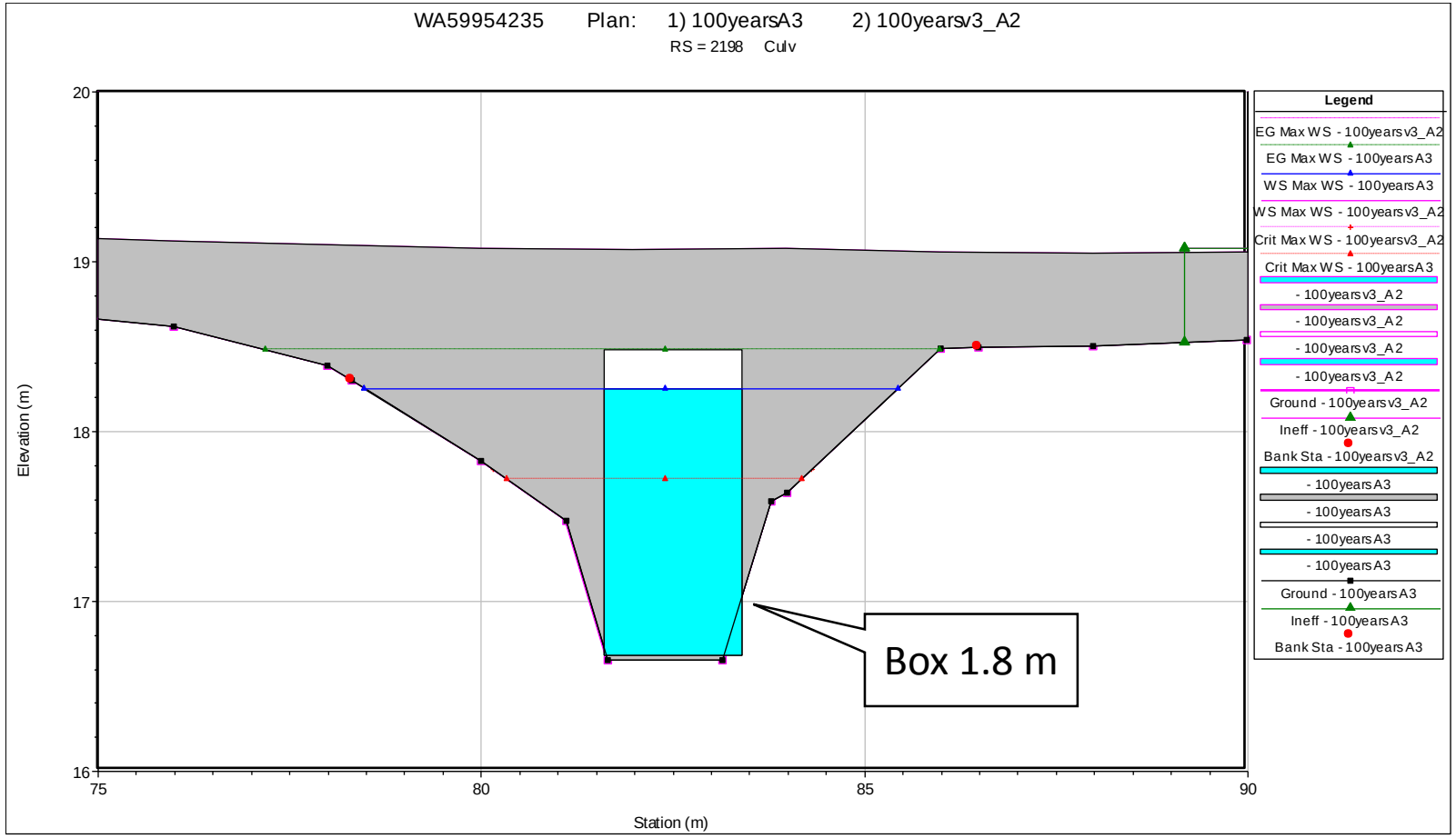


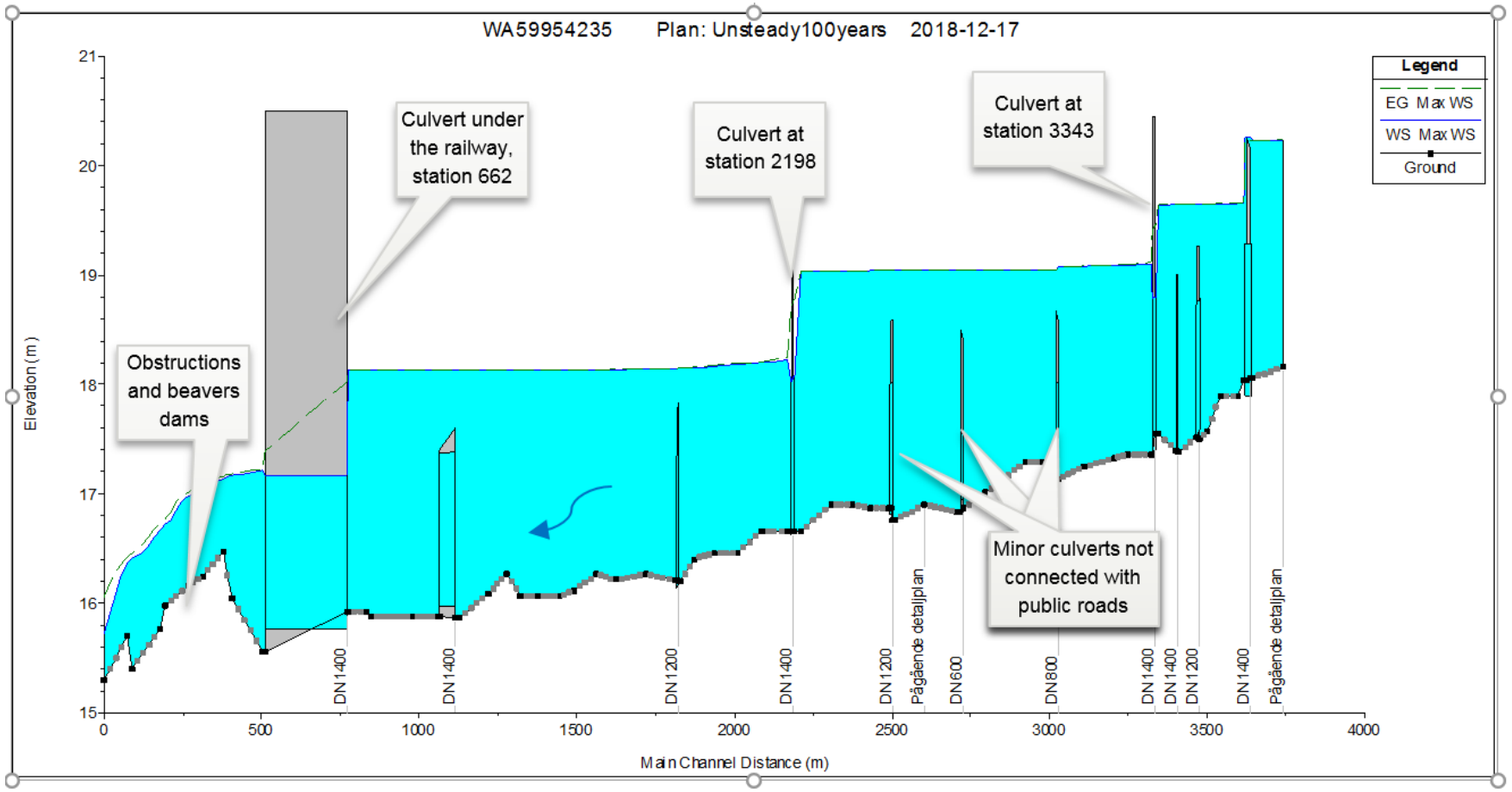
Scenarios

Basis of the updated calculations
Scenarios

Scenario\Change	Reviewed hydraulic model	Proposal of development	Wider ditch US station 2198	Larger culvert at station 2198	HEC-RAS plan
Previous report					Unsteady100years
New base line	X				Unsteady100yearsB
Development	X	X			Unsteady100yearsA1
Mitigation measure 1: a wider ditch	X	X	X		Unsteady100yearsA2
Mitigation measure 2: a larger culvert	X	X		X	Unsteady100yearsA3

Results

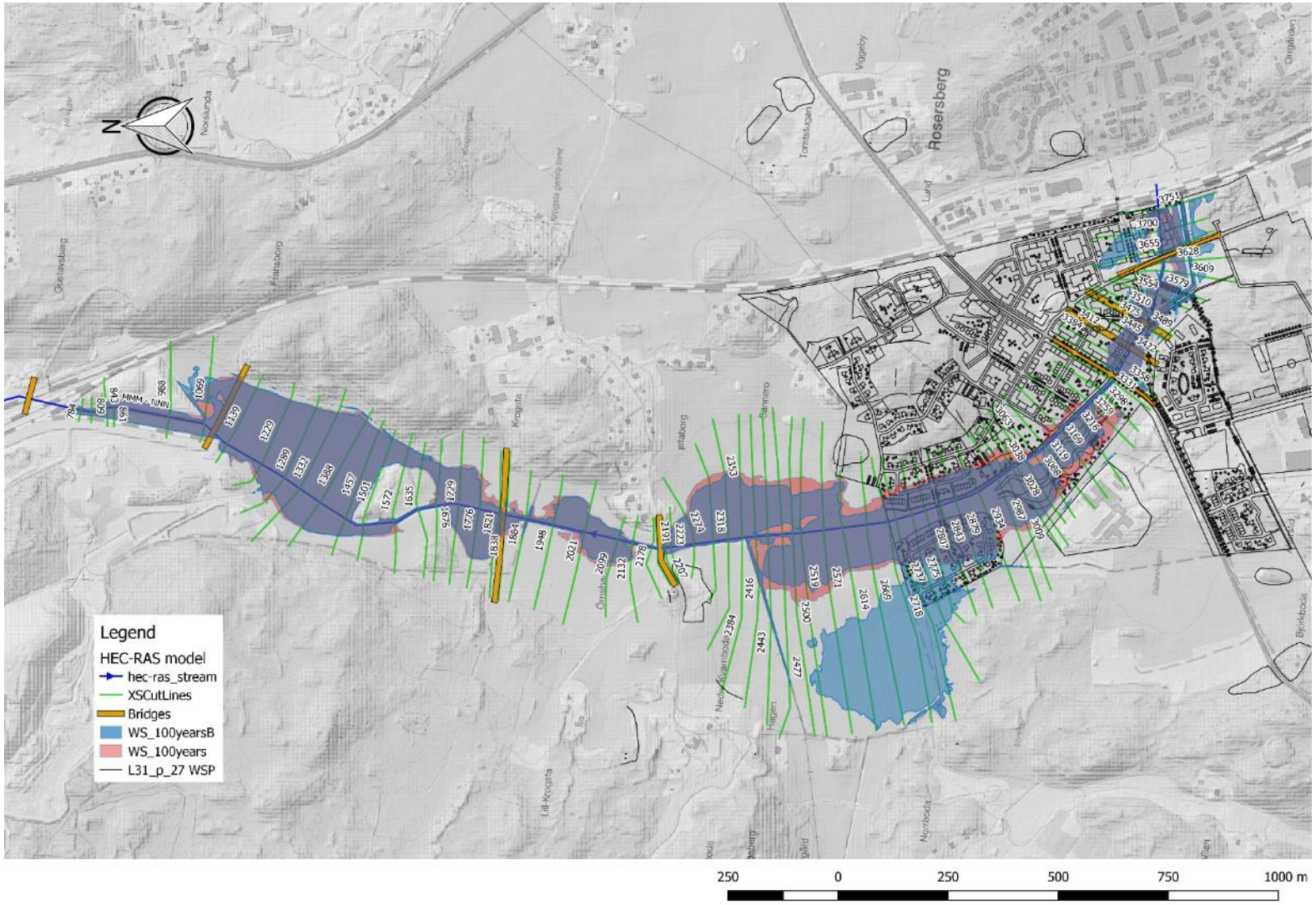
Results Summary



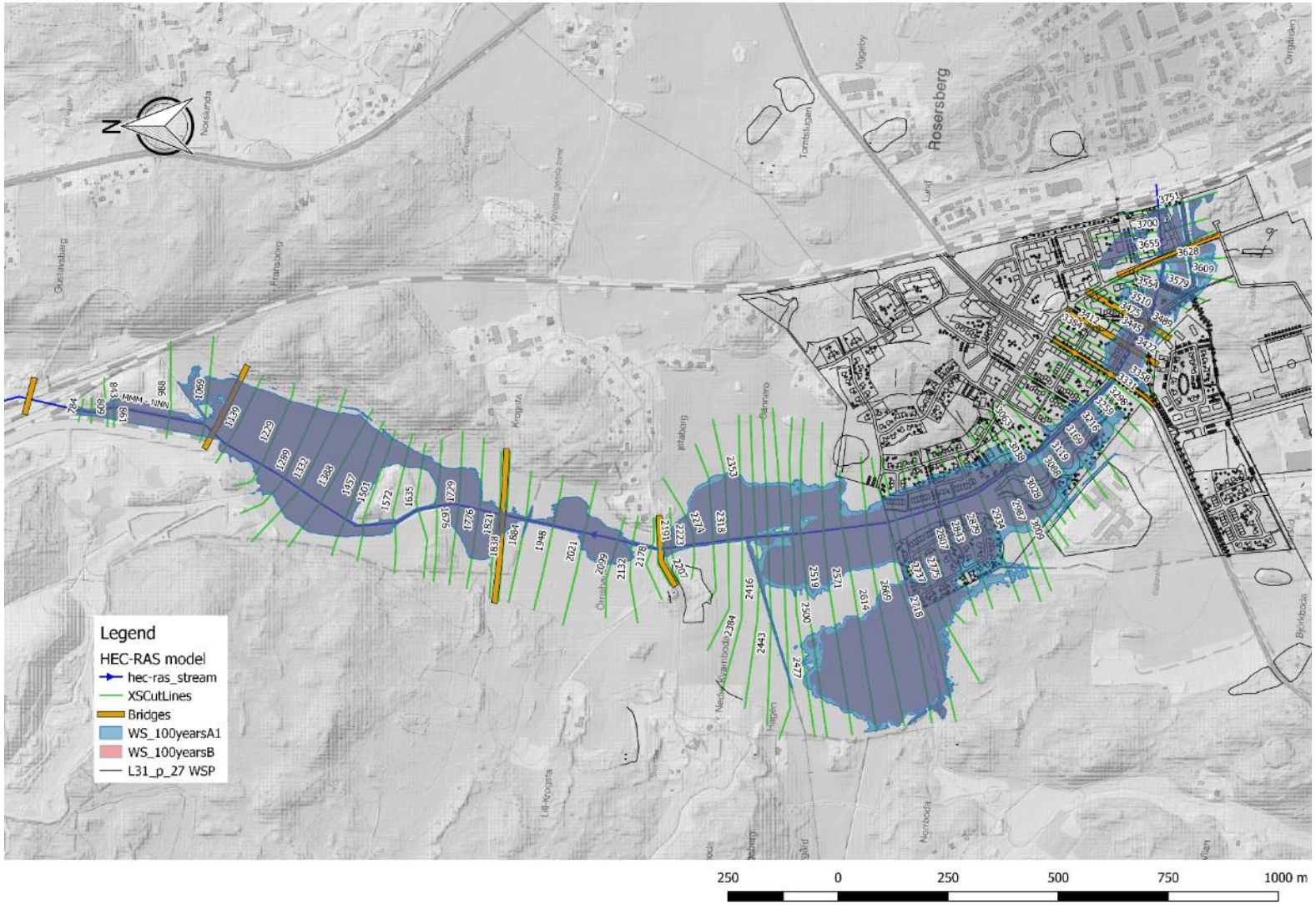
Results Summary

	Max Water surface [m]			Q peak [m3/s]		
Scenario	Upstream the railway	Upstream culvert 2198	Upstream culvert 3343	Downstream the railway	Downstream culvert 2198	Downstream culvert 3343
Previous report	18.13	19.03	19.63	2.91	4.80	3.82
New base line	17.97	18.85	19.55	3.16	4.41	3.98
Development	17.99	18.92	19.69	3.18	4.55	4.27
Mitigation measure 1: a wider ditch	17.93	18.82	19.58	3.11	4.30	4.74
Mitigation measure 2: a larger culvert	18.07	18.70	19.58	3.29	6.04	4.75

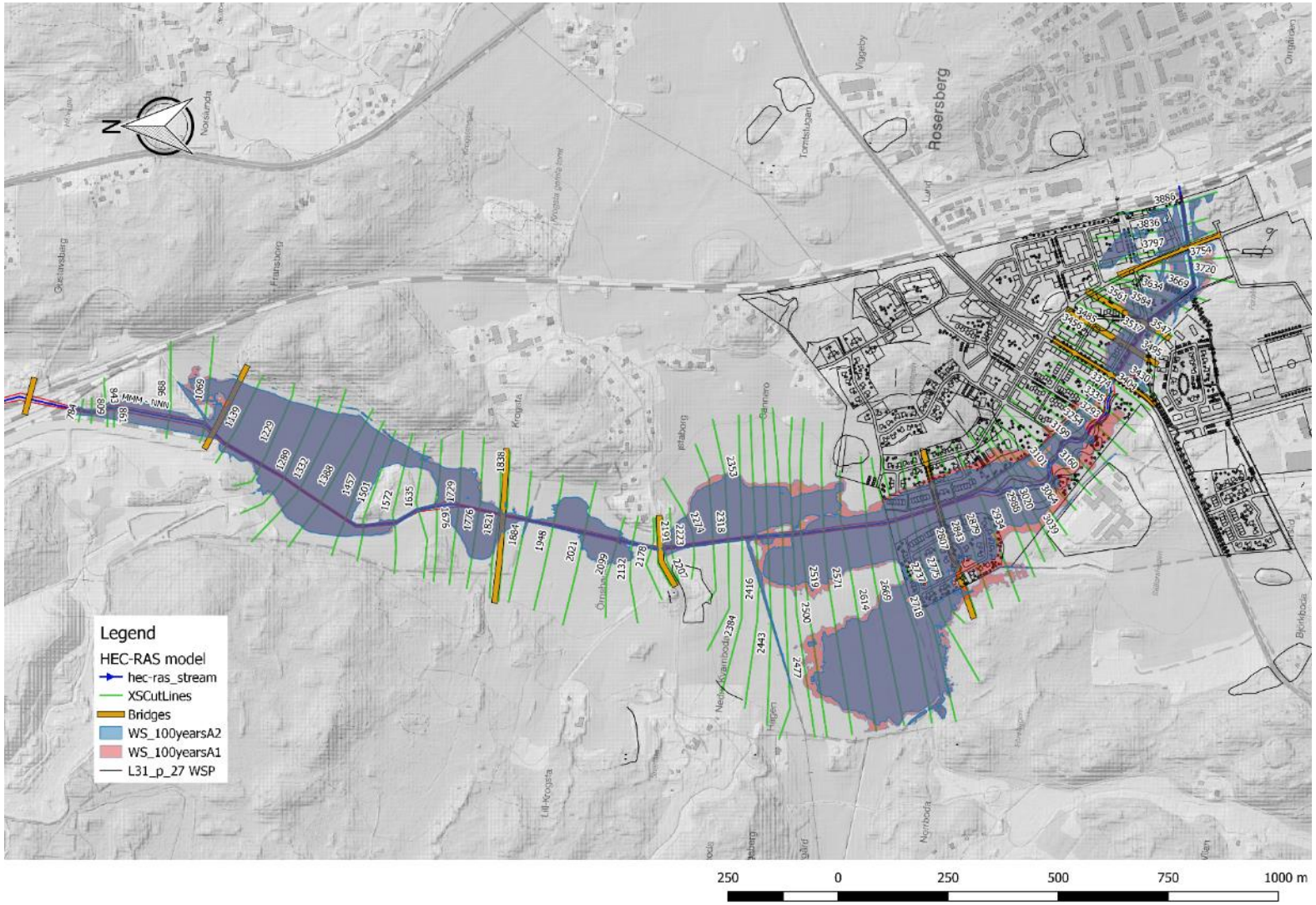
Results
100 years flood map new base line (red previous report)



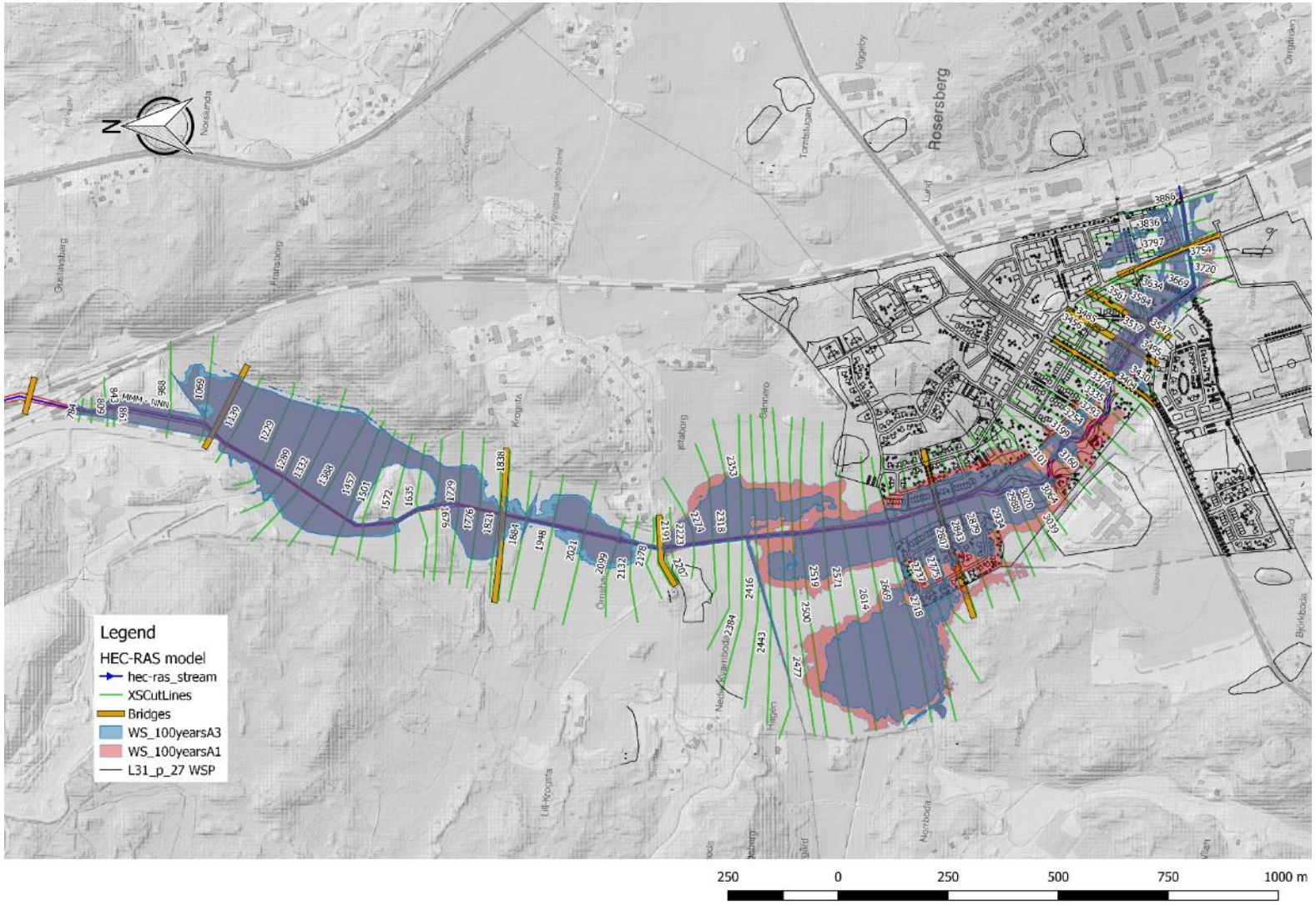
Results
100 years flood map for ”Development” (red new base line)



Results
100 years flood map for ”Mit. Measure 1” (red Development)



Results
100 years flood map for ”Mit. Measure 2” (red Development)



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Discussion

- Results are slightly lower than previous calculations
  - new max water level is 18.85 m for floods of 100 years of return period
- The development has a minor impact
  - Less than 15 cm increase in term of max water levels upstream station 2200
- The flood mitigation measure 1 (a wider ditch) can reduce the max water levels to the same values observed in the current conditions
- The flood mitigation measure 2 (a larger culver) can also reduce the maximum water levels to the same values observed in the current conditions
  - but it slightly increases the flood area downstream the culvert

Recomendation assuming mitigation measure 1 is implemented

- The new development area considering a highest water level of
  - 18.80 m for the sector upstream the station 2200.
  - 19.60 m for the sector upstream the station 3358

Tack!

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