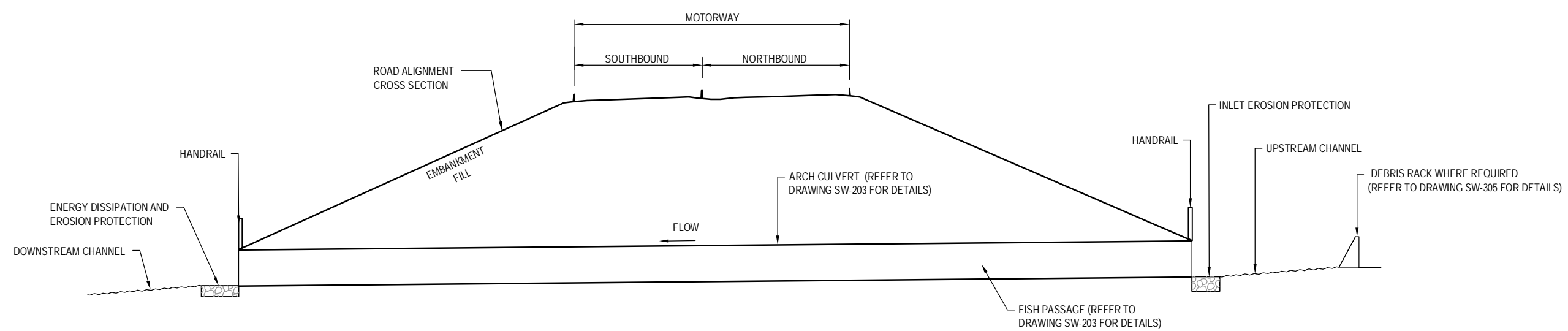


TYPICAL LONGITUDINAL SECTION - CONCRETE PIPE CULVERT  
NOT TO SCALE



TYPICAL LONGITUDINAL SECTION - ARCH CULVERT  
NOT TO SCALE

0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT
AMD	DATE	DESIGN REVIEW	REVD D. MGR	APPD A. MGR	PURPOSE OF ISSUE / AMENDMENT

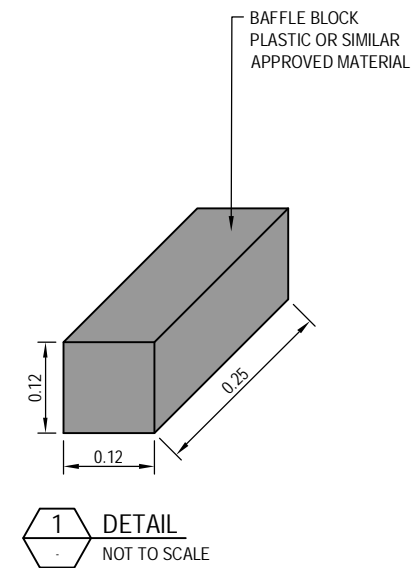
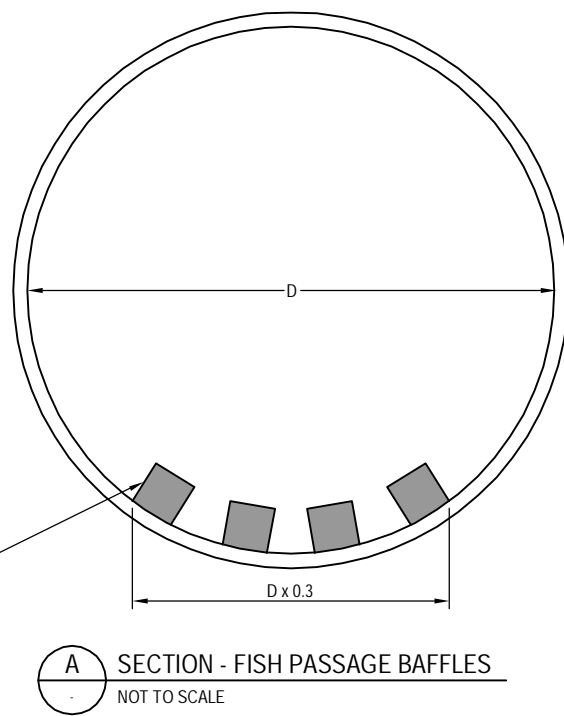
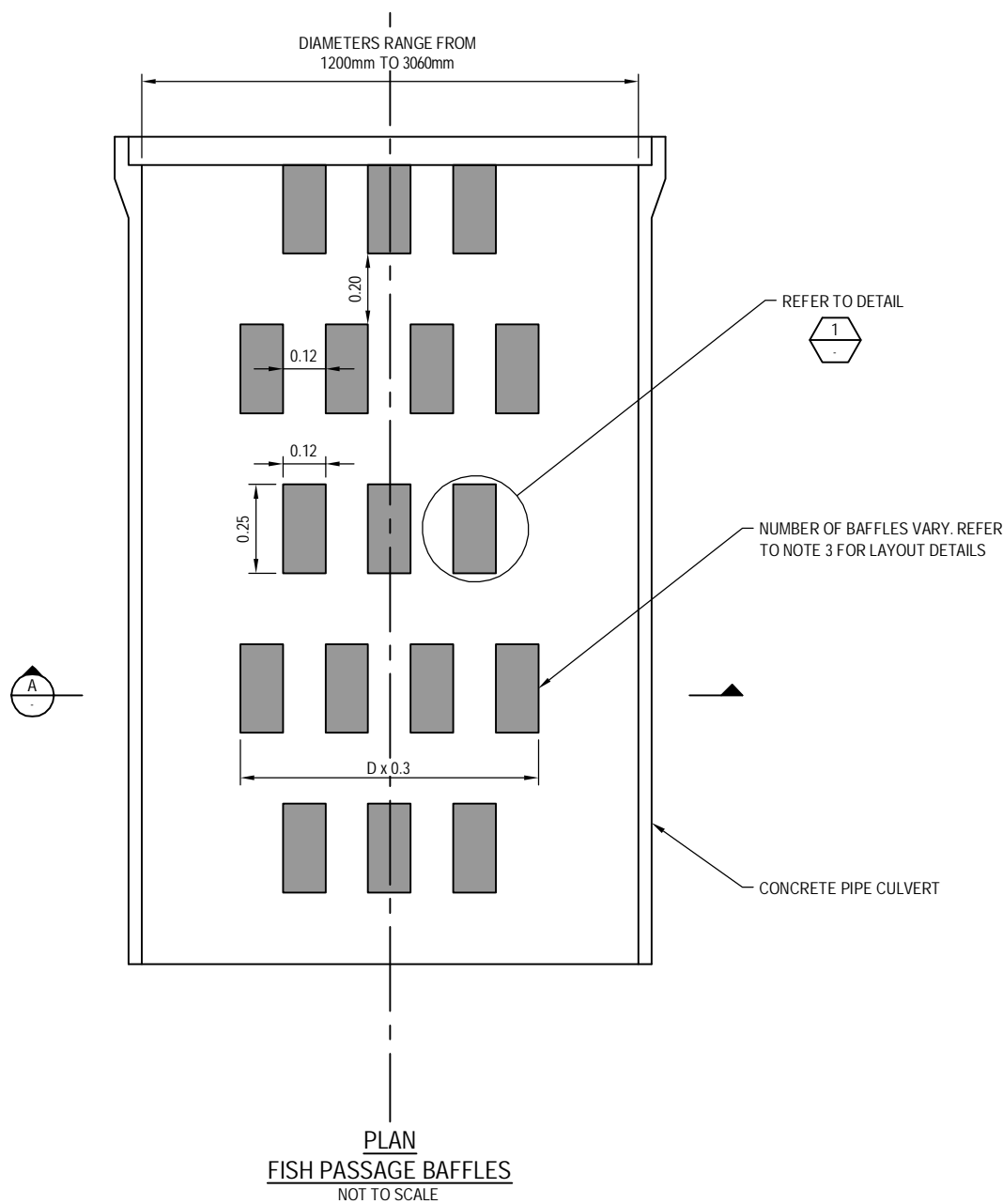


**DISCLAIMER**  
The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN SP / AN	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

OPERATIONAL WATER MANAGEMENT TYPICAL CULVERT LONGITUDINAL SECTION			
SCALE NOT TO SCALE	CONTRACT No PA3748	DRAWING No SW-201	AMDT 0

S:\Further North - PAA\300 Design\300.5 Technical\01-Drawing Production\CA00 Drawings\SW-202\_SW-203.dwg Plot date: 16 August, 2013 - 2:16 PM



TYPICAL FISH PASSAGE BAFFLES  
(FROM NORTHERN GATEWAY TOLL ROAD)

#### NOTES

- CULVERT INLET TO START WITH THE LESSER NUMBER OF BAFFLES IN THE TABLE FLUSH AGAINST INLET.
- BAFFLES TO BE CONSTRUCTED FOR FULL LENGTH OF CULVERT.
- 

CULVERT DIAMETER (D) m	NUMBER OF BAFFLES IN ALTERNATING ROWS
1.200	3 AND 4
1.350	3 AND 4
1.600	4 AND 5
1.800	5 AND 6
1.950	6 AND 7
2.100	6 AND 7
2.550	8 AND 9
3.060	10 AND 11

INTERPOLATED FROM AUCKLAND REGIONAL COUNCIL "FISH PASSAGE IN THE AUCKLAND REGION - A SYNTHESIS OF CURRENT RESEARCH" TR2009/084

0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT
AMD	DATE	DESIGN REVIEW	REVD D. MGR	APPD A. MGR	PURPOSE OF ISSUE / AMENDMENT



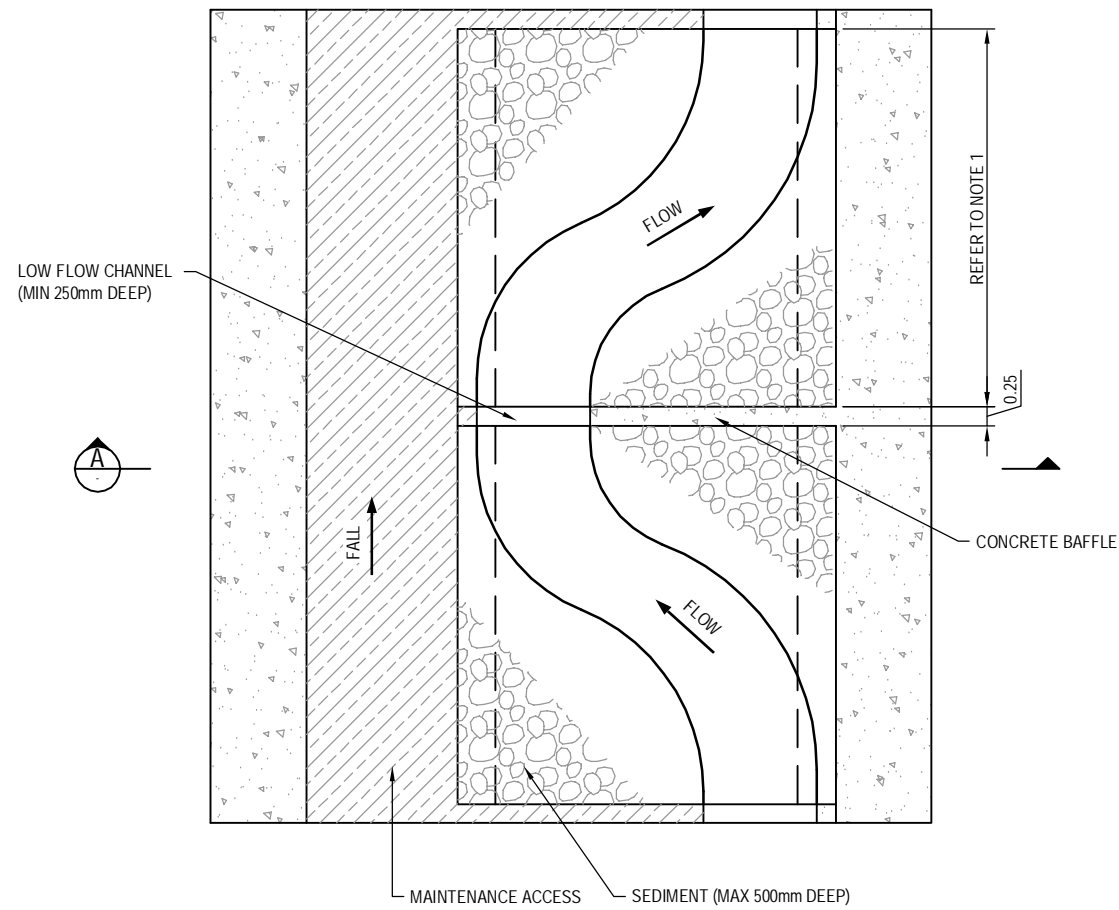
#### DISCLAIMER

The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

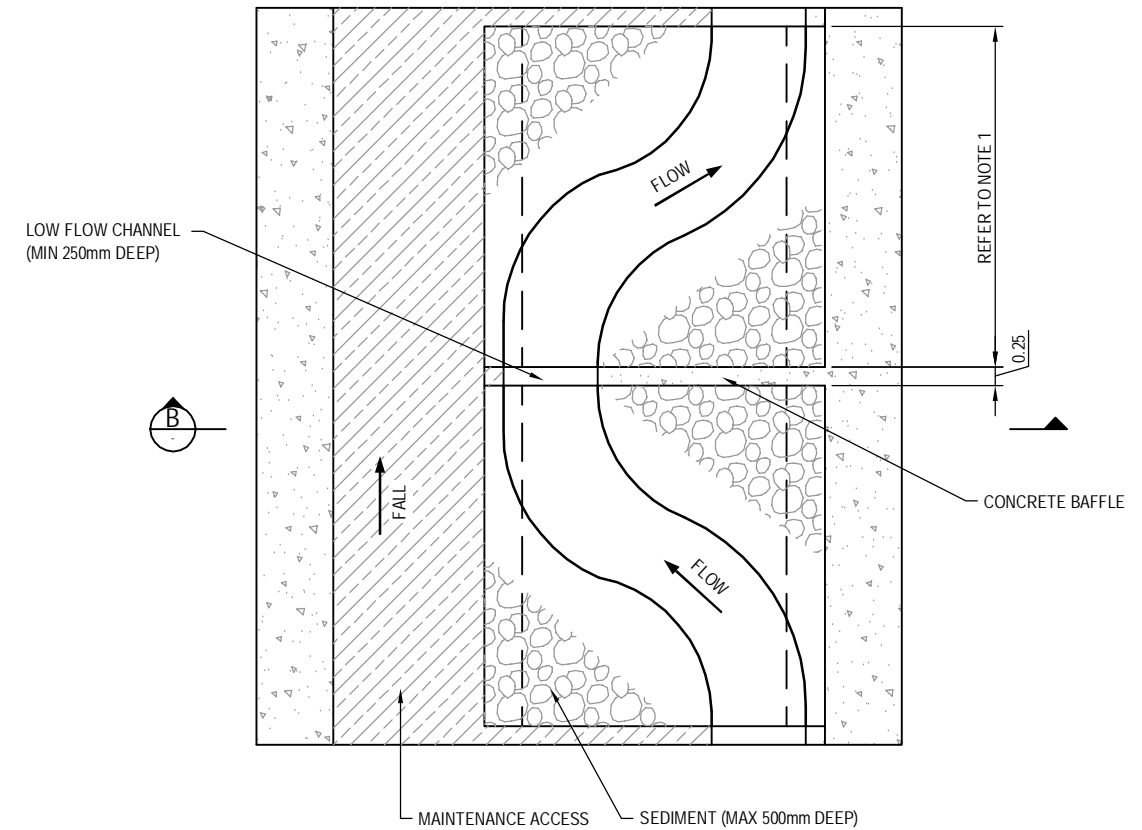
ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN SP / AN	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

OPERATIONAL WATER MANAGEMENT TYPICAL CONCRETE PIPE CULVERT FISH PASSAGE BAFFLE DETAILS			
SCALE NOT TO SCALE	CONTRACT No PA3748	DRAWING No SW-202	AMDT 0

S:\Further North - PAA\300 Design\300.5 Technical\01-Drawing Production\CA00 Drawings\SW-202\_SW-203.dwg Plot Date: 16 August, 2013 - 2:17 PM



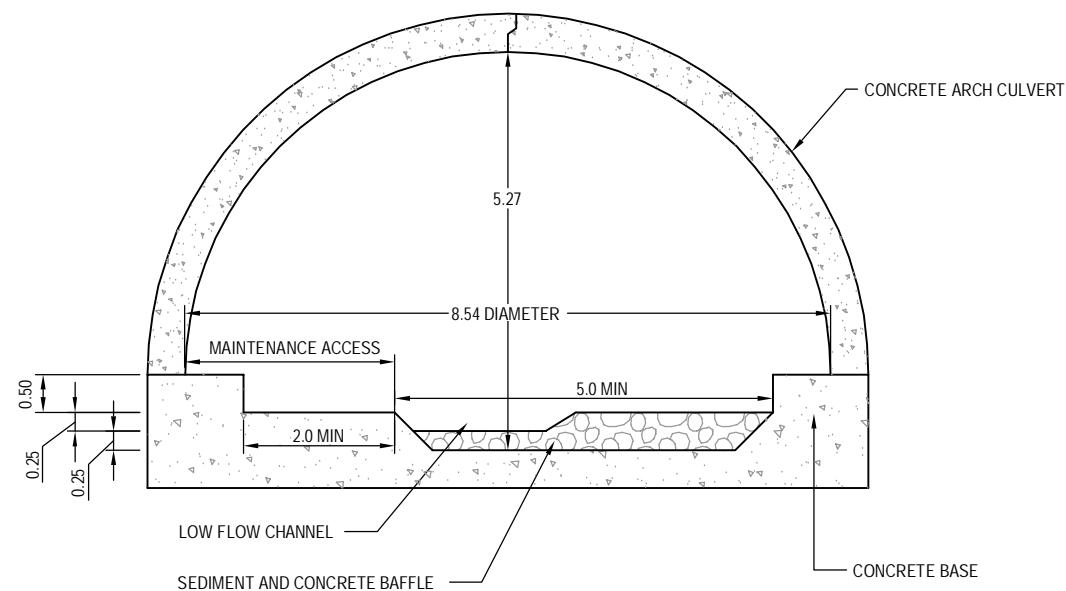
PLAN  
FISH PASSAGE NATURAL BED  
(CULVERT 54700)  
SCALE 1:100 @ A3



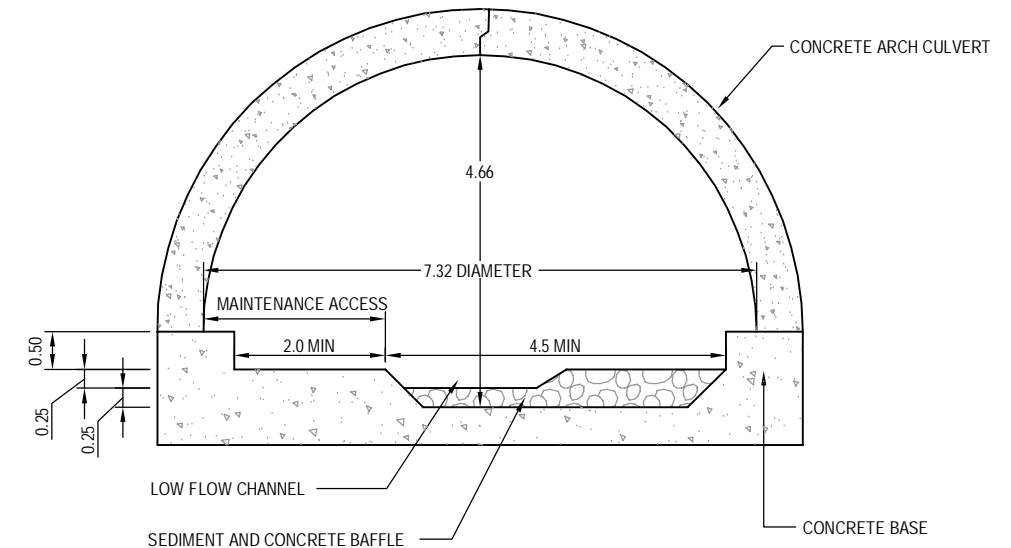
PLAN  
FISH PASSAGE NATURAL BED  
(CULVERTS 49500 & 60200)  
SCALE 1:100 @ A3

#### NOTE

1. LENGTH BETWEEN CONCRETE BAFFLES TO BE REFLECTIVE OF EXISTING STREAM MORPHOLOGY. TO BE CONFIRMED WITH FRESH WATER ECOLOGISTS AT DESIGN STAGE.



A SECTION  
SCALE 1: 100 @ A3



B SECTION  
SCALE 1: 100 @ A3

0 0.5 1.0 1.5 2.0 2.5m  
SCALE 1:100 @ A3 SIZE

0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT
AMD	DATE	DESIGN REVIEW	REVD D. MGR	APPD A. MGR	PURPOSE OF ISSUE / AMENDMENT

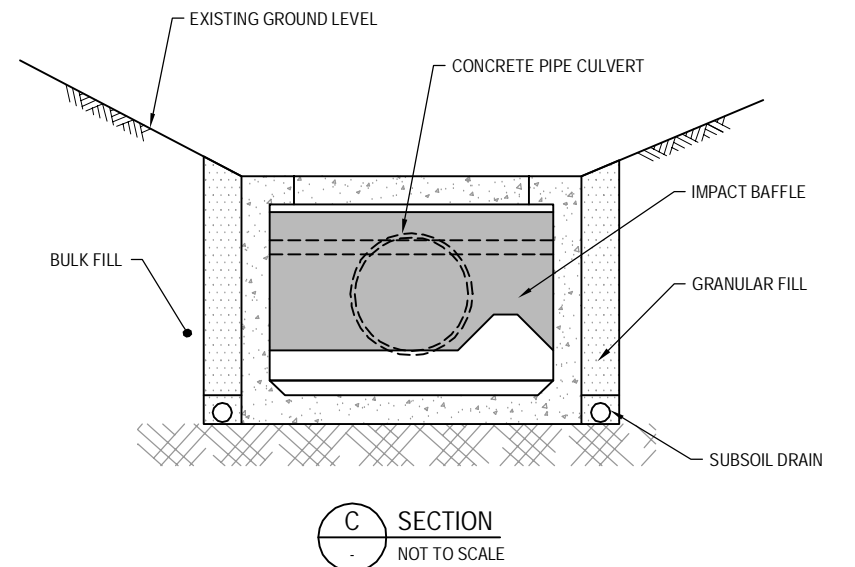
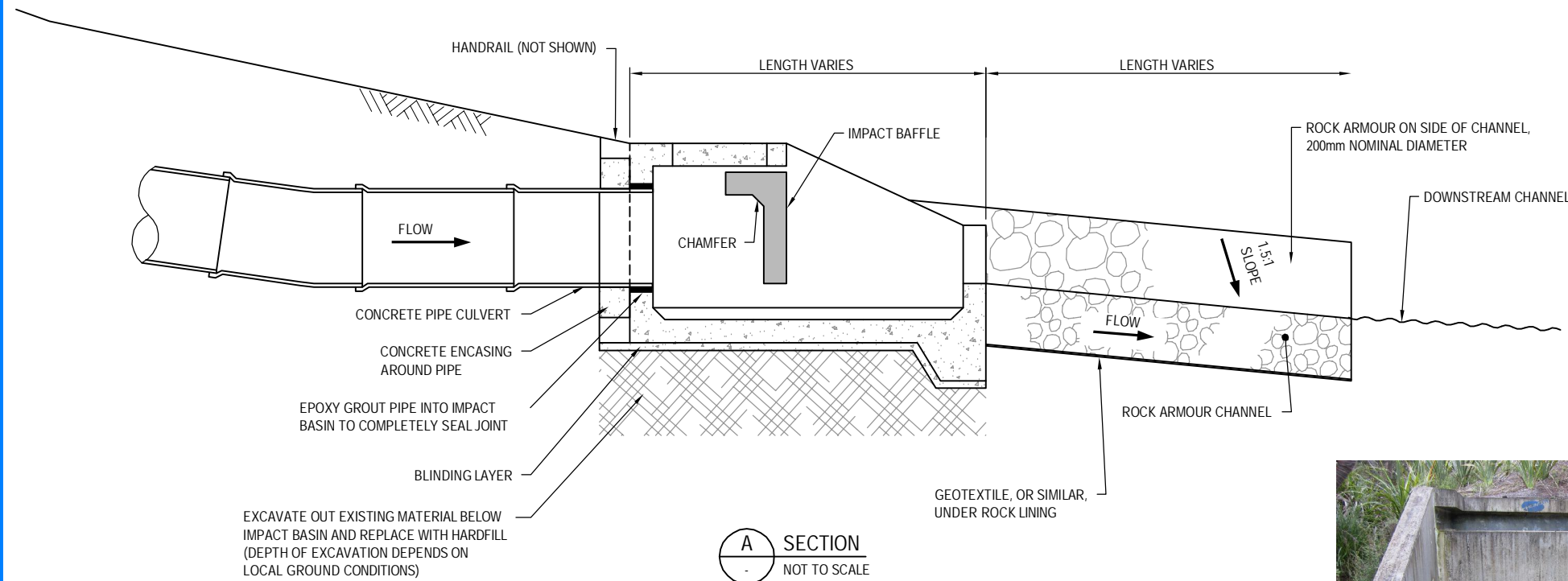
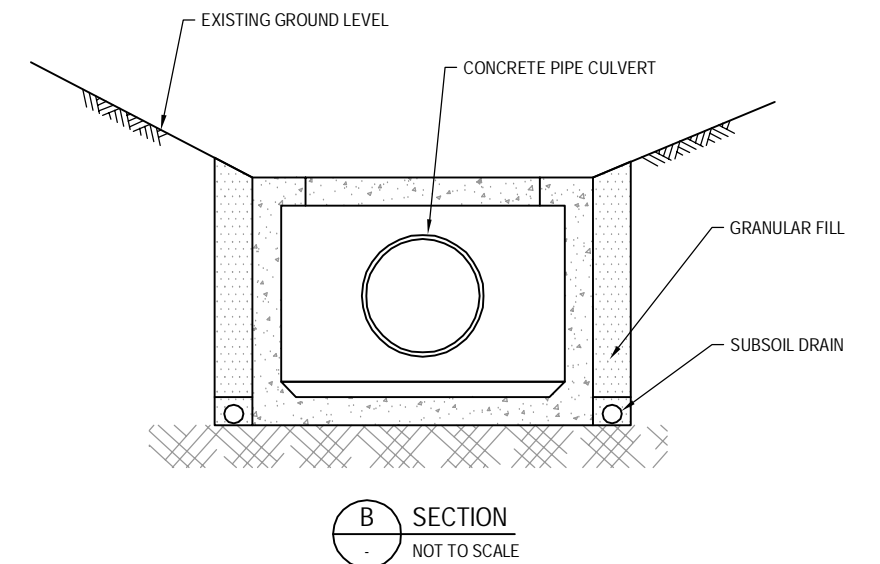
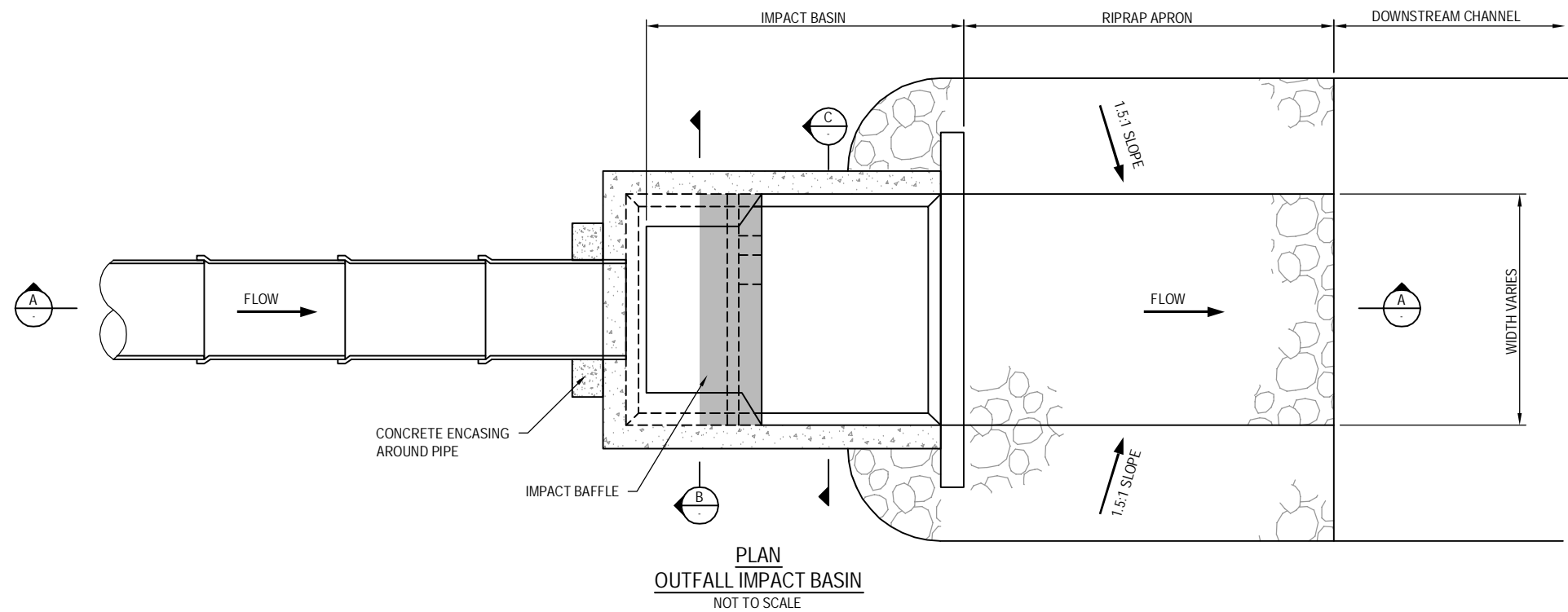


**DISCLAIMER**  
The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN SP / AN	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

OPERATIONAL WATER MANAGEMENT ARCH CULVERT FISH PASSAGE NATURAL BED DETAILS			
SCALE AS SHOWN	CONTRACT No PA3748	DRAWING No SW-203	AMDT 0

S:\Further North - PAA\300 Design\300.5 Technical\01-Drawing Production\CA00 Drawings\SW-301\_SW-307.dwg Plot Date: 19 August, 2013 - 13:35 PM



TYPICAL IMPACT BASIN  
(FROM NORTHERN GATEWAY TOLL ROAD)

## NOTES

- REFER TO DRAWING SW-150 FOR SUMMARY OF BRIDGES, CULVERTS & STREAM DIVERSIONS.
- FINAL DETAIL OF IMPACT BASIN TO BE DETERMINED AT DESIGN STAGE RELATIVE TO CULVERT SIZE.

0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT
AMD	DATE	DESIGN REVIEW	REVD D. MGR	APPD A. MGR	PURPOSE OF ISSUE / AMENDMENT



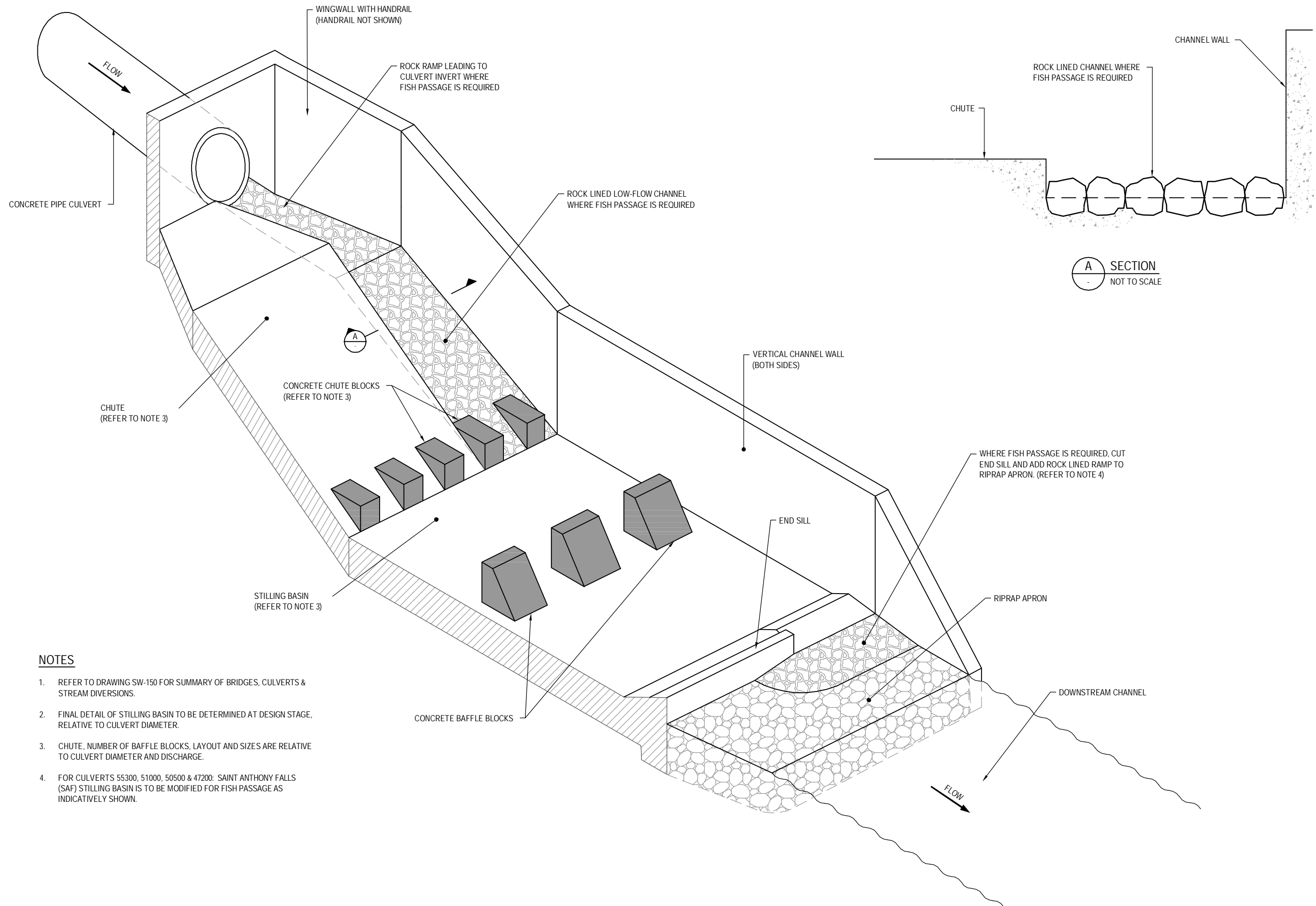
**DISCLAIMER**  
The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN SP / AN	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

OPERATIONAL WATER MANAGEMENT TYPICAL ENERGY DISSIPATION STRUCTURE IMPACT BASIN			
SCALE NOT TO SCALE	CONTRACT No PA3748	DRAWING No SW-301	AMDT 0



S:\Further North - PAA\300 Design\300.5 Technical\01-Drawing Production\CA00 Drawings\SW-301\_SW-307.dwg Plot Date: 16 August , 2013 - 2:21 PM



#### NOTES

1. REFER TO DRAWING SW-150 FOR SUMMARY OF BRIDGES, CULVERTS & STREAM DIVERSIONS.
2. FINAL DETAIL OF STILLING BASIN TO BE DETERMINED AT DESIGN STAGE, RELATIVE TO CULVERT DIAMETER.
3. CHUTE, NUMBER OF BAFFLE BLOCKS, LAYOUT AND SIZES ARE RELATIVE TO CULVERT DIAMETER AND DISCHARGE.
4. FOR CULVERTS 55300, 51000, 50500 & 47200: SAINT ANTHONY FALLS (SAF) STILLING BASIN IS TO BE MODIFIED FOR FISH PASSAGE AS INDICATIVELY SHOWN.

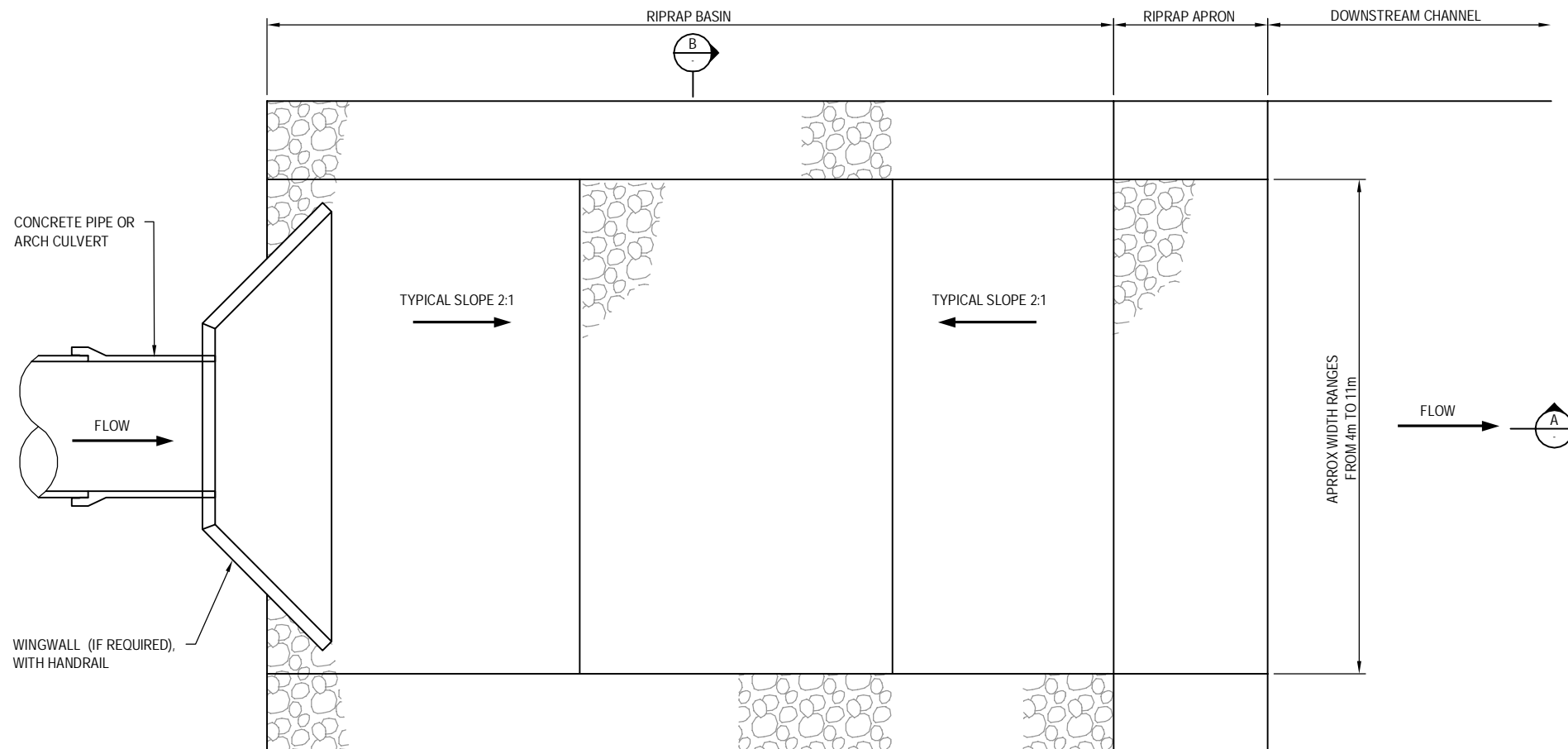
0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT
AMD	DATE	DESIGN REVIEW	REVD D. MGR	APPD A. MGR	PURPOSE OF ISSUE / AMENDMENT



**DISCLAIMER**  
The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN SP / AN	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

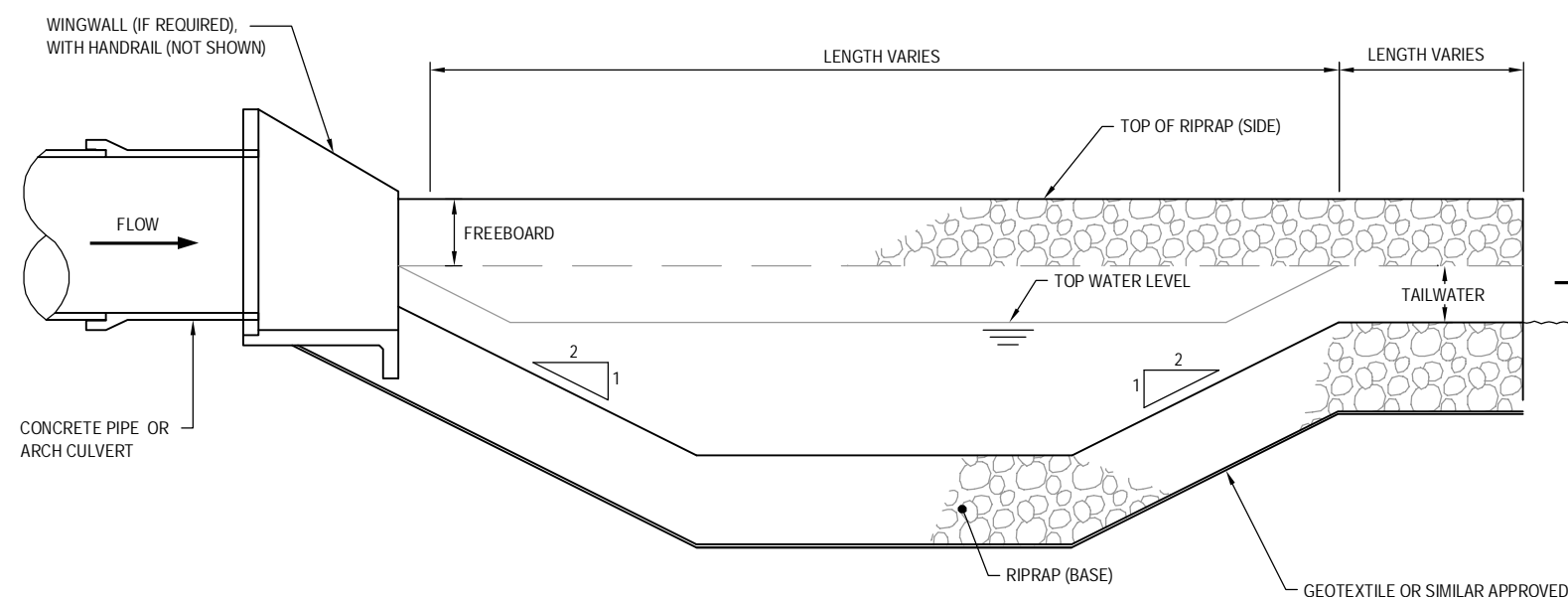
OPERATIONAL WATER MANAGEMENT TYPICAL ENERGY DISSIPATION STRUCTURE SAINT ANTHONY FALLS (SAF) STILLING BASIN			
SCALE NOT TO SCALE	CONTRACT No PA3748	DRAWING No SW-302	AMDT 0



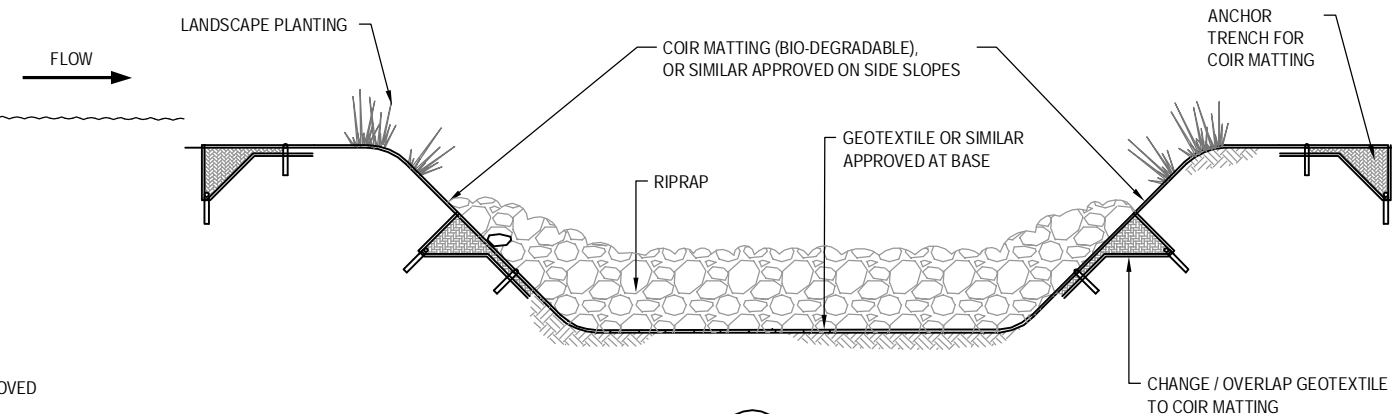
PLAN  
RIPRAP BASIN AND APRON  
NOT TO SCALE

## NOTES

1. REFER TO DRAWING SW-150 FOR SUMMARY OF BRIDGES, CULVERTS & STREAM DIVERSIONS.
2. FINAL DETAIL OF RIPRAP BASIN TO BE DETERMINED AT DESIGN STAGE RELATIVE TO CULVERT SIZE.



A SECTION  
NOT TO SCALE



B SECTION  
NOT TO SCALE

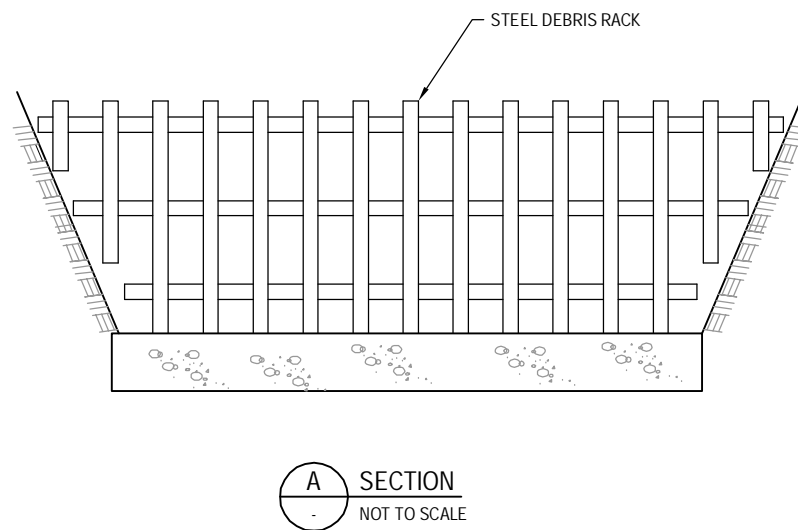
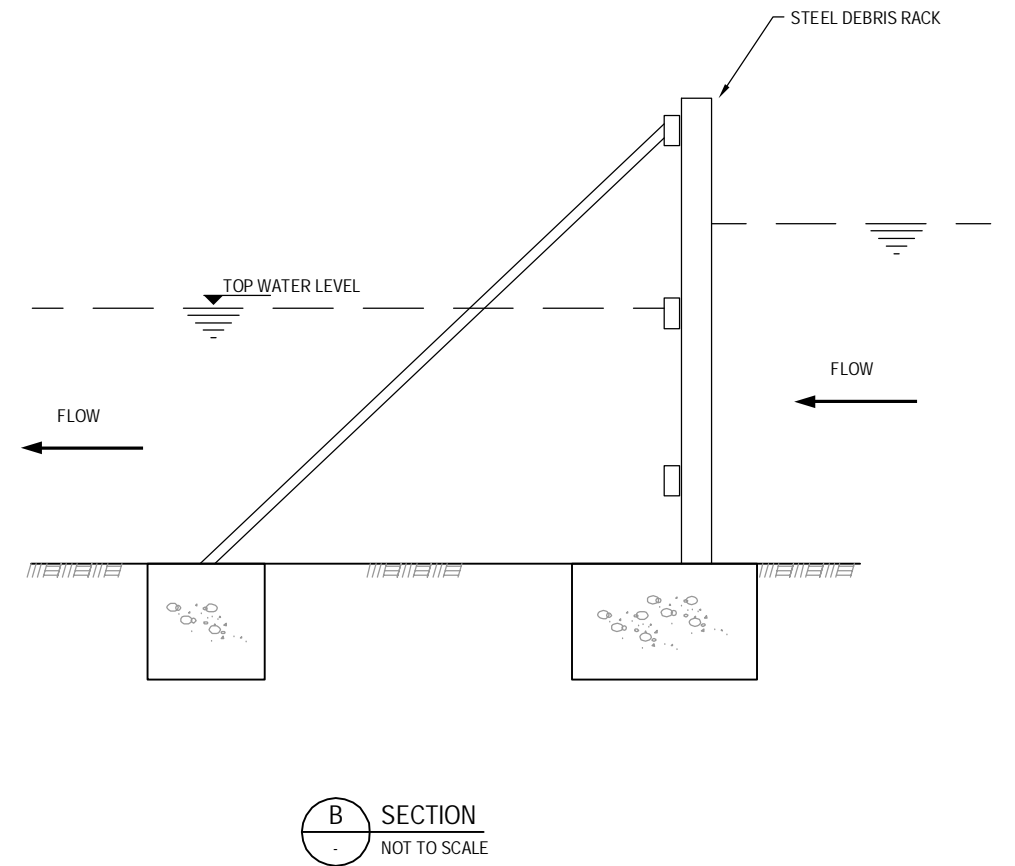
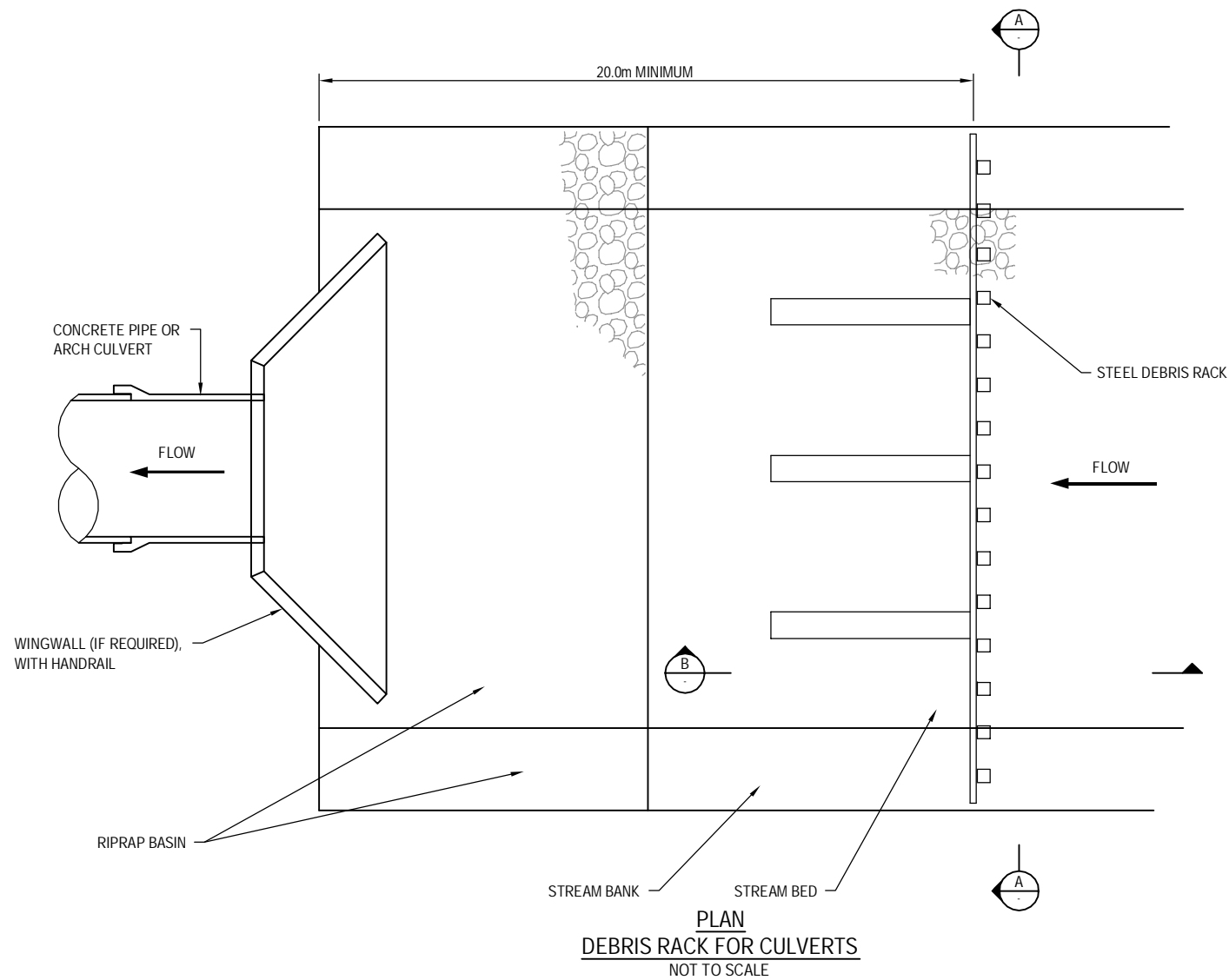
0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT
AMD	DATE	DESIGN REVIEW	REVD D. MGR	APPD A. MGR	PURPOSE OF ISSUE / AMENDMENT



**DISCLAIMER**  
The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN SP / AN	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

OPERATIONAL WATER MANAGEMENT TYPICAL ENERGY DISSIPATION STRUCTURE RIPRAP BASIN			
SCALE NOT TO SCALE	CONTRACT No PA3748	DRAWING No SW-303	AMDT 0



#### NOTE

1. FINAL DETAILS OF DEBRIS RACK TO BE DETERMINED AT DESIGN STAGE

0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT
AMD	DATE	DESIGN REVIEW	REVD D. MGR	APPD A. MGR	PURPOSE OF ISSUE / AMENDMENT



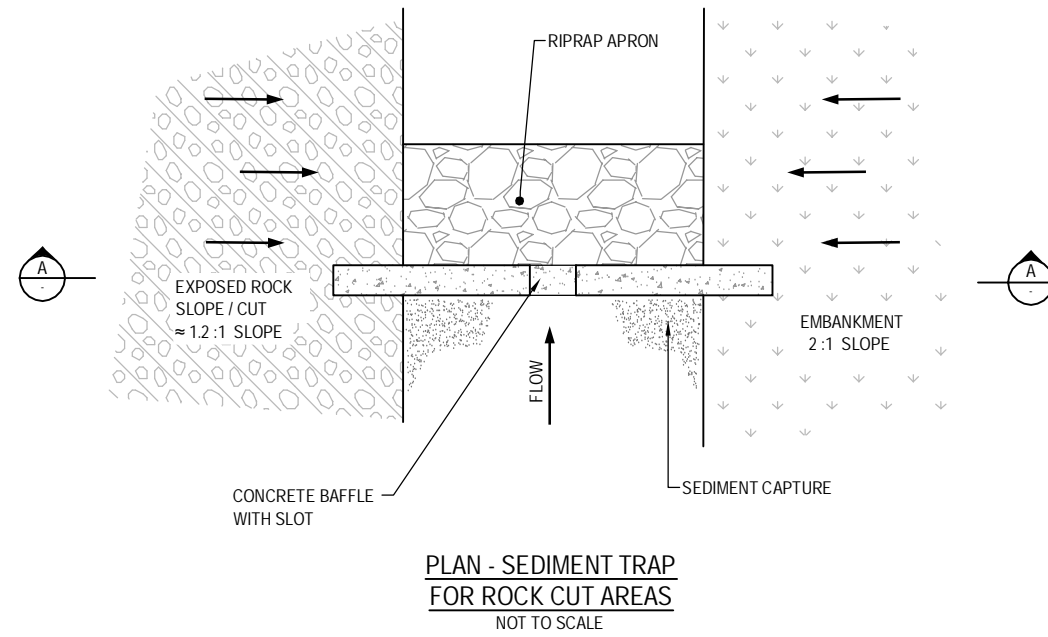
**DISCLAIMER**  
The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN SP / AN	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

OPERATIONAL WATER MANAGEMENT TYPICAL DETAIL DEBRIS RACK FOR CULVERTS			
SCALE NOT TO SCALE	CONTRACT No PA3748	DRAWING No SW-305	AMDT 0





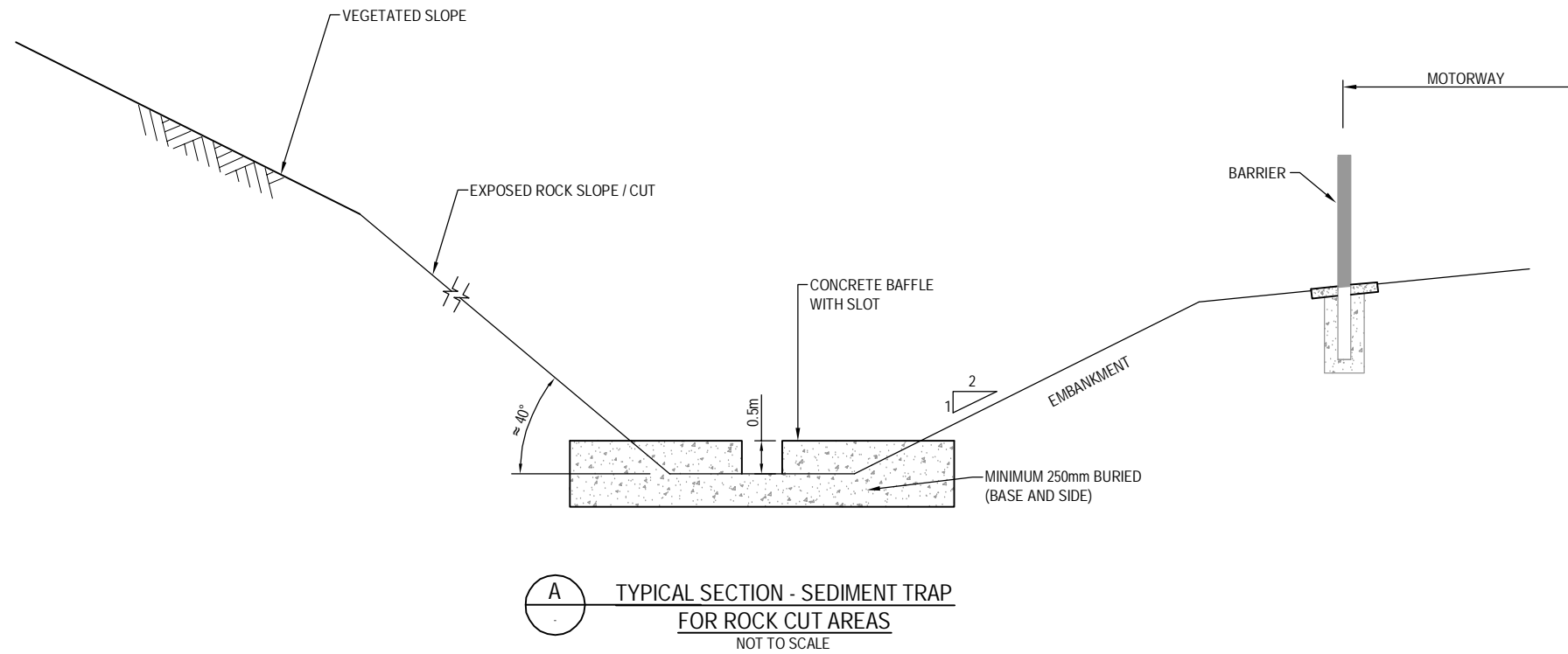


PLAN - SEDIMENT TRAP  
FOR ROCK CUT AREAS  
NOT TO SCALE

#### NOTES

1. FINAL DETAILS OF SEDIMENT TRAP TO BE CONFIRMED AT DESIGN STAGE.
2. SEDIMENT TRAP TO BE USED ONLY WHERE THERE ARE EXPOSED ROCK SLOPES / CUTS.
3. SEDIMENT TRAP SPACING (m) TO BE AS PER TABLE BELOW.

		ROCK CUT HEIGHT (m)			
		5 to 10	10 to 20	20 to 30	30 to 40
SWALE SLOPE	0 to 1%	100	100	100	100
	1 to 3%	100	45	25	25
	3 to 5%	60	20	15	15



TYPICAL SECTION - SEDIMENT TRAP  
FOR ROCK CUT AREAS  
NOT TO SCALE

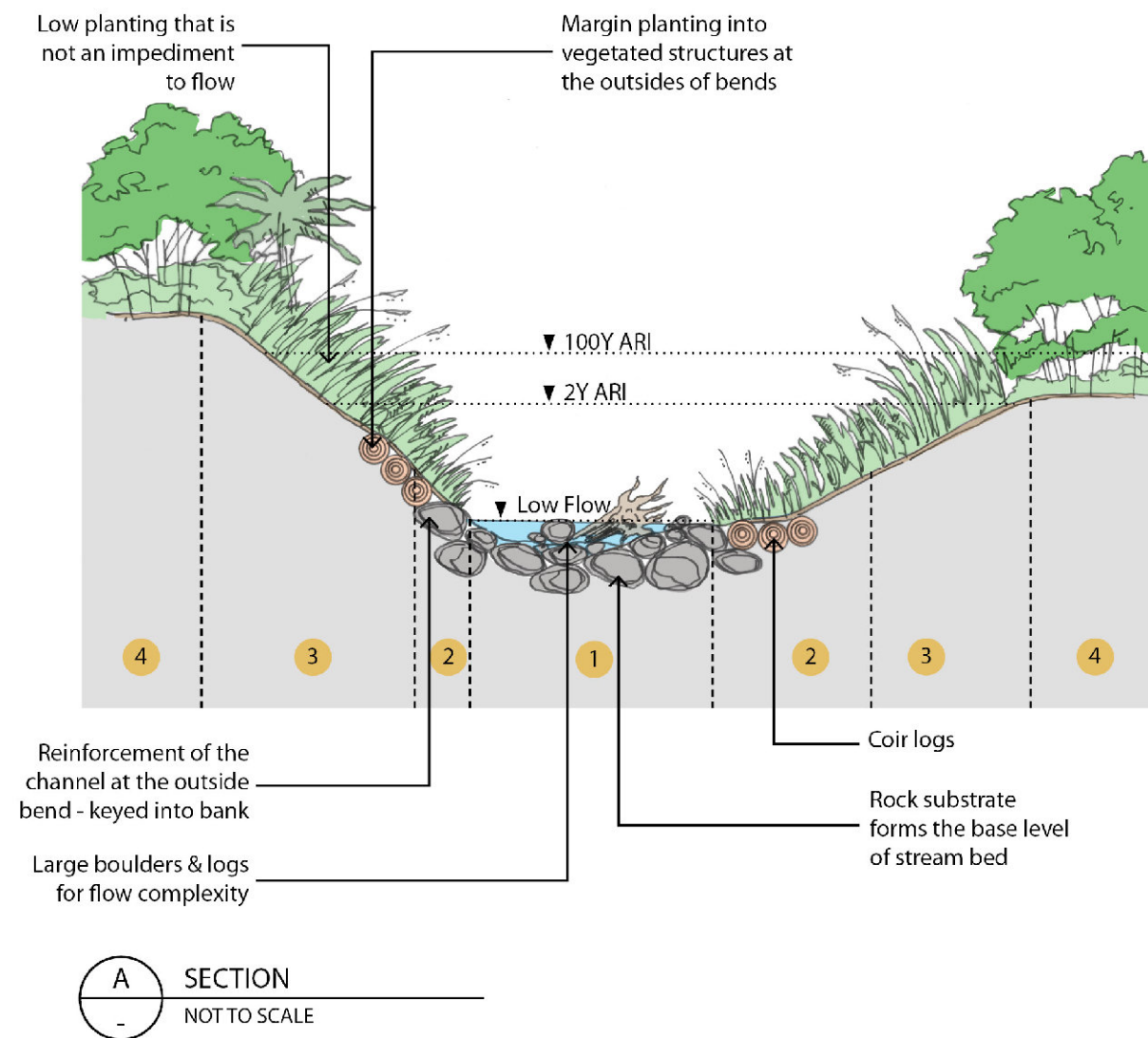
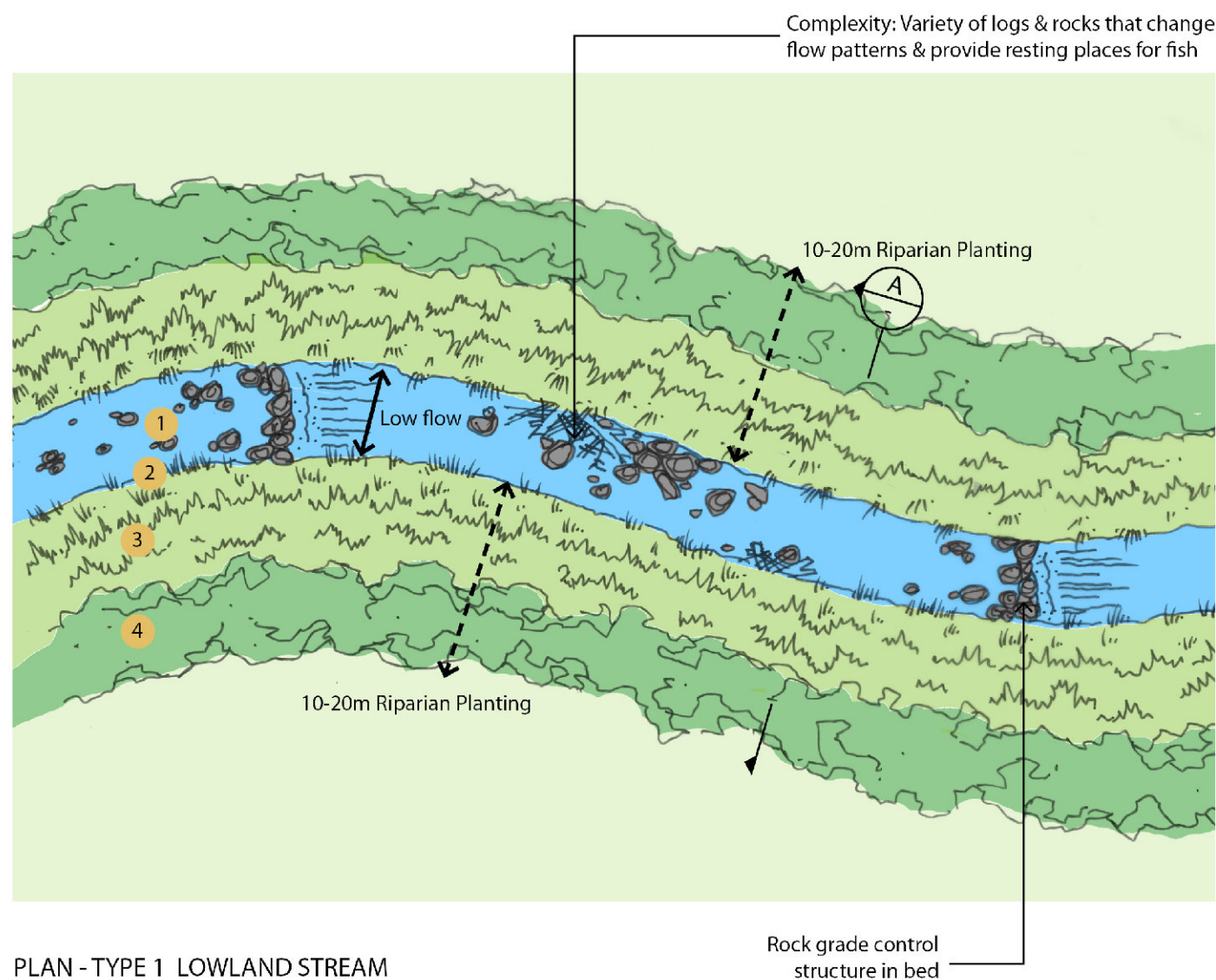
0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT
AMD	DATE	DESIGN REVIEW	REVD D. MGR	APPD A. MGR	PURPOSE OF ISSUE / AMENDMENT



**DISCLAIMER**  
The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN SP / AN	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

OPERATIONAL WATER MANAGEMENT TYPICAL DETAIL - SEDIMENT TRAP FOR ROCK CUT AREAS			
SCALE NOT TO SCALE	CONTRACT No PA3748	DRAWING No SW-307	AMDT 0



Typical Riparian Planting:

1. Stream	2. Stream Edge	3. Littoral Zone (Occasionally floods)	4. Forest Zone
Slow flowing areas to include: - Ruatahi - Lake Clubrush - Sharp Spike Sedge - Raupo - Pukio - Giant Umbrella Sedge	Typically contains: - Ponga - Kiokio - Ruatahi - Giant Umbrella Sedge	Typically contains: - Flax - Giant Umbrella Sedge - Range of bushes & sedges - Cabbage tree - Manuka - Mahoe - Mapou - Karamu - Ponga - Kahikatea - Kiokio - Totara	Typically contains: - Rimu - Totara - Tanekaha - Kanuka - Titoki - Kowhai - Puriri with pockets of: - Kauri - Kahikatea - Karaka

0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT
AMT	DATE	DESIGN REVIEW	REV'D D. MGR	APPROD A. MGR	PURPOSE OF ISSUE / AMENDMENT

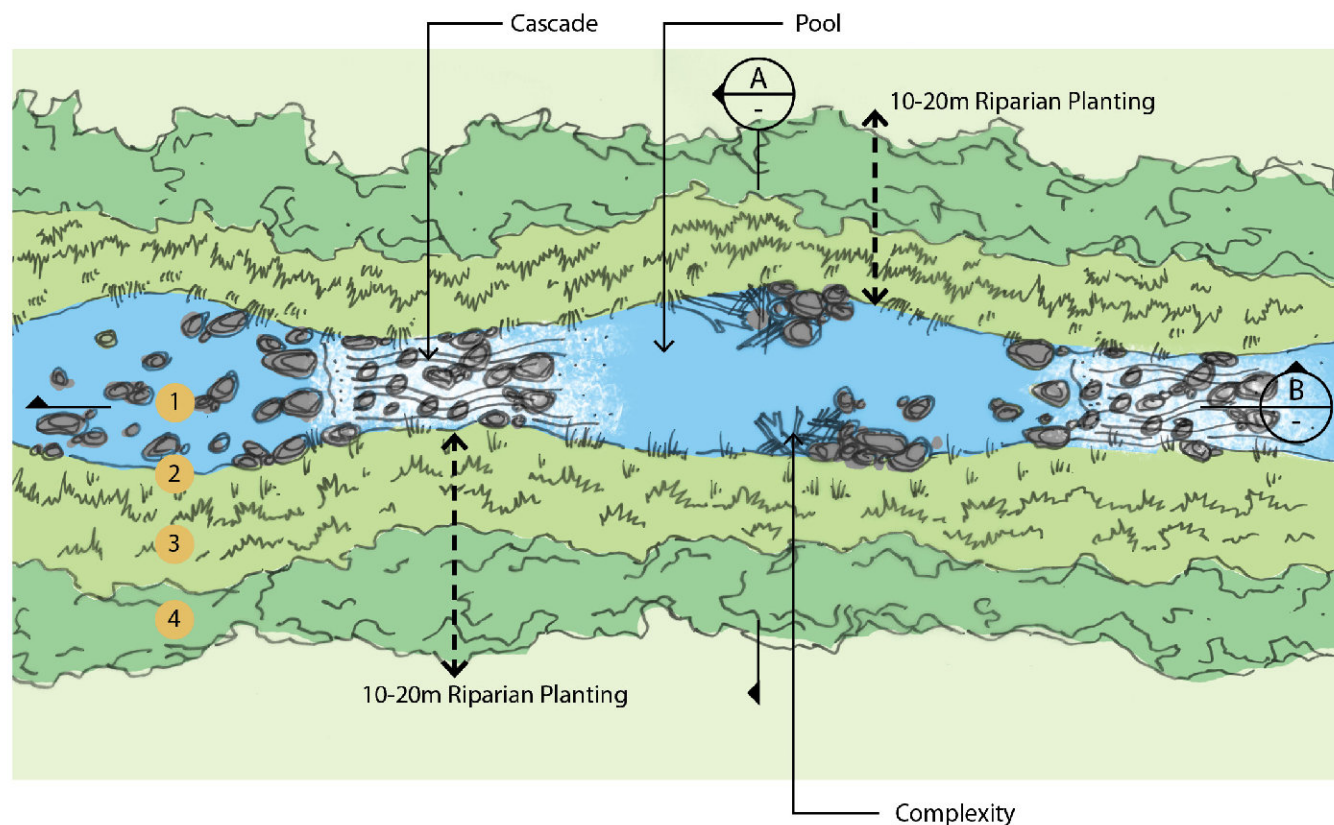


**DISCLAIMER**  
 The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

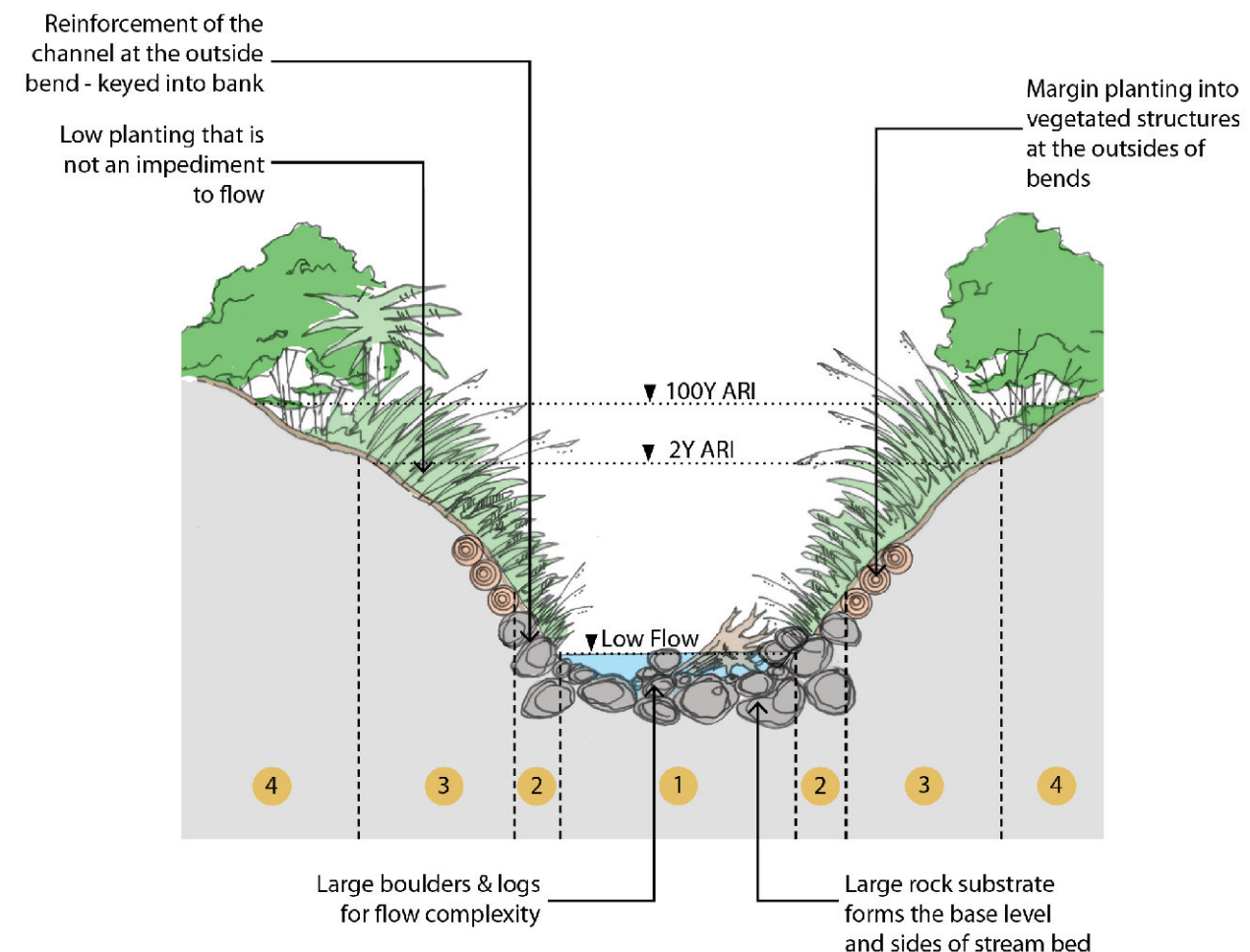
ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN JW	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

OPERATIONAL WATER MANAGEMENT STREAM DIVERSION TYPES TYPICAL TYPE 1 – LOWLAND STREAM			
SCALE NOT TO SCALE	CONTRACT No PA3748	DRAWING No SW-401	AMDT 0





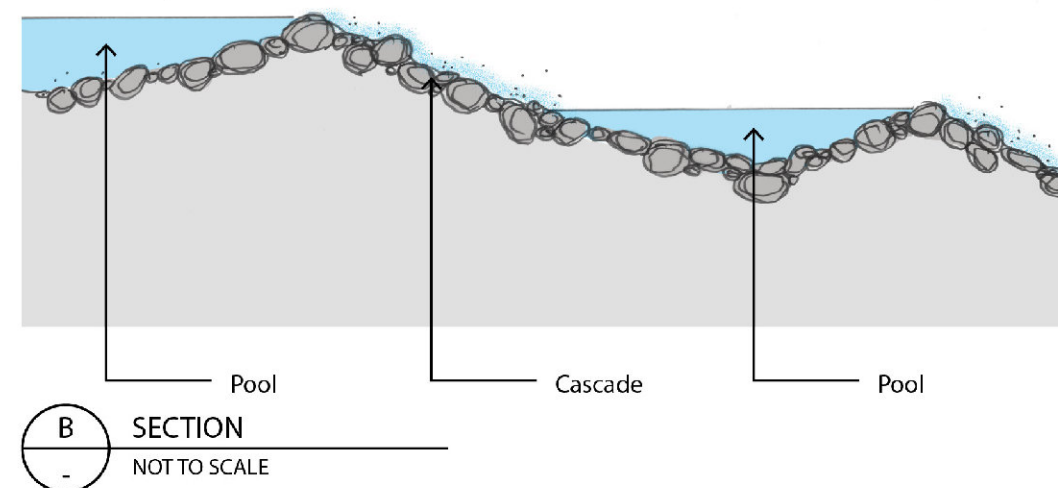
PLAN - TYPE 2 STEEP STREAM  
NOT TO SCALE



A SECTION  
NOT TO SCALE

Typical Riparian Planting:

1. Stream	2. Stream Edge	3. Littoral Zone (Occasionally floods)	4. Forest Zone
- No planting	Typically contains: - Ponga - Kiokio	Typically contains: - Flax - Range of bushes & sedges - Cabbage tree - Manuka - Mahoe - Mapou - Karamu - Ponga - Kahikatea - Kiokio - Totara	Typically contains: - Rimu - Totara - Tanekaha - Kanuka - Titoki - Kowhai - Puriri with pockets of: - Kauri - Kahikatea - Karaka



B SECTION  
NOT TO SCALE

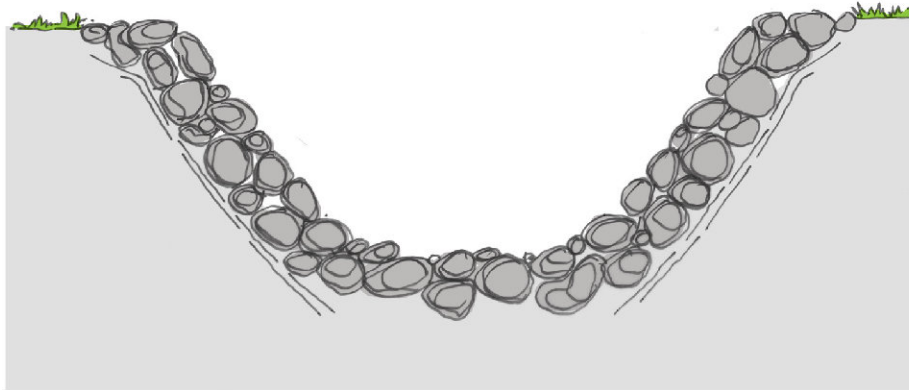
REV	DATE	BY	CHKD	APPD	DESCRIPTION
0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT



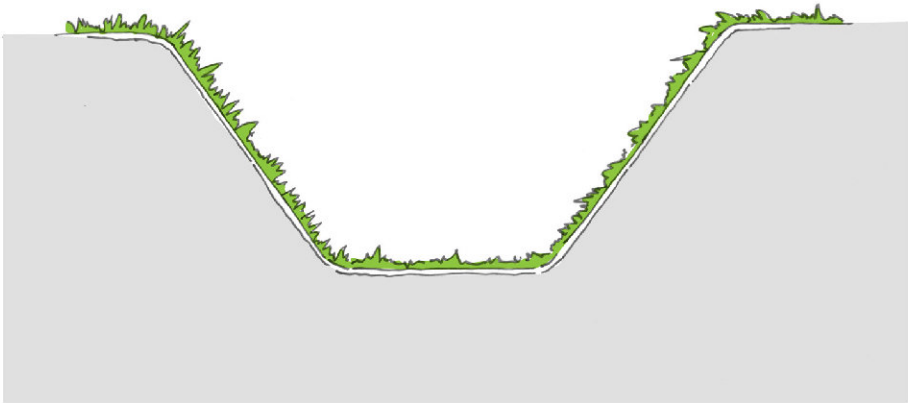
**DISCLAIMER**  
The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN JW	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

OPERATIONAL WATER MANAGEMENT STREAM DIVERSION TYPES TYPICAL TYPE 2 - STEEP STREAM			
SCALE NOT TO SCALE	CONTRACT No PA3748	DRAWING No SW-402	AMDT 0



Rock-Lined Flow Channel for High Flow and/or Steep Gradients



Grass-Lined Flow Channel for Low Flow and/or Flat Gradients

TYPICAL SECTIONS - TYPE 3 FLOW CHANNEL  
NOT TO SCALE

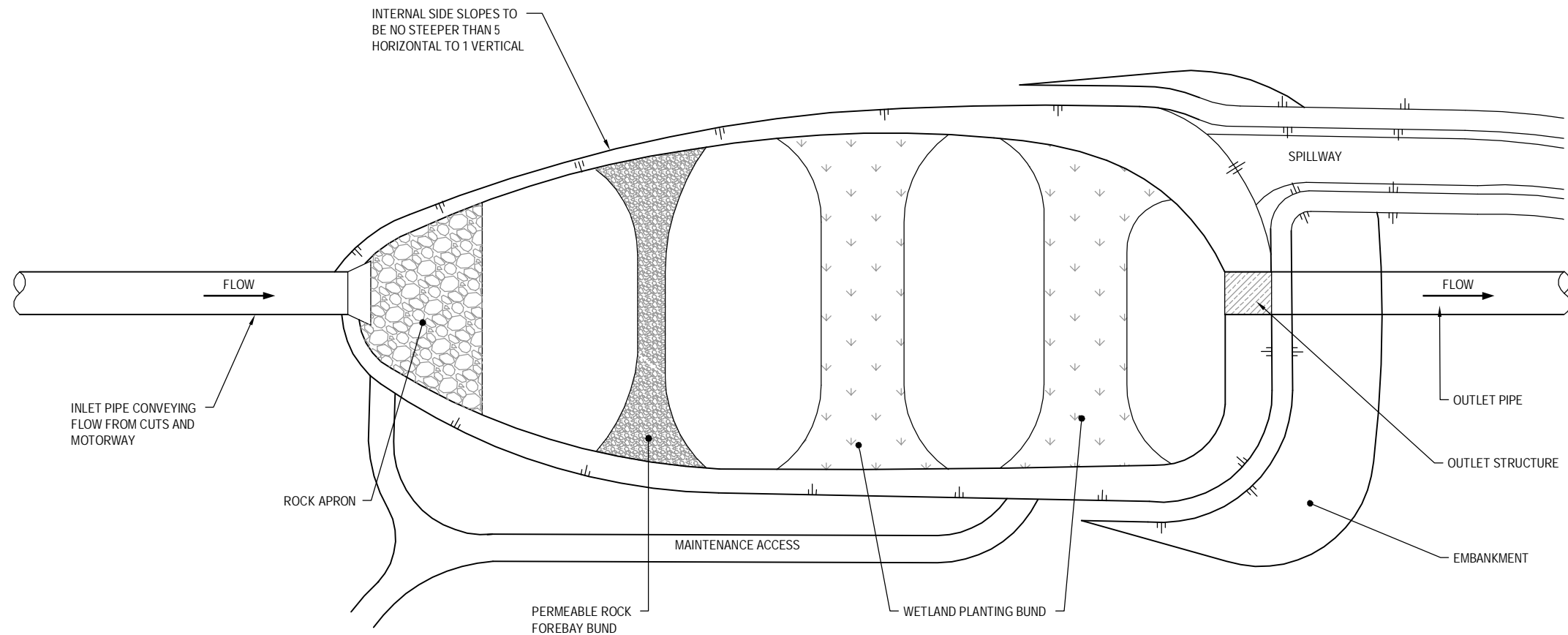
0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT
AMD	DATE	DESIGN REVIEW	REV'D D. MGR	APPR'D A. MGR	PURPOSE OF ISSUE / AMENDMENT



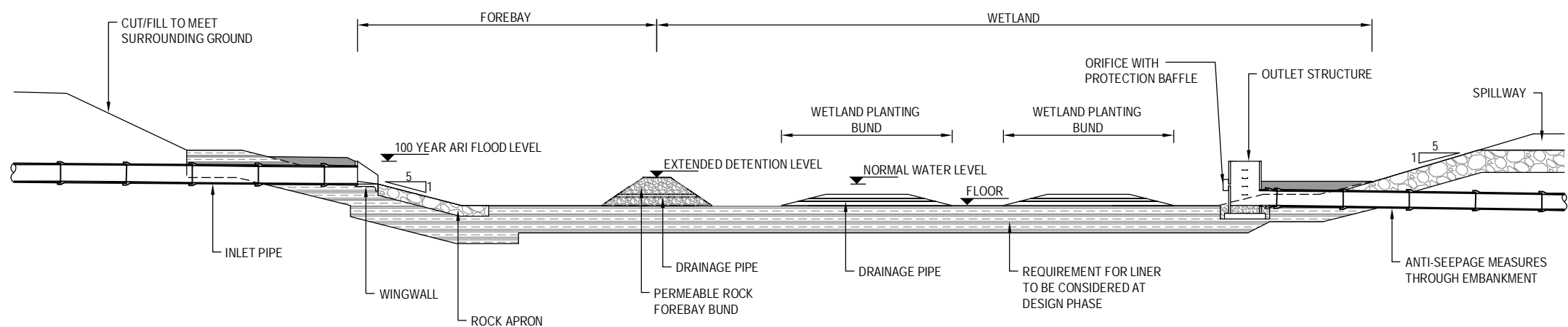
**DISCLAIMER**  
The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN JW	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

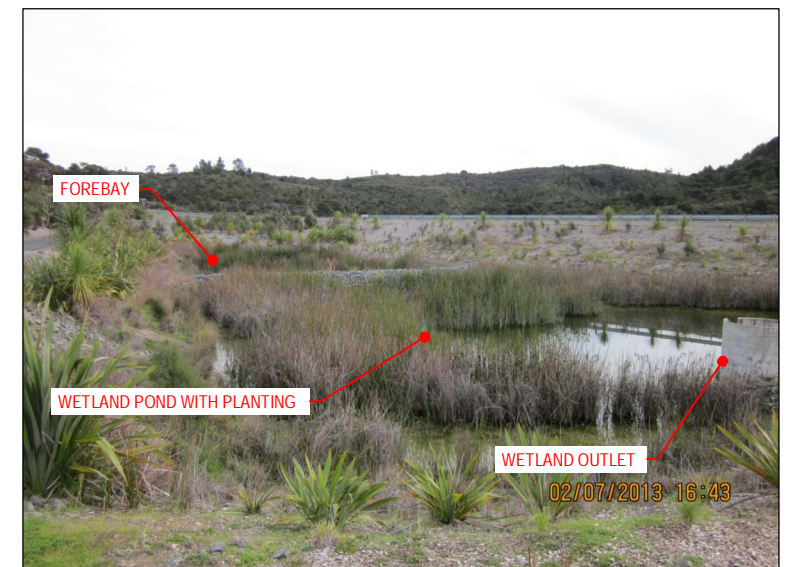
OPERATIONAL WATER MANAGEMENT STREAM DIVERSION TYPES TYPICAL TYPE 3 – FLOW CHANNEL			
SCALE NOT TO SCALE	CONTRACT No PA3748	DRAWING No SW-403	AMDT 0



PLAN - TYPICAL WETLAND  
NOT TO SCALE



SECTION - TYPICAL WETLAND  
NOT TO SCALE



TYPICAL WETLAND  
(FROM NORTHERN GATEWAY TOLL ROAD)  
NOT TO SCALE

0	30/08/13	TF	MW	TI	ISSUE FOR NOR / CONSENT
AMD	DATE	DESIGN REVIEW	REVD D. MGR	APPD A. MGR	PURPOSE OF ISSUE / AMENDMENT



**DISCLAIMER**  
The information shown on this drawing is solely for the purposes of supporting RMA applications for statutory approvals. All information shown is subject to review for compliance with approved consents and the outcomes of final design.

ARA TŪHONO - PŪHOI TO WELLSFORD			
PŪHOI TO WARKWORTH - FOR RMA APPROVALS			
DRAWN SP / AN	DRAFTING CHECK DS	REVIEWED DISCIPLINE MANAGER MW	APPROVED ALLIANCE MANAGER TI
DESIGNED DS	DESIGN REVIEW TF		

OPERATIONAL WATER MANAGEMENT TYPICAL WETLAND PLAN AND SECTION			
SCALE NOT TO SCALE	CONTRACT No PA3748	DRAWING No SW-501	AMDT 0