



Mike Adams
EcoStream 2018

Incorporating Wood in Urban Systems





Agenda

1. Benefits of Wood
2. Wood in Urban Setting
3. Design Considerations
4. Examples
5. Questions

Benefits of Wood



In-Channel

- Turbulence
- Carbon/nutrient trap
- Cover
- Toe stability
- Wood recruitment
- Bedform diversity
- Grade Control

Floodplain

- Carbon source
- Roughness
- Trap debris
- Habitat

Wood in an urban setting

Toe wood

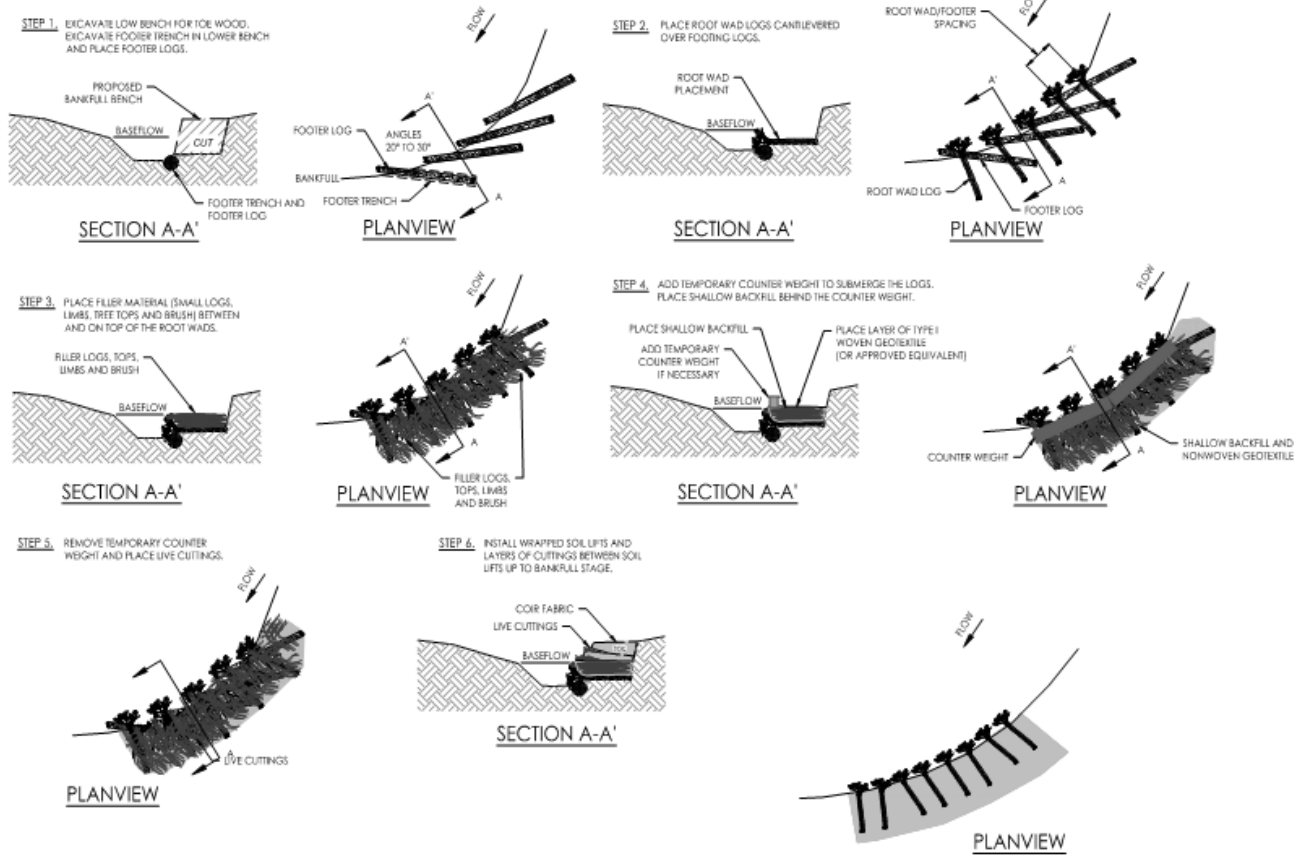
- Submerged wood
- Sod or lifts on top
- Stabilizing toe structure
- Undercut bank

Floodplain assemblage

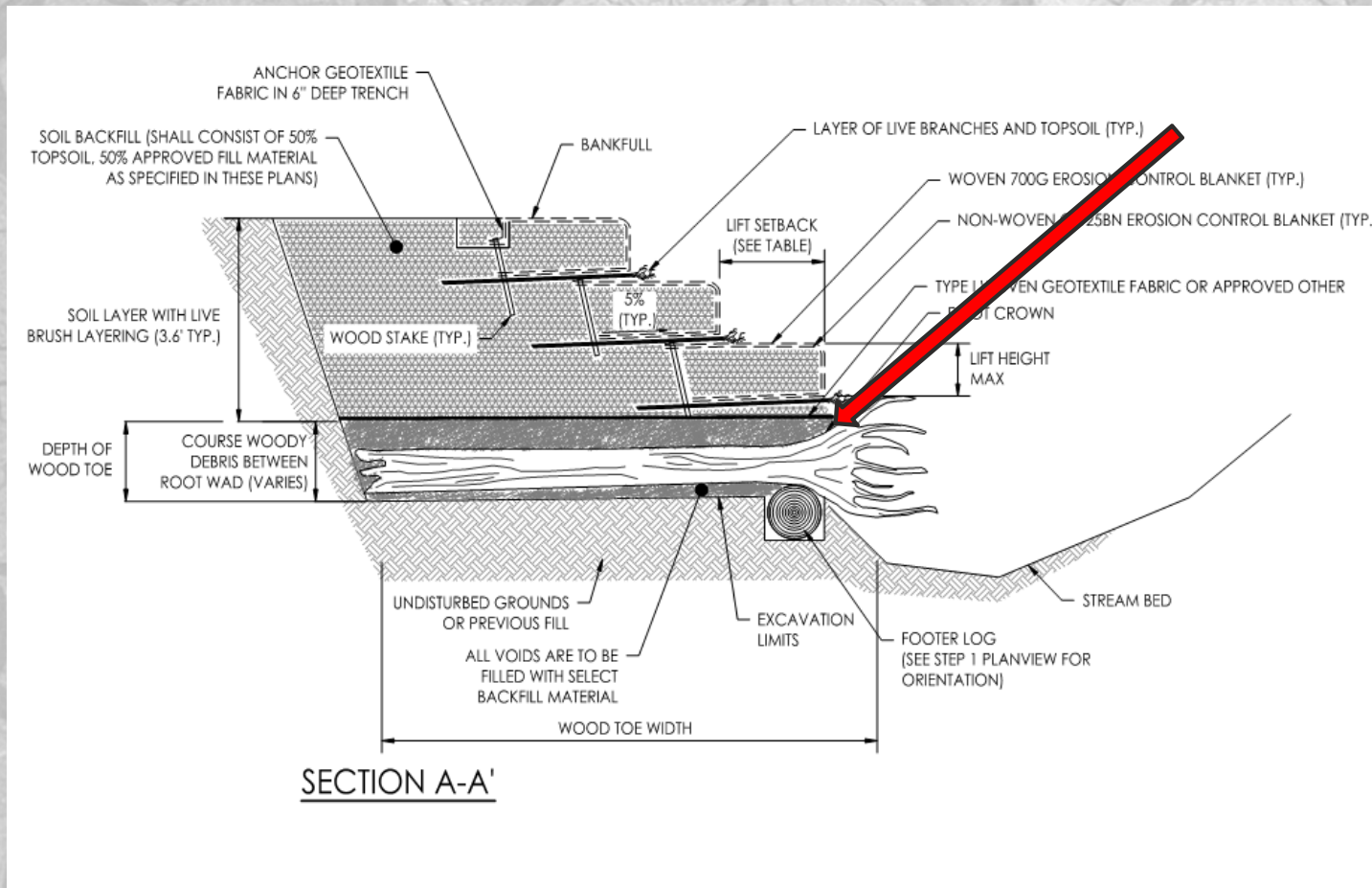
- Roughness element
- Variable distance from channel
- Requires floodplain



Design Considerations – Toe Wood

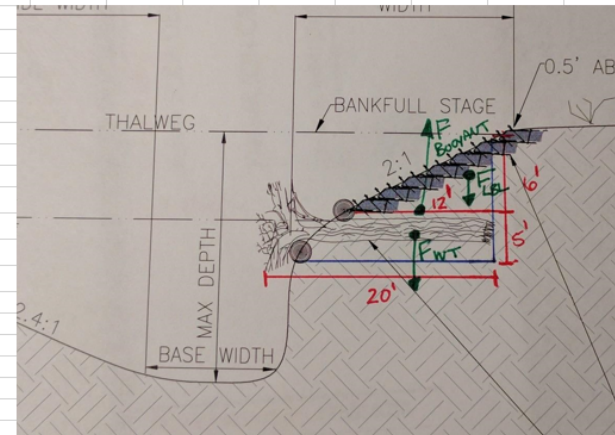


Design Considerations – Toe Wood

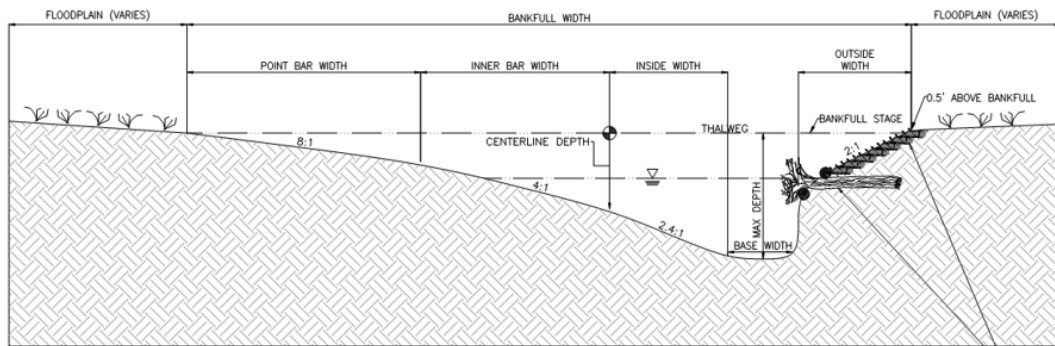


Design Considerations – Toe Wood

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	D _{WOOD}		3 ft			F _{TLB}	-12125 lbs/ft								
2	D _{LSL}		10 ft			F _{WOODTOE}	-3375 lbs/ft								
3	W _{TOP LBL}		0 ft			F _{B-LBL}	7800 lbs/ft								
4	W _{BOTTOM LBL}		25 ft			F _{B-WT}	4680 lbs/ft								
5	W _{WOOD}		25 ft			NET FORCE	-3020 lbs/ft								
6						FS	1.24								
7	Wood Toe Wood %		100%												
8	Wood Toe Soil %		0%												
9															
10	Y _{WATER}		62.4 lbs/ft ³			M _{TLB}	-101041.6667								
11	Y _{SOIL DRY}		97 lbs/ft ³			M _{WOODTOE}	-42187.5								
12	Y _{WOOD}		45 lbs/ft ³			M _{B-LBL}	65000								
13	Y _{WOOD/SOIL MIXTURE}		45 lbs/ft ³			M _{B-WT}	58500								
14						NET MOMENT	-19729.16667								
15						FS	1.16								



Wood Species	Fresh Green Wood			Air-dried Seasoned Wood		
	Density (lb/ft ³)	Weight per Cord (lb/cord)	(20% moisture content per weight unit)	Density (lb/ft ³)	Weight per Cord (lb/cord)	
5. Afrosia			0.71	44		
6. Alder	0.72	45	3604	0.45	28	2218
7. Apple			0.66 - 0.83	41 - 52		
8. Ash, black			52	34		
9. Ash, Oregon			46	30		
10. Ash, white			45	41		
11. Ash, Green	0.85	53	4237	0.64	40	3178
12. Aspen			43	26		
13. Balsp			0.18	11		
14. Bastwood			42	26		
15. Bamboo			0.30 - 0.40	19 - 25		
16. Beech, American			54	45		
17. Birch, Britsh			57	44		
18. Birch, Paper			50	38		
19. Black Ash			0.54	34		
20. Black locust	0.93	58	4614	0.79	49	3952
21. Black walnut	0.91	57	4579	0.61	38	3053
22. Bur oak	0.99	62	4923	0.69	43	3475
23. Cottonwood	0.93	58	4620	0.45	28	2218
24. Cedar, Alaska			36	31		
25. Cedar, Eastern Red			37	33		
26. Cedar, Northern White			38	22		
27. Cedar, Southern White			26	23		
28. Cedar, Western Red			27	23		
29. Cherry, black			45	35		
30. Chestnut			55	50		
31. Cottonwood, Eastern			49	29		
32. Cottonwood, Northern Black			46	24		
33. Cypress, Southern			51	32		
34. Douglas Fir, Coast Region			38	0.53	33	
35. Douglas Fir, Rocky Mountain Region			35	30		
36. Ebony			0.96 - 1.12	60 - 70		
37. Elm, American			54	35		
38. Elm, Rock			53	44		
39. Elm, Slippery			56	37		
40. Fir, Balsam			45	25		
41. Fir, Commercial White			46	27		
42. Gum, black			45	35		
43. Gum, red			50	34		
44. Hackberry	0.82	51	4039	0.59	37	2938
45. Hemlock, Eastern			50	28		



BUFFALO BAYOU
TYPICAL SECTION - POOL RIGHT

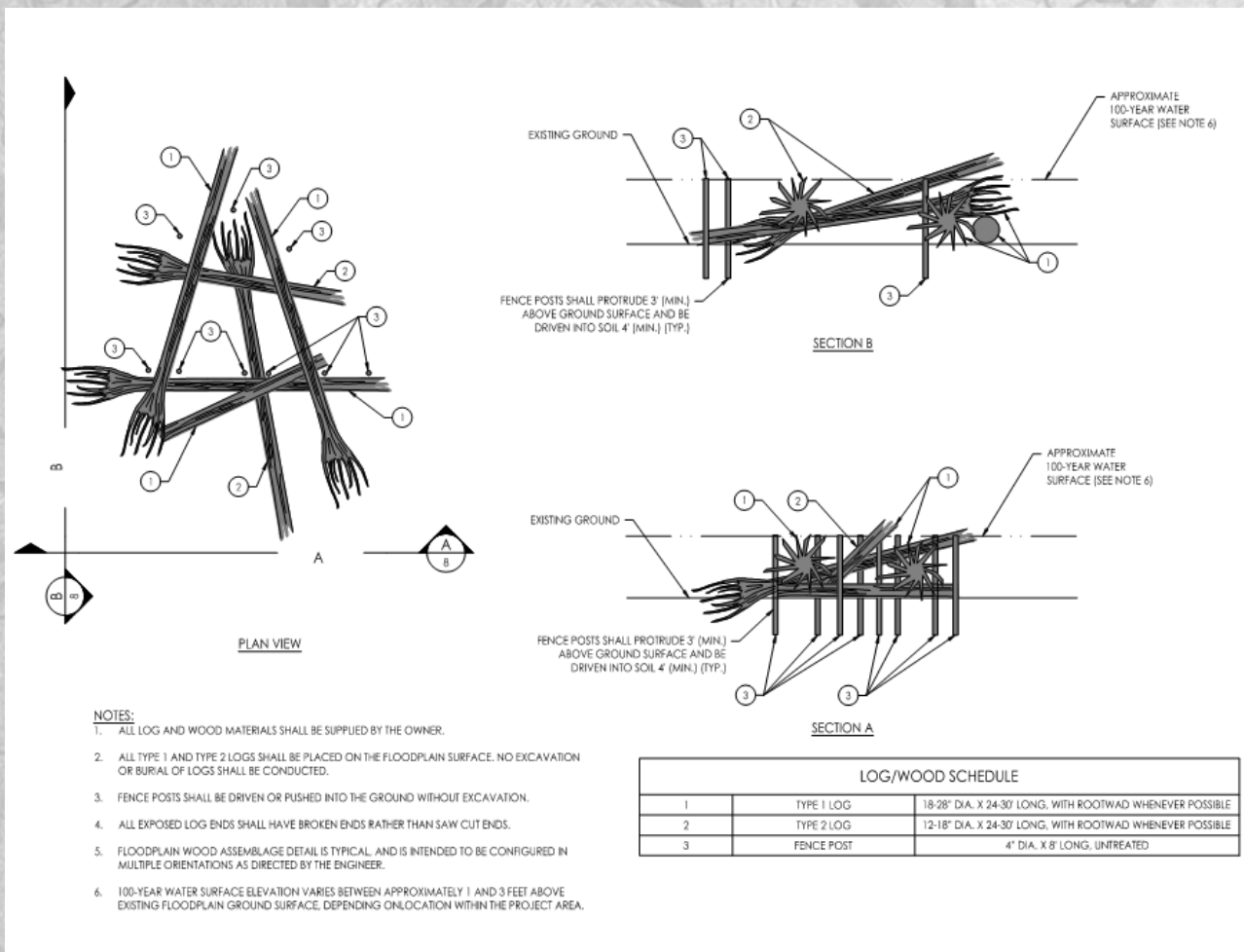
DIMENSION	VALUE
BANKFULL AREA	1092 FT ²
BANKFULL WIDTH	121.2 FT
POINT BAR WIDTH	39.1 FT
INNER BAR WIDTH	31.6 FT
INSIDE WIDTH	19.8 FT
BASE WIDTH	11.8 FT
OUTSIDE WIDTH	18.9 FT
MAX DEPTH (THALWEG)	21.0 FT
CENTERLINE DEPTH	12.8 FT

THALWEG (DEEPEST POINT IN A CROSS SECTION) IS LOCATED IN THE OUTSIDE 1/3 OF BANKFULL WIDTH.

- NOTES:
- ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE UPSTREAM DIRECTION
 - ● GRADE POINT IS THE CENTERLINE OF THE ALIGNMENT
 - ALL SHARP CORNERS SHOULD BE ROUNDED
 - MAX DEPTH IS MEASURED FROM THE CHANNEL THALWEG TO BANKFULL

FOR INFORMATION ON THE OUTSIDE OF THE MEANDER BEND SEE DETAIL #1, SHEET 51 - CORR LIFT AND TOE WOOD PROTECTION

Design Considerations – Floodplain Assemblage



Crawford Reach

Durham, OR (Outside Portland)

Setting

- Landscaping company
- Extensive adjacent wetlands



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Goals

- Stabilize banks in place
- Beaver resiliency



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Goals

- Stabilize banks in place
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Construction

- Doug firs
- Pump around with screen



Crawford Reach

Durham, OR (Outside Portland)

Setting

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Goals

- Stabilize banks in place
- Beaver resiliency

Construction

- Doug firs
- Pump around with screen

Results

- Erosion - Deposition



Crawford Reach

Durham, OR (Outside Portland)

Setting

- Landscaping company
- Extensive adjacent wetlands

Goals

- Stabilize banks in place
- Beaver resiliency

Construction

- Doug firs
- Pump around with screen

Results

- Flood resilience
- Recruitment



Crawford Reach

Durham, OR (Outside Portland)

Setting

- Landscaping company
- Extensive adjacent wetlands

Goals

- Stabilize banks in place
- Beaver resiliency

Construction

- Doug firs
- Pump around with screen

Results

- Near-bank velocity reduction



Crawford Reach

Durham, OR (Outside Portland)

Setting

- Landscaping company
- Extensive adjacent wetlands

Goals

- Stabilize banks in place
- Beaver resiliency

Construction

- Doug firs
- Pump around with screen

Results

- Revegetation of banks



Wolftrap Creek

Vienna, VA (Outside Washington, DC)

Setting

- Urban Park



Wolftrap Creek

Vienna, VA (Outside Washington, DC)

Setting

- Urban Park

Goals

- Stabilize banks in place
- Minimize tree take
- Preserve / mimic what's working



Wolftrap Creek

Vienna, VA (Outside Washington, DC)

Setting

- Urban Park

Goals

- Stabilize banks in place
- Minimize tree take
- Preserve / mimic what's working

Construction

- On-site materials
- Dry / pump around



Wolftrap Creek

Vienna, VA (Outside Washington, DC)

Setting

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Goals

- Stabilize banks in place
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Construction

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Setting

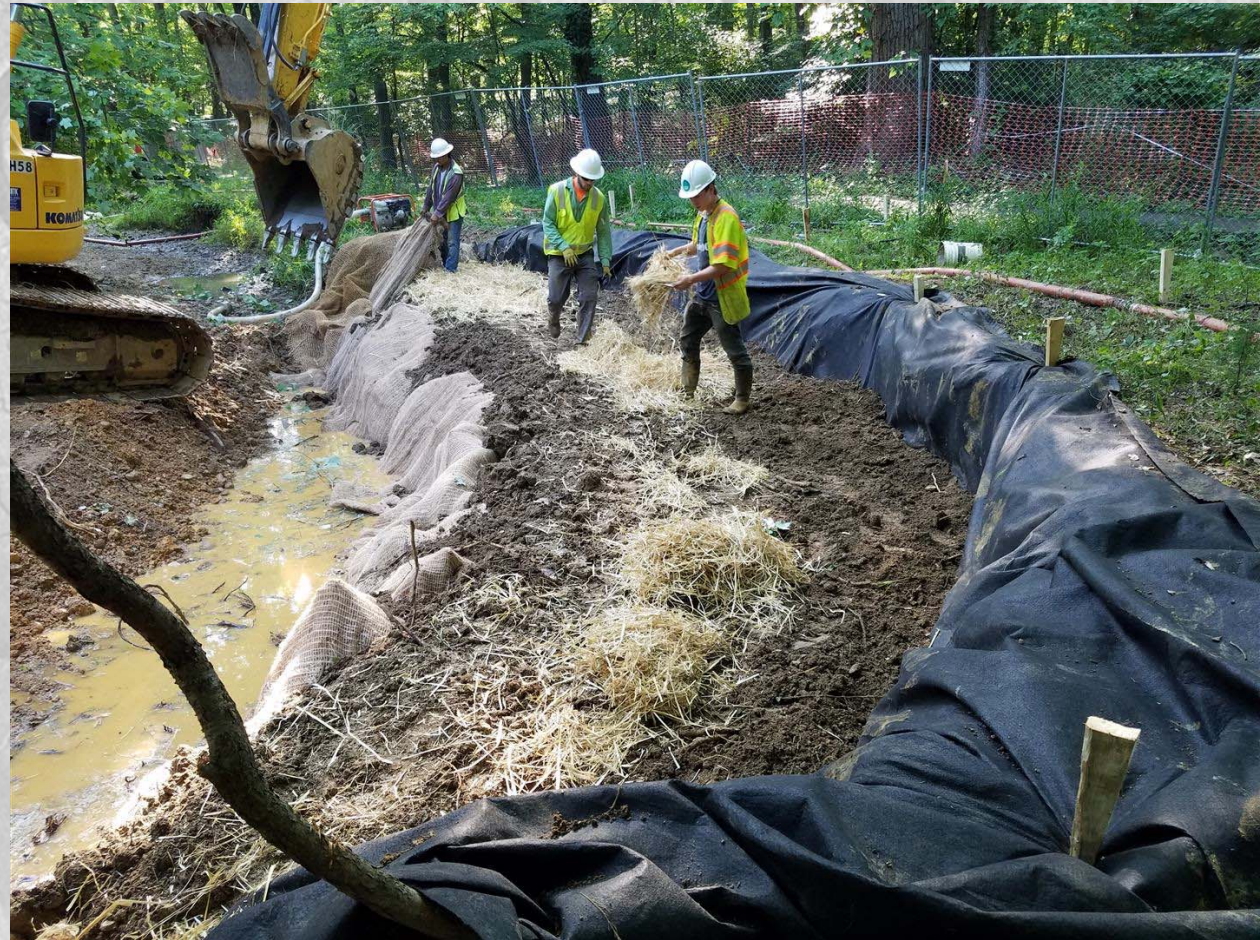
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Goals

- Stabilize banks in place
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Construction

- On-site materials
- Dry / pump around



Wolftrap Creek

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Setting

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Construction

- On-site materials
- Dry / pump around



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Construction

- On-site materials
- Dry / pump around



Wolftrap Creek

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Setting

- Urban Park

Goals

- Stabilize banks in place
- Minimize tree take
- Preserve / mimic what's working

Construction

- On-site materials
- Dry / pump around

Results

- Fish habitat / benthics
- Redds



Wolftrap Creek

Vienna, VA (Outside Washington, DC)

Setting

- Urban Park

Goals

- Stabilize banks in place
- Minimize tree take
- Preserve / mimic what's working

Construction

- On-site materials
- Dry / pump around

Results

- Fish habitat / benthics



Wolftrap Creek

Vienna, VA (Outside Washington, DC)

Setting

- Urban Park

Goals

- Stabilize banks in place
- Minimize tree take
- Preserve / mimic what's working

Construction

- On-site materials
- Dry / pump around

Results

- Woody material recruitment



Wolftrap Creek

Vienna, VA (Outside Washington, DC)

Setting

- Urban Park

Goals

- Stabilize banks in place
- Minimize tree take
- Preserve / mimic what's working

Construction

- On-site materials
- Dry / pump around

Results

- Stabilized bank



Wolftrap Creek

Vienna, VA (Outside Washington, DC)

Setting

- Urban Park

Goals

- Stabilize banks in place
- Minimize tree take
- Preserve / mimic what's working

Construction

- On-site materials
- Dry / pump around

Results

- Increased floodplain roughness
- Wood recruitment



Wolftrap Creek

Vienna, VA (Outside Washington, DC)

Setting

- Urban Park

Goals

- Stabilize banks in place
- Minimize tree take
- Preserve / mimic what's working

Construction

- On-site materials
- Dry / pump around

Results

- Micro habitat
- Roughness



Wolftrap Creek

Vienna, VA (Outside Washington, DC)

Setting

- Urban Park

Goals

- Stabilize banks in place
- Minimize tree take
- Preserve / mimic what's working

Construction

- On-site materials
- Dry / pump around

Results

- Floodplain roughness



Wolftrap Creek

Vienna, VA (Outside Washington, DC)

Setting

- Urban Park

Goals

- Stabilize banks in place
- Minimize tree take
- Preserve / mimic what's working

Construction

- On-site materials
- Dry / pump around

Results

- Floodplain roughness



Dewey Creek

Dumfries, VA (Outside Washington, DC)

Setting

- Urban corridor



Dewey Creek

Dumfries, VA (Outside Washington, DC)

Setting

- Urban corridor

Goals

- Sediment transport
- Cover (fish)
- Floodplain reconnection



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Goals

- Sediment transport
- Cover (fish)
- Floodplain reconnection



Dewey Creek

Dumfries, VA (Outside Washington, DC)

Setting

- Urban corridor

Goals

- Sediment transport
- Cover (fish)
- Floodplain reconnection

Construction

- On-site / imported materials
- Dry / pump around



Dewey Creek

Dumfries, VA (Outside Washington, DC)

Setting

- Urban corridor

Goals

- Sediment transport
- Cover (fish)
- Floodplain reconnection

Construction

- On-site / imported materials
- Dry / pump around

Results

- Sub-surface habitat



Dewey Creek

Dumfries, VA (Outside Washington, DC)

Setting

- Urban corridor

Goals

- Sediment transport
- Cover (fish)
- Floodplain reconnection

Construction

- On-site / imported materials
- Dry / pump around

Results

- Pool holding
- Support of point-bar deposition



Bonita Reach

Tigard, OR (Outside Portland)

Setting

- Urban industrial park
- Sewer / parking lot / apartments



Bonita Reach

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Setting

- Urban industrial park
- Sewer / parking lot / apartments

Goals

- Stabilize banks in place
- Beaver resiliency



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Setting

- Urban industrial park
- Sewer / parking lot / apartments

Goals

- Stabilize banks in place
- Beaver resiliency

Construction

- Doug firs
- Pump around with screen



Bonita Reach

Tigard, OR (Outside Portland)

Setting

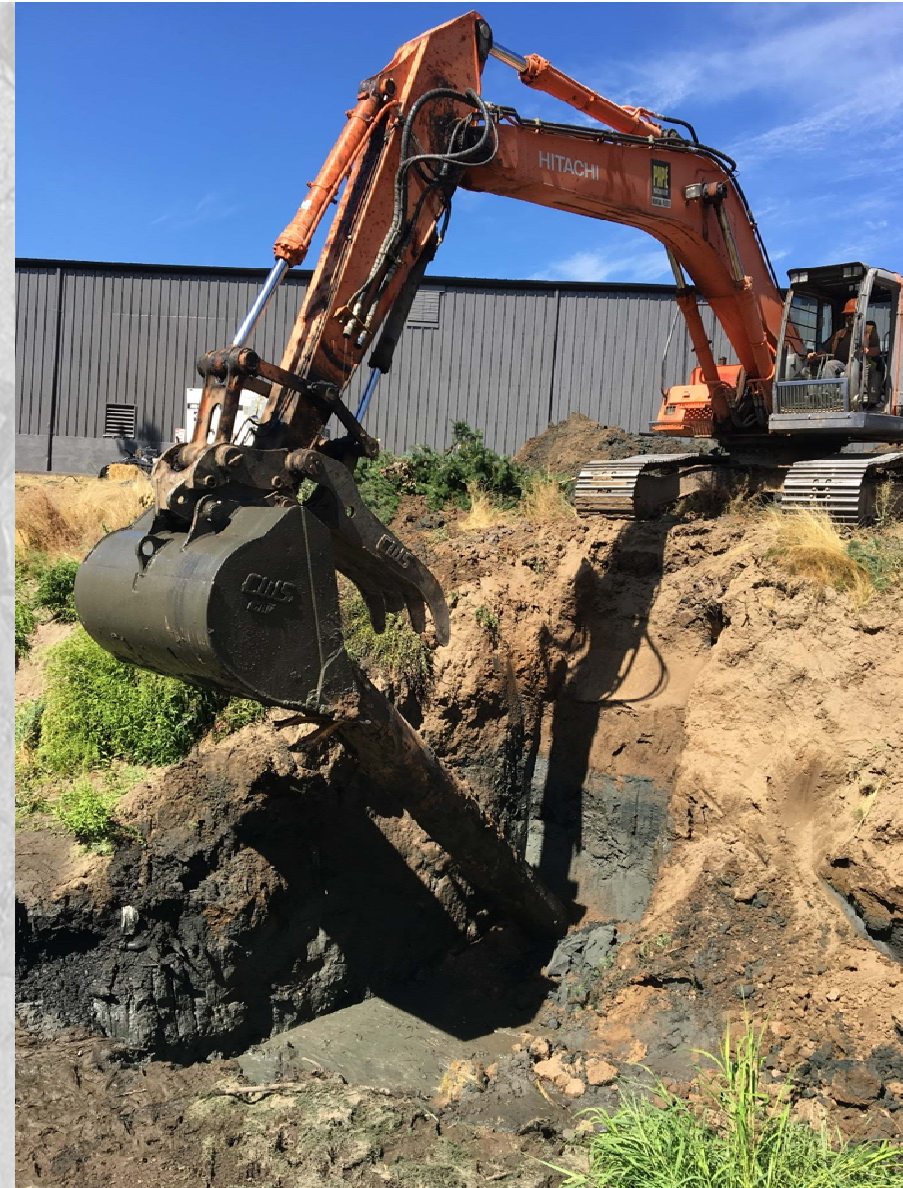
- Urban industrial park
- Sewer / parking lot / apartments

Goals

- Stabilize banks in place
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Construction

- Doug firs
- Pump around with screen



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Goals

- Stabilize banks in place
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Construction

- Doug firs
- Pump around with screen



Bonita Reach

Tigard, OR (Outside Portland)

Setting

- Urban industrial park
- Sewer / parking lot / apartments

Goals

- Stabilize banks in place
- Beaver resiliency

Construction

- Doug firs
- Pump around with screen

Results

- 1:1 bank slope



Bonita Reach

Tigard, OR (Outside Portland)

Setting

- Urban industrial park
- Sewer / parking lot / apartments

Goals

- Stabilize banks in place
- Beaver resiliency

Construction

- Doug firs
- Pump around with screen

Results

- Toe stability
- Wood recruitment



Bonita Reach

Tigard, OR (Outside Portland)

Setting

- Urban industrial park
- Sewer / parking lot / apartments

Goals

- Stabilize banks in place
- Beaver resiliency

Construction

- Doug firs
- Pump around with screen

Results

- Lamprey / benthics



Bonita Reach

Tigard, OR (Outside Portland)

Setting

- Urban industrial park
- Sewer / parking lot / apartments

Goals

- Stabilize banks in place
- Beaver resiliency

Construction

- Doug firs
- Pump around with screen

Results

- Habitat infrastructure



Bonita Reach

Tigard, OR (Outside Portland)

Setting

- Urban industrial park
- Sewer / parking lot / apartments

Goals

- Stabilize banks in place
- Beaver resiliency

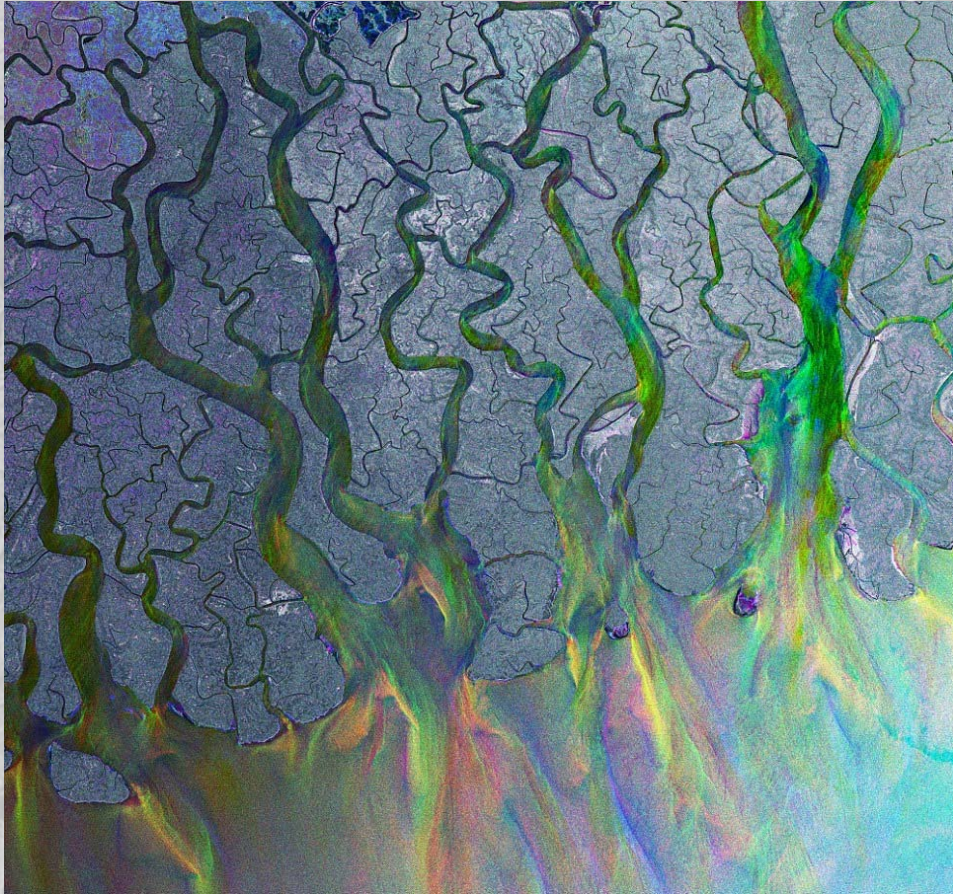
Construction

- Doug firs
- Pump around with screen

Results

- Off-channel habitat





Acknowledgements

- **Clean Water Services (OR)**
- **Town of Vienna (VA)**
- **Prince William County (VA)**
- **EQR**
- **RES**
- **Endicott Woods Enterprises**
- **Biohabitats**