Nechako River Geomorphology and Sediment Transport





Nechako River Water Engagement Initiative

Presentation Overview

- 1. Watershed overview
 - Geomorphic history
 - Channel morphology changes
 - Hydrology changes

2. Vanderhoof reach

- Anticipated conditions prior to flow diversion
- Specific gauge analysis
- Hydrodynamic conditions
- Substrate conditions

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Geomorphology Overview

- Relatively low gradient system
- Nechako plains formed at end of last glaciation and deposited fines across landscape (Armstrong and Tipper, 1948; Holland, 1976)
- Today these plains are used for agricultural and forestry





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Cheslatta Fan Avulsion

- Avulsion mechanics, history and sediment quantity estimates provided in Rood and Neill (1987) and HayCo (2000)
- Estimated sediment eroded and deposited into the upper river using photogrammetry and GIS
- 1.31 Mm³ eroded with 0.3 Mm³ deposited between Scour Hole lake and Cheslatta Falls
- Primarily fine gravels, sands and silts entrained into upper river.























Summary of Nechako System

- Hydrograph has changed
- Channel is becoming smaller where there are bar features
- Historically there was a limited amount of sediment production upstream of dam
- Appears to be lots of sand, but there are lots of sand bed reaches









1953 airphoto (very low Q) Reservoir was being filled Planform is not dominated by gravel features

Near lower patch



Channel Slope Change



Downstream distance (m)

Water Surface Slope



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Downstream distance (m)

Contemporary hydrodynamic conditions

- Vanderhoof Reach does not have 'typical' hydrodynamic conditions
- Zone of high velocity moves as discharge moves
- Likely have sand transport during almost all flows



Substrate in Vanderhoof Reach



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Apparent backwatering upstream of bridge





How the hydraulic gradient changes with discharge





Upstream hydraulics controlled by channel geometry





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Upstream hydraulics controlled by channel roughness

Substrate Conditions



Underwater images

Underwater Camera Observations





Underwater Camera Observations

- Large variation in substrate condition
- Upper site has some natural substrate that appears good from the surface





Substrate Conditions Summary

- Cobbles at upstream end of reach
- Gravels at downstream end of reach
- Sand moving as sheets over stable substrate at some locations
- Outside corner of bends remain clear of fines

Suggest fines moving on inside corners



Bedload Sampling





How much bedload is there?



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Bedload transport downstream of the bridge





Sediment Transport Summary

Year	Bedload sediment transport (m ³ /annum)	
	Upper Site	Lower Patch
2013	1,050	3,500
2014	750	2,750
2015	9,250	3,050
Average	3,700	3,100

No evidence that cobbles move during floods



Specific Gauge Analysis Overview





Specific Gauge Analysis Overview

08JC001 - NECHAKO RIVER AT VANDERHOOF - DD: 1 Rating: 0000





Specific Gauge Analysis Overview



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From Weatherly and Jakob (2014)

Specific Gauge Analysis



08JC001 - NECHAKO RIVER AT VANDERHOOF - DD: 1 F

Alternative Specific Gauge Analysis



Flow measurements plotted against a single rating curve



Vanderhoof Specific Gauge

Flow measurements plotted against a single rating curve



Thank you

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