

APPENDIX E

SUMMARY OF IMPAIRMENTS

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RESILIENCY PLAN – SUMMARY OF IMPAIRMENTS

Lazy C Upstream Reach

PROCESS	IMPAIRMENTS	POTENTIAL DESIGN ACTIONS
Channel and Floodplain formation (sedimentation, erosion)	River confined to straight entrenched channel along southside of valley with no right bank floodplain; little left bank floodplain engagement. Floodplain development limits potential for channel & floodplain formation.	Increase large wood loading to encourage complex channel and floodplain formation. Excavate floodplain benches along left bank to spread out flow and reduce in-channel velocities. Acquire floodplain properties on left bank to provide space necessary to restore natural processes.
Floodplain connectivity	Incised and confined channel limits floodplain connectivity. Localized bank protection along left bank is inhibiting formation of an inset floodplain. Floodplain development limits potential for improving floodplain connectivity.	Increase large wood loading to encourage channel and floodplain engagement. Excavate floodplain benches along left bank to spread out flow and reduce in-channel velocities. Acquire floodplain properties on left bank to provide space necessary to restore natural processes.
Sediment transport / bed mobility	Channel confinement increases sediment transport capacity and limits gravel retention and bar formation.	Increase large wood loading to partition shear stress and aggrade sediment. Acquire floodplain properties on left bank to provide space necessary to restore natural processes.
Channel migration	Channel confinement limits sediment deposition which reduces channel migration rates. Ongoing and historical clearing of in-stream wood limits channel migration. Localized bank protection limits channel migration.	Increase large wood loading to encourage channel migration. Increase large wood loading within floodplain and on edges of floodplain benches to allow for channel migration while floodplain is occupied by existing development. Acquire floodplain properties on left bank to provide space necessary to restore natural processes.

PROCESS	IMPAIRMENTS	POTENTIAL DESIGN ACTIONS
Large wood	<p>Lack of channel migration limits wood recruitment.</p> <p>Ongoing and historical clearing of in-stream wood reduce quantity of instream large wood.</p>	<p>Increase large wood loading.</p> <p>Acquire floodplain properties on left bank to provide space necessary to restore natural processes.</p> <p>Restore conifers to riparian zone to provide future sources of large wood.</p>
Riparian and Wetland Habitat Formation	<p>Lack of overbank flooding limits formation of floodplain wetlands.</p> <p>Deciduous trees dominate riparian zone due to historic forest clearing.</p>	<p>Increase large wood loading for floodplain connectivity and wetland habitat formation.</p> <p>Excavate floodplain benches to increase quantity of floodplain and wetland habitat.</p> <p>Acquire floodplain properties on left bank to provide space necessary to restore natural processes.</p> <p>Restore conifers to riparian zone to provide future sources of large wood.</p>
Aquatic Habitat Formation	<p>Formation of complex aquatic habitat limited by lack of large wood, channel confinement, and low degree of floodplain connectivity.</p>	<p>Increase large wood loading to increase channel migration, sediment retention, and aquatic habitat formation (e.g., pools and cover).</p> <p>Excavate floodplain benches to increase quantity of off-channel habitat.</p> <p>Acquire floodplain properties on left bank to provide space necessary to restore natural processes.</p> <p>Restore conifers to riparian zone to provide future sources of large wood.</p>

Lazy C Downstream

PROCESS	IMPAIRMENTS	POTENTIAL DESIGN ACTIONS
Channel and Floodplain formation (sedimentation, erosion)	Floodplain development limits potential for channel & floodplain formation.	<p>Increase large wood loading to encourage complex channel and floodplain formation.</p> <p>Acquire floodplain properties on left bank to provide space necessary to restore natural processes.</p>
Floodplain connectivity	<p>Localized left bank protection is inhibiting formation of an inset floodplain.</p> <p>Floodplain development limits potential for improving floodplain connectivity.</p>	Acquire floodplain properties on left bank to provide space necessary to restore natural processes.
Sediment transport / bed mobility	Development is inhibiting natural recovery of gravel retention, bar formation, and bank erosion.	Acquire floodplain properties on left bank to provide space necessary to restore natural processes.
Channel migration	<p>Localized bank protection and floodplain development limit up-valley channel migration.</p> <p>Channel migration rates are increased above historical levels due to aggradation in Powerlines reach and clearing of riparian vegetation.</p>	<p>Strategically place large wood to slow channel migration rates closer to historical levels, to buy time for property acquisition and relocation, and to allow restoration of riparian forest.</p> <p>Acquire floodplain properties on left bank to provide space necessary to restore natural processes.</p>
Large wood	<p>Clearing of left bank riparian forest limits wood recruitment.</p> <p>Reduction in channel migration rates due to floodplain development and bank armoring limits wood recruitment.</p>	<p>Increase large wood loading.</p> <p>Acquire floodplain properties on left bank to provide space necessary to restore natural processes.</p> <p>Restore conifers to riparian zone to provide future sources of large wood.</p>
Riparian and Wetland Habitat Formation	<p>Development and lack of overbank flooding limits formation of floodplain wetlands.</p> <p>Deciduous trees and immature riparian vegetation due to historical forest clearing.</p>	<p>Restore conifers to riparian zone to provide future sources of large wood.</p> <p>Acquire floodplain properties on left bank to provide space necessary to restore natural processes.</p>

PROCESS	IMPAIRMENTS	POTENTIAL DESIGN ACTIONS
Aquatic Habitat Formation	Formation of complex aquatic habitat limited by lack of large wood, channel confinement, and low degree of floodplain connectivity.	<p>Increase large wood loading to encourage formation of complex aquatic habitat, create pools, and provide cover.</p> <p>Acquire floodplain properties on left bank to provide space necessary to restore natural processes.</p> <p>Restore conifers to riparian zone to provide future sources of large wood.</p>

Powerlines

PROCESS	IMPAIRMENTS	POTENTIAL DESIGN ACTIONS
Channel and Floodplain formation (sedimentation, erosion)	<p>Upstream channel confinement (e.g., Lazy C, Wolcotts Flats etc.) increased sediment supply to this sub-reach.</p> <p>Aggradation coupled with historical forest clearing has transformed sub-reach from anabranching forested island morphology to a braided wide channel.</p>	<p>Increase large wood loading to encourage forested island development and stable channel formation as well as narrow widened channel segments.</p> <p>Acquire floodplain properties to provide space necessary to restore natural processes.</p>
Floodplain connectivity	None	Acquire floodplain properties to provide space necessary to restore natural processes.
Sediment transport / bed mobility	Frequent bed mobilization and sediment deposition in braided sections negatively impacts salmon redds.	<p>Increase large wood loading to partition shear stress and reduce bed mobilization frequency within braided channel sections.</p> <p>Acquire floodplain properties to provide space necessary to restore natural processes.</p>
Channel migration	<p>Historical forest clearing and low levels of stable large wood increased channel migration rates above likely historical levels.</p> <p>High channel migration rates increase risk of avulsion through side channels which would decrease the amount of in-channel and side-channel habitat.</p>	<p>Increase large wood loading within main-channel and side-channels to reduce channel migration rates and avulsion risk and promote development of forested islands.</p> <p>Acquire floodplain properties to provide space necessary to restore natural processes.</p>
Large wood	Historical forest clearing and instream wood removal have reduced levels of stable large wood in the main channel and side channels.	<p>Increase large wood loading throughout the reach.</p> <p>Acquire floodplain properties on left bank to provide space necessary to restore natural processes.</p> <p>Restore conifers to riparian zone to provide future sources of large wood.</p>
Riparian and Wetland Habitat Formation	Channel migration rates greater than historical levels are limiting ability of riparian vegetation to mature.	<p>Increase large wood loading to slow channel migration rates closer to historical levels.</p> <p>Restore conifers to riparian zone to provide future sources of large wood.</p> <p>Acquire floodplain properties to provide space necessary to restore natural processes.</p>

PROCESS	IMPAIRMENTS	POTENTIAL DESIGN ACTIONS
<p>Aquatic Habitat Formation</p>	<p>Increased sedimentation due to upstream channel confinement is encouraging the formation of unstable morphologies (braided channels) which negatively impact salmonid habitat.</p>	<p>Increase large wood loading to increase stability of braided channel habitats, encourage formation of complex habitats, and increase quantity of pools with cover.</p> <p>Acquire floodplain properties to provide space necessary to restore natural processes.</p> <p>Restore conifers to riparian zone to provide future sources of large wood.</p>