



LIST OF CONCEPTUAL GRAVEL AUGMENTATION SITES

Conceptual Gravel Augmentation Site	Located In Project Area	Appendix Page	Approx. Source Material Volume(cy)	Approx. Placement Volume Per Year (cy)
GA-1	1.1	L-1	22,484	1,000
GA-2	1.1	L-4	9,380	500
GA-3	1.1	L-7	7,654	800
GA-4	1.2	L-10	40,539	1,500
GA-5	1.2, 2	L-13	6,363	500
GA-6	3.1	L-16	10,912	1,000
GA-7	7	L-19	23,253	1,000
GA-8	8, 9	L-22	47,771	1,000
GA-9	10.1, 10.2	L-25	30,537	1,000
GA-10	10.2, 10.3	L-28	83,916	1,500
GA-11	13, 14.1	L-31	12,625	1,000
GA-12	14.2	L-34	0	500
GA-13	15.1, 15.2	L-37	77,828	0



GA-1

Gravel Placement Locations

This site is accessed from the Rattlesnake Trail dispersed campground on NF-4713. The target placement is 1,000 cy between three placement sites along the left bank annually. Location 1.1 can be accessed directly from the dispersed campground, and Locations 1.2 and 1.3 will require temporary roads traveling downstream from the campground.

Target Condition

The target condition in the floodplain is to have an established low-flow channel set back from the main channel and the potential for multiple channels to activate on the floodplain at the 2-year flood flow. The channels will have room to migrate and anastomose, recruit large wood, and incise to the elevation of lesser flood flows. Successful floodplain channel creation will lead to riparian growth and areas with successful benching will show emergent vegetation. The GA-1 figure displays the areas where material will be sourced. Benched areas should be connected and drain to the main channel or floodplain channel.

Approximate Placement Parameters for GA-1 (feet)

Target Annual Placement (cy)				1,000
Location	Height	Width	Length	Volume (cy)
1.1	2	12	415	369
1.2	2	12	320	284
1.3	2	12	400	360
Total Annual Placement (cy)				1,013

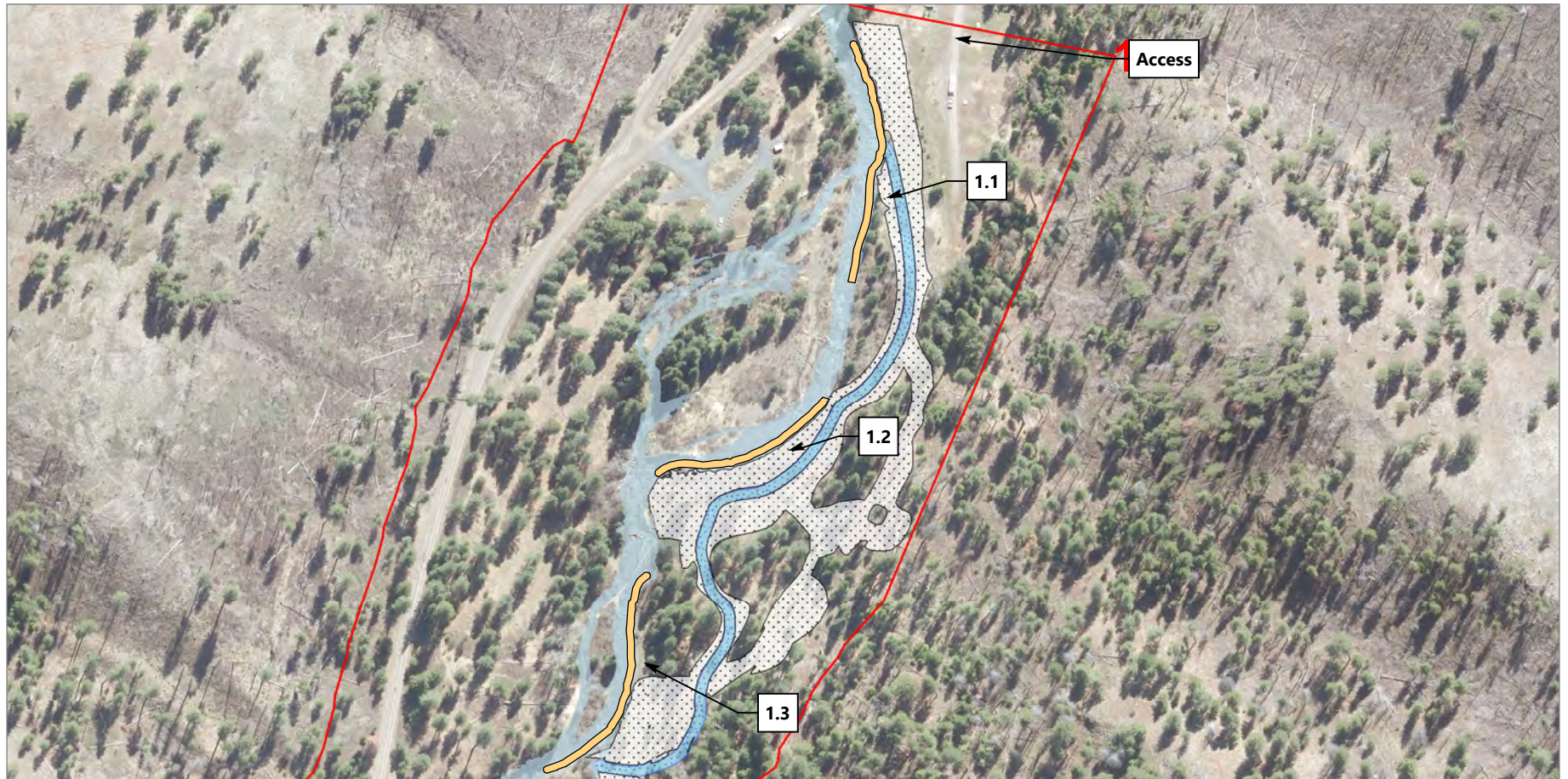
Implementation Plan

For all three placement locations, material will be sourced from the adjacent floodplain benching activity and floodplain channel creation. This activity will start directly next to the main channel and expand outwards from there. Material for the portions of placement locations that are not adjacent to benching sites will be sourced from the nearest ones. Annual monitoring (see Monitoring Form) will guide adaptive management based on the river's response to initial restoration efforts for both the excavation and placement of material.







GA-1 Gravel Placement Locations

<p>Location 1.1</p> <p>This material will be sourced from the adjacent floodplain benching and floodplain channel creation activity. It will come first by opening the floodplain channel and by benching the floodplain down the bank from the campground. Following this, the floodplain channel will be extended downstream, and benching will occur alongside it. Finally, the area that is set back from the floodplain channel will be benched.</p>	<p>Location 1.2</p> <p>This material will be sourced from floodplain benching activity directly adjacent to the main channel. As the benching is widened, the floodplain channel will become a source and will be expanded with the benching in the upstream and downstream directions.</p>
<p>Location 1.3</p> <p>Material for this location will be sourced first through the opening of the downstream end of the floodplain channel, and benching the floodplain along the main channel and upstream of the floodplain channel. Following this, both activities will expand upstream and up the bank until they connect with material sourcing activities associated with the other two placement locations.</p>	

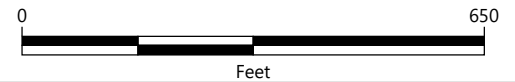


LEGEND:

-  1-year Flood Flow
-  Gravel Placement Locations
-  Excavation (2-yr. floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-2

Gravel Placement Locations

This site is located on the right bank across from site GA-1. It is accessed from Tucannon Road (NF-47) from a dispersed campground. The placement target for this site is 500 cy of gravel annually between three placement locations. Access to Location 2.1 will require a temporary wooden bridge if the side channel between it and the road is active. Locations 2.2 and 2.3 will both be accessed by temporary roads extending from Tucannon Road.

Target Condition

Along with providing material to feed to the main channel, the objective at this site is to reconnect the floodplain with the main channel as described in Section 9.3, Goals and Objectives, in the main report. The GA-2 figure displays the areas where material will be sourced. Successful material sourcing will show an established low-flow channel and the high, unvegetated patches in the floodplain lowered and connected to the main channel at the 2-year flood flow elevation.

Approximate Placement Parameters for GA-2 (feet)

Target Annual Placement (cy)				500
Location	Height	Width	Length	Volume (cy)
2.1	2.2	12	130	127
2.2	2.2	12	140	137
2.3	2.2	12	225	238
Total Annual Placement (cy)				502

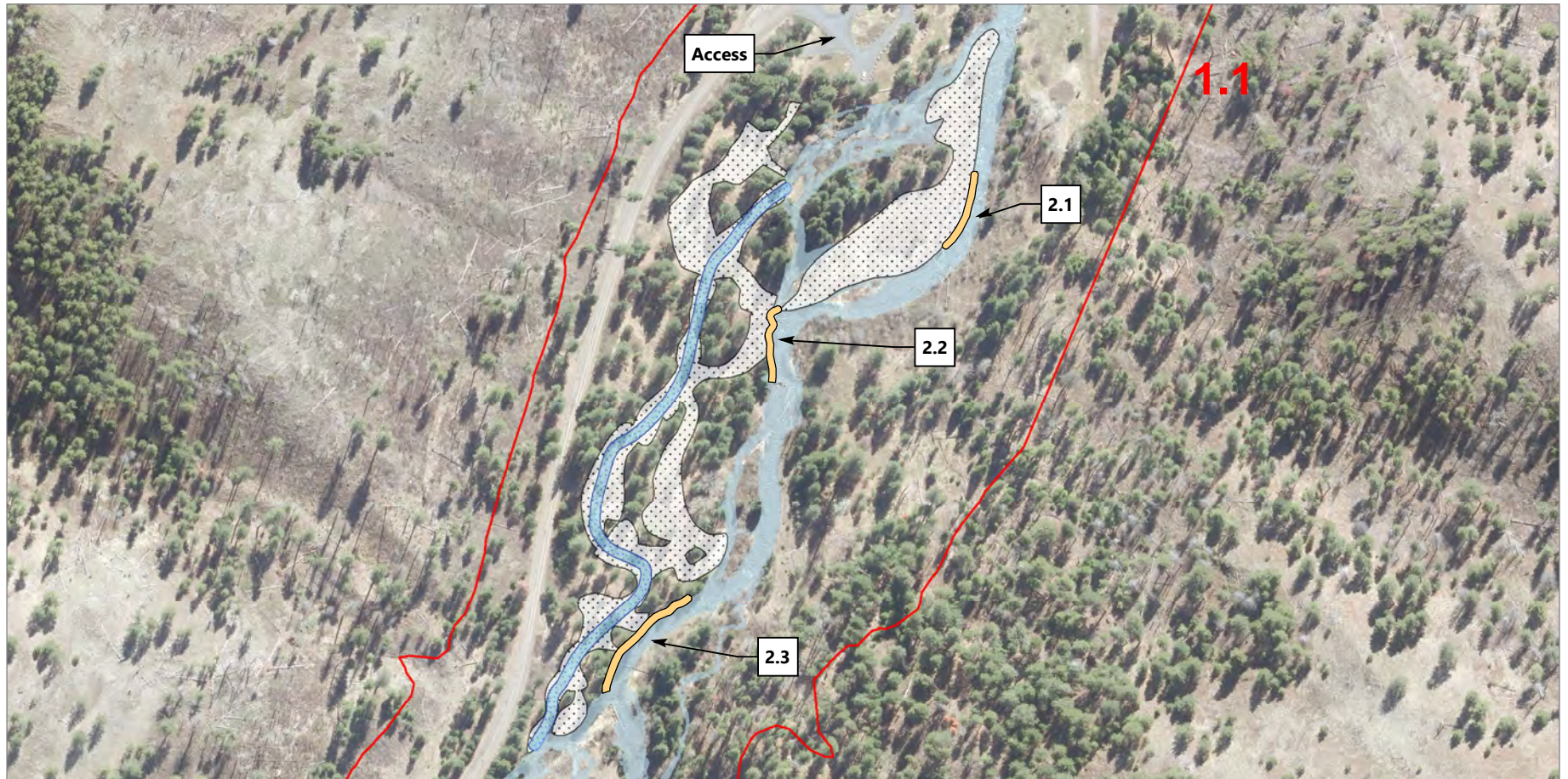
Implementation Plan

For all three placement locations, material will be sourced from the adjacent floodplain benching activity and floodplain channel creation. Material for the portions of placement locations that are not adjacent to benching sites will be sourced from the nearest ones. Annual monitoring (see Monitoring Form) will guide adaptive management based on the river's response to initial restoration efforts for both the excavation and placement of material.







GA-2 Gravel Placement Locations

<p>Location 2.1</p> <p>This material will be sourced from the adjacent floodplain on the bank of the island. This material is relatively low already, so benching the entire floodplain features will not take long. It will begin at the upstream end of the island and expand until the entire island has been benched. Following this, material will be sourced from the portion of the floodplain between the floodplain channel and the road.</p>	<p>Location 2.2</p> <p>Sourcing for this location will begin by opening the upstream end of the floodplain channel and benching the floodplain directly adjacent. Following this, the floodplain bordering the placement location will be benched and expand upstream and downstream until it connects with the floodplain channel. Sourcing will continue down the floodplain channel until it meets with sourcing efforts coming up the floodplain channel from Location 2.3.</p>
<p>Location 2.3</p> <p>Initial material will be sourced by opening the floodplain channel and benching the surrounding floodplain. This effort will expand up the floodplain channel, benching the adjacent floodplain along the way. Finally, the area upstream of the placement location that is between the floodplain channel and the main channel will be benched.</p>	

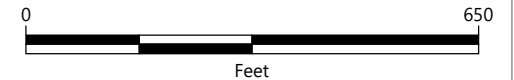


LEGEND:

-  1-year Flood Flow
-  Gravel Placement Locations
-  Sourcing (2-year floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-3

Gravel Placement Locations

This site is located on an island directly downstream from GA-2. The site will be accessed by a temporary road extending from Tucannon Road and a temporary bridge connected the right bank to the island at the upstream end of the island. The placement target here is 800 cy annually along one placement location.

Target Condition

Along with providing material to feed to the main channel, the objective at this site is to reconnect the floodplain with the main channel as described in Section 9.3, Goals and Objectives, in the main report, and to reestablish channels across the island. The GA-3 figure displays the areas where material should be sourced over the course of the restoration effort through floodplain benching and floodplain channel creation.

Approximate Placement Parameters for GA-3 (feet)

Target Annual Placement (cy)				800
Location	Height	Width	Length	Volume (cy)
3.1	3	12	540	780
Total Annual Placement (cy)				780

Implementation Plan

Material will be sourced from floodplain benching and floodplain channel creation. Placement will extend from the downstream end of the large midstream boulder to the bottom of the island. Material will be sourced sequentially (see Section 9.5), to prioritize providing immediate habitat benefits.







GA-3 Gravel Placement Locations

Location 3.1

Material for this location will be sourced first by opening the top and bottom of the floodplain channel. Floodplain channel creation will then expand from the upstream end along with floodplain benching adjacent to the floodplain channel. The floodplain along the main channel adjacent to the placement location will be benched once the floodplain channels are completed.

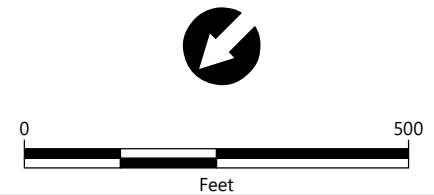


LEGEND:

-  1-year Flood Flow
-  Gravel Placement Locations
-  Sourcing (2-year floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-4

Gravel Placement Locations

This site will be accessed from a temporary road extending from Tucannon Road and a temporary bridge at the upstream end of the site. Temporary roads will extend from the bridge to each placement location and each source location as they are established. The placement target here is 1,500 cy annually between three placement locations on the left bank and one on the right bank.

Target Condition

Along with providing material to feed to the main channel, the objective at this site is to reconnect the floodplain with the main channel as described in Section 9.3, Goals and Objectives, in the main report. The GA-4 figure displays the areas where material should be sourced over the course of the restoration effort through floodplain benching and floodplain channel creation. The target condition for the left bank is to have multiple established floodplain channels and a lowered floodplain extending all the way to the valley wall. For the right bank, the target condition is to lower a small part of the floodplain that is currently elevated and unvegetated.

Approximate Placement Parameters for GA-4 (feet)

Target Annual Placement (cy)				1,500
Location	Height	Width	Length	Volume (cy)
4.1	2.6	12	230	266
4.2	2.6	12	405	468
4.3	2.6	12	295	341
4.4	2.6	12	185	382
Total Annual Placement (cy)				1,457

Implementation Plan

Material will be sourced from floodplain benching and floodplain channel creation on the left bank and only floodplain benching on the right bank. Placement locations are concentrated at the upstream and downstream portions of the site on the left bank and the middle of the site on the right bank. Material will be sourced sequentially (see Section 9.5), to prioritize providing immediate habitat benefits and minimizing material transport across the site.







GA-4 Gravel Placement Locations

<p>Location 4.1</p> <p>Material will be sourced first from opening both floodplain channels and benching the adjacent floodplain from the main channel to the valley wall. Floodplain benching and floodplain channel creation will expand simultaneously downstream until connecting with the efforts associated with Location 4.2.</p>	<p>Location 4.2</p> <p>Material will be sourced first from the opening of the outlets of both floodplain channels and benching of the adjacent floodplain. Following this, floodplain benching will expand upstream along the main channel until they connect with the benching associated with Location 4.1, and then they will expand over to the valley wall and continue back downstream creating the floodplain channel and benching the floodplain simultaneously.</p>
<p>Location 4.3</p> <p>Material will be sourced through floodplain benching starting at the upstream end of the marked floodplain on the right bank.</p>	<p>Location 4.4</p> <p>Material will be sourced from floodplain benching upstream of this location. Benching will begin at the floodplain channel outlet that is furthest downstream and continue downstream along a relic channel until it reaches the placement location.</p>

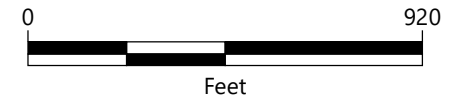


LEGEND:

-  1-year Flood Flow
-  Gravel Placement Locations
-  Sourcing (2-year floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-5

Gravel Placement Locations

Access for this site is through private property off Tucannon Road. Temporary roads will extend either from this private property or directly from Tucannon Road to the placement locations. The target placement is 500 cy annually between three placement sites.

Target Condition

Along with providing material to feed to the main channel, the objective at this site is to reconnect the floodplain with the main channel as described in Section 9.3, Goals and Objectives, in the main report. The GA-5 figure displays the areas where material should be sourced over the course of the restoration effort through floodplain benching and floodplain channel creation. The target is to connect and lower the unvegetated portions of this floodplain by establishing multiple floodplain channels and benching the available floodplain around them.

Approximate Placement Parameters for GA-5 (feet)

Target Annual Placement (cy)				500
Location	Height	Width	Length	Volume (cy)
5.1	2.4	12	95	101
5.2	2.4	12	195	208
5.3	2.4	12	195	208
Total Annual Placement (cy)				517

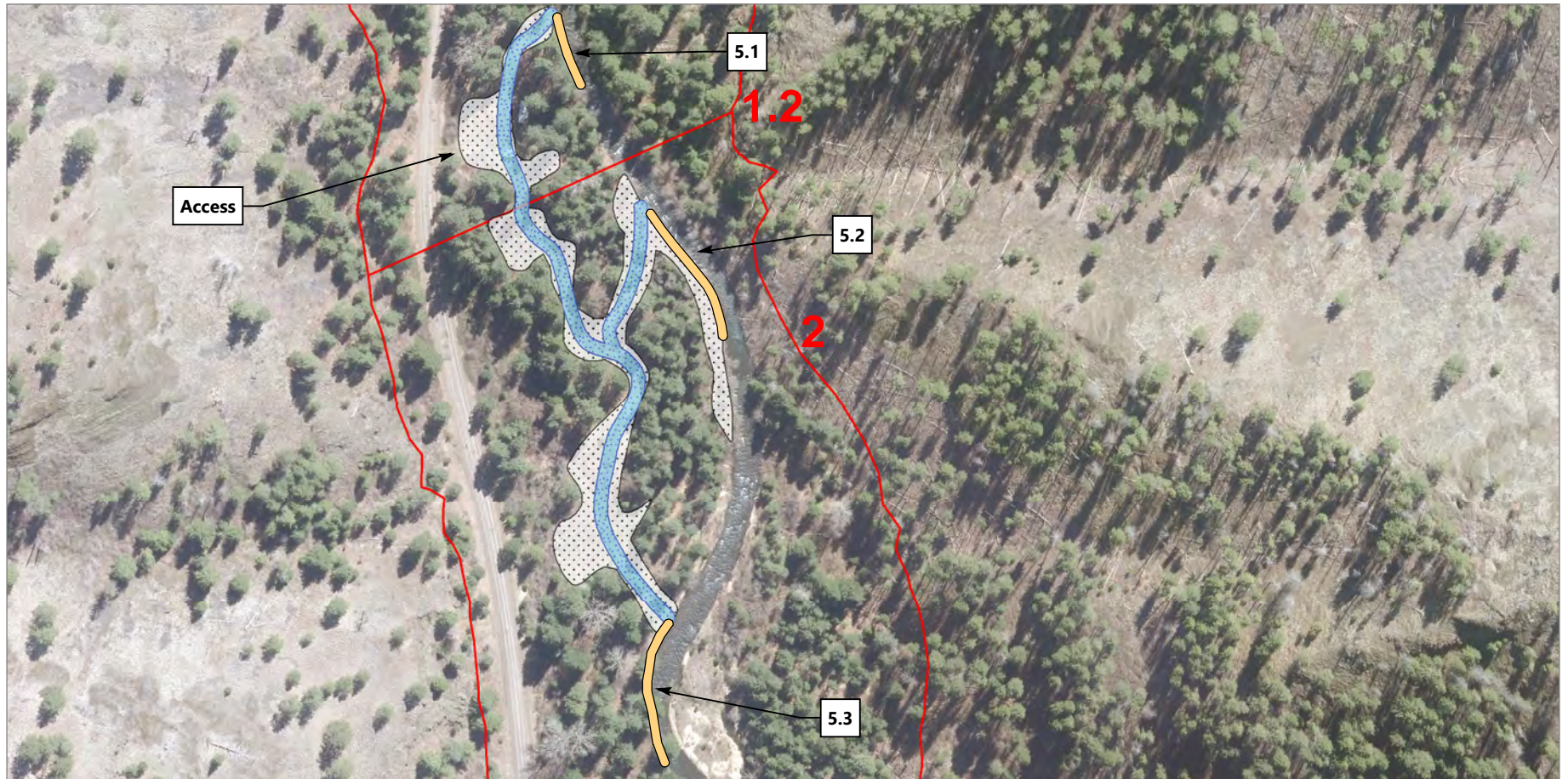
Implementation Plan

Material for each placement location will be sourced from the closest floodplain channel creation or floodplain benching, which will continue to expand until they are all connected.







GA-5 Gravel Placement Locations

<p>Location 5.1</p>	<p>Location 5.2</p>
<p>Material will first come from the opening of the floodplain channel nearest to the placement location and benching of the adjacent floodplain. The sourcing will expand downstream until it connects with the material sourcing associated with Location 5.2.</p>	<p>Material will first come from the opening of the floodplain channel nearest to this location, which will expand downstream until it reaches its confluence with the other floodplain channel. Then it will come from the floodplain adjacent to the main channel, starting at the upstream end and expanding downstream.</p>
<p>Location 5.3</p> <p>Material will come from the opening of the floodplain channel and benching of the adjacent floodplain. This will expand upstream until it connects with sourcing efforts associated with Locations 5.1 and 5.2.</p>	

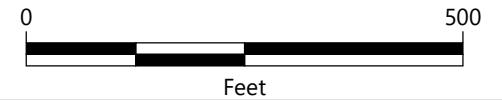


LEGEND:

-  1-year Flood Flow
-  Gravel Placement Locations
-  Sourcing (2-year floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-6

Gravel Placement Locations

Access for this site is the bridge on Tucannon Road and a small road near the downstream end of the site. Temporary roads will provide access to Locations 6.2 and 6.3. The placement target here is 1,000 cy between three placement locations.

Target Condition

Along with providing material to feed to the main channel, the objective at this site is to reconnect the floodplain surrounding Locations 6.2 and 6.3 with the main channel as described in Section 9.3, Goals and Objectives, in the main report. The GA-6 figure displays the areas where material should be sourced over the course of the restoration effort through floodplain benching and floodplain channel creation. The target is to connect and lower the unvegetated portions of the floodplain and to establish one floodplain channel surrounding Location 6.2.

Approximate Placement Parameters for GA-6 (feet)

Target Annual Placement (cy)				1,000
Location	Height	Width	Length	Volume (cy)
6.1	2.5	12	140	1,656
6.2	2.5	12	390	433
6.3	2.5	12	375	4,417
Total Annual Placement (cy)				1,006

Implementation Plan

Material for Locations 6.2 and 6.3 will be sourced from the floodplain channel creation or floodplain benching nearest them. Material for Location 6.1 will be sourced from GA-10 and transported to this site.







GA-6 Gravel Placement Locations

Location 6.1	Location 6.2
<p>Material will be transported here via dump truck and placed with the given dimensions during low flows, or placed en masse in the channel during high-flow events when the material will be entrained immediately.</p>	<p>Material will be sourced first by opening the upstream and downstream ends of the floodplain channel and then by benching the floodplain along the main channel and expanding up the bank until the floodplain channel is reached. Then the floodplain channel will be connected before benching continues farther up the bank.</p>
Location 6.3	
<p>Material will be transported to this placement location from the immediately surrounding floodplain area. Material will be sourced first from the upstream and downstream ends of the source area closest to the river to allow more floodplain connection as material is transported away from the placement location.</p>	

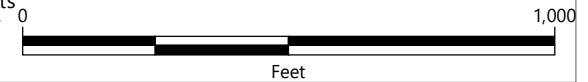


LEGEND:

-  1-year Flood Flow
-  Gravel Placement Locations
-  Sourcing (2-year floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-7

Gravel Placement Locations

Access to the left bank at this site is from the road to the intake for Curl Lake. Access to the right bank will require a temporary bridge placed downstream of the intake. A temporary road along the right bank will provide access to Location 7.1. The target placement here is 1,000 cy annually placed between two locations.

Target Condition

Along with providing material to feed to the main channel, the objective at this site is to reconnect the floodplain surrounding Locations 7.1 and 7.2 the main channel as described in Section 9.3, Goals and Objectives, in the main report. The GA-7 figure displays the areas where material should be sourced over the course of the restoration effort through floodplain benching and floodplain channel creation. The target here is to lower the unvegetated portions of the floodplain on the right bank through benching and establish one low-flow floodplain channel.

Approximate Placement Parameters for GA-7 (feet)

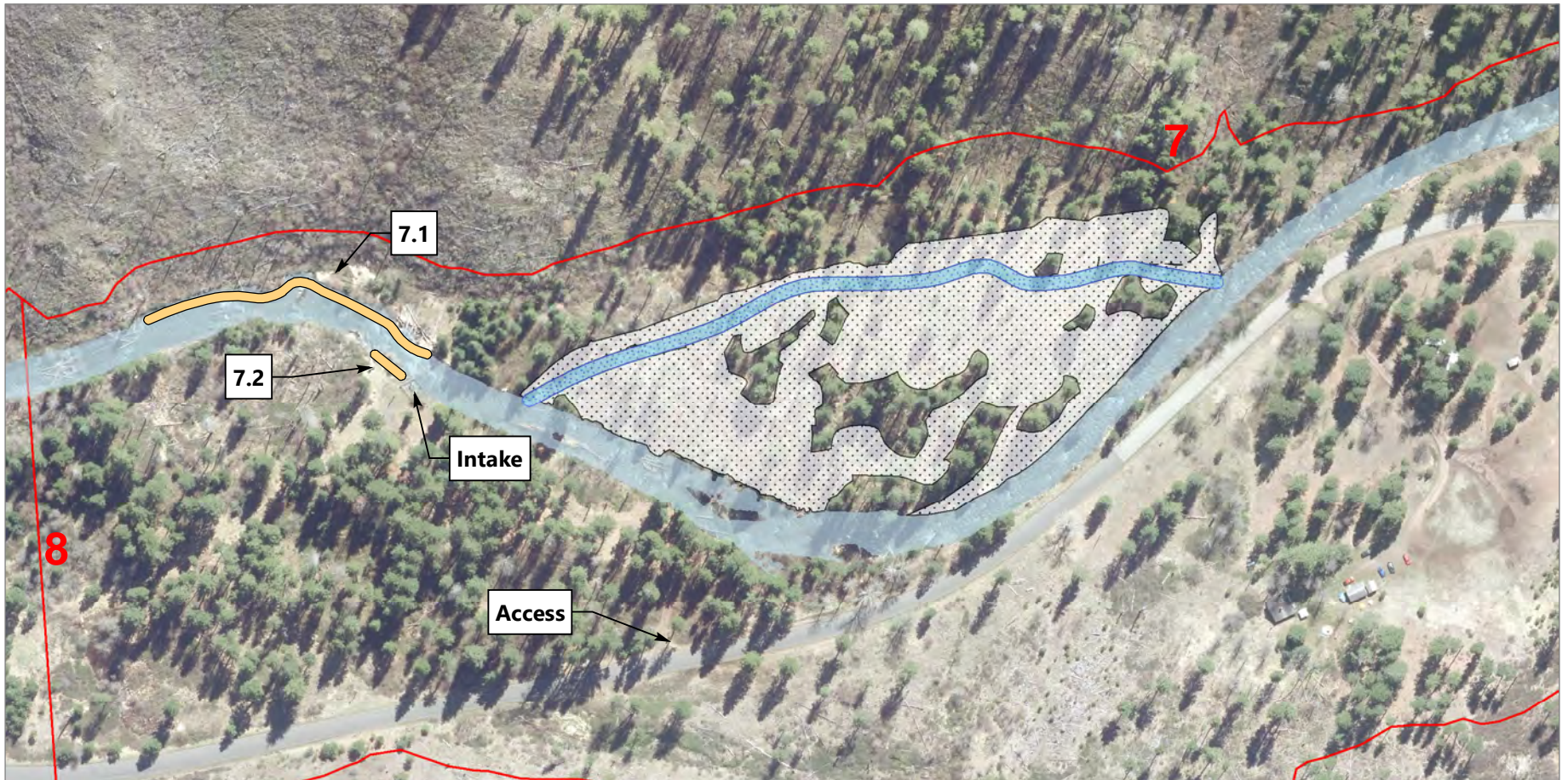
Target Annual Placement (cy)				1,000
Location	Height	Width	Length	Volume (cy)
7.1	2.4	12	415	443
7.2	23	12	55	562
Total Annual Placement (cy)				1,005

Implementation Plan





Material for Location 7.1 will be sourced from the nearest floodplain channel creation or floodplain benching activity, and material for Location 7.2 will be sourced from site GA-10.

**GA-7 Gravel Placement Locations**

Location 7.1	Location 7.2
<p>Material will be sourced first by opening the outlet of the floodplain channel. It will then be sourced by expanding the floodplain channel upstream until it connects with its upstream portion and benching a narrow band of floodplain around it. Once the channel is connected, benching will expand across the floodplain at the connection point and then continue downstream.</p>	<p>Material will be sourced from GA-10 and transported to this site via dump truck. This placement location is only to be used during high-flow events when the material can be placed en masse and entrained immediately.</p>

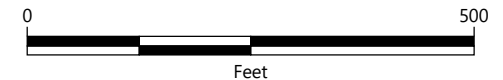


LEGEND:

-  1-year Flood Flow
-  Gravel Placement Locations
-  Sourcing (2-year floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-8

Gravel Placement Locations

Access to this site will require a temporary road extending from Tucannon Road and a temporary bridge to get across the river. The target placement here is 1,000 cy placed between two placement locations.

Target Condition

Along with providing material to feed to the main channel, the objective at this site is to reconnect the floodplain upstream of the lake with the main channel as described in Section 9.3, Goals and Objectives, in the main report. Part of the objective here is to connect channels that have already formed on the downstream end of the lake with upstream counterparts and to transform the leaky lake into vibrant floodplain with complex channels. The GA-8 figure displays the areas where material should be sourced over the course of the restoration effort through floodplain benching and floodplain channel creation. Material should be sourced sequentially (see Sequencing of Material Sourcing) to prioritize providing immediate habitat benefits and minimizing material transport across the site.

Approximate Placement Parameters for GA-8 (feet)

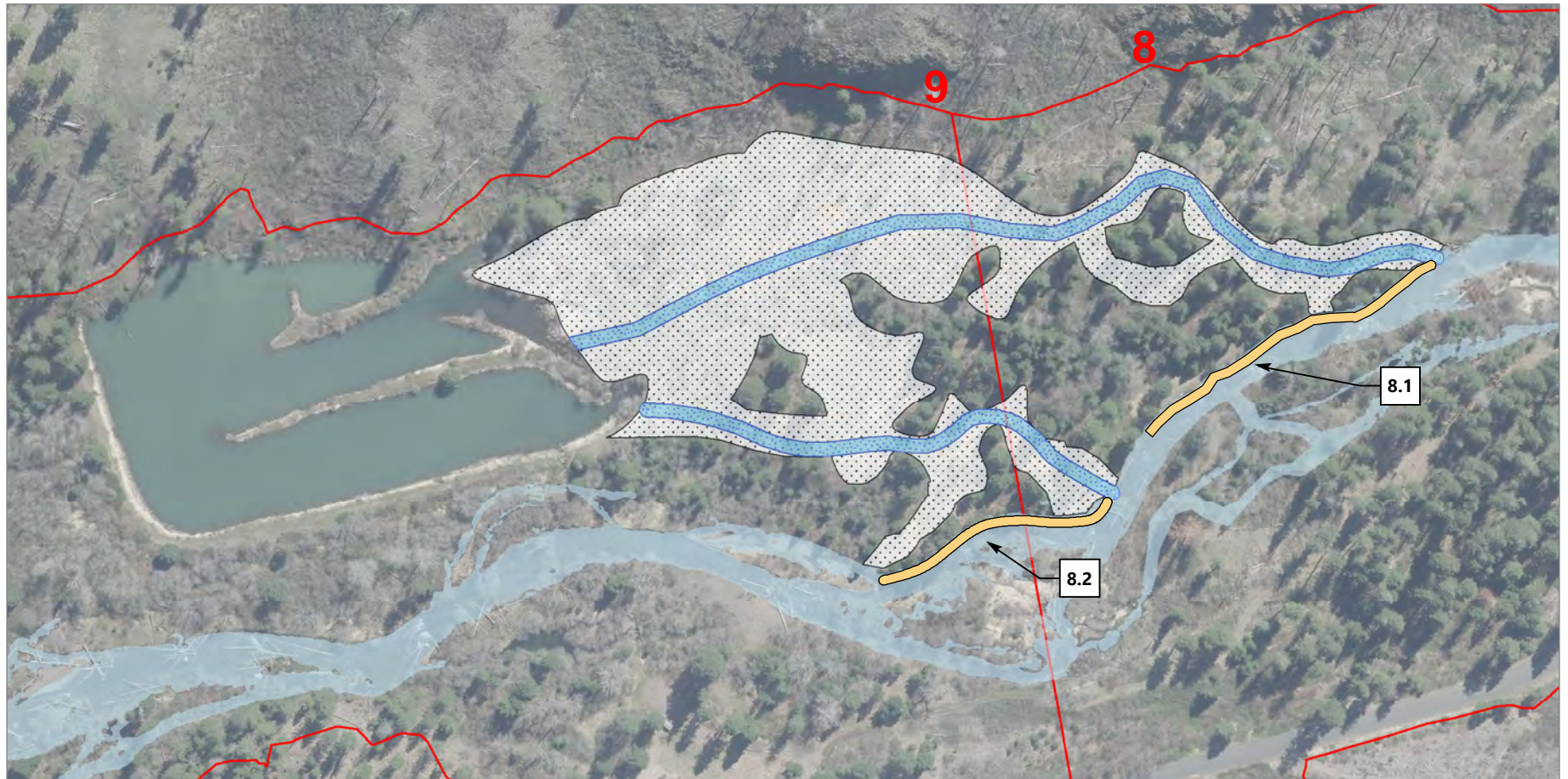
Target Annual Placement (cy)				1,000
Location	Height	Width	Length	Volume (cy)
8.1	2.9	12	435	561
8.2	3	12	325	433
Total Annual Placement (cy)				994

Implementation Plan





Material sourcing will begin on the upstream ends of the two floodplain channels and expand downstream until they connect with the lake. It will then expand to lower the remainder of the unvegetated floodplain on the upstream side of the lake.

**GA-8 Gravel Placement Locations**

Location 8.1	Location 8.2
<p>Material will be sourced by opening the floodplain channel and benching the floodplain surrounding it. Both activities will continue downstream until the channel connects to the lake. Then, floodplain benching will continue up the bank from the floodplain channel to the valley wall.</p>	<p>Material will be sourced by opening the floodplain channel and benching the floodplain surrounding it. Both activities will continue downstream until the channel connects to the lake. Then, floodplain benching will continue up the bank until it reaches the other floodplain channel and down the bank until it reaches the main channel at the downstream end of the placement location.</p>

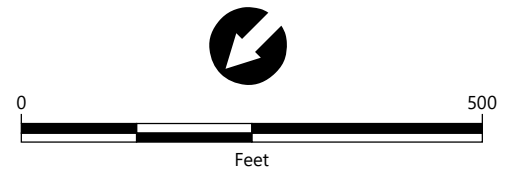


LEGEND:

-  1-year Flood Flow
-  Gravel Placement Locations
-  Sourcing (2-year floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-9

Gravel Placement Locations

This site will be accessed via a temporary bridge at the downstream end of the site. Temporary roads will extend upstream to provide access to Locations 9.1 and 9.2. The target placement value is 1,000 cy annually between the three placement locations.

Target Condition

Along with providing material to feed to the main channel, the objective at this site is to reconnect the unvegetated floodplain on the right bank with the main channel as described in Section 9.3, Goals and Objectives, in the main report. The GA-9 figure displays the areas where material should be sourced over the course of the restoration effort through floodplain benching and floodplain channel creation. Successful restoration here will show two established low-flow channels and the unvegetated portions of the floodplain lowered to the 2-year flood flow elevation.

Approximate Placement Parameters for GA-9 (feet)

Target Annual Placement (cy)				1,000
Location	Height	Width	Length	Volume (cy)
9.1	2.9	12	190	245
9.2	2.9	12	325	419
9.3	2.9	12	250	322
Total Annual Placement (cy)				986

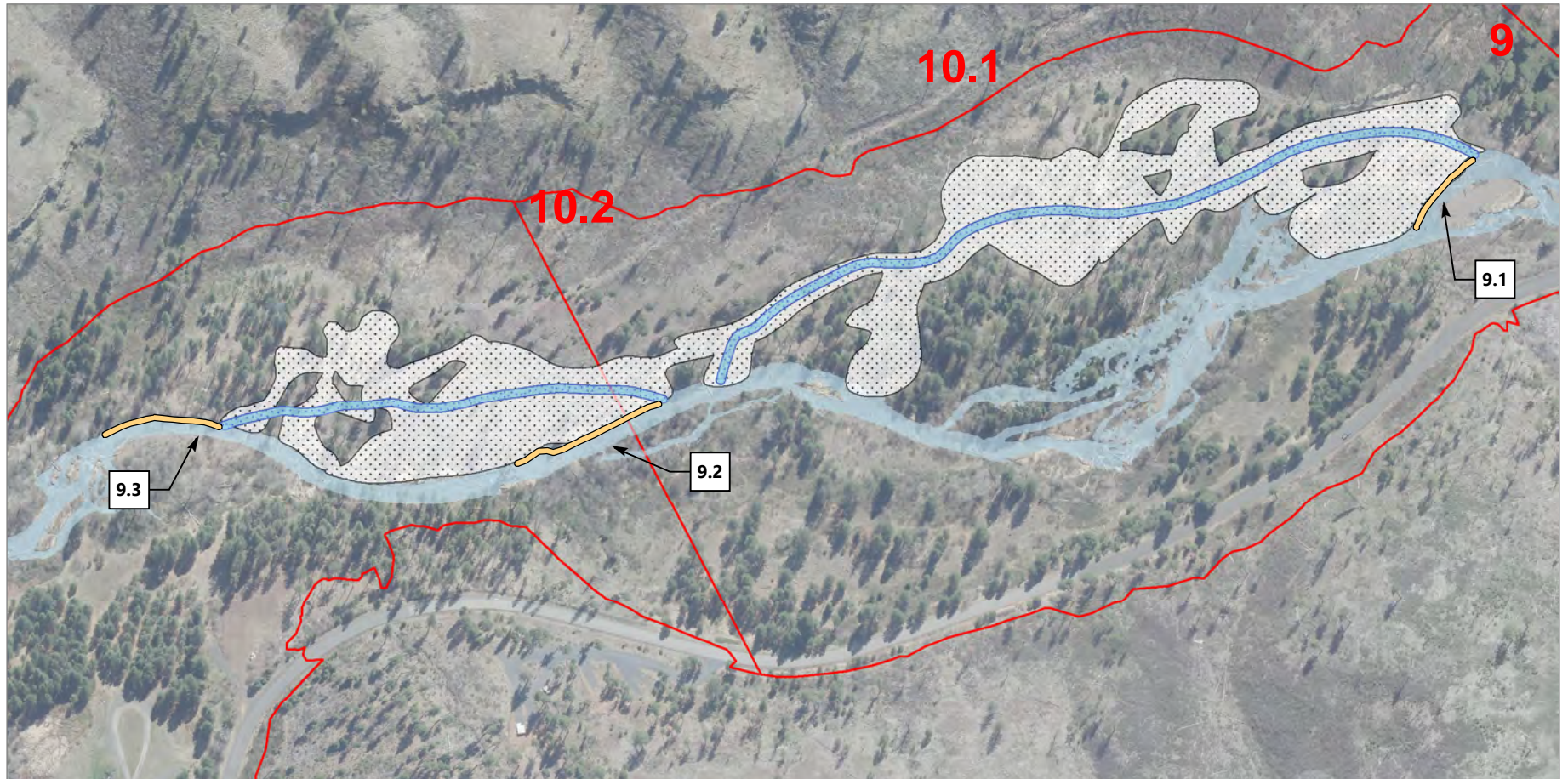
Implementation Plan

Material sourcing will begin on the upstream and downstream ends of the floodplain channels and extend towards each other, benching a narrow band of the floodplain along the way from the upstream direction only. Once the floodplain channels are established, benching will expand away from the floodplain channel both up and down the bank starting at the upstream ends.







GA-9 Gravel Placement Locations

<p>Location 9.1</p> <p>Material will be sourced by opening the floodplain channel and benching the adjacent floodplain. Floodplain channel creation will continue downstream until the channel is established and then floodplain benching will expand up and down the bank from the floodplain channel starting on the upstream end and then extend downstream.</p>	<p>Location 9.2</p> <p>Sourcing will begin by opening the upstream end of the second floodplain channel and benching the surrounding floodplain. Floodplain channel creation will continue downstream until it connects with sourcing for Location 9.3 and then floodplain benching will expand up and down the bank from the floodplain channel starting on the upstream end. When this area is completely benched, material will be sourced from the floodplain surrounding the upstream floodplain channel.</p>
<p>Location 9.3</p> <p>Sourcing will begin by opening the downstream end of the second floodplain channel and benching the surrounding floodplain. Floodplain channel creation will continue upstream until it connects with sourcing for Location 9.2 and then floodplain benching will expand up and down the bank from the floodplain channel starting on the upstream end. When this area is completely benched, material will be sourced from the floodplain surrounding the upstream floodplain channel.</p>	

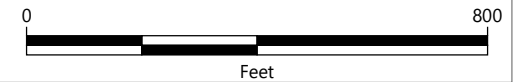


LEGEND:

-  1-year Flood Flow
-  Gravel Placement Locations
-  Sourcing (2-year floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-10

Gravel Placement Locations

Access to the left bank of this site will be directly from Tucannon Road, and access to the right bank will be via a temporary bridge at the downstream end. Access to each placement location will require temporary roads extending from Tucannon Road and from the bridge. The target placement value is 1,500 cy between six placement locations.

Target Condition

Along with providing material to feed to the main channel, the objective at this site is to reconnect the unvegetated floodplain on both sides of the river with the main channel as described in Section 9.3, Goals and Objectives, in the main report. The GA-10 figure displays the areas where material will be sourced over the course of the restoration effort through floodplain benching and floodplain channel creation. Successful restoration at this site will include the establishment of multiple low-flow channels and engagement of a large portion of the two 2-year floodplain on both banks.

Approximate Placement Parameters for GA-10 (feet)

Target Annual Placement (cy)				1,500
Location	Height	Width	Length	Volume (cy)
10.1	1.8	12	350	280
10.2	1.8	12	265	212
10.3	1.8	12	385	308
10.4	1.8	12	375	300
10.5	1.8	12	165	132
10.6	1.8	12	330	262
Total Annual Placement (cy)				1,494

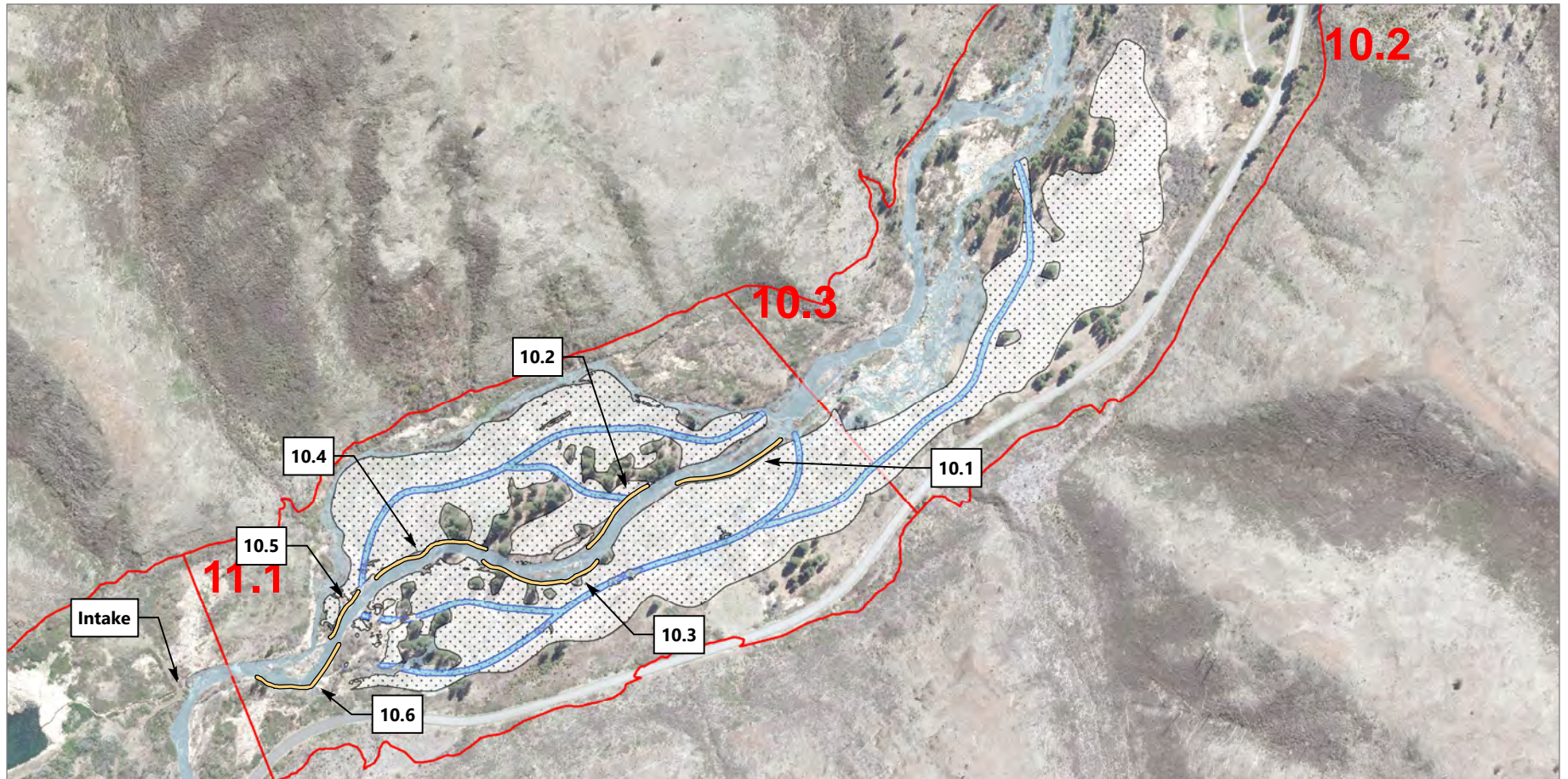
Implementation Plan

Material sourcing will start by opening the upstream and downstream ends of the floodplain channels and benching the available surrounding floodplain on the upstream end. The priority at this site is to establish the floodplain channels. After this is accomplished, floodplain benching will expand from the floodplain channels and up the bank from the main channel.







GA-10 Gravel Placement Locations

<p>Location 10.1</p> <p>Material will be sourced initially from the upstream end of the most upstream floodplain channel and benching the surrounding floodplain. Floodplain channel creation will continue downstream with a narrow band of benched floodplain surrounding it until it reaches its confluence with the next floodplain channel. Following this, the floodplain will be benched along the main channel, and finally up the bank from the floodplain channel and into the area upstream of the first floodplain channel. Some of this material will be used for placement at GA-7.</p>	<p>Location 10.2</p> <p>Material will be sourced initially by opening the upstream end of the two floodplain channels on the right bank. Following this, the area surrounding the upstream floodplain channel will be benched, and then floodplain channel creation and benching will expand simultaneously downstream between the second floodplain channel and the valley wall. Finally, the second floodplain channel will be created down to its confluence with the first.</p>
<p>Location 10.3</p> <p>Material for this location will be sourced from benching the floodplain along the main channel adjacent to the placement location. It will then expand up the bank until it reaches the floodplain channel and continue up the channel until it reaches sourcing associated with Location 10.1. Following this, material will be sourced by benching the floodplain adjacent to the river upstream of the placement location and eventually up the bank from the floodplain channel.</p>	<p>Location 10.4</p> <p>Material for this location will come from benching the floodplain adjacent to the main channel and expanding back towards the floodplain channel. Following this, it will come from floodplain benching between the floodplain channel and the valley wall.</p>
<p>Location 10.5</p> <p>Material for this location will come first from opening the downstream end of the floodplain channel just upstream of it. It will continue up the floodplain channel until it connects with sourcing associated with Location 10.2.</p>	<p>Location 10.6</p> <p>Material for this location will come first from opening the downstream ends of the two floodplain channels on the left bank and expanding them upstream until they connect with the rest of the floodplain channel. Following this, material will be sourced by benching the floodplain between the two floodplain channels and between the floodplain channel and the road.</p>

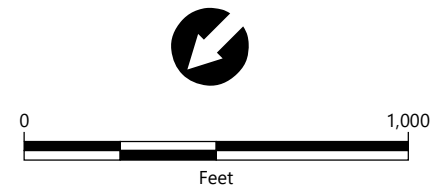


LEGEND:

-  1-year Flood Flow
-  Gravel Placement Locations
-  Sourcing (2-year floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-11

Gravel Placement Locations

Access to this placement location is from Tucannon Road and the Tucannon Fish Hatchery Access Road. Location 11.1 is upstream of the bridge that crosses the Tucannon River on the Fish Hatchery Access Road. Location 11.2 will be accessed from the Fish Hatchery Access Road, and Location 11.3 will be accessed from an established dirt road that extends from Tucannon Road. The target placement value at this site is 1,000 cy between the three placement sites.

Target Condition

Along with adding to the placement of gravel in the river that is associated with the management of the fish hatchery, goals at this site include reconnecting the high, unvegetated floodplain on the left bank with the main channel in the manner described in Section 9.3, Goals and Objectives, in the main report. The GA-11 figure displays the areas where material will be sourced over the course of the restoration effort through floodplain benching.

Approximate Placement Parameters for GA-11 (feet)

Target Annual Placement (cy)				1,000
Location	Height	Width	Length	Volume (cy)
11.1	2.7	12	170	202
11.2	2.8	12	360	448
11.3	2.8	12	285	355
Total Annual Placement (cy)				1,004

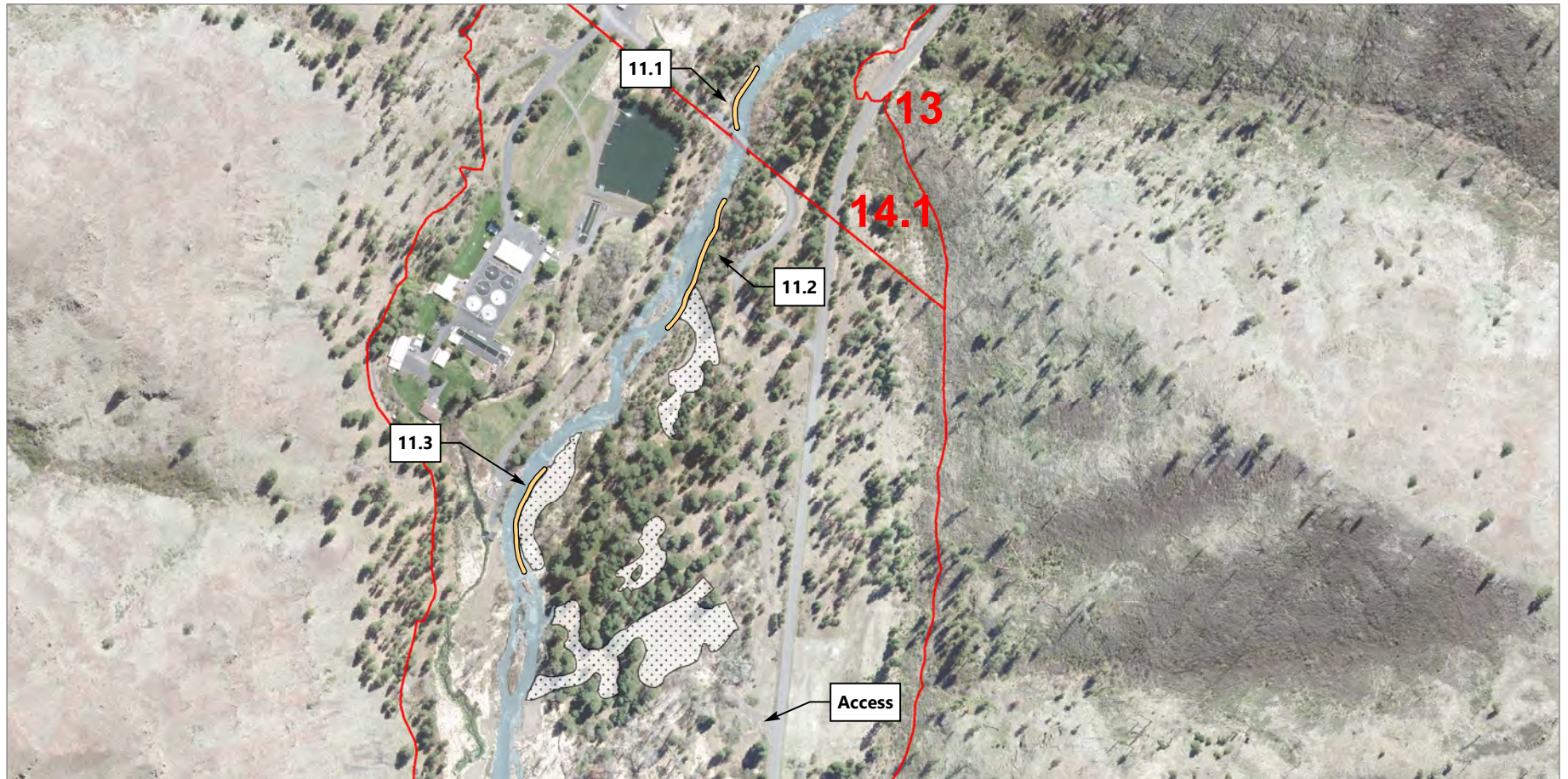
Implementation Plan

Material sourcing will begin with benching the floodplain adjacent to the main channel and expand up the bank to the high benches set back from the main channel. Material associated with the management of the fish hatchery will be incorporated into the placement at this site.







GA-11 Gravel Placement Locations

Location 11.1	Location 11.2
<p>Material associated with the management of the fish hatchery will be placed at this location upstream of the dam. It can be placed with the given dimensions at low flow or en masse during high-flow events when it will be immediately entrained.</p>	<p>Material for this location will be sourced from benching of the unvegetated floodplain. Benching will begin adjacent to the main channel at the lower end of the placement area and continue up the bank and downstream until the entire marked area is benched. Following this, material will be sourced from the high unvegetated areas in the downstream part of the site. Sourcing material from here will require transporting it up through the site, which can be accomplished mostly using established dirt roads.</p>
<p>Location 11.3</p> <p>Material for this location will be sourced by benching the floodplain directly adjacent to it. This benching will begin on the upstream end and expand up the bank and then in the downstream direction. When benching is complete in this area, material will be sourced from the larger area downstream starting adjacent to the channel and moving up the bank.</p>	

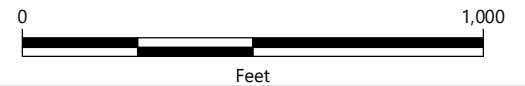


LEGEND:

-  1-year Flood Flow
-  Gravel Placement Locations
-  Sourcing (2-year floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-12

Gravel Placement Locations

Access to this site will be via temporary roads that will extend from Tucannon Road. Gravel placement at Location 12.1 will be from atop the high bank. Placement at Location 12.2 will start downstream of the deep pool on the outside of the bend.

Target Condition

This site has been slated as solely a gravel placement location. Material placed here will be sourced from GA-13. The target placement value is 500 cy annually between the two placement locations that are shown in the GA-12 figure.

Approximate Placement Parameters for GA-12 (feet)

Target Annual Placement (cy)				500
Location	Height	Width	Length	Volume (cy)
12.1	3	12	170	227
12.2	3	12	205	273
Total Annual Placement (cy)				500





GA-12 Gravel Placement Locations

Location 12.1	Location 12.2
Material placed here will be sourced from GA-13.	Material placed here will be sourced from GA-13.

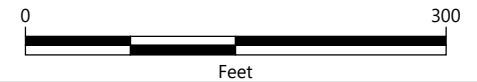


LEGEND:

-  Gravel Placement Locations
-  1-year Flood Flow

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
2. Vertical datum is North American Vertical Datum of 1988, feet.
3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.





GA-13

Gravel Placement Locations

Access to this site is via private property off McGovern Lane on the left bank of the river. This location will be a source only and material from here will be used in GA-12 just upstream.

Target Condition

The main objectives at this site are to reconnect the unvegetated floodplain on the left bank with the main channel as described in Section 9.3, Goals and Objectives, in the main report, and also to mitigate flood risk to the properties downstream by increasing the flood storage capacity. The GA-13 figure displays the areas where material will be sourced over the course of the restoration effort through floodplain benching and floodplain channel creation. Material will be sourced sequentially to prioritize allowing water onto the floodplain.

Implementation Plan

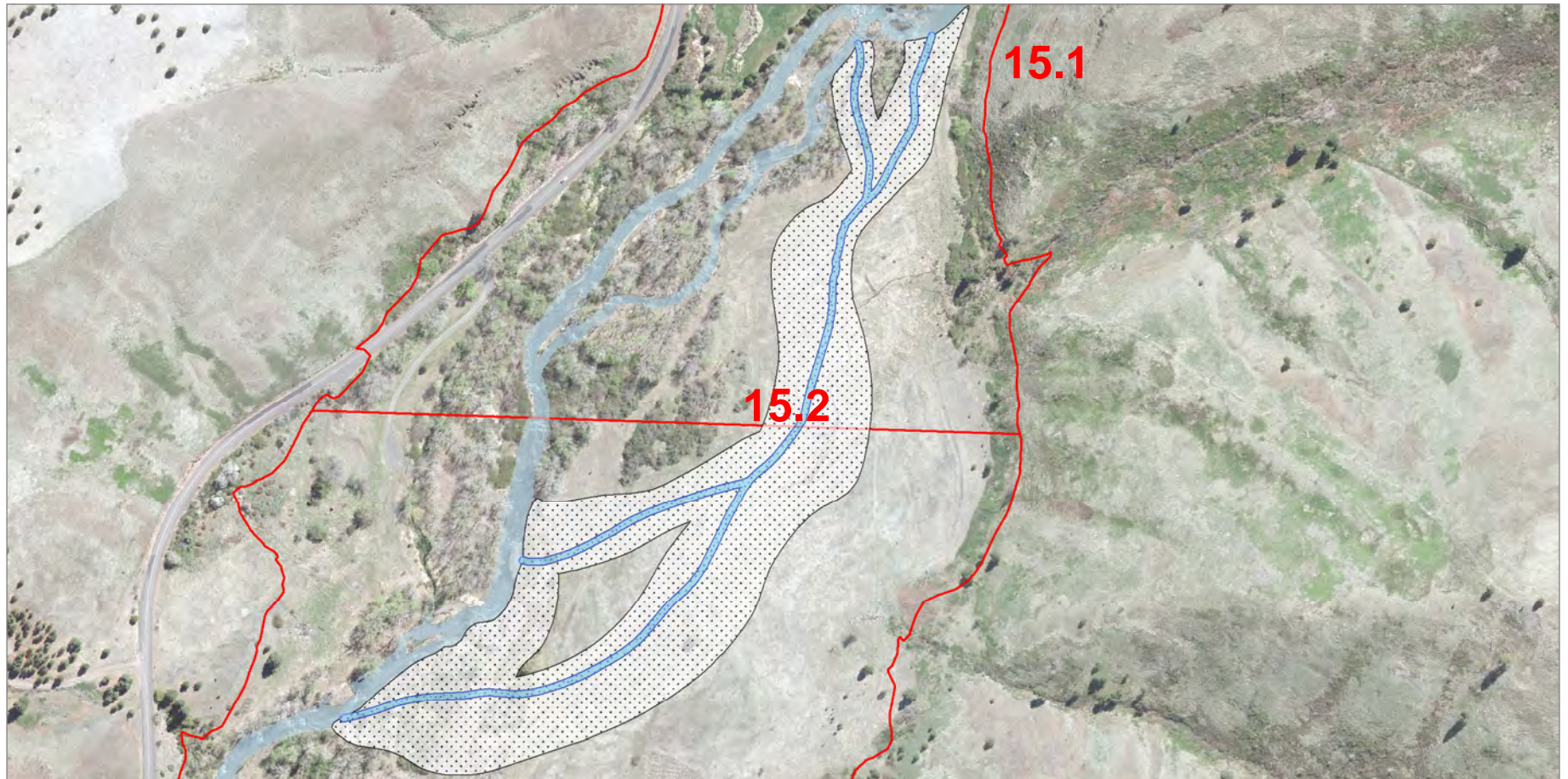
Material sourcing at this site will begin with benching of the floodplain and creation of the two floodplain channels at the upstream end of the site. All the marked areas along the main channel will be sourced for material before moving downstream. Following this, the floodplain channel will be established with a narrow band of benched floodplain surrounding them, and finally floodplain benching will expand outwards from the floodplain channels. Material sourced from this site will be placed at the two placement locations in GA-12.






GA-13 Gravel Placement Locations

Location 13

Material for this location will be sourced as described above.

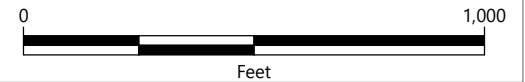


LEGEND:

-  1-year Flood Flow
-  Sourcing (2-year floodplain elev.)
-  Floodplain Channel (winter flow elev.)

NOTES:

1. Horizontal datum is WA State Plane South, NAD83, U.S. Feet.
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3. Aerial imagery provided by GeoTerra. Flown April 19, (2018).
4. LiDAR elevation data provided by QSI (2018).
5. The conditions and recommendations in this map are based on LiDAR data from 2017 and site visits in 2019. Flood events and geomorphic changes have occurred since then and may have changed the topography relative to what is shown.



CONTRACT NO.: _____

DATE: _____

NO.: _____

FIELD INSPECTOR: _____

PROJECT / LOCATION: Tucannon River Gravel Augmentation / WA

REQUESTED ACTION FORM

Submitted to:	
Agency:	_____
Name:	_____
Contact Info:	_____

SOURCING RECOMMENDATIONS		
Action type	Y/N	Description
Floodplain benching		
Floodplain channel creation		
Existing stockpile		
Maintenance/Emergency management		

GRAVEL PLACEMENT RECOMMENDATIONS				
New placement dimensions (ft)				
Location	height	width	length	volume (CYDs)
.1				
.2				
.3				
.4				
.5				
.6				
Description:				

LIMITATIONS: The form represents the observations of the field inspector. Measurements taken are approximate and are intended to provide a general sense of the site conditions at the time. Notes on the site conditions and interpretations of those conditions made to complete this form are those of the field representative. The recommendations for action were made in consultation with the monitoring form reviewer.

Review Signature: _____
Date: _____

Field Inspector Signature: _____ Date: _____
County Review Signature: _____ Date: _____

CONTRACT NO.: _____

DATE: _____

NO.: _____

FIELD INSPECTOR: _____

**GRAVEL AUGMENTATION
MONITORING FORM**

PROJECT / LOCATION: Tucannon River Gravel Augmentation / WA

Submitted to:		RECOMMENDATIONS		Weather Temp. & Precip.	
Agency:		Continue plan	Modify		
Name:		<i>Circle one</i>		Times of Site Visits:	
Contact Info:		When action is recommended see attached action form		From	To

Discharge	cfs	<i>Link to gauge</i>
------------------	-----	----------------------

FLOODPLAIN CHANGE

Floodplain Channels	y/n	Floodplain Benching	y/n
Are they connected to the main channel?		Is it connected to the main channel?	
Are they wetted during winter flows?		Is it wetted during the 2-year flow?	
Are they providing complexity/fish habitat?		Is it providing complexity/promoting veg.?	

Observations:

GRAVEL ENTRAINMENT

Location	Amt. Placed Yr. Prior	% remaining	Downstream travel (ft)	% channel spread
.1				
.2				
.3				
.4				
.5				
.6				

Observations:

<p><i>LIMITATIONS: The form represents the observations of the field inspector. Measurements taken are approximate and are intended to provide a general sense of the site conditions at the time. Notes on the site conditions and interpretations of those conditions made to complete this form are those of the field representative. The recommendations for action were made in consultation with the monitoring form reviewer.</i></p>	<p>Review Signature: _____</p>
	<p>Date: _____</p>
<p>Field Inspector Signature: _____</p>	<p>Date: _____</p>
<p>County Review Signature: _____</p>	<p>Date: _____</p>

CONTRACT NO.: _____

DATE: _____



NO.: _____

FIELD INSPECTOR: _____

PROJECT / LOCATION: Tucannon River Gravel Augmentation / WA

GRAVEL AUGMENTATION MONITORING FORM

Vegetation		
Describe extent/type of veg.	% benched floodplain with emergent veg.	%

Photographs - Vegetation	
Comment:	Comment:
	
Comment:	Comment:

Photographs - Sourcing	
Comment:	Comment:
Comment:	Comment:
Comment:	Comment:

<p><i>LIMITATIONS: The form represents the observations of the field inspector. Measurements taken are approximate and are intended to provide a general sense of the site conditions at the time. Notes on the site conditions and interpretations of those conditions made to complete this form are those of the field representative. The recommendations for action were made in consultation with the monitoring form reviewer.</i></p>		<p>Review Signature: _____</p> <p>Date: _____</p>
Field Inspector Signature: _____		Date: _____
County Review Signature: _____		Date: _____

CONTRACT NO.: _____

DATE: _____

NO.: _____

FIELD INSPECTOR: _____

**GRAVEL AUGMENTATION
MONITORING FORM**

PROJECT / LOCATION: Tucannon River Gravel Augmentation / WA

Photographs - Placement	
Comment: _____	Comment: _____
Comment: _____	Comment: _____
Comment: _____	Comment: _____

<p><i>LIMITATIONS: The form represents the observations of the field inspector. Measurements taken are approximate and are intended to provide a general sense of the site conditions at the time. Notes on the site conditions and interpretations of those conditions made to complete this form are those of the field representative. The recommendations for action were made in consultation with the monitoring form reviewer.</i></p>	<p>Review Signature: _____</p>
	<p>Date: _____</p>
<p>Field Inspector Signature: _____</p>	<p>Date: _____</p>
<p>County Review Signature: _____</p>	<p>Date: _____</p>