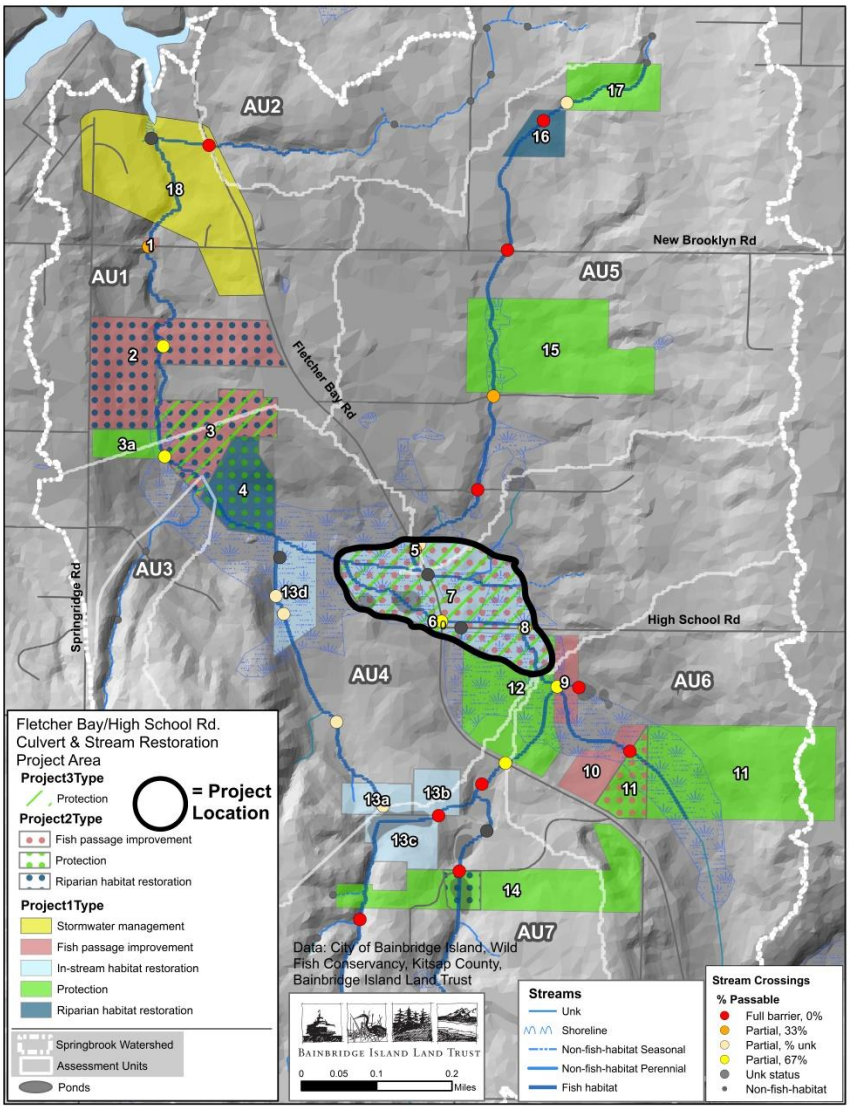
Appendix IV

Project 7 Fletcher Bay Road NE and High School Road Culvert and Stream Improvements



The intersection and proximity of Fletcher Bay Road NE and High School Road is a nexus of complicated problems arising from past engineered solutions, stream modifications, multiple stream channels, roads, and existing land use. The project team worked extensively with landowners and partner organizations (City of Bainbridge Island, WDFW, Suquamish Tribe), gathered historical and current data (survey's etc.), and walked the land multiple times to develop proposals to address the main issues in this area. The project team recommends that instead of addressing the issues individually (see projects 5,6,7,8 ID'd in the Project Map on page 1) that an alternative for addressing the entire suite of issues in the area as an interrelated whole be pursued. The complexity and differing opinions amongst landowners on an agreed upon approach was such that it was not possible to advance to Conceptual Design phase during the term of the Springbrook Creek grant funded project. Continued effort to build upon the design options contained in this document to provide a foundation toward further analysis of the options, to build consensus with the landowners, and develop a final design, then find funding is recommended. This is an important area of the watershed that needs attention. Since the majority of the culverts are under City of Bainbridge Island roads, they are the likely lead on further efforts.

The area includes drainage from four assessment units (AU 4, 5, 6 and 7) – draining approximately 600 acres of the 999 acre Springbrook Creek watershed. There are 7 culverts (Figure 1) that partially or fully block fish passage under, adjacent or in proximity to the main roads in this intersection area, and several are in need of replacement to address fish passage, stormwater, and aging infrastructure. The stream reaches of SBO1D, SBO1E, SB01-2, SB01F and portions of SB01G and SB01-1 flow through this area. There are 7 individual landowners who live on the stream or in the proximity of the stream.

Fletcher Bay Road NE and High School Road are major Island arterials, and as congestion has increased on State Highway 305 (the major road that serves the Seattle-Bainbridge Washington State Ferry and leads to Poulsbo off island to the North) these roads have become secondary bi-ways for local traffic. The large paved area with a high number of vehicles traveling through or stopping to turn at the intersection of these two roads makes tire debris and other toxic pollutants a high concern.

Currently, the main channel of Springbrook Creek flows from high-quality forested wetland and riparian habitat southeast of the intersection (as characterized in as Upper Springbrook Creek SB01-1 and SB01-2) through a perched and undersized culvert under High School Road (C1, Figure 2), then is forced to make a 90 degree turn west into a blackberry-covered ditch immediately adjacent to High School Road. It runs 580 feet further west it is then channeled through a rusting and undersized culvert under Fletcher Bay Road NE (C2). Scouring of this ditch and flooding of the property to the north (Parcel 029 in Figure 1) is a frequent occurrence due to the inadequate capacity of this culvert (C2) to handle high water flows.

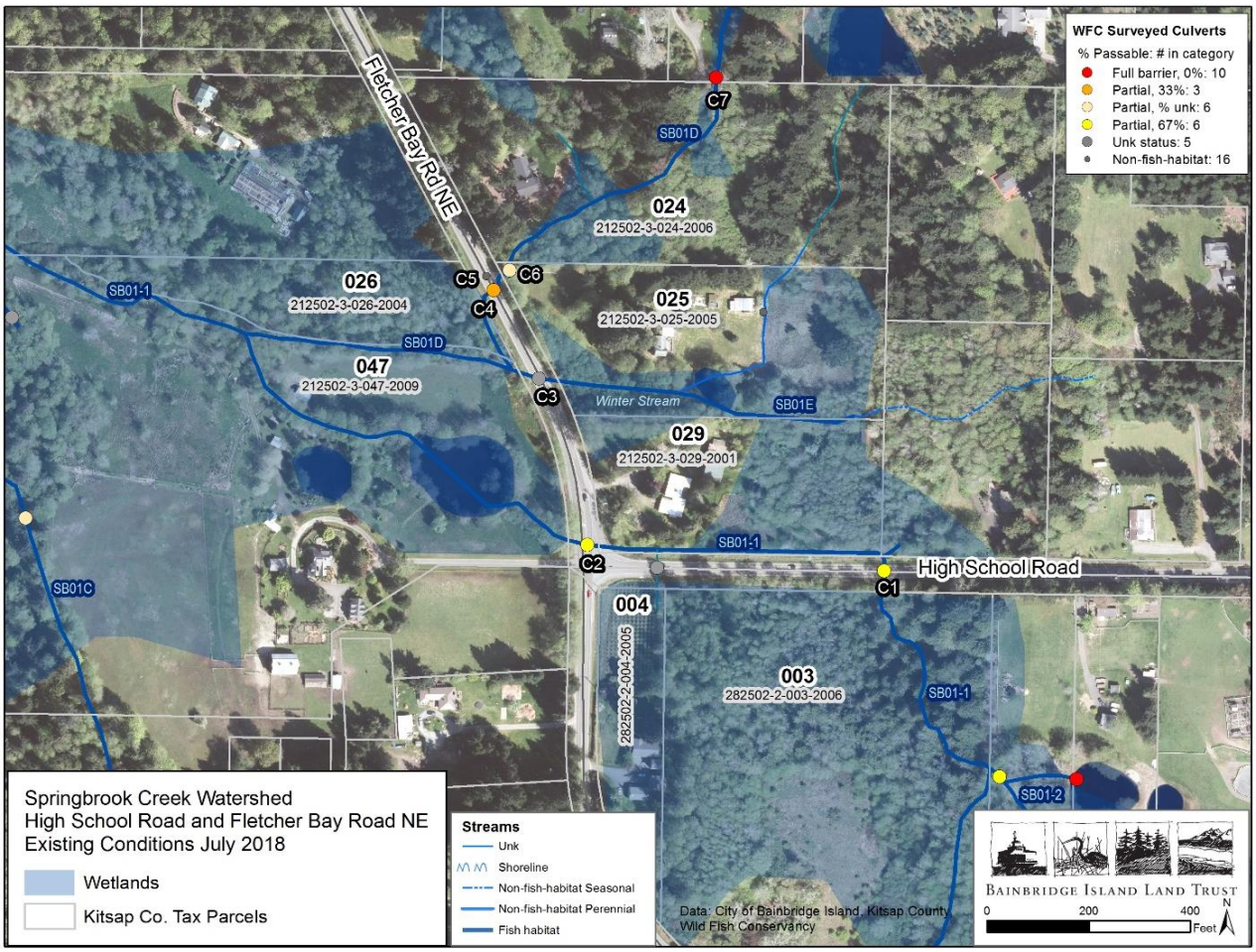


Figure 1. Existing Conditions.

Figure 2. Looking North towards High School Road and perched culvert (C1) outflow into 580-ft ditch.

Past the outlet of culvert C2 Springbrook Creek flows into a shallow pond. The pond was constructed in 1983 as part of an Eagle Scout project with a goal of salmon enhancement, with sides sloping down to an approximate central depth of 12 feet according to the landowner of parcel 047. The current depth of the pond is unknown but the landowner believes it is shallower due to sediment inputs. As part of the pond project, a channel was excavated west of the pond to create an outflow channel and weirs and spawning gravel were installed. Many juvenile cutthroat and coho were netted in these weirs and downstream when the stream was surveyed in 2014. Wayne Daley, an engineer who was involved with the landowner in the creation of the pond, indicates that approximately 5,000 coho were reared in the pond over 3 years and for approximately 5 – 7 years, salmon returned to the pond area. The landowners bought parcel 047 (and additional neighboring parcels) in 1981 and indicated that prior to the construction of the pond, the stream flowed north on the west side of Fletcher Bay Road NE to intersect with what they refer to as the "Winter Stream", then the stream flowed west along their north property line. A plat map obtained from 1908 shows an approximation of this route of the stream. Prior to the pond being constructed, the landowners describe the pond area as having characteristics of a wetland and that the area of the pond was lower topographically, with some side flow from Springbrook Creek. They also indicated that when the pond was constructed, it was filled by rain and subsurface flow, but soon thereafter Springbrook Creek swelled and migrated from the ditch along Fletcher Bay Road NE into the current channel into the pond. Excavation work to further develop the channel into the pond occurred about 18 months after its creation. The stream has retained this route from C2 directly into the pond since that time.

Interviews with landowners downstream of parcel 047 revealed a number of observations on how the stream changed following the construction of the pond. Indications were that stream flow was reduced, the stream route downstream changed, and stream sediment in the stream was observed to be higher especially in the first few years following construction. (A sediment input spike about 15-20 years ago is attributable to slope collapses along the SB01C tributary following management changes further up the system.) The highest in-stream summer temperatures in the watershed were logged just below this pond, where the Winter Stream joins the Springbrook Creek mainstem, and the poor diversity of the aquatic macroinvertebrate community here is indicative of stressors such as sediment inputs, low dissolved oxygen, high temperatures, and the human fecal bacteria detected just south of High School Road upstream of the site. The landowner has worked with Kitsap Conservation District to fence livestock away from the stream, and the low concentrations of animal fecal bacteria detected at the monitoring site (L) on the property indicate that these efforts are effective.

The northeastern tributary (SBO1D) of Springbrook Creek is seasonal, but includes 4,900 ft. of potential fish habitat and drains a 216-acre basin. In the rainy season it is prone to flooding near Fletcher Bay Road NE, where flow is constricted through an undersized culvert under a gravel driveway (C6) serving parcel 025. In very wet times, the landowner experiences standing water in proximity of the culvert when the stream overtops the driveway. From C6, the majority of the flow of SB01D passes under Fletcher Bay Road NE here through culvert C4, but a portion continues along the east side of the road and joins what landowners in the area sometimes referred to as the 'Winter Stream' to flow under the road through culvert C3. The water flowing through culvert C4 is forced into a left-hand turn into a shallow ditch along the west side of the Fletcher Bay road for 150' before joining the Winter Stream at an acute angle. The landowner of 026 describes that during periods of heavy rain, this flow is augmented by stormwater from the Fletcher Bay Road NE ditches passing through culvert C5 as well. Given the topography (Figure 5) and the direction of water flow out of culvert C4, water will have a natural tendency to flow overland to the southwest through parcel 026, and this is what the landowners were seeing during high flow periods when the ditch was overgrown with blackberry-dominated vegetation. They cleared the vegetation and found that the water has since remained in the ditch, but without active maintenance water is likely to tend to flow out and southwest. Other alterations along the ditch and culverts by landowners include construction of a stone basin in their efforts to curtail erosion at the C3 culvert outlet, and footpath over an additional small culvert (Figure 4).

Figure 3. Undersized culvert C6.

Figure 4. Stone basin and footpath at culvert C3.

Major culvert maintenance and replacement work will be needed at this intersection to improve stormwater capacity and fish passage. The project team and landowners looked at possible alternatives beyond simple replacement of culverts in their present locations to consider actions that affect greater restoration of stream health and fish habitat quality. These alternatives were designed to address limiting factors of: impeded fish passage; degraded riparian conditions; invasive plants; constrained floodplains; high stream temperatures; unfiltered stormwater runoff from roads to the stream; and degraded aquatic life conditions, while contributing to overall watershed function, meeting landowners' needs, addressing failing infrastructure, reducing the number of culverts, and restoring lost wetland habitat. All options require additional study to understand positive and negative impacts on the stream, public infrastructure (roads and culverts), and property owner use.

Designs that reroute the stream from current channels and ditches must consider the topography (Figure 5) to design routes that will function properly and not migrate in undesirable directions over time. Another factor considered in restoration design was how the creek flowed through this area historically. We were assisted in this effort by Dan Groff, a resident at the intersection who works at the Bainbridge Island Historical Museum. A 1909 map he provided shows only the main stem of Springbrook Creek, and shows this flowing in approximately its present channel south of High School Road, and continuing in a smooth arc to the northwest to flow through the wetlands in Parcel 029 in Figure 5 and into the Winter Stream before crossing Fletcher Bay Road NE. A subdivision map for the "Island Center Garden Tracts" from almost the

same time period shows the creek diverted into a ditch immediately north of High School Road, flowing almost directly west under Fletcher Bay Road (C2), then north along the west side of Fletcher Bay Road to around C3 on Figure 5, then westward, which again is how the owners of Parcel 047 remember the creek flowing before the pond was constructed in 1983. A Kitsap County tax parcel survey from the 1980s shows the creek flowing westward across north-central parcel 003, then turning north and meandering back and forth over the parcel 003/004 boundary before crossing High School Road (at about the unlabeled gray culvert in Figure 5) and flowing into the ditch north of the road. A 1988 map shows Springbrook Creek in a stream route similar to the present day, but shows an additional channel flowing from the Johnson Farm pond almost directly north down through Parcel 003 just east of the Parcel 003/004 boundary, to cross High School Road at the unmapped culvert.

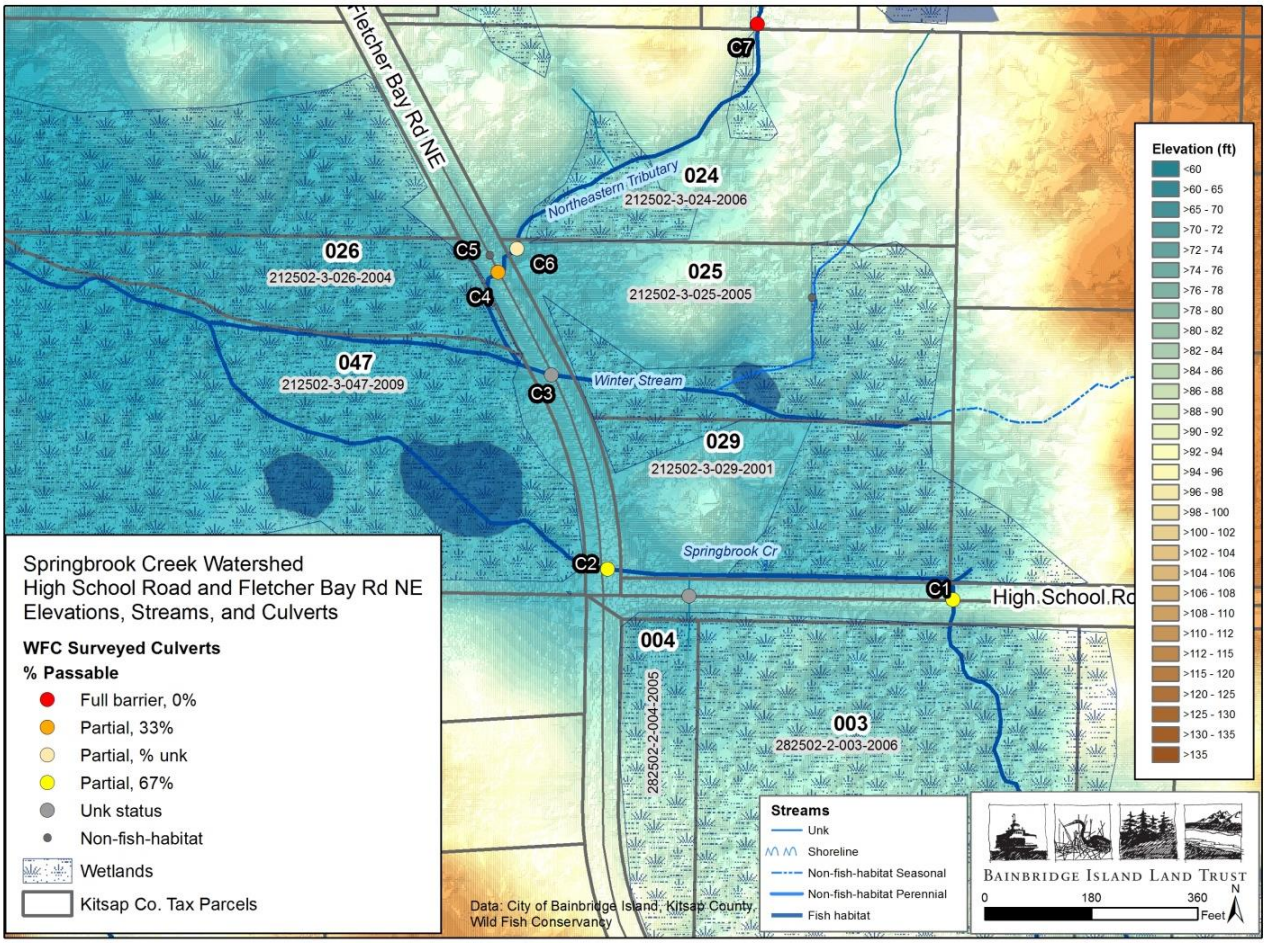


Figure 5. Elevations , streams, wetlands, and culverts in the High School Road and Fletcher Bay Road NE vicinity.

OPTION 1 [NOTE THAT NUMBERING OF OPTIONS DOES NOT SIGNIFY PREFERENCE]

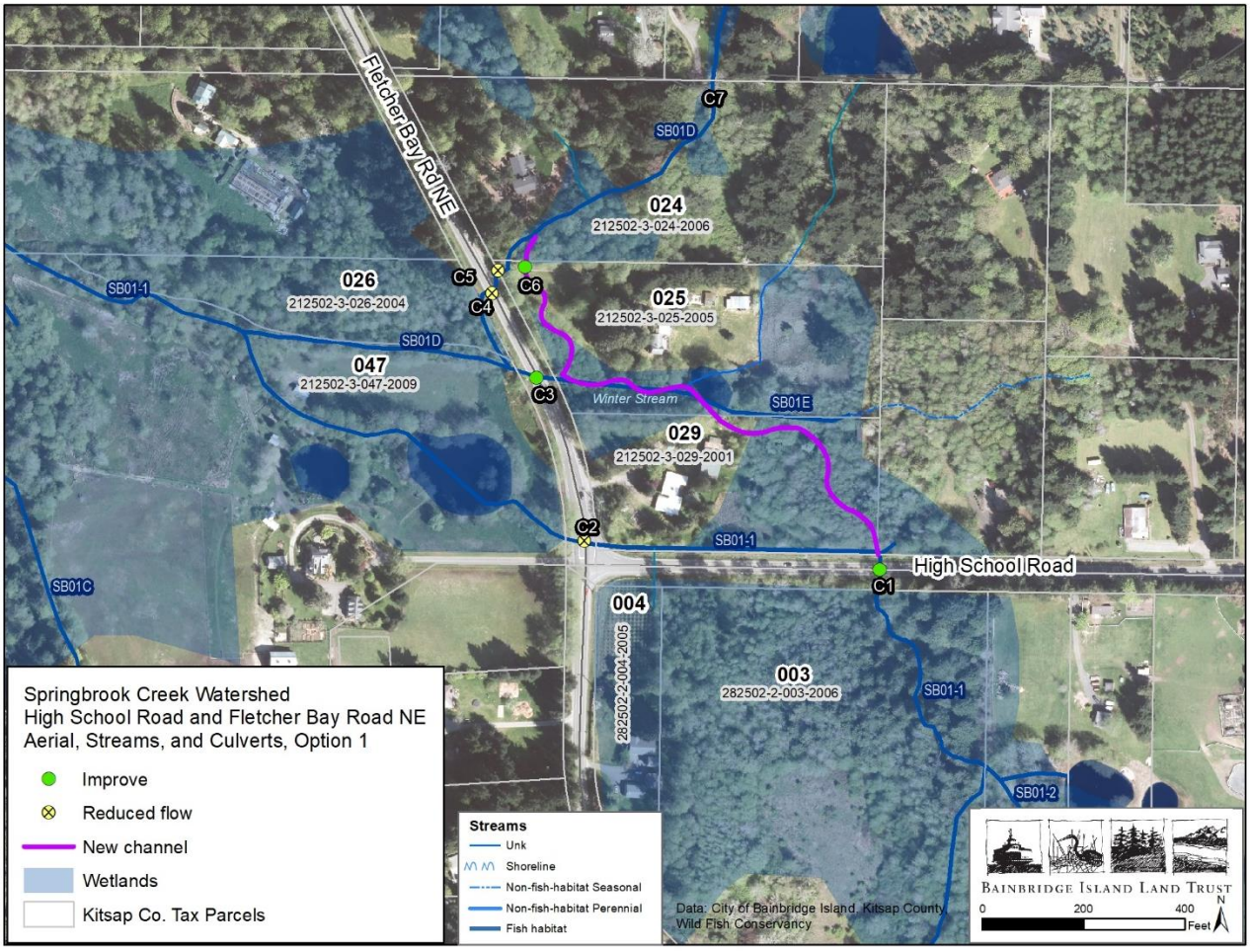


Figure 6. High School Road-Fletcher Bay Road NE Restoration Option 1.

This option is designed to move the streams away from roads and into more natural flow patterns. The movement of the northeastern tributary out of the roadside ditch and into a more natural channel flowing through healthy native vegetation down the east side of Fletcher Bay Road NE to cross at C3 is an element common to all 4 options. The mainstem of Springbrook Creek would be removed from the High School Road ditch and instead flow through wetland habitat in Parcel 029 and into the currently seasonal stream and pond on Parcel 025. This approximates an early mapped stream route (from 1909) and is anticipated to greatly reduce the influx of road surface pollutants into the fish-bearing streams. The owners of Parcel 029 have expressed initial support for bringing more of the stream through habitat on their properties. The owners of parcel 025 have expressed interest in working towards a solution that would benefit the community that would also not restrict reasonable land use on the property nor negatively impact any surrounding property owners. The number of culverts carrying substantial stream flow would be reduced from 6 to 3 (C1, C3, and a moved C6), and these 3 would be replaced with culverts appropriately sized for fish passage and movement of water and debris during peak flow. Roadside ditches would still carry runoff through the other existing culverts, and improved filtration to prevent transport of these concentrated pollutants into the streams would thus be a crucial project component. However, replacement and

maintenance costs would be greatly reduced because these culverts would no longer be undersized for their purpose.

A large part of the expense and complexity of this project would be design, permitting, and construction of the new channel through wetlands in Parcel 029. Vegetation is primarily alders over dense shrubs so although construction would require use of machinery and create noticeable short-term impacts, this habitat could recover quickly given conscientious attention to low-impact techniques and replanting. The predominant drawback to this design is that the perennial water flow to the pond and downstream channel that were created or improved for salmon rearing in Parcel 047 would be lost. Some water would likely still fill the pond from subsurface flow, flow in from road runoff (which would need to be well-filtered to avoid highly concentrated inputs of pollution), and springs appear to provide some water to the pond, but further evaluation would be needed to model the extent of the changes in water and vegetation in the ponds and flow of water below.

Pros: Restoration of simplified natural flow patterns through intact habitats. Very good separation of stream from roads. Reduction from 6 culverts to 3.

Cons: Loss of flow through pond on Parcel 047 and associated fish habitat within the pond and downstream channel. Complexity of design, permitting, and construction of new channels through wetlands, and disturbance of wetland vegetation.

OPTION 2

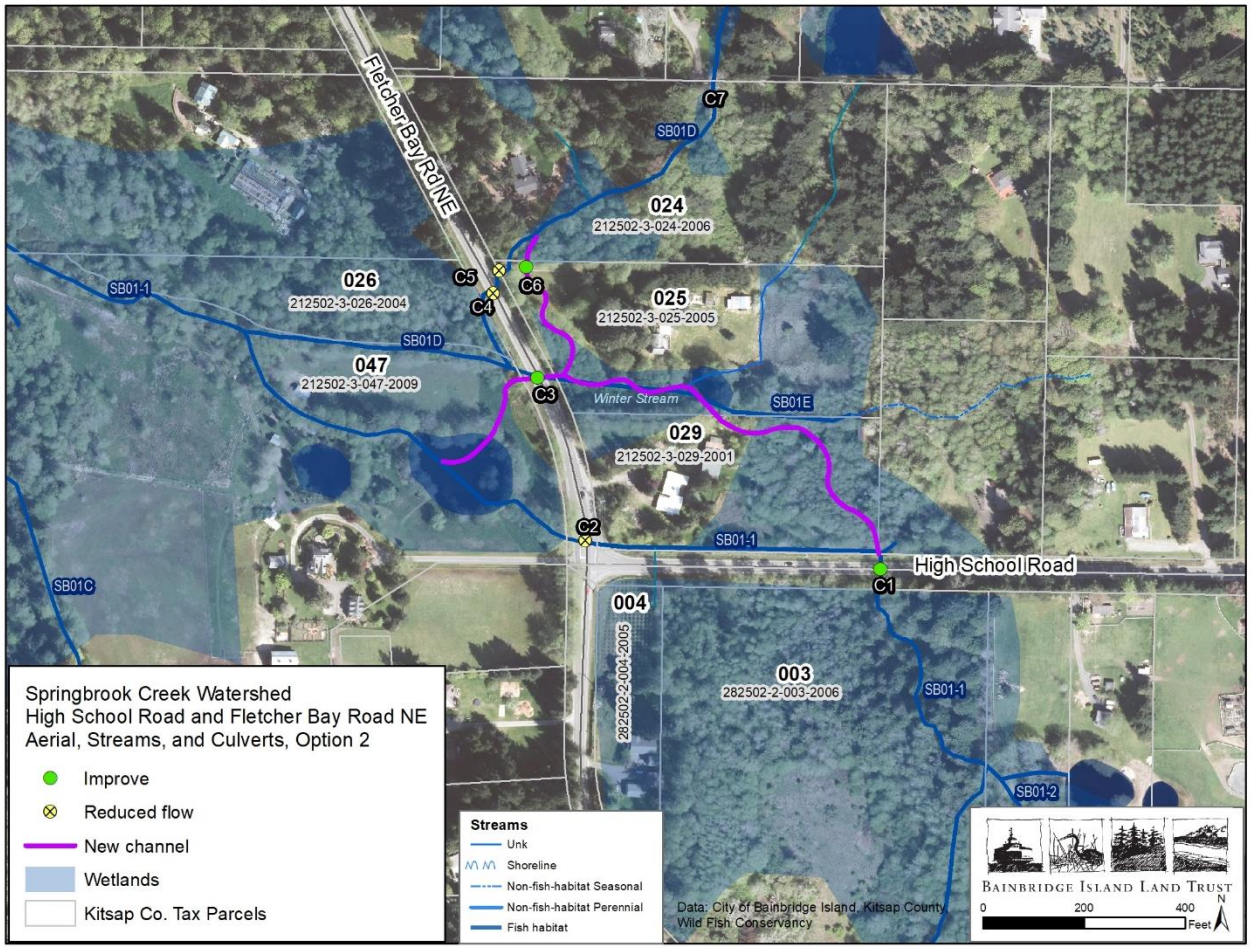


Figure 7. High School Road-Fletcher Bay Road NE Restoration Option 2.

This option is similar to Option 1, but addresses the issue of perennial water supply to the pond and downstream channel by bringing the stream channel down into it west of Fletcher Bay Road NE. Benefits are much the same as for Option 1. The primary drawback of this option are the issues it creates for Parcel 047, which is managed as a small farm. The fences on this property were rebuilt fairly recently in a partnership with the Kitsap Conservation District to improve buffering of the stream from livestock and clearing, and this alternative would involve removal and rebuilding of some fences. A final design would have to include considerations such as the new extent of landscaping, reconfiguration and potential loss of animal pastures, fencing, routes for equipment to access pastures with associated new culverts and/or bridges, the degree to which the former channel would be protected vs decommissioned to expand management flexibility, etc. A possibility raised by landowners is to ameliorate the logistic challenges on 047 by constructing a new culvert a bit south of the current C3.

Pros: Same as Option 1 but added benefit of keeping water flow through the pond and channel on Parcel 047.

Cons: Same as Option 1 with additional channel construction and associated issues, but addresses water flow to pond on Parcel 047. Added complexity of design to accommodate farm operations on this parcel and potential impacts to current aesthetics on the property.

OPTION 3

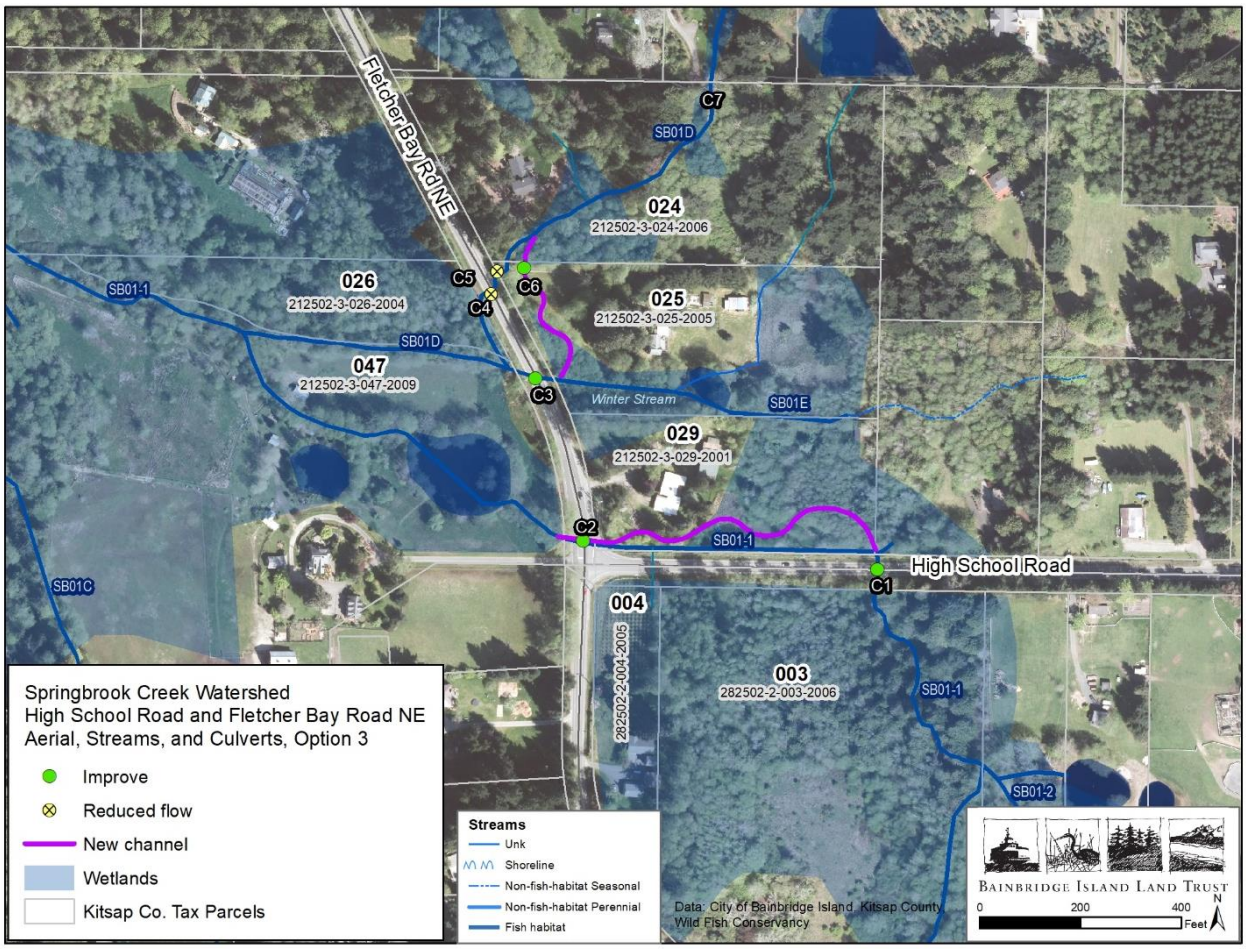


Figure 8. High School Road-Fletcher Bay Road NE Restoration Option 3.

This is a more conservative option, designed to move streams somewhat away from roads and into more natural channels in level undeveloped areas adjacent to the current ditches, without substantially altering flows west of Fletcher Bay Road NE. Vegetative filtering would be greatly improved and the number of culverts carrying substantial stream flow would be reduced from 6 to 4, but unlike Options 1 or 2 these would include the long culvert right at the intersection (C2). Replacement with an appropriately-sized culvert with modifications to adequately filter runoff from such a large intersection right over the mainstem of the creek would be very expensive, and long-term assurance that pollutants would be prevented from reaching the stream would be lower than that provided by moving the stream completely away from the intersection. Roadside ditches would still carry runoff through the other existing culverts, and improved filtration to prevent transport of these concentrated pollutants would still be a project component.

Pros: Modest improvement in separation of streams from roads and more natural channels. Reduction from 6 culverts to 4.

Cons: Retains flow through C2 at the major intersection, retaining high contamination risk. Keeps channels in sub-optimal habitats in proximity to roads.

OPTIONS 4A AND 4B

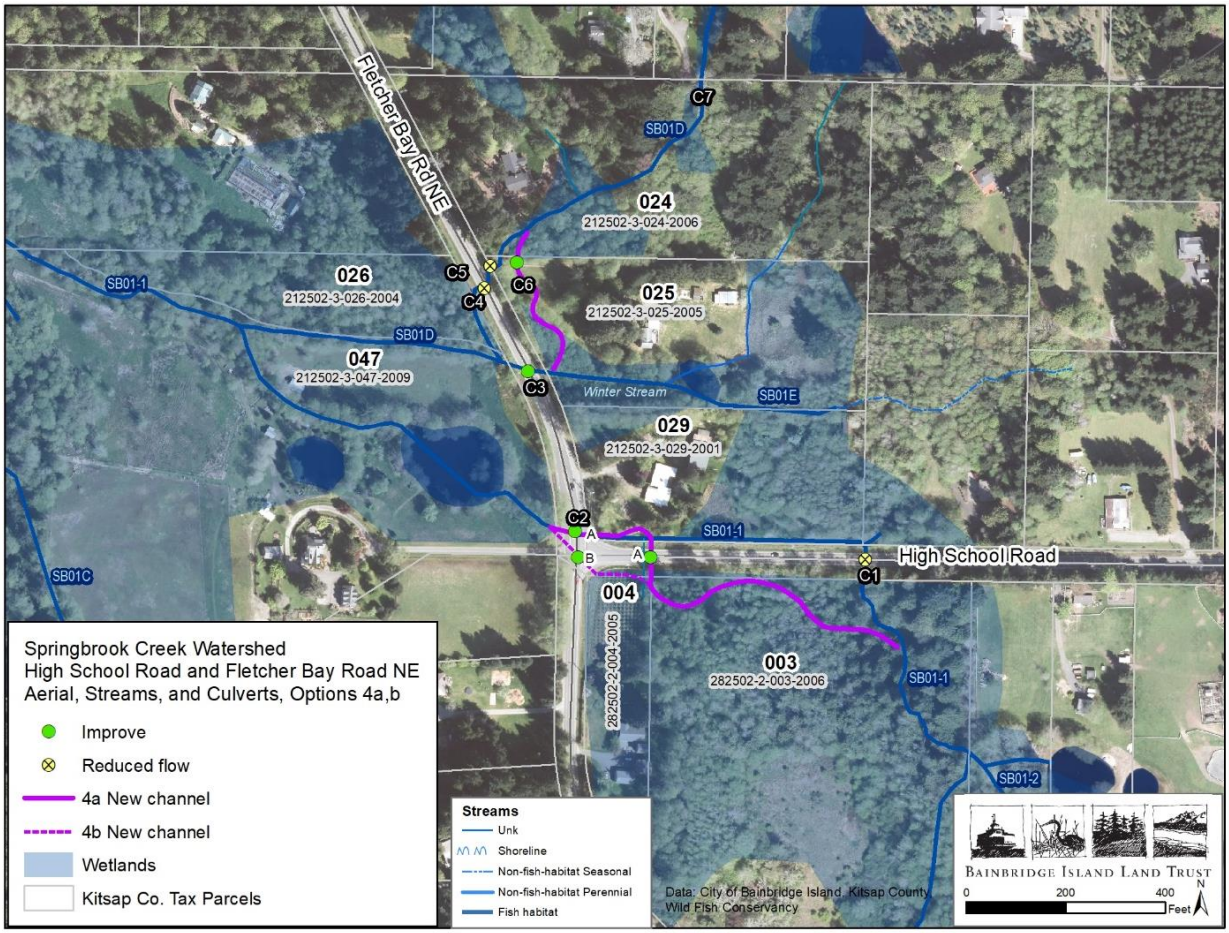


Figure 9. High School Road-Fletcher Bay Road NE Restoration Options 4a and 4b.

Options 4a and 4b are similar to Option 3 in taking a more conservative approach to move streams moderately away from roads and reduce culverts without disrupting the stream flows west of Fletcher Bay Road NE. However, these options keeps the stream largely south of High School Road, through higher-quality habitat than on Parcel 029. The general flow path from southeast of the intersection to northwest is evident from the elevations (Figure 5) and likely was a historic stream channel. Option 4A would still take the stream across High School Road to avoid impacts to the blueberry fields at the north end of Parcel 004, which are very important to this landowner. This would eliminate stream flow through C1, but would just divert this flow over to a culvert further west. This might achieve similar separation of the stream from High School Road as Option 3, with the same number of culverts as that option (a total reduction from 6 to 4).

Option 4b, which was proposed by an affected landowner, would add a new, longer culvert running diagonally under the main intersection just south of C2 (dashed line in Figure 9) and reduce the number of culverts carrying substantial stream flow from 6 to 3. This is the one option that reduces the number of culverts to 3 while keeping the perennial stream flow into the pond on Parcel 047. However, construction of the diagonal culvert appropriately sized and with modifications to adequately filter runoff from the substantial road pollutants at this intersection would be very expensive. Long culverts are also not favored for fish passage. This option would also be highly impactful to Parcel 004, most likely cutting through the blueberry fields and altering the hydrology of portions of the property. That landowner would have to voluntarily agree to these substantial impacts, which is only likely if they see the potential for the rerouted creek and riparian vegetation as a considerable aesthetic improvement.

Either 4a or 4b comes with the same drawbacks as those for Option 3, due to the mainstem of Springbrook Creek still crossing at this major intersection. These options would also involve substantial impacts to mature coniferous forest and intact functioning stream and riparian habitat on Parcel 003. Another route considered (but not mapped above) would bring the stream up to High School Road and to the intersection before angling across in the new culvert, in order to avoid impacts to Parcel 004. However this would come at the cost of more of the stream adjacent to the road and more susceptible to harmful runoff.

4a Pros: Modest improvement in separation of streams from roads and more natural channels. Reduction from 6 culverts to 4. Avoids impacts to Parcel 004.

4a Cons: Retains flow through C2 at the major intersection, retaining high contamination risk. Keeps channels in sub-optimal habitats in proximity to roads. Impacts to intact forest, stream and wetland habitats on Parcel 003 and complexity of design, permitting, and implementation of channel construction through mature coniferous vs. alder-dominated wetland forest.

4b Pros: Modest improvement in separation of streams from roads and more natural channels. Reduction from 6 culverts to 3.

4b Cons: Retains flow through C2 at the major intersection, retaining high contamination risk. Keeps channels in sub-optimal habitats in proximity to roads. High impacts to blueberry fields in Parcel 004. Impacts to intact stream, riparian, and wetland habitats on Parcel 003 and complexity of design, permitting, and implementation of channel construction through wetland forest. Added expense and logistic challenges of a long culvert. Long culverts are not favorable for fish improvements.