TECHNICAL MEMORANDUM

Date: February 14, 2024

To: **Michelle Perdue – Kitsap County Public Works**

From: Phil Struck, Struck Environmental, Inc.

Copies to: Joe Rutan, P.E. Kitsap County Public Works
Shawn Alire, Kitsap County Public Works

SUBJECT: **DUNCAN CREEK AT COLCHESTER DRIVE**
FISH PASSAGE BARRIER REMOVAL – PRELIMINARY DESIGN SUMMARY

INTRODUCTION

This technical memorandum (TM) describes the preliminary design for Kitsap County Public Works (County) proposed replacement of the existing Duncan Creek fish passage barrier at Colchester Drive East in south Kitsap County, Washington (Figure 1).

The project is proposed for funding by the WSDOT PROTECT program, which is a collaboration of the WDFW/RCO Fish Barrier Removal Board (FBRB) Grant Program and WSDOT. In accordance with the funding requirements, this TM has been prepared consistent with the WDFW *Water Crossing Guidelines* (2013) and the documentation requirements described in FBRB Manual 22.

Duncan Creek crosses under Colchester Drive through an existing 36-inch diameter corrugated metal pipe about 0.06 river miles (RM) upstream from the stream discharge to Puget Sound. The WDFW has assessed this culvert as 0% passable (Barrier ID 15.0191 0.06 – see Attachment A).

Goals and Objectives

The goal of the project is to benefit all life forms and stages of aquatic life by providing access to critical spawning and rearing habitat in approximately 0.53-miles of Duncan Creek upstream of the existing barrier. Correcting the fish barrier culvert will restore biological and hydrologic functions, including substrate and large woody material (LWM) transport, nutrient enhancement and biological diversity in the watershed. The project will restore habitat access for four species of salmonids as well as other aquatic species. Specific objectives of the project consist of:

- Eliminate an existing 0% passable barrier structure;
- Restore sediment and LWM transport to the downstream reach;
- Provide fish access to approximately 0.53 miles of good quality upstream habitat; and
- Provide a water crossing structure that is resilient to peak flows and future climate change.

SCALE IN MILES

0 2 4

Figure 1. Vicinity Map

Duncan Creek at Colchester Drive

Kitsap County Public Works

PROJECT SUMMARY DESCRIPTION

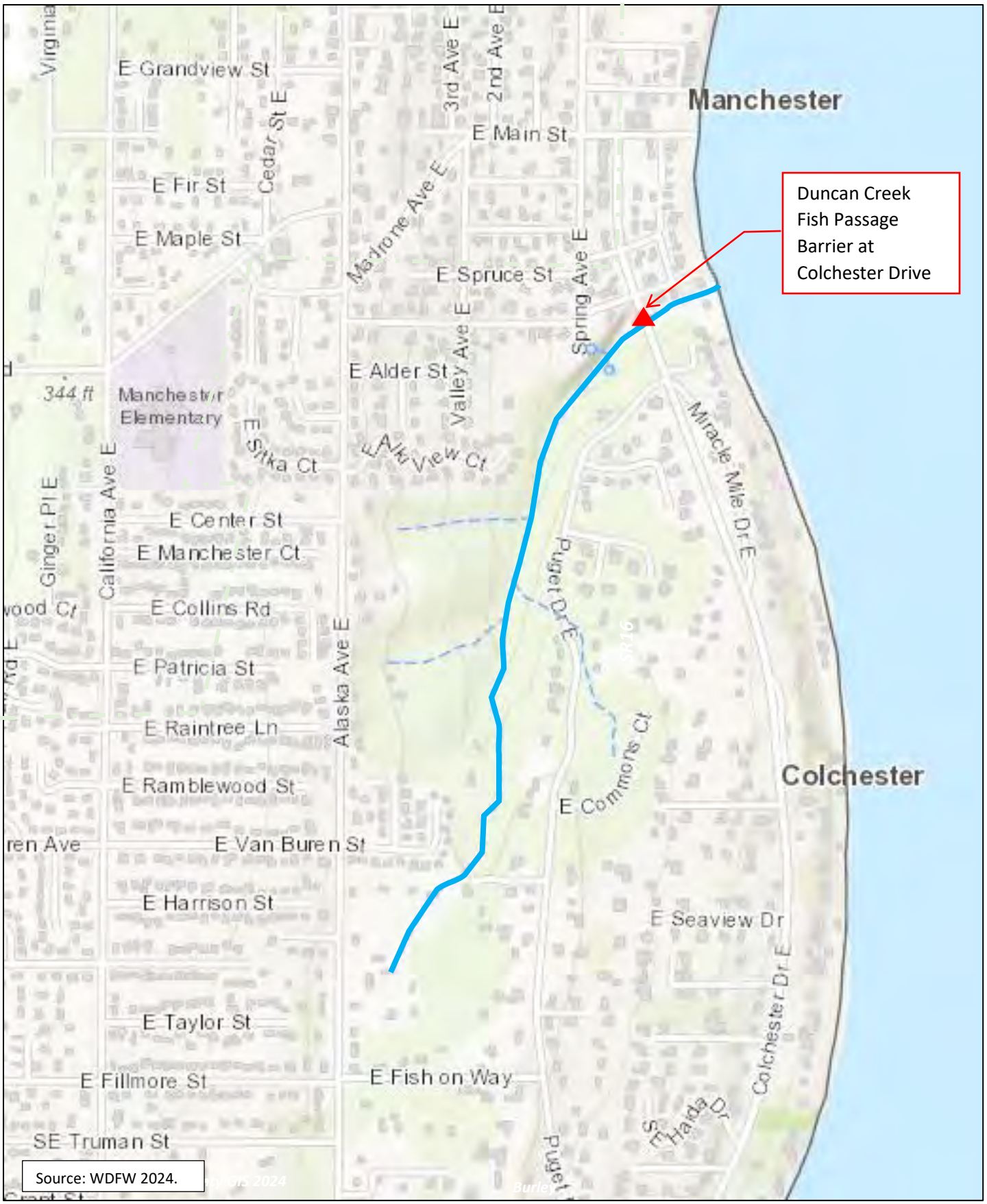
The project consists of replacement of a 250-ft long, 36-inch diameter impassable corrugated metal pipe system under Colchester Drive with a new 14-ft wide by 110-ft long bottomless concrete box culvert. The new culvert will be designed using stream simulation methods and approximately 40-ft of new channel would be constructed upstream and downstream of the new culvert to tie into existing stream channel. The existing stormwater system, which is co-mingled with the stream, would be replaced with a new stormwater conveyance system and outfall. Large woody material (LWM) and riparian plantings would be installed to provide habitat complexity and cover. There are no roadway capacity increases associated with the project.

SITE DESCRIPTION

The project site is located on lower Duncan Creek in south Kitsap County, Washington (Figure 2). Duncan Creek enters Puget Sound approximately 0.1 miles south of the Manchester village in unincorporated Kitsap County. The creek drains a total area of approximately 280 acres that is located to the west and south (Figure 3). Single family residential development occupies approximately seventy percent of the basin, concentrated primarily to the west of Alaska Avenue between East Alder Street on the north and East Harrison Street on the south, with additional patches to the east of Alaska Avenue. Forested ravines and the forested creek valley make up the remainder of the basin.

Duncan Creek crosses under Colchester Drive south of its intersection with Hemlock Street through a 250-ft long, 36-inch diameter pipe system (Photo 1). The pipe system conveys the creek flow eastward through a 125-ft culvert section to a manhole that turns the flow southward for another 125 feet to another manhole that returns the flow to an easterly direction through a short pipe section that daylights to an open channel section that flows for approximately 350-ft before reaching the shore of Puget Sound (Figure 4).

Photo 1: 36-inch CMP and control structure outfall downstream of Colchester Drive.



SCALE IN FEET

0 300 600

Figure 2. Barrier Location
Duncan Creek at Colchester Drive
Kitsap County Public Works

SCALE IN FEET

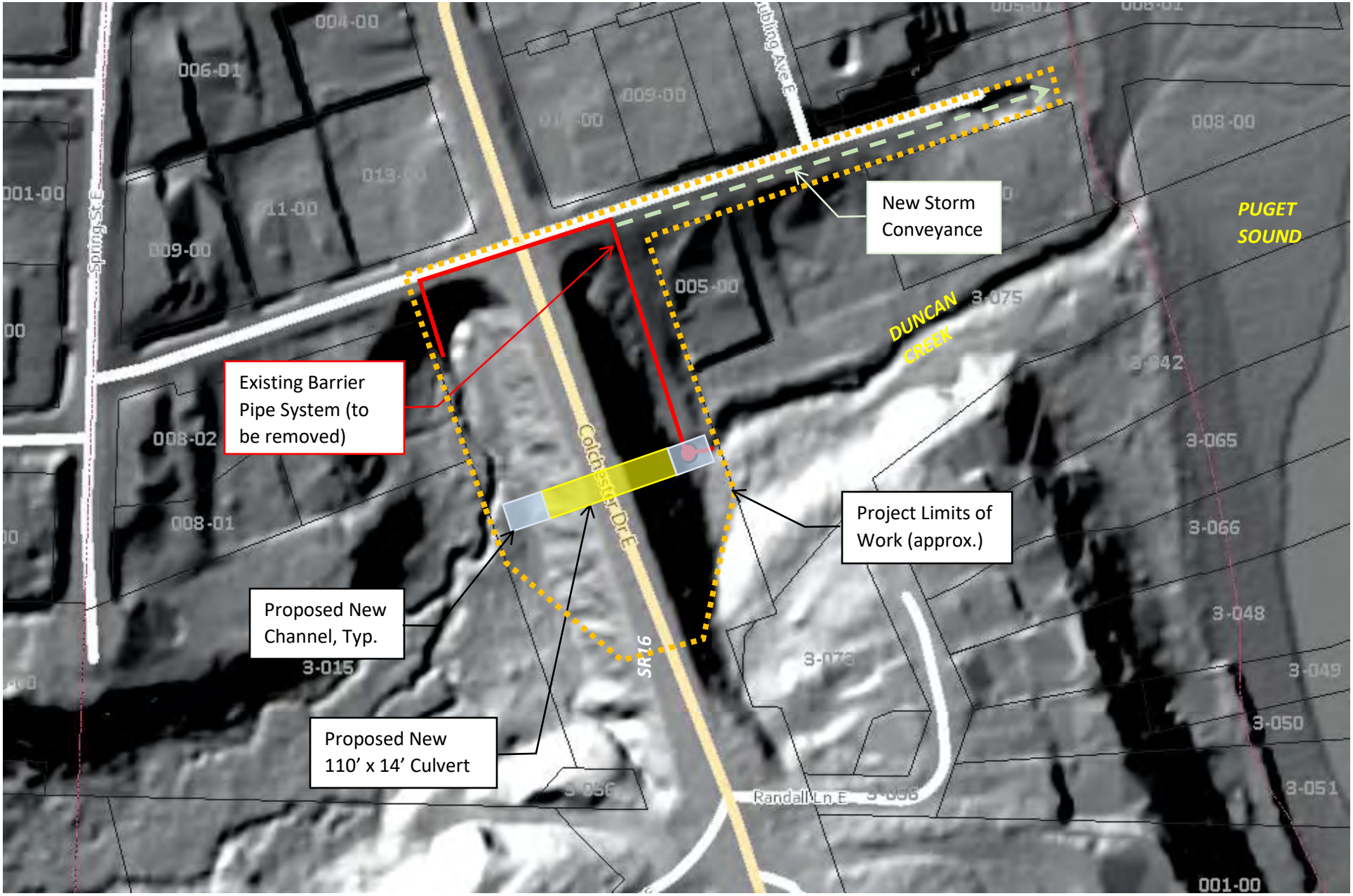
0 200 400

N

Figure 3. Duncan Creek Basin

Duncan Creek at Colchester Drive

Kitsap County Public Works



SCALE IN FEET

0 50 100

Figure 4. Existing Barrier and Schematic Plan

Duncan Creek at Colchester Drive

Kitsap County Public Works

Stream Conditions at Project Site

The stream reach immediately upstream of the culvert site generally consists of an incised channel within a disturbed vegetation corridor. Disturbed conditions reflect the roadway embankment and historic channelization of the stream to the comingled storm system (Photo 2). Upstream of the disturbed reach, the stream has an 8 to 9-ft bankfull width (BFW) and is moderately sloped through a wetland system with pool-riffle morphology, good spawning gravel and mature forest riparian buffer. The stream reach immediately downstream of the site consists of a typical 8-ft BFW channel, transitioning to a 20-ft wide tidally influenced channel near the discharge to Puget Sound. Habitat is moderately disturbed in the lower reach from existing development and historic vegetation clearing (Photo 3).

Photo 2: Upstream Conditions.

Photo 3: Downstream Conditions.

HYDROLOGY

Stream hydrology is primarily rainfall dependent, except for summer dry periods when base flows are supported primarily by headwater wetlands and shallow groundwater. Typical flows based on a 2017 NHC study of the basin (NHC 2017) and the WDFW climate change adjustment factor (WDFW 2024) are summarized in Table 1.

Table 1. Typical Stream Flows.

Condition	Flow (cfs)[1]	Flow With WDFW Climate Change (cfs) [2]
100 year event	78.6	112.5
50 year event	66.8	NA
10 year event	43.0	NA
2 year event	22.2	NA

[1] NHC 2017.

[2] WDFW Culvert and Climate Change web site (2024) predicts 47.27% increase in flow for 100 year event.

GEOMORPHOLOGY

A preliminary geomorphic assessment was conducted for an area approximately 200-ft upstream and downstream of the culvert site. The geomorphic assessment consisted of bankfull width (BFW) measurements, assessment of riparian vegetation and fish habitat, documentation of channel morphology and general site observations.

Bankfull Width

BFW measurements were taken at several locations as part of the 2017 Northwest Hydraulic Consultants stream study (NHC 2017). A preliminary BFW of 8-ft was measured by NHC. Kitsap County met with WDFW and the Suquamish Tribe at the site in January 2024 as part of early project design coordination to verify the BFW that will be used for final design (Attachment B). The WDFW and tribe measured BFW of between 8.3-ft and 12.3-ft. A final BFW was not determined. For the purpose of this preliminary design assessment, a BFW of 9-ft is assumed. Final BFW will be determined as part of future design based on additional geomorphic analysis, hydraulics and consultation with WDFW and the Suquamish Tribe.

Flood Plain Utilization Ratio

The Floodplain Utilization Ratio (FUR) refers to the width of the floodplain relative to the stream channel. The FUR was calculated by dividing the flood-prone width by the BFW. Upstream FUR values of between 10 and 13 reach indicates an unconfined channel condition.

Channel Geometry

The stream is typically a single-thread and straight slightly meandering in the vicinity of the project site. Channel geometry typically consists of a 4 to 6-ft wide base flow channel, with wider areas upstream that are associated with debris jams made up of wood from the surrounding riparian buffer. Upstream morphology is typically pool-riffle with occasional step-pool with grade controlling debris jam steps. About 250 feet downstream of the culvert site the channel widens to about 20-ft due to tidal influence.

Stream Gradient

The stream gradient at the site was determined by NHC survey and is shown in the plans in Attachment C. The steam gradient through the site is 2.4 percent.

HABITAT CONDITIONS

This section describes existing and potential future fish use at the site, and habitat conditions upstream and downstream of the barrier.

Fish Presence

Fish presence information was derived from the WDFW Salmonscape database (2024) and the WDFW Culvert Assessment Report for the site. Table 2 summarizes fish presence data.

Table 2. Fish species at the project site.

Species	Presence (Presumed, Modeled, or Documented)	Data Source	ESA Listing
Winter Steelhead Trout	Presumed	WDFW 2024[1]	Threatened, Puget Sound ESU
Coho salmon	Documented	WDFW 2024[2]	Species of Concern, Puget Sound
Searun Cutthroat Trout	Presumed	WDFW 2024[1]	Not warranted
Resident Trout	Documented	WDFW 2024[2]	Not warranted

[1] WDFW Barrier Report 15.0191 0.06 (01/31/2024).
[2] WDFW Salmonscape (2024)

Fish Habitat Character and Quality

Areas upstream of the project site provide good spawning habitat due to the size of streambed sediment, riparian cover, LWM, and channel complexity. The upstream reach has well shaded pools, LWM clusters and low-velocity channel margins that provide good spawning conditions, resting habitat for migrating adult salmonids and rearing habitat for juveniles. A mature forested riparian vegetation buffer that is typically 150-ft wide or more extends that full length of the 0.53 miles of fish habitat that will be made accessible by the project.

The area immediately downstream of the culvert provides both rearing and spawning habitat with sufficient shade, cover, channel complexity, and appropriately sized streambed material to support all of the species and life history stages of salmonids that may utilize the stream. Gravel and small cobbles suitable for spawning were observed with suitable flow during spawning seasons.

Related Restoration and Enhancement Projects

A new stormwater conveyance and treatment system is proposed to treat the lower basin including Colchester Drive. This new stormwater system will replace the existing system, which must be removed as part of the project because it creates a fish passage barrier where Duncan Creek is diverted into the storm system at Colchester Drive. The new stormwater system will separate stormwater and stream flows and ensure that runoff from Colchester Drive is treated and discharged into marine water instead of discharged untreated directly into Duncan Creek as exists under current conditions. This will ensure that sustainable stormwater management is

provided that prevents pre-spawn mortality, which is critical due to the project location near a high ADT road at the base of the watershed. Preliminary design of the new stormwater collection, conveyance and treatment system is provided in Attachment C.

Upstream and Downstream Fish Passage Barriers

There are no mapped fish passage barriers upstream or downstream of the project site.

Habitat Gain From Project

Based on the WDFW barrier assessment, the project will result in approximately 0.53 miles of fish habitat gain.

Land Ownership and Maintenance Considerations

Kitsap County owns the culvert, embankment and roadway at the site. As such, the County's ownership of the site ensures long term protection of habitat that will be made available from the barrier removal project.

Site Constraints and Maintenance Considerations

There are no site constraints and maintenance requirements that are likely to present significant challenges to proposed restoration actions.

PRELIMINARY ALTERNATIVES ANLAYSIS

The following three general barrier removal alternatives were identified based on project goals, objectives, the site assessment, hydrology, cost and engineering feasibility:

- New box culvert
- New bridge
- Road removal and abandonment

Each of these alternatives is described and evaluated below.

Alternative 1: New Box Culvert

Alternative 1 consists of a new concrete box culvert. The culvert would be installed by excavating and removing the old culvert, installing the new culvert with constructed stream channel, and then backfilling the culvert excavation. Wingwalls and headwalls would be used to establish the toe of slope for the back filled culvert.

Colchester Drive would be likely closed during construction with traffic detoured to other County roads. It is expected that the construction would not have a significant impact on traffic because there are multiple, short (0.5 miles or less) detour options.

Environmental/habitat benefits consist of a new culvert that allows fish passage and creates a more natural stream channel. Environmental impacts would consist of approximately 0.25 acres of shrub and grass vegetation that is currently on the road embankment that would be removed and replanted.

The estimated cost for this alternative is approximately $3.84M. Preliminary assessments indicate the site is well suited for the culvert option due to stream BFW and gradient. The primary advantages of the culvert option are lower cost and shorter construction duration.

Alternative 2: New Bridge

This option would replace the existing culvert with an new 70-foot (approximately) long bridge. The bridge would likely be constructed of precast concrete girders, a cast in place concrete deck, and driven piles.

The bridge could be built in two stages; however, it would most likely be completed in one stage with the road being closed during construction. Excavation of the embankment fill and removal of the existing culvert could be done after the bridge is substantially completed. Utilities would be supported during construction by hanging them from the bridge. The stream channel would then be reconstructed using stream simulation design methods in place of the removed culvert.

Environmental/habitat benefits include removal of a significant amount of roadway fill. The stream would be widened, riparian vegetation restored and more channel complexity and light, which would result in a more natural stream condition. Impacts would consist of temporary removal of vegetation that is currently on the side of the road. This alternative is estimated to have a 20 percent higher cost than the culvert option due to the bridge length needed to span the opening. Costs would be in the range of approximately $4.6M. The bridge option would also likely require more time to complete due to more cast in place concrete requirements.

Alternative 3: Remove Road

The road removal option would remove the existing barrier structure, create an open channel with no crossing structure. This would require a dead end on Colchester Drive with a hammerhead turnaround for emergency vehicles. This option would eliminate the use of this road for through traffic, which would negatively affect areas residents, emergency vehicle access, and access to the nearby Manchester US Navy facility. This option would likely require the reconstruction of nearby roads to provide the level of service that would be lost by closure of Colchester Drive. This alternative is therefore considered infeasible due to a combination of cost, public impact, and the importance of Colchester Drive as a transportation facility.

Preferred Alternative

The alternative evaluation considered the following criteria:

- Abilit to meet project goals and objectives
- Benefits to targeted fish species and life stages
- Economic feasibility (appropriate cost-to-benefit ratio)
- Conformance with WDFWS *Water Crossing Design Guidelines* (WCDG)
- Ongoing maintenance requirements
- Project sustainability and resilience
- Community support

Based on the alternative description and evaluation criteria provided above, the box culvert option is the preferred alternative. The culvert option reflect the following advantages:

- Large hydraulic opening to accommodate peak flows and debris passage.
- Lower cost compared to the bridge option.
- Shorter construction schedule compared to the bridge option.
- Meets stream simulation design criteria for culverts as recommended in the WCDG.

The culvert alternative is shown in preliminary engineering plans in Appendix C and is described in greater detail below.

PRELIMINARY DESIGN

This section describes the specific design criteria for the project. Refer to the preliminary plan sheets in Attachment C for additional details.

Design Methods

Primary design methods and standards used for the project are as follows:

- WDFW *Water Crossing Design Guidelines* (2013)
- WDFW *Incorporating Climate Change into the Design of Water Crossing Structures* (2017)
- WAC Hydraulic Code Rules 220-660
- Kitsap County Design Standards, which incorporate both WSDOT standards and guidelines of AASHTO Geometric Design of Highways and Streets.

In combination, these standards reflect best available science, regulatory requirements and local agency standards.

Preliminary Design Criteria

Table 3 summarizes design criteria for the project. All preliminary design criteria will be confirmed as part of final design. Streambed aggregate design will also be determined as part of final design.

Table 3. Proposed Preliminary Design Criteria.

Design Criteria	Value
Bankfull Width	9-ft
Climate Change Adjustment Factor	8.5%
Flood Plain Utilization Ration	13:1 (unconfined)
Channel Gradient	2.4%
Base Flow Channel Width	5-ft

Preliminary Engineering

Culvert and channel design data is summarized below. Refer to the preliminary design drawings in Appendix C for details. Note that the existing preliminary design plans show a culvert width of 10-ft compared to the preliminary design criteria of 14-ft. Final culvert dimensions will be verified with WDFW and the Suquamish Tribe and finalized as part of final design.

Proposed Culvert Structure

The proposed culvert structure is expected to have the following design features. These design elements are preliminary and subject to change based on more detailed analysis and WDFW and Suquamish Tribe feedback.

- Type: Bottomless box culvert
- Width: 14 feet
- Rise: 12.0 feet
- Length: 110 feet
- Slope: 2.4%
- Freeboard at 100 year event: 4.0 feet

Proposed Roadway Geometrics

The roadway will have the following geometric features:

- 11-ft travel lanes
- 5-ft shoulder
- 32-ft total width
- Guard rail traffic barrier

The roadway elevation will not increase relative to existing conditions. There will be no increase in pollutant generating impervious surfaces.

Proposed Channel

The proposed channel will have the following design features:

- Channel Bottom Width: 5.0 feet
- Bankfull channel width: 8.0 feet
- Total channel width through culvert: 14.0 feet
- Streambed material: 50% streambed sediment, 30% 4" Streambed Cobbles, 20% 8" Streambed Cobbles (preliminary)
- Streambed profile: 2.4%
- Countersunk depth (percentage): 3.0 feet (25%)

Large Woody Material

Large woody material will be included in the stream design. Logs will be incorporated into the streambed sediment to provide additional stability and stream channel complexity. Logs will be used to help retain sediment in the downstream sediment-starved segment. No full spanning logs and log steps or weirs are proposed in the design.

Potential Debris Loading

Potential for significant debris loading is moderate due to the proximity of adjacent/upstream mature forest. Woody material up to 30-inch diameter has potential to be encountered during peak flow events. A minimum of 3-ft head clearance during peak flow conditions will therefore be provided.

Climate Change Considerations

The proposed design addresses the predicted effects of climate change and is anticipated to be climate resilient under future conditions. To evaluate the effects that climate change may have on the stream, the WDFW's *Culverts and Climate Change* web application was used to estimate the projected future increase in the 100-year flow and BFW and these values were then used for design.

Utility Considerations

Proposed utility relocations consist of the existing stormwater pipe system that is comingled with Duncan Creek. This stormwater system will be separated from the stream, and a new stormwater conveyance system and marine outfall will be constructed to eliminate the existing stream outfall.

Existing overhead power line, water line, sanitary sewer and an existing fiber optic line will be supported through construction and relocated as necessary to accommodate the new culvert. Utility line relocation will be performed by the utility in advance of the barrier removal as required by County franchise agreements.

Impacts to Traffic and Roadway

Colchester Drive will remain open during construction to the extent feasible. If necessary, traffic can be detoured approximately 0.5 miles. Given the availability of short detour options at this site, it is unlikely that construction will cause significant impacts to traffic.

Wetland and Stream Buffer Considerations

The project will occur within wetlands, and wetland and stream buffers. Portions of the wetland and buffer that may be affected have been previously disturbed by roadway construction and utilities and consist primarily of small trees, native shrubs, grass and Himalayan blackberry. Disturbed areas within the construction limits will be replanted with native vegetation after completion of new culvert installation. Wetland delineation, specific impact areas, mitigation plans and mitigation monitoring methods, as required under federal, state and County regulations, will be developed as part of final design.

Permitting and Stakeholder Consultation

A site visit was performed with the WDFW and Suquamish Tribe in January 2023. The purpose of this meeting was to verify barrier status and discuss conceptual design options. Further coordination with WDFW and the tribe will occur as part of final design and permitting.

The project is not listed on the current work plan for the West Sound Partners for Ecosystem Restoration (WSPER), which is the Local Integrating Organization (LIO) for Kitsap County; however, the project has been submitted to WSPER for inclusion on the habitat work plan. A letter of support from WSPER is provided in Attachment B. Project permitting including cultural resources assessments, Corps of Engineers Nationwide Permit, and WDFW HPA would be completed as part of final design in 2025.

COST ESTIMATE

Cost estimates were developed as part of preliminary design and details are provided in Attachment D. The estimated total project cost is $3.482 million. The cost estimate includes design and permitting, construction, and construction management and administration. Project costs are summarized in Table 4.

Table 4. Preliminary project cost estimate summary.

Cost Element	Estimated Cost	Percent of Total
Final Design	$430,000	12%
Permits	$43,000	1%
Construction	$2,366,000	68%
Contingency and Inflation	$643,000	19%
Total Project Cost	**$3,482,000**	**100%**

REFERENCES

Barnard, R.J., J. Johnson, P. Brooks, K.M. Bates, B. Heiner, J.P. Klavas, D.C. Ponder, P.D. Smith, and P.D. Powers. 2013. Water Crossings Design Guidelines. Washington Department of Fish and Wildlife, Olympia, Washington.

Northwest Hydraulic Consultants 2017. Hydrologic and hydraulic analysis of Duncan Creek flooding, culvert replacement, and flow control options. Prepared for Kitsap County Public Works. December 2017.

WDFW (Washington Department of Fish and Wildlife). 2024. PHS on the Web: An Interactive Map of WDFW Priority Habitats and Species Information for Project Review. Available at: http://wdfw.wa.gov/mapping/phs/.

WDFW (Washington Department of Fish and Wildlife). 2024. SalmonScape Fish Database and Mapping Application. Available at: https://fortress.wa.gov/dfw/salmonscape/.

WDFW 2024. Culverts and Climate Change Web Site. https://geodataservices.wdfw.wa.gov/hp/culvert-app/ Accessed December 18, 2023.

WDFW 2024. *Washington State Fish Passage.* https://geodataservices.wdfw.wa.gov/hp/fishpassage/index.html

ATTACHMENTS

A – WDFW Barrier Report
B – Lead Entity Documentation
C – Preliminary Design Drawings
D – Preliminary Cost Estimate

ATTACHMENT A:

WDFW BARRIER REPORT

WDFW Fish Passage and Diversion Screening Inventory Database

Site Description Report

Site ID 15.0191 0.06 **Project** COUNTY ☐ **Mitigated**

Geographic Coordinates

Latitude (WGS 84):	47.552809
Longitude (WGS 84):	-122.54455009
East (NAD 83 HARN)	1,135,558.6
North (NAD 83 HARN)	815,976.4

Waterbody

Stream:	Duncan Cr
Tributary To:	Puget Sound
WRIA:	15.0191
River Mile:	0.06
Fish Use Potential:	Yes
FUP Criteria:	Biological

General Location

Road Name:	Colchester Dr E
Mile Post:	-999.99
County:	Kitsap
WDFW Region:	6

Owner

Type:	County
Name:	Kitsap County

PI Species

☐ Sockeye	☐ Chinook	☑ Sea Run Cutthroat
☐ Pink	☑ Coho	☑ Resident Trout
☑ Chum	☑ Steelhead	☐ Bull Trout

Associated Features

☑ Culvert	☐ Dam	☐ Natural Barrier	☐ Diversion
☐ Non-Culvert Xing	☐ Other	☐ Fishway	

Location/Directions

Just south of the intersection with E. Hemlock Street in Manchester.

Site Comments

Juvenile and adult cutthroat observed by WDFW staff (2001). Coho have been observed attempting to spawn in lower reaches of Duncan Creek (see Committee to Restore Duncan Cr) Juvenile and adult cutthroat observed by WDFW (2001).

WDFW Fish Passage and Diversion Screening Inventory Database

Level A Culvert Assessment Report

Site ID:	**15.0191 0.06**				
Latitude:	**47.552809**	Stream:	**Duncan Cr**	WRIA:	**15.0191**
Longitude:	**-122.54455009**	Tributary To:	**Puget Sound**	Fish Use Potential:	**Yes**

Data Source: Washington Department of Fish and Wildlife

Field Crew: High;Sherman Review Date: 1/31/2024

Culvert Details / **Level A Parameters**

ID	Shape	Material	Span	Rise	Length	WDIC	Apron	WSDrop	Location	Countersunk	Backwater	Slope (%)	Sediment
1.1	RND	OTH	0.91	0.91	107.60	0.30	NO	0.00		No	No	2.40	

All dimensions in meters

Channel Description

Toe Width (m):	2
Average Width (m):	1.96
Culvert/Stream Width Ratio:	0.46

Plunge Pool

Length (m):	0.00
Max Depth (m):	-99.99
OHW Width (m):	-999.99

Road

Fill Depth (m):	5.00

Assessment Results

		Tidal Influence:	No	Tidegate Present:	No
Barrier:	Yes	Passability (%):	0	Method:	Level A
Reason:	Slope	Fishway Present:	No	Recheck:	

Comments

Inlet is 0.91m RND PCC with boulder riprap and sed depth of 0.21m. Outlet is 0.91m RND CST with rusted out invert. Last section of pipe includes a vertical standpipe with cutout inlet, but sediment has eliminated internal WSD.

Potential Habitat Gain

Survey Type:	PS2	Spawning (sq m):	686	Length (m):	846
Significant Reach:	Yes	Rearing (sq m):	472	**PI Total**	16.31

WDFW Fish Passage and Diversion Screening Inventory Database

Habitat Survey Summary Report

Site ID:	**15.0191 0.06**				
Latitude:	**47.552809**	Longitude:	**-122.54455009**	WRIA:	**15.0191**
Stream:	**Duncan Cr**	Tributary To:	**Puget Sound**	PI Total:	**16.31**

Survey Type PS2

Spreadsheet File(s):

150191, 150191a

Downstream Survey

Date: 7/3/2001 Crew: Blatt;Whitney Length (m): 126

Downstream Comments:

There are three recently installed log controls and a rock control (for a bed control) downstream of Colcester Drive, along with a new ABS driveway culvert. The project includes the addition of spawning gravel. Coho fry seen in all pools.

Upstream Survey

Date: 1/17/2002 Crew: Blatt;Whitney Length (m): 846

Upstream Comments:

Reach 1 - Spawning habitat inundated by fine sediment settling above culvert. Reach 2,3,&4 - Rearing habitat modified due to going dry in summer months. Survey ended due to gradient and stream size. One accessible tributary for only 46 meters.

Potential Habitat Gain

Lineal (m): 846

Spawning Area (sq m): 686

Rearing Area (sq m): 472

Distribution

- (•) Anadromous
- ( ) Resident Only
- ( ) Unknown

Gain Direction (Resident Only)

Potential Species Benefit

☐ Sockeye / Kokanee	☐ Chinook	☑ Searun Cutthroat
☐ Pink	☑ Coho	☑ Resident Trout
☑ Chum	☑ Steelhead	☐ Bull Trout

WDFW Fish Passage and Diversion Screening Inventory Database

Barrier Priority Index Report

Site ID: 15.0191 0.06

Stream	Duncan Cr	Trib To	Puget Sound	WRIA	15.0191

Habitat (H) Estimatiom Method PS2

	B	H	M	D	C	Species PI
Sockeye					2	0.00
Pink			2		2	0.00
Chum	1	384	2	1	2	6.62
Coho	1	422	2	1	2	3.03
Chinook			2		2	0.00
Steelhead	1	422	2	1	2	1.37
Searun Cutthroat	1	422	2	1	2	2.81
Resident Trout	1	472	1	1	2	2.48
Dolly/Bull Trout					2	0.00
				TOTAL PI		**16.31**

B = proportion of fish passage improvement (1, 0.67, 0.33).

H = potential habitat gain (square meters), spawning habitat for sockeye, pink and chum, rearing habitat for the rest.

M= mobility modifier (anadromous = 2, resident = 1).

D = stock condition modifier (critical = 3, depressed = 2, not 2 or 3 = 1).

C= repair cost modifier (<$100K = 3, $100K - $500K = 2, >$500K = 1).

WDFW Fish Passage and Diversion Screening Inventory Database

Image Report - Active

Site ID:	**15.0191 0.06**				
Latitude:	**47.552809**	Stream:	**Duncan Cr**	WRIA:	**15.0191**
Longitude:	**-122.54455009**	Tributary To:	**Puget Sound**	Fish Use Potential:	**Yes**

Associated Features

☑ Culvert	☐ Dam	☐ Natural Barrier	☐ Diversion
☐ Non-Culvert Xing	☐ Other	☐ Fishway	

Image Name: 15.0191 0.06_1.JPG

Image Name: 15.0191 0.06_2.JPG

Image Name: 15.0191 0.06_3.JPG

Image Name: 15.0191 0.06_4.JPG, Date/Time: 11/16/2021 12:44

ATTACHMENT B:

CORRESPONDENCE

West Sound Partners
for Ecosystem Recovery

February 12, 2024

Michelle Perdue, Stormwater Program Manager
Kitsap County Department of Public Works
614 Division Street MS-26
Port Orchard, WA 98366

Subject: Letter of Support for Duncan Creek at Colchester Drive Fish Barrier Removal Project

Dear Ms. Perdue,

The West Sound Partners for Ecosystem Recovery (WSPER)—a Lead Entity for salmon recovery and a Local Integrating Organization for ecosystem recovery made up of technical experts, practitioners, and citizens of the cities, counties, and tribes in eastern Water Resource Inventory Area 15—express support for Kitsap County Public Works' grant application to fund the restoration of Duncan Creek at Colchester Drive.

The Duncan Creek project will restore fish passage to approximately 0.52 miles of Duncan Creek by eliminating a 0% passable barrier at Colchester Drive. The existing barrier is near the stream mouth approximately 300 feet from Puget Sound, and it prevents the movement with sediment and limits use by steelhead, coho salmon, chum salmon, and sea-run cutthroat from utilizing over one-half mile of potentially productive spawning and rearing habitat. The project will restore steelhead, coho salmon, and chum salmon access and is consistent with WSPER recovery plans, including the East Kitsap Steelhead Recovery Plan and the draft Shared Strategy for Puget Sound – East Kitsap Watershed Chapter.

As a science-based organization, our partners constantly work to identify, prioritize, and seek funding to recover ecosystems and salmon populations. The West Sound Partners for Ecosystem Recovery Technical Advisory Group expressed support for this application through a vote by email between February 5 and February 9. Fish barrier removal is a priority for ecosystem recovery in our region, and we look forward to the project's implementation.

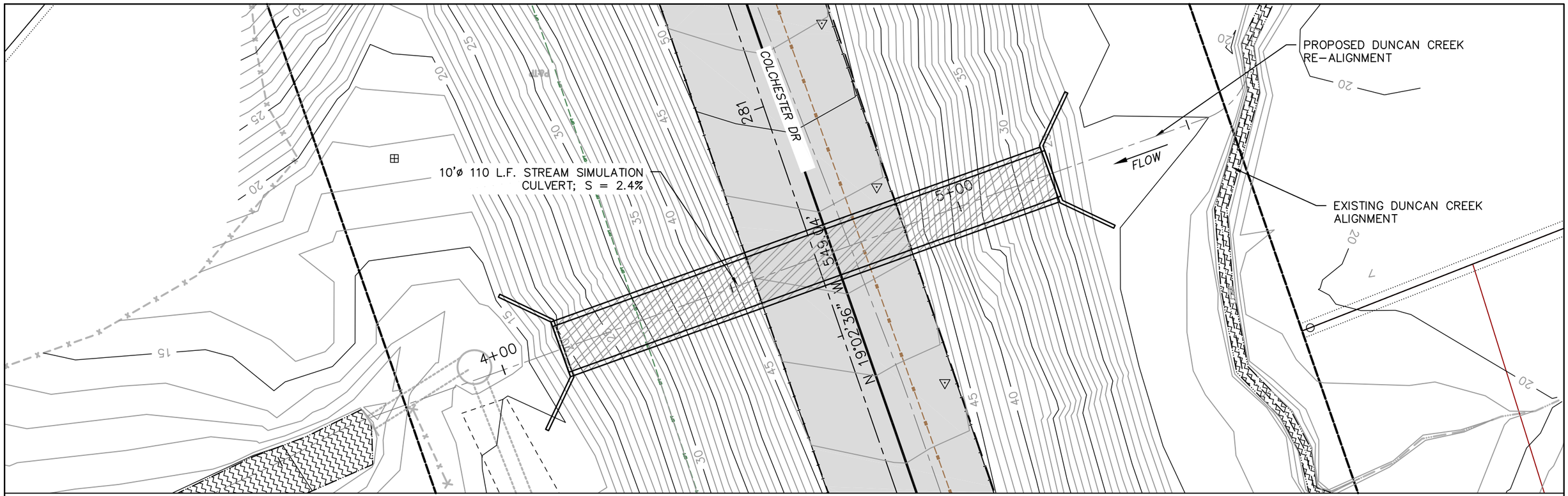
Sincerely,

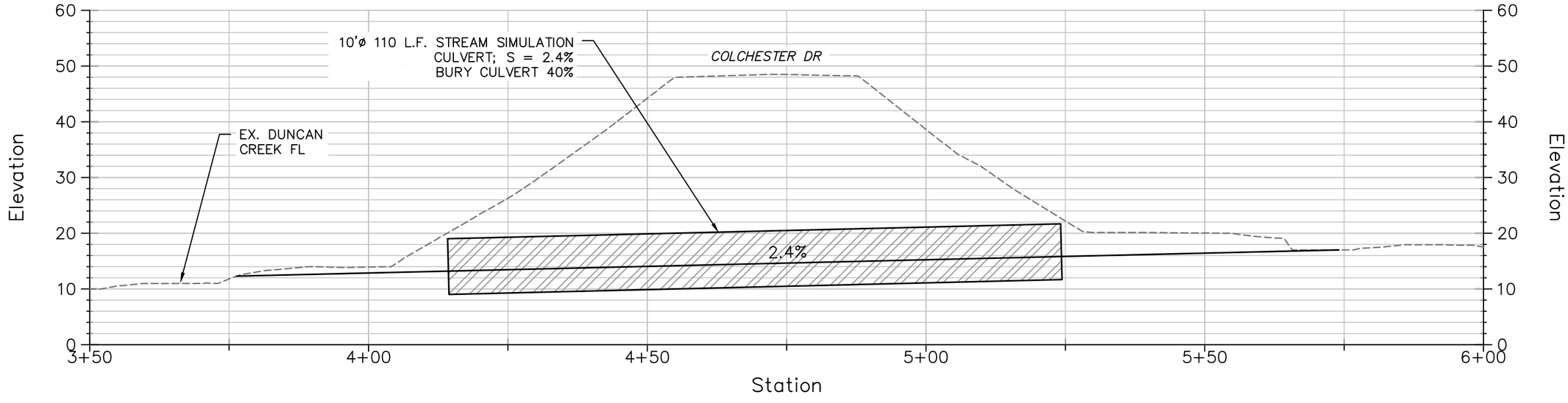
Renee Johnson

Renee Johnson| WSPER Coordinator
Kitsap County Department of Community Development
Port Orchard, WA 98366

ATTACHMENT C:

PELIMINARY ENGINEERING PLANS





KITSAP COUNTY

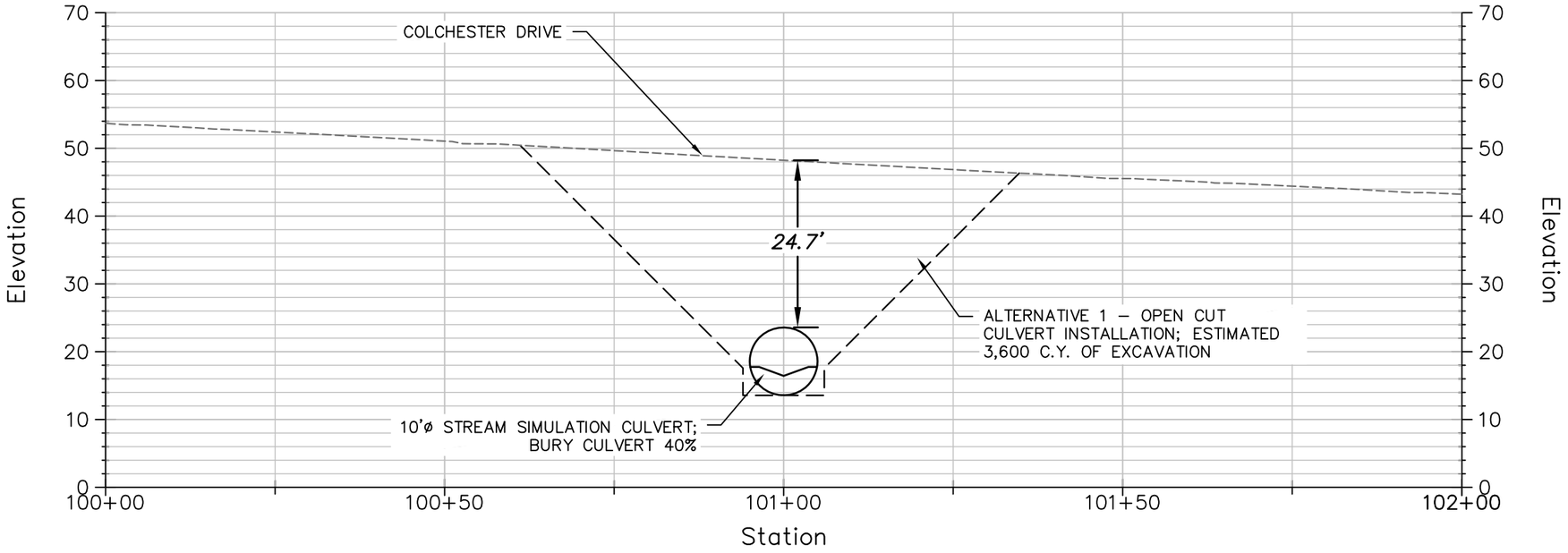
nhc
northwest hydraulic consultants
12787 gateway drive south
tukwila, washington 98168-3308
phone: (206) 241-6000
fax: (206) 439-2420

Job:	2001396
Rev:	0
Drft:	DDH
Chkd:	ERR
Date:	18Jan18

DUNCAN CREEK ALTERNATIVES

PROPOSED CULVERT PLAN & PROFILE

FIGURE A1



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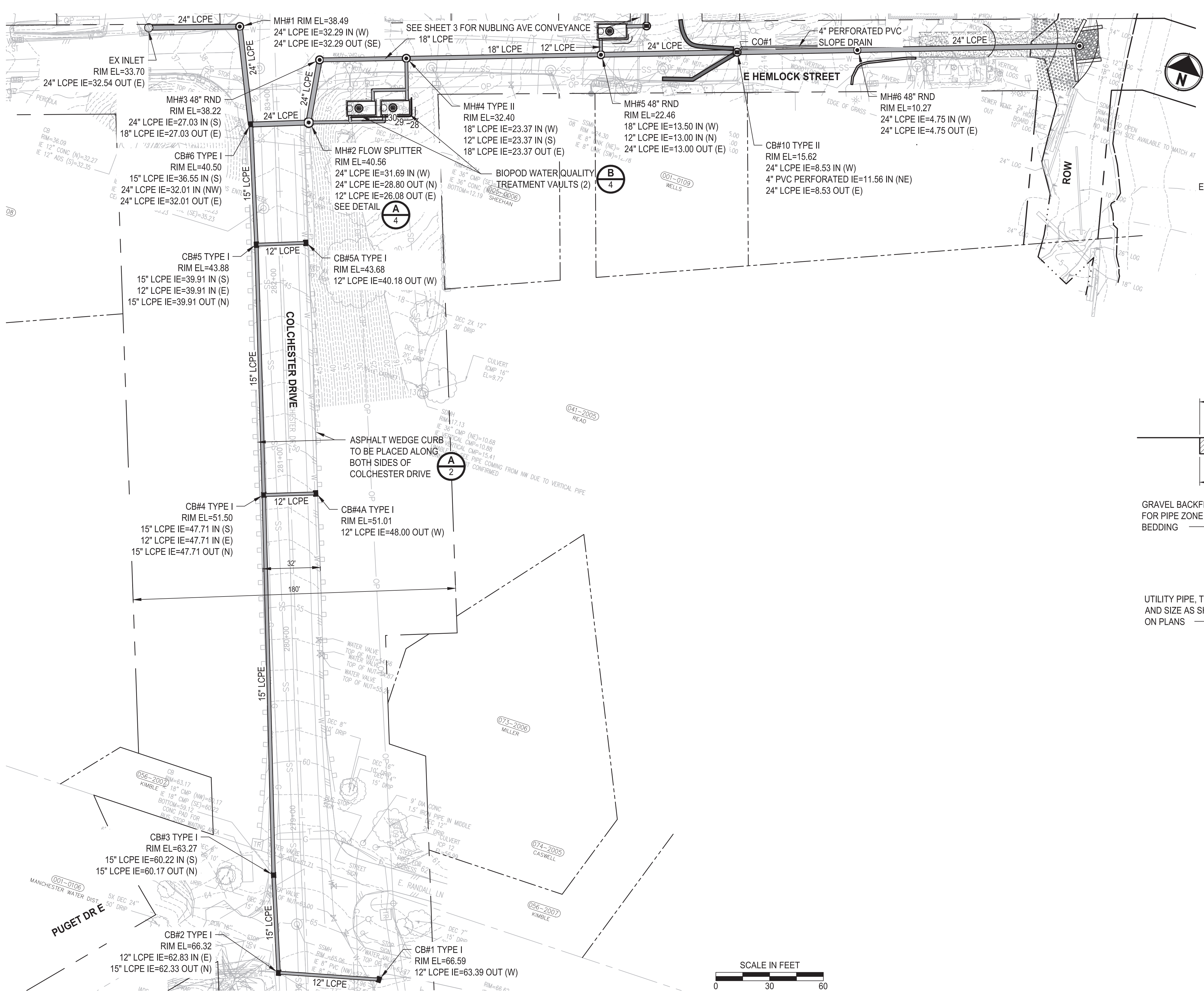
DUNCAN CREEK ALTERNATIVES

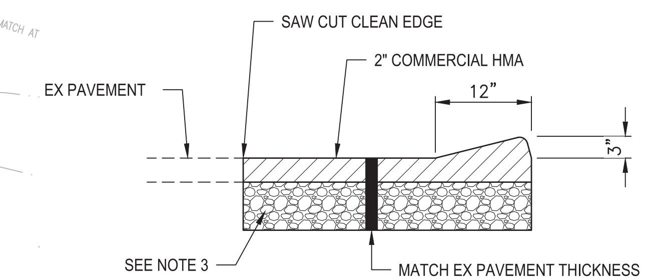
PROPOSED CULVERT - OPEN CUT ALTERNATIVE
SECTION VIEW

FIGURE A2



GENERAL NOTES

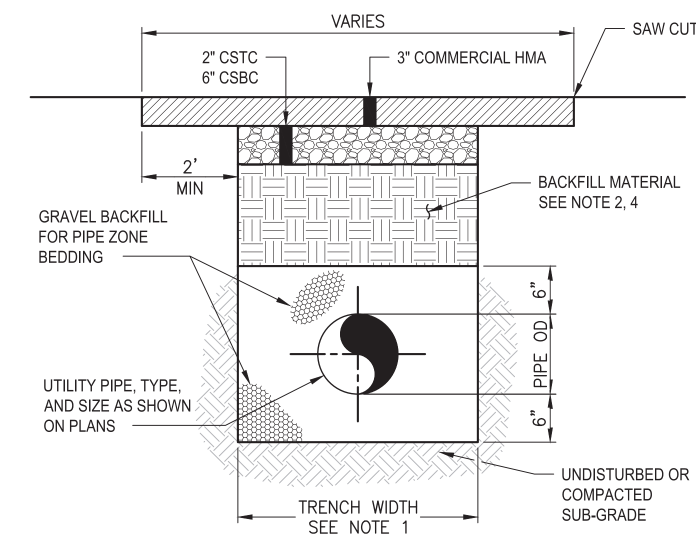
1. ALL DRAINAGE STRUCTURES PER WSDOT STD PLANS UNLESS NOTED.
2. ALL PIPE TRENCHING AND PAVEMENT REPAIR TO ADHERE TO DETAIL B/TYP BELOW.



NOTES:

1. PROVIDE POSITIVE SLOPE TO CATCH BASIN.
2. TACK FACE OF SAWCUT OR JOINT WITH AR 4000W OR EQUIVALENT.
3. COMPACT TO 95% MAX DENSITY

ASPHALT WEDGE CURB
DETAIL A/2
SCALE



NOTES:

1. SEE WSDOT STANDARD SPECIFICATIONS SECTION 2-09.4 FOR MEASUREMENT OF TRENCH WIDTH.
2. BACKFILL TRENCHES WITH SPECIAL BORROW OR SUITABLE NATIVE MATERIAL AS DIRECTED BY THE ENGINEER.
3. SEE WSDOT STANDARD SPECIFICATIONS SECTION 9-03.12(3) FOR GRAVEL BACKFILL FOR PIPE ZONE BEDDING.
4. COMPACT TO 95% OF MAXIMUM DENSITY.

PIPE TRENCHING AND PAVEMENT REPAIR
DETAIL B/TYP
SCALE

Parametrix
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P 360.377.0014
WWW.PARAMETRIX.COM

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BOARD OF COMMISSIONERS:	HORIZONTAL DATUM:
ROBERT GELDER CHARLOTTE GARRIDO EDWARD E. WOLFE	NAD 1983(91) WASHINGTON STATE PLANE NORTH ZONE, US SURVEY FT
DIRECTOR OF PUBLIC WORKS: ANDREW NELSON, PE	VERTICAL DATUM: NGVD29

REVISIONS

No.	BY	DATE	DESCRIPTION

SURVEYED:	PMX
DESIGNED:	RS
DRAWN:	RS
CHECKED:	DD
CRP No.	
DATE:	7/10/20

RHIANNON K SAYLES, STATE OF WASHINGTON, 58086, REGISTERED PROFESSIONAL ENGINEER

KITSAP COUNTY 1857 WASHINGTON

KITSAP COUNTY
DEPT. OF PUBLIC WORKS
614 DIVISION STREET MS-26
PORT ORCHARD, WA 98366
TEL:(360) 337-5777 FAX:(360) 337-4867

COLCHESTER DRIVE STORMWATER IMPROVEMENTS

COLCHESTER DRIVE CONVEYANCE PLAN

KITSAP COUNTY, WASHINGTON
SECTION 22, TOWNSHIP 24 NORTH, RANGE 2 EAST, W.M.

SHEET 2 OF 6

ATTACHMENT D:

PRELIMINARY COST ESTIMATE

KITSAP COUNTY PUBLIC WORKS
DUNCAN CREEK FISH BARRIER RESTORATION
PRELIMINARY COST ESTIMATE

By: P.Struck
Date: 1/25/24

Bid Item	Description	Unit	# of Units	Unit Cost	Total Cost
1	Minor Change	EST.	1	$ 30,000.00	$30,000
2	Protection and Support of Existing Utilities	LS	1	$ 20,000.00	$20,000
6	Mobilization	LS	1	$ 194,990.00	$194,990
7	Project Temporary Traffic Control	LS	1	$ 75,000.00	$75,000
8	Clearing and Grubbing	LS	1	$ 25,000.00	$25,000
9	Removal of Structure and Obstruction	LS	1	$ 50,000.00	$50,000
10	Remove Asphalt Concrete	SY	500	$ 20.00	$10,000
11	Sawcut Asphalt Concrete Pavement	LF	60	$ 10.00	$600
12	Roadway Excavation Inc. Haul	CY	300	$ 35.00	$10,500
13	Channel Excavation Incl. Haul	CY	150	$ 80.00	$12,000
14	Unsuitable Foundation Excavation Incl. Haul	CY	100	$ 60.00	$6,000
15	Special Borrow Incl. Haul	Ton	50	$ 60.00	$3,000
16	Trimming and Cleanup	Each	1	$ 10,000.00	$10,000
17	Crushed Surfacing Base Course	Ton	200	$ 55.00	$11,000
18	Crushed Surfacing Top Course	Ton	150	$ 70.00	$10,500
19	HMA Class 1/2 In. PG 58H-22	Ton	360	$ 250.00	$90,000
20	Contractor Designed Buried Culvert Structure	LS	1	$ 980,000.00	$980,000
22	Stormwater Treatment	LS	1	$ 90,000.00	$90,000
23	Corrugated Polyethylene Storm Sewer Pipe 12 In. Diam.	LF	550	$ 100.00	$55,000
24	Corrugated Polyethylene Storm Sewer Pipe 18 In. Diam.	LF	450	$ 150.00	$67,500
25	New storm marine outfall at Hemlock Street	LS	1	$ 90,000.00	$90,000
26	Catch Basin Type 1	Each	6	$ 3,000.00	$18,000
27	Catch Basin Type 2	Each	4	$ 5,000.00	$20,000
28	Temporary Stream Diversion and Fish Block Net	LS	1	$ 65,000.00	$65,000
29	Temporary Erosion and Sediment Control	LS	1	$ 10,000.00	$10,000
30	High Visibility Fence	LF	400	$ 10.00	$4,000
31	Coir Erosion Control Blanket	SY	800	$ 10.00	$8,000
32	PSIPE	LS	1	$ 10,000.00	$10,000
33	Coarse Compost	LS	1	$ 5,000.00	$5,000
34	Plastic Line	LF	600	$ 8.00	$4,800
35	Beam Guardrail Type 31	LF	150	$ 100.00	$15,000
36	Rock for Erosion and Scour Protection Class A	Ton	50	$ 500.00	$25,000
37	Streambed Sediment	Ton	200	$ 75.00	$15,000
38	Streambed Cobble	Ton	200	$ 80.00	$16,000
39	Streambed Boulders	Each	50	$ 80.00	$4,000
40	Dewatering	LS	1	$ 50,000.00	$50,000
41	Large Woody Material	Each	12	$ 2,000.00	$24,000
42	Field Office Building	LS	1	$ 10,000.00	$10,000
				Subtotal Construction	**$2,144,890**

Sales Tax	9.2%	$197,330
	Total Construction	**$2,342,220**
Contingency and Inflation	30.0%	$643,467
Final Design	20.0%	$428,978
Permits	2.0%	$42,898
Construction Engineering Svcs	Consultant	$25,000
Construction Management	By KCPW	$0
	GRAND TOTAL PROJECT	**$3,482,563**