March 12, 2015

Josh Tacchini, PE
City of Corvallis Public Works Department
1245 NE 3rd Street
Corvallis, Oregon 97330

Subject: Floodplain Permitting for SWMP – Dixon Creek Log Crib Replacement and Fish Passage.

Dear Mr. Tacchini,

River Design Group (RDG) was retained by the City of Corvallis to provide professional engineering design services for a streambank restoration and a fish passage project on Dixon Creek in northwest Corvallis. The project is located on Dixon Creek downstream from 29th Street in a Zone AE on FIRM community panel 41003C0183F as shown in Figure 1.

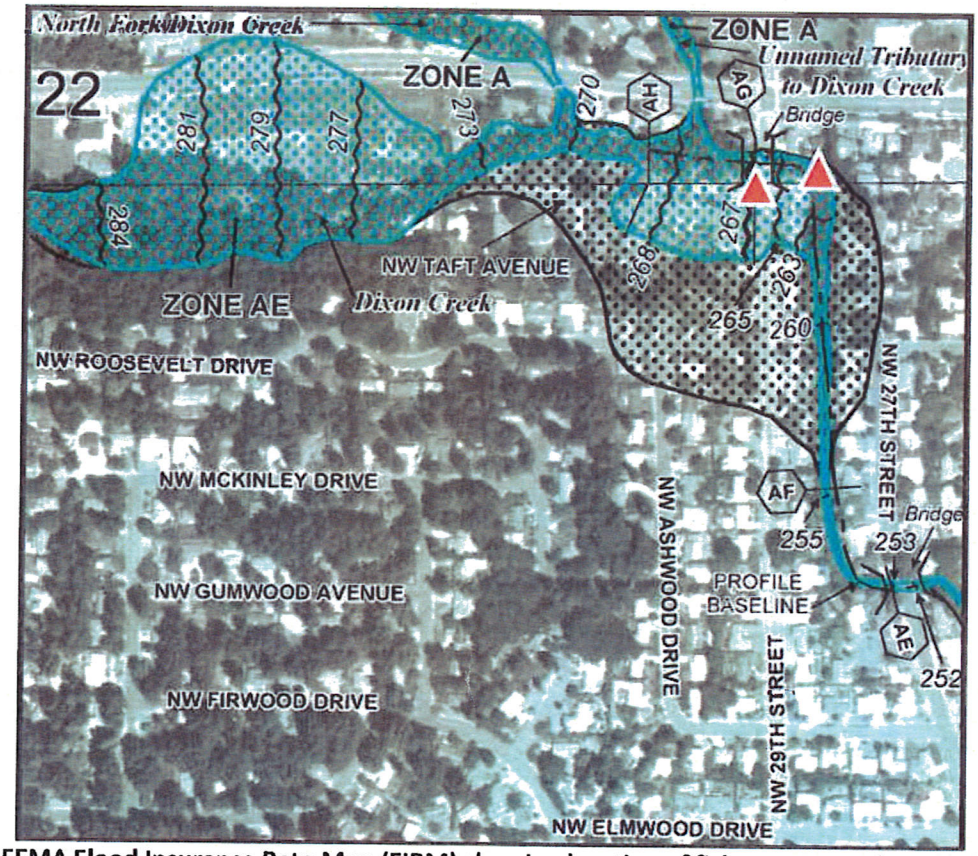

Figure 1. FEMA Flood Insurance Rate Map (FIRM) showing location of fish passage and streambank restoration projects (red triangles) and floodplain extents.

The project location within a Zone AE area indicates an area likely inundated by the base flood, with established elevations. A floodway was not defined for Dixon Creek in the Benton County FIS. Inclusion in this hazard mapping makes the project subject to City of Corvallis Land Development Code Chapter 4.5 Floodplain Provisions. The City of Corvallis Natural Hazards Map identifies this region as partial protection floodplain.

The proposed projects on Dixon Creek address in-stream conditions that were identified in the City of Corvallis Storm Water Master Plan (SWMP) (Brown and Caldwell 2000). The replacement of the aging timber crib wall is meant to remove a source of contamination from creosote-coated timbers within the stream channel, while restoring the bank with ecologically sensitive bioengineering techniques. Evaluating fish passage at the 29th Street crossing was identified in the SWMP, and this project intends to improve passage through the crossing with modifications to the culvert and an engineered riffle.

The proposed in-stream projects are designed to be compliant with the City Land Development Code Floodplain Provisions. Both projects are appurtenant to the channel in purpose and function and therefore the actions cannot be separated from the channel itself. Water dependant uses, including work on drainage and stormwater facilities, is permitted within flood hazard areas by City Code (4.5.90.02 e) provided that certain conditions are met, including a demonstration of no rise in base flood. The following information is meant to demonstrate that the project is in compliance with the code both with a pre-project / with-project comparison of hydraulic model results and through a volumetric exchange that removes 34 cubic yards of material from the project site. This memorandum is intended to accompany the floodplain development permit.

Project Description and Purpose: Dixon Creek Crib Wall

The Dixon Creek crib wall is located downstream from the NW 29th Street-Dixon Creek crossing. With project stationing starting at the NW 29th Street crossing outlet, the crib wall starts at STA 0+93 and ends at STA 2+09. The wall is between 4 and 5 ft high, 116 feet long, and conforms to an approximate 90-degree bend in Dixon Creek. The crib wall is constructed from creosote-impregnated telephone poles held by concrete-stabilized piers, also constructed from wooden poles. The crib structure appears to have been installed to steady the toe of Dixon Creek to prevent lateral erosion and to stabilize the streambank and slope above the wall. The height of bank varies along the length of the wall from approximately 12 to 20 ft. The age of the wall and subsurface conditions are unknown based on our visual observations.

The log crib wall has been previously studied, and its condition and presence were noted in the SWMP in 2000 (Brown and Caldwell 2000). The plan noted the structure was being undermined and recommended a pre-emptive replacement with an "environmentally-appropriate structure associated with upper bank riparian revegetation". Current conditions of the log crib structure are shown in Figure 2.

Figure 0. An overview of the Dixon Creek crib wall. On left, looking upstream at wall near apex of bend and right photo is looking downstream at wall

The structure has been undermined in places throughout its length, and erosion and condition of the wall are worse at the downstream portion of the wall. The downstream approximate third of the structure is deflecting inward towards the channel. Material behind this portion of the wall has been eroded, creating a void behind the wall at the streambank toe, as seen in Figure 3.

Figure 3. View of undermined portion of crib wall deflecting into channel.

The wall is intended to be replaced with a bioengineering streambank restoration, consisting of a vegetated rock wall with large wood, and a planted upper slope. The location of the streambank is proposed for the same location as existing, and the course of Dixon creek would remain the same with the project. A schematic section of the proposed project is shown in Figure 4, and more detail on the project is included in Appendix B.

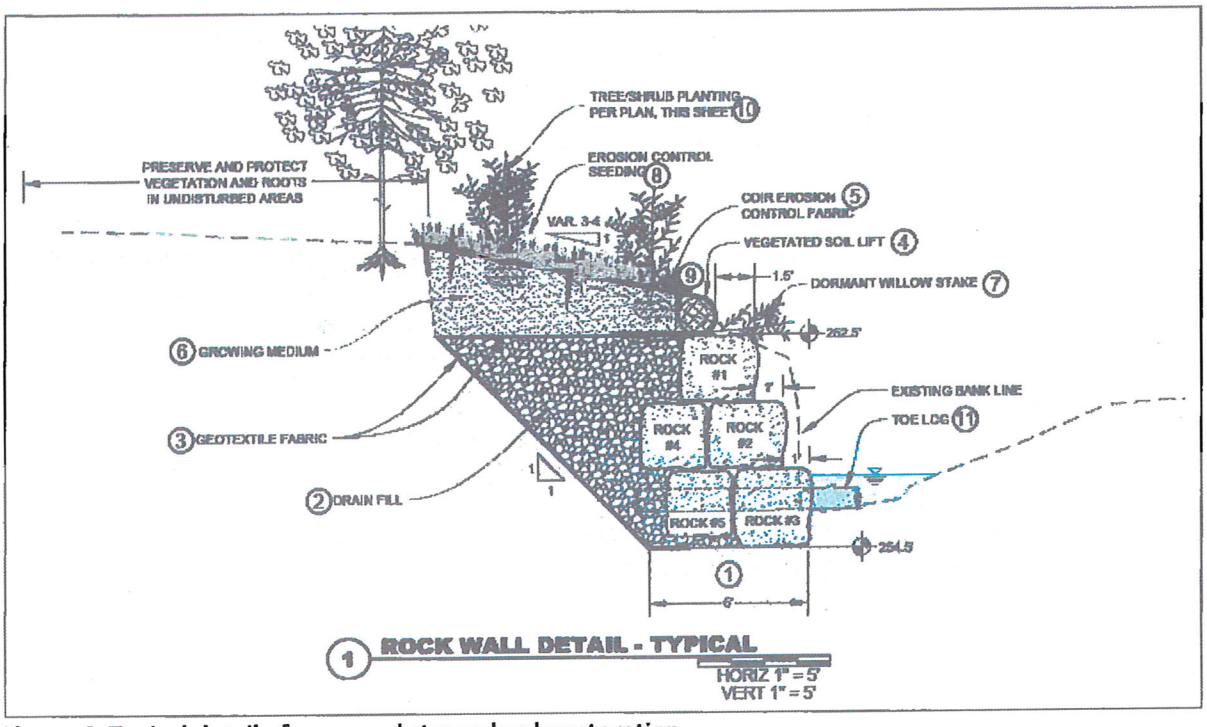

Figure 4. Typical detail of proposed streambank restoration.

29th Street Fish Passage

The City of Corvallis SWMP also identifies fish passage as a concern at the 29th Street concrete box culverts. As part of this project, passage conditions through the culvert were evaluated using procedures identified by the Oregon Department of Fish and Wildlife (ODFW) and NOAA Fisheries. As such, the culvert was evaluated at flows occurring 90% of the time yearly, but not for extremely low or extremely high flows. Passage through the box culverts is most impacted at low flows, when water depths in the culvert are too shallow for fish passage. Additionally, at low flows a jump exists downstream of the culvert concrete apron. This portion of the project intends to provide fish passage by retrofitting the culvert to consolidate depth at low flows, and to provide an engineered riffle downstream of the culverts to eliminate the jump downstream of the structure.

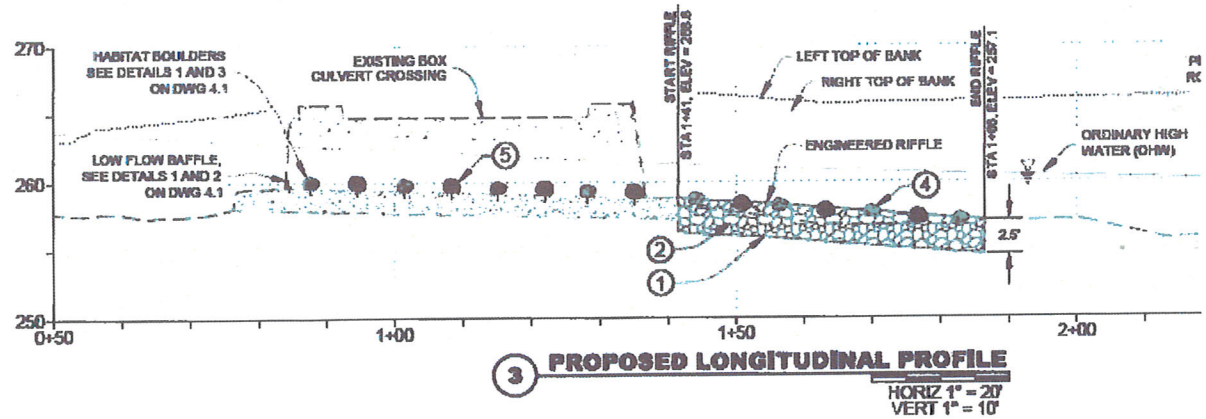

Figure 5. Profile of 29th Street box culverts and proposed fish passage retrofits.

Project drawings representing the proposed projects in greater detail, including topographic survey, grading, existing and proposed ground topography are included in Appendix B.

100-YEAR BASE FLOOD NET-RISE IMPACTS

Impacts of the proposed project on base flood water surface elevations (WSELs) were evaluated by comparing a hydraulic model representing existing conditions (EG) with a model representing with-project conditions (FG). The models cover the same extent of Dixon Creek encompassing the project area, and extending both upstream and downstream of the project area. Figure 6 provides an overview of the hydraulic model depicting cross-section layout.

Figure 6. Plan view of hydraulic model layout showing cross-section locations. Water flows from left to right and then top to bottom of the figure.

Base flood discharge is documented in the FIS for this reach of Dixon Creek at the 29th Street crossing. The base flood value from the FIS was used to analyze potential water surface rise impacts from the project. A summary of the results are provided in Table 1.

Table 1. Summary of modeled discharge.

Recurrence	Discharge (cfs)	Notes
100-year RI - FIS	465	Base Flood

The existing condition (EG) hydraulic model was developed from ground geometry comprised of bathymetric field data from a topographic survey, a topographic survey of in-channel features and structures, and from LiDAR. Peak flow data (Table 1) were input into the hydraulic model for analysis. The model produced a baseline set of conditions from which project affects can be evaluated.

A with-project / finished ground (FG) hydraulic model was developed from proposed ground topography that was created for the site grading plan in Autocad Civil3D. The FG model represents the as-designed topography throughout the project areas, and also represents unaltered portions of ground upstream and downstream from the project areas.

A normal depth boundary condition at the downstream extent of the reach was used for both models, and allows potential changes in water surface elevation to be evaluated independent of any backwater affects that could mask changes in water surface elevation. Roughness values were based on roughness values presented for Dixon Creek in the Benton County FIS and range from 0.08 to 0.13 on the overbank and floodplain regions, and 0.04 to 0.05 in the channel.

Water surface elevations (WSELs) from the with-project model were compared to WSELs from the existing conditions model to isolate any rise impacts to base flood water surface elevations attributable to the project. A comparison of WSELs shows a region downstream of the proposed project where the water surface is not affected by the work, a region through the project area where there is a slight lowering in WSEL, and then an upstream reach where the lowered FG WSEL begins to converge with the EG WSEL. Water surface profiles are shown in Figure 7.

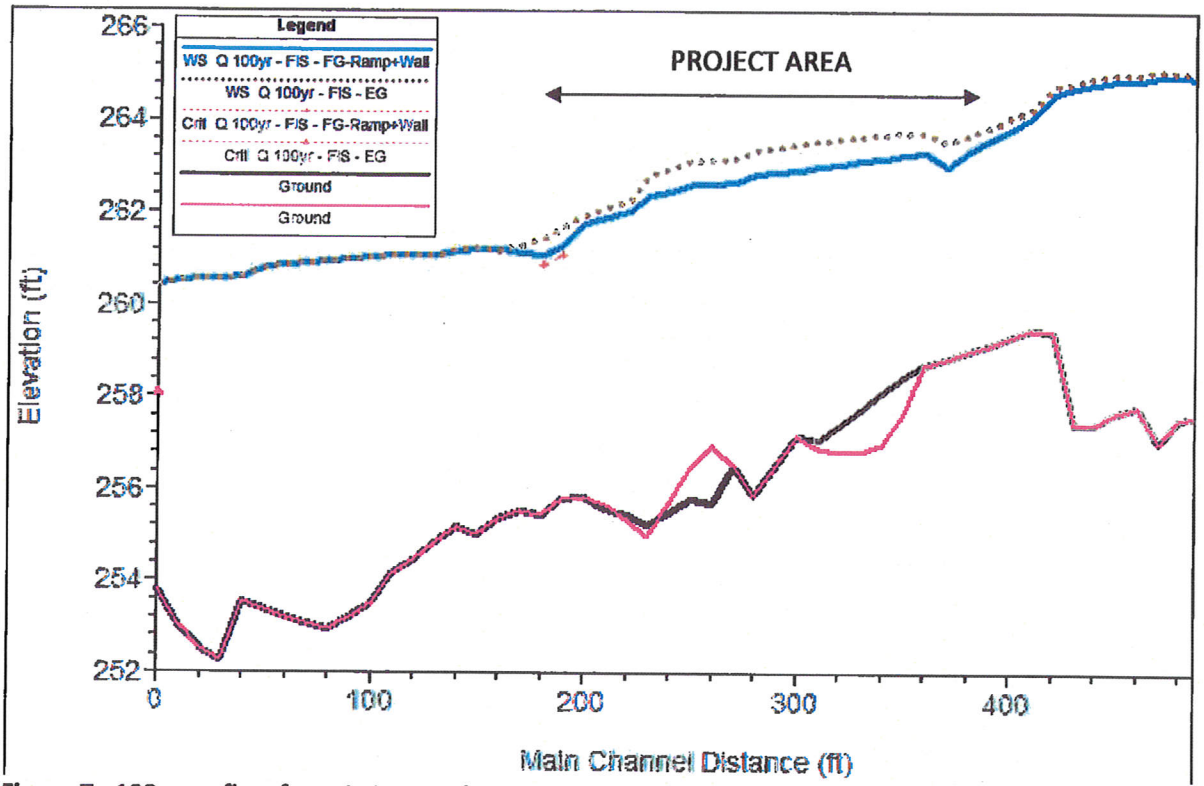

Figure 7. 100-year flow for existing conditions modeled WSEL (red) and proposed conditions modeled WSEL (blue) in the project reach.

The lowering throughout the project area is attributable to a volumetric exchange, where 34 cubic yards of bank material is removed as a result of the project. A cross-section typical of the project reach, showing a comparison of existing ground (EG) versus proposed finished ground (FG), is shown in Figure 8 to illustrate conditions that result in the volumetric exchange.

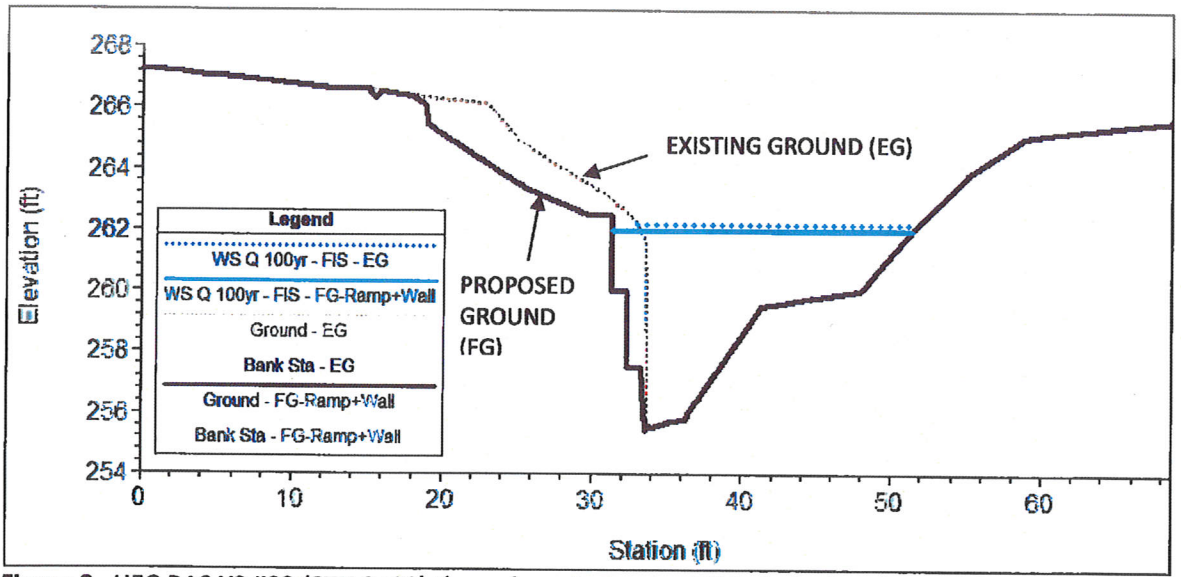

Figure 8. HEC-RAS XS #23 (STN 2+80) through project area. EG is dashed and FG solid lines, showing volumetric exchange / net removal typical of project area.

The maximum reduction in WSEL is shown mid-way though the stream bank portion of the project and is approximately 0.5 ft. The project area with the engineered riffle for fish passage also exhibits a reduction in WSEL, which is attributable to the streambank work occurring downstream. Water surface profiles, and the relative change in water surface are provided in Table 2.

Table 2. HEC-RAS model output comparing existing (EG) to proposed conditions (FG).

XS # / River Station		Water Surface Elevation Existing (EG)	Water Surface Elevation Proposed (FG)	Difference (FG-EG)*
50	0+05.00	265.06	264.96	-0.1
49	0+10.00	265.05	264.95	-0.1
48	0+20.00	265.07	264.96	-0.11
47	0+30.00	265.08	264.98	-0.1
46	0+40.00	265	264.9	-0.1
45	0+50.00	265	264.89	-0.11
44	0+60.00	264.93	264.81	-0.12
43	0+70.00	264.85	264.73	-0.12
42	0+80.00	264.73	264.6	-0.13
41	0+90.00	264.24	264.06	-0.18
40	1+00.00	264.05	263.83	-0.22
39	1+10.00	263.87	263.58	-0.29
38	1+20.00	263.68	263.32	-0.36
37	1+30.00	263.49	263.01	-0.48
36	1+40.00	263.73	263.29	-0.44
35	1+50.00	263.72	263.24	-0.48
34	1+60.00	263.67	263.15	-0.52
33	1+70.00	263.64	263.1	-0.54
32	1+80.00	263.6	263.06	-0.54
31	1+90.00	263.55	263.01	-0.54
30	2+00.00	263.47	262.91	-0.56
29	2+20.00	263.34	262.82	-0.52
28	2+30.00	263.18	262.63	-0.55
27	2+40.00	263.14	262.62	-0.52
26	2+50.00	263.12	262.59	-0.53
25	2+60.00	262.95	262.45	-0.5
24	2+70.00	262.8	262.35	-0.45
23	2+80.00	262.22	262	-0.22
22	2+90.00	262.1	261.89	-0.21
21	3+00.00	261.93	261.75	-0.18
20	3+10.00	261.66	261.26	-0.4
19	3+20.00	261.39	261.05	-0.34
18	3+30.00	261.29	261.09	-0.2
17	3+40.00	261.16	261.18	0.02
16	3+50.00	261.23	261.19	-0.04

XS # / River Station		Water Surface Elevation Existing (EG)	Water Surface Elevation Proposed (FG)	Difference (FG-EG)*
15	3+60.00	261.17	261.15	-0.02
14	3+70.00	261.07	261.07	0
13	3+80.00	261.08	261.08	0
12	3+90.00	261.05	261.05	0
11	4+00.00	261.02	261.02	0
10	4+10.00	260.97	260.97	0
9	4+20.00	260.92	260.92	0
8	4+30.00	260.88	260.88	0
7	4+40.00	260.85	260.85	0
6	4+50.00	260.79	260.79	0
5	4+60.00	260.57	260.57	0
4	4+70.00	260.56	260.56	0
3	4+80.00	260.55	260.55	0
2	4+90.00	260.5	260.5	0
1	5+00.00	260.43	260.43	0

*negative number denotes water surface lowering post-project

SUMMARY

This letter conveys assurance that the proposed project is designed to not produce a rise in base flood, achieved through volumetric exchange and net removal of material from the channel. All materials proposed for the project that will become permanent features in the channel/floodplain are designed to be resistant to flood damage and consist of stable large rocks, logs, in-situ cobble and gravel materials, and native vegetation, appropriate for the channel environment. Proposed works are ballasted to prevent floatation and dislocation from the project site.

If I may answer any questions or be of further assistance please do not hesitate to contact me.

Respectfully,

Chris Smith, P.E., CFM
Project Engineer

Appendix A – No-Rise Certification

FLOODWAY "NO-RISE/NO-IMPACT" CERTIFICATION

This document is to certify than I am a duly qualified engineer licensed to practice in the State of Oregon. It is to further certify that the attached technical data supports the fact that the proposed SWMP – Dixon Creek Log Crib Replacement and Fish Passage project at the 29th Street bridge and downstream will not impact the base flood elevation, floodway elevation, or floodway widths on Dixon Creek as published in the Flood Insurance Study for Benton County, Oregon and Incorporated Areas, dated June 2, 2011.

Christopher Smith
Name

Water Resources Engineer
Title