CHAPTER 6

WATERSHED PLANNING AND ANALYSIS: DIXON CREEK

6.1 INTRODUCTION

Dixon Creek originates in the hills to the northwest of Corvallis. Most of its length lies within the City where it is an important feature of many residential backyards. It also runs through several school properties and parks before reaching commercial property at 9th Street and Reiman Avenue and, shortly thereafter, the Willamette River. The Dixon Creek watershed contains 2,712 acres. The largest land use at present is low-density residential, which covers over one third of the watershed. In addition, medium-density residential, Oregon State University forest (McDonald Forest) land, and vacant parcels each cover about 400 acres.

In the future, if the watershed is developed to full build-out according to the City's Comprehensive Plan, the current vacant land may be largely converted into low- and high-density residential use. Other changes may include a decrease in medium-density residential and an increase in commercial land use. Overall, the number of impervious acres is estimated to increase by 13 percent, from 897 acres to 1,017 acres.

6.2 WATERSHED FINDINGS

Information on watershed conditions was obtained by collecting public comments at open houses, working with City staff to identify maintenance and operation problems, conducting a technical stream evaluation of selected reaches, and modeling the conveyance system for the existing and future build-out scenarios. This information was compiled by stream reach and is summarized in Section 6.2.5. A map of the Dixon Creek watershed, presented as Figure 6-1, shows the location of the stream within the City and identifies some of the major observations made during the watershed study.

Dixon Creek has the characteristics of a highly urbanized stream: increased channel widths and depths with accelerated bank erosion. In most places, the channel is tightly constrained between encroaching houses or other buildings, often a result of filling or stream channel realignment, as shown in Figure 6-2, Photo 1. The encroachment has contributed to flooding and erosion problems, and to habitat loss.

The City has completed several projects in recent years designed to improve conditions in Dixon Creek. Channel restoration and habitat improvements have taken place at Porter Park and at Jefferson School, as shown in Figure 6-2, Photos 2 and 3, respectively. The increased culvert capacity that was provided at Grant Avenue and Garfield Avenue in 1997 has lessened flooding problems along the creek, as shown in Figure 6-2, Photo 4.

Many opportunities for improvements exist in the Dixon Creek watershed. Figure 6-2, Photo 5 shows an example of commercial parking lots along the lower reaches of Dixon Creek draining directly to the creek without water quality treatment. All reaches of the stream offer riparian enhancement opportunities, as shown in Figure 6-2, Photo 6. Some of these opportunities will be lost if not implemented prior to further development.

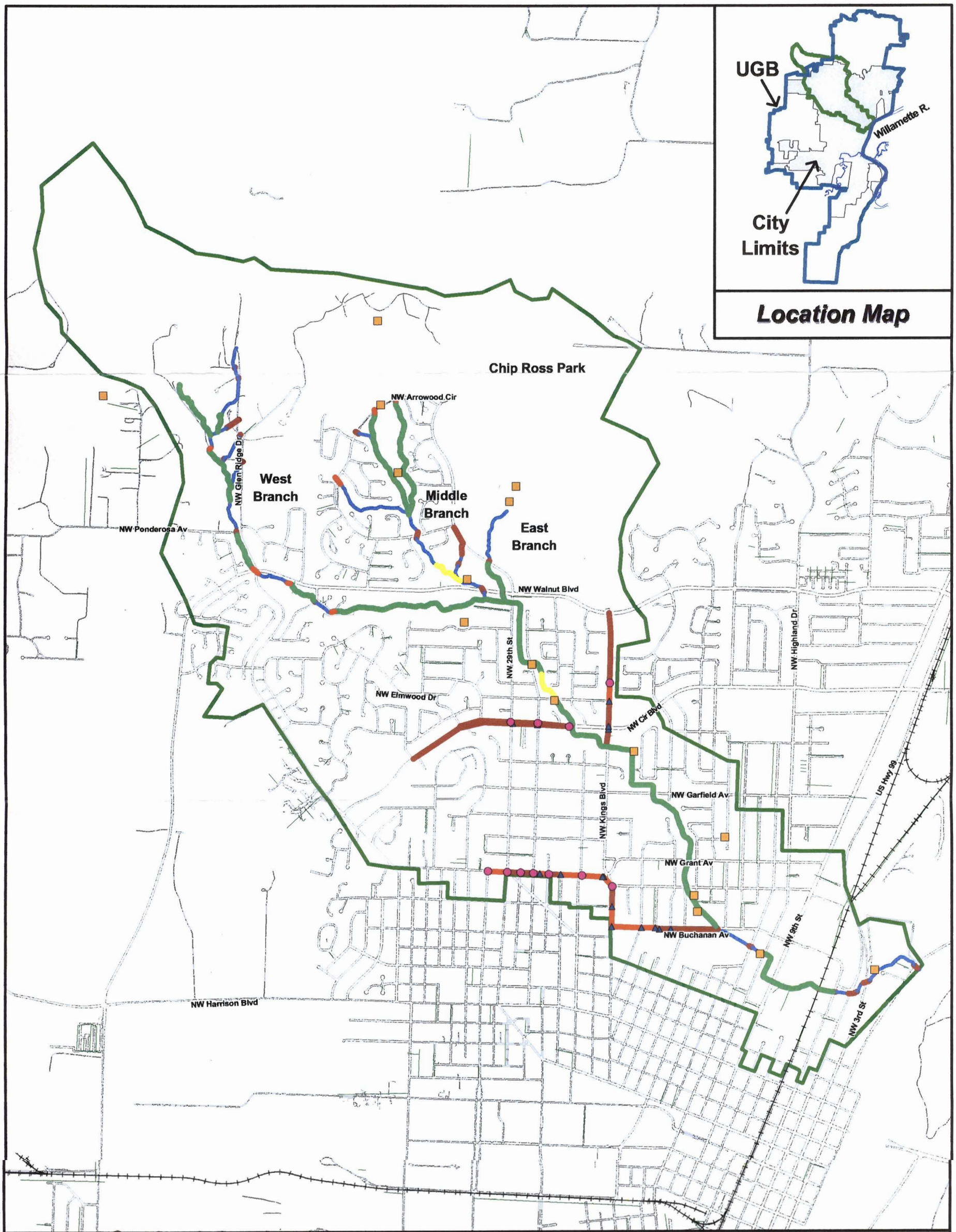

Figure 6-1 Dixon Creek Problem Areas

LEGEND

- Pipes/Bridges
- Channels
- Basin Boundary
- Reported Problems (recorded at open house)
- Surcharged Manholes (10-year future storm)
- Flooded Manholes (10-year future storm)
- High Velocity Areas (> 4 fps, 2-year future storm)
- Undersized Conduits (10-year future storm)
- Undersized Channels (10-year future storm)

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report/figures/Fig6-1v4.wor, October 12, 2000, base data from City of Corvallis GIS Department

Figure 6-2. Watershed Photos

Photo 1. Constricted Dixon Creek channel

Photo 2. Channel restoration at Porter Park

Photo 3. Riparian improvements at Jefferson School

Photo 4. New culverts at Garfield Avenue

Photo 5. Parking lot runoff at Avery Square Shopping Center

Photo 6. Enhancement opportunities behind Northwest Hills Baptist Church

6.2.1 Public Comments

The Stormwater Planning Committee (SWPC), with the support of City staff, has encouraged and facilitated public input into the watershed planning process. Public meetings were held at the Northwest Hills Baptist Church located within the watershed. The first meeting was held on March 30, 1999, and the second on April 6, 1999. During the meetings, residents were encouraged to share their knowledge of problem areas and to identify opportunities for improving the health of Dixon Creek, its watershed, and its stormwater functions. Reach-specific comments are in Section 6.2.5. Some general comments are provided below:

- "Should protect natural areas (including wetlands). Natural areas promote wildlife."
- "Lower part of Dixon Creek is choked with algae during summer."
- "People do things to channels without understanding impacts."
- "On Dixon Creek, erosion occurs where there is inadequate vegetation."
- "Increased flooding from upslope development."

6.2.2 City Staff Reports

City Engineering and Utilities Operation staff is very familiar with most of the watershed through their day-to-day activities. They provided input into the planning process by identifying known problem areas, recommending areas for stream enhancement activities, and recounting the extent and duration of flooding during major storm events. For example, the extent of flooding from the February 1996 storm was well documented. During that storm, high water and road closures were common within the region bound to the west by Kings Boulevard, to the north by Circle Boulevard, to the east by 9th Street, and to the south by Buchanan Avenue. To reduce the potential for future flooding, especially in the Arthur Circle area, the City initiated a flood mitigation project that added culvert capacity at Grant Avenue and Garfield Avenue, and increased channel capacity by laying back the stream banks at Porter Park. As a result, the conveyance system has undergone less flooding in these reaches during subsequent large rainfall events, including the December 28, 1998 storm, which was a 10-year event.

6.2.3 Field Study Observations

Watershed Applications, a stream rehabilitation specialty firm, conducted a series of field investigations beginning in November 1997 to provide input on the health of City streams. Field personnel evaluated selected lengths of Dixon, Squaw, Sequoia, Jackson, Frazier, and Oak Creeks during these stream walks. A summary of their observations is in section 6.2.5. Detailed descriptions of the field study observations are in Appendix B.

6.2.4 Modeling Results

A computer model for the Dixon Creek watershed identified the hydraulic capacity and projected flows in the pipes, culverts, and channels of the conveyance system for existing and future build-out scenarios. Existing conditions are based on the current level of development at the time of modeling. See Chapter 3 for modeling parameters and assumptions. Future conditions are based on full development (build-out) of the watershed as identified in the City's Comprehensive Plan. A full

range of storm events was modeled for the existing and future scenarios, including the 2-, 10-, 25-, and 100-year storm events.

Table 6-1 shows the hydraulic structures (pipes, culverts, bridge crossings, etc.) that are undersized for the City's 10-year design storm. It is important to note that flooding reported by staff and the public was likely more than in a 10-year storm event. Undersized structures are defined as being surcharged (under pressure) or experiencing flooding. Recommendations to address the undersized structures are in section 6.3. A complete summary of all modeled segments is in Appendix C.

Flooding of the Willamette River impacts the capacity of Dixon Creek's downstream reaches. For example, the Willamette River 100-year floodwater elevation covers the area up to an elevation of 218 feet; consequently, the capacity of the channel immediately upstream of elevation 218 is reduced. The model was constructed to determine the capacity of the channel without the backwater effects of the Willamette River. The modeling shows two channel sections where water elevations from the design storm will overtop the streambank. Both segments occur where surveyed cross-section information was not available; therefore, the channel cross-sections were estimated.

Table 6-1. Modeled Flow for Undersized Hydraulic Structures within the Dixon Creek Watershed, cubic feet per second

Reach/Location/Model segment	Full pipe or channel capacity	10-year storm flows		Flooding predicted by model	Flooding reported by staff or public
		Existing	Future		
9th Street to Buchanan Avenue/Undersized pipe along Buchanan Avenue from 18th Street to 19th Street /DIX275	29	31	31	No	Yes
9th Street to Buchanan Avenue/Undersized pipe along Buchanan Avenue from 19th Street to Kings Boulevard /DIX280	30	31	31	No	Yes
9th Street to Buchanan Avenue/Undersized pipe along Kings Boulevard from Buchanan Avenue to Lincoln Avenue /DIX285	30	31	31	No	Yes
9th Street to Buchanan Avenue/Undersized pipe along Kings Boulevard from Beca Avenue to Grant Avenue /DIX295	12	13	13	Yes	Yes
9th Street to Buchanan Avenue/Undersized pipe along Grant Avenue from Kings Boulevard to 23rd Street. Flooded manhole /DIX300, DIX305	11	13	13	Yes	No
9th Street to Buchanan Avenue/Undersized pipe along Grant Avenue from 26th Street to 27th Street. Flooded manhole /DIX320, DIX325	7.4	8.3	8.3	Yes	No
9th Street to Buchanan Avenue/Undersized pipe along Grant Avenue from 29th Street to 30th Street. Flooded manhole /DIX340	14	15	15	Yes	No
Garfield Avenue to Kings Boulevard/Undersized pipe along Kings Boulevard from Elmwood Drive to Larch Avenue. Flooded manhole /DIX435	18	19	19	Yes	Yes

Reach/Location/Model segment	Full pipe or channel capacity	10-year storm flows		Flooding predicted by model	Flooding reported by staff or public
		Existing	Future		
Kings Boulevard to Circle Boulevard/Undersized pipe along Circle Boulevard discharging into Dixon Creek. Flooded or surcharged manholes along Circle Boulevard from Dixon Creek to 29th Street /DIX395	34	62	62	Yes	Yes
Circle Boulevard to 29th Street/Overflow in channel upstream of Elmwood Drive /DIX613	157	354	358	Yes	No
29th Street to Walnut Boulevard (West Branch)/Undersized culvert at Walnut Place /DIX830	62	90	92	Yes	No
29th Street to Walnut Boulevard (West Branch)/Undersized culvert at Witham Village /DIX850	132	100	100	Yes	No
Walnut Boulevard to Headwaters (West Branch)/Undersized culvert at Walnut Boulevard /DIX860	186	118	119	Yes	No
Walnut Boulevard to Headwaters (West Branch)/Undersized culvert at Live Oak Drive /DIX920	29	27	27	Yes	No
Walnut Boulevard to Headwaters (Middle Branch)/Overflow in channel upstream of pond along Walnut Boulevard /DIX698	65	91	93	Yes	No
Walnut Boulevard to Headwaters (Middle Branch)/Undersized culvert at Arrowood Circle near Sitka Place /DIX800	20	8.0	8.4	Yes	No
Walnut Boulevard to Headwaters (Middle Branch)/Undersized culvert at Arrowood Circle between Boxwood Place and Snowbrush Drive /DIX755	43	24	25	Yes	Yes
Walnut Boulevard to Headwaters (Middle Branch)/Undersized culvert at Arrowood Circle near Snowbrush Drive /DIX730	12	10.3	10.5	Yes	Yes

The hydrologic/hydraulic model also estimated velocities occurring in channel segments to determine areas at risk for channel or streambank erosion. The velocities during the 2-year storm—the storm size most responsible for determining the channel configuration—were compared to the velocity criteria presented in Chapter 3. In general, the criteria identify that velocities in excess of 4 feet per second may cause erosion of the streambank or streambed. Those segments with velocities in excess of the criteria are shown in Table 6-2. Recommendations to address the areas with high velocities are shown in Table 6-3.

Due to steep slopes and the confined nature of the channel, the model predicts that the majority of the Dixon Creek channel shows velocities above the criteria, resulting in erosion. Some of these areas have been identified as having erosion problems (Figure 6-2, Photo 6). However, property owners or the City have already stabilized some of the channel segments at risk of erosion (Figure 6-2, Photo 1).

Table 6-2. Modeled Velocities for Dixon Creek Channel Segments Exceeding 4 Feet per Second

Reach/Model segment	2-year storm		Erosion observed	Existing bank stabilization
	Existing velocities	Future velocities		
3rd Street to Railroad Tracks/DIX220	5.62	5.62	Yes	No
Railroad Tracks to 9th Street/DIX490	6.83	6.84	Yes	No
Railroad Tracks to 9th Street/DIX500	6.71	6.74	Yes	No
9th Street to Buchanan Avenue/DIX510	4.96	4.98	Yes	No
Buchanan Avenue to Grant Avenue/DIX540	5.65	5.68	Yes	No
Buchanan Avenue to Grant Avenue/DIX555	4.44	4.47	Yes	No
Grant Avenue to Garfield Avenue/DIX565	5.06	5.08	Yes	Yes
Grant Avenue to Garfield Avenue/DIX570	5.00	5.06	Yes	Yes
Garfield Avenue to Kings Boulevard/DIX580	6.05	6.11	Yes	No
Garfield Avenue to Kings Boulevard/DIX585	4.38	4.47	Yes	Yes
Kings Boulevard to Circle Boulevard/DIX595	8.20	8.21	Yes	Yes
Circle Boulevard to 29th Street/DIX605	4.21	4.22	No	No
Circle Boulevard to 29th Street/DIX613	5.78	5.84	No	Yes
Circle Boulevard to 29th Street/DIX615	4.83	4.87	No	Yes
Circle Boulevard to 29th Street/DIX625	6.10	6.14	Yes	Yes
Circle Boulevard to 29th Street/DIX630	4.22	4.25	Yes	Yes
29th Street to Walnut Boulevard (West Branch)/DIX665	6.76	6.77	Yes	No
29th Street to Walnut Boulevard (West Branch)/DIX805	5.53	5.55	No	No
29th Street to Walnut Boulevard (West Branch)/DIX810	5.19	5.20	Yes	No
29th Street to Walnut Boulevard (West Branch)/DIX815	5.51	5.52	Yes	No
29th Street to Walnut Boulevard (West Branch)/DIX820	5.31	5.33	Yes	No
29th Street to Walnut Boulevard (West Branch)/DIX825	6.23	6.24	No	No
29th Street to Walnut Boulevard (West Branch)/DIX845	4.81	4.82	Yes	No
Walnut Boulevard to Headwaters (West Branch)/DIX865	10.17	10.15	Yes	No
Walnut Boulevard to Headwaters (West Branch)/DIX885	7.87	7.89	Yes	No
Walnut Boulevard to Headwaters (West Branch)/DIX890	7.16	7.17	No	No
Walnut Boulevard to Headwaters (West Branch)/DIX915	8.34	8.34	No	No
Walnut Boulevard to Headwaters (West Branch)/DIX930	6.43	6.41	No	No
Walnut Boulevard to Headwaters (West Branch)/DIX950	4.13	4.13	No	No
Walnut Boulevard to Headwaters (Middle Branch)/DIX710	5.69	5.78	No	No
Walnut Boulevard to Headwaters (Middle Branch)/DIX715	5.70	5.78	No	No
Walnut Boulevard to Headwaters (Middle Branch)/DIX720	5.58	5.68	No	No
Walnut Boulevard to Headwaters (Middle Branch)/DIX725	4.36	4.45	No	No
Walnut Boulevard to Headwaters (Middle Branch)/DIX735	6.33	6.38	Yes	No
Walnut Boulevard to Headwaters (Middle Branch)/DIX740	5.56	5.62	Yes	No
Walnut Boulevard to Headwaters (Middle Branch)/DIX745	6.94	7.01	Yes	No
Walnut Boulevard to Headwaters (Middle Branch)/DIX750	4.23	4.28	No	No
Walnut Boulevard to Headwaters (Middle Branch)/DIX760	5.78	5.84	Yes	No
Walnut Boulevard to Headwaters (Middle Branch)/DIX795	3.88	4.08	No	No
29th Street to Headwaters (East Branch)/DIX640	4.62	4.62	Yes	No
29th Street to Headwaters (East Branch)/DIX650	4.38	4.40	Yes	No

Note: Only segments with velocities in excess of 4 feet per second were selected.

6.2.5 Stream Reach Summaries

For study purposes, Dixon Creek was divided into a number of reaches based on physical characteristics of the stream, property ownership, and any other unique characteristics that might distinguish one section of the stream from the rest. The study findings are summarized in the following sections by reach description. The comments provided by the public are shown as they were recorded during public meetings. Clarification of the comments is provided, where necessary, and is shown in parenthesis.

Willamette River to 3rd Street

Public Comments: "Severe erosion. High velocity after Highway 99. Lost two oak trees."

City Staff Reports: Woody debris can be found within several sections of the channel. The tree cover in this reach is good. During summer months a stagnant pool exists upstream of the culvert at 2nd Street. During low-flow periods, fish passage is not possible at the downstream end of the culvert on 2nd Street due to the current culvert configuration. A recent stream restoration project improved flow characteristics and replanted the streambanks near 3rd Street. Improvements included widening the south side of the bank to establish a low-flow channel and increase high-flow capacity. Private ownership extends to the centerline of the creek on the south side, and the City owns the north side.

Field Observations: A technical evaluation of the physical conditions within this reach was not performed.

Modeling Results: Culverts and bridges within this reach are adequately sized for the full range of modeled storms for existing and future build-out conditions. Stream velocities were predicted to be relatively low for the 2-year storm event. This area is in the Willamette River 100-year floodplain with floodwater elevations to an elevation of 218 feet. Water surface elevation in downstream portions of Dixon Creek will be impacted by Willamette River flood events.

3rd Street to Railroad Tracks

Public Comments: No public comments were received for this reach.

City Staff Reports: The channel is narrow and incised throughout this reach. A portion of this reach has been dedicated to the City. This reach lacks adequate tree canopy shading. No flooding was experienced in this area, even during the 1996 and 1998 storm events. Oregon Department of Transportation (ODOT) owns the area between 3rd and 4th Streets. Fish passage issues through culverts in this area will need to be addressed by ODOT. City Parks Department maintains the area through an intergovernmental agreement with ODOT.

Field Observations: A technical evaluation of the physical conditions within this reach was not performed. Prior to urbanization, this portion of Dixon Creek provided downstream storage capacity. When development occurred in this area, fill was imported to minimize seasonal flooding.

Modeling Results: Culverts and bridges within this reach are adequately sized for the 10-year storm event for existing and future build-out conditions. The model showed that stream velocities between 5th Street and the railroad tracks would exceed the 4-feet-per-second criteria during the 2-year storm event.

Railroad Tracks to 9th Street

Public Comments: "How much responsibility does Avery Square have for stream discharge?"

City Staff Reports: A Stream Restoration Project was recently completed on a small section of this reach. The channel and adjacent lands in this reach have been dedicated to the City. This reach lacks adequate tree canopy shading. The City has not received reports of flooding in this area even during the 1996 and 1998 storm events. The left bank (facing upstream) at Avery Square is experiencing erosion and bank failure.

Field Observations: Overhead canopy coverage is very poor, and overall instream and riparian habitat quality is extremely poor. Native herbaceous wetland species such as rushes and sedges (e.g. Scirpus sp.), along with reed canarygrass and other weedy graminoids, occur along the channel bottom upstream of Reiman Avenue. Stormwater runoff entering the stream directly from the Avery Square parking lot could contribute to water quality degradation. Slump failures of the over-steepened left bank (facing upstream) are located downstream of 9th Street. Significant erosion is evident on the right bank downstream of the Reiman Avenue crossing. Minor bank erosion from Reiman Avenue to 9th Street.

Modeling Results: Culverts and bridges within this reach will pass the 10-year storm event for existing and future build-out conditions. Stream velocities in this reach exceed the 4-feet-per-second criteria during the 2-year storm event.

9th Street to Buchanan Avenue

Public Comments: "House is 20 feet from creek and slowly settling. House is 40 years old. (Stream bank stability is suspect.)"

City Staff Reports: A City Stream Restoration Project was recently completed at Corvallis High School. A City sanitary sewer located downstream of 11th Street acts as a low dam that ponds water upstream of the pipe crossing. A 36-inch storm sewer enters the stream near the Buchanan Avenue bridge. The 36-inch sewer serves the drainage basin to the west, which is a mix of commercial and residential development. This storm drain presents an opportunity for end-of-pipe treatment prior to discharge to Dixon Creek. This reach has mixed tree cover. Private ownership extends to the centerline of the stream. Parking lots upstream of 9th Street drain directly to the creek. Sediment accumulations occur near the high school.

Field Observations: Significant bank erosion was observed at Corvallis High School, including a partially slumped area of the right bank about 200 feet downstream of Buchanan Avenue. Since the time of the field observation, the City has stabilized a section of this reach (as noted under City Staff Reports). Stormwater runoff from school property discharges directly to the stream with potential water quality degradation. Non-native English Laurel provides fair canopy cover within this reach.

Overall instream and riparian habitat quality is low. A 12-inch diameter (sanitary sewer) pipe and rubble cover forms a low weir with a 1.5-foot drop about 125 feet downstream of 11th Street. This blockage creates fish passage issues and may raise water temperatures. A revetment composed of demolition debris is located at the bend downstream of 10th Street. Fine-sized sediment deposits accumulate upstream of 9th Street due to the low stream gradient. The outside bend of the channel upstream of 9th Street is progressively failing along the steep banks.

Modeling Results: Modeling showed that existing culverts and bridges within this reach are adequately sized for the existing and future build-out conditions. Most of the pipe system that runs from Buchanan Avenue to Kings Boulevard to Grant Avenue is undersized during the 10-year storm event. Stream velocities between 9th and 10th Streets exceed the 4-feet-per-second criteria during the 2-year storm event.

Buchanan Avenue to Grant Avenue

Public Comments: "Wants engineer to visit. Experiencing erosion of bank."

"Erosion – undercutting of west bank between Beca Avenue and Buchanan Avenue."

City Staff Reports: This reach has excellent tree cover. Private property extends to the centerline of the stream. Some private property owners have constructed their own stream restoration project in this reach. Ponding of water occurs upstream of an instream concrete obstruction at 15th Street and Lincoln Avenue.

Field Observations: Overhead canopy cover in this reach is generally good with canopy provided largely by ornamental plants and conifers. Overall instream and riparian habitat quality is low. The left bank is eroding downstream of the junction of 15th Street and Lincoln Avenue and excessive sediment has accumulated upstream of the Buchanan Avenue culvert.

Modeling Results: Structures along this reach are adequately sized to pass the 10-year storm event. Modeled stream velocities in this reach for the 2-year storm event exceed the 4-feet-per-second criteria.

Grant Avenue to Garfield Avenue

Public Comments: "13th and Greeley - still localized flooding that goes up and down with stream. Can the City route storm drain to south (near high school)?"

City Staff Reports: Vista Place (near Grant Avenue and 15th Street) had high water in the street during the February 1996 storm. A City Flood Mitigation Project was completed at both the Grant Avenue and Garfield Avenue crossings by the construction of high-flow culverts, and by laying back and revegetating the streambanks. Property owners have provided the City with maintenance easements in this reach. The City will maintain the channel in this reach to help provide hydraulic capacity. Porter Park has problems with pet wastes and lack of tree canopy. The park is a candidate site for a water quality or flood storage facility.

Field Observations: Overhead canopy cover in this reach is generally good with canopy provided largely by ornamental plants and conifers. The streambank has been laid back and matting added prior to planting willows. Foot traffic is heavy through this reach with a well-worn trail along the south bank of the stream. Overall instream and riparian habitat quality is low.

Modeling Results: Existing culverts and bridges are adequately sized for the full range of modeled storms for existing and future build-out conditions. Stream velocities in this reach are above the 4 feet per second criteria for the 2-year storm event.

Garfield Avenue to Kings Boulevard

Public Comments: "Autnuk (Arthur) Circle - concern about the rapid rise in creek, even for smaller storm events."

City Staff Reports: The February 1996 storm caused high water and closed roads in several locations. Flooding was especially severe along Arthur Circle. A Flood Mitigation Project improved the hydraulic conditions in this area and no flooding problems have been noted since the project. Some flooding complaints during large storms have been received from residents along Kings Boulevard north of Dixon Creek. Maintenance easements have been acquired for stream access in this reach. The large storm drain coming into Dixon Creek at Kings Boulevard has the potential for end-of-pipe treatment technologies.

Field Observations: Overhead canopy cover in this reach is generally good with canopy provided largely by ornamental plants and conifers. Overall instream and riparian habitat quality is low. A major storm drain discharges into Dixon Creek within this reach at the culvert in Kings Boulevard. This line originates near Walnut Boulevard and runs parallel to Kings Boulevard.

Modeling Results: The culverts within this reach can pass the range of modeled storms for existing or future build-out conditions. A section of the piped system located along Kings Boulevard to the north between Elmwood Drive and Larch Avenue is undersized for the 10-year storm event. Stream velocities in this reach exceed the 4 feet per second criteria for the 2-year storm event.

Kings Boulevard to Circle Boulevard

Public Comments: No public comments were received for this reach.

City Staff Reports: A City Stream Restoration Demonstration Project was completed in this reach in 1997. The Jefferson School property has the potential to be used for flood storage or a water quality project. A major storm pipe running along Circle Boulevard discharges into Dixon Creek in this reach. Large storms cause manholes to flood along parts of Circle Boulevard, but the flows drain along the street until they reach the next inlet and re-enter the system. This piped system presents an opportunity for end-of-pipe treatment.

Field Observations: Sediment accumulation in a box culvert at Circle Boulevard has reduced the hydraulic capacity of this structure. Relatively recent enhancement plantings at the Jefferson School site have supplemented mature alders on the south bank. As a result, the canopy coverage of the channel should improve over time. Low-flood benches with undercut banks are extensive along this

reach. Overall, the instream and riparian habitat conditions are degraded; however, recent riparian enhancements should improve conditions. A large open space area immediately adjacent to the stream provides a potentially valuable opportunity to create a relatively large passive flood storage facility. This site, part of the Jefferson School property, could be a true multi-objective urban stream rehabilitation project. Habitat, recreational, and visual improvements could be readily integrated into the flood alleviation design. A major storm drain discharges into Dixon Creek at the culvert in Circle Boulevard. The storm drain originates in Woodland Meadows and runs parallel to Circle Boulevard to its discharge point.

Modeling Results: The pipe discharging from Circle Boulevard to Dixon Creek is undersized for the 10-year storm event for both existing and future conditions. Several manholes are flooded or surcharged along Circle Boulevard. The open channel segment in this reach shows modeled velocities in excess of 4 feet per second for the 2-year storm event.

Circle Boulevard to 29th Street

Public Comments: "Blue heron, nutria, beaver, ducks, et al. used to be in this area. All gradually gone. Can we improve habitat for wildlife?"

City Staff Reports: This reach has some streambank erosion. Telephone poles are used in one segment of the stream to help protect the banks. Public education may help promote stream stewardship activities and to discourage activities with potential negative effects. The culvert at 27th Street limits fish passage. Private ownership extends to the center of the creek in many areas. The City has easements in other areas. Property owners have reinforced the bank with concrete slabs in many locations.

Field Observations: Closely spaced alders form a significant channel pinch point at 29th Street. Fish passage is hampered at the box culverts beneath 27th Street. Grass-covered flood benches occur, some forming significant undercut banks. Overhead canopy cover is moderately good considering small channel size. Bare upper bank areas occur between 27th and 29th Streets, which are subject to low levels of erosion. Overall instream and riparian habitat quality is low, in part due to the armoring of streambanks along this reach.

Modeling Results: The model shows that the channel upstream of Elmwood is undersized and that flow overtops the banks for the 10-year storm event. The channel and bank geometry in this area should be confirmed with a topographic survey. Stream velocities exceed the 4-feet-per-second criteria for the 2-year storm event along this entire reach.

29th Street to Walnut Boulevard (West Branch)

Public Comments: "Drainage from Roosevelt to Taft - flooding houses and basements."

"Oak Creek drainage (Skyline West) going into Dixon Basin? Could this be re-routed to Oak?"

City Staff Reports: This reach has some good stream functions. Blackberry is common along stream banks in this reach. The City has maintenance easements along most of this reach of the stream. The large parking lot at the Northwest Hills Baptist Church may be contributing to water quality degradation. Water elevations have been high in this reach, but no reports of flooding. Public education and institutional cooperation could present stream stewardship opportunities along this reach.

Field Observations: A large area (+5 acres) of open space in the vicinity of the Northwest Hills Baptist Church, which is most likely used for seasonal recreation, presents an opportunity for significant flood storage. A passive flood storage facility could be designed to enhance natural features and offer recreational use of the area during the non-flood season. Bank and channel erosion was observed at locations along Walnut Boulevard, upstream of 29th Street behind Hoover School and the Northwest Hills Baptist Church.

Modeling Results: Culverts at Walnut Place and Witham Village appeared undersized for the 10-year storm event. Velocities in excess of 4 feet per second were modeled in several segments of this reach for the future 2-year storm event.

Walnut Boulevard to Headwaters (West Branch)

Public Comments: No public comments were received for this reach.

City Staff Reports: This reach has good canopy cover and fish habitat. A portion of the drainage system originates in the County. One of the side branches drains into a field inlet above Amanda Place. At this location, improvements to the channel and field inlet were made as part of the City's 1999 Flood Mitigation Project. A section of the streambank along Glenridge Drive has overly steep banks covered with blackberries. An experimental fish passage culvert has been installed at Acacia Place.

Field Observations: A technical evaluation of the physical conditions within this reach was not performed.

Modeling Results: The models shows that the culverts under Walnut Boulevard and Live Oak Drive are undersized for the 10-year storm event under existing and future build-out conditions. Stream velocities in this reach exceed the 4 feet per second, 2-year storm criteria in several places.

Walnut Boulevard to Headwaters near Arrowood Circle (Middle Branch)

Public Comments: "Forested slope vs. grassed in other areas difference between the two in planning."

"Near Arrowood – drainage on street not properly placed and flows from West Fork west to other tributary."

"Summer flow is polluting the Timberhill Dixon tributaries. Also, North Fork channel was filled with sediment. North Fork used to be main channel; now channel to the west is the larger channel. Also, upslope of Arrowood, land is now cut off from downslope, which alters seepage."

"Old detention facility silted in."

City Staff Reports: Residential yard encroachments into the riparian areas have occurred.

Field Observations: This area has the potential to be a valuable demonstration project located in a highly visible area. The project could demonstrate low-tech and aesthetically pleasing strategies for relieving chronic sedimentation/erosion from small headwater streams with poor instream and riparian habitat conditions, such as the 300-foot-long segment immediately above Arrowood Circle. Walnut Boulevard culverts have fish passage issues and excess sediment accumulation. There is potential water quality degradation at 29th Street and Timberhill Park resulting from domestic animal waste. Channel erosion was noted for 300 feet upstream of Arrowood Circle near Sitka Place. The creek is mostly designated as open space in this reach and access is good.

Modeling Results: Model results show that the channel upstream of the pond is undersized, although this needs to be confirmed with additional surveys of channel cross-sections. Three of the four culverts under Arrowood Circle are undersized for the 10-year storm event, although the amount of flooding appears to be less than 1 cfs except near Snowbrush Place. The two branches of the channel in the greenway between Twinberry Place and Huckleberry Place both appear to have velocities that exceed the 4-feet-per-second criteria for the 2-year storm event.

29th Street to Headwaters in Chip Ross Park (East Branch)

Public Comments: "Springs all over hillsides."

"Natural springs are impacted by development."

"Timberhill area yet to be developed, wants to have quality protection of ecological functions and values."

"Timberhill runoff is causing problems in the existing development."

City Staff Reports: This area is in relatively good shape and has the opportunity to be preserved. The culvert in 29th Street may impact fish passage.

Field Observations: A technical evaluation of the physical conditions within this reach was not performed.

Modeling Results: Full stream bank capacity was not exceeded by the range of modeled storms for existing or future build-out conditions. Stream velocities near Walnut Boulevard exceed the 4 feet per second, 2-year storm event criteria in Timberhill Park.

6.2.6 Watershed Summary

Most of the Dixon Creek channel has flow velocities that exceed the erosion criteria of 4 feet per second during the 2-year storm event. To prevent erosion, residents have armored the streambanks along many of these segments. Most of the culverts and bridges along Dixon Creek are large enough to pass the 10-year storm event, in part due to several City projects constructed within the last few years. However, several pipe systems contributing to Dixon's middle reaches have flooding and surcharging problems.

A number of habitat concerns exist in the watershed. In the downstream reaches, fish passage is blocked at 2nd Street during low flows and the channel is narrow and incised downstream of the railroad tracks. Canopy cover is mixed, with good tree cover in some areas and non-existent in others. In the middle reaches, the City has completed stream restoration projects at several locations within the watershed including Corvallis High School, Porter Park, and Jefferson Elementary School. Overall, instream and riparian habitat quality is low throughout the middle reaches and the quality of the canopy cover varies. In both the lower and middle reaches, water quality may be degraded due to untreated stormwater runoff from parking lots. Canopy cover and fish habitat improve in the upper reaches and headwaters of Dixon Creek.

Opportunities exist for preserving headwater areas not yet impacted by development. Other locations, including along Walnut Boulevard in the vicinity of the Northwest Hills Baptist Church, may provide opportunities for stream enhancement and water quality improvement. End-of-pipe stormwater treatment may be appropriate at several stormwater discharge locations. City access to the stream is compromised by private property ownership that extends to the centerline of the stream at many locations.

6.3 WATERSHED MANAGEMENT OPTIONS

Recommendations for the Dixon Creek watershed are shown in Table 6-3.

The recommended options vary considerably from reach to reach. In the lower reaches, higher stream velocities and commercial development along the stream banks have led to an emphasis on stabilizing streambanks, re-establishing canopy cover, and minimizing fish passage issues with culverts. In its middle reaches, Dixon Creek is a tightly confined channel running through largely residential neighborhoods. Many of the recommendations for the middle reaches focus on ways to change public behavior, such as crafting citywide ordinances and working with schools to develop examples of good riparian practices. The upper reaches of Dixon Creek are not as intensively developed. Recommendations for this section emphasize preservation and enhancement of open space and habitat.

The consultant team and City staff identified three levels of watershed management options. Table 6-4 and Figure 6-3 show the recommendations and locations for the short-term management program, along with estimated costs.

Activities that can be implemented citywide through modifications and additions to current City code and development standards are summarized in Chapter 5. Recommended examples include development standards to reduce stormwater runoff quantity and to improve water quality, and

measures to reduce construction-related erosion. Other citywide activities focus on public education and involvement, including the development of a stream stewardship program.

Table 6-5 and Figure 6-4 present the long-term recommendations and their locations. The options include more capital projects than the other management options. Many of the recommended activities require the construction of end-of-pipe treatment facilities to improve water quality. Other capital projects will improve streambank stability and improve fish passage.

Table 6-3. Dixon Creek Options

Reach	Abridged observations	Recommended activity	Timing
Willamette River to 3rd Street	1) High velocities have created areas of erosion at a number of locations.	a. Stabilize streambank slopes with matting and vegetation and provide a more natural stream configuration.	Long-term
		b. Develop and implement citywide guidelines for preventing additional runoff volume or excessive velocities into the stream.	Ongoing
	2) During summer months a stagnant pool exists upstream of culvert. No fish passage is possible at downstream end of culvert on 2nd Street during low-flow periods.	a. Adjust culvert elevations to address fish passage and stagnant pool issues or install low flow culvert.	Long-term
3rd Street to Railroad tracks	1) City staff has reported that the channel is narrow and incised throughout this reach. Modeled velocities exceed the erosion criteria.	a. Stabilize streambank and provide a more natural stream configuration.	Short-term
	2) This reach lacks adequate tree canopy shading.	a. Provide vegetation to improve canopy cover.	Short-term
	3) Fish passage issues through culverts in this area will need to be addressed by ODOT.	a. Work with ODOT and ODFW to address fish passage issues.	Short-term
Railroad tracks to 9th Street	1) Overhead canopy coverage is very poor as noted by both City staff and the field investigation. The field investigation also found that overall instream and riparian habitat quality is extremely poor. Native herbaceous wetland species such as rushes and sedges (e.g. Scirpus sp.) occur along the channel bottom upstream of Reiman along with reed canarygrass and other weedy graminoids.	a. Provide plantings to increase shading on south side of stream where space allows.	Short-term
	2) The left bank (looking upstream) at Avery Square is experiencing erosion and bank failure, as is the right bank downstream of Reiman Avenue. Modeled stream velocities exceed criteria.	a. Will require land dedication from private landowner, and stabilize existing slope.	Short-term

Table 6-3. Dixon Creek Options (continued)

Reach	Abridged observations	Recommended activity	Timing
Railroad tracks to 9th Street (cont.)	3) Stormwater runoff entering stream directly from the Avery Square parking lot may contribute to water quality degradation.	a. Install structural stormwater treatment facilities to treat water from Avery Square parking lot.	Long-term
		b. Develop citywide guidelines for treatment of parking lot runoff.	Ongoing
9th Street to Buchanan Avenue	1) It has been reported that a 40-year old house 20 feet from creek is slowly settling from unknown causes.	a. Monitor streambank and house elevations.	Short-term
	2) A City sanitary sewer constructed of 12-inch diameter steel pipe and rubble cover form a low weir with a 1.5-foot drop about 125 feet downstream of 11th Street. This blockage creates fish passage and water temperature issues.	a. Investigate potential of creating a slot in the concrete cap of the sanitary sewer to reduce water surface elevation of water backing up behind blockage or provide stream channel improvements to allow fish to pass blockage.	Short-term
	3) Stormwater runoff from high school property discharges directly to stream with potential water quality degradation.	a. Install structural stormwater treatment facilities to treat runoff from high school.	Long-term
		b. Develop citywide guidelines for treatment for parking lot runoff.	Ongoing
		c. Work with high school to modify groundskeeping and create buffer strip along the stream.	Short-term
	4) Overall instream and riparian habitat quality is low.	a. Develop citywide guidelines for improving stream and riparian habitat.	Ongoing
		b. Improve riparian area through establishment of native vegetation.	Short-term
	5) A revetment composed of demolition debris is located at the bend downstream of 10th Street.	a. Replace demolition debris with stream stabilization and vegetation at bend downstream of 10th Street.	Short-term
	6) Steep streambanks failing at bend upstream of 9th Street. Modeled velocities exceed erosion criteria.	a. Stabilize streambank and provide a more natural stream configuration.	Short-term

Table 6-3. Dixon Creek Options (continued)

Reach	Abridged observations	Recommended activity	Timing
9th Street to Buchanan Avenue (cont.)	7) Fine sized sediment deposits accumulate upstream of 9th Street due to the low stream gradient.	a. Remove sediment upstream of 9th Street and monitor to determine source.	Short-term
		b. Develop citywide guidelines to reduce sources of construction site erosion and prevent streambank erosion.	Ongoing
	8) Large storm drain discharging in this reach may degrade water quality.	a. Install end-of-pipe technology for treating stormwater.	Long-term
		b. Develop citywide guidelines for improving the water quality of parking lot runoff through treatment.	Ongoing
	9) The pipe system along Buchanan Avenue and upstream is undersized for the 10-year storm.	a. Replace pipes along Buchanan Avenue, Kings Boulevard, and Grant Avenue.	Short-term
Buchanan Avenue to Grant Avenue	1) Citizen wants an engineer (from City) to visit and observe erosion of stream bank. City staff reports property owners restoring section of stream. Erosion is undercutting the west bank between Beca Avenue and Buchanan Avenue. Modeled velocities exceed erosion criteria.	a. Coordinate with private property owners on stream restoration in this reach (supply materials and expertise).	Long-term
	2) Ponding of water occurs at an instream concrete obstruction at 15th Street and Lincoln Avenue.	a. Pinpoint location and remove concrete obstruction if no adverse effects will result.	Short-term
	3) Overall instream and riparian habitat quality is low.	a. Develop citywide guidelines for improving stream and riparian habitat.	Ongoing
		b. Coordinate with private property owners' restoration project (supply materials and expertise).	Long-term
	4) Excessive sediment accumulation at Buchanan Avenue.	a. Remove sediment from culvert and monitor to determine source.	Long-term
		b. Develop citywide guidelines to reduce sources of construction site erosion and prevent streambank erosion.	Ongoing

Table 6-3. Dixon Creek Options (continued)

Reach	Abridged observations	Recommended activity	Timing
Grant Avenue to Garfield Avenue	1) In vicinity of 13th Street and Greeley Avenue, there is localized flooding that goes up and down with stream.	a. Monitor extent and duration of flooding near 13th and Greeley.	Short-term
	2) Vista Place (near Grant Avenue and 15th Street) had high water in street during the February 1996 storm. The City's Flood Mitigation Program appears to have addressed the hydraulic restrictions.	a. Monitor stream levels at Vista Place to confirm success of flood mitigation project.	Short-term
	3) Overall instream and riparian habitat quality is low.	a. Develop citywide guidelines for improving stream and riparian habitat.	Ongoing
		b. Improve riparian area through plantings along stream.	Long-term
Garfield Avenue to Kings Boulevard	1) Near Arthur Circle, concern about rapid rise in creek, even for smaller storm events. The February 1996 storm caused high water and closed roads in several locations along Arthur Circle.	a. Monitor stream levels at Arthur Circle to confirm success of flood mitigation project.	Short-term
	2) Overall instream and riparian habitat quality is low. Channel is confined, but appears to have excess capacity near Garfield Avenue.	a. Develop citywide guidelines for improving stream and riparian habitat.	Ongoing
		b. Extend habitat improvements upstream of Porter Park by placing large woody debris in channel upstream of Garfield Avenue (after confirming success of flood mitigation effort at Arthur Circle).	Long-term
	3) Flooding complaints have been received from property owners along Kings Boulevard north of Dixon Creek. Modeling shows an undersized pipe between Elmwood Drive and Larch Avenue. City staff has expressed concern that this large storm drain may degrade instream water quality.	a. Replace the affected pipes along Kings Boulevard between Larch Avenue and Dixon Creek and install end-of-pipe technology for treating storm water.	Long-term
		b. Develop citywide guidelines for improving the water quality of parking lot runoff through treatment.	Ongoing

Table 6-3. Dixon Creek Options (continued)

Reach	Abridged observations	Recommended activity	Timing
Kings Boulevard to Circle Boulevard	1) City staff reported that instream water quality might be degraded by the large storm drain along Circle Boulevard. Water flowing from manholes has flooded the street for short periods during large storms. Modeling shows the pipe that discharges from Circle Boulevard to Dixon Creek is undersized for both existing and future conditions.	a. Replace undersized pipe and install end-of-pipe technology for treating storm water.	Long-term
		b. Develop citywide guidelines for improving the water quality of parking lot runoff through treatment.	Ongoing
	2) Excessive sedimentation was found in culvert at Circle Boulevard.	a. Remove sediment from culvert and monitor to determine upstream sources.	Long-term
		b. Develop citywide guidelines to reduce erosion of sediment into stream and to stabilize stream banks.	Ongoing
	3) The overhead cover and aquatic habitat are better than many other reaches along this stream. However, the overall instream and riparian habitat conditions are degraded.	a. Develop citywide guidelines for improving instream water quality.	Ongoing
		b. Develop citywide guidelines for improving stream and riparian habitat.	Ongoing
	4) A large area of under-utilized, publicly owned open space at school site immediately adjacent to the stream provides a potentially valuable opportunity to create a relatively large passive flood storage facility. This can be a true multi-objective urban stream rehabilitation project, with habitat, recreational, and visual improvements readily integrated into the flood alleviation design.	a. Construct multi-use riparian facility to provide water quality/detention benefits with cooperation of school district.	Short-term
Circle Boulevard to 29th Street	1) Public has noted loss of wildlife in area.	a. Develop citywide guidelines for riparian protection.	Ongoing
	2) City staff has noted some streambank erosion in this reach. Telephone poles are being used in one segment of the stream to help protect the banks. Modeled velocities exceed the erosion criteria. The field investigation reported grass-covered flood benches with significant undercut banks.	a. Provide public information to promote stream stewardship activities and to discourage activities with potential negative effects.	Ongoing
		b. Pinpoint the erosion problems and stabilize streambanks using log cribs and vegetative techniques where walls aren't required.	Long-term

Table 6-3. Dixon Creek Options (continued)

Reach	Abridged observations	Recommended activity	Timing
	3) The box culverts at 27th Street limit fish passage.	a. Improve culverts to allow fish passage.	Long-term
	4) Closely spaced alders form a significant channel pinch point at 29th Street.	a. Monitor situation to determine if pinch point is contributing to local flooding problems.	Short-term
	5) Modeling shows the channel upstream of Elmwood Drive to be undersized. Field investigations reported houses close to channel and privately constructed walls and other structures constricting the channel.	a. Remove encroaching structures where needed to increase channel cross-section.	Short-term
29th Street to Walnut Boulevard (West Branch)	1) Drainage from Roosevelt to Taft has created flooding in houses and basements. It appears that the Oak Creek drainage (Skyline West) is going into Dixon Basin. Could this be re-routed to Oak?	a. Continue to monitor, modeling does not show a problem in this area. Determine size of storm to initiate flooding and the extent of flooding under this scenario.	Short-term
	2) The large parking lot at the Northwest Hills Baptist Church may be contributing to water quality degradation.	a. Public information and institutional cooperation could present stream stewardship opportunities.	Ongoing
		b. Develop citywide guidelines for improving the water quality of parking lot runoff through treatment.	Ongoing
	3) Bank and channel erosion was observed at locations along Walnut Boulevard, upstream of 29th Street behind Hoover School and the Northwest Hills Baptist Church. Modeled velocities exceed the erosion criteria.	a. Pinpoint erosion and stabilize streambanks using vegetative techniques. Replant streambanks with native vegetation.	Short-term
		b. Develop citywide guidelines for preventing additional runoff volume and excessive velocities into the stream.	Ongoing
	4) Modeling shows an undersized culvert at Walnut Place.	a. Replace culvert.	Short-term
	5) Modeling shows an undersized culvert at Witham Village.	a. Replace culvert.	Short-term

Table 6-3. Dixon Creek Options (continued)

Reach	Abridged observations	Recommended activity	Timing
Walnut Boulevard to Headwaters (West Branch)	1) A portion of the drainage system originates in the County.	a. Coordinate City and County development standards in this area to help protect quality of stream and riparian habitat.	Ongoing
	2) Modeling shows an undersized culvert at Walnut Boulevard.	a. Replace culvert.	Short-term
	3) Modeling shows an undersized culvert at Live Oak Drive.	a. Replace culvert.	Short-term
	4) City staff has reported erosion concerns along Glenridge Drive between Walnut Boulevard and Ponderosa Avenue. Modeled velocities exceed the erosion criteria at this point.	a. Stabilize channel using vegetative means.	Long-term
	5) Modeled velocities exceed the erosion criteria near Live Oak Drive, but the channel has not been inspected.	a. Preserve and enhance riparian vegetation to decrease runoff volume and velocities.	Short-term
Walnut Boulevard to Arrowood Circle Headwaters (Middle Branch)	1) Summer flow is polluting the Timberhill area Dixon tributaries.	a. City staff to monitor extent of problem.	Short-term
	2) Drainage on street not properly located near Arrowood. Flows from West Fork west to other tributary.	a. City staff to monitor extent of problem.	Short-term
	3) North Fork channel was filled with sediment. North Fork used to be main channel; now channel to the west is the larger channel.	a. Develop citywide guidelines to reduce erosion of sediment into stream and to stabilize stream banks.	Ongoing
	4) An old detention facility has filled with silt.	a. Allow facility to remain filled with silt. Enhance wetland aspects of facility to improve water quality and riparian area.	Short-term
	5) Model results show stream velocities between Twinberry Place and Huckleberry Place exceed the erosion criteria, but these sections have not been inspected.	a. Regrade streambanks in greenway to a lower angle, replant with native woody vegetation, construct rock check dams.	Short-term
		b. Develop citywide guidelines for preventing additional runoff volume and excessive velocities into the stream.	Ongoing

Table 6-3. Dixon Creek Options (continued)

Reach	Abridged observations	Recommended activity	Timing
Walnut Boulevard to Arrowood Circle Headwaters (Middle Branch) (cont.)	6) Channel degradation and chronic sediment source in 300-foot segment upstream of Arrowood Circle near Sitka Place.	a. Regrade streambanks upstream of Sitka Place to a lower angle, replant with native woody vegetation, construct rock check dams.	Short-term
	7) Modeling shows the channel along Walnut Boulevard upstream of the detention facility is undersized.	a. Layback channel to provide greater capacity.	Short-term
	8) Modeling shows the culvert at Arrowood Circle near Sitka Place is undersized.	a. Replace culvert.	Short-term
	9) Modeling shows the culvert at Arrowood Circle between Boxwood Place and Snowbrush Place is undersized.	a. Replace culvert.	Short-term
	10) Modeling shows the culvert at Arrowood Circle near Snowbrush Place is undersized.	a. Replace culvert.	Short-term
29th Street to Headwaters in Chip Ross Park (East Branch)	1) Springs all over the hillsides are the source of stream flow in the upper reaches of Dixon Creek. They may cause erosion problems with exposed soil from new development. The Timberhill area is yet to be developed and needs to have quality protection of ecological functions and values. Model results show velocities exceed the erosion criteria.	a. Develop citywide guidelines to reduce erosion of sediment into stream and to stabilize streambanks.	Ongoing
		b. Consider development of citywide guidelines to increase setbacks from stream and to provide added protection to streams and riparian area.	Ongoing

Table 6-4. Dixon Creek Short-Term Program

Reach	Recommended activity	Capital cost ($)	Annual O&M ($)	Project type[1]
3rd Street to Railroad tracks	1) Stabilize streambank and provide a more natural stream configuration.	60,000	3,000	
	2) Provide vegetation to improve canopy cover.	2,800	140	Orange line
	3) Work with ODOT and ODFW to address fish passage issues at Highway 99.	1,920	360	
Railroad tracks to 9th Street	1) Provide plantings on south side of stream to increase shading.	3,200	160	
	2) Stabilize streambank and provide a more natural stream configuration.	14,000	700	Green line
9th Street to Buchanan Avenue	1) Monitor streambank and house elevations.	NA	250	
	2) Create a slot in the concrete cap of the sanitary sewer downstream of 11th Street to reduce water surface elevation of water backing up behind blockage or provide stream channel improvements to allow fish to pass blockage.	2,000	360	
	3) Work with high school to modify groundskeeping and create buffer strip along stream.	1,920	NA	
	4) Improve riparian area through establishment of native vegetation as part of streambank stabilization projects.	12,000	600	
	5) Replace demolition debris downstream of 10th Street with vegetative streambank stabilization.	30,000	1,500	Green line
	6) Stabilize streambank and provide a more natural stream configuration.	7,000	350	Yellow line
	7) Remove sediment upstream of 9th Street and monitor to determine source.	NA	250	
	9) Replace undersized pipes along Buchanan Avenue, Kings Boulevard, and Grant Avenue.	757,000	NA	Red line
Buchanan Avenue to Grant Avenue	2) Remove obstruction near 15th Street and Lincoln Avenue.	5,000	NA	

[1]Project types are in the Figure 6-3 map legend.
NA = Not applicable.

Table 6-4. Dixon Creek Short-Term Program (continued)

Reach	Recommended activity	Capital cost ($)	Annual O&M ($)	Project type[1]
Grant Avenue to Garfield Avenue	1) Monitor stream levels at 13th Street and Greeley Avenue to determine extent and duration of reported flooding.	NA	750	☑
	2) Monitor stream levels at Vista Place (near 15th and Grant) to confirm success of flood mitigation project.	NA	750	☑
Garfield Avenue to Kings Boulevard	1) Monitor stream levels at Arthur Circle to confirm success of flood mitigation project.	NA	750	☑
Kings Boulevard to Circle Boulevard	4) Construct multi-use riparian facility to provide water quality/detention benefits in cooperation with the school district.	226,000	2,260	⊼
Circle Boulevard to 29th Street	4) Monitor situation to determine if pinch point near 29th Street is contributing to local flooding problems.	NA	750	☑
	5) Remove encroaching structures, widen channel, and install rock walls where necessary to increase channel cross-section and capacity.	120,000	6,000	Yellow line
29th Street to Walnut Boulevard (West Branch)	1) Continue to monitor, modeling does not show a problem in this area. Determine size of storm to initiate flooding and the extent of flooding under this scenario.	NA	1,300	☑
	3) Stabilize streambanks using vegetative techniques. Replant streambanks with native vegetation.	210,000	10,500	Green line
	4) Replace culvert at Walnut Place with 60-inch pipe.	14,900	NA	Red line
	5) Replace culvert at Witham Village with 42-inch pipe.	6,900	NA	Red line

[1]Project types are in the Figure 6-3 map legend.
NA = Not applicable.

Table 6-4. Dixon Creek Short-Term Program (continued)

Reach	Recommended activity	Capital cost ($)	Annual O&M ($)	Project type[1]
Walnut Boulevard to Headwaters (West Branch)	2) Replace culvert at Walnut Boulevard with 36-inch pipe.	16,600	NA	Red line
	3) Replace culvert at Live Oak Drive with 42-inch pipe.	4,700	NA	Red line
	5) Preserve and enhance riparian vegetation to decrease runoff volume and velocities.	196,000	9,800	
Walnut Boulevard to Arrowood Circle (Middle Branch)	1) City staff to monitor extent of summer flow pollution problem in headwaters.	NA	200	☑
	2) City staff to monitor extent of flows from Middle Fork to West Fork of Dixon Creek at Arrowood Circle.	NA	750	☑
	4) Allow facility to remain filled with silt. Consider wetland enhancement activities to improve water quality or riparian area.	5,000	1,100	
	5) Regrade streambanks in greenway to a lower angle, replant with native woody vegetation, construct rock check dams.	600,000	30,000	
	6) Regrade streambanks upstream of Sitka Place to a lower angle, replant with native woody vegetation, construct rock check dams.	60,000	3,000	
	7) Widen channel upstream of detention facility along Walnut Boulevard to provide greater capacity.	120,000	6,000	Yellow line
	8) Replace culvert at Arrowood Circle near Sitka Place.	13,600	NA	Red line
	9) Replace culvert at Arrowood Circle between Boxwood Place and Snowbrush Place.	8,700	NA	Red line
	10) Replace culvert at Arrowood Circle near Snowbrush Place.	7,300	NA	Red line
Total		**$2,506,540**	**$81,580**	

[1]Project types are in the Figure 6-3 map legend.
NA = Not applicable.

Table 6-5. Dixon Creek Long-Term Program

Reach	Recommended activity	Capital cost ($)	Annual O&M ($)	Project type[1]
Willamette River to 3rd Street	1) Stabilize streambank slopes using matting and vegetation.	28,000	1,400	Green line
	2) Adjust culvert elevations to address fish passage and stagnant pool issues or install low-flow culvert.	17,000	1,700	
Railroad tracks to 9th Street	3) Install structural stormwater treatment facilities to treat water from Avery Square parking lot.	20,000	2,200	
9th Street to Buchanan Avenue	3) Install structural stormwater treatment facilities to treat runoff from high school.	15,000	1,650	
	8) Install end-of-pipe technology for treating stormwater from Buchanan Avenue.	15,000	1,650	
Buchanan Avenue to Grant Avenue	1) Coordinate with private property owners on stream restoration to stabilize streambanks.	2,400	180	Green line
	3) Coordinate with private property owners to improve habitat.	1,200	NA	
	4) Remove sediment from culvert at Buchanan Avenue and monitor to determine source.	NA	275	
Grant Avenue to Garfield Avenue	3) Improve riparian area with native plantings throughout reach.	21,000	1,050	
Garfield Avenue to Kings Boulevard	2) Extend habitat upstream of Porter Park by placement of large wood debris.	6,000	300	
	3) Replace undersized pipe along Kings Boulevard and install end-of-pipe technology for treating storm water.	158,000	1,650	Red line
Kings Boulevard to Circle Boulevard	1) Replace undersized pipe along Circle Boulevard and install end-of-pipe technology for treating storm water.	106,000	1,650	Red line
	2) Remove sediment from culvert at Circle Boulevard and monitor effectiveness of upstream erosion controls.	NA	275	
Circle Boulevard to 29th Street	2) Stabilize streambanks with log cribs and vegetative techniques where walls not required.	7,000	350	Green line
	3) Improve culverts at 27th Street to allow fish passage past blockage.	3,800	190	
Walnut Boulevard to Headwaters (West Branch)	4) Stabilize channel along Glenridge Drive using vegetative means.	49,000	2,450	Green line
Total		**449,400**	**16,970**	

[1]Project types are in the Figure 6-4 map legend.
NA = Not applicable.

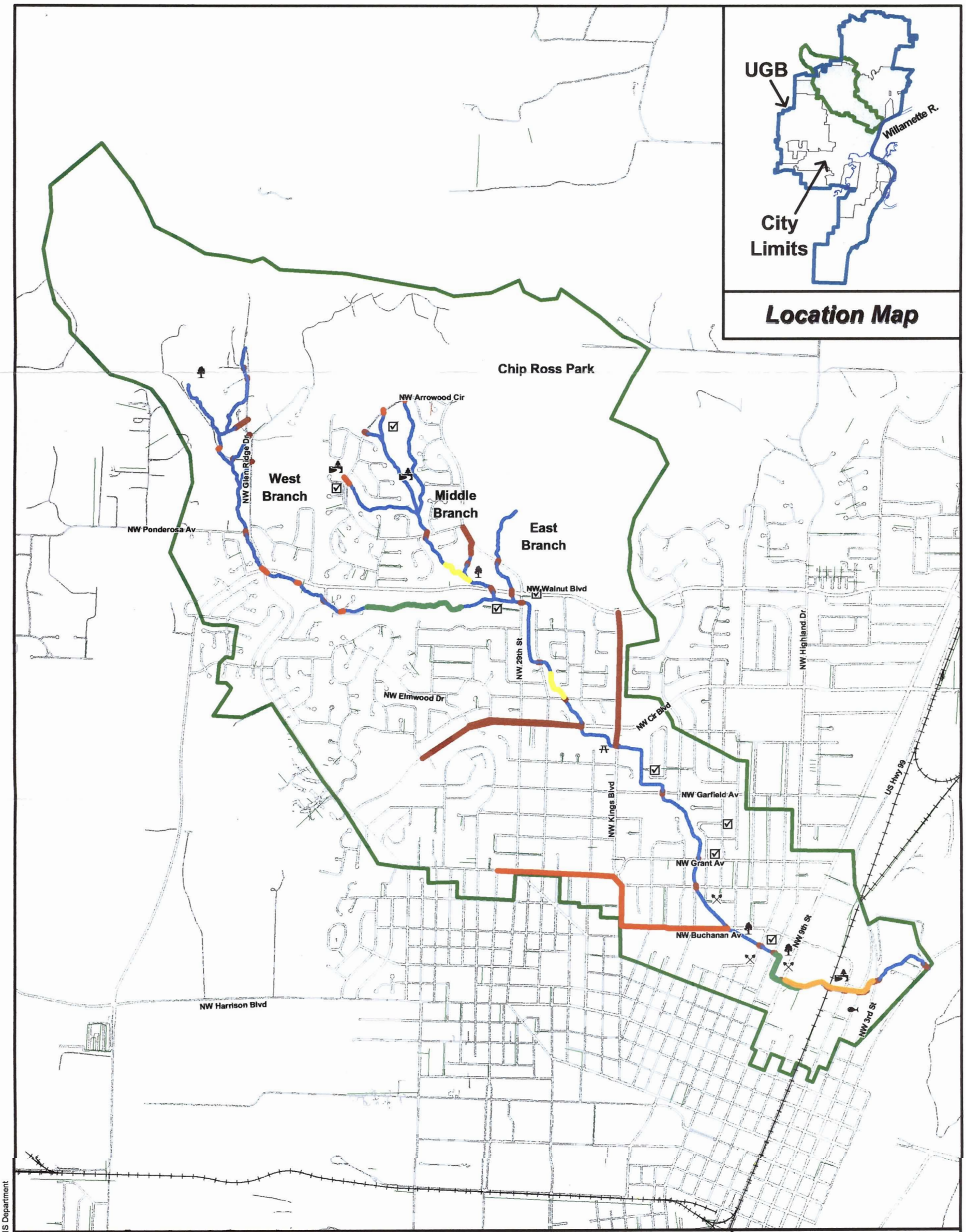

Figure 6-3 Short Term Project Locations

LEGEND

- Pipes/Bridges
- Channels
- Basin Boundary
- Bank Stabilization
- Canopy Revegetation
- Channel Improvement
- Replace Pipe/Bridge
- Fish Passage
- Buffer/Riparian Habitat
- Floodplain Reconnection
- Treatment Facility
- Flood Management Structure
- Maintenance
- Monitor
- Multi-Use Facility

N

Feet 600 0 600 1200 1800 2400 Feet

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report/figures/Fig6-3v3.wor, October 12, 2000, base data from City of Corvallis GIS Department

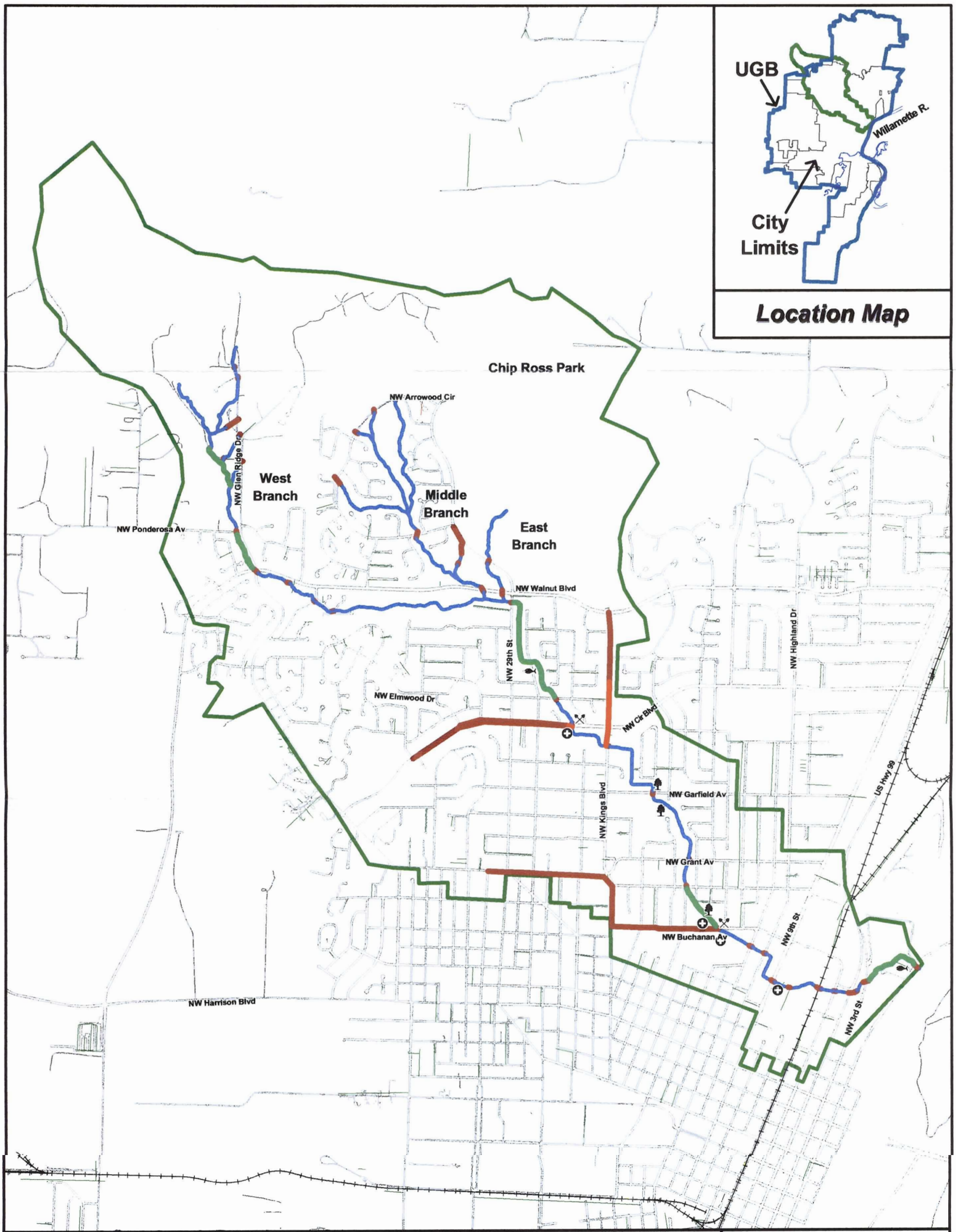

Figure 6-4 Long Term Project Locations

LEGEND

- Pipes/Bridges
- Channels
- Basin Boundary
- Bank Stabilization
- Canopy Revegetation
- Channel Improvement
- Replace Pipe/Bridge
- Fish Passage
- Buffer/Riparian Habitat
- Floodplain Reconnection
- Treatment Facility
- Flood Management Structure
- Maintenance
- Monitor
- Multi-Use Facility

N

Feet 600 0 600 1200 1800 2400 Feet

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