

**CITY COUNCIL AGENDA ITEM**  
CITY OF SHORELINE, WASHINGTON

<b>AGENDA TITLE:</b>	McAleer Creek and Lyon Creek Surface Water Basin Plans Discussion
<b>DEPARTMENT:</b>	Public Works
<b>PRESENTED BY:</b>	John Featherstone, Engineer II – Surface Water
<b>ACTION:</b>	<input type="checkbox"/> Ordinance <input type="checkbox"/> Resolution <input type="checkbox"/> Motion <input checked="" type="checkbox"/> Discussion <input type="checkbox"/> Public Hearing

**PROBLEM/ISSUE STATEMENT:**

The adopted 2011 Surface Water Master Plan emphasized a basin planning approach to improve the management of the City of Shoreline’s (City’s) surface water and infrastructure. The purpose of the City’s basin planning effort is to provide a comprehensive representation of the natural and built infrastructure within the City’s portions of various drainage basins so that the City can direct its stormwater management resources toward correcting existing issues and minimizing potential future problems.

The City completed its first basin plan for the Thornton Creek basin in 2009, followed by the Storm Creek Basin Plan and the Boeing Creek Basin Plan in 2013. These reports provided the City with a list of prioritized capital projects and a FEMA floodplain analysis. The Boeing and Storm Creek Basin Plans additionally conducted a systematic condition assessment of the City’s stormwater pipes, a major effort involving video inspection of tens of thousands of linear feet of pipe and creation of a prioritized list of recommended pipe repairs based on the inspection results.

The McAleer Creek and Lyon Creek Basin Plans were completed in November 2015, assessing surface water conditions throughout those basins in the northeast areas of the City, including drainage, erosion, infrastructure condition, water quality, and aquatic habitat. These assessments included identification of problems and recommended management actions to address the problems. The recommended management actions include capital projects such as repair and replacement of infrastructure and stormwater water quality retrofit, improved maintenance, outreach programs or other corrective actions.

The initial City-wide basin planning effort is scheduled for completion in 2016, with conclusion of the Puget Sound Drainages Basin Plan (currently in development).

**McAleer Creek Basin Issues**

The primary issues in the McAleer Creek basin are related to aging and/or insufficient stormwater infrastructure. The pipe condition assessment found that 10 to 25 percent of the stormwater pipes in the basin are in poor structural condition and may require repair

in the near future. Additionally, persistent drainage problems were identified at two specific locations: 6<sup>th</sup> Avenue NE and NE 200<sup>th</sup> Street (generally due to insufficient infrastructure) and the area east of 15<sup>th</sup> Avenue NE between NE 185<sup>th</sup> Street and NE 195<sup>th</sup> Street (generally due to high groundwater and seepage conditions). No major flooding concerns were found along the main channel of McAleer Creek that passes through the City (approximately two-thirds of a mile in length).

### **Lyon Creek Basin Issues**

The dominant issue within the Lyon Creek basin is persistent flooding when flows in Ballinger Creek exceed the capacity of the culvert-and-pipe system along 25<sup>th</sup> Avenue NE between Brugger's Bog Park and NE 195<sup>th</sup> Street.

The Lyon Creek basin also has issues related to aging and/or insufficient stormwater infrastructure. The pipe condition assessment found that 10 to 30 percent of the stormwater pipes in the basin are in poor structural condition and may require repair in the near future.

### **RESOURCE/FINANCIAL IMPACT:**

There is no resource or financial impact associated with this discussion. A few of the highest priority management actions recommended by the McAleer Creek and Lyon Creek Basin Plans – such as the 25<sup>th</sup> Avenue NE flood reduction project and selected high priority pipe repairs – are already in the process of being addressed. However, the majority of recommended management actions identified in the McAleer Creek and Lyon Creek Basin Plans will be prioritized alongside other City-wide management actions identified in the other surface water basin plans. This process of prioritizing and programming recommended surface water management actions is expected to take place during the upcoming Surface Water Master Plan Update in 2016.

### **RECOMMENDATION**

No action is required at this time. This item is for Council discussion. The basin plan recommended surface water management actions and associated costs will be prioritized as part of the 2016 Surface Water Master Plan Update.

Approved By:            City Manager **DT**    City Attorney **MK**

## **INTRODUCTION**

The City completed the McAleer Creek and Lyon Creek Basin Plans to assess conditions in those basins, including drainage, erosion, water quality, and habitat. The assessment includes identification of problems and programmatic management actions to address the problems. These programmatic management actions may include capital projects such as repair and replacement of infrastructure and stormwater water quality retrofit, maintenance, monitoring, outreach programs, and other potential solutions.

## **BACKGROUND**

The McAleer Creek and Lyon Creek Basin Plans project began in April 2014. Both basins are located in the northeastern part of the City. The scope of the basin plans was to comprehensively assess surface water conditions in the landscape and conveyance network (i.e., streams, ditches, and pipes) so that integrated strategies that include maintenance, repair and replacement, capital, and outreach programs can be used to address problems. Methods of assessment include specific evaluation of hydrology and drainage, erosion, water quality, infrastructure condition assessment, and aquatic habitat (i.e. streams and wetlands).

The City contains approximately two (2) square miles of the eight (8) square mile McAleer Creek basin, which also spans portions of Lynnwood, Edmonds, Mountlake Terrace, and Lake Forest Park (Attachment A: McAleer Creek Basin Vicinity Map). The McAleer Creek main stem flows through the Ballinger neighborhood, roughly parallel to Forest Park Drive NE. Other notable surface water features within the City's portion of the McAleer Creek basin include Echo Lake and multiple tributaries to Whisper Creek east of 15<sup>th</sup> Avenue NE. The majority of the McAleer Creek basin within the City is upland areas with stormwater systems and a few small tributary streams that eventually drain to the main stem of McAleer Creek. For a basin-wide stormwater system map, see Attachment B: McAleer Creek Open Channel and Piped Drainage Network.

The City contains approximately 0.26 square miles of the four (4) square mile Lyon Creek basin which spans portions of the cities of Brier, Mountlake Terrace, Shoreline and Lake Forest Park (Attachment C: Lyon Creek Basin Vicinity Map). Ballinger Creek, a tributary to Lyon Creek, flows through the Ballinger neighborhood from north to south in the vicinity of 25<sup>th</sup> Avenue NE. For a basin-wide stormwater system map, see Attachment D: Lyon Basin Drainage Network.

Management strategies recommended by basin plans have been prioritized initially within respective basins only, and will eventually be prioritized on a City-wide scale (in the 2016 Surface Water Master Plan Update) so they can be strategically implemented in the future according to need and resource availability.

## **DISCUSSION**

Links to both basin plan final reports (PDF format) are on the City's website: <http://www.shorelinewa.gov/government/departments/public-works/surface-water-utility/mcaleer-creek-and-lyon-creek-ballinger-creek-basin-plans-project>.

The following discussion provides an update on some of the findings of the basin plans, including hydrology and hydraulic analysis, infrastructure condition, water quality, habitat and fish passage, and a summary of recommendations:

### **Basin Hydrologic and Hydraulic Analysis**

Hydraulic models for the main stem channels of McAleer Creek and Ballinger Creek within the City were developed as part of the respective basin planning efforts, utilizing existing hydrologic models that incorporated geology, topography, land cover (impervious surfaces and vegetation), and historic precipitation records. An existing hydrologic model was used as input to the hydraulic model to simulate rainfall-runoff relationships under different sizes of rainfall events. The hydraulic model was used to identify preliminary floodplain boundaries for planning purposes only. Surface water systems other than the McAleer Creek and Ballinger Creek main stem channels (including smaller tributary streams, piped drainages, and ditch-and-culvert systems) were not evaluated in the hydraulic modeling effort.

#### McAleer Creek Results

Modeling indicates that culverts and bridges on the McAleer Creek main stem are not flooded at 100-year flows. These results are confirmed by a general lack of historical flooding-related service requests along the McAleer Creek main stem as well as the existing FEMA Flood Insurance Rate Map (FIRM) map (last revised 5/16/1995), which depicts the 100-year flood as contained within the creek channel. The McAleer Creek Basin Plan includes a map that shows the extent of the 100-year floodplain according to the hydraulic model results (Attachment E).

#### Ballinger Creek Results

Modeling indicates that many culverts along the Ballinger Creek main stem flood during 2-year flows. The areas of inundation and flooding frequency in model results are generally confirmed by City staff field observations as well as historical flooding-related service requests and claims. Floodwaters tend to accrue on private property east of 25<sup>th</sup> Avenue NE and north of NE 195<sup>th</sup> Street, as well as on the City's North Maintenance Facility site and the adjacent 25<sup>th</sup> Avenue NE roadway. The Lyon Creek Basin Plan includes a map that shows the extent of the 100-year floodplain according to the hydraulic model results (Attachment F).

### **Infrastructure Condition Assessment**

The condition assessment included inspection of 1,221 stormwater pipes with a total length of 93,401 feet within the McAleer Creek basin (Attachment G), and 234 stormwater pipes with a total length of 18,842 feet within the Lyon Creek basin (Attachment H). The condition assessment included an overall rating of each pipe based on maintenance condition and structural condition. The findings indicate that poor pipe conditions are relatively common across both basins, to the extent that 10% to 25% of all pipes within the McAleer Creek and Lyon Creek basins are probably in very poor structural condition and may require replacement within the next five or ten years.

### **Water Quality**

Since 2001, the City has been monitoring water quality at two (2) locations within the McAleer Creek basin and one (1) location within the Lyon Creek basin. The data at all three locations generally indicate the water quality is moderately degraded to an extent

typical of urban streams but that these degraded conditions are stable or slightly improving.

Water quality results for the two McAleer Creek basin locations consistently rate as having a “moderate concern” per the Water Quality Index (WQI) rating system provided by the Washington State Department of Ecology (Ecology). The primary constituents of concern in McAleer Creek are fecal coliform, dissolved oxygen, and nutrients (nitrogen and phosphorus). A WQI rating cannot be calculated for Ballinger Creek because multiple water quality parameters needed for WQI are not monitored.

Echo Lake is within the McAleer Creek basin. During the summer months, King County monitors the water quality at the Echo Lake swimming beach for fecal coliform bacteria, closing the beach as needed if bacteria counts are too high. Since 2001, the City with partner volunteers has also participated in King County’s Lake and Stream monitoring program to monitor water quality conditions in Echo Lake. The 2013 monitoring report indicated that while Echo Lake water quality has remained relatively stable, there might be a slight trend toward eutrophication (leading to algae growth). New stormwater treatment facilities installed under the Aurora Avenue Improvements Project are expected to improve water quality for some of the runoff entering the lake; effectiveness of these water quality treatment facilities will be monitored as part of Ecology’s Regional Stormwater Monitoring Program Effectiveness Study.

#### **Habitat and Fish Passage – McAleer Creek**

Most of the McAleer Creek basin in the City consists of headwater drainage areas with only 2.8 miles of open stream channel; the main stem accounts for roughly half a mile with remaining length divided among multiple small tributary streams such as Whisper Creek. The McAleer Creek main stem within the City is documented as being used by several species of salmonid fish, including cutthroat and steelhead trout, and Coho and Chinook salmon. Channel conditions include variable riparian vegetation, wetlands, and pool and riffle habitat. None of the culvert crossings along the main stem of McAleer Creek within the City are documented by the Washington State Department of Fish and Wildlife (WDFW) SalmonScape website as full migration barriers, although the culvert at Forest Park Drive is identified as a partial barrier and the NE 196<sup>th</sup> Street control structure is listed as an “unknown” fish barrier. Additionally, the WDFW documents three partial-barrier culverts along the McAleer Creek main stem downstream of the City boundary.

McAleer Creek tributaries within the City were not specifically investigated for the basin plan with regard to fish use, habitat, or migration barriers. However, it was generally observed that cutthroat trout may be expected in some larger tributaries such as Whisper Creek.

#### **Habitat and Fish Passage – Ballinger Creek**

The City has jurisdiction over only 0.26 square miles of the total four (4) square mile Lyon Creek basin, or less than 7% of the total basin area. However, the Ballinger Creek main stem channel is a relatively prominent surface water feature within this small area, running approximately 3,300 feet in length from north to south. Two small tributaries flow into Ballinger Creek from the east.

Channel conditions are generally degraded in the City portion of the basin, with the exception of the two reaches of Ballinger Creek that have been rehabilitated: the reach in Brugger's Bog Park and a short segment at the northeast corner of 25<sup>th</sup> Avenue NE and NE 195<sup>th</sup> Street. The stream channel has benefited in these areas from native riparian vegetation plantings, invasive plant removal and re-grading to create pool and riffle habitat.

These stream sections are presumed to be used by cutthroat trout. There are a number of full or partial fish barriers along Ballinger Creek within the City (as documented by WDFW SalmonScape), including the culvert-and-pipe system along 25<sup>th</sup> Avenue NE downstream of Brugger's Bog Park. Additionally, there are multiple partial fish barriers along Ballinger Creek downstream of the City boundary, including the NE 195<sup>th</sup> Street culvert which is immediately downstream.

### **SUMMARY OF RECOMMENDATIONS**

McAleer Creek Basin Plan recommended stormwater management actions include the following:

- Stormwater Pipe Repair and Replacement – divided into multiple recommended projects for different priorities and types of repair and maintenance actions.
- Small projects to improve drainage at five (5) locations:
  - 6<sup>th</sup> Avenue NE and NE 200<sup>th</sup> Street Flood Reduction
  - NE 190<sup>th</sup> Street Flood Reduction east of 18<sup>th</sup> Avenue NE
  - NE 192<sup>nd</sup> Street Ditch Improvements between 15<sup>th</sup> Avenue NE and 16<sup>th</sup> Avenue NE
  - 25<sup>th</sup> Avenue NE Ditch Improvements between NE 175<sup>th</sup> Street and NE 178<sup>th</sup> Street
  - NE 177<sup>th</sup> Street Drainage Improvements between 21<sup>st</sup> Place NE and 22<sup>nd</sup> Place NE
- Small retrofit projects to improve water quality at three (3) locations:
  - Echo Lake Biofiltration Swale along the Interurban Trail north of NE 195<sup>th</sup> Street
  - N 199<sup>th</sup> Street and Wallingford Avenue N Bioretention swales
  - NE 192<sup>nd</sup> Street and Burke Avenue N Bioretention swales
- Studies regarding various basin-specific and/or City-wide stormwater management approaches:
  - Groundwater Study
  - NE 185<sup>th</sup> Street Station Subarea Stormwater Study
  - Evaluate Lateral Stormwater Connections
  - Evaluate Stormwater Utility Easement Acquisitions
  - Evaluation of Stream Designations
  - Echo Lake Water Quality Improvement Study
  - Eastern Boundary Drainage Systems Study

Lyon Creek Basin Plan recommended stormwater management actions include the following:

- Stormwater Pipe Repair and Replacement – divided into multiple recommended projects for different priorities and types of repair and maintenance actions.

- 25<sup>th</sup> Avenue NE Flood Reduction Project – includes replacing both the 25<sup>th</sup> Avenue NE culvert-and-pipe system downstream of Brugger’s Bog Park and the NE 195<sup>th</sup> Street culvert within the City of Lake Forest Park just south of the City boundary.
  - Conceptual design developed by basin plan estimates an approximate \$5M total cost for improvements. This cost estimate, as requested by City staff, does not attempt to estimate some potential additional costs due to currently undetermined permitting requirements or other contingencies.
  - Due to the severity and frequency of this flooding issue and the potential for direct flooding impacts to the City’s North Maintenance Facility (NMF), the 25<sup>th</sup> Avenue NE Flood Reduction Project has been made a high priority. Flood reduction improvements are targeted to be designed and installed as soon as possible to minimize flooding risk and other potential impacts to the NMF. Surface water funding has been programmed for 2016-2018 for this project, and consultant selection is currently underway.

### **STAKEHOLDER OUTREACH**

An open house was held for the McAleer Creek and Lyon Creek Basin Plans at City Hall on May 13, 2014. A second open house was held at Brugger’s Bog Park on September 17, 2014. Both meetings utilized display boards showing basin problems and proposed projects to solicit public input on surface water problems and concerns in each of the respective basins.

Public concerns and suggestions at these meetings related to the McAleer Creek basin included:

- Need to improve Echo Lake Creek channel
- Echo Lake protection
- Request for more rain gardens
- Suggestion to daylight Cedarbrook Creek through Cedarbrook School property

Public concerns and suggestions at these meetings related to the Lyon Creek basin included:

- Bad pipes and fish passage issues on 25th Avenue NE
- Flood reduction projects in the vicinity of Brugger’s Bog Park and Ballinger Open Space Park
- Concern about stormwater pollution originating in Shoreline and other upstream areas entering Lake Forest Park
- Concern about pollutants entering stormwater from the former King County Brugger’s Bog Maintenance Facility
- Concern about the volume of flows entering Lake Forest Park
- Suggestion to mitigate flows in Ballinger Creek by encouraging homeowner installation of rain gardens

### **COUNCIL GOAL ADDRESSED**

The basin plans and their recommended projects support Council Goal # 2: Provide safe, efficient, and effective infrastructure to support our land use, transportation, and surface water plans.

### **RESOURCE/FINANCIAL IMPACT**

There is no resource or financial impact associated with this discussion. A few of the highest priority management actions recommended by the McAleer Creek and Lyon Creek Basin Plans – such as the 25<sup>th</sup> Avenue NE flood reduction project and selected high priority pipe repairs – are already in the process of being addressed. However, the majority of recommended management actions identified in the McAleer Creek and Lyon Creek Basin Plans will be prioritized alongside other City-wide management actions identified in the other surface water basin plans. This process of prioritizing and programming recommended surface water management actions is expected to take place during the upcoming Surface Water Master Plan Update in 2016.

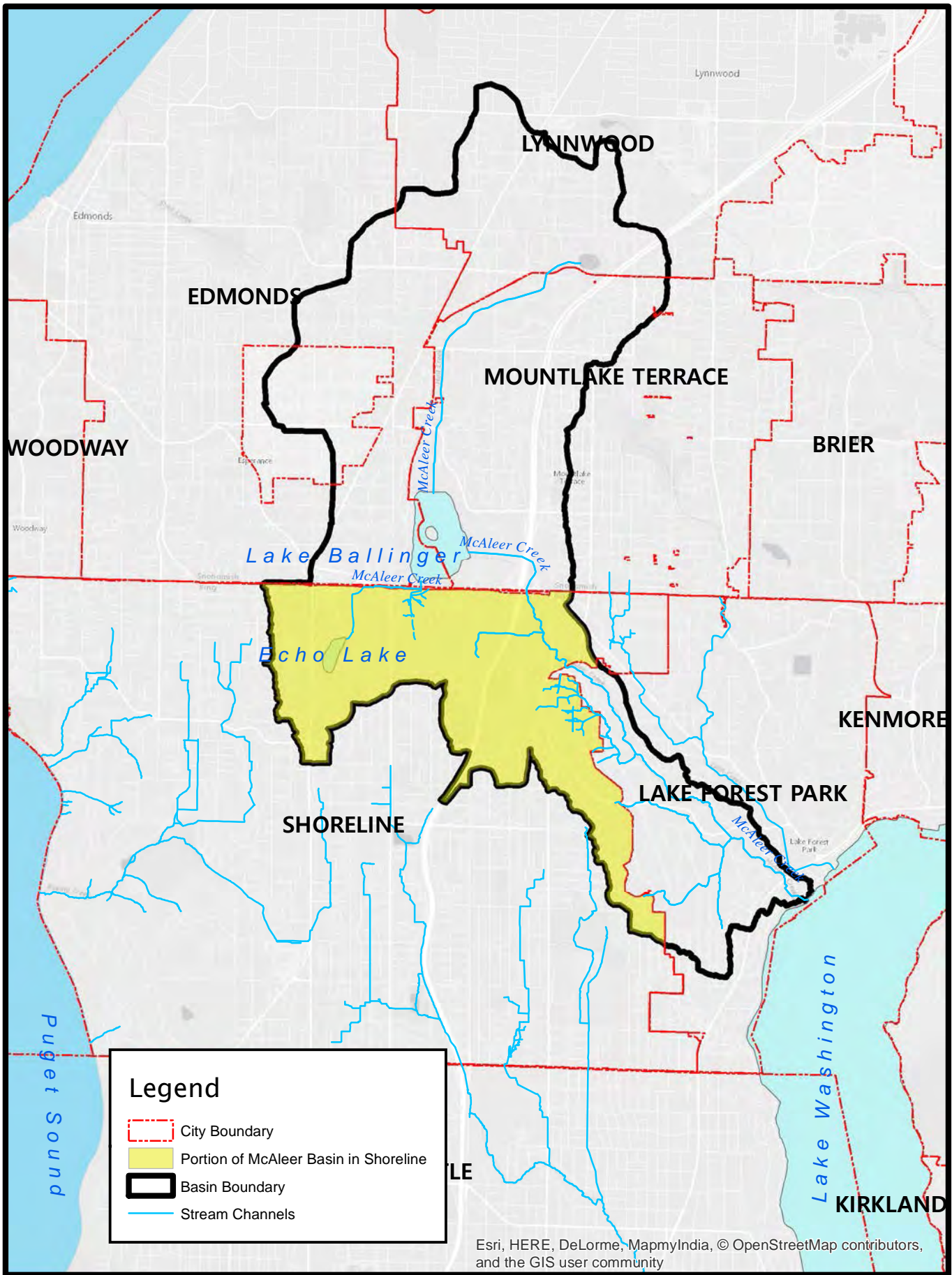
### **RECOMMENDATION**

No action is required at this time. This item is for Council discussion. The basin plan recommended surface water management actions and associated costs will be prioritized as part of the 2016 Surface Water Master Plan Update.

### **ATTACHMENTS**

- Attachment A: McAleer Creek Basin Vicinity Map
- Attachment B: McAleer Creek Open Channel and Piped Drainage Network
- Attachment C: Lyon Creek Basin Vicinity Map
- Attachment D: Lyon Basin Drainage Network
- Attachment E: Preliminary 100-year Floodplain Map for McAleer Creek
- Attachment F: Preliminary 100-year Floodplain Map of Ballinger Creek in Shoreline
- Attachment G: McAleer Creek Pipe Condition Assessment Ratings Greater than Five
- Attachment H: Lyon Creek Pipe Condition Assessment Ratings Greater than Five



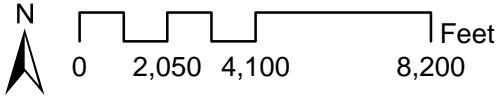


**Legend**

- City Boundary
- Portion of McAleer Basin in Shoreline
- Basin Boundary
- Stream Channels

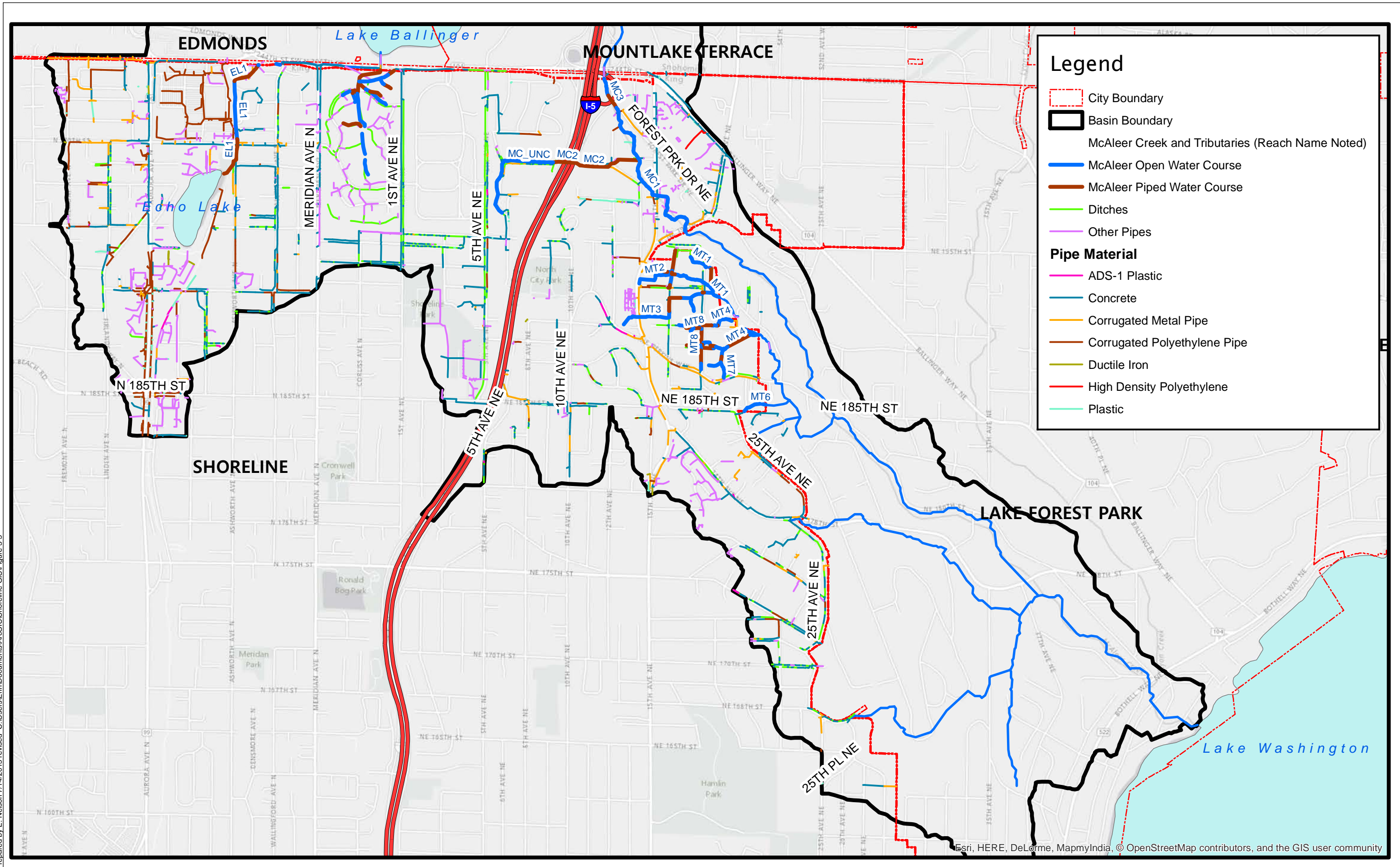
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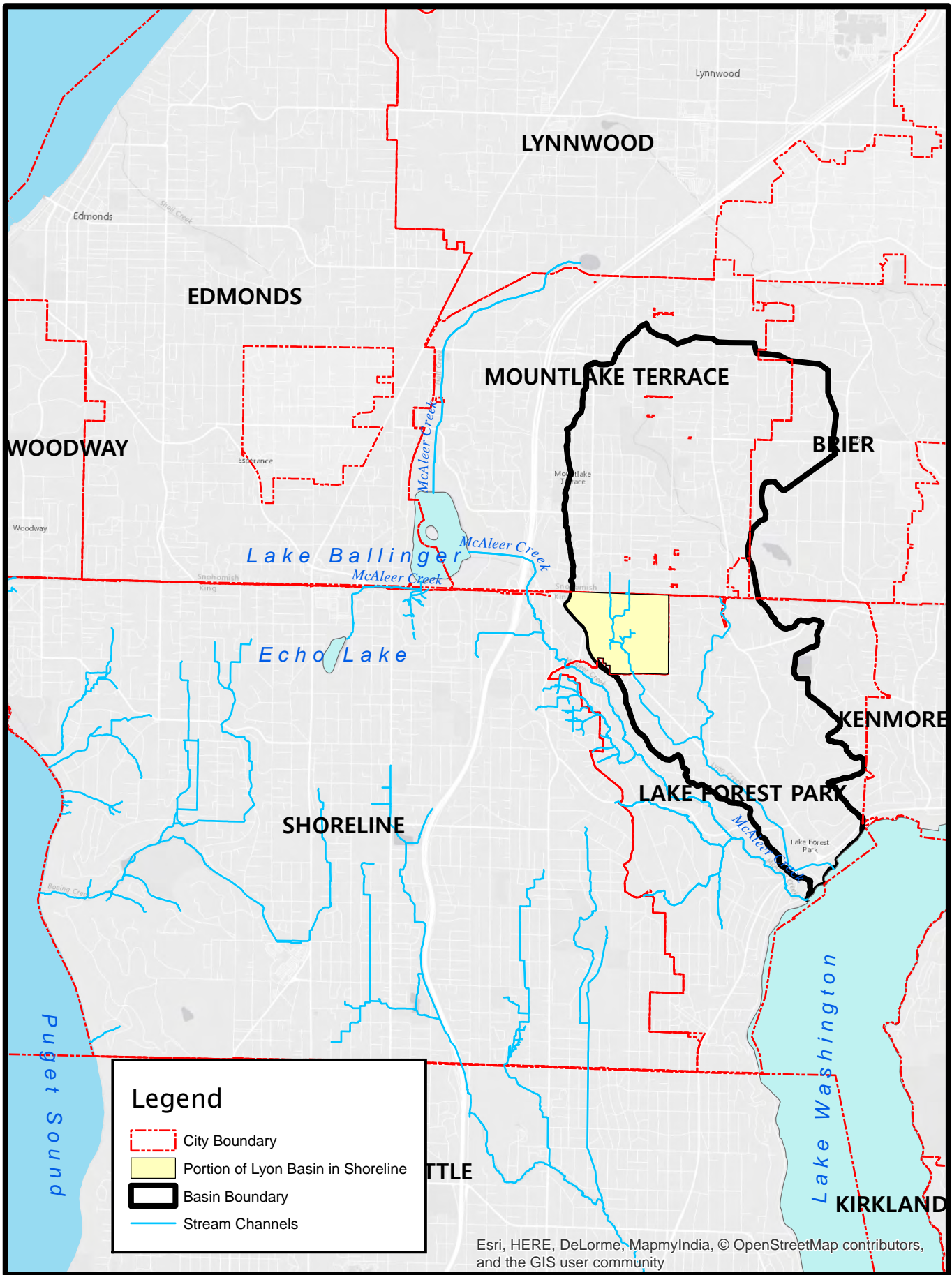
Prepared by E. Nelson 7/29/2015



**Figure ES-1. McAleer Creek Basin Vicinity Map**

Prepared by E. Nelson 7/14/2015 revised C:\Users\Erin\Documents\ArcGIS\Shoreline GIS\Figure 3-5





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Prepared by E. Nelson 7/13/2015 revised

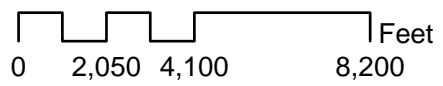
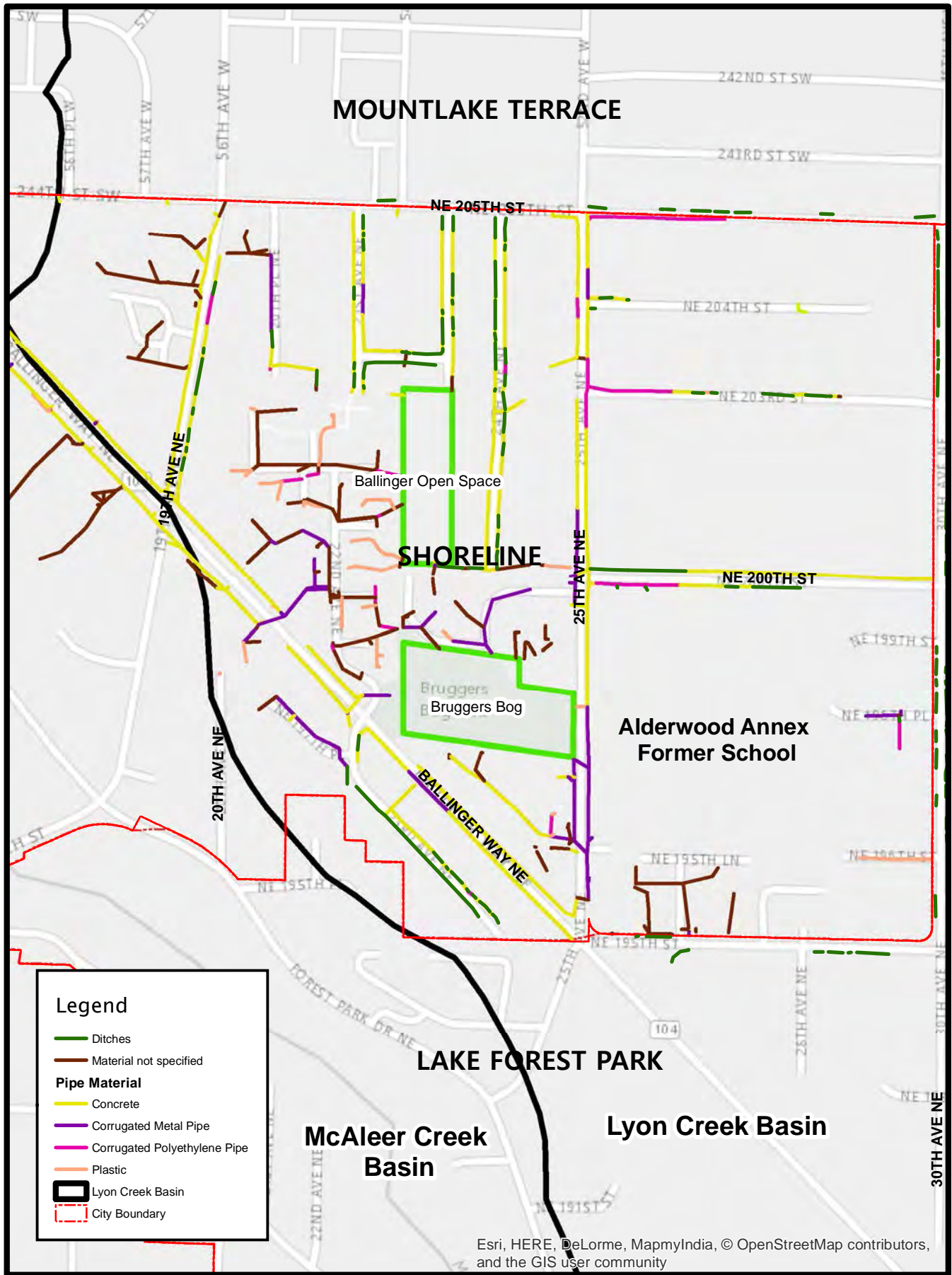


Figure ES-1. Lyon Creek Basin Vicinity Map

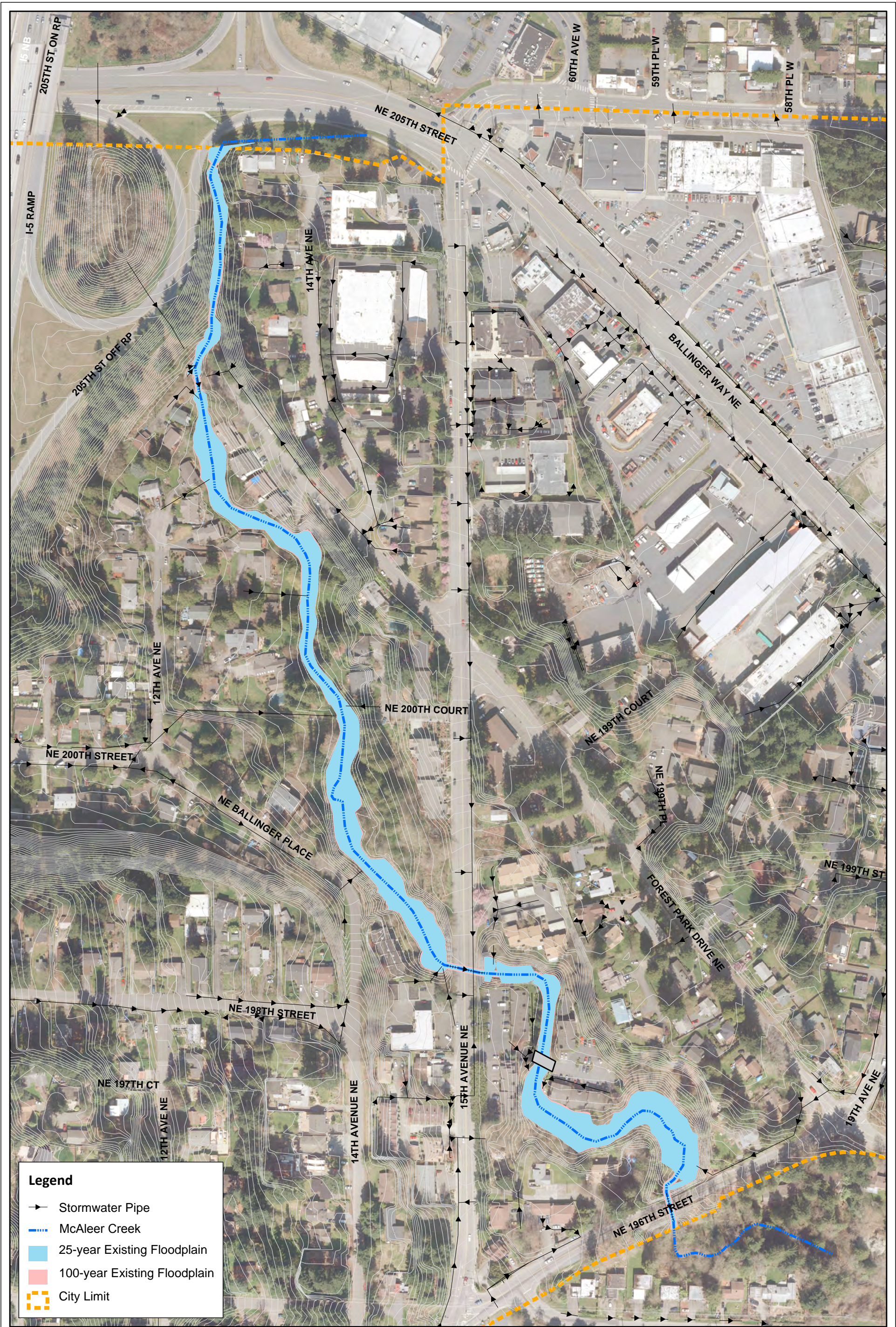
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Figure 3-6. Lyon Basin Drainage Network



**Legend**

- Stormwater Pipe
- McAleer Creek
- 25-year Existing Floodplain
- 100-year Existing Floodplain
- City Limit

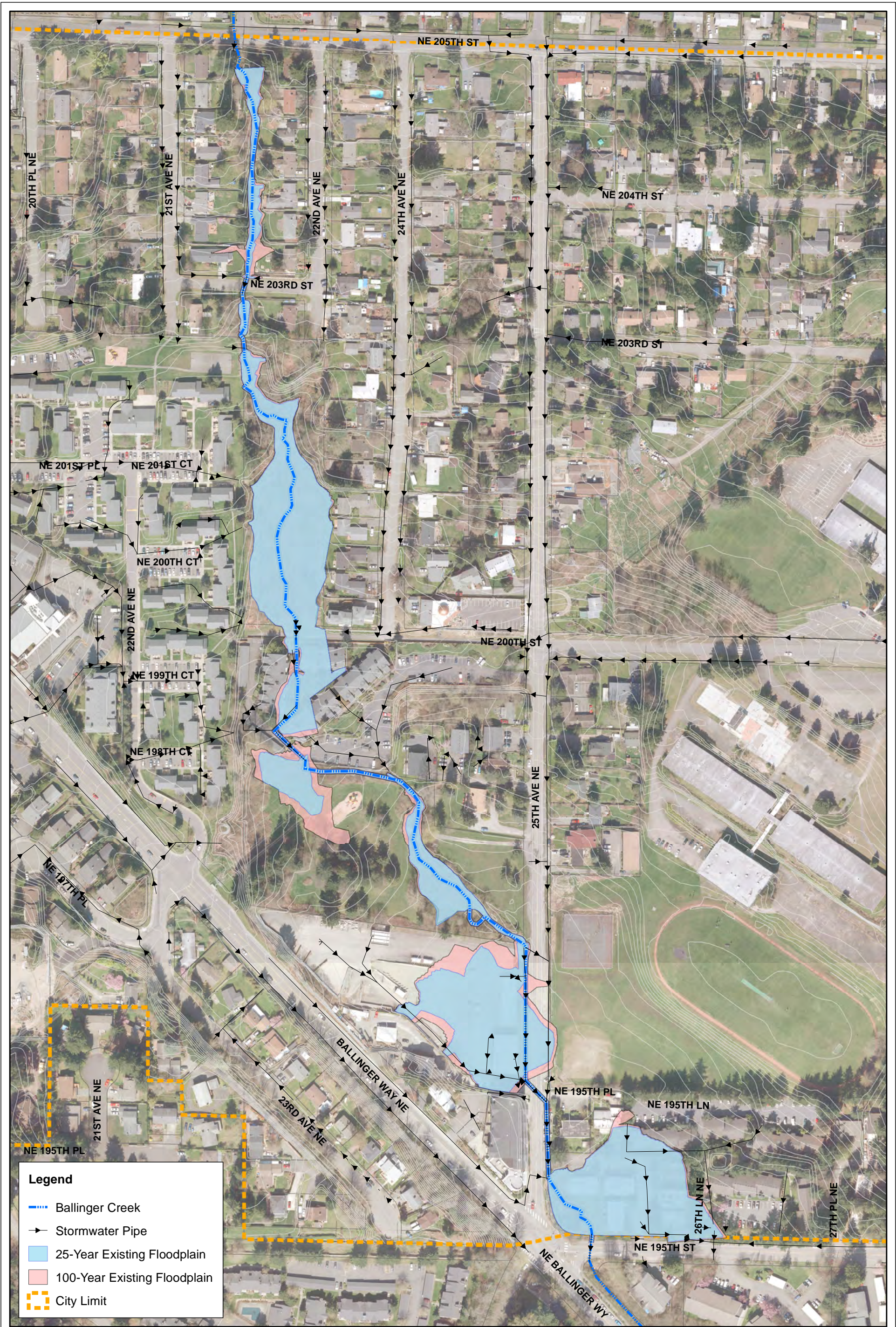


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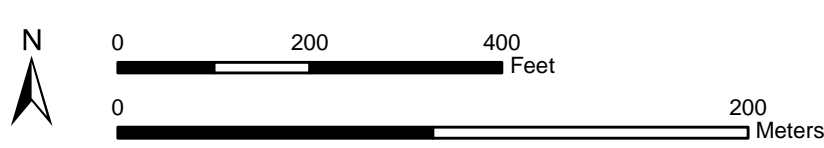
Figure 3-6. Preliminary 100-year Floodplain Map for McAleer Creek  
Shoreline, WA

Prepared by MLP, 12/17/2014



**Legend**

- Ballinger Creek
- Stormwater Pipe
- 25-Year Existing Floodplain
- 100-Year Existing Floodplain
- City Limit

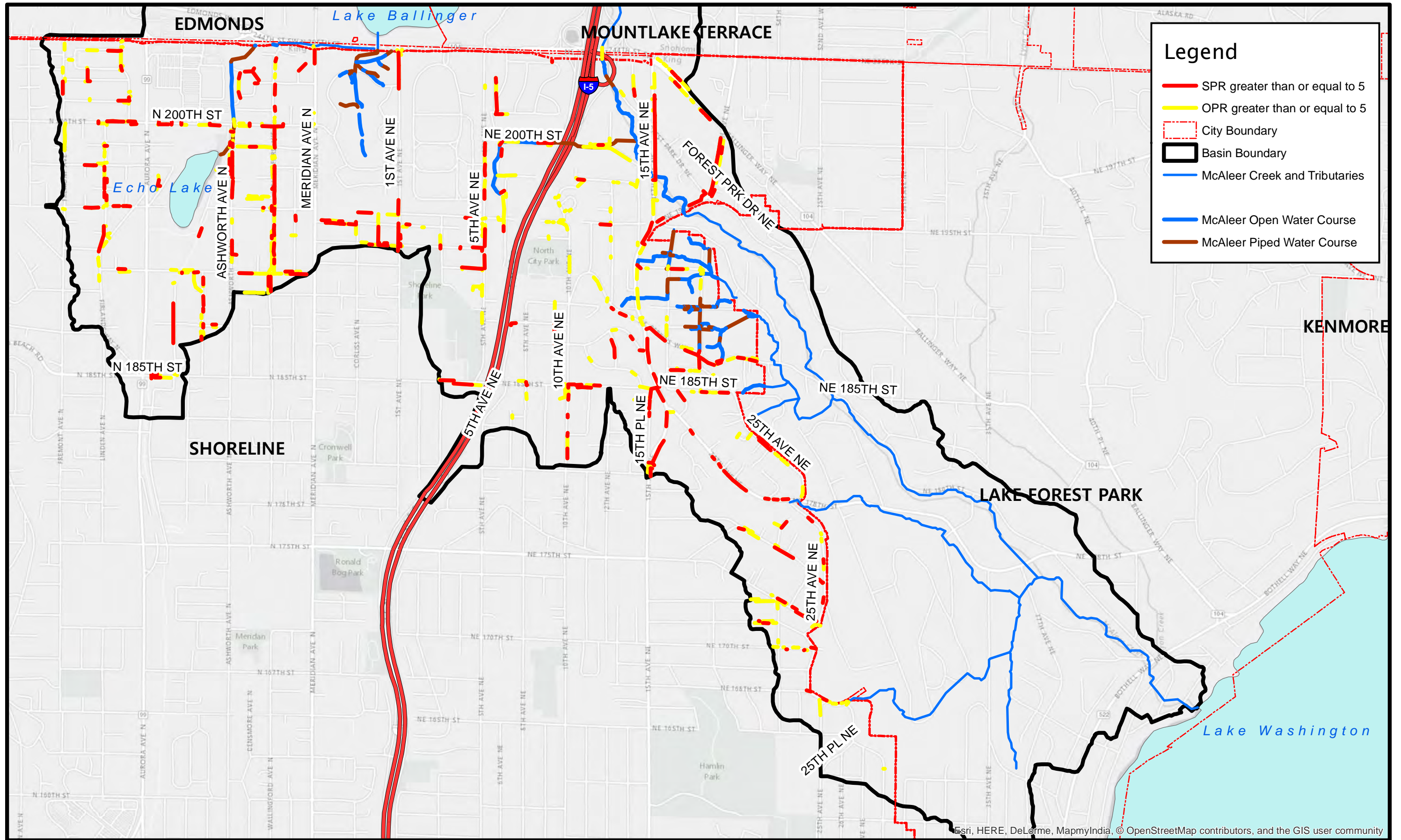


**Figure 3-7: Preliminary 100-year Floodplain Map of Ballinger Creek in Shoreline**  
 Shoreline, WA

Prepared by MLP, 12/17/2014



Prepared by E. Nelson 7/16/2015 revised C:\Users\Erin\Documents\ArcGIS\Shoreline GIS\Figure 3-8



Note:  
 SPR = Structural Pipe Rating (NASSCO system)  
 OPR = Overall Pipe Rating (NASSCO system)

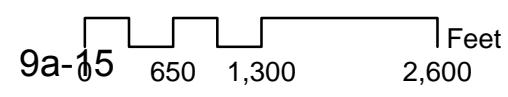
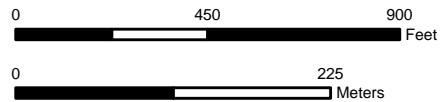
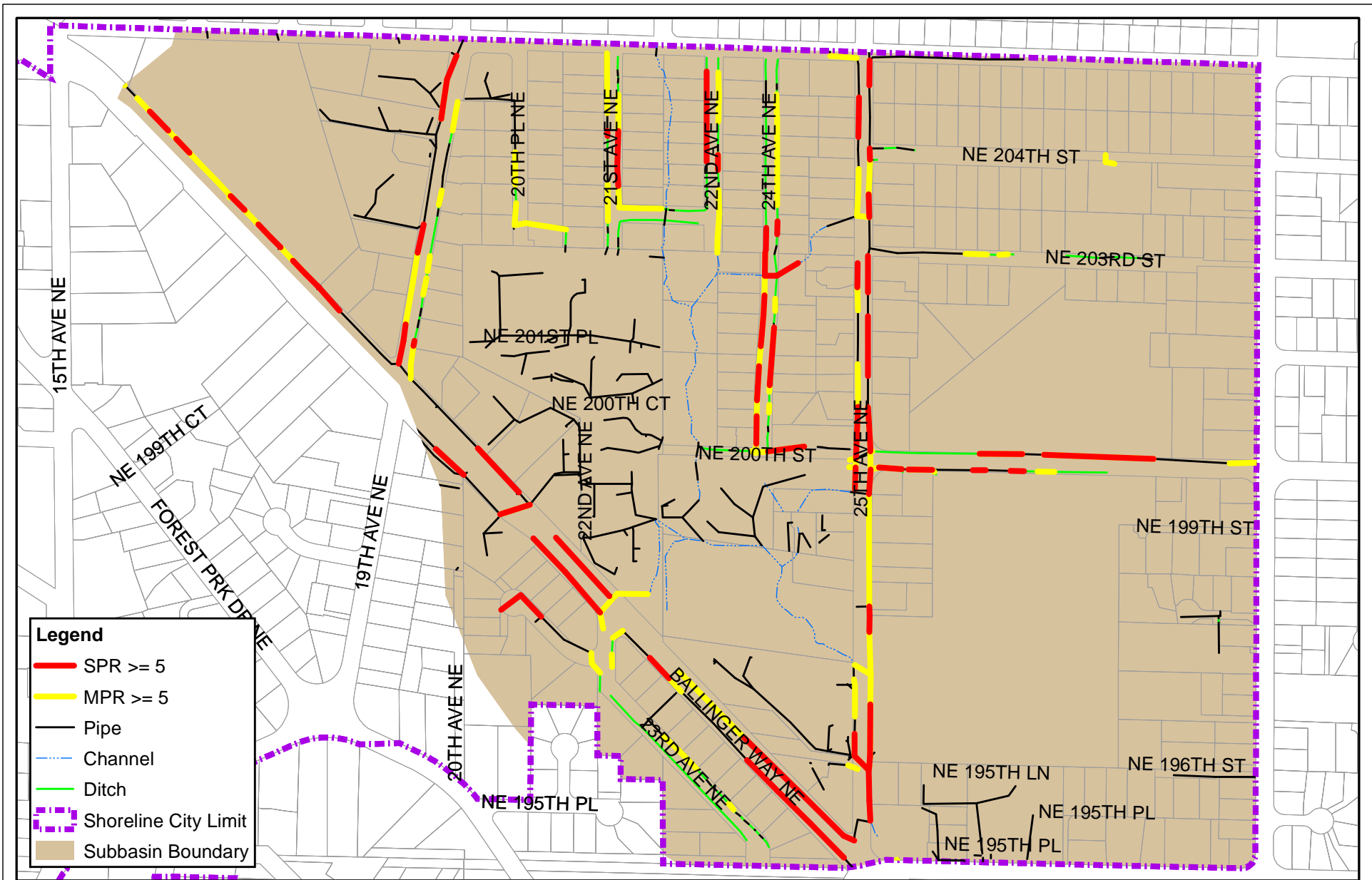


Figure 3-8. McAleer Creek Pipe Condition Assessment Ratings Greater than 5  
 ATTACHMENT G



**Figure 3-9: Condition Assessment Ratings  
Greater than 5 in Lyon Creek Basin**  
Shoreline, WA