CONSOLIDATED STORMWATER MASTER PLAN

Prepared for
City of Fairview, Oregon

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EXECUTIVE SUMMARY

The City of Fairview (City) developed the Consolidated Stormwater Master Plan (CSMP) to combine all needed infrastructure improvements along with federal and state water quality requirements for each project into one comprehensive document. Currently the City is working with 12 stormwater-related documents including three master plans, five National Pollutant Discharge Elimination System Municipal Storm Sewer System permit-related documents, two action plans, a Stormwater Management Plan, and the City's stormwater model. These documents address both stormwater quantity and quality issues. The City contracted with Brown and Caldwell to develop the CSMP. The CSMP will guide the City in prioritizing capital projects and setting both stormwater rates and system development charges (SDCs). The project development process and project summary completed by Brown and Caldwell are briefly described below.

Brown and Caldwell defined the project goals and objectives; identified potential projects; analyzed potential projects; modeled existing and future conditions in the City; and prioritized projects. During project development, Brown and Caldwell completed site visits, interviewed staff and stakeholders, developed a preliminary project list, described project benefits and estimated project costs. This preliminary project list was reviewed by City staff and narrowed to those most relevant to the current City goals.

Selected projects were prioritized based on 11 criteria that included cost, funding source, mandates, special interests, safety, complexity, impact, environmental benefit, permitting, sustainability, and livability. Projects resulting in the highest ranking tended to be the less expensive re-vegetation projects required to meet Total Maximum Daily Load requirements. Inspection of pipes to determine condition and possible need for replacement and dry well registration also ranked high.

Projects that did not rank highly included large capital projects. These projects typically cost over $100,000. Two of the more expensive projects focus on floodplain development but the stormwater modeling did not show a strong correlation between stormwater detention at the specified project location and reductions in downstream flooding. Several projects were reviewed, ranked and scored but are on private property or within Multnomah County right-of-way. While addressed in this CSMP, these projects will not be included in future rate or system development charge assessments.

The CSMP provides the City of Fairview with information on 28 selected project (11 of these on private property or within Multnomah County right-of-way). These projects are shown on detailed maps and in descriptive project sheets including cost estimates. The City can use this information for updating stormwater rates and system development charges. The project analysis sheets, cost estimates, and maps can also be used to apply for grant funding or to begin conversations with other agencies and jurisdictions on opportunities to work cooperatively on stormwater enhancements.

CHAPTER 1

INTRODUCTION

The City of Fairview, Oregon (City) has been working to manage its stormwater program from numerous documents including two Stormwater Master Plans; the *Storm Drainage Master Plan for Northeast Fairview* (Newton Consultants, Inc., March 2003) and the *Capital Improvements Plan* (CH2M Hill, February 2000). These plans address stormwater quantity and improvements associated with stormwater conveyance. In addition the City is a co-permittee with the City of Gresham and Multnomah County on a National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit. The NPDES MS4 discharge permit requires the City to reduce the discharge of pollutants to waters of the State from the MS4 to the Maximum Extent Practicable. The City sought to develop a Consolidated Stormwater Master Plan (CSMP) to combine all needed infrastructure improvements along with federal and state water quality requirements for each project into one comprehensive document.

Authorization

The City contracted with Brown and Caldwell in June 2007 to develop a CSMP that addresses both stormwater quantity issues and the specific stormwater quality requirements of the NPDES MS4 discharge permit. This document will guide the City in setting both stormwater rates and system development charges, and in providing a tool for capital improvement project implementation.

Purpose and Scope

This study included developing levels of service, reviewing existing information, and developing and prioritizing projects. Projects were developed to address both water quantity and quality issues, utilizing hydrologic and hydraulic modeling as well as information from the Total Maximum Daily Load regulatory program and the NPDES MS4 discharge permit to guide project development. The project scope included the following:

- Define project objectives and establish levels of service to use in evaluating capital improvement projects through a workshop with the Public Works Director, Engineering Technician, Public Works Operations and Maintenance Supervisor, and Planning Director.
- Review existing information available through reports that have been developed for the City over the past 15 years and through anecdotal information via interviews with stakeholder agencies which contribute to, or receive, City stormwater. Develop an inventory of previously identified projects.
- Screen projects through discussions with City staff to focus engineering and modeling efforts on projects of highest priority to the City.
- Identify modeling needs to complete the CSMP in a technical memorandum.
- Visit sites and develop recommendations.
- Model projects using the XP-SWMM™ model provided by Crawford Engineering Associates.
- Develop project alternatives, screen projects, and develop preliminary cost estimates.
- Develop geographic information system (GIS) maps showing the location of projects, existing conditions, and proposed improvements.

- Prioritize projects using a workshop approach with the Public Works Director and Engineering Technician; include in the prioritization process lifecycle operations and maintenance costs.
- Develop a Stormwater Capital Improvement Program (CIP) for recommended projects with cost estimates and priorities for each recommendation.

NPDES MS4 Discharge Permit Coordination

Development of the City's CSMP is in direct compliance with the City's NPDES MS4 Discharge Permit. The permit requires that the City's Stormwater Management Plan be updated on a regular basis. When it is updated the Stormwater Management Plan is incorporated into the permit and becomes part of the permit requirements. During the last Stormwater Management Plan update in 2006, it was stated that the City's stormwater CIP would be revised and updated in 2007. Development of the CSMP and the resulting updated CIP meets the requirements of the NPDES MS4 discharge permit.

Report Organization

The CSMP includes the following:

- Introduction
- Levels of Service – Description of project goals and objectives, current information on potential problem areas, and internal and external levels of service.
- Project Screening – Description of the methods used to identify projects, initial project screening, modeling, and project design.
- Project Prioritization – Description of the workshop and process used to prioritize projects for the Stormwater CIP.
- Project Analysis Sheets and Maps – Detailed descriptions of projects, cost estimates of projects, and Geographic Information System (GIS) maps of projects that were selected for the CIP.

CHAPTER 2

LEVELS OF SERVICE

The levels of service for surface water quantity and quality were developed at a meeting on June 13, 2007 with the Public Works Director, Planning Director, Engineering Technician, and Public Works Operations and Maintenance Supervisor. The levels of service were then used in developing capital improvement projects as part of the Consolidated Stormwater Master Plan (CSMP). Fully understanding the direct relationship between service levels and the cost of conducting the activities and building the facilities strengthens the City's ability to provide reasonable justification for expenditures and articulate trade-offs between alternatives. The levels of service are discussed in detail below. The meeting notes from June 13, 2007 are included in Appendix A.

Project Goals and Objectives

The goal of the CSMP is to identify surface water management projects and provide the necessary information to set stormwater rates and system development charges. The objectives of the CSMP include:

- Comply with current and expected stormwater regulatory requirements, in particular the Phase I National Pollutant Discharge Elimination System (NPDES) Municipal Storm Sewer System (MS4) permit schedule, with which the City is a co-permittee with the City of Gresham and Multnomah County.
- Review 303(d) listings and Total Maximum Daily Loads (TMDLs) for the Columbia Slough and Willamette River.
- Address existing and future stormwater quantity issues of flooding and conveyance.
- Develop a prioritized list of capital and management system improvements.
- Develop recommendations for establishing adequate financing of the stormwater program.

Current Information

Initial projects to address known problem areas for surface water management were identified during the levels of service meeting. The initial known problem areas included where Raintree Creek crosses under the railroad at Interstate 84 (I-84), the stretch on Fairview Creek from Halsey Street to I-84, and Thompson ditch. Raintree Creek eventually became project RT-1; Fairview Creek from Halsey to I-84 became project FV-1; and the Thompson Street Stormwater Improvement project became project OS-1. These projects are discussed again in Chapters 3 and 4, and analyzed in detail in Chapter 5.

Levels of Service

During the June 13, 2007 meeting, internal and external levels of service for stormwater quality and quantity were developed for the City, and the City's existing levels of service were documented. These levels of service were incorporated into project design and used during the project prioritization process. They were the basis of the project kick-off and were referred to throughout project development.

Internal

Internal levels of service identify the operational procedures at which the organization must excel to satisfy its customers. Internal levels of service at the City include the following:

- Consider water quality with every newly constructed facility and any improvements
- Use onsite disposal of stormwater; i.e., infiltration

Existing

Existing levels of service include practices in which the City is currently engaged to meet the needs of the customer. These include the following:

- Limit stormwater flooding of property
- Meet NPDES MS4 permit limits and maximum extent practicable requirements
- Meet general design standards for developers
- Use the Portland Stormwater Management Manual
- Meet TMDL wasteload allocations
- Meet State Goal 5 requirements
- Meet City Parks goals
  - Pursue active recreation
  - Move away from acquisition for open space
  - Use passive park for stormwater facilities
  - Install no ponds in active recreation areas
- Avoid changing Fairview Lake operation—raise weir to 11.58 feet during the summer, lower to approximately 9 feet in the winter

External

Based on discussions at the Level of Service meeting on June 13, 2007, the City decided to add an external level of service criterion to reduce flooding. This level of service criteria states that the City will strive to ensure a maximum water surface elevation (WSEL) one foot below the finished floor of the building for the 100-year flood event.

External levels of service include practices in which the City is currently engaged to meet the requirements of outside jurisdictions. These include the following:

- Meet Oregon Department of Fish and Wildlife habitat requirements
- Follow prior agreements with Multnomah County Drainage District for minimal detention of stormwater flows in the City
- Meet Federal Emergency Management Administration requirements for floodplain development
- Comply with requirements of the Federal Clean Water Act

Design

Based on the level of service meeting, it was determined that project designs should focus on water quantity, water quality, or both. Projects related to water quantity were analyzed using existing flows and future flows. The modeling is discussed further in Chapter 3. Projects related to water quality considered the City's stormwater NPDES permit, TMDLs, and 303(d) listings as discussed below.

Water Quantity

Based on the discussions at the level of service meeting, it was determined that when flooding is identified as an issue, the 100-year future flows and WSELs needed to be considered during project design. Brown and Caldwell developed a technical memorandum, *Summary of Hydrologic and Hydraulic Model Requirements*, included as Appendix B, to document projects that had been identified and the understanding of what would be needed for the CSMP. Brown and Caldwell updated the existing XPSWMM model provided by David Crawford of Crawford Engineering Associates, for full build-out conditions for Fairview Creek, No Name Creek, and the Raintree Subbasin. The results of this modeling are included as Appendix D, *Summary of Hydrologic and Hydraulic Modeling*.

Water Quality

All new stormwater projects must assess the impacts on receiving waters and consider design alternatives that may improve water quality. Existing structural facilities were evaluated during preparation of the Interim Evaluation Report, submitted to the Oregon Department of Environmental Quality (DEQ) in 2006, to determine if additional pollutant removal could be achieved through retrofitting. The City's NPDES MS4 Permit requires reducing pollutants to the Maximum Extent Practicable, demonstrating progress toward reducing TMDL-related pollutants, and reviewing pollutants on the 303(d) list. This is stated in the permit as follows:

- "Each co-permittee must reduce the discharge of the pollutants from the MS4 to the maximum extent practicable" (Schedule A(2)).
- "Adequate progress toward achieving assigned wasteload allocations will be demonstrated through the implementation of best management practices that are targeted at TMDL related pollutants" (Schedule D(2)(d)).
- "The co-permittee must qualitatively review the pollutants that are on the 2002 303(d) list that are relevant to the co-permittee's MS4 discharges" (Schedule D(2)(e)).

The primary bodies of water in the City of Fairview are Fairview Creek and Fairview Lake. Fairview Creek discharges to Fairview Lake, which discharges to the Columbia Slough. The Columbia Slough is a tributary of the Willamette River. Secondary bodies of water include No Name Creek, Osborn Creek, Raintree Creek, Silent Creek, and Salmon Creek. While in Fairview, Salmon Creek is within the Sandy Improvement Drainage District and is pumped to the Columbia River. The other secondary streams in Fairview all drain to the Columbia Slough via Fairview Lake. TMDLs for mercury, temperature, bacteria, nutrients, and toxics have been established for the watersheds that Fairview is part of—the Willamette River Basin and the Columbia Slough. On the project analysis sheet for each project, the potential pollutants that could be reduced are included in the section "Project Benefit to City."

TMDLs

DEQ has identified the City as a Designated Management Agency for established TMDLs for the Willamette Basin and the Columbia Slough. In addition, the City's NPDES discharge permit requires the City to show

progress toward meeting the TMDL requirements. TMDLs for mercury, temperature, and bacteria were adopted by DEQ in 2006 for the Willamette River Basin. DEQ developed TMDLs in 1998 for the Columbia Slough for nutrient related parameters (chlorophyll *a*, dissolved oxygen, pH, and phosphorus), bacteria, and toxics (dissolved lead, DDE/DDT, PCBs, dieldrin, and 2,3,8,7 TCDD). These TMDLs affect all stream resources within Fairview, except Salmon Creek which discharges to the Columbia River, as the TMDLs are equally applicable to all tributaries within the basin. This applicability is irrespective of ownership, location in the watershed, or size of stream.

303(d) List

The City's NPDES MS4 permit requires a qualitative review of the pollutants on the 2002 303(d) list. The 303(d) list includes pollutants that are of concern. When a TMDL has been developed for a pollutant, it is removed from the 303(d) list. Fairview Creek is on the 2004/06 303(d) list for bacteria (E. *coli* and fecal coliform) and temperature. These are also covered under the Willamette River TMDL.

CHAPTER 3

PROJECT SCREENING

Brown and Caldwell reviewed existing documents, conducted interviews, and met with City of Fairview (City) staff to identify projects. Projects were developed based on field work and modeling results. This process is discussed in more detail below.

Existing Data

Capital stormwater projects were identified based on previously published documents and thorough discussions with City staff. The following documents were reviewed at project initiation:

- *Storm Drainage Master Plan for Northeast Fairview* (Newton, 2003)
- *Capital Improvements Plan* (CH2M Hill, February 2000)
- National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit (Oregon Department of Environmental Quality, expires January 31, 2009)
- Retro-fit Memo (URS, August 2005)
- Development of Retrofit Options (GeoSyntec, 2006)
- *Fairview Creek Action Plan* (Fairview Creek Watershed Council, 2003)
- *Columbia Slough Action Plan* (Columbia Slough Watershed Council, 2003)
- *Stormwater Management Plan* (Brown and Caldwell, 2006) and associated documents
- Evaluation of Stormwater with Respect to Established TMDLs and 303(d) Listed Parameters (URS, 2006)
- Fairview Creek Hydraulic Model (Crawford Engineering Associates, November 2006)
- Total Maximum Daily Loads (TMDLs) for the Columbia Slough (DEQ, 1998)
- TMDLs for the Willamette Basin (DEQ, 2006)

In addition, interviews were conducted with adjacent jurisdictions and organizations which work on stormwater issues. These included the following:

- Multnomah County Drainage District No. 1
- Sandy Drainage District
- City of Gresham
- Multnomah County Transportation
- Columbia Slough Watershed Council
- City of Wood Village
- City of Troutdale
- Oregon Department of Transportation, Troutdale Office

Based on the above document review and interviews, a comprehensive project list was developed and over 100 projects were inventoried. This list is included in Appendix C.

Screening

The City chose several projects for further analysis based on the comprehensive project list in Appendix C, ongoing flooding concerns, and existing or upcoming regulatory requirements. A list of the projects selected is included below. Each project is reviewed in Chapter 4 and discussed in detail in Chapter 5.

Project List

General/Programmatic Projects (GN)

- GN-1: Closed-circuit television inspection
- GN-2: Pipe, manhole, and catchbasin rehabilitation
- GN-3: Catch basin retrofit program

Groundwater Projects (GW)

- GW-1: Dry Well Registration
- GW-2: Dry Well Pre-treatment

Fairview Creek Projects (FV)

- FV-1: Fairview Creek between Halsey Street and Interstate 84 (I-84)
- FV-2: Flooding on Halsey Street by Fieldstone Apartments
- FV-3a-e: South of Halsey Street and west of 207th Avenue, riparian vegetation or floodplain storage on private or public property
- FV-4: Salish Ponds and Wetlands
- FV-5: Old Town Green Streets Opportunities
- FV-6: Heron Point Restoration
- FV-7: McDonald Brothers Restoration
- FV-8: Fairview Village Detention Ponds

No Name Creek Projects (NN)

- NN-1: Undersized Culvert for No Name Creek at Sandy Boulevard
- NN-2: Flooding of Church parking lot on Halsey Street from No Name Creek
- NN-3: Revegetation behind Fairview Oaks Apartments

Raintree Sub-basin Projects (RT)

- RT-1: Raintree Creek Culvert under Railroad
- RT-2: Park Cleone Detention Pond Retrofit
- RT-3: 7th Street, from Main north to Railroad Ditch
- RT-4: Pipe replacements at 6th and Harrison Streets

Osborn Sub-basin Projects (OS)

- OS-1: Thompson Street Storm Drain Improvements

Modeling

The City had an existing model of Fairview Creek prepared by Crawford Engineering Associates prior to development of the Consolidated Stormwater Master Plan (CSMP). To support the development of the CSMP, Brown and Caldwell updated the existing model, created future conditions for Fairview Creek, and

developed a new model for existing and future conditions for the Raintree sub-basin. Modeling work was completed using data provided by Crawford Engineering Associates and the City. The *Summary of Hydrologic and Hydraulic Modeling* technical memorandum is included as Appendix D. It provides a history of past modeling efforts; outlines the information used to modify the existing model and to develop the new Raintree model; documents the hydrologic and hydraulic modeling assumptions; and includes tables of model results for the existing and future conditions.

Project Design

Brown and Caldwell visited project sites with City staff. Based on the field work, additional data was gathered and project alternatives were developed and documented using project analysis sheets and geographic information system. Additional documents consulted during project design include the following:

- *City of Fairview Drainage Master Plan* (CH2M Hill, 1986)
- *Storm Drainage Master Plan* (Oakley Engineering, 1993)
- Flood Insurance Study, City of Fairview, Oregon (Federal Emergency Management Agency, 1995) and associated Letters of Map Change posted through September 2007
- Engineering drawings for all the bridges on Fairview Creek between Halsey Street and I-84
- Old Salish Ponds Regional Stormwater Detention Facility—Operational Characteristics (CH2M Hill, 1999)
- *Assessment of Fairview Creek Flow Control Options Technical Memorandum* (CH2M Hill, 2000)
- Townsend Farms Business Park—Stormwater Management Memo (City of Fairview, January 18, 2005)
- Stormwater Fund, 2007-2008 Budget (City of Fairview, 2007)
- *North Troutdale Storm Drainage Master Plan* (Otak, 2007)
- Engineering drawings for Fieldstone Apartments

Project analysis sheets and maps were developed for each of the projects and are discussed in further detail in Chapter 5.

CHAPTER 4

PRIORITIZATION PROCESS

On October 24, 2007 Brown and Caldwell met with the City of Fairview's Public Works Director and Engineering Technician to refine the prioritization criteria, choose alternatives and prioritize projects. The results of the prioritization process are shown below in Table 4-1, Consolidated Stormwater Master Plan–Prioritized Projects. The prioritization criteria are included in Table 4-2, Prioritization Criteria. The prioritization meeting agenda, criteria, and assigned weighting factors for each project are also included in Appendix E.

Table 4-1. Consolidated Stormwater Master Plan - Prioritized Projects

Ranking Matrix				Performance Criteria Scores										
		COST (IN 1,000's)	RATING	COST	FUNDING SOURCE	MANDATE	SPECIAL INTEREST	SAFETY LIABILITY	COMPLEXITY	IMPACT	ENVIRON. BENEFIT	PERMITTING	SUSTAINABILITY	LIVABILITY
ID	Project Name			*1.0*	*0.4*	*0.4*	*0.3*	*1.0*	*0.6*	*1.0*	*0.4*	*0.4*	*0.4*	*0.4*
FV-3a	S of Halsey & W of 207th (N of Salish Ponds)	$34	16.20	3	2	3	2	1	3	3	3	3	3	3
FV-3b	S of Halsey & W of 207th (Rip. Veg City Prop near 207th)	$25	16.20	3	2	3	2	1	3	3	3	3	3	3
FV-3c	S of Halsey & W of 207th (Rip Veg Private)	$42	16.20	3	2	3	2	1	3	3	3	3	3	3
FV-7	McDonald Brothers (Riparian Planting)	$20	15.70	3	2	2	3	1	3	3	3	3	3	2
GN-1	CCTV Inspection	$27	15.60	3	1	2	2	3	3	2	2	3	2	3
FV-6a	Heron Point (Riparian Planting)	$115	14.70	2	2	2	3	1	3	3	3	3	3	2
RT-2a	Park Cleone Detention Pond retrofit pond & swale	$34	14.40	3	2	3	2	1	3	2	2	3	2	3
NN3	No Name Creek Reveg Fairview Oaks	$15	14.00	3	2	2	2	1	3	2	2	3	3	2
GW-1	Dry Well Registration	$18	13.80	3	1	3	2	1	2	2	3	2	3	3
GN-2	Pipe Replacement and Rehabilitation Over 15 years*	$49	13.40	3	1	1	2	2	3	2	1	3	2	2
FV-8	Fairview Village Detention Ponds	$17	13.30	3	1	2	1	1	3	2	2	3	3	2
RT-1	Railroad Crossing	$32	13.00	3	1	1	2	3	2	2	1	2	2	1
GN-3	Catch Basin Retrofits Over 10 years*	$18	13.00	3	1	3	2	1	2	2	2	3	2	2
OS-1	Thompson Street Stormdrain Improvements	$161	13.00	2	1	2	2	2	2	2	2	3	3	2
RT-4	Pipe Replacement @ 6th & Harrison	$84	12.60	2	1	1	2	2	2	2	2	3	3	2
GW-2	Dry Well Retrofit	$75	12.60	3	1	3	2	1	2	2	3	1	2	2
FV-5	Old Town Green Streets Over 10 years*	$73	12.30	3	1	2	1	1	2	2	3	3	1	2
RT-3	7th Street Storm Pipe	$96	11.90	3	2	1	1	1	2	2	1	3	2	2
FV-2	Flooding on Halsey by Fieldstone Apartments	$45	11.50	3	1	1	1	2	2	1	1	3	2	2
RT-2b	Park Cleone Creek Daylight	$44	11.40	1	2	2	2	1	2	2	2	3	2	3
FV-6b	Heron Point 3ac WQ facility (Private)	$425	11.30	1	2	2	3	1	1	3	3	1	2	2
FV-4	Salish Ponds and Wetlands (Park Improvements)	$280	11.30	1	3	1	3	2	1	2	1	2	2	3
NN-2	Church Parking Lot	$28	10.90	2	1	1	1	2	1	2	2	1	3	2
NN-1a	Undersized Culvert at Sandy	$199	10.80	1	2	1	2	3	1	2	1	2	1	2
FV-1	Fairview Creek between Halsey and I-84	$816	9.90	1	3	1	1	3	1	1	1	1	3	1
FV-3d	S of Halsey & W of 207th 3ac floodplain City BANKING	$417	8.30	1	1	1	1	1	1	1	3	1	2	3
FV-3e	S of Halsey & W of 207th 5ac floodplain Private BANKING	$645	8.30	1	1	1	1	1	1	1	3	1	2	3
NN-1b	Undersized Culvert at Sandy Bypass	$0	0.00	0	0	0	0	0	0	0	0	0	0	0
	Totals	$3,834												

Notes:

Grey fill means not paid for by Stormwater fund (private, county, parks)

* The cost for these projects is per year

Table 4-2 Prioritization Criteria

CRITERIA	WEIGHT	Score Definition		
		3	2	1
1 **COST**	1.0	< 100,000	>100,000 and <250,000	>250,000
2 **POTENTIAL FUNDING SOURCE**	0.4	Grant$$/SRF$$/FEMA$$	Joint/Jurisdictional Funded project; Non-profit partners	No likely outside funding source
3 **MANDATES**	0.4	Project carries a Fed or State Mandate w/ deadline.	Mandated w/ flexible timeline over 2 FY's.	No Mandate
4 **SPECIAL INTEREST**	0.3	Pet project, City Council directed		
5 **SAFETY/LIABILITY**	1.0	Sig. Hazard, Threat to life and limb and or property		No safety hazard
6 **COMPLEXITY**	0.6	May be done by small crew in less than a months time	Typical moderate level of difficulty project.	Req's significant Design, contract SP's Complex construction
7 **IMPACT**	1.0	Affects region-wide w/ sig. Downstream &/or Upstream impacts	Affects small sub-basin.	Affects only 1 or 2 individual properties
8 **ENVIRONMENTAL BENEFIT**	0.4	Significantly improves water quality and wildlife habitat	Moderately improves water quality and wildlife habitat	None
9 **PERMITTING**	0.4	No permitting issues	Potential permitting issues	Significant issues. Possibly not permittable
10 **SUSTAINABILITY**	0.4	No imbalance.		Imbalance.
11 **LIVABILITY**	0.4	This is what our grandkids would want.	This will work for my generation.	Okay for now.

Criteria Definition	
1 COST	Total estimated cost of CIP.
2 FUNDING SOURCE	Is the cost supported by Grant $$, or Joint projects?
3 MANDATE	Is the project mandated by the state or federal gov't or under court order?
4 SPECIAL INTEREST	Is this project directed by Council?
5 SAFETY/LIABILITY	What potential safety and/or liability issues are involved?
6 COMPLEXITY	How quickly can the solution be implemented and with what level of effort?
7 IMPACT	How large an area and/or how many people does the problem impact?
8 ENVIRONMENTAL BENEFIT	Are there direct environmental benefits associated with the projects?
9 PERMITTING	In the current permitting environment, will this project have difficulties in obtaining local, federal or state permits?
10 SUSTAINABILITY	Can the project be done without causing an imbalance in resources (i.e., funding, manpower, environment, etc.)?
11 LIVABILITY	Are we improving the quality of life? Is this what our grandchildren would want?

CHAPTER 5

PROJECT ANALYSIS SHEETS AND MAPS

The projects listed below were analyzed as part of the Consolidated Stormwater Master Plan. The following project analysis sheets include information on existing conditions, an analysis of the problem, modeling information, proposed solutions, design assumptions, project benefits, and estimated project costs. Each project has an associated figure that illustrates primary project elements.

Project List

General/Programmatic Projects (GN)

- GN-1: Closed-circuit television inspection
- GN-2: Pipe, manhole, and catchbasin rehabilitation
- GN-3: Catch basin retrofit program

Groundwater Projects (GW)

- GW-1: Dry Well Registration
- GW-2: Dry Well Pre-treatment

Fairview Creek Projects (FV)

- FV-1: Fairview Creek between Halsey Street and Interstate 84
- FV-2: Flooding on Halsey Street by Fieldstone Apartments
- FV-3: South of Halsey Street and west of 207th Avenue, riparian vegetation or floodplain storage on private or public property
- FV-4: Salish Ponds and Wetlands
- FV-5: Old Town Green Streets Opportunities
- FV-6: Heron Point Restoration
- FV-7: McDonald Brothers Restoration
- FV-8: Fairview Village Detention Ponds

No Name Creek Projects (NN)

- NN-1: Undersized Culvert for No Name Creek at Sandy Boulevard
- NN-2: Flooding of Church parking lot on Halsey Street from No Name Creek
- NN-3: Revegetation behind Fairview Oaks Apartments

Raintree Sub-basin Projects (RT)

- RT-1: Raintree Creek Culvert under Railroad
- RT-2: Park Cleone Detention Pond Retrofit
- RT-3: 7th Street- from Main north to Railroad Ditch
- RT-4: Pipe replacements at 6th and Harrison

Osborn Creek Sub-basin Projects (OS)

- OS-1: Thompson Street Stormwater Improvements

Project Name: CCTV Inspection
Project Number: GN-1
Project Type: Flood hazard reduction
Sub-Basin: General or city-wide

Existing Conditions: As storm sewer pipes are aging and reaching the end of their expected lifespan their condition is deteriorating. The City is currently resurfacing streets on an annual basis and replacement of aging pipe could occur concurrently. The City would like to establish a pipe rehabilitation program to provide funding for replacing pipes according to age and condition or as opportunities arise during street work.

Problem Analysis: There are 72,000 feet of storm sewer culverts, inlet leaders, and pipe in the City of Fairview (according to the GIS coverages) that are not considered private. The expected life of corrugated steel and metal pipe is 25 years. The expected lifespan of concrete, ductile iron and plastic (ABS, ADS, HDPE, PVC, RCSP) sewer pipe is usually estimated at 75-100 years. 12,000 feet of the City's storm system is older than 25 years and 1,100 feet of pipe are of unknown age. To determine if replacement of pipe is necessary, check for cross connections with the sanitary sewer and look for pipe settlement, an inspection program should be completed. Recommend inspecting pipes that have a high consequence of failure first.

Modeling Information: No modeling was performed for this analysis.

Proposed Solution/Project Description: Inspection of all pipes that are older than 25 years or have an unknown age, a total of 13,100 feet.

Design Assumptions: Assumed closed circuit television inspection of all pipes over 25 years and of unknown age. Inspection and cleaning costs approximately $1.50/ft, assuming easy access and no traffic control requirements. Cost can go up if access is difficult.

Project Benefit to City

During pipe inspection, crews can check for cross connections with sanitary sewer. Eliminating cross connections will reduce bacteria.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
CCTV Inspection	LF	$ 1.50	13,100	$ 19,650
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
			Total	$ 19,650
			Contingency (20%)*	
			Sub-Total	$ 19,650
			Engineering and Administration (**%)	$ 6,878
			Total Land Costs	$ -
			***Project Cost**	**$ 26,528**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Pipe, manhole, and catchbasin rehabilitation
Project Number: GN-2
Project Type: Flood hazard reduction
Sub-Basin: General or city-wide

Existing Conditions: As storm sewer pipes are aging and reaching the end of their expected lifespan their condition is deteriorating. The City is currently resurfacing streets on an annual basis and replacement of aging pipe could occur concurrently. The City would like to establish a pipe rehabilitation program to provide funding for replacing pipes according to age and condition or as opportunities arise during street work.

Problem Analysis: There are 72,000 feet of storm sewer culverts, inlet leaders, and pipe in the City of Fairview (according to the GIS coverages) that are not considered private. The expected life of corrugated steel and metal pipe is 25 years. The expected lifespan of concrete and plastic (ABS, ADS, HDPE, PVC, RCSP) sewer pipe is usually estimated at 75-100 years. 1,800 feet of the City's storm system is older than 25 years and constructed with metal pipe (CMP, Steel). There are approximately 500 feet of metal pipe with an unknown age. We recommend inspection and replacement of all metal pipe over 25 years old and of unknown age; and regular inspection of all pipe that provides critical services. Manholes and catchbasins should be replaced simultaneously.

In the future, plastic pipe and concrete pipe will need to be brought into the rehabilitation program. If it was assumed that all pipes last 100 years and all pipes are of equal value, the City should replace 10% of their pipes per year. In reality, that is not the case since pipes have different levels of criticality and different consequences of failure. See project GN-1 for closed circuit television inspection costs.

Modeling Information: No modeling was performed for this analysis.

Proposed Solution/Project Description: Assumed all metal pipe older than 25 years and of unknown age needs to be replaced. If the city replaces 150 feet per year, over the course of approximately 15 years all the metal pipe currently older than 25 years and of unkown age will be replaced. Pipe rehabilitation program of approximately $50,000/year used to replace approximately 150 feet of pipe, 1 manholes, and 2 catchbasins. Consider replacing with concrete or plastic pipe for longer life. This project is dependent on the outcome of project GN-1 CCTV Inspection and the amount may need to be increased over time to include all pipes and avoid falling further behind in needed repairs.

Design Assumptions: Pipe replacement construction cost approximately $150 per foot. Assumes pipe replacement will be incorporated into other street projects; does not include costs for mobilization, traffic control, street paving, and removal of existing infrastructure. (NOTE: 12" CSP estimated at $100/ft for RT-3. This GN-1 cost est. higher to account for larger pipes.)

Project Benefit to City

Replacement of aging storm sewer pipes will reduce the risk of pipe collapse and potential associated flooding issues. Eliminating cross connections will reduce bacteria.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Pipe rehabilitation	LF	$ 150	150	$ 22,500
Manhole replacement	LS	$ 5,000	1	$ 5,000
Catchbasin replacement	LS	$ 1,500	2	$ 3,000
				$ -
				$ -
				$ -
				$ -
			Total	$ 30,500
			Contingency (20%)	$ 6,100
			Sub-Total	$ 36,600
			Engineering and Administration (**%)	$ 12,810
			Total Land Costs	$ -
			***Project Cost**	**$ 49,410**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Catch basin retrofits
Project Number: GN-3
Project Type: Water quality
Sub-Basin: General or city-wide

Existing Conditions: The 6/7/06 "Development of Retrofit Options" memo from GeoSyntec recommends catch basin retrofits (under Site X, city-wide) and parking lot retrofits (under Site V, city-wide) for water quality improvement in Fairview.

Problem Analysis: The City currently has 449 catch basin sumps, 2 water quality manholes, and 48 catch basins. Based on the 6/7/06 memo from GeoSyntec, we recommend adding sumps to the 48 remaining catch basins. The proposed catch basin retrofits in the GeoSyntec memo include replacement of existing self cleaning catch basins with sumped catch basins (also known as water quality inlets) to provide for storage and removal of sediment loads from publicly owned catch basins in higher pollutant source areas; and addition of catch basin inserts to publicly owned catch basins. The proposed parking lot retrofits include installation of oil/water separators; catch basin inserts; and swales in publicly owned parking lots. Catch basin inserts evaluated for both options included grate inlet skimmer boxes, filtration units, and throat openings to capture oil.

Modeling Information: No modeling was performed for this analysis.

Proposed Solution/Project Description: Catch basin retrofit program of $18,023 per year to replace approximately 5 catch basins with sumped catch basins, resulting in 50 new sumped catch basins over ten years for a total project cost of $180,023 over ten years.

Design Assumptions: Design assumptions for catch basin retrofits based on the 6/7/06 GeoSyntec memo. City recommended using a unit cost of $500 for removal of self-cleaning inlets and $1500 for replacement of catch basins with sumped catch basins. Based on the high maintenance efforts required, we are not recommending catch basin inserts.

Project Benefit to City

Self cleaning catch basins do not function as effective sediment traps, therefore retrofit of catch basins in higher pollutant load areas will improve water quality. Water quality benefits which may be achieved through catch basin retrofits include reductions in the following TMDL parameters: TSS and nutrients (TP and TN).

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization (per 5 catch basins)	LS	$ 1,000	1	$ 1,000
Traffic Control (per 5 catch basins)	LS	$ 125	1	$ 125
Removal of self cleaning inlets	EA	$ 500	5	$ 2,500
Catchbasins (Concrete sumped inlets,	EA	$ 1,500	5	$ 7,500
				$ -
				$ -
				$ -
				$ -
			Total	$ 11,125
			Contingency (20%)	$ 2,225
			Sub-Total	$ 13,350
			Engineering and Administration (**%)	$ 4,673
			Total Land Costs	$ -
			***Project Cost**	**$ 18,023**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Dry Well Registration
Project Number: GW-1
Project Type: Water quality
Sub-Basin: Groundwater

Existing Conditions: The City of Fairview has stormwater injection facilities that are regulated under the Department of Environmental Quality's Underground Injection Control (UIC) Program. Injection systems are any man-made design, structure or activity which discharges below the ground or subsurface. Common designs include drywells, trench drains, sumps, perforated piping, floor drains, drainfields and drill holes. The City needs to either register, close, modify the system to meet requirements or apply for a water pollution control facility permit for all public stormwater injection facilities.

Problem Analysis: The City currently has three public stormwater injection facilities (drywells) requiring registration or permitting as a water pollution control facility (WPCF). As part of the registration or permitting process, the City needs to complete an inventory of their injection facilities. As part of the inventory process, the City will need to compile data on land use associated with each infiltration facility; proximity of water supply wells and 2-year time of travel of the groundwater at those locations where a water supply well is located; any information on potential soil or groundwater contamination; elevation of groundwater; depth of infiltration facility; presence of a confinement barrier or filtration medium; and ability to prevent accidental or illicit spills. Field work, review of available literature and GIS input will be required to complete an inventory.

To register the injection systems, the City must submit the inventory; evaluate the impacts to groundwater (volume, quality, geology, density, land use); develop a decommissioning plan for wells that don't meet the State requirements; and certify that storm water does not drain from hazardous substance use, handling, or storage areas; **or** submit a permit application. In addition, the City must prepare and implement a storm water management plan that addresses UIC rules and groundwater protection.

Modeling Information: No modeling was performed for this analysis.

Proposed Solution/Project Description: To meet State requirements, the City needs to complete field work; review available literature; input GIS; analyze data; and submit their registration, an updated stormwater management plan, and implementation report.

Design Assumptions: Assumes three drywells, and assumes all drywells can be registered. Cost estimate does not include costs for designing pre-treatment (see GW-2), obtaining WPCF permits or decommissioning wells if drywells cannot be registered. Assumes a 2-person field crew for field verification. Fees for registration under the UIC program are $125 per facility. Alternatively, the City can apply for a WPCF permit. The UIC stormwater management plan may require identification of representative locations for monitoring and sampling; assumes the City's existing stormwater management plan will adequately address other required components of the UIC stormwater management plan with minor modifications.

Project Benefit to City

Meet State Underground Injection Control requirements; protect quality of groundwater.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Field work	HR	$ 115	16	$ 1,840
Literature review	HR	$ 115	12	$ 1,380
GIS input and analysis	HR	$ 115	24	$ 2,760
DEQ Registration	HR	$ 115	20	$ 2,300
Storm water management plan	HR	$ 115	20	$ 2,300
Registration fee	LS	$ 125	3	$ 375
				$ -
			Total	$ 10,955
			Contingency (20%)	$ 2,191
			Sub-Total	$ 13,146
			Engineering and Administration (**%)	$ 4,601
			Total Land Costs	$ -
			***Project Cost**	**$ 17,747**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Dry Well Pre-treatment
Project Number: GW-2
Project Type: Water quality
Sub-Basin: Groundwater

Existing Conditions: The City has three drywells for stormwater discharge that may require pre-treatment under the Underground Injection Control (UIC) rules. Additional injection systems (i.e., drywells) requiring pre-treatment may be identified during the dry well registration process (GW-1).

Problem Analysis: Two of the drywells that may require pre-treatment are located on Broadway St. north of Halsey St (identified as Drywells 1 and 2). One of the drywells that may require pre-treatment is located on 205th Avenue south of Sandy Blvd (identified as Drywell 3). Drywells 1 and 2 have estimated drainage areas of 1.8 acres and 1.1 acres, respectively. Drywell 3 has an estimated drainage area of 0.4 acres. The land use in the drainage areas for Drywells 1 and 2 is low density residential and low traffic volume streets. The land use in the drainage area for Drywell 3 is primarily moderate traffic volume streets.

Modeling Information: No modeling was performed for this analysis.

Proposed Solution/Project Description: There are a variety of stormwater treatment facilities that could be installed to pre-treat stormwater draining into the drywells including swales, sumped catch basins or manholes, and proprietary devices such as Contech Stormfilters. Additional analysis of each site will be required to determine what facilities are feasible and preferred. For cost estimating purposes, assume addition of swales and sumped catch basins (also known as water quality inlets) is selected to provide for pre-treatment of stormwater prior to discharge to the subsurface in the drywells.

Design Assumptions: Assume modifications to the existing storm drains contributing to the drywells will be required. Assume all catchbasins currently have self-cleaning inlets which will need to be replaced with sumped inlets. Assume 100' of additional storm drain pipe will be required to route flow to swales and route swale outflow to drywells. Based on land use, assume 75 feet of swale required per acre treated for Drywells 1 and 2 and 200 feet of swale required per acre treated for Drywell 3. Assume that swales can be constructed in existing City right-of-way and no land acquisition is required.

Project Benefit to City

Meet State Underground Injection Control requirements; protect quality of groundwater.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 10,000	1	$ 10,000
Traffic Control	LS	$ 1,000	1	$ 1,000
Removal of self cleaning inlets	EA	$ 500	5	$ 2,500
Concrete sumped inlets, Type B	EA	$ 1,500	5	$ 7,500
Storm drain pipe	LF	$ 150	100	$ 15,000
Planting	acre	$ 15,000	0.1	$ 1,500
Swale construction	LF	$ 25	300	$ 7,500
Planting Irrigation	acre	$ 11,000	0.1	$ 1,100
			Total	$ 46,100
			Contingency (20%)	$ 9,220
			Sub-Total	$ 55,320
			Engineering and Administration (**%)	$ 19,362
			Total Land Costs	$ -
			***Project Cost**	**$ 74,682**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Fairview Creek between Halsey and I-84
Project Type: Flood Hazard Reduction
Project Number: FV-1
Sub-Basin: Fairview Creek

Existing Conditions: A study completed by CH2M Hill, "Assessment of Fairview Creek Flow Control Options" (July, 2000) indicates that during the 100-year storm Fairview Creek has the potential to cause localized flooding of houses and private property along the 223rd reach of Fairview Creek between Halsey Street and Bridge Street. A FEMA analysis also indicates the potential for flooding. The CH2M Hill report recommends building levees to control flow and the City wants to know if there are better alternatives.

Problem Analysis: The XP-SWMM model was updated to analyze this area and confirmed early conclusions that structures along this reach are at risk during the 100-year storm. Water surface elevations and finished floor elevations are shown on the associated GIS map. Four basic alternatives were identified as potential solutions: (1) improve conveyance through this reach, (2) reduce flows by building upstream detention, (3) provide high flow bypass, or (4) protect structures with small levees as previously recommended.

Modeling Information: The reach in question is between Halsey and just downstream of Bridge street on Fairview Creek. During the 100-year event for future conditions, flows range between 216 cfs and 227 cfs. The slope of the creek varies through this reach but, on average, is approximately 2%. The model nodes are shown on the associated GIS map.

Proposed Solution/Project Description: As described above, 4 solutions were considered. (1) Conveyance - this is not a recommended option since it would be extremely difficult to permit changes to the streambed. (2) Detention - this was analyzed by modeling the impact of creating 20-acre feet of detention upstream of 207th. This detention provided about 10-cfs reduction in flow and minor changes (less than 0.2 feet) in water surface elevations. Therefore, the detention alternative was eliminated as a viable alternative. (3) High flow bypass - this is discussed in further detail below. (4) Flood proofing the houses by building levees - this would require work on private property; would not remove the houses from the floodplain without extensive FEMA involvement; would require ongoing maintenance expenses; would channelize Fairview Creek and cause increased erosive forces; would require a difficult approval process from Oregon Department of State Lands and the US Army Corps of Engineers; and there would be access issues for building the levees. In addition, the previous report estimated flood proofing to cost approximately $28,000. Without conducting a detailed analysis of the assumptions or the requirements at each property, this estimate appears to be low by an or

Design Assumptions: The preferred alternative is a high flow bypass pipe along 223rd/Fairview Road. Detailed cost for a 48" bypass pipe down Fairview Road are provided below.

Project Benefit to City

Protect private homes from flooding.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 30,000	1	$ 30,000
48" Concrete Pipe with restoration	LF	$ 250	1,800	$ 450,000
72" Manholes	EA	$ 8,000	7	$ 56,000
Outfall energy dissipater	EA	$ 8,000	1	$ 8,000
				$ -
				$ -
			Total	$ 544,000
			Contingency (20%)	$ 108,800
			Sub-Total	$ 652,800
			Engineering and Administration (**%)	$ 163,200
			Total Land Costs	
			***Project Cost**	**$ 816,000**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Flooding on Halsey by Fieldstone Apartments
Project Number: FV-2
Project Type: Flood Hazard Reduction
Sub-Basin: Fairview Creek

Existing Conditions: Fieldstone Apartments, 20650 NE Halsey (Project H from Source #21) – Run-off from complex sheet flows through apartment parking lot which drains to 1 sump which overflows a private manhole, and causes runoff along Halsey into infiltration swales. The City provided development info for Fieldstone apartments and elevations from the development drawings indicate that during the 100-year storm there is additional flow from the wetlands through the apartment complex. There are 2 detention ponds and the parking lot is also designed as a detention basin. Always floods in conjunction with high water in wetlands south of apartments (see FV-4).

Problem Analysis: After reviewing the design drawings of this development it appears the drainage system is designed to convey runoff from the wetlands south of the site to Halsey St which is north of the site. The problem is the area to the south is the Fairview Creek floodplain and therefore a large amount of water can be conveyed to Halsey St. This has caused flooding problems in the past; however, there have been no reports of flooding since an infiltration swale was completed on Halsey St.

Modeling Information: Future flows - Node Glisan8: 100-year (4.9 in) max flow 113 cfs, max WSEL 199.6'; Node Glisan9: flow of 117 cfs, WSEL of 197.1' (197 confirms the floodplain evaluation from the FEMA maps) Max WSEL similar for all storms (water quality through 100-year).

Proposed Solution/Project Description: If problems start being reported one solution is to remove the pipes through the berms in the two ponds on the south side of the apartments. These pipes appear to be originally intended as outfalls for the two ponds, however based on the pipe inverts of 196.5 and 196.25 the flow appears to be coming onto the apartment property from Fairview Creek during large storm events and not away from the apartments. Removing these pipes would eliminate this potential. As phase 1, we recommend eliminating the pipe and creating a weir at the southwest pond. In addition, field test the infiltration rate of the existing dry well near Halsey to confirm it meets the design infiltration rate. If the design infiltration rate is not met, the drywell should be modified. If there is still a flooding problem, phase 2 would be to eliminate the pipe and create a weir at the northeast pond.

Design Assumptions: The cost estimate is only for Phase 1 - eliminating the pipe, creating a weir at the southwest pond and field testing the drywell infiltration rate. The estimate does not include costs for retrofitting the drywell if the design rate is not met. The graded trench drain at the northwest driveway entrance to the apartments appears to be the location where water exits the apartments' drainage system. Removing this drain might reduce the amount of runoff entering the road however this could cause flooding of the parking lot and perhaps some apartments. A complete modeling of the apartment complex would be required to recommend the removal of the drain.

Project Benefit to City

Addressing drainage at the Halsey Street apartments related to flow from the adjacent City-owned natural area will reduce a flood hazard.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 5,000	1	$ 5,000
Pipe and MH Removal and Backfill	EA	$ 12,000	1	$ 12,000
Construct Pond overflow Weirs	EA	$ 8,000	1	$ 8,000
Infiltration Test	LS	$ 2,500	1	$ 2,500
				$ -
				$ -
				$ -
				$ -
				$ -
			Total	$ 27,500
			Contingency (20%)	$ 5,500
			Sub-Total	$ 33,000
			Engineering and Administration (**%)	$ 11,550
			Total Land Costs	-
			***Project Cost**	**$ 44,550**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: South of Halsey and west of 207th - riparian vegetation on City property near Salish ponds

Project Number: FV-3a

Project Type: Water Quality & Flood Hazard Reduction

Sub-Basin: Fairview Creek

Existing Conditions: Opportunity to improve water quality through continued planting of riparian vegetation on land owned by City near Salish ponds. Site recommended for constructed wetland, expansion of existing wetland, or wetpond in 6/7/06 GeoSyntec retrofit memo (Site V, FV Site 9).

Problem Analysis: The City-owned property south of Fieldstone Apartments has an existing lightly forested area bordered by open grassy fields which have pockets of wetland vegetation (sedges and rushes). There are power lines running through the area, which could limit the desired height of some tree plantings. Recommend coordinating planting plans with power line owner. Shading Fairview Creek in this area would contribute to addressing the temperature TMDL.

Modeling Information: Future flows - Node Glisan8: 100-year (4.9 in) max flow 113 cfs, max WSEL 199.6'; Node Glisan9: flow of 117 cfs, WSEL of 197.1' (197 confirms the floodplain evaluation from the FEMA maps) Max WSEL similar for all storms (water quality through 100-year).

Proposed Solution/Project Description: Using only currently City-owned land near Salish ponds, plant the area adjacent to the channel of Fairview Creek (approx. 400' of channel length) with trees and shrubs to create a riparian buffer and improve shading of the creek.

Design Assumptions: Riparian shading project: 430' x 80' (40' each side of creek) = 0.8 acres
Cost estimate assumes irrigation is required.
Cost estimate assumes that work will be performed by contractors.
There is a potential for the work to be performed at lower cost if performed by SOLV or other nonprofit restoration group.

Project Benefit to City

Shading the creek will provide credit towards addressing the temperature TMDL.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Planting	acre	$ 15,000	0.8	$ 12,000
Planting irrigation	acre	$ 11,000	0.8	$ 8,800
				$ -
				$ -
				$ -
				$ -
				$ -
			Total	$ 20,800
			Contingency (20%)	$ 4,160
			Sub-Total	$ 24,960
			Engineering and Administration (**%)	$ 8,736
			Total Land Costs	
			***Project Cost**	**$ 33,696**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: South of Halsey and west of 207th - riparian vegetation on City property near 207th

Project Number: FV-3b

Project Type: Water Quality & Flood Hazard Reduction

Sub-Basin: Fairview Creek

Existing Conditions: Opportunity to improve water quality through continued planting of riparian vegetation on land owned by City near 207th. Upstream site recommended for constructed wetland, expansion of existing wetland, or wetpond in 6/7/06 GeoSyntec retrofit memo (Site V, FV Site 9).

Problem Analysis: The City-owned property south of Fieldstone Apartments has an existing lightly forested area bordered by open grassy fields which have pockets of wetland vegetation (sedges and rushes). There are power lines running through the area, which could limit the desired height of some tree plantings. Recommend coordinating planting plans with power line owner. Shading Fairview Creek in this area would contribute to addressing the temperature TMDL.

Modeling Information: Future flows - Node Glisan8: 100-year (4.9 in) max flow 113 cfs, max WSEL 199.6'; Node Glisan9: flow of 117 cfs, WSEL of 197.1' (197 confirms the floodplain evaluation from the FEMA maps) Max WSEL similar for all storms (water quality through 100-year).

Proposed Solution/Project Description: Using only currently City-owned land near 207th, plant the area adjacent to the channel of Fairview Creek (approx. 600' of channel length) with trees and shrubs to create a riparian buffer and improve shading of the creek.

Design Assumptions: Riparian shading project: 300' x 80' (40' each side of creek) = 0.6 acres
Cost estimate assumes irrigation is required.
Cost estimate assumes that work will be performed by contractors.
There is a potential for the work to be performed at lower cost if performed by SOLV or other nonprofit restoration group.

Project Benefit to City

Shading the creek will provide credit towards addressing the temperature TMDL.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Planting	acre	$ 15,000	0.6	$ 9,000
Planting irrigation	acre	$ 11,000	0.6	$ 6,600
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -

Total	$ 15,600
Contingency (20%)	$ 3,120
Sub-Total	$ 18,720
Engineering and Administration (**%)	$ 6,552
Total Land Costs	$ -
***Project Cost**	**$ 25,272**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: South of Halsey and west of 207th - riparian vegetation on private property
Project Number: FV-3c
Project Type: Water Quality & Flood Hazard Reduction
Sub-Basin: Fairview Creek

Existing Conditions: Opportunity to improve water quality through continued planting of riparian vegetation on private property. The land north of Salish ponds that is not currently owned by the City could be acquired (via donation) for a water quality project. Site recommended for constructed wetland, expansion of existing wetland, or wetpond in 6/7/06 GeoSyntec retrofit memo (Site V, FV Site 9).

Problem Analysis: The City-owned property south of Fieldstone Apartments has an existing lightly forested area bordered by open grassy fields which have pockets of wetland vegetation (sedges and rushes). Shading Fairview Creek in this area would contribute to addressing the temperature TMDL.

Modeling Information: Future flows - Node Glisan8: 100-year (4.9 in) max flow 113 cfs, max WSEL 199.6'; Node Glisan9: flow of 117 cfs, WSEL of 197.1' (197 confirms the floodplain evaluation from the FEMA maps) Max WSEL similar for all storms (water quality through 100-year).

Proposed Solution/Project Description: Using only currently privately-owned land, plant the area adjacent to the channel of Fairview Creek (approx. 600' of channel length) with trees and shrubs to create a riparian buffer and improve shading of the creek.

Design Assumptions: Riparian shading project: 520' x 80' (40' each side of creek) = 1.0 acres
Cost estimate assumes irrigation is not required.
Cost estimate assumes that work will be performed by contractors.
There is a potential for the work to be performed at lower cost if performed by SOLV or other nonprofit restoration group.

Project Benefit to City

Shading the creek will provide credit towards addressing the temperature TMDL.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Planting	acre	$ 15,000	1.0	$ 15,000
Planting irrigation	acre	$ 11,000	1.0	$ 11,000
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -

Total	$ 26,000
Contingency (20%)	$ 5,200
Sub-Total	$ 31,200
Engineering and Administration (**%)	$ 10,920
Total Land Costs	$ -
***Project Cost**	**$ 42,120**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: South of Halsey and west of 207th - 3 acre floodplain storage on existing City property
Project Number: FV-3d
Project Type: Water Quality and Flood Hazard Mitigation
Sub-Basin: Fairview Creek

Existing Conditions: Opportunity to improve water quality through implementation of constructed wetland or wetpond on land owned by City. There is existing wetland vegetation on the land, indicating that development of the parcel could require expensive mitigation. Site recommended for constructed wetland, expansion of existing wetland, or wetpond in 6/7/06 GeoSyntec retrofit memo (Site V, FV Site 9).

Problem Analysis: The City-owned property south of Fieldstone Apartments has an existing lightly forested area bordered by open grassy fields which have pockets of wetland vegetation (sedges and rushes). The open field north of the West Salish Pond could be recontoured to provide additional off-channel floodplain storage for high flow events. Providing additional floodplain storage in this location has not been shown through modeling to reduce downstream flooding problems in Fairview Creek.

Modeling Information: Future flows - Node Glisan8: 100-year (4.9 in) max flow 113 cfs, max WSEL 199.6'; Node Glisan9: flow of 117 cfs, WSEL of 197.1' (197 confirms the floodplain evaluation from the FEMA maps) Max WSEL similar for all storms (water quality through 100-year).

Proposed Solution/Project Description: Using City-owned land, re-contour 3 acres of the open field area north of the West Salish Pond to provide off-channel floodplain storage, from 199 to 195.7 feet (to provide 10 acre-ft of storage) north of West Salish Pond. Enhance water quality treatment by planting 3 acres with native wetland and upland vegetation.

Design Assumptions: Recontouring project: 3 acres
404 wetland permit may be required to re-contour existing wetland area.

Project Benefit to City

The modeling results indicate that projects which include recontouring the fields to provide additional off-channel floodplain storage for high-flow events, may reduce peak flood volumes by up to 10 cfs but will not create a significant reduction in peak water surface elevations during the 100-year storm. Therefore, focusing work on revegetation only (for water quality) will likely be a more cost effective use of the site.

Additional water quality benefits which may be achieved through the overflow of Fairview Creek into the enhanced vegetation of the wetland area include reductions in nutrients (TP and TN), bacteria, and TSS.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization	acre	$ 15,000	3.0	$ 45,000
Grading	acre	$ 30,000	3.0	$ 90,000
Erosion Control	acre	$ 5,000	3.0	$ 15,000
404 wetland permitting (possible cost)	*project*	*$ 50,000*	1	$ 50,000
Planting	acre	$ 15,000	3.0	$ 45,000
Planting irrigation	*acre*	*$ 11,000*	3.0	$ 33,000
				$ -
				$ -
			Total	$ 278,000
			Contingency (20%)	$ 55,600
			Sub-Total	$ 333,600
			Engineering and Administration (**%)	$ 83,400
			Total Land Costs	$ -
			***Project Cost**	**$ 417,000**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: South of Halsey and west of 207th - 5 acre floodplain storage on existing private property

Project Number: FV-3e

Project Type: Water Quality & Flood Hazard Reduction

Sub-Basin: Fairview Creek

Existing Conditions: Opportunity to improve water quality through implementation of constructed wetland or wetpond on land north of Salish ponds that is not currently owned by the City but could be acquired (via donation). There is existing wetland vegetation on the land, indicating that development of the parcel could require expensive mitigation. Site recommended for constructed wetland, expansion of existing wetland, or wetpond in 6/7/06 GeoSyntec retrofit memo (Site V, FV Site 9).

Problem Analysis: The property south of Fieldstone Apartments has an existing lightly forested area bordered by open grassy fields which have pockets of wetland vegetation (sedges and rushes). If the non-City owned parcel north of the East Salish Pond is acquired, it would provide an excellent location for a re-contouring project to provide enhanced wetland functions and off-channel floodplain storage. Providing additional floodplain storage in this location has not been shown through modeling to reduce downstream flooding problems in Fairview Creek.

Modeling Information: Future flows - Node Glisan8: 100-year (4.9 in) max flow 113 cfs, max WSEL 199.6'; Node Glisan9: flow of 117 cfs, WSEL of 197.1' (197 confirms the floodplain evaluation from the FEMA maps) Max WSEL similar for all storms (water quality through 100-year).

Proposed Solution/Project Description: Re-contour 5 acres of the field north of East Salish Pond to provide off-channel floodplain storage, from 196 to 194 feet (to provide 10 acre-ft of storage). Enhance water quality treatment by planting 5 acres with native wetland and upland vegetation.

Design Assumptions: Recontouring project: 5 acres
404 wetland permit may be required to re-contour existing wetland area.

Project Benefit to City

The modeling results indicate that projects which include recontouring the fields to provide additional off-channel floodplain storage for high-flow events, may reduce peak flood volumes by up to 10 cfs but will not create a significant reduction in peak water surface elevations during the 100-year storm. Therefore, focusing work on revegetation only (for water quality) will likely be a more cost effective use of the site.

Additional water quality benefits which may be achieved through the overflow of Fairview Creek into the enhanced vegetation of the wetland area include reductions in nutrients (TP and TN), bacteria, and TSS.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization	acre	$ 15,000	5.0	$ 75,000
Grading	acre	$ 30,000	5.0	$ 150,000
Erosion Control	acre	$ 5,000	5.0	$ 25,000
404 wetland permitting (possible cost)	*project*	*$ 50,000*	1	$ 50,000
Planting	acre	$ 15,000	5.0	$ 75,000
Planting irrigation	*acre*	*$ 11,000*	5.0	$ 55,000
				$ -
				$ -
				$ -
			Total	$ 430,000
			Contingency (20%)	$ 86,000
			Sub-Total	$ 516,000
			Engineering and Administration (**%)	$ 129,000
			Total Land Costs	$ -
			***Project Cost**	**$ 645,000**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Salish Ponds and Wetlands
Project Number: FV-4
Project Type: Water Quality (primary) & Flood Hazard Reduction
Sub-Basin: Fairview Creek

Existing Conditions: Salish Ponds and wetlands between Salish Ponds and Fieldstone Apartments. Evaluate existing inflow and outflow structures and pond functions; develop ideas for pond maintenance and operation plan.

Problem Analysis: Observed extensive shoreline compaction and erosion along West Salish Pond due to fishing users. Opportunity to create designated fishing locations (made clear with trail markers, paths, small shoreline "decks" and/or benches, etc.) while repairing and protecting shoreline in other areas with enhanced vegetation. City has been installing riparian plantings along Fairview Creek between the ponds with the Multnomah Youth Corp. Constructed wetland to the north of the ponds is a mitigation site; vegetation does not appear to be thriving, possible opportunity for enhancement. Entire site extensively used by public, observed occasional evidence of animal waste left by trail. Opportunity to add additional signs for public education about water quality, wetlands, etc. and provide additional "Dogi Pot" waste disposal bags and bins. Disadvantages to signs: easily ruined by graffiti and other vandalism.

Modeling Information: Future flows - Node Glisan8: 100-year (4.9 in) max flow 113 cfs, max WSEL 199.6'; Node Glisan9: flow of 117 cfs, WSEL of 197.1' (197 confirms the floodplain evaluation from the FEMA maps) Max WSEL similar for all storms (water quality through 100-year).

Proposed Solution/Project Description: Perform shoreline repair and revegetation in conjunction with establishment of designated fishing locations. Add additional public education signs about water quality, wetlands, fisheries, etc. and add additional "Dogi Pot" waste disposal bags and bins (similar to Market St. Pond). See FV-2 and FV-3 for analysis of area north of Salish Ponds.

Design Assumptions: Assume shoreline repair for 2100' x 20' = 1.0 acres. Assume lump sum cost for designated fishing location projects of $10,000 per site x 10 sites. Assume lump sum estimates for public education signs of $2,000 per sign x 5 signs (use replaceable anti-graffiti cover over sign content so that if vandalism occurs, repair is less expensive). Estimate for Dogi Pot system is $250/system. Assumes irrigation required for plantings.

Project Benefit to City

Water quality benefits which may be achieved by reducing shoreline erosion include reductions in TSS. Providing additional Dogi Pot waste disposal systems could provide credit towards reducing bacteria. Additional public education signs will contribute to meeting public education requirements of NPDES MS4 stormwater permit.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization	acre	$ 15,000	1.0	$ 15,000
Grading	acre	$ 30,000	1.0	$ 30,000
Erosion Control	acre	$ 5,000	1.0	$ 5,000
Planting	acre	$ 15,000	1.0	$ 15,000
Planting Irrigation	acre	$ 11,000	1.0	$ 11,000
Fishing Sites	each	$ 10,000	10	$ 100,000
Public education signs	each	$ 2,000	5	$ 10,000
Dogi Pot systems	each	$ 250	4	$ 1,000
				$ -
			Total	$ 187,000
			Contingency (20%)	$ 37,400
			Sub-Total	$ 224,400
			Engineering and Administration (**%)	$ 56,100
			Total Land Costs	$ -
			***Project Cost**	**$ 280,500**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Old Town Green Streets Opportunities
Project Type: Water Quality Retrofit
Project Number: FV-5
Sub-Basin: Fairview Creek

Existing Conditions: The City is repaving streets in Old Town and there are opportunities to simultaneously improve water quality through implementation of Green Streets and other low impact development features. Green Streets use vegetated facilities to manage stormwater runoff at its source. The Old Town streets already provide some management of stormwater using vegetated areas, primarily lawns adjacent to streets and swales in alleys. Most streets in Old Town do not have sidewalks or curb and gutter systems. Alleys between streets are grassy swales and gravel roads. The area is very flat and generally has low infiltration, and there may be large boulders. Bioretention is a possibility.

Problem Analysis: Ahead of re-paving projects, evaluate opportunities for systematic retrofits throughout Old Town. There is an opportunity to add bioretention planting strips, vegetated swales, and other low impact development (LID) features (similar to City of Portland vegetated stormwater facilities) to the streets as they are repaved. Design alternatives vary depending upon whether curb & gutter systems are added. These systems would primarily serve as water quality features to contribute to meeting TMDL requirements, with some limited uptake of flow potentially reducing flood flows in Fairview Crk.

Modeling Information: No modeling was performed for this analysis.

Proposed Solution/Project Description: Establish a Green Streets retrofit program of $73,000 per year. In first year, develop City of Fairview design standards for pass-through bioretention planting strips and construct 2 pilot study sites. In following 9 years, construct an average of 4 sites per year. The number of pass-through bioretention planting strips that can be constructed each year will depend on the size of the facilities and complexity of the installation. Program could begin with Lincoln Street during repaving in 2008.

Design Assumptions: Assume construction costs for bioretention planting strips or flow-through planter boxes are approximately $10,000 each, based on average drainage area of approximately 1 to 1.5 acres of mixed residential and light commercial land use. Construction costs will vary depending on sizing and complexity of installation. There are approximately 28 blocks in the Old Town area, ranging in size from 2 to 4 acres. Approximately 2 bioretention planting strips could be used per block to treat the runoff from the block, resulting in a potential opportunity for installation of up to 56 bioretention planting strips total. However, it is estimated that site constraints and other conditions will limit application to approximately 38 sites.
Cost estimate does not include re-paving (due to expectation that work will be performed in conjunction with planned street repaving projects) or significant modifications to existing storm sewer pipe. This project will have a high up front engineering cost however this will reduce to a standard drawing once the City has installed a few of the retrofits.

Project Benefit to City

Water quality benefits from bioretention planting strips or boxes which may contribute toward addressing TMDLs include reductions in nutrients (TP and TN), bacteria, and TSS. The additional soil filtration of stormwater and street shading provided through planting strips or boxes that include street trees could also potentially provide limited credit towards addressing the temperature TMDL. This program primarily benefits water quality but, through infiltration, could also slightly reduce peak flows during high storm events.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Bioretention planting strip or box	each	$ 10,000	4	$ 40,000
(4 per year for 10 years)				
Mobilization (1 per year for 10 years)	LS	$ 5,000	1	$ 5,000
				$ -
			Total	$ 45,000
			Contingency (20%)	$ 9,000
			Sub-Total	$ 54,000
			Engineering and Administration (**%)	$ 18,900
			Total Land Costs	
			***Project Cost**	**$ 72,900**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Heron Point - Riparian planting
Project Number: FV-6a
Project Type: Water Quality
Sub-Basin: Fairview Creek

Existing Conditions: Heron Point has potential as a restoration site. Existing conditions are primarily blackberry along riparian corridor and is a good site to add shading. Stream runs primarily East to West in this area, however full canopy cover would adequately shade the stream because of the relatively narrow stream channel. The City has a dedicated conservation easement in Heron Point, although the site is in private ownership.

Problem Analysis: The large natural area surrounding Fairview Creek and the tributary to Fairview Creek in the Heron Point area is dominated by reed canary grass with pockets of cattail, blackberry, and deciduous trees. Installing riparian plantings of native trees and shrubs would contribute to addressing the temperature TMDL. There are power lines running through the area, which could limit the desired height of some tree plantings. Recommend coordinating planting plans with power line owner. Could work with SOLV or other stream restoration groups to reduce cost by using volunteers for plantings.

Modeling Information: Model node at 223rd is "FvLake": future 100-year max flow 410 cfs, max water surface elevation (WSEL) of 17.9'
Max WSEL varies slightly for storms (future water quality storm max WSEL is 16.5', future 10-year storm max WSEL is 17.6')

Proposed Solution/Project Description: Plant the area adjacent to Fairview Creek (approximately 1800' of channel length) and the tributary (600') with riparian trees and shrubs to enhance the riparian buffer and shade the creek.

Design Assumptions: Riparian shading project: 2400' x 80' (40' each side of creek) = 4.4 acres
Cost estimate assumes irrigation is not required.
Cost estimate assumes that work will be performed by contractors.
There is a potential for the work to be performed at lower cost if performed by SOLV or other nonprofit restoration group.

Project Benefit to City

Shading the creek will provide credit towards addressing the temperature TMDL.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Planting	acre	$ 15,000	4.4	$ 66,000
Mobilization	LS	$ 5,000	1.0	$ 5,000
				$ -
				$ -
				$ -
Planting Irrigation	acre	$ 11,000	0.0	$ -
				$ -
				$ -
				$ -
				$ -
				$ -
			Total	$ 71,000
			Contingency (20%)	$ 14,200
			Sub-Total	$ 85,200
			Engineering and Administration (**%)	$ 29,820
			Total Land Costs	$ -
			***Project Cost**	**$ 115,020**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Heron Point - 3 acre water quality facility on existing private property
Project Number: FV-6b
Project Type: Water Quality
Sub-Basin: Fairview Creek

Existing Conditions: Heron Point has potential for a 3 acre floodplain storage and/or water quality facility. Existing conditions are primarily blackberry along riparian corridor and is a good site to add shading. Stream runs primarily East to West in this area, however full canopy cover would adequately shade the stream because of the relatively narrow stream channel. The City has a dedicated conservation easement in Heron Point, although the site is in private ownership.

Problem Analysis: The large natural area surrounding Fairview Creek and the tributary to Fairview Creek in the Heron Point area is dominated by reed canary grass with pockets of cattail, blackberry, and deciduous trees. Recontouring the site to establish a water quality treatment facility adjacent to the stream system would improve water quality at a downstream location in the watershed. City would need to ensure water quality facility could be built on land with conservation easement, or else acquire property. There are power lines running through the area, which could limit the desired height of some tree plantings. Recommend coordinating planting plans with power line owner.

Modeling Information: Model node at 223rd is "FvLake": future 100-year max flow 410 cfs, max water surface elevation (WSEL) of 17.9'
Max WSEL varies slightly for storms (future water quality storm max WSEL is 16.5', future 10-year storm max WSEL is 17.6')

Proposed Solution/Project Description: Re-contour 3 acres of the site to establish an off-line high flow water quality treatment facility such as a forested wetland. Recommend acquiring property through donation if water quality facility is constructed.

Design Assumptions: Recontouring project: 3 acres
Cost estimates assumes no land acquisition costs.
Cost estimate assumes that work will be performed by contractors.
404 wetland permit may be required to re-contour existing wetland area.

Project Benefit to City

Water quality benefits from a water quality treatment facility include reductions in nutrients (TP and TN), TSS, and bacteria (if facility is designed to minimize waterfowl use).

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization	acre	$ 15,000	3.0	$ 45,000
Grading	acre	$ 30,000	3.0	$ 90,000
Facility inlet & outlet structures	LS	$ 15,000	2.0	$ 30,000
Erosion Control	acre	$ 5,000	3.0	$ 15,000
Planting	acre	$ 15,000	3.0	$ 45,000
Planting Irrigation	acre	$ 11,000	3.0	$ 33,000
404 wetland permitting (possible cost)	*project*	*$ 25,000*	1	$ 25,000
				$ -
				$ -
				$ -
				$ -
			Total	$ 283,000
			Contingency (20%)	$ 56,600
			Sub-Total	$ 339,600
			Engineering and Administration (**%)	$ 84,900
			Total Land Costs	$ -
			***Project Cost**	**$ 424,500**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: McDonald Brothers Site - Riparian Restoration
Project Number: FV-7
Project Type: Water Quality
Sub-Basin: Fairview Creek

Existing Conditions: The McDonald Brothers site has potential for restoration. The site is landlocked with no access, and the property could be donated to the City. The City may be able to acquire temporary access through the Heron Point easement. This site should have been planted with wetland plants as a prior approved mitigation project but it was not planted.

Problem Analysis: There is a border of deciduous trees along the western property boundary of the McDonald site and a small forested area (approx. 0.5 acres) in the northwest corner of the property. The rest of the property, including the area surrounding Fairview Creek, is unshaded. Installing riparian plantings of native trees and shrubs would contribute to addressing the temperature TMDL. A riparian planting project could be undertaken by the private landowner with materials and volunteers provided by the City (to enhance existing wetland mitigation project) or the City could seek to acquire the property through donation by the private landowner.

Modeling Information: Model node just upstream of the McDonald Brothers site is FC-1R: future 100-year max flow is 436 cfs, max water surface elevation is 14.9'
Max WSEL varies slightly for storms (water quality storm max WSEL is 14.1', 10-year storm max WSEL is 14.6')

Proposed Solution/Project Description: Plant the area adjacent to Fairview Creek (approximately 250' of channel length) with riparian trees and shrubs to enhance the riparian buffer and shade the creek (provide materials and labor to private landowner or acquire property through donation).

Design Assumptions: Riparian shading project: 250' x 80' (40' each side of creek) = 0.5 acres; Assume no irrigation is required.
Due to the small size of the project, it is possible that it would be difficult to find a contractor to complete the project alone. Cost estimate therefore assumes that FV-7 would be performed in conjunction with FV-6, although mobilization costs are included for both projects.
There is a potential for the work to be performed at lower cost if performed by SOLV or other nonprofit restoration group.

Project Benefit to City

Shading the creek will provide credit towards addressing the temperature TMDL.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Planting	acre	$ 15,000	0.5	$ 7,500
Mobilization	LS	$ 5,000	1.0	$ 5,000
				$ -
				$ -
				$ -
				$ -
				$ -
			Total	$ 12,500
			Contingency (20%)	$ 2,500
			Sub-Total	$ 15,000
			Engineering and Administration (**%)	$ 5,250
			Total Land Costs	
			***Project Cost**	**$ 20,250**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Fairview Village Detention Ponds - Market, Chinook, Multnomah
Project Number: FV-8
Project Type: Water Quality Retrofit
Sub-Basin: Fairview Creek

Existing Conditions: Market Drive Detention Pond – currently maintaining to bring back to grade. The swale has a clay bottom and there is no infiltration. Will operate as a retention pond. Chinook Detention Pond – Pond with swale in the bottom. Multnomah Pond – Used to be an agricultural pond. Evaluate design for improvements. Very shallow, there may be opportunities for retrofits.

Problem Analysis: The Market Drive Pond is maintained by mowing short due to recreational use of the area by residents and dogs. Although there would be greater water quality treatment if the vegetation were allowed to grow taller, mowing is preferred because residents are more likely to pick up after their dogs if the grass is short. "Dogi Pot" waste removal bags are provided. There is some dry weather flow through the pond, likely to due groundwater infiltration into the storm drainage pipes and runoff from lawn irrigation. There is a swale around the outside of the pond area that is intended to receive low flows. Low flows are currently bypassing the swale until the vegetation is fully re-established in it. The inflow manhole may need to have a flow bypass weir installed to direct low flows to the swale. Rock weirs could be added to the swale to reduce flow velocities. The berm between the pond and Fairview Creek was evaluated to determine how flow would leave the pond if the outlet became plugged during a high flow event (due to consideration over how such an event would affect the adjacent home). There is a low point in the berm that appears to provide an emergency overflow point.
The Chinook Detention Pond and the Multnomah Pond both contain forested areas and appear to be functioning well. There is blackberry invading both sites, which the City pays for mowing and removal of periodically. Both ponds contain standing water and function as wetlands at low points.
The Multnomah Pond would benefit from additional native plantings.

Modeling Information: Detailed modeling of the ponds was not performed.

Proposed Solution/Project Description: For the Market Drive Pond, add 5 rock weirs to the swale to reduce flow velocities and enhance water quality treatment through extended residence time. Install bypass weir in inflow manhole after vegetation in swale is established to provide low flow routing through swale. For Multnomah Pond, plant 0.2 acres of native trees and shrubs in open area adjacent to flow.

Design Assumptions: Assume cost of rock weirs = $1,000 each. Assume installation of bypass weir = $1,000. These estimated costs include mobilization, materials, equipment, and time. Assume no irrigation required for plantings.

Project Benefit to City

Water quality benefits which may be achieved through increasing the detention time of stormwater in the Market Drive swale using rock weirs and increased shrub vegetation include reductions in the following TMDL parameters: nutrients (TP and TN), bacteria, and TSS.

Additional water quality benefits which may be achieved through the overflow of Fairview Creek into the enhanced vegetation of the pond include reductions in nutrients (TP and TN), bacteria, and TSS.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Rock weirs (Market Pond & Swale)	each	$ 1,000	5	$ 5,000
Bypass weir in manhole (Market Pond &	each	$ 1,000	1	$ 1,000
Planting (Market Pond & Swale)	acre	$ 15,000	0.1	$ 1,500
Planting (Multnomah Pond)	acre	$ 15,000	0.2	$ 3,000
				$ -
				$ -
			Total	$ 10,500
			Contingency (20%)	$ 2,100
			Sub-Total	$ 12,600
			Engineering and Administration (**%)	$ 4,410
			Total Land Costs	
			***Project Cost**	**$ 17,010**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Undersized Culvert at Sandy Blvd. - Replace culvert under Sandy
Project Number: NN-1a
Project Type: Flood Hazard Reduction
Sub-Basin: No Name Creek

Existing Conditions: The culvert under Sandy Blvd has been identified as being undersized in prior Master Plans. The undersized culvert causes flooding on Sandy Blvd and closes the road during large storms in this important commercial area. The County plans to widen Sandy Blvd., but they haven't included a design to increase culvert capacity. This project requires immediate attention so that it can be incorporated during Sandy road construction or private development projects. This alternative examines increasing the culvert capacity under Sandy Blvd. NN-1b examines diverting flow to Fairview Creek. Downstream of the Sandy Blvd. culvert, there is a 30-inch pipe on private property (the Hufford Property) at 22713 NE Sandy Blvd. that appears to be undersized.

Problem Analysis: An existing pair of 30" CMP pipes, with a capacity of 55-cfs, conveys No Name Creek under Sandy Blvd. The area has reports of flooding. The headwall was observed and the entrances to the pipes are not aligned with the creek; and the condition of the pipes are not ideal for hydraulic entrance into the pipes. If the culvert at Sandy is increased in size the additional flow could potentially affect downstream properties. Additional analysis of the downstream system capacity will be needed in the future.

Modeling Information: The XP-SWMM model shows the 100-year flow for this reach at 166-cfs. The nodes in the model are NN-2 to NN_Sandy1. The models inverts for this location are different from the inverts shown on the 2004 Group Mackenzie drawings. The sizing of the new culvert is based on the surveyed inverts from the 2004 drawings. Based on the drawings, the new manhole in the middle of Sandy Blvd has an invert elevation of 40.86 and the outfall has an invert elevation of 38.00. The exact alignment of the pipe is not known, however the length is estimated to be 200 feet. Therefore, the slope is estimated at approximately 1.4%.

Proposed Solution/Project Description: The flows and slope indicate a 48" pipe (n=0.013) will pass the 100-year flow under Sandy Blvd. However, north of Sandy Blvd, the pipe is directed through two consecutive pipes on private property that have not been analyzed for capacity. These pipes need to be analyzed in a more detailed study. Alternatively, once the flow makes it under Sandy, a new alignment could go alongside Sandy Blvd then north along the west property line to the existing outfall. With this new alignment there is the option to replace the pipe with an open creek.

Design Assumptions: Design assumptions are for a new pipe constructed along the same alignment of the existing pipe. The new pipe is 48-inch concrete pipe with manholes at each pipe intersection and bend and headwalls at both upstream and downstream ends. The design and the cost estimate assume that fish passage is not required through this culvert due to upstream barriers under the I-84 crossing. If fish passage is required, it is likely that a larger open bottom culvert will be required. The design does not include replacing the 30-inch pipe on the private property at 22713 NE Sandy Blvd.

Project Benefit to City

Addressing capacity issues on Sandy Boulevard will reduce a flood hazard.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 20,000	1	$ 20,000
48-inch RCP (Gravel Restoration)	LF	$ 220	120	$ 26,400
48-inch RCP (pavement Restoration)	LF	$ 250	80	$ 20,000
Headwall	EA	$ 12,000	2	$ 24,000
72-inch Manholes	EA	$ 8,000	2	$ 16,000
Erosion Control	LS	$ 6,000	1	$ 6,000
Remove Existing Pipe	LS	$ 20,000	1	$ 20,000
				$ -
				$ -
			Total	$ 132,400
			Contingency (20%)	$ 26,480
			Sub-Total	$ 158,880
			Engineering and Administration (**%)	$ 39,720
			Total Land Costs	$ -
			***Project Cost**	**$ 198,600**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Undersized Culvert at Sandy Blvd. - Bypass flow to Fairview Creek
Project Number: NN-1b
Project Type: Flood Hazard Reduction
Sub-Basin: No Name Creek

Existing Conditions: An undersized culvert has been identified in prior Master Plans. The undersized culvert causes flooding on Sandy Blvd and closes the road during large storms in this important commercial area. The County plans to widen Sandy Blvd., but they haven't included a design to increase culvert capacity. This project requires immediate attention so that it can be incorporated during Sandy road construction or private development projects. This alternative examines increasing culvert capacity under Sandy Blvd. NN-1a examines increasing capacity of the culvert under Sandy Blvd. Downstream of the Sandy Blvd. culvert, there is a 30-inch pipe on private property (the Hufford Property) at 22713 NE Sandy Blvd. that appears to be undersized.

Problem Analysis: An existing pair of 30" CMP pipes, with a capacity of 55-cfs, conveys No Name Creek under Sandy Blvd. The area has reports of flooding. The headwall was observed and the entrances to the pipes are not aligned with the creek and the condition of the pipes are not ideal for hydraulic entrance into the pipes.

Modeling Information: This alternative considers diverting flow from No Name Creek to Fairview Creek upstream of Sandy Boulevard. The original Oakley Engineering report (April, 1993) showed this diversion channel along the south side of Sandy Boulevard. The reason for this was the flow from Node NN-2R1 was required in the diversion channel to justify the cost of constructing the channel. With an estimated capacity of 55-cfs and the 25-year flow from NN-2R1 as 68-cfs, if the diversion channel was moved upstream a new culvert would still be required under Sandy Blvd.

Proposed Solution/Project Description: Unless 98-cfs during the 25-year storm was diverted to Fairview Creek, the No Name Creek culvert at Sandy Boulevard would still flood. Therefore diverting all the 25-year flow along the I-84 embankment would not eliminate the need for replacing the No-Name culverts at Sandy Boulevard. Since the No Name Creek culverts at Sandy will need replacing, unless the diversion is along Sandy Boulevard, the best alternative would be Alternative NN-1a, to simply enlarge the culvert.

Design Assumptions: A diversion of this magnitude would require much greater detailed study of this specific area including bank and bed stability issues within the creek. The permitting issues for this magnitude of transfer between basins are unknown. Based on the above information, we recommend against this alternative and have not conducted further analysis of this project.

Project Benefit to City

This alternative would not eliminate the need for replacing the No Name Creek Culvert at Sandy Boulevard and has been eliminated from the alternatives.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
			Total	$ -
			Contingency (20%)	$ -
			Sub-Total	$ -
			Engineering and Administration (**%)	$ -
			Total Land Costs	$ -
			***Project Cost**	**$ -**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Church parking lot flooding
Project Number: NN-2
Project Type: Flood Hazard Reduction
Sub-Basin: No Name Creek

Existing Conditions: No Name Creek, 22820 NE Halsey (Project A from Source #21) – No Name Creek bisects property. The Ukrainian Church parking lot floods during high-flow events. Low-flow events flow east and stay in No Name Creek. High flow events bypass via a weir and flow west into Fairview Creek. Need to confirm operation of bypass and determine if this is still a good practice.

Problem Analysis: One issue associated with this area appears to be flooding on private property caused by the condition of the private property. The property is currently going through a redevelopment transition and a new grading plan and parking lot design is being prepared. The correction of flooding at this site should be addressed through the design of this parking area and could include raising inlet grate elevations, installing flap gates, and providing an area for flood storage. The second issue is development constraints caused by No Name Creek bisecting the lot on the west side. The stream could benefit from riparian shading.

Modeling Information: Water surface elevations from the 100-year storm appear to cause some flooding of the church parking area, however does not flood the structure. Surrounding development should be designed to avoid impacts to the 100-year floodplain. The nodes and water surface elevations are shown in the associated map included in the Stormwater Master Plan.

Proposed Solution/Project Description: No City surface water conveyance projects are proposed for this area. The correction of flooding at this site should be addressed through the design of this parking area and could include raising inlet grate elevations, installing flap gates, and providing an area for flood storage. It is recommended that future development of the site adjacent to the church be designed to emphasize No-Name Creek as a visual amenity to the site in either in its current location or realigned if approved by ODFW and the Army Corp. Plant the area adjacent to the channel of No Name Creek (approx. 600' of channel length) with trees and shrubs to create a riparian buffer and improve shading of the creek.

Design Assumptions: Riparian shading project: 450' x 80' (40' each side of creek) = 0.8 acres; Assume no irrigation is required.
Cost estimate assumes a contractor is hired to complete the work, but due to the small size of the project, it is possible that it would be difficult to find a contractor to complete the project alone.
There is a potential for the work to be performed at lower cost if performed by SOLV or other nonprofit restoration group.

Project Benefit to City

Shading the creek will provide credit towards addressing the temperature TMDL.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Planting (by volunteer/nonprofit group)	LS	$ 15,000	0.8	$ 12,000
Mobilization	LS	$ 5,000	1	$ 5,000
				$ -
				$ -
				$ -
			Total	$ 17,000
			Contingency (20%)	$ 3,400
			Sub-Total	$ 20,400
			Engineering and Administration (**%)	$ 7,140
			Total Land Costs	$ -
			***Project Cost**	**$ 27,540**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: No Name Creek - Revegetation behind Fairview Oaks Apartments
Project Number: NN-3
Project Type: Water Quality
Sub-Basin: No Name Creek

Existing Conditions: There is minimal vegetation and compacted stream banks behind the Fairview Oaks Apartments on No Name Creek near Halsey. Opportunity to improve water quality through planting of riparian vegetation on private property.

Problem Analysis: No Name Creek travels through the Fairview Oaks Apartments (a public housing project owned by Portland Development Authority) to the north of Halsey St. The channel banks are compacted and lack vegetation near Halsey Street, and the stream could benefit from riparian shading.

Modeling Information: No modeling was performed for this analysis.

Proposed Solution/Project Description: Using only currently privately-owned land, plant the area adjacent to the channel of Fairview Creek (approx. 600' of channel length) with trees and shrubs to create a riparian buffer and improve shading of the creek. Due to the small size of the project, it is possible that it would be difficult to find a contractor to complete the project alone. Either complete project with a volunteer organization or lump this project with other planting projects.

Design Assumptions: Riparian shading project: 600' x 20' (10' each side of creek) = 0.3 acres
Cost estimate assumes irrigation is not required; and that work will be performed by contractors. Due to the small size of the project, the City may want to lump this project with another and reduce mobilization costs.
There is a potential for the work to be performed at lower cost if performed by SOLV or other nonprofit restoration group.

Project Benefit to City

Shading the creek will provide credit towards addressing the temperature TMDL.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 5,000	1.0	$ 5,000
Planting	Acre	$ 15,000	0.3	$ 4,500
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
			Total	$ 9,500
			Contingency (20%)	$ 1,900
			Sub-Total	$ 11,400
			Engineering and Administration (**%)	$ 3,990
			Total Land Costs	$ -
			***Project Cost**	**$ 15,390**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Raintree Railroad Crossing
Project Number: RT-1
Project Type: Flood Hazard Reduction
Sub-Basin: Raintree Creek

Existing Conditions: Raintree Railroad Crossing, Depot Street, 6th to 7th (Project D from Source #21) - 36-inch pipe feeds area. Outlet is an 18-inch CMP under the Union Pacific Railroad. Invert elevation going in is 105.4, coming out is 103.6 and the top of the rail above the CMP is 124.0 As a result of the undersized culvert, the area is acting as a detention pond. This site is high maintenance (crew goes out several times/winter to clear). Limited water quality treatment. Need to make sure new development will not adversely affect water quality or increase flooding. There is currently no flooding of homes. Need to know the risk to homes if the culvert fails.

Problem Analysis: City will be requiring new development on Depot St. to provide on-site treatment and storage. Maintenance concerns for undersized culvert at railroad tracks remain. The City may need to negotiate an access easement with the new development along Depot Street and Union Pacific Railroad to ensure City staff can access culvert for maintenance. A trash rack at the culvert could improve maintenance problems. Increasing the size of the culvert (as recommended in the 2000 City CIP from 18" to 36") could increase downstream flows and cause unanticipated flooding downstream. A full analysis of downstream culverts and channel capacity would be required prior to increasing the size of the railroad culvert.

Modeling Information: Modeling results indicate railroad will flood if culvert is plugged, providing an outlet for the water and reduced the flooding risk to home sites along Depot Street. The maximum WSEL modeled for future 100-year storm conditions immediately upstream of the railroad culvert is 117.4 ft and the maximum flow is 29.9 cfs (at Node 00583 S).

Proposed Solution/Project Description: Add a trash rack to the railroad culvert and provide regularly scheduled maintenance crew removal of debris several times a year (or as needed). Negotiate an access easement with new development and Union Pacific Railroad along Depot Street for culvert maintenance (if needed).

Design Assumptions: Due to the location of the trash rack and potential access problems, we assumed that the trash rack would require a sophisticated design. The cost could also include installing a trail for access.

Project Benefit to City

Adding a trash rack to the railroad culvert and providing regularly scheduled maintenance to remove debris could reduce nuisance flooding associated with the undersized culvert.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Trash rack	LS	$ 20,000	1.0	$ 20,000
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
			Total	$ 20,000
			Contingency (20%)	$ 4,000
			Sub-Total	$ 24,000
			Engineering and Administration (**%)	$ 8,400
			Total Land Costs	
			***Project Cost**	**$ 32,400**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Park Cleone Detention Pond Retrofit - Regrade, add check dams, and plant existing swale
Project Number: RT-2a
Project Type: Water Quality Retrofit
Sub-Basin: Raintree Creek

Existing Conditions: Park Cleone, north end of the NE 214th Ave cul-de-sac, S. of I-84. Opportunity to improve water quality through conversion of current flood detention pond into infiltration or filtration facility. This is not a problem area for flooding.

Problem Analysis: Opportunity to enhance water quality treatment by increasing diversity of plantings in and around pond. Area could be established into more of a native "rain garden" or wetland-type feature. Perennial flow present due to springs in contributing area. In addition, the swale area is steep and flows could be slowed down through installation of 5 check dams.

Modeling Information: Park Cleone, Node 00579 S: future 100-year max flow 17.3 cfs, max WSEL 119.9'
End of NE 213th, Node 00491 S: future 100-year max flow 1.8 cfs, max WSEL 131.5'

Proposed Solution/Project Description: Enhance water quality treatment by increasing diversity of plantings in and around pond and swale. Plant 0.5 acres with native wetland and upland vegetation. Regrade swale and install check dams to slow flow and reduce erosive forces.

Design Assumptions: Plantings for 0.3 acres
Cost estimate assumes irrigation is not required.
Cost estimate assumes that work will be performed by contractors.

Project Benefit to City

Increasing native plantings of trees and shrubs at Park Cleone will provide credit towards addressing the temperature TMDL. Additional water quality benefits from water quality treatment facility includes reductions in nutrients (TP and TN), TSS, and bacteria (if facility is designed to minimize waterfowl use).

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Planting	acre	$ 15,000	0.5	$ 7,500
Mobilization	LS	$ 3,000	1	$ 3,000
Grading	acre	$ 30,000	0.1	$ 3,000
Erosion control	acre	$ 5,000	0.5	$ 2,500
Check dams	LS	$ 1,000	5	$ 5,000
				$ -
				$ -
				$ -
				$ -
			Total	$ 21,000
			Contingency (20%)	$ 4,200
			Sub-Total	$ 25,200
			Engineering and Administration (**%)	$ 8,820
			Total Land Costs	
			***Project Cost**	**$ 34,020**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Park Cleone Detention Pond Retrofit - Daylight pipe
Project Number: RT-2b
Project Type: Water Quality Retrofit
Sub-Basin: Raintree Creek

Existing Conditions: Park Cleone, north end of the NE 214th Ave cul-de-sac, S. of I-84. Opportunity to daylight a pipe and add a swale at the south edge of the park to improve water quality. This is not a problem area for flooding.

Problem Analysis: Opportunity to enhance water quality treatment by daylighting a pipe, adding a swale, and increasing diversity of plantings. Area could be established into more of a native "rain garden" or wetland-type feature. Perennial flow present due to springs in contributing area.

Modeling Information: Park Cleone, Node 00579 S: future 100-year max flow 17.3 cfs, max WSEL 119.9'
End of NE 213th, Node 00491 S: future 100-year max flow 1.8 cfs, max WSEL 131.5'

Proposed Solution/Project Description: Daylight the pipe that conveys flow from the end of NE 213th, along the southern edge of the field, to the existing swale. Includes a new 8 foot wide crossing for maintenance equipment

Design Assumptions: Installation of 200 foot long swale and planting for 0.2 acres associated with swale and surrounding area. Assume irrigation required for plantings in and around swale. 8-10 foot wide earthen crossing with concrete pipe. Based cost of concrete pipe on the ODOT 2006 bid item pricing inventory. Assumed maintenance staff can access facility from 213th.

Project Benefit to City

Increasing native plantings of trees and shrubs at Park Cleone will provide credit towards addressing the temperature TMDL. Additional water quality benefits which may be achieved through the overflow of Raintree Creek into the enhanced vegetation of the site includes reductions in nutrients (TP and TN), bacteria, and TSS.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 5,000	1	$ 5,000
Remove Existing Pipe	LS	$ 10,000	1	$ 10,000
Erosion Control	LS	$ 2,000	1.0	$ 2,000
Planting	acre	$ 15,000	0.2	$ 3,000
Swale construction	LF	$ 25	200	$ 5,000
Planting Irrigation	acre	$ 11,000	0.2	$ 2,200
				$ -
				$ -
				$ -
			Total	$ 27,200
			Contingency (20%)	$ 5,440
			Sub-Total	$ 32,640
			Engineering and Administration (**%)	$ 11,424
			Total Land Costs	
			***Project Cost**	**$ 44,064**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: 7th Street - From Main north to Railroad Ditch
Project Number: RT-3
Project Type: Flood Hazard Reduction
Sub-Basin: Raintree Creek

Existing Conditions: 7th Street from Main St to end of 7th Street and along 7th Street right of way to railroad ditch. Addition of a new storm drain has been included in the existing CIP, transfer to new CSMP. Site may be included with additional modeling for Raintree Railroad Crossing.

Problem Analysis: The City of Fairview 2000 Capital Improvements Plan recommended adding a new storm drain along 7th Street from Main Street to the Railroad Ditch (Project SDMP-14). The purpose of the project was to relieve street and lot ponding along 7th Street. When the new storm drain is added, additional "green streets" features could also be added such as flow-through bioretention planting strips tied into the new system.

Modeling Information: Node 00810S at corner of 7th & Main, max future 100-yr WS Elev = 166.2
Node 00808s at corner of 6th and Main, Max future 100-yr WS Elev = 139.5
Max Flow thru conduit = 0.5 cfs

Proposed Solution/Project Description: Add a 12" CSP storm sewer pipe, two manholes, and 3 catch basins to 7th Street. Incorporate site into FV-5 Green Streets Program

Design Assumptions: Based on information within the 2000 Capital Improvement Plan completed by CH2M Hill.

Project Benefit to City

Water quality benefits from bioretention planting strips or boxes which may contribute toward addressing TMDLs include reductions in nutrients (TP and TN), bacteria, and TSS.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
12" CSP	LF	$ 100	450	$ 44,955
48" manhole	EA	$ 5,000	2.0	$ 10,000
Field inlets / catchbasins	EA	$ 1,500	3	$ 4,500
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
			Total	$ 59,455
			Contingency (20%)	$ 11,891
			Sub-Total	$ 71,346
			Engineering and Administration (**%)	$ 24,971
			Total Land Costs	
			***Project Cost**	**$ 96,317**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: 6th and Harrison
Project Number: RT-4
Project Type: Flood Hazard Reduction
Sub-Basin: Raintree Creek

Existing Conditions: The 18-inch corrugated metal pipe that runs under Harrison at the intersection of 6th has rusted out at the bottom. The pipe that runs under 6th at the same location is also in disrepair. There is localized flooding on the property on the west side of 6th, between Harrison and the Alley.

Problem Analysis: Used the rational method to calculate diameter needed for concrete pipe. Pipe A had an estimated area of 1.2 acres, Pipe B had an estimated area of 8.91 acres. Used a rainfall intensity of 2.5 to 2.9 inches/hour for both pipes. The runoff coefficient estimated for Pipe A is 0.375 and for pipe B is 0.44. Manning's n for a concrete pipe is 0.011. Slope (ft/hundred) for pipe A is 0.402 and for pipe B is 1.273. These numbers resulted in a diameter of 10-inch for pipe A and 18-inch for pipe B.

Modeling Information: No modeling was performed for this analysis.

Proposed Solution/Project Description: Need to replace the two stormwater pipes at Harrison and 6th, install a new catch basin to capture the flooding on the west side of 6th, and replace two flow through catch basins with sumped catch basins and install one new sumped catch basin (SE corner of intersection; SW corner of intersection; and on the west side of 6th at the Alley.)

Design Assumptions: Assumed pipe replacement will occur concurrent with street repairs. Due to the shallow nature of pipe A, assume it will be replaced with ductile iron pipe. Going price for 12-inch ductile iron is $23 to $27.30 per lineal foot plus installation costs; assuming $100/ft. Assume 18-inch RCP installation is $125/foot. Assumed no cost for erosion control since project is in conjunction with street repairs.

Project Benefit to City

Replacement of aging storm sewer pipes will reduce the risk of pipe collapse and potential associated flooding issues. Water quality benefits which may be achieved through construction of catch basins with sediment traps include reductions in the following TMDL parameters: TSS and nutrients (TP and TN).

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 5,000	1	$ 5,000
12-inch ductile iron	LF	$ 100	37	$ 3,700
18-inch RCP	LF	$ 125	216	$ 27,000
Catchbasin	EA	$ 1,500	4	$ 6,000
48" manhole	EA	$ 5,000	1	$ 5,000
Erosion Control	ACRE	$ -	1	$ -
Remove Existing Pipe, CBs, MHs	LS	$ 5,000	1	$ 5,000
				$ -
				$ -
			Total	$ 51,700
			Contingency (20%)	$ 10,340
			Sub-Total	$ 62,040
			Engineering and Administration (**%)	$ 21,714
			Total Land Costs	$ -
			***Project Cost**	**$ 83,754**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Name: Thompson Street Storm Drain Improvements
Project Number: OS-1
Project Type: Flood Hazard Reduction
Sub-Basin: Osborn Creek

Existing Conditions: There is localized flooding at the intersection of Thompson and 205th. The existing ditch on the south side of Thompson is very deep and posses a safety hazard.

Problem Analysis: Included in previous Stormwater Master Plans and Capital Improvement Plans.

Modeling Information: No modeling was performed for this analysis.

Proposed Solution/Project Description: Plans and specifications have been prepared for this project which were not constructed due to the high bid prices received.

Design Assumptions: Rebid the project with updated specifications at a more favorable time of year.

Project Benefit to City

Reduce flood risk and safety hazard.

***Project Costs**

Item	Unit	Unit Cost	Quantity	Cost
Low bid				$107,600
				$ -
				$ -
			Total	$ 107,600
			Contingency (20%)	$ 21,520
			Sub-Total	$ 129,120
			Engineering and Administration (**%)	$ 32,280
			Total Land Costs	$ -
			***Project Cost**	**$ 161,400**

** 35% for construction costs up to $100,000
25% for construction cost over $100,000
** The estimated costs are based on year 2007 dollars*

Project Purpose: Reduce flood hazards by repairing pipe.

Raintree Creek
Project: RT 4

6th and Harrison

Legend

- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 50 100 200 Feet

1 inch equals 100 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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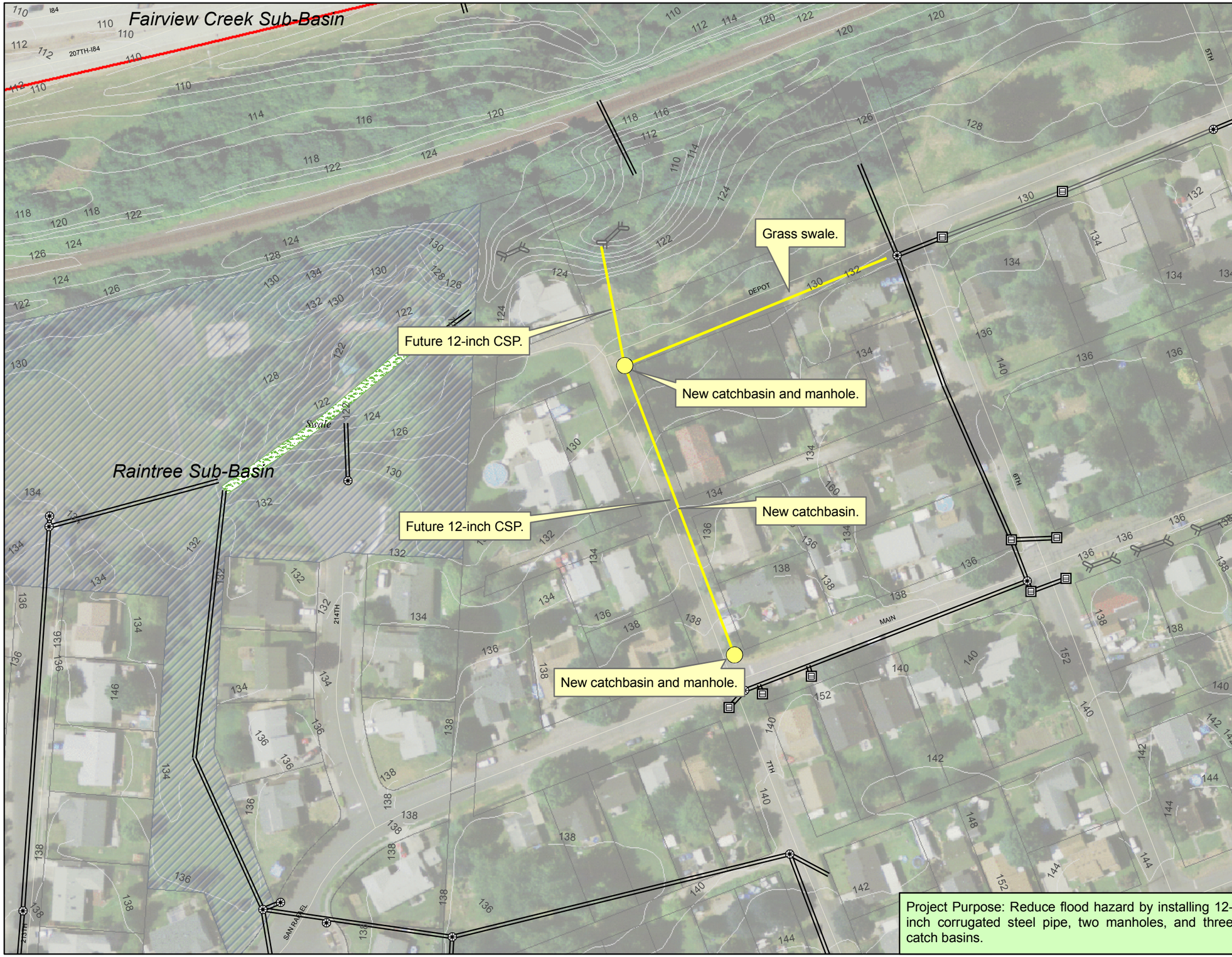

Project Purpose: Reduce flood hazard by installing 12-inch corrugated steel pipe, two manholes, and three catch basins.

Raintree Creek
Project: RT 3

7th Street

Legend

- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 50 100 200 Feet

1 inch equals 100 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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Project Purpose: Improve water quality through flood hazard reduction (RT-1), and water quality retrofits (RT-2a, b).

Raintree Creek
Project: RT 1, 2

Raintree Railroad Crossing, Park Cleone Detention Pond Retrofit, Daylight Pipe

Legend

- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 50 100 200 Feet

1 inch equals 100 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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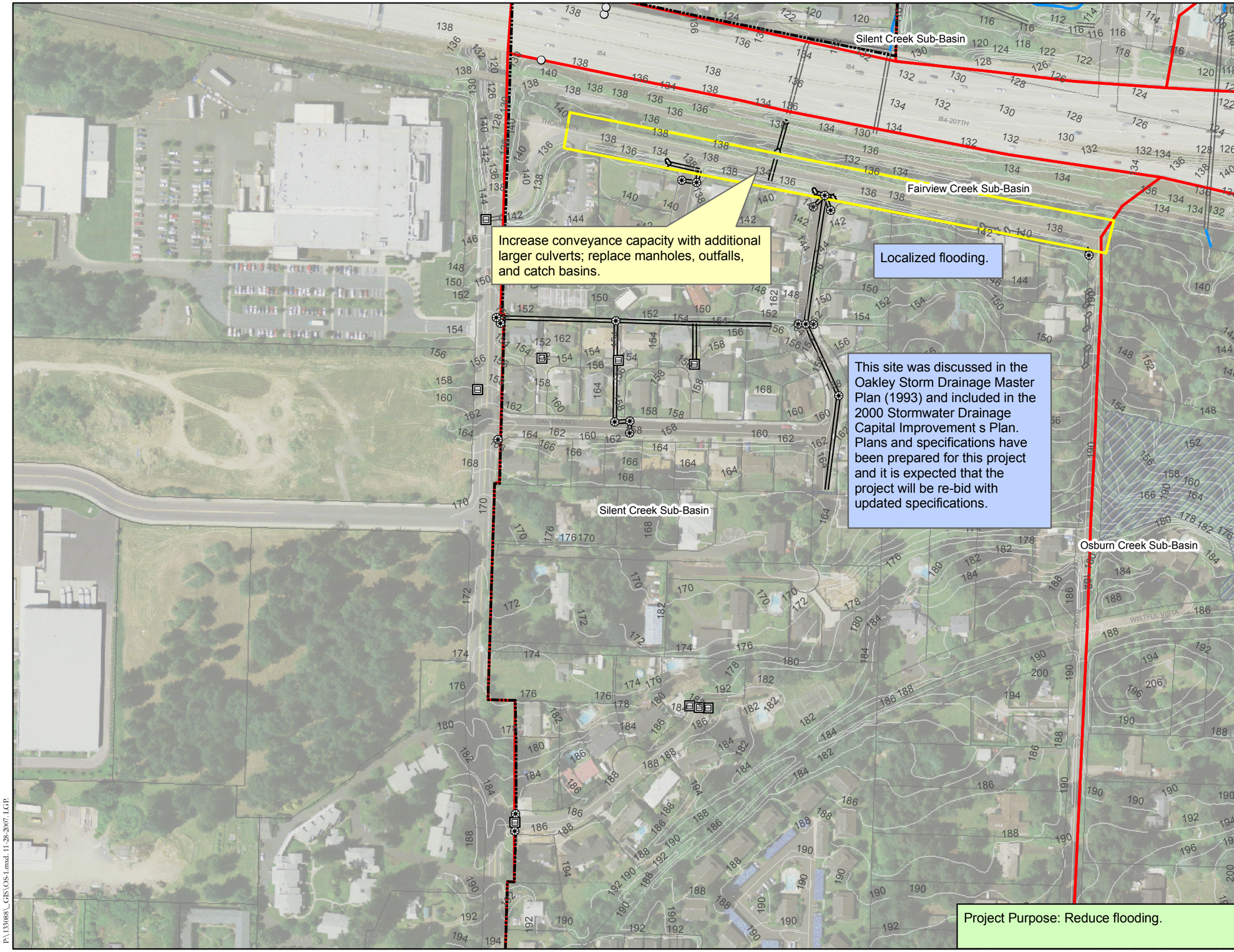

City of Fairview
Project: OS-1

Thompson Street Storm Drain Improvements

Legend

- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 100 200 400 Feet

1 inch equals 200 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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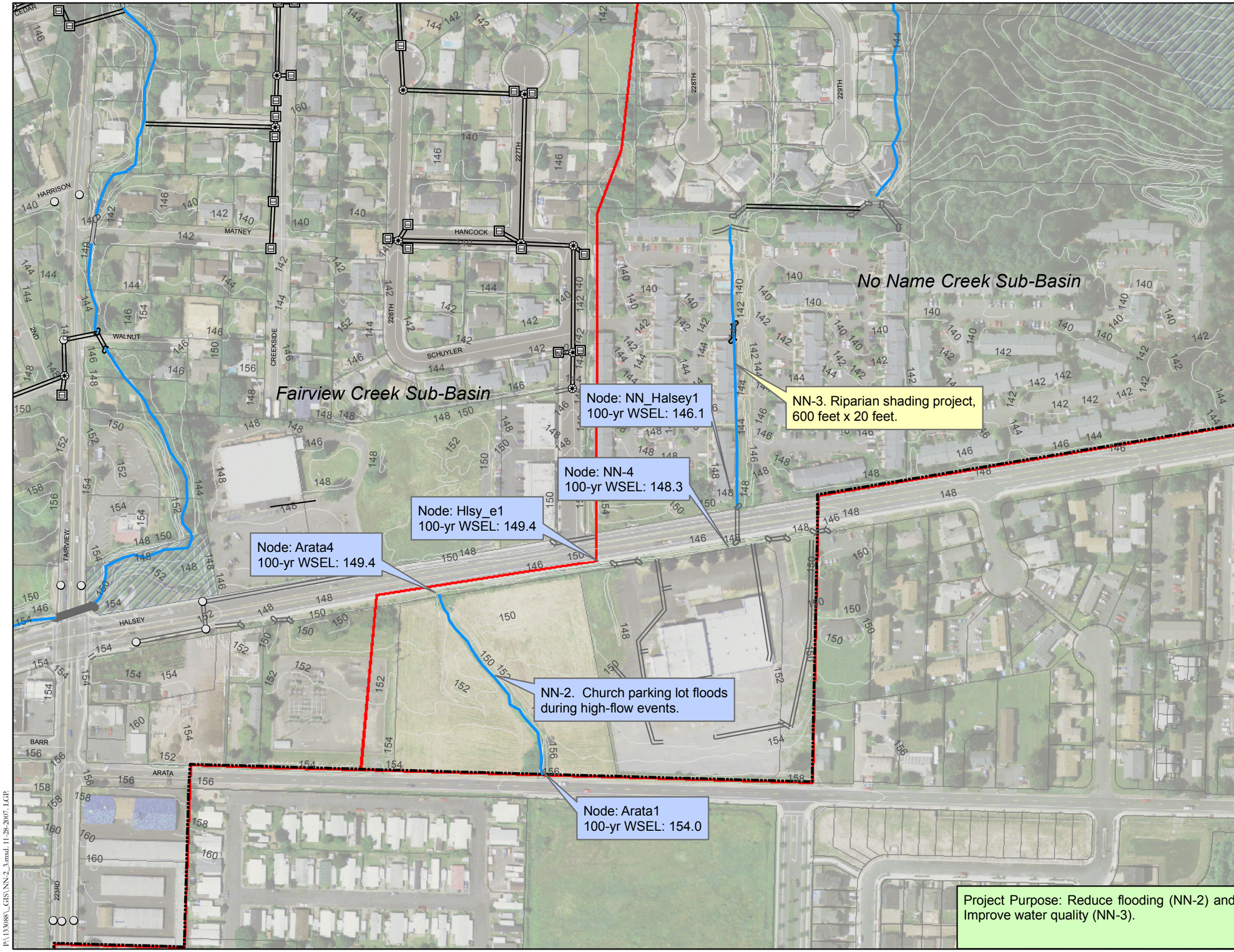

No Name Creek
Project: NN-2, 3

Church parking lot
Fairview Oaks Apt.s

Legend

- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 100 200 400 Feet

1 inch equals 200 feet

Consolidated Stormwater
Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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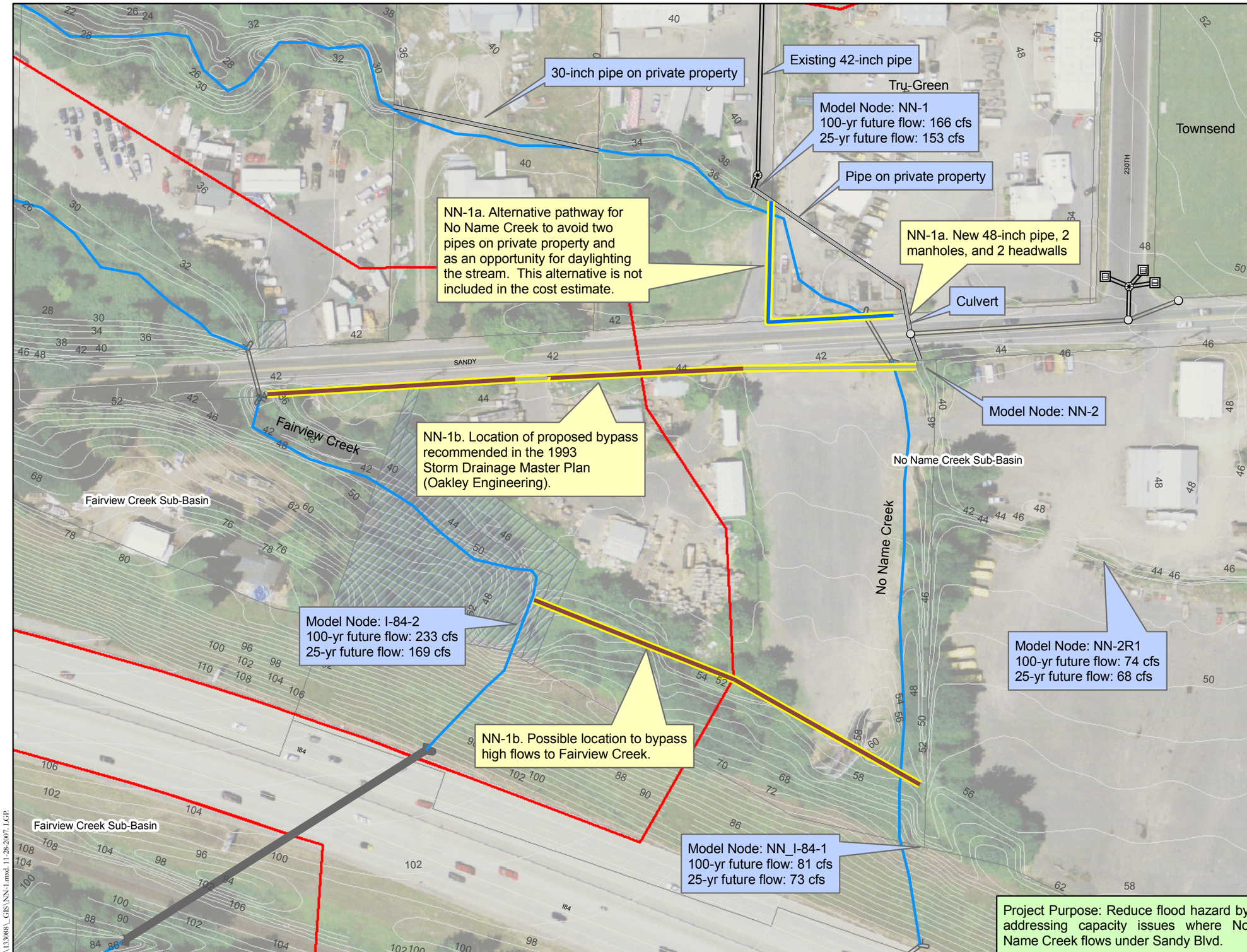

No Name Creek
Project: NN-1

Undersized Culvert at Sandy

Legend

- 30 in pipe; existing
- culvert
- daylight pipe
- ditch
- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 50 100 200 Feet

1 inch equals 100 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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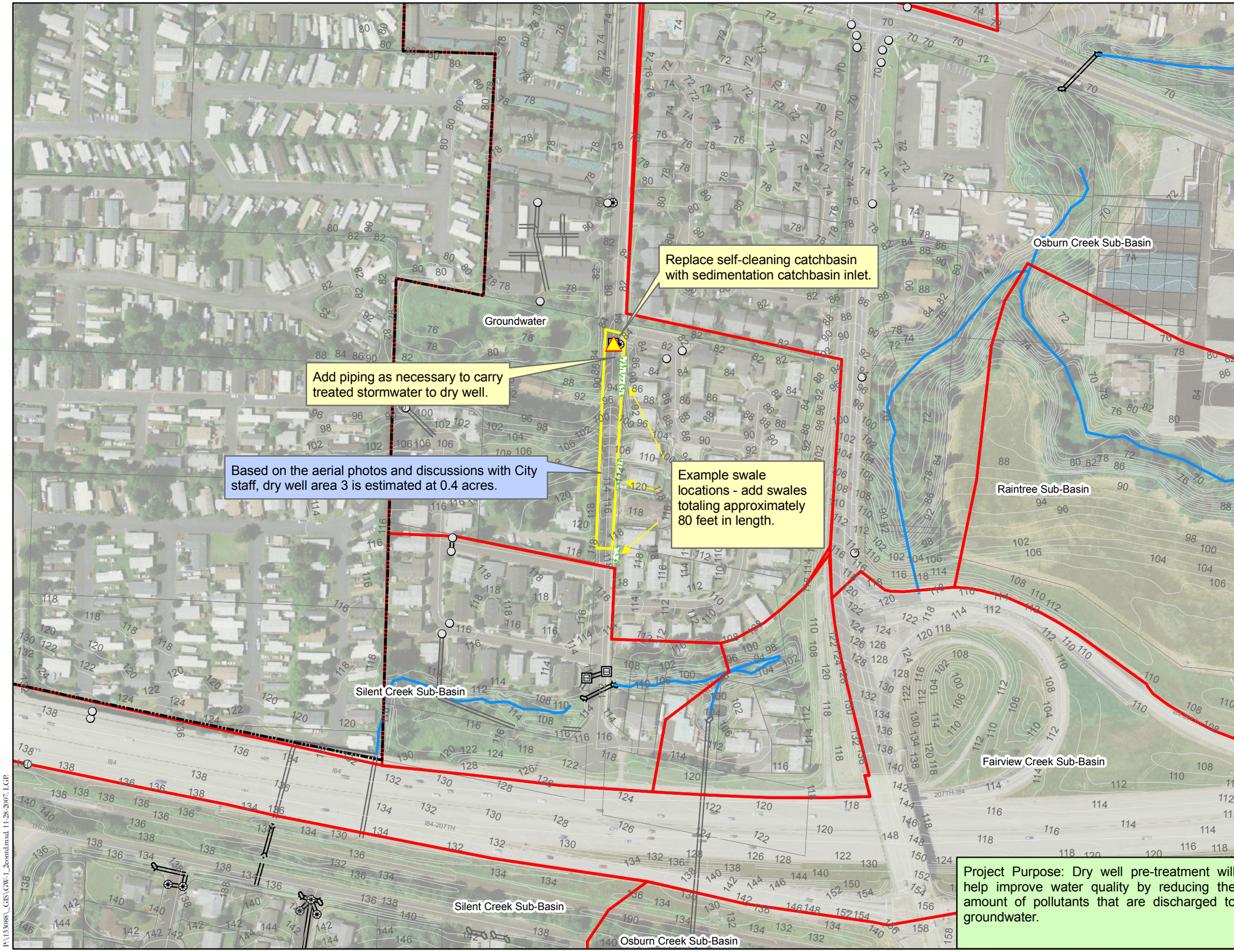
City of Fairview
Project: GW-1, 2 cont'd.

Dry well pre-treatment



Project Purpose: Dry well pre-treatment will help improve water quality by reducing the amount of pollutants that are discharged to groundwater.

Legend

- Dry well
- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 100 200 400 Feet

1 inch equals 200 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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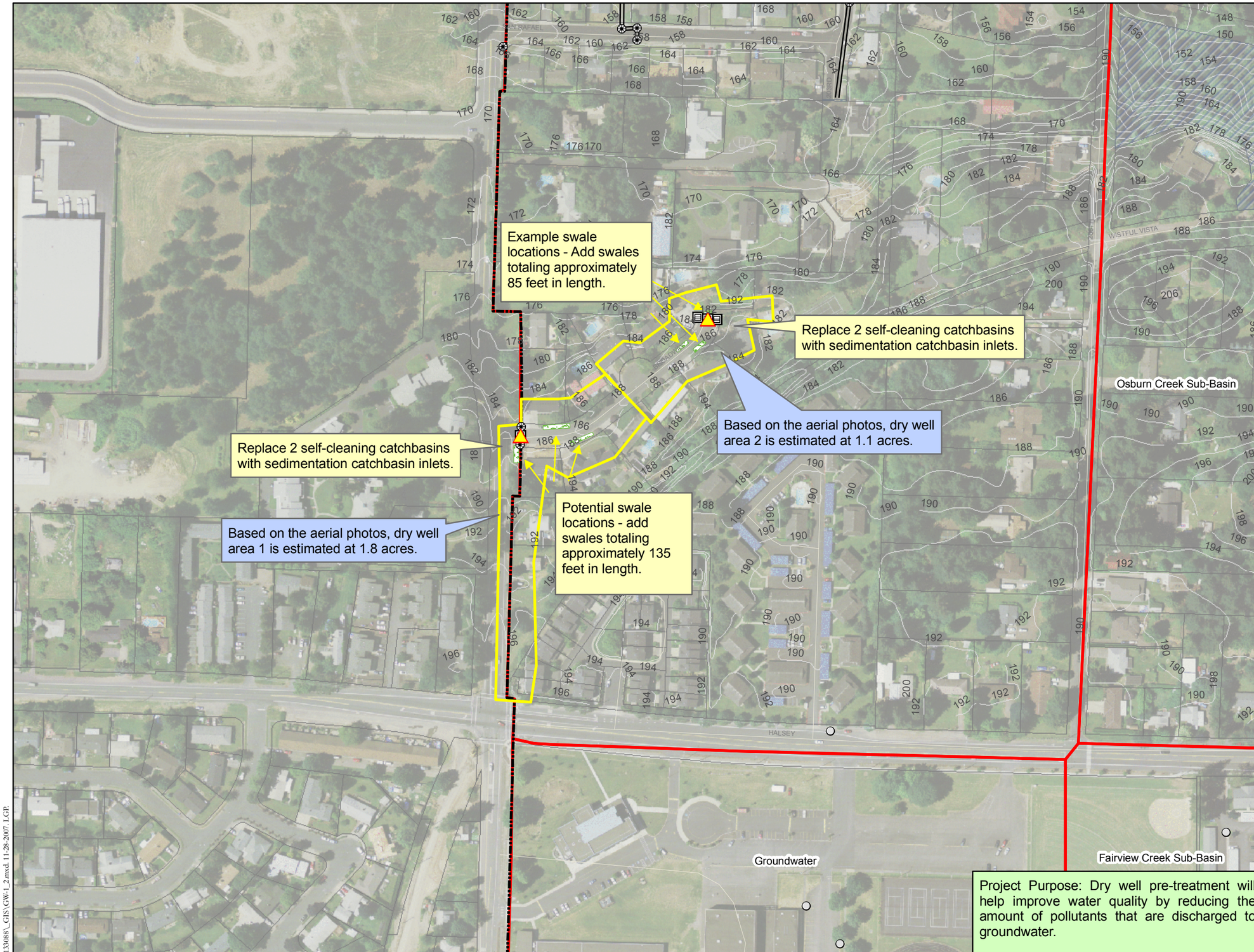

Project Purpose: Dry well pre-treatment will help improve water quality by reducing the amount of pollutants that are discharged to groundwater.

City of Fairview
Project: GW-1,2

Dry well pre-treatment

Legend

- Dry well
- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 100 200 400 Feet

1 inch equals 200 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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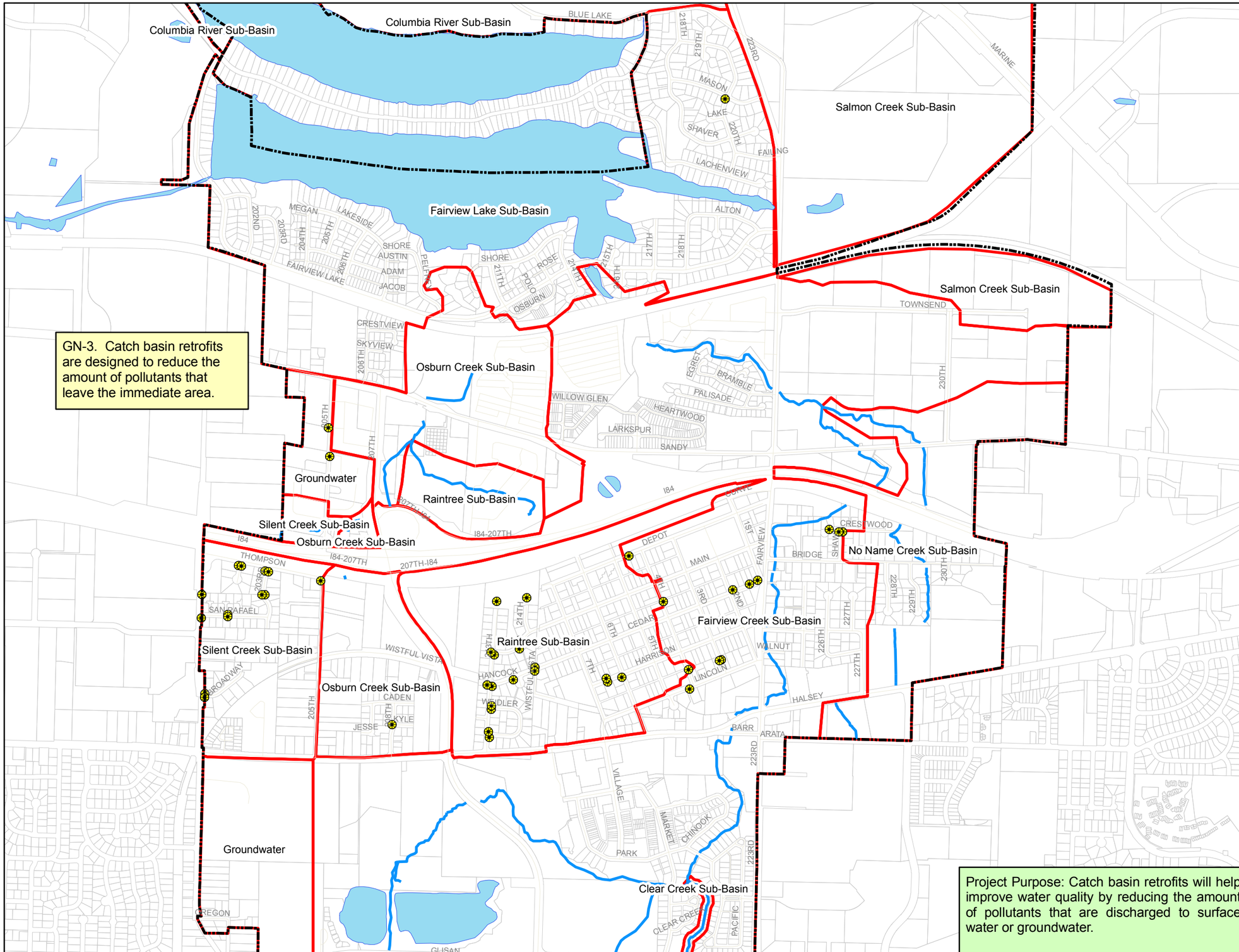

City of Fairview
Project: GN-3

Catch basin retrofits

Legend

- CBs that need sumps
- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 500 1,000 2,000 Feet

1 inch equals 1,000 feet

Project Purpose: Catch basin retrofits will help improve water quality by reducing the amount of pollutants that are discharged to surface water or groundwater.

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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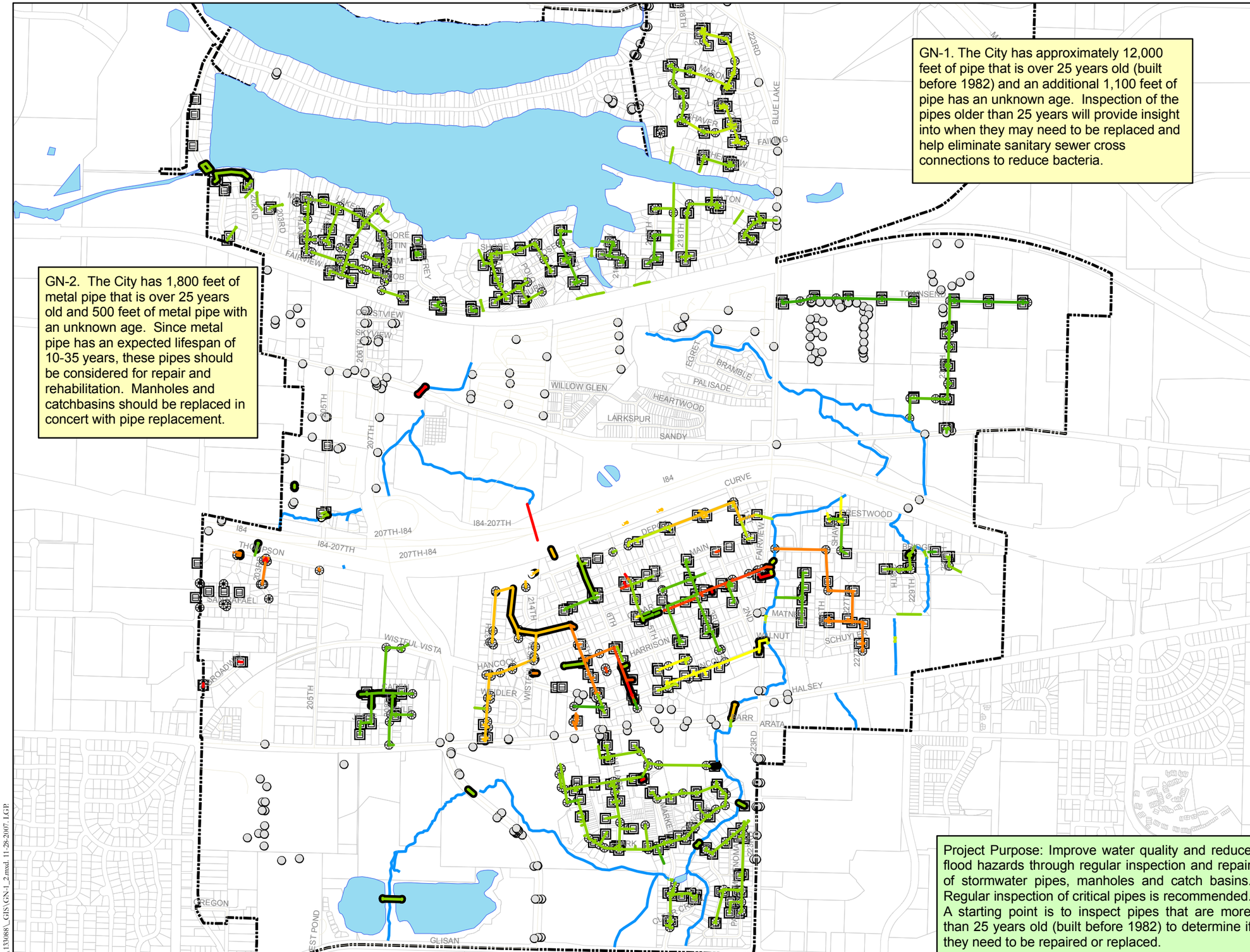

City of Fairview
Project: GN-1, 2

Infrastructure Repair and Rehabilitation

Legend

City Pipe Age

- Unknown
- 1957
- 1971-74
- 1975-79
- 1985-89
- 1990-94
- 1995-99
- 2000-04
- 2005-07
- CMP/Steel Pipe
- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

0 500 1,000 2,000 Feet

1 inch equals 1,000 feet

N

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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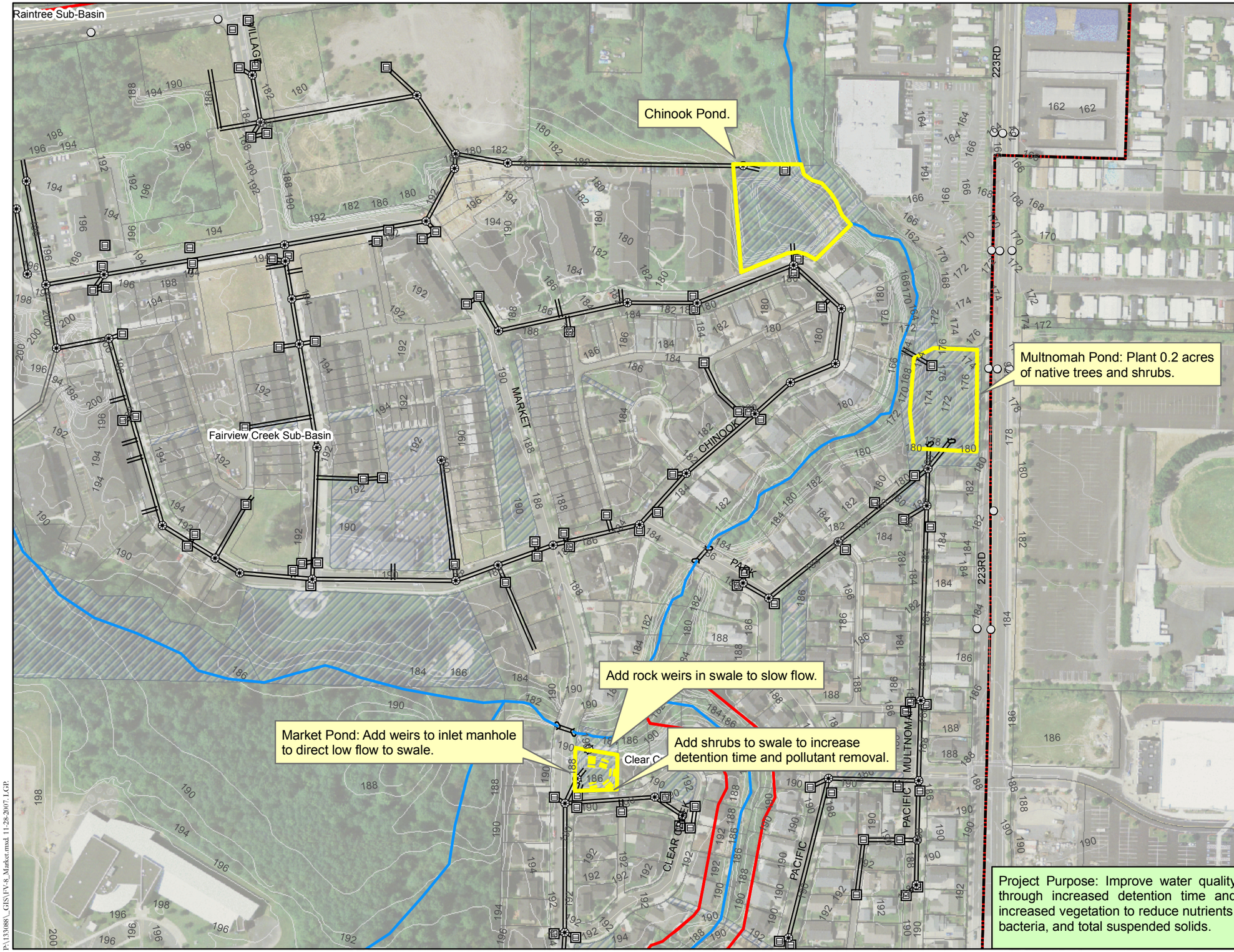


Fairview Creek Project: FV-8

Fairview Village Detention Ponds

Legend

- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 100 200 400 Feet

1 inch equals 200 feet

Project Purpose: Improve water quality through increased detention time and increased vegetation to reduce nutrients, bacteria, and total suspended solids.

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

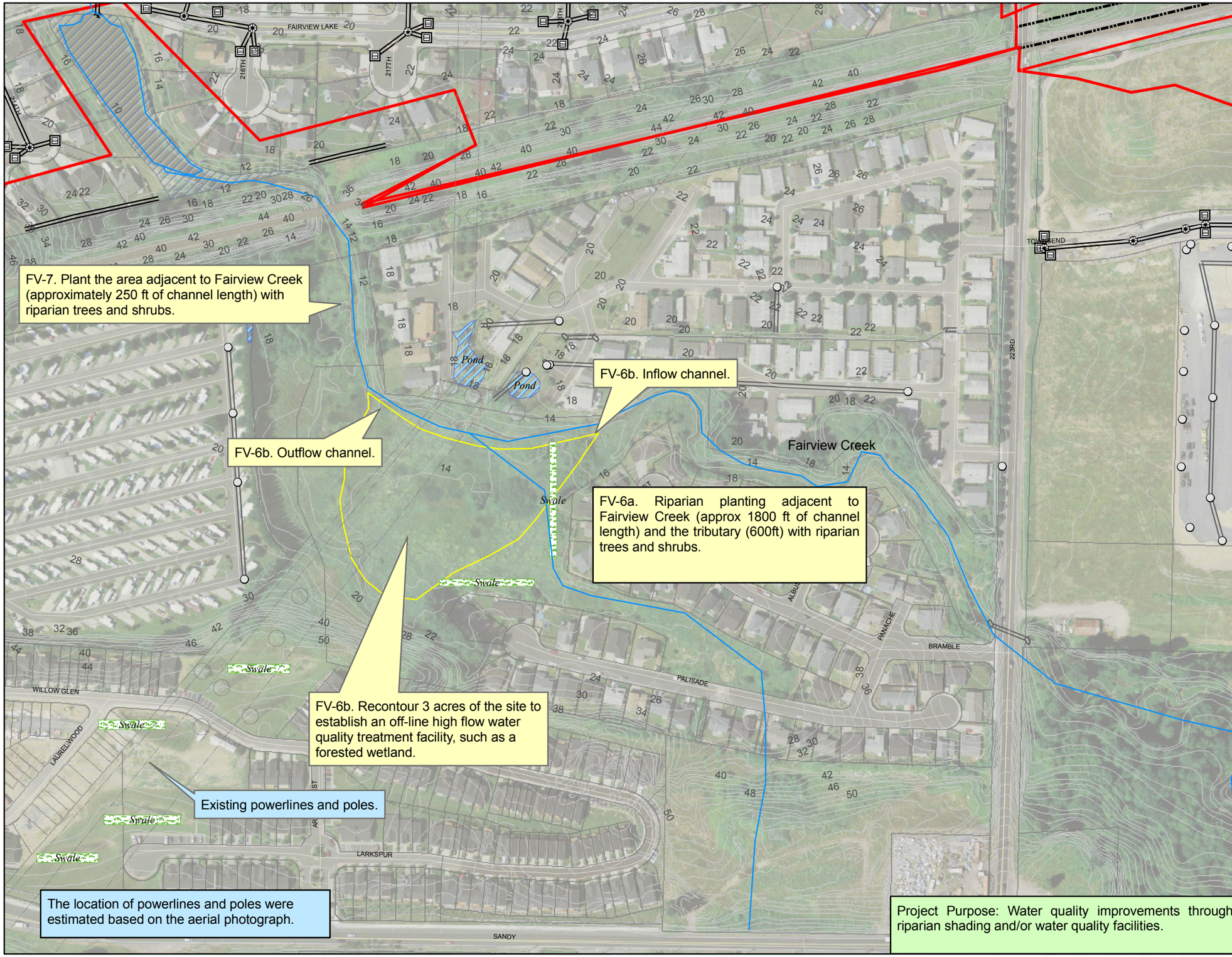
BROWN AND CALDWELL

Data Source: City of Fairview GIS

P:\133/088_GIS\FV-8_Market.mxd, 11-28-2007, LGP.

Fairview Creek
Project: FV-6 and 7

Heron Point and the McDonald Brothers Site



Legend

- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 100 200 400 Feet

1 inch equals 200 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

Project Purpose: Water quality improvements through riparian shading and/or water quality facilities.

P:\133088_GIS\FV-6_7.mxd 11-28-2007 LGP

Fairview Creek
Project: FV-5

Old Town Green Streets Opportunities

Fairview Creek Sub-Basin

Raintree Sub-Basin

Fairview Creek Sub-Basin

Swale

Example location for a flow-through bioretention planting strip

Example location for a flow-through bioretention planting strip

Area: 2.2 acres

I84

DEPOT

MAIN

1ST

BRIDGE

5TH

7TH

214TH

4TH

HARRISON

2ND

3RD

MATNEY

WALNUT

CEDAR

HANCOCK

WATERFUL VISTA

LINCOLN

FAIRVIEW

Legend

- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 100 200 400 Feet

1 inch equals 200 feet

Project Purpose: Improve water quality through use of green design. For example, add approximately 2 flow-through bioretention planting strips per block, approximately 4 per year, as streets are repaved.

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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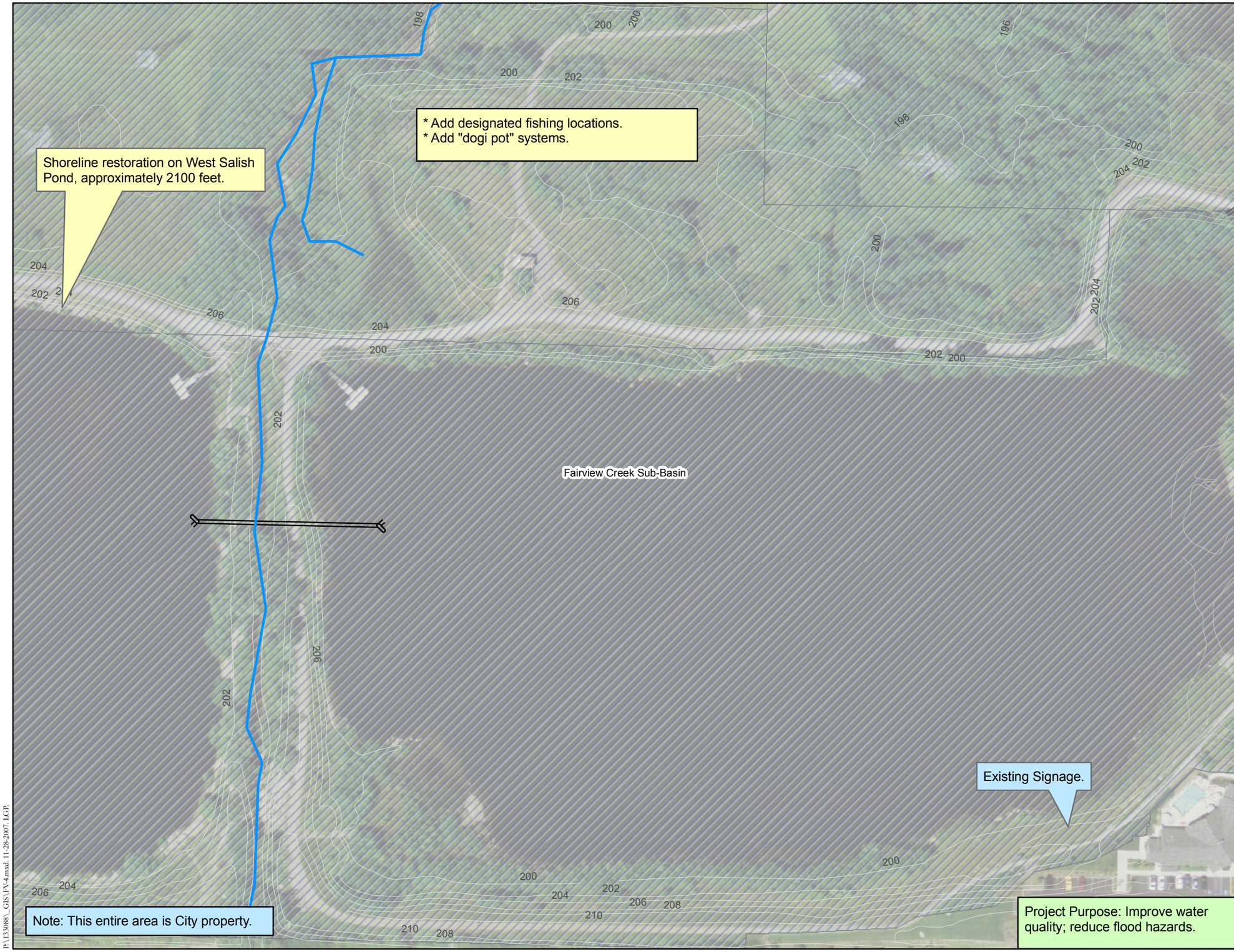
Fairview Creek
Project: FV-4

Salish Ponds and Wetlands



Legend

- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 50 100 200 Feet

1 inch equals 100 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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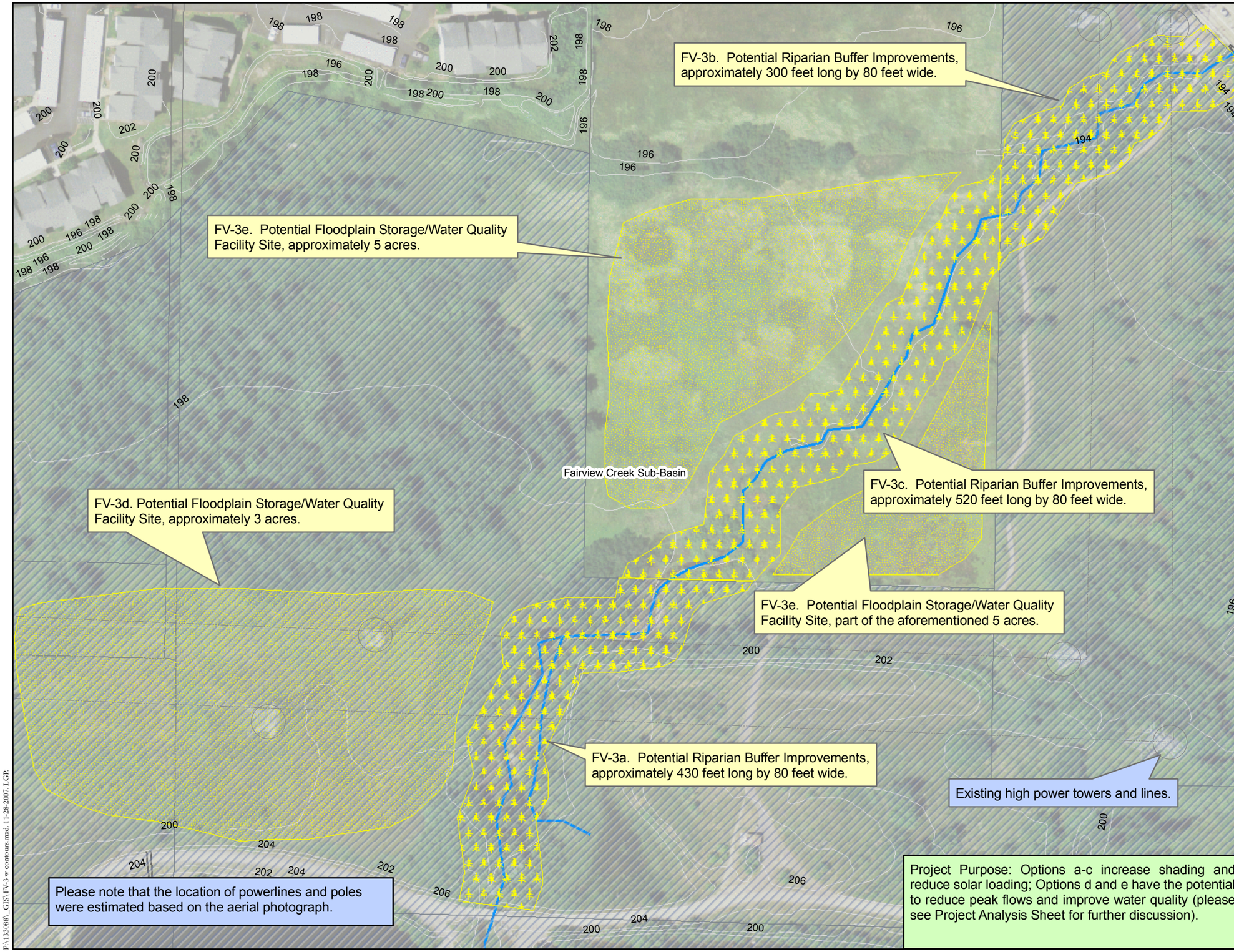

Fairview Creek
Project: FV-3

South of Halsey, West of 207th: Options for riparian planting and flood storage/water quality facilities

Legend

- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 50 100 200 Feet

1 inch equals 100 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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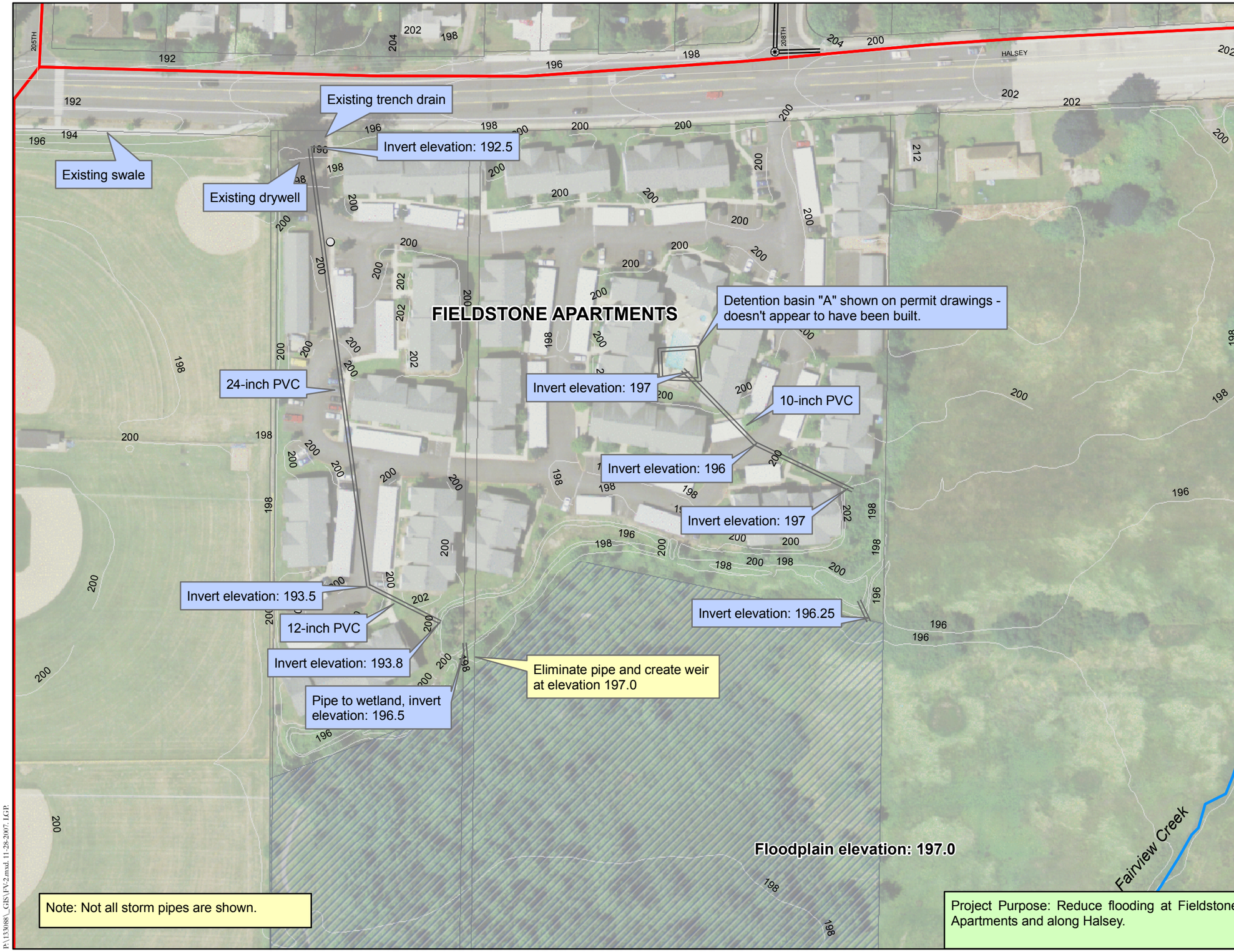

Note: Not all storm pipes are shown.

Project Purpose: Reduce flooding at Fieldstone Apartments and along Halsey.

Fairview Creek
Project: FV-2

Flooding on Halsey by Fieldstone Apartments

Legend

- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 50 100 200 Feet

1 inch equals 100 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

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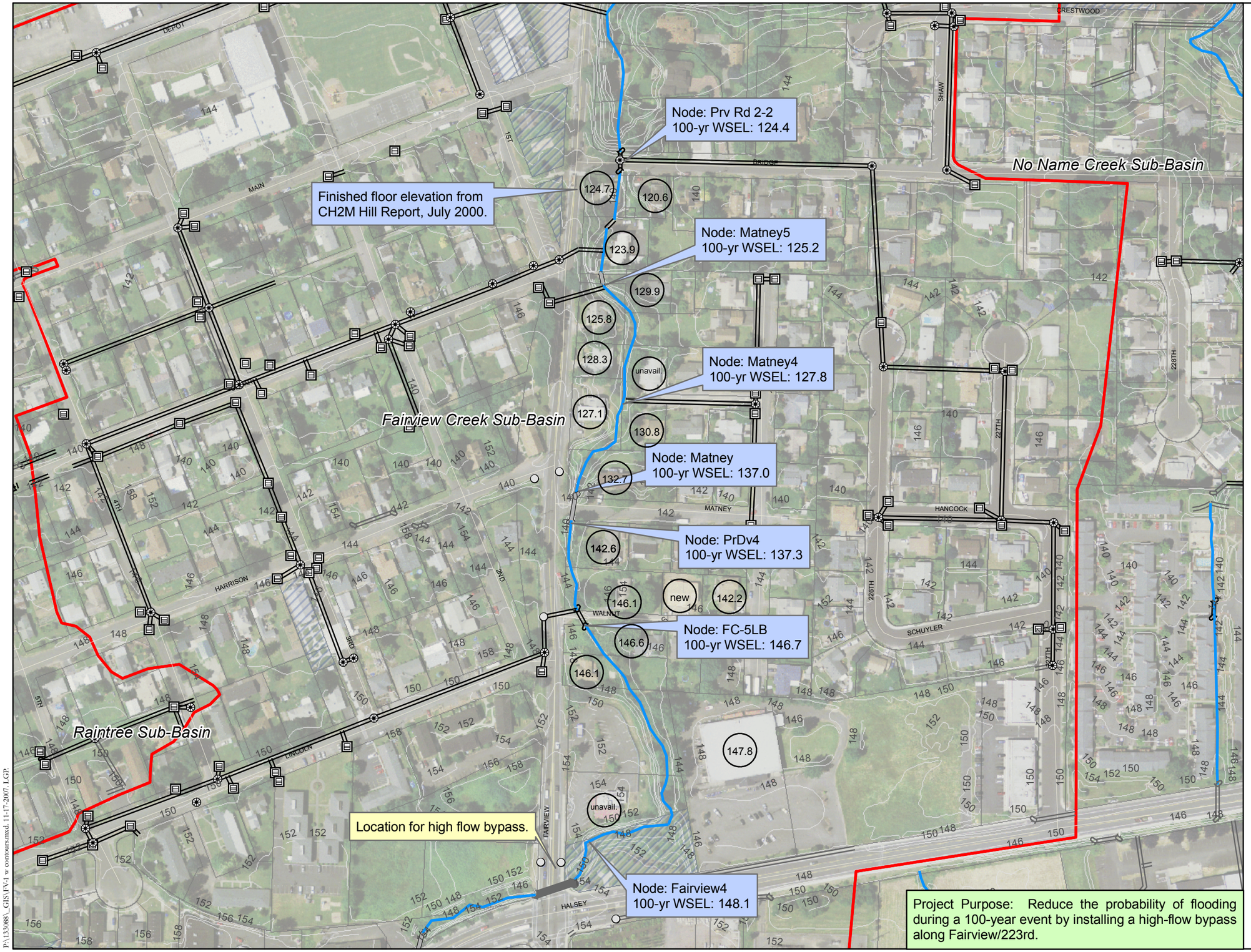


Project Purpose: Reduce the probability of flooding during a 100-year event by installing a high-flow bypass along Fairview/223rd.

Fairview Creek
Project: FV-1

Fairview Creek between Halsey and I-84

Legend

- 147.8 Finished floor elevation from CH2M Hill Report, July 2000
- Fairview City Limits
- Basins
- taxlots
- City property
- Catchbasins
- Manholes
- Private MHs, CBs
- Private pipe
- Pipe
- Bridge; Box Culvert
- Private Box Culvert
- Tributary
- Pond
- Swale
- Pond and Swale
- Proposed Project Features
- Existing Project Features

N

0 100 200 400 Feet

1 inch equals 200 feet

Consolidated Stormwater Master Plan

CITY OF FAIRVIEW

BROWN AND CALDWELL

Data Source: City of Fairview GIS

P:\133/088_GIS\FV-1 w contours.mxd, 11-17-2007, LGP

APPENDIX A

Level of Service Meeting - Notes

Fairview Storm Water Level of Service Meeting June 13, 2007

- Purpose
  - Define project objectives and preliminary LOS to be used in evaluating the CIP
- Attendees
  - City of Fairview
    - Linda Hulme
    - Bob Cochran
    - Steve Richards
    - John Gessner
  - Brown and Caldwell
    - John Rundall
    - Laura Porter
    - Steffran Neff
- Objectives/Project Goals
  - Looking at CIP project list not necessarily 5 or 10 year plan
  - Looking at build out
    - Residential build out predicted in 5 years
  - Determine event model versus continuous model
    - Using XPSWMM
    - Over half of Fairview currently modeled
- Current Information
  - Rain tree railroad crossing
    - 18 in culvert under crossing
    - 36 in pipe that goes to area
    - New development
    - Acting as a detention pond feel 18 in culvert is undersized
    - No current flood problems
    - Maintenance crew goes out several times/winter to clear
    - Very limited water quality treatment
    - Make sure new development will not adversely affect water quality or increase flooding
  - Light foot culvert near crossing
    - Used to flood; hasn't for years
    - Have done proactive maintenance to make sure it is clear
  - Walnut/223rd flooding
    - Models high; not seen by superintendent
    - Was recommendations for building up wall
  - Bridge street and Walnut show up on 100 year flood maps
    - Culverts were replaced after initial FEMA modeling
  - Area between Halsy and I-84 show up on FEMA maps in 100 year event
    - Five culverts
      - Bridge
      - Arnold
      - Walnut
      - Matney
      - Linglebach
    - Culverts seem to flow
    - Models show houses and private property flooding
  - FEMA modeled City of Fairview storm water flooding in 1993
  - City of Fairview modeled storm water flooding in 2000
  - Currently do sandbagging for flooded private property
  - No significant impact from groundwater flooding
    - Private homes do have sump pumps
  - Need to determine how to work cooperatively with other jurisdictions
    - Railroads
    - County
    - Upstream impacts
    - Have erosion problems due to flooding
    - New impervious surfaces or significant development
      - New casino project proposed
  - Changed hydrological regime from upstream entities
    - address impact of extended flow durations
    - No physical impacts have yet been realized
    - From Gresham regional detention facility on Birdsdale/202nd
  - Thompson Ditch should be looked at in master plan
  - Salish Ponds
    - Appears to be maximized for the storm water retention
    - Major trout fishing destination
  - Salish Park
    - May be need for shade to meet temperature TMDL
    - Will be looking at external park improvements this year (grass, parking, benches)
- Existing LOS
  - External LOS
    - Customer Needs
      - Limit impact to property
        - MWSE 1 foot from the finish floor of building for 100 year event
    - Sustainability
      - To be defined
    - Capacity
      - To be defined
  - Internal LOS
    - Design
      - Meet ODFW habitat requirements
      - Every facility that is newly constructed needs to consider water quality
      - Water quality should be considered for improvements
        - BC to look to City for input
      - Consider use of 50 or 100 year storm design to limit amount of overtime or emergency response
      - Do not use dry wells
        - Have one injection well
      - Use infiltration trenches
    - Performance
      - To be defined
    - Quality
      - To be defined
    - Operations
      - To be defined
  - Meet permit limits
  - Meet general design standards for developers
    - Might go higher on good stewardship or habitat enhancement
    - Conveyance is designed for 25 year; might go higher
      - Example Bridge Street culverts designed for 100 year storm
    - What freeboard should we design to?
  - Use Portland Storm Water Management Manual
  - Permit requires Fairview to meet MEP
  - Type of treatment attempts to meet TMDLs
  - Adopted local ordinances that meet Goal 5
    - Wetland and riparian regulations
    - Significant Environmental concern overlay
      - Upland habitat
      - Competing goals between storm water and environmental goals
        - Example should we cut down a forest to build a retention pond
      - Existing forested and wetland areas identified in environmental inventory
        - Example 205th neighborhood
  - Parks goals
    - Pursue active recreation
    - Move away from acquisition for open space
    - Use passive park for storm water facilities
    - No ponds in active recreation areas
      - Flooding path is much better than flooding playground
  - Adopted FMEA requirements for floodplain development
  - Verbal agreement with MCDD#1
    - Have minimal detention of storm water flows prior to receiving Gresham flows
  - Raise Wier of Fairview Lake to 14 ft during Summer; lower to 11ft (or so) in Winter
    - Modification to existing storm water management of Lake Fairview is not deemed necessary (don't totally take off table)
    - Lake gives Fairview the opportunity to not need detention
    - Recently spent $800K on wier

Fairview Storm Water Level of Service Meeting, June 13, 2007

1 Purpose

1.1 Define project objectives and preliminary LOS to be used in evaluating the CIP

2 Attendees

2.1 City of Fairview

Linda Hulme

Bob Cochran

Steve Richards

John Gessner

2.2 Brown and Caldwell

John Rundall

Laura Porter

Steffran Neff

3 Objectives/Project Goals

3.1 Looking at CIP project list not necessarily 5 or 10 year plan

3.2 Looking at build out

Residential build out predicted in 5 years

3.3 Determine event model versus continuous model

Using XPSWMM

Over half of Fairview currently modeled

4 Current Information

4.1 Raintree railroad crossing

18 in culvert under crossing

36 in pipe that goes to area

New development

Acting as a detention pond feel 18 in culvert is undersized

No current flood problems

Maintenance crew goes out several times/winter to clear

Very limited water quality treatment

Make sure new development will not adversely affect water quality or increase flooding

Fairview Storm Water Level of Service Meeting, June 13, 2007

4.2 Light foot culvert near crossing

Used to flood; hasn't for years

Have done proactive maintenance to make sure it is clear

4.3 Walnut/223rd flooding

Models high; not seen by superintendent

Recommendations for building floodwall

4.4 Bridge street and Walnut show up on 100 year flood maps

Culverts were replaced after initial FEMA modeling

4.5 Area between Halsey and I-84 show up on FEMA maps in 100 year event

Five culverts

- Bridge
- Arnold
- Walnut
- Matney
- Linglebach

Culverts seem to flow

Models show houses and private property flooding

4.6 FEMA modeled City of Fairview storm water flooding in 1993

4.7 City of Fairview modeled storm water flooding in 2000

4.8 Currently do sandbagging for flooded private property

4.9 No significant impact from groundwater flooding

Private homes do have sump pumps

4.10 Need to determine how to work cooperatively with other jurisdictions

Railroads

County

Upstream impacts

Have erosion problems due to flooding

New impervious surfaces or significant development

- New casino project proposed

Fairview Storm Water Level of Service Meeting, June 13, 2007

4.11 Changed hydrological regime from upstream entities

Address impact of extended flow durations

No physical impacts have yet been realized

From Gresham regional detention facility on Birdsdale/202nd

4.12 Thompson Ditch should be looked at in master plan

4.13 Salish Ponds

Appears to be maximized for the storm water retention

Major trout fishing destination

4.14 Salish Park

May be need for shade to meet temperature TMDL

Will be looking at external park improvements this year (grass, parking, benches)

5 Existing LOS

5.1 Meet permit limits

5.2 Meet general design standards for developers

Might go higher on good stewardship or habitat enhancement

Conveyance is designed for 25 year; might go higher

Example Bridge Street culverts designed for 100 year storm

What freeboard should we design to?

5.3 Use Portland Storm Water Management Manual

5.4 Permit requires Fairview to meet MEP

5.5 Type of treatment attempts to meet TMDLs

5.6 Adopted local ordinances that meet Goal 5

Wetland and riparian regulations

Significant Environmental concern overlay

Upland habitat

Competing goals between storm water and environmental goals

Example should we cut down a forest to build a retention pond

Existing forested and wetland areas identified in environmental inventory

Example 205th neighborhood

5.7 Parks goals

Pursue active recreation

Move away from acquisition for open space

Use passive park for storm water facilities

No ponds in active recreation areas

Flooding path is much better than flooding playground

5.8 Adopted FEMA requirements for floodplain development

5.9 Verbal agreement with MCDD#1

Have minimal detention of storm water flows prior to receiving Gresham flows

5.10 Raise Weir of Fairview Lake to 14 ft during Summer; lower to 11ft (or so) in Winter

Modification to existing storm water management of Fairview Lake is not deemed necessary (don't totally take off table)

Lake gives Fairview the opportunity to not need detention

Recently spent $800K on weir

6 Internal LOS

6.1 Design

Meet ODFW habitat requirements

Every facility that is newly constructed needs to consider water quality

Water quality should be considered for improvements

BC to look to City for input

Consider use of 50 or 100 year storm design to limit amount of overtime or emergency response

Do not use dry wells

Have one injection well

Use infiltration trenches

6.2 Performance

To be defined

6.3 Quality

To be defined

6.4 Operations

To be defined

Fairview Storm Water Level of Service Meeting, June 13, 2007

7 External LOS

7.1 Customer Needs

Limit impact to property

MWSE 1 foot from the finish floor of building for 100 year event

7.2 Sustainability

To be defined

7.3 Capacity

To be defined

APPENDIX B

Summary of Hydrologic and Hydraulic Model Requirements

Technical Memorandum, August 1, 2007

BROWN AND CALDWELL

Technical Memorandum

6500 SW Macadam Avenue, Suite 200
Portland, Oregon 97239

Prepared for: Linda Hulme, City of Fairview

Project Title: Consolidated Stormwater Master Plan

Project No: 133088.003.001

Subject: Summary of Hydrologic and Hydraulic Model Requirements

Date: August 1, 2007

Prepared by: Laura Porter, Brown and Caldwell
Leah Johanson, P.E., Brown and Caldwell
John Rundall, P.E., Brown and Caldwell
Jennifer Belknap Williamson, Brown and Caldwell

CONTENTS

BACKGROUND INFORMATION 2
MODEL APPROACH 2
Modeling Schedule 2
Hydraulics 3
Hydrology 5
RESULTS 6
ATTACHMENTS 7

Limitations:

This document was prepared solely for the City of Fairview in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Fairview and Brown and Caldwell dated June 8, 2007. This document is governed by the specific scope of work authorized by the City of Fairview; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Fairview and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Background Information

The purpose of this technical memorandum is to document our requirements for hydrologic and hydraulic modeling for the City of Fairview's Consolidated Stormwater Master Plan. Our summary is based on our Level of Service meeting with City of Fairview personnel and our discussions with David Crawford at Crawford Engineering Associates (Crawford). It is our intent that this technical memorandum provides enough information for Crawford to begin a data inventory and start developing an existing system model to both validate known issues and identify any issues that are as yet unknown.

Model Approach

Updates to the XPSWMM model are required to evaluate the capacity of problem areas in the existing system, assess hydraulic impacts of future development within the City and surrounding communities, and determine the system improvements needed to maintain the required level of service.

Water quality will not be evaluated, although the modifications to the stormwater model will be made to accommodate a possible future requirement for water quality modeling.

System improvements are expected to focus primarily on increasing conveyance capacity for culverts and channels. The evaluation will also address channel velocities and the need for erosion protection. The improvements are assumed to be consistent with the existing approach to not detain peak flows so they can be routed through to Multnomah County Drainage District (MCDD) #1 facilities before the peak flows from upstream communities. However, the current "flush-through" approach would not preclude the use of local detention facilities to address specific drainage problems identified in the analysis.

The modeling will focus on two of the four main drainage subbasins in the City, Fairview Creek, and No Name Creek. It is not anticipated that modeling will be needed for the Osburne Creek and Salmon Creek subbasins because they have not changed significantly since prior modeling was completed. The Osburne Creek subbasin is largely built-out and MCDD has modeled the Alcoa development site. Although the Salmon Creek subbasin may undergo future development, the subbasin is not a high priority area for City stormwater management activities. Flow in Salmon Creek is managed by MCDD and there are no existing total maximum daily load (TMDL) water quality concerns because the creek flows directly into the Columbia River.

Figure 1 (attached) shows the limits of the study area, the subbasins in the City, and potential Capital Improvement Project (CIP) areas of focus for the modeling effort.

Modeling Schedule

The modeling will take place in two phases. Phase 1 will include modeling of existing and future conditions without additional drainage improvements by the City. Brown and Caldwell assumes Phase 1 modeling will be completed by August 20, 2007, with results provided in a summary table explaining the location and type of deficiencies identified (including peak flows and velocities modeled for each storm for all deficient areas). City staff will review the deficiencies identified by the analysis and determine which problem areas should be mitigated by August 24, 2007. After the results of Phase 1 are received and analyzed by the City, Brown and Caldwell will visit sites identified as problem areas and develop potential CIPs to address the drainage deficiencies and water quality improvements. Brown and Caldwell will provide preliminary CIPs to Crawford by September 21, 2007.

In Phase 2, Crawford will model existing and future conditions including the proposed CIPs. Through an iterative process with Crawford, Brown and Caldwell will determine the improvements required and Crawford will verify that the selected elements meet the Level of Service requirements. Brown and Caldwell assumes Phase 2 modeling will be completed within 2 weeks of Crawford receiving the preliminary CIPs, or no later than October 5, 2007.

Hydraulics

Hydraulics analysis includes information related to the model revision as well as design criteria.

Model Revision

The present model only includes the main channels; runoff is collected from large subbasins and introduced to the system at only a few locations. The modifications to the model will include: 1) subdividing the subbasins and adding additional locations where flow enters the model and 2) updating the conveyance elements (culverts and channel configurations) for the Fairview Creek and No Name Creek subbasins. The focus of the model revisions will be to add greater detail to drainage features in areas of interest identified by the City and Brown and Caldwell. The level of detail added will be sufficient for the results to be used by Brown and Caldwell to provide preliminary schematic designs and cost estimates of CIPs.

A draft summary of background information identified by Brown and Caldwell through interviews and review of existing data is included in Attachment 1. The background information includes projects, programs, and problem areas identified by the City and adjacent municipalities that could affect stormwater management in Fairview. This draft summary will be further refined by Brown and Caldwell, the City, and Crawford prior to the start of modeling to identify information relevant to the modeling effort. Some of the projects are repeated in the draft background summary list due to inclusion by multiple sources as areas of concern.

Other projects in the background summary list are identified as potential solutions to existing problems. These existing problem areas should be included in the model as areas of interest; however the existing conditions should be included in Phase 1 of the modeling rather than the proposed solutions provided in the background summary list. CIPs will be developed by Brown and Caldwell to address existing problems that will be modeled in Phase 2. Additional projects in the background summary list that are identified by adjacent municipalities as high-priority projects with likelihood of being implemented within the next 10 years may be included in the future conditions models in Phase 1 and Phase 2. The projects to include in the future conditions model will be identified by the City.

The City has identified several potential priority projects and the model needs to be complex enough to address these issues. These include:

1. Fairview Creek along 223rd bank, 1712 NE 223rd Avenue (Project I from Source #21)–Federal Emergency Management Agency (FEMA) analysis indicates the area between Halsey Street and I-84 has flooding of houses and private property during the 100-year event. This includes five culvert crossings at Bridge, Arnold, Walnut, Matney, and Linglebach.

2. Fieldstone Apartments, 20650 NE Halsey Street (Project H from Source #21)–Private manhole overflows onto Halsey Street. Need conveyance improvements—run-off from wetlands sheet flows through apartment parking lot, overflows manhole, and flows along Halsey Street. Stormwater from wetlands eventually ends up in swales along Halsey Street.

3. No Name Creek, 22820 NE Halsey Street (Project A from Source #21)–No Name Creek bisects property. The Ukrainian Church parking lot floods during high-flow events. Low-flow events stay in No Name Creek. High-flow events bypass via a weir into Fairview Creek. Need to confirm operation of bypass and determine if this is still a good practice. See sketch included as Attachment 2.

4. No Name Creek, 22820 NE Sandy Boulevard (Project B from Source #21)–An undersized culvert has been identified in prior Master Plans. Floods Sandy Boulevard and closes road. Preliminary design to divert to Fairview Creek.

5. Raintree Railroad Crossing, Depot Street, 6th Street to 7th Street (Project D from Source #21)–36-inch pipe feeds area. Outlet is an 18-inch culvert under railroad. Area acting as a detention pond. New development in progress. Culvert undersized. High maintenance (crew goes out several times/winter to clear.) Limited water quality treatment. Need to make sure new development will not adversely affect water quality or increase flooding.

6. Park Cleone, north end of the NE 214th Avenue cul-de-sac, south of I-84. Opportunity to improve water quality through conversion of current flood detention pond into infiltration or filtration facility. Not a problem area for flooding, but include in model in conjunction with railroad crossing.

7. Halsey Street (south of) and just west of 207th Avenue. Opportunity to improve water quality through implementation of constructed wetland or wetpond on land owned by City. Not a problem area for flooding, but include in model in conjunction with Fieldstone Apartments to evaluate quantity of flow into area for design of possible water quality Best Management Practices.

8. McGill Ponds north of I-84, south of Sandy Boulevard, west of NE 223rd Avenue. Ponds treat stormwater drainage from I-84 (from just west of 238th Drive to 201st Avenue). Outlet of ponds estimated as 12-inch pipe to ditch that drains to Fairview Creek. Ponds are not necessarily a problem area, but want to ensure discharge from ponds is included in the model. See sketch included as Attachment 3.

9. 7th Street from Main Street to end of 7th Street and along 7th Street right of way to railroad ditch. Addition of a new storm drain has been included in the existing CIP, however this site may need additional modeling (Crawford to verify with City).

The additional discharge points and drainage system components added to the model will provide more detail for simulation of runoff entering the system. The selection of discharge points will be made keeping in mind that water quality analysis capability may be needed in the future. Crawford will coordinate these modifications with City staff's map of proposed discharge points.

Additional collection system information is needed to build further detail in the model and evaluate the collection system. Crawford will outline the extent of the proposed model improvements and confirm the level of detail required by the City. The City will provide Crawford with additional surveying to provide the detail (elevations, locations, pipe sizes, etc.) needed to update the model.

It is not anticipated that the modeling will include changes to Fairview Lake water surface elevations and the control structure weir. In addition, it is not anticipated that the modeling will include evaluating the water quality effects of specific water quality measures or water quality treatment facilities (although CIPs that are focused on water quality treatment or include water quality components may be included in Phase 2).

Design Criteria

The general design criterion is to provide storm drainage facilities to convey runoff through the city to Fairview Lake and the MCDD system ahead of the peak flows generated from the surrounding communities. The system is to be sized to convey runoff from the 100-year event with the maximum water surface elevation no closer than 1 foot to the finished grade of buildings and public roadways.

Other criteria of the Level of Service desired by the City are as follows:

- Internal level of service
  - Meet Oregon Department of Fish and Wildlife habitat requirements
  - Every newly-constructed facility needs to consider water quality
  - Consider use of 50- or 100-year storm design to limit amount of overtime or emergency response
  - Do not use dry wells
  - Use on-site disposal
- External level of service
  - Meet permit limits and maximum extent practicable requirements
  - Meet general design standards for developers
  - Use Portland Stormwater Management Manual
  - Meet TMDL wasteload allocations
  - State Goal 5 requirements
  - City Parks goals
    - Pursue active recreation
    - Move away from acquisition for open space
    - Use passive park for stormwater facilities
    - Eliminate ponds in active recreation areas
  - Adopted FEMA requirements for floodplain development
  - Verbal agreement with MCDD for minimal detention of stormwater flows in the City
  - Avoid changing Fairview Lake operation—raise weir to 14 feet during the summer, lower to approximately 11 feet in the winter

Hydrology

Hydrology includes land use and design storm considerations.

Land Use

Runoff will be modeled for existing and future land development conditions within the City. Future conditions will represent full build-out using current zoning classifications and is expected to occur within the next 5 to 10 years.

Future conditions scenarios will also assume additional development in surrounding communities (City of Gresham) over the next 10 years. City of Gresham should be modeled at full build-out for the Fairview Creek sub basin. The City will identify projects with high likelihood of being implemented within the next 10 years by adjacent municipalities from the background summary list to include in the future conditions models.

Design Storm Events

The analysis of the system hydraulics will be based on design storm scenarios already developed by Crawford as follows:

- 1-day (24-hour) design storm
- 5-day design storm
- 30-day design storm

The 1-day and 5-day storms for both 25-year and 100-year events will be evaluated. The system performance will also be evaluated for the 30-day design storm which is estimated at a somewhat greater than a 50-year return interval.

Results

Crawford will provide results at three stages in the project. Upon completion of Phase 1 (by August 20, 2007), Crawford will provide results for current and future conditions in a summary table that includes water surface elevations, peak flows and velocities modeled for each storm at the areas of interest, along with full channel profiles where appropriate. The Phase 1 modeling summary table will describe the location and type of deficiencies identified, including the proximity of water surface elevations to the finished grade elevations of roadways and buildings.

Brown and Caldwell will provide preliminary CIPs to Crawford by September 21, 2007, for the start of Phase 2. Crawford will provide results of modeling existing and future conditions including the proposed CIPs in an informal table with content similar to the results for Phase 1 modeling. Through an iterative process with Crawford, Brown and Caldwell will determine the improvements required and Crawford will verify that the selected elements meet the Level of Service requirements. Brown and Caldwell assumes Phase 2 modeling will be completed within 2 weeks of Crawford receiving the preliminary CIPs, or no later than October 5, 2007.

At the completion of Phase 2, Crawford will formally summarize the modeling assumptions and results for Phase 1 and Phase 2 in a technical memorandum that may be included as an appendix to the Consolidated Stormwater Master Plan. Brown and Caldwell assumes the final model summary memorandum will be submitted by October 12, 2007, for review by the City and Brown and Caldwell. Any necessary revisions will be completed by Crawford by October 19, 2007. The technical memorandum will have enough information to be read and understood by someone unfamiliar with the project and include enough detail that the modeling could be replicated by a third party to get similar results. The technical memorandum will include information such as methodology, assumptions, background information, model input data, summary of water surface elevations, verification/calibration process, inconsistencies in the modeling, and advice regarding improvements that should be made in future modeling. Background information should include summaries of modeling that has been completed in the last 3 years that would affect the City, i.e., FEMA modeling and regional modeling done for MCDD.

List of Attachments

Attachment 1 Draft Background Information Summary List (Summary of all projects, programs, and problem areas that have been recently identified in and around Fairview that could affect stormwater management in Fairview)

Attachment 2 Sketch of Project A, No Name Creek, 22820 NE Halsey Street, from Linda Hulme

Attachment 3 Drawing of McGill Ponds with hand notes added by Brown and Caldwell, from Oregon Department of Transportation

Attachment 1: Background Summary Information List

Preliminary Potential CIP's

Phase 1 Modeling	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Source # (key at bottom)	Notes	Status	City Comments
Yes	**223rd Ave - Fairview Cr along 223rd over bank, 1712 NE 223rd Ave**	I	Area between Halsey and I-84 show up on FEMA maps in 100-year events. Model shows houses and private property flooding. Related to culverts at Bridge, Arnold, Walnut, Matney, and Linglebach.	Flooding.	21	See CH2M Hill report. Crawford needs to model this.		In
Yes	**Halsey - Fieldstone Apartments, 20650 NE Halsey**	H	Private manhole overflows onto Halsey	Need conveyance improvements - run-off from wetlands sheet flows through apartment parking lot, overflows manhole, and flows along Halsey. Stormwater from wetlands eventually ends up in swales along Halsey.	21			Halsey swales OK review briefly in connection with Source 5, X and Fairview site 9
Yes	**Halsey St (South of) and just west of 207th Ave near NE**	X, Fairview site 9	WT: Wetland; WP: Wet Detention Pond	Improve WQ through retrofit; site has access to large tributary area, could treat future resdt'l development and flows from Fairview Creek, part of site may already include wetlands	5	Not in Fairview MP	Unknown	In - Water Quality, Ask David to look at briefly for quantity (Fieldstone)
Yes	**NoName Creek, 22820 NE Halsey**	A	No Name Cr bisects property. Low-flow events stay in No Name Cr. High flow events bypass via a weir into Fairview Creek. Need to confirm operation of bypass and determine if this is still a good practice.	Existing conditions limit development.	21	Crawford needs to model this.		Floods Ukrainian Church parking lot
Yes	**Osburn Creek Railroad Crossing**	17	Replace 18" CMP culvert with 36" CSP designed to convey future 100-year flow of 88 cfs.	Existing culvert undersized for all frequency existing peak flows.	22		Done?	Raintree RR Crossing In source 2 SDMP - 17, source 21 - D
Yes	**Park Cleone North end of the NE 214th Ave cul-de-sac, S. of 1-84**	R, Fairview site 5	WP: Wet Detention Pond; SNF: Sandfilter [City staff recommend infiltration/filtration facility due to safety concerns for children using park]	Improve WQ through retrofit; if Site Q (Fairview 4) is not implemented, Site R would treat a portion of that flow.	5	Not in Fairview MP	Unknown	In - Water Quality Only Model w/RR Crossing?
Yes	**Raintree Creek Railroad Crossing**	SDMP-17	Replace existing 18-inch CSP w/ 36-inch CSP	Inadequate existing and future conveyance capacity	2		Unknown	In
Yes	**Raintree Railroad Crossing, Depot Street, 6th to 7th**	D	36-inch pipe feeds area. Outlet is a 18" culvert under railroad. Area acting as a detention pond.	New development in progress. Culvert undersized. High maintenance (crew goes out several times/winter to clear.) Limited water quality treatment. Need to make sure new development will not adversely affect water quality or increase flooding.	21			Source #2 SDMP - 17 In
Yes (Maybe)	**7th Street Collector**	14 / SDMP-14	Construct 250 feet of 12" CSP along 7th Street between Main Street and the end of 7th Street. From the end of 7th Street construct 200' of 12" CSP within the 7th Street easement, outfalling to the railroad ditch. Install new field inlets at the intersec	Frequent ponding along 7th Street occurs due to the flat topography and lack of storm drainage facilities.	22 / 2	BC observed no flooding 2001	Done? Unknown	In source #2 SDMP - 14 Project in CIP - Do not need to model?

Attachment 1: Background Summary Information List

Preliminary Potential CIP's

Phase 1 Modeling	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Source # (key at bottom)	Notes	Status	City Comments
No	205th and Thompson	E	Undersized culvert? Used to have flooding here, but haven't seen any recently. Part of Osburne Cr system.	Flooding?	21	Are swales on Halsey included in model? Not sure this is still a problem since ODOT took care of I-84 and 205th. Review Oakley Master Plan.		In - Do not model, All County Plans
No	223rd Ave - Fairview Creek along 223rd Avenue, north of Halsey Street	133, 149	Riparian homeowner outreach for restoration of native vegetation, particularly understory species.	Foster environmental stewardship.	7	Fairview Action Plan project #11		In - Water Quality Only
No	223rd Ave Storm Drain Intallation (Salmon Crk watershed)		NE 223rd Ave Storm Drain Intallation (Salmon Crk watershed)	Improve drainage in an area that is relatively flat and zoned for industrial development	1	NE 223rd is a County road	Would be driven by development of adjacent properties	Project in CIP - Do not model
No	223rd Ave: Sandy Blvd. to Marine Dr. (same as 223rd Ave Storm Drain Installation)	143	Improve 223rd to major collector standards to incl. 2 travel lanes, center turn/median, sidewalks, bike lanes. Possible culvert replacement for fish passage. Requires replacement of RR bridge (Project 198?)	Traffic flow improvements, improve multi-modal use	18	Medium to High Priority. Part of Port/County Transportation Plan. Metro Councilor wants to see it done.	Future Implementation Funding constraints	223rd Ave Storm Drain - Newton Source #1
No	Arata Rd: 223rd Ave to 238th Dr.	129	Construct to 3 lane collector standards w/ center lane, bike lanes, sidewalks	New development is driving project. Traffic flow improvements, improve multi-modal use	18	High priority, need funding (?)	Short-term to future implementation Funding constraints	Possible connection with 21-A
No	Birdsdale NW to Riverside Storm Drain	900900	Upsize the storm drain pipe in NW 14th from Birdsdale to Riverview. Existing pipe is 48" diameter; suggested replacement pipe size is 66". This matches the pipe size upstream and downstream from this location.	Project will increase system capacity to allow for continued growth and to reduce the potential for local flooding. The project is identified in the 1988 and Draft 2002 Master Plan.	14	p360 of Gresham CIP	Funded in 2005-2006	Will quantity increase?
No	Burnside to Civic Drive Storm Drain	905200	This project constructs 36" and 60" diameter storm drain pipe to provide additional system capacity. This project drains approximately 600 acres. The project is located in the Northwest Neighborhood District.	Eliminates surcharging in local storm drain system and localized street flooding/manhole surcharging upstream.	14	p364 of Gresham CIP	Funded in 2009-2011	Will quantity increase?
No	City-wide - Public catchbasin retrofits, Citywide	W	CI: Catchbasin inserts; SM: Sedimentation manholes	Improve WQ through retrofit of existing systems	5	Not in Fairview MP	Unknown	In - Water Quality Only
No	City-wide - Publicly owned parking lot retrofits, Citywide	V	OWS: Oil/Water Separator; CI: Catchbasin insert; SWL: Swale	Improve WQ through retrofit of existing systems	5	Not in Fairview MP	Unknown	In - Water Quality Only
No	Division to Kelly Stormdrain	910700	Upsize the main trunk line on Division. Existing pipe size is 12-inch in diameter. Suggested replacement pipe size is 24-inch. This project is located in the Central City Neighborhood and in the Fairview Creek Drainage Basin.	Eliminates local storm drain system flooding.	14	p412 of Gresham CIP	UNFUNDED.	Will quantity increase?

Attachment 1: Background Summary Information List

Preliminary Potential CIP's

Phase 1 Modeling	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Source # (key at bottom)	Notes	Status	City Comments
No	Fairview Creek Channel Restoration in Gresham	906100	Project repairs stream channels to prevent and eliminate bank erosion. Multiple benefits include increase in conveyance capacity and flood storage stormwater discharges, with value added water quality improvement and fish and wildlife habitat. Located in Rockwood and Northwest neighborhood districts.	Fairview Creek provides stormwater conveyance for the City of Gresham. Stream bank erosion, sediment accumulation and debris blockages exist at these various creek locations and frequently occur after flood events. Natural stream channels are an essential element in the conveyance of stormwater discharges within the City of Gresham. The project will assure the improvement of conveyance and improve water quality and habitat functions.	14	p365 of Gresham CIP	Funded in 2005-2006	Ongoing
No	Fairview Creek to Fairview Lake	156	Wetland Enhancement Project	Wetland Enhancement Project	7	Fairview Action Plan project #13		In - Water Quality Only
No	Fairview Lake Detention Pond 218th Ave (South of NE 218th) near NE Lachenview St	N, Fairview Site 1	WP: Wet Detention Pond	Improve WQ through retrofit; serves a significant area, site is close to Fairview Lake & would provide treatment prior to stormwater discharge to Lake	5	Not in Fairview MP	Not needed? Does existing BMP at site already perform adequately?	In - Water Quality Only
No	Fairview Lake Way NE and NE 211th Ave (NW corner of intersection, in park)	Q, Fairview site 4	DP: Dry Pond; SNF: Sand Filter	Improve WQ through retrofit; site has access to large tributary area & is a park, commercial & industrial areas drain to site	5	Not in Fairview MP	Unknown status; Upstream BMPs exist, potential low public acceptance, high site elevation versus creek elevation	Tentatively Out Water Quality only
No	Marine Drive - Culverts		Two 72" corrugated metal pipes are deteriorating.	Multnomah County project 323-02? Benefits: mitigation, flood storage, increased capacity. County responsibility to replace, but might make more sense to realign Salmon Creek and have it discharge to the Slough. Sleeve existing culverts. Maybe Fairview could do the engineering; MCDD could work on permits; and County could complete construction.	13/17	Might be a good project for partnering.	Multnomah County responsibility.	Support
No	Newell Park	912900	This project provides about 500 feet of 30" storm drain to serve areas to the south and east. It discharges into an existing drainage swale that also requires upgrading as part of this project, which is in the North Central Neighborhood District.	This project provides a storm drain in a location that currently has no system. There is an existing storm drain south and an existing drainage swale north of the project location, which this storm drain will connect to prevent localized flooding and erosion. This project will permit continued growth in an area of Gresham north of Stark and west of 223rd Avenue.	14	p376 of Gresham CIP	Funded in 2005-2006	Do development regs control quantity? Location - Clear Creek corner?
No	No Name Creek Railroad Crossing	15	Replace the existing 16" CSP culvert with a 48" diameter CSP culvert designed to convey future 100-year flow of 95 cfs.	Existing culvert has less than 2-year capacity for existing and future undetained flows. Potential flooding of an adjacent house during large storm events. Frequent ponding could impact railroad embankment.	22		Done?	ODOT culvert replaced 1996 w/36" CMP. Check diameter under RR

Attachment 1: Background Summary Information List

Preliminary Potential CIP's

Phase 1 Modeling	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Source # (key at bottom)	Notes	Status	City Comments
No	No Name Creek, 22713 NE Sandy Blvd	C	Undersized private culvert. Identified in prior Master Plans	Culvert undersized.	21			See source #1 Project in CIP - Do not model MC
No	No Name Creek, 22820 NE Sandy Blvd	B	Undersized culvert? Identified in prior Master Plans.	Floods Sandy Blvd and road closes. Prelim design to divert to Fairview Cr.	21	Is this a City concern? Sandy is a County road.		See source #1 Project in CIP - Do not model MC
No	No-Name Creek Diversion to Fairview Creek, related ditch improvements; NE Sandy Blvd		650 feet of diversion ditch added to extend No-Name Creek along south side of NE Sandy Blvd to Fairview Creek, dual 5' w x 4' h box culverts, inlet-outlet stabilization, easement acquisition, fence relocation	Increase runoff conveyance capacity to address deficiency of 179 cfs for 25-year event	1	Needs to be done, high priority	Unknown	Project in CIP - Do not model MC
No	Pump station #4		Designed for 600 cfs, at full build out needs to be 700 cfs. Need to do wet well analysis; might need to change discharge. Goal is to not modify pump station.		13/17		Increase in capacity currently not needed. Dependent on how fast development occurs.	Project in CIP - Do not model
No	Riparian Revegetation - Fairview Creek at Salish Ponds and Fairview Community Park	138, 147	Restore Fairview Creek at Salish Ponds and Fairview Community Park	Conservation, ongoing maintenance of restoration efforts	7	Fairview Action Plan project #9 - Only include on CIP list if there's a way to vastly improve water quality.	Ongoing	In - Water Quality Only
No	Riparian Revegetation - Fairview Creek Woods near NE 223rd Ave.	135	Enhance habitat in Fairview Creek watershed woods just east of 223rd Avenue and downstream. (City owns 3 acres.)	Potential useful area for treating stormwater.	7			In - Water Quality Only
No	Salish Ponds Wetlands Park - North of Glisan Street to 207th Street Bridge crossing Fairview Creek	138, 146	Development of vegetation restoration and education outreach plans; Coordinate restoration plans with Reynolds School District adoption; Further study of the site potential for wildlife and water quality improvements.	Facilitate adoption of site by Reynolds School District, develop restoration plans	7	Fairview Action Plan project #8	Needs shade. Provides flood control. Ongoing	In - Water Quality Only
No	Sandy Blvd Diversion	13	Construct a diversion ditch south of Sandy Blvd. from No Name Creek to Fairview Creek. Size ditch to convey a full buildout 100-year diversion rate of 100 cfs. A 10' bottom width, 2H:1V side slopes, 0.4% longitudinal slope and average total depth of 4 feet are required. At the Fairview Creek Sandy Blvd. crossing, add one 60 linear foot 42" CSP culvert adjacent to the existing 6'x6' box culvert at this crossing.	This improvement is required for a 100-year design capacity in Fairview Creek, after the proposed 100 cfs Sandy Blvd No Name Creek Diversion.	22		Done?	In See Source #1
No	Sandy Blvd. General Issues		General issues discussed w/ Mult. Co.	Sandy Blvd. floods near Townsend Farms Business Park development, but if fixed it would move problems downstream to undersized private culvert; Phased approach planned for Sandy improvements as Townsend Farms develops. Potential re-design of Sandy has been evaluated with green design components (Linda has hard copy of report)	18		Future	Support

Attachment 1: Background Summary Information List

Preliminary Potential CIP's

Phase 1 Modeling	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Source # (key at bottom)	Notes	Status	City Comments
No	Sandy Blvd. NE Storm Drain Installation		NE Sandy Blvd. Storm Drain Installation	Improve drainage in an area that is relatively flat and zoned for industrial development	1	Sandy Blvd. is a County road	Would be driven by development of adjacent properties. Unknown status	Project in CIP - Do not model MC
No	Thompson Street Ditch	4	Add 30" CSP at Thompson Street adjacent to existing 24-inch culvert. 25-year design capacity of improvement. Replace 18-inch culvert under 202nd Avenue with 30-inch CSP. 25-year design capacity improvement.	Increase capacity	22		Done?	30" under 202nd Ave completed See source 21 - F
No	Thompson, 202nd to 203rd, Ditch	F	Unsafe ditch, see prior master plans. Part of Osburne Cr system.	Safety issues due to steep bank? Year-round flows b/c of industry	21			In - Do not model, All County Plans
No	*Non Structural - Osburn Creek North of Sandy Boulevard	155	Riparian business landowner outreach. Restoration of native vegetation, business watershed stewardship outreach program, protection of existing large trees from beaver damage.	Environmental stewardship; provide a vegetated corridor.	7	Fairview Action Plan project #17		In - Water Quality Only
No	*Non Structural - Port of Portland Model for Alcoa site		Includes information on weir and flood storage with major assumption changes from previous models. Analyzes where Arata Creek connects into Salmon Creek.	Reviewing flood storage options due to future increase in impervious area - enhance Salmon Cr and ditch; feed waters into wetlands using upstream weir.	13/17	Hendricks okay w/Crawford using model, but will need to get from MCDD.	In progress.	Check w/David - completed by MCDD?
No	*Non Structural - No Name Creek, Riparian homeowner and business owner outreach.	153	Business and homeowner outreach programs	Potential upland corridor connection.	7	Fairview Action Plan project #15		In - Water Quality Only
No	*Non Structural - Green Streets General Issues		General issues discussed w/ Mult. Co.	Metro Green Street Program provides partial funding for fish passage barrier removal and Green street design. Mult. Co. adds WQ improvements (manholes for detention, etc.) where feasible into designs, and has pursued green street design charettes (Halsey St) but found groundwater table too high	18			Support
No	*Non Structural - Fairview Lake - Support Annual Hands Around our Lake program	152	Continue support of program; work with Lake Property Owners Association with ongoing management of Fairview Lake; further study of scope and feasibility of additional restoration opportunities; outreach and publicity of riparian buffer planting and stewardship issues through City of Fairview Community Development Riparian Buffer Information Binder.	Restoration of native vegetation, wetland restoration, water quality, homeowner outreach, mult-use local environmental management	7	Fairview Action Plan project #14	Ongoing	In - Water Quality Only

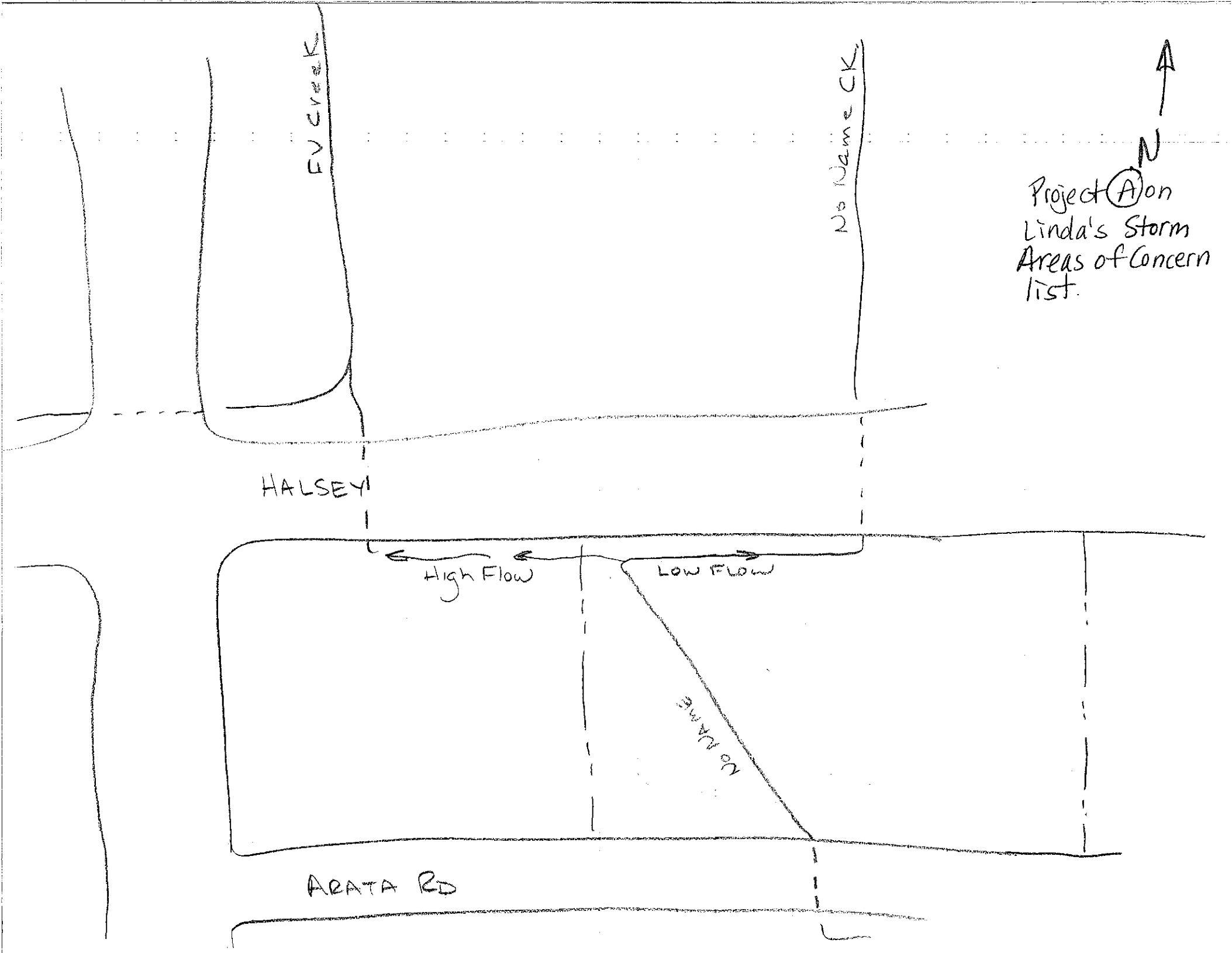
Attachment 1: Background Summary Information List

Preliminary Potential CIP's

Phase 1 Modeling	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Source # (key at bottom)	Notes	Status	City Comments
No	*Non Structural - Fairview Creek near Smith Church	150	Work to get zoned as Significant Environmental Concern or other protection, conserve and enhance cutthrout trout habitat.	The 223rd and Sandy Corner is a high priority to have a zoning change and conserve the canopy and existing habitat.	7	Fairview Action Plan project #12. See "Assessment of Fairview Creek Flow Control Options- Technical Memorandum (CH2M Hill, July 200)"		In - Water Quality Only

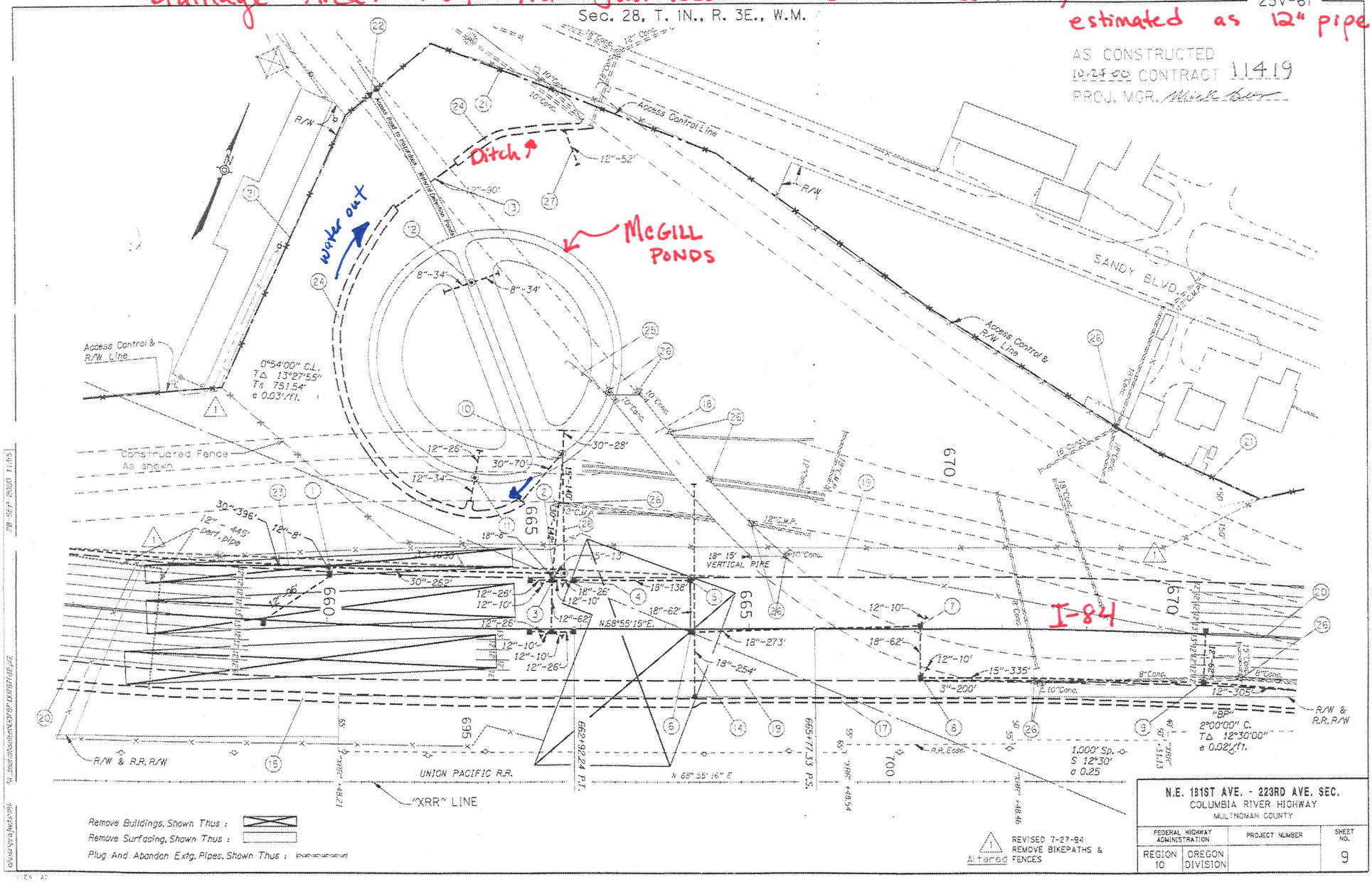
Key

Source ID #	Potential CIP identification sources
1	Storm Drainage Master Plan for Northeast Fairview (Newton, 2003)
2	Capital Improvements Plan (CH2M Hill, February 2000)
3	NPDES MS4 Discharge Permit (DEQ, expires January 31, 2009)
4	Retro-fit Memo (URS, August 2005)
5	Development of Retrofit Options (GeoSyntec, 2006)
6	Fairview Creek Action Plan (2003) - Linda Hulme
7	Columbia Slough Action Plan (2003) - Linda Hulme
8	Stormwater Management Plan (Brown and Caldwell, 2006) and associated documents
9	Evaluation of Stormwater with Respect to Established TMDL's and 303(d) Listed Parameters (URS, 2006)
10	Fairview Creek Hydraulic Model (Crawford Engineering Associates, November 2006)
11	Total Maximum Daily Loads for the Columbia Slough (DEQ, 1998)
12	Total Maximum Daily Loads for the Willamette Basin (DEQ, 2006)
13	Multnomah County Drainage District No. 1 - Dave Hendricks
14	City of Gresham - Reviewed CIP
15	Columbia Slough Watershed Council - Linda Hulme
16	City of Troutdale - Amy Pepper
17	Sandy Drainage District - Dave Hendricks
18	Multnomah County Transportation - Ed Abrahamson
19	City of Wood Village
20	Oregon Department of Transportation, Troutdale Office
21	City of Fairview - Linda Hulme
22	City of Faiview Storm Drainage Master Plan (Oakley Engineering, 1993)


FV Creek
No Name CK
N
Project (A) on
Linda's Storm
Areas of Concern
list.
HALSEY
High Flow
Low Flow
No Name
ARATA RD

ODOT drawings of McGill Ponds

Drainage Area: I-84 from just west of 238th to 201st, Outlet of Ponds estimated as 12" pipe.



APPENDIX C

Preliminary Potential CIP List

Fairview - Preliminary Potential CIP list

PCIP So	Potential CIP identification sources	Review completed by	Notes
1	Storm Drainage Master Plan for Northeast Fairview	Jennifer	Hard copy from City
2	Capital Improvements Plan (CH2M Hill, February 2000)	Jennifer	Hard copy from City
3	NPDES MS4 Discharge Permit (DEQ, expires January	Jennifer (no applicable CIPs)	.pdf from City
4	Retro-fit Memo (URS, August 2005)	Same as Source 5	
5	Development of Retrofit Options (GeoSyntec, 2006)	Jennifer	Hard copy from City
6	Fairview Creek Action Plan (2003) - Linda Hulme	Laura	Hard copy from City, reviewed with Linda Hulme on 6/25/07
7	Columbia Slough Action Plan (2003) - Linda Hulme	Laura	Hard copy from City, reviewed with Linda Hulme on 6/25/07
8	Stormwater Management Plan (Brown and Caldwell,	Jennifer	Electronic copy from prior work
9	Evaluation of Stormwater with Respect to Established	Jennifer and Laura	No projects listed - reduce run-off is the take home message.
10	Fairview Creek Hydraulic Model (Crawford Engineering	Report unavailable	No memo is available. Linda plans to have Crawfor write up information as part of the CSMP modeling.
11	Total Maximum Daily Loads for the Columbia Slough	Jennifer (no applicable CIPs)	Jennifer downloaded numeric data for 303(d) listings.
12	Total Maximum Daily Loads for the Willamette Basin	Jennifer (no applicable CIPs)	Jennifer downloaded numeric data for 303(d) listings.
13	Multnomah County Drainage District No. 1 - Dave	Laura	6/22/07 meeting with Dave Hendricks, Linda Hulme
14	City of Gresham - Reviewed CIP	Laura	Linda Hulme to follow up with Tom McCausland regarding questions
15	Columbia Slough Watershed Council - Linda Hulme	Laura	Reviewed Action Plan with Linda Hulme on 6/25/07
16	City of Troutdale - Amy Pepper	Laura	6/19/07 mtg with Amy Pepper, Reviewed 2007 North Troutdale Storm Drainage Master Plan
17	Sandy Drainage District - Dave Hendricks	Laura	6/22/07 meeting with Dave Hendricks, Linda Hulme
18	Multnomah County Transportation - Ed Abrahamson	Jennifer	7/6/07 mtg w/ Ed Abrahamson, Linda Hulme
19	City of Wood Village	Data unavailable	Recent modeling completed for Wood
20	Oregon Department of Transportation, Troutdale Office	Laura	See Multnomah County Transportation projects.
21	City of Fairview - Linda Hulme	Laura	Areas of concern list, developed by Linda Hulme.
22	City of Faiview Storm Drainage Master Plan (Oakley	Laura	Hard copy from City.

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
18	201st Ave: Halsey St. to RR Overcrossing	127	Widen 201st Ave to major collector standards, Drainage Improvements and lighting	Traffic flow improvements, improve multi-modal use	All Gresham now (formerly 1/2)	Gresham now responsible	Unknown
18	202nd Ave, SE - MP: 0.823	397-01	Replace culvert to improve fish passage in Fairview Creek	Improve fish passage	Gresham responsible for road now, not County	Lowest Priority (Group C)	Unknown
21	205th and Thompson	E	Undersized culvert? Used to have flooding here, but haven't seen any recently. Part of Osburne Cr system.	Flooding?		Crawford needs to model this and include swales on Halsey. Not sure this is still a problem since ODOT took care of I-84 and 205th. Review Oakley Master Plan.	
2	205th Ave. Storm Drain	SDMP-12	Storm drain, Thompson St to Wistful Vista Drive	Relieve high water table and surface ponding problems		Status unknown	Unknown
2	205th Ave. Storm Drain	SDMP-22	Storm drain, Wistfull Vista Drive to Halsey St	Relieve Halsey St drainage ditch and sumped areas			Unknown
22	205th Avenue Storm Drain, Thompson Street to Wistful Vista Drive	12	Locate the discharge location from the existing apartments across from Reynolds School and construct a manhole to intercept this discharge. Provide a stubout for future service to the developable lot west of the existing apartments. Construct 550 feet of 18" storm drain east along Wistful Vista to convey a future 10-year flow of 12 cfs. Construct 800 feet of 24-inch storm drain along 205th to convey a future 10-year flow of 27 cfs, to allow for future rerouting of runoff to the Reynolds School sumps and ditch. Construct 50 feet of 30" CSP outfall pipe across Thompson Street to the railroad ditch.	Reduce ponding on lots between 203rd Avenue and 205th Avenue, north of Wistful Vista Drive.			Done?

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
22	205th Avenue Storm Drain, Wistful Vista to Halsey Street	22	Construct 1050 feet of 24" CSP storm drain along 205th, between Halsey Street and Wistful Vista Drive. Should be designed to convey a 10-year flow of 15 cfs.	Upstream development.			Done?
2	223rd Ave north of Sandy Blvd culvert addition	SDMP-18	Add Culvert		Modeling for Source 2 indicated existing facility provides 100-year protection	See p. 5-9	Not in 1999 CIP
18	223rd Ave RR Undercrossing - North site	197	Reconstruct RR bridge on 223rd Ave, 2000' north of I-84 for wider travel lanes, bike lanes, sidewalks	Traffic flow improvements, improve multi-modal use	Funding constraints; Would occur with additional development	Lower priority	Future
18	223rd Ave RR Undercrossing - South of Sandy Blvd	198	Construct new RR bridge (or adjust opening) for 223rd Ave to incl. bike lanes and sidewalks.	Traffic flow improvements, improve multi-modal use		Expect 2007 Construction, need RR approval (?)	2007 implementation
18	223rd Ave, SE/NE - MP: 2.303 Fish Passage Project	323-02	Replace culvert to improve fish passage in Fairview Creek	Improve fish passage	Funding constraints, Hope to accomplish with Planned Road Projects	High Priority (Group A)	Unknown
18	223rd Ave: Halsey St to Sandy Blvd.	135	Reconstruct 223rd Ave to minor arterial standards (requires RR bridge reconstruction Project 197 to occurs as well) to incl 2 travel lanes, center turn lane/median, sidewalks and bike lanes.	Traffic flow improvements, improve multi-modal use	Funding constraints; Would occur with additional development	Lower priority	Future
18	223rd Ave: Sandy Blvd. to Marine Dr.	143	Improve 223rd to major collector standards to incl. 2 travel lanes, center turn/median, sidewalks, bike lanes. Possible culvert replacement for fish passage. Requires replacement of RR bridge (Project 198?)	Traffic flow improvements, improve multi-modal use	Funding constraints	Medium to High Priority. Part of Port/County Transportation Plan. Metro Councilor wants to see it done.	Future
22	223rd Avenue Culvert Addition	18	Add one 48" CSP culvert adjacent to the existing 9' diameter CMP to increase the capacity of this crossing to the anticipated 100-year full buildout flow of 660 cfs.	The 9' CMP culvert at this crossing has an existing 100-year capacity and full-buildout 10-year capacity.			Done?
2	7th Street Collector	SDMP-14	New storm drain along 7th Street fro Main St to Railroad Ditch	Relieve street and lot ponding along 7th St		BC observed no flooding 2001	Unknown
16	Arata Creek Culvert Improvement within the Dunbar Avenue Area	CIP No. 2	Replace existing 45 feet of 4-ft diameter culvert with a single 6-ft culvert or with two smaller barrels providing equivalent hydraulic capacity.	An existing 4-foot diameter culvert conveys flows under the driveway east of the new Marine Drive culvert crossing and west of Dunbar Avenue. We recommend upsizing the culvert to a 6-ft diameter culvert to match conveyance of adjacent upstream and downstream culverts.	Implementation of this CIP will improve the conveyance capacity of the Dunbar area and should be implemented as funds become available.	See p. 7-7 of North Troutdale Storm Drainage Master Plan. Arata Cr is a tributary to Salmon Ck which discharges to the Columbia R. after passing through Fairview.	Short-term
13/17	Arata Creek Culvert under Railroad tracks		Upsize culvert. Higher priority project than weir on Arata Creek. Includes enhancement of 2 ditches through Alcoa property.				

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
16	Arata Creek Drain Line Improvements from Marine Drive to Salmon Creek	CIP No. 3	Two improvements are proposed for this CIP. Install 160 feet of 48-inch CMP culvert under the railroad immediately upstream of the outlet to Salmon Creek and 520 feet of 48-inch PVC drain line directly west of the airport runway and parallel to the existing drain lines. The culvert through the railroad embankment will need to be bored.	The additional culverts reduce the water surface elevations for Arata Creek locations south of Marine Drive.	These improvements should be implemented prior to the development of the land areas north of Halsey Street.	See p. 7-9 of North Troutdale Storm Drainage Master Plan. Arata Cr is a tributary to Salmon Ck which discharges to the Columbia R. after passing through Fairview.	Before development of any of the land north of Halsey. See figure 7-7 of North Troutdale Storm Drainage Master Plan.
18	Arata Rd: 223rd Ave to 238th Dr.	129	Construct to 3 lane collector standards w/ center lane, bike lanes, sidewalks	New development is driving project. Traffic flow improvements, improve multi-modal use	Funding constraints	High priority, need funding (?)	Short-term to future
22	Arata Road Diversion	21	Regrade the existing ditch north of Arata Road to divert flows exceeding the 5 cfs capacity of the undersized 15" CSP existing outfall pipe to No Name Creek. A diversion rate of 10 cfs is anticipated for the 10-year event. Regrading the north ditch will require replacing two existing culverts. Replace existing culverts with 21" CSP.	Increase capacity.			Done?
22	Bridge Street Private Drive, Downstream	20	Replace the existing 5'x3.5' arch culvert at this crossing with two parallel 6'x4' box culverts.	Dual box culverts are required at this crossing to convey the future 5-year event. Because of the limited space available and head losses downstream at Bridge Street, design for events greater than the future 5-year is not feasible.			Done?
22	Bridge Street Private Drive, Upstream	19	Replace the two existing 48" CMP culverts at this crossing with two parallel 6'x6' box culverts to convey the future 100 year event.	This crossing is undersized for all existing and future events evaluated. Flows exceeding capacity are expect to flood low lying apartments downstream.			Done?
14	Burnside (East) Pollution Reduction Facility	911300	Install a pollution reduction facility (PRF) at Burnside Street, just east of Fairview Creek. This water quality area drains a 19 acre residential area constructed from 1960-1970. this project is in the North Central Neighborhood and in the Fairview Creek Drainage Basin.	There is no existing water quality in this area and this facility would improve the quality of stormwater flowing into Fairview Creek.	UNFUNDED.	p418 of CIP	
14	Burnside (West) Pollution Reduction Facility	911200	This project would install a pollution reduction facility at Burnside Street prior to discharging to Fairview Creek. The 9 acre area drains a fully developed area dominated by commercial and residential properties. A portion of Burnside Street is also located within the drainage area served by this project. This project is in the North Central Neighborhood and in the Fairview Creek Drainage Basin.	There is no water quality treatment in this area and this facility would improve the quality of stormwater flowing to Fairview Creek.	UNFUNDED.	p417 of CIP	
18	Burnside Rd, E - MP: 2.498 Fish Passage Project	306-01	Replace culvert to improve fish passage in Fairview Creek	Improve fish passage	Gresham responsible for road now, not County	Middle Priority (Group B)	Unknown
14	Burnside to Civic Drive Storm Drain	905200	This project constructs 36" and 60" diameter storm drain pipe to provide additional system capacity. This project drains approximately 600 acres. The project is located in the Northwest Neighborhood District.	Eliminates surcharging in local storm drain system and localized street flooding/manhole surcharging upstream.	Funded in 2009-2011	p364 of CIP	
13/17	Change in design storm		MCDD might change how they define their design storm due to global warming/weather trend changes.		Disagreement among stakeholders as to what the change should be.		

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
14	Cleaning Effectiveness Study	914200	Analyze City's street- and catchbasin-cleaning practices to determine most efficient methods and schedule for optimal pollutant removal from stormwater runoff.	Will assist City in economically meeting state and federal permit conditions for water quality improvement, pollutant removal, and annual reporting.	UNFUNDED.	p436 of CIP	
16	Columbia River Highway Bypass	CIP No. 5	Install a bypass where future flows leave the drainage area north of Halsey and cross Colubmia River Highway. The bypass will consist of five elements: 50 feet of 24-inch trenched culvert under Columbia River Highway, 160 feet of 24-inch drain line, 40 feet of 24-inch culvert under a railroad embankment, another 40 feet of 36-inch drain line, and 80 feet of 36-inch culvert under a second railroad embankment. The culverts will need to be bored through the railroad embankment.	The proposed CIP will provide a drainage outlet for runoff from part of the land area lying north of Halsey and south of Columbia River Highway. The existing 24-inch drain line located in the Columbia Rivery Highway's railroad underpass does not provide sufficient conveyance capacity for future flows.	This CIP should be implemented before additional flows are generated from the area north of Halsey. Its development should be concurrent with other downstream improvements associated with CIP No.s 3 and 6.	See p. 7-13 of North Troutdale Storm Drainage Master Plan. Arata Cr is a tributary to Salmon Ck which discharges to the Columbia R. after passing through Fairview.	Before development of land north of Halsey and draining to Columbia River Highway Bypass. See figure 7-7 of North Troutdale Storm Drainage Master Plan.
22	Creekside Terrace Storm Drain	2	Install a manhole in Creekside Terrace, at the location of the beginning of the existing 10" CMP outfall pipe. Replace the 10" CMP outfall and downstream open ditch with 250 feet of 12" CSP to Fairview Creek. Replace existing field inlets located 70 feet south of the proposed manhole location. Construct 70 feet of 12" CSP along the west side of Creekside Terrace to connect these new field inlets and to allow for possible future extensions of this storm drain to accomodate potential road improvements.	Increase capacity; reduce flooding.			Done?
1	Culvert capacity expansion NE 223rd Ave		Culvert capacity expansion NE 223rd Ave	Address deficiency of 187 cfs for existing 72-in culvert for Fairview Creek under NE 223rd Ave for 25-year event	No longer needed	Formerly a high priority project	Out
13/17	Marine Drive - Culverts		Two 72" corrugated metal pipes are deteriorating.	Multnomah County project 323-02? Benefits: mitigation, flood storage, increased capacity.	Multnomah County responsibility.	Might be a good project for partnering. County responsibility to replace, but might make more sense to realign Salmon Creek and have it discharge to the Slough. Sleeve existing culverts. Maybe Fairview could do the engineering; MCDD could work on permits; and County could complete construction.	
22	Depot Street Storm Drain	1	Replace the existing undersized storm drains in Depot Street and 1st Street with 12" and 15" CSP. Replace the 12" CSP outfall under 1st Street and downstream open ditch with 18" CSP. At Fairview Avenue replace the existing outfall with an 18" CSP outfall.	Increase capacity			Done?
21	Thompson, 202nd to 203rd, Ditch	F	Unsafe ditch, see prior master plans. Part of Osburne Cr system.	Safety issues due to steep bank? Year-round flows b/c of industry			

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
14	Division Street Diversion	910800	This project will construct a diversion structure to divert the flows from the area south of Division Street into the proposed Birdsdale water quality facility. This 18 acre area drains a developed residential area constructed from the 1950-1970s, as well as a portion of Division Street. Ths project is in the Northwest Neighborhood and in the Fairview Creek Drainage Basin.	there is no existing water quality treatment in this area and flows can be accomodated in the Birdsdale Facility.	UNFUNDED.	p413 of CIP	
14	Division to Kelly Stormdrain	910700	Upsize the main trunk line on Division. Existing pipe size is 12-inch in diameter. Suggested replacement pipe size is 24-inch. This project is located in the Central City Neighborhood and in the Fairview Creek Drainage Basin.	Eliminates local storm drain system flooding.	UNFUNDED.	p412 of CIP	
13/17	Edgefield McMennamin's expansion		Expected increase in impervious area - not sure where stormwater will discharge.		County property.	Might need to talk to Travis regarding this area.	
1	Salmon Creek watershed: Evaluation of Flood Mitigation Alternatives		Additional pump station and/or increased storage capacity	Inform decision for address need for flood mitigation			Unknown
22	Fairview Ave. Culvert Replacement	6	Replace 72" CMP at 223rd Ave with two 84" CSP parallel pipes; Replace the 45 linear feet of 6'x3.5' CMP arch culvert at Halsey Street with an 8'x4' box culvert to match the downstream structure. A new headwall and trash grate will be required at the new 8'x4' box culvert entrance.	Limited capacity of culverts is expected to result in overtopping of Barr Road and Halsey Street for the 2-year and larger flows. In addition the Fairview Cr channel through the mobile home park upstream of Barr Road has only an existing 5-year capacity. This project will upgrade to a 5-year design capacity.			Done?
21	223rd Ave - Fairview Cr along 223rd over bank, 1712 NE 223rd Ave	I	Area between Halsey and I-84 show up on FEMA maps in 100-year events. Model shows houses and private property flooding. Related to culverts at Bridge, Arnold, Walnut, Matney, and Linglebach.	Flooding.		See CH2M Hill report. Crawford needs to model this.	
7	223rd Ave - Fairview Creek along 223rd Avenue, north of Halsey Street	133, 149	Riparian homeowner outreach for restoration of native vegetation, particularly understory species.	Foster environmental stewardship.		Fairview Action Plan project #11	
14	Fairview Creek Channel Restoration	906100	This project repairs stream channels to prevent and eliminate bank erosion. Multiple benefits include increase in conveyance capacity and flood storage stormwater discharges, with value added water quality improvement and fish and wildlife habitat. The project is located in the Rockwood and Northwest neighborhood districts.	Fairview Creek provides stormwater conveyance for the City of Gresham. Stream bank erosion, sediment accumulation and debris blockages exist at these various creek locations and frequently occur after flood events. Natural stream channels are an essential element in the conveyance of stormwater discharges within the City of Gresham. The project will assure the improvement of conveyance and improve water quality and habitat functions.	Funded in 2005-2006	p365 of CIP	
14	Fairview Creek Flood Control	907600	This project is for property acquisition, design and construction of stormwater detention located on Fairview Creek east of Birdsdale and north of Division. The project requires excavation and construction of facilities to regulate Fairview Creek flows. This project is located in the Northwest Neighborhood District.	This facility will provide for storage of flood lfows to reduce flooding downstream and will also provide for water quality treatment of low flows. The public will benefit through reduced flooding, reduced erosion, and improved water quality. Human, fish and wildlife habitat enhancements are secondary goals. This project is being coordinated with the Fairview Creek Water Quality Facility on the same site (project no. 900800).	Funded in 2005-2006	p367 of CIP	

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
14	Non-Structural - Fairview Creek Flood Plain Re-Mapping	913000	This project will provide for Engineering services to identify current areas inundated by flood events. The re-mapping will identify the correct flood areas in the Fairview Creek basin, which has changed as a result of recent projects. This project is in the Northwest and North Central Neighborhoods and in the Fairview Creek Drainage Basin.	Accurate identification of flood storage areas will determine where flood areas constrain and impact development.	UNFUNDED.	p429 of CIP	
14	Fairview Creek Improvement - Burnside to Stark	910600	This project is a re-vegetation and public awareness project. Project elements include (1) removing invasive plants, channel encroachments and locations of overly dense vegetation; and (2) working with homeowners and volunteer organizations for re-establishing native plantings. Sections of the creek reach are also experiencing bank under-cutting. Vegetative methods are to be used for bank stabilization. Public awareness items include the impacts that maintenance, animal waste and debris dumping, encroachments have on water quality, wildlife habitat and conveyance. Homeowner involvement is critical for long-term success of this project. Existing 30' easement use must be verified. This project is in the North Central Neighborhood and in the Fairview Creek Drainage Basin.	Water quality improvement and flood control.	Funded in 2008-2009	p375 of CIP	
7	Fairview Creek near Smith Church	150	Work to get zoned as Significant Environmental Concern or other protection, conserve and enhance cutthrout trout habitat	The 223rd and Sandy Corner is a high priority to have a zoning change and conserve the canopy and existing habitat.		Fairview Action Plan project #12. See "Assessment of Fairview Creek Flow Control Options-Technical Memorandum (CH2M Hill, July 200)"	
7	Fairview Creek to Fairview Lake	156	Wetland Enhancement Project	Wetland Enhancement Project		Fairview Action Plan project #13	
14	Fairview Creek Water Quality Facility	900800	This project provides for the design and construction of a stormwater quality treatment facility. The facility will treat the stormwater runoff fromm a 1.3 square mile area of the Fairview Creek Drainage basin. The project is located in the Northwest Neighborhood District.	This project is a critical component of the 1988 and 2002 Fairview Creek Drainage Master Plans and will improve the water quality of Fairview Creek.	Funded in 2005-2006	p359 of CIP	
7	Fairview Lake - Support Annual Hands Around our Lake program	152	Continue support of program; work with Lake Property Owners Association with ongoing management of Fairview Lake; further study of scope and feasibility of additional restoration opportunities; outreach and publicity of riparian buffer planting and stewardship issues through City of Fairview Community Development Riparian Buffer Information Binder.	Restoration of native vegetation, wetland restoration, water quality, homeowner outreach, mult-use local environmental management	Ongoing	Fairview Action Plan project #14	Ongoing
22	Fairview Lake Management Plan	24	Since a number of municipalities could benefit from the development of such a plan, it is recommended that the project be jointly administered and jointly funded.	Flood storage benefits; recreational and aesthetic benefits; water quality; wildlife; potential for a bypass system for high flow events or spills.			Done?
2	Farview Ave north of NE Sandy Blvd culvert addition		Add 48" culvert to existing 108" culvert		Modeling for Source 2 indicated existing facility provides 100-year protection	See p. 5-5, Proposed in 1993 plan for Fairview Creek Basin	Not in 1999 CIP
21	Halsey - Fieldstone Apartments, 20650 NE Halsey	H	Private manhole overflows onto Halsey	Need conveyance improvements - run-off from wetlands sheet flows through apartment parking lot, overflows manhole, and flows along Halsey. Stormwater from wetlands eventually ends up in swales along Halsey.			

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
22	Fifth Street Storm Drain	9	Construct approximately 350' of 12" storm drain along 5th Street between Main Street and Depot Street. Construct approximately 350' of 12" CSP along Depot Street between 5th Street and 6th Street. At the intersection of 6th Street and Depot Street construct 50 feet of new 15" CSP outfall to replace the existing 2" CMP and 6" pipe which currently conveys flows under Depot Street at this intersection. Construct field inlets to collect surface flows at 6th Street and to intercept flows from the existing 12" CMP outfall. Install field inlets at the intersection of 5th and Main, 5th and Depot, and 6th and Depot. Where existing facilities exist, connect new field inlets to existing storm drains.	Increase capacity; reduce ponding.			Done?
1	Non Structural - Flood Plain Mapping (FIRM/LOMR)		Flood Plain Mapping (FIRM/LOMR)	Establish common base flood elevation, inform long term drainage and development planning			Unknown
18	Glisan St: 202nd Ave to 207th Ave	110	Construct Glisan St to arterial standards incl. Drainage Improvements, bike lanes, sidewalks, center turn lane	Traffic flow improvements, improve multi-modal use	Funding constraints; 1/2 in Mult. County, 1/2 in Gresham	Low priority. Not expected soon (by Ed Abrahamson)	Far future
14	Glisan Street Swale	910900	Install a diversion manhole to divert the stormwater flows to a pollution reduction facility (PRF) or sedimentation manhole and a vegetated swale located along the south side of NE Glisan St. The swale will be located on a piece of land to be purchased. This project is in the North Central Neighborhood and in the Fairview Creek Drainage Basin.	There is no existing water quality treatment in this area and this facility would improve stormwater quality flowing to Fairview Creek.	UNFUNDED.	p414 of CIP	
18	Non-Structural - Green Streets General Issues		General issues discussed w/ Mult. Co.	Metro Green Street Program provides partial funding for fish passage barrier removal and Green street design. Mult. Co. adds WQ improvements (manholes for detention, etc.) where feasible into designs, and has pursued green street design charettes (Halsey St) but found groundwater table too high			
22	Halsey Street Bypass	11	Consturct a high flow bypass pipe to divert flows from Fairview Creek at the bend in the creek channel immediately upstream of the mobile home park property. A diversion rate of 250 cfs is required to attain a future 100-year design capacity for downstream facilities. 350 linear feet of two parallel 54" CSP is required to convey the required 100-year diversion rate of 250 cfs. 300 feet of open ditch is required to convey the 250 cfs diversion from the bypass discharge location to the 223rd Ave culvert crossing. A ditch with 20 foot bottom width, 2H:1V side slopes and minimum depth of 3.5 feet is required to convey the 100-year design flow.	Need to attain 100-year future design capacity.			Done?
8	Non Structural - Industrial Stormwater Management Program		A plan for managing industrial facilities in the City.	A component of the City's Stormwater Management Plan to control pollutants in stormwater discharges from industrial and commercial facilities.			
2	Main Street and Cedar Street Drainage	DADP-E	Intercept culvert flow acress Cedar St to 24-in pipe in 7th St. Install storm drain in Main St b/w 6th & 7th. Connect to existing 12-in CMP in 6th. **[Replaced 2000]**		Pipe found - no flooding observed		On hold

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
16	Marine Drive Curve Bypass South of Airport	CIP No. 6	This CIP consists of two components: 2100 feet of 36-inch drain line north of an parallel to Marine Drive and an additional 150 feet of 36-inch culvert crossing Marine Drive east of the Corporate Center. For ease of permitting, we selected a buried drain line rather than proposing an open channel.	The drain line parallel to Marine Drive will provide a cross-connection between the two south-to-north drainage systems and will help to balance flows. Localized flooding northeast of the Marine Drive culvert will be reduced. The additional Marine Drive culvert will supplement the conveyance capacity of the existing culvert. These two culverts will provide enough conveyance capacity to convey additional flows from the area north of the Columbia River Highway. Otherwise localized flooding is predicted upstream of these culverts.	This CIP should be implemented before upstream development is implemented. Development should be concurrent with CIP No. 3.	See p. 7-15 of North Troutdale Storm Drainage Master Plan. Arata Cr is a tributary to Salmon Ck which discharges to the Columbia R. after passing through Fairview.	Before development of land north of Halsey and draining to Columbia River Highway Bypass. See figure 7-7 of North Troutdale Storm Drainage Master Plan.
22	Matney Street Culvert Replacement	8	Regrade Matney Street at the Fairview Ave intersection to channel out-of-bank flood flows back into the Fairview Creek channel. Construct a 1' high curb upstream of the culvert crossing to facilitate channeling upstream out of bank flows into the new Matney Street culvert structure and to increase available head.	Design to convey a 100-year flow of 500 cfs, after upstream improvements. The existing crossing has a rectangular 9'x5' opening. A 14'x5' opening is required for future flows.			Done?
1	223rd Ave Storm Drain Intallation (Fairview Crk watershed)		NE 223rd Ave Storm Drain Intallation (Fairview Crk watershed)	Improve drainage in an area that is relatively flat and zoned for industrial development	Would be driven by development of adjacent properties	NE 223rd is a County road	Unknown
1	223rd Ave Storm Drain Intallation (Salmon Crk watershed)		NE 223rd Ave Storm Drain Intallation (Salmon Crk watershed)	Improve drainage in an area that is relatively flat and zoned for industrial development	Would be driven by development of adjacent properties	NE 223rd is a County road	Unknown
5	Fairview Lakeway NE and NE 211th Ave (NW corner of intersection, in park)	Q, Fairview site 4	DP: Dry Pond; SNF: Sand Filter	Improve WQ through retrofit; site has access to large tributary area & is a park, commercial & industrial areas drain to site	Downsides noted: Upstream BMPs exist, potential low public acceptance, high site elevation versus creek elevation	Not in Fairview MP	Unknown
1	Sandy Blvd. NE Storm Drain Installation		NE Sandy Blvd. Storm Drain Installation	Improve drainage in an area that is relatively flat and zoned for industrial development	Would be driven by development of adjacent properties	Sandy Blvd. is a County road	Unknown
14	Newell Park	912900	This project provides about 500 feet of 30" storm drain to serve areas to the south and east. It discharges into an existing drainage swale that also requires upgrading as part of this project, which is in the North Central Neighborhood District.	This project provides a storm drain in a location that currently has no system. There is an existing storm drain south and an existing drainage swale north of the project location, which this storm drain will connect to prevent localized flooding and erosion. This project will permit continued growth in an area of Gresham north of Stark and west of 223rd Avenue.	Funded in 2005-2006	p376 of CIP	
22	No Name Creek Railroad Crossing	15	Replace the existing 16" CSP culvert with a 48" diameter CSP culvert designed to convey future 100-year flow of 95 cfs.	Existing culvert has less than 2-year capacity for existing and future undetained flows. Potential flooding of an adjacent house during large storm events. Frequent ponding could impact railroad embankment.			Done?
21	No Name Creek, 22713 NE Sandy Blvd	C	Undersized private culvert. Identified in prior Master Plans	Culvert undersized.			

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
21	No Name Creek, 22820 NE Sandy Blvd	B	Undersized culvert? Identified in prior Master Plans.	Floods Sandy Blvd and road closes. Prelim design to divert to Fairview Cr.		Is this a City concern? Sandy is a County road.	
7	No Name Creek, Riparian homeowner and business owner outreach.	153	Business and homeowner outreach programs	Potential upland corridor connection.		Fairview Action Plan project #15	
1	No-Name Creek Diversion to Fairview Creek, related ditch improvements; NE Sandy Blvd		650 feet of diversion ditch added to extend No-Name Creek along south side of NE Sandy Blvd to Fairview Creek, dual 5' w x 4' h box culverts, inlet-outlet stabilization, easement acquisition, fence relocation	Increase runoff conveyance capacity to address deficiency of 179 cfs for 25-year event		Needs to be done, high priority	Unknown
21	NoName Creek, 22820 NE Halsey	A	No Name Cr bisects property. Low-flow events stay in No Name Cr. High flow events bypass via a weir into Fairview Creek. Need to confirm operation of bypass and determine if this is still a good practice.	Existing conditions limit development.		Crawford needs to model this.	
5	North end of the NE 214th Ave cul-de-sac, S. of 1-84	R, Fairview site 5	WP: Wet Detention Pond; SNF: Sandfilter [City staff recommend infiltration/filtration facility due to safety concerns for children using park]	Improve WQ through retrofit; if Site Q (Fairview 4) is not implemented, Site R would treat a portion of that flow.		Not in Fairview MP	Unknown
5	*North of Glisan and West of NE 207th Ave*	*T, Fairview Site 7*	*WP: Wet Detention Pond*	*Improve WQ through retrofit of existing systems*	*Work has been completed at site, may not be feasible to get low flows into ponds*	*In City of Fairview Master Plan*	*Out*
14	Birdsdale NW to Riverside Storm Drain	900900	This project will upsize the storm drain pipe in NW 14th from Birdsdale to Riverview. The existing pipe is 48" diameter; suggested replacement pipe size is 66". This matches the pipe size upstream and downstream from this location. The smaller pipe is a restriction causing stormwater to back up in the pipe and cause flooding. this project is in the Northwest Neighborhood District.	the project will increase system capacity to allow for continued growth and to reduce the potential for local flooding. The project is identified in the 1988 and Draft 2002 Master Plan.	Funded in 2005-2006	p360 of CIP	
2	Old Salish Pond - Phase 2	SDMP-7	Construct overflow weirs to allow for controlled discharge from Fairview Creek	Enhance facility to increase detention capability and attenuate dowstream flows		Out? See p. 5-9 for disc. of Ph. 1	Unknown
8	Non Structural - Operations and Maintenance Plan		A plan for operating and maintaining stormwater quantity and quality infrastructure throughout the City.	A component of the City's Stormwater Management Plan to reduce pollutants from commercial and residential areas.			
7	Osburn Creek North of Sandy Boulevard	155	Riparian business landowner outreach. Restoration of native vegetation, business watershed stewardshiop outreach program, protection of existing large trees from beaver damage.	Environmental stewardship; provide a vegetated corridor.		Fairview Action Plan project #17	
22	Osburn Creek Railroad Crossing	17	Replace 18" CMP culvert with 36" CSP designed to convey future 100-year flow of 88 cfs.	Existing culvert undersized for all frequency existing peak flows.			Done?
13/17	Non Structural - Port of Portland Model for Alcoa site		Includes information on weir and flood storage with major assumption changes from previous models. Analyzes where Arata Creek connects into Salmon Creek.	Reviewing flood storage options due to future increase in impervious area - enhance Salmon Cr and ditch; feed waters into wetlands using upstream weir.	In progress.	Hendricks okay w/Crawford using model, but will need to get from MCDD.	
5	City-wide - Public catchbasin retrofits, Citywide	W	CI: Catchbasin inserts; SM: Sedimentation manholes	Improve WQ through retrofit of existing systems		Not in Fairview MP	Unknown
8	Non Structural - Public Reporting Program		A plan for public reporting of illegal dumping and illegal connections.	A component of the City's Stormwater Management Plan to detect and remove illicit discharges.			
5	City-wide - Publicly owned parking lot retrofits, Citywide	V	OWS: Oil/Water Separator; CI: Catchbasin insert; SWL: Swale	Improve WQ through retrofit of existing systems		Not in Fairview MP	Unknown

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
13/17	Pump station #4		Designed for 600 cfs, at full build out needs to be 700 cfs. Need to do wet well analysis; might need to change discharge. Goal is to not modify pump station.		Increase in capacity currently not needed. Dependent on how fast development occurs.		
2	Raintree Creek Railroad Crossing	SDMP-17	Replace existing 18-inch CSP w/ 36-inch CSP	Inadequate existing and future conveyance capacity			Unknown
21	Raintree Railroad Crossing, Depot Street, 6th to 7th	D	36-inch pipe feeds area. Outlet is a 18" culvert under railroad. Area acting as a detention pond.	New development in progress. Culvert undersized. High maintenance (crew goes out several times/winter to clear.) Limited water quality treatment. Need to make sure new development will not adversely affect water quality or increase flooding.			
14	Red Sunset Park Detention	910000	In partnership with the City of Gresham Parks Division, convert a portion of Red Sunset Park to a detention basin to be used during high flow events. The duck pond that is currently in the park would drain and return to existing water levels within 24 hours of a 100-year rainfall event. The basic structure of the park would not change. This project is in the Northeast Neighborhood District.	Eliminate surcharging in the local storm drain system and flooding of local streets downstream from this location.	Funded in 2005-2006	p372 of CIP	
13/17	Regional Model		Assumptions: maxed zoning, full build-out, 85% impervious area, quantity only, 100-year storm.	Regional Flood control. Hendricks okay w/Crawford using model, but needs to get permission from MCDD.	Completed.	Hendricks okay w/Crawford using model, but needs to get permission from MCDD.	
22	Riedel Ponds Detention	7	Construct a detention facility at the existing Riedel Ponds site. The facility will require 1500 linear feet of berm, with a top elevation of 207.0 feet and typical height of 6 to 7 feet. Construct a detention control structure and 54" detention control outfall pipe to attain design paramaters (see Master Plan).	Detention required to attain a 100-year design capacity downstream.			Done?
7	Riparian Revegetation - Fairview Creek at Salish Ponds and Fairview Community Park	138, 147	Restore Fairview Creek at Salish Ponds and Fairview Community Park	Conservation, ongoing maintenance of restoration efforts	Ongoing	Fairview Action Plan project #9 - Only include on CIP list if there's a way to vastly improve water quality.	Ongoing
7	Riparian Revegetation - Fairview Creek Woods near NE 223rd Ave.	135	Enhance habitat in Fairview Creek watershed woods just east of 223rd Avenue and downstream. (City owns 3 acres.)	Potential useful area for treating stormwater.			
7	Salish Ponds Wetlands Park - North of Glisan Street to 207th Street Bridge crossing Fairview Creek	138, 146	Development of vegetation restoration and education outreach plans; Coordinate restoration plans with Reynolds School District adoption; Further study of the site potential for wildlife and water quality improvements	Facilitate adoption of site by Reynolds School District, develop restoration plans	Ongoing	Fairview Action Plan project #8	Needs shade. Provides flood control.
16	Salmon Creek Weir Improvement	CIP No. 1	Increase the crest length of the existing relief weir located along Salmon Creek and the width of the channel which receives water from the weir. The suggested weir length and the channel width are 50 feet.	Model results show that this improvement reduces the water surface elevation in Salmon Creek and consequently reduces the tailwater elevation for both Arata Creek and for the Salmon Creek crossing at Sundial Road. Expanding the existing 10-foot weir crest length to approximately 50-feet and widening the channel extending north 450 feet from the relief weir to approximately 50 feet maintains the water level in Salmon Creek.	Should not be implemented until modeling analysis has been completed by SDIC.	See p. 7-5 of North Troutdale Storm Drainage Master Plan. Arata Cr is a tributary to Salmon Ck which discharges to the Columbia R. after passing through Fairview.	Short-term

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
22	San Rafael Diversion	3	Construct 460 linear feet of 12" CSP in San Rafael Street from the existing storm manhole in San Rafael to the 203rd Avenue storm drain. Construct 600 linear feet of 6" perforated sub-drainage pipe parallel to the proposed 12" diversion storm drain. Plug existing private 12" pipe out at the San Rafael Street manhole.	Groundwater problems; surface flooding			Done?
2	San Rafael Diversion	SDMP-3	Construct storm drain and sub-drain	Relieve local flooding along San Rafael Street and Thompson Street			Out
22	Sandy Blvd Diversion	13	Construct a diversion ditch south of Sandy Blvd. from No Name Creek to Fairview Creek. Size ditch to convey a full buildout 100-year diversion rate of 100 cfs. A 10' bottom width, 2H:1V side slopes, 0.4% longitudinal slope and average total depth of 4 feet are required. At the Fairview Creek Sandy Blvd. crossing, add one 60 linear foot 42" CSP culvert adjacent to the existing 6'x6' box culvert at this crossing.	This improvement is required for a 100-year design capacity in Fairview Creek, after the proposed 100 cfs Sandy Blvd No Name Creek Diversion.			Done?
18	Sandy Blvd, NE - MP: 0.97 Fish Passage Project	318-01	Replace culvert to improve fish passage in Fairview Creek	Improve fish passage	Funding constraints, Hope to accomplish with Planned Road Projects	High Priority (Group A)	Unknown
18	Sandy Blvd. General Issues		General issues discussed w/ Mult. Co.	Sandy Blvd. floods near Townsend Farms Business Park development, but if fixed it would move problems downstream to undersized private culvert; Phased approach planned for Sandy improvements as Townsend Farms develops. Potential re-design of Sandy has been evaluated with green design components (Linda has hard copy of report)			Future
18	Sandy Blvd.: 207th to 238th Ave (223rd Ave Improvements)	716	Construct Intersection improvements at 223rd Ave and Sandy Blvd.	Traffic flow improvements	Design includes additional manholes to provide detention	Expect 2007 Construction, has been funded	2007 implementation
22	Seventh Street Collector	14	Construct 250 feet of 12" CSP along 7th Street between Main Street and the end of 7th Street. From the end of 7th Street construct 200' of 12" CSP within the 7th Street easement, outfalling to the railroad ditch. Install new field inlets at the intersection of 7th and Main Street.	Frequent ponding along 7th Street occurs due to the flat topography and lack of storm drainage facilities.			Done?
22	Shae's East Sump Diversion	5	Construct a 12" CSP storm drain to connect the sump at Bridge Street to the existing 12" CSP outfall at the intersection of Crestwood and Shaw. Approximately 350 feet of pipe is required.	Surface ponding			Done?
21	Silent Ck I-84 Crossing, E 205th and Thompson	G	24-inch pipe flows into an 18-inch culvert.	Floods under I-84. ODOT project since it's under I-84.		Does this project matter?	
16	Arata Creek South - Culvert Improvements	CIP No. 4	Install an additional 470 feet of 36-inch culvert where Arata Creek crosses the railroad embankment north of Interstate 84 and additional piping under the paved area directly north of the embankment. The culvert will need to be bored through the railroad embankment.	Any development of the area north of Halsey will increase the flows to the Arata Creek system. The existing railraod culvert needs to be augmented with an additional culvert to prevent localized flooding in the area immediately upstream of the railroad embankment.	This CIP should be implemented before the flows to Arata Creek begin to increase due to future development on the north side of Halsey.	See p. 7-11 of North Troutdale Storm Drainage Master Plan. Arata Cr is a tributary to Salmon Ck which discharges to the Columbia R. after passing through Fairview.	Before development of land north of Halsey. See figure 7-7 of North Troutdale Storm Drainage Master Plan.

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
5	Halsey St (South of) and just west of 207th Ave near NE	X, Fairview site 9	WT: Wetland; WP: Wet Detention Pond	Improve WQ through retrofit; site has access to large tributary area, could treat future resdt'l development and flows from Fairview Creek, part of site may already include wetlands		Not in Fairview MP	Unknown
5	*218th Ave (South of NE 218th) near NE Lachenview St*	*N, Fairview Site 1*	*WP: Wet Detention Pond*	*Improve WQ through retrofit; serves a significant area, site is close to Fairview Lake & would provide treatment prior to stormwater discharge to Lake*	*Existing BMP at site already performs adequately*	*Not in Fairview MP*	*Out*
5	*Fairview Lake Way (South of NE Fariview Lake Way) and east of NE 214th Ave*	*P, Fairview Site 3*	*WP: Wet Detention Pond*	*Improve WQ through retrofit; would treat flow from a large tributary area, existing facility is large and may only require minor modifications to outlet structure design*	*Retrofit may be too costly and hard to permit due to location near creek & lake.*	*Not in Fairview MP*	*Out*
5	*Sandy Blvd. (South of NE Sandy) and west of NE 223rd Ave*	*S, Fairview Site 6*	*DP: Dry Pond; HYD: Hydrodynamic device*	*Improve WQ through retrofit; site has access to large tributary area w/ industrial & commercial land uses with little other stormwater treatment*	*City's long-term plan for site is unimproved park/open space; creek is ~10' below adjacent grade implying costly construction*	*Not in Fairview MP*	*Out*
18	Stark St, SE - MP: 2.299 Fish Passage Project	304-01	Replace culvert to improve fish passage in Fairview Creek	Improve fish passage	Gresham responsible for road now, not County	Middle Priority (Group B)	Unknown
14	Stark Street (East) Swale	911000	This project would install a diversion manhole to divert storm flows to a pollution reduction facility (PRF) or sediment manhole and then to a vegetated swale located along the norht side of SE Stark St. The PRF would remove pollutants while the vegetated facility would remove fine sediments and soluble nutrients and metals. The swale will be located ina piece of land to be purchased. This project is in the North Central Neighborhood and in the Fairview Creek Drainage Basin.	There is no existing water quality treatment in this area and this facility would improve stormwater quality flowing to Fairview Creek.	UNFUNDED.	p415 of CIP	
14	Stark Street (West) Pollution Reduction Facility (PRF)	911100	Install a pollution reduction facility at the intersection of SE Stark St. and SE 205th. This project is in the North Central Neighborhood and in the Fairview Creek Drainage Basin.	There is no existing water quality treatment in this area. This facility would improve stormwater quality flowing to Fairview Creek.	UNFUNDED.	p416 of CIP	
14	Stark Street Culvert	910400	This CIP would eliminate the fish barrier that currently exists downstream from the culvert under Stark. This is accomplished by placing a fish ladder downstream from Stark. Invasive plant species are to be removed and replaced with native plant species to provide shade. this project is in the North Central Neighborhood and in the Fairview Creek Drainage Basin.	Provides passage for fish (meets ODFW requirements for fish passage) and in conjunction with FC01a, increases flood protection along this section of the creek.	UNFUNDED.	p411 of CIP	
22	Stone Reservoir Detention Facility	10	Require detention storage at the abandoned Stone Reservoir location as a condition of development. See Master Plan for details.	Upstream development.			Done?
22	Thompson Street Ditch	4	Add 30" CSP at Thompson Street adjacent to existing 24-inch culvert. 25-year design capacity of improvement. Replace 18-inch culvert under 202nd Avenue with 30-inch CSP. 25-year design capacity improvement.	Increase capacity			Done?

Source #	Name or Location of Potential CIP	Project No. or Short Name	Project Description	Project Justification / Purpose	Reason not implemented	Notes	Status
5	*Salish Ponds located north of Glisan (Upstream of the ponds)*	*U, Fairview Site 8*	*WT: wetland*	*Improve WQ through retrofit; site has access to large tributary area & is downstream of flood control basins*	*City has identified site as mitigation for 207th St. project; only large storm flows would be treated.*	*Not in Fairview MP*	*Out*
22	Walnut Drive (Private Road) Bridge Replacement	16	Replace the existing bridge with two parallel 7'x5' box culverts to convey a future 100-year flow of 460 cfs.	Bridge crossing has an existing 2-year capacity. Flow overtopping this road is expected to flood nearby downstream properties. Backwater flooding of 1 house upstream is also possible.			Done?
14	Non Structural - Water Quality Monitoring - Fairview Creek Pollution Reduction Facility	914300	Monitor two stormwater runoff events at or just upstream of potential structural Pollution Reduction Facilities. Water quality sites to be monitored are Burnside East (CIP 911300), Burnside West (911200), Stark East (CIP 911000), and Stark West (CIP 911100).	Verification of modeling data to determine that water quality facilities are warranted to treat basin runoff and to customize design of Polution Reduction Facility or modify city BMPs.	UNFUNDED.	p437 of CIP	
13/17	166th - Windmere Flats at 166th.		Portland project to provide overflow flood storage.		Portland project.		
18	Wood Village Blvd.: Arata Rd. to Halsey St.	710	Construct new extension of Wood Village Blvd. as major collector.	Traffic flow improvements, improve multi-modal use	Funding constraints, dependent on funding through MTIP	High Priority. 5-10 years out, sooner if possible	Short-term to future

APPENDIX D

Summary of Hydrologic and Hydraulic Modeling

BROWN AND CALDWELL

Technical Memorandum

6500 SW Macadam Avenue, Suite 200
Portland, Oregon 97239

Prepared for: Linda Hulme, City of Fairview

Project Title: Consolidated Stormwater Master Plan

Project No: 133088.003.001

Subject: Summary of Hydrologic and Hydraulic Modeling

Date: November 21, 2007

Prepared by: Leah Johanson, P.E., Brown and Caldwell
Jim Harper, P.E., Brown and Caldwell

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Limitations:

This document was prepared solely for the City of Fairview in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Fairview and Brown and Caldwell dated June 8, 2007. This document is governed by the specific scope of work authorized by the City of Fairview; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Fairview and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Summary

The following technical memorandum describes the modeling effort for the City of Fairview Consolidated Stormwater Master Plan (CSMP). The focus of this study was to update the existing model, create future conditions for Fairview Creek, and create a new model for existing and future conditions for the Raintree sub-basin. All model work was completed using data provided by the City of Fairview (City). This document provides a history of past modeling efforts, outlines the existing available information used to modify the existing models and to develop the new Raintree model, and documents our hydrologic and hydraulic modeling assumptions. Model results for the existing and future conditions are included as attachments.

Fairview Modeling History

Fairview Creek has been studied and modeled a number of times in the past. Some of these efforts looked at the entire length of the creek through the City and beyond, while other efforts concentrated on specific reaches of the creek. During the initial data gathering stage, Brown and Caldwell reviewed seven projects that modeled the Fairview Creek region, as listed in Table 1.

Table 1. Fairview Modeling Summary

Project	Model	Consultant	Year
FEMA modeling	Unknown	Unknown	Early 80s
FEMA study	HEC-2	CH2M Hill	1986
Stormwater master plan	XP-SWMM	Oakley Engineering	1993
FEMA analysis of Fairview Creek	HEC-2	Newton	1995
Drainage basin modeling report–investigation of LSI flows to No Name and Fairview Creeks	XP-SWMM	CH2M Hill	1997
Assessment of flow control for the bridges on Fairview Creek from Halsey to I-84	XP-SWMM	CH2M Hill	2000
Gresham detention pond	XP-SWMM	HDR	2003
FEMA analysis for two areas–The Village and Heron Point	XP-SWMM	Crawford Engineering Associates	2006

Oakley Engineering developed the first XP-SWMM model for Fairview Creek in 1993 and this model served as the basis for future XP-SWMM models. Subsequent models were developed by CH2M Hill, with the most significant upgrade completed in 1997. HDR has also completed some XP-SWMM modeling for the City of Gresham, which is upstream of Fairview.

The latest model is the existing conditions regional model that Crawford Engineering Associates developed in 2006 (Crawford Model). In our analysis we determined that the Crawford Model was based on results from the 1997 CH2M Hill model. The Crawford Model is a large scale regional model that includes modeling of the upstream Gresham system.

Model Approach

The focus of this study was to update the existing conditions model, create future conditions for Fairview Creek, and create a new model for existing and future conditions for the Raintree sub-basin. The scope of this study did not include creating or validating the existing conditions model for Fairview Creek. The City and Brown and Caldwell assumed the existing conditions model had been validated previously for both the hydrologic and hydraulic parameters. In this study, existing and future conditions are defined as the current and projected future land use conditions and the resulting hydrologic runoff generation.

The starting model for this study was the Crawford Model, an existing conditions model developed and last updated by Crawford Engineering. The modeling completed by Brown and Caldwell as part of the CSMP focused on the following three drainage areas:

- Fairview Creek
- No-Name Creek
- Raintree Creek

Figure 1 shows the limits of the study area and the sub-basins that were evaluated. No Name Creek was included in the Fairview Creek analysis. A separate model was created to simulate conditions for Raintree Basin. The following four models were created as part of this effort:

- *Existing Conditions Model:* Existing regional model developed by Crawford Engineering. Based on information provided by the City, basin divides were updated to reflect new roads and percent imperviousness was updated to reflect land use changes.
- *Future Conditions Model:* The Existing Conditions Model was modified using future land use projections for both Fairview and Gresham as provided by the City.
- *Raintree Sub-basin Existing Model:* New model created by Brown and Caldwell to simulate existing conditions within just the Raintree sub-basin.
- *Raintree Sub-basin Future Conditions Model:* New model created by Brown and Caldwell to simulate projected future land use conditions within just the Raintree sub-basin.

The following sections describe the modeling assumptions and modifications to both the hydrology and hydraulics portions of the models.

Hydrology

The hydrology portion of the models includes land use and design storm considerations. As described below, land use data and rainfall information was provided by the City and this information was used to develop and update the models.

Land Use

Land use data provided by the City was examined, and updated conditions and projections were included in the existing and future conditions for the Fairview Creek and the Raintree subbasin models.

Fairview Creek Model

Existing Conditions. The Crawford Model was updated slightly to create the Fairview Existing Conditions Model. The basin divides for the Fairview Creek and No-Name creek basins were reviewed and updated based on input from the City. No modifications to the basin areas were made outside the City. The impervious percentage of sub-basins was also updated. Table 2 summarizes the changes made between the Crawford Model and the new Fairview Existing Conditions Model, showing the sub-basin name along with the area and percent impervious.

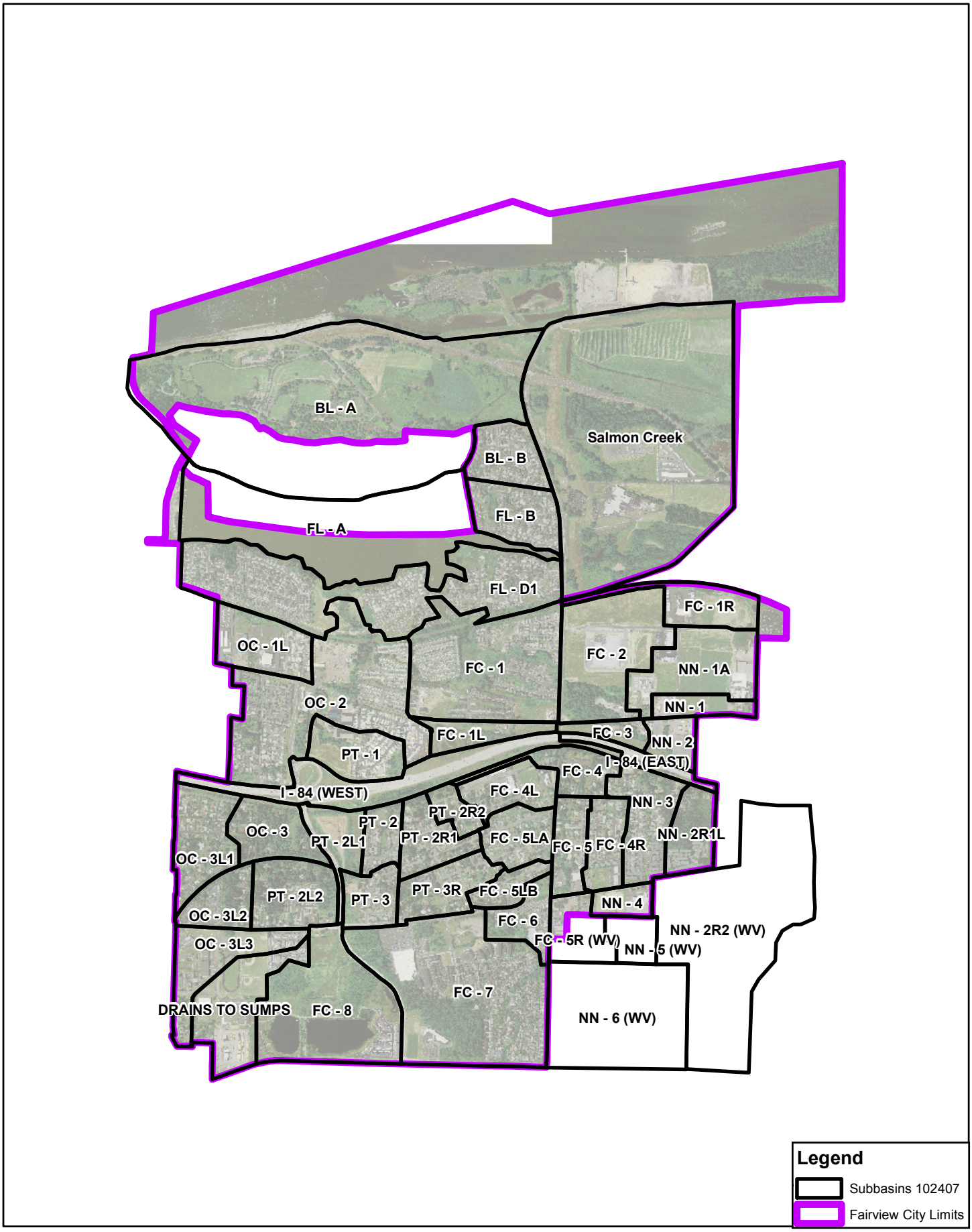


Figure 1 - Fairview Study Boundary and Subbasins

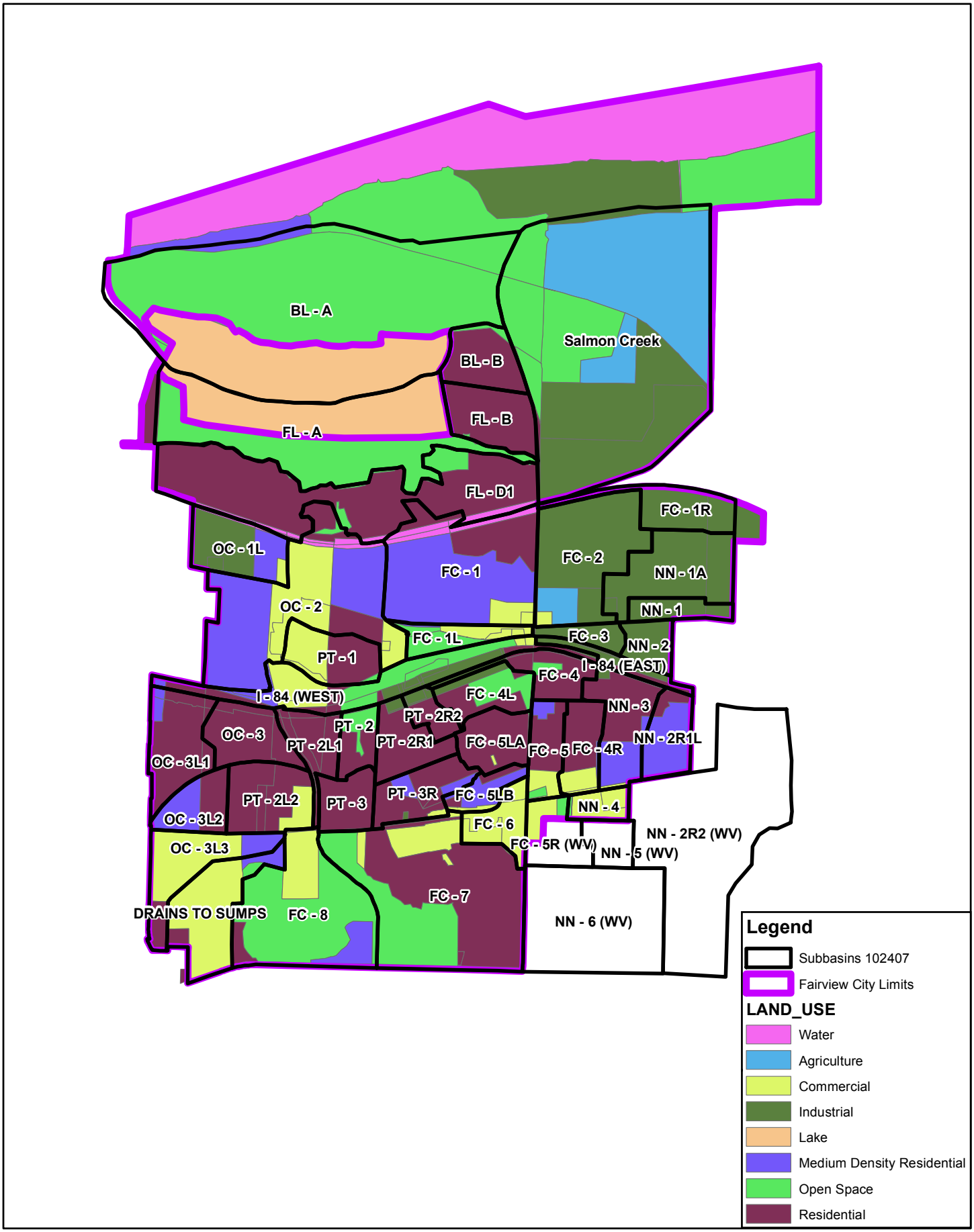
Table 2. Existing Conditions Model Revisions				
Sub-basin name	Crawford Model area, acres	Crawford Model impervious percentage	Existing conditions model area, acres	Existing conditions model impervious percentage
FC-1[1]	NA	NA	90.6	0
FC - 1L[1]	NA	NA	15.5	0
FC-1R	31	0	25	0
FC-2	89	0	63	0
FC-3	13	27	9	50
FC-4	24	40	19	50
FC-4L	19	42	21	50
FC-5	20	48	18	50
FC-5LA	29	38	21	50
FC-6	17	15	18	80
FC-7	135	35	126	50
NN-1	32	0	12	85
NN-2	9.6	0	13	75
NN-2R1	97.3	0	97	85
NN-2R1L	30.1	0	20	0
NN-2R2	156.8	0	140	50
NN-3	30.1	0	32	50
NN-4	12.2	0	10	85
NN-6	55.7	0	81	0

[1]Sub-basins FC-1 and FC1L were added to node FC-1 as sub-basins 2 and 3.

Table 2 represents changes to the model only and not information for the entire model. Complete basin information, along with what hydraulic node the sub-basins discharges to, can be found in the detailed model information tables that are attached to this report. No other changes were made to the hydrology of the Crawford Model for existing conditions.

Future Conditions. To develop the Fairview Future Conditions Model, the Fairview Existing Conditions Model was modified by applying projections for future land use changes to the percent imperviousness for the sub-basins. The City's zoning map was used to project the future land use changes. Figure 2 shows the City's zoning map used for this report. Based on the zoning designations, the impervious areas were established for future land use projections using the values in Table 3. In sub-basins with multiple land uses, the total area for each land use type was determined and a weighted percent impervious was calculated.

Table 3. Projected Impervious Land Use Percentages	
Type of use	Impervious percentage
Residential	60
Multi-family	70
Residential	50
Commercial	85
Industrial	85
Open space	2
Agricultural	2
Vacant	2



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0 1,000 2,000 4,000 Feet

1 inch equals 2,000 feet

N

Figure 2 - Fairview Future Land Use

Table 4 summarizes the total area, the existing and future percent impervious area, and the resulting 100-year flow modeled for each sub-basin within the City for the Fairview Model. The results from the original Crawford Model are also presented for comparison.

Table 4. Impervious Area Comparison

Name	Existing land use model						Future land use model		
	CEA Model			Updated model			Updated model		
	Area, acres	Impervious, percent	100-year flow, cfs[1]	Area, acres	Impervious, percent	100-year maximum flow, cfs[1]	Area, acres	Impervious, percent	100-year maximum flow, cfs[1]
FC-1R	31	0	5.9	131	20	30.0	131	65	47.3
FC-2	89	0	29.3	63	40	20.7	63	75	29.9
FC-3	13	27	4.8	9	50	3.9	9	85	4.7
FC-4	24	40	6.7	19	50	6.1	19	57	6.6
FC-4L	19	42	6.5	21	50	7.9	21	42	7.4
FC-4R	19	35	8.0	19	35	8.1	19	67	9.1
FC-5	20	48	9.0	18	50	8.3	18	64	8.7
FC-5LA	29	38	10.7	21	50	8.6	21	60	9.1
FC-5LB	11	62	4.8	11	62	4.9	11	69	5.1
FC-5R	20	57	9.5	20	57	9.5	20	24	8.3
FC-6	17	15	5.4	18	80	8.5	18	84	8.7
FC-7	135	35	48.8	126	50	51.0	126	44	48.9
FC-8	93	73	0.0	93	73	0.0	93	73	0.0
FC-8L	44	45	0.0	44	45	0.0	44	45	0.0
Glisan8	93	73	44.1	93	73	44.1	93	45	39.3
I-84	6.4	0	3.0	6	0	3.0	6	60	3.3
NN-1	32	0	9.6	12	85	5.7	12	85	5.7
NN-2	9.6	0	4.2	13	75	6.3	13	85	6.4
NN-2R1	97.3	0	38.6	97	85	48.4	97	85	48.4
NN-2R1L	30.1	0	11.8	20	0	7.9	20	68	9.8
NN-2R2	156.8	0	60.0	140	50	64.9	140	85	71.0
NN-3	30.1	0	11.5	32	50	14.4	32	65	15.1
NN-4	12.2	0	5.7	10	85	5.0	10	80	5.0
NN-5	12.2	0	5.3	12	0	5.3	12	75	5.9
NN-6	55.7	0	27.6	81	0	40.3	81	85	41.1

[1] cfs = cubic feet per second

Raintree Sub-basin Model

Existing and Future Conditions. New models were created by Brown and Caldwell to simulate existing and future conditions within the Raintree sub-basin. Figure 3 shows the sub-basin delineations that were created for the Raintree Model. Thirty-eight sub-basins were delineated based on elevation contours, the storm drainage network, and input from City staff. Recent aerial photographs were used to determine the existing percent impervious for each of the sub-basins. The City's zoning map, obtained from the City, was used to determine future percent impervious, as described above. Table 5 summarizes the area, existing percent impervious and future percent impervious for the Raintree sub-basins.

Table 5. Raintree Percent Impervious

ModelSubID	Area, acre	Existing, percent	Future, percent
00489	4.41	50	61
00492	1.17	25	60
00494	1.38	50	60
498	1.99	50	60
00500	3.01	50	67
00501	11.71	50	63
502	1.43	50	60
00508	2.11	50	60
00509	3.58	50	60
00511	1.31	50	60
513	1.16	50	47
00514	2.24	50	60
00516	3.34	50	60
00517	0.86	25	60
00574	2.05	50	60
00579	3.27	25	42
00583	6.68	25	65
00614	1.78	50	60
00635	2.26	50	60
00639	1.75	50	60
00663	1.39	50	60
00753	0.34	50	60
00765	3.00	50	60
00808	2.19	50	60
00810	1.55	50	60
4038	3.34	50	61
00491s	2.44	50	42
00498_2	1.46	50	60
00574_2	2.21	50	59
511_grass	4.55	25	60
i84_OpenSpace_SE	12.42	44	71

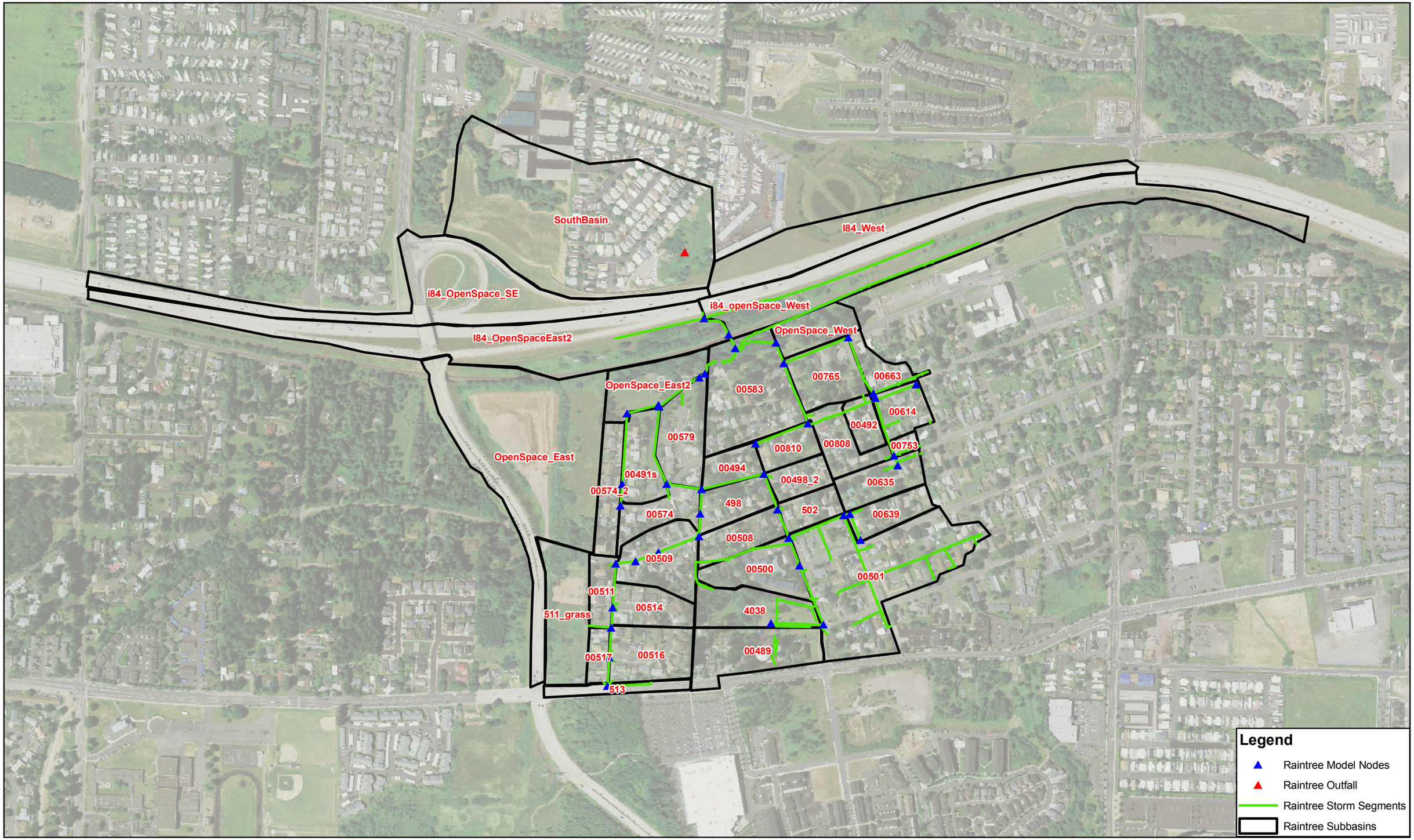
Table 5. Raintree Percent Impervious			
i84_openSpace_West	14.65	5	64
I84_OpenSpaceEast2	15.42	67	52
I84_West	8.98	42	7
OpenSpace_East	18.42	21	61
OpenSpace_East2	3.09	5	3
OpenSpace_West	2.15	5	84
SouthBasin	24.81	47	70

Design Storm Events

The analysis of the system was based on the 1-day (24-hour) design storm for the following events and associated total rainfall:

- 100-year (5 inches)
- 50-year (4.5 inches)
- 25-year (3.9 inches)
- 10-year (3.5 inches)
- Water quality storm (1.7 inches)

The SCS Type 1A 24-hour rain distribution was used to develop the rain distribution for the events, as presented in Figure 4.



P:\133088_GIS\HH_TM_Fig3.mxd, 11-21-2007, LMJ, LGP

0 250 500 1,000 Feet

1 inch equals 500 feet

N

Figure 3 - Raintree Model Sub-basins

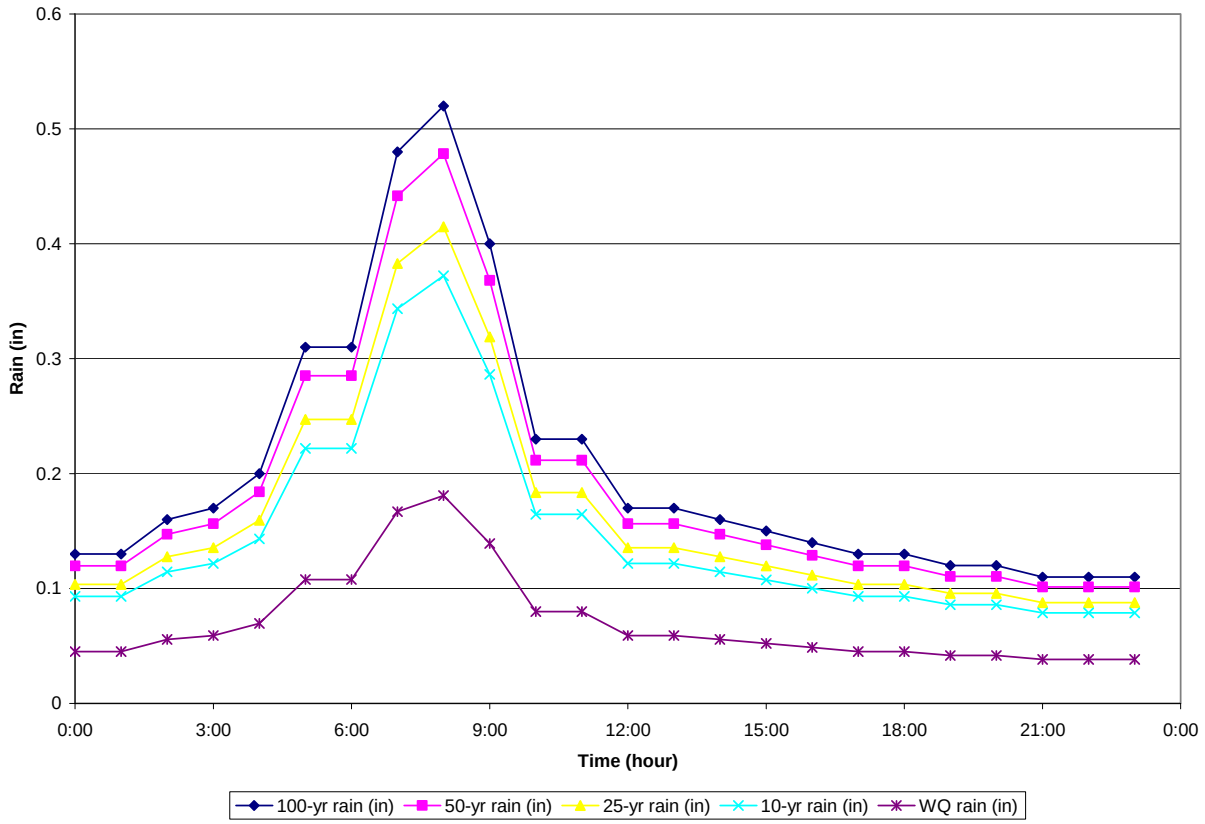


Figure 4. SCS Type 1A 24-hour rain distribution

Hydraulics

The hydraulic system within the existing Crawford Model was used to model the hydraulics of Fairview Creek. No modifications to the hydraulic elements were made to the model received from Crawford Engineering. Figure 5 shows the model segments and nodes for Fairview Creek and the Raintree sub-basin.

The Raintree hydraulic model was developed using GIS information supplied by the City. The Raintree Model simulated 40 nodes, 46 conduits, 2 weirs, 2 storage nodes, and 38 sub-basins. The City provided invert elevations for manhole nodes and pipe type and diameter for pipe conduits. Of the 46 conduits simulated, nine were simulated as natural channels. Maximum depth of natural channels was assumed to be 3 to 10 feet depending on the channel location. Bottom width for natural channels was assumed to be 2 to 5 feet. Side slopes for natural channels were estimated at 1:2 (horizontal:vertical). Storage node model inputs were based on the contour map provided by the City.

Results

A detailed analysis of the modeled water surface elevations with structure elevations throughout the City was conducted as part of this study. This study investigated problem areas as identified by the City and further discussed in the Consolidated Stormwater Master Plan (Brown and Caldwell, 2007), but did not investigate in detail the potential for flooding throughout the City. Model results can be used in the future to identify potential flooding problems by comparing the capacity or velocity of the different elements of the conveyance system with the projected flow for the storm events. Water surface elevations, flow rates, and velocities of existing and future conditions for both Fairview Creek and the Raintree subbasin are attached.

Attachments

Fairview Creek

A. Existing Conditions Water Surface Elevations

B. Existing Conditions Flow Rates for Modeling Reaches

C. Existing Conditions Velocity for Modeling Reaches

D. Future Conditions Water Surface Elevations

E. Future Conditions Flow Rates for Modeling Reaches

F. Future Conditions Velocity for Modeling Reaches

Raintree Basin

G. Existing Conditions Water Surface Elevations

H. Existing Conditions Flow Rates

I. Existing Conditions Velocity

J. Future Conditions Water Surface Elevations

K. Future Conditions Flow Rates

L. Future Conditions Velocity

ATTACHMENT A

Fairview Creek

Existing Conditions – Water Surface Elevations

City of Fairview
Water Surface Elevations (ft)
Existing Conditions

Name	Invert Elevation ft	100-yr Max Water Elevation (ft)	50-yr Max Water Elevation (ft)	25-yr Max Water Elevation (ft)	10-yr Max Water Elevation (ft)	WQ Max Water Elevation (ft)
2953-F-011	191.25	192.5	192.5	192.4	192.4	192.0
2951-F-001	208.88	210.7	210.8	210.3	210.3	209.7
2951-F-002	206.92	208.3	208.3	208.1	208.1	207.6
2951-F-003	203.41	204.7	204.7	204.5	204.5	204.1
2951-F-004	201.66	203.6	203.6	203.2	203.2	202.6
2951-F-005	201.22	203.1	203.1	202.8	202.8	202.1
2951-F-006	200.34	202.2	202.2	201.9	201.9	201.3
2951-F-007	199.21	200.7	200.7	200.5	200.5	200.0
2951-F-008	197.95	199.5	199.5	199.2	199.2	198.8
2952-F-002	196.69	198.3	198.3	198.0	198.0	197.5
2952-F-003	195.43	196.8	196.8	196.6	196.6	196.2
2952-F-004	193.65	195.4	195.4	195.1	195.1	194.6
2952-F-005	188	193.6	193.6	191.3	191.3	190.2
2952-F-006	185	186.5	186.5	186.4	186.4	186.0
2952-F-601	183	185.1	185.1	184.9	184.9	184.3
2951-F-250	199	208.2	208.2	208.0	208.0	206.7
2951-F-251	199	208.2	208.2	208.0	208.0	206.7
2951-F-252	203.5	208.2	208.2	208.0	208.0	206.7
3051-F-241	205.5	210.3	210.3	210.2	210.2	208.3
2951-F-248	205.5	210.2	210.2	210.1	210.1	208.3
2951-F-249	209.1	209.8	209.8	209.1	209.1	209.1
2951-F-253	203.3	207.3	207.3	207.1	207.1	206.3
2951-F-257	205.1	207.0	207.0	206.8	206.8	206.1
2951-F-258	203.8	206.4	206.4	206.1	206.1	204.5
2952-F-259	203.1	205.4	205.4	205.1	205.1	203.9
2952-F-260	201.5	204.0	204.0	203.7	203.7	202.3
2952-F-261	200.6	203.1	203.1	202.3	202.3	201.1
2952-F-262	199.2	203.1	203.1	202.1	202.1	200.1
2952-F-263	199	201.6	201.6	201.2	201.2	199.8
2952-F-264	196.5	199.4	199.4	198.7	198.7	197.3
2952-F-265	194.6	199.1	199.1	198.3	198.3	195.5
2952-F-266	194.12	198.7	198.7	197.9	197.9	195.5
Temp1	194.1	196.7	196.7	196.3	196.3	194.9
GI_ovflw11	186	188.2	188.2	187.8	187.8	186.7
2951-F-254	203.6	207.3	207.3	207.1	207.1	206.3
2951-F-255	203.2	205.8	205.8	205.7	205.7	205.1
2951-F-260	202.6	205.6	205.6	205.5	205.5	205.0
xsect2n	200.27	203.8	203.8	203.7	203.7	203.2
xsect3n	199.6	202.8	202.8	202.6	202.6	202.4
W_OS_Pond	194.5	202.7	202.7	202.5	202.5	200.9
1484	201	202.8	202.8	202.6	202.6	202.0
E_OS_Pond	194.5	202.8	202.8	202.6	202.6	200.8
1482	197.5	198.4	198.4	198.4	198.4	198.3
Glisan4	199.69	202.7	202.7	202.5	202.5	202.3
FC-8L	199.18	202.4	202.4	202.1	202.1	201.8
FC-8	199.23	202.3	202.3	202.0	202.0	201.2
RDL-J	197	201.6	201.6	201.3	201.3	200.6
Glisan7	197	201.6	201.6	201.3	201.3	200.6
1111	200	201.6	201.6	201.3	201.3	200.6
1108	198.74	201.6	201.6	201.3	201.3	200.7
Glisan8	197.7	199.6	199.6	199.5	199.5	199.3
Glisan9	194.5	197.1	197.1	197.0	197.0	196.9
ns2.47	189.9	193.8	193.8	193.7	193.7	193.5
ns9	187.6	193.3	193.3	193.1	193.1	192.2

City of Fairview
Water Surface Elevations (ft)
Existing Conditions

Name	Invert Elevation ft	100-yr Max Water Elevation (ft)	50-yr Max Water Elevation (ft)	25-yr Max Water Elevation (ft)	10-yr Max Water Elevation (ft)	WQ Max Water Elevation (ft)
N1475	187.17	192.4	192.4	192.1	192.1	191.2
N1476	187.12	191.9	191.9	191.7	191.7	191.0
N1477	187.1	191.9	191.9	191.7	191.7	191.0
ns8	187	191.7	191.7	191.5	191.5	190.8
ns7	186.3	190.0	190.0	189.7	189.7	189.2
NS2.27	185.1	189.6	189.6	189.4	189.4	188.5
Glisan12	184.16	188.2	188.2	187.8	187.8	186.7
Glisan13	184	187.1	187.1	186.7	186.7	186.0
N1472	183	185.2	185.2	184.7	184.7	183.7
Glisan14	182.3	185.2	185.2	184.8	184.8	183.7
Glisan15	181.5	184.9	184.9	184.5	184.5	183.5
N1468	180	182.2	182.2	182.0	182.0	181.4
N1462	180.3	181.6	181.6	181.3	181.3	180.7
N1463	179.5	181.2	181.2	181.0	181.0	180.3
N1467	178	180.1	180.1	179.7	179.7	179.0
Glisan16	176	177.8	177.8	177.6	177.6	177.1
Glisan17	172	175.4	175.4	175.0	175.0	173.9
PrivateRd1	171.5	172.3	172.3	172.0	172.0	171.8
PrivateRd2	170.12	172.0	172.0	171.7	171.7	171.2
N1466	168.1	171.0	171.0	170.7	170.7	169.9
NS0.6	167.2	169.6	169.6	169.4	169.4	168.8
ns0.5	160	165.6	165.6	165.2	165.2	164.1
NS0.3	159.9	164.3	164.3	164.0	164.0	163.1
N1473	156.7	161.4	161.4	161.0	161.0	159.9
N1474	156.55	161.3	161.3	160.9	160.9	159.9
FC-7	155.1	157.1	157.1	156.9	156.9	156.3
PrivateRd4	151.4	155.5	155.5	155.2	155.2	154.0
Barr	151.3	154.1	154.1	153.8	153.8	152.9
Barr1	151	153.8	153.8	153.5	153.5	152.7
FC-6	150.5	153.3	153.3	152.8	152.8	151.8
Barr2	150.5	153.0	153.0	152.5	152.5	151.6
Barr3	149.9	152.8	152.8	152.3	152.3	151.4
Barr4	148.8	152.3	152.3	151.5	151.5	150.2
Barr5	147.4	152.3	152.3	151.4	151.4	149.6
FC-5R	147.4	152.3	152.3	151.4	151.4	149.4
Halsey1	146.7	152.1	152.1	151.3	151.3	149.3
Halsey2	146.3	150.6	150.6	150.0	150.0	148.4
Halsey3	145.5	150.6	150.6	149.9	149.9	148.4
1044	188.13	189.4	189.4	189.3	189.3	188.9
1042	183	184.3	184.3	184.1	184.1	183.8
1040	178.49	179.8	179.8	179.7	179.7	179.3
1038	175.49	176.7	176.7	176.6	176.6	176.2
1036	170.47	171.6	171.6	171.5	171.5	171.1
1034	164.7	165.8	165.8	165.7	165.7	165.3
1032	157.9	159.0	159.0	158.9	158.9	158.6
1030	151.3	152.5	152.5	152.4	152.4	152.0
1028	147.47	150.6	150.6	149.9	149.9	148.2
Halsey4	145.5	150.6	150.6	149.9	149.9	148.2
Fairview1	145.5	150.6	150.6	149.9	149.9	148.2
Fairview2	145.5	150.4	150.4	149.7	149.7	148.1
Fairview3	144.8	148.3	148.3	147.8	147.8	146.7
Fairview4	144	147.9	147.9	147.4	147.4	146.2
2953-F-605	195.9	200.0	200.0	198.6	198.6	198.0
NN_Glisan2	187.8	192.0	192.0	190.5	190.5	190.0

City of Fairview
Water Surface Elevations (ft)
Existing Conditions

Name	Invert Elevation ft	100-yr Max Water Elevation (ft)	50-yr Max Water Elevation (ft)	25-yr Max Water Elevation (ft)	10-yr Max Water Elevation (ft)	WQ Max Water Elevation (ft)
NN_Glisan3	183.21	185.0	185.0	184.9	184.9	184.3
NN_Glisan4	164	170.0	170.0	168.6	168.6	166.4
NN_Glisan5	164.1	166.9	166.9	166.7	166.7	166.0
917	185.65	185.7	185.7	185.7	185.7	185.7
918	170.95	171.0	171.0	171.0	171.0	171.0
NN-6	161.5	164.0	164.0	163.8	163.8	163.2
NN_Glisan6	160.3	163.5	163.5	163.2	163.2	162.4
NN-5	152.44	157.4	157.4	157.3	157.3	156.5
ArataDivA	153	157.3	157.3	157.3	157.3	156.4
ArataDivB	151.4	157.1	157.1	157.1	157.1	156.4
ArataDivC	147.8	148.3	148.3	148.3	148.3	148.3
Arata1	151.76	154.0	154.0	154.0	154.0	153.9
Arata2	150	152.0	152.0	152.0	152.0	151.5
Arata3	147	149.5	149.5	149.4	149.4	148.4
Arata4	146	149.4	149.4	148.7	148.7	146.9
Hlsy_e1	143.82	149.4	149.4	148.7	148.7	146.8
Hlsy_e2	144.16	148.3	148.3	147.9	147.9	146.6
NN-4	144.1	148.3	148.3	147.9	147.9	146.3
NN_Halsey1	144.32	146.1	146.1	146.1	146.1	145.6
NN_Halsey2	136	139.1	139.1	139.1	139.1	137.9
NN_Halsey3	136	137.8	137.8	137.8	137.8	137.2
NN_Halsey4	118.5	120.6	120.6	120.5	120.5	120.4
NN_Halsey5	114.5	117.1	117.1	117.0	117.0	116.6
NN_Halsey6	114.5	117.0	117.0	116.8	116.8	116.0
NN_Bridge1	104	104.9	104.9	104.9	104.9	104.6
NN_Bridge2	92	96.8	96.8	96.8	96.8	95.4
NN_Bridge3	90	96.8	96.8	96.7	96.7	95.4
NN-3	90	96.8	96.8	96.7	96.7	95.4
I-84	90	96.3	96.3	96.2	96.2	95.2
NN_I-84-1	86	87.5	87.5	87.5	87.5	86.9
NN_I-84-2	64	67.3	67.3	67.1	67.1	66.2
NN_I-84-3	38.2	43.0	43.0	42.9	42.9	40.4
NN-2R1L	105.5	106.3	106.3	106.2	106.2	105.8
NN-2R2	95.55	98.0	98.0	97.6	97.6	96.6
NN2R-RRS	95.05	97.0	97.0	96.7	96.7	95.9
NN2R-RRN	91.8	94.2	94.2	94.0	94.0	93.0
NN2R-I-84E	91.8	93.9	93.9	93.6	93.6	92.8
NN2R-238S	88.2	89.8	89.8	89.5	89.5	88.8
NN2R-238N	79.6	81.7	81.7	81.4	81.4	80.6
NN2R-238	79.6	81.4	81.4	81.1	81.1	80.4
NN2R-TSE	74	77.4	77.4	77.1	77.1	75.7
NN2R-TSW	61.4	62.8	62.8	62.4	62.4	61.8
NN2R-WVMHP	61	62.8	62.8	62.4	62.4	61.8
NN-2R1	46	55.6	55.6	54.4	54.4	48.6
NN2R-AlotW	42	42.9	42.9	42.8	42.8	42.5
NN-2	38	43.0	43.0	42.9	42.9	40.1
NN_Sandy1	37.6	42.3	42.3	41.7	41.7	39.2
NN-1	36	40.1	40.1	39.9	39.9	38.2
NN_Sandy2	32	34.1	34.1	34.0	34.0	33.1
NN_Sandy3	22	25.7	25.7	25.6	25.6	24.7
NN_Sandy4	20	22.4	22.4	22.3	22.3	21.3
Fairview6	141.4	146.6	146.6	145.8	145.8	144.2
Fairview7	141.4	146.5	146.5	145.5	145.5	143.9
FC-5LB	141.4	146.5	146.5	145.5	145.5	143.9

City of Fairview
Water Surface Elevations (ft)
Existing Conditions

Name	Invert Elevation ft	100-yr Max Water Elevation (ft)	50-yr Max Water Elevation (ft)	25-yr Max Water Elevation (ft)	10-yr Max Water Elevation (ft)	WQ Max Water Elevation (ft)
PrDv1	141.4	145.0	145.0	144.5	144.5	143.4
PrDv2	141.4	144.4	144.4	143.9	143.9	143.0
PrDv3	141.1	143.3	143.3	142.9	142.9	142.3
PrDv4	134	136.8	136.8	136.3	136.3	135.3
Matney	133.5	136.5	136.5	135.8	135.8	134.0
Matney1	131.1	136.7	136.7	136.0	136.0	134.1
Matney2	131	133.6	133.6	133.2	133.2	132.3
Matney3	127.3	130.4	130.4	130.0	130.0	129.1
Matney4	123.5	127.6	127.6	127.4	127.4	126.6
Matney5	120.6	124.9	124.9	124.1	124.1	122.5
FC-5LA	120.6	124.9	124.9	124.0	124.0	122.5
PrvRd2	120.6	124.8	124.8	123.9	123.9	122.4
PrvRd2-1	120	124.3	124.3	123.4	123.4	121.7
PrvRd2-2	118.4	124.2	124.2	123.3	123.3	121.5
FC-5	118.4	124.1	124.1	123.2	123.2	121.4
PrvRd3-1	118.4	124.0	124.0	123.0	123.0	121.3
PrvRd3-2	118.4	122.8	122.8	122.2	122.2	120.8
PrvRd3-3	114.4	119.0	119.0	118.6	118.6	117.7
FC-4L	114.15	117.5	117.5	116.7	116.7	115.2
BridgeSt1	113.65	117.2	117.2	116.4	116.4	115.0
BridgeSt2	109.5	111.8	111.8	111.6	111.6	110.8
BridgeSt3	104.2	107.0	107.0	106.5	106.5	105.9
BridgeSt4	95.9	98.1	98.1	97.7	97.7	97.0
BridgeSt5	90	92.5	92.5	92.2	92.2	91.4
BridgeSt6	87.4	90.1	90.1	89.6	89.6	88.7
BridgeSt7	80	84.0	84.0	83.3	83.3	81.9
BridgeSt8	77	78.7	78.7	78.5	78.5	77.9
FC-4R	75.7	78.0	78.0	77.4	77.4	76.4
FC-4	75.2	78.0	78.0	77.4	77.4	76.3
I-84-1	73.1	74.3	74.3	74.0	74.0	73.6
I-84-2	51.1	55.0	55.0	54.3	54.3	52.7
I-84-3	48	49.9	49.9	49.6	49.6	49.0
I-84-4	44	46.8	46.8	46.4	46.4	45.6
I-84-5	41	43.8	43.8	43.5	43.5	42.7
I-84-6	37	40.7	40.7	40.2	40.2	39.2
I-84-7	35.6	36.5	36.5	36.4	36.4	36.1
FC-3	31.9	34.2	34.2	33.6	33.6	32.6
Sandy	29.8	32.6	32.6	32.0	32.0	30.9
Sandy1	26.7	29.4	29.4	28.8	28.8	27.9
Sandy2	24.3	26.9	26.9	26.7	26.7	26.3
Sandy3	21.7	26.8	26.8	26.7	26.7	26.3
Sandy4	18	26.8	26.8	26.7	26.7	26.3
Sandy5	18	26.8	26.8	26.7	26.7	26.3
Sandy6	17.4	26.7	26.7	26.6	26.6	26.3
Sandy7	17.4	22.9	22.9	22.5	22.5	20.9
Sandy8	17.2	22.7	22.7	22.2	22.2	20.9
Sandy9	19.8	22.9	22.8	22.2	22.2	20.9
Sandy10	19.8	22.3	22.3	21.8	21.8	20.2
Sandy11	17	22.2	22.2	21.8	21.8	19.5
Confluence	16.4	21.6	21.6	21.2	21.2	19.5
Confluenc1	15.6	21.5	21.5	21.1	21.1	19.2
Confluenc2	14.6	19.8	19.8	19.5	19.5	17.7
FC-2	14.4	19.6	19.6	19.2	19.2	17.5
FvLake	13.6	17.7	17.7	17.5	17.5	16.3

City of Fairview
Water Surface Elevations (ft)
Existing Conditions

Name	Invert Elevation ft	100-yr Max Water Elevation (ft)	50-yr Max Water Elevation (ft)	25-yr Max Water Elevation (ft)	10-yr Max Water Elevation (ft)	WQ Max Water Elevation (ft)
FvLake1	13	17.5	17.5	17.3	17.3	16.1
FvLake2	12.5	17.5	17.5	17.2	17.2	16.1
FvLake3	12	16.5	16.5	16.2	16.2	15.1
FvLake4	11.4	16.3	16.3	16.0	16.0	15.0
FvLake5	11.3	15.1	15.1	14.9	14.9	14.3
FvLake6	10.6	14.8	14.8	14.7	14.7	14.1
FC-1R	9.5	14.7	14.7	14.6	14.6	14.1
FvLake8	9.4	14.5	14.5	14.3	14.3	14.0
FvLake9	9.7	14.2	14.2	14.1	14.1	14.0
FvLake10	8	14.1	14.1	14.1	14.1	14.0
FvLake13	7.5	14.1	14.1	14.1	14.1	14.0
FRV_LAKE	7.5	14.0	14.0	14.0	14.0	14.0
Hlsy_w1	144.2	149.4	149.4	148.7	148.7	146.9
Hlsy_w2	145.9	149.4	149.4	148.7	148.7	146.9
Hlsy_w3	145.8	149.3	149.3	148.6	148.6	146.9
Hlsy_w4	146.33	149.3	149.3	148.6	148.6	146.9
Hlsy_w5	145.84	148.0	148.0	147.9	147.9	146.9
Hlsy_w6	144.97	146.9	146.9	146.2	146.2	145.0
Fairview5	142.4	146.9	146.9	146.2	146.2	144.7

ATTACHMENT B

Fairview Creek

Existing Conditions – Flow Rates for Modeling Reaches

City of Fairview
Flow Rates for Modeling Reaches (cfs)
Existing Conditions

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Flow (cfs)	50-Year Max Flow (cfs)	25-Year Max Flow (cfs)	10-Year Max Flow (cfs)	WQ Max Flow (cfs)
2953F2000A	2953-F-011	1044	188.4	191.25	71	25	25	19	19	8
2951F0010	2951-F-001	2951-F-002	206.92	208.88	16	16	16	12	12	5
2951F0020	2951-F-002	2951-F-003	203.91	206.92	21	16	16	12	12	5
2951F0030	2951-F-003	2951-F-004	201.66	203.41	29	16	16	12	12	5
2951F0040	2951-F-004	2951-F-005	201.22	201.66	19	16	16	12	12	5
2951F0050	2951-F-005	2951-F-006	200.34	201.22	18	16	16	12	12	5
2951F0060	2951-F-006	2951-F-007	199.46	200.34	18	16	16	12	12	5
2951F0070	2951-F-007	2951-F-008	197.95	199.21	28	16	16	12	12	5
2951F0080	2951-F-008	2952-F-002	196.69	197.95	28	16	16	12	12	5
2952F0020	2952-F-002	2952-F-003	195.43	196.69	28	16	16	12	12	5
2952F0030	2952-F-003	2952-F-004	193.65	195.43	33	16	16	12	12	5
2952F0040	2952-F-004	2952-F-005	192.75	193.65	25	16	16	12	12	5
2952F0050	2952-F-005	2952-F-006	185	188	17	15	15	12	12	5
2952F0060	2952-F-006	2952-F-601	183	185	94	15	15	12	12	5
2952F2680	2952-F-601	Glisan16	176	183	2163	23	23	17	17	7
3051F2470	3051-F-247	2951-F-250	199	199	5782	1445	1445	1445	1445	1445
2951F2500	2951-F-250	2951-F-251	199	199	10452	3550	3550	3550.	3550	3550
WEIR#42	2951-F-251	2951-F-252	203.5	205.3	0	124	124	124	124	124
Fuj_1	2951-F-252	2951-F-253	203.3	203.5	0	63	63	63	63	47
Fuj_2	2951-F-252	2951-F-253	203.3	203.5	39	63	63	63	63	47
WEIR#43	2951-F-252	2951-F-253	203.3	203.5	0	0	0	0	0	0
3051F2400	3051-F-240	3051-F-241	205.5	205.5	67	133	133	85	85	26
3051F2410B	3051-F-241	2951-F-248	205.5	205.5	67	91	91	47	47	12
3051F2410A	3051-F-241	2951-F-250	205	207	37	41	41	41	41	18
WEIR#44	2951-F-248	2951-F-249	0	0.05	0	91	91	46	46	0
2951F2490	2951-F-249	2951-F-253	203.7	209.1	317	91	91	53	53	0
2951F2530A	2951-F-253	2951-F-254	203.8	203.3	16288	-127	-127	-121	-121	-78
2951F2530B	2951-F-253	2951-F-257	205.1	205.7	471	67	67	47	47	5
2951F2570	2951-F-257	2951-F-258	203.8	205.1	125	67	67	47	47	5
2951F2580	2951-F-258	2952-F-259	203.1	203.8	557	67	67	47	47	5
2952F2590	2952-F-259	2952-F-260	201.5	203.1	1002	67	67	47	47	5
2952F2600	2952-F-260	2952-F-261	200.6	201.5	949	67	67	47	47	5
2952F2610	2952-F-261	2952-F-262	199.2	200.6	4213	67	67	47	47	5
2952F2620	2952-F-262	2952-F-263	199	199.2	30	67	67	47	47	5
2952F2630	2952-F-263	2952-F-264	196.5	199	2570	67	67	47	47	5
2952F2640	2952-F-264	2952-F-265	194.6	196.5	4889	67	67	47	47	5
2952F2660	2952-F-266	Temp1	194.1	194.12	232	67	67	47	47	5
OF_1	Temp1	Gl_ovflw11	186	194.1	261	67	67	47	47	5
OF_2	Gl_ovflw11	Glisan12	184.16	186	1633	67	67	47	47	5
Glisan_1	2951-F-254	2951-F-255	203.2	203.6	0	63	63	59	59	39
Glisan_2	2951-F-254	2951-F-255	203.2	203.6	46	63	63	59	59	39
WEIR#8	2951-F-254	2951-F-255	203.2	203.6	0	0	0	0	0	0
2951F2550	2951-F-255	2951-F-260	202.6	203.2	1531	127	127	118	118	78
xsect1	2951-F-260	xsect2n	200.27	202.6	1390	127	127	118	118	78
xsect2	xsect2n	xsect3n	199.6	200.27	1181	127	127	118	118	78
xsect3	xsect3n	Glisan4	199.69	199.6	1095	-52	-52	-48	-48	-46
WEIR#51	xsect3n	W_OS_Pond	0	0.05	0	54	54	38	38	20
WEIR#54	xsect3n	1484	0	0.05	0	36	36	34	34	20
OS_Equal	W_OS_Pond	E_OS_Pond	194.5	194.5	1	14	14	13	13	7
WoutPrim	W_OS_Pond	1108	200	200.5	2	3	3	3	3	1
WoutSecn	W_OS_Pond	1108	204.25	204.5	536	0	0	0	0	0
EoutPrim	E_OS_Pond	1482	197.5	199	3	5	5	5	5	4
EoutSecn	E_OS_Pond	1482	204.25	204.5	256	0	0	0	0	0
xsect4	Glisan4	FC-8L	199.18	199.69	1369	52	52	48	48	39
xsect5	FC-8L	FC-8	199.23	199.18	131	-51	-51	-48	-48	-39
WEIR#52	FC-8L	W_OS_Pond	0	0.05	0	0	0	0	0	0
WEIR#55	FC-8L	E_OS_Pond	0	0.05	0	0	0	0	0	0
xsect6	FC-8	1108	198.74	199.23	624	104	104	79	79	39
WEIR#53	FC-8	W_OS_Pond	0	0.05	0	-50	-50	-32	-32	0
WEIR#56	FC-8	E_OS_Pond	0	0.05	0	-3	-3	0	0	0
RDL-10	RDL-J	Glisan7	197	197	268	-7	-7	-7	-7	-7
RDL_HF	Glisan7	1111	200	200.5	197	0	0	0	0	0
RDL_LF	Glisan7	1108	199	199	2	-12	-12	-11	-11	-8
2.8	1108	Glisan8	197.7	198.74	13635	105	105	81	81	38
2.75	Glisan8	Glisan9	194.5	197.7	19919	109	109	86	86	42
2.65	Glisan9	ns2.47	189.9	194.5	1823	113	113	90	90	44
2.47	ns2.47	ns9	187.6	189.9	9981	109	110	86	86	43
NS_9	ns9	N1475	187.17	187.6	2547	109	109	86	86	43
L1461	N1475	N1476	187.12	187.17	2506	109	109	86	86	43
3721.1	N1476	N1477	187.1	187.12	0	109	109	86	86	43
TargetBrg	N1476	N1477	187.1	187.12	0	0	0	0	0	0
L1463	N1477	ns8	187	187.1	7236	109	109	86	86	43

City of Fairview
Flow Rates for Modeling Reaches (cfs)
Existing Conditions

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Flow (cfs)	50-Year Max Flow (cfs)	25-Year Max Flow (cfs)	10-Year Max Flow (cfs)	WQ Max Flow (cfs)
NS_8	ns8	ns7	186.3	187	6881	109	110	86	86	43
NS_7	ns7	NS2.27	185.1	186.3	7197	109	109	86	86	43
2.27	NS2.27	Glisan12	184.16	185.1	2853	109	109	86	86	43
2.19	Glisan12	Glisan13	184	184.16	808	155	156	113	113	43
2.16	Glisan13	N1472	183	184	3259	155	156	113	113	43
ECovBrg	N1472	Glisan14	182.3	183	0	155	156	113	113	43
Estbrg	N1472	Glisan14	182.3	183	0	0	0	0	0	0
2.13	Glisan14	Glisan15	181.5	182.3	1764	155	156	112	112	43
2.06	Glisan15	N1468	180	181.5	1217	155	155	112	112	43
us_Market	N1468	N1462	180.3	180	6469	-155	-155	-112	-112	-43
Market.1	N1462	N1463	179.5	180.3	0	155	155	112	112	43
Market_rd	N1462	N1463	179.5	180.3	0	0	0	0	0	0
ds_Market	N1463	N1467	178	179.5	6869	155	155	112	112	43
NS_4	N1467	Glisan16	176	178	5251	155	155	112	112	43
NS_3	Glisan16	Glisan17	172	176	15592	156	156	116	116	44
US_park	Glisan17	PrivateRd1	171.5	172	9848	156	156	116	116	44
ParkLn	PrivateRd1	PrivateRd2	170.12	171.5	0	156	156	116	116	44
Road_Ppark	PrivateRd1	PrivateRd2	170.12	171.5	0	0	0	0	0	0
1.891	PrivateRd2	N1466	168.1	170.12	35839	156	156	116	116	44
NS_0.8	N1466	NS0.6	167.2	168.1	6231	156	156	116	116	44
NS_0.6	NS0.6	ns0.5	160	167.2	8404	156	156	116	116	44
NS_0.5	ns0.5	NS0.3	159.9	160	493	156	156	116	116	44
NS_0.4	NS0.3	N1473	156.7	159.9	2791	156	156	116	116	44
FootBrg	N1473	N1474	156.55	156.7	0	156	156	116	116	44
Footbrdg2	N1473	N1474	156.55	156.7	0	0	0	0	0	0
L1460	N1474	FC-7	155.1	156.55	2702	156	156	116	116	44
NS_0.3	FC-7	PrivateRd4	151.4	155.1	2593	165	165	127	127	48
NS0.2	PrivateRd4	Barr	151.3	151.4	1380	165	165	127	127	48
BarrSt	Barr	Barr1	151	151.3	0	165	165	127	127	48
WEIR#10	Barr	Barr1	151	151.3	0	0	0	0	0	0
1.706	Barr1	FC-6	150.5	151	454	165	165	127	127	48
PrvBldg	FC-6	Barr2	150.5	150.5	0	168	168	129	129	49
WEIR#11	FC-6	Barr2	150.5	150.5	0	0	0	0	0	0
1.701	Barr2	Barr3	149.9	150.5	6257	168	168	129	129	49
1.7	Barr3	Barr4	148.8	149.9	5228	168	168	129	129	49
1.681	Barr4	Barr5	147.6	148.8	1831	168	168	129	129	49
1.675	Barr5	FC-5R	147.4	147.6	1275	168	168	129	129	49
Halsey	FC-5R	Halsey1	146.7	147.4	0	171	171	131	131	50
WEIR#12	FC-5R	Halsey1	146.7	147.4	0	0	0	0	0	0
1.657	Halsey1	Halsey2	146.3	146.7	1333	171	171	131	131	49
1.656	Halsey2	Halsey3	145.5	146.3	2522	171	171	131	131	49
1.65	Halsey3	Halsey4	145.5	145.5	109	171	171	130	130	49
1045	1044	1042	183.27	188.19	74	25	25	19	19	8
1043	1042	1040	178.75	183.055	74	25	25	19	19	8
1041	1040	1038	175.75	178.55	71	25	25	19	19	8
1039	1038	1036	170.75	175.55	84	25	25	19	19	8
1037	1036	1034	164.98	170.53	99	25	25	19	19	8
1035	1034	1032	158.17	164.77	108	25	25	19	19	8
1033	1032	1030	151.58	157.97	97	25	25	19	19	8
1031	1030	1028	147.47	151.382	85	25	25	19	19	8
1029	1028	Halsey4	146	147.47	72	25	25	19	19	8
1.641	Halsey4	Fairview1	145.5	145.5	323	179	179	135	135	52
FrvAve1	Fairview1	Fairview2	145.5	145.5	0	179	179	135	135	51
WEIR#47	Fairview1	Fairview2	145.5	145.5	0	0	0	0	0	0
1.631	Fairview2	Fairview3	144.8	145.5	269	179	179	135	135	51
1.63	Fairview3	Fairview4	144	144.8	1218	179	179	135	135	51
1.615	Fairview4	Fairview5	142.4	144	1363	179	179	135	135	51
NN235	2953-F-605	NN_Glisan2	187.8	195.9	85	71	71	60	60	26
NN230	NN_Glisan2	NN_Glisan3	183.21	187.8	111	71	71	60	60	26
NN_Glsn_2	NN_Glisan3	NN_Glisan4	164	183.21	0	82	82	60	60	26
WEIR#35	NN_Glisan3	NN_Glisan4	164	183.21	0	0	0	0	0	0
NN_Glsn_7	NN_Glisan4	NN_Glisan5	164.1	164	0	-77	-77	-60	-60	-26
WEIR#36	NN_Glisan4	NN_Glisan5	164.1	164	0	3	3	0	0	0
NN215	NN_Glisan5	NN-6	161.5	164.1	1737	75	75	60	60	26
919	917	918	170.95	185.65	359	0	0	0	0	0
920	918	NN-6	161.5	170.95	588	0	0	0	0	0
NN210	NN-6	NN_Glisan6	160.3	161.5	902	114	114	92	92	39
NN205	NN_Glisan6	NN-5	152.66	160.3	439	110	110	91	91	39
ArataDiv1	NN-5	ArataDivA	153	153	1	10	10	12	12	9
Arata_1	NN-5	Arata1	151.76	152.44	0	36	36	35	35	31
WEIR#23	NN-5	Arata1	151.76	152.44	0	75	75	56	56	0
WEIR#46	ArataDivA	ArataDivB	151.4	153	0	311	317	333	333	9

City of Fairview
Flow Rates for Modeling Reaches (cfs)
Existing Conditions

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Flow (cfs)	50-Year Max Flow (cfs)	25-Year Max Flow (cfs)	10-Year Max Flow (cfs)	WQ Max Flow (cfs)
Hals_ABS	ArataDivC	Hlsy_w5	147.05	147.8	84	5	5	5	5	4
NN195	Arata1	Arata2	150	152	4316	110	110	92	92	31
NN190	Arata2	Arata3	147	150	16375	110	110	92	92	31
NN185	Arata3	Arata4	146.8	147	6396	111	111	95	95	31
NN180	Arata4	Hlsy_w1	144.2	146	1194	28	28	19	19	-2
NN150	Arata4	Hlsy_e1	143.82	146	1732	72	72	66	66	31
Halsey_4	Hlsy_e1	Hlsy_e2	144.16	143.82	0	-68	-68	-61	-61	-30
WEIR#25	Hlsy_e1	Hlsy_e2	144.16	143.82	0	0	0	0	0	0
NN140	Hlsy_e2	NN-4	144.1	144.16	256	67	67	61	61	30
Halsey_5	NN-4	NN_Halsey1	144.32	144.1	0	-70	-70	-63	-63	-31
WEIR#28	NN-4	NN_Halsey1	144.32	144.1	0	0	0	0	0	0
NN130	NN_Halsey1	NN_Halsey2	136	144.32	106	77	77	76	76	31
Halsey_6	NN_Halsey2	NN_Halsey3	136	136	0	71	71	67	67	31
WEIR#29	NN_Halsey2	NN_Halsey3	136	136	0	0	0	0	0	0
NN120	NN_Halsey3	NN_Halsey4	120	136	212	71	71	64	64	31
NN115	NN_Halsey4	NN_Halsey5	114.5	118.5	10953	71	71	64	64	31
NN110	NN_Halsey5	NN_Halsey6	114.5	114.5	59	70	70	63	63	31
NNBrdg_1	NN_Halsey6	NN_Bridge1	104	114.5	0	70	70	63	63	31
WEIR#30	NN_Halsey6	NN_Bridge1	104	114.5	0	0	0	0	0	0
NN100	NN_Bridge1	NN_Bridge2	92	104	9178	70	70	63	63	31
NN95	NN_Bridge2	NN_Bridge3	90	92	40257	70	70	69	69	30
NN90	NN_Bridge3	NN-3	90	90	2487	70	70	90	90	28
NNBrdg_2	NN-3	I-84	90	90	0	79	79	80	80	30
WEIR#31	NN-3	I-84	90	90	0	0	0	0	0	0
NN_I-84_1	I-84	NN_I-84-1	86	90	0	41	41	40	40	30
WEIR#32	I-84	NN_I-84-1	86	90	0	40	40	33	33	0
NN70	NN_I-84-1	NN_I-84-2	64	86	1685	81	81	73	73	30
NN65	NN_I-84-2	NN_I-84-3	38.2	64	9938	81	81	73	73	30
NN60	NN_I-84-3	NN-2	38	38.2	667	81	81	73	73	30
NN2R-RR1	NN-2R1L	NN2R-RRS	95.5	105.5	331	8	8	6	6	1
NN2R_RR	NN-2R2	NN2R-RRS	95.05	95.55	0	65	65	49	49	15
WEIR#37	NN-2R2	NN2R-RRS	95.05	95.55	0	0	0	0	0	0
NN2R2	NN2R-RRS	NN2R-RRN	91.8	95.05	249	73	73	55	55	17
NN2R3	NN2R-RRN	NN2R-I-84E	91.8	91.8	172	73	73	55	55	17
NN2R_I-84	NN2R-I-84E	NN2R-238S	88.2	91.8	0	73	73	55	55	17
WEIR#38	NN2R-I-84E	NN2R-238S	88.2	91.8	0	0	0	0	0	0
NN2R5	NN2R-238S	NN2R-238N	79.6	88.2	910	73	73	55	55	17
NN2R6	NN2R-238N	NN2R-238	79.6	79.6	77	73	73	55	55	17
NN2R_238	NN2R-238	NN2R-TSE	74	79.6	0	73	73	55	55	17
WEIR#39	NN2R-238	NN2R-TSE	74	79.6	0	0	0	0	0	0
NN2R8	NN2R-TSE	NN2R-TSW	61.4	74	285	73	73	55	55	17
NN2R9	NN2R-TSW	NN2R-WVMHP	61	61.4	23005	73	73	55	55	17
NN2R_WVHP	NN2R-WVMHP	NN-2R1	46	61	0	73	73	61	61	17
WEIR#40	NN2R-WVMHP	NN-2R1	46	61	0	0	0	0	0	0
NN2R11	NN-2R1	NN2R-AlotW	42	46	84	76	76	72	72	30
NN2R12	NN2R-AlotW	NN-2	38	42	924	75	75	71	71	30
NNSandy_1	NN-2	NN_Sandy1	37.6	38	0	55	55	55	55	29
NNSandy_2	NN-2	NN_Sandy1	37.6	38	27	55	55	55	55	29
WEIR#34	NN-2	NN_Sandy1	37.6	38	0	101	101	67	67	0
NNSandy_3	NN_Sandy1	NN-1	36	37.6	0	80	80	73	73	29
NNSandy_4	NN_Sandy1	NN-1	36	37.6	70	80	80	73	73	29
WEIR#33	NN_Sandy1	NN-1	36	37.6	0	0	0	0	0	0
NN45	NN-1	NN_Sandy2	32	36	718	165	165	150	150	58
NN40	NN_Sandy2	NN_Sandy3	22	32	17070	165	165	150	150	58
NN35	NN_Sandy3	NN_Sandy4	20	22	2879	165	165	151	151	58
NN30	NN_Sandy4	Confluence	16.4	20	5209	165	165	150	150	58
1.522	Fairview6	Fairview7	141.4	141.4	177	188	188	138	138	53
1.503	Fairview7	FC-5LB	141.4	141.4	435	188	187	138	138	53
NoName	FC-5LB	PrDv1	141.4	141.4	0	178	178	139	139	53
WEIR#13	FC-5LB	PrDv1	141.4	141.4	0	11	11	0	0	0
1.501	PrDv1	PrDv2	141.4	141.4	217	189	189	139	139	53
1.5	PrDv2	PrDv3	141.1	141.4	5217	189	189	139	139	53
1.49	PrDv3	PrDv4	134	141.1	10989	189	189	138	138	53
1.463	PrDv4	Matney	133.5	134	25232	189	189	139	139	53
MatneySt	Matney	Matney1	131.1	133.5	0	190	189	139	139	53
WEIR#14	Matney	Matney1	131.1	133.5	0	0	0	0	0	0
1.461	Matney1	Matney2	131	131.1	638	189	190	139	139	53
1.46	Matney2	Matney3	127.3	131	3382	189	189	139	139	53
1.44	Matney3	Matney4	123.5	127.3	3754	189	189	139	139	53
1.41	Matney4	Matney5	120.6	123.5	6095	189	189	140	140	53
1.368	Matney5	FC-5LA	120.6	120.6	174	189	189	139	139	53
PrvRd2.1	FC-5LA	PrvRd2	120.6	120.6	0	192	192	140	140	54

City of Fairview
Flow Rates for Modeling Reaches (cfs)
Existing Conditions

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Flow (cfs)	50-Year Max Flow (cfs)	25-Year Max Flow (cfs)	10-Year Max Flow (cfs)	WQ Max Flow (cfs)
WEIR#15	FC-5LA	PrvRd2	120.6	120.6	0	0	0	0	0	0
1.366	PrvRd2	PrvRd2-1	120	120.6	2648	192	192	140	140	54
1.36	PrvRd2-1	PrvRd2-2	118.4	120	951	192	192	140	140	54
1.343	PrvRd2-2	FC-5	118.4	118.4	472	192	192	140	140	54
PrvRd3	FC-5	PrvRd3-1	118.4	118.4	0	195	195	142	142	55
WEIR#16	FC-5	PrvRd3-1	118.4	118.4	0	0	0	0	0	0
1.341	PrvRd3-1	PrvRd3-2	118.4	118.4	148	195	195	142	142	55
1.34	PrvRd3-2	PrvRd3-3	114.4	118.4	1464	195	195	142	142	55
7385	PrvRd3-3	FC-4L	116.1	116.3	9176	195	195	142	142	55
BridgeSt	FC-4L	BridgeSt1	113.75	114.25	0	198	198	144	144	55
WEIR#17	FC-4L	BridgeSt1	113.75	114.25	0	0	0	0	0	0
7300	BridgeSt1	BridgeSt2	109.5	113.65	10668	198	198	144	144	55
7250	BridgeSt2	BridgeSt3	104.2	109.5	1330	198	198	144	144	55
7060	BridgeSt3	BridgeSt4	95.9	104.2	3162	200	199	145	145	55
6770	BridgeSt4	BridgeSt5	90	95.9	3123	198	198	144	144	55
6550	BridgeSt5	BridgeSt6	87.4	90	9506	198	198	144	144	55
6350	BridgeSt6	BridgeSt7	80	87.4	23041	198	198	144	144	55
6250	BridgeSt7	BridgeSt8	77	80	15284	199	198	144	144	55
6150	BridgeSt8	FC-4	75.2	77	61514	198	198	144	144	55
FC-4R-1	FC-4R	FC-4	75.2	75.7	21	8	8	6	6	2
I-84_1	FC-4	I-84-1	73.1	75.2	0	203	203	147	147	56
WEIR#18	FC-4	I-84-1	73.1	75.2	0	0	0	0	0	0
I-84_2	I-84-1	I-84-2	51.1	73.1	0	204	203	147	147	56
WEIR#19	I-84-1	I-84-2	51.1	73.1	0	0	0	0	0	0
5805	I-84-2	I-84-3	48	51.1	44805	204	203	147	147	56
5750	I-84-3	I-84-4	44	48	59906	204	203	147	147	56
5635	I-84-4	I-84-5	41	44	6836	203	203	147	147	56
5540	I-84-5	I-84-6	37	41	59799	203	203	147	147	56
5380	I-84-6	I-84-7	35.6	37	28483	204	203	147	147	56
5300	I-84-7	FC-3	31.9	35.6	27297	204	203	147	147	56
SandBlvd	FC-3	Sandy	29.8	31.9	0	205	205	148	148	56
WEIR#20	FC-3	Sandy	29.8	31.9	0	0	0	0	0	0
5160	Sandy	Sandy1	26.7	29.8	9621	205	205	148	148	56
5100	Sandy1	Sandy2	24.3	26.7	13864	205	205	148	148	56
4980	Sandy2	Sandy3	21.7	24.3	18693	205	205	148	148	56
4800	Sandy3	Sandy4	18	21.7	14722	205	205	148	148	56
4605	Sandy4	Sandy5	18	18	5439	205	205	148	148	56
WEIR#21	Sandy5	Sandy6	0	0	0	205	205	148	148	56
4601	Sandy6	Sandy7	25.6	25.6	2399	205	205	148	148	56
4600	Sandy7	Sandy8	17.2	17.4	6271	227	230	170	170	56
4560	Sandy8	Sandy9	19.8	17.2	74483	-274	-275	-176	-176	-56
4555	Sandy9	Sandy10	19.8	19.8	1461	249	251	161	161	56
4545	Sandy10	Sandy11	17	19.8	73856	490	489	316	316	56
4540	Sandy11	Confluence	16.4	17	8934	307	309	234	234	56
4460	Confluence	Confluenc1	15.6	16.4	13197	398	402	334	334	103
4320	Confluenc1	Confluenc2	14.6	15.6	9583	350	352	293	293	103
4000	Confluenc2	FC-2	14.4	14.6	11728	336	338	281	281	103
BlueLkRd	FC-2	FvLake	14.2	15.3	0	351	350	297	297	106
WEIR#22	FC-2	FvLake	14.2	15.3	0	0	0	0	0	0
3865	FvLake	FvLake1	13	13.6	5191	352	352	298	298	106
3740	FvLake1	FvLake2	12.5	13	4326	352	352	296	296	106
3600	FvLake2	FvLake3	12	12.5	1631	347	347	292	292	106
3300	FvLake3	FvLake4	11.4	12	2738	346	346	291	291	106
3040	FvLake4	FvLake5	11.3	11.4	945	345	345	290	290	106
2770	FvLake5	FvLake6	10.6	11.3	3571	345	345	290	290	106
2470	FvLake6	FC-1R	9.5	10.6	11243	344	344	288	288	106
1811	FC-1R	FvLake8	9.4	9.5	2187	368	368	302	302	106
1810	FvLake8	FvLake9	9.7	9.7	445	368	368	302	302	106
1789	FvLake9	FvLake10	8	9.7	9638	368	368	302	302	106
1170	FvLake10	FvLake13	7.5	8	10764	368	368	302	302	106
1070	FvLake13	FRV_LAKE	7.5	7.5	116	368	368	302	302	106
NN175	Hlsy_w1	Hlsy_w2	145.9	144.2	5723	-20	-20	-15	-15	1
Halsey_1	Hlsy_w2	Hlsy_w3	146.3	146.3	0	19	19	14	14	-1
WEIR#26	Hlsy_w2	Hlsy_w3	146.3	146.3	0	0	0	0	0	0
NN165	Hlsy_w3	Hlsy_w4	146.33	145.8	2536	-18	-18	-14	-14	1
Halsey_2	Hlsy_w4	Hlsy_w5	146.45	146.33	0	-17	-17	-14	-14	1
WEIR#27	Hlsy_w4	Hlsy_w5	146.45	146.33	0	0	0	0	0	0
Halsey_3	Hlsy_w5	Hlsy_w6	144.97	145.84	0	22	22	19	19	4
WEIR#24	Hlsy_w5	Hlsy_w6	144.97	145.84	0	0	0	0	0	0
NN151	Hlsy_w6	Fairview5	142.6	144.97	30434	21	22	19	19	4
1.552	Fairview5	Fairview6	141.4	142.4	3506	188	188	138	138	53

ATTACHMENT C

Fairview Creek

Existing Conditions – Velocity for Modeling Reaches

City of Fairview
Velocity for Modeling Reaches (fps)
Existing Conditions

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Vel. (fps)	50-Year Max Vel. (fps)	25-Year Max Vel. (fps)	10-Year Max Vel. (fps)	WQ Max Vel. (fps)
2953F2000A	2953-F-011	1044	188.4	191.25	71	8.9	8.9	8.4	8.4	6.7
2951F0010	2951-F-001	2951-F-002	206.92	208.88	16	6.0	6.0	5.7	5.7	4.6
2951F0020	2951-F-002	2951-F-003	203.91	206.92	21	7.2	7.2	6.8	6.8	5.5
2951F0030	2951-F-003	2951-F-004	201.66	203.41	29	5.0	5.0	4.7	4.7	3.8
2951F0040	2951-F-004	2951-F-005	201.22	201.66	19	4.1	4.1	3.9	3.9	3.2
2951F0050	2951-F-005	2951-F-006	200.34	201.22	18	4.1	4.1	3.8	3.8	3.1
2951F0060	2951-F-006	2951-F-007	199.46	200.34	18	4.7	4.7	4.3	4.3	3.4
2951F0070	2951-F-007	2951-F-008	197.95	199.21	28	4.8	4.8	4.5	4.5	3.6
2951F0080	2951-F-008	2952-F-002	196.69	197.95	28	4.7	4.7	4.4	4.4	3.5
2952F0020	2952-F-002	2952-F-003	195.43	196.69	28	5.0	5.0	4.6	4.6	3.6
2952F0030	2952-F-003	2952-F-004	193.65	195.43	33	4.8	4.8	4.5	4.5	3.5
2952F0040	2952-F-004	2952-F-005	192.75	193.65	25	4.8	4.8	4.4	4.4	3.4
2952F0050	2952-F-005	2952-F-006	185	188	17	2.5	2.5	2.0	2.0	1.6
2952F0060	2952-F-006	2952-F-601	183	185	94	1.0	1.0	0.9	0.9	0.8
2952F2680	2952-F-601	Glisan16	176	183	2163	3.7	3.7	3.4	3.4	2.8
3051F2470	3051-F-247	2951-F-250	199	199	5782	0.5	0.5	0.5	0.5	0.5
2951F2500	2951-F-250	2951-F-251	199	199	10452	0.9	0.9	0.9	0.9	0.9
WEIR#42	2951-F-251	2951-F-252	203.5	205.3	0	0.0	0.0	0.0	0.0	0.0
Fuj_1	2951-F-252	2951-F-253	203.3	203.5	0	9.3	9.3	9.3	9.3	9.3
Fuj_2	2951-F-252	2951-F-253	203.3	203.5	39	9.3	9.3	9.3	9.3	9.3
WEIR#43	2951-F-252	2951-F-253	203.3	203.5	0	0.0	0.0	0.0	0.0	0.0
3051F2400	3051-F-240	3051-F-241	205.5	205.5	67	6.8	6.8	5.0	5.0	3.2
3051F2410B	3051-F-241	2951-F-248	205.5	205.5	67	4.7	4.7	2.5	2.5	1.8
3051F2410A	3051-F-241	2951-F-250	205	207	37	8.4	8.4	8.2	8.2	6.8
WEIR#44	2951-F-248	2951-F-249	0	0.05	0	0.0	0.0	0.0	0.0	0.0
2951F2490	2951-F-249	2951-F-253	203.7	209.1	317	1.1	1.1	0.8	0.8	0.0
2951F2530A	2951-F-253	2951-F-254	203.8	203.3	16288	-2.7	-2.7	-2.7	-2.7	-2.7
2951F2530B	2951-F-253	2951-F-257	205.1	205.7	471	0.9	0.9	0.7	0.7	0.3
2951F2570	2951-F-257	2951-F-258	203.8	205.1	125	1.6	1.6	1.5	1.5	1.3
2951F2580	2951-F-258	2952-F-259	203.1	203.8	557	3.0	3.0	3.0	3.0	1.6
2952F2590	2952-F-259	2952-F-260	201.5	203.1	1002	3.6	3.6	3.2	3.2	1.8
2952F2600	2952-F-260	2952-F-261	200.6	201.5	949	4.3	4.3	4.2	4.2	2.2
2952F2610	2952-F-261	2952-F-262	199.2	200.6	4213	3.4	3.4	3.4	3.4	2.2
2952F2620	2952-F-262	2952-F-263	199	199.2	30	9.8	9.8	7.3	7.3	3.2
2952F2630	2952-F-263	2952-F-264	196.5	199	2570	4.8	4.8	4.7	4.7	2.6
2952F2640	2952-F-264	2952-F-265	194.6	196.5	4889	2.4	2.4	2.5	2.5	1.9
2952F2660	2952-F-266	Temp1	194.1	194.12	232	10.7	10.7	9.3	9.3	3.6
OF_1	Temp1	Gl_ovflw11	186	194.1	261	2.8	2.8	2.8	2.8	1.6
OF_2	Gl_ovflw11	Glisan12	184.16	186	1633	0.3	0.3	0.2	0.2	0.1
Glisan_1	2951-F-254	2951-F-255	203.2	203.6	0	6.6	6.6	6.5	6.5	5.6
Glisan_2	2951-F-254	2951-F-255	203.2	203.6	46	6.6	6.6	6.5	6.5	5.6
WEIR#8	2951-F-254	2951-F-255	203.2	203.6	0	0.0	0.0	0.0	0.0	0.0
2951F2550	2951-F-255	2951-F-260	202.6	203.2	1531	5.4	5.4	5.3	5.3	4.3
xsect1	2951-F-260	xsect2n	200.27	202.6	1390	4.8	4.8	4.7	4.7	4.5
xsect2	xsect2n	xsect3n	199.6	200.27	1181	3.5	3.5	3.5	3.5	3.5
xsect3	xsect3n	Glisan4	199.69	199.6	1095	-4.0	-4.0	-4.0	-4.0	-4.0
WEIR#51	xsect3n	W_OS_Pond	0	0.05	0	0.0	0.0	0.0	0.0	0.0
WEIR#54	xsect3n	1484	0	0.05	0	0.0	0.0	0.0	0.0	0.0
OS_Equal	W_OS_Pond	E_OS_Pond	194.5	194.5	1	2.9	2.9	2.6	2.6	1.3
WoutPrim	W_OS_Pond	1108	200	200.5	2	4.2	4.2	4.4	4.4	2.2
WoutSecn	W_OS_Pond	1108	204.25	204.5	536	0.0	0.0	0.0	0.0	0.0
EoutPrim	E_OS_Pond	1482	197.5	199	3	6.5	6.5	6.3	6.3	5.0
EoutSecn	E_OS_Pond	1482	204.25	204.5	256	0.0	0.0	0.0	0.0	0.0
xsect4	Glisan4	FC-8L	199.18	199.69	1369	2.8	2.8	2.8	2.8	2.8
xsect5	FC-8L	FC-8	199.23	199.18	131	-2.7	-2.7	-2.7	-2.7	-2.7
WEIR#52	FC-8L	W_OS_Pond	0	0.05	0	0.0	0.0	0.0	0.0	0.0
WEIR#55	FC-8L	E_OS_Pond	0	0.05	0	0.0	0.0	0.0	0.0	0.0
xsect6	FC-8	1108	198.74	199.23	624	3.7	3.7	3.5	3.5	3.1
WEIR#53	FC-8	W_OS_Pond	0	0.05	0	0.0	0.0	0.0	0.0	0.0
WEIR#56	FC-8	E_OS_Pond	0	0.05	0	0.0	0.0	0.0	0.0	0.0
RDL-10	RDL-J	Glisan7	197	197	268	-0.9	-0.9	-0.9	-0.9	-0.9
RDL_HF	Glisan7	1111	200	200.5	197	1.1	1.1	1.1	1.1	0.9
RDL_LF	Glisan7	1108	199	199	2	-4.7	-4.7	-4.5	-4.5	-4.0
2.8	1108	Glisan8	197.7	198.74	13635	3.8	3.8	3.6	3.6	2.9
2.75	Glisan8	Glisan9	194.5	197.7	19919	2.0	2.0	2.0	2.0	2.0
2.65	Glisan9	ns2.47	189.9	194.5	1823	1.7	1.7	1.7	1.7	1.7
2.47	ns2.47	ns9	187.6	189.9	9981	1.5	1.5	1.5	1.5	1.5
NS_9	ns9	N1475	187.17	187.6	2547	1.4	1.4	1.4	1.4	1.3
L1461	N1475	N1476	187.12	187.17	2506	2.2	2.2	2.2	2.2	2.2
3721.1	N1476	N1477	187.1	187.12	0	2.4	2.4	2.0	2.0	1.3
TargetBrg	N1476	N1477	187.1	187.12	0	0.0	0.0	0.0	0.0	0.0
L1463	N1477	ns8	187	187.1	7236	1.2	1.2	1.2	1.2	1.2

City of Fairview
Velocity for Modeling Reaches (fps)
Existing Conditions

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Vel. (fps)	50-Year Max Vel. (fps)	25-Year Max Vel. (fps)	10-Year Max Vel. (fps)	WQ Max Vel. (fps)
NS_8	ns8	ns7	186.3	187	6881	1.2	1.2	1.2	1.2	1.2
NS_7	ns7	NS2.27	185.1	186.3	7197	1.4	1.4	1.4	1.4	1.4
2.27	NS2.27	Glisan12	184.16	185.1	2853	1.3	1.3	1.4	1.4	1.4
2.19	Glisan12	Glisan13	184	184.16	808	2.0	2.0	1.8	1.8	1.4
2.16	Glisan13	N1472	183	184	3259	3.7	3.7	3.6	3.6	3.1
ECovBrg	N1472	Glisan14	182.3	183	0	5.5	5.5	4.9	4.9	4.1
Estbrg	N1472	Glisan14	182.3	183	0	0.0	0.0	0.0	0.0	0.0
2.13	Glisan14	Glisan15	181.5	182.3	1764	0.7	0.7	0.6	0.6	0.5
2.06	Glisan15	N1468	180	181.5	1217	1.3	1.3	1.2	1.2	0.9
us_Market	N1468	N1462	180.3	180	6469	-3.5	-3.5	-3.3	-3.3	-2.4
Market.1	N1462	N1463	179.5	180.3	0	7.2	7.2	6.6	6.6	5.7
Market_rd	N1462	N1463	179.5	180.3	0	0.0	0.0	0.0	0.0	0.0
ds_Market	N1463	N1467	178	179.5	6869	4.5	4.5	4.1	4.1	3.1
NS_4	N1467	Glisan16	176	178	5251	4.0	4.0	3.6	3.6	2.5
NS_3	Glisan16	Glisan17	172	176	15592	1.6	1.6	1.5	1.5	1.3
US_park	Glisan17	PrivateRd1	171.5	172	9848	6.8	6.8	6.0	6.0	3.9
ParkLn	PrivateRd1	PrivateRd2	170.12	171.5	0	5.6	5.6	5.1	5.1	3.2
Road_Ppark	PrivateRd1	PrivateRd2	170.12	171.5	0	0.0	0.0	0.0	0.0	0.0
1.891	PrivateRd2	N1466	168.1	170.12	35839	5.2	5.2	4.7	4.7	3.5
NS_0.8	N1466	NS0.6	167.2	168.1	6231	3.3	3.3	3.1	3.1	2.5
NS_0.6	NS0.6	ns0.5	160	167.2	8404	1.3	1.3	1.1	1.1	0.8
NS_0.5	ns0.5	NS0.3	159.9	160	493	1.7	1.7	1.5	1.5	1.1
NS_0.4	NS0.3	N1473	156.7	159.9	2791	2.2	2.2	2.1	2.1	2.1
FootBrg	N1473	N1474	156.55	156.7	0	3.7	3.7	2.8	2.8	1.2
Footbrdg2	N1473	N1474	156.55	156.7	0	0.0	0.0	0.0	0.0	0.0
L1460	N1474	FC-7	155.1	156.55	2702	3.4	3.4	3.2	3.2	2.8
NS_0.3	FC-7	PrivateRd4	151.4	155.1	2593	1.4	1.4	1.2	1.2	0.8
NS0.2	PrivateRd4	Barr	151.3	151.4	1380	3.0	3.0	3.0	3.0	2.8
BarrSt	Barr	Barr1	151	151.3	0	5.1	5.1	4.4	4.4	2.5
WEIR#10	Barr	Barr1	151	151.3	0	0.0	0.0	0.0	0.0	0.0
1.706	Barr1	FC-6	150.5	151	454	7.4	7.4	7.4	7.4	6.8
PrvBldg	FC-6	Barr2	150.5	150.5	0	6.4	6.4	6.0	6.0	4.2
WEIR#11	FC-6	Barr2	150.5	150.5	0	0.0	0.0	0.0	0.0	0.0
1.701	Barr2	Barr3	149.9	150.5	6257	5.7	5.7	5.5	5.5	3.7
1.7	Barr3	Barr4	148.8	149.9	5228	3.7	3.7	3.7	3.7	2.9
1.681	Barr4	Barr5	147.6	148.8	1831	3.3	3.3	3.3	3.3	3.2
1.675	Barr5	FC-5R	147.4	147.6	1275	5.7	5.7	5.8	5.8	5.9
Halsey	FC-5R	Halsey1	146.7	147.4	0	2.2	2.2	1.9	1.9	1.4
WEIR#12	FC-5R	Halsey1	146.7	147.4	0	0.0	0.0	0.0	0.0	0.0
1.657	Halsey1	Halsey2	146.3	146.7	1333	9.6	9.6	8.8	8.8	6.4
1.656	Halsey2	Halsey3	145.5	146.3	2522	1.7	1.7	1.7	1.7	1.5
1.65	Halsey3	Halsey4	145.5	145.5	109	1.8	1.8	1.7	1.7	1.6
1045	1044	1042	183.27	188.19	74	9.2	9.2	8.7	8.7	6.9
1043	1042	1040	178.75	183.055	74	9.2	9.2	8.6	8.6	6.9
1041	1040	1038	175.75	178.55	71	8.8	8.8	8.3	8.3	6.6
1039	1038	1036	170.75	175.55	84	10.1	10.1	9.4	9.4	7.5
1037	1036	1034	164.98	170.53	99	11.3	11.3	10.6	10.6	8.4
1035	1034	1032	158.17	164.77	108	12.1	12.1	11.3	11.3	9.0
1033	1032	1030	151.58	157.97	97	11.1	11.1	10.4	10.4	8.3
1031	1030	1028	147.47	151.382	85	8.5	8.5	8.1	8.1	7.3
1029	1028	Halsey4	146	147.47	72	6.3	6.3	5.9	5.9	4.7
1.641	Halsey4	Fairview1	145.5	145.5	323	2.1	2.1	2.0	2.0	1.7
FrvAve1	Fairview1	Fairview2	145.5	145.5	0	2.3	2.3	2.0	2.0	1.2
WEIR#47	Fairview1	Fairview2	145.5	145.5	0	0.0	0.0	0.0	0.0	0.0
1.631	Fairview2	Fairview3	144.8	145.5	269	9.6	9.6	8.7	8.7	6.2
1.63	Fairview3	Fairview4	144	144.8	1218	3.8	3.8	3.6	3.6	2.8
1.615	Fairview4	Fairview5	142.4	144	1363	3.0	3.0	2.8	2.8	2.2
NN235	2953-F-605	NN_Glisan2	187.8	195.9	85	3.4	3.4	3.1	3.1	3.1
NN230	NN_Glisan2	NN_Glisan3	183.21	187.8	111	5.1	5.1	4.7	4.7	4.3
NN_Glsn_2	NN_Glisan3	NN_Glisan4	164	183.21	0	11.9	11.9	8.8	8.8	5.7
WEIR#35	NN_Glisan3	NN_Glisan4	164	183.21	0	0.0	0.0	0.0	0.0	0.0
NN_Glsn_7	NN_Glisan4	NN_Glisan5	164.1	164	0	-13.5	-13.5	-10.7	-10.7	-5.3
WEIR#36	NN_Glisan4	NN_Glisan5	164.1	164	0	0.0	0.0	0.0	0.0	0.0
NN215	NN_Glisan5	NN-6	161.5	164.1	1737	4.2	4.2	3.9	3.9	3.2
919	917	918	170.95	185.65	359	0.0	0.0	0.0	0.0	0.0
920	918	NN-6	161.5	170.95	588	0.0	0.0	0.0	0.0	0.0
NN210	NN-6	NN_Glisan6	160.3	161.5	902	4.1	4.1	3.8	3.8	2.8
NN205	NN_Glisan6	NN-5	152.66	160.3	439	2.9	2.9	2.7	2.7	2.7
ArataDiv1	NN-5	ArataDivA	153	153	1	0.5	0.5	0.6	0.6	0.4
Arata_1	NN-5	Arata1	151.76	152.44	0	16.2	16.2	16.0	16.0	14.1
WEIR#23	NN-5	Arata1	151.76	152.44	0	0.0	0.0	0.0	0.0	0.0
WEIR#46	ArataDivA	ArataDivB	151.4	153	0	0.0	0.0	0.0	0.0	0.0

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Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Vel. (fps)	50-Year Max Vel. (fps)	25-Year Max Vel. (fps)	10-Year Max Vel. (fps)	WQ Max Vel. (fps)
Hals_ABS	ArataDivC	Hlsy_w5	147.05	147.8	84	6.0	6.0	6.0	6.0	5.9
NN195	Arata1	Arata2	150	152	4316	2.3	2.3	2.3	2.3	2.2
NN190	Arata2	Arata3	147	150	16375	4.3	4.3	4.3	4.3	3.8
NN185	Arata3	Arata4	146.8	147	6396	5.2	5.2	5.3	5.3	4.5
NN180	Arata4	Hlsy_w1	144.2	146	1194	0.3	0.3	0.3	0.3	0.2
NN150	Arata4	Hlsy_e1	143.82	146	1732	0.3	0.3	0.3	0.3	0.2
Halsey_4	Hlsy_e1	Hlsy_e2	144.16	143.82	0	-9.6	-9.6	-8.6	-8.6	-4.5
WEIR#25	Hlsy_e1	Hlsy_e2	144.16	143.82	0	0.0	0.0	0.0	0.0	0.0
NN140	Hlsy_e2	NN-4	144.1	144.16	256	1.1	1.1	1.0	1.0	1.1
Halsey_5	NN-4	NN_Halsey1	144.32	144.1	0	-12.4	-12.4	-11.4	-11.4	-7.2
WEIR#28	NN-4	NN_Halsey1	144.32	144.1	0	0.0	0.0	0.0	0.0	0.0
NN130	NN_Halsey1	NN_Halsey2	136	144.32	106	6.3	6.3	6.3	6.3	3.8
Halsey_6	NN_Halsey2	NN_Halsey3	136	136	0	11.8	11.8	11.5	11.5	8.3
WEIR#29	NN_Halsey2	NN_Halsey3	136	136	0	0.0	0.0	0.0	0.0	0.0
NN120	NN_Halsey3	NN_Halsey4	120	136	212	5.6	5.6	5.4	5.4	4.5
NN115	NN_Halsey4	NN_Halsey5	114.5	118.5	10953	2.9	2.9	2.9	2.9	2.9
NN110	NN_Halsey5	NN_Halsey6	114.5	114.5	59	2.3	2.3	2.3	2.3	2.3
NNBrdg_1	NN_Halsey6	NN_Bridge1	104	114.5	0	16.2	16.2	15.9	15.9	13.5
WEIR#30	NN_Halsey6	NN_Bridge1	104	114.5	0	0.0	0.0	0.0	0.0	0.0
NN100	NN_Bridge1	NN_Bridge2	92	104	9178	2.7	2.7	2.7	2.7	2.7
NN95	NN_Bridge2	NN_Bridge3	90	92	40257	1.4	1.4	1.4	1.4	1.4
NN90	NN_Bridge3	NN-3	90	90	2487	1.4	1.4	1.4	1.4	1.4
NNBrdg_2	NN-3	I-84	90	90	0	6.3	6.3	6.4	6.4	3.6
WEIR#31	NN-3	I-84	90	90	0	0.0	0.0	0.0	0.0	0.0
NN_I-84_1	I-84	NN_I-84-1	86	90	0	14.2	14.2	14.1	14.1	12.6
WEIR#32	I-84	NN_I-84-1	86	90	0	0.0	0.0	0.0	0.0	0.0
NN70	NN_I-84-1	NN_I-84-2	64	86	1685	2.9	2.9	2.8	2.8	2.1
NN65	NN_I-84-2	NN_I-84-3	38.2	64	9938	4.2	4.2	4.3	4.3	4.2
NN60	NN_I-84-3	NN-2	38	38.2	667	3.5	3.5	3.1	3.1	3.1
NN2R-RR1	NN-2R1L	NN2R-RRS	95.5	105.5	331	1.4	1.4	1.3	1.3	1.2
NN2R_RR	NN-2R2	NN2R-RRS	95.05	95.55	0	11.6	11.6	10.7	10.7	8.3
WEIR#37	NN-2R2	NN2R-RRS	95.05	95.55	0	0.0	0.0	0.0	0.0	0.0
NN2R2	NN2R-RRS	NN2R-RRN	91.8	95.05	249	5.1	5.1	4.5	4.5	2.9
NN2R3	NN2R-RRN	NN2R-I-84E	91.8	91.8	172	5.4	5.4	5.4	5.4	4.6
NN2R_I-84	NN2R-I-84E	NN2R-238S	88.2	91.8	0	13.9	13.9	13.0	13.0	9.7
WEIR#38	NN2R-I-84E	NN2R-238S	88.2	91.8	0	0.0	0.0	0.0	0.0	0.0
NN2R5	NN2R-238S	NN2R-238N	79.6	88.2	910	3.5	3.5	3.1	3.1	1.9
NN2R6	NN2R-238N	NN2R-238	79.6	79.6	77	6.0	6.0	5.5	5.5	3.5
NN2R_238	NN2R-238	NN2R-TSE	74	79.6	0	10.5	10.5	8.7	8.7	5.4
WEIR#39	NN2R-238	NN2R-TSE	74	79.6	0	0.0	0.0	0.0	0.0	0.0
NN2R8	NN2R-TSE	NN2R-TSW	61.4	74	285	4.6	4.6	4.2	4.2	3.0
NN2R9	NN2R-TSW	NN2R-WVMHP	61	61.4	23005	27.6	26.9	25.2	25.2	7.0
NN2R_WVHP	NN2R-WVMHP	NN-2R1	46	61	0	10.7	10.7	10.6	10.6	3.8
WEIR#40	NN2R-WVMHP	NN-2R1	46	61	0	0.0	0.0	0.0	0.0	0.0
NN2R11	NN-2R1	NN2R-AlotW	42	46	84	3.0	3.0	2.9	2.9	2.4
NN2R12	NN2R-AlotW	NN-2	38	42	924	4.2	4.2	4.1	4.1	3.7
NNSandy_1	NN-2	NN_Sandy1	37.6	38	0	11.0	11.0	11.0	11.0	7.5
NNSandy_2	NN-2	NN_Sandy1	37.6	38	27	11.0	11.0	11.0	11.0	7.5
WEIR#34	NN-2	NN_Sandy1	37.6	38	0	0.0	0.0	0.0	0.0	0.0
NNSandy_3	NN_Sandy1	NN-1	36	37.6	0	8.1	8.1	7.3	7.3	5.6
NNSandy_4	NN_Sandy1	NN-1	36	37.6	70	8.1	8.1	7.3	7.3	5.6
WEIR#33	NN_Sandy1	NN-1	36	37.6	0	0.0	0.0	0.0	0.0	0.0
NN45	NN-1	NN_Sandy2	32	36	718	5.1	5.1	4.9	4.9	3.5
NN40	NN_Sandy2	NN_Sandy3	22	32	17070	4.2	4.2	4.1	4.1	2.7
NN35	NN_Sandy3	NN_Sandy4	20	22	2879	5.7	5.7	5.6	5.6	4.4
NN30	NN_Sandy4	Confluence	16.4	20	5209	2.1	2.1	2.1	2.1	1.6
1.522	Fairview6	Fairview7	141.4	141.4	177	2.0	2.0	2.0	2.0	1.9
1.503	Fairview7	FC-5LB	141.4	141.4	435	1.8	1.8	1.8	1.8	1.6
NoName	FC-5LB	PrDv1	141.4	141.4	0	14.5	14.5	11.8	11.8	7.3
WEIR#13	FC-5LB	PrDv1	141.4	141.4	0	0.0	0.0	0.0	0.0	0.0
1.501	PrDv1	PrDv2	141.4	141.4	217	7.8	7.8	6.8	6.8	4.5
1.5	PrDv2	PrDv3	141.1	141.4	5217	4.7	4.7	4.7	4.7	3.6
1.49	PrDv3	PrDv4	134	141.1	10989	5.6	5.6	5.6	5.6	4.2
1.463	PrDv4	Matney	133.5	134	25232	5.3	5.3	5.3	5.3	5.1
MatneySt	Matney	Matney1	131.1	133.5	0	5.0	5.0	4.5	4.5	3.7
WEIR#14	Matney	Matney1	131.1	133.5	0	0.0	0.0	0.0	0.0	0.0
1.461	Matney1	Matney2	131	131.1	638	9.3	9.3	7.9	7.9	5.2
1.46	Matney2	Matney3	127.3	131	3382	4.3	4.3	3.9	3.9	2.7
1.44	Matney3	Matney4	123.5	127.3	3754	2.2	2.2	1.8	1.8	1.2
1.41	Matney4	Matney5	120.6	123.5	6095	2.1	2.1	2.1	2.1	2.1
1.368	Matney5	FC-5LA	120.6	120.6	174	2.8	2.8	2.8	2.8	2.3
PrvRd2.1	FC-5LA	PrvRd2	120.6	120.6	0	3.8	3.8	3.5	3.5	2.4

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Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Vel. (fps)	50-Year Max Vel. (fps)	25-Year Max Vel. (fps)	10-Year Max Vel. (fps)	WQ Max Vel. (fps)
WEIR#15	FC-5LA	PrvRd2	120.6	120.6	0	0.0	0.0	0.0	0.0	0.0
1.366	PrvRd2	PrvRd2-1	120	120.6	2648	5.1	5.1	4.8	4.8	3.9
1.36	PrvRd2-1	PrvRd2-2	118.4	120	951	2.2	2.2	2.2	2.2	1.9
1.343	PrvRd2-2	FC-5	118.4	118.4	472	3.6	3.6	3.6	3.6	3.1
PrvRd3	FC-5	PrvRd3-1	118.4	118.4	0	4.1	4.1	3.0	3.0	1.5
WEIR#16	FC-5	PrvRd3-1	118.4	118.4	0	0.0	0.0	0.0	0.0	0.0
1.341	PrvRd3-1	PrvRd3-2	118.4	118.4	148	9.2	9.2	9.1	9.1	6.4
1.34	PrvRd3-2	PrvRd3-3	114.4	118.4	1464	5.8	5.8	5.2	5.2	3.5
7385	PrvRd3-3	FC-4L	116.1	116.3	9176	3.6	3.6	3.6	3.6	3.1
BridgeSt	FC-4L	BridgeSt1	113.75	114.25	0	5.9	5.9	5.7	5.7	5.3
WEIR#17	FC-4L	BridgeSt1	113.75	114.25	0	0.0	0.0	0.0	0.0	0.0
7300	BridgeSt1	BridgeSt2	109.5	113.65	10668	12.2	12.2	10.9	10.9	7.8
7250	BridgeSt2	BridgeSt3	104.2	109.5	1330	4.8	4.8	4.5	4.5	3.6
7060	BridgeSt3	BridgeSt4	95.9	104.2	3162	4.7	4.7	4.6	4.6	3.5
6770	BridgeSt4	BridgeSt5	90	95.9	3123	4.8	4.8	4.3	4.3	3.0
6550	BridgeSt5	BridgeSt6	87.4	90	9506	4.0	4.0	3.8	3.8	2.9
6350	BridgeSt6	BridgeSt7	80	87.4	23041	4.8	4.8	4.8	4.8	4.5
6250	BridgeSt7	BridgeSt8	77	80	15284	8.8	8.8	7.8	7.8	5.5
6150	BridgeSt8	FC-4	75.2	77	61514	4.0	4.0	3.8	3.8	3.4
FC-4R-1	FC-4R	FC-4	75.2	75.7	21	2.9	2.9	2.7	2.7	2.0
I-84_1	FC-4	I-84-1	73.1	75.2	0	16.5	16.5	14.9	14.9	10.9
WEIR#18	FC-4	I-84-1	73.1	75.2	0	0.0	0.0	0.0	0.0	0.0
I-84_2	I-84-1	I-84-2	51.1	73.1	0	14.1	14.1	12.7	12.7	9.3
WEIR#19	I-84-1	I-84-2	51.1	73.1	0	0.0	0.0	0.0	0.0	0.0
5805	I-84-2	I-84-3	48	51.1	44805	11.6	11.6	10.3	10.3	7.2
5750	I-84-3	I-84-4	44	48	59906	4.9	4.9	4.4	4.4	3.0
5635	I-84-4	I-84-5	41	44	6836	5.3	5.3	4.9	4.9	4.0
5540	I-84-5	I-84-6	37	41	59799	3.0	3.0	2.9	2.9	2.6
5380	I-84-6	I-84-7	35.6	37	28483	6.2	6.2	6.2	6.2	4.8
5300	I-84-7	FC-3	31.9	35.6	27297	3.2	3.2	3.2	3.2	3.1
SandBlvd	FC-3	Sandy	29.8	31.9	0	13.7	13.7	12.9	12.9	10.6
WEIR#20	FC-3	Sandy	29.8	31.9	0	0.0	0.0	0.0	0.0	0.0
5160	Sandy	Sandy1	26.7	29.8	9621	12.4	12.4	11.4	11.4	7.9
5100	Sandy1	Sandy2	24.3	26.7	13864	9.4	9.4	8.9	8.9	5.3
4980	Sandy2	Sandy3	21.7	24.3	18693	3.3	3.3	3.2	3.2	3.6
4800	Sandy3	Sandy4	18	21.7	14722	1.3	1.3	1.2	1.2	0.9
4605	Sandy4	Sandy5	18	18	5439	0.6	0.6	0.5	0.5	0.3
WEIR#21	Sandy5	Sandy6	0	0	0	0.0	0.0	0.0	0.0	0.0
4601	Sandy6	Sandy7	25.6	25.6	2399	4.9	4.9	4.4	4.4	3.3
4600	Sandy7	Sandy8	17.2	17.4	6271	6.3	6.3	5.3	5.3	2.5
4560	Sandy8	Sandy9	19.8	17.2	74483	-6.6	-6.5	-4.9	-4.9	-2.2
4555	Sandy9	Sandy10	19.8	19.8	1461	16.7	16.8	13.3	13.3	8.3
4545	Sandy10	Sandy11	17	19.8	73856	5.6	5.8	5.6	5.6	5.3
4540	Sandy11	Confluence	16.4	17	8934	5.3	5.3	4.5	4.5	3.0
4460	Confluence	Confluenc1	15.6	16.4	13197	2.5	2.5	2.4	2.4	2.3
4320	Confluenc1	Confluenc2	14.6	15.6	9583	3.7	3.7	3.7	3.7	3.5
4000	Confluenc2	FC-2	14.4	14.6	11728	4.6	4.6	4.5	4.5	3.5
BlueLkRd	FC-2	FvLake	14.2	15.3	0	13.1	13.1	12.4	12.4	9.2
WEIR#22	FC-2	FvLake	14.2	15.3	0	0.0	0.0	0.0	0.0	0.0
3865	FvLake	FvLake1	13	13.6	5191	2.8	2.8	2.7	2.7	2.0
3740	FvLake1	FvLake2	12.5	13	4326	1.4	1.4	1.4	1.4	1.3
3600	FvLake2	FvLake3	12	12.5	1631	3.1	3.1	3.1	3.1	2.7
3300	FvLake3	FvLake4	11.4	12	2738	2.3	2.3	2.1	2.1	1.4
3040	FvLake4	FvLake5	11.3	11.4	945	3.9	3.9	3.6	3.6	2.4
2770	FvLake5	FvLake6	10.6	11.3	3571	1.9	1.9	1.8	1.8	1.1
2470	FvLake6	FC-1R	9.5	10.6	11243	0.8	0.8	0.7	0.7	0.4
1811	FC-1R	FvLake8	9.4	9.5	2187	1.8	1.8	1.6	1.6	0.8
1810	FvLake8	FvLake9	9.7	9.7	445	4.6	4.6	3.9	3.9	1.5
1789	FvLake9	FvLake10	8	9.7	9638	1.6	1.6	1.4	1.4	0.5
1170	FvLake10	FvLake13	7.5	8	10764	0.5	0.5	0.4	0.4	0.1
1070	FvLake13	FRV_LAKE	7.5	7.5	116	4.7	4.7	3.8	3.8	1.4
NN175	Hlsy_w1	Hlsy_w2	145.9	144.2	5723	-0.2	-0.2	-0.2	-0.2	0.0
Halsey_1	Hlsy_w2	Hlsy_w3	146.3	146.3	0	2.7	2.7	2.5	2.5	-1.7
WEIR#26	Hlsy_w2	Hlsy_w3	146.3	146.3	0	0.0	0.0	0.0	0.0	0.0
NN165	Hlsy_w3	Hlsy_w4	146.33	145.8	2536	0.8	0.8	-0.7	-0.7	0.6
Halsey_2	Hlsy_w4	Hlsy_w5	146.45	146.33	0	-9.8	-9.8	-8.2	-8.2	2.1
WEIR#27	Hlsy_w4	Hlsy_w5	146.45	146.33	0	0.0	0.0	0.0	0.0	0.0
Halsey_3	Hlsy_w5	Hlsy_w6	144.97	145.84	0	8.2	8.2	8.3	8.3	4.2
WEIR#24	Hlsy_w5	Hlsy_w6	144.97	145.84	0	0.0	0.0	0.0	0.0	0.0
NN151	Hlsy_w6	Fairview5	142.6	144.97	30434	0.0	0.0	0.0	0.0	0.0
1.552	Fairview5	Fairview6	141.4	142.4	3506	1.9	1.9	1.9	1.9	1.9

ATTACHMENT D

Fairview Creek

Future Conditions – Water Surface Elevations

City of Fairview
Water Surface Elevations
Future Conditions

Name	Invert Elevation ft	100-yr Max Water Elevation (ft)	50-yr Max Water Elevation (ft)	25-yr Max Water Elevation (ft)	10-yr Max Water Elevation (ft)	WQ Max Water Elevation (ft)
2953-F-011	191.25	193.6	193.5	193.2	193.1	192.4
2951-F-001	208.88	213.0	211.8	211.0	210.6	209.9
2951-F-002	206.92	209.2	208.6	208.4	208.2	207.8
2951-F-003	203.41	205.9	205.2	204.8	204.7	204.3
2951-F-004	201.66	204.8	204.2	203.7	203.5	202.8
2951-F-005	201.22	204.2	203.6	203.2	203.0	202.3
2951-F-006	200.34	202.9	202.6	202.3	202.2	201.5
2951-F-007	199.21	201.1	201.0	200.8	200.7	200.2
2951-F-008	197.95	199.9	199.7	199.5	199.4	198.9
2952-F-002	196.69	199.1	198.5	198.3	198.2	197.7
2952-F-003	195.43	198.5	197.3	196.8	196.7	196.3
2952-F-004	193.65	197.9	196.7	195.4	195.3	194.7
2952-F-005	188	197.3	196.2	194.3	193.1	190.4
2952-F-006	185	186.6	186.6	186.5	186.5	186.1
2952-F-601	183	185.8	185.7	185.5	185.4	184.8
2951-F-250	199	208.3	208.2	208.1	208.0	206.9
2951-F-251	199	208.3	208.2	208.1	208.0	206.9
2951-F-252	203.5	208.3	208.2	208.1	208.0	206.9
3051-F-241	205.5	210.4	210.3	210.2	210.1	208.5
2951-F-248	205.5	210.3	210.2	210.1	210.1	208.5
2951-F-249	209.1	209.9	209.7	209.2	209.1	209.1
2951-F-253	203.3	207.4	207.3	207.2	207.1	206.4
2951-F-257	205.1	207.1	207.0	206.8	206.8	206.2
2951-F-258	203.8	206.4	206.3	206.1	206.0	204.7
2952-F-259	203.1	205.5	205.4	205.2	205.1	204.0
2952-F-260	201.5	204.1	204.0	203.8	203.7	202.5
2952-F-261	200.6	203.5	203.0	202.4	202.2	201.3
2952-F-262	199.2	203.5	203.0	202.3	202.1	200.3
2952-F-263	199	201.7	201.6	201.3	201.2	200.0
2952-F-264	196.5	199.6	199.3	198.9	198.7	197.5
2952-F-265	194.6	199.4	199.0	198.5	198.2	195.8
2952-F-266	194.12	198.9	198.6	198.1	197.8	195.7
Temp1	194.1	196.9	196.7	196.5	196.3	195.1
GI_ovflw11	186	188.3	188.2	188.1	187.9	186.8
2951-F-254	203.6	207.4	207.3	207.1	207.1	206.4
2951-F-255	203.2	205.8	205.8	205.7	205.7	205.2
2951-F-260	202.6	205.6	205.6	205.5	205.5	205.1
xsect2n	200.27	203.8	203.8	203.8	203.7	203.3
xsect3n	199.6	202.9	202.9	202.8	202.7	202.4
W_OS_Pond	194.5	202.8	202.7	202.7	202.6	201.2
1484	201	202.9	202.8	202.8	202.7	202.1
E_OS_Pond	194.5	202.8	202.8	202.7	202.6	201.1
1482	197.5	198.4	198.4	198.4	198.4	198.4
Glisan4	199.69	202.7	202.7	202.6	202.5	202.3
FC-8L	199.18	202.4	202.4	202.3	202.1	201.8
FC-8	199.23	202.4	202.4	202.2	202.1	201.3
RDL-J	197	201.7	201.7	201.5	201.4	200.7
Glisan7	197	201.7	201.7	201.5	201.4	200.7
1111	200	201.7	201.7	201.5	201.4	200.7

City of Fairview
Water Surface Elevations
Future Conditions

Name	Invert Elevation ft	100-yr Max Water Elevation (ft)	50-yr Max Water Elevation (ft)	25-yr Max Water Elevation (ft)	10-yr Max Water Elevation (ft)	WQ Max Water Elevation (ft)
1108	198.74	201.7	201.7	201.5	201.4	200.7
Glisan8	197.7	199.6	199.6	199.5	199.5	199.3
Glisan9	194.5	197.1	197.1	197.1	197.0	196.9
ns2.47	189.9	193.8	193.8	193.8	193.7	193.5
ns9	187.6	193.4	193.4	193.3	193.2	192.3
N1475	187.17	192.4	192.4	192.3	192.2	191.2
N1476	187.12	192.0	192.0	191.9	191.8	191.1
N1477	187.1	191.9	191.9	191.8	191.7	191.1
ns8	187	191.7	191.7	191.6	191.6	190.8
ns7	186.3	190.0	190.0	189.9	189.8	189.2
NS2.27	185.1	189.6	189.6	189.5	189.4	188.6
Glisan12	184.16	188.3	188.2	188.0	187.9	186.8
Glisan13	184	187.2	187.1	187.0	186.8	186.1
N1472	183	185.3	185.2	185.1	184.9	183.8
Glisan14	182.3	185.3	185.2	185.0	184.9	183.8
Glisan15	181.5	185.0	184.9	184.8	184.6	183.5
N1468	180	182.3	182.2	182.1	182.0	181.4
N1462	180.3	181.6	181.6	181.5	181.3	180.7
N1463	179.5	181.3	181.2	181.1	181.0	180.4
N1467	178	180.2	180.1	180.0	179.8	179.0
Glisan16	176	177.9	177.8	177.7	177.6	177.1
Glisan17	172	175.5	175.5	175.3	175.1	174.0
PrivateRd1	171.5	172.3	172.3	172.2	172.1	171.9
PrivateRd2	170.12	172.0	172.0	171.9	171.8	171.2
N1466	168.1	171.1	171.0	170.9	170.8	170.0
NS0.6	167.2	169.7	169.6	169.5	169.4	168.9
ns0.5	160	165.7	165.6	165.4	165.3	164.2
NS0.3	159.9	164.4	164.4	164.2	164.1	163.2
N1473	156.7	161.6	161.5	161.2	161.1	160.0
N1474	156.55	161.5	161.4	161.2	161.0	160.0
FC-7	155.1	157.2	157.2	157.0	156.9	156.4
PrivateRd4	151.4	155.6	155.6	155.4	155.3	154.1
Barr	151.3	154.2	154.1	153.9	153.8	152.9
Barr1	151	153.9	153.8	153.7	153.6	152.8
FC-6	150.5	153.4	153.3	153.0	152.8	151.8
Barr2	150.5	153.2	153.0	152.7	152.5	151.6
Barr3	149.9	153.0	152.9	152.5	152.3	151.4
Barr4	148.8	152.6	152.4	151.9	151.6	150.3
Barr5	147.4	152.6	152.4	151.8	151.5	149.7
FC-5R	147.4	152.6	152.4	151.8	151.5	149.5
Halsey1	146.7	152.4	152.2	151.7	151.4	149.4
Halsey2	146.3	151.0	150.7	150.3	150.1	148.5
Halsey3	145.5	151.0	150.7	150.3	150.1	148.5
1044	188.13	190.4	190.3	190.1	189.9	189.3
1042	183	185.3	185.2	184.9	184.8	184.2
1040	178.49	180.9	180.8	180.5	180.4	179.7
1038	175.49	177.6	177.5	177.3	177.2	176.6
1036	170.47	172.4	172.3	172.1	172.0	171.5
1034	164.7	166.5	166.4	166.3	166.2	165.7

City of Fairview
Water Surface Elevations
Future Conditions

Name	Invert Elevation ft	100-yr Max Water Elevation (ft)	50-yr Max Water Elevation (ft)	25-yr Max Water Elevation (ft)	10-yr Max Water Elevation (ft)	WQ Max Water Elevation (ft)
1032	157.9	159.7	159.6	159.6	159.5	159.0
1030	151.3	154.5	153.8	153.2	152.9	152.4
1028	147.47	152.1	151.6	150.9	150.3	148.7
Halsey4	145.5	150.9	150.7	150.3	150.0	148.4
Fairview1	145.5	150.9	150.7	150.2	150.0	148.4
Fairview2	145.5	150.7	150.5	150.1	149.8	148.3
Fairview3	144.8	148.5	148.3	148.1	147.9	146.8
Fairview4	144	148.1	147.9	147.6	147.4	146.3
2953-F-605	195.9	200.0	200.0	198.7	198.6	198.1
NN_Glisan2	187.8	192.1	192.0	190.6	190.5	190.1
NN_Glisan3	183.21	185.0	185.0	184.9	184.8	184.3
NN_Glisan4	164	170.0	170.0	169.1	168.4	166.5
NN_Glisan5	164.1	166.9	166.9	166.8	166.7	166.1
917	185.65	185.7	185.7	185.7	185.7	185.7
918	170.95	171.0	171.0	171.0	171.0	171.0
NN-6	161.5	164.0	164.0	163.9	163.8	163.2
NN_Glisan6	160.3	163.5	163.4	163.3	163.2	162.5
NN-5	152.44	157.4	157.4	157.3	157.3	156.8
ArataDivA	153	157.3	157.3	157.3	157.2	156.7
ArataDivB	151.4	157.1	157.1	157.1	157.1	156.7
ArataDivC	147.8	148.3	148.3	148.3	148.3	148.3
Arata1	151.76	154.0	154.0	154.0	154.0	153.9
Arata2	150	152.0	152.0	152.0	152.0	151.6
Arata3	147	149.5	149.5	149.5	149.4	148.5
Arata4	146	149.4	149.2	148.8	148.4	146.9
Hlsy_e1	143.82	149.4	149.2	148.8	148.4	146.9
Hlsy_e2	144.16	148.4	148.3	147.9	147.7	146.7
NN-4	144.1	148.4	148.3	147.9	147.7	146.4
NN_Halsey1	144.32	146.1	146.1	146.1	146.1	145.6
NN_Halsey2	136	139.1	139.1	139.1	138.8	137.9
NN_Halsey3	136	137.8	137.8	137.8	137.7	137.3
NN_Halsey4	118.5	120.6	120.6	120.5	120.5	120.4
NN_Halsey5	114.5	117.1	117.1	117.0	117.0	116.6
NN_Halsey6	114.5	117.0	117.0	116.8	116.7	116.0
NN_Bridge1	104	104.9	104.9	104.9	104.9	104.6
NN_Bridge2	92	96.8	96.8	96.8	96.7	95.8
NN_Bridge3	90	96.8	96.8	96.8	96.7	95.8
NN-3	90	96.8	96.8	96.8	96.7	95.8
I-84	90	96.3	96.3	96.3	96.2	95.5
NN_I-84-1	86	87.5	87.5	87.5	87.4	86.9
NN_I-84-2	64	67.3	67.2	67.2	67.1	66.3
NN_I-84-3	38.2	43.1	43.0	43.0	42.9	40.5
NN-2R1L	105.5	106.4	106.4	106.3	106.2	105.9
NN-2R2	95.55	98.1	98.0	97.7	97.6	96.8
NN2R-RRS	95.05	97.1	97.0	96.8	96.7	96.1
NN2R-RRN	91.8	94.3	94.2	94.1	94.0	93.3
NN2R-I-84E	91.8	94.1	93.9	93.7	93.6	92.9
NN2R-238S	88.2	89.9	89.8	89.6	89.5	89.0
NN2R-238N	79.6	81.8	81.7	81.6	81.5	80.8

City of Fairview
Water Surface Elevations
Future Conditions

Name	Invert Elevation ft	100-yr Max Water Elevation (ft)	50-yr Max Water Elevation (ft)	25-yr Max Water Elevation (ft)	10-yr Max Water Elevation (ft)	WQ Max Water Elevation (ft)
NN2R-238	79.6	81.5	81.4	81.2	81.1	80.6
NN2R-TSE	74	77.4	77.4	77.3	77.2	76.0
NN2R-TSW	61.4	63.1	62.8	62.5	62.4	62.0
NN2R-WVMHP	61	63.1	62.8	62.5	62.4	62.0
NN-2R1	46	55.8	55.5	54.9	54.2	48.9
NN2R-AlotW	42	42.9	42.9	42.9	42.8	42.6
NN-2	38	43.0	43.0	42.9	42.8	40.3
NN_Sandy1	37.6	42.4	42.2	41.8	41.5	39.3
NN-1	36	40.1	40.0	39.9	39.8	38.4
NN_Sandy2	32	34.1	34.1	34.0	34.0	33.2
NN_Sandy3	22	25.8	25.7	25.7	25.6	24.8
NN_Sandy4	20	22.5	22.4	22.3	22.3	21.4
Fairview6	141.4	146.8	146.6	146.1	145.9	144.4
Fairview7	141.4	146.7	146.5	145.9	145.6	144.1
FC-5LB	141.4	146.7	146.5	145.9	145.6	144.0
PrDv1	141.4	145.3	145.1	144.7	144.6	143.5
PrDv2	141.4	144.6	144.4	144.1	144.0	143.1
PrDv3	141.1	143.7	143.4	143.1	142.9	142.3
PrDv4	134	137.3	136.8	136.5	136.3	135.4
Matney	133.5	137.0	136.6	136.2	135.9	134.2
Matney1	131.1	137.1	137.0	136.3	136.1	134.3
Matney2	131	133.8	133.6	133.4	133.2	132.4
Matney3	127.3	130.6	130.4	130.2	130.0	129.2
Matney4	123.5	127.8	127.6	127.4	127.5	126.8
Matney5	120.6	125.2	124.9	124.5	124.1	122.7
FC-5LA	120.6	125.2	124.9	124.5	124.1	122.6
PrvRd2	120.6	125.1	124.8	124.4	124.0	122.6
PrvRd2-1	120	124.6	124.3	124.0	123.5	121.9
PrvRd2-2	118.4	124.4	124.2	123.9	123.4	121.7
FC-5	118.4	124.3	124.1	123.9	123.3	121.6
PrvRd3-1	118.4	124.2	124.0	123.8	123.1	121.5
PrvRd3-2	118.4	123.6	122.8	122.4	122.2	120.9
PrvRd3-3	114.4	119.1	119.0	118.8	118.7	117.9
FC-4L	114.15	117.9	117.5	117.0	116.7	115.3
BridgeSt1	113.65	117.6	117.2	116.7	116.5	115.1
BridgeSt2	109.5	111.9	111.8	111.7	111.6	111.0
BridgeSt3	104.2	107.1	107.0	106.7	106.6	106.0
BridgeSt4	95.9	98.3	98.1	97.9	97.8	97.1
BridgeSt5	90	92.7	92.5	92.3	92.2	91.5
BridgeSt6	87.4	90.2	90.1	89.8	89.7	88.8
BridgeSt7	80	84.3	84.0	83.6	83.3	82.1
BridgeSt8	77	78.8	78.7	78.5	78.5	78.0
FC-4R	75.7	78.4	78.0	77.7	77.5	76.5
FC-4	75.2	78.3	78.0	77.6	77.4	76.5
I-84-1	73.1	74.4	74.3	74.1	74.1	73.7
I-84-2	51.1	55.4	55.0	54.6	54.3	52.9
I-84-3	48	50.0	49.9	49.7	49.6	49.1
I-84-4	44	46.9	46.8	46.5	46.4	45.7
I-84-5	41	44.0	43.8	43.7	43.5	42.8

City of Fairview
Water Surface Elevations
Future Conditions

Name	Invert Elevation ft	100-yr Max Water Elevation (ft)	50-yr Max Water Elevation (ft)	25-yr Max Water Elevation (ft)	10-yr Max Water Elevation (ft)	WQ Max Water Elevation (ft)
I-84-6	37	40.9	40.7	40.4	40.3	39.3
I-84-7	35.6	36.6	36.5	36.4	36.4	36.1
FC-3	31.9	34.5	34.2	33.8	33.6	32.7
Sandy	29.8	32.9	32.6	32.3	32.1	31.0
Sandy1	26.7	29.7	29.4	29.0	28.8	28.1
Sandy2	24.3	27.0	26.9	26.8	26.7	26.4
Sandy3	21.7	26.9	26.8	26.7	26.7	26.4
Sandy4	18	26.9	26.8	26.7	26.7	26.4
Sandy5	18	26.9	26.8	26.7	26.7	26.4
Sandy6	17.4	26.8	26.7	26.7	26.6	26.3
Sandy7	17.4	23.3	23.2	22.9	22.7	21.0
Sandy8	17.2	23.1	22.9	22.7	22.5	21.0
Sandy9	19.8	23.5	23.3	22.8	22.5	21.0
Sandy10	19.8	22.7	22.5	22.2	21.9	20.2
Sandy11	17	22.7	22.5	22.2	22.0	19.9
Confluence	16.4	21.8	21.7	21.5	21.4	19.8
Confluenc1	15.6	21.7	21.6	21.4	21.3	19.6
Confluenc2	14.6	20.2	20.1	19.8	19.6	18.0
FC-2	14.4	20.0	19.8	19.5	19.3	17.8
FvLake	13.6	17.9	17.9	17.7	17.6	16.5
FvLake1	13	17.7	17.7	17.5	17.4	16.4
FvLake2	12.5	17.7	17.6	17.4	17.3	16.3
FvLake3	12	16.7	16.6	16.4	16.3	15.4
FvLake4	11.4	16.5	16.4	16.2	16.1	15.2
FvLake5	11.3	15.3	15.2	15.1	15.0	14.4
FvLake6	10.6	15.0	14.9	14.8	14.7	14.2
FC-1R	9.5	14.9	14.8	14.7	14.6	14.1
FvLake8	9.4	14.7	14.6	14.5	14.4	14.1
FvLake9	9.7	14.3	14.3	14.2	14.2	14.0
FvLake10	8	14.2	14.2	14.1	14.1	14.0
FvLake13	7.5	14.2	14.1	14.1	14.1	14.0
FRV_LAKE	7.5	14.0	14.0	14.0	14.0	14.0
Hlsy_w1	144.2	149.4	149.2	148.8	148.4	146.9
Hlsy_w2	145.9	149.4	149.2	148.8	148.4	146.9
Hlsy_w3	145.8	149.4	149.2	148.7	148.4	146.9
Hlsy_w4	146.33	149.4	149.2	148.7	148.4	146.9
Hlsy_w5	145.84	148.2	148.1	147.6	147.4	146.9
Hlsy_w6	144.97	147.1	146.9	146.5	146.3	145.0
Fairview5	142.4	147.1	146.9	146.5	146.3	144.9

ATTACHMENT E

Fairview Creek

Future Conditions – Flow Rates for Modeling Reaches

City of Fairview
Flow rates for Modeling Reaches (cfs)
Future Conditions

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Flow (cfs)	50-Year Max Flow (cfs)	25-Year Max Flow (cfs)	10-Year Max Flow (cfs)	WQ Max Flow (cfs)
2953F2000A	2953-F-011	1044	191.25	188.4	71	63	58	50	45	21
2951F0010	2951-F-001	2951-F-002	208.88	206.92	16	22	21	17	15	7
2951F0020	2951-F-002	2951-F-003	206.92	203.91	21	22	20	17	15	7
2951F0030	2951-F-003	2951-F-004	203.41	201.66	29	22	20	17	15	7
2951F0040	2951-F-004	2951-F-005	201.66	201.22	19	22	20	17	15	7
2951F0050	2951-F-005	2951-F-006	201.22	200.34	18	22	20	17	15	7
2951F0060	2951-F-006	2951-F-007	200.34	199.46	18	22	20	17	15	7
2951F0070	2951-F-007	2951-F-008	199.21	197.95	28	22	20	17	15	7
2951F0080	2951-F-008	2952-F-002	197.95	196.69	28	22	20	17	15	7
2952F0020	2952-F-002	2952-F-003	196.69	195.43	28	22	20	17	15	7
2952F0030	2952-F-003	2952-F-004	195.43	193.65	33	21	20	17	15	7
2952F0040	2952-F-004	2952-F-005	193.65	192.75	25	21	20	17	15	7
2952F0050	2952-F-005	2952-F-006	188	185	17	20	18	16	15	7
2952F0060	2952-F-006	2952-F-601	185	183	94	20	18	16	15	7
2952F2680	2952-F-601	Glisan16	183	176	2163	44	41	34	31	15
3051F2470	3051-F-247	2951-F-250	199	199	5782	1445	1445	1445	1445	1445
2951F2500	2951-F-250	2951-F-251	199	199	10452	3550	3550	3550	3550	3550
WEIR#42	2951-F-251	2951-F-252	205.3	203.5	0	124	124	124	124	124
Fuj_1	2951-F-252	2951-F-253	203.5	203.3	0	63	63	63	62	47
Fuj_2	2951-F-252	2951-F-253	203.5	203.3	39	63	63	63	62	47
WEIR#43	2951-F-252	2951-F-253	203.5	203.3	0	0	0	0	0	0
3051F2400	3051-F-240	3051-F-241	205.5	205.5	67	144	126	93	81	31
3051F2410B	3051-F-241	2951-F-248	205.5	205.5	67	103	85	54	42	14
3051F2410A	3051-F-241	2951-F-250	207	205	37	41	41	41	41	23
WEIR#44	2951-F-248	2951-F-249	0.05	0	0	102	84	54	42	0
2951F2490	2951-F-249	2951-F-253	209.1	203.7	317	102	85	60	57	0
2951F2530A	2951-F-253	2951-F-254	203.3	203.8	16288	-129	-126	-124	-119	-84
2951F2530B	2951-F-253	2951-F-257	205.7	205.1	471	73	65	52	45	8
2951F2570	2951-F-257	2951-F-258	205.1	203.8	125	73	65	52	45	8
2951F2580	2951-F-258	2952-F-259	203.8	203.1	557	73	65	52	45	8
2952F2590	2952-F-259	2952-F-260	203.1	201.5	1002	73	65	52	45	8
2952F2600	2952-F-260	2952-F-261	201.5	200.6	949	73	65	52	45	8
2952F2610	2952-F-261	2952-F-262	200.6	199.2	4213	73	65	52	45	8
2952F2620	2952-F-262	2952-F-263	199.2	199	30	73	65	52	45	8
2952F2630	2952-F-263	2952-F-264	199	196.5	2570	73	65	52	45	8
2952F2640	2952-F-264	2952-F-265	196.5	194.6	4889	73	65	52	45	8
2952F2660	2952-F-266	Temp1	194.12	194.1	232	73	65	51	45	8
OF_1	Temp1	Gl_ovflw11	194.1	186	261	73	65	52	45	8
OF_2	Gl_ovflw11	Glisan12	186	184.16	1633	73	65	51	45	8
Glisan_1	2951-F-254	2951-F-255	203.6	203.2	0	65	63	60	59	42
Glisan_2	2951-F-254	2951-F-255	203.6	203.2	46	65	63	60	59	42
WEIR#8	2951-F-254	2951-F-255	203.6	203.2	0	0	0	0	0	0
2951F2550	2951-F-255	2951-F-260	203.2	202.6	1531	129	126	121	118	84
xsect1	2951-F-260	xsect2n	202.6	200.27	1390	129	126	121	118	84
xsect2	xsect2n	xsect3n	200.27	199.6	1181	129	126	121	118	84
xsect3	xsect3n	Glisan4	199.6	199.69	1095	-52	-52	-51	-49	-46
WEIR#51	xsect3n	W_OS_Pond	0.05	0	0	56	55	51	44	22
WEIR#54	xsect3n	1484	0.05	0	0	37	36	34	33	22
OS_Equal	W_OS_Pond	E_OS_Pond	194.5	194.5	1	15	14	13	13	8
WoutPrim	W_OS_Pond	1108	200.5	200	2	3	3	3	3	2
WoutSecn	W_OS_Pond	1108	204.5	204.25	536	0	0	0	0	0
EoutPrim	E_OS_Pond	1482	199	197.5	3	5	5	5	5	4
EoutSecn	E_OS_Pond	1482	204.5	204.25	256	0	0	0	0	0
xsect4	Glisan4	FC-8L	199.69	199.18	1369	52	52	51	49	40
xsect5	FC-8L	FC-8	199.18	199.23	131	-52	-52	-51	-49	-40
WEIR#52	FC-8L	W_OS_Pond	0.05	0	0	0	0	0	0	0
WEIR#55	FC-8L	E_OS_Pond	0.05	0	0	0	0	0	0	0
xsect6	FC-8	1108	199.23	198.74	624	107	106	96	85	40
WEIR#53	FC-8	W_OS_Pond	0.05	0	0	-52	-51	-45	-37	0
WEIR#56	FC-8	E_OS_Pond	0.05	0	0	-4	-3	-1	0	0
RDL-10	RDL-J	Glisan7	197	197	268	-7	-7	-7	-7	-7
RDL_HF	Glisan7	1111	200.5	200	197	0	0	0	0	0
RDL_LF	Glisan7	1108	199	199	2	-12	-12	-11	-11	-8
2.8	1108	Glisan8	198.74	197.7	13635	109	108	98	88	39
2.75	Glisan8	Glisan9	197.7	194.5	19919	113	109	98	89	42
2.65	Glisan9	ns2.47	194.5	189.9	1823	117	113	103	93	45
2.47	ns2.47	ns9	189.9	187.6	9981	114	112	102	92	44
NS_9	ns9	N1475	187.6	187.17	2547	114	112	102	92	44
L1461	N1475	N1476	187.17	187.12	2506	114	112	102	92	44
3721.1	N1476	N1477	187.12	187.1	0	114	112	102	92	44
TargetBrg	N1476	N1477	187.12	187.1	0	0	0	0	0	0
L1463	N1477	ns8	187.1	187	7236	114	112	102	92	44

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NS_8	ns8	ns7	187	186.3	6881	114	112	102	92	44
NS_7	ns7	NS2.27	186.3	185.1	7197	114	112	102	92	44
2.27	NS2.27	Glisan12	185.1	184.16	2853	113	112	102	92	44
2.19	Glisan12	Glisan13	184.16	184	808	165	157	140	122	45
2.16	Glisan13	N1472	184	183	3259	165	157	140	122	45
ECovBrg	N1472	Glisan14	183	182.3	0	165	157	140	122	45
Estbrg	N1472	Glisan14	183	182.3	0	0	0	0	0	0
2.13	Glisan14	Glisan15	182.3	181.5	1764	165	157	140	122	45
2.06	Glisan15	N1468	181.5	180	1217	165	157	139	121	45
us_Market	N1468	N1462	180	180.3	6469	-165	-157	-139	-121	-45
Market.1	N1462	N1463	180.3	179.5	0	165	157	139	121	45
Market_rd	N1462	N1463	180.3	179.5	0	0	0	0	0	0
ds_Market	N1463	N1467	179.5	178	6869	165	157	139	121	45
NS_4	N1467	Glisan16	178	176	5251	165	157	139	121	45
NS_3	Glisan16	Glisan17	176	172	15592	169	160	141	125	48
US_park	Glisan17	PrivateRd1	172	171.5	9848	169	160	141	125	48
ParkLn	PrivateRd1	PrivateRd2	171.5	170.12	0	169	160	141	125	48
Road_Ppark	PrivateRd1	PrivateRd2	171.5	170.12	0	0	0	0	0	0
1.891	PrivateRd2	N1466	170.12	168.1	35839	169	160	141	125	48
NS_0.8	N1466	NS0.6	168.1	167.2	6231	169	160	141	125	48
NS_0.6	NS0.6	ns0.5	167.2	160	8404	169	160	141	125	48
NS_0.5	ns0.5	NS0.3	160	159.9	493	169	159	141	125	48
NS_0.4	NS0.3	N1473	159.9	156.7	2791	169	159	141	125	48
FootBrg	N1473	N1474	156.7	156.55	0	169	159	141	125	48
Footbrdg2	N1473	N1474	156.7	156.55	0	0	0	0	0	0
L1460	N1474	FC-7	156.55	155.1	2702	170	160	141	125	48
NS_0.3	FC-7	PrivateRd4	155.1	151.4	2593	182	171	146	133	52
NS0.2	PrivateRd4	Barr	151.4	151.3	1380	182	171	146	133	52
BarrSt	Barr	Barr1	151.3	151	0	182	171	146	133	52
WEIR#10	Barr	Barr1	151.3	151	0	0	0	0	0	0
1.706	Barr1	FC-6	151	150.5	454	182	171	146	133	52
PrvBldg	FC-6	Barr2	150.5	150.5	0	182	172	147	133	52
WEIR#11	FC-6	Barr2	150.5	150.5	0	0	0	0	0	0
1.701	Barr2	Barr3	150.5	149.9	6257	182	172	147	133	52
1.7	Barr3	Barr4	149.9	148.8	5228	183	172	147	133	52
1.681	Barr4	Barr5	148.8	147.6	1831	183	172	147	133	52
1.675	Barr5	FC-5R	147.6	147.4	1275	184	173	147	133	52
Halsey	FC-5R	Halsey1	147.4	146.7	0	184	173	148	134	53
WEIR#12	FC-5R	Halsey1	147.4	146.7	0	0	0	0	0	0
1.657	Halsey1	Halsey2	146.7	146.3	1333	184	173	148	133	53
1.656	Halsey2	Halsey3	146.3	145.5	2522	184	173	148	133	53
1.65	Halsey3	Halsey4	145.5	145.5	109	184	174	148	134	53
1045	1044	1042	188.19	183.27	74	63	58	50	45	21
1043	1042	1040	183.055	178.75	74	63	58	50	45	21
1041	1040	1038	178.55	175.75	71	63	58	50	45	21
1039	1038	1036	175.55	170.75	84	63	58	50	45	21
1037	1036	1034	170.53	164.98	99	63	58	50	45	21
1035	1034	1032	164.77	158.17	108	63	58	50	45	21
1033	1032	1030	157.97	151.58	97	63	58	50	45	21
1031	1030	1028	151.382	147.47	85	63	58	50	45	21
1029	1028	Halsey4	147.47	146	72	63	58	50	45	21
1.641	Halsey4	Fairview1	145.5	145.5	323	202	185	158	142	58
FrvAve1	Fairview1	Fairview2	145.5	145.5	0	202	185	158	142	58
WEIR#47	Fairview1	Fairview2	145.5	145.5	0	0	0	0	0	0
1.631	Fairview2	Fairview3	145.5	144.8	269	202	185	158	142	58
1.63	Fairview3	Fairview4	144.8	144	1218	202	185	158	142	58
1.615	Fairview4	Fairview5	144	142.4	1363	202	185	158	142	58
NN235	2953-F-605	NN_Glisan2	195.9	187.8	85	71	71	65	58	28
NN230	NN_Glisan2	NN_Glisan3	187.8	183.21	111	72	71	65	58	28
NN_Glsn_2	NN_Glisan3	NN_Glisan4	183.21	164	0	83	82	65	58	28
WEIR#35	NN_Glisan3	NN_Glisan4	183.21	164	0	0	0	0	0	0
NN_Glsn_7	NN_Glisan4	NN_Glisan5	164	164.1	0	-77	-76	-65	-58	-28
WEIR#36	NN_Glisan4	NN_Glisan5	164	164.1	0	3	3	0	0	0
NN215	NN_Glisan5	NN-6	164.1	161.5	1737	75	75	65	58	28
919	917	918	185.65	170.95	359	0	0	0	0	0
920	918	NN-6	170.95	161.5	588	0	0	0	0	0
NN210	NN-6	NN_Glisan6	161.5	160.3	902	114	110	96	87	41
NN205	NN_Glisan6	NN-5	160.3	152.66	439	111	107	96	87	41
AratаDiv1	NN-5	AratаDivA	153	153	1	9	11	12	12	9
Arata_1	NN-5	Arata1	152.44	151.76	0	36	36	35	35	32
WEIR#23	NN-5	Arata1	152.44	151.76	0	75	71	61	51	0
WEIR#46	AratаDivA	AratаDivB	153	151.4	0	223	178	263	355	12

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Hals_ABS	AratаDivC	Hlsy_w5	147.8	147.05	84	5	5	5	5	4
NN195	Arata1	Arata2	152	150	4316	111	106	96	86	32
NN190	Arata2	Arata3	150	147	16375	111	131	96	86	32
NN185	Arata3	Arata4	147	146.8	6396	112	107	96	84	32
NN180	Arata4	Hlsy_w1	146	144.2	1194	28	26	21	17	-1
NN150	Arata4	Hlsy_e1	146	143.82	1732	72	71	67	63	32
Halsey_4	Hlsy_e1	Hlsy_e2	143.82	144.16	0	-69	-67	-62	-59	-32
WEIR#25	Hlsy_e1	Hlsy_e2	143.82	144.16	0	0	0	0	0	0
NN140	Hlsy_e2	NN-4	144.16	144.1	256	68	66	62	59	32
Halsey_5	NN-4	NN_Halsey1	144.1	144.32	0	-71	-69	-65	-61	-33
WEIR#28	NN-4	NN_Halsey1	144.1	144.32	0	0	0	0	0	0
NN130	NN_Halsey1	NN_Halsey2	144.32	136	106	80	80	76	61	33
Halsey_6	NN_Halsey2	NN_Halsey3	136	136	0	71	70	68	61	33
WEIR#29	NN_Halsey2	NN_Halsey3	136	136	0	0	0	0	0	0
NN120	NN_Halsey3	NN_Halsey4	136	120	212	71	69	66	62	33
NN115	NN_Halsey4	NN_Halsey5	118.5	114.5	10953	71	69	65	62	33
NN110	NN_Halsey5	NN_Halsey6	114.5	114.5	59	71	68	64	61	33
NNBrdg_1	NN_Halsey6	NN_Bridge1	114.5	104	0	70	69	64	61	33
WEIR#30	NN_Halsey6	NN_Bridge1	114.5	104	0	1	0	0	0	0
NN100	NN_Bridge1	NN_Bridge2	104	92	9178	71	68	64	61	33
NN95	NN_Bridge2	NN_Bridge3	92	90	40257	71	69	69	62	31
NN90	NN_Bridge3	NN-3	90	90	2487	71	79	101	62	29
NNBrdg_2	NN-3	I-84	90	90	0	80	77	92	69	31
WEIR#31	NN-3	I-84	90	90	0	0	0	0	0	0
NN_I-84_1	I-84	NN_I-84-1	90	86	0	41	41	40	40	31
WEIR#32	I-84	NN_I-84-1	90	86	0	40	38	37	30	0
NN70	NN_I-84-1	NN_I-84-2	86	64	1685	82	79	74	70	31
NN65	NN_I-84-2	NN_I-84-3	64	38.2	9938	82	79	74	70	31
NN60	NN_I-84-3	NN-2	38.2	38	667	82	79	74	70	31
NN2R-RR1	NN-2R1L	NN2R-RRS	105.5	95.5	331	10	9	7	7	2
NN2R_RR	NN-2R2	NN2R-RRS	95.55	95.05	0	71	65	55	49	22
WEIR#37	NN-2R2	NN2R-RRS	95.55	95.05	0	0	0	0	0	0
NN2R2	NN2R-RRS	NN2R-RRN	95.05	91.8	249	81	74	63	56	24
NN2R3	NN2R-RRN	NN2R-I-84E	91.8	91.8	172	81	74	63	56	24
NN2R_I-84	NN2R-I-84E	NN2R-238S	91.8	88.2	0	81	74	63	56	24
WEIR#38	NN2R-I-84E	NN2R-238S	91.8	88.2	0	0	0	0	0	0
NN2R5	NN2R-238S	NN2R-238N	88.2	79.6	910	81	74	63	56	24
NN2R6	NN2R-238N	NN2R-238	79.6	79.6	77	81	74	63	56	24
NN2R_238	NN2R-238	NN2R-TSE	79.6	74	0	81	74	63	56	24
WEIR#39	NN2R-238	NN2R-TSE	79.6	74	0	0	0	0	0	0
NN2R8	NN2R-TSE	NN2R-TSW	74	61.4	285	81	74	63	56	24
NN2R9	NN2R-TSW	NN2R-WVMHP	61.4	61	23005	81	74	63	56	24
NN2R_WVHP	NN2R-WVMHP	NN-2R1	61	46	0	81	74	66	64	24
WEIR#40	NN2R-WVMHP	NN-2R1	61	46	0	0	0	0	0	0
NN2R11	NN-2R1	NN2R-AlotW	46	42	84	77	75	73	71	37
NN2R12	NN2R-AlotW	NN-2	42	38	924	76	75	72	70	37
NNSandy_1	NN-2	NN_Sandy1	38	37.6	0	55	55	55	55	33
NNSandy_2	NN-2	NN_Sandy1	38	37.6	27	55	55	55	55	33
WEIR#34	NN-2	NN_Sandy1	38	37.6	0	106	94	72	59	0
NNSandy_3	NN_Sandy1	NN-1	37.6	36	0	81	79	75	71	33
NNSandy_4	NN_Sandy1	NN-1	37.6	36	70	81	79	75	71	33
WEIR#33	NN_Sandy1	NN-1	37.6	36	0	0	0	0	0	0
NN45	NN-1	NN_Sandy2	36	32	718	166	162	153	146	66
NN40	NN_Sandy2	NN_Sandy3	32	22	17070	166	162	153	146	66
NN35	NN_Sandy3	NN_Sandy4	22	20	2879	166	162	153	146	66
NN30	NN_Sandy4	Confluence	20	16.4	5209	166	162	153	146	66
1.522	Fairview6	Fairview7	141.4	141.4	177	216	188	159	144	61
1.503	Fairview7	FC-5LB	141.4	141.4	435	216	188	159	144	61
NoName	FC-5LB	PrDv1	141.4	141.4	0	178	178	159	144	62
WEIR#13	FC-5LB	PrDv1	141.4	141.4	0	44	12	0	0	0
1.501	PrDv1	PrDv2	141.4	141.4	217	218	190	159	144	62
1.5	PrDv2	PrDv3	141.4	141.1	5217	218	190	159	144	62
1.49	PrDv3	PrDv4	141.1	134	10989	218	190	159	144	62
1.463	PrDv4	Matney	134	133.5	25232	218	190	159	144	62
MatneySt	Matney	Matney1	133.5	131.1	0	223	213	160	145	62
WEIR#14	Matney	Matney1	133.5	131.1	0	0	0	0	0	0
1.461	Matney1	Matney2	131.1	131	638	218	197	160	144	62
1.46	Matney2	Matney3	131	127.3	3382	218	190	160	144	62
1.44	Matney3	Matney4	127.3	123.5	3754	218	190	159	144	62
1.41	Matney4	Matney5	123.5	120.6	6095	218	190	159	144	62
1.368	Matney5	FC-5LA	120.6	120.6	174	218	190	159	144	62
PrvRd2.1	FC-5LA	PrvRd2	120.6	120.6	0	221	193	161	144	63

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WEIR#15	FC-5LA	PrvRd2	120.6	120.6	0	0	0	0	0	0
1.366	PrvRd2	PrvRd2-1	120.6	120	2648	221	193	160	144	63
1.36	PrvRd2-1	PrvRd2-2	120	118.4	951	221	193	160	144	63
1.343	PrvRd2-2	FC-5	118.4	118.4	472	221	193	160	145	63
PrvRd3	FC-5	PrvRd3-1	118.4	118.4	0	224	195	162	146	64
WEIR#16	FC-5	PrvRd3-1	118.4	118.4	0	0	0	0	0	0
1.341	PrvRd3-1	PrvRd3-2	118.4	118.4	148	224	195	162	146	64
1.34	PrvRd3-2	PrvRd3-3	118.4	114.4	1464	224	196	162	146	64
7385	PrvRd3-3	FC-4L	116.3	116.1	9176	224	195	162	146	64
BridgeSt	FC-4L	BridgeSt1	114.25	113.75	0	227	199	163	147	64
WEIR#17	FC-4L	BridgeSt1	114.25	113.75	0	0	0	0	0	0
7300	BridgeSt1	BridgeSt2	113.65	109.5	10668	227	198	163	147	64
7250	BridgeSt2	BridgeSt3	109.5	104.2	1330	227	199	163	147	64
7060	BridgeSt3	BridgeSt4	104.2	95.9	3162	228	200	164	147	64
6770	BridgeSt4	BridgeSt5	95.9	90	3123	227	199	163	147	64
6550	BridgeSt5	BridgeSt6	90	87.4	9506	227	199	163	147	64
6350	BridgeSt6	BridgeSt7	87.4	80	23041	227	198	163	147	64
6250	BridgeSt7	BridgeSt8	80	77	15284	227	199	163	147	64
6150	BridgeSt8	FC-4	77	75.2	61514	227	199	163	147	64
FC-4R-1	FC-4R	FC-4	75.7	75.2	21	9	8	7	6	2
I-84_1	FC-4	I-84-1	75.2	73.1	0	233	203	168	150	65
WEIR#18	FC-4	I-84-1	75.2	73.1	0	0	0	0	0	0
I-84_2	I-84-1	I-84-2	73.1	51.1	0	233	204	169	150	65
WEIR#19	I-84-1	I-84-2	73.1	51.1	0	0	0	0	0	0
5805	I-84-2	I-84-3	51.1	48	44805	233	204	169	150	65
5750	I-84-3	I-84-4	48	44	59906	233	204	169	150	65
5635	I-84-4	I-84-5	44	41	6836	232	204	169	150	65
5540	I-84-5	I-84-6	41	37	59799	232	203	169	150	65
5380	I-84-6	I-84-7	37	35.6	28483	233	204	169	150	65
5300	I-84-7	FC-3	35.6	31.9	27297	233	204	169	150	65
SandBlvd	FC-3	Sandy	31.9	29.8	0	234	205	170	150	66
WEIR#20	FC-3	Sandy	31.9	29.8	0	0	0	0	0	0
5160	Sandy	Sandy1	29.8	26.7	9621	234	205	170	150	66
5100	Sandy1	Sandy2	26.7	24.3	13864	234	205	171	151	66
4980	Sandy2	Sandy3	24.3	21.7	18693	234	205	170	151	66
4800	Sandy3	Sandy4	21.7	18	14722	234	206	170	151	66
4605	Sandy4	Sandy5	18	18	5439	234	206	170	151	66
WEIR#21	Sandy5	Sandy6	0	0	0	234	205	170	151	66
4601	Sandy6	Sandy7	25.6	25.6	2399	234	205	170	150	66
4600	Sandy7	Sandy8	17.4	17.2	6271	271	252	219	199	66
4560	Sandy8	Sandy9	17.2	19.8	74483	-358	-327	-264	-219	-66
4555	Sandy9	Sandy10	19.8	19.8	1461	285	253	214	184	66
4545	Sandy10	Sandy11	19.8	17	73856	693	613	479	383	66
4540	Sandy11	Confluence	17	16.4	8934	346	319	284	262	66
4460	Confluence	Confluenc1	16.4	15.6	13197	462	435	388	358	128
4320	Confluenc1	Confluenc2	15.6	14.6	9583	403	379	337	311	128
4000	Confluenc2	FC-2	14.6	14.4	11728	391	367	326	299	128
BlueLkRd	FC-2	FvLake	15.3	14.2	0	409	385	340	314	134
WEIR#22	FC-2	FvLake	15.3	14.2	0	0	0	0	0	0
3865	FvLake	FvLake1	13.6	13	5191	410	386	341	316	134
3740	FvLake1	FvLake2	13	12.5	4326	411	387	341	314	134
3600	FvLake2	FvLake3	12.5	12	1631	405	381	336	310	133
3300	FvLake3	FvLake4	12	11.4	2738	405	381	336	309	133
3040	FvLake4	FvLake5	11.4	11.3	945	404	380	335	309	133
2770	FvLake5	FvLake6	11.3	10.6	3571	404	380	335	309	133
2470	FvLake6	FC-1R	10.6	9.5	11243	404	380	335	308	133
1811	FC-1R	FvLake8	9.5	9.4	2187	436	409	354	325	133
1810	FvLake8	FvLake9	9.7	9.7	445	436	409	355	325	133
1789	FvLake9	FvLake10	9.7	8	9638	436	409	355	325	133
1170	FvLake10	FvLake13	8	7.5	10764	436	409	355	325	133
1070	FvLake13	FRV_LAKE	7.5	7.5	116	436	409	355	325	133
NN175	Hlsy_w1	Hlsy_w2	144.2	145.9	5723	-19	-19	-16	-13	1
Halsey_1	Hlsy_w2	Hlsy_w3	146.3	146.3	0	18	18	15	13	-1
WEIR#26	Hlsy_w2	Hlsy_w3	146.3	146.3	0	0	0	0	0	0
NN165	Hlsy_w3	Hlsy_w4	145.8	146.33	2536	-17	-17	-15	-12	1
Halsey_2	Hlsy_w4	Hlsy_w5	146.33	146.45	0	-17	-17	-15	-12	1
WEIR#27	Hlsy_w4	Hlsy_w5	146.33	146.45	0	0	0	0	0	0
Halsey_3	Hlsy_w5	Hlsy_w6	145.84	144.97	0	21	21	19	17	4
WEIR#24	Hlsy_w5	Hlsy_w6	145.84	144.97	0	0	0	0	0	0
NN151	Hlsy_w6	Fairview5	144.97	142.6	30434	25	24	22	19	4
1.552	Fairview5	Fairview6	142.4	141.4	3506	216	188	159	144	61

ATTACHMENT F

Fairview Creek

Future Conditions – Velocity for Modeling Reaches

City of Fairview
Velocity for Modeling Reaches (fps)
Future Conditions

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Vel (fps)	50-Year Max Vel (fps)	25-Year Max Vel. (fps)	10-Year Max Vel. (fps)	WQ Max Vel. (fps)
2953F2000A	2953-F-011	1044	191.25	188.4	71	11.0	10.8	10.5	10.3	8.6
2951F0010	2951-F-001	2951-F-002	208.88	206.92	16	7.1	6.8	6.0	6.0	5.0
2951F0020	2951-F-002	2951-F-003	206.92	203.91	21	7.4	7.4	7.3	7.1	6.0
2951F0030	2951-F-003	2951-F-004	203.41	201.66	29	5.1	5.1	5.0	4.9	4.1
2951F0040	2951-F-004	2951-F-005	201.66	201.22	19	4.4	4.2	4.1	4.0	3.5
2951F0050	2951-F-005	2951-F-006	201.22	200.34	18	4.4	4.3	4.1	4.0	3.4
2951F0060	2951-F-006	2951-F-007	200.34	199.46	18	5.2	5.1	4.8	4.7	3.7
2951F0070	2951-F-007	2951-F-008	199.21	197.95	28	5.1	5.0	4.8	4.7	3.9
2951F0080	2951-F-008	2952-F-002	197.95	196.69	28	5.1	5.0	4.8	4.6	3.8
2952F0020	2952-F-002	2952-F-003	196.69	195.43	28	5.3	5.2	5.0	4.9	4.0
2952F0030	2952-F-003	2952-F-004	195.43	193.65	33	5.2	5.1	4.9	4.8	3.9
2952F0040	2952-F-004	2952-F-005	193.65	192.75	25	5.0	5.0	4.9	4.7	3.8
2952F0050	2952-F-005	2952-F-006	188	185	17	3.1	3.0	2.6	2.4	1.7
2952F0060	2952-F-006	2952-F-601	185	183	94	0.9	0.9	0.8	0.8	0.7
2952F2680	2952-F-601	Glisan16	183	176	2163	4.4	4.3	4.1	4.0	3.3
3051F2470	3051-F-247	2951-F-250	199	199	5782	0.5	0.5	0.5	0.5	0.5
2951F2500	2951-F-250	2951-F-251	199	199	10452	0.9	0.9	0.9	0.9	0.9
WEIR#42	2951-F-251	2951-F-252	205.3	203.5	0	0.0	0.0	0.0	0.0	0.0
Fuj_1	2951-F-252	2951-F-253	203.5	203.3	0	9.3	9.3	9.3	9.3	9.3
Fuj_2	2951-F-252	2951-F-253	203.5	203.3	39	9.3	9.3	9.3	9.3	9.3
WEIR#43	2951-F-252	2951-F-253	203.5	203.3	0	0.0	0.0	0.0	0.0	0.0
3051F2400	3051-F-240	3051-F-241	205.5	205.5	67	7.3	6.4	5.1	5.0	3.5
3051F2410B	3051-F-241	2951-F-248	205.5	205.5	67	5.3	4.4	2.8	2.4	1.9
3051F2410A	3051-F-241	2951-F-250	207	205	37	8.4	8.4	8.3	8.2	7.1
WEIR#44	2951-F-248	2951-F-249	0.05	0	0	0.0	0.0	0.0	0.0	0.0
2951F2490	2951-F-249	2951-F-253	209.1	203.7	317	1.1	1.1	0.9	0.8	0.0
2951F2530A	2951-F-253	2951-F-254	203.3	203.8	16288	-2.7	-2.7	-2.7	-2.7	-2.7
2951F2530B	2951-F-253	2951-F-257	205.7	205.1	471	0.9	0.8	0.8	0.7	0.4
2951F2570	2951-F-257	2951-F-258	205.1	203.8	125	1.7	1.6	1.5	1.5	1.3
2951F2580	2951-F-258	2952-F-259	203.8	203.1	557	3.0	3.0	3.0	3.0	1.8
2952F2590	2952-F-259	2952-F-260	203.1	201.5	1002	3.7	3.6	3.3	3.2	2.0
2952F2600	2952-F-260	2952-F-261	201.5	200.6	949	4.3	4.3	4.2	4.2	2.5
2952F2610	2952-F-261	2952-F-262	200.6	199.2	4213	3.4	3.4	3.4	3.4	2.5
2952F2620	2952-F-262	2952-F-263	199.2	199	30	10.5	9.5	7.8	7.2	3.6
2952F2630	2952-F-263	2952-F-264	199	196.5	2570	4.9	4.8	4.7	4.7	2.9
2952F2640	2952-F-264	2952-F-265	196.5	194.6	4889	2.4	2.4	2.4	2.4	2.0
2952F2660	2952-F-266	Temp1	194.12	194.1	232	11.1	10.6	9.6	9.3	4.1
OF_1	Temp1	Gl_ovflw11	194.1	186	261	2.8	2.8	2.8	2.8	1.8
OF_2	Gl_ovflw11	Glisan12	186	184.16	1633	0.3	0.3	0.3	0.3	0.1
Glisan_1	2951-F-254	2951-F-255	203.6	203.2	0	6.6	6.6	6.5	6.5	5.7
Glisan_2	2951-F-254	2951-F-255	203.6	203.2	46	6.6	6.6	6.5	6.5	5.7
WEIR#8	2951-F-254	2951-F-255	203.6	203.2	0	0.0	0.0	0.0	0.0	0.0
2951F2550	2951-F-255	2951-F-260	203.2	202.6	1531	5.5	5.4	5.3	5.2	4.5
xsect1	2951-F-260	xsect2n	202.6	200.27	1390	4.8	4.8	4.7	4.7	4.5
xsect2	xsect2n	xsect3n	200.27	199.6	1181	3.5	3.5	3.5	3.5	3.5
xsect3	xsect3n	Glisan4	199.6	199.69	1095	-4.0	-4.0	-4.0	-4.0	-4.0
WEIR#51	xsect3n	W_OS_Pond	0.05	0	0	0.0	0.0	0.0	0.0	0.0
WEIR#54	xsect3n	1484	0.05	0	0	0.0	0.0	0.0	0.0	0.0
OS_Equal	W_OS_Pond	E_OS_Pond	194.5	194.5	1	2.9	2.9	2.7	2.6	1.5
WoutPrim	W_OS_Pond	1108	200.5	200	2	3.9	3.9	4.3	4.4	3.0
WoutSecn	W_OS_Pond	1108	204.5	204.25	536	0.0	0.0	0.0	0.0	0.0
EoutPrim	E_OS_Pond	1482	199	197.5	3	6.5	6.5	6.4	6.4	5.2
EoutSecn	E_OS_Pond	1482	204.5	204.25	256	0.0	0.0	0.0	0.0	0.0
xsect4	Glisan4	FC-8L	199.69	199.18	1369	2.8	2.8	2.8	2.8	2.8
xsect5	FC-8L	FC-8	199.18	199.23	131	-2.7	-2.7	-2.7	-2.7	-2.7
WEIR#52	FC-8L	W_OS_Pond	0.05	0	0	0.0	0.0	0.0	0.0	0.0
WEIR#55	FC-8L	E_OS_Pond	0.05	0	0	0.0	0.0	0.0	0.0	0.0
xsect6	FC-8	1108	199.23	198.74	624	3.7	3.7	3.7	3.6	3.1
WEIR#53	FC-8	W_OS_Pond	0.05	0	0	0.0	0.0	0.0	0.0	0.0
WEIR#56	FC-8	E_OS_Pond	0.05	0	0	0.0	0.0	0.0	0.0	0.0
RDL-10	RDL-J	Glisan7	197	197	268	-0.9	-0.9	-0.9	-0.9	-0.9
RDL_HF	Glisan7	1111	200.5	200	197	1.1	1.1	1.1	1.1	1.0
RDL_LF	Glisan7	1108	199	199	2	-4.8	-4.6	-4.5	-4.5	-4.1
2.8	1108	Glisan8	198.74	197.7	13635	3.8	3.9	3.8	3.7	2.9
2.75	Glisan8	Glisan9	197.7	194.5	19919	2.0	2.0	2.0	2.0	2.0
2.65	Glisan9	ns2.47	194.5	189.9	1823	1.7	1.7	1.7	1.7	1.7
2.47	ns2.47	ns9	189.9	187.6	9981	1.5	1.5	1.5	1.5	1.5
NS_9	ns9	N1475	187.6	187.17	2547	1.4	1.4	1.4	1.4	1.3
L1461	N1475	N1476	187.17	187.12	2506	2.2	2.2	2.2	2.2	2.2
3721.1	N1476	N1477	187.12	187.1	0	2.4	2.4	2.2	2.1	1.3
TargetBrg	N1476	N1477	187.12	187.1	0	0.0	0.0	0.0	0.0	0.0
L1463	N1477	ns8	187.1	187	7236	1.2	1.2	1.2	1.2	1.2

City of Fairview
Velocity for Modeling Reaches (fps)
Future Conditions

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Vel (fps)	50-Year Max Vel (fps)	25-Year Max Vel. (fps)	10-Year Max Vel. (fps)	WQ Max Vel. (fps)
NS_8	ns8	ns7	187	186.3	6881	1.2	1.2	1.2	1.2	1.2
NS_7	ns7	NS2.27	186.3	185.1	7197	1.4	1.4	1.4	1.4	1.4
2.27	NS2.27	Glisan12	185.1	184.16	2853	1.3	1.3	1.3	1.3	1.4
2.19	Glisan12	Glisan13	184.16	184	808	2.0	2.0	1.9	1.9	1.4
2.16	Glisan13	N1472	184	183	3259	3.7	3.7	3.7	3.7	3.1
ECovBrg	N1472	Glisan14	183	182.3	0	5.6	5.5	5.3	5.1	4.1
Estbrg	N1472	Glisan14	183	182.3	0	0.0	0.0	0.0	0.0	0.0
2.13	Glisan14	Glisan15	182.3	181.5	1764	0.7	0.7	0.7	0.7	0.5
2.06	Glisan15	N1468	181.5	180	1217	1.3	1.3	1.3	1.2	1.0
us_Market	N1468	N1462	180	180.3	6469	-3.6	-3.5	-3.4	-3.3	-2.4
Market.1	N1462	N1463	180.3	179.5	0	7.3	7.2	7.0	6.8	5.7
Market_rd	N1462	N1463	180.3	179.5	0	0.0	0.0	0.0	0.0	0.0
ds_Market	N1463	N1467	179.5	178	6869	4.6	4.5	4.4	4.2	3.1
NS_4	N1467	Glisan16	178	176	5251	4.0	4.0	3.8	3.7	2.5
NS_3	Glisan16	Glisan17	176	172	15592	1.7	1.7	1.6	1.5	1.3
US_park	Glisan17	PrivateRd1	172	171.5	9848	7.0	6.9	6.5	6.2	4.1
ParkLn	PrivateRd1	PrivateRd2	171.5	170.12	0	5.7	5.6	5.4	5.3	3.4
Road_Ppark	PrivateRd1`	PrivateRd2	171.5	170.12	0	0.0	0.0	0.0	0.0	0.0
1.891	PrivateRd2	N1466	170.12	168.1	35839	5.3	5.2	5.0	4.8	3.6
NS_0.8	N1466	NS0.6	168.1	167.2	6231	3.3	3.3	3.2	3.1	2.6
NS_0.6	NS0.6	ns0.5	167.2	160	8404	1.3	1.3	1.2	1.2	0.8
NS_0.5	ns0.5	NS0.3	160	159.9	493	1.8	1.7	1.6	1.6	1.1
NS_0.4	NS0.3	N1473	159.9	156.7	2791	2.3	2.2	2.2	2.1	2.1
FootBrg	N1473	N1474	156.7	156.55	0	4.0	3.8	3.3	3.0	1.3
Footbrdg2	N1473	N1474	156.7	156.55	0	0.0	0.0	0.0	0.0	0.0
L1460	N1474	FC-7	156.55	155.1	2702	3.5	3.5	3.4	3.3	2.8
NS_0.3	FC-7	PrivateRd4	155.1	151.4	2593	1.4	1.4	1.3	1.2	0.9
NS0.2	PrivateRd4	Barr	151.4	151.3	1380	3.0	3.0	3.0	3.0	2.8
BarrSt	Barr	Barr1	151.3	151	0	5.4	5.2	4.7	4.5	2.6
WEIR#10	Barr	Barr1	151.3	151	0	0.0	0.0	0.0	0.0	0.0
1.706	Barr1	FC-6	151	150.5	454	7.4	7.4	7.4	7.4	6.9
PrvBldg	FC-6	Barr2	150.5	150.5	0	6.5	6.4	6.2	6.1	4.3
WEIR#11	FC-6	Barr2	150.5	150.5	0	0.0	0.0	0.0	0.0	0.0
1.701	Barr2	Barr3	150.5	149.9	6257	5.7	5.7	5.6	5.5	3.8
1.7	Barr3	Barr4	149.9	148.8	5228	3.7	3.7	3.7	3.7	3.0
1.681	Barr4	Barr5	148.8	147.6	1831	3.1	3.2	3.3	3.3	3.3
1.675	Barr5	FC-5R	147.6	147.4	1275	5.8	5.8	5.7	5.7	5.9
Halsey	FC-5R	Halsey1	147.4	146.7	0	2.3	2.2	2.0	1.9	1.4
WEIR#12	FC-5R	Halsey1	147.4	146.7	0	0.0	0.0	0.0	0.0	0.0
1.657	Halsey1	Halsey2	146.7	146.3	1333	9.8	9.6	9.2	8.9	6.5
1.656	Halsey2	Halsey3	146.3	145.5	2522	1.7	1.7	1.7	1.7	1.5
1.65	Halsey3	Halsey4	145.5	145.5	109	1.8	1.8	1.8	1.7	1.6
1045	1044	1042	188.19	183.27	74	11.4	11.3	10.9	10.7	8.9
1043	1042	1040	183.055	178.75	74	11.3	11.2	10.9	10.6	8.9
1041	1040	1038	178.55	175.75	71	10.8	10.7	10.4	10.1	8.5
1039	1038	1036	175.55	170.75	84	12.5	12.3	11.9	11.6	9.7
1037	1036	1034	170.53	164.98	99	14.2	14.0	13.5	13.1	10.9
1035	1034	1032	164.77	158.17	108	15.1	14.9	14.4	14.0	11.6
1033	1032	1030	157.97	151.58	97	13.4	13.4	13.2	12.9	10.8
1031	1030	1028	151.382	147.47	85	9.6	9.6	9.6	9.5	9.3
1029	1028	Halsey4	147.47	146	72	8.9	8.2	7.3	7.0	6.0
1.641	Halsey4	Fairview1	145.5	145.5	323	2.3	2.3	2.1	2.1	1.7
FrvAve1	Fairview1	Fairview2	145.5	145.5	0	2.5	2.3	2.1	2.0	1.3
WEIR#47	Fairview1	Fairview2	145.5	145.5	0	0.0	0.0	0.0	0.0	0.0
1.631	Fairview2	Fairview3	145.5	144.8	269	10.1	9.8	9.2	8.9	6.5
1.63	Fairview3	Fairview4	144.8	144	1218	3.9	3.8	3.7	3.6	2.9
1.615	Fairview4	Fairview5	144	142.4	1363	3.0	3.0	2.9	2.9	2.4
NN235	2953-F-605	NN_Glisan2	195.9	187.8	85	3.4	3.4	3.2	3.1	3.1
NN230	NN_Glisan2	NN_Glisan3	187.8	183.21	111	5.2	5.1	4.8	4.7	4.3
NN_Glsn_2	NN_Glisan3	NN_Glisan4	183.21	164	0	11.9	11.9	9.3	8.6	5.9
WEIR#35	NN_Glisan3	NN_Glisan4	183.21	164	0	0.0	0.0	0.0	0.0	0.0
NN_Glsn_7	NN_Glisan4	NN_Glisan5	164	164.1	0	-13.5	-13.5	-11.5	-10.4	-5.6
WEIR#36	NN_Glisan4	NN_Glisan5	164	164.1	0	0.0	0.0	0.0	0.0	0.0
NN215	NN_Glisan5	NN-6	164.1	161.5	1737	4.2	4.2	4.0	3.9	3.2
919	917	918	185.65	170.95	359	0.0	0.0	0.0	0.0	0.0
920	918	NN-6	170.95	161.5	588	0.0	0.0	0.0	0.0	0.0
NN210	NN-6	NN_Glisan6	161.5	160.3	902	4.1	4.1	3.8	3.7	2.9
NN205	NN_Glisan6	NN-5	160.3	152.66	439	2.9	2.8	2.7	2.7	2.7
AratаDiv1	NN-5	AratаDivA	153	153	1	0.4	0.5	0.6	0.6	0.5
Arata_1	NN-5	Arata1	152.44	151.76	0	16.2	16.1	16.1	16.0	14.7
WEIR#23	NN-5	Arata1	152.44	151.76	0	0.0	0.0	0.0	0.0	0.0
WEIR#46	AratаDivA	AratаDivB	153	151.4	0	0.0	0.0	0.0	0.0	0.0

City of Fairview
Velocity for Modeling Reaches (fps)
Future Conditions

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Vel (fps)	50-Year Max Vel (fps)	25-Year Max Vel. (fps)	10-Year Max Vel. (fps)	WQ Max Vel. (fps)
Hals_ABS	AratаDivC	Hlsy_w5	147.8	147.05	84	6.0	6.0	6.0	6.0	5.9
NN195	Arata1	Arata2	152	150	4316	2.3	2.3	2.3	2.2	2.2
NN190	Arata2	Arata3	150	147	16375	4.3	4.3	4.3	4.3	3.8
NN185	Arata3	Arata4	147	146.8	6396	5.2	5.2	5.3	5.3	4.6
NN180	Arata4	Hlsy_w1	146	144.2	1194	0.3	0.3	0.3	0.3	0.2
NN150	Arata4	Hlsy_e1	146	143.82	1732	0.3	0.3	0.3	0.3	0.2
Halsey_4	Hlsy_e1	Hlsy_e2	143.82	144.16	0	-9.7	-9.4	-8.7	-8.2	-4.7
WEIR#25	Hlsy_e1	Hlsy_e2	143.82	144.16	0	0.0	0.0	0.0	0.0	0.0
NN140	Hlsy_e2	NN-4	144.16	144.1	256	1.1	1.1	1.1	1.0	1.1
Halsey_5	NN-4	NN_Halsey1	144.1	144.32	0	-12.5	-12.3	-11.6	-10.2	-7.3
WEIR#28	NN-4	NN_Halsey1	144.1	144.32	0	0.0	0.0	0.0	0.0	0.0
NN130	NN_Halsey1	NN_Halsey2	144.32	136	106	6.5	6.5	6.3	5.0	3.8
Halsey_6	NN_Halsey2	NN_Halsey3	136	136	0	11.8	11.8	11.7	10.9	8.4
WEIR#29	NN_Halsey2	NN_Halsey3	136	136	0	0.0	0.0	0.0	0.0	0.0
NN120	NN_Halsey3	NN_Halsey4	136	120	212	5.6	5.5	5.5	5.4	4.5
NN115	NN_Halsey4	NN_Halsey5	118.5	114.5	10953	2.9	2.9	2.9	2.9	2.9
NN110	NN_Halsey5	NN_Halsey6	114.5	114.5	59	2.3	2.3	2.3	2.3	2.3
NNBrdg_1	NN_Halsey6	NN_Bridge1	114.5	104	0	16.2	16.2	16.0	15.9	13.7
WEIR#30	NN_Halsey6	NN_Bridge1	114.5	104	0	0.0	0.0	0.0	0.0	0.0
NN100	NN_Bridge1	NN_Bridge2	104	92	9178	2.7	2.7	2.7	2.7	2.7
NN95	NN_Bridge2	NN_Bridge3	92	90	40257	1.4	1.4	1.4	1.4	1.4
NN90	NN_Bridge3	NN-3	90	90	2487	1.5	1.5	1.5	1.4	1.4
NNBrdg_2	NN-3	I-84	90	90	0	6.3	6.1	7.3	5.4	3.6
WEIR#31	NN-3	I-84	90	90	0	0.0	0.0	0.0	0.0	0.0
NN_I-84_1	I-84	NN_I-84-1	90	86	0	14.2	14.1	14.1	14.1	12.9
WEIR#32	I-84	NN_I-84-1	90	86	0	0.0	0.0	0.0	0.0	0.0
NN70	NN_I-84-1	NN_I-84-2	86	64	1685	2.9	2.9	2.8	2.8	2.1
NN65	NN_I-84-2	NN_I-84-3	64	38.2	9938	4.2	4.3	4.3	4.2	4.2
NN60	NN_I-84-3	NN-2	38.2	38	667	3.5	3.5	3.2	2.8	3.1
NN2R-RR1	NN-2R1L	NN2R-RRS	105.5	95.5	331	1.4	1.4	1.4	1.4	1.2
NN2R_RR	NN-2R2	NN2R-RRS	95.55	95.05	0	12.0	11.6	11.0	10.7	8.9
WEIR#37	NN-2R2	NN2R-RRS	95.55	95.05	0	0.0	0.0	0.0	0.0	0.0
NN2R2	NN2R-RRS	NN2R-RRN	95.05	91.8	249	5.3	5.1	4.8	4.5	3.3
NN2R3	NN2R-RRN	NN2R-I-84E	91.8	91.8	172	5.4	5.4	5.4	5.4	5.4
NN2R_I-84	NN2R-I-84E	NN2R-238S	91.8	88.2	0	14.2	13.9	13.4	13.1	10.6
WEIR#38	NN2R-I-84E	NN2R-238S	91.8	88.2	0	0.0	0.0	0.0	0.0	0.0
NN2R5	NN2R-238S	NN2R-238N	88.2	79.6	910	3.7	3.5	3.3	3.2	2.2
NN2R6	NN2R-238N	NN2R-238	79.6	79.6	77	6.1	6.0	5.7	5.5	4.1
NN2R_238	NN2R-238	NN2R-TSE	79.6	74	0	11.2	10.6	9.5	8.8	6.2
WEIR#39	NN2R-238	NN2R-TSE	79.6	74	0	0.0	0.0	0.0	0.0	0.0
NN2R8	NN2R-TSE	NN2R-TSW	74	61.4	285	4.7	4.6	4.4	4.2	3.3
NN2R9	NN2R-TSW	NN2R-WVMHP	61.4	61	23005	25.2	27.1	24.3	26.1	7.7
NN2R_WVHP	NN2R-WVMHP	NN-2R1	61	46	0	10.6	10.4	11.0	10.8	4.7
WEIR#40	NN2R-WVMHP	NN-2R1	61	46	0	0.0	0.0	0.0	0.0	0.0
NN2R11	NN-2R1	NN2R-AlotW	46	42	84	3.1	3.0	2.9	2.8	2.6
NN2R12	NN2R-AlotW	NN-2	42	38	924	4.2	4.3	4.3	4.3	4.0
NNSandy_1	NN-2	NN_Sandy1	38	37.6	0	11.0	11.0	11.0	11.0	7.8
NNSandy_2	NN-2	NN_Sandy1	38	37.6	27	11.0	11.0	11.0	11.0	7.8
WEIR#34	NN-2	NN_Sandy1	38	37.6	0	0.0	0.0	0.0	0.0	0.0
NNSandy_3	NN_Sandy1	NN-1	37.6	36	0	8.2	8.0	7.4	7.1	5.8
NNSandy_4	NN_Sandy1	NN-1	37.6	36	70	8.2	8.0	7.4	7.1	5.8
WEIR#33	NN_Sandy1	NN-1	37.6	36	0	0.0	0.0	0.0	0.0	0.0
NN45	NN-1	NN_Sandy2	36	32	718	5.1	5.0	5.0	4.9	3.7
NN40	NN_Sandy2	NN_Sandy3	32	22	17070	4.2	4.1	4.1	4.0	2.9
NN35	NN_Sandy3	NN_Sandy4	22	20	2879	5.8	5.7	5.6	5.6	4.6
NN30	NN_Sandy4	Confluence	20	16.4	5209	2.1	2.1	2.0	2.0	1.5
1.522	Fairview6	Fairview7	141.4	141.4	177	2.0	2.0	2.0	2.0	1.9
1.503	Fairview7	FC-5LB	141.4	141.4	435	1.8	1.8	1.8	1.8	1.6
NoName	FC-5LB	PrDv1	141.4	141.4	0	14.5	14.5	13.0	12.1	7.9
WEIR#13	FC-5LB	PrDv1	141.4	141.4	0	0.0	0.0	0.0	0.0	0.0
1.501	PrDv1	PrDv2	141.4	141.4	217	8.2	7.8	7.2	6.9	4.8
1.5	PrDv2	PrDv3	141.4	141.1	5217	4.7	4.7	4.7	4.7	3.8
1.49	PrDv3	PrDv4	141.1	134	10989	5.6	5.6	5.6	5.6	4.5
1.463	PrDv4	Matney	134	133.5	25232	5.3	5.3	5.3	5.3	5.2
MatneySt	Matney	Matney1	133.5	131.1	0	5.8	5.8	4.6	4.7	3.8
WEIR#14	Matney	Matney1	133.5	131.1	0	0.0	0.0	0.0	0.0	0.0
1.461	Matney1	Matney2	131.1	131	638	9.8	9.6	8.4	8.0	5.5
1.46	Matney2	Matney3	131	127.3	3382	4.5	4.4	4.1	4.0	2.9
1.44	Matney3	Matney4	127.3	123.5	3754	2.3	2.2	2.0	1.9	1.3
1.41	Matney4	Matney5	123.5	120.6	6095	2.1	2.1	2.1	2.1	2.1
1.368	Matney5	FC-5LA	120.6	120.6	174	2.9	2.8	2.7	2.8	2.4
PrvRd2.1	FC-5LA	PrvRd2	120.6	120.6	0	4.1	3.8	3.5	3.5	2.6

City of Fairview
Velocity for Modeling Reaches (fps)
Future Conditions

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation ft	Downstream Invert Elevation ft	Capacity cfs	100-Year Max Vel (fps)	50-Year Max Vel (fps)	25-Year Max Vel. (fps)	10-Year Max Vel. (fps)	WQ Max Vel. (fps)
WEIR#15	FC-5LA	PrvRd2	120.6	120.6	0	0.0	0.0	0.0	0.0	0.0
1.366	PrvRd2	PrvRd2-1	120.6	120	2648	5.4	5.1	4.8	4.8	4.0
1.36	PrvRd2-1	PrvRd2-2	120	118.4	951	2.2	2.2	2.2	2.2	1.9
1.343	PrvRd2-2	FC-5	118.4	118.4	472	3.6	3.6	3.6	3.6	3.2
PrvRd3	FC-5	PrvRd3-1	118.4	118.4	0	4.6	4.1	3.4	3.0	1.7
WEIR#16	FC-5	PrvRd3-1	118.4	118.4	0	0.0	0.0	0.0	0.0	0.0
1.341	PrvRd3-1	PrvRd3-2	118.4	118.4	148	9.2	9.2	9.2	9.2	6.7
1.34	PrvRd3-2	PrvRd3-3	118.4	114.4	1464	5.9	5.8	5.4	5.2	3.7
7385	PrvRd3-3	FC-4L	116.3	116.1	9176	3.7	3.6	3.6	3.6	3.2
BridgeSt	FC-4L	BridgeSt1	114.25	113.75	0	6.0	5.9	5.8	5.7	5.4
WEIR#17	FC-4L	BridgeSt1	114.25	113.75	0	0.0	0.0	0.0	0.0	0.0
7300	BridgeSt1	BridgeSt2	113.65	109.5	10668	12.8	12.2	11.4	10.9	8.2
7250	BridgeSt2	BridgeSt3	109.5	104.2	1330	5.0	4.8	4.7	4.6	3.7
7060	BridgeSt3	BridgeSt4	104.2	95.9	3162	4.7	4.7	4.7	4.6	3.7
6770	BridgeSt4	BridgeSt5	95.9	90	3123	5.1	4.8	4.5	4.3	3.2
6550	BridgeSt5	BridgeSt6	90	87.4	9506	4.2	4.0	3.9	3.8	3.1
6350	BridgeSt6	BridgeSt7	87.4	80	23041	4.8	4.8	4.8	4.8	4.7
6250	BridgeSt7	BridgeSt8	80	77	15284	9.3	8.8	8.2	7.9	5.8
6150	BridgeSt8	FC-4	77	75.2	61514	4.1	4.0	3.9	3.8	3.4
FC-4R-1	FC-4R	FC-4	75.7	75.2	21	3.3	3.2	2.8	2.6	2.1
I-84_1	FC-4	I-84-1	75.2	73.1	0	17.2	16.5	15.5	15.0	11.5
WEIR#18	FC-4	I-84-1	75.2	73.1	0	0.0	0.0	0.0	0.0	0.0
I-84_2	I-84-1	I-84-2	73.1	51.1	0	14.7	14.1	13.2	12.7	9.8
WEIR#19	I-84-1	I-84-2	73.1	51.1	0	0.0	0.0	0.0	0.0	0.0
5805	I-84-2	I-84-3	51.1	48	44805	12.1	11.6	10.8	10.3	7.6
5750	I-84-3	I-84-4	48	44	59906	5.1	4.9	4.6	4.4	3.2
5635	I-84-4	I-84-5	44	41	6836	5.5	5.3	5.1	4.9	4.1
5540	I-84-5	I-84-6	41	37	59799	3.1	3.0	3.0	2.9	2.7
5380	I-84-6	I-84-7	37	35.6	28483	6.3	6.2	6.2	6.2	5.1
5300	I-84-7	FC-3	35.6	31.9	27297	3.2	3.2	3.2	3.2	3.2
SandBlvd	FC-3	Sandy	31.9	29.8	0	14.0	13.7	13.2	13.0	11.1
WEIR#20	FC-3	Sandy	31.9	29.8	0	0.0	0.0	0.0	0.0	0.0
5160	Sandy	Sandy1	29.8	26.7	9621	12.9	12.4	12.0	11.5	8.5
5100	Sandy1	Sandy2	26.7	24.3	13864	9.4	9.4	9.4	8.9	5.8
4980	Sandy2	Sandy3	24.3	21.7	18693	3.8	3.7	3.6	3.5	3.5
4800	Sandy3	Sandy4	21.7	18	14722	1.2	1.3	1.3	1.3	1.1
4605	Sandy4	Sandy5	18	18	5439	0.7	0.6	0.5	0.5	0.3
WEIR#21	Sandy5	Sandy6	0	0	0	0.0	0.0	0.0	0.0	0.0
4601	Sandy6	Sandy7	25.6	25.6	2399	5.1	4.9	4.6	4.4	3.4
4600	Sandy7	Sandy8	17.4	17.2	6271	6.2	6.3	5.9	5.7	2.9
4560	Sandy8	Sandy9	17.2	19.8	74483	-7.5	-7.1	-6.3	-5.6	-2.4
4555	Sandy9	Sandy10	19.8	19.8	1461	17.8	17.1	15.7	14.2	9.0
4545	Sandy10	Sandy11	19.8	17	73856	6.8	6.4	5.6	5.6	5.3
4540	Sandy11	Confluence	17	16.4	8934	5.4	5.4	5.0	4.9	3.1
4460	Confluence	Confluenc1	16.4	15.6	13197	2.5	2.5	2.5	2.4	2.4
4320	Confluenc1	Confluenc2	15.6	14.6	9583	3.7	3.7	3.7	3.7	3.6
4000	Confluenc2	FC-2	14.6	14.4	11728	4.7	4.6	4.6	4.5	3.7
BlueLkRd	FC-2	FvLake	15.3	14.2	0	13.6	13.4	13.0	12.7	9.7
WEIR#22	FC-2	FvLake	15.3	14.2	0	0.0	0.0	0.0	0.0	0.0
3865	FvLake	FvLake1	13.6	13	5191	2.9	2.9	2.8	2.7	2.1
3740	FvLake1	FvLake2	13	12.5	4326	1.5	1.5	1.4	1.4	1.3
3600	FvLake2	FvLake3	12.5	12	1631	3.2	3.2	3.1	3.1	2.8
3300	FvLake3	FvLake4	12	11.4	2738	2.4	2.4	2.3	2.2	1.6
3040	FvLake4	FvLake5	11.4	11.3	945	4.0	4.0	3.8	3.7	2.7
2770	FvLake5	FvLake6	11.3	10.6	3571	2.0	1.9	1.9	1.8	1.3
2470	FvLake6	FC-1R	10.6	9.5	11243	0.8	0.8	0.8	0.7	0.5
1811	FC-1R	FvLake8	9.5	9.4	2187	1.9	1.8	1.7	1.7	0.9
1810	FvLake8	FvLake9	9.7	9.7	445	5.2	5.0	4.5	4.2	1.9
1789	FvLake9	FvLake10	9.7	8	9638	1.9	1.8	1.6	1.5	0.6
1170	FvLake10	FvLake13	8	7.5	10764	0.6	0.5	0.5	0.4	0.2
1070	FvLake13	FRV_LAKE	7.5	7.5	116	5.5	5.2	4.5	4.1	1.7
NN175	Hlsy_w1	Hlsy_w2	144.2	145.9	5723	-0.2	-0.2	-0.2	-0.2	0.0
Halsey_1	Hlsy_w2	Hlsy_w3	146.3	146.3	0	2.7	2.7	2.6	2.4	-1.7
WEIR#26	Hlsy_w2	Hlsy_w3	146.3	146.3	0	0.0	0.0	0.0	0.0	0.0
NN165	Hlsy_w3	Hlsy_w4	145.8	146.33	2536	0.8	0.8	-0.8	-0.8	0.6
Halsey_2	Hlsy_w4	Hlsy_w5	146.33	146.45	0	-9.4	-9.4	-8.6	-7.3	2.1
WEIR#27	Hlsy_w4	Hlsy_w5	146.33	146.45	0	0.0	0.0	0.0	0.0	0.0
Halsey_3	Hlsy_w5	Hlsy_w6	145.84	144.97	0	7.3	7.3	7.4	7.3	4.2
WEIR#24	Hlsy_w5	Hlsy_w6	145.84	144.97	0	0.0	0.0	0.0	0.0	0.0
NN151	Hlsy_w6	Fairview5	144.97	142.6	30434	0.0	0.0	0.0	0.0	0.0
1.552	Fairview5	Fairview6	142.4	141.4	3506	1.9	1.9	1.9	1.9	1.9

ATTACHMENT G

Raintree Sub-basin

Existing Conditions – Water Surface Elevations

City of Fariview
Raintree Basin Water Surface Elevations (ft)
Existing Conditions

Node	Invert El (ft)	100-yr WSEL	50-yr WSEL	25-yr WSEL	10-yr WSEL	WQ WSEL
00489s	164.20	164.7	164.6	164.6	164.6	164.5
00491s	130.10	131.2	130.9	130.6	130.5	130.4
00492s	132.83	134.3	134.2	134.1	134.0	133.5
00494s	130.62	131.6	131.6	131.5	131.5	131.2
00496s	133.50	133.9	133.9	133.9	133.8	133.7
00498s	138.00	138.7	138.7	138.6	138.6	138.4
00500s	139.70	140.5	140.4	140.4	140.3	140.1
00501s	140.85	141.7	141.7	141.6	141.5	141.3
00502s	138.30	139.4	139.3	139.3	139.2	139.0
00503s	143.28	143.6	143.6	143.6	143.6	143.5
00508s	149.40	149.8	149.8	149.8	149.7	149.6
00509s	159.39	159.9	159.9	159.8	159.8	159.7
00510s	166.79	167.2	167.1	167.1	167.1	167.0
00511s	170.45	170.9	170.9	170.9	170.9	170.7
00513s	191.19	191.4	191.4	191.4	191.4	191.3
00514s	188.19	188.5	188.5	188.5	188.4	188.4
00516s	190.10	190.5	190.5	190.5	190.5	190.4
00517s	188.97	189.5	189.5	189.5	189.4	189.3
00570s	137.86	138.4	138.3	138.3	138.3	138.2
00571s	132.72	133.6	133.6	133.5	133.5	133.2
00573s	127.90	130.7	130.6	130.4	130.2	129.4
00574s	139.26	139.5	139.5	139.5	139.5	139.4
00579s	116.20	119.5	119.4	119.1	119.0	118.5
00580s	116.40	119.5	119.4	119.1	119.0	118.5
00582s	103.60	108.3	108.1	108.1	108.1	106.9
00583s	105.40	111.5	110.8	109.8	109.6	107.3
00584s	134.67	135.0	134.9	134.9	134.9	134.8
00614s	137.24	137.6	137.5	137.5	137.5	137.4
00635s	141.05	141.7	141.7	141.6	141.5	141.3
00639s	142.00	142.0	142.0	142.0	142.0	142.0
00645s	125.75	126.2	126.2	126.2	126.1	126.0
00663s	128.00	130.7	130.6	130.4	130.3	129.5
00725s	132.46	134.3	134.2	134.1	134.0	133.5
00738s	137.00	137.3	137.3	137.3	137.2	137.2
00753s	124.06	125.1	125.0	124.8	124.8	124.5
00765s	137.64	137.9	137.8	137.8	137.8	137.8
00808s	139.10	139.4	139.4	139.4	139.4	139.3
00810s	165.80	166.1	166.1	166.1	166.1	166.0
04038s	123.58	125.0	124.9	124.8	124.7	124.3
00698s	100.90	105.9	105.9	105.9	105.8	101.7
outfall	90.00	91.5	91.5	91.5	91.5	90.8
storage_Eastside	120.00	121.3	121.2	121.1	121.1	120.7
storage_Westside	110.00	111.5	110.8	110.1	110.1	110.0

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ATTACHMENT H

Raintree Sub-basin

Existing Conditions – Flow Rates

City of Fairview
Raintree Basin Flows
Existing Conditions

Link	Upstream Node	To Node	Length	Slope	Capacity (cfs)	100-yr Flow	50-yr Flow (cfs)	25-yr Flow (cfs)	10-yr Flow (cfs)	WQ Flow (cfs)
205S	00496S	00491S	405	0.84	3.3	1.1	1.0	0.9	0.8	0.4
206S	00574S	00496S	121	4.76	7.8	1.1	1.0	0.9	0.8	0.4
195S	00511S	00510S	113	3.24	10.4	2.8	2.6	2.2	2.0	1.0
196S	00510S	00509S	140	5.31	14.9	2.8	2.6	2.2	2.0	1.0
197S	00509S	00508S	248	4.02	13.0	3.7	3.4	2.9	2.6	1.3
198S	00508S	00570S	130	8.87	19.2	4.3	3.9	3.4	3.0	1.5
199S	00570S	00571S	139	3.70	12.4	4.3	3.9	3.4	3.0	1.5
201S	00571S	00494S	201	1.04	41.9	11.8	10.9	9.3	8.4	4.0
200S	00498S	00571S	366	1.44	27.2	7.6	7.0	5.9	5.4	2.6
437S	00810S	00808S	319	0.46	2.4	0.4	0.4	0.3	0.3	0.1
191S	00513S	00516S	163	0.67	2.9	0.3	0.3	0.2	0.2	0.1
192s	00516S	00517S	170	0.66	2.9	1.2	1.1	0.9	0.8	0.4
193S	00517S	00514S	115	0.68	2.9	1.3	1.2	1.0	0.9	0.4
194S	00514S	00511S	251	7.07	9.5	1.9	1.7	1.5	1.3	0.6
262S	00503S	00500S	169	2.12	32.9	2.0	1.9	1.6	1.4	0.7
256S	00500S	00502S	174	0.81	20.3	6.3	5.8	5.0	4.5	2.1
255S	00502S	00498S	117	0.26	11.5	6.7	6.1	5.2	4.7	2.3
265s	00501S	00500S	338	0.34	6.1	3.5	3.2	2.8	2.5	1.2
350	00492s	00738S	29	1.29	4.1	1.0	1.0	1.0	1.1	1.1
MinDitch1	00738S	00663S	288	2.33	7.7	1.6	1.5	1.3	1.1	0.6
14	00492s	00738S	28	1.32	4.1	1.3	1.3	1.3	1.2	1.2
culvert1	00663S	00765S	161	1.05	6.6	2.0	1.8	1.5	1.4	0.7
culvert2	00808S	00765S	357	3.80	7.0	0.7	0.6	0.5	0.5	0.2
17	00753S	00492s	352	1.18	3.9	0.7	0.6	0.5	0.5	0.2
18	00808S	00492s	369	1.30	1.6	0.3	0.3	0.2	0.2	0.1
19	00583S	00582S	85	2.12	15.3	20.4	18.8	16.2	15.2	7.0
00698S	00698s	00583S	275	6.61	13.0	3.4	3.1	2.7	2.4	1.2
3323	00765S	00698s	103	0.47	7.2	3.4	3.1	2.7	2.4	1.2
453	00635s	00753S	38	0.63	2.8	0.6	0.5	0.5	0.4	0.2
20	00579s	00583S	195	5.54	141.4	14.4	13.2	11.3	10.2	4.9
21	00491S	00725s	190	1.11	3.8	1.7	1.6	1.4	1.2	0.6
22	00725s	00573s	12	0.83	4.6	1.7	1.6	1.4	1.2	0.6
23	00573s	00580S	120	9.58	42.2	13.9	12.8	11.0	9.9	4.7
24	00580S	00579s	36	0.56	49.7	13.9	12.9	11.0	9.9	4.8
25	00494S	00573s	450	0.60	51.9	12.2	11.2	9.6	8.6	4.2
26	00614s	00492s	267	0.69	1.8	0.5	0.4	0.4	0.3	0.2
27	00639s	00501S	37	0.54	2.6	0.5	0.4	0.4	0.3	0.2
28	00645s	00639s	168	0.57	2.7	0.0	0.0	0.0	0.0	0.0
29	00489S	00503S	327	6.40	9.2	2.0	1.9	1.6	1.4	0.7
30	04038s	00489S	311	0.51	7.5	0.9	0.8	0.7	0.6	0.3
32	Storage_WestSide	00583S	485	3.01	8.8	2.0	1.9	1.6	1.4	0.7
33	Storage_EastSide	00583S	22	20.91	3.4	0.7	0.5	0.0	0.0	0.0
itch_RR_I8	00582S	00584S	400	0.68	22.9	20.4	18.8	16.3	15.8	7.0
XingCulver	00584S	outfal	392	2.78	17.5	20.1	20.1	20.1	20.1	9.9
1	00580S	00579s				0.0	0.0	0.0	0.0	0.0
weir2	00583S	00582S				0.0	0.0	0.0	0.0	0.0

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ATTACHMENT I

Raintree Sub-basin

Existing Conditions - Velocity

City of Fairview
Raintree Basin Velocties (fps)
Existing Conditions

Link	Upstream Node	To Node	Length	Slope	100-yr Vel. (Fps)	50-yr Vel. (fps)	25-yr Vel. (fps)	10-yr Flow (fps)	WQ Flow (fps)
205S	00496S	00491S	405	0.84	3.2	3.1	3.1	3.0	2.5
206S	00574S	00496S	121	4.76	4.9	4.8	4.6	4.5	3.6
195S	00511S	00510S	113	3.24	7.9	7.7	7.4	7.2	5.8
196S	00510S	00509S	140	5.31	7.2	7.1	6.8	6.6	5.3
197S	00509S	00508S	248	4.02	9.2	9.0	8.6	8.3	6.7
198S	00508S	00570S	130	8.87	10.6	10.4	10.0	9.7	7.9
199S	00570S	00571S	139	3.70	6.0	5.8	5.5	5.3	4.2
201S	00571S	00494S	201	1.04	6.9	6.8	6.5	6.3	5.1
200S	00498S	00571S	366	1.44	6.3	6.1	5.9	5.7	4.6
437S	00810S	00808S	319	0.46	2.3	2.2	2.1	2.1	1.7
191S	00513S	00516S	163	0.67	1.3	1.3	1.3	1.2	1.0
192s	00516S	00517S	170	0.66	3.0	2.9	2.8	2.7	2.1
193S	00517S	00514S	115	0.68	4.0	3.9	3.7	3.6	2.9
194S	00514S	00511S	251	7.07	6.6	6.5	6.2	6.0	4.8
262S	00503S	00500S	169	2.12	2.9	2.8	2.7	2.6	2.1
256S	00500S	00502S	174	0.81	4.5	4.3	4.1	3.9	3.0
255S	00502S	00498S	117	0.26	4.9	4.7	4.5	4.3	3.3
265s	00501S	00500S	338	0.34	3.6	3.6	3.4	3.3	2.7
350	00492s	00738S	29	1.29	2.3	2.3	2.2	2.2	2.3
MinDitch1	00738S	00663S	288	2.33	0.5	0.5	0.5	0.5	0.4
14	00492s	00738S	28	1.32	2.6	2.6	2.6	2.5	2.4
culvert1	00663S	00765S	161	1.05	2.8	2.9	2.9	2.9	2.5
culvert2	00808S	00765S	357	3.80	2.0	1.9	1.8	1.8	1.4
17	00753S	00492s	352	1.18	2.3	2.3	2.2	2.1	1.9
18	00808S	00492s	369	1.30	1.6	1.6	1.5	1.4	1.3
19	00583S	00582S	85	2.12	11.5	10.6	9.2	8.6	5.1
00698S	00698s	00583S	275	6.61	0.6	0.6	0.6	0.6	0.6
3323	00765S	00698s	103	0.47	2.3	2.2	2.2	2.2	1.9
453	00635s	00753S	38	0.63	3.0	2.9	2.8	2.7	2.1
20	00579s	00583S	195	5.54	1.0	1.0	1.0	1.0	0.9
21	00491S	00725s	190	1.11	2.3	2.3	2.2	2.1	1.4
22	00725s	00573s	12	0.83	0.2	0.2	0.2	0.2	0.1
23	00573s	00580S	120	9.58	1.3	1.3	1.3	1.3	1.1
24	00580S	00579s	36	0.56	2.1	2.2	2.2	2.1	2.1
25	00494S	00573s	450	0.60	3.0	3.0	2.8	2.7	2.2
26	00614s	00492s	267	0.69	1.6	1.6	1.5	1.5	1.4
27	00639s	00501S	37	0.54	0.7	0.7	0.7	0.7	0.6
28	00645s	00639s	168	0.57	0.0	0.0	0.0	0.0	0.0
29	00489S	00503S	327	6.40	6.0	5.9	5.6	5.5	4.4
30	04038s	00489S	311	0.51	2.3	2.2	2.2	2.1	1.7
32	Storage_WestSide	00583S	485	3.01	0.3	0.3	0.4	0.3	0.3
33	Storage_EastSide	00583S	22	20.91	0.3	0.3	0.0	0.0	0.0
itch_RR_I8	00582S	00584S	400	0.68	0.7	0.7	0.7	0.7	0.6
XingCulver	00584S	outfal	392	2.78	11.4	11.4	11.4	11.4	10.2
1	00580S	00579s							
weir2	00583S	00582S							

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ATTACHMENT J

Raintree Sub-basin

Future Conditions – Water Surface Elevations

City of Fariview
Raintree Basin Water Surface Elevations (ft)
Future Conditions

Node	Invert El (ft)	100-yr WSEL	50-yr WSEL	25-yr WSEL	10-yr WSEL	WQ WSEL
00489s	164.20	164.7	164.7	164.7	164.6	164.5
00491s	130.10	131.5	131.4	131.0	130.8	130.4
00492s	132.83	134.7	134.6	134.4	134.3	133.6
00494s	130.62	131.8	131.7	131.6	131.6	131.3
00496s	133.50	133.9	133.9	133.9	133.9	133.8
00498s	138.00	138.8	138.8	138.7	138.7	138.5
00500s	139.70	140.6	140.5	140.5	140.4	140.2
00501s	140.85	141.8	141.8	141.7	141.6	141.4
00502s	138.30	139.5	139.5	139.4	139.3	139.0
00503s	143.28	143.7	143.6	143.6	143.6	143.5
00508s	149.40	149.9	149.9	149.8	149.8	149.7
00509s	159.39	160.0	160.0	159.9	159.9	159.7
00510s	166.79	167.2	167.2	167.2	167.2	167.1
00511s	170.45	171.0	171.0	171.0	170.9	170.8
00513s	191.19	191.4	191.4	191.4	191.4	191.3
00514s	188.19	188.5	188.5	188.5	188.5	188.4
00516s	190.10	190.6	190.6	190.5	190.5	190.4
00517s	188.97	189.6	189.6	189.5	189.5	189.3
00570s	137.86	138.5	138.4	138.4	138.4	138.2
00571s	132.72	133.8	133.7	133.6	133.6	133.3
00573s	127.90	131.0	131.0	130.7	130.6	129.7
00574s	139.26	139.5	139.5	139.5	139.5	139.4
00579s	116.20	119.9	119.8	119.5	119.3	118.3
00580s	116.40	119.9	119.8	119.5	119.4	118.3
00582s	103.60	110.5	109.9	108.9	108.5	107.7
00583s	105.40	117.4	115.9	113.3	112.2	108.5
00584s	134.67	135.0	135.0	135.0	134.9	134.9
00614s	137.24	137.6	137.6	137.6	137.5	137.5
00635s	141.05	141.8	141.8	141.7	141.6	141.4
00639s	142.00	142.0	142.0	142.0	142.0	142.0
00645s	125.75	126.3	126.3	126.2	126.2	126.1
00663s	128.00	131.0	131.0	130.7	130.6	129.7
00725s	132.46	134.6	134.5	134.4	134.2	133.6
00738s	137.00	137.3	137.3	137.3	137.3	137.2
00753s	124.06	125.3	125.2	125.0	124.9	124.5
00765s	137.64	137.9	137.9	137.8	137.8	137.8
00808s	139.10	139.5	139.5	139.4	139.4	139.3
00810s	165.80	166.2	166.2	166.1	166.1	166.0
04038s	123.58	125.2	125.1	125.0	124.9	124.4
00698s	100.90	105.9	105.9	105.9	105.9	102.0
outfall	90.00	91.5	91.5	91.5	91.5	91.1
storage_Eastside	120.00	123.1	122.6	122.1	122.0	121.3
storage_Westside	110.00	117.6	116.0	113.5	112.3	110.2

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ATTACHMENT K

Raintree Sub-basin

Future Conditions – Flow Rates

City of Fairview
Raintree Basin Flows
Future Conditions

Link	Upstream Node	To Node	Length	Slope	Capacity (cfs)	100-yr Flow	50-yr Flow (cfs)	25-yr Flow (cfs)	10-yr Flow (cfs)	WQ Flow (cfs)
205S	00496S	00491S	405	0.84	3.3	1.3	1.2	1.0	0.9	0.4
206S	00574S	00496S	121	4.76	7.8	1.3	1.2	1.0	0.9	0.4
195S	00511S	00510S	113	3.24	10.4	4.1	3.8	3.2	2.9	1.0
196S	00510S	00509S	140	5.31	14.9	4.1	3.8	3.2	2.9	1.0
197S	00509S	00508S	248	4.02	13.0	5.2	4.8	4.1	3.7	1.3
198S	00508S	00570S	130	8.87	19.2	5.9	5.4	4.6	4.2	1.5
199S	00570S	00571S	139	3.70	12.4	5.9	5.4	4.6	4.2	1.5
201S	00571S	00494S	201	1.04	41.9	15.3	14.1	12.0	10.8	4.0
200S	00498S	00571S	366	1.44	27.2	9.4	8.7	7.4	6.7	2.6
437S	00810S	00808S	319	0.46	2.4	0.5	0.4	0.4	0.3	0.1
191S	00513S	00516S	163	0.67	2.9	0.3	0.3	0.2	0.2	0.1
192s	00516S	00517S	170	0.66	2.9	1.3	1.2	1.0	0.9	0.4
193S	00517S	00514S	115	0.68	2.9	1.6	1.5	1.3	1.1	0.4
194S	00514S	00511S	251	7.07	9.5	2.3	2.1	1.8	1.6	0.6
262S	00503S	00500S	169	2.12	32.9	2.5	2.3	1.9	1.7	0.7
256S	00500S	00502S	174	0.81	20.3	7.9	7.3	6.2	5.6	2.1
255S	00502S	00498S	117	0.26	11.5	8.3	7.7	6.6	5.9	2.3
265s	00501S	00500S	338	0.34	6.1	4.4	4.0	3.4	3.1	1.2
350	00492s	00738S	29	1.29	4.1	1.1	1.1	1.0	1.0	1.1
MinDitch1	00738S	00663S	288	2.33	7.7	2.1	1.9	1.6	1.5	0.6
14	00492s	00738S	28	1.32	4.1	1.3	1.3	1.3	1.3	1.2
culvert1	00663S	00765S	161	1.05	6.6	2.5	2.3	2.0	1.8	0.7
culvert2	00808S	00765S	357	3.80	7.0	0.8	0.7	0.6	0.6	0.2
17	00753S	00492s	352	1.18	3.9	0.8	0.8	0.6	0.6	0.2
18	00808S	00492s	369	1.30	1.6	0.4	0.3	0.3	0.3	0.1
19	00583S	00582S	85	2.12	15.3	29.9	27.9	24.1	21.9	7.0
00698S	00698s	00583S	275	6.61	13.0	4.2	3.9	3.3	3.0	1.2
3323	00765S	00698s	103	0.47	7.2	4.2	3.9	3.3	3.0	1.2
453	00635s	00753S	38	0.63	2.8	0.7	0.7	0.6	0.5	0.2
20	00579s	00583S	195	5.54	141.4	17.3	16.9	14.4	13.0	4.9
21	00491S	00725s	190	1.11	3.8	1.8	1.7	1.5	1.3	0.6
22	00725s	00573s	12	0.83	4.6	1.8	1.7	1.5	1.3	0.6
23	00573s	00580S	120	9.58	42.2	16.6	16.2	13.8	12.5	4.7
24	00580S	00579s	36	0.56	49.7	16.6	16.2	13.8	12.5	4.8
25	00494S	00573s	450	0.60	51.9	15.7	14.5	12.4	11.2	4.2
26	00614s	00492s	267	0.69	1.8	0.6	0.5	0.4	0.4	0.2
27	00639s	00501S	37	0.54	2.6	0.6	0.5	0.4	0.4	0.2
28	00645s	00639s	168	0.57	2.7	0.0	0.0	0.0	0.0	0.0
29	00489S	00503S	327	6.40	9.2	2.5	2.3	1.9	1.7	0.7
30	04038s	00489S	311	0.51	7.5	1.1	1.0	0.8	0.8	0.3
32	Storage_WestSide	00583S	485	3.01	8.8	5.6	5.2	4.6	4.1	0.7
33	Storage_EastSide	00583S	22	20.91	3.4	2.0	1.9	1.4	1.1	0.0
itch_RR_I8	00582S	00584S	400	0.68	22.9	29.9	27.9	24.1	21.9	7.0
XingCulver	00584S	outfal	392	2.78	17.5	20.1	20.1	20.1	20.1	9.9
1	00580S	00579s				0.0	0.0	0.0	0.0	0.0
weir2	00583S	00582S				0.0	0.0	0.0	0.0	0.0

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ATTACHMENT L

Raintree Sub-basin

Future Conditions - Velocity

City of Fairview
Raintree Basin Velocties (fps)
Future Conditions

Link	Upstream Node	To Node	Length	Slope	100-yr Vel. (Fps)	50-yr Vel. (fps)	25-yr Vel. (fps)	10-yr Flow (fps)	WQ Flow (fps)
205S	00496S	00491S	405	0.84	3.16	3.3	3.3	3.2	2.5
206S	00574S	00496S	121	4.76	5.16	5.1	4.8	4.7	3.6
195S	00511S	00510S	113	3.24	8.8	8.6	8.2	8.0	5.8
196S	00510S	00509S	140	5.31	8.15	8.0	7.6	7.4	5.3
197S	00509S	00508S	248	4.02	10.05	9.8	9.4	9.2	6.7
198S	00508S	00570S	130	8.87	11.59	11.4	10.9	10.6	7.9
199S	00570S	00571S	139	3.70	6.86	6.7	6.3	6.1	4.2
201S	00571S	00494S	201	1.04	7.45	7.3	7.0	6.8	5.1
200S	00498S	00571S	366	1.44	6.59	6.4	6.2	6.0	4.6
437S	00810S	00808S	319	0.46	2.42	2.4	2.3	2.2	1.7
191S	00513S	00516S	163	0.67	1.19	1.2	1.1	1.1	1.0
192s	00516S	00517S	170	0.66	3.01	2.9	2.8	2.7	2.1
193S	00517S	00514S	115	0.68	4.29	4.2	4.0	3.9	2.9
194S	00514S	00511S	251	7.07	6.47	6.3	6.0	5.9	4.8
262S	00503S	00500S	169	2.12	2.99	2.9	2.8	2.7	2.1
256S	00500S	00502S	174	0.81	4.82	4.7	4.4	4.3	3.0
255S	00502S	00498S	117	0.26	5.27	5.1	4.8	4.7	3.3
265s	00501S	00500S	338	0.34	3.85	3.8	3.6	3.5	2.7
350	00492s	00738S	29	1.29	2.39	2.3	2.2	2.2	2.3
MinDitch1	00738S	00663S	288	2.33	0.58	0.6	0.5	0.5	0.4
14	00492s	00738S	28	1.32	2.43	2.6	2.6	2.6	2.4
culvert1	00663S	00765S	161	1.05	2.92	2.9	2.9	2.9	2.5
culvert2	00808S	00765S	357	3.80	2.03	2.0	1.8	1.8	1.4
17	00753S	00492s	352	1.18	2.32	2.3	2.2	2.1	1.9
18	00808S	00492s	369	1.30	1.62	1.6	1.5	1.5	1.3
19	00583S	00582S	85	2.12	16.89	15.8	13.6	12.4	5.1
00698S	00698s	00583S	275	6.61	0.59	0.6	0.6	0.5	0.6
3323	00765S	00698s	103	0.47	2.5	2.4	2.2	2.2	1.9
453	00635s	00753S	38	0.63	3.13	3.1	2.9	2.8	2.1
20	00579s	00583S	195	5.54	0.93	0.9	0.9	0.9	0.9
21	00491S	00725s	190	1.11	2.35	2.2	2.0	2.0	1.4
22	00725s	00573s	12	0.83	0.21	0.2	0.2	0.2	0.1
23	00573s	00580S	120	9.58	1.39	1.4	1.3	1.3	1.1
24	00580S	00579s	36	0.56	2.35	2.3	2.2	2.2	2.1
25	00494S	00573s	450	0.60	3.1	3.0	2.9	2.8	2.2
26	00614s	00492s	267	0.69	1.56	1.5	1.5	1.5	1.4
27	00639s	00501S	37	0.54	0.76	0.7	0.7	0.7	0.6
28	00645s	00639s	168	0.57	0	0.0	0.0	0.0	0.0
29	00489S	00503S	327	6.40	6.38	6.2	6.0	5.8	4.4
30	04038s	00489S	311	0.51	2.41	2.4	2.3	2.2	1.7
32	Storage_WestSide	00583S	485	3.01	0.61	0.6	0.6	0.5	0.3
33	Storage_EastSide	00583S	22	20.91	0.8	0.7	0.6	0.5	0.0
itch_RR_I8	00582S	00584S	400	0.68	0.8	0.7	0.7	0.7	0.6
XingCulver	00584S	outfal	392	2.78	11.39	11.4	11.4	11.4	10.2
1	00580S	00579s				0.0	0.0	0.0	0.0
weir2	00583S	00582S				0.0	0.0	0.0	0.0

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APPENDIX E

Prioritization Meeting

Agenda, Criteria, and Prioritized Projects

Prioritization Meeting
October 24, 2007, 1-3:30
City of Fairview
Consolidated Stormwater Master Plan

AGENDA

1. Review Goals (15 min)
    - Levels of Service
    - Water Quality
2. Refine Criteria Matrix (15 min)
3. Choose Alternatives (15 min)
4. Prioritize Projects (45 min)

Today's Goal – Prioritized list of projects based on the ranking matrix.

Levels of Service

- Meet Oregon Department of Fish and Wildlife habitat requirements
- Consider water quality with every newly constructed facility
- Limit stormwater flooding of property, i.e., maximum water surface elevation of a storm with a 1 percent probability of occurrence (100-year storm) should have a maximum water surface elevation 1 foot from the finished floor of the building
- Meet permit limits and maximum extent practicable requirements
- Meet City Parks goals
    - Pursue active recreation
    - Move away from acquisition for open space
    - Use passive park for stormwater facilities
    - No ponds in active recreation areas
- Follow prior agreements with Multnomah County Drainage District (MCDD) for minimal detention of stormwater flows in the City

Water Quality

The City of Fairview has TMDLs on the Columbia Slough and/or the Willamette River for the following constituents:

- mercury
- temperature
- bacteria
- nutrients – chlorophyll *a*, dissolved oxygen, pH, and phosphorus
- toxics – dissolved lead, DDE/DDT, PCBs, dieldrin, and 2,3,8,7 TCDD

Consolidated Stormwater Master Plan - Prioritized Projects

Ranking Matrix				Performance Criteria Scores										
		COST (IN 1,000's)	RATING	COST	FUNDING SOURCE	MANDATE	SPECIAL INTEREST	SAFETY LIABILITY	COMPLEXITY	IMPACT	ENVIRON. BENEFIT	PERMITTING	SUSTAINABILITY	LIVABILITY
ID	**Project Name**			*1.0*	*0.4*	*0.4*	*0.3*	*1.0*	*0.6*	*1.0*	*0.4*	*0.4*	*0.4*	*0.4*
FV-3a	S of Halsey & W of 207th (N of Salish Ponds)	**$34**	**16.20**	3	2	3	2	1	3	3	3	3	3	3
FV-3b	S of Halsey & W of 207th (Rip. Veg City Prop near 207	**$25**	**16.20**	3	2	3	2	1	3	3	3	3	3	3
FV-3c	S of Halsey & W of 207th (Rip Veg Private)	**$42**	**16.20**	3	2	3	2	1	3	3	3	3	3	3
FV-7	McDonald Brothers (Riparian Planting)	**$20**	**15.70**	3	2	2	3	1	3	3	3	3	3	2
GN-1	CCTV Inspection	**$25**	**15.60**	3	1	2	2	3	3	2	2	3	2	3
FV-6a	Heron Point (Riparian Planting)	**$115**	**14.70**	2	2	2	3	1	3	3	3	3	3	2
RT-2a	Park Cleone Detention Pond retrofit pond & swale	**$34**	**14.40**	3	2	3	2	1	3	2	2	3	2	3
NN3	No Name Creek Reveg Fairview Oaks	**$15**	**14.00**	3	2	2	2	1	3	2	2	3	3	2
GN-4	Dry Well Registration	**$20**	**13.80**	3	1	3	2	1	2	2	3	2	3	3
GN-2	Pipe Replacement and Rehabilitation Over 20 years*	**$60**	**13.40**	3	1	1	2	2	3	2	1	3	2	2
FV-8	Fairview Village Detention Ponds	**$17**	**13.30**	3	1	2	1	1	3	2	2	3	3	2
RT-1	Railroad Crossing	**$32**	**13.00**	3	1	1	2	3	2	2	1	2	2	1
GN-3	Catch Basin Retrofits Over 10 years*	**$18**	**13.00**	3	1	3	2	1	2	2	2	3	2	2
OS-1	Thompson Street Stormdrain Improvements	**$107**	**13.00**	2	1	2	2	2	2	2	2	3	3	2
RT-4	Pipe Replacement @ 6th & Harrison	**$84**	**12.60**	2	1	1	2	2	2	2	2	3	3	2
GW-2	Dry Well Retrofit	**$79**	**12.60**	3	1	3	2	1	2	2	3	1	2	2
FV-5	Old Town Green Streets Over 10 years*	**$65**	**12.30**	3	1	2	1	1	2	2	3	3	1	2
RT-3	7th Street Storm Pipe	**$96**	**11.90**	3	2	1	1	1	2	2	1	3	2	2
FV-2	Flooding on Halsey by Fieldstone Apartments	**$45**	**11.50**	3	1	1	1	2	2	1	1	3	2	2
RT-2b	Park Cleone Creek Daylight	**$44**	**11.40**	1	2	2	2	1	2	2	2	3	2	3
FV-6b	Heron Point 3ac WQ facility (Private)	**$425**	**11.30**	1	2	2	3	1	1	3	3	1	2	2
FV-4	Salish Ponds and Wetlands (Park Improvements)	**$264**	**11.30**	1	3	1	3	2	1	2	1	2	2	3
NN-2	Church Parking Lot	**$5**	**10.90**	2	1	1	1	2	1	2	2	1	3	2
NN-1a	Undersized Culvert at Sandy	**$199**	**10.80**	1	2	1	2	3	1	2	1	2	1	2
FV-1	Fairview Creek between Halsey and I-84	**$816**	**9.90**	1	3	1	1	3	1	1	1	1	3	1
FV-3d	S of Halsey & W of 207th 3ac floodplain City BANKIN	**$417**	**8.30**	1	1	1	1	1	1	1	3	1	2	3
FV-3e	S of Halsey & W of 207th 5ac floodplain Private BANI	**$645**	**8.30**	1	1	1	1	1	1	1	3	1	2	3
NN-1b	Undersized Culvert at Sandy Bypass	**$0**	**0.00**	0	0	0	0	0	0	0	0	0	0	0
	Totals	**$3,748**												

Notes:

Grey fill means not paid for by Stormwater fund (private, county, parks)

* The cost for these projects is per year

Prioritization Criteria

		Score Definition		
CRITERIA	**WEIGHT**	**3**	**2**	**1**
1 COST	**0.2**	< 100,000	>100,000 and <250,000	>250,000
2 POTENTIAL FUNDING SOURCE	**0.4**	Grant$$/SRF$$/FEMA$$	Joint/Jurisdictional Funded project; Non-profit partners	No likely outside funding source
3 MANDATES	**0.8**	Project carries a Fed or State Mandate w/ deadline.	Mandated w/ flexible timeline over 2 FY's.	No Mandate
4 SPECIAL INTEREST	**0.8**	Pet project, City Council directed		
5 SAFETY/LIABILITY	**1.0**	Sig. Hazard, Threat to life and limb and or property		No safety hazard
6 COMPLEXITY	**0.6**	May be done by small crew in less than a months time	Typical moderate level of difficulty project.	Req's significant Design, contract SP's Complex construction
7 IMPACT	**1.0**	Affects region-wide w/ sig. Downstream &/or Upstream impacts	Affects small sub-basin.	Affects only 1 or 2 individual properties
8 CONCURRENCE	**0.4**	Req'd/ pre-requisite project for other budgeted projects or for inter-jurisdictional projects	Related work w/in 2-3 FY's	No related work
9 ENVIRONMENTAL BENEFIT	**0.8**	Significantly improves water quality and wildlife habitat	Moderately improves water quality and wildlife habitat	None
10 PERMITTING	**0.6**	No permitting issues	Potential permitting issues	Significant issues. Possibly not permittable
11 SUSTAINABILITY	**0.8**	No imbalance.		Imbalance.
12 LIVABILITY	**0.8**	This is what our grandkids would want.	This will work for my generation.	Okay for now.

Criteria Definition	
1 COST	Total estimated cost of CIP.
2 FUNDING SOURCE	Is the cost supported by Grant $$, or Joint projects?
3 MANDATE	Is the project mandated by the state or federal gov't or under court order?
4 SPECIAL INTEREST	Is this project directed by Council?
5 SAFETY/LIABILITY	What potential safety and/or liability issues are involved?
6 COMPLEXITY	How quickly can the solution be implemented and with what level of effort?
7 IMPACT	How large an area and/or how many people does the problem impact?
8 CONCURRENCE	Does the work coincide w/ other city work or other jurisdictions' scheduled work?
9 ENVIRONMENTAL BENEFIT	Are there direct environmental benefits associated with the projects?
10 PERMITTING	In the current permitting environment, will this project have difficulties in obtaining local, federal or state permits?
11 SUSTAINABILITY	Can the project be done without causing an imbalance in resources (i.e., funding, manpower, environment, etc.)?
12 LIVABILITY	Are we improving the quality of life? Is this what our grandchildren would want?