Ad Hoc Stormwater, Wastewater and Water Citizens Advisory Committee
Thursday, February 25, 2021 - 6:00 PM
Newberg City Hall
414 E First Street (teleconference meeting)

Join from a PC, Mac, iPad, iPhone or Android device:
Please click this URL to join.
https://zoom.us/j/92390258709?pwd=U0QzdmZFcFpzeEU0WDR1eVNtcDUwZz09

Or join by phone:
Dial (for higher quality, dial a number based on your current location):
+1 669 900 6833, +1 253 215 8782, +1 346 248 7799, +1 929 205 6099,
+1 301 715 8592, +1 312 626 6799

Webinar ID: 923 9025 8709
Passcode: 571700

Email any comments to Brett.Musick@newbergoregon.gov

I. CALL MEETING TO ORDER – *6:00PM*

II. ROLL CALL

Maryl Kunkel	Bill Rourke	Casey Creighton	Mike Gougler
Peter Siderius	Denise Bacon	Jeremiah Horton	Leonard Rydell

III. APPROVAL OF MINUTES – *6:00PM to 6:05PM*

- **December 17, 2020**
- **January 7, 2021**

IV. NEW BUSINESS

- Wastewater Master Plan Technical Update Presentation, Keller – *6:10PM to 6:45PM*
- Stormwater Master Plan Technical Update Presentation, HBH – *6:45PM to 7:30PM*

ACCOMMODATION OF PHYSICAL IMPAIRMENTS: In order to accommodate persons with physical impairments, please notify the Engineering Department of any special physical or language accommodations you may need as far in advance of the meeting as possible, and no later than two business days prior to the meeting. To request these arrangements, please contact the Engineering Department at (503) 537-1273. For TTY services please dial 711.

V. OLD BUSINESS – *7:30 PM to 8:00 PM*

- Stormwater Policy Discussion, Committee
    - **i.** Rydell Letter of February 9, 2021 (Letter to Committee No. 5)
        1. Memo - Staff Notes Related to Rydell Letter of 2-9-2021
            a. LID Guidance Template ("Low Impact Development in Western Oregon: A Practical Guide for Watershed Health")

VI. PUBLIC COMMENTS – *8:00 PM to 8:05 PM*

VII. ITEMS FROM STAFF – *8:05 PM to 8:10 PM*

VIII. ITEMS FROM COMMITTEE MEMBERS – *8:10 PM to 8:15 PM*

IX. ADJOURNMENT

ACCOMMODATION OF PHYSICAL IMPAIRMENTS: In order to accommodate persons with physical impairments, please notify the Engineering Department of any special physical or language accommodations you may need as far in advance of the meeting as possible, and no later than two business days prior to the meeting. To request these arrangements, please contact the Engineering Department at (503) 537-1273. For TTY services please dial 711.

CITY OF NEWBERG STORMWATER, WASTEWATER, AND WATER CAC MINUTES
WEDNESDAY, December 17, 2020 6:00 PM
City Hall, 414 E. First Street, Newberg (teleconference meeting)

I. CALL MEETING TO ORDER
The meeting was called to order at 6:00 PM.

II. ROLL CALL

Members Present:	Maryl Kunkel	Denise Bacon	Mike Gougler
	Leonard Rydell	Connie Woodberry	Bill Rourke
	Casey Creighton		

Members Absent: Jeremiah Horton and Peter Siderius

Staff Present: Brett Musick, Senior Engineer
Kaaren Hofmann, City Engineer
Doug Rux, Community Development Director

III. COMMITTEE PURPOSE AND GENERAL BACKGROUND
This agenda item was not discussed.

IV. NEW BUSINESS
A. Stormwater Master Plan Technical Update Consultant Presentation, HBH
Senior Engineer Musick introduced Natalie Jennings from HBH. He explained the process for the master plan update.

Ms. Jennings discussed the purpose of the Stormwater Master Plan, why it was being updated, the project scope, the Committee's role in the process, definitions, evaluation criteria for capital improvement projects, and maps of problem areas and duration of flooding per the computer system model.

Committee Member Woodberry asked about the definition of flooding and differentiating water on the surface and water that was potentially damaging. When prioritizing, she thought the areas that had the most potential for damage or were currently damaging should be done first. Ms. Jennings said quantifying what damaged would be caused was beyond the scope of what they could do. Those areas that were surrounded by houses were considered more important than those in the middle of fields.

Committee Member Rydell thought there needed to be some ground truthing for these problem areas because his area was marked and he had not had a problem and had lived there for over 40 years. SE Musick said they had been working with maintenance to check what the model was showing versus what had been experienced in the field. They could update the maps with that information.

Ms. Jennings said the maps showed the identification of the problem areas per the calculations, not necessarily how the City would prioritize them. There were also other maintenance issues that were not included in the model that would need to be prioritized as well.

Committee Member Woodberry asked if the level of street debris clogging the storm drains was also taken into account. SE Musick said yes, maintenance had identified areas where there were clogs and they were being taken into consideration as well.

Ms. Jennings said there were maintenance recommendations as well as capital improvement recommendations. She then discussed the maintenance issues map and prioritization criteria for the capital improvement projects.

Committee Member Rydell thought safety/liability should be a higher priority.

Committee Member Woodberry was confused about the definitions of liability and impact. She thought they should look at the words being used for the criteria.

There was discussion regarding using different criteria for prioritization. Committee Member Woodberry would send her ideas to staff.

The Committee reviewed the criteria and how they were defined as well as made suggested changes.

Committee Member Gougler suggested they look at the bureaucratic process without spending money on physical repairs that would allow flooding issues to be solved.

SE Musick thought those were valid issues, but were outside the scope of the Stormwater Master Plan.

Community Development Director Rux said the Committee could make recommendations for the City to evaluate the administration of the stream corridor program and other issues. These could be taken to the Planning Commission and Council and the Council could direct staff to address them. He also suggested they define the criteria terms and staff could bring back other stormwater master plan criteria from other jurisdictions and the Committee could make comments on them at the next meeting.

Committee Member Rydell thought they needed to change the drainage philosophy for stormwater calculations. They needed to keep the total flows the same not just keeping the flow rates the same. There should be a zero runoff standard.

Ms. Jennings reviewed the design criteria and next steps.

Chair Kunkel agreed that they should investigate zero runoff.

Committee Member Woodberry suggested creating a separate agenda item to discuss the Committee's recommendations on City policies and the pragmatic elements of the Stormwater Master Plan update as a separate agenda item.

Committee Member Rydell thought the policies needed to be incorporated into the master plan, to set the goal of not draining water into the river, especially in the winter.

Ms. Jennings thought that applied to new development, but the master plan was dealing with existing problems in the system. They were working on the Capital Improvement Plan and the development standards were going to be updated in the future.

Committee Member Woodberry thought these were complimentary issues and should drive each other.

V. OLD BUSINESS

A. Rydell Motion Recommendations 3Dec20

Chair Kunkel said Committee Member Rydell recommended rescinding the motion from the last meeting. There would need to be a motion to open up the discussion.

Committee Member Rydell did not think they had enough information to vote on the evaluation threshold at the last meeting.

MOTION: Rydell moved to revisit the discussion and reconsider the vote. Motion died for lack of a second.

VI. PUBLIC COMMENTS

None

VII. ITEMS FROM STAFF

SE Musick reminded the Committee about security training and use of City email accounts.

VIII. ITEMS FROM COMMITTEE MEMBERS

None

IX. ADJOURNMENT

The meeting was adjourned at 8:02 PM.

CITY OF NEWBERG STORMWATER, WASTEWATER, AND WATER CAC MINUTES
THURSDAY, January 7, 2021 6:00 PM
City Hall, 414 E. First Street, Newberg (teleconference meeting)

I. CALL MEETING TO ORDER
The meeting was called to order at 6:00 PM.

II. ROLL CALL

Members Present:	Maryl Kunkel	Denise Bacon	Peter Siderius
	Leonard Rydell	Connie Woodberry	Bill Rourke
	Jeremiah Horton	Mike Gougler (arrived late)	
Members Absent:	Casey Creighton		
Staff Present:	Brett Musick, Senior Engineer		
	Kaaren Hofmann, City Engineer		
	Doug Rux, Community Development Director		

III. APPROVAL OF MINUTES – DECEMBER 2, 2020

MOTION: Rydell/Bacon moved to approve the December 2, 2020 meeting minutes. Motion carried (7 Yes/0 No).

IV. NEW BUSINESS

A. Wastewater Master Plan Technical Update Consultant Presentation, Keller
Senior Engineer Musick introduced Emily Flock and Peter Olson from Keller Associates.

Ms. Flock discussed the system updates in the Wastewater Master Plan including the buildout scenario, Riverfront Master Plan and the Riverrun Subdivision, and Crestview area. She explained the planning criteria for the collection system hydraulic evaluation. They were moving forward with 2 feet below rim for the evaluation threshold and the design criteria for improvements would be 85% full depth at peak flows. Major trunk lines may be upsized one additional, nominal pipe size.

Committee Member Rydell asked about the impacts for the different thresholds and what was actually happening.

Mr. Olson said they had real world data in the 2018 Wastewater Master Plan as the model was calibrated with the flow monitoring data and the consultants had worked with City staff on groundtruthing. The scope of this project was not to vet the existing model but to use the model that went through the lengthy detailed process and add new areas and clarify the criteria that they would be using.

Ms. Flock discussed the modeled system and drainage basins.

Committee Member Woodberry asked if this project's focus was on pipes or if it included the Wastewater Treatment Plant.

City Engineer Hofmann said the Wastewater Treatment Plant had been recently upgraded for the next 20-25 years and the focus of this work was on the pipes and pump stations.

Committee Member Gougler asked if the plans included the sewer line at the intersection of Fernwood and Brutscher. CE Hofmann said it would be ODOT's responsibility to move the sewer line.

Ms. Flock explained the updated system evaluation and areas of interest/evaluation for overflows.

Committee Member Woodberry asked what happened when there were overflows. Ms. Flock said they were reported to DEQ and DEQ and the City would look at the reasons for the overflows.

Committee Member Siderius asked if any of the overflows went into the creeks. The Hess Creek trunkline followed right along Hess Creek and he thought there was a plan to move the trunkline out of the stream corridor.

Mr. Olson said the 2018 Master Plan included moving the trunkline.

Committee Member Siderius noted it was one of the older trunklines in the City. He was concerned about the continuous erosion of the stream corridor and how the manhole covers were already 6 feet out of the ground. He thought it should be a high priority area.

CE Hofmann said it was a high priority. The plan was to line the sewer pipe north of 99W in the next year and do some additional flow monitoring to know how big the pipe needed to be south of 99W. It was within the ten year plan to get it taken care of.

Mr. Olson stated lining the upper end of Hess Creek and taking care of Inflow and Infiltration was Priority 1A in the Master Plan, putting in a new trunk line to intercept the flows that went to Hess Creek was Priority 1B, and the Springbrook trunkline upgrades was Priority 1C. It would be a phased approach.

There was discussion regarding maintaining historic infiltration into the ground, major events and erosion, and policies for new construction.

Ms. Flock reviewed the next steps in the process and the information that would be brought back to the next meeting.

Committee Member Siderius suggested if they were able to do better at infiltration and keeping peak flows out of streams and trunklines, maybe they did not have to do so much with pump stations. Instead of increasing capacity of pipes and pump stations, if they increased the infiltration of water within the City, it would be a cheaper solution.

CE Hofmann said more infiltration into the ground would mean the water would get into the sewer pipes which would cause more of an issue for the City. They had been working on fixing the sewer pipes so they could limit the amount of stormwater into sewer pipes. That was why they wanted to do the flow monitoring so they would not have to make the sewer pipes as large.

Committee Member Siderius said if there were rain gardens in people's yards to capture the water further away from the sewer lines, was that more cost effective than upsizing pipes. He thought they could look at what other cities were doing to address this issue. He questioned if they needed bigger pipes or if they needed to handle stormwater better.

Committee Member Woodberry would like to know how many pipes had already been replaced and where the City was in term of future replacements.

V. OLD BUSINESS

A. Rydell Letter of 12/17/2020 – Storm Drainage Plan Recommendations

Chair Kunkel said there were issues with Zoom at the last meeting and there was a committee member who wanted to second the motion made by Committee Member Rydell regarding the 2 feet below rim for the evaluation threshold. She asked if he wanted to make the motion again.

MOTION: Rydell/Gougler moved to withdraw the recommendation to adopt the 2 feet below rim evaluation threshold and open it up for further discussion. Motion passed 6-2 with Committee Member Rourke and Chair Kunkel opposed.

Committee Member Rydell thought before any policy was adopted the Committee should receive: 1. Completed copies of the consultant studies and a reasonable period of time review them, 2. A full description of the prioritized list and costs for needed improvements, 3. Four options with projected costs on system development maintenance costs including an option for doing nothing, an option for minimal improvements, an option for medium improvements, and an option for full improvements, and 4. Recommendations from the City Engineer, Public Works Director, Community Development Director, and design consultants.

Committee Member Woodberry said they had made the decision without a lot of information on the implications of the choices. The economic impact on citizens was still not clear. The Committee was looking for more information so they could make better decisions that were not only based on the status quo.

Committee Member Rydell thought the City engineers who had knowledge of the system should make the recommendations, not the consultants.

SE Musick explained the process for making the recommendation which was in conjunction with the studies, City staff, and previous advisory committee that created the 2018 Master Plan.

Committee Member Siderius would like to know the amount of water that was coming from each of the three basins. CE Hofmann said they did not have a way to know how much was coming from each basin.

Committee Member Siderius recommended finding a way for the data to be gathered.

There was discussion regarding how the data could be collected and reasons why the threshold question had been raised.

Committee Member Siderius thought the issues they were dealing with were Inflow and Infiltration, pipe size, pump size, sewage treatment plant size, and number of customers using the sewer system.

Committee Member Rydell thought City staff needed to give the Committee a recommendation.

Chair Kunkel said those recommendations were made in the 2018 Master Plan update.

Community Development Director Rux said the primary focus of this work was the Riverfront Master Plan area and what was needed for the wastewater, water, and stormwater system for that area. The secondary focus was the lingering issue about flows in the pipe and what they needed to be. It could be this group's recommendation that it was still a concern and something that staff should come back to further evaluate.

CE Hofmann said they went through this process in the 2018 Master Plan and at that time, the committee and staff recommended that the projects be prioritized based on the hydraulic grade line being 2 feet below the rim. There was a minority that was still unsure that was the right thing and wanted the City to look at a different hydraulic grade line. The Council adopted the 2018 Master Plan with the intention of looking at the grade line again. Her recommendation remained the same, to pick the projects based on 2 feet below the rim. When they designed projects, they based it on the pipe being no more than 85% full. There were not issues with sewage backing up into people's basements. The additional information that Committee Member Rydell had requested was outside the scope of this project.

MOTION: Woodberry/Kunkel moved to adopt the 2 feet below rim evaluation threshold. The threshold was still an issue of concern and needed further evaluation in the future. Motion carried (8 Yes/0 No).

Chair Kunkel reminded the Committee not to send out personal emails to each other as conversations needed to be open to the public and they might unintentionally create a quorum. She asked if staff was forwarding member comments to the Committee.

CDD Rux said yes, they were. The Committee was a public body and governed by state laws. Discussions needed to be transparent and there could be issues with off-line conversations that the public was not aware of. Any Committee member could submit comments or concerns directly to staff and they would be shared with the Committee and discussed at meetings.

Committee Member Rydell was happy with this process.

Chair Kunkel discussed the Storm Drainage Plan recommendations in Committee Member Rydell's December 17 letter.

Committee Member Rydell said they were keeping stormwater flows to historic levels, but they were not having historic flows at a certain rate during a period of time stay the same. The stormwater code did not recognize the fact that they were not controlling total runoff, they were only controlling the rate of runoff. Some things they could do were to stop creating new impervious areas, have narrower streets, parking lots should be pavers, and the total runoff of a site should be maintained. He planned to send his code change recommendations in another letter to the Committee.

This item would be discussed at the next meeting.

B. Staff Memo – Stakeholders for Determination of Stormwater Drainage Policy Changes
SE Musick said this was background information for the upcoming recommendations that could come from the Committee.

VI. PUBLIC COMMENTS

None

VII. ITEMS FROM STAFF

SE Musick confirmed the Committee received the link to the cyber securing training.

VIII. ITEMS FROM COMMITTEE MEMBERS

None

IX. ADJOURNMENT

The meeting was adjourned at 8:28 PM.

Technical Update to the Wastewater Master Plan - CAC #4A

February 18, 2021

KELLER ASSOCIATES

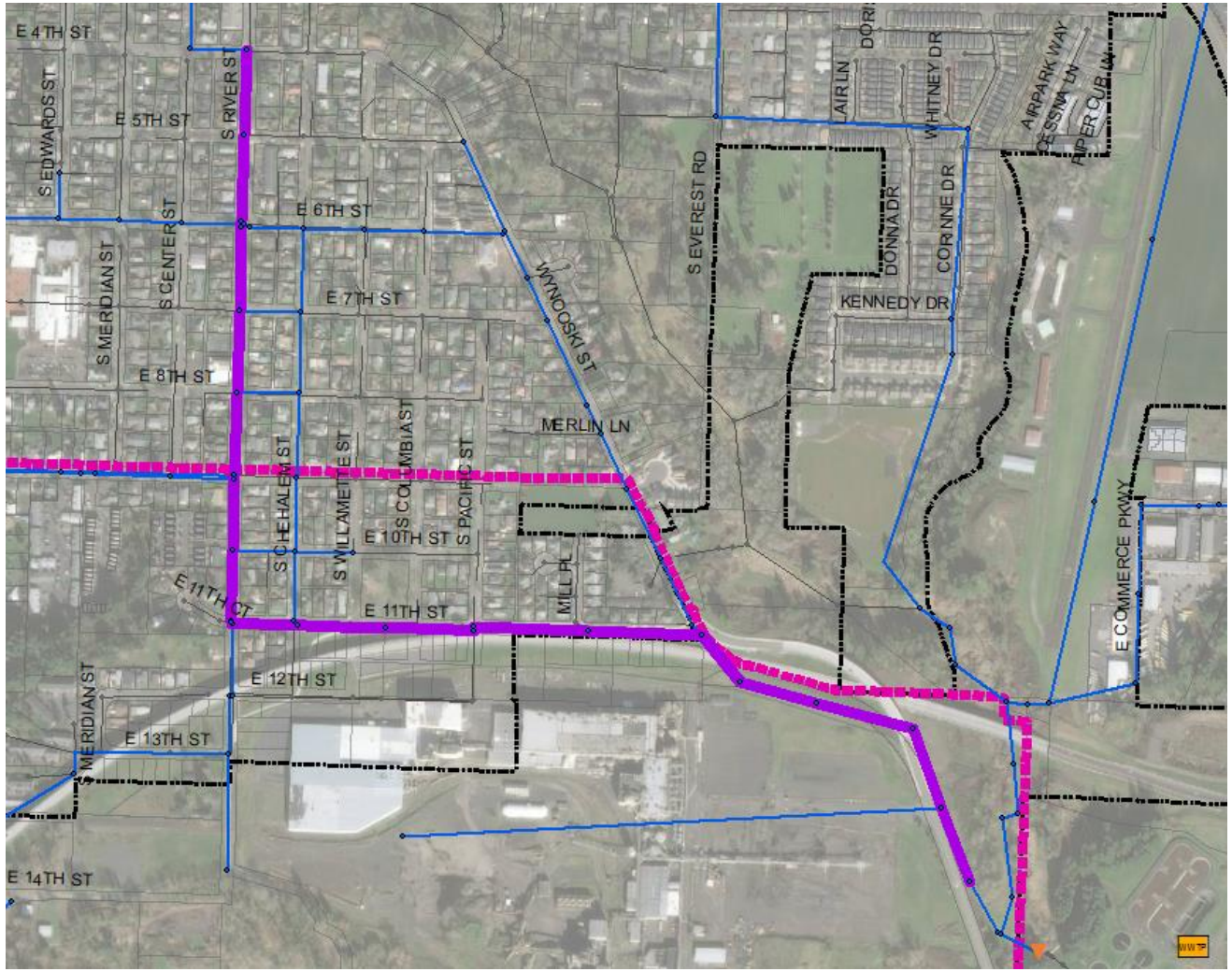
City of Newberg

Agenda

- Update to Alternatives
  - S River Street and E Eleventh
  - Springbrook Area
- Recommended Improvements
  - Riverfront
  - Crestview
- Capital Improvement Plan (CIP)
- Next Steps

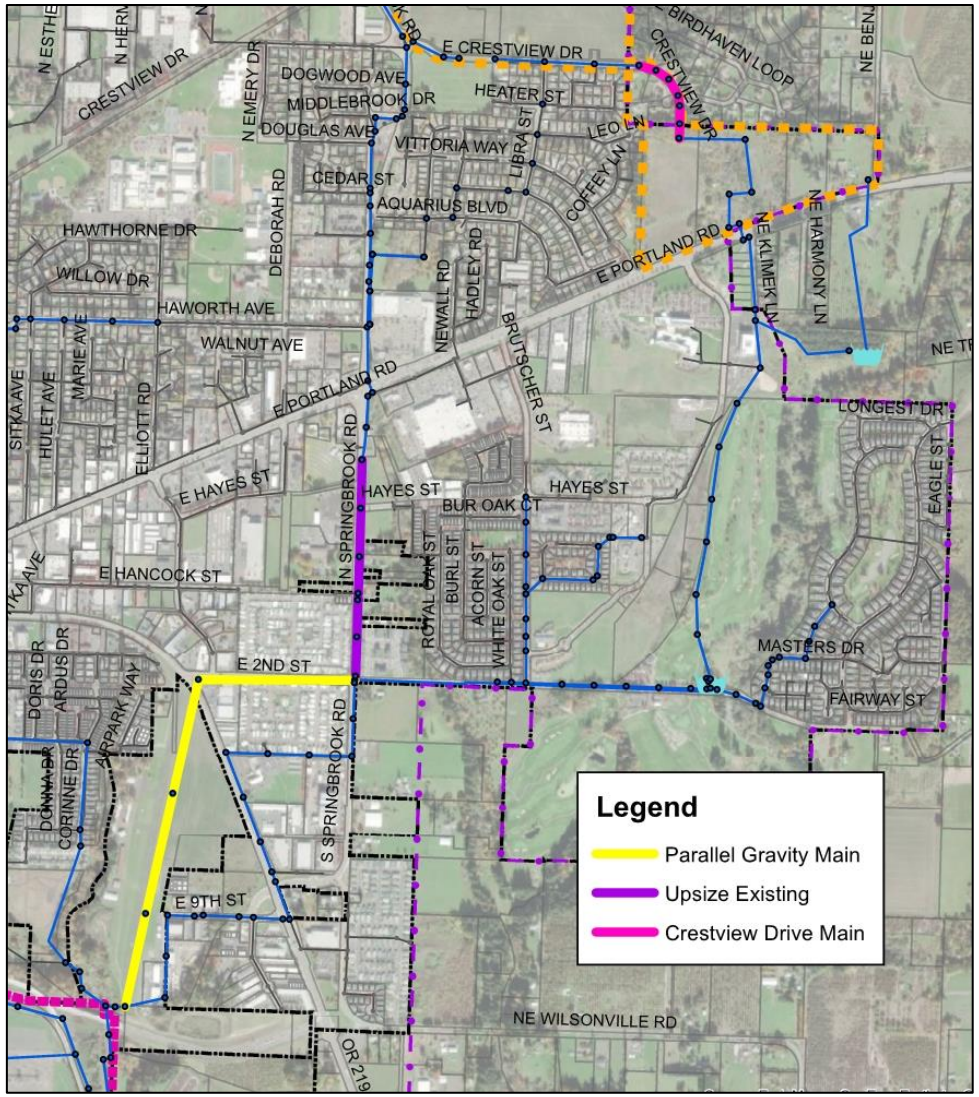
S River Street and E Eleventh Street

- Trunkline undersized for peak flows.
- Not a good candidate for parallel pipeline or flow redirection.
- Potential that I/I reduction could decrease improvements size.
  - 2018 WWMP addresses City-wide I/I reduction plan and priorities.
- Recommend upsize existing line.
  - Evaluate possible I/I reductions during predesign phase.



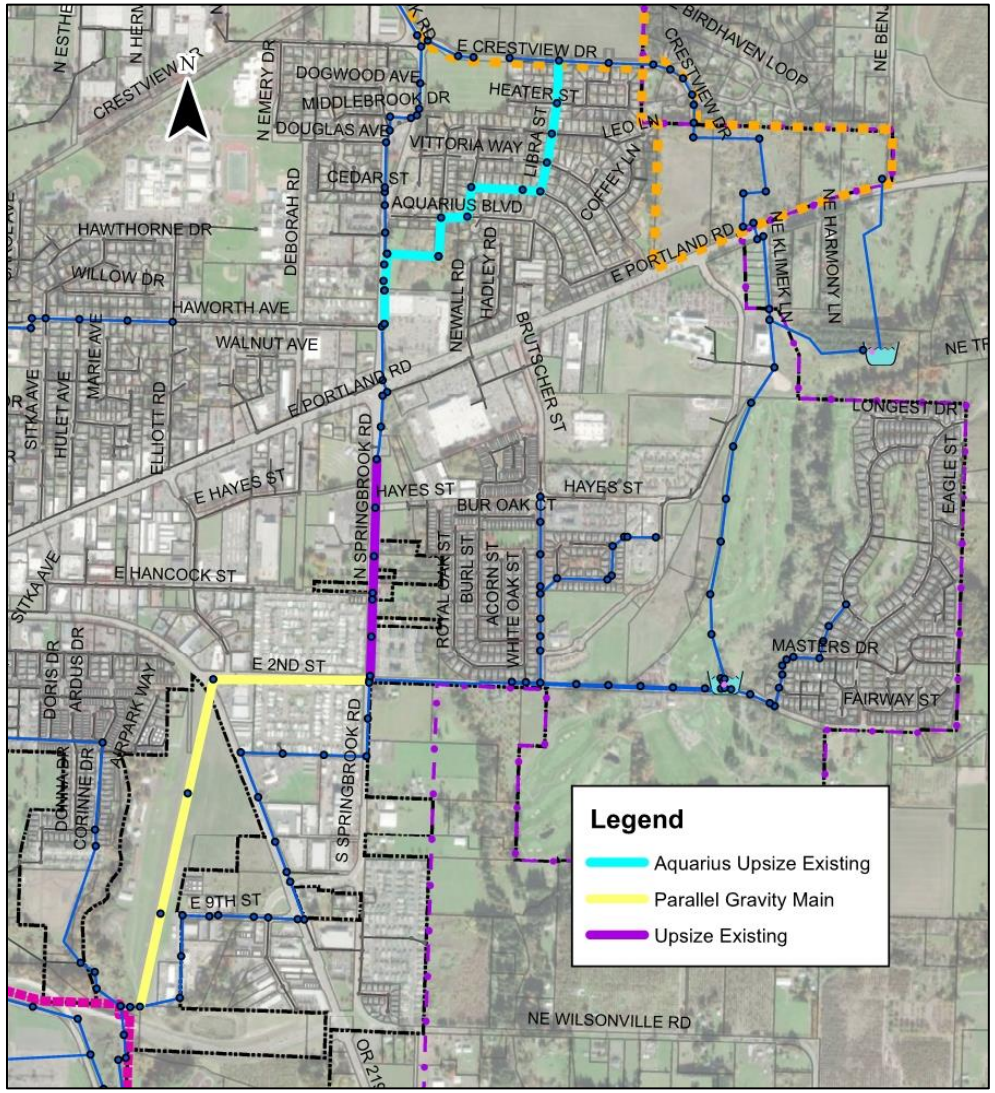
Springbrook Basin – Alternative 1

- Direct E Crestview Dr to east. Flows to Fernwood PS.
  - Main portion of E Crestview Drive included in both alternatives.
- Improvements include,
  - Small portion of E Crestview Drive line to connect to Crestview Crossing;
  - Upsize Fernwood PS;
  - Upsize existing line from E Fernwood Road to north of Hayes Street;
  - New, parallel pipeline east on E Second Street (same alignment as 2018 WWMP, one nominal pipe size larger).



Springbrook Basin – Alternative 2

- Direct E Crestview Dr to west. Flows through Aquarius Blvd subdivision to N Springbrook Road.
- Improvements include,
  - Upsized pipeline through Aquarius Blvd subdivision;
  - Upsize existing line from E Fernwood Road to north of Hayes Street; one nominal size larger than Alt. 1;
  - New, parallel pipeline east on E Second Street (matches Alt. 1).



Springbrook Basin – Lifecycle Analysis

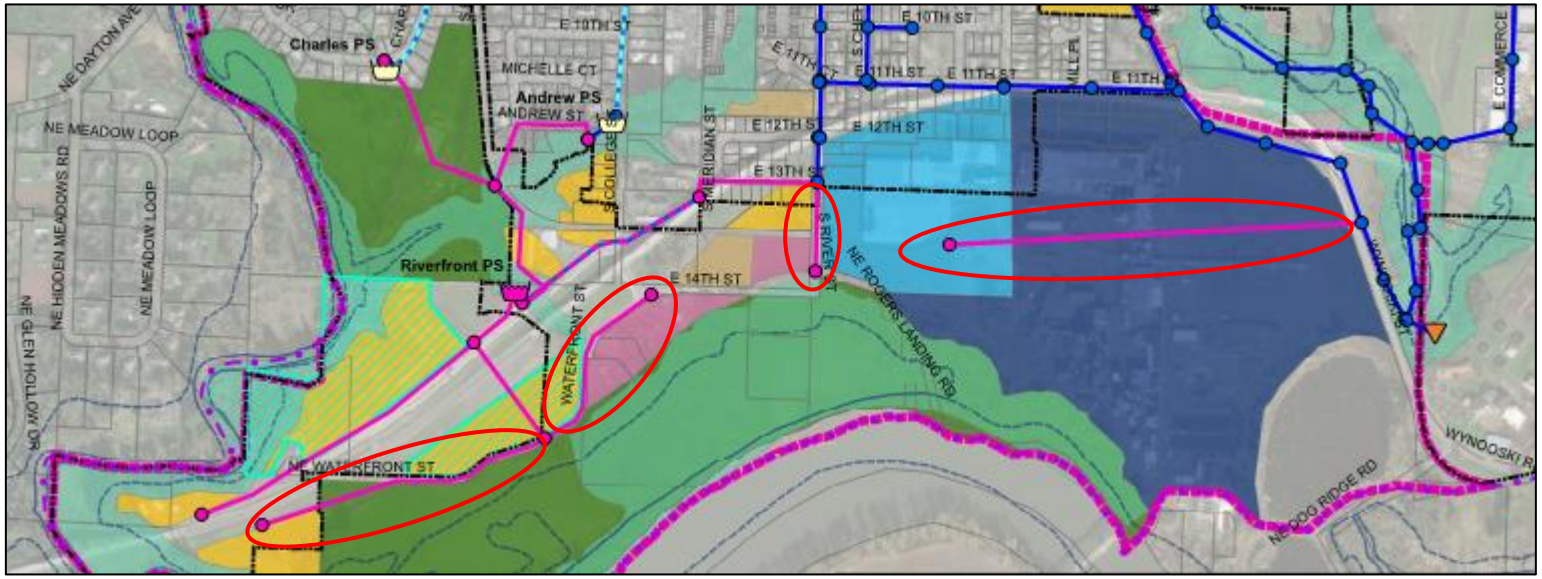
Alternative 1 - Crestview East		
Item	**Annual Cost**	
Annual electricity	$	9,600
Pump maintenance	$	3,200
Annual O&M (rounded)	$	13,000
20-Year O&M (rounded)	$	230,000
Pump capital cost	$	202,000
Pipe improvements capital cost	$	5,314,000
20-Year Lifecycle Cost (rounded):	**$**	**5,746,000**

Alternative 2 - Crestview West		
Item	**Annual Cost**	
Annual electricity	$	8,100
Pump maintenance	$	3,200
Annual O&M (rounded)	$	12,000
20-Year O&M (rounded)	$	212,300
Pump capital cost	$	202,000
Pipe improvements capital cost	$	6,617,000
20-Year Lifecycle Cost (rounded):	**$**	**7,032,000**

- Alternative 1 is recommended – Direct E Crestview Drive flow east.

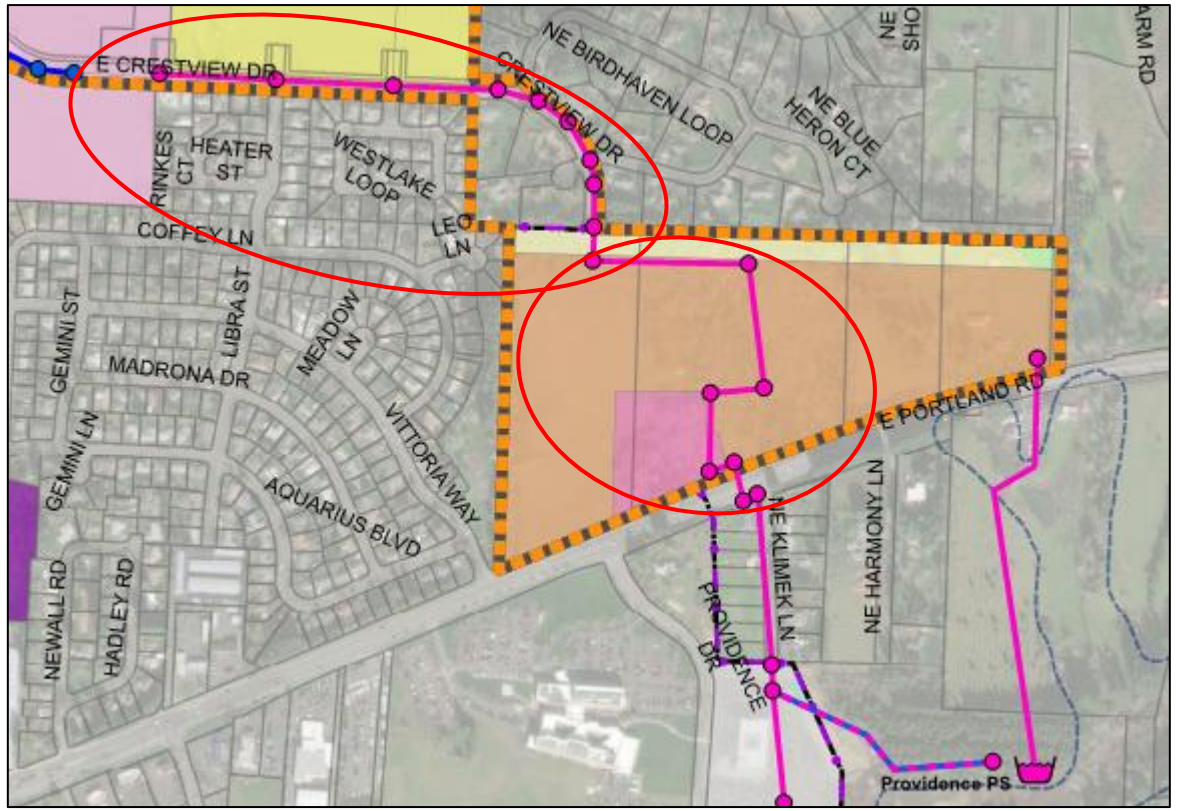
Recommended Improvements - Riverfront District

- Updated future infrastructure improvements to reflect Riverfront Master Plan.



Recommended Improvements – Crestview Area

- Updated future infrastructure improvements to reflect E Crestview Drive and Crestview Crossing.
- Adjusted priority because both are currently in development.



Capital Improvement Plan (CIP)

ID#	Item	Primary Purpose	Total Estimated Cost (2021)	SDC Growth Apportionment		City's Estimated Portion
				%	Cost	
Priority 1 Improvements						
1.a	Hess Creek Phase 1 - CIPP	Capacity & I/I reduction	$ 1,351,000	2%	$ 27,020	$ 1,323,980
1.b	Hess Creek Phase 2 - Parallel Gravity Main	Capacity	$ 7,460,000	2%	$ 149,200	$ 7,310,800
1.c	Springbrook Road	Capacity	$ 5,314,000	20%	$ 1,062,800	$ 4,251,200
1.d	E Pinehurst Court	Capacity	$ 318,000	0%	$ -	$ 318,000
1.e	Pump Station Improvements (Short-term)	Condition	$ 118,000	1%	$ 1,180	$ 116,820
1.f	I/I Projects	Capacity & Condition	$ 2,700,000	50%	$ 1,350,000	$ 1,350,000
1.g	E Crestview Drive Infrastructure	Future Development	$ 928,000	100%	$ 928,000	$ -
1.h	Crestview Crossing Infrastructure	Future Development	$ 1,414,000	100%	$ 1,414,000	$ -
1.i	Maintenance Shops Improvements	Capacity & Condition	$ 804,000	20%	$ 160,800	$ 643,200
		Priority 1 Total (rounded):	**$ 20,407,000**		**$ 5,093,000**	**$ 15,314,000**
Priority 2 Improvements						
2.a	Hess Creek Phase 3 - Pump Station	Capacity	$ 2,539,000	2%	$ 50,780	$ 2,488,220
2.b	S River and E Eleventh Street	Capacity	$ 5,103,000	17%	$ 867,510	$ 4,235,490
2.c	HWY 240 Pump Station Upsize	Capacity	$ 642,000	19%	$ 121,980	$ 520,020
2.d	N Main and S Wynooski Street	Capacity	$ 797,000	1%	$ 7,970	$ 789,030
2.e	Pump Station Improvements (Long-term)	Condition	$ 459,000	11%	$ 50,490	$ 408,510
2.f	I/I Projects	Capacity & Condition	$ 3,150,000	50%	$ 1,575,000	$ 1,575,000
2.g	Wastewater Master Plan	Planning	$ 300,000	100%	$ 300,000	$ -
		Priority 2 Total (rounded):	**$ 12,990,000**		**$ 2,974,000**	**$ 10,017,000**
Priority 3 Improvements						
3.a	NE Chehalem Drive Phase 1	Future Development	$ 2,217,000	100%	$ 2,217,000	$ -
3.b	Riverfront Infrastructure	Future Development	$ 4,787,000	100%	$ 4,787,000	$ -
3.c	Riverfront Industrial Infrastructure	Future Development	$ 1,154,000	100%	$ 1,154,000	$ -
3.d	Providence PS Infrastructure	Future Development	$ 1,734,000	100%	$ 1,734,000	$ -
3.e	NE Chehalem Drive Phase 2	Future Development	$ 990,000	100%	$ 990,000	$ -
3.f	I/I Projects	Capacity & Condition	$ 3,150,000	50%	$ 1,575,000	$ 1,575,000
		Priority 3 Total (rounded):	**$ 14,032,000**		**$ 12,457,000**	**$ 1,575,000**
Priority 4 Improvements						
4.a	Chehalem & Creekside PS Displacement/Future Trunk Line	Operations	$ 3,498,000	44%	$ 1,539,120	$ 1,958,880
4.b	Charles and Andrew PS Displacement	Operations	$ 1,109,000	44%	$ 487,960	$ 621,040
		Priority 4 Total (rounded):	**$ 4,607,000**		**$ 2,028,000**	**$ 2,580,000**
		Total Wastewater Collection System Improvement Costs (rounded):	**$ 52,036,000**		**$ 22,552,000**	**$ 29,486,000**

- Planning-level cost estimates.
- Includes system-wide collection improvements (including those unmodified from the 2018 WWMP) for ease of reference.
- All costs have been updated to 2021 dollars.

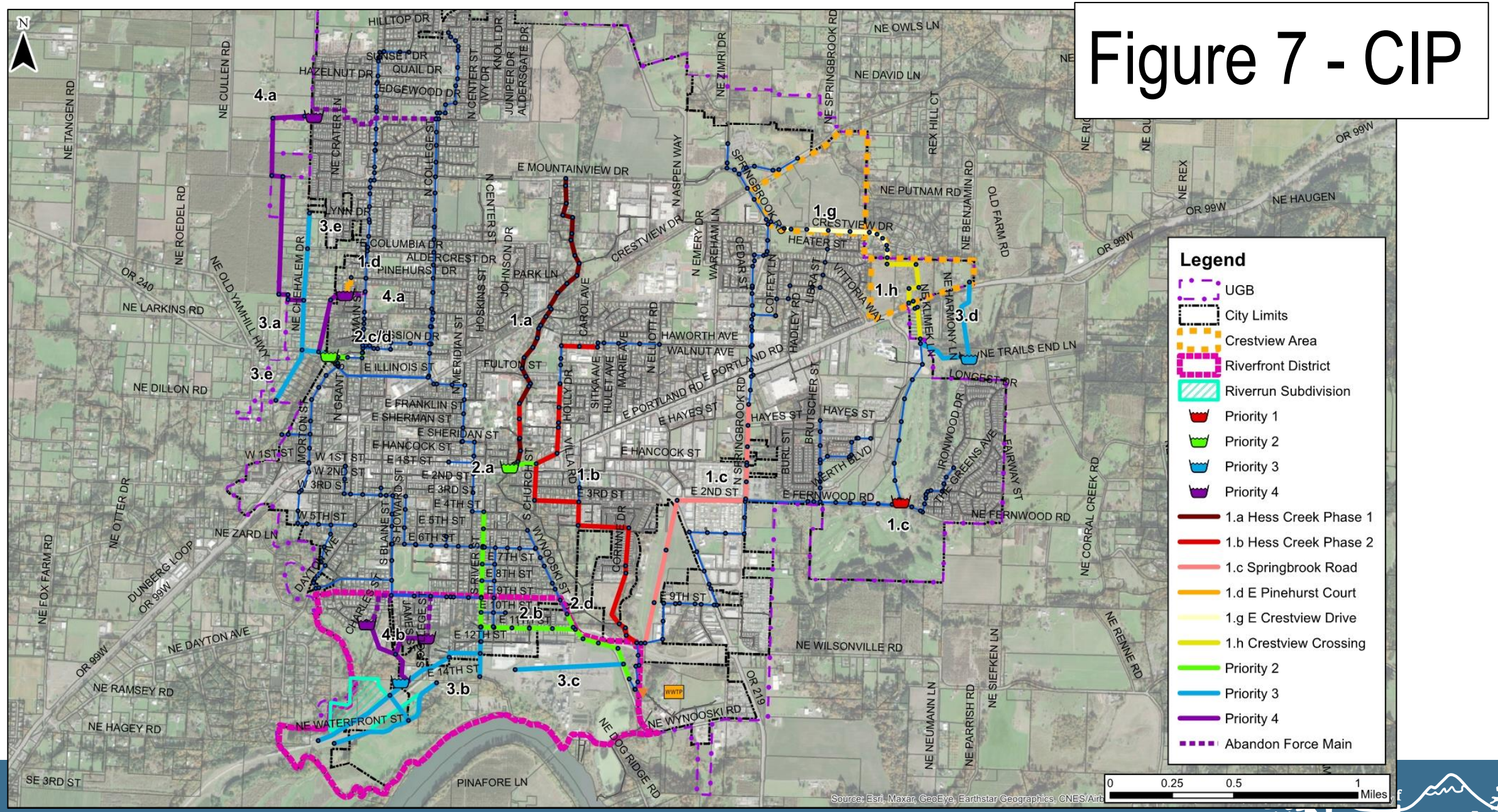
City of Newberg

Priority 1 CIP

- CIP for Priority 1 Improvements over the next six years.

ID#	Item	Total Estimated Cost (2021)	Opinion of Probable Costs (2021)					
			2022	2023	2024	2025	2026	2027
Priority 1 Improvements								
1.a	Hess Creek Phase 1 - CIPP	$ 1,351,000	$ 337,750	$ 1,013,250	$ -	$ -	$ -	$ -
1.b	Hess Creek Phase 2 - Parallel Gravity Main	$ 7,460,000	$1,865,000	$ 2,797,500	$2,797,500	$ -	$ -	$ -
1.c	Springbrook Road	$ 5,314,000	$ -	$ -	$ -	$1,328,500	$1,992,750	$1,992,750
1.d	E Pinehurst Court	$ 318,000	$ 318,000	$ -	$ -	$ -	$ 318,000	$ -
1.e	Pump Station Improvements (Short-term)	$ 118,000	$ -	$ -	$ -	$ 118,000	$ -	$ -
1.f	I/I Projects	$ 2,700,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000
1.g	E Crestview Drive Infrastructure	$ 928,000	$ 232,000	$ 348,000	$ 348,000	$ -	$ -	$ -
1.h	Crestview Crossing Infrastructure	$ 1,414,000	$ 353,500	$ -	$ -	$ 353,500	$ 353,500	$ 353,500
1.i	Maintenance Shops Improvements	$ 804,000	$ -	$ -	$ 201,000	$ 201,000	$ 201,000	$ 201,000
	Priority 1 Total (rounded):	**$ 20,407,000**	**$3,557,000**	**$ 4,609,000**	**$3,797,000**	**$2,451,000**	**$3,316,000**	**$2,998,000**

Figure 7 - CIP


Legend
UGB
City Limits
Crestview Area
Riverfront District
Riverrun Subdivision
Priority 1
Priority 2
Priority 3
Priority 4
1.a Hess Creek Phase 1
1.b Hess Creek Phase 2
1.c Springbrook Road
1.d E Pinehurst Court
1.g E Crestview Drive
1.h Crestview Crossing
Priority 2
Priority 3
Priority 4
Abandon Force Main
0 0.25 0.5 1 Miles
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airb
4.a
3.e
1.d
3.a
2.c/d
1.a
1.g
1.h
3.d
1.c
2.a
1.b
2.d
2.b
4.b
3.b
3.c
OR 240
NE LARKINS RD
NE DILLON RD
NE DAYTON AVE
NE RAMSEY RD
NE HAGEY RD
NE WATERFRONT ST
NE WYNOOSKI RD
NE WILSONVILLE RD
NE FERNWOOD RD
E PORTLAND RD
E MOUNTAINVIEW DR
CRESTVIEW DR
NE PUTNAM RD
NE HAUGEN
OR 99W
OR 219
NE DOG RIDGE RD
PINAFORE LN
SE 3RD ST
NE ZARD LN
DUNBERG LOOP
NE OLD YAMHILL HWY
NE CULLEN RD
NE TANGEN RD
NE ROEDEL RD
NE FOX FARM RD
NE OTTER DR
NE CORRAL CREEK RD
NE RENNE RD
NE SIEFKEN LN
NE PARRISH RD
NE NEUMANN LN
NE OWLS LN
NE DAVID LN
NE ZIMRI DR
NE SPRINGBROOK RD
NE BENJAMIN RD
OLD FARM RD
REX HILL CT
NE REX
NE TRAILS END LN
LONGEST DR
NE HARMONY LN
NE KLIMEK LN
HEATER ST
VITTORIA WAY
LIBRA ST
COFFEY LN
CEDAR ST
HADLEY RD
WAREHAM LN
N EMERY DR
N ASPEN WAY
SPRINGBROOK RD
HILLTOP DR
SUNSET DR
QUAIL DR
HAZELNUT DR
EDGEWOOD DR
KNOLL DR
JUNIPER DR
ALDERSGATE DR
IVY DR
N CENTER ST
N COLLEGE ST
NE CRATER LN
LYNN DR
E COLUMBIA DR
ALDERCREST DR
PINEHURST DR
NE CHEHALEM DR
N MAIN ST
N GRANT ST
N MERIDIAN ST
HOSKINS ST
JOHNSON DR
PARK LN
CAROL AVE
HOLLY DR
SITKA AVE
HULET AVE
MARIE AVE
N ELLIOTT RD
HAWORTH AVE
WALNUT AVE
FULTON ST
E ILLINOIS ST
E FRANKLIN ST
E SHERMAN ST
E SHERIDAN ST
E HANCOCK ST
W 1ST ST
E 1ST ST
W 2ND ST
E 2ND ST
W 3RD ST
E 3RD ST
E 4TH ST
W 5TH ST
E 5TH ST
E 6TH ST
E 7TH ST
E 8TH ST
E 9TH ST
E 10TH ST
E 11TH ST
E 12TH ST
E 14TH ST
E HAYES ST
HAYES ST
MORTON ST
S BLAINE ST
S HOWARD ST
S CHURCH ST
S RIVER ST
WYNOOSKI ST
CORINNA DR
DAYTON AVE
CHARLES ST
JAMES ST
COLLEGE ST
S SPRINGBROOK RD
BURL ST
BRUTSCHER ST
WORTH BLVD
THE GREENS AVE
IRONWOOD DR
FAIRWAY ST
WWTP

Next Steps

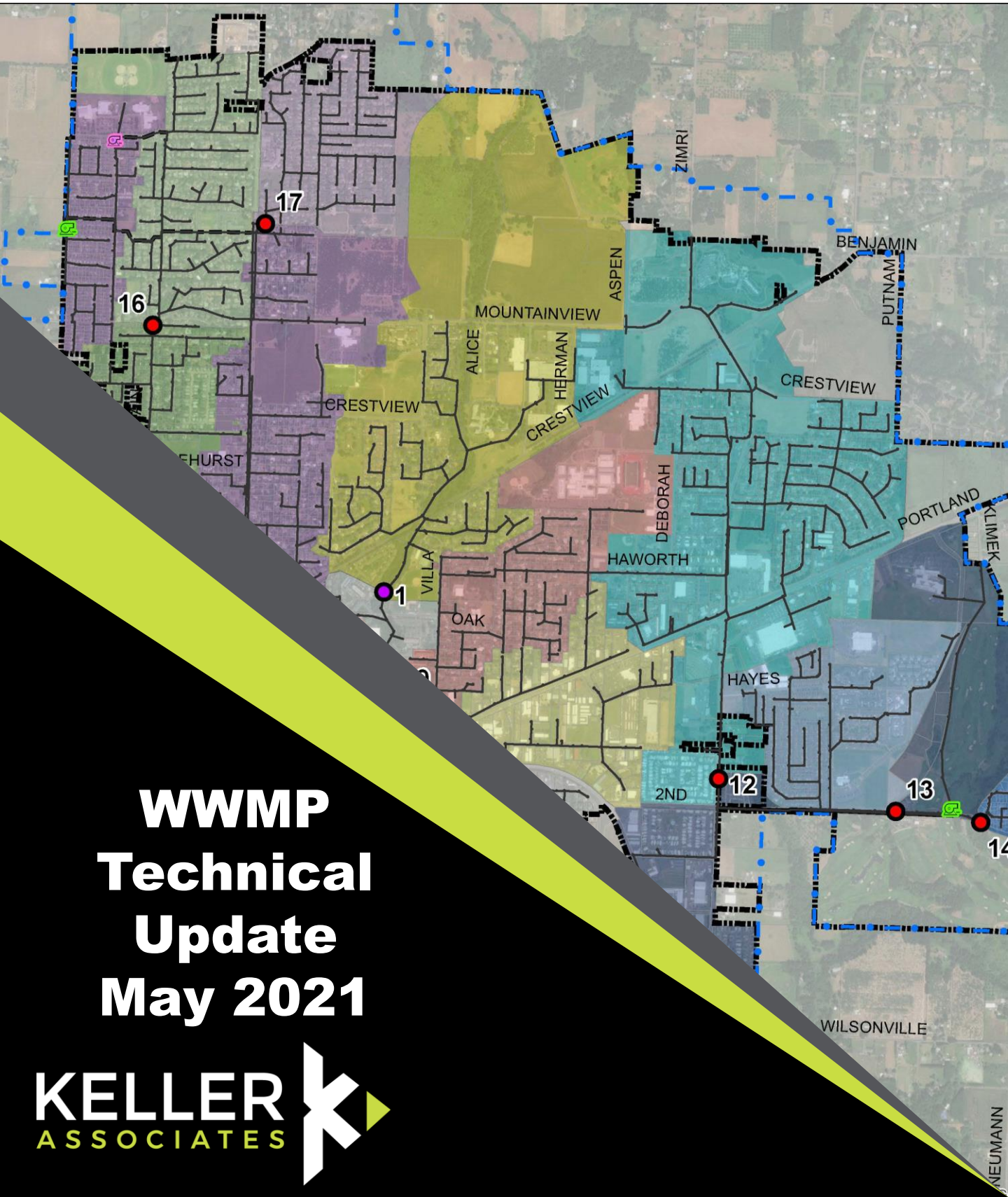
- Incorporate feedback from CAC on draft documents.
- Prepare for Planning Commission (PC) hearing and City Council (CC) hearing.
- Present to PC and CC.
- Incorporate any feedback or comments from PC and CC meetings.
- Complete final draft of WWMP Technical Update.

Questions or Comments?

Reference Slides

City of Newberg OREGON

Appendix K



WWMP Technical Update May 2021

KELLER ASSOCIATES

TECHNICAL MEMORANDUM/REPORT

CITY OF NEWBERG WASTWATER MASTER PLAN TECHNICAL UPDATE

ADDENDUM – RIVERFRONT MASTER PLAN

DRAFT

MAY 2021

PROJECT NO. 220045

PREPARED BY:

KELLER ASSOCIATES

245 Commercial St SE, Suite 210
Salem, OR 97301
(503) 364-2002

PREPARED FOR:

City of Newberg OREGON

City of Newberg
414 E. First Street
Newberg OR 97132
(503) 554-1223

TABLE OF CONTENTS

APPENDICES

ACRONYMS, ABBREVIATIONS, AND SELECTED DEFINITIONS

AACE	Association for the Advancement of Cost Engineering
AADF	average annual daily flow
AAGR	average annual growth rate
ac	acre
ADWF	average dry weather flow
AWWF	average wet weather flow
CAC	citizen advisory committee
CCTV	closed circuit television
CDBG	community development block grants
CIP	Capital Improvement Plan
CIPP	cured-in-place pipe
CMS	construction management services
DEQ	Oregon Department of Environmental Quality
EDU	equivalent dwelling unit
ft	feet or foot
ft^3	cubic feet or cubic foot
GIS	geographic information system
gpad	gallons per acre per day
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
I/I	infiltration and inflow
in	inch
KW	kilowatt
kwh	kilowatt hour
LF	linear foot
MG	million gallons
MGD	million gallons per day
MMDWF	max month dry weather flow
MMWWF	max month wet weather flow
O&M	operation and maintenance
OH&P	overhead and profit
PDAF	peak day flow
PkWF	peak week flow
PIF	peak instantaneous flow
PLC	programmable logic controller
PS	pump station
PVC	polyvinyl chloride
PWDS	public works design standards
SCADA	supervisory control and data acquisition
sqft	square feet or square foot
TDH	total dynamic head
UGB	urban growth boundary
VFD	variable frequency drive
WWMP	wastewater master plan
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

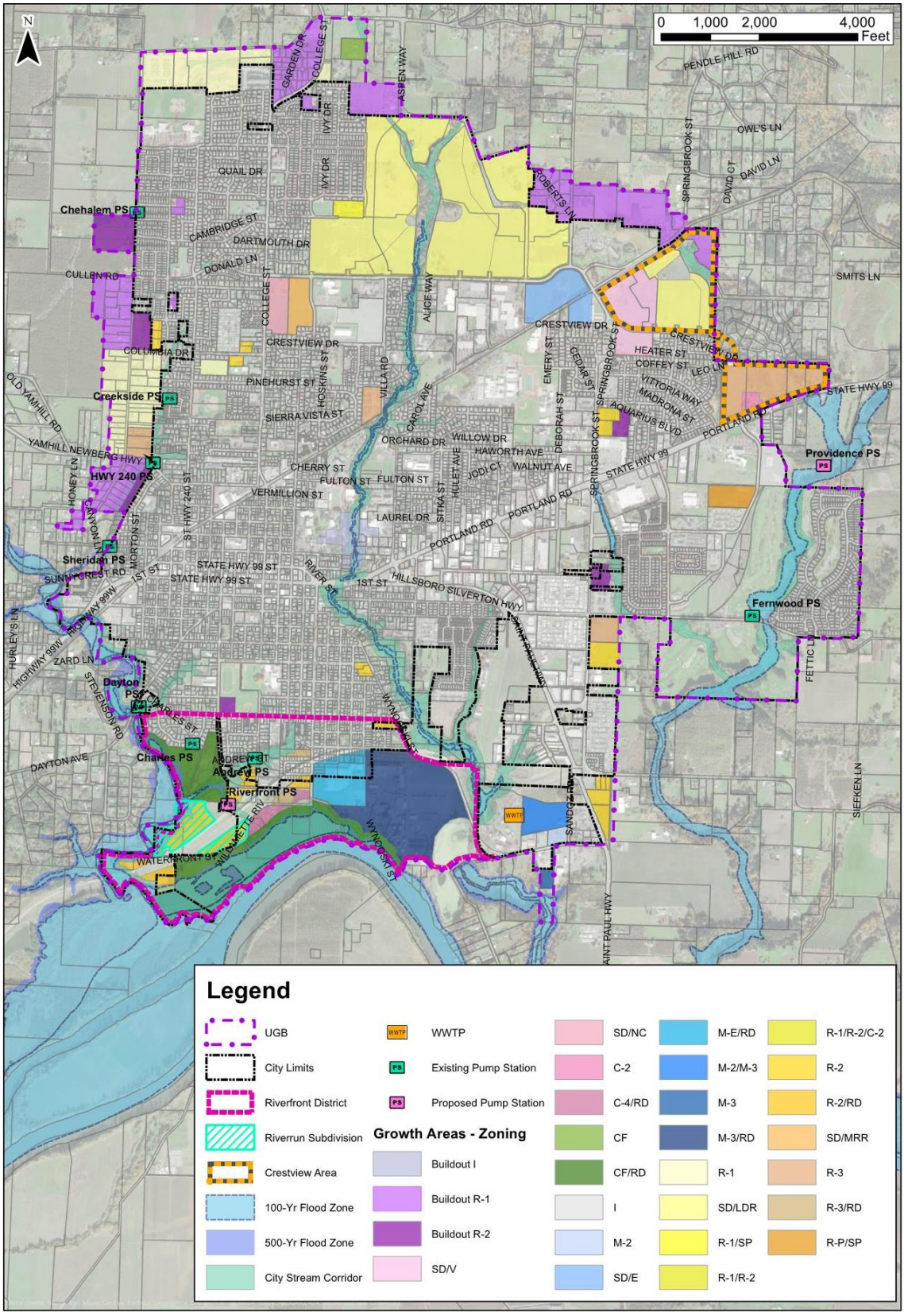
In 2018, the City of Newberg, Oregon (City) completed a wastewater master plan (WWMP) for the City's sanitary sewer collection system and wastewater treatment plant (WWTP). Since the adoption of the 2018 WWMP, the City accepted the Riverfront Master Plan in September 2019. This wastewater master plan technical update incorporates the new information on zoning, infrastructure, and development within the Riverfront district in alignment with the accepted master plan. The Riverrun Subdivision development within this area was reflected and updated during this process. Additionally, the City decided to include the E Crestview Drive and Crestview Crossing projects in the Springbrook Basin in the technical update evaluation. These projects in the Springbrook basin have resulted in the possibility of routing additional flow further east within the basin.

The technical update shall serve as a planning guide for operating, maintaining, constructing, and expanding the City's wastewater collection system. The technical update will be incorporated as an addendum to the 2018 WWMP as Appendix K. The update is consistent with buildout growth projections and design flows documented in the 2018 WWMP with updates specifically to the Riverfront and Springbrook basins. This update does not include an update to the evaluation of the WWTP. This section summarizes the major findings of the update, including brief discussions of alternatives considered and final recommendations.

ES.1 STUDY AREA

The 2018 WWMP study area consisted of all areas within the City of Newberg Urban Growth Boundary (UGB). This technical update was limited to the Riverfront and Crestview areas of the City and collection system infrastructure that serves these areas. Figure ES-1 (next page) shows the existing City limits, UGB, growth areas identified in the 2018 WWMP and highlights updated information for this technical update in the Riverfront and Crestview areas. Figure 2 (See Appendix A) shows the Riverfront Master Plan study area with proposed zoning and wastewater infrastructure. Figure 3 (See Appendix A) shows the Crestview area with proposed wastewater infrastructure. Both projects are currently under construction. Crestview Crossing is a private development.

FIGURE ES-1: STUDY AREAS



ES.2 POPULATION AND FLOWS

No additional population or flow analyses were completed as part of this update. Summary of the population and flow projections from the 2018 WWMP are shown in Section 1.2.

ES.3 PLANNING CRITERIA

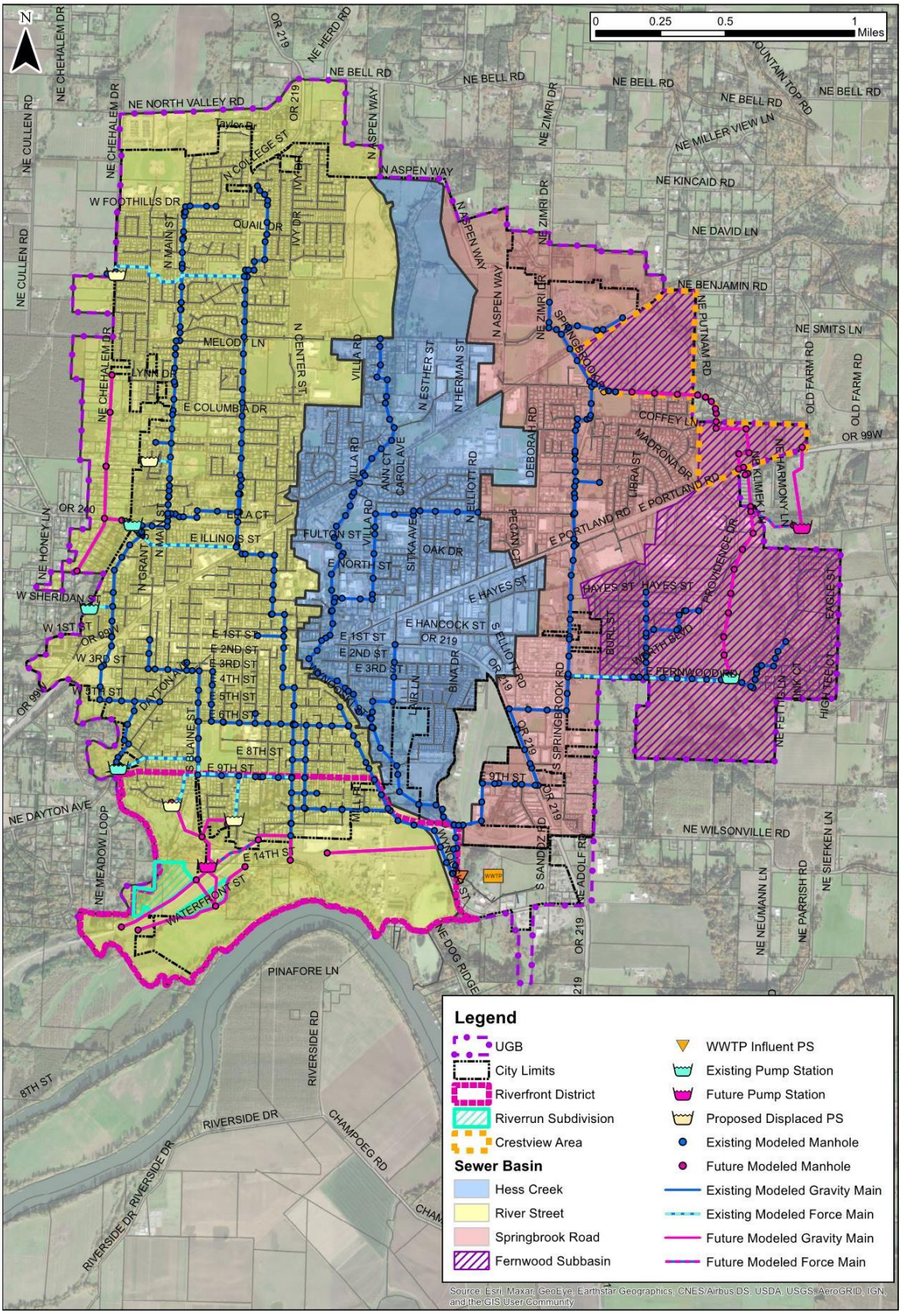
City-defined goals and objectives, Public Works Design Standards (PWDS), engineering best practices, and regulatory requirements form the basis for planning and design. The technical update limited evaluation to the Riverfront and Crestview areas and associated collection system infrastructure. The City's conveyance system was sized for the projected buildout peak instantaneous flow rates associated with the 5-year, 24-hour storm event. Consistent with the 2018 WWMP, the evaluation threshold for pipeline upsizing was wastewater flow level rising to within two feet of a manhole rim. Gravity pipelines were sized to carry peak design flows at 85% of pipeline depth. Pump stations were designed to handle the peak flows with the largest pump out of service (defined as firm capacity). Additional discussion of planning criteria is included in Section 1.3.

ES.4 COLLECTION SYSTEM COMPUTER MODEL UPDATE

The computer model update was completed in InfoSWMM (Version 14.7, Update #2) using the 2018 WWMP buildout scenario as the basis. As discussed in previous sections, the Riverfront and Crestview areas were the focus and revised as part of this technical update. Modeled infrastructure shown in Figure ES-2 (next page) reflects buildout conditions. Sanitary Sewer drainage basins are also shown in Figure ES-2. Chapter 2 provides additional information on the model update.

The Riverfront Master Plan proposed wastewater infrastructure and Riverrun Subdivision as-builts for Phases 1 and 2 and preliminary plans for Phase 3 were incorporated into the model as part of this update. Base loads from the updated growth areas were estimated by zoning designations and area using flows presented in Section 1.2. Updates to Springbrook Basin included infrastructure added to E Crestview Drive and Crestview Crossing. E Crestview Drive is currently under construction and construction drawings were used to add manholes and pipelines along E Crestview Drive. The new infrastructure on E Crestview Drive redirects some future flows from growth areas north to the east and downstream to the Fernwood Pump Station, changing the Fernwood drainage basin from the 2018 WWMP. Crestview Crossing preliminary utility report was used to add infrastructure and base loads to the model update.

FIGURE ES-2: MODELED INFRASTRUCTURE



ES.5 UPDATED BUILDOUT SYSTEM CAPACITY LIMITATIONS

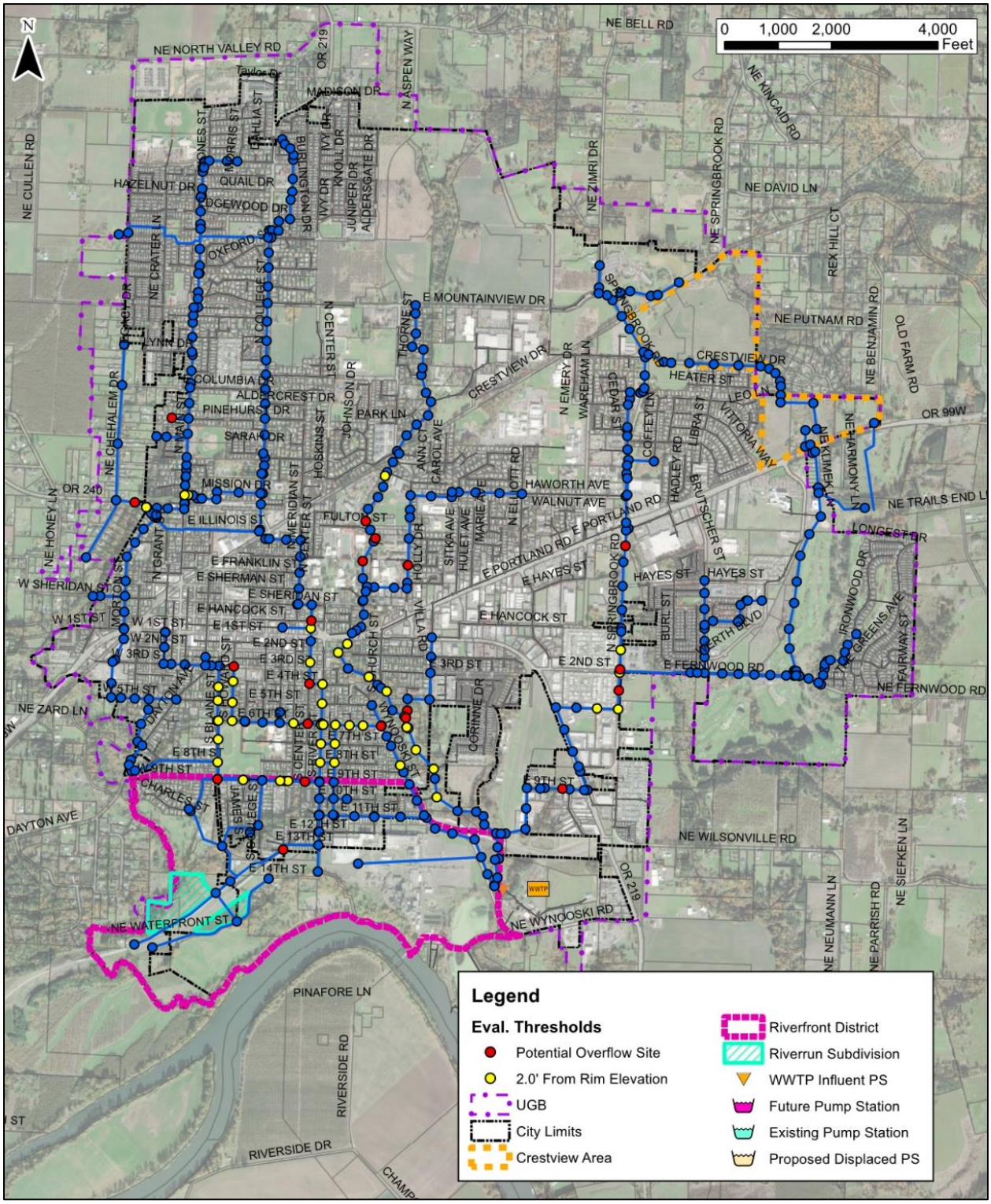
Results of the updated model simulation for buildout conditions are shown in Figure ES-3 (next page). The red manholes indicate potential overflow locations in the system. Overflows have been observed historically by the City staff on Hess Creek, N Villa Road, and S Springbrook Road. These locations are the highest priority and concern for the system as overflows pose public health risks, environmental concerns, and possible Oregon Department of Environmental Quality (DEQ) action. Comparing the model results of the updated system and the 2018 model, the flow redirection at E Crestview Drive does not resolve the capacity limitations on the Springbrook trunk line that were identified in the 2018 WWMP. Additional areas of interest in the updated evaluation, but not in the 2018 WWMP include backwater in the Riverfront district and Fernwood Pump Station undersized pumps. Additional information on the updated evaluation is included in Section 2.2.

ES.6 ALTERNATIVES CONSIDERED

Chapter 3 discusses alternatives that were considered to address the collection system deficiencies in the Riverfront and Springbrook areas. Multiple, feasible alternatives to address capacity deficiencies along the S River Street and E Eleventh Street trunk line were not identified given existing infrastructure and development. Additional discussion and recommended improvements to upsize existing trunk lines are described in Chapter 4.

Two alternatives were evaluated for the Springbrook basin to direct flow from the new E Crestview Drive infrastructure. Alternative 1 would entail directing flow from E Crestview Drive to the east and then south through Crestview Crossing, eventually flowing to the Fernwood Pump Station. A new parallel pipeline south of E Fernwood Road would alleviate capacity issues in the existing Springbrook trunkline and/or convey flow from the Fernwood Pump Station. This alternative includes upsizing the firm capacity at the Fernwood Pump Station. Alternative 2 would entail directing flow from E Crestview Drive through the Aquarius Blvd subdivision and then flow west to the Springbrook Road trunk line near Haworth Avenue. The parallel gravity main south of E Fernwood Road follows the same proposed alignment as Alternative 1. This alternative does not include any upsizing to the Fernwood Pump Station. Additional details and lifecycle cost comparison for the alternatives are shown in Chapter 4. The 20-year lifecycle costs for Alternative 1 are lower than those for Alternative 2, therefore Alternative 1 improvements are the recommended improvements for the Springbrook basin.

FIGURE ES-3: UPDATED SYSTEM EVALUATION



ES.7 RECOMMENDED IMPROVEMENTS

Recommended improvements to collection system infrastructure that vary from the recommendations of the 2018 WWMP are summarized below. All recommended collection system improvements are described in Chapter 4, including recommendations that match the 2018 WWMP. This was done so that system-wide, collection system recommendations are in one location in the WWMP for easy reference. Project cost estimates are included in Chapter 4 and have been updated from the 2018 WWMP, even if a recommended project has not changed.

Updated Recommended Pipelines Improvements

The recommended alternative for Springbrook Road has been updated since the 2018 WWMP and is Alternative 1 as described in the previous section. The improvements include upsizing the firm capacity of Fernwood Pump Station, upsizing a portion of the existing Springbrook line from E Fernwood Road to north of Hayes Street, and a new parallel gravity line added west on E Second Street from the E Fernwood Road intersection.

The recommended improvements on S River Street and E Eleventh Street have also been updated since the 2018 WWMP. The improvements include upsizing the existing trunkline from upstream of the influent pump station on S Wynooski Road up through E Eleventh Street and S river Street to E Fourth Street. The extents of these recommendations have increased since the 2018 WWMP as the recommended size has increased one nominal pipe size and a few additional segments are now included in the improvements to match pipe size along the trunk line.

Future infrastructure recommended in the Riverfront and Crestview areas have been updated to match the model updated infrastructure as described in Chapter 2. These areas generally include additional pipe length from the approximations in the 2018 WWMP. The firm capacities have been updated for the Riverfront and Providence proposed pump stations. Their firm capacities have decreased slightly with the flow changes in the updated infrastructure. The Riverfront infrastructure still includes the recommendation to displace the Charles and Andrews Pump Stations in the future.

Additional descriptions and cost estimates for the updated recommended improvements as well as additional collection system improvements (matching the 2018 WWMP) are included in Chapter 4. Figure 7 (See Appendix A) shows the locations of all recommended collection system improvements.

Recommended Pump Station Improvements

Additional pump station condition assessments were not included in the scope of this update. The main modification in the technical update was to remove the Dayton Pump Station Replacement project from the CIP as it has been completed since the 2018 WWMP. Upsizing the Fernwood Pump Station was included in the Springbrook Basin recommendations. Otherwise, pump station recommendations have not changed from the 2018 WWMP, though the cost estimates have been increased to 2021 dollars using the ENR index.

ES. 8 CAPITAL IMPROVEMENT PLAN (CIP)

The updated opinion of probable cost of the recommended collection system improvements is listed in Table ES-1 (Capital Improvement Plan). This plan includes all recommended collection system improvements including the projects that have not changed in scope from the 2018 WWMP. This was done for ease of reference for future planning use. Capital costs developed for

the recommended improvements are Class 5 estimates as defined by the Association for the Advancement of Cost Engineering (AACE) in alignment with the 2018 WWMP. Actual construction costs may differ from the estimates presented, depending on specific design requirements and the economic climate at the time a project is bid. The range of accuracy for a Class 5 cost estimate is broad, but these are typical levels of accuracy for planning work and match the process from the 2018 WWMP. It is important to communicate this level of accuracy to policy- and decision-makers. Costs shown are planning-level estimates and should be updated as the project is further refined in the project development, pre-design, and design phases. Contractor's overhead and profit are worked into the base construction cost and the other indirect costs are identified and included, where required, as a specific line item. The CIP is based on modeling data that was available during the completion of this master plan. When projects are carried forward to predesign and design phases, the model, data, assumptions, etc., should be re-evaluated to make any necessary adjustments to the basis of the project. An estimated schedule for the next six years is shown in Table ES-2.

TABLE ES-1. 20-YEAR CAPITAL IMPROVEMENT PLAN (CIP)

ID#	Item	Primary Purpose	Total Estimated Cost (2021)	SDC Growth Apportionment		City's Estimated Portion
				%	Cost	
Priority 1 Improvements						
1.a	Hess Creek Phase 1 - CIPP	Capacity & I/I reduction	$ 1,351,000	2%	$ 27,020	$ 1,323,980
1.b	Hess Creek Phase 2 - Parallel Gravity Main	Capacity	$ 7,460,000	2%	$ 149,200	$ 7,310,800
1.c	Springbrook Road	Capacity	$ 5,314,000	20%	$ 1,062,800	$ 4,251,200
1.d	E Pinehurst Court	Capacity	$ 318,000	0%	$ -	$ 318,000
1.e	Pump Station Improvements (Short-term)	Condition	$ 118,000	1%	$ 1,180	$ 116,820
1.f	I/I Projects	Capacity & Condition	$ 2,700,000	50%	$ 1,350,000	$ 1,350,000
1.g	E Crestview Drive Infrastructure	Future Development	$ 928,000	100%	$ 928,000	$ -
1.h	Crestview Crossing Infrastructure	Future Development	$ 1,414,000	100%	$ 1,414,000	$ -
1.i	Maintenance Yard Improvements	Capacity & Condition	$ 804,000	20%	$ 160,800	$ 643,200
		Priority 1 Total (rounded):	**$ 20,407,000**		**$ 5,093,000**	**$ 15,314,000**
Priority 2 Improvements						
2.a	Hess Creek Phase 3 - Pump Station	Capacity	$ 2,539,000	2%	$ 50,780	$ 2,488,220
2.b	S River and E Eleventh Streets	Capacity	$ 5,103,000	17%	$ 867,510	$ 4,235,490
2.c	HWY 240 Pump Station Upsize	Capacity	$ 642,000	19%	$ 121,980	$ 520,020
2.d	N Main and S Wynooski Streets	Capacity	$ 616,000	1%	$ 6,160	$ 609,840
2.e	Pump Station Improvements (Long-term)	Condition	$ 459,000	11%	$ 50,490	$ 408,510
2.f	I/I Projects	Capacity & Condition	$ 3,150,000	50%	$ 1,575,000	$ 1,575,000
2.g	Wastewater Master Plan	Planning	$ 300,000	100%	$ 300,000	$ -
		Priority 2 Total (rounded):	**$ 12,809,000**		**$ 2,972,000**	**$ 9,838,000**
Priority 3 Improvements						
3.a	NE Chehalem Drive Phase 1	Future Development	$ 2,217,000	100%	$ 2,217,000	$ -
3.b	Riverfront Infrastructure	Future Development	$ 4,787,000	100%	$ 4,787,000	$ -
3.c	Riverfront Industrial Infrastructure	Future Development	$ 1,154,000	100%	$ 1,154,000	$ -
3.d	Providence PS Infrastructure	Future Development	$ 1,734,000	100%	$ 1,734,000	$ -
3.e	NE Chehalem Drive Phase 2	Future Development	$ 990,000	100%	$ 990,000	$ -
3.f	I/I Projects	Capacity & Condition	$ 3,150,000	50%	$ 1,575,000	$ 1,575,000
		Priority 3 Total (rounded):	**$ 14,032,000**		**$ 12,457,000**	**$ 1,575,000**
Priority 4 Improvements						
4.a	Chehalem & Creekside PS Displacement/Future Trunk Line	Operations	$ 3,498,000	44%	$ 1,539,120	$ 1,958,880
4.b	Charles & Andrew PS Displacement	Operations	$ 1,109,000	44%	$ 487,960	$ 621,040
		Priority 4 Total (rounded):	**$ 4,607,000**		**$ 2,028,000**	**$ 2,580,000**
		Total Wastewater Collection System Improvement Costs (rounded):	**$ 51,855,000**		**$ 22,550,000**	**$ 29,307,000**

Notes:

1. The opinion of probable cost herein is concept level information only based on our perception of current conditions at the project location and its accuracy is subject to significant variation depending upon project definition and other factors. This estimate reflects our opinion of probable costs at this time and is subject to change as the project design matures. This cost opinion is in 2021 dollars and does not include escalation to time of actual construction. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the cost presented herein.
2. All costs in 2021 Dollars. Costs include mobilization (5%), contractor overhead and profit (OHP; 15%), contingency (30%), engineering and construction management services (CMS; 20-30%), and legal, administrative, and permitting services (2%).
3. Acronyms: Cure-in-place pipe (CIPP), infiltration and inflow (I/I), pump station (PS)
4. The Capital Improvement Plan does not include annual pipeline replacement, pipeline cleaning and inspection, and lift station maintenance budgets. These budgets are discussed in Chapter 5.

TABLE ES-2: PRIORITY 1 CAPITAL IMPROVEMENT PLAN

ID#	Item	Total Estimated Cost (2021)	Opinion of Probable Costs (2021)					
			2022	2023	2024	2025	2026	2027
Priority 1 Improvements								
1.a	Hess Creek Phase 1 - CIPP	$ 1,351,000	$ 337,750	$ 1,013,250	$ -	$ -	$ -	$ -
1.b	Hess Creek Phase 2 - Parallel Gravity Main	$ 7,460,000	$1,865,000	$ 2,797,500	$2,797,500	$ -	$ -	$ -
1.c	Springbrook Road	$ 5,314,000	$ -	$ -	$ -	$1,328,500	$1,992,750	$1,992,750
1.d	E Pinehurst Court	$ 318,000	$ 318,000	$ -	$ -	$ -	$ 318,000	$ -
1.e	Pump Station Improvements (Short-term)	$ 118,000	$ -	$ -	$ -	$ 118,000	$ -	$ -
1.f	I/I Projects	$ 2,700,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000
1.g	E Crestview Drive Infrastructure	$ 928,000	$ 232,000	$ 348,000	$ 348,000	$ -	$ -	$ -
1.h	Crestview Crossing Infrastructure	$ 1,414,000	$ 353,500	$ -	$ -	$ 353,500	$ 353,500	$ 353,500
1.i	Maintenance Shops Improvements	$ 804,000	$ -	$ -	$ 201,000	$ 201,000	$ 201,000	$ 201,000
	Priority 1 Total (rounded):	**$ 20,407,000**	**$3,557,000**	**$ 4,609,000**	**$3,797,000**	**$2,451,000**	**$3,316,000**	**$2,998,000**

Note: The opinion of probable cost herein is concept level information only based on our perception of current conditions at the project location and its accuracy is subject to significant variation depending upon project definition and other factors. This estimate reflects our opinion of probable costs at this time and is subject to change as the project design matures. This cost opinion is in 2021 dollars and does not include escalation to time of actual construction. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the cost presented herein.

ES. 9 2018 WWMP REFERENCES

Table ES-3 (next page) summarizes the sections and references in the 2018 WWMP that have been modified by this technical update. The table correlates the technical update section and/or references with the corresponding modified section and/or references (including page numbers) of the 2018 WWMP. Brief descriptions of the modifications from the technical update are included in the last column of the table.

TABLE ES-3: 2018 WWMP REFERENCES

Technical Update Section or Reference	2018 WWMP Report Section or Reference	Page/s	Description
1.3	2.5.1	2-11	Summary of additional discussion on evaluation threshold.
2.1.1, Figure 2	4.2.1, Figure 12	4-7, App A	Riverfront Master Plan and Riverrun Subdivision updates to proposed wastewater infrastructure and estimated future loading for Riverfront District.
2.1.2, Figure 3	4.2.1, Figure 12	4-7, App A	E Crestview Drive and Crestview Crossing updates to proposed wastewater infrastructure and estimated future loading for Crestview Area in the Springbrook sewer basin.
2.1, Figure 1	4.2.1, Figure 12	4-7, App A	Buildout system loading updated with additional information on Riverfront District and Crestview areas.
2.2, Figure 6	4.2.3, Figure 15	4-8, App A	Updated buildout capacity evaluation.
3.2, Figure 3.1 & Figure 3.2 (pg 3-2 & 3-3)	5.2.2, Figure 17	5-6 to 5-8, App A	Additional evaluation and alternatives have been added to the Springbrook basin evaluation with the Crestview area updates.
4.2	5.1.1	5-1	Dayton PS replacement has been completed, so recommendation for replacement was eliminated.
Chapter 4, Figure 7	6.1, 6.2, Figures 18 & 28	6-1 to 6-10, App A	Updated recommended inprovements to the collection system. All recommended project cost estimates have been updated (those in report body and in cost estimate appendix). Recommended projects with updates to scope include Priority 1 Lift Station Improvements (Dayton PS replacement has been removed), Springbrook Road, S River Street, Providence LS future infrastructure, Riverfront future infrastructure, and Crestview future infrastructure (added since 2018 WWMP).
Chapter 5, Table 5-1	12.1, 12.2, Table 12-2	12-1, 12-2, 12-3	Capital Improvement Plan (CIP) has been updated.
Appendix C	Appendix E	-	Cost estimate additional information has been updated.
Appendix D	Appendix F	-	Priority 1 Collection System Project Sheets have been updated.

CHAPTER 1 – PROJECT PLANNING

The City of Newberg owns and operates a municipal wastewater collection system and a wastewater treatment plant (WWTP). In 2018, the City of Newberg completed a Wastewater Master Plan (WWMP) to assess the needs of the City for the wastewater system, evaluate if the existing collection system and WWTP could meet those needs, and provide a plan to implement improvements to the wastewater system so the City could continue to meet their level of service goals. Since the adoption of the WWMP, the City accepted the Riverfront Master Plan in September 2019. The City acceptance of the Riverfront Master Plan initiated the WWMP technical update process. The technical update included evaluating the Riverfront Master Plan recommendations for zoning and wastewater infrastructure within the Riverfront area. The Riverrun Subdivision development within this area was also reflected and updated during this process. Additionally, the City decided to include the E Crestview Drive and Crestview Crossing projects in the Springbrook Basin in the technical update evaluation. These projects in the Springbrook basin have resulted in the possibility of routing additional flow further east within the basin.

The City desired a technical update to the 2018 WWMP that evaluated the Riverfront and Crestview area updates as they pertain to the collection system. The technical update shall serve as a planning guide for operating, maintaining, constructing, and expanding the City's wastewater collection system. The technical update will be incorporated as an addendum to the 2018 WWMP as Appendix K. The update provides recommendations for buildout conditions to continue to meet the wastewater collection needs of the City. The update reflects buildout growth projections and design flows documented in the 2018 WWMP with updates specifically to the Riverfront and Springbrook basins. This update does not include an update to the evaluation of the WWTP.

1.1 STUDY AREA

The 2018 WWMP study area consisted of all areas within the City of Newberg Urban Growth Boundary (UGB). This technical update was limited to the Riverfront and Crestview areas of the City and collection system infrastructure that serves these areas. Figure 1 Appendix A shows the existing City limits, UGB, growth areas identified in the 2018 WWMP and highlights updated information available on the Riverfront and Crestview areas. Figure 2 shows the Riverfront Master Plan study area with proposed zoning and wastewater infrastructure. Figure 3 shows the Crestview area with proposed wastewater infrastructure. Both projects are currently under construction. Crestview Crossing is a private development.

1.2 POPULATION AND FLOWS

The update uses the population projections and flow analysis presented in the 2018 WWMP. No additional population or flow analyses were completed as part of this update. A summary of the population and flow projections from the 2018 WWMP are shown in Tables 1-1 and 1-2.

TABLE 1-1: POPULATION AND PROJECTIONS

Year	Population	Source
1980	10,394	U.S. Census, Population Research Center: PSU
1990	13,086	U.S. Census, Population Research Center: PSU
2000	18,064	U.S. Census, Population Research Center: PSU
2010	22,110	U.S. Census, Population Research Center: PSU
2017	23,480	PSU Preliminary Population (Nov. 2017)
2022	25,797	Projected Using Coordinated Growth Rate of 1.9%
2027	28,343	Projected Using Coordinated Growth Rate of 1.9%
2032	31,139	Projected Using Coordinated Growth Rate of 1.9%
2037	33,811	Projected Using Coordinated Growth Rate of 1.3%

Notes: PSU - Portland State University; Coordinated Growth Rates (AAGR) from PSU Coordinated Population Forecast 2017-2067 Yamhill County.
Source: City of Newberg 2018 WWMP

TABLE 1-2: FLOW PROJECTION SUMMARY

	Design Flow (MGD)	Design Unit Flow (gpcd)	Projected Unit Flow (gpcd)[2]	Projected Design Flow (MGD)				
Year	2015	2015	-	2017	2022	2027	2032	2037
Population	22,900	22,900	-	23,480	25,797	28343	31,139	33,811
ADWF	2.27	99	99	2.33	2.56	2.81	3.09	3.35
$MMDWF_{10}$	4.48	196	196	4.60	5.05	5.55	6.09	6.62
AADF	3.32	145	145	3.40	3.74	4.11	4.51	4.90
AWWF	4.38	191	191	4.49	4.94	5.42	5.96	6.47
$MMWWF_5$	9.66	422	250	9.81	10.4	11.0	11.7	12.4
PWkF	10.0	438	275	10.2	10.8	11.5	12.3	13.0
$PDAF_5$	21.5	941	325	21.7	22.5	23.3	24.2	25.1
PIF_5[1]	28.0	1,223	425	28.2	29.2	30.3	31.5	32.6

Notes: 1. MGD - million gallons per day, gpcd - gallons per capita per day, ADWF - average dry weather flow, MMDWF - max month dry weather flow, AADF - average annual flow, AWWF - average wet weather flow, MMWWF max month wet weather flow, PWkF - peak week flow, PDAF - peak day flow, PIF - peak instantaneous flow
2. The DEQ method produces a design flow of 67.1 MGD. PIF5 flow was adjusted based on continuous flow data from peak days between 2012 and 2015.
3. Projected unit flow scaled down to reflect reduced I/I in future developments.
Source: City of Newberg 2018 WWMP

1.3 PLANNING CRITERIA

The City's conveyance system was evaluated for the projected buildout peak instantaneous flow rates associated with the 5-year, 24-hour storm event. Based on the Comprehensive Plan updated in September 2015, buildout for the UGB and URA are projected to occur at approximately the same time as the planning period for the 2018 WWMP (2037).

Evaluation Threshold

The evaluations performed as part of this technical update were used to update and prioritize recommended improvements to address deficiencies in the collection system. These improvements are organized into the Capital Improvement Plan (CIP). The evaluation threshold is used to identify deficiencies in infrastructure and trigger improvement projects. Different thresholds can be used to help prioritize deficiencies in the system. Evaluation thresholds can progressively be lower in subsequent studies as a City makes progress on improvements. Some examples of evaluation thresholds for pipelines include 85% full depth of pipe, top of pipe, 1-foot above top of pipe, 2-feet below rim, at rim elevation. Part of this update was to reconsider different evaluation thresholds. A key component to this discussion was the Citizen Advisory Committee (CAC). This committee is made up of citizens of the City who were involved throughout the development of this update, reviewed draft documents, and provided feedback to be considered in this update. The committee discussed the various options for the evaluation threshold and decided to continue with the evaluation threshold used in the 2018 WWMP of 2.0 feet below rim elevation. The committee was interested in looking more closely at the impacts to the recommended improvements and subsequent CIP resulting from the various evaluation thresholds. The committee recommended to the City that a study be completed with this information in the future. Providing recommendations and CIP for multiple evaluation thresholds was not in the scope of this update. Further discussion on the evaluation threshold and impacts to the system evaluation are in Chapter 2. It should be noted that the evaluation threshold is not a design standard (though they can align) and the CIP pipeline projects are all sized to conform to design criteria as described below.

Design Criteria

The design criteria govern the design of improvements and new infrastructure. Often many of the design criteria are included in the Public Works Design Standards (PWDS). For this update, gravity collection pipelines will be sized to carry peak design flows at 85% depth of the pipe. Where appropriate, new lines will be sized one nominal pipe size larger than what is needed for areas that may not be at buildout by the end of the planning period. Additionally, it should be noted that efforts to reduce I/I in the collection system could further extend the service population. Pump stations will be designed to handle the peak flows with the largest pump out of service (defined as firm capacity). These are consistent with industry and the Oregon DEQ design guidelines.

Growth Areas

The future buildout growth areas identified in the 2018 WWMP serve as the basis for the scenario evaluated in this master plan update. The growth areas updated as part of the evaluation were limited to the Riverfront and Crestview areas. These areas and flow assumptions were updated with information provided by the City for the Riverfront area including the Riverfront Subdivision and the Crestview area including the Crestview Drive and Crestview Crossing projects. Additional discussion of these areas is included in Chapter 2.

Residential flows were projected using growth area, average lot size, population density, and ADWF per capita attributed with residential contributions. Commercial, industrial, and institutional flows were projected using growth areas identified in the 2018 WWMP and typical flow per acre values (Metcalf and Eddie, 3rd Edition). Projected flows per zoning designation used in this update to estimate flows for growth areas are summarized in Table 1-3.

TABLE 1-3: PROJECTED FLOWS BY ZONING

Zoning	Dwelling Units per Acre	Average Lot Size[A] (sqft)	Average Lot Size[A] (ac)	Pop. Density[A, B] (people/ac)	Flow[C, D] (gpad)
R-1	4.4	9,900	0.227	12	880
R-2	9.0	4,840	0.111	24	1,800
R-3, R-4	16.5	2,640	0.061	44	3,301
M-1, M-2, M-3, M-E	N/A	N/A	N/A	N/A	1,250
C-1, C-2, C-3, C-4	N/A	N/A	N/A	N/A	1,250
I	Institutional (Providence, GFU, etc.)	N/A	N/A	N/A	2,000

Note: sqft - square feet, ac - acre, gpad - gallons per acre per day, GFU - George Fox University

[A]Allocates 25% of area for roads and other public dedication, except on industrial and commercial area where 20% is allocated.

[B]Assume 2.69 people/dwelling unit (2010 US Census).

[C]Residential flows based on Design ADWF per capita from Table 1-2 (99 gpcd). Industrial, commercial, and institutional values from Metcalf and Eddie, 3rd Edition.

[D]Utilizes average annual dry-weather flows.

CHAPTER 2 – MODEL UPDATE & SYSTEM EVALUATION

This chapter contains a description and evaluation of the model update for the collection system, including pump stations and pipelines, evaluation for the City of Newberg.

2.1 COLLECTION SYSTEM COMPUTER MODEL UPDATE

This section summarizes the updates to the wastewater collection system model. The computer model developed for the 2018 WWMP buildout scenario was used as the basis. The 2018 model used City GIS database as well as survey data collected as part of the project to update the elevation data in the model. The 2018 model was completed in InfoSWMM Suite 14.5, Update #9. InfoSWMM is a fully dynamic model which allows for evaluation of complex hydraulic flow patterns. This update was completed in InfoSWMM (Version 14.7, Update #2). Modeled infrastructure is shown in Figure 4 and reflects buildout conditions. The three main trunkline basins area also shown on Figure 4. The following sections provide additional descriptions of the updated areas of the model.

2.1.1 Riverfront Master Plan and Riverrun Subdivision

The Riverfront Master Plan proposed wastewater infrastructure and Riverrun Subdivision as-builts for Phases 1 and 2 and preliminary plans for Phase 3 were incorporated into the model as part of this update. Appendix D in the Riverfront Master Plan provides recommended utility improvements to serve the Riverfront area as proposed in the master plan (included in Appendix B). Figure 2 shows the updated growth areas and model infrastructure to reflect the Riverfront Master Plan. The Riverfront Master Plan does not include wastewater flow estimations or evaluation. Base loads from the growth areas were estimated by zoning designations and area using flows presented in Table 1-3.

The Riverrun Subdivision is within the Riverfront area (as seen in Figure 2). The subdivision has three planned phases. Phases 1 and 2 are on the north side of the bypass and include 91 lots. Phase 3 is on the south side of the bypass and includes 41 lots. Wastewater loads for these two areas were estimated using the number of proposed lots in the subdivision, people per dwelling unit and the previously established unit flows.

2.1.2 Springbrook Basin

E Crestview Drive and Crestview Crossing

E Crestview Drive is currently under construction. Construction drawings for E Crestview Drive were used to add manholes and pipelines along E Crestview Drive. A preliminary wastewater report for Crestview Crossing PUD has previously been completed. This report was used to update growth areas and proposed infrastructure. Base loads for Crestview Crossing were provided in the report and used the 2018 WWMP unit flows as a basis. Infiltration and inflow (I/I) was added in the model rather than from the report as the model I/I is more conservative and has been calibrated to field conditions as part of the 2018 WWMP process. Updated growth areas and infrastructure for the Crestview area are shown in Figure 3.

Updated Sanitary Sewer Subbasin

The new infrastructure on E Crestview Drive redirects some future flows from growth areas north to the east and down to the Fernwood Pump Station (see northern portion of Crestview area on Figure 3). In the 2018 WWMP, the flow from these growth areas was directed west towards the Springbrook Road trunkline. The updated Fernwood Pump Station drainage basin is reflected in Figure 4. The subbasin is still part of the larger Springbrook basin. The Fernwood Pump Station discharges flow to the Springbrook trunkline at the intersection of S Springbrook Road and E Fernwood Road.

2.2 UPDATED BUILDOUT SYSTEM CAPACITY LIMITATIONS

After the updates described above were incorporated into the computer model, the model was exercised to perform an updated system evaluation and identify capacity limitations throughout the system. Figure 5 shows the results of this evaluation. Various evaluation thresholds, as introduced in Chapter 1, are shown by the different color manholes. The different colored manholes indicate at what evaluation threshold the area would trigger evaluation of improvements. The red manholes indicate potential overflow locations in the system. Overflows have been observed historically by the City staff on Hess Creek, N Villa Road, and S Springbrook Road. These locations are the highest priority and concern for the system as overflows pose public health risks, environmental concerns, and possible Oregon Department of Environmental Quality (DEQ) action.

As discussed in Chapter 1, the CAC recommended using 2.0 feet below rim elevation be used as the evaluation threshold for this update, which matches the threshold used in the 2018 WWMP. Figure 6 shows the system evaluation with annotations on the areas of interest/evaluation based on this evaluation threshold (2.0 feet below rim elevation). Most of the capacity limitations impact a group of manholes as indicated by the areas of interest/evaluation. A summary of the areas identified is listed below along with the probable cause of capacity limitation.

A. E Pinehurst Ct, topographic low point
B. N Main St, downstream bottleneck
C. Excess flows from HWY240 cause backups
D. HWY240 PS, undersized pumps
E. S River/E Eleventh St, undersized
F. Riverfront District, backwater (S River/E Eleventh St)
G. S Wynooski St, undersized
H. N Villa Rd, downstream bottleneck
I. Hess Creek, undersized and limited or no access to line
J. S Springbrook Rd, undersized and topographic low point
K. E Fernwood/Springbrook Rd, undersized
L. Fernwood PS, undersized pumps

The areas identified above match the areas identified in the 2018 WWMP, except the Riverfront District and Fernwood PS areas have been added from the technical update evaluation.

2.2.1 Springbrook Basin

As mentioned previously, the Crestview area updates result in redirecting some growth area flow away from the Springbrook trunk line north of the Fernwood Pump Station discharge in comparison

to the 2018 WWMP. Comparing the model results of the updated system and the 2018 model, the flow redirection at E Crestview Drive does not resolve the capacity limitations on the Springbrook trunk line that were identified in the 2018 WWMP. Improvements for both options of flow direction will be evaluated in the alternatives (see Chapter 3 for more discussion).

2.2.2 Pipeline Conditions

In-field pipeline material condition inspection and review were not included as part of this update. However, it is important to note that one of the basic assumptions of the hydraulic model is that all the lines are free from physical obstructions such as roots and accumulated debris. Such maintenance issues, which certainly exist, must be discovered and addressed through consistent maintenance efforts. The modeled capacities discussed in this chapter represent the capacity assuming the sewer lines are in good working order.

CHAPTER 3 – ALTERNATIVES CONSIDERED

The primary driver of the WWMP update was to incorporate the Riverfront Master Plan to evaluate the impacts and subsequent improvements recommended for this area of the collection system. This update also reviews the Springbrook basin and impacts from the E Crestview Drive and Crestview Crossing developments. This chapter discusses alternatives that were considered to address the collection system deficiencies in the Riverfront and Springbrook areas. Multiple, feasible alternatives to address capacity deficiencies along the S River Street and E Eleventh Street trunk line were not identified for this area given existing infrastructure and development. Redirecting flow to another basin or a parallel line that provides cost savings were not identified along the existing alignment. The recommended improvements to upsize existing trunk line and additional discussion are described in Chapter 4. The alternatives evaluation and recommended improvements from the 2018 WWMP remain applicable to the other capacity deficiencies identified outside of the Riverfront and Crestview areas in this update and are summarized in Chapter 4.

3.1 PLANNING CRITERIA

The planning criteria used for this collection system facilities planning effort are summarized as follows and discussed in Chapter 1. The City's conveyance system will be sized for the projected, buildout peak instantaneous flow rates associated with the 5-year, 24-hour storm event. The City and CAC decided that the criteria for requiring improvements (evaluation threshold) is when the water surface reaches within 2 feet of a manhole rim elevation. Recommended improvements will be sized per design criteria to flow at 85% depth or less for the buildout peak flows. Additionally, it should be noted that efforts to reduce I/I in the collection system could further extend the life of the pipeline with regards to capacity.

3.2 ALTERNATIVES DISCUSSION

Alternatives are described and discussed below. Maps of the alternatives accompany each description below. Overall planning level project cost estimates for alternatives are presented in Chapter 4. For each set of alternatives, there is also an unstated option to do nothing and make no changes. This option perpetuates existing deficiencies and increases the risk of surcharging, overflows, environmental damages, DEQ violations, and subsequent fines. Deficiencies identified in Section 2 that do not have multiple, feasible alternatives for improvements are addressed in Section 4. Alternatives are organized by location. As a general policy, all pipelines that are replaced in the alternative, at a minimum, match the upstream pipeline size. This is considered an industry good practice. Some specific cases are noted where existing downstream pipe segments are smaller in size than the improvements recommended in the alternative. Advantages and disadvantages of alternatives, including capital cost and operations and maintenance (O&M) considerations, are also discussed below. Detailed cost estimates of the improvements summarized in this section are presented in Appendix C.

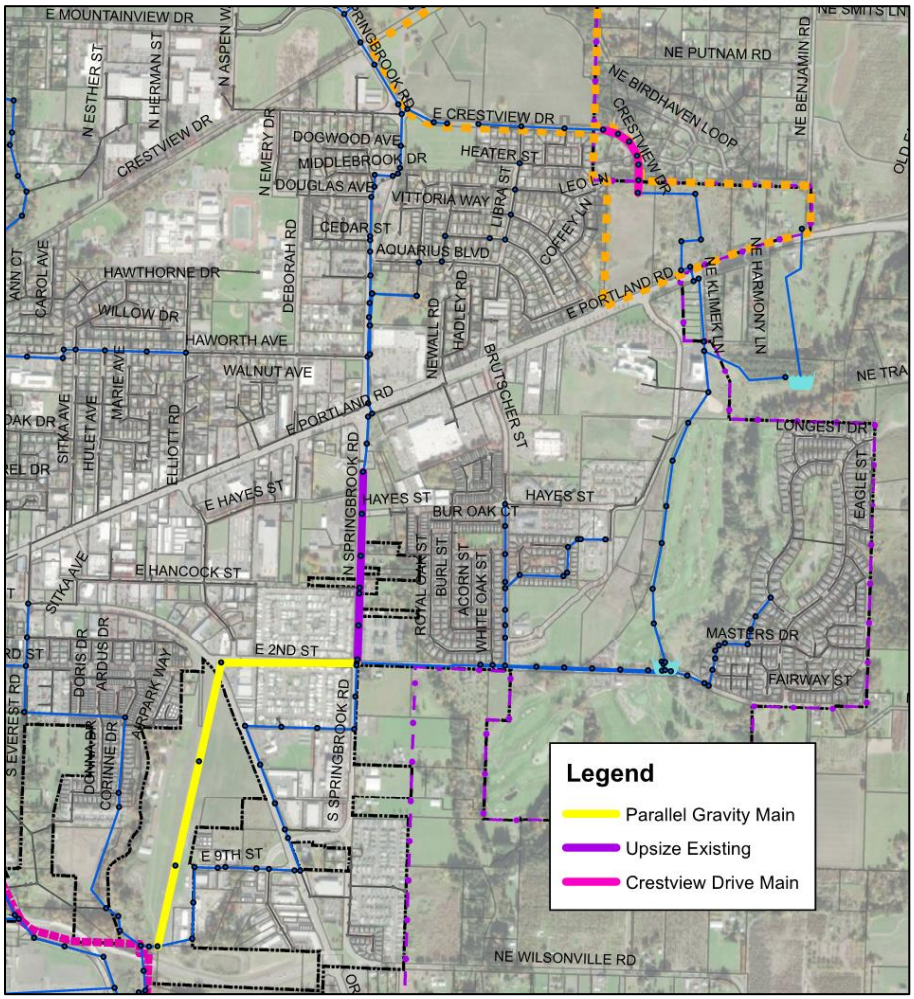
Springbrook Basin

The two alternatives evaluated for the Springbrook basin were to direct the flow from E Crestview Drive to the east or to the west. The improvements in the full Springbrook basin were evaluated collectively for each of the alternatives. The two alternatives are described and evaluated in the following sections.

Alternative 1 – E Crestview Drive East

The main portion of flow draining to E Crestview Drive would be directed to the east, and then south through Crestview Crossing, eventually flowing to the Fernwood Pump Station (as shown in Figure 3-1). This alternative includes a small portion of new 8-inch line on E Crestview Drive to connect to Crestview Crossing to the SE, upsizing the firm capacity at the Fernwood Pump Station by approximately 250 gallons per minute (gpm), upsizing approximately 2,300 linear feet (LF) of existing 15-inch line on Springbrook Road from E Fernwood Road to north of Hayes Street to 18-inch, and a new, 24-inch parallel gravity main to the south. The parallel gravity main that would run west on E Second Street to HWY 219, then turn south and route through the Sportsman Airpark property and reconnect to the existing trunk line south of the airport before it drops into the creek bottom. This parallel line could be designed to receive all flows from either the Fernwood Lift Station force main or from the S Springbrook Road trunk line. These connections could be designed with overflow capabilities to transfer flow from one trunk line to the other if needed. Otherwise, a flow split downstream of the existing manhole in E Fernwood Road and S Springbrook Street could be utilized to send most of the flow down the new airport trunk line. The extents of the improvements are shown in Figure 3-1.

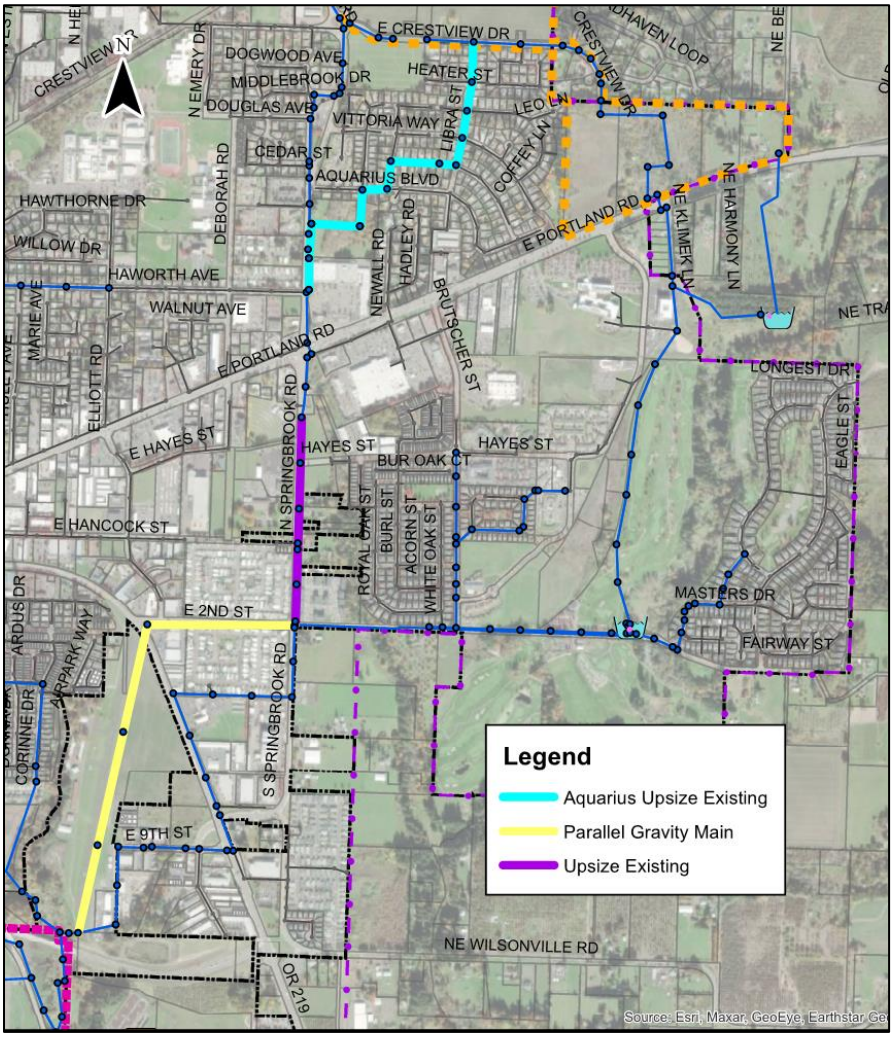
FIGURE 3-1: ALTERNATIVE 1, E CRESTVIEW DRIVE EAST



Alternative 2 – E Crestview Drive West

The main portion of flow from E Crestview Drive would be directed south through the Aquarius Blvd subdivision and then flow west to the Springbrook Road trunk line near Haworth Avenue (as shown in Figure 3-2). This alternative includes upsizing approximately 4,400 LF in Aquarius Blvd subdivision to 15-inch pipe. Additional improvements downstream would include upsizing approximately 2,300 LF of existing 15-inch line on Springbrook Road to 21-inch, and a new, 24-inch parallel gravity main to the south. The parallel gravity main follows the same proposed alignment as Alternative 1. This alternative does not include any upsizing to the Fernwood Pump Station, but the improvements on Springbrook Road are one nominal pipe size larger than those in Alternative 1. The extents of the improvements are shown below in Figure 3-2.

FIGURE 3-2: ALTERNATIVE 2, E CRESTVIEW DRIVE WEST



Lifecycle Cost Evaluation

A 20-year lifecycle cost evaluation was completed for the two alternatives. Two of the three pumps at the existing Fernwood Pump Station were installed in 2001 and the third was installed in 2010. The typical lifecycle of pumps is estimated at 20 years. Pump replacement was assumed in the 20-

year lifecycle for both alternatives. The same base pump can be used for both alternatives. The impeller size and the average efficiencies of the pumps vary between the alternatives. Annual pump electrical demands and maintenance costs were estimated for each alternative. The annual O&M cost is converted to a 20-year total using a net present value approach with a rate of 1.2%. Table 3-1 shows the 20-year lifecycle cost comparison. Alternative 1, directing Crestview Drive east, has the lower 20-year lifecycle cost despite its higher annual O&M.

TABLE 3-1: SPRINGBROOK ALT. 20-YEAR LIFECYCLE COSTS

Alternative 1 - Crestview East	
Item	**Annual Cost**
Annual electricity	$ 9,600
Pump maintenance	$ 3,200
Annual O&M (rounded)	$ 13,000
20-Year O&M (rounded)	$ 230,000
Pump capital cost	$ 202,000
Pipe improvements capital cost	$ 5,314,000
20-Year Lifecycle Cost (rounded):	**$ 5,746,000**
Alternative 2 - Crestview West	
Item	**Annual Cost**
Annual electricity	$ 8,100
Pump maintenance	$ 3,200
Annual O&M (rounded)	$ 12,000
20-Year O&M (rounded)	$ 212,300
Pump capital cost	$ 202,000
Pipe improvements capital cost	$ 6,617,000
20-Year Lifecycle Cost (rounded):	**$ 7,032,000**

Both alternatives include continued use of two, 15-inch diameter segments (approximately 200 feet) downstream of the improvements (north of the Newberg-Dundee Bypass and south of the Airpark). These segments drop down into the Hess Creek corridor and increase in slope, preventing them from being capacity limiting. The City can choose to replace and upsize the downstream portion of this trunk line during preliminary design to avoid the downstream pipeline from being smaller than the upstream pipeline. The average useful life of a pipeline is roughly 50-75 years; longer than the projected growth of this study. It is advisable to review growth beyond this study's buildout conditions and consider the impacts to the Springbrook Road gravity main during the preliminary design phase.

3.3 INFILTRATION AND INFLOW (I/I) DISCUSSION

Infiltration and inflow (I/I) are concerns in the Newberg collection system. The City completed an I/I Study in 2015 that included pump run time analysis, continuous flow monitoring, night-time monitoring, smoke testing, and CCTV inspection. The study provided a prioritized list of improvements and areas of high I/I for the City to focus their mitigation efforts. The 2018 WWMP collected additional data and updated the I/I evaluation and prioritization areas. The City has made concerted efforts to fund and complete annual I/I mitigation projects, particularly since the 2015 I/I Study was completed. Operators have noted that surcharging and peak flows seen at the WWTP

during large storm events has decreased with the continued I/I mitigation efforts. Additional information and details on the City's I/I efforts and prioritization can be found in the 2018 WWMP (Sections 7 and 8).

CHAPTER 4 – RECOMMENDED IMPROVEMENTS

This section consists of the recommended plan to address the wastewater collection system deficiencies identified in previous chapters, as well as recommendations from the 2018 WWMP that have not been modified in scope in this technical update. This was done so that system-wide, collection system recommendations are in one location in the WWMP for easy reference. A location map showing the improvements to the collection system is shown in Figure 7 (Appendix A).

4.1 RECOMMENDED PIPELINE IMPROVEMENTS

This section summarizes the recommended pipeline improvements to address deficiencies from Chapter 2, including recommended alternatives from Chapter 3 and recommendations from the 2018 WWMP that have not changed in scope. Project cost estimates are included in this chapter and have been updated from the 2018 WWMP, even if a recommended project scope has not changed with the technical update. Cost estimates with additional information for all recommended improvements can be found in Appendix C.

4.1.1 Priority 1 – Address Existing Deficiencies

Priority 1 addresses short-term, existing capacity deficiencies. Primary existing deficiencies were identified in the 2018 WWMP. There was no additional information from this update that would change the existing deficiencies. The recommended alternatives from Chapter 3 are summarized and additional improvements from the 2018 WWMP are expanded upon below. Individual project summary sheets for Priority 1 projects, including location maps, are included in Appendix D.

Hess Creek Trunk Line and N Villa Road

The recommended improvements for the Hess Creek trunk line and N Villa Road have not been changed from the 2018 WWMP. The recommended project includes a new pump station, parallel gravity main, and partial abandonment of the Hess Creek Line (Figure 7). These improvements will alleviate some of the O&M challenges with the Hess Creek trunk line by utilizing a new pump station near E Portland Road to direct flow to a proposed parallel line on S Church Street, E Third Street, and Corinne Drive; and abandon the trunk line in the southern portion of Hess Creek.

These improvements can be completed as one project but is recommended to be divided into three phases. Phase 1 includes cured-in-place-pipe (CIPP) of the upper portion of Hess Creek trunk line followed by flow monitoring of the basin to evaluate flows for pre-design of the pump station and parallel line. There are two segments of pipeline in the upper portion that should not be lined as they will be upsized in Phase 2. Phase 2 includes design and construction of the parallel line, as well as improvements to two sections of the existing Hess Creek trunk line that are undersized for existing flows. The final phase is design and construction of the pump station and force main, and connection to the parallel gravity line. Phase 1 and 2 are included in Priority 1 improvements. Phase 3 is included as a Priority 2 improvement. Phase 1 and 2 will provide I/I reduction and re-direct flow from the east side of the canyon away from the Hess Creek trunk line down the parallel line. A summary of the estimated costs of Phase 1 and 2 is presented in Table 4-1.

TABLE 4-1: HESS CREEK IMPROVEMENTS, PHASE 1 & 2 COST ESTIMATE

	Item	Unit	Unit Price	Quantity	Cost
Phase 1					
	CIPP, 8 to 18-inch[1]	LF	$ 145	6,800	$ 986,000
	Flow monitoring	LS	$ 30,000	1	$ 30,000
				Subtotal (rounded)	$ 1,016,000
	Mobilization	%	5	-	$ 50,800
				Subtotal (rounded)	$ 1,067,000
	Contingency	%	10	-	$ 106,700
				Subtotal (rounded)	$ 1,174,000
	Engineering and CMS	%	15	-	$ 176,100
				Phase 1 Cost (rounded):	**$ 1,351,000**
	[1]Additional 30% added to unit price for Hess Creek accessibility constraints				
Phase 2					
	Parallel gravity main				$ 2,915,500
	Upsize existing pipeline				$ 1,435,000
				Subtotal (rounded)	$ 4,351,000
	Mobilization	%	5	-	$ 217,550
				Subtotal (rounded)	$ 4,569,000
	Contingency	%	30	-	$ 1,370,700
				Subtotal (rounded)	$ 5,940,000
	Engineering (25%) and Soft Costs				$ 1,520,000
				Phase 2 Cost (rounded):	**$ 7,460,000**

Springbrook Road

The recommended alternative for Springbrook Road is Alternative 1 – E Crestview Drive directed east. The improvements include a small portion of new 8-inch line from E Crestview Drive to connect to Crestview Crossing to the SE, upsizing the firm capacity of Fernwood Pump Station, upsizing a portion of the existing Springbrook line north of E Fernwood Road, and a new parallel gravity line added west on E Second Street from the E Fernwood Road intersection. The parallel gravity line will be bored under Highway 219 and then run through Sportsman Airpark. The City Community Development Department had been in discussion with Airpark for other projects during the 2018 WWMP process and the City thinks it is probable that the Airpark would be willing to negotiate an easement for the gravity sewer. The upsized portion on Springbrook Road and new parallel line match the extents of the 2018 WWMP recommendations, though the size of the improvements has changed with the flow modifications in the technical update. During preliminary design it should be determined if the downstream pipeline should be replaced to match the upstream pipeline size. Table 4-2 shows the estimated costs. It is advisable to review growth beyond this study's buildout conditions and consider the impacts to the Springbrook Road gravity main when the next Buildable Lands Study is completed.

TABLE 4-2: SPRINGBROOK IMPROVEMENTS COST ESTIMATE

Item	Unit	Unit Price	Quantity	Cost
Parallel gravity main				$ 1,562,200
Upsize existing pipeline				$ 1,314,500
Upsize Fernwood PS				$ 202,000
			Subtotal (rounded)	$ 3,079,000
Mobilization	%	5	-	$ 153,950
			Subtotal (rounded)	$ 3,233,000
Contingency	%	30	-	$ 969,900
			Subtotal (rounded)	$ 4,203,000
Engineering (25%) and Soft Costs				$ 1,110,750
			Project Total Cost (rounded):	**$ 5,314,000**

E Pinehurst Court

The recommended improvements for E Pinehurst Court have not changed from the 2018 WWMP. E Pinehurst Court in the Highway 240 basin has overflow concerns due to road elevations and the N Main Street trunk line invert elevation. It is recommended that the line on E Pinehurst Court be disconnected from the N Main Street trunk line, re-graded to the west, and extended south to connect to the existing line on Creekside Court (Figure 7). Preliminary design should confirm Creekside Pump Station has capacity to handle E Pinehurst Court flows. E Pinehurst Court flows should also be considered when evaluating Creekside Pump Station displacement (see Section 4.1.3 for more discussion). Estimated costs are summarized in Table 4-3.

TABLE 4-3: E PINEHURST COURT IMPROVEMENTS COST ESTIMATE

Item	Unit	Unit Price	Quantity	Cost
Pinehurst Court				
Disconnect and re-direct to Creekside LS				$ 183,000
Mobilization	%	5	-	$ 9,150
			Subtotal (rounded)	$ 193,000
Contingency	%	30	-	$ 57,900
			Subtotal (rounded)	$ 251,000
Engineering (25%) and Soft Costs				$ 66,400
			Project Total Cost (rounded):	**$ 318,000**

Additional Improvement Projects

The additional improvements projects summarized here have not changed from the 2018 WWMP. The City completed a master plan on expanding and upgrading the City maintenance yard facilities. The recommended improvements project includes remodel of the building (completed in 2016/2017), major site work, a new fleet building, and new administration building. This project is being funded over multiple years and through multiple sources as it is relevant to several City divisions. The cost reflected in the CIP (Chapter 5) was provided by the City in 2018 as the portion of the project costs to be allocated from the sewer funds and has been updated to 2021 dollars with the ENR index. The City is allocating $450,000-$600,000 annually for I/I specific projects. These projects will be directed by the I/I based priority improvements recommended in the 2018 WWMP and coordination with other utility projects. This work is considered part of the

annual replacement budget work for pipelines and manholes (see Chapter 5 for additional discussion).

E Crestview Drive and Crestview Crossing

The Crestview area as shown in Figure 3, includes the E Crestview Drive and Crestview Crossing infrastructure. While this infrastructure is development driven, construction on both projects is currently moving forward. With this timeline, the projects have been included in the Priority 1 CIP, which differs from the priority of the 2018 WWMP. The scopes of these projects have been modified from the 2018 WWMP to reflect the most current information the City has on the ongoing projects. E Crestview Drive includes approximately 2,500 linear feet on 8-inch gravity main. Crestview Crossing is a private development and includes approximately 3,200 linear feet of gravity main. The development is currently in the design phase. The estimated costs for this infrastructure are summarized in Table 4-4.

TABLE 4-4: E CRESTVIEW DRIVE AND CRESTVIEW CROSSING INFRASTRUCTURE COST ESTIMATE

Item	Unit	Unit Price	Quantity	Cost
E Crestview Drive				
New pipeline				$ 521,000
Subtotal (rounded)				$ 521,000
Mobilization	%	5	-	$ 26,050
Subtotal (rounded)				$ 548,000
Contingency	%	30	-	$ 164,400
Subtotal (rounded)				$ 713,000
Engineering (25%) and Soft Costs				$ 214,250
E Crestview Drive Total Cost (rounded):				**$ 928,000**
Item	**Unit**	**Unit Price**	**Quantity**	**Cost**
Crestview Crossing				
New pipeline				$ 801,000
Subtotal (rounded)				$ 801,000
Mobilization	%	5	-	$ 40,050
Subtotal (rounded)				$ 842,000
Contingency	%	30	-	$ 252,600
Subtotal (rounded)				$ 1,095,000
Engineering (25%) and Soft Costs				$ 318,750
Crestview Crossing Total Cost (rounded):				**$ 1,414,000**

4.1.2 Priority 2 – Address Future Deficiencies

Hess Creek Trunk Line and N Villa Road

As mentioned previously, Phase 3 of the Hess Creek and Villa Road Improvements – New Pump Station – is included in the Priority 2 projects. The cost estimate for Phase 3 is summarized in Table 4-5.

TABLE 4-5: HESS CREEK IMPROVEMENTS, PHASE 3 COST ESTIMATE

Phase 3					
	Pump Station				$ 1,369,000
	Mobilization	%	5	-	$ 68,450
				Subtotal (rounded)	$ 1,438,000
	Contingency	%	30	-	$ 431,400
				Subtotal (rounded)	$ 1,870,000
	Engineering (25%) and Soft Costs				$ 668,500
				Phase 3 Cost (rounded):	**$ 2,539,000**

S River and E Eleventh Streets

Capacity deficiencies along the S River and E Eleventh Streets trunk line cause capacity issues upstream along S Blaine, Howard, and Chehalem Streets; and E Sixth and Ninth Streets. To alleviate these capacity issues, approx. 900 linear feet would be upsized from 21-inch to 30-inch diameter along S River Street between E Fourth and Sixth Streets. In addition, approximately 1,900 linear feet of 36-inch diameter pipeline would replace existing 21- and 30-inch diameter pipeline along S River Street south of E Sixth Street to Eleventh Street. Approximately 4,700 linear feet of existing 30- and 36-inch pipe along E Eleventh and S Wynooski Street is to be upsized to 42-inch pipe (Figure 7). The extents of these recommendations have increased since the 2018 WWMP as the recommended size has increased one nominal pipe size and a few additional segments are now included in the improvements to match pipe size along the trunk line. The new 42-inch diameter pipeline on E Eleventh Street and S Wynooski Street would result in smaller diameter downstream pipelines (further south on S Wynooski Street and to the influent pump station). There is one 24-inch diameter segment (approximately 300 feet in length, just upstream of the influent pump station) downstream of the improvements, which has a significantly higher slope than the other segments preventing it from being capacity limiting. During preliminary design it should be assessed if the downstream pipeline should be replaced to match the upstream pipeline size. The cost estimate for these improvements is summarized in Table 4-6.

TABLE 4-6: S RIVER AND E ELEVENTH STREET IMPROVEMENTS COST ESTIMATE

Item	Unit	Unit Price	Quantity	Cost
Upsize existing pipeline				$ 2,972,000
Mobilization	%	5	-	$ 148,600
			Subtotal (rounded)	$ 3,121,000
Contingency	%	30	-	$ 936,300
			Subtotal (rounded)	$ 4,058,000
Engineering (25%) and Soft Costs				$ 1,044,500
			Project Total Cost (rounded):	**$ 5,103,000**

As noted in the 2018 WWMP, City staff are aware there is at least one connection between the S River Street trunk line and the S Chehalem Street pipeline (former trunk line) at E Sixth Street. It is known that there are likely additional connections between the S River Street trunk line and the S Chehalem Street pipeline. The model was calibrated with observed flow monitoring data and closely matched flow, depth, and velocity data upstream at Vermillion Street during the 2018 WWMP process. Additional flow monitoring (number of locations focused in this area) and data collection could be beneficial to further characterize flow throughout the S River Street trunk line.

This is recommended as part of the preliminary design of any improvements related to the S River Street trunk line. Parallel lines could be investigated during preliminary design as a potential alternative alignment as these existing, adjacent lines may be in worse condition and benefit from replacement and upsizing.

Highway 240 Pump Station

The recommended improvements for the Highway 240 Pump Station have not changed from the 2018 WWMP. Highway 240 Pump Station will need upsized pumps as part of Priority 2. Prior to reaching the firm capacity at Highway 240, the pumps at the pump station should be upsized to handle peak flows at buildout (approximately 3,000 gpm at buildout with pump station displacement, recommended below). It is recommended the pump station controls/telemetry be adjusted now to add an alarm to alert operations staff when all pumps are running. This information will indicate if flows at Highway 240 are beyond the firm capacity of the pump station. The cost estimate is summarized in Table 4-7. This estimate assumes pumps can be replaced while maintaining the operations and does not require bypass pumping.

It should be noted that prior to upsizing Highway 240, the recommended S River and E Eleventh Streets improvements should be completed to prevent additional surcharging and overflows in the area. When the Highway 240 pumps are upsized, the Highway 240 diversion structure should be adjusted to prevent flow from being re-directed to the Dayton Pump Station, eliminating potential surcharging and overflows in the downstream pipeline or at the Dayton Pump Station. Operations at Highway 240 Pump station should be adjusted when the pumps are upsized to utilize both 10-inch force mains to maintain velocities of 7 feet per second or lower.

TABLE 4-7: HWY 240 PUMP STATION IMPROVEMENTS COST ESTIMATE

Item	Unit	Unit Price	Quantity	Cost
Upsize pump	EA	$ 130,000	3	$ 390,000
Mobilization	%	5	-	$ 19,500
			Subtotal (rounded)	$ 410,000
Contingency	%	25	-	$ 102,500
			Subtotal (rounded)	$ 513,000
Engineering and CMS	%	25	-	$ 128,250
			Project Total Cost (rounded):	**$ 642,000**

N Main and S Wynooski Streets Pipeline Improvements

The recommended improvements for N Main and S Wynooski Streets have not changed from the 2018 WWMP. N Main Street exceeds the surcharge threshold in future scenarios along Clifford Court. There is a single 12-inch diameter pipeline segment just upstream of the Highway 240 diversion structure. It is recommended this pipeline be upsized to be a 15-inch diameter to match the upstream pipeline and alleviate surcharging on N Main Street (Figure 7). While replacing this segment, it should be regraded with the segment upstream (WWGM1566) to resolve an inverse slope highlighted by survey data collected in 2017 for the 2018 WWMP. In addition, there is another pipeline segment upstream (WWGM1568) that has an inverse slope based on survey data and should be regraded to correct the slope (Figure 7).

It is recommended the pipeline segment on S Wynooski Street north of E Eleventh Street be upsized from 10-inch to 15-inch diameter pipeline to alleviate surcharging along S Wynooski

Street (Figure 7). There is a short segment of 10-inch diameter pipeline downstream of this segment that has a steep slope that prevents it from causing capacity deficiencies. During preliminary design it can be determined if this segment should be replaced to match the new upstream pipeline size. Cost estimates for both N Main Street and S Wynooski Street Improvements are summarized in Table 4-8.

TABLE 4-8: N MAIN AND S WYNOOSKI STREETS IMPROVEMENTS COST ESTIMATE

Item	Unit	Unit Price	Quantity	Cost
N Main Street Improvements				
Upsize/regrade existing pipeline				$ 224,000
Mobilization	%	5	-	$ 11,200
Subtotal (rounded)				$ 236,000
Contingency	%	30	-	$ 70,800
Subtotal (rounded)				$ 307,000
Engineering and CMS	%	25	-	$ 76,800
Project Total Cost (rounded):				**$ 384,000**
Item	**Unit**	**Unit Price**	**Quantity**	**Cost**
S Wynooski Street Improvements				
Upsize existing pipeline				$ 135,000
Mobilization	%	5	-	$ 6,800
Subtotal (rounded)				$ 142,000
Contingency	%	30	-	$ 42,600
Subtotal (rounded)				$ 185,000
Engineering and CMS	%	25	-	$ 46,300
Project Total Cost (rounded):				**$ 232,000**

Additional Improvement Projects

The additional improvements projects summarized here have not changed from the 2018 WWMP. The City will continue to budget $450,000-$600,000 annually for I/I related improvements. This work will continue to be directed by the I/I based priority improvements highlighted in the 2018 WWMP and any additional I/I evaluations completed. Continued coordination with other utility projects could provide cost savings for the City. This work is considered part of the annual replacement budget work for pipelines and manholes. Further discussion of annual replacement budgets is included in Chapter 5.

In addition, a master plan update is recommended within Priority 2 to re-evaluate the existing system and system needs as growth occurs. This will assist the City staff in directing their funds to the highest priority improvement projects to continue delivering wastewater services to the rate payers.

4.1.3 Future Infrastructure and Pump Stations

There are three areas where future infrastructure is recommended to service future growth. In two of these areas, pump station displacement options are recommended in conjunction with the addition of future infrastructure. These projects are summarized below. During any subsequent phases of any pump station abandonments, a return-on-investment analysis should be completed.

Providence PS Future Infrastructure

These improvements have minor changes since the 2018 WWMP with the updated information on the Crestview Crossing development. North of the Fernwood Pump Station, a regional pump station is recommended to serve future development northeast of the intersection of E Portland Road and Harmony Lane (east portion of Crestview Crossing). The approximate location of this future pump station is located on Figure 3. The approximate location of the pump station was assessed during the 2018 WWMP process considering future development and elevation contours and has not been modified from the 2018 WWMP. The new force main will discharge into the existing line on Providence Drive. During pre-design, exact location and size should consider any Buildable Lands Study and future developments. The preliminary Crestview Crossing development indicates that the two properties NE of Harmony Lane are unable to flow by gravity to the existing line on Providence Drive and will require pumping with the new pump station. The estimated loading to the proposed Providence Pump Station has been reduced sine the 2018 WWMP with the information on Crestview Crossing. The future infrastructure estimated costs are summarized in Table 4-9.

TABLE 4-9: PROVIDENCE PS FUTURE INFRASTRUCTURE COST ESTIMATE

Item	Unit	Unit Price	Quantity	Cost
Gravity Main				$ 507,000
Pump Station (including Force Main)				$ 478,000
Subtotal (rounded)				$ 985,000
Mobilization	%	5	-	$ 49,250
Subtotal (rounded)				$ 1,035,000
Contingency	%	30	-	$ 310,500
Subtotal (rounded)				$ 1,346,000
Engineering (25%) and Soft Costs				$ 387,500
Providence PS Total Cost (rounded):				**$ 1,734,000**

NE Chehalem Drive Future Infrastructure and Pump Station Displacement

The future infrastructure along NE Chehalem Drive summarized here has not changed from the 2018 WWMP. Future infrastructure along NE Chehalem Drive will be necessary to service growth predicted through buildout. It is recommended the gravity pipelines discharge to the Highway 240 wet well. There is an existing stub out for an inlet from the west that can be utilized to connect the future pipeline. Near-future infrastructure, includes a pipeline from approximately E Mountainview Drive, south on NE Chehalem Drive to Highway 240 (W Illinois Street) and east to the pump station (Figure 7). This infrastructure cost estimate is in Table 4-10 as Phase 1. The design of this infrastructure is nearly complete. The most recent engineer's opinion of probable cost is reflected in Table 4-10. See pump station displacement considerations below that impact the vertical alignment of this pipeline. Additional infrastructure for buildout growth includes pipeline extensions to the north and south of the Phase 1 pipeline along NE Chehalem Drive (Figure 7). These improvements are summarized as Phase 2 in Table 4-10.

In addition to serving future growth, this infrastructure could allow for the displacement of Chehalem and Creekside Pump Stations. Additional gravity pipelines with approximate alignments shown in Figure 7 could transport Chehalem and Creekside Pump Station flows to the Highway 240 Pump Station. This infrastructure is recommended to decrease the capital cost and O&M required to continue operation and maintenance of the two pump stations. The vertical

alignment of Phase 1 improvements would need to be lower in general to facilitate the displacement of Chehalem and Creekside Pump Stations. Phase 3 in Table 4-10 summarizes the cost estimate for these changes.

TABLE 4-10: NE CHEHALEM DRIVE FUTURE INFRASTRUCTURE AND PUMP STATION DISPLACEMENT COST ESTIMATE

	Item	Unit	Unit Price	Quantity	Cost
Phase 1					
	NE Chehalem Drive Infrastructure				$ 1,683,000
				Subtotal (rounded)	$ 1,683,000
	Contingency	%	10	-	$ 169,000
				Subtotal (rounded)	$ 1,852,000
	Engineering and CMS	LS	-	1	$ 365,000
				Phase 1 Cost (rounded):	**$ 2,217,000**
Phase 2					
	New pipeline				$ 580,000
	Mobilization	%	5	-	$ 29,000
				Subtotal (rounded)	$ 609,000
	Contingency	%	30	-	$ 182,700
				Subtotal (rounded)	$ 792,000
	Engineering and CMS	%	25	-	$ 198,000
				Phase 2 Cost (rounded):	**$ 990,000**
Phase 3 (Chehalem and Creekside PS displacement)					
	New pipeline				$ 1,931,000
	Pump station demolition/removal				$ 33,000
				Subtotal (rounded)	$ 1,964,000
	Mobilization	%	5	-	$ 98,200
				Subtotal (rounded)	$ 2,063,000
	Contingency	%	30	-	$ 618,900
				Subtotal (rounded)	$ 2,682,000
	Engineering (25%) and Soft Costs				$ 815,600
				Phase 3 Cost (rounded):	**$ 3,498,000**
				Project Total Cost (rounded):	**$ 6,705,000**

Riverfront Future Infrastructure and Pump Station Displacement

Future infrastructure in the Riverfront area will be necessary to service growth planned for the Riverfront Master Plan. Approximate regional pump station, force main, and gravity main locations based on the Riverfront Master Plan are shown in Figure 2. See pump station displacement considerations below that impact the vertical alignment of the pump station. The force main discharge near E Twelfth Street will require upsize of the downstream pipeline. For planning and development purposes, the industrial gravity main (identified as GM D1 in the Riverfront Master Plan) across the old mill property that is anticipated to serve the industrial area in the Riverfront District has been separated from other infrastructure in the Riverfront area. Cost estimates for the recommended infrastructure and improvements are in summarized as Phase 1 and Riverfront Industrial Line in Table 4-11.

In addition to serving future growth, this infrastructure could allow for the displacement of Andrew and Charles Pump Stations. Additional gravity pipelines with approximate alignments shown in Figure 2 could transport Andrew and Charles Pump Station flows to the new, regional Riverfront Pump Station. This infrastructure is reflected in the Riverfront Master Plan and is recommended to decrease the capital cost and O&M required to continue operation of the two existing pump stations. The vertical alignment of Phase 1 improvements should consider the displacement of

Andrew and Charles Pump Stations during design phase. The estimated cost of displacement and new gravity pipelines for Andrew and Charles Pump Stations is summarized in Phase 2 in Table 4-11.

TABLE 4-11: RIVERFRONT INFRASTRUCTURE AND PUMP STATION DISPLACEMENT COST ESTIMATE

	Item	Unit	Unit Price	Quantity	Cost
Phase 1					
	New pipeline				$ 2,047,000
	Pump Station				$ 691,000
	Subtotal (rounded)				$ 2,738,000
	Mobilization	%	5	-	$ 136,900
	Subtotal (rounded)				$ 2,875,000
	Contingency	%	30	-	$ 862,500
	Subtotal (rounded)				$ 3,738,000
	Engineering (25%) and Soft Costs				$ 1,048,900
	Phase 1 Cost (rounded):				**$ 4,787,000**
Riverfront Industrial Line					
	New pipeline				$ 654,000
	Subtotal (rounded)				$ 654,000
	Mobilization	%	5	-	$ 32,700
	Subtotal (rounded)				$ 687,000
	Contingency	%	30	-	$ 206,100
	Subtotal (rounded)				$ 894,000
	Engineering (25%) and Soft Costs				$ 259,400
	Riverfront Industrial Line Cost (rounded):				**$ 1,154,000**
Phase 2 (Charles and Andrew PS displacement)					
	New pipeline				$ 513,000
	Pump station demolition/removal				$ 22,000
	Subtotal (rounded)				$ 535,000
	Mobilization	%	5	-	$ 26,750
	Subtotal (rounded)				$ 562,000
	Contingency	%	30	-	$ 168,600
	Subtotal (rounded)				$ 731,000
	Engineering (25%) and Soft Costs				$ 377,750
	Phase 2 Cost (rounded):				**$ 1,109,000**
	Project Total Cost (rounded):				**$ 5,896,000**

4.2 RECOMMENDED PUMP STATION IMPROVEMENTS

Additional pump station condition assessments were not included in the scope of this technical update. The main modification in the technical update was to remove the Dayton Pump Station Replacement project from the short-term improvements in the CIP as it has been completed since the 2018 WWMP. Upsizing the Fernwood Pump Station was included in the Springbrook Basin recommendations. Otherwise, pump station recommendations have not changed from the 2018 WWMP. Pump stations that are recommended to be displaced, do not have long-term condition improvements associated with them. Costs presented in the following tables are planning level estimates and are in 2021 dollars (updated from the 2018 WWMP using the ENR index). Actual costs may vary and should be refined further in the pre-design process. Engineering costs assume that multiple pump station projects will be grouped together for project administration efficiencies.

4.2.1 Priority 1 – Address Existing Deficiencies

Priority 1 pump station improvements address existing, short-term condition deficiencies that should be addressed in the next six years. Improvement costs are summarized by pump station in Table 4-12. Cost estimate details can be found in Appendix C. There are no recommended short-term improvements for the Andrew Pump Station.

TABLE 4-12: PUMP STATION SHORT-TERM IMPROVEMENTS COST ESTIMATE

Site	Recommended Improvements Cost
Charles Pump Station	$ 3,700
Chehalem Pump Station	$ 900
Creekside Pump Station	$ 16,600
Fernwood Pump Station	$ 15,900
HWY 240 Pump Station	$ 12,600
Sheridan Pump Station	$ 15,500
Pump Station Improvements Subtotal	*$ 66,000*
Contingency (30%)	*$ 19,800*
Engineering (35%)	*$ 30,100*
Administration (2%)	*$ 1,800*
Total Improvements Cost (rounded)	***$ 118,000***

4.2.2 Priority 2 – Address Future Deficiencies

The following table summarizes recommended, long-term Priority 2 improvements by pump station (Table 4-13). These recommended improvements assume that Andrew, Charles, Chehalem, and Creekside pump stations are displaced through other CIP projects (discussed above) and therefore no long-term improvements are necessary. The Dayton Pump Station has recently been replaced as noted previously, so it is assumed that the new pump station will not need long-term improvements. Cost estimate details can be found in Appendix C.

TABLE 4-13: PUMP STATION LONG-TERM IMPROVEMENTS COST ESTIMATE

Site	Recommended Improvements Cost
Fernwood Pump Station	$ 72,600
HWY 240 Pump Station	$ 46,900
Sheridan Pump Station	$ 138,100
Pump Station Improvements Subtotal	*$ 257,600*
Contingency (30%)	*$ 77,300*
Engineering (35%)	*$ 117,300*
Administration (2%)	*$ 6,700*
Total Improvements Cost (rounded)	***$ 459,000***

4.2.3 Future Infrastructure and Pump Station Displacement

Two new pump stations to service future growth are recommended within the planning period. They were discussed in conjunction with future pipelines above in Section 4.1.3. Recommended pump station displacement options were also discussed in Section 4.1.3.

CHAPTER 5 – CAPITAL IMPROVEMENT PLAN (CIP)

This section consists of the recommended capital improvement plan (CIP) to address the wastewater collection system deficiencies identified in previous chapters. A location map showing the improvements to the collection system is shown in Figure 7 (Appendix A).

5.1 BASIS FOR ESTIMATE OF PROBABLE COST

Capital costs developed for the recommended improvements are Class 5 estimates as defined by the Association for the Advancement of Cost Engineering (AACE) in alignment with the 2018 WWMP. Actual construction costs may differ from the estimates presented, depending on specific design requirements and the economic climate at the time a project is bid. An AACE Class 5 estimate is normally expected to be within -50 and +100 percent of the actual construction cost. As a result, the final project costs will vary from the estimated presented in this document. The range of accuracy for a Class 5 cost estimate is broad, but these are typical levels of accuracy for planning work and they apply to all alternatives so that the relative estimated costs of the alternatives are comparable and can be used for decision-making. It is important to communicate this level of accuracy to policy- and decision-makers. Costs shown are planning-level estimates and can vary depending on market conditions; they shall be updated as the project is further refined in the project development, pre-design, and design phases. Contractor's overhead and profit are worked into the base construction cost and the other indirect costs are identified and included, where required, as a specific line item. The CIP is based on modeling data that was available during the completion of this facilities plan. When projects are carried forward, the model, data, assumptions, etc., should be re-evaluated to make any necessary adjustments to the basis of the project. Individual project sheets for Priority 1 projects are included in Appendix D ([to be completed]). Each project sheet consists of a project objective, description, location map, and cost estimate.

5.2 SUMMARY OF PROBABLE COSTS

The summary of the Newberg collection system improvement costs is in Table 5-1 (Capital Improvement Plan (CIP)). These costs include all improvements described in Chapter 4, which include those modified with the technical update as well as those unmodified from the 2018 WWMP. As summarized previously, the primary projects with changes to their scope since the 2018 WWMP include Springbrook Road (1.c), short-term pump station improvements (1.e), E Crestview Drive (1.g, Crestview Crossing (1.h), S River and E Eleventh Streets (2.b), and Riverfront infrastructure (3.b and 3.c). The percent system development charge (SDC) eligibility for each project factored in the existing design flow, existing capacity, and capacity after the improvements are completed. The amount of capacity that can be utilized for future connections is divided by the future capacity. For projects that did not have an increase in flows, the percent SDC eligible is derived from the percent growth in population over the 20-year planning period (aligns with 2018 WWMP population projections).

TABLE 5-1: 20-YEAR CAPITAL IMPROVEMENT PLAN (CIP)

ID#	Item	Primary Purpose	Total Estimated Cost (2021)	SDC Growth Apportionment		City's Estimated Portion
				%	Cost	
Priority 1 Improvements						
1.a	Hess Creek Phase 1 - CIPP	Capacity & I/I reduction	$ 1,351,000	2%	$ 27,020	$ 1,323,980
1.b	Hess Creek Phase 2 - Parallel Gravity Main	Capacity	$ 7,460,000	2%	$ 149,200	$ 7,310,800
1.c	Springbrook Road	Capacity	$ 5,314,000	20%	$ 1,062,800	$ 4,251,200
1.d	E Pinehurst Court	Capacity	$ 318,000	0%	$ -	$ 318,000
1.e	Pump Station Improvements (Short-term)	Condition	$ 118,000	1%	$ 1,180	$ 116,820
1.f	I/I Projects	Capacity & Condition	$ 2,700,000	50%	$ 1,350,000	$ 1,350,000
1.g	E Crestview Drive Infrastructure	Future Development	$ 928,000	100%	$ 928,000	$ -
1.h	Crestview Crossing Infrastructure	Future Development	$ 1,414,000	100%	$ 1,414,000	$ -
1.i	Maintenance Yard Improvements	Capacity & Condition	$ 804,000	20%	$ 160,800	$ 643,200
		Priority 1 Total (rounded):	**$ 20,407,000**		**$ 5,093,000**	**$ 15,314,000**
Priority 2 Improvements						
2.a	Hess Creek Phase 3 - Pump Station	Capacity	$ 2,539,000	2%	$ 50,780	$ 2,488,220
2.b	S River and E Eleventh Streets	Capacity	$ 5,103,000	17%	$ 867,510	$ 4,235,490
2.c	HWY 240 Pump Station Upsize	Capacity	$ 642,000	19%	$ 121,980	$ 520,020
2.d	N Main and S Wynooski Streets	Capacity	$ 616,000	1%	$ 6,160	$ 609,840
2.e	Pump Station Improvements (Long-term)	Condition	$ 459,000	11%	$ 50,490	$ 408,510
2.f	I/I Projects	Capacity & Condition	$ 3,150,000	50%	$ 1,575,000	$ 1,575,000
2.g	Wastewater Master Plan	Planning	$ 300,000	100%	$ 300,000	$ -
		Priority 2 Total (rounded):	**$ 12,809,000**		**$ 2,972,000**	**$ 9,838,000**
Priority 3 Improvements						
3.a	NE Chehalem Drive Phase 1	Future Development	$ 2,217,000	100%	$ 2,217,000	$ -
3.b	Riverfront Infrastructure	Future Development	$ 4,787,000	100%	$ 4,787,000	$ -
3.c	Riverfront Industrial Infrastructure	Future Development	$ 1,154,000	100%	$ 1,154,000	$ -
3.d	Providence PS Infrastructure	Future Development	$ 1,734,000	100%	$ 1,734,000	$ -
3.e	NE Chehalem Drive Phase 2	Future Development	$ 990,000	100%	$ 990,000	$ -
3.f	I/I Projects	Capacity & Condition	$ 3,150,000	50%	$ 1,575,000	$ 1,575,000
		Priority 3 Total (rounded):	**$ 14,032,000**		**$ 12,457,000**	**$ 1,575,000**
Priority 4 Improvements						
4.a	Chehalem & Creekside PS Displacement/Future Trunk Line	Operations	$ 3,498,000	44%	$ 1,539,120	$ 1,958,880
4.b	Charles & Andrew PS Displacement	Operations	$ 1,109,000	44%	$ 487,960	$ 621,040
		Priority 4 Total (rounded):	**$ 4,607,000**		**$ 2,028,000**	**$ 2,580,000**
		Total Wastewater Collection System Improvement Costs (rounded):	**$ 51,855,000**		**$ 22,550,000**	**$ 29,307,000**

Notes:

1. The opinion of probable cost herein is concept level information only based on our perception of current conditions at the project location and its accuracy is subject to significant variation depending upon project definition and other factors. This estimate reflects our opinion of probable costs at this time and is subject to change as the project design matures. This cost opinion is in 2021 dollars and does not include escalation to time of actual construction. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the cost presented herein.
2. All costs in 2021 Dollars. Costs include mobilization (5%), contractor overhead and profit (OHP; 15%), contingency (30%), engineering and construction management services (CMS; 20-35%), and legal, administrative, and permitting services (2%).
3. The Capital Improvement Plan does not include annual pipeline replacement, pipeline cleaning and inspection, and lift station maintenance budgets. These budgets are discussed in Section 5.4.

5.3 PROJECT SCHEDULE

An estimated schedule for Priority 1 improvements is shown in Table 5-2. Individual schedules for each project will be further refined at a later date by the City during the pre-design phase for each proposed improvement. Costs presented here are planning-level estimates. Actual costs may vary depending on market conditions and must be updated as projects are further refined in the project development, pre-design, and design phases.

TABLE 5-2: PRIORITY 1 CAPITAL IMPROVEMENT PLAN

ID#	Item	Total Estimated Cost (2021)	Opinion of Probable Costs (2021)					
			2022	2023	2024	2025	2026	2027
Priority 1 Improvements								
1.a	Hess Creek Phase 1 - CIPP	$ 1,351,000	$ 337,750	$ 1,013,250	$ -	$ -	$ -	$ -
1.b	Hess Creek Phase 2 - Parallel Gravity Main	$ 7,460,000	$1,865,000	$ 2,797,500	$2,797,500	$ -	$ -	$ -
1.c	Springbrook Road	$ 5,314,000	$ -	$ -	$ -	$1,328,500	$1,992,750	$1,992,750
1.d	E Pinehurst Court	$ 318,000	$ 318,000	$ -	$ -	$ -	$ 318,000	$ -
1.e	Pump Station Improvements (Short-term)	$ 118,000	$ -	$ -	$ -	$ 118,000	$ -	$ -
1.f	I/I Projects	$ 2,700,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000
1.g	E Crestview Drive Infrastructure	$ 928,000	$ 232,000	$ 348,000	$ 348,000	$ -	$ -	$ -
1.h	Crestview Crossing Infrastructure	$ 1,414,000	$ 353,500	$ -	$ -	$ 353,500	$ 353,500	$ 353,500
1.i	Maintenance Shops Improvements	$ 804,000	$ -	$ -	$ 201,000	$ 201,000	$ 201,000	$ 201,000
	Priority 1 Total (rounded):	**$ 20,407,000**	**$3,557,000**	**$ 4,609,000**	**$3,797,000**	**$2,451,000**	**$3,316,000**	**$2,998,000**

Note: The opinion of probable cost herein is concept level information only based on our perception of current conditions at the project location and its accuracy is subject to significant variation depending upon project definition and other factors. This estimate reflects our opinion of probable costs at this time and is subject to change as the project design matures. This cost opinion is in 2021 dollars and does not include escalation to time of actual construction. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the cost presented herein.

5.4 OTHER ANNUAL COSTS

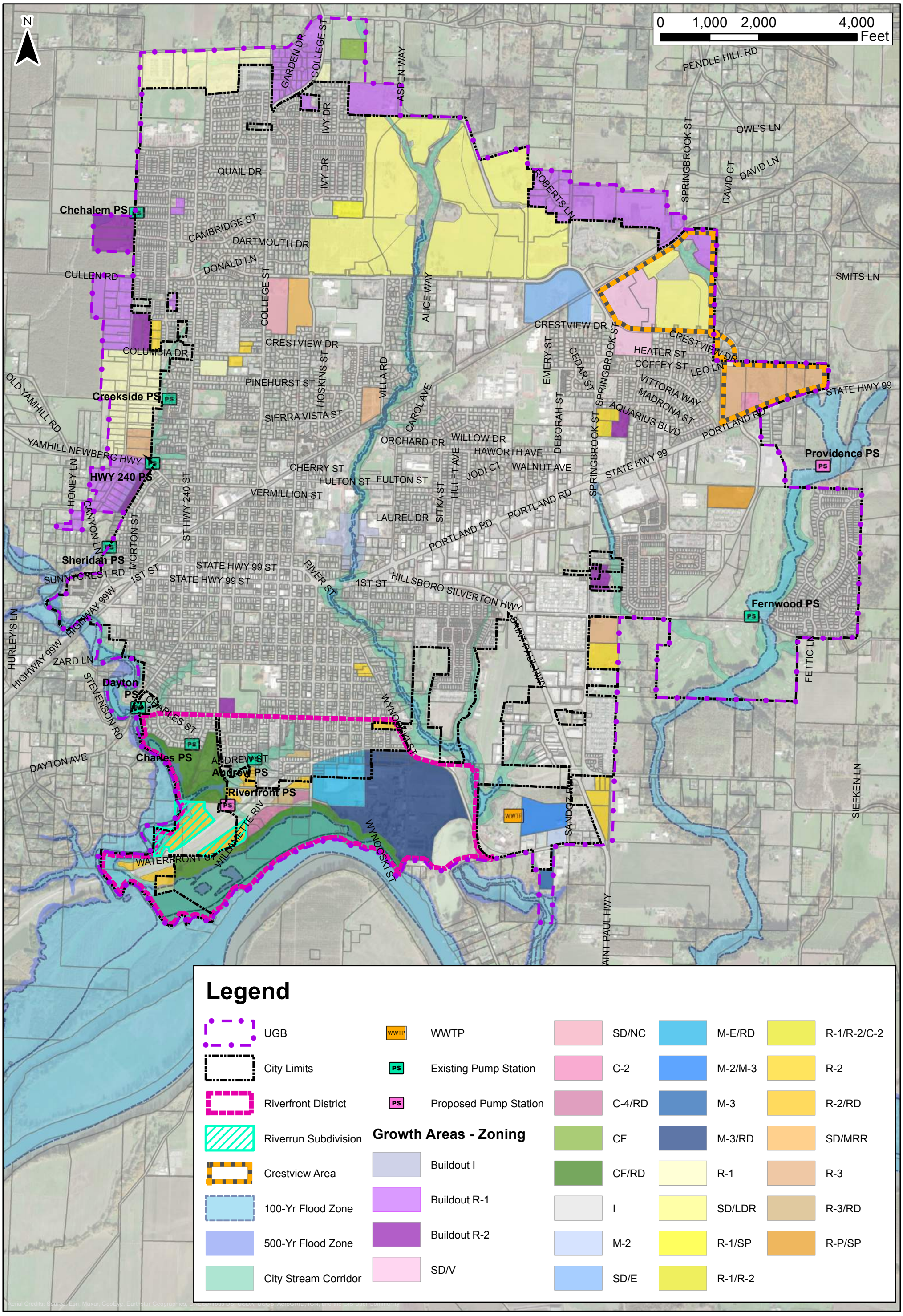
Additional evaluation of other annual costs was not included in the scope of the technical update. The section below summarizes recommendations from the 2018 WWMP. In addition to the capital improvement costs presented in Table 5-1, the following expected annual operating costs are recommended for consideration in setting annual budgets for the collection system:

- Additional collection system replacement/rehabilitation needs: Based on linear feet of pipeline, and number of manholes and cleanouts, the City should budget a total of $1,285,000/year for pipeline replacement/rehabilitation (to be either contracted out or completed using City crews). The City already budgets $450,000 for I/I related pipeline replacement/rehabilitation projects. This amount, combined with the other priority capital improvement projects, the City will be targeting enough manholes, pipelines, etc. to cover the recommended average annual amount.
- Pump station annual costs will go down as the City prepares to abandon four small pump stations and build one large and one medium pump station.
- Collection system cleaning and CCTV needs: City maintenance staff currently follow a five-year timeline to clean and CCTV inspect the entire system. No change is recommended to the current practice of cleaning and CCTV inspection.
- Annual O&M costs for the collection system may increase due to the increase in linear feet of pipeline. However, lowering the need to enter into the Hess creek area to service the Hess creek trunk line may amount to a net zero impact to O&M costs due to Priority 1 improvements.

Report Appendices

Appendix A

Figures

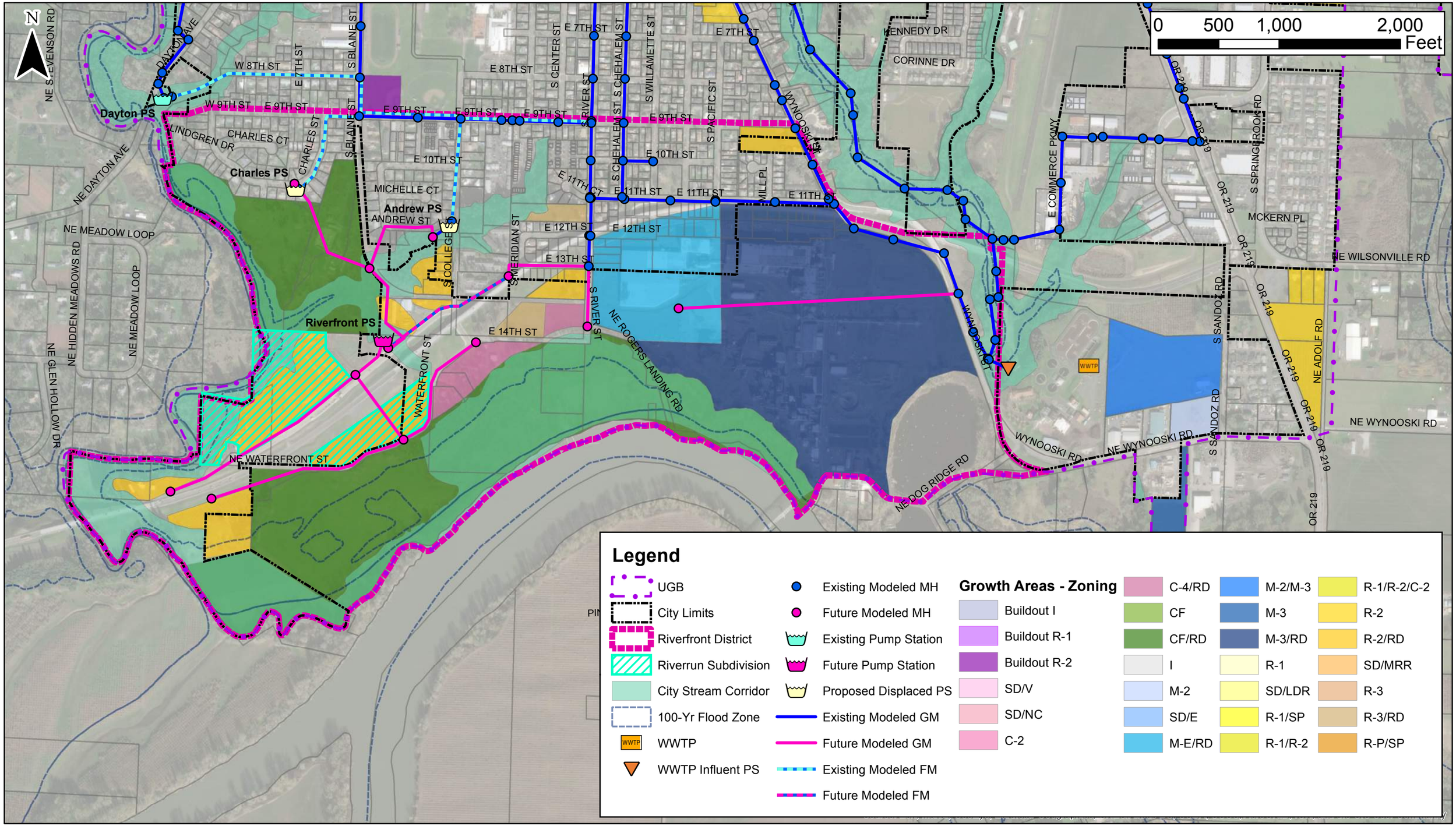


Study Area and Growth Areas

Wastewater Master Plan Update

Figure 1

City of Newberg, OR



Legend

- UGB
- City Limits
- Riverfront District
- Riverrun Subdivision
- City Stream Corridor
- 100-Yr Flood Zone
- WWTP
- WWTP Influent PS
- Existing Modeled MH
- Future Modeled MH
- Existing Pump Station
- Future Pump Station
- Proposed Displaced PS
- Existing Modeled GM
- Future Modeled GM
- Existing Modeled FM
- Future Modeled FM

Growth Areas - Zoning

- Buildout I
- Buildout R-1
- Buildout R-2
- SD/V
- SD/NC
- C-2
- C-4/RD
- CF
- CF/RD
- I
- M-2
- SD/E
- M-E/RD
- M-2/M-3
- M-3
- M-3/RD
- R-1
- SD/LDR
- R-1/SP
- R-1/R-2
- R-1/R-2/C-2
- R-2
- R-2/RD
- SD/MRR
- R-3
- R-3/RD
- R-P/SP

KELLER ASSOCIATES

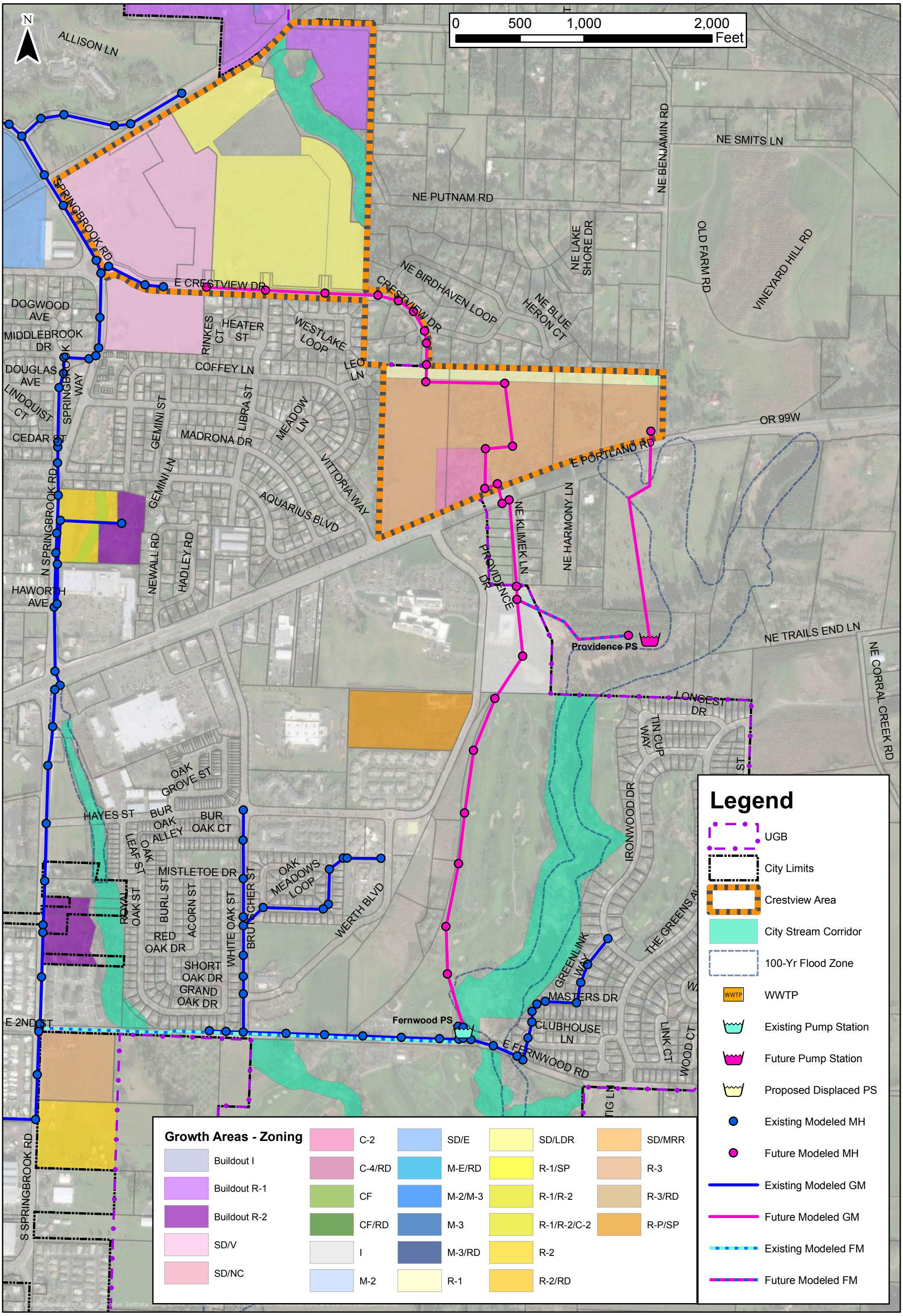
Riverfront and Riverrun Areas

Wastewater Master Plan Update

City of Newberg OREGON

Figure 2

City of Newberg, OR



KELLER ASSOCIATES

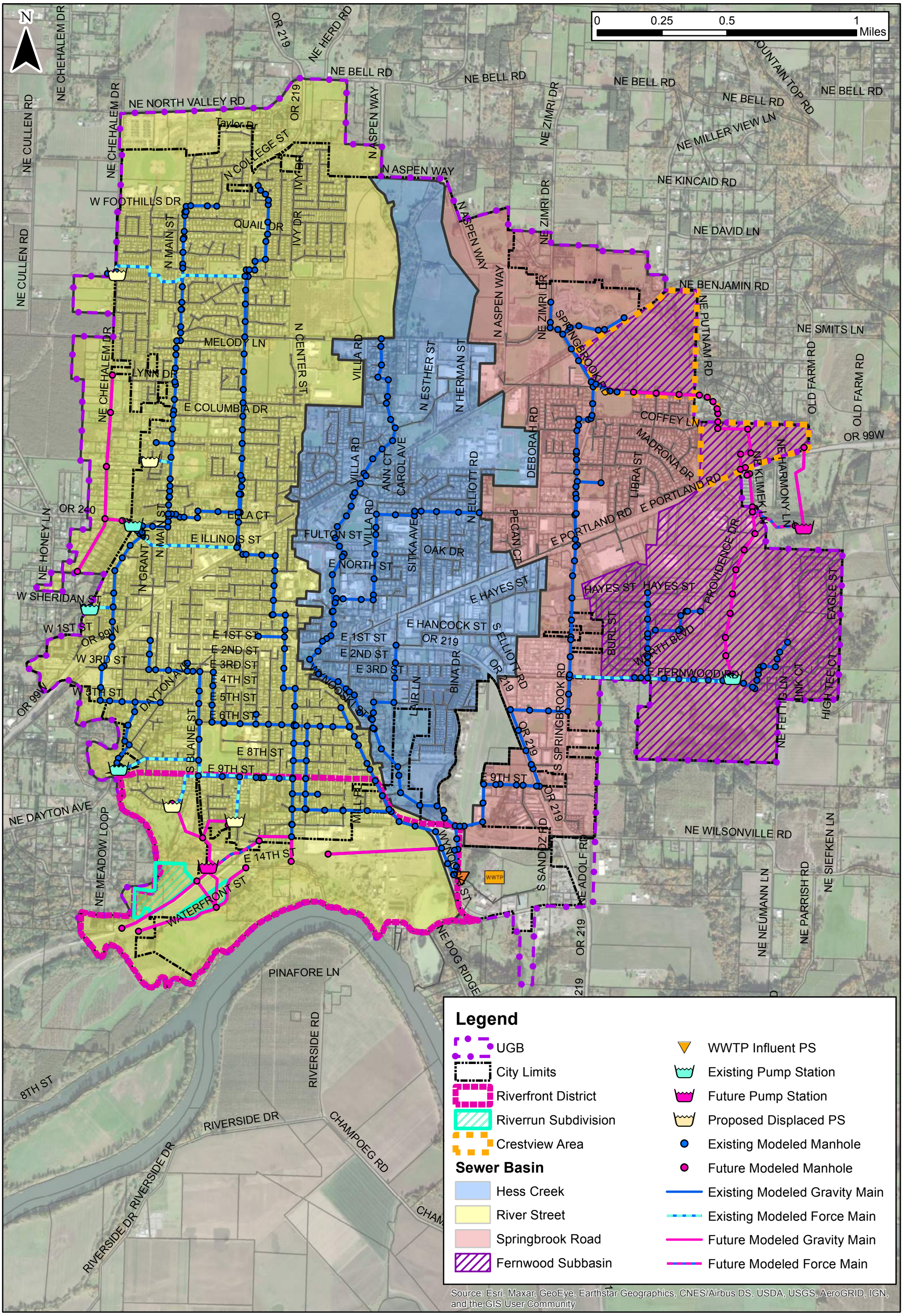
Crestview Area

Wastewater Master Plan Update

City of Newberg OREGON

Figure 3

City of Newberg, OR



KELLER ASSOCIATES

Modeled Facilities and Basins

Wastewater Master Plan Update

City of Newberg OREGON

Figure 4

City of Newberg, OR

N

0 0.25 0.5 1 Miles

NE BELL RD
NE NORTH VALLEY RD
Taylor Dr
OR 219
NE CHEHALEM DR
N COLLEGE ST
IVY DR
KNOLL DR
N ASPEN WAY
NE ZIMRI DR
NE MILLER VIEW LN
NE KINCAID RD
NE DAVID LN
W FOOTHILLS DR
QUAIL DR
N MAIN ST
HOLIDAY LN
PARK CT
ALLISON LN
NE BENJAMIN RD
MELODY LN
LYNN DR
N CENTER ST
VILLA RD
N ESTHER ST
N HERMAN ST
SPRINGBROOK RD
NE PUTNAM RD
NE LAKE SHORE DR
OLD FARM RD
WAREHAM LN
COFFEY LN
CRESTVIEW DR
E COLUMBIA DR
NE BLUME LN
PARK LN
CEDAR ST
MADRONA DR
EMMA LN
LAUREL CT
E LA CT
OR 240
NE HONEY LN
E ILLINOIS ST
FULTON ST
ANN CT
CAROL AVE
ELM LN
N ELLIOTT RD
LIBRA ST
E PORTLAND RD
NE KLIMEK LN
NE HARMONY LN
MORTON ST
N GRANT ST
E NORTH ST
SITKA AVE
OAK DR
PECAN CT
DEBORAH RD
E SHERMAN ST
E HAYES ST
HAYES ST
PROVIDENCE DR
W 1ST ST
OR 99W
E 1ST ST
E HANCOCK ST
S ELLIOTT RD
BURL ST
NORTH BLVD
E FERNWOOD RD
W 3RD ST
E 2ND ST
E 3RD ST
E 4TH ST
E 5TH ST
E 6TH ST
W 5TH ST
S LINCOLN ST
DAYTON AVE
S BLAINE ST
S RIVER ST
WYNOOSKI ST
LAIR LN
DONNA DR
BINA DR
S SPRINGBROOK RD
LINK CT
NE FETTIG LN
E 8TH ST
E 9TH ST
E 10TH ST
E 12TH ST
E 13TH ST
E 14TH ST
NE DAYTON AVE
CHARLESTON
MILL PL
OR 219
NE WILSONVILLE RD
NE MEADOW LOOP
S COLLEGE ST
WWTP
S SANDOZ RD
NE ADOLF RD
WATERFRONT ST
NE NEUMANN LN
NE PARRISH RD
PINAFORE LN
RIVERSIDE RD
8TH ST
RIVERSIDE DR
CHAMPOEG RD
NE DOG R

Legend

Eval. Thresholds

- Potential Overflow Site
- 2.0' From Rim Elevation
- Surcharged 1.0' Above Top of Pipe
- Surcharged Above Top of Pipe
- UGB
- City Limits
- Crestview Area
- Riverfront District
- Riverrun Subdivision
- WWTP Influent PS
- Future Pump Station
- Existing Pump Station
- Proposed Displaced PS
- Modeled MH
- Modeled Pipe

and the GIS User Community

KELLER ASSOCIATES

Updated System Evaluation

Wastewater Master Plan Update

City of Newberg OREGON

Figure 5

City of Newberg, OR

Areas of Interest/Evaluation

- A - Pinehurst Ct, topographic low point
- B - N. Main St, downstream bottleneck
- C - Excess flows from HWY240
- D - HWY240 LS, undersized pumps
- E - S. River St, undersized
- F - Riverfront District, prop. infrastructure and backwater
- G - Wynooski St, undersized
- H - Villa Rd, downstream bottleneck
- I - Hess Creek, undersized and limited or no access to line
- J - S. Springbrook Rd, undersized and topographic low point
- K - Fernwood/Springbrook Rd, undersized
- L - Fernwood PS, undersized pumps

Legend

Eval. Thresholds

- Potential Overflow Site
- 2.0' From Rim Elevation
- UGB
- City Limits
- Crestview Area
- Riverfront District
- Riverrun Subdivision
- WWTP Influent PS
- Future Pump Station
- Existing Pump Station
- Proposed Displaced PS

0 0.25 0.5 1 Miles

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Updated System Evaluation - Annotated

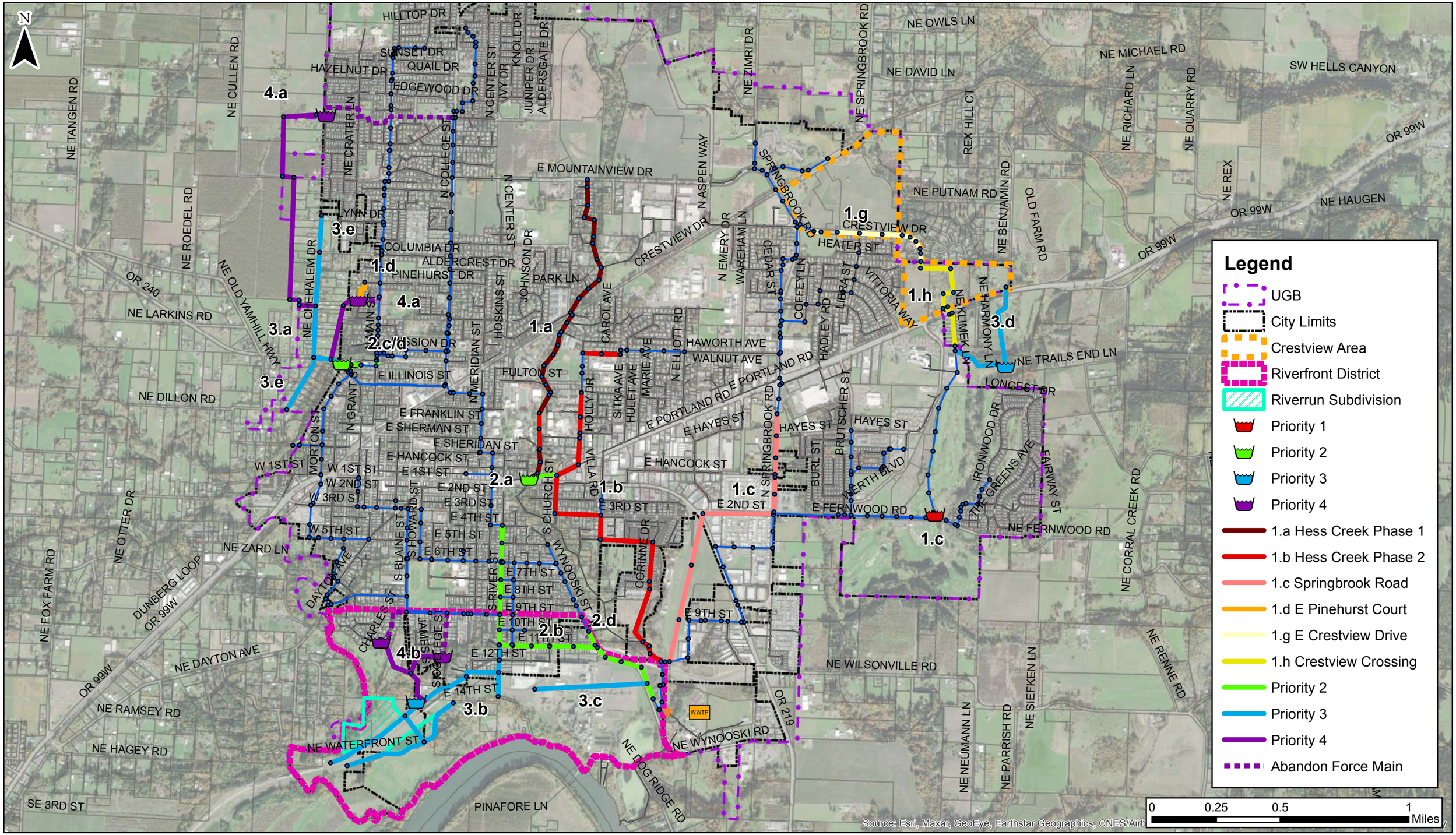
Wastewater Master Plan Update

KELLER ASSOCIATES

City of Newberg OREGON

Figure 6

City of Newberg, OR



KELLER ASSOCIATES

Updated CIP

Wastewater Master Plan Update

City of Newberg OREGON

Figure 7

City of Newberg, OR

Appendix B

Riverfront MP Excerpts

REGULATORY ACTIONS

Regulatory actions are an essential first step toward realizing the vision of the Riverfront Master Plan. Changing City regulations is also squarely within the City's authority, whereas other actions described later require the City to work with other public agencies or private entities to effect change.

Amend the Comprehensive Plan to Reflect the Intent of the Riverfront Master Plan

The City of Newberg's Comprehensive Plan is a set of policies and map of land use designations that guide growth and development within the Newberg Urban Growth Boundary (UGB). It includes several existing policies related to the Riverfront District, put into place by the 2002 Riverfront Master Plan, many of which need to be revised because they are out of date or inconsistent with the current vision for the area.

Updates include:

- Removing references to the "Smurfit Newsprint Processing Plant"
- Revising policies to more closely match the vision and goals of this plan
- Updating references to the Newberg-Dundee Bypass
- Amending the boundary of the Riverfront District classification to include the Riverfront Industrial Site and lands north of the Bypass.

Detailed changes to the Comprehensive Plan are provided in the Appendix F (TM6 - Comprehensive Plan Amendments).

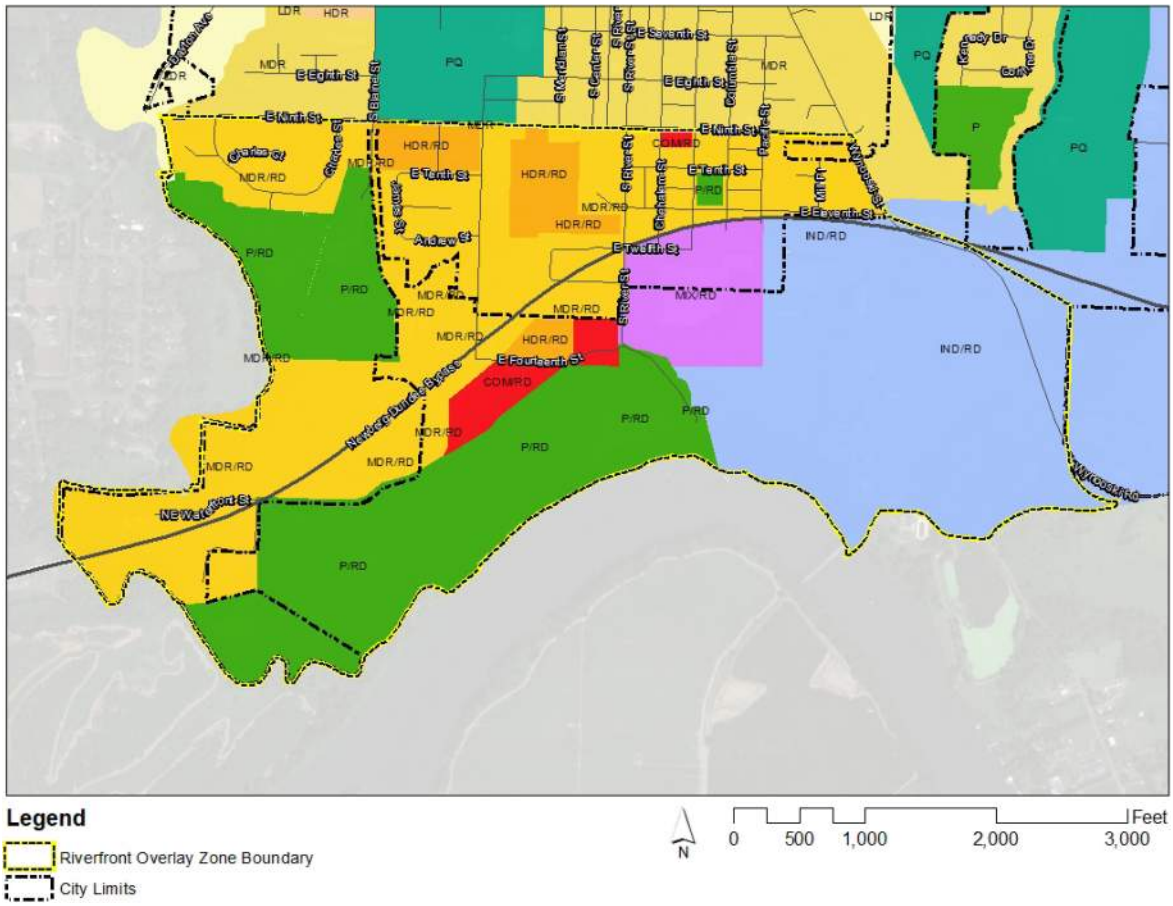


FIGURE 38. PROPOSED COMPREHENSIVE PLAN DESIGNATIONS

APPENDIX D

RIVERFRONT MASTER PLAN
City of Newberg

Technical Memorandum 4:

Infrastructure Needs

wallis engineering

MEMORANDUM

DATE:	April 12, 2019
TO:	Andrew Parish, AICP Angelo Planning
FROM:	Jane Vail, P.E. Wallis Engineering
RE:	Infrastructure Needs for Newberg Riverfront Master Plan Update Job No. 1441A
EXHIBITS:	*Exhibit A – Existing Water System Map* *Exhibit B – Existing Wastewater System Map* *Exhibit C – Existing Storm Drainage Map* *Exhibit D – Recommended Water System Improvements* *Exhibit E – Wastewater System Sub-Basins* *Exhibit F – Recommended Wastewater System Improvements*

BACKGROUND

The City of Newberg's Riverfront Master Plan Update has included the creation and evaluation of several land use/transportation alternatives for the Riverfront Area. Through discussion with the project's advisory committees, stakeholders, and property owners in the Riverfront Area, the process has resulted in the selection of a preferred alternative, "Alternative E." This land use/transportation program includes a variety of uses in the study area, including single-family and multi-family residential developments, mixed-use nodes of activity, parks and passive open space, and employment uses.

This memorandum describes the existing utility infrastructure and previously-planned improvements to this infrastructure within the planning area. It also provides recommendations for improvements to the water, wastewater, and stormwater infrastructure as the area develops.

The current planning effort will update the 2002 Newberg Riverfront Master Plan. That previous plan made specific recommendations as to infrastructure improvements based on anticipated phasing and land use.

At the time of the 2002 Riverfront Master Plan, the riverfront industrial site (WestRock) was not included in the riverfront planning area, and the Newberg-Dundee Bypass was in the conceptual design phase - and at a different alignment than constructed. In other words, the 2002 Master Plan's recommended street and utility improvements were based on different conditions than the current existing conditions. However, from the perspective of total water demand and wastewater flow, there are few differences between the land uses shown in the 2002 Master Plan and Yamhill County zoning efforts and the preferred land use alternatives identified in the current planning effort. The overall water demand and projected wastewater flow values from past land use planning efforts are reflected in the City's 2017 Water Master Plan and 2018 Wastewater Master Plan. The recommendations made in these two utility master plans are still relevant to the current planning effort.

In the course of preparing this memorandum, the following planning documents were reviewed:

- 2002 Newberg Riverfront Master Plan
- 2002 City of Newberg Water Treatment Facilities Plan
- 2007 City of Newberg Wastewater Treatment Plant Facilities Plan Update
- 2007 City of Newberg Sewerage Master Plan Update
- 2014 City of Newberg Stormwater Master Plan Update
- 2015 Newberg Wastewater I&I Study
- 2016 City of Newberg Comprehensive Plan Text (Ordinance 1967)
- 2017 City of Newberg Water Master Plan
- 2018 City of Newberg Wastewater Master Plan
- 1996 Yamhill County Comprehensive Land Use Plan

EXISTING AND PLANNED UTILITY INFRASTRUCTURE

Existing utilities within the project area include wastewater, stormwater, potable water, and private utilities (electricity, natural gas, and telecommunications). Much of the project area is relatively underdeveloped, so utilities are limited in extent and size.

Water System

The existing water system is owned and operated by the City of Newberg. The study area is located within Zone 1, which is served by three reservoirs: the North Valley Reservoir Nos. 1 and 2 located on the north side of the City, and the Corral Creek Reservoir, located east of the City. These reservoirs are fed by transmission mains from the water treatment plant, which is located on the southeast corner of the study area. A well field south of the study area supplies a portion of the City's water, which is conveyed to their water treatment plant. A water transmission main conveys treated drinking water from the treatment plant north through the riverfront industrial site to the rest of the City.

The area north of the Bypass is served by an existing water distribution network, with distribution mains 2 to 8 inches in diameter. Several properties just south of the Bypass, including the riverfront industrial site, are also served by water main extensions from the distribution system north of the Bypass.

Non-potable water system elements were not reviewed as part of this memorandum effort. The City of Newberg has a re-use water system, which is currently confined to the City's Wastewater Treatment Plant. The riverfront industrial site property has water rights to water from the Willamette River, and this privately-owned non-potable water was used in the past

for mill operations. Additional details about this non-potable water system were not available.

A map of the existing potable water system within the project limits is included as *Exhibit A* on the following page.

No planned improvements to the water system within the planning area are described in the City's 2017 Water Master Plan. The 2002 Newberg Riverfront Master Plan proposed water distribution mains along the roads proposed and recommended for improvement by that planning effort.

Wastewater System

Existing wastewater infrastructure within the project limits is largely limited to the area north of the Bypass. The City of Newberg's wastewater treatment plant is located just east of the project study area.

The portion of the study area north of the Bypass is currently served by two lift stations (the Charles Lift Station and the Andrew Lift Station) and a network of gravity sewer mains and trunk lines, which ultimately convey wastewater west to the City's wastewater treatment plant. A small lift station also serves Rogers Landing, conveying wastewater to the gravity sewer system to the north. The riverfront industrial site is served by a single gravity sewer connection at the northwest corner of the site.

A map of the existing wastewater system within the project limits is included as *Exhibit B*.

The City's 2018 Wastewater Master Plan recommends improvements to the existing wastewater system within the planning area. The Wastewater Master Plan proposed abandoning the Charles Lift Station and Andrew Lift Station in the northeast portion of the study area, and replacing them with a single lift station (the Riverfront Lift Station) and a series of gravity mains (projects C4.b and C3.b in the Wastewater Master Plan). The Riverfront Lift Station would also serve a portion of the southeast portion of the study area with several gravity sewer extensions to the south and the east. The Wastewater Master Plan also recommended upsizing several gravity mains within the study area to convey future flows. No wastewater improvements are described for the eastern portion of the study area. The 2002 Riverfront Master Plan proposed some gravity mains along the roads proposed and recommended for improvement by that planning effort.

Stormwater System

The study area is drained by a system of natural drainages, open channels, and storm drain lines. Currently, the study area drains in three directions: west to Chehalem Creek, south to the Willamette River, and east to Hess Creek.

The southern portion of the site lies within the 100-year flood plain of the Willamette River, and Chehalem Creek.

Underground stormwater lines are few in number, and largely confined to the northern portion of the study area. A stormwater main bisects the study area, conveying stormwater from the drainage lines in the northern portion of the study area south to outfall at the Willamette River. This line was previously the wastewater outfall from the former wastewater treatment plant.

A map of the existing drainage and stormwater system within the project limits is included as *Exhibit C*.

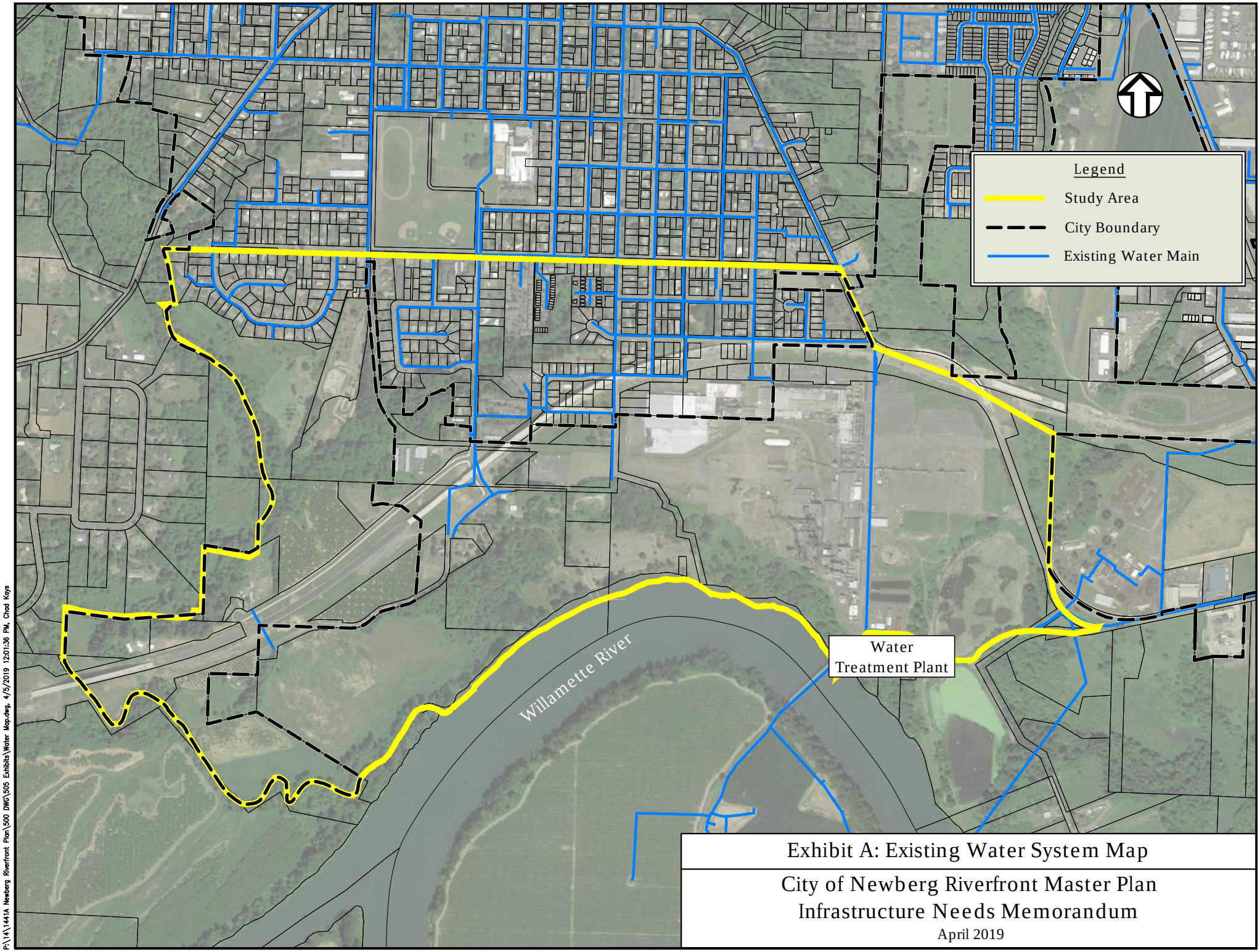
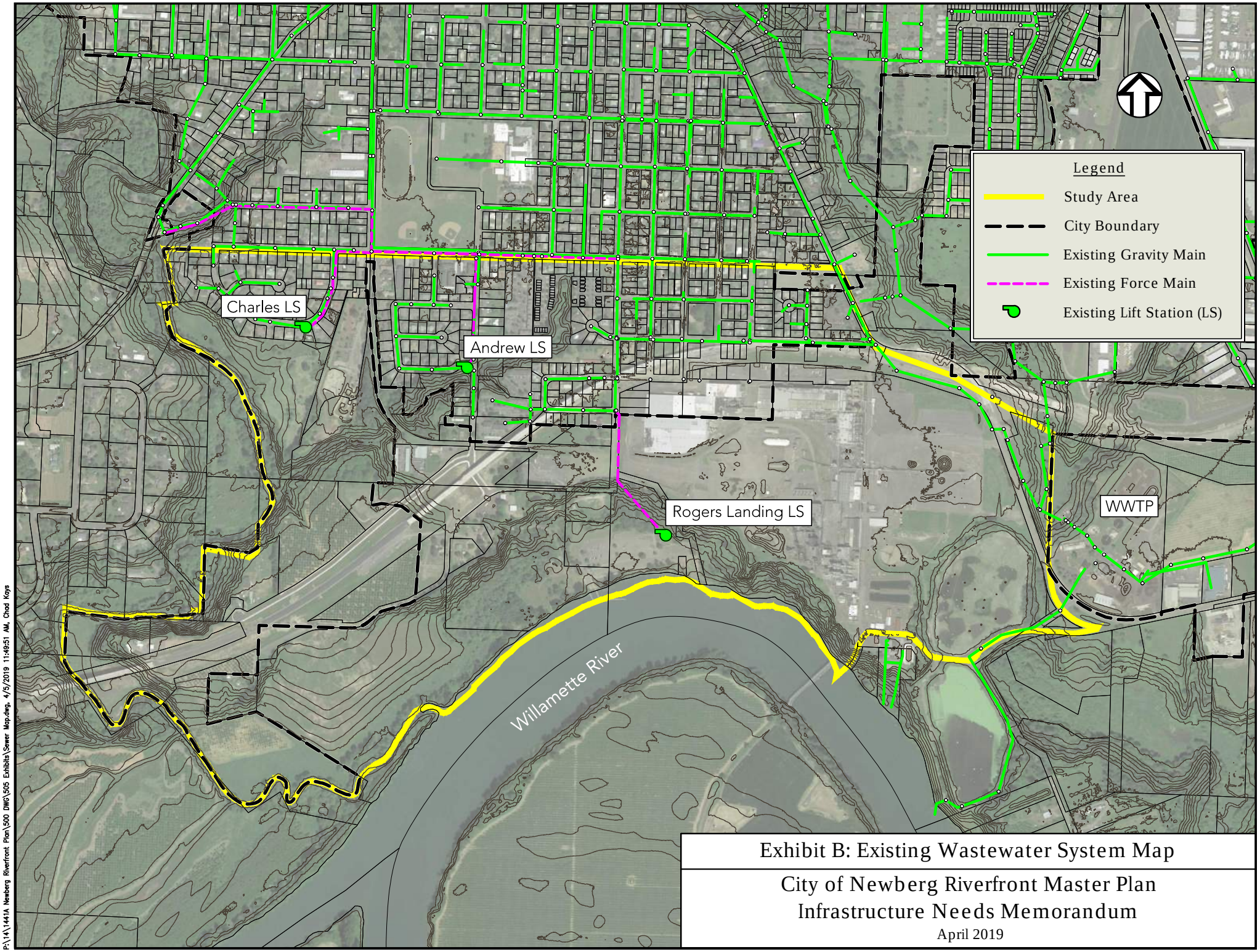


Exhibit A: Existing Water System Map

City of Newberg Riverfront Master Plan
Infrastructure Needs Memorandum
April 2019

P:\14\1441A Newberg Riverfront Plan\500 DWG\505 Exhibits\Water Map.dwg, 4/5/2019 12:01:36 PM, Chad Kaya



P:\14\1441A Newberg Riverfront Plan\500 DWG\505 Exhibits\Sewer Map.dwg, 4/5/2019 11:49:51 AM, Chad Kaya

Exhibit B: Existing Wastewater System Map

City of Newberg Riverfront Master Plan
Infrastructure Needs Memorandum
April 2019

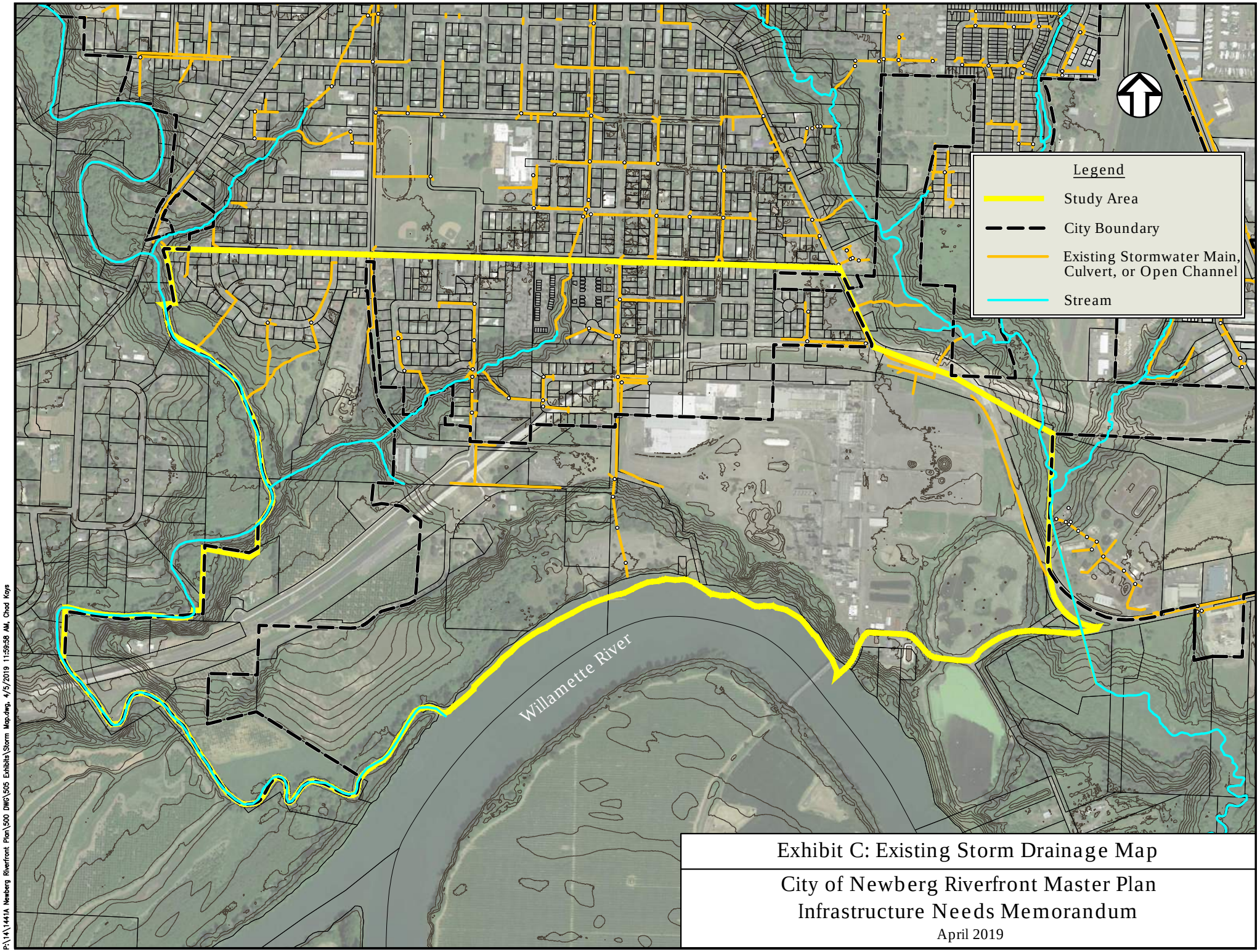


Exhibit C: Existing Storm Drainage Map

City of Newberg Riverfront Master Plan
Infrastructure Needs Memorandum
April 2019

P:\14\1441A Newberg Riverfront Plan\500 DWG\505 Exhibits\Storm Map.dwg, 4/5/2019 11:59:58 AM, Chad Koys

No improvements to the stormwater system within the planning area are currently included in the 2014 City of Newberg Stormwater Master Plan Update. The 2002 Riverfront Master Plan proposed stormwater lines along some of the roads proposed and recommended for improvement by that planning effort. It also proposed disposal of stormwater runoff into to the existing stormwater main outfalling to the Willamette River. The capacity of that existing stormwater main to accept additional flow was not discussed in the 2002 Plan.

Franchise Utilities

As part of this planning effort, the City of Newberg contacted privately-owned franchise utilities in order to generally ascertain the extent of their facilities within the planning area. These franchise utility companies currently provide electricity, gas, cable, and telephone services to customers within the planning area.

PGE provides electricity to Newberg, and has a substation on the riverfront industrial site. In contacting PGE, they were unaware of any known issues serving the area.

NW Natural provides natural gas within the planning area, though their mapped facilities appear to be largely located north of the Bypass. They do have a 12-inch high pressure gas line serving the riverfront industrial site. This line is also the primary feed for the City of Newberg.

Comcast and Frontier provide cable and telephone services within the planning area. Frontier has very little facilities within the planning area, and no facilities south of the Newberg-Dundee Bypass.

RECOMMENDED UTILITY INFRASTRUCTURE IMPROVEMENTS

Improvements to the existing water, wastewater, and stormwater infrastructure will be necessary in order to support the preferred land use alternative. Recommended improvements are described in the following paragraphs, organized according to the type of infrastructure. These recommendations are based on the City's standards, the City's GIS system, existing utility infrastructure plans, and engineering judgement. No water or wastewater modeling was completed as part of this planning effort.

It is important to note that recommendations are limited by the general nature of land use planning, and that further utility master planning will be necessary to confirm and elaborate on the recommendations made in this memorandum.

Water System

The area south of the Newberg-Dundee Bypass and a small area on the west side of the study area just north of the Bypass currently have no water distribution system. As this area develops, it will require an entirely new water distribution network. New water mains should be constructed within the footprint of proposed roadways. To serve new development south of the Bypass, a water distribution main can be extended west from the transmission main near the water treatment plant. This new water distribution main should extend to the western portion of the study area, and should connect to the existing water system to the north where possible to provide a fully looped system. To serve the north side of the Bypass, a water main could be extended from S College Street southwest along E Weatherly Way. This water main should also be connected to the water main serving the area south of the Bypass to provide a fully looped system.

The majority of the study area north of the Bypass is currently served by an existing water distribution network. The size of existing distribution mains are relatively small within this area, and will likely not provide sufficient fire flow for future connections as the area south of the Bypass develops. Some improvements will be necessary to the distribution system north of the Bypass in order to make distribution network connections to serve the planning area.

The minimum size of water distribution mains will be 8-inches, per City standards. Final sizing will require a more in depth analysis to ensure that minimum fire flow is maintained throughout the water system in accordance with City standards.

Recommended improvements to the existing potable water system are illustrated in *Exhibit D* on the following page and summarized in Table 1 below.

Table 1 – Recommended Water Infrastructure Improvements

Description	Sub-basin	Minimum Size	Length
Water Main	B	8-Inch	8,200 ft

It should be noted that the developer of the riverfront industrial site has the capability of using the existing non-potable water system infrastructure, and water rights.

Wastewater System

The planning area currently lacks a complete wastewater system, and will require extensive sewer infrastructure improvements to serve new development. In order to determine these system improvements, the study area was broken into six sub-basins according to the existing collection system and topography. These sub-basins are shown in *Exhibit E*. The wastewater infrastructure necessary to serve these sub-basins is illustrated on *Exhibit F* and summarized in Table 2 below.

Table 2 – Recommended Wastewater Infrastructure Improvements

Description	Sub-basin Served	Size/Capacity
Riverfront Lift Station	B	950 gpm[1]
Force Main B1	B	8-in[1], 1000 ft
Gravity Main B1	B	8-in, 2600 ft
Gravity Main B2	B	8-in, 1600 ft
Gravity Main B3	B	8-in, 3400 ft
Gravity Main B4	A, B, C, D	18-in[1], 1300 ft
Gravity Main C1	C	8-in, 500 ft
Gravity Main D1	D	10-in, 2400 ft

1. Capacity and size are from the City's 2018 Wastewater Master Plan

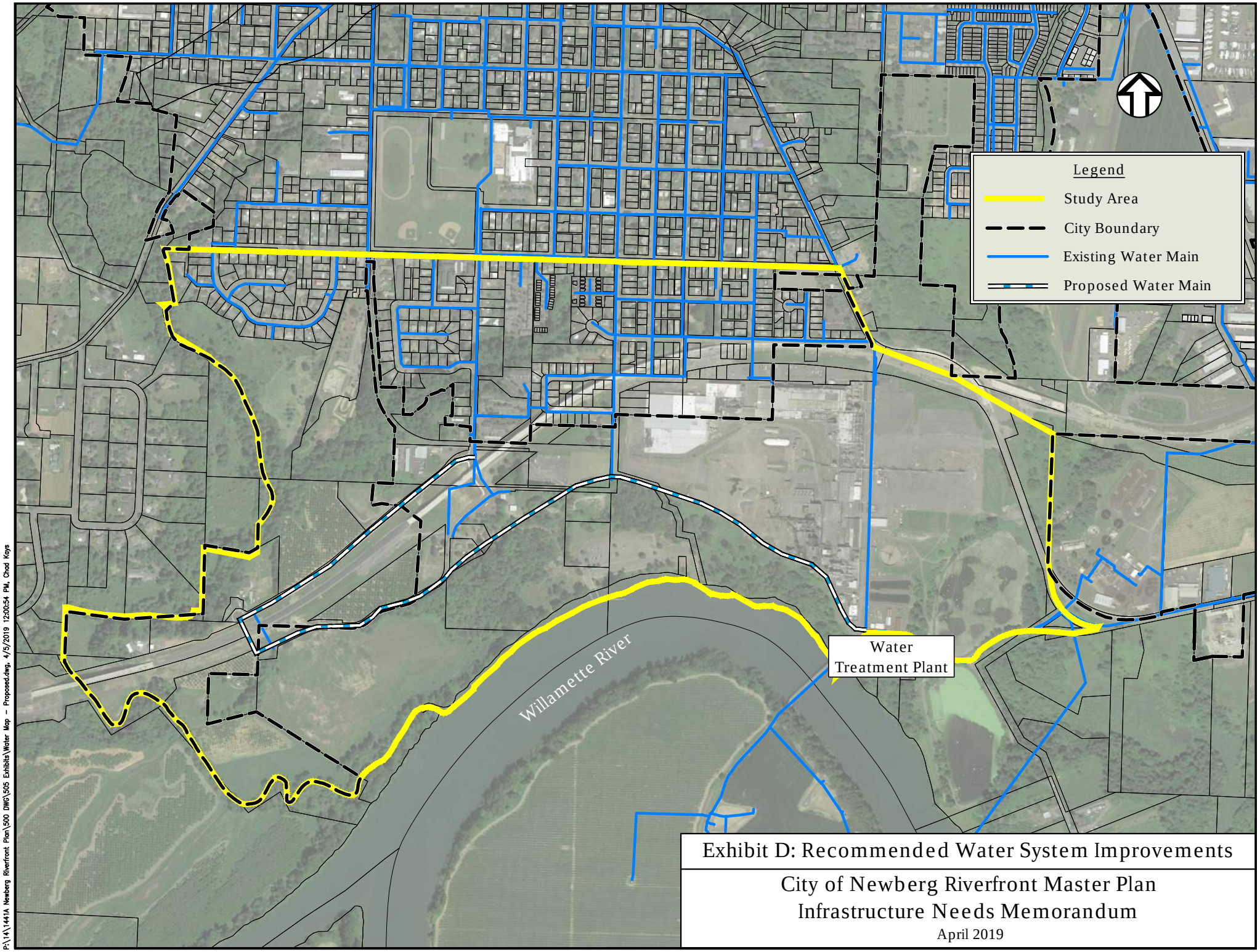
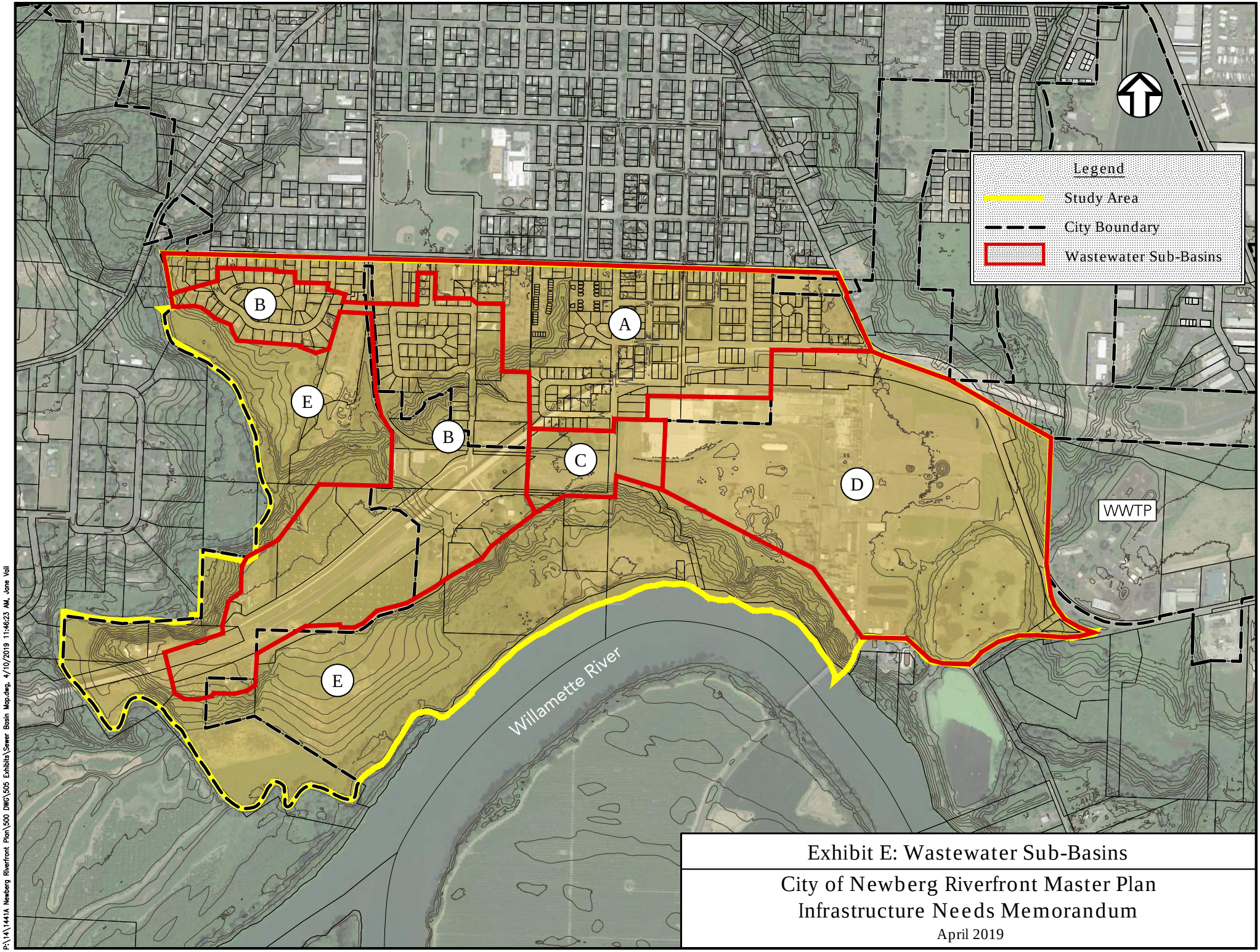


Exhibit D: Recommended Water System Improvements

City of Newberg Riverfront Master Plan
Infrastructure Needs Memorandum
April 2019



P:\14\1441A Newberg Riverfront Plan\500 DWG\505 Exhibits\Sewer Basin Map.dwg, 4/10/2019 11:46:23 AM, Jane Vail

Exhibit E: Wastewater Sub-Basins

City of Newberg Riverfront Master Plan
Infrastructure Needs Memorandum

April 2019

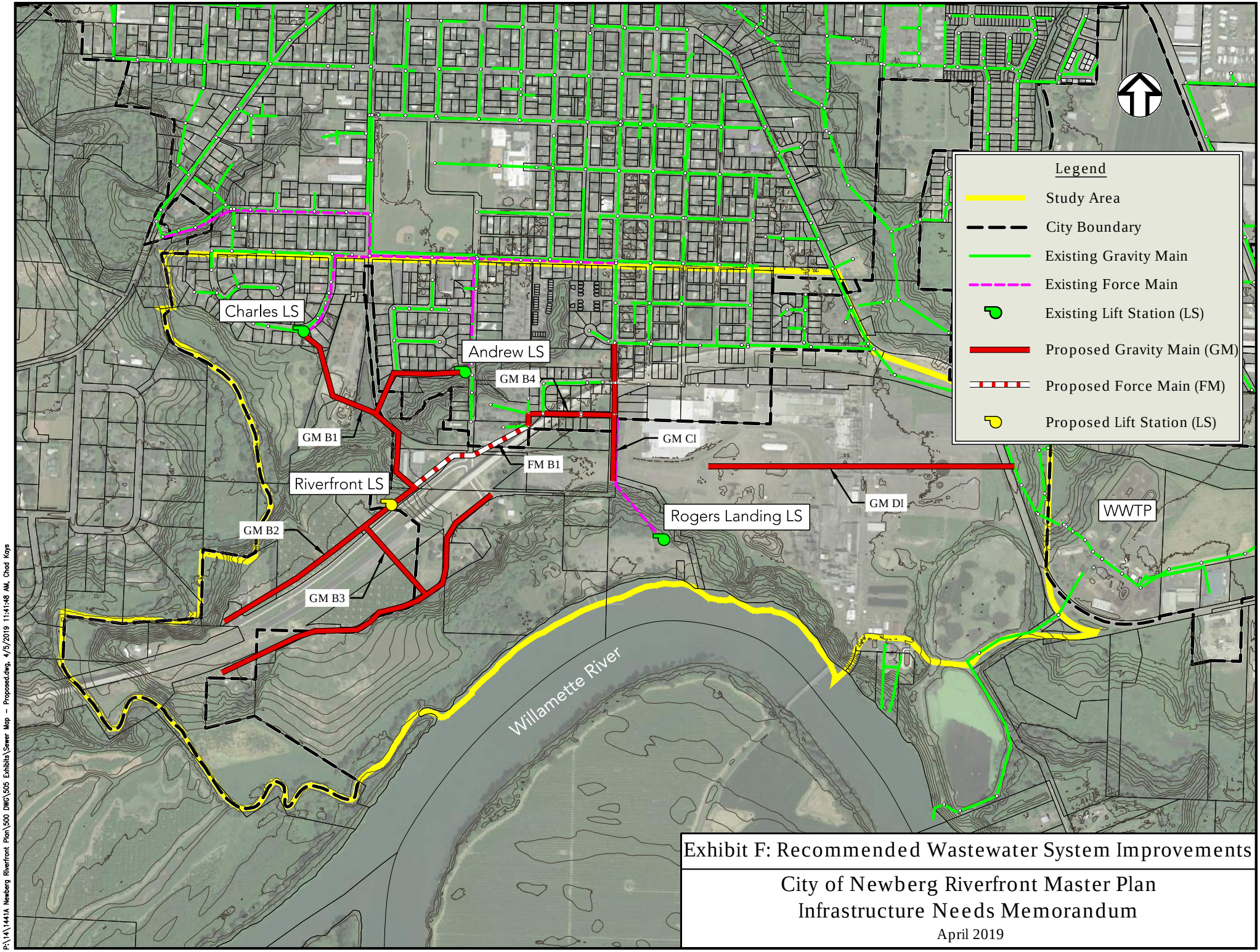


Exhibit F: Recommended Wastewater System Improvements

City of Newberg Riverfront Master Plan
Infrastructure Needs Memorandum
April 2019

P:\14\1441A Newberg Riverfront Plan\500 DWG\505 Exhibits\Sewer Map - Proposed.dwg, 4/5/2019 11:41:48 AM, Chad Kays

A detailed description of each sub-basin and the recommended improvement is described below.

Sub-Basin A. This sub-basin consists of the northern portion of the study area that is served by an existing network of gravity wastewater lines. Because this area is highly developed, and the proposed master plan does not significantly change land use, no new wastewater infrastructure is required beyond that recommended by the 2018 Wastewater Master Plan.

Sub-Basin B. This sub-basin consists of the western portion of the study area – currently served by the Charles Lift Station and Andrew Lift Station – and the additional area to be served by the proposed Riverfront Lift Station and associated collection system described in the Wastewater Master Plan. As discussed above, the Wastewater Master Plan recommended abandoning the Charles Lift Station and Andrew Lift Station. This will require upgrading the Riverfront Lift Station and force main, constructing several new gravity sewers, and upsizing one existing gravity sewer. No major changes are recommended to this proposed infrastructure, although minor adjustments to sewer alignments will be necessary to match proposed roads. This infrastructure is labeled as Gravity Main B1, B2, B3, and B4, and Force Main B1 on *Exhibit E*.

Sub-Basin C. This sub-basin consists of a mostly undeveloped land and a small portion of the riverfront industrial site in the vicinity of S River Street. Based upon the depth of the existing sewer in S. River Street (per City GIS), this area can be served by a gravity sewer extension, shown as Gravity Main C1 on *Exhibit E*.

Sub-Basin D. This area consists of the eastern portion of the riverfront industrial site. This sub-basin can be served by gravity lines flowing east into the existing trunk line on NE Wynooski Road, which currently conveys wastewater to the wastewater treatment plant. This line is labeled as Gravity Main D1 on *Exhibit E*.

Sub-Basin E. This sub-basin consists of the parks and open space within the study area, largely located within the flood plain and stream corridors. Rogers Landing is currently the only portion of this sub-basin with sewer service. Rogers Landing is served by a lift station, pumping wastewater to the collection system north of the Newberg-Dundee Bypass. Because most of this sub-basin lies within the flood plain, it is unlikely to see significant development. It has been suggested that the Rogers Landing area could be the future site of an amphitheater, as well as potential additional park improvements. Depending on the projected wastewater flows and the capacity of the existing lift station, improvements may be necessary to the lift station and potentially the force main. If new facilities are constructed outside of the Rogers Landing area, they will require new lift stations to convey flow to the collection system, because this sub-basin lies at a lower elevation than the rest of the City.

Final alignment and sizing of new sewer system infrastructure will be determined during final design of street infrastructure and development. Alignment and sizing will depend on the specific developments that are constructed, locations of roads, and exact depths of existing gravity lines.

Stormwater System

The existing stormwater system within the planning area consists of stormwater drainage collection and conveyance facilities north of the Bypass. All development will need to comply with the City's stormwater management requirements, as articulated in their Design Standards.

In accordance with these requirements, any development within the planning area will need to collect, treat, detain, convey, and dispose of the stormwater runoff generated by the development. This applies to public improvements that generate impervious surfaces – such as streets, sidewalks, and paths. It also applies to private developments, which construct roofs, streets, sidewalks, and parking lots.

Collection and conveyance of stormwater runoff will likely consist of a combination of underground structure and pipes, and low-impact development conveyance improvements, such as swales and flow-through planters. Treatment of stormwater runoff will likely consist of either mechanical or low-impact development treatment facilities. Detention of stormwater can take place using underground storage, ponds, and other methods. There is considerable flexibility as to the specific design of stormwater collection, conveyance, treatment, and detention facilities. A variety of factors will influence specific design solutions, such as site geography, available land surface, soil conditions, City preference, developer preference, construction cost, long-term maintenance costs, and aesthetics.

There may be some conveyance within the study area through underground stormwater pipes, which are often constructed within publicly-owned streets. Assuming the proposed and existing streets shown on the preferred alternative, we estimate a total of at least 12,000 linear feet of stormwater mains. This number does not account for the variation of street alignments that may occur as the City moves forward with planning and design, and does not include the construction of additional streets and associated storm conveyance.

Treated stormwater runoff is typically disposed of using infiltration into native soils or by conveyance into an adjacent stormwater facility or natural body of water. All methods of disposal have specific requirements and limitations. Disposal of stormwater runoff will depend on site-specific soil characteristics, the location of the site with respect to adjacent stormwater infrastructure, and the capacity of adjacent infrastructure.

Infiltration of treated stormwater runoff is often preferred over other methods because of its simplicity and relatively lower cost. However, native soils must be capable of infiltrating stormwater at or above a minimum rate for infiltration of runoff to be a viable disposal method. That capability can only be determined by onsite tests, and native soils can vary greatly in characteristics throughout an area.

According to the soils map included in the City's 2014 Stormwater Master Plan Update, native soils within the planning area are generally classified as having lower infiltration capability. This map is based on general information; the actual infiltration rates at specific locations within the planning area will vary. As each property develops, the developer will determine soil conditions and the viability of infiltration as a method of stormwater disposal. It should be noted that the Oregon Department of Environmental Quality requires registration of underground infiltration facilities such as drywells per their Underground Injection Control Program. It should also be noted that infiltration also requires consideration of existing groundwater levels and consideration of the environmental sensitivity of an area; infiltration of stormwater runoff into a floodplain or wetland is not typically acceptable.

If stormwater runoff cannot be disposed of by infiltration, it will need to be conveyed to another location, such as an adjacent stormwater pipe, pond, or infiltration facility. If an adjacent stormwater facility is available, the developer will need to demonstrate that it has capacity for disposing stormwater from the proposed development. If this adjacent stormwater facility is owned by other individuals or entities, rights to access, use, and maintenance will need to be negotiated between all parties.

Treated stormwater runoff can also be disposed of in an adjacent body of water. There are multiple stream corridors within the study area, including the Willamette River. It is important to note that disposal of stormwater runoff to these corridors may trigger additional permitting and engineering requirements according to the governing regulatory authorities. Disposal of stormwater runoff in these bodies of water should consider the hydraulic and erosion control implications of additional runoff, with the goal of protecting these existing stream corridors. They should also consider the characteristics of the treated runoff. The City's TDML Implementation Plan is the primary regulatory driver for stormwater management activities, and has specific parameters of concern for stormwater runoff, including bacteria, mercury, and water temperature. However, other regulatory authorities will have jurisdiction for disposal of treated stormwater runoff within stream corridors in the planning area. The developer will likely need to consult with an environmental permitting specialist in order to determine the specific regulatory requirements for their stormwater management improvements.

The construction of a regional stormwater facility for treatment, detention, and/or disposal may address many of the difficulties individual developers face with stormwater management. There are, however, very limited options for locating such a facility. Public ownership of land is limited within the project area to landfill property owned by Yamhill County to areas within the floodplain (such as Rogers Landing, leased by Yamhill County from the City and two private owners).

One area that might be considered for possible use as a regional stormwater facility are the existing lagoons at the southeast corner of the planning area, within the riverfront industrial site property. It could be feasible to repurpose these existing lagoons as stormwater detention ponds for treated stormwater runoff from the surrounding areas, with modifications to the existing outfall to allow controlled disposal of runoff to the Willamette River. These two lagoons currently hold water, and outfall to the Willamette River. In the past, the lagoons were used for disposal of paper mill process water; the degree of biological and/or chemical contamination, the dimensions, and the condition of the lagoons are relatively unknown.

Any use of these ponds for stormwater management will likely necessitate investigation of the condition of the lagoon basin floor for contaminants which might adversely affect the Willamette River. Depending on the degree of contamination and the requirements of regulatory authorities, cleanup might also be required. In addition, some agreement would need to be made for stormwater conveyance to the pond, pond use, access, and maintenance between the property owner, the City, and properties contributing stormwater.

Please note that we cannot recommend specific details as to proposed stormwater improvements. The sizing of stormwater facilities will depend entirely on development of each site, and how much onsite detention and/or infiltration is built.

Franchise Utilities

As part of this master planning effort, City staff spoke directly with franchise utilities within the planning area to elicit comments and concerns regarding the proposed plan.

When contacted for feedback, PGE noted that some industrial and commercial uses may have larger loads and require upgrades to their facilities. The extent of this work would be determined at the development phase. PGE was concerned that improvements protect their existing facilities in the area – particularly the substation on the riverfront industrial site.

In conversations with the City, NW Natural expressed concerns that their existing infrastructure is protected throughout future development, particularly the high pressure line serving Newberg (located on the riverfront industrial site).

Comcast had no concerns of note.

Frontier noted that they have minimal facilities within the planning area, and noted that with their current facilities they could serve around 200 new customers. Their facilities appear to be largely located north of the Bypass, so serving new customers south of the Bypass would require construction of new facilities – another 100 customers could be served with this work. Increasing service beyond that point would require more new facility construction and considerable expense on Frontier's part.

Appendix C

Cost Estimate Additional Information

Springbrook Road Improvements - Alternative 1 (E Crestview Drive directed east)

Item	Unit	Unit Price	Quantity	Cost
Parallel gravity main				
24-inch PVC gravity pipe	LF	$ 205	4,965	$ 1,017,825
Manhole 72-inch (>21-inch pipe)	EA	$ 16,500	17	$ 280,500
Highway boring	LF	$ 600	135	$ 81,000
Roadway restoration (full lane)	LF	$ 60	1,600	$ 96,000
Soil restoration	LF	$ 5	3,365	$ 16,825
Flow diversion structure	EA	$ 20,000	1	$ 20,000
Bypass pumping	LS	$ 50,000	1	$ 50,000
Upsize existing				
18-inch PVC gravity pipe	LF	$ 185	2,300	$ 425,500
Re-connect laterals	EA	$ 500	8	$ 4,000
Manhole 60-inch (18- to 21-inch pipe)	EA	$ 14,000	7	$ 98,000
Roadway restoration (full lane)	LF	$ 60	2,300	$ 138,000
Traffic Control (Highway)	LF	$ 10	2,300	$ 23,000
Control density backfill	LF	$ 165	2,300	$ 379,500
8-inch PVC gravity pipe	LF	$ 135	1,100	$ 148,500
Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	4	$ 48,000
Bypass pumping	LS	$ 50,000	1	$ 50,000
			Subtotal (rounded)	$ 2,877,000
Fernwood PS upsize				
Upsize pump station	LS	$202,000	1	$ 202,000
			Subtotal (rounded)	$ 202,000
Mobilization	%	5	-	$ 153,950
			Subtotal (rounded)	$ 3,233,000
Contingency	%	30	-	$ 969,900
			Subtotal (rounded)	$ 4,203,000
Engineering and CMS	%	25	-	$ 1,050,750
Easement	AC	$ 30,000	2.0	$ 60,000
			Project Total Cost (rounded):	**$ 5,314,000**

Springbrook Road Improvements - Alternative 2 (E Crestview Drive directed west)

Item	Unit	Unit Price	Quantity	Cost
Parallel gravity main				
24-inch PVC gravity pipe	LF	$ 205	4,965	$ 1,017,825
Manhole 72-inch (>21-inch pipe)	EA	$ 16,500	17	$ 280,500
Highway boring	LF	$ 600	135	$ 81,000
Roadway restoration (full lane)	LF	$ 60	1,600	$ 96,000
Soil restoration	LF	$ 5	3,365	$ 16,825
Flow diversion structure	EA	$ 20,000	1	$ 20,000
Upsize existing				
21-inch PVC gravity pipe	LF	$ 195	2,300	$ 448,500
Re-connect laterals	EA	$ 500	8	$ 4,000
Manhole 60-inch (18- to 21-inch pipe)	EA	$ 14,000	7	$ 98,000
Roadway restoration (full lane)	LF	$ 60	2,300	$ 138,000
Traffic Control (Highway)	LF	$ 10	2,300	$ 23,000
Control density backfill	LF	$ 165	2,300	$ 379,500
			Subtotal (rounded)	$ 2,604,000
Aquarius subdivision				
15-inch PVC gravity pipe	LF	$ 170	4,400	$ 748,000
Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	15	$ 180,000
Re-connect laterals	EA	$ 500	90	$ 45,000
Roadway restoration (full lane)	LF	$ 60	4,400	$ 264,000
			Subtotal (rounded)	$ 1,237,000
Mobilization	%	5	-	$ 192,050
			Subtotal (rounded)	$ 4,034,000
Contingency	%	30	-	$ 1,210,200
			Subtotal (rounded)	$ 5,245,000
Engineering and CMS	%	25	-	$ 1,311,250
Easement	AC	$ 30,000	2.0	$ 60,000
			Project Total Cost (rounded):	**$ 6,617,000**

Hess Creek Improvements (all phases)

	Item	Unit	Unit Price	Quantity	Cost
Phase 1					
	CIPP, 8 to 18-inch[1]	LF	$ 145	6,800	$ 986,000
	Flow monitoring	LS	$ 30,000	1	$ 30,000
				Subtotal (rounded)	$ 1,016,000
	Mobilization	%	5	-	$ 50,800
				Subtotal (rounded)	$ 1,067,000
	Contingency	%	10	-	$ 106,700
				Subtotal (rounded)	$ 1,174,000
	Engineering and CMS	%	15	-	$ 176,100
				Phase 1 Cost (rounded):	**$ 1,351,000**
	[1]Additional 30% added to unit price for Hess Creek accessibility constraints				
Phase 2					
	Parallel gravity main				
	27-inch PVC gravity pipe	LF	$ 220	4,700	$ 1,034,000
	24-inch PVC gravity pipe	LF	$ 205	900	$ 184,500
	15-inch PVC gravity pipe	LF	$ 170	1,200	$ 204,000
	12-inch PVC gravity pipe	LF	$ 160	1,900	$ 304,000
	Re-grading pipe	LF	$ 135	2,400	$ 324,000
	Re-connect laterals	EA	$ 500	200	$ 100,000
	Roadway restoration	LF	$ 30	9,800	$ 294,000
	Install access road	LF	$ 60	1,300	$ 78,000
	Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	8	$ 96,000
	Manhole 72-inch (>21-inch pipe)	EA	$ 16,500	18	$ 297,000
	Existing pipe rehab/replacement				
	36-inch PVC gravity pipe	LF	$ 245	700	$ 171,500
	18-inch PVC gravity pipe	LF	$ 185	900	$ 166,500
	Manhole 60-inch (18- to 21-inch pipe)	EA	$ 14,000	3	$ 42,000
	Manhole 72-inch (>21-inch pipe)	EA	$ 16,500	4	$ 66,000
	Install access road	LF	$ 60	1,600	$ 96,000
	Soil restoration	LF	$ 5	1,600	$ 8,000
	Hess Creek constructability	%	150	-	$ 825,000
	Bypass pumping	LS	$ 60,000	1	$ 60,000
				Subtotal (rounded)	$ 4,351,000
	Mobilization	%	5	-	$ 217,550
				Subtotal (rounded)	$ 4,569,000
	Contingency	%	30	-	$ 1,370,700
				Subtotal (rounded)	$ 5,940,000
	Engineering and CMS	%	25	-	$ 1,485,000
	Floodplain hydraulic study	LS	$ 20,000	1	$ 20,000
	Permitting	LS	$ 15,000	1	$ 15,000
				Phase 2 Cost (rounded):	**$ 7,460,000**
Phase 3					
	Pump Station, 2700-gpm	EA	$ 1,200,000	1	$ 1,200,000
	12-inch force main	LF	$ 90	700	$ 63,000
	Highway Boring	LF	$ 600	160	$ 96,000
	Local grinder pump	EA	$ 9,500	1	$ 9,500
				Subtotal (rounded)	$ 1,369,000
	Mobilization	%	5	-	$ 68,450
				Subtotal (rounded)	$ 1,438,000
	Contingency	%	30	-	$ 431,400
				Subtotal (rounded)	$ 1,870,000
	Engineering and CMS	%	25	-	$ 467,500
	Easement	AC	$ 30,000	1.20	$ 36,000
	Permitting & wetland mitigation	LS	$ 165,000	1	$ 165,000
				Phase 3 Cost (rounded):	**$ 2,539,000**
				Project Total Cost (rounded):	**$ 11,350,000**

S River St and E Eleventh St Improvements

Item	Unit	Unit Price	Quantity	Cost
42-inch PVC gravity pipe	LF	$ 275	4,700	$ 1,292,500
36-inch PVC gravity pipe	LF	$ 245	1,900	$ 465,500
30-inch PVC gravity pipe	LF	$ 230	900	$ 207,000
Re-connect laterals	EA	$ 500	75	$ 37,500
Manhole 72-inch (>21-inch pipe)	EA	$ 16,500	23	$ 379,500
Highway boring	LF	$ 600	150	$ 90,000
Roadway restoration (full lane)	LF	$ 60	7,500	$ 450,000
Bypass pumping	LS	$ 50,000	1	$ 50,000
			Subtotal (rounded)	$ 2,972,000
Mobilization	%	5	-	$ 148,600
			Subtotal (rounded)	$ 3,121,000
Contingency	%	30	-	$ 936,300
			Subtotal (rounded)	$ 4,058,000
Engineering and CMS	%	25	-	$ 1,014,500
Flow monitoring	LS	$ 30,000	1	$ 30,000
			Project Total Cost (rounded):	**$ 5,103,000**

E Pinehurst Court

Item	Unit	Unit Price	Quantity	Cost
E Pinehurst Court				
Cap and abandon line	EA	$ 1,500	1	$ 1,500
8-inch PVC gravity pipe	LF	$ 135	300	$ 40,500
Re-grading pipe	LF	$ 135	400	$ 54,000
Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	2	$ 24,000
Re-connect laterals	EA	$ 500	9	$ 4,500
Re-connect manholes	EA	$ 1,500	4	$ 6,000
Roadway restoration (full lane)	LF	$ 60	440	$ 26,400
Landscape restoration	LF	$ 20	260	$ 5,200
Bypass pumping	LS	$ 20,000	1	$ 20,000
			Subtotal (rounded)	$ 183,000
Mobilization	%	5	-	$ 9,150
			Subtotal (rounded)	$ 193,000
Contingency	%	30	-	$ 57,900
			Subtotal (rounded)	$ 251,000
Engineering and CMS	%	25	-	$ 62,750
Easement	AC	$ 30,000	0.12	$ 3,600
			Project Total Cost (rounded):	**$ 318,000**

N Main Street and S Wynooksi Street

Item	Unit	Unit Price	Quantity	Cost
N Main Street Improvements				
15-inch PVC gravity pipe	LF	$ 170	500	$ 85,000
Re-connect laterals	EA	$ 500	10	$ 5,000
Manhole 60-inch (18- to 21-inch pipe)	EA	$ 14,000	5	$ 70,000
Roadway restoration (full lane)	LF	$ 60	350	$ 21,000
Landscape restoration	LF	$ 20	150	$ 3,000
Bypass pumping	LS	$ 40,000	1	$ 40,000
			Subtotal (rounded)	$ 224,000
Item	**Unit**	**Unit Price**	**Quantity**	**Cost**
S Wynooski Street Improvements				
15-inch PVC gravity pipe	LF	$ 170	350	$ 59,500
Re-connect laterals	EA	$ 500	2	$ 1,000
Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	1	$ 12,000
Re-connect manholes	EA	$ 1,500	1	$ 1,500
Roadway restoration (full lane)	LF	$ 60	350	$ 21,000
Bypass pumping	LS	$ 40,000	1	$ 40,000
			Subtotal (rounded)	$ 135,000
Mobilization	%	5	-	$ 17,950
			Subtotal (rounded)	$ 377,000
Contingency	%	30	-	$ 113,100
			Subtotal (rounded)	$ 491,000
Engineering and CMS	%	25	-	$ 122,750
			Project Total Cost (rounded):	**$ 614,000**

E Crestview Drive, Crestview Crossing

	Item	Unit	Unit Price	Quantity	Cost
	E Crestview Drive				
	8-inch PVC gravity pipe	LF	$ 135	2,500	$ 337,500
	Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	9	$ 108,000
	Roadway restoration	LF	$ 30	2,500	$ 75,000
				Subtotal (rounded)	$ 521,000
	Mobilization	%	5	-	$ 26,050
				Subtotal (rounded)	$ 548,000
	Contingency	%	30	-	$ 164,400
				Subtotal (rounded)	$ 713,000
	Engineering and CMS	%	25	-	$ 178,250
	Easement	AC	$ 30,000	1.20	$ 36,000
				E Crestview Drive Cost (rounded):	**$ 928,000**
	Crestview Crossing				
	10-inch PVC gravity pipe	LF	$ 150	3,200	$ 480,000
	Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	11	$ 132,000
	Highway boring	LF	$ 600	160	$ 96,000
	Roadway restoration	LF	$ 30	3,100	$ 93,000
				Subtotal (rounded)	$ 801,000
	Mobilization	%	5	-	$ 40,050
				Subtotal (rounded)	$ 842,000
	Contingency	%	30	-	$ 252,600
				Subtotal (rounded)	$ 1,095,000
	Engineering and CMS	%	25	-	$ 273,750
	Easement	AC	$ 30,000	1.50	$ 45,000
				Crestview Crossing Cost (rounded):	**$ 1,414,000**

Providence PS Infrastructure

	Item	Unit	Unit Price	Quantity	Cost
	Providence PS				
	8-inch PVC gravity pipe	LF	$ 135	2,000	$ 270,000
	Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	7	$ 84,000
	Highway boring	LF	$ 600	160	$ 96,000
	Roadway restoration	LF	$ 30	1,900	$ 57,000
	Pump station, 150 gpm	EA	$ 400,000	1	$ 400,000
	6-inch force main	LF	$ 60	1,300	$ 78,000
				Subtotal (rounded)	$ 985,000
	Mobilization	%	5	-	$ 49,250
				Subtotal (rounded)	$ 1,035,000
	Contingency	%	30	-	$ 310,500
				Subtotal (rounded)	$ 1,346,000
	Engineering and CMS	%	25	-	$ 336,500
	Easement	AC	$ 30,000	1.70	$ 51,000
				Providence PS Cost (rounded):	**$ 1,734,000**

NE Chehalem Drive

	Item	Unit	Unit Price	Quantity	Cost
Phase 1					
	NE Chehalem Drive Infrastructure	LS	-	1	$ 1,683,000
				Subtotal (rounded)	$ 1,683,000
	Contingency	%	10	-	$ 169,000
				Subtotal (rounded)	$ 1,852,000
	Engineering and CMS	LS	-	1	$ 365,000
				Phase 1 Cost (rounded):	**$ 2,217,000**
Phase 2					
	12-inch PVC gravity pipe	LF	$ 160	1,400	$ 224,000
	8-inch PVC gravity pipe	LF	$ 135	900	$ 121,500
	Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	8	$ 96,000
	Roadway restoration (full lane)	LF	$ 60	2,300	$ 138,000
				Subtotal (rounded)	$ 580,000
	Mobilization	%	5	-	$ 29,000
				Subtotal (rounded)	$ 609,000
	Contingency	%	30	-	$ 182,700
				Subtotal (rounded)	$ 792,000
	Engineering and CMS	%	25	-	$ 198,000
				Phase 2 Cost (rounded):	**$ 990,000**
Phase 3 (Chehalem and Creekside PS displacement)					
	15-inch PVC gravity pipe	LF	$ 170	400	$ 68,000
	12-inch PVC gravity pipe	LF	$ 160	5,700	$ 912,000
	8-inch PVC gravity pipe	LF	$ 135	1,500	$ 202,500
	Bore (creek crossing)	LF	$ 600	100	$ 60,000
	Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	26	$ 312,000
	Roadway restoration (full lane)	LF	$ 60	700	$ 42,000
	Soil restoration	LF	$ 5	6,900	$ 34,500
	Rock Allowance	LS	$ 300,000	1	$ 300,000
	Pump station demolition/removal (including building)	LS	$ 22,000	1	$ 22,000
	Pump station demolition/removal (no building)	LS	$ 11,000	1	$ 11,000
				Subtotal (rounded)	$ 1,964,000
	Mobilization	%	5	-	$ 98,200
				Subtotal (rounded)	$ 2,063,000
	Contingency	%	30	-	$ 618,900
				Subtotal (rounded)	$ 2,682,000
	Engineering and CMS	%	25	-	$ 670,500
	Environmental Permitting and Mitigation	LS	$ 50,000	1	$ 50,000
	Easement	AC	$ 30,000	3.17	$ 95,100
				Phase 3 Cost (rounded):	**$ 3,498,000**
				Project Total Cost (rounded):	**$ 6,705,000**

Riverfront PS and Improvements

	Item	Unit	Unit Price	Quantity	Cost
Phase 1					
	18-inch PVC gravity pipe	LF	$ 185	1,500	$ 277,500
	8-inch PVC gravity pipe	LF	$ 135	6,800	$ 918,000
	Re-connect laterals	EA	$ 500	15	$ 7,500
	Manhole 60-inch (18- to 21-inch pipe)	EA	$ 14,000	5	$ 70,000
	Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	23	$ 276,000
	Roadway restoration (full lane)	LF	$ 60	8,300	$ 498,000
	Pump station, 550 gpm	EA	$ 600,000	1	$ 600,000
	8-inch force main	LF	$ 70	1,300	$ 91,000
				Subtotal (rounded)	$ 2,738,000
	Mobilization	%	5	-	$ 136,900
				Subtotal (rounded)	$ 2,875,000
	Contingency	%	30	-	$ 862,500
				Subtotal (rounded)	$ 3,738,000
	Engineering and CMS	%	25	-	$ 934,500
	Easement	AC	$ 30,000	3.81	$ 114,400
				Phase 1 Cost (rounded):	**$ 4,787,000**
Riverfront Industrial Line					
	10-inch PVC gravity pipe	LF	$ 150	2,600	$ 390,000
	Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	9	$ 108,000
	Roadway restoration (full lane)	LF	$ 60	2,600	$ 156,000
				Subtotal (rounded)	$ 654,000
	Mobilization	%	5	-	$ 32,700
				Subtotal (rounded)	$ 687,000
	Contingency	%	30	-	$ 206,100
				Subtotal (rounded)	$ 894,000
	Engineering and CMS	%	25	-	$ 223,500
	Easement	AC	$ 30,000	1.19	$ 35,900
				Riverfront Industrial Line Cost (rounded):	**$ 1,154,000**
Phase 2 (Charles and Andrew PS displacement)					
	10-inch PVC gravity pipe	LF	$ 150	1,100	$ 165,000
	8-inch PVC gravity pipe	LF	$ 135	2,100	$ 283,500
	Manhole 48-inch (<18-inch pipe)	EA	$ 12,000	7	$ 84,000
	Bore (creek crossing)	LF	$ 600	100	$ 60,000
	Bore (railroad crossing)	LF	$ 600	100	$ 60,000
	Roadway restoration	LF	$ 30	600	$ 18,000
	Soil restoration	LF	$ 5	1,500	$ 7,500
	Pump station demolition/removal (no building)	LS	$ 11,000	2	$ 22,000
				Subtotal (rounded)	$ 535,000
	Mobilization	%	5	-	$ 26,750
				Subtotal (rounded)	$ 562,000
	Contingency	%	30	-	$ 168,600
				Subtotal (rounded)	$ 731,000
	Engineering and CMS	%	25	-	$ 182,750
	Environmental Permitting and Mitigation	LS	$ 165,000	1	$ 165,000
	Easement	AC	$ 30,000	1.00	$ 30,000
				Phase 2 Cost (rounded):	**$ 1,109,000**
				Project Total Cost (rounded):	**$ 5,896,000**

Pump Station Improvements (Short-term)

Site	Recommended Improvement	Recommended Completion Time	Cost
Charles Pump Station	Add manhole cover lock	1-5 Years	$1,700
	Install removable bollards in front for traffic protection	1-5 Years	$2,000
		Subtotal	*$3,700*
Chehalem Pump Station	Upgrade generator maintenance records	1-2 Years	$900
		Subtotal	*$900*
Creekside Pump Station	Install bollards for traffic protection	1-5 Years	$2,000
	Replace heater with heat tape in the valve enclosure for freeze protection	1-5 Years	$1,400
	Remount wash water backflow preventer at least 12-inches aboveground	1-5 Years	$3,500
	Relocate the portable generator connection point so it is 34 inches aboveground	1-5 Years	$1,500
	Add fencing around the station	1-5 years	$8,200
		Subtotal	*$16,600*
Fernwood Pump Station	Verify pump operating point and adjust operation (if needed) to improve capacity	Year 1	$1,400
	Check and correct (if needed) hazardous area seal-offs	1-2 Years	$2,000
	Install steel safety grating at the valve vault	1-5 Years	$1,600
	Install flow directing inlet at the influent pipe to the wet well	1-5 Years	$8,500
	Remove unused equipment from the building	1-5 Years	$1,500
	Repaint building doors	1-5 Years	$900
		Subtotal	*$15,900*
Highway 240 Pump Station	Install steel safety grating at the valve vault	1-5 Years	$1,600
	Repaint building doors	1-5 Years	$900
	Install flow directing inlet at the influent pipe to the wet well	1-5 Years	$8,500
	Install steel safety grating at the flow meter vault	1-5 Years	$1,600
		Subtotal	*$12,600*
Sheridian Pump Station	Add strip heater unit in electrical enclosure	1-2 Years	$400
	Replace burnt-out LED lights for depth display in control panel	1-5 Years	$2,400
	Remount wash water backflow preventer at least 12-inches aboveground	1-5 Years	$3,500
	Add fencing around the station	1-5 years	$8,200
	Replace heat tape with electrical heater	1-5 Years	$1,000
		Subtotal	*$15,500*
		Lift Station Improvements Subtotal	*$66,000*
		Contingency (30%)	$19,800
		Engineering (35%)	$30,100
		Administration (2%)	$1,800
		Lift Station Total Costs (rounded)	**$118,000**

Pump Station Improvements (Long-term)

Site	Recommended Improvement	Recommended Completion Time	Cost
Fernwood Lift Station	Add video monitoring	11-20 Years	$41,400
	Add flow meter on the discharge pipe	1-10 years	$25,100
	Install backflow control on overflow	1-10 Years	$6,100
		Subtotal	*$72,600*
Highway 240 Lift Station	Add video monitoring	11-20 Years	$41,400
	Replace pump guide rails	5-10 Years	$5,500
		Subtotal	*$46,900*
Sheridian Lift Station	Replace conductive level sensor with pressure transducer level sensor	11-20 Years	$7,100
	Add video monitoring	11-20 Years	$41,400
	Install backflow control on overflow	1-10 Years	$6,100
	Remove mixing valve	1-10 Years	$1,200
	Install pressure gauges on discharge pipes	5-10 Years	$2,000
	Add flow meter on the discharge pipe	5-10 years	$25,100
	Install a permanent ladder in the valve vault	5-10 Years	$6,100
	Install a dedicated standby generator	5-10 Year	$49,100
		Subtotal	*$138,100*
		Subtotal	$257,600
		Contingency (30%)	$77,300
		Engineering (35%)	$117,300
		Administration (2%)	$6,700
		Lift Station Total Costs (rounded)	**$459,000**

Appendix D

Priority 1 Project Sheets

Collection System Project: Hess Creek Phase 1 - CIPP
Project Identifier: 1.a

Objective: Cured-in-place pipe lining of the upper portion of the Hess Creek trunk line to reduce I/I influence and extend the life of the pipe (dark red line on location map below). Two pipe segments along this portion do not need to be lined as they will be upsized in Phase 2. Flow monitoring in the basin will also be completed to inform the design phase of Hess Creek Phase 2 Project.

Key Issues: Access to the Hess Creek trunk line is limited and can be difficult. Truck access is very limited.

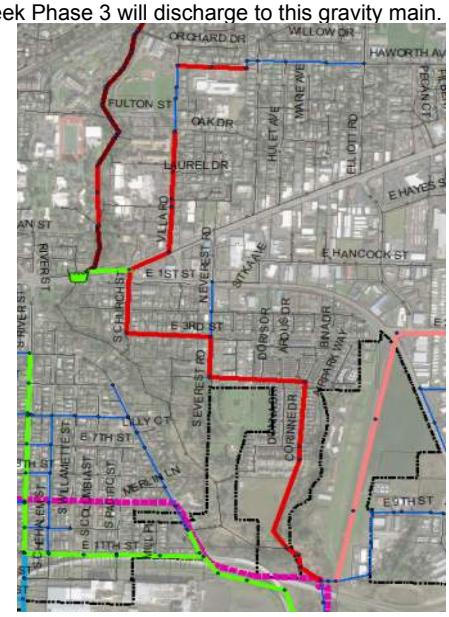
Item	Cost (2021)
CIPP, 8 to 18-inch[1]	$ 986,000
Flow monitoring	$ 30,000
Construction Subtotal (rounded)	***$ 1,016,000***
Mobilization	$ 51,000
Contingency	$ 107,000
Engineering and CMS	$ 177,000
Total Project Cost (rounded)	***$ 1,351,000***

[1]Additional 30% added to unit price for Hess Creek accessibility constraints

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinionof accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

Collection System Project: Hess Creek Phase 2 - Parallel Gravity Main
Project Identifier: 1.b

Objective: Resolve undersized downstream pipeline along N Villa Road. Construct gravity line parallel to the Hess Creek canyon and reduce flow going to the Hess Creek trunk line. The new pump station in Hess Creek Phase 3 will discharge to this gravity main.



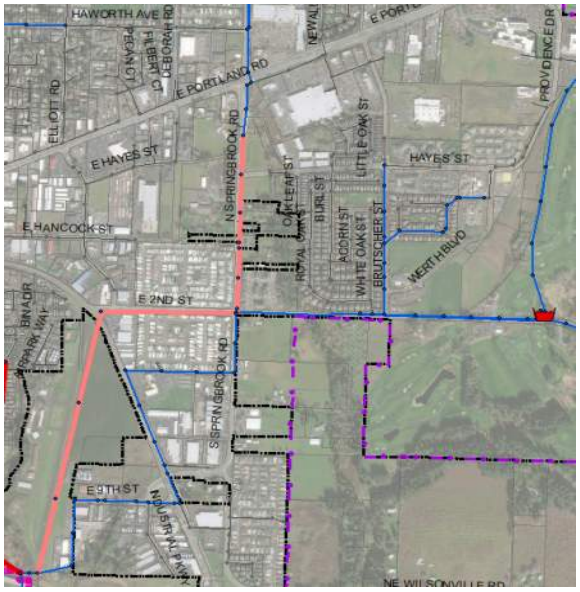
Key Issues: The most downstream segments of this project are in the Hess Creek canyon and acces is limited. Groundwater could be high in this area as well.

Item	Cost (2021)
Parallel gravity main	
27-inch PVC gravity pipe	$ 1,034,000
24-inch PVC gravity pipe	$ 184,500
15-inch PVC gravity pipe	$ 204,000
12-inch PVC gravity pipe	$ 304,000
Re-grading pipe	$ 324,000
Re-connect laterals	$ 100,000
Roadway restoration	$ 294,000
Install access road	$ 78,000
Manhole 48-inch (<18-inch pipe)	$ 96,000
Manhole 72-inch (>21-inch pipe)	$ 297,000
Existing pipe rehab/replacement	
36-inch PVC gravity pipe	$ 171,500
18-inch PVC gravity pipe	$ 166,500
Manhole 60-inch (18- to 21-inch pipe)	$ 42,000
Manhole 72-inch (>21-inch pipe)	$ 66,000
Install access road	$ 96,000
Soil restoration	$ 8,000
Hess Creek constructability	$ 825,000
Bypass pumping	$ 60,000
Construction Subtotal (rounded)	***$ 4,351,000***
Mobilization	$ 218,000
Contingency	$ 1,371,000
Engineering and CMS	$ 1,485,000
Floodplain hydraulic study	$ 20,000
Permitting	$ 15,000
Total Project Cost (rounded)	***$ 7,460,000***

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinionof accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

Collection System Project: Springbrook Road
Project Identifier: 1.c

Objective: Increase capacity of the Springbrook Road trunk line and firm capacity of Fernwood Pump Station to accommodate development in the basin. Improvements include upsizing the firm capacity of Fernwood Pump Station, upsizing a portion of the existing Springbrook line north of E Fernwood Road, and a new parallel gravity line added west on E Second St from the E Fernwood Road intersection.



Key Issues: Pipeline will need to be bored under HWY 219. Easement negotiation with Sportsman Airpark.

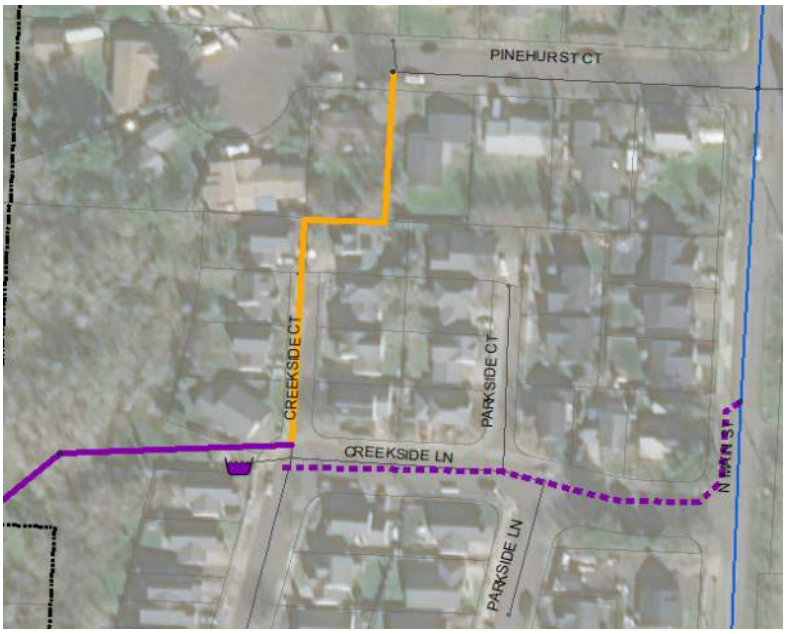
Item	Cost (2021)
Parallel gravity main	
24-inch PVC gravity pipe	$ 1,017,825
Manhole 72-inch (>21-inch pipe)	$ 280,500
Highway boring	$ 81,000
Roadway restoration (full lane)	$ 96,000
Soil restoration	$ 16,825
Flow diversion structure	$ 20,000
Bypass pumping	$ 50,000
Upsize existing	
18-inch PVC gravity pipe	$ 425,500
Re-connect laterals	$ 4,000
Manhole 60-inch (18- to 21-inch pipe)	$ 98,000
Roadway restoration (full lane)	$ 138,000
Traffic Control (Highway)	$ 23,000
Control density backfill	$ 379,500
8-inch PVC gravity pipe	$ 148,500
Manhole 48-inch (<18-inch pipe)	$ 48,000
Bypass pumping	$ 50,000
Fernwood PS upsize	
Upsize pump station	$ 202,000
Construction Subtotal (rounded)	***$ 3,079,000***
Mobilization	$ 154,000
Contingency	$ 970,000
Engineering and CMS	$ 1,051,000
Easement	$ 60,000
Total Project Cost (rounded)	***$ 5,314,000***

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

Collection System Project: E Pinehurst Court
Project Identifier: 1.d

Objective: Eliminate overflows at E Pinehurst Court. The grade of E Pinehurst Court and shallow gravity main produce a potential overflow site when the trunk line on N Main Street flow close to full. This project will re-direct flow from E Pinehurst Court south to existing lines on Creekside Court and to the Creekside Pump Station basin.

Key Issues: Easements will be needed to connect to Creekside court. There are local grinder pumps on E Pinehurst that could potentially be removed if the vertical alignment allows; this should be evaluated during design.



Item	Cost (2021)
Cap and abandon line	$ 1,500
8-inch PVC gravity pipe	$ 40,500
Re-grading pipe	$ 54,000
Manhole 48-inch (<18-inch pipe)	$ 24,000
Re-connect laterals	$ 4,500
Re-connect manholes	$ 6,000
Roadway restoration (full lane)	$ 26,400
Landscape restoration	$ 5,200
Bypass pumping	$ 20,000
Construction Subtotal (rounded)	***$ 183,000***
Mobilization	$ 10,000
Contingency	$ 58,000
Engineering and CMS	$ 63,000
Easement	$ 3,600
Total Project Cost (rounded)	***$ 318,000***

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinionof accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

Collection System Project: Pump Station Improvements (Short-term)
Project Identifier: 1.e

Objective: This project includes a variety of short-term improvements to existing pump stations. The Dayton PS was replaced recently and has no short-term improvement recommendations. Andrew PS also does not have any short-term improvement recommendations.

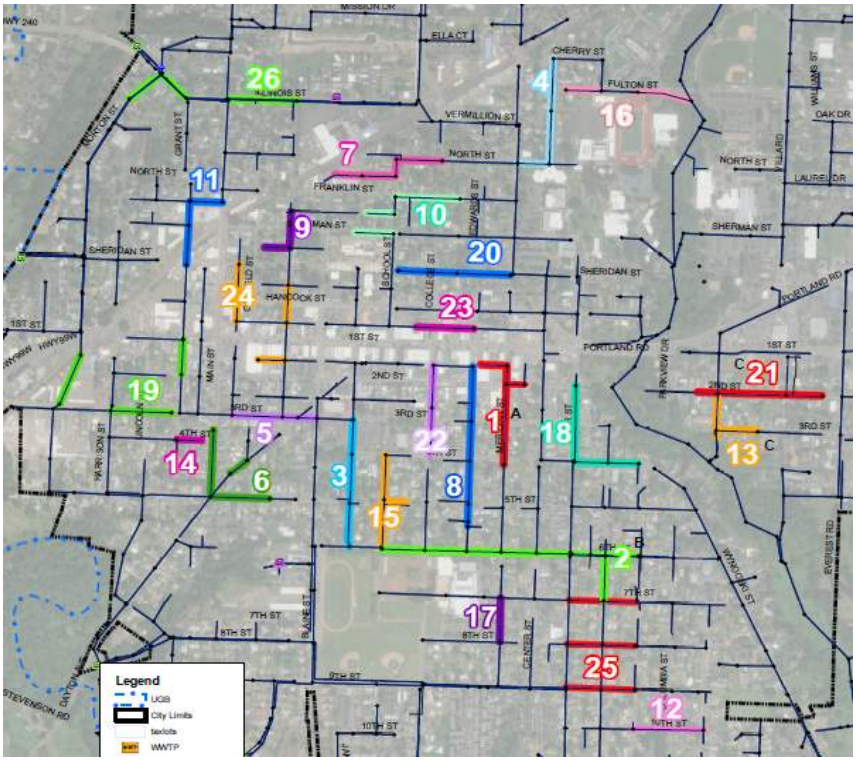
Item	Cost (2021)
Charles Pump Station	$ 3,700
Chehalem Pump Station	$ 900
Creekside Pump Station	$ 16,600
Fernwood Pump Station	$ 15,900
HWY 240 Pump Station	$ 12,600
Sheridan Pump Station	$ 15,500
Construction Subtotal (rounded)	***$ 66,000***
Contingency	$ 19,800
Engineering and CMS	$ 30,100
Administration	$ 1,800
Total Project Cost (rounded)	***$ 118,000***

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinionof accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

Collection System Project: I/I Projects
Project Identifier: 1.f

Objective: Reduce I/I in the system. Focus annual pipeline replacement in areas of high I/I as identified in the 2018 WWMP. Potentially postpone larger capital improvements on trunk lines and at WWTP by reducing I/I influence and peak flows in the system.

Key Issues: I/I data should be updated periodically to provide current recommendations for reducing I/I in the system. Coordination with other utilities could provide cost-savings for the City.



Item	Cost (2021)
I/I Projects	$ 2,700,000
Total Project Cost (rounded)	***$ 2,700,000***

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinionof accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

Collection System Project: E Crestview Drive Infrastructure
Project Identifier: 1.g

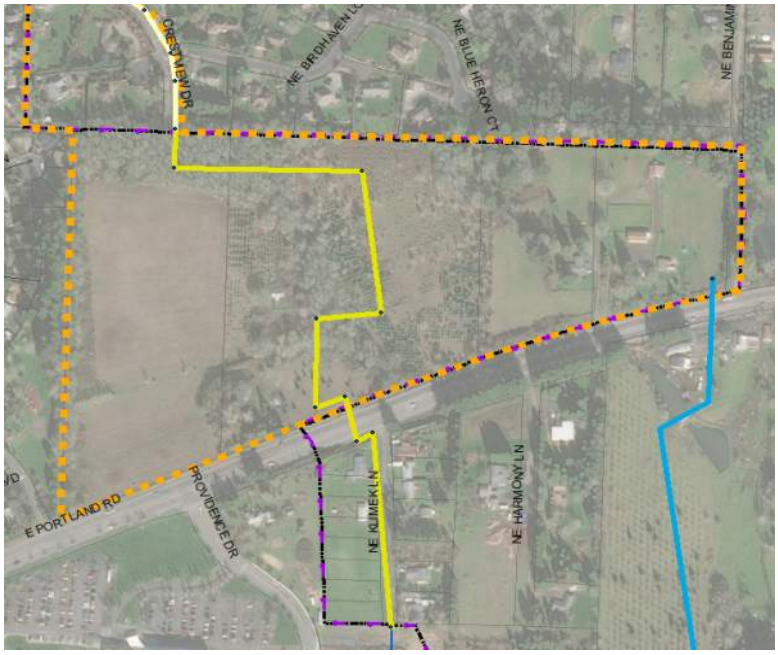
Objective: Development driven infrastructure along E crestview Drive. Proposed infrastructure based on City provided drawings.

Item	Cost (2021)
8-inch PVC gravity pipe	$ 337,500
Manhole 48-inch (<18-inch pipe)	$ 108,000
Roadway restoration	$ 75,000
Construction Subtotal (rounded)	***$ 521,000***
Mobilization	$ 27,000
Contingency	$ 165,000
Engineering and CMS	$ 179,000
Easement	$ 36,000
Total Project Cost (rounded)	***$ 928,000***

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinionof accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

Collection System Project: Crestview Crossing Infrastructure
Project Identifier: 1.h

Objective: Development driven infrastructure for the Crestview Crossing area. Proposed infrastructure is based on the Crestview Crossing PUD (March 2019) Report from the City.



Item	Cost (2021)
10-inch PVC gravity pipe	$ 480,000
Manhole 48-inch (<18-inch pipe)	$ 132,000
Highway boring	$ 96,000
Roadway restoration	$ 93,000
Construction Subtotal (rounded)	***$ 801,000***
Mobilization	$ 41,000
Contingency	$ 253,000
Engineering and CMS	$ 274,000
Easement	$ 45,000
Total Project Cost (rounded)	***$ 1,414,000***

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinionof accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

Collection System Project: Maintenance Yard Improvements
Project Identifier: 1.i

Objective: A Master Plan was completed for the City maintenance yard. This project was in the City's draft CIP 2017-2022 at the time of the 2018 WWMP. The project will include major site work, new fleet building, and eventually new administration building. The maintenance yard is utilized by a number of City divisions.

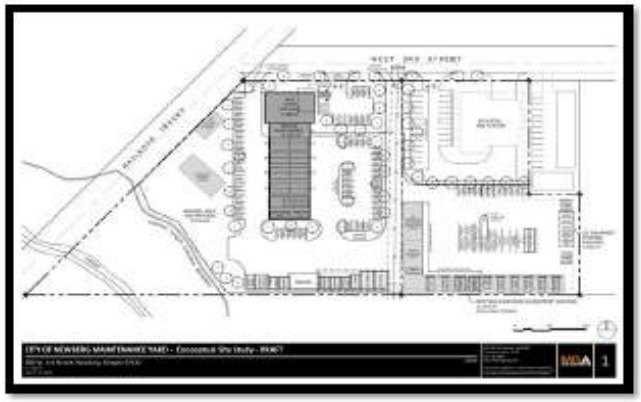


FIGURE 1 CONCEPTUAL PUBIC WORKS MAINTENANCE YARD PLAN

Item	Cost (2021)
Project Total Cost (rounded)	$ 804,000
Cost from 2018 WWMP - includes mob., eningeering, and admin. From sewer utility portion (increased by ENR)	

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinionof accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

2020 Newberg Stormwater Master Plan Update

Citizen's Advisory Committee Meeting #3B

February 25th, 2021

City of Newberg

Updates/Additions Since Last Draft

- **Section 3 Stormwater System Capacity Evaluation-** Updated
  - Table 3-7 updated
  - Table 3-8 updated
  - Maintenance Figures updated
- **Section 4 Maintenance and Programmatic Evaluation** - Added
  - Regulatory conditions
  - Maintenance activities
  - Standards Review
  - Blank section for community comments (to be provided by CAC)
- **Section 5 Integrated Management Strategy-** Added
  - Maintenance recommendations
  - Engineering study recommendations
  - Capital Improvement Plan (CIP)
- **Section 6 Implementation Plan-** Added
  - Updated prioritization criteria
- **Project summary sheets**

Items to be Completed

- Staffing Levels Analysis
- Project Prioritization
- SDC Analysis

Maintenance Updates

- Capacity problem areas have been organized with identifiers that associate with Table 3-7
- Table 3-8 now includes all maintenance issues reported by staff for this plan
- Figure 3-3 was split into 4 separate figures to more clearly define pipe age deficiencies, pipe material deficiencies, maintenance issues and projects, and CCTV records
- Table 4-1 shows how much maintenance has been completed the last few years

Maintenance Issues

- 17 confirmed flooding areas
- 41 catch basins, manholes, pipes, or outfalls need replacement
- 1 sink hole
- 8 locations need maintenance (not a CIP)
- 18 spot repairs

Other Non-Capacity-Related Issues

- Pipes older than 50 years
- Pipe material degrading
  - Cast iron
  - Clay
  - Steel
  - Corrugated metal pipe
- CCTV identifies issues with a PACP score of 5, (pipe has failed or will fail within 5 years)

Regulatory Conditions

- Willamette Total Maximum Daily Load (TMDL) - currently required
- Future NPDES MS4 Permit – possible future discharge requirements by DEQ

Current Maintenance Activities

Activity	2018	2019	2020
Catch basins inspected	75	?	?
Grates and inlets inspected	0	36	234
Catch basins cleaned	75	72	173
Storm line inspected (feet)	2,089	35,500	21,200
Storm line cleaned (feet)	4,390	37,500	22,300
Minor repairs	362 feet of storm line 4 structures	8	7
Stormwater facility inspection and cleaning	26	37	80
Ditch Cleaned (feet)	125	1,900	220
Street sweeping (curb miles)	?	0.28	0.53

Development Standards Recommendations

- Strengthen existing design standards language encouraging infiltration solutions such as rain gardens, infiltration trenches, pervious pavers, etc.
- Consistent with regional trends, require water quality treatment for both new and replaced impervious areas when redevelopment occurs.
- Community input from CAC will be included after the next meeting

Existing Development Standards of Interest to CAC

4.9 Low Impact Development Approaches (LIDA)

LIDAs offer options to comply with stormwater management requirements. The five objectives of LIDA are to:

I. Conserve Existing Resources
II. Minimize Disturbance
III. Minimize Soil Compaction
IV. Minimize Imperviousness
V. Direct Runoff from Impervious Areas onto Pervious Areas

4.6.8 Facility Selection Hierarchy

The hierarchy of preference for public and or private water quantity and/or water quality facilities is listed below in the order of preference by the City Engineer and Public Works Maintenance Department. The highest technically feasible option must be used (1=highest, 4=lowest). Applicants must provide the appropriate technical analysis and evaluation and demonstrate the need to move from a higher option to a lower option as reviewed & approved by the City during the land use application or permit review application process.

Detention Facilities	Water Quality Facilities
LIDA Facilities/Regional Facility	LIDA Facilities/Regional Facility
Surface Pond	Swale
Underground Tanks/Pipes	Proprietary Treatment Systems
Fee in lieu of construction payment	Fee in lieu of construction payment

Figure 4.5 Approvable Low Impact Development Approaches

Application	Green Roof	Porous Pavement/Pavers	Flow-through Planter	Infiltration Planter[1] / Rain Garden	Vegetated Filter Strip	Swale
Quantity Control	✓	✓	✓	✓		
Quality Control	✓	✓	✓	✓	✓	✓
Impervious Area Reduction	✓	✓				
Infiltrate		✓		✓	✓	✓
Private Property	✓	✓	✓	✓	✓	✓
Public Street/ROW			✓		✓	✓
Steep Slope	✓		✓			
Soils with Low Infiltration Rate[2]	✓	✓	✓		✓	✓
High GW Table	✓		✓		✓	✓
Contaminated Soils	✓		✓			

[1] Water proofing maybe required for the building, foundation or a crawlspace.
[2] Infiltration testing is required to determine rate.

Capital Improvement Projects (CIP)

- Capacity Projects - Table 5-2 and Figure 5-1
- Maintenance Projects - Figure 3-5 & Table 3-8
- Annual pipe replacement program - Figures 3-3, 3-4, and 3-6
- Combined Projects - Figure 5-2

Prioritization Criteria for CIP Projects

After the last CAC meeting related to the Stormwater Master Plan Update, changes were made. It is not a strictly numerical system and is better defined by the following.

Category ID	Project Category
A	Projects required by regulations
B	Projects that fix documented flooded areas
C	Projects where maintenance issues correspond with model issues
D	Projects that are located in roads selected for repaving
E	Projects that address flooding that occurs most frequently in model results. This includes a combination of duration of flooding at the 25-year event, and intensity of the storm where flooding first occurs (2-year storm event, 10-year storm event, or 25-year storm event).
F	Projects that will reduce flooding in the areas with the largest potential for damage
G	Projects that will benefit the largest number of properties
H	Projects that reduce long-term maintenance by removing pipes and/or structures that currently require more maintenance than is typical of that type of structure
I	Conjunctive or multiple use potential, particularly as a balance between moving water and enhancing stream water quality and habitat/aesthetics
J	Low permitting complexity

Next Steps

- HBH will incorporate feedback from the CAC and TAC into final draft
- CAC will be given the full final draft to review
- CAC meeting #4B
  - Provide SWMP feedback & design criteria recommendations
- City Council workshop
- Planning Commission hearing/recommendation
- City Council hearing/approval
- Final SWMP document
- Move forward with Design Standard changes and any other recommendations the Council approves or provides direction for.

Comments/ Questions?

City of Newberg
Stormwater Master Plan

Prepared for
City of Newberg, Oregon
February 11, 2021

City of Newberg
Stormwater Master Plan

Prepared for
City of Newberg, Oregon
November 25, 2020

HBH
CONSULTING
ENGINEERS

501 E 1st Street
Newberg, OR 97132
Phone: 503.554.9553
Fax: 503.537.9554

Acknowledgements

HBH appreciates the assistance and constructive review comments given by the City of Newberg engineering, public works maintenance, operations, and planning staff in the preparation of this Stormwater Master Plan update.

Specifically, the project team recognizes the following personnel for their efforts:

- Brett Musick, PE, Newberg Engineering – Senior Engineer / Project Manager
- Kaaren Hofmann, PE, Newberg Engineering – City Engineer
- Russ Thomas, Newberg Public Works – Public Works Director
- Vance Barton – Newberg Public Works Interim Public Works Superintendent
- Keith McKinnon, Newberg Engineering – GIS Specialist
- Kristen Svicarovich, PE, Newberg Engineering – Associate Engineer

Table of Contents

List of Figures

List of Tables

List of Abbreviations

CIP	capital improvement project
City	City of Newberg
cfs	cubic feet per second
CRRC	Citizen Rate Review Committee
DEQ	Oregon Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GIS	geographic information system
HDPE	high density polyethylene
H/H	hydrologic and hydraulic
IDDE	Illicit Discharge Detection and Elimination
LID	low impact development
Master Plan	Stormwater Master Plan
MS4	Municipal Separate Storm Sewer System
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NGVD29	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
Hwy 99W	Oregon Highway 99W
RCP	reinforced concrete pipe
SWMM	Surface Water Management Model
SWMP	Storm Water Master Plan
TMDL	Total Maximum Daily Load
UGB	urban growth boundary
URA	urban reserve area
WQ	water quality

Section 1

Introduction

This Stormwater Master Plan (Master Plan or SWMP) documents the methods and results of stormwater system capacity and stormwater program evaluations for the Newberg study area. The study area for this Master Plan includes land within Newberg's urban growth boundary (UGB) and Yamhill County land upstream of the UGB that drains to tributaries of Chehalem Creek Tributary, Hess Creek, and Spring Brook. This section provides a summary of the need for the plan, the plan objectives, a description of the approach for preparing the plan, and a summary of how the plan is organized.

1.1 Need for the Plan

According to Portland State University's Population Research Center, Newberg's population was 24,045 on July 1, 2019. The Newberg Comprehensive Plan projects population to grow to 28,602 in 2025 and 31,336 in 2030. As projected growth continues to fill in the UGB, and the City plans for future expansion into the urban reserve areas, City staff must plan for such development in a way to maintain the character of the community. Stormwater master planning offers one mechanism to anticipate and address infrastructure and programmatic needs in conjunction with development and expansion.

The City will use this Master Plan as a tool to proactively address stormwater management with prioritized stormwater capital improvement projects (CIPs) that work in conjunction with the City's ongoing stormwater program that includes development standards addressing stormwater. This project provides an opportunity to expand upon the City's current planning approach to improve public safety, water quality, and aesthetic benefits while addressing storm drain capacity in several flood-prone areas.

Programmatic recommendations set forth in this plan will also address long-term management requirements under the City's Total Maximum Daily Load (TMDL) program with the Oregon Department of Environmental Quality (DEQ).

1.2 Plan Objectives

This multi-objective Master Plan addresses stormwater quantity control and current stormwater system capacity limitations. In conjunction with the development of the capital improvement program, a summary of recommendations to address water quality and long-term stream stabilization is provided from the 2014 Master Plan in Appendix C. In summary, the main objectives of this plan are as follows:

- update the City's stormwater system hydrologic and hydraulic models to evaluate system capacity
- develop an integrated stormwater system capital improvement program to address storm system capacity needs and water quality
- continue compliance with water quality regulations
- review the City's stormwater management program and make recommendations on activities and staffing where applicable
- identify implementation priorities and impacts to the program budget
- develop a Master Plan document that is useful and easy to read, reference, and update

1.3 Approach

The approach for developing this Master Plan is summarized in the following paragraphs. This approach was developed to meet the City's stormwater management objectives and increase the understanding of the existing stormwater infrastructure. The data collection, evaluation, and improvement strategies were conducted as follows:

1. The 2014 Storm Water Master Plan was used as the base for this update, and portions were updated.
2. The City's storm drain geographic information system (GIS) data were reviewed and supplemental data were collected through field investigations in the 2014 Master Plan. Existing water quantity and quality control facilities were also reviewed.
3. Collected data were used to update the stormwater hydrologic and hydraulic (H/H) model and associated model attributes such as subcatchment drainage areas, land uses, and topography.
4. City staff were interviewed to identify known drainage problem areas.
5. Alternatives were developed for improvements to the stormwater infrastructure.
6. Improvements were evaluated with City staff to determine the best alternatives for incorporation into both the future management program and the City's capital improvement program.
7. Project costs were developed, along with a proposed implementation timeline, consistent with anticipated program funding.
8. The approach was documented in this Master Plan to provide information in a clear and easy–to-use format.

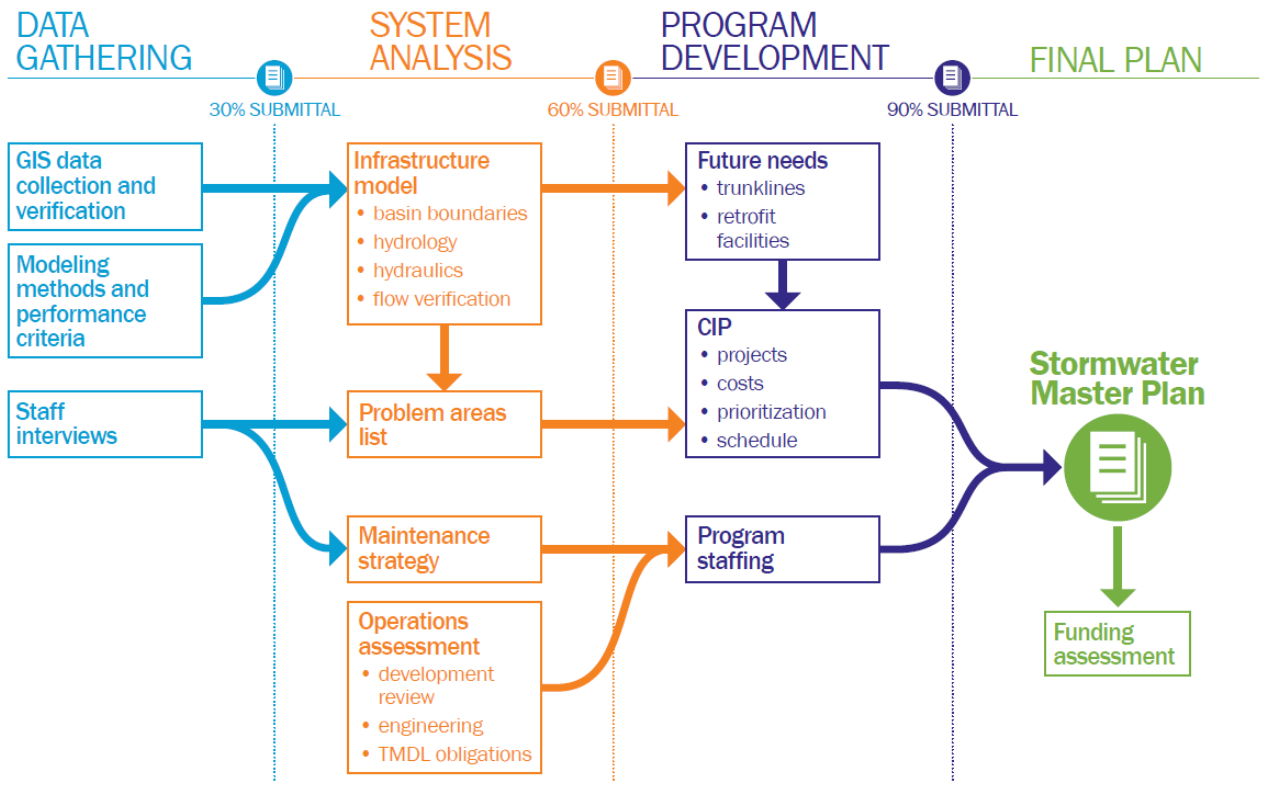


Figure 1-1. Stormwater Master Plan approach

1.4 Plan Organization

This Master Plan is organized as follows:

- Section 2 includes a description of study area characteristics and associated mapping.
- Section 3 describes the methods used to conduct a storm system capacity evaluation including hydrologic and hydraulic modeling.
- Section 4 provides a review of the existing maintenance and programmatic management activities and identifies future program needs.
- Section 5 describes the methods and results of integrating the programmatic and capital measures to address the City's storm system capacity and water quality needs.
- Section 6 describes the recommended capital improvement project prioritization and implementation schedule to address storm system capacity and water quality.
- Appendices A through D provide supporting and technical information used in the development of the Master Plan document.

Section 2
Study Area Characteristics

This section includes an overview of study area characteristics including location, topography, soils, land use, climate and rainfall, drainage system, and current stormwater quality conditions.

2.1 Location

The City of Newberg is located 25 miles southwest of Portland, Oregon, along the Oregon Highway 99W (Hwy 99W) corridor. Newberg is in northeast Yamhill County and is bordered by the Chehalem Mountains to the north and the Willamette River to the south.

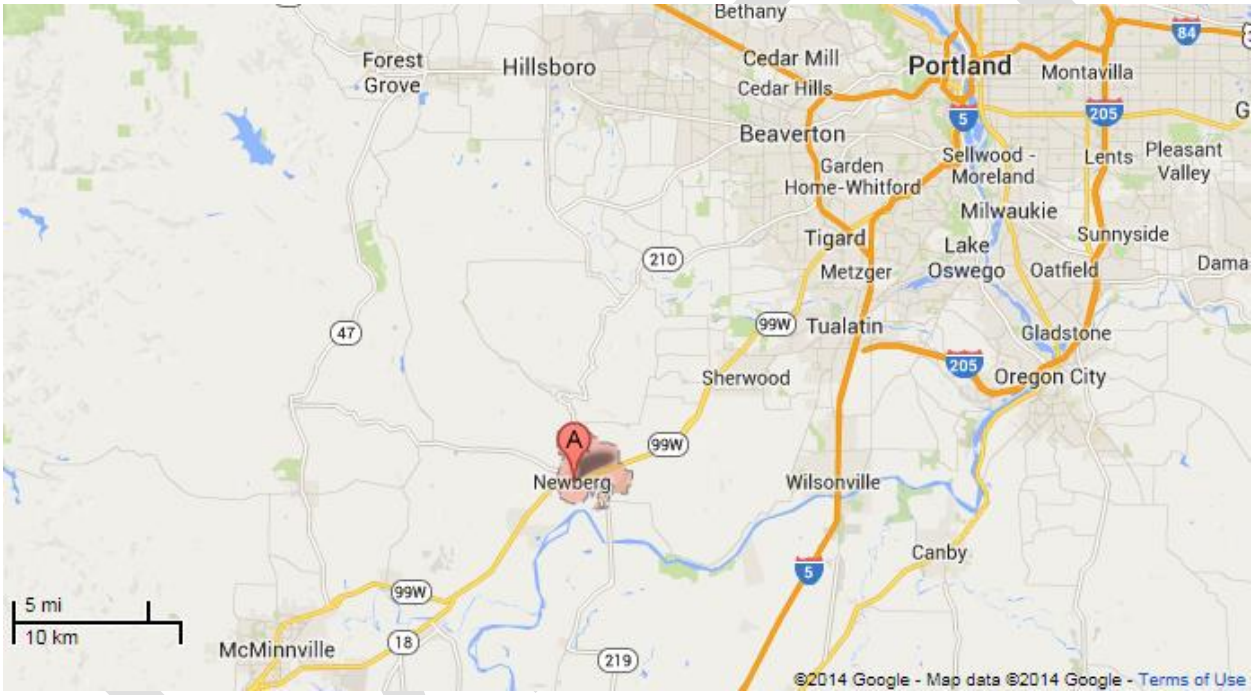


Figure 2-1. Vicinity map

The city is approximately 5.8 square miles and is drained by Chehalem Creek, Hess Creek, and Spring Brook. Chehalem Creek and Spring Brook drain to the Willamette River near River Mile 51.0 and River Mile 47.2, respectively. Hess Creek enters Spring Brook downstream of the city limits.

2.2 Topography

Topographic information was compiled using 2012 aerial imagery and LiDAR data on the North American Vertical Datum of 1988 (NAVD88). Anecdotal information from City staff, Google Earth, and six field visits by a previous consultant staff were used to supplement these data.

Newberg is located within the Willamette River Valley and gently slopes from the north down to the Willamette River to the south. The highest point within the city is located at elevation 456.3 and the lowest is near the Willamette River at elevation 62.2. The Hess Creek and Spring Brook watersheds extend into the mountains and flow through Newberg. Outside of the city, the watersheds extend up to elevations of 1,249.4 and 1,225.8, respectively. The creeks within the city flow from north to south and provide a natural drainage system throughout the city. The average slope within the city boundary ranges from 0.5 percent to 27.4 percent and averages approximately 5.6 percent. The average slope of Hess Creek passing through the center of the city from north to the south is approximately 1 percent. Figure 2-2 illustrates the city topography.

2.3 Soils

Soil classification is an important characteristic to consider when evaluating runoff flow rates and volumes. Soil types within the study area were identified using data from the Natural Resource Conservation Service Soil (NRCS) Survey. Soil information is based upon data obtained from the NRCS Web Soil Survey (2013) which publishes information from the 1974 publication from the U.S. Department of Agriculture Soil Conservation Service titled *Soil Survey of Yamhill Area, Oregon*.

Table 2-1 shows soil types, soil characteristics and distribution within the UGB according to the NRCS soil survey.

Table 2-1. Soil Characteristics

NRCS map unit name	NRCS map symbol	Hydrologic soil group	Percent coverage in UGB
Aloha silt loam	Ah	C	42.8
Amity silt loam	Am	D	8.3
Carlton silt loam, 0 to 7 Percent slopes	CaB	C	0.1
Carlton silt loam, 7 to 12 Percent slopes	CaC	C	0.1
Carlton silt loam, 12 to 20 percent slopes	CaD	C	0.1
Cloquato silt loam	Cm	B	0.0
Cove silty clay loam, thick surface	Cs	D	0.7
on silt loam	Da	D	0.4
Dayton silt loam, thick surface	Dc	D	0.8
Hazelair silty clay loam, 2 to 7 percent slopes	HcB	D	0.5
Hazelair silty clay loam, 7 to 20 percent slopes	HcD	D	0.7
Jory clay loam, 2 to 7 percent slopes	JrB	B	0.7
Jory clay loam, 12 to 20 percent slopes	JrD	B	0.2
Jory clay loam, 20 to 30 percent slopes	JrE	B	0.0
Jory clay loam, 30 to 60 percent slopes	JRF	B	0.1
Laurelwood silt loam, 3 to 12 percent slopes	LuC	B	0.1
Laurelwood silt loam, 12 to 20 percent slopes	LuD	B	0.2
Nekia clay loam, 2 to 7 percent slopes	NcB	B	0.2
Nekia clay loam, 7 to 20 percent slopes	NcD	B	0.5
Panther silty clay loam, 4 to 20 percent slopes	PaD	D	0.0

Table 2-1. Soil Characteristics			
NRCS map unit name	NRCS map symbol	Hydrologic soil group	Percent coverage in UGB
Shale rock land	SH	D	0.0
Stony land	SL	A	0.3
Terrace escarpments	Te	C	6.0
Water	WATER	Water	0.0
Wapato silty clay loam	Wc	D	3.0
Willakenzie silty clay loam, 2 to 12 percent slopes	WeC	C	0.3
Willakenzie silty clay loam, 12 to 20 percent slopes	WeD	C	0.1
Willakenzie silty clay loam, 20 to 30 percent slopes	WeE	C	0.0
Willamette silt loam, 0 to 3 percent slopes	WIA	B	0.8
Willakenzie silty clay loam, moderately shallow, 7 to 20 percent slopes	WkD	C	0.1
Woodburn silt loam, 0 to 7 percent slopes	WuB	C	28.0
Woodburn silt loam, 7 to 12 percent slopes	WuC	C	2.6
Woodburn silt loam, 12 to 20 percent slopes	WuD	C	2.4

The soils listed in Table 2-1 are illustrated within the study area in Appendix E.

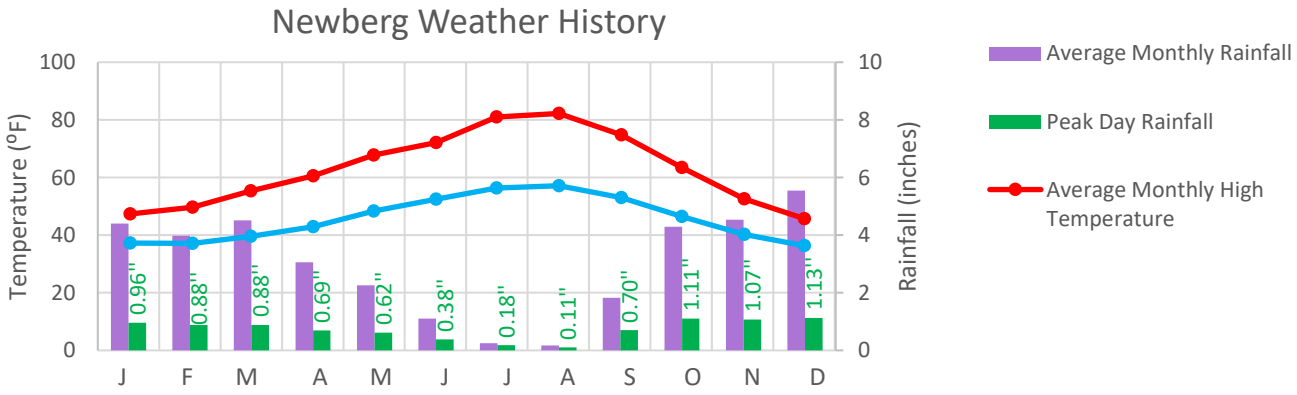
2.4 Land Use

According to Portland State University's Population Research Center, Newberg's population was 24,045 on July 1, 2019. The City's Comprehensive Plan projects significant population growth over the next several decades, with the 2030 population projection at 31,336 and the 2040 population projection at 36,709. The city is largely developed within the current UGB, but does have some significant remaining vacant areas in the northeast portion of the city. Currently land use includes a mix of residential land use and industrial and commercial corridor along Hwy 99W.

Figure 2-3 shows the land use coverage within Newberg and the UGB.

2.5 Climate and Rainfall

The north Willamette Valley experiences relatively warm, dry summers and mild wet winters. The Coast Range provides some shielding from Pacific Ocean storms. Most of the precipitation in this area falls



between the months of October and April; however, short, intense summertime storms contribute to the annual rainfall as well. The following recent climate data is based on City of Newberg recordings from 2010 to 2019.

For a longer historical record of the area, the Western Regional Climate Center presents the following historic records from 1928 to 2005 for nearby McMinnville, Oregon (station 355384). The normal daily high temperatures range from approximately 83 degrees in August to 46 degrees in January. Normal daily low temperatures range from approximately 50 degrees in July to 33 degrees in January. The average annual precipitation is approximately 41.8 inches with 6.7 inches of snowfall.

2.6 Drainage System

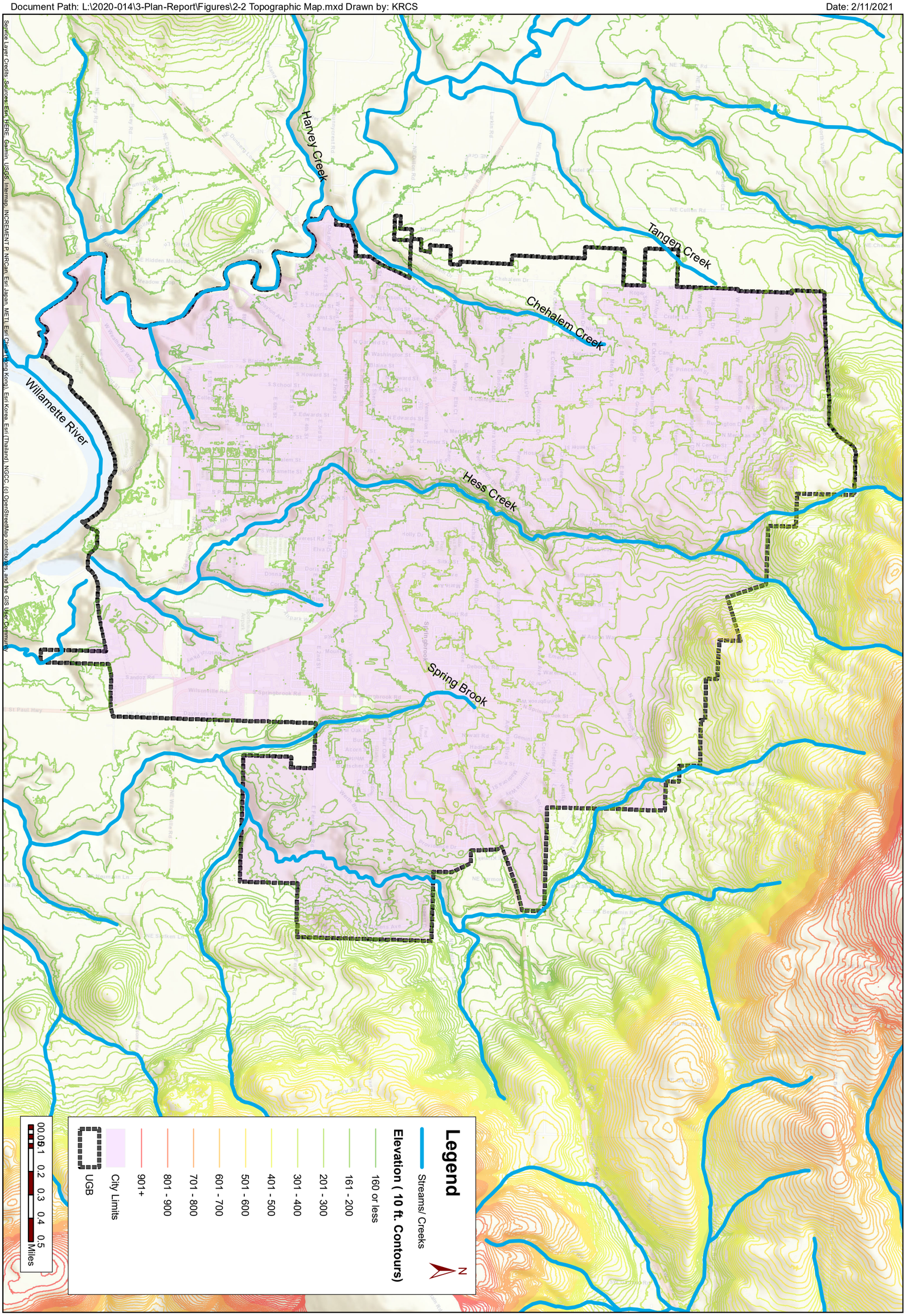
The city's drainage system is defined by the three creeks running from north to south through the city. From west to east, the creeks include Chehalem Creek, Hess Creek, and Spring Brook. All of the creeks flow into the Willamette River, which is one of the Columbia River's primary tributaries.

The City conveyance system contains approximately 77 miles of pipes and culverts, and 64 miles of open channels, creeks, and rivers.

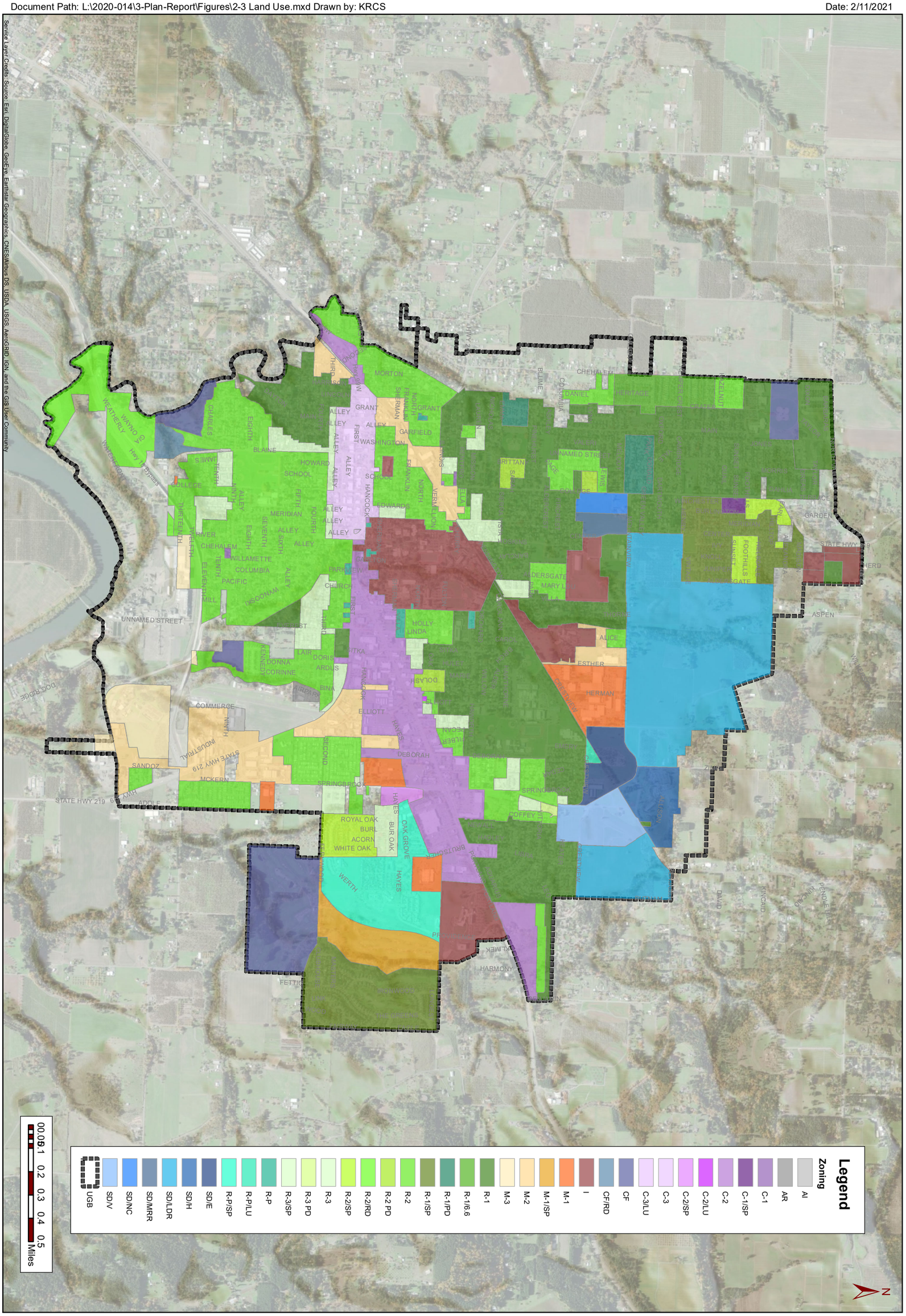
For the purposes of the modeling effort for this plan, subcatchments were delineated to capture drainage to City-owned 12-inch-diameter and larger storm drain piping and major open channel conveyances within the UGB. Inlet leads, pipes smaller than 12 inches in diameter, and pipes not owned by the City were generally not included in this effort.

Drainage areas for Hess Creek and Spring Brook were also delineated to capture the extent of their respective watersheds which extend beyond the UGB. The Hess Creek watershed extends north of the existing UGB to Mountain Top Road and is bound to the west by Chehalem Creek and to the east by Spring Brook. The drainage area for Spring Brook extends north of the existing UGB to Mountain Top Road and east of the UGB to NE Old Parrett Mountain Road and NE Kramien Road.

Figure 2-4 illustrates delineated subcatchments and the modeled pipe system on a citywide scale. More detailed mapping associated with system modeling is presented in Section 3.



HBH CONSULTING ENGINEERS	City of Newberg	Topographic Map	2020 City of Newberg Stormwater Master Plan	Figure 2-2



HBH CONSULTING ENGINEERS	City of Newberg	**Land Use**	**2020 City of Newberg Stormwater Master Plan**	Figure **2-3**

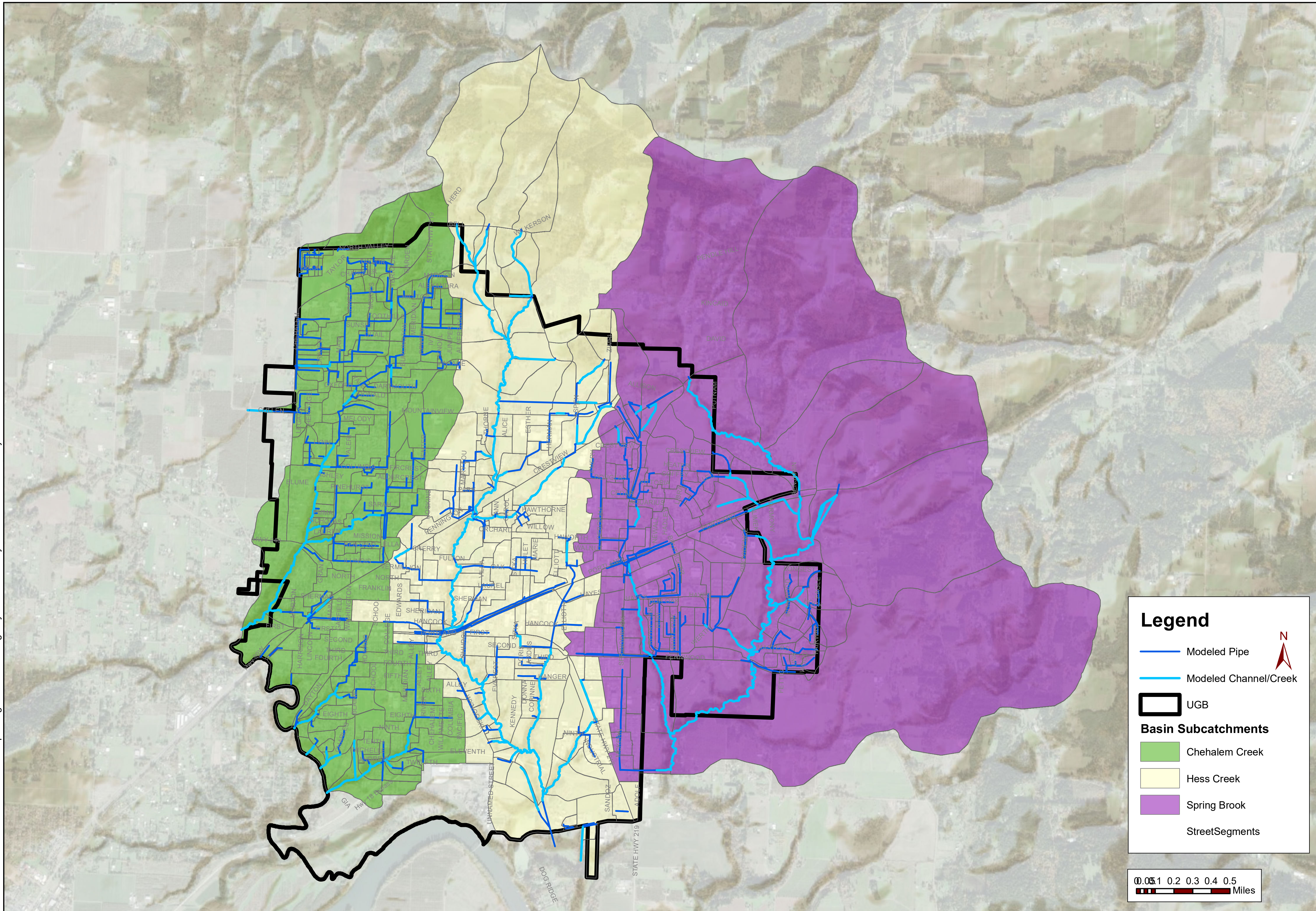


Figure 2-4

2020 City of Newberg Stormwater Master Plan

Drainage System and Study Area

City of Newberg

HBH CONSULTING ENGINEERS

Date: 2/11/2021

Document Path: L:\2020-01413-Plan-Report\Figures\2-4 Drainage System and Study Areamxd.mxd Drawn by: KRCS

Section 3

Stormwater System Capacity Evaluation

To identify flooding problems and need for Capital Improvement Program (CIP) projects, two primary methods of system evaluation were utilized. First, the City's public stormwater drainage system was evaluated using a hydrologic and hydraulic model to simulate the rainfall to runoff characteristics and route estimated flows through the City's conduits and channels. The stormwater drainage system was evaluated under both existing system and CIP scenarios. The CIP scenario assumes all of the Capital Improvement Program projects are completed, so the future system can be evaluated. This section provides a description of the modeling methods used for the system capacity evaluation and provides a summary of results.

The second method of system evaluation was to identify drainage capacity and other infrastructure problems through discussions with City staff and a review of existing reports that document potential problems. The compilation of additional problem areas is documented in Section 3.5.

3.1 Model Development

Computational Hydraulics International's PC SWMM, v. 7.2.2785, was the software used to model the City's storm system. PC SWMM provides a graphical interface for the U.S. Environmental Protection Agency (EPA) SWMM5 engine. The PC SWMM interface is integrated with Esri ArcGIS. Files transferred to the City will be in EPA SWMM5 format, which may be used by the City for internal modeling and future updates after the completion of this Stormwater Master Plan (Master Plan).

The model of the City's storm drain system includes most City-owned storm drainage pipes 12 inches and larger in diameter and major open-channel conveyances. Inlet leads, pipes smaller than 12 inches in diameter, and pipes not owned by the City were generally not included in this effort. System mapping completed for the model development is shown in Appendix A, which contains a key map at a 1" = 2,000' scale and seven full size system maps at a 1" = 500' scale.

The storm system model also includes limited channel modeling for the east branch of Chehalem Creek, Hess Creek and two branches of Spring Brook. This was not updated as part of the 2020 SWMP. A Yamhill County Flood Study was developed in 1980 and includes models of Chehalem Creek and Hess Creek. However, as urbanization has significantly changed the creek systems since the development of these earlier models, current channel information was estimated from more recent LIDAR topographic information and verified through limited field work as part of the 2014 master plan update. Culvert and bridge data were incorporated from the City's geographic information system (GIS) and as-built maps.

Model development requires input of meteorological data, subcatchment hydrology, and surface water system hydraulic input parameters. Precipitation data, as design storms, were used to evaluate system capacity. Input parameters associated with subcatchment hydrology and surface water system hydraulics were developed through use of the City's GIS data. Gaps in City GIS data were filled using data from City field verifications in the 2014 Stormwater Master Plan.

3.1.1 Horizontal and Vertical Datum

All reported elevations and coordinates in this study are measured in feet and use the NAVD88 and the North American Datum of 1983 (NAD83) state plane coordinate system, respectively.

A section of the City's storm-drain system GIS data were on the National Geodetic Vertical Datum of 1929 (NGVD29) prior to the 2013 update and were converted to NAVD88. The conversion from NAVD88 to NGVD29 is to subtract 3.415 feet. All elevations in this plan and analysis are believed to be in NAVD88, but other City records, such as older as-built drawings, may show different elevations on other datums.

3.1.2 Design Storms

Traditional design storms are synthetic rainfall events used to evaluate the capacity of storm drainage systems and design capital improvements for the desired level of capacity and flood protection.

Design storms evaluated for this study included the 2-year, 10-year, 25-year, and 50-year 24-hour duration design storms.

The rainfall depths for these design storms were based on isopluvial maps published in the NOAA Atlas 2, Volume X. The rainfall distribution for these design storms is based on the Soil and Conservation Service (SCS) 24-hour, Type IA distribution, which is applicable to western Oregon, Washington, and northwestern California. Table 3-1 lists the precipitation depths for each design storm used in the model.

Table 3-1. Design Storm Depths

Design storm event	Rainfall depth, inches
2-year, 24-hour	2.5
10-year, 24-hour	3.5
25-year, 24-hour	4.0
50-year, 24-hour	4.2

3.1.3 System Nomenclature

This master planning effort incorporated the same nomenclature as the City's GIS for all the different elements all the stormwater system. Most of the manholes in the system are labeled STMH followed by an identifier number. Most of the pipes within the system are identified with STGM followed by a unique number. For the modeling effort additional identifiers were created for the modeled creek system and to provide additional detail to the pipe system. Open channel reaches on the three main creeks were labeled with CC, HC, or SB followed by a number. These labels represent Chehalem Creek, Hess Creek and Spring Brook, respectively. Numbering was started at the lower reaches and numbers increased in the upstream direction. Tributaries were named CCT1 (Chehalem Creek Tributary 1) followed by a number. Additional nodes were included in the model as breaking points between reaches, at slope changes, and where manholes were discovered that were not part of the GIS inventory. These additional nodes were labeled with a J followed by a number.

Subcatchments or drainage basins were developed and each subcatchment was named according to the name of the drainage element that the subcatchment drained into. For example, the runoff from subcatchment SC_STMG128 would enter the system STMG128. The key map in Appendix A illustrates the

location of the modeled elements within the study area. Detailed maps which include the location of the modeled elements, named subcatchments, and inlet nodes are also located in Appendix A.

3.1.4 Hydrologic Data

This section includes a summary of subcatchment delineations and model input parameters used to define the hydrologic characteristics of the subcatchments. Table 3-2 identifies and describes model attributes associated with subcatchments as utilized by the previous consultant.

Table 3-2. Subcatchment Model Attributes

Attribute	Value
Name/Outlet	Identified by the storm drain element that has been identified according to the subcatchment inlet node
Area	Area of the subcatchment in acres
Width	Characteristic width of the overland flow path for sheet flow in feet
Slope	Average percent slope of the subcatchment
Imperv	Average percent of land area that is directly connected impervious area
Nimperv	Manning's *n* for overland flow over the impervious portion of the subcatchment (default value = 0.015)
Nperv	Manning's *n* for overland flow over the pervious portion of the subcatchment (default value = 0.030)
Dstore-Imperv	Depth of depression storage on the impervious portion of the subcatchment (default value = 0.05)
Dstore-Perv	Depth of depression storage on the pervious portion of the subcatchment (default value = 0.2)
ZeroImperv	Percent of the impervious area with no depression storage (default value = 25)
Routing	Runoff from pervious and impervious areas routes to a node within the storm drain system (value=OUTLET)
PctRouted	Percent runoff routed between subcatchments (default = 100)
Groundwater	Groundwater routing is not included (value=NO)
CurveNo	SCS pervious curve number calculated as an area-weighted average, based on the hydrologic soil group within each subcatchment

The curve number method was used to model runoff characteristics. PC SWMM utilizes a pervious curve number to calculate the infiltration for each sub-catchment. This method is documented in the U.S. EPA *Technical Release 55*.

The pervious curve number is based on the underlying soil type, as shown in Table 3-3.

Table 3-3. Pervious Curve Numbers

Land Use	Hydrologic Soil Group (HSG)			
	A	B	C	D
Impervious	98	98	98	98
Open space/grass	39	61	74	80

For the existing conditions model, the percentage of impervious surface was estimated using the City's impervious surface and tax lot layers in GIS and spot-checking with aerial imagery by the previous

consultant. There were some manual edits made as part of the 2020 master plan based on looking at aerial photographs for areas where flooding appeared excessive based on land use. For the CIP model, the percent impervious assumed to remain the same as the updated existing model, since new development is required to have post-development runoff not exceed pre-development runoff when impervious area is increased by 500 sq. ft.

Appendix B, Table B-1, provides model parameters and peak flows for each subcatchment and modeled design storm. Table B-2, provides model parameters and runoff volumes for each subcatchment and modeled design storm.

3.1.5 Hydraulic Data

This section describes the model input parameters used to characterize the hydraulic characteristics of the system.

System hydraulics were based on GIS data provided by the City and the model created in the 2014 update. No information in the existing model was verified as part of this project. Where needed, model data were supplemented with GIS data, as-built information, and maps provided by the City, aerial imagery, and LIDAR/Google Earth topographic information. The City collected field survey data to validate invert and rim elevations and system geometry as part of the 2014 Master Plan process. Hydraulic components developed from these data and imported into the model included conduits and junctions. A description of hydraulic components is provided in the following sections.

3.1.5.1 Nodes

Model nodes include storm drain utility manholes, catch basins, and other relevant connection points or locations where a conduit change occurs. Model nodes have the attributes as listed in Table 3-4.

Table 3-4. Model Node Attributes

Attribute	Value
ID	Unique identifier
Invert elevation	Invert elevation of the node in feet.
Depth	Depth (feet) = Rim elevation – invert elevation.
Ponded area	Area available for ponding of water atop of the node after flooding occurs in square feet. Allows ponded water to be stored and subsequently returned to the drainage system when capacity exists.

Appendix B, Table B-2, provides model parameters and peak flows for each modeled node.

3.1.5.2 Conduits

Model conduits include pipes, culverts, and open channels. Model conduits have the model attributes as shown in Table 3-5.

Table 3-5. Model Conduit Attributes	
Attribute	**Value**
ID	GIS Unique ID (when available)
Length	Length between upstream and downstream junctions in feet
Roughness	Manning's Roughness Coefficient: • Concrete Pipe: 0.013 • Corrugated Metal Pipe: 0.024 • Ductile Iron (DI): 0.013 • HDPE: 0.0125 • PVC: 0.0125 • Unknown: 0.013 • Open channel: 0.04 – 0.10
Cross-Section	Circular, trapezoidal, or irregular
Inlet Elevation	Elevation of conduit inlet in feet
Outlet Elevation	Elevation of conduit outlet in feet
Geom1	• Circular: diameter in feet • Trapezoidal: max depth in feet
Geom2	Trapezoidal: bottom width in feet
Geom3	Trapezoidal: left slope (horizontal/vertical)
Geom4	Trapezoidal: right slope (horizontal/vertical)
Barrels	One for single pipe, two or more for parallel pipes

Table B-2 in Appendix B provides model parameters, 25-year recurrence interval peak flows, and the calculated hydraulic capacity for each modeled conduit.

3.1.5.3 Storage

No storage facilities were included in the 2014 model, but a few simplified conservative storage nodes were added to the current model that were in between pipes that needed to be modeled. Futures updates of this plan should add details to these an all other storage facilities in the City to add accuracy to the model.

3.1.5.4 Outfalls

The study area includes 16 piped outfalls. Model outfalls have the attributes shown in Table 3-6.

Table 3-6. Outfall Model Attributes	
Attribute	**Value**
Name	Unique identifier
Invert elevation	Invert elevation of the outfall in feet
Rim elevation	Ground surface elevation at the outfall in feet
Type	Type of outfall boundary condition; options used include: • FREE: Outfall stage is determined by minimum of critical flow depth and normal flow depth in the connecting conduit. • FIXED: Outfall stage is set to a fixed value equal to the top of the outfall pipe; this condition was selected for system evaluation and CIP sizing in systems draining to Chehalem Creek, Hess Creek, and Spring Brook.

3.2 Evaluation Criteria

Section 4 of the City's 2015 Public Works Design and Construction Standards includes design requirements for storm drainage systems in Newberg. At the time of the current SWMM model updates, the City is using the *2015 Newberg's Public Works Design & Construction Standards*, so that manual was referenced for establishing the design standards for evaluating the capacity of the stormwater infrastructure. The existing and CIP storm drainage pipe network was evaluated for capacity based on the 25-year design storm event.

For the purpose of evaluating the capacity of the existing and CIP storm drainage infrastructure, flooding was defined as any surcharge over the rim elevation of a manhole or above the bank elevation of open channels. Minor flooding is defined as flooding that occurs for less than 2-hours during the peak 24-hour design storm. Major flooding is defined as flooding that occurs for more than 2-hours during the peak 24-hour design storm.

Since the 2014 SWMP update, the City has updated the Stormwater Design Standards. The new standards include a change to using the 25-year, 24-hour design storm for sizing stormwater pipes conveying water from drainage areas less than 250 acres in size. The previous plan evaluated the 10-year design storm for the model evaluation, but the capital improvement projects (CIPs) were designed to convey the 25-year design storm. This change in evaluation criteria standardizes Newberg's evaluation criteria with most other communities in the region. Although it will show a larger number of problem areas than were shown in the previous plan, it should be understood that there are likely not many more problems in the City than existed before, just a stricter view of what is a problem area. This allows for better prioritization of all projects.

3.3 Model Validation

Preliminary modeling results were reviewed with City staff during a meeting with the previous consultant in November 2013 and compared to known flooding problems reported by the City's maintenance crews. Anecdotal accounts of flooding were generally consistent with the locations where flooding occurs in the modeled system. In some cases, City staff report flooding problems due to sediment build-up or other field conditions (e.g. a grading problem that prevents adequate collection of runoff into the stormwater system) that are not reflected in the hydraulic model. These problems were documented for CIP development, but did not require a change in the hydraulic model.

Discussions with City staff lead to several minor adjustments to the modeled drainage system. Most notably, maintenance staff identified locations between Oxford Street and Meadowview Drive, where maintenance crews had addressed flooding problems through field adjustments to the drainage system that had not yet been documented in the City's GIS database. The model was revalidated with maintenance staff in September 2020. Adjustments were made as necessary. After adjusting the modeled system to reflect field conditions, the model validation was complete.

Flow monitoring was not possible due to the timing of this project and when large storms occur in Newberg. It is recommended that future updates include flow monitoring and model calibration.

3.4 Model Results

PC SWMM (version 7.2.2785) was used to simulate the 2-year, 10-year, 25-year, and 50-year design storms for the current and CIP conditions.

Results of the hydrologic/hydraulic (H/H) model simulations are tabulated in Appendix B (Table B-1 for hydrologic peak flow results and Table B-2 for hydraulic results). For reporting purposes, the hydrologic

results reflect all simulated design storms, and the hydraulic results tables reflect just the 25-year flows, which were used to identify capacity deficiencies in most areas of the City. Hydraulic results for other storm events are available in the electronic project files.

The hydrologic results table (Table B-1) is sorted by basin and subcatchment, and includes the subcatchment name, modeled inlet node ID, subcatchment area, curve number, impervious area, and associated design flow. The hydraulic results table (Table B-2) is sorted by system basin and conduit, and includes the conduit name, upstream and downstream node ID, length, size, invert and rim elevations, and existing and CIP 25-year peak flows and water surface elevations.

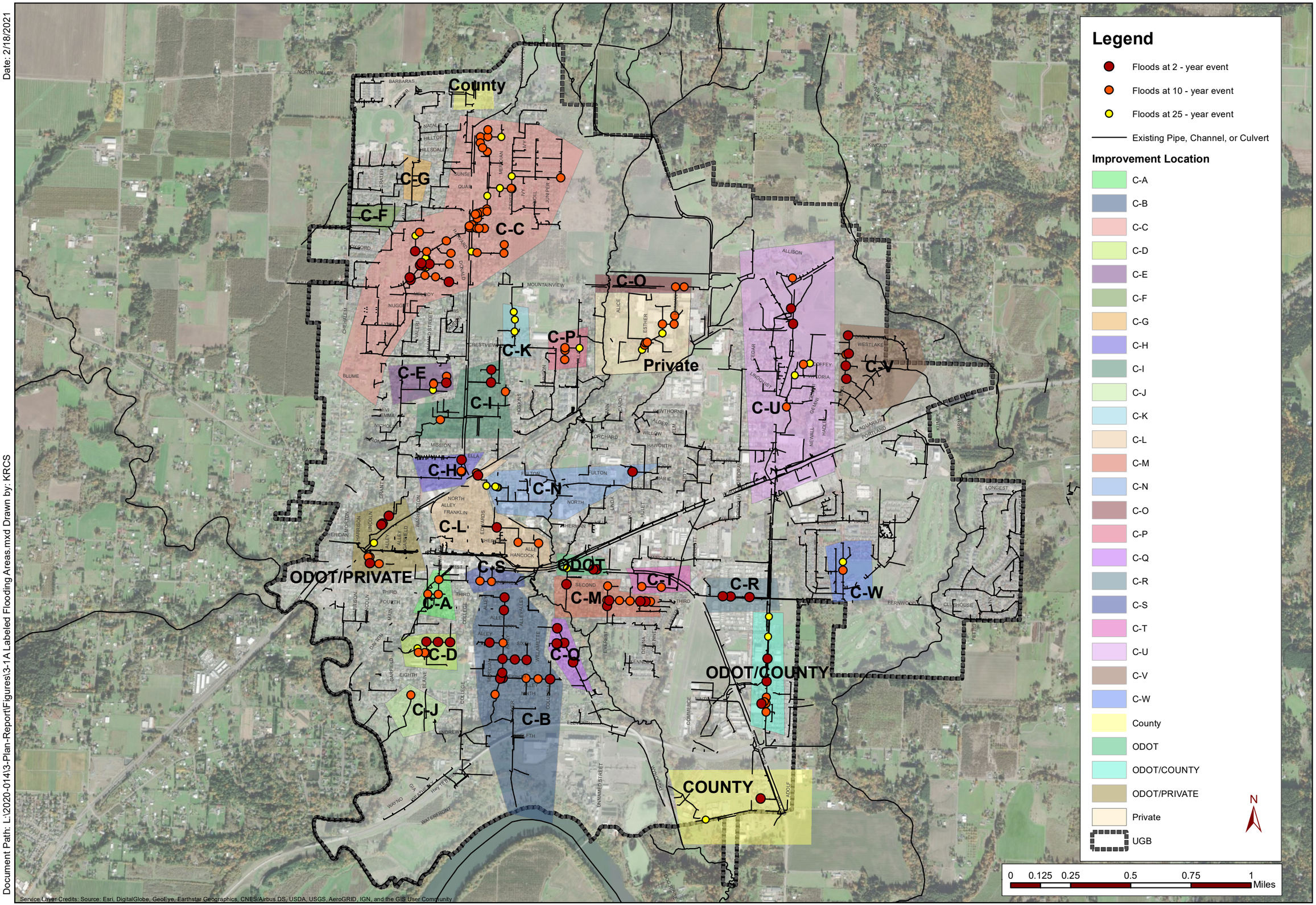
3.4.1 Initial Identification of Flooding Problems

Based on the hydraulic model results summarized in Table B-2, conduits experiencing backwater conditions that resulted in flooding of the upstream manhole were identified. Figures 3-1 and 3-2 illustrate predicted flooding.

The model results were reviewed with City staff in September and November 2020. City staff provided comment and discussion about each identified modeled flooding area. Table 3-7 summarizes the identified flooding problem areas.

Date: 2/18/2021

Document Path: L:\2020-01413-Plan-Report\Figures\3-1A Labeled Flooding Areas.mxd Drawn by: KRCS



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 3-1

2020 City of Newberg Stormwater Master Plan

Model Capacity Problem Areas

City of Newberg

HBH CONSULTING ENGINEERS

Date: 2/18/2021

Drawn by: KRCS

Document Path: L:\2020-014\3-Plan-Report\Figures\3-2 Hours Flooding at 25-year Event.mxd

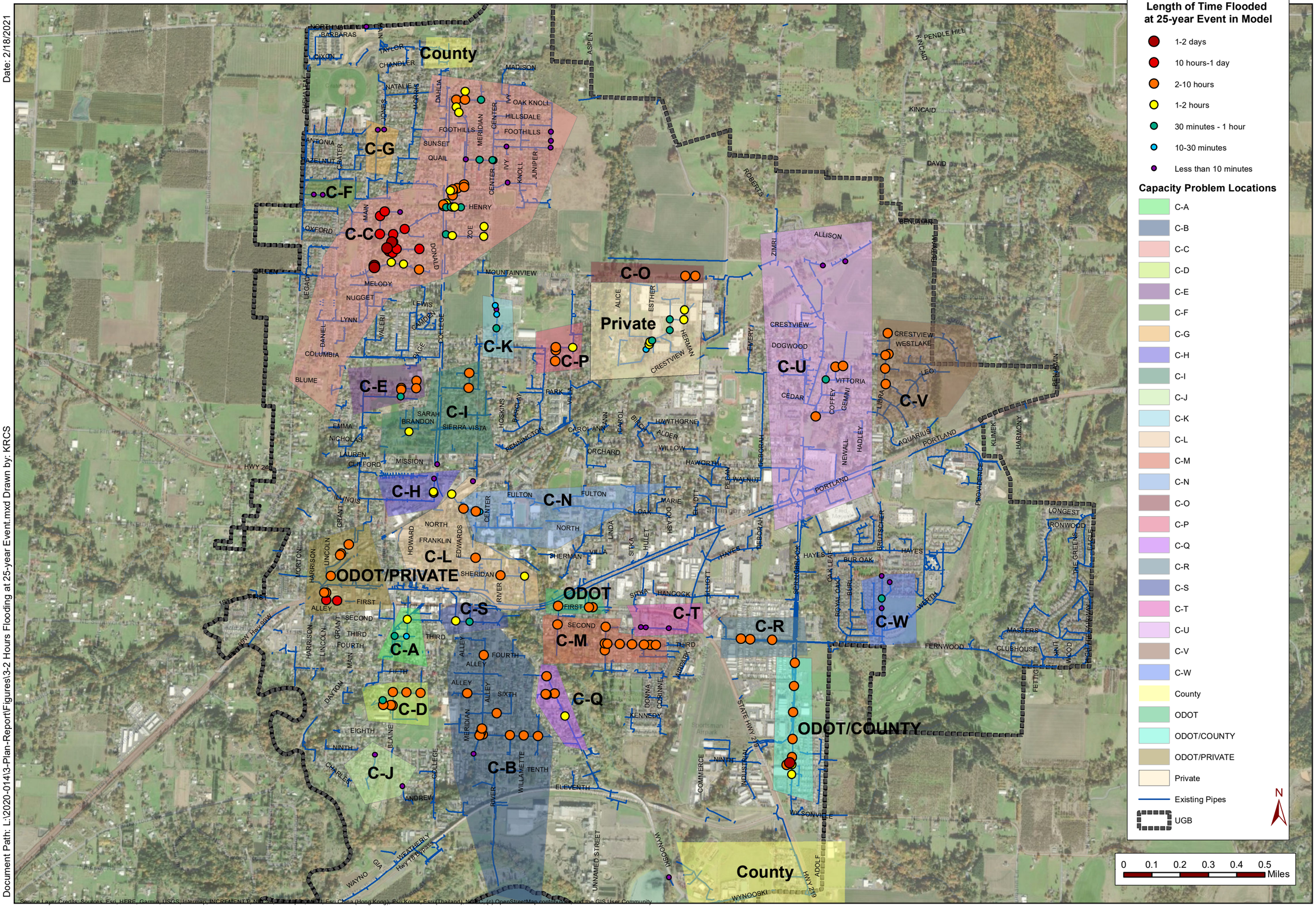


Figure 3-2

2020 City of Newberg Stormwater Master Plan

Hours Flooding in Model at 25-year Event

City of Newberg

HBH CONSULTING ENGINEERS

Table 3-7. Flooding Problem Areas from Model						
Problem Area	Location	Event(s) deficiency occurs	Problem description	Potential solution	Length of conveyance improvements, linear feet	Contributing drainage area, acres
	Chehalem Creek					
C-A	South Blaine Street, between East 6th Street and East 7th St.	2-yr	This area was partially upgraded through a recent project, but more is needed.	Upsize existing stormwater pipes to 21" and 18" to convey flows.	1,035	39
C-B	South Center Street, between East 3rd Street and East 9th Street	2-yr	Currently a reach of 21" stormwater pipe runs through private property and under several houses. This is undersized and causes flooding along E 8th St, E 7th St, and S Center St. There are other undersized pipes in Center St.	In conjunction with the proposed River St. transportation improvements, divert extra flows from Center St. over to new lines in River St. to 8th street. From there are a few options for routing, Option A was selected for the master plan, but any of them would work if those roads are more feasible or being rehabbed sooner. A-continue to route down River St. to the River. B-Route down 9th St. to College St. to Chehalem Creek C-Route down 8th St. to Wynooski St. to Hess Creek	6,049	100
C-C	Oxford Street, between Winchester Drive and East Mountainview Drive	2-yr	Flow is currently restricted by fourteen undersized pipes. Pipe diameters increase and decrease in numerous places throughout this alignment. The City has installed some upsized pipes to address acute problems. This project provides a broader solution.	Upsize existing stormwater pipes to 18", 36" & 48" to provide capacity for flows.	958	166
C-D	6th & Blain St.	2-yr	Flow is currently restricted by six undersized pipes.	Upsize existing stormwater pipes to 15" & 18" to convey flows. Move pipes into the public right-of-way.	1,253	25
C-E	Pinehurst Dr.	2-yr	Flow is currently restricted by six undersized pipes.	Upsize existing stormwater pipes to 15" &18" to convey flows. Move pipes into the public right-of-way.	1,386	13
C-F	Crater Ln.	25-yr	Flow is backing up at a culvert and causing flooding upstream.	Upsize existing culvert to 24" to convey flows.	28	142
C-G	Partridge Ln.	25-yr	Flow is currently restricted by an undersized pipe.	Upsize existing stormwater pipes to 24" to convey flows.	223	30
C-H	Illinois St.	10-yr	Flow is currently restricted by two undersized pipes.	Upsize existing stormwater pipes to 18" to convey flows.	498	2
C-I	Ditch & Pinehurst Dr.	2-yr	Flow is currently restricted by two undersized pipes.	Upsize existing stormwater pipes to 24"&36" to convey flows.	693	136
C-J	Charles St.	10-yr	Flow is currently restricted by an undersized pipe.	Upsize existing stormwater pipes to 15" to convey flows.	171	12
C-K	Center St.	25-yr	Flow is currently restricted by two undersized pipes.	Upsize existing stormwater pipes to 30" to convey flows.	302	58
	Hess Creek					
C-L	N Edwards Street, from Vermillion Street to E Sheridan Street	2-yr	The City has reported drainage problems along Vermillion St between N College St and the railroad. Currently a flat and undersized pipe discharges stormwater along the railroad tracks. This neighborhood does not have a defined connection to the public stormwater system.	Add a drainage system to convey flows from Vermillion St to the existing drainage system at E Sheridan St. Increase existing pipes to 12", 18" & 24" to convey flows.	4,493	19
C-M	E 3rd and S Church Streets	2-yr	Modeling shows flooding problems along E 3rd St and S Church.	Add a 18" stormwater pipe to connect the stormwater system from E 3rd St to S Church St to provide conveyance and storage. Upsize existing stormwater pipes to 15"-18", as estimated by modeling. Divert some flow down Doris Dr.	2,448	41
C-N	Various, see map	2-yr	Flow is currently restricted by ten undersized pipes.	Upsize existing stormwater pipes to 18" & 24" to convey flows. Some pipes need to be replaced due to material.	1,891	25
C-O	Mountainview Dr.	10-yr	Flow is currently restricted by private undersized private pipes and backs up onto City-owned streets.	Divert flows away from private property through new pipe along Mountain View Dr. to Hess Creek.	1,455	78
C-P	Crestview Dr. and Villa Rd.	10-yr	Flow is currently restricted by three undersized pipes.	Upsize existing stormwater pipes to 15" to convey flows.	573	29
C-Q	Wynooski St. 5th to Merlin	2-yr	Flow is currently restricted by three undersized pipes.	Upsize existing stormwater pipes to 15" & 18" to convey flows.	1,251	21
C-R	E 2nd St.	2-yr	Flow is currently restricted by several undersized pipes.	Add two additional pipes to change the direction of flow.	113	11
C-S	E 2nd St.	10-yr	Flow is currently restricted by an undersized pipe.	Upsize existing stormwater pipes to 15" to convey flows.	526	6
C-T	E 2nd St.H-1	10-yr	Flow is currently restricted by two undersized pipes.	Upsize existing stormwater pipes to 18" to convey flows.	775	14
	Spring Brook					
C-U	North Springbrook Road, north of Highway (Hwy) 99W	2-yr	Modeling shows flooding problems along N Springbrook Rd . The upstream stormwater system along N Springbrook Rd was upgraded during installation of traffic improvements, but flows are constricted from a 30" pipe down to an 8"-12" section of pipe near Middlebrook Dr.	Upsize the stormwater pipes along N Springbrook Rd to 30" diameter and connect the system to the existing system to the south. This includes spur lines that are undersized and three new pipes. Divert flows away from channel to Springbrook Rd.	2,855	173
C-V	Libra Street and Victoria Way	2-yr	Modeling shows flooding problems along Libra St during the current and future conditions 10-year storm event. This system needs frequent maintenance to address silt accumulation.	Install pipes along Crestview Dr. and Coffee Dr. to divert flows away from flooding locations.	957	33
C-W	Brutscher St.	10-yr	Flow is currently restricted by an undersized pipe.	Upsize existing stormwater pipes to 18" to convey flows.	260	19

3.5 Reported Problem Areas

In addition to reviewing simulated problem areas identified through hydraulic modeling, other locations of drainage concerns were identified through the following methods:

- Maintenance Problem Map – During the Master Plan background information gathering period, maintenance and engineering staff developed a map of known problem areas throughout the City. Known problem areas include some of the capacity problems predicted through modeling and also problems that are the result of challenging maintenance conditions (i.e. areas with frequent need of leaf or sediment removal). The maintenance problem map also includes some locations where the piped stormwater system is located beneath private buildings. Relocating these pipes to public right-of-way is a high priority for the City.
- Citizen Report – City staff maintain records of drainage problems reported by citizen. The majority of the complaints are resolved through responsive maintenance visits to alleviate a blockage in the drainage network. Occasionally, a reported problem is indicative of a larger problem that needs to be addressed through infrastructure changes. During the master planning period one citizen report was included in the overall problem area list, and another's concern was also discovered by the model as a major problem area.
- 2001 & 2014 Master Plans – the City's initial Stormwater Master Plan was completed in 2001, and identifying 50 locations for potential stormwater capacity improvements and the most recent update in 2014 which provided an updated list of capital improvement projects. Since 2001, many of the project areas have been addressed through capital projects or resolved through other means, such as adjusted maintenance procedures or through reconstruction of the drainage system along Hwy 99W. Other projects are no longer required, as development patterns (and therefore flow rates) have shifted from what was assumed in the previous modeling. A detailed review of the 2001 Master Plan identified three remaining project areas that should be considered for inclusion in this Master Plan, and several areas from the 2014 Master Plan.

Table 3-8 includes a compilation of reported problem areas, sorted and numbered by drainage basin. These are all maintenance issues and not capacity related. In several cases, the same problem was reported by multiple sources. These overlaps are noted. The reported problem area locations are shown in Figure 3-5.

Table 3-8. Reported Problem Areas

Identifier	Location	Problem description	Frequency/ duration	Source of information	Drainage basin	Model in this area	Notes
F-1	College Street north of railroad tracks	Inadequate storm system in LID; Roadside drainage ditches overtop and flood neighboring properties.		2014 SWMP: City - engineering map City - photos during flood event	Chehalem	Model shows minor (<2 hour) flooding in 10-year event.	
F-2	Columbia and Kemper Crest	Street and intersection water backs up from ditch in county.	heavy rainfall	2014 SWMP: maintenance questionnaire	Chehalem		
F-3	Columbia and Kemper Crest	Road and ditches flood	every rainfall	2014 SWMP: maintenance questionnaire	Chehalem		Needs debris removal on downstream farm property.
F-4	1st and Harrison Streets	Flooding in front of Subway.	every rainfall	2014 SWMP: maintenance questionnaire	Chehalem		No storm drain in this area?
F-5	2nd and Main Streets	Street floods at Naps Thriftway parking lot driveway on 2nd Street.	heavy rainfall	2014 SWMP: maintenance questionnaire	Chehalem		No mapped drainage system in this area.
F-6	9th and River Streets, southeast Corner	Roadway floods 10-12' radius around catch basin.	heavy rainfall	2014 SWMP: maintenance questionnaire	Chehalem		Suggestion to move catch basin and raise the corner bubbler, near, but not connected to, DP-C-4.
F-7	Dayton Avenue near Johanna Court	Roadway drainage flows into driveways and causes minor damage of driveways and sidewalk. Report confirmed by maintenance staff.	1-2 times/year	2014 SWMP: citizen e-mail report	Chehalem		No drainage system in this area. Possible green street solution in existing planter strips.
F-8	College and Vermillion Streets	Intersection ponding	every rainfall	2014 SWMP: maintenance questionnaire	Hess		Recommends repaving.
F-9	College and Vermillion Streets	Gravel street area floods.	heavy rainfall	2014 SWMP: maintenance questionnaire	Hess		
F-10	Hess Creek at Hoover Park	Flooding during January 2012 storm event.		2014 SWMP: City - photos during storm event	Hess		Is Hoover Park part of the floodplain?
F-11	Hoover Park	Trash, beaver dams, and people place debris in creek to slow the flow.	every rainfall	2014 SWMP: maintenance questionnaire	Hess		Needs frequent maintenance and public education regarding Hoover Park's natural floodplain.
F-12	College and Franklin Streets	Intersection ponding	every rainfall	2014 SWMP: maintenance questionnaire	Hess		Recommends repaving; no mapped drainage system at this intersection.
F-13	College and Sherman Streets	Bubbler backs up	heavy rainfall	2014 SWMP: maintenance questionnaire	Hess		No mapped drainage system at this intersection
F-14	Haworth Avenue between Elliot and Pecan Streets (near high school)	Flooding during January 2012 storm event. Flooding on/off of private property; standing water on roadway and onto school grounds.		2014 SWMP: City - photos during storm event	Spring Brook		Construction near high school has resolved Haworth drainage problems. No recent flooding observed.
F-15	Haworth Avenue between Elliot and Pecan Streets (near high school)	Flooding during January 2012 storm event. Flooding on/off of private property; standing water on roadway and onto school grounds.		2014 SWMP: City - photos during storm event	Spring Brook		Construction near high school has resolved Haworth drainage problems. No recent flooding observed.
F-16	Springbrook Road near 2nd Street	Flooding during January 2012 storm event.		2014 SWMP: City - photos during storm event	Spring Brook		Oregon Department of Transportation bypass project to replace Springbrook Road drainage system.
F-17	Spring Brook at Golf Course	Flooding during January 2012 storm event.		2014 SWMP: City - photos during storm event	Spring Brook		Is the golf course part of the floodplain?
F-18	Myrtlewood Dr.	surcharging		Cartegraph	Chahelem		stiF08014
F-19	Myrtlewood Dr.	surcharging		Cartegraph	Chahelem		stiF08017
F-20	Myrtlewood Dr.	Flooding complaint, install trash rack		Cartegraph	Chahelem		stiF12099
M-R-1	Douglas Ave.	Replace		Cartegraph	Spring Brook		stmg1206
M-R-2	Vermillion Street between College Street and railroad tracks	Undersized and flat pipe discharges to tracks with no fall. (Note: GIS data do not show a pipe in this area.)		2014 SWMP: City - engineering map	Hess	Model shows 10-year flooding in adjacent system.	Most commonly reported problem; also reported on crew surveys. Maintenance suggestion to repave at College and Vermillion Streets, stgm4578
M-R-3	College Street and Sheridan Street	Bored through		Cartegraph	Chehalem		stgm2048

Table 3-8. Reported Problem Areas

Identifier	Location	Problem description	Frequency/ duration	Source of information	Drainage basin	Model in this area	Notes
M-R-4	Between 1st and 2nd Streets at Howard Street	Storm drain pipe is under commercial building.	n/a	2014 SWMP: City - engineering map	Chehalem		
M-R-5	Fourth St. & Meridian St.	Replace		Cartegraph	Hess		stgm0750
M-R-6	Ninth St. and Charles St.	Replace		Cartegraph	Chehalem		stgm4095
M-R-7	Between 8th and 9th Streets near Center Street	Flat sloped pipe runs under house on private property; needs to be rerouted.		2014 SWMP: City - engineering map	Chehalem	Model shows 10-year flooding upstream of problem pipe.	
M-R-8	S River Street and 11th Court	Two clay sewer tile pipe segments are deteriorating, and require replacement. Replacement should be sized to convey flows.	n/a	2014 SWMP: Master Plan	Chehalem		City staff confirmed this problem needs attention. stmg3369
M-R-9	Natural system crossing College Street, south of Andrew Street	Steep ravine; multiple pipe materials; potential to collapse and fail.		2014 SWMP: City - engineering map	Chehalem		Field visit needed?
M-R-9	College Street south of Andrew Street	Existing pipe system under College Street is composed of multiple pipe materials, causing ongoing maintenance problems and concerns over long-term stability.	n/a	2014 SWMP: 2001 Master Plan	Chehalem		City staff confirmed this problem needs attention.
M-R-10	Inlet at Mountainview Park (mobile home village)	Debris gets trapped against grate.		2014 SWMP: maintenance questionnaire	Spring Brook		Clean upstream - owned by Parks and Rec, stil11034
M-R-11	N College St @ Second St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG12042
M-R-12	Third St. @ Chehalem St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG1208
M-R-13	Antonia Way	Bored through		Cartegraph	Chehalem		stmF07006
M-R-14	Center St. @ 8th St.	doesn't meet standard		Cartegraph	Hess		stiG131
M-R-15	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG135
M-R-16	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG136
M-R-17	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13064
M-R-18	S Meridian St.	doesn't meet standard		Cartegraph	Hess		stiG13078
M-R-19	S Center St.	ADA issue		Cartegraph	Hess		stiG13018
M-R-20	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13017
M-R-21	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13076
M-R-22	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13015
M-R-23	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13088
M-R-24	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13012
M-R-25	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13063
M-R-26	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13033
M-R-27	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13032

Table 3-8. Reported Problem Areas

Identifier	Location	Problem description	Frequency/ duration	Source of information	Drainage basin	Model in this area	Notes
M-R-28	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13034
M-R-29	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13036
M-R-30	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13037
M-R-31	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiH13003
M-R-32	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiH13005
M-R-33	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiH13004
M-R-34	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13044
M-R-35	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13045
M-R-36	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13042
M-R-37	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13043
M-R-38	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13061
M-R-39	Round Catch Basins between 6th St., Wynooski St., S Meridian St., and 10th St.	Round Catch Basin that doesn't drain well, needs to be replaced with modern design		Cartegraph	Hess		stiG13060
M-R-13	Antonia Way	Bored through		Cartegraph	Chehalem		stmF07006
M-R-40	E Sheridan St.	Replace and increase size			Hess		stoG120006
M-SH-1	Hemlock Ln	Sink hole		Cartegraph	Hess		stiG10011
M-MN-1	Aldersgate Dr.& Sunset Dr.	roots		Cartegraph	Hess		stgm3561, stgm2883
M-MN-2	Cedar St.	plugged		Cartegraph	Spring Brook		stgm2452
M-MN-3	Eight St. & Pacific	roots		Cartegraph	Hess		stgm2208
M-MN-4	W Fifth St.	needs inlet marked		Cartegraph	Chehalem		stiF1210040
M-MN-5	Highway 99	clean		Cartegraph	Hess		stiH12102
M-MN-6	E Second St.	debris on grate		Cartegraph	Hess		stiI12050
M-MN-7	Creek downstream of Kemper Crest Drive	Downstream creek discharge blocked; causes Kemper Crest to back up.		2014 SWMP: City - engineering map	Chehalem	Model shows 10-year flooding around existing pond.	Also reported on crew surveys. stiI1247
M-MN-8	E Fernwood Dr.	Beaver Dam		Cartegraph	Spring Brook		stiJ12081
M-MN-9	E 2nd. Street	Debris on grate		Cartegraph	Spring Brook		stiI12051
M-SR-1	Solstice Ln.	Bored Through		Cartegraph	Chehalem		stgm3738
M-SR-2	N Meridian St.	Bored Through		Cartegraph	Chehalem		stgm2596, stgm4457
M-SR-3	Cedar St.	Bored Through		Cartegraph	Spring Brook		stgm1924
M-SR-4	Redwood Ct.	Reline the pipe or use root guard		Cartegraph	Chehalem		stgm0122, stgm2667

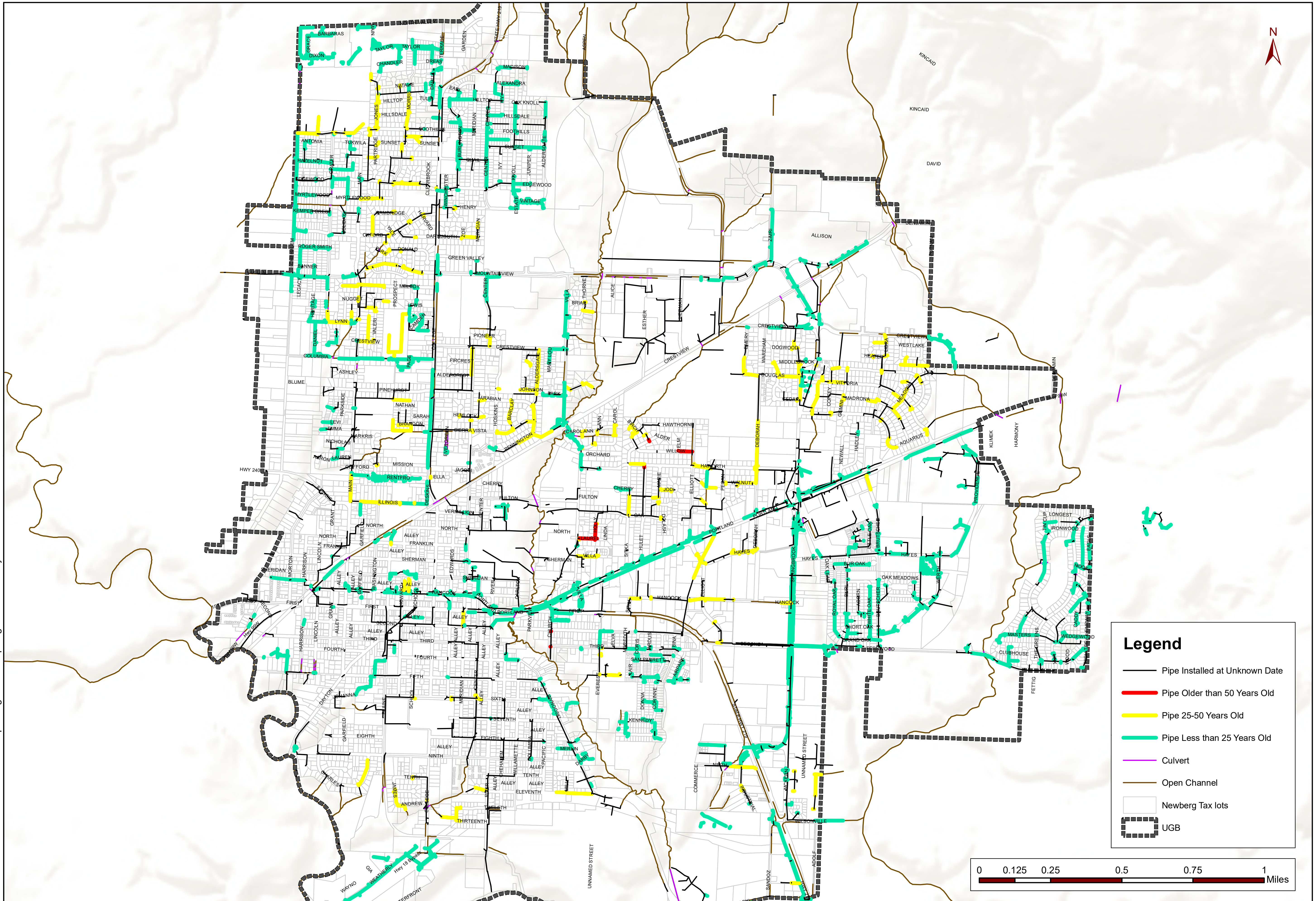
Table 3-8. Reported Problem Areas

Identifier	Location	Problem description	Frequency/ duration	Source of information	Drainage basin	Model in this area	Notes
M-SR-5	N Lincoln St @ First St.	offset pipes		Cartegraph	Chehalem		stgm5477
M-SR-6	Howard St. @ Sixth St.	Root Removal and several spot repairs needed.		Cartegraph	Chehalem		stgm3838
M-SR-7	Renne Park	Broken Pipe		Cartegraph	Chehalem		stgm0206
M-SR-8	Eighth St.	separated pipe		Cartegraph	Chehalem		stgm2390
M-SR-9	Nineth St. @ Charles St.	repair		Cartegraph	Chehalem		stgm1327
M-SR-12	Nineth St. @ Charles St.	Repair void upstream		Cartegraph	Chehalem		stiF131
M-SR-13	Nineth St. @ Charles St.	Repair holes in upstream pipe connections		Cartegraph	Chehalem		stiF132
M-SR-14	W Foothills Dr.			Cartegraph	Chehalem		StmF07006
M-SR-15	W Oxford St.	Broken pipe		Cartegraph	Chehalem		stmG08013
M-SR-16	Highway 99	Spot Repair		Cartegraph	Hess		stmI1110016
M-SR-17	Hancock St. @ Main St.	Repair protruding tap		Cartegraph	Chehalem		stiF12049
M-SR-18	First St. @ Church St.	Repair by adding concrete to bottom		Cartegraph	Hess		stiH12032

Figure 3-3

2020 City of Newberg Stormwater Master Plan

Pipe Age



Date: 2/11/2021

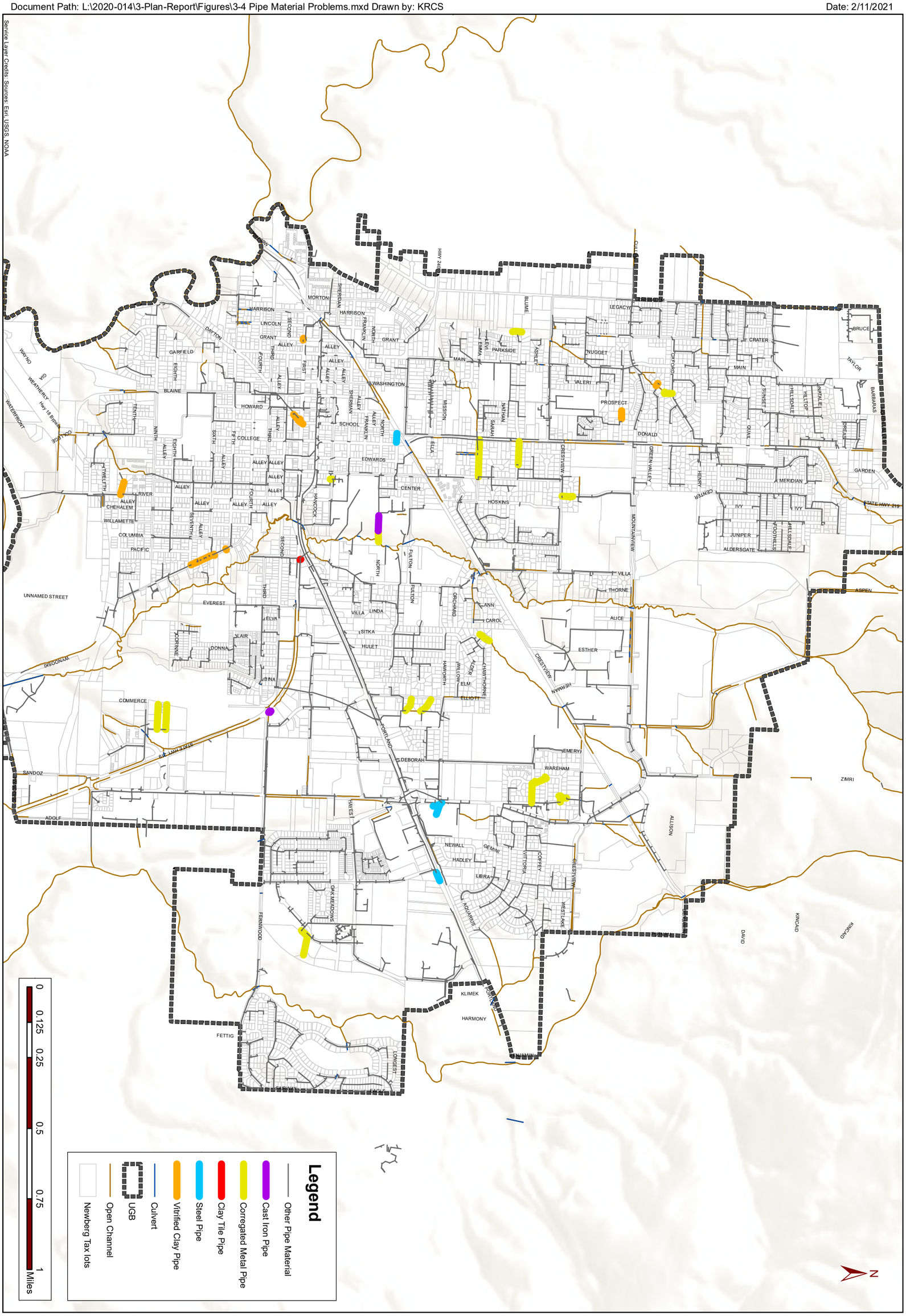
Document Path: L:\2020-014\3-Plan-Report\Figures\3-3 Pipe Age.mxd Drawn by: KRCS

City of Newberg

HBH CONSULTING ENGINEERS

Document Path: L:\2020-014\3-Plan-Report\Figures\3-4 Pipe Material Problems.mxd Drawn by: KRCS

Date: 2/11/2021



HBH CONSULTING ENGINEERS

City of Newberg

Pipe Material Problems

2020 City of Newberg Stormwater Master Plan

Figure **3-4**

Date: 2/18/2021

Document Path: L:\2020-014\3-Plan-Report\Figures\3-5 Reported Stormwater System Maintenance Problem Areas.mxd Drawn by: KRCS

Service Layer Credits: Sources: Esri, USGS, NOAA

N

Legend

- Spot repair
- Maintenance Needed
- Replace Pipe
- New Pipe
- Replace Outlet and Increase Size
- Spot Repair Manhole
- Replace Manhole
- Spot Repair Catch Basin
- Maintenance Issue Catch Basin
- Replace Catch Basin
- Sink Hole
- Flooding or Surcharging
- Existing Pipes
- Culvert
- UGB
- Open Channel
- Newberg Tax lots

0 0.125 0.25 0.5 0.75 1 Miles

Figure 3-5

2020 City of Newberg Stormwater Master Plan

Reported Stormwater System Maintenance Problem Areas

City of Newberg

HBH CONSULTING ENGINEERS

Date: 2/11/2021

Drawn by: KRCS

Document Path: L:\2020-014\3-Plan-Report\Figures\3-6 Pipes with PACP Scores of 3 or More.mxd

Labels on PACP 5 Pipes are the unique ID with "stgm" removed for clarity on the drawing. This way they can be cross referenced with CCTV records to determine the correct repair/replacement.

Legend

Worst PACP Score in Pipe

- 3 Fair (Pipe may fail in 10-20 years)
- 4 Poor (Pipe will probably fail in 5-10 years)
- 5 Immediate attention (Pipe has failed or will likely fail within 5 years)
- PACP <3 or not inspected
- Culvert
- Open Channel
- Newberg Tax lots
- UGB

0 0.125 0.25 0.5 0.75 1 Miles

N

Service Layer Credits: Sources: Esri, USGS, NOAA

Figure 3-6

2020 City of Newberg Stormwater Master Plan

Pipes with PACP Scores of 3 or More

City of Newberg

HBH CONSULTING ENGINEERS

Section 4

Maintenance and Programmatic Evaluation

This section documents the City's stormwater program activities as they relate to maintenance of the stormwater infrastructure, water quality protection, engineering, and development review. In general, the activities are divided into two categories: maintenance activities are those conducted by the operations and maintenance staff; programmatic activities are those conducted by administrative and engineering staff. This section also includes an evaluation of the City's existing design standards related to stormwater management and a staffing analysis to identify the staff levels needed to implement the recommended stormwater related activities.

4.1 Stormwater Program History

The City's Public Works Department is responsible for implementing the stormwater management program to meet regulatory requirements. The Public Works Department includes staff that performs roles related to engineering, operations, and maintenance. All staff plays a role in maintaining water quality and managing stormwater runoff.

In 2001, the City adopted Ordinance 2571 that codified the stormwater management program (Newberg Municipal Code (NMC) 13.20 and 13.25). The ordinance included adoption of a stormwater management fee that applies to all properties with impervious surfaces within the City. The stormwater management fee enables the City to fund maintenance and engineering activities, as well as capital projects related to the stormwater infrastructure. The City's Citizens Rate Review Committee (CRRC) meets regularly to adjust the stormwater management fee, along with the fees related to other City utilities. In 2012, the City adopted Ordinance 2754 to update the stormwater management guidelines in NMC 13.25.

Historically, the City's stormwater management program was formed around addressing drainage capacity and flooding problems. In the last decade, the program has shifted to address increasing water quality regulations.

4.2 Regulatory Conditions

The City's current stormwater program has been expanded to address the regulatory requirements of the Total Maximum Daily Load (TMDL) program. Due to its size, Newberg is not currently subject to the National Pollutant Discharge Elimination System (NPDES) permitting requirements for the municipal separate storm sewer system.

4.2.1 Willamette River TMDL

In September 2006, the Willamette River was listed by DEQ and the United States Environmental Protection Agency (USEPA) as a 303(d) stream. Near Newberg, the parameters of concern are bacteria, mercury, and temperature. Additional pollutants, such as dissolved oxygen, turbidity, and toxics are identified as problematic for specific tributaries and portions of the Willamette River, but are not listed as concerns in areas covered by Newberg. In 2008, DEQ and the City agreed to a TMDL Implementation Plan to reduce pollutant

loads and temperatures in Chehalem Creek, Hess Creek, and Spring Brook, all of which drain to the Willamette River. This was updated in 2018.

The City's TMDL Implementation Plan includes six minimum measures:

- public education
- public involvement
- illicit discharge detection and elimination
- construction site stormwater control
- post-construction run-off control
- pollution prevention in municipal operations

In January 2018, the City completed its third 5-year review of activities from 2013 through 2017 related to the TMDL Implementation Plan and outlined strategies for the next 5-year cycle (2018-2022). The TMDL Implementation Plan remains the City's primary regulatory driver for stormwater management activities.

4.2.2 Future NPDES MS4 Program

In Oregon, DEQ has been delegated the authority from USEPA to implement the MS4 NPDES permitting program, including writing and issuing MS4 permits for municipal stormwater discharges. To date, NPDES MS4 permits have been issued to municipalities with populations greater than 50,000 and smaller communities within larger urbanized areas. Due to its location away from the urbanized areas, the City has not yet been required to obtain a NPDES MS4 Permit. However, if DEQ expands the current permit program to reach a larger number of communities, then Newberg could be subject to a NPDES MS4 permit.

The City's TMDL activities are generally aligned with typical NPDES permit requirements. Fulfilling TMDL obligations puts the City in a good position to comply with a future NPDES permit if DEQ expands the NPDES MS4 permitting program to regulate smaller cities.

4.3 Maintenance Program Review

This section provides an assessment of the resources currently available to maintain the City's stormwater collection system and provides recommendations for improved system operation and efficiency. This section is still being updated and coordinated with maintenance.

4.3.1 Current Activities

The City's stormwater maintenance program is primarily reactive. This assessment is based upon staff interviews and an analysis of the current maintenance program's structure and funding. For example, most inspections, cleaning, and repairs are performed as the result of problems reported by customers, or "hot spots" known to City staff. Typical stormwater maintenance activities are described below. Table 4-1 quantifies a 3 year period of stormwater system maintenance activities, since the new documentation system was implemented.

Structure Inspection – The City currently uses inspections of catch basins, manholes, grates, and inlets primarily as an investigative tool to determine the cause of ponding and drainage problems. The current inspection program is mostly reactive since the inspections are not a part of a preventive maintenance program. In 2010, the City conducted a larger number of catch basin inspections, as part of an effort to locate and map the public infrastructure. However, in recent years, inspections have been limited to those areas where problems are reported.

Structure Cleaning – Catch basins are cleaned to address problems that are reported through customer complaints or that come to the attention of staff by other means. The maintenance staff also conduct preventative maintenance cleaning of several known "hot spots" that routinely have problems with sediment build-up.

Storm Line Inspections –As with catch basin/manhole inspections, storm line inspections are used primarily as an investigative tool. In 2013, the City purchased a new CCTV vehicle with improved maneuverability and video capability. The new system allows staff to observe the condition of storm lines as the camera is moving through the system, reducing the time spent reviewing video. The increased functionality increased storm line inspections that the maintenance crews can complete on an annual basis.

Storm Line Cleaning – Storm line cleaning is conducted in response to reported and known problem areas. Storm line cleaning has been greatly reduced since 2009 (from 18,800 feet in 2009 to less than 4,000 feet in 2012) due to staff reductions. Newer pipe systems in the city have been designed to be "self cleaning," with flow velocities pushing sediment downstream to adjacent catch basins. Most storm line cleaning is to address larger blockages, like rocks, trash, or debris and the associated built-up of sediment behind the blockage.

Ditch Cleaning – City staff occasionally clean and maintain conveyance ditches along roadsides and the railroad right-of-way in order to maintain flow paths to adjacent areas of the public drainage system. Ditch cleaning is typically on a limited basis, in areas adjacent to culverts.

Minor Repairs – Maintenance crews occasionally identify and repair minor structural problems with the stormwater infrastructure and install new structures to address minor flooding problems or replace aged infrastructure. The City currently budgets $50,000 per year for stormwater repair and $15,000 for pipe and materials. Additional staff and materials budget is needed to replace deteriorating infrastructure.

Stormwater Facility Maintenance – In response to the TMDL Implementation Plan, the City has been strengthening a program to inspect and clean stormwater facilities, including detention ponds. The City current has 114 public stormwater facilities and the number of facility inspections has steadily increased since the TMDL Implementation Plan was approved.

Street Sweeping – Street sweeping occurs on a rotational basis and the City has established a monthly sweeping schedule with an online map to notify residents when their neighborhood is scheduled for sweeping. The schedule plans for each zone to be swept eleven times per year, though weather and emergency maintenance needs occasionally impact the sweeping schedule. In 2012, the City purchased a vacuum sweeper to improve collection and efficiency. The City has been averaging over 4,000 curb miles swept per year with a debris collection rate of 0.24 cubic feet per mile. They have also experimented with a contract street sweeper in some locations in the city.

Table 4-1. City of Newberg, Stormwater System Maintenance Activities			
Activity	2018	2019	2020
Grates and inlets inspected	0	36	234
Catch basins cleaned	75	72	173
Storm line inspected, feet	2089	35,500	21,200
Storm line cleaned, feet	4390	37,500	22,300
Minor repairs	• 362 feet storm line • 4 structures	8	7
Stormwater facility inspection and cleaning	26	37	80
Ditch Cleaned, feet	125	1,900	220
Street sweeping, curb miles	?	0.28	0.53

Note: Data from City of Newberg TMDL Implementation Plan, Annual Report 2012 and and 5th Year Review (submitted: March 29, 2013). As well as the 2018 City of Newberg TMDL Implementation Plan

4.3.2 Maintenance Program Analysis

The City's current maintenance program is focused on addressing immediate needs and correcting high priority problems.

The City is strongly encouraged to keep moving the maintenance program toward a more proactive, preventive maintenance approach, allowing the City to provide an increased level of service to the community at reasonable cost.

4.4 Programmatic Activity Review

The City's programmatic activities cover engineering, administration, and management activities to implement a successful stormwater management program. This section provides an assessment of the resources currently available to conduct programmatic activities.

4.4.1 Current Activities

Based on discussions with City staff, the City's programmatic efforts are generally focused on TMDL compliance, development review, capital project management, and stormwater fee administration. These activities are generally assigned to different staff members, though development review and capital project management are both assigned to the public works engineers.

TMDL Compliance – Many of the program activities conducted by City staff serve to satisfy requirements of the City's TMDL Implementation Plan. The City reports annually to DEQ on the progress toward meeting measurable goals related to public education, public involvement, illicit discharge detection and elimination, construction site runoff control, post construction stormwater runoff control, pollution prevention in municipal operations, and temperature management. In addition to the maintenance activities described in Section 4.3, the City conducts the following programmatic activities related to TMDL compliance:

- public outreach and education events
- storm drain stenciling
- public involvement in stormwater ordinance, design manual, and stormwater utility rate
- stormwater program website and citizen reporting

- illicit discharge complaint response
- household hazardous waste collection (in conjunction with Yamhill County)
- construction site inspections and erosion control enforcement
- development of stormwater ordinance and stormwater design standards
- stormwater plan review, inspection, and enforcement for new development
- staff training
- stream corridor overlay and stream bank protection ordinance
- stream trees program

Most of the TMDL compliance activities (outside of maintenance and development review) are conducted by the City's Environmental Specialist, which is funded at 0.5 FTE from the stormwater program though the TMDL tasks are taking increasing time as the required programs are implemented. Additional details regarding these programs are included in the City's TMDL Implementation Plan and TMDL Annual Reports.

Development Review – City staff currently spend the equivalent of approximately 1.0 FTE completing development review activities, which include establishing engineering conditions following pre-application meetings, reviewing development submittals, and conducting inspections during and after construction. Development review activities and inspections cover both construction site erosion and sediment control and the post-construction stormwater facilities. Development review cost is shared by transportation and other departments, as it is most efficient for the engineering reviewer to evaluate all aspects of development submittals at one time.

Capital Project Management – Other than development review and customer response, the City's engineering staff spend the bulk of their time managing the City's CIP program. As staff resources have been reduced, most design work is now being completed through consultant contracts. City staff are performing less design work and focused more on managing consultants and contractors, which allows a fewer number of staff to oversee a larger number of projects.

Stormwater Fee Administration – Programmatic activities also include the administration of the City's stormwater utility fee, which funds the stormwater management program. The stormwater program currently funds 0.45 FTE in general administration.

4.4.2 Future Needs

The following future needs have been identified through evaluation of regulatory obligations, discussions with City staff, and comparison to similar sized stormwater programs in other Oregon cities.

GIS Mapping – In preparing for work on this Stormwater Master Plan (Master Plan), City staff identified data gaps in the City's existing GIS database. In particular, pipe and structure information has been entered into the system using two different vertical datums. A combination of field work and engineering judgment was used to resolve many of the data gaps while preparing the PC SWMM hydraulic model of the stormwater system. However, spot checks in the field continue to reveal areas where the field system and the GIS database are inconsistent. A regular schedule for ongoing field data collection would allow the City to continually improve the accuracy of the GIS database. In addition, some as-built plans did not provide all information for a pipe, or it wasn't entered into GIS from the as-built plans. These areas should continue to be updated. In addition, the City should require attributes listed in Appendix E to be included in all GIS files submitted by developments to aide City staff in performing their tasks. The current requirements are not clear in requirements.

TMDL Implementation Activities – The City's current program to address TMDL requirements is well-organized. The City is taking proactive steps to evaluate the effectiveness of program components and make adjustments to the TMDL Implementation Plan through adaptive management. The City's program would benefit from the following enhancements which would improve the level of service for residents and enhance the water quality program related to TMDL compliance.

- Stormwater facility inspection (covered under maintenance discussion) – regular and ongoing inspections are needed to identify maintenance needs.
- Illicit Discharge education for City staff– the City has recently adopted new illicit discharge screening procedures. Public works staff are likely to encounter illicit discharges as they are conducting other activities around the City. One-time training is needed for all public works staff, so they will readily recognize the signs of a potential illicit discharge and understand the reporting procedures.
- IDDE education for businesses– establishing a program to provide illicit discharge education for business owners is a preventative measure to reduce non-stormwater discharge to the drainage system.
- Private facility maintenance enforcement– The City's recently modified stormwater management municipal code (NMC 13.25.300) requires owners of private stormwater facilities to conduct and record annual facility inspections and perform necessary maintenance. An ongoing program is needed to track whether required activities have been completed and then follow-up with enforcement.
- Electronic database system– An electronic database system would assist the City with the handling of customer complaints, tracking calls, and tracking the City's response. An electronic database could also be used to track illicit discharge concerns logged by City field staff and the follow-up investigations and resolution.
- WQ Sensitive O&M Manual– Maintenance staff and the TMDL Implementation plan have identified the need for the City to develop standard operating procedures for maintenance activities that address water quality protection during regular maintenance. The SOPs should also include guidelines for performing inspections and maintenance of the stormwater system.

Monitoring Program – The City has considered the opportunity to establish an in-stream monitoring program that could track flows as well as water quality data. Flow data would be useful in evaluating changes in runoff rates as the watersheds develop. While not a current obligation, water quality monitoring may eventually be required as part of the City's TMDL Implementation Plan. Due to other immediate program needs and the significant resources that would be required, it is not currently recommended that the City pursue the establishment of an in-stream monitoring program. However, the City may re-evaluate monitoring needs during the future TMDL Implementation Plan 5-year reviews, the next of which will occur in 2023.

Engineering Services – City staff performing development review and capital project management are currently meeting the demand for these services. No changes to the structure of these activities are recommended at this time. If the City sees a substantial increase in new development activity, staff levels should be adjusted accordingly to support the increased need for development review and construction inspection as well as the potential to construct additional capital projects through an increase in system development fees.

4.5 Development Standards Review

Consistent with TMDL implementation Plan requirements, the City adopted municipal code for stormwater management in 2012. NMC 13.25 addresses Erosion Control, Illicit Discharge Detection and Elimination, Stormwater Management (facility design, installation, and maintenance), and Enforcement and Penalties.

Following code adoption, the City completed an update to the Public Works Design and Construction Standards in 2015 and it includes a comprehensive chapter to address stormwater requirements. This chapter includes standards and submittal requirements for conveyance, water quantity, and water quality. Erosion and sediment control guidelines are outlined in the 2014 Erosion Control Manual, adopted from Clean Water Services.

During the development of this Master Plan, the City's Public Works Design and Construction Standards were reviewed with respect to TMDL obligations and recommendations from the stream channel vulnerability assessment. The review also considered regional and national trends in stormwater management.

4.5.1 Design Standards Recommendations

Based on a review of regulatory programs, regional trends, and local stream conditions, the City may consider incorporating the following principles into the stormwater design standards:

- Strengthen existing design standards language encouraging infiltration solutions such as rain gardens, infiltration trenches, pervious pavers, etc.
- Consistent with regional trends, require water quality treatment for both new and replaced impervious area when redevelopment occurs.

4.5.2 Community Recommendations

- These recommendations will be provided in the final draft.

4.6 Staffing Analysis

This section provides an assessment of the resources necessary to perform maintenance and programmatic activities to support the City's stormwater management program and address TMDL Implementation Plan obligations. This is in progress and will be provided in the final draft.

Section 5

Integrated Management Strategy

This section provides a summary of recommendations to address future regulatory objectives and capital project recommendations to address existing storm system capacity deficiencies, future storm system needs, and water quality objectives.

Section 5.1 includes programmatic recommendations for maintenance activities, water quality programs, and staffing. The programmatic recommendations also include one-time projects that are needed to implement the stormwater management program. Section 5.2 focuses on the development of larger capital improvement projects (CIPs), integrated to address capacity and water quality concerns. Section 5.3 outlines several ongoing infrastructure expenses to replace aging infrastructure and enhance water quality through retrofits.

5.1 Programmatic Recommendations

The regulatory evaluation summarized in Section 4 assessed the ability of the City of Newberg's (City) stormwater program to meet Total Maximum Daily Load (TMDL) program requirements, and a review of the City's 2015 Public Works Design and Construction Standards. The City's stormwater program currently contains many of the elements of a successful and regulatory compliant program; therefore, the following recommendations include only minor adjustments and additions to the existing program.

5.1.1 Maintenance Recommendations

In addition to providing ongoing responsive maintenance to identified problem areas, the City is strongly encouraged to move the maintenance program toward a more proactive, preventive maintenance approach, to provide an increased level of service to the community at reasonable cost. Over time, as the condition of the system is documented, repairs made where required, and systems cleaned before they become problems, the number of customer service investigations should be reduced. With a fully functional preventive maintenance program, the long-term costs associated with future repairs, rehabilitation, and replacement will be minimized. Specific recommendations include the following:

- Establish a proactive inspection schedule to evaluate structures visually and record videos of storm lines. Routine inspections likely will result in more work orders for cleaning, based on inspection results. In addition to identifying maintenance needs, routine inspections can be used to meet illicit discharge screening requirements of the City's TMDL Implementation Plan. The recommended inspection plan includes the following:
  - Visual inspection (and cleaning as needed) of 20 percent of catch basins, manholes, and inlets each year
  - Video inspection of 20 percent of storm lines each year. The City's video schedule would aim to cover higher risk storm lines (those in the downtown and older areas of Newberg) once every 3 years and the remainder of the city on a 6- to 8-year cycle. More frequent evaluation of older pipes is needed to identify deteriorating pipes that are in need of replacement.

5.1.2 Program Recommendations

The City's programmatic stormwater activities are on track to meet TMDL compliance obligations and to provide a responsive level of service for customer complaints, development review, and capital project management. In addition to continuing with current TMDL implementation activities, development review, and capital project management, the following recommendations would allow the City to improve understanding of the existing drainage infrastructure and enhance water quality related services.

- Allocate staff time for ongoing field data collection to improve the accuracy of the City's geographic information system (GIS) stormwater database. The suggested schedule is to have two staff members spend 1 day per month collecting field data. Importing data and making adjustments to the GIS database are expected to take another 8 to 16 hours per month. This should include all attribute data in Appendix E that will fully define pipes, and allow for modeling in the future.
- After mapping of the public system is complete, continue monthly GIS mapping activities to locate and document the type and condition of private stormwater management facilities. The City's stormwater management code now requires private owners to conduct and document regular facility maintenance. The City will need facility locations to contact property owners and enforce the municipal code. Mapping and tracking maintenance on private facilities may also allow the City to take credit for the water quality improvement from private facilities if TMDL benchmarking becomes a regulatory requirement for the City.

- Conduct annual training for all public works staff on TMDL-related topics. In the beginning, the training should be focused on illicit discharge identification and reporting. Future trainings could cover the updated stormwater design standards, the water quality maintenance manual, or other water quality-related topics.
- Establish programs to implement the stormwater code (NMC 13.25). These programs include illicit discharge investigation and response and private facility maintenance tracking.
- Conduct regular field screenings of outfalls and other areas of previously observed stream bank erosion to document changes in bank conditions and identify locations for stream bank stability projects. Allocating at least 1 day per month for stream observation would allow City staff to visit areas of concern several times a year on a rotational basis.
- Continue participation in watershed groups and professional associations to understand how monitoring data are being collected by other small communities and utilized by regulatory agencies. Observing regulatory trends among other Oregon jurisdictions will allow the City to evaluate the need for a stormwater monitoring program in the future.

5.1.3 Staffing Recommendations

This is in progress and will be provided in the final draft.

5.1.4 Engineering Projects and Studies

The City's stormwater program would see benefits from funding several one-time engineering projects and studies that would support implementation of the stormwater program. Recommended engineering projects and studies include the following:

- Water Quality Sensitive O&M Manual – as described in Section 5.1.2.
- Master Plan Update – This Master Plan is intended to identify stormwater management activities and projects over the next 10 to 15 years. As the projects in this Master Plan are completed and new developments are constructed, the City will need to complete a Master Plan Update.

Table 5-1 identifies the required funding and proposed schedule to implement engineering projects and studies.

Table 5-1. Engineering Projects and Studies

Project number	Program name	Total cost, $	Timeline
P-1	Master Plan Update with Model Calibration	250,000	2025

5.2 Integrated CIP Development

This section identifies the projects designed to address the problem areas identified in Section 3. Problem areas include capacity problems identified through SWMM modeling and shown on Figures 3-1 and 3-2 as well as reported problem areas listed in Table 3-8 and depicted on Figure 3-3. To the extent possible, CIPs were developed as integrated solutions to address multiple objectives (e.g., flood control with enhanced water quality treatment or pipe replacement/realignment with capacity improvement) or to address multiple drainage problem areas with a single, comprehensive project.

5.2.1 Project Identification

CIP locations were identified by reviewing the model results presented in Figures 3-1, 3-2 and Table 3-7 for capacity related CIP improvements. The identifier for capacity improvements starts with "C-". Maintenance reported problem areas in Table 3-8 and shown in Figures 3-5 and 3-6.

Locations of know old pipes or bad pipe material are shown in Figures 3-3 and 3-4. These are not included as part to the CIP improvements because there is no existing issue with them. However, they should be prioritized in the pipe replacement program. Typical lifespan of pipe is 50-100 years, so those pipes that are older than 50, or suspected to be older than 50, if no date is know, should be planned for replacement as funds allow. Materials such as clay, steel, corrugated metal, and cast iron tend to degrade faster than plastic or ductile iron pipes. These older materials should be prioritized for replacement as funds allow.

The maintenance staff records maintenance issues in a program called Cartegraph. Those records were compiled on Figure 3-5 and Table 3-8. Maintenance projects are labeled starting with "M-" and then more finer designations of Replacement "M-R-", Maintenance Needed "M-MN-" and Spot Repair "M-SR-". Figure 3-6 is based on the PACP ratings given by maintenance staff. The numbers shown are the worst ranking of any defect on the pipe, not the average score. The labels on the PACP figure are the pipe name without the "stgm", so the CCTV recordings/PACP review sheets can be cross referenced for what needs to be done.

Many of the reported problems have a clearly identifiable solution. Examples of this are pipes located under private property that require realignment, deteriorating pipes needing replacement, and areas lacking existing infrastructure.

The SWMM model was utilized to evaluate potential solutions for identified capacity problems. Potential solutions included upsizing of existing pipes, expansion of infrastructure, or installation of additional storage features such as underground vaults or regional detention ponds. In most cases, capacity problems are related to short stretches of undersized pipes. Upsizing existing pipe is more cost effective than acquiring property to add detention storage at the flooding locations. In addition, the stream channel vulnerability assessment showed that the natural stream channels are generally stable under current flow and development conditions, which indicates that significant upstream detention storage is not needed for existing development. Future development areas may need to utilize regional storage systems to meet the City's stormwater design standards and prevent any further degradation.

Following these evaluations, a strategy meeting was conducted with City staff to review the problem areas and potential alternative solutions. Small improvements along the same area were combined into larger projects that provide a longer term solution. To integrate development of the flood control and water quality CIPs, the identified capacity problem areas were reviewed to determine whether water quality facilities (such as a rain garden, stormwater planter, or green street design) could be sized and located to address the capacity problem or to provide treatment in addition to a upsized conveyance pipe. In areas where the capacity problem is a result of undersized trunklines, opportunities for adding additional water quality treatment were limited.

The resulting project list includes the recommended capital projects, including small pipe and culvert replacements, larger realignments of existing drainage networks, and construction of new stormwater infrastructure in underserved neighborhoods.

5.2.2 Unit Cost Estimates

Unit cost information for construction elements of the CIP facilities was compiled for the 2014 SWMP by using bid tabulations from recent local construction projects and *Site Work & Landscaping Cost Data* (RS Means, 2012) was referenced for additional work not covered by recent bid tabs. The unit costs were adjusted based on results of bids on recent City projects. The unit costs were adjusted for inflation based on the October 2020 ENR ratio and exchanging HDPE for PVC.

Preliminary CIP cost estimates are based on the unit cost information for construction elements plus a 30 percent contingency. Permitting, surveying and design, and construction administration costs are based on a general percentage of the total construction cost. Land acquisition costs are not included in the estimates.

Project unit costs and detailed cost estimates for each CIP are located in Appendix D. CIPs with multiple components contain a detailed cost estimate for each project component.

5.2.3 CIP Sizing and Conceptual Design

This section includes a summary of the CIP sizing and conceptual design criteria based on the type of system improvement proposed. System improvements include piping improvements, infiltration planter boxes for water quality, and bank stabilization and outfall protection for channel improvements. Proposed CIPs may reflect a combination of these system improvements.

Conveyance – Design criteria for new conveyance piping are based the City's 2015 Public Works Design and Construction Standards. In most areas of the City, pipes were sized to convey the 25-year design storm event flow. In areas where the flooding is in an arterial or major collector, the 50-year future condition flow was the standard.

5.2.4 CIP Project Summary

Table 5-2 includes, a problem description, and project description for each CIP. The CIPs are presented by each of the three basins. The following CIP designations are applicable:

Figure 5-1 shows the location of each of the proposed capacity CIPs. Figure 5-2 shows all projects including capacity projects and maintenance projects. Detailed CIP fact sheets are provided in Appendix D and include additional conceptual design detail and a map locating the proposed system improvements. Appendix D also contains detailed cost estimates for each project. Section 6 provides a priority ranking of CIPs and the planned schedule for implementation.

5.3 Ongoing Capital Projects

The capital projects listed in Table 5-2 address specific infrastructure needs. The City's stormwater system also faces long term challenges related to asset management. The stormwater program would benefit by allocating funds each fiscal year to upgrade existing infrastructure and enhance water quality treatment. Two ongoing capital projects are recommended, as described below.

5.3.1 Annual Pipe Replacement Program

The City's stormwater infrastructure is a significant asset. Stormwater pipes typically have a design life of 50-75 years. The longevity of the infrastructure depends on many factors, including pipe material, installation methods, site conditions, traffic loads, and maintenance frequency. While a preventative maintenance program can extend the life of the pipe network, some areas of the City are still composed of clay tile pipe. Other areas are deteriorating and will need replacement as part of the City's asset management strategy.

The areas in greatest need of pipe replacement include pipes located under private residences and the deteriorating clay tile pipe in River Street. These known problem areas will require significant capital projects, and have been included in the Table 5-2 CIP list. Future areas that require replacement would be identified through the preventative maintenance inspection program. An annual pipe replacement program would establish "system replacement" as an annually recurring capital project. This funding would allow the City to replace aging pipes and structures that show significant deterioration during preventive maintenance inspections.

Targeted pipe replacement can be completed by City maintenance crews or by contractors from the City's small works roster. This is a cost effective way to upgrade infrastructure without incurring the engineering and administrative costs that come with larger capital projects. Funding annual pipe replacement at $100,000 per year would allow the City to replace only a small percentage (less than one percent) of the total existing pipe each year. However, the annual pipe replacement program is an ongoing investment in asset management that will allow the City to address small needs before they grow into larger, more costly problems.

Table 5-2. Comprehensive CIP Summary

CIP number	CIP name	Proposed CIP location	Event(s) deficiency occurs	Problem description	CIP description	Length of conveyance improvements, linear feet (LF)	Contributing drainage area, acres	Estimated capital implementation cost total, $
Basin 1 - Chehalem Creek								
C-A	S Blaine St. Improvements	N Elliot Road, north of Highway 99W	2-yr	This area was partially upgraded through a recent project, but more is needed.	Upsize existing stormwater pipes to 21" and 18" to convey flows.	1,035	39	$ 104,527
C-B	S Center St. Improvements	N Edwards Street, from Vermillion Street to E Sheridan Street	2-yr	Currently a reach of 21" stormwater pipe runs through private property and under several houses. This is undersized and causes flooding along E 8th St, E 7th St, and S Center St. There are other undersized pipes in Center St.	In conjunction with the proposed River St. transportation improvements, divert extra flows from Center St. over to new lines in River St. to 8th street. From there are a few options for routing, Option A was selected for the master plan, but any of them would work if those roads are more feasible or being rehabbed sooner. A-continue to route down River St. to the River. B-Route down 9th St. to College St. to Chehalem Creek C-Route down 8th St. to Wynooski St. to Hess Creek	6,049	100	$ 2,415,715
C-C	Oxford St. Improvements	E 3rd and S Church Streets	2-yr	Flow is currently restricted by fourteen undersized pipes. Pipe diameters increase and decrease in numerous places throughout this alignment. The City has installed some upsized pipes to address acute problems. This project provides a broader solution.	Upsize existing stormwater pipes to 18", 36" & 48" to provide capacity for flows.	958	166	$ 364,964
C-D	6th & Blain St. Improvements	Various, see map	2-yr	Flow is currently restricted by six undersized pipes.	Upsize existing stormwater pipes to 15" & 18" to convey flows. Move pipes into the public right-of-way.	1,253	25	$ 312,773
C-E	Pinehurst Dr. Improvements	Various, see map	2-yr	Flow is currently restricted by six undersized pipes.	Upsize existing stormwater pipes to 15" &18" to convey flows. Move pipes into the public right-of-way.	1,386	13	$ 328,688
C-F	Crater Ln. Improvements	Crestview Dr. and Villa Rd.	25-yr	Flow is backing up at a culvert and causing flooding upstream.	Upsize existing culvert to 24" to convey flows.	28	142	$ 10,168
C-G	Partridge Ln. Improvements	Wynooski St. 5th to Merlin	25-yr	Flow is currently restricted by an undersized pipe.	Upsize existing stormwater pipes to 24" to convey flows.	223	30	$ 80,980
C-H	Illinois St. Improvements	Various, see map	10-yr	Flow is currently restricted by two undersized pipes.	Upsize existing stormwater pipes to 18" to convey flows.	498	2	$ 139,183
C-I	Ditch & Pinehurst Dr. Improvements	E 2nd St.	2-yr	Flow is currently restricted by two undersized pipes.	Upsize existing stormwater pipes to 24"&36" to convey flows.	693	136	$ 283,916
C-J	Charles St. Improvements	E 2nd St.	10-yr	Flow is currently restricted by an undersized pipe.	Upsize existing stormwater pipes to 15" to convey flows.	171	12	$ 39,339
C-K	Center St. Improvements	E 2nd St.H-1	25-yr	Flow is currently restricted by two undersized pipes.	Upsize existing stormwater pipes to 30" to convey flows.	302	58	$ 138,377
Basin 2 – Hess Creek								
C-L	N Edwards St. Improvements	N Edwards Street, from Vermillion Street to E Sheridan Street	2-yr	The City has reported drainage problems along Vermillion St between N College St and the railroad. Currently a flat and undersized pipe discharges stormwater along the railroad tracks. This neighborhood does not have a defined connection to the public stormwater system.	Add a drainage system to convey flows from Vermillion St to the existing drainage system at E Sheridan St. Increase existing pipes to 12", 18" & 24" to convey flows.	4,493	19	$ 1,024,049
C-M	E Third St. Improvements	E 3rd and S Church Streets	2-yr	Modeling shows flooding problems along E 3rd St and S Church.	Add a 18" stormwater pipe to connect the stormwater system from E 3rd St to S Church St to provide conveyance and storage. Upsize existing stormwater pipes to 15"-18", as estimated by modeling. Divert some flow down Doris Dr.	2,448	41	$ 647,954
C-N	N Ellitiot Rd. Improvements	Various, see map	2-yr	Flow is currently restricted by ten undersized pipes.	Upsize existing stormwater pipes to 18" & 24" to convey flows. Some pipes need to be replaced due to material.	1,891	25	$ 650,305
C-O	Mountainview Dr. Improvements	Mountainview Dr.	10-yr	Flow is currently restricted by private undersized private pipes and backs up onto City-owned streets.	Divert flows away from private property through new pipe along Mountain View Dr. to Hess Creek.	1,455	78	$ 334,725

Table 5-2. Comprehensive CIP Summary

CIP number	CIP name	Proposed CIP location	Event(s) deficiency occurs	Problem description	CIP description	Length of conveyance improvements, linear feet (LF)	Contributing drainage area, acres	Estimated capital implementation cost total, $
C-P	Crestview Dr. Improvements	Crestview Dr. and Villa Rd.	10-yr	Flow is currently restricted by three undersized pipes.	Upsize existing stormwater pipes to 15" to convey flows.	573	29	$ 131,819
C-Q	Wynooski St. Improvements	Wynooski St. 5th to Merlin	2-yr	Flow is currently restricted by three undersized pipes.	Upsize existing stormwater pipes to 15” & 18" to convey flows.	1,251	21	$ 309,198
C-R	2nd St. Crossing	E 2nd St.	2-yr	Flow is currently restricted by several undersized pipes.	Add two additional pipes to change the direction of flow.	113	11	$ 31,582
C-S	E 2nd St. @ River St. Improvements	E 2nd St.	10-yr	Flow is currently restricted by an undersized pipe.	Upsize existing stormwater pipes to 15" to convey flows.	526	6	$ 121,007
C-T	E 2nd St. @ Ardus St. Improvements	E 2nd St.H-1	10-yr	Flow is currently restricted by two undersized pipes.	Upsize existing stormwater pipes to 18" to convey flows.	775	14	$ 216,600
Basin 3 – Spring Brook								
S-1	N Springbrook Rd. Improvements	North Springbrook Road, north of Highway (Hwy) 99W	2-yr	Modeling shows flooding problems along N Springbrook Rd . The upstream stormwater system along N Springbrook Rd was upgraded during installation of traffic improvements, but flows are constricted from a 30" pipe down to an 8"-12" section of pipe near Middlebrook Dr.	Upsize the stormwater pipes along N Springbrook Rd to 30" diameter and connect the system to the existing system to the south. This includes spur lines that are undersized and three new pipes. Divert flows away from channel to Springbrook Rd.	2,855	173	$ 1,124,759
S-2	Libra St. Improvements	Libra Street and Victoria Way	2-yr	Modeling shows flooding problems along Libra St during the current and future conditions 10-year storm event. This system needs frequent maintenance to address silt accumulation.	Install pipes along Crestview Dr. and Coffee Dr. to divert flows away from flooding locations.	957	33	$ 220,159
S-3	BruTscher St. Improvements	Brutscher St.	10-yr	Flow is currently restricted by an undersized pipe.	Upsize existing stormwater pipes to 18" to convey flows.	260	19	$ 72,666
City-Wide								
A-1	Stream Bank Protection Projects	Multiple locations	No capacity issues					TBD

Date: 2/11/2021

Document Path: L:\2020-0143-Plan-Report\Figures\5-1 Capital Improvement Plan.mxd Drawn by: KRCS

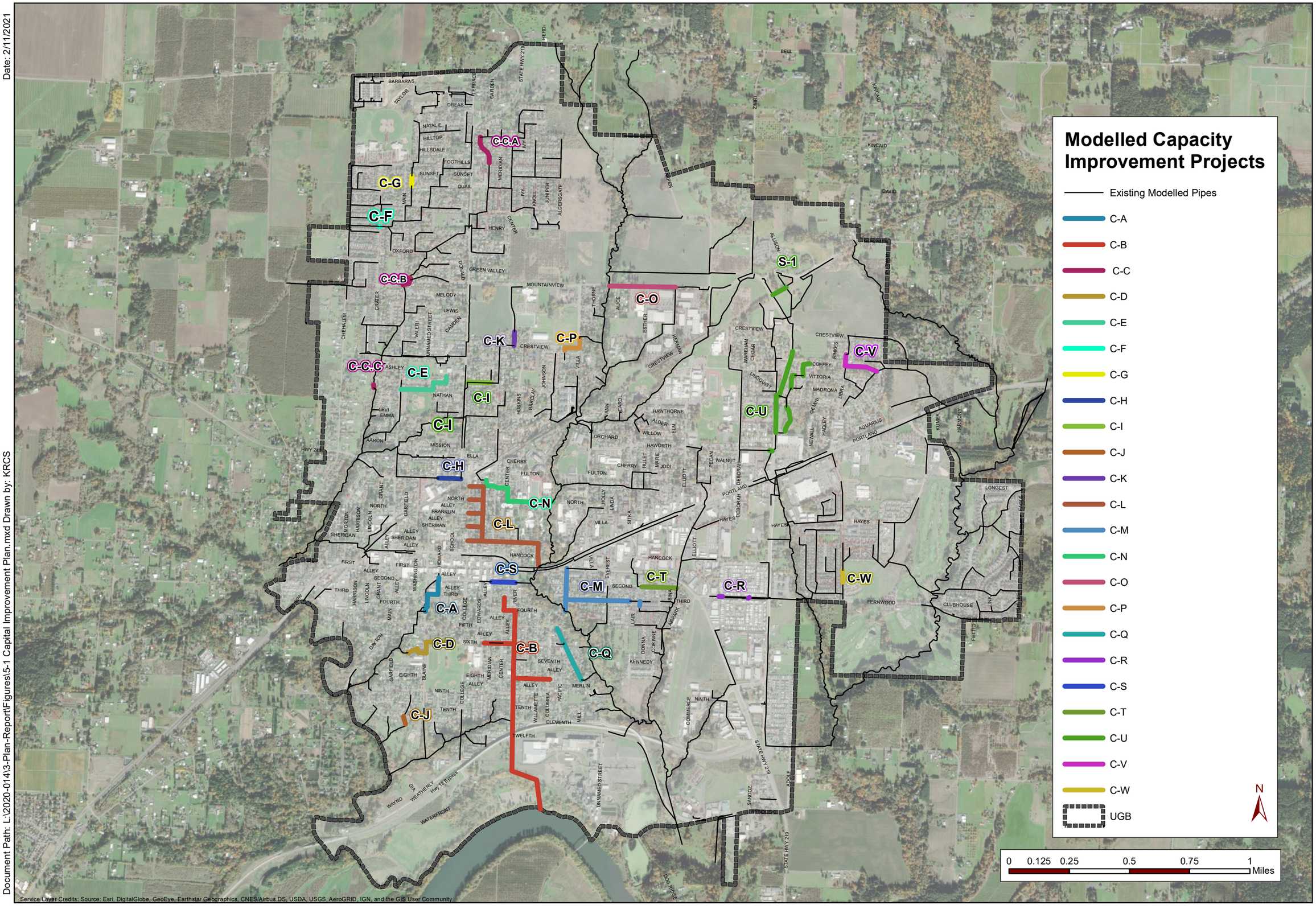


Figure 5-1

2020 City of Newberg Stormwater Master Plan

Modelled Capacity Capital Improvement Plan

City of Newberg

HBH CONSULTING ENGINEERS

Date: 2/11/2021

Document Path: L:\2020-014\3-Plan-Report\Figures\5-2 Capital Improvement Plan-All.mxd Drawn by: KRCS

Service Layer Credits:

Legend

- Replace Manhole
- Replace Catch Basin
- Replace Outlet
- Pipe Older than 50 Years Old
- Pipe Material Issue
- Riverfront Master Plan Improvements
- Maintenence Noted Replacement Pipe
- PACP Score of 5
- Stream Channel Improvements
- Modeled Capacity Based Improvements
- Existing Pipe, Channel, or Culvert
- Culvert
- Open Channel
- Newberg Tax lots
- UGB

0 0.125 0.25 0.5 0.75 1 Miles

Figure 5-2

2020 City of Newberg Stormwater Master Plan

Capital Improvement Plan Overview

City of Newberg

HBH CONSULTING ENGINEERS

Section 6

Implementation Plan

This section presents a proposed implementation plan for the capital projects and program recommendations outlined in section 5. The plan includes capital project prioritization, so that the City of Newberg (City) can budget for projects in 5-year increments. The City is not under regulatory obligations to complete stormwater-related capital projects. Instead, the implementation timeline is based on local priorities, which were established during the development of this Stormwater Master Plan (Master Plan). Following the capital project prioritization, Section 6.2 presents a financial analysis to evaluate the funding needed to implement this Master Plan.

6.1 Capital Improvement Project (CIP) Priority Evaluation

The capital projects presented in Section 5.2 represent a long term strategy to address flooding, capacity upgrades, stream bank stability, and water quality enhancements. Effective implementation of this Master Plan requires prioritizing projects and establishing a schedule for design and construction.

6.1.1 Prioritization Criteria

Strategy meetings were conducted with City staff to review project alternatives and establish implementation priorities. A list of prioritization criteria was developed to align with local priorities. The prioritization criteria is used as guidelines to help the City determine which projects should be budgeted for first. Stormwater CIP projects are to be prioritized based on the degree to which each project meets the criteria. The previous plan had a numerical ranking system. This plan has updated this methodology to allow for thoughtful consideration of all projects and how they should relate to each other.

Projects that meet multiple criteria will be ranked as a high priority improvement and performed first. For example, areas that have frequent reported flooding that are shown in the model to have long duration of flooding will have a high priority. Another example of a high priority project would be one that is a small project in scope and/or cost that reduces flooding in a large geographical area. An example of a low priority improvement is an area shown in the model to flood for only a short duration in the 25-year event that has had no documented flooding.

Following are the CIP prioritization criteria used in this plan:

Table 6-1. Prioritization Criteria

Category ID	Project Category
A	Projects required by regulations
B	Projects that fix documented flooded areas
C	Projects where maintenance issues correspond with model issues
D	Projects that are in roads set for repaving
E	Projects that address flooding that occurs most frequently in model results. This includes a combination of duration of flooding at the 25-year event, and intensity of the storm where flooding first occurs (2-year storm event, 10-year storm event, or 25-year storm event).
F	Projects that will reduce flooding in the areas with the largest potential for damage
G	Projects that will benefit the largest number of properties
H	Projects that reduce long-term maintenance by removing pipes and/or structures that currently require more maintenance than is typical of that type of structure
I	Conjunctive or multiple use potential, particularly as a balance between moving water and enhancing stream water quality and habitat/aesthetics
J	Low permitting complexity

6.1.2 CIP Prioritization

CIP Prioritization will be part of future drafts.

6.2 Financial Analysis

The financial analysis will be part of future drafts.

Appendix A: Modeled Drainage System Maps

To be included in the final Draft

Appendix B: Hydrologic and Hydraulic Modeling Inputs/Results Tables

To be included in the final Draft

Appendix C: Channel Vulnerability Data

Section 4

Stream Channel Vulnerability Assessment

Section 4 documents the stream channel vulnerability assessment that was conducted to evaluate and assess existing and potential future channel conditions in the streams within Newberg. The field visits for this assessment occurred between October 15 and 17, 2013.

The primary objectives of the stream channel vulnerability assessment included the following:

- Assess existing physical channel conditions relative to the current flow regime and level of development.
- Identify existing problem areas, including areas of bank instability or excessive erosion.
- Assess the potential for future channel issues that could occur as a result of increased flows or watershed changes.

Figure 4-1 shows the location of mapped stream channels, floodplains, and stream corridor zoning within the City of Newberg.

4.1 Methods

The methodology used in this stream vulnerability assessment included:

1. review of existing documentation;
2. qualitative field assessment of selected stream channels within the City limits; and
3. comparison of hydrologic and hydraulic modeling results to observed channel morphology.

4.1.1 Data Review

Several data sources were reviewed prior to conducting the field assessment. The list of sources and description of contents is shown below.

City of Newberg Data – City staff occasionally walk stream channels within the city to assess water quality conditions and document outfall conditions. The City provided photos and data sheets to BC, documenting previously observed conditions. The City also provided photos of past flood events, documenting water elevations resulting from high flows. These data were reviewed relative to current data, and were used to augment the field data collected in October 2013, since not all stream channel reaches were walked within the timeframe allotted for this project.

George Fox University Data – George Fox University (GFU) students have been collecting data and conducting restoration projects in the reach of Hess Creek that runs through the GFU campus. The City provided BC with stream channel cross section data collected by the students. Additionally, Clyde Thomas, facility manager and stream restoration facilitator at GFU provided details on work that is being conducted on Hess Creek on the GFU campus.

City GIS Data – City GIS data were reviewed prior to conducting the stream visit, including the following:

- stormwater infrastructure
- zoning

- streams and wetlands
- floodplains
- city boundary
- aerial photograph
- LiDAR imagery

Chehalem Watershed Assessment–The Yamhill Basin Council conducted a Chehalem Watershed Assessment in June 2001 through an Oregon Watershed Enhancement Board (OWEB) grant and local matching funds (Yamhill Basin Council. 2001). The Chehalem Watershed includes Chehalem Creek, Hess Creek, and Spring Brook. This document was reviewed specifically for information about the stream channels that are situated in Newberg, including Hess Creek, tributaries of Spring Brook, and a small tributary of Chehalem Creek. Regional geologic information was obtained from this report, as well as information on fish habitat and barriers, wetlands, and other watershed characteristics.

4.1.2 Field Assessment

A field assessment was conducted between October 15 and October 17, 2013, during a relatively dry period, with no measured rainfall in the previous 5 days. Approximately 3 miles of stream channel were walked, including portions of the following reaches, shown on Figure 4-1. The field assessment included the following reaches:

- Hess Creek
  - Upstream of Villa Road in the vicinity of Mountainview Drive (upper reach)
  - George Fox University (middle reach)
  - Hoover Park (middle reach)
  - Corinne Drive Tributary
  - Wynooski Street/Wastewater Treatment Plant (lower reach)
- Chehalem Creek Tributary
  - Upstream of Hwy 240 to Columbia Drive
  - Upstream of Sunnycrest Road
- Spring Brook
  - Benjamin Road and Lake Shore Drive reach (outside City limits)
  - West Tributary between Fred Meyer (Hayes Road) and Fernwood Road (West Tributary reach)

General observations of bank and bed materials, vegetation, erosion, general confinement, and outfalls were made. Photos were taken to document conditions, and occasional measurements of bankfull widths and depths were taken with a stadia rod (in tenths of feet). Latitude and longitude coordinates along with elevations were recorded using a hand-held GPS unit.

The field data and locations of photographs were recorded in a field notebook. Field notes were scanned, and data and photos were transferred to excel spreadsheets. These field notes are provided in Appendix C.

LEGEND

- FLOODWAY
- 0.2 PCT ANNUAL CHANCE FLOOD HAZARD
- 0.1 PCT ANNUAL CHANCE FLOOD HAZARD
- STREAM CORRIDOR
- STREAMS
- RAILROAD
- URBAN GROWTH BOUNDARY (UGB)
- CITY LIMITS
- TAX LOTS

Tangen Creek
Harvey Creek
Hess Creek
Chehalem Creek
Willamette River
Spring Brook
Section Observed
Section Walked
Section Observed
Section Walked
Section Walked
Section Walked
Section Walked
Section Observed
Section Walked
Section Walked
Section Observed
N
0 0.25 0.5 1 Miles

STORMWATER MASTER PLAN UPDATE

FIGURE 4-1. MAPPED STREAM CHANNELS, FLOODPLAINS, AND STREAM CORRIDOR ZONING

NEWBERG, OREGON

City of Newberg

Brown AND Caldwell

JUNE 2014

4.1.3 Flow modeling

A PC-SWMM hydrologic and hydraulic model was constructed to evaluate existing and future stream flows based on predicted land use changes (described in Section 3). Existing conditions modeled flows were compared to observed channel morphology to evaluate patterns and potential morphological changes that might occur with increased flows as predicted in the future condition models.

4.2 Results

Descriptions of the general stream channel characteristics in the reaches observed during our field investigation are provided in Table 4-1 and with more detail in Appendix C. In general, the condition of stream channels within the city limits are variable and likely dependent on a number of factors including riparian conditions (i.e., width of riparian area and vegetation); stream channel gradient and valley confinement; land uses in the general vicinity; and stormwater outfall locations.

4.2.1 Geologic Conditions and Erosivity

The predominant geology of Hess Creek and the other tributaries within the city is Willamette silt (Yamhill Basin Council, 2001), lacustrine (lake) and fluvial (river) deposits consisting of unconsolidated and semi-consolidated silt, clay, sand and gravel. With the exception of the upper reaches of Hess Creek in the vicinity of Mountainview Drive, the bed and bank material of all of the stream channels that were walked consisted of silt and clay. Downstream of Mountainview Drive, conglomerate (mixed sand and small rounded gravel) was observed in the banks. Upstream of Mountainview Drive, bedrock (siltstone) was present in the streambed.

The geologic material for which these stream channels are situated are resistant to slumping and can result in nearly vertical banks. Erosion was observed downstream of culverts or outfalls where flow was concentrated. Outside of these predictable locations where flow is concentrated erosion was also observed in several reaches where blocks of silt have caved into the channel. This type of bank failure is most likely a result of destabilization from undercut banks, animal activity (burrows from mountain beavers or nutria), surface disturbance, or soil saturation. This type of erosion was observed most notably in the Chehalem Creek tributary upstream of Highway 240, the Crestview reach of Hess Creek upstream of the railroad, and the lower reach of Hess Creek near the confluence with the Corinne Drive Tributary.

4.2.1.1 Specific Problem Areas

Below are specific problem areas or poor conditions that were noted during our stream walks. These are locations where restoration, repair or maintenance projects should be considered.

4.2.1.1.1 Chehalem Tributary

- Hill slope failure upstream of Highway 240 on the west bank. Re-vegetation and stabilization would prevent future slumping.
- Beaver dam at Sheridan Road crossing (downstream of Highway 240). The beaver dam observed during our stream walk was removed; however, this location is likely prone to beaver activity and should be monitored to ensure beavers do not get re-established. The road fill above the culvert is at least 30 feet high, and a large storm event that coincides with a culvert blockage could have devastating consequences.

Table 4-1. Summary of Stream Channel Characteristics

Stream	Segment	Location of modeled flow	Drainage area (acres)	2-year max total inflow (cfs)		Percent change	2-year unit discharge (cfs/acre)		Average bankfull width (ft)	Average bankfull depth (ft)	Average gradient (ft/ft)
				Existing	Future		Existing	Future			
Chehalem Tributary	North of Hwy 240	Creekside Lane and Creekside Court	329.5	42.5	45	5.56	0.13	0.14	8	4	0.016
	South of Hwy 240	West Sheridan Street (downstream side)	753	132.5	136.5	2.93	0.18	0.18	6	4	0.006
Hess Creek	North of Mountainview Drive	Edgewood Drive and Aldersgate Drive	946.5	56.2	62.5	10.08	0.06	0.07	9	3	0.008
	Mountainview Drive to Villa Road/Railroad	Crestview Drive	1,135.20	72.1	80.6	10.55	0.06	0.07	9	3	0.008
	Villa Road/Railroad to Hwy 99W	Fulton Street (downstream side)	1,451.10	100.2	110.7	9.49	0.07	0.08	10	3	0.005
	Hwy 99W to City Limit (near Wynooski Street)	Merlin Lane	1,861.70	174.4	181.8	4.07	0.09	0.10	11	2.5	0.002
Spring Brook	West Tributary, Hwy 99W to City Limit (Fernwood Road)	Hayes Street	358.4	74.4	80.6	7.69	0.21	0.22	7	3	0.012
	North of Hwy 99W near Benjamin Road	Benjamin Road	465.1	21.4	22.5	4.89	0.05	0.05	8	3	0.008

4.2.1.1.2 Hess Creek

- Upstream of Mountainview Drive, a stormwater ditch outfalls above Hess Creek on the hill slope. This discharge has resulted in extensive erosion at the outfall. Additional energy dissipation should be installed in this area, and consideration extending pipe directly to Hess Creek would help alleviate the hill slope erosion.
- In the reach above the railroad (Crestview), the stream has eroded material away from a sanitary sewer manhole that is now located in the stream channel. This manhole should be inspected for integrity and evaluated with respect to potential future impacts to channel migration and erosion.
- GFU has spent a lot of time and energy on the restoration of Hess Creek through the campus. Care should be taken to minimize changes to flow or hydraulics (such as Fulton Street culvert) that could negatively impact the restoration that has occurred.
- Significant erosion is occurring at the outfall location of the detention pond located on the Corinne Drive tributary to Hess Creek.

4.2.1.1.3 General Problem Observations

- Erosion is occurring at numerous stormwater outfalls and culvert crossings throughout the city. Outfalls and culvert crossing should be designed with sufficient energy dissipation with a mix of material sizes or geotextile fabric to minimize erosion of the fine grained silt.
- Invasive vegetation species such as reed canary grass, blackberries, and nightshade are prevalent in all the stream reaches (except GFU where restoration work as occurred). There are many opportunities to improve riparian vegetation conditions along Hess Creek (especially in the lower reach) and other Newberg tributaries.

4.2.2 Channel Geomorphology

Channel dimensions were plotted against drainage area and modeled 2-year discharges to evaluate for potential relationships between channel shape and flow conditions.

There is a fairly good correlation of drainage area to bankfull channel width for the stream channels walked in October 2013 (Figure 4-2).

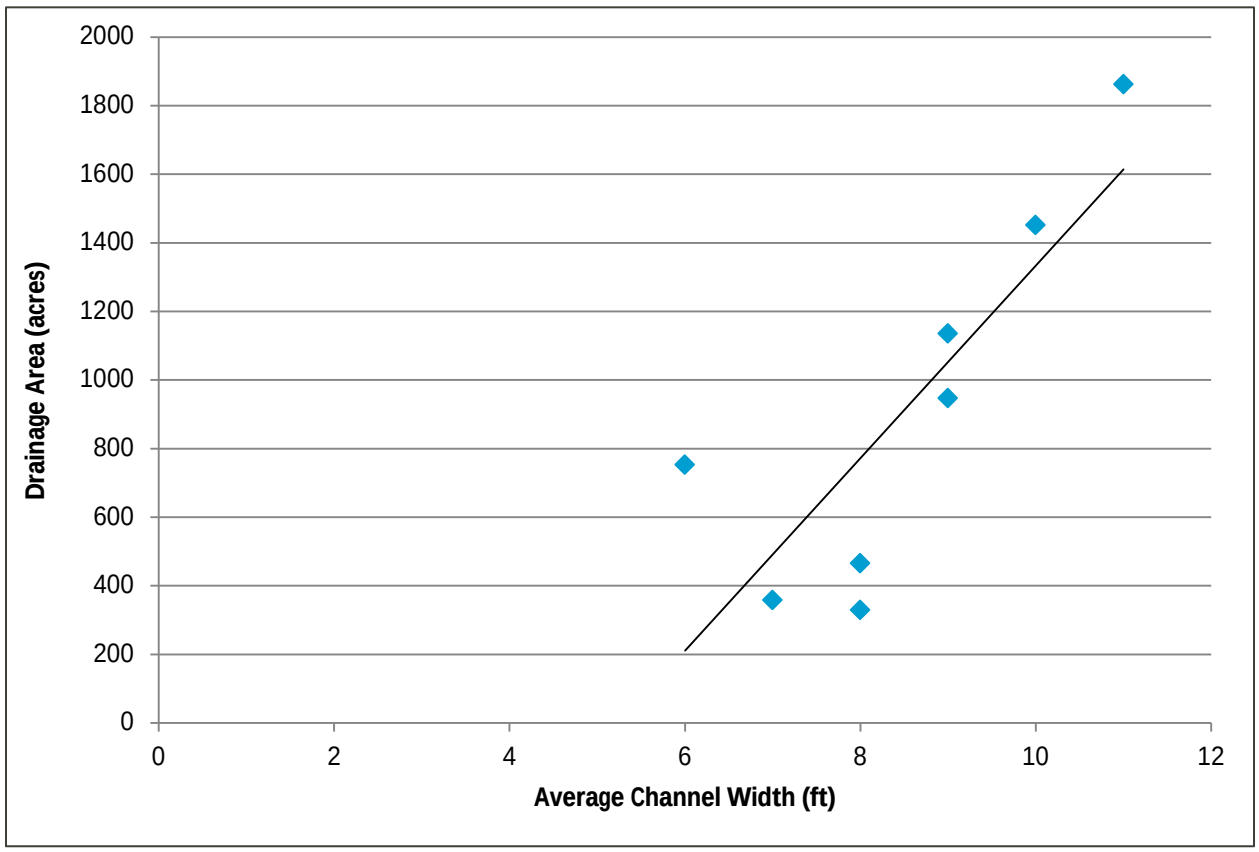


Figure 4-2. Drainage area versus channel width

However, a correlation was not found between discharge and stream channel width (Figure 4-3) or area (Figure 4-4).

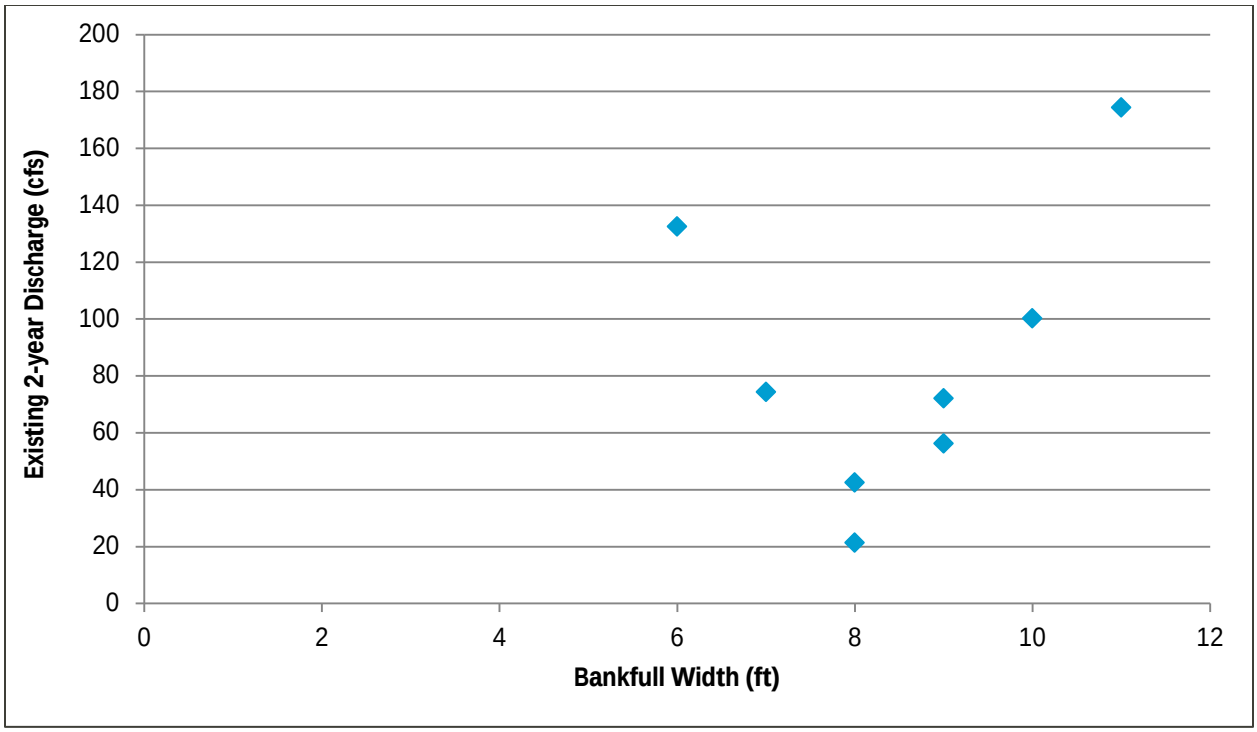


Figure 4-3. Existing 2-year discharge versus bankfull width

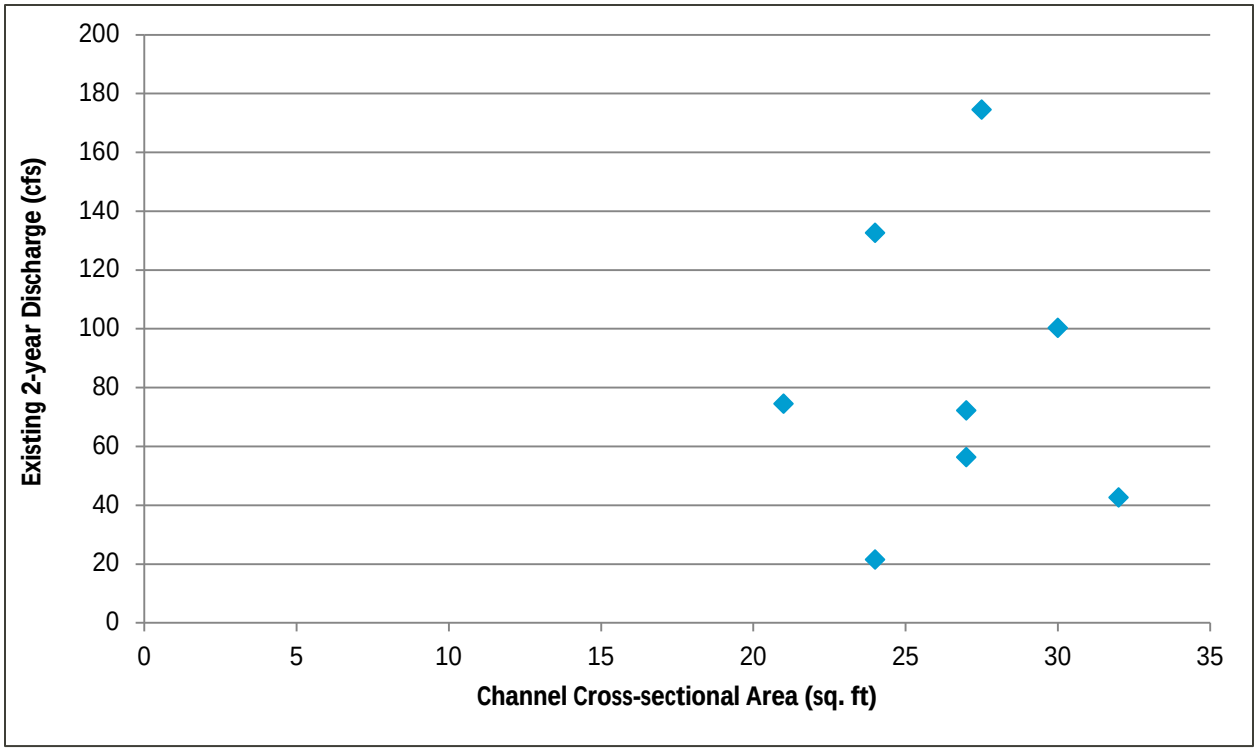


Figure 4-4. Existing 2-year discharge versus channel cross-sectional area

Figures 4-3 and 4-4 indicate that other factors besides stream channel discharge are likely influencing the geomorphology of stream channels in Newberg. For instance, constrictions in the stream channels such as culvert crossings tend to dampen the impact of peak flows and resulting erosion in downstream reaches. Examples of this include the Fulton Street culvert upstream of GFU, and the Sheridan Street crossing on the Chehalem Tributary on the west side of the city. Additionally, wide floodplains for which stream channels have room to move, and where overbank flooding can occur without risk of damage to infrastructure also dampens the erosive effects of high stream flow discharges.

The stream channel section with the highest unit area discharge (0.21 cfs/acre) is the Spring Brook tributary downstream of Hayes Street. This reach of stream channel was in relatively good condition despite the high velocity discharges it experiences relative to the overall drainage area. This could be because there are retention/detention facilities upstream that were not included in the model, the fairly wide riparian area that consists of large trees and native vegetation, and the connection of the stream channel to its floodplain. Flow control or stormwater detention in other parts of the city could have positive effects for stream channel conditions as well.

The City has designated "stream corridor zoning," limiting the type and location of development near stream channels based on a study completed in 1995 to comply with statewide planning Goal 5, "Open Spaces, Scenic and Historic Areas, and Natural Resources." The stream corridor zoning coincides with the natural floodplain area of stream channels within the city limits, providing fairly wide and undeveloped riparian areas in some cases.

4.2.3 Future Conditions

The area of the city that is expected to further develop in the next several years is located north of Mountainview Drive where large agricultural properties will be converted to residential developments. Flow increases are predicted for the upper reaches of Hess Creek based on modeling results. These increases will be less apparent downstream because of hydraulic conditions in the middle reaches (culvert crossings, etc.). The reach that is most vulnerable to increased flows is upstream of the railroad tracks (Crestview), where erosion is already prevalent.

Based on the modeling effort, flow increases are also expected on the west tributary of Spring Brook, particularly as the Austin Property is developed.

Future development of the South Industrial Area is located outside (downstream) of the modeling limits for this Stormwater Master Plan. Design standards to protect streams evaluated in this study should be carried into the South Industrial Area to protect existing stream channels.

No future flooding in the open stream channels is predicted for the 10-year flows based on hydraulic modeling, however, stream channel erosion could occur if measures aren't taken to control flows, maintain wide riparian areas and open floodplains, or dissipate energy at outfall locations and culvert crossings.

4.3 Recommendations

The City has already taken steps that help alleviate channel erosivity by designating stream corridors for protection in the zoning code. Other measures that should be considered to reduce potential future channel impacts include the following:

- Encourage or require new development to maximize infiltration of stormwater runoff when soil conditions allow. The infiltration of stormwater runoff reduces the impact of increase flows on stream corridors and is critical to the reduction of the channel forming annual flow events.
- Require flow control measures for smaller storms for new development. The 24-hour synthetic storms used for sizing detention can be conservative and therefore the small channel forming flows

are not addressed in the standards. Although this will not fully address all smaller storm events we recommend adding half the 2-year, 24-hour storm as a flow control storm in addition to the larger storms.

- Ensure culvert crossings, stormwater outfalls, and stream channel crossings (bridges) are designed and installed properly (e.g., aligned with stream flow and include energy dissipation) to minimize erosion downstream.
- Conduct regular field screenings of outfalls and other areas of previously observed erosion to document changes in bank conditions and identify locations for stream bank stability projects. Allocating at least one day per month for stream observation would allow City staff to visit areas of concern several times a year on a rotational basis.
- Vegetation does contribute to stream bank stability, and if invasive species such as reed canary grass are removed, replacement vegetation should be planted immediately.

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Chehalem Creek Tributary, Upstream of Sunnycrest Road

Stream
Chehalem Creek Newberg Tributary

Reach
Lower Reach (upstream of Sunnycrest)

General Characteristics

Gradient:	≈ 0.006 ft/ft
Valley Width:	100 – 150 feet
Planform:	Meandering
Average BFW:	≈ 6 ft
Average BFD:	≈ 4 ft
Substrate:	Silt
Vegetation:	Blackberries, ferns, mixed forest.
Beaver Activity:	Upstream of Sheridan Road culvert.

Issues
Some bank erosion and slumps.

Aerial view of Chehalem Creek Tributary, Sunnycrest (W 1st St) Reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Typical stream section above Highway 240

Stream
Chehalem Creek Newberg Tributary

Reach
Upper Reach (upstream of Hwy 240)

General Characteristics

Gradient:	≈ 0.016 ft/ft
Valley Width:	50 – 100 feet
Planform:	Relatively straight
Average BFW:	≈ 8 ft
Average BFD:	≈ 4 ft
Substrate:	Silt
Vegetation:	Blackberries, ferns, narrow mixed forest.
Beaver Activity:	None

Issues
Bank slumps, erosion and hillslope failures.

Aerial view of Chehalem Creek Tributary, upstream Hwy 240 reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Photo of Corrine Drive Tributary channel upstream of detention pond/lake (bottom photo).

Stream
Hess Creek

Reach
East Tributary (Corrine Drive)

General Characteristics

Gradient:	≈ 0.01 ft/ft
Valley Width:	<100 feet
Planform:	Relatively straight
Average BFW:	≈ 5 ft (City data)
Average BFD:	≈ 2.7 ft (City data)
Substrate:	Silt above detention pond, and downstream at confluence
Vegetation:	Mixed
Beaver Activity:	None

Issues
Erosion at detention pond outlet. Channel incision downstream (City data).

Aerial view of Hess Creek, Corrine Drive Tributary

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Hess Creek channel about WWTP

Stream
Hess Creek

Reach
Lower Reach (WWTP)

General Characteristics

Gradient:	≈ 0.002 ft/ft
Valley Width:	250 – 300 feet
Planform:	Meandering
Average BFW:	≈ 9 ft
Average BFD:	≈ 4 ft
Substrate:	Silt
Vegetation:	Reed canary grass, blackberries
Beaver Activity:	No recent activity observed.

Issues
Invasive vegetation. Very long piped section downstream of WWTP.

Aerial view of Hess Creek, WWTP reach.

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Example photos of stream reach above Crestview. Significant bank erosion in this reach.

Stream
Hess Creek

Reach
Upper Reach (Above Crestview)

General Characteristics

Gradient:	≈ 0.008 ft/ft
Valley Width:	100 – 150 feet
Planform:	Meandering
Average BFW:	≈ 9 feet
Average BFD:	≈ 3 feet
Substrate:	Silt (loose and thick in places)
Vegetation:	Residential pasture, blackberries, reed canary grass
Beaver Activity:	Moderate

Issues
Bank erosion (exposed sewer manhole)
Culvert of unknown purpose

Aerial view of Hess Creek, Crestview Reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Photo of mainstem Hess Creek at confluence with Corrine Drive Tributary

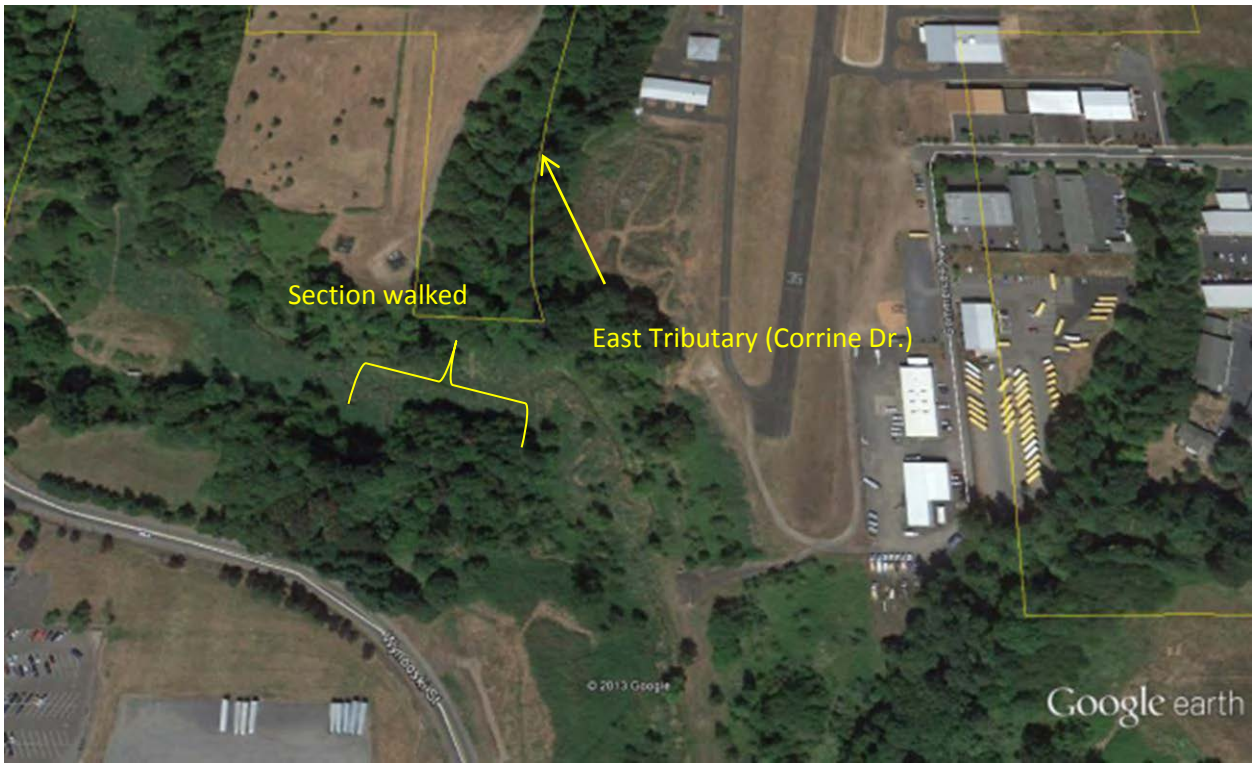
Stream
Hess Creek

Reach
Lower Reach (Near Confluence with East Trib)

General Characteristics

Gradient:	≈ 0.002 ft/ft
Valley Width:	200 – 300 feet
Planform:	Meandering
Average BFW:	≈ 11 feet
Average BFD:	≈ 2.5 feet
Substrate:	Silt
Vegetation:	Reed canary grass, blackberries, mixed vegetation along slopes at forest edge.
Beaver Activity:	None

Issues
Fair amount of bank slumping in this reach



Aerial view of Hess Creek, East Tributary Confluence Reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Typical stream section upstream of NE Benjamin Road

Stream
Spring Brook Mainstem

Reach
Upper Reach (Upstream of Benjamin Road)

General Characteristics

Gradient:	≈ 0.008 ft/ft
Valley Width:	100 – 150 feet
Planform:	Meandering
Average BFW:	≈ 8 ft
Average BFD:	≈ 3 ft
Substrate:	Silt
Vegetation:	Shrubs, lawn (residential areas)
Beaver Activity:	None

Issues
Flooding at Benjamin Road during larger events

Aerial view of Spring Brook in the vicinity of NE Benjamin Road

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Example photos of Hess Creek through Hoover Park (downstream of Hwy 99), and flooding during January 2011.

Stream
Hess Creek

Reach
Lower Reach (Hoover Park)

General Characteristics

Gradient:	≈ 0.006 ft/ft
Valley Width:	200 – 300 feet
Planform:	Channelized
Average BFW:	≈ 8 feet
Average BFD:	≈ 3 feet
Substrate:	Silt
Vegetation:	Lawn, blackberries and reed canary grass in undeveloped areas.
Beaver Activity:	None

Issues
Park flooding during larger storms.

Aerial view of Hess Creek, Hoover Park reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Example photos of stream reach below Mountainview Drive. Residential drainage pipes enter channel on west side.

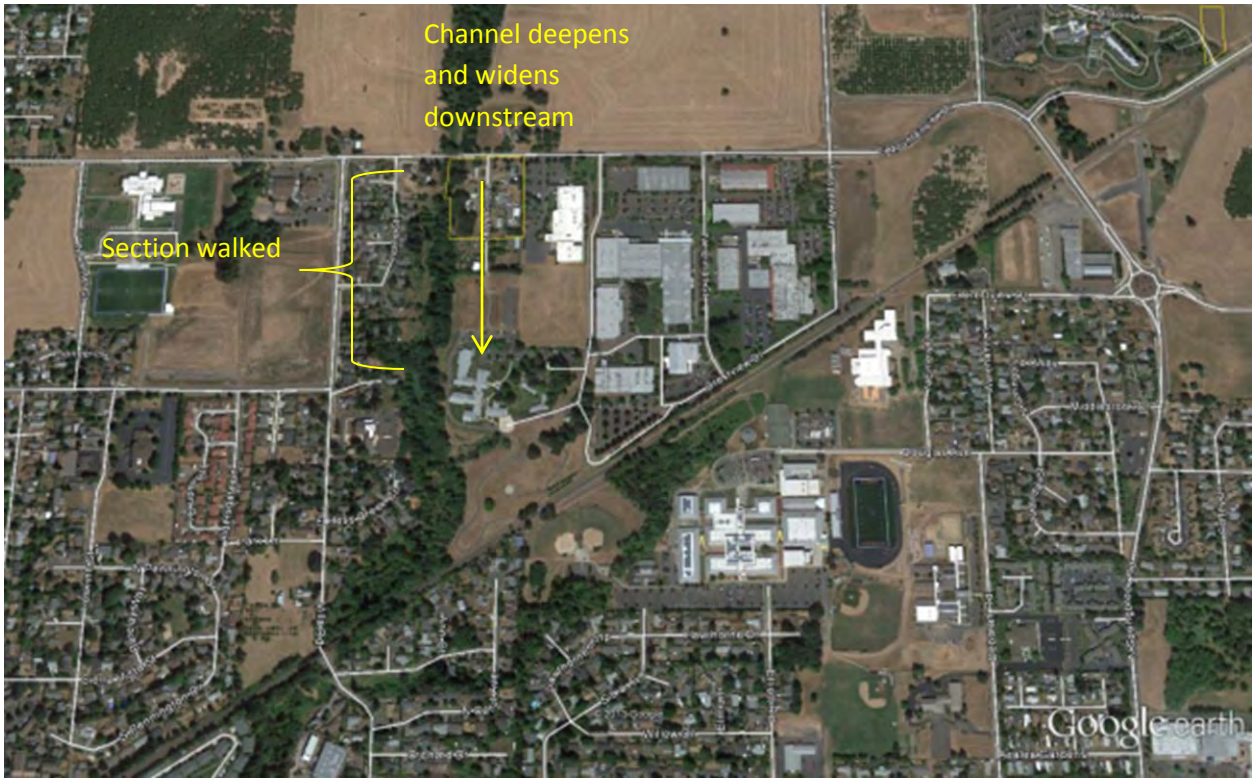
Stream
Hess Creek

Reach
Upper Reach (Below Mtn. View Dr.)

General Characteristics

Gradient:	≈ 0.008 ft/ft
Valley Width:	100 -150 feet
Planform:	Meandering
Average BFW:	≈ 7 feet (3 – 12)
Average BFD:	≈ 3 feet (2 - 10
Substrate:	Primarily silt, some gravel
Vegetation:	Residential landscaping, lawn, trees adjacent to channel
Beaver Activity:	None

Issues
Downcutting. Some bank erosion.



Aerial view of Hess Creek, Mountainview downstream

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

One of many beaver dams in the Hess Creek reach above Mountainview Drive

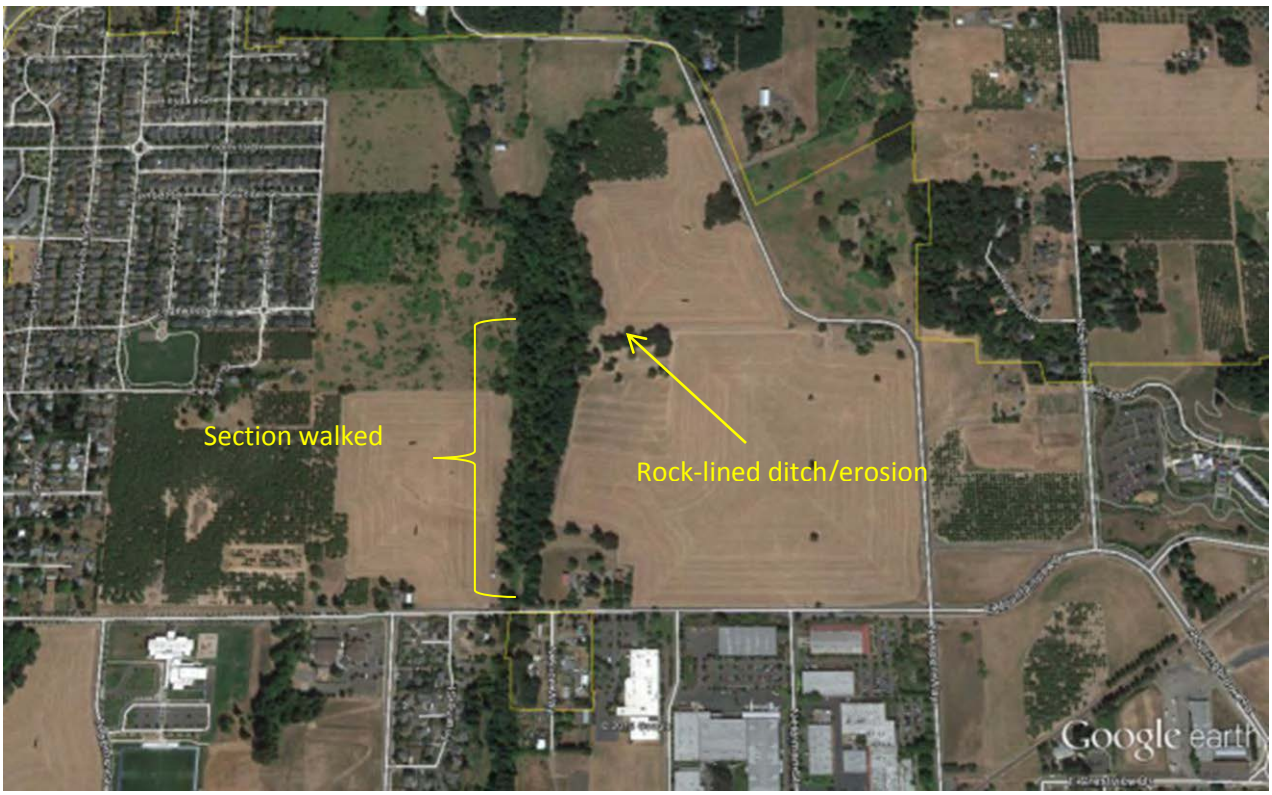
Stream
Hess Creek

Reach
Upper Reach (Above Mtn. View Dr.)

General Characteristics

Gradient:	≈ 0.008 ft/ft
Valley Width:	100 – 150 feet
Planform:	Meandering
Average BFW:	≈ 9 feet
Average BFD:	≈ 3 feet
Substrate:	Primarily silt, some gravel, bedrock above Mountainview Dr
Vegetation:	Narrow forested riparian area, reed canary grass
Beaver Activity:	Significant

Issues
Significant erosion at ditch outfall



Aerial view of Hess Creek, Mountainview Drive Reach

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Typical stream section between Fernwood Rd and Hayes St

Stream
Spring Brook West Tributary

Reach
Upper Reach (Upstream of Fernwood)

General Characteristics

Gradient:	≈ 0.012 ft/ft
Valley Width:	50 – 100 feet
Planform:	Relatively straight
Average BFW:	≈ 7 ft
Average BFD:	≈ 3 ft
Substrate:	Silt
Vegetation:	Mixed forest. Fairly nice riparian area.
Beaver Activity:	None

Issues
Many groundwater seeps, especially on west bank.

Aerial view of Spring Brook West Tributary in the vicinity of E Fernwood Rd

CITY OF NEWBERG
STREAM VULNERABILITY ASSESSMENT STREAM REACH DESCRIPTIONS

Example photo of Hess Creek through GFU campus

Stream
Hess Creek

Reach
Middle Reach (George Fox University)

General Characteristics

Gradient:	≈ 0.005 ft/ft
Valley Width:	150 – 200 feet
Planform:	Meandering
Average BFW:	≈ 10 feet
Average BFD:	≈ 3 feet
Substrate:	Silt
Vegetation:	Native plants (significant restoration activity)
Beaver Activity:	None

Issues
No significant issues. GFU has and continues to restore reach.

Aerial view of Hess Creek, George Fox University Reach

Appendix D: CIP Fact Sheets and Cost Estimate

Table 8-1 - Recommended Projects Costs Summary

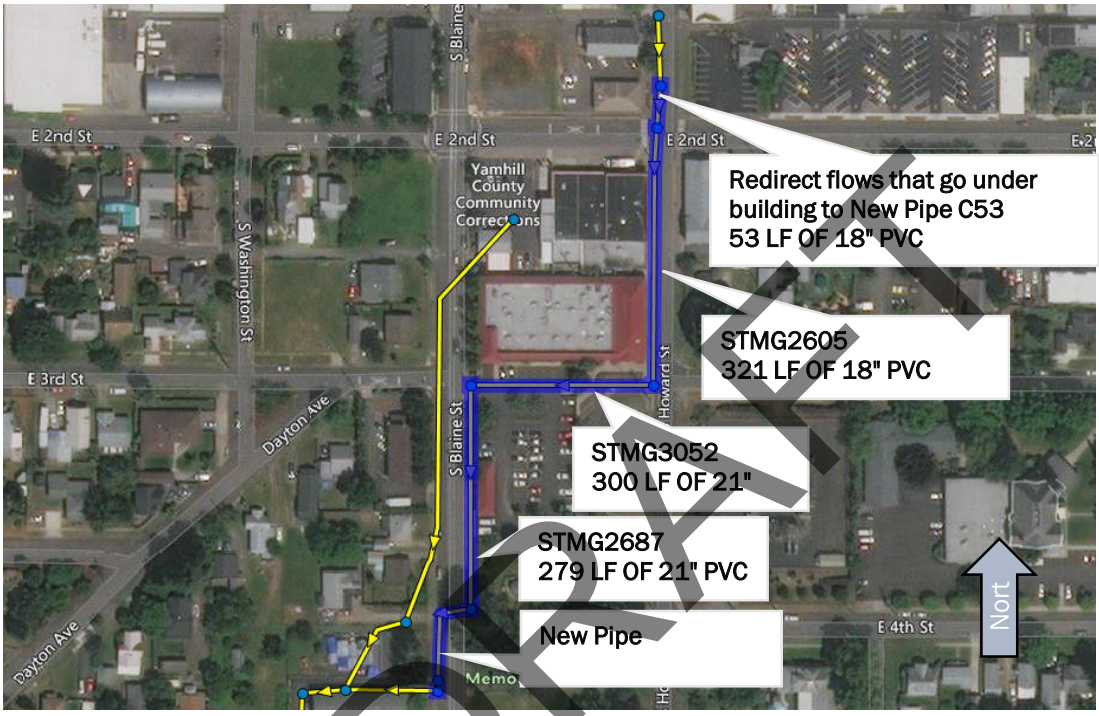
No.	Project Name	Preliminary Estimated Cost
Priority 1A Projects(0-5 years)		
C-A	S Blaine St. Improvements	$ 104,527
C-B	S Center St. Improvements	$ 2,415,715
C-C.A	Oxford St. Improvements - Section 1	$ 177,193
C-C.B	Oxford St. Improvements - Section 2	$ 142,677
C-C.C	Oxford St. Improvements - Section 3	$ 45,094
C-D	6th & Blain St. Improvements	$ 312,773
C-E	Pinehurst Dr. Improvements	$ 328,688
C-F	Crater Ln. Improvements	$ 10,168
C-G	Partridge Ln. Improvements	$ 80,980
C-H	Illinois St. Improvements	$ 139,183
C-I	Ditch & Pinehurst Dr. Improvements	$ 283,916
C-J	Charles St. Improvements	$ 39,339
C-K	Center St. Improvements	$ 138,377
C-L	N Edwards St. Improvements	$ 40,962
C-M	E Third St. Improvements	$ 647,954
C-N	N Ellitiot Rd. Improvements	$ 650,305
C-O	Mountainview Dr. Improvements	$ 53,556
C-P	Crestview Dr. Improvements	$ 131,819
C-Q	Wynooski St. Improvements	$ 309,198
C-R	2nd St. Crossing	$ 31,582
C-S	E 2nd St. @ River St. Improvements	$ 121,007
C-T	E 2nd St. @ Ardus St. Improvements	$ 216,600
C-U.A	N Springbrook Rd. Improvements - Section 1	$ 94,466
C-U.B	N Springbrook Rd. Improvements - Section 2	$ 164,847
C-V	Libra St. Improvements	$ 220,159
C-W	BruTscher St. Improvements	$ 2,907
Total Recommended Improvement Project Costs		**$ 6,903,990**

C-A: S Blaine St. Improvements

Drainage	Chehalem Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	39 acres
Objective(s) Addressed	Pipe Replacement of those under structure, Flood Control

Project Description:

Decommission the stormwater pipes which are in private property and add/upsize pipes to 18” and 21” to convey flows and connect to the new stormwater system along S Blaine St. A previous project ended at 5th street, this is the rest of the previous project.



Cost Estimate:

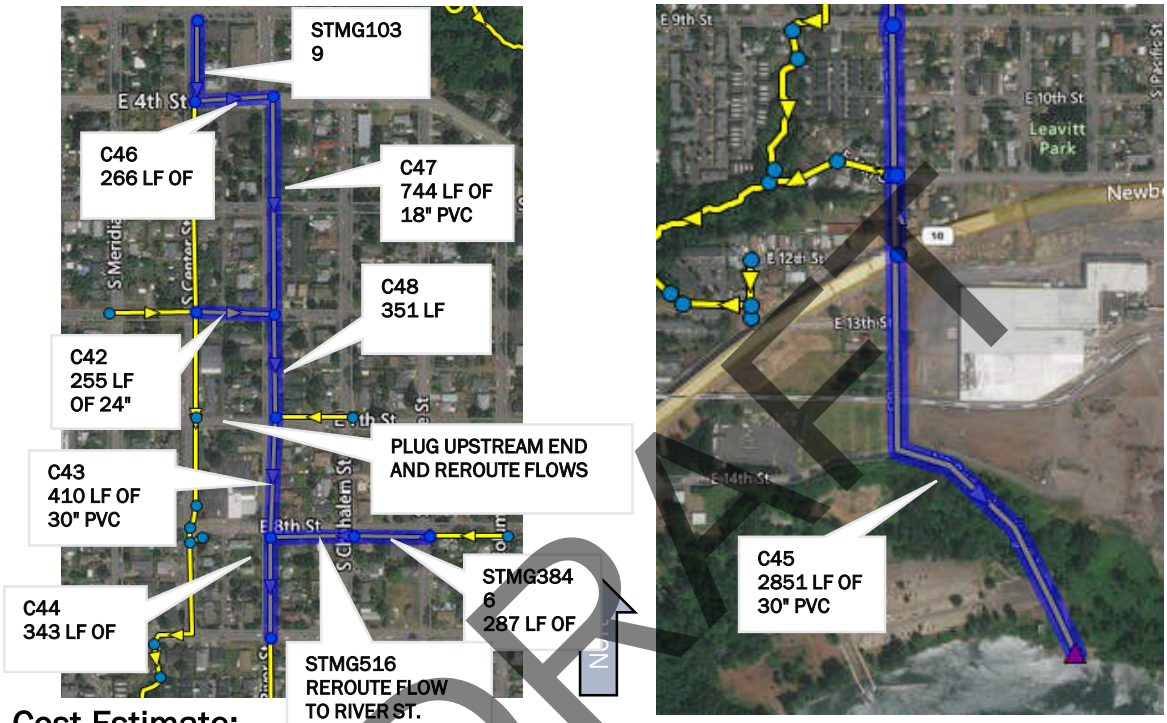
Description	Quantity	Unit	Unit Cost	Total Costs
18" PVC Pipeline	374	LF	$ 147	$ 54,978
21" PVC Pipeline	661	LF	$ 176	$ 116,336
Capital Expenses Subtotal				**$ 54,978**
Mobilization/Demobilization	10%	LS		$ 5,498
Traffic Control	5%	LS		$ 2,749
Erosion Control	2%	LS		$ 1,100
Construction Cost Subtotal				**$ 64,324**
Construction Contingency	30%	LS		$ 19,297
Capital Expense Total				**$ 83,622**
Engineering	20%	LS		$ 16,724
Legal and Administrative	5%	LS		$ 4,181
Capitol Implementation Cost Total				**$ 104,527**

C-B: S Center St. Improvements

Drainage	Chehalem Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	100 acres
Objective(s) Addressed	Flood Control, avoiding private property

Project Description:

Flooding along E 8th St, E 7th St, and S Center St occurs. There are proposed improvements to River St. and the Center St. flooding can be routed along a new trunk line in River St. to the river. This will include upsizing some existing stormwater pipes.



Cost Estimate:

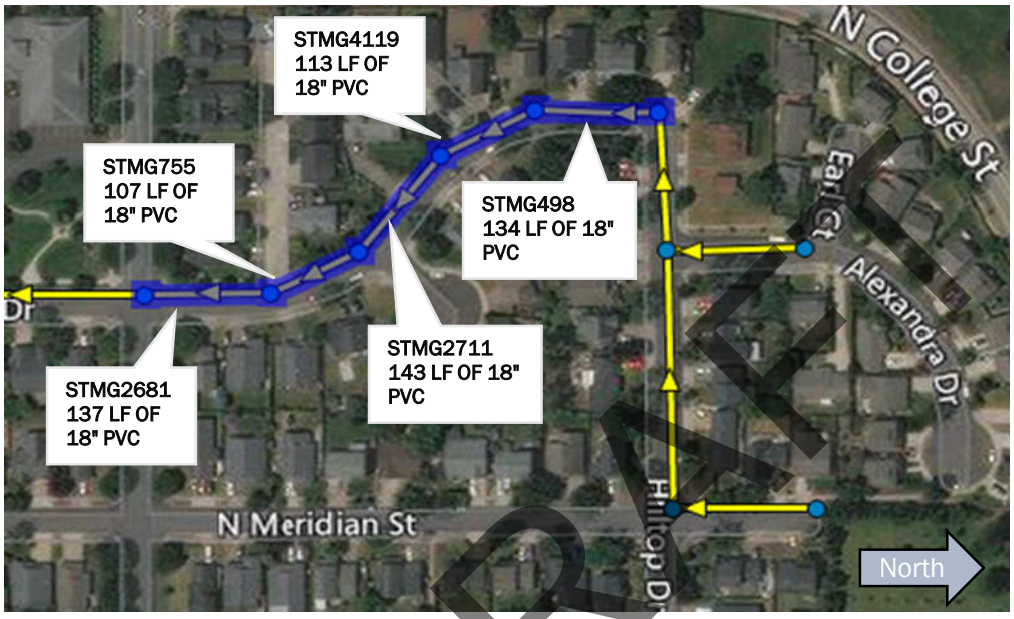
Description	Quantity	Unit	Unit Cost	Total Costs
18" PVC Pipeline	1289	LF	$ 147	$ 189,483
21" PVC Pipeline	550	LF	$ 176	$ 96,800
24" PVC Pipeline	606	LF	$ 191	$ 115,746
30" PVC Pipeline	3604	LF	$ 241	$ 868,564
Capital Expenses Subtotal				**$ 1,270,593**
Mobilization/Demobilization	10%	LS		$ 127,059
Traffic Control	5%	LS		$ 63,530
Erosion Control	2%	LS		$ 25,412
Construction Cost Subtotal				**$ 1,486,594**
Construction Contingency	30%	LS		$ 445,978
Capital Expense Total				**$ 1,932,572**
Engineering	20%	LS		$ 386,514
Legal and Administrative	5%	LS		$ 96,629
Capitol Implementation Cost Total				**$ 2,415,715**

C-C.A: Oxford St. Improvements - Section 1

Drainage	Chehalem Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	166 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.



Cost Estimate:

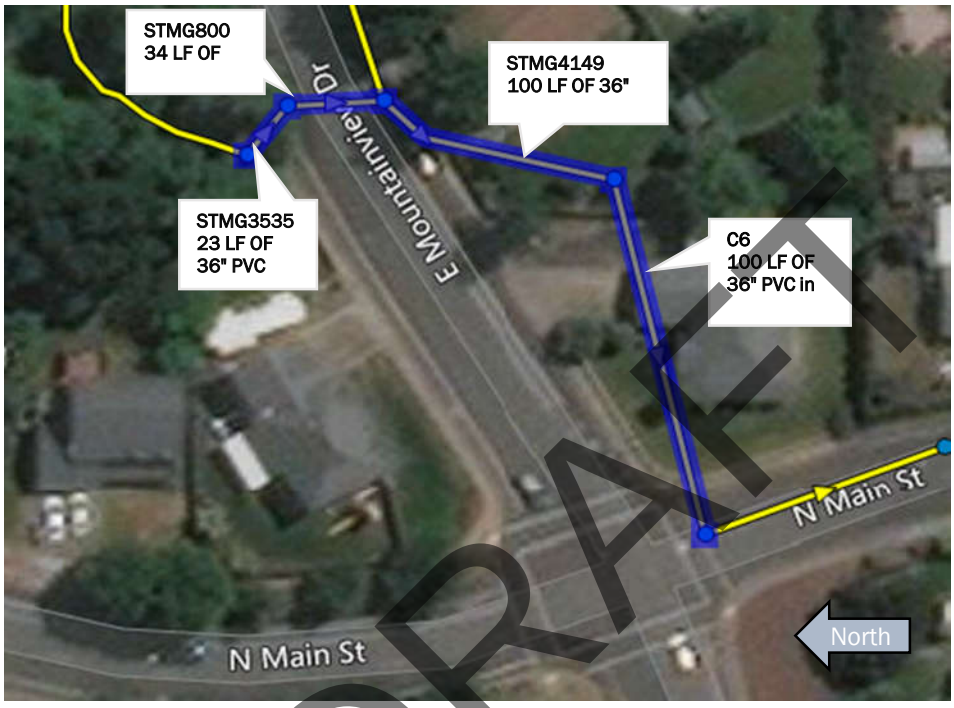
Description	Quantity	Unit	Unit Cost	Total Costs
18" PVC Pipeline	634	LF	$ 147	$ 93,198
Capital Expenses Subtotal				**$ 93,198**
Mobilization/Demobilization	10%	LS		$ 9,320
Traffic Control	5%	LS		$ 4,660
Erosion Control	2%	LS		$ 1,864
Construction Cost Subtotal				**$ 109,042**
Construction Contingency	30%	LS		$ 32,712
Capital Expense Total				**$ 141,754**
Engineering	20%	LS		$ 28,351
Legal and Administrative	5%	LS		$ 7,088
Capitol Implementation Cost Total				**$ 177,193**

C-C.B: Oxford St. Improvements - Section 2

Drainage	Chehalem Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	166 acres
Objective(s) Addressed	Flood Control, avoid private property

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding. The new pipes will be in the right-of-way, and not under private property.



Cost Estimate:

Description	Quantity	Unit	Unit Cost	Total Costs
36" PVC Pipeline	257	LF	$ 292	$ 75,044
Capital Expenses Subtotal				**$ 75,044**
Mobilization/Demobilization	10%	LS		$ 7,504
Traffic Control	5%	LS		$ 3,752
Erosion Control	2%	LS		$ 1,501
Construction Cost Subtotal				**$ 87,801**
Construction Contingency	30%	LS		$ 26,340
Capital Expense Total				**$ 114,142**
Engineering	20%	LS		$ 22,828
Legal and Administrative	5%	LS		$ 5,707
Capitol Implementation Cost Total				**$ 142,677**

C-C.C: Oxford St. Improvements - Section 3

Drainage	Chehalem Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	166 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.

Cost Estimate:

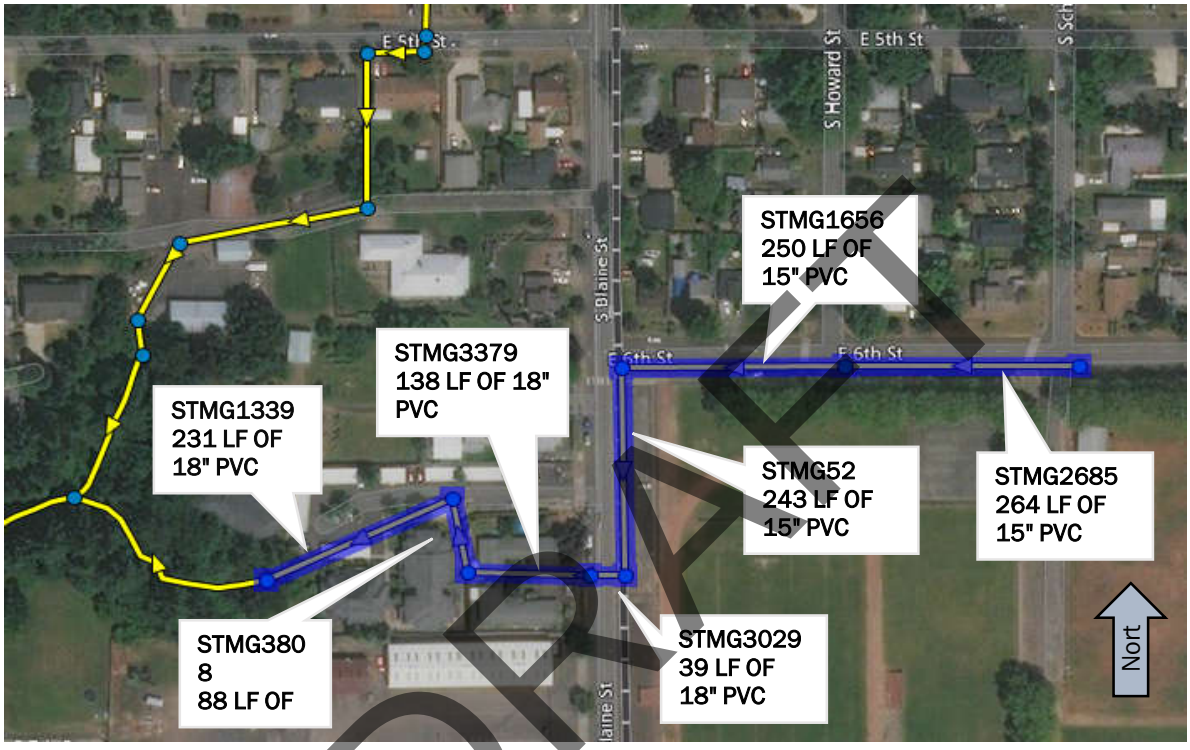
Description	Quantity	Unit	Unit Cost	Total Costs
48" PVC Pipeline	67	LF	$ 354	$ 23,718
Capital Expenses Subtotal				**$ 23,718**
Mobilization/Demobilization	10%	LS		$ 2,372
Traffic Control	5%	LS		$ 1,186
Erosion Control	2%	LS		$ 474
Construction Cost Subtotal				**$ 27,750**
Construction Contingency	30%	LS		$ 8,325
Capital Expense Total				**$ 36,075**
Engineering	20%	LS		$ 7,215
Legal and Administrative	5%	LS		$ 1,804
Capitol Implementation Cost Total				**$ 45,094**

C-D: 6th & Blain St. Improvements

Drainage	Chehalem Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	25.4 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.



Cost Estimate:

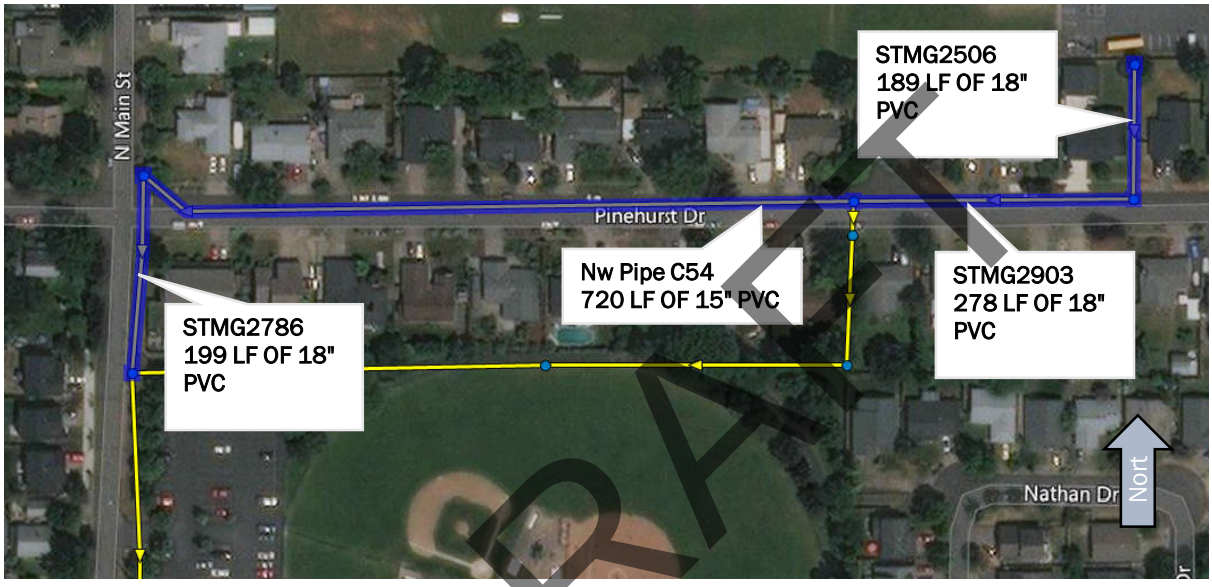
Description	Quantity	Unit	Unit Cost	Total Costs
15" PVC Pipeline	757	LF	$ 121	$ 91,597
18" PVC Pipeline	496	LF	$ 147	$ 72,912
Capital Expenses Subtotal				**$ 164,509**
Mobilization/Demobilization	10%	LS		$ 16,451
Traffic Control	5%	LS		$ 8,225
Erosion Control	2%	LS		$ 3,290
Construction Cost Subtotal				**$ 192,476**
Construction Contingency	30%	LS		$ 57,743
Capital Expense Total				**$ 250,218**
Engineering	20%	LS		$ 50,044
Legal and Administrative	5%	LS		$ 12,511
Capitol Implementation Cost Total				**$ 312,773**

C-E: Pinehurst Dr. Improvements

Drainage	Chehalem Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	13 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is constricted through pipes in park, so an additional parallel pipe is recommended in the adjacent street. It is currently sized to work in combination with the one in the park, but it could be sized to abandon the line through the park.



Cost Estimate:

Description	Quantity	Unit	Unit Cost	Total Costs
15" PVC Pipeline	1187	LF	$ 121	$ 143,627
18" PVC Pipeline	199	LF	$ 147	$ 29,253
Capital Expenses Subtotal				**$ 172,880**
Mobilization/Demobilization	10%	LS		$ 17,288
Traffic Control	5%	LS		$ 8,644
Erosion Control	2%	LS		$ 3,458
Construction Cost Subtotal				**$ 202,270**
Construction Contingency	30%	LS		$ 60,681
Capital Expense Total				**$ 262,950**
Engineering	20%	LS		$ 52,590
Legal and Administrative	5%	LS		$ 13,148
Capitol Implementation Cost Total				**$ 328,688**

C-F: Crater Ln. Improvements

Drainage	Chehalem Creek
Flooding Occcurs	Less than 1 hr @ 25 year event
Contributing Drainage Area	142 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.

Cost Estimate:

Description	Quantity	Unit	Unit Cost	Total Costs
24" PVC Pipeline	28	LF	$ 191	$ 5,348
Capital Expenses Subtotal				**$ 5,348**
Mobilization/Demobilization	10%	LS		$ 535
Traffic Control	5%	LS		$ 267
Erosion Control	2%	LS		$ 107
Construction Cost Subtotal				**$ 6,257**
Construction Contingency	30%	LS		$ 1,877
Capital Expense Total				**$ 8,134**
Engineering	20%	LS		$ 1,627
Legal and Administrative	5%	LS		$ 407
Capitol Implementation Cost Total				**$ 10,168**

C-G: Partridge Ln. Improvements

Drainage	Chehalem Creek
Flooding Occcurs	Only 6 min. @ 25 year event
Contributing Drainage Area	30 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.

Cost Estimate:

Description	Quantity	Unit	Unit Cost	Total Costs
24" PVC Pipeline	223	LF	$ 191	$ 42,593
Capital Expenses Subtotal				**$ 42,593**
Mobilization/Demobilization	10%	LS		$ 4,259
Traffic Control	5%	LS		$ 2,130
Erosion Control	2%	LS		$ 852
Construction Cost Subtotal				**$ 49,834**
Construction Contingency	30%	LS		$ 14,950
Capital Expense Total				**$ 64,784**
Engineering	20%	LS		$ 12,957
Legal and Administrative	5%	LS		$ 3,239
Capitol Implementation Cost Total				**$ 80,980**

C-H: Illinois St. Improvements

Drainage	Chehalem Creek
Flooding Occcurs	10 year event
Contributing Drainage Area	2 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.

Cost Estimate:

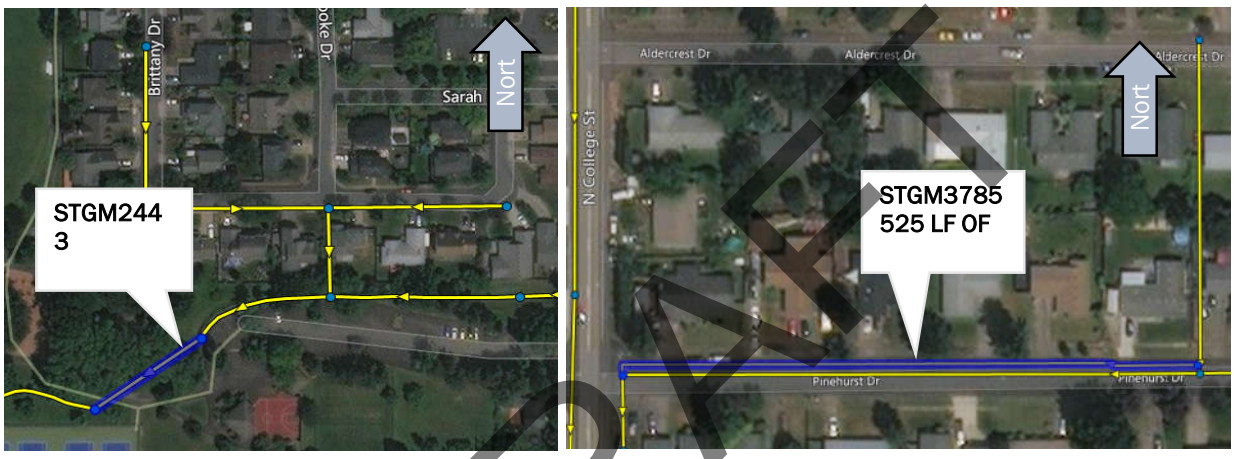
Description	Quantity	Unit	Unit Cost	Total Costs
18" PVC Pipeline	498	LF	$ 147	$ 73,206
Capital Expenses Subtotal				**$ 73,206**
Mobilization/Demobilization	10%	LS		$ 7,321
Traffic Control	5%	LS		$ 3,660
Erosion Control	2%	LS		$ 1,464
Construction Cost Subtotal				**$ 85,651**
Construction Contingency	30%	LS		$ 25,695
Capital Expense Total				**$ 111,346**
Engineering	20%	LS		$ 22,269
Legal and Administrative	5%	LS		$ 5,567
Capitol Implementation Cost Total				**$ 139,183**

C-I: Ditch & Pinehurst Dr. Improvements

Drainage	Chehalem Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	136 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.



Cost Estimate:

Description	Quantity	Unit	Unit Cost	Total Costs
24" PVC Pipeline	525	LF	$ 191	$ 100,275
36" PVC Pipeline	168	LF	$ 292	$ 49,056
Capital Expenses Subtotal				**$ 149,331**
Mobilization/Demobilization	10%	LS		$ 14,933
Traffic Control	5%	LS		$ 7,467
Erosion Control	2%	LS		$ 2,987
Construction Cost Subtotal				**$ 174,717**
Construction Contingency	30%	LS		$ 52,415
Capital Expense Total				**$ 227,132**
Engineering	20%	LS		$ 45,426
Legal and Administrative	5%	LS		$ 11,357
Capitol Implementation Cost Total				**$ 283,916**

C-J: Charles St. Improvements

Drainage	Chehalem Creek
Flooding Occcurs	10 year event
Contributing Drainage Area	12 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.

Cost Estimate:

Description	Quantity	Unit	Unit Cost	Total Costs
15" PVC Pipeline	171	LF	$ 121	$ 20,691
Capital Expenses Subtotal				**$ 20,691**
Mobilization/Demobilization	10%	LS		$ 2,069
Traffic Control	5%	LS		$ 1,035
Erosion Control	2%	LS		$ 414
Construction Cost Subtotal				**$ 24,208**
Construction Contingency	30%	LS		$ 7,263
Capital Expense Total				**$ 31,471**
Engineering	20%	LS		$ 6,294
Legal and Administrative	5%	LS		$ 1,574
Capitol Implementation Cost Total				**$ 39,339**

C-K: Center St. Improvements

Drainage	Chehalem Creek
Flooding Occcurs	25 year event
Contributing Drainage Area	58 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.

Cost Estimate:

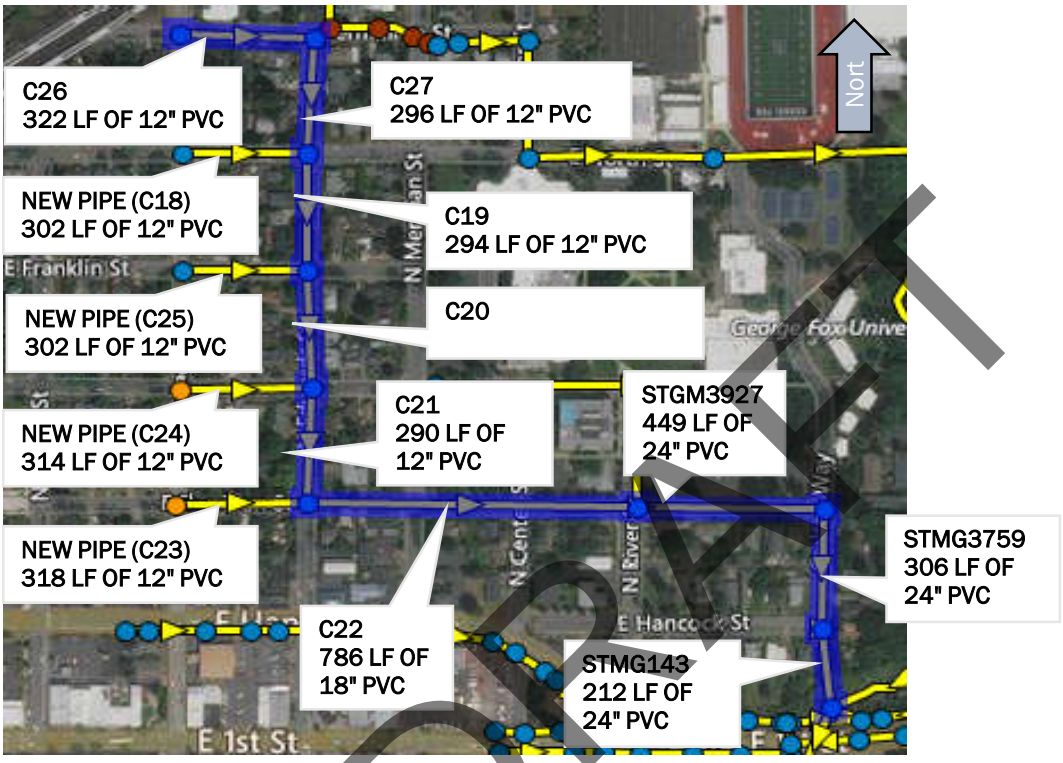
Description	Quantity	Unit	Unit Cost	Total Costs
30" PVC Pipeline	302	LF	$ 241	$ 72,782
Capital Expenses Subtotal				**$ 72,782**
Mobilization/Demobilization	10%	LS		$ 7,278
Traffic Control	5%	LS		$ 3,639
Erosion Control	2%	LS		$ 1,456
Construction Cost Subtotal				**$ 85,155**
Construction Contingency	30%	LS		$ 25,546
Capital Expense Total				**$ 110,701**
Engineering	20%	LS		$ 22,140
Legal and Administrative	5%	LS		$ 5,535
Capitol Implementation Cost Total				**$ 138,377**

C-L: N Edwards St. Improvements

Drainage	Hess Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	19 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding. There are also several streets with no pipes that are experiencing flooding. There are new pipes added in those areas.



Cost Estimate:

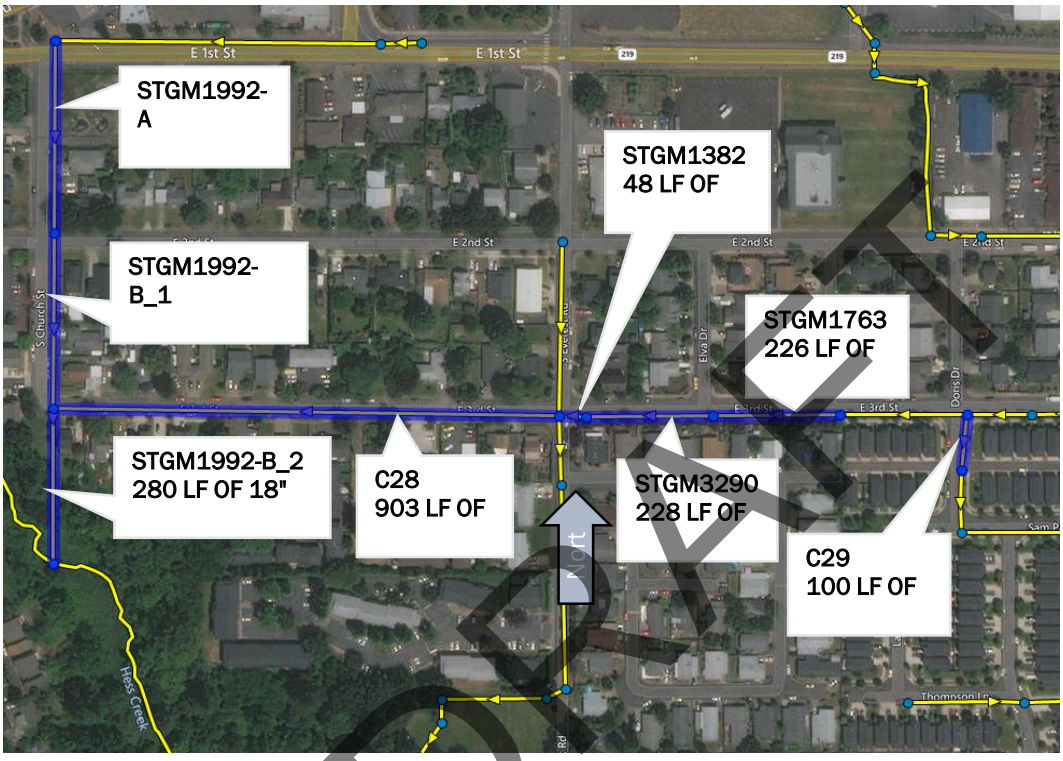
Description	Quantity	Unit	Unit Cost	Total Costs
12" PVC Pipeline	2740	LF	$ 87	$ 238,380
18" PVC Pipeline	786	LF	$ 147	$ 115,542
24" PVC Pipeline	967	LF	$ 191	$ 184,697
Capital Expenses Subtotal				**$ 538,619**
Mobilization/Demobilization	10%	LS		$ 53,862
Traffic Control	5%	LS		$ 26,931
Erosion Control	2%	LS		$ 10,772
Construction Cost Subtotal				**$ 630,184**
Construction Contingency	30%	LS		$ 189,055
Capital Expense Total				**$ 819,239**
Engineering	20%	LS		$ 163,848
Legal and Administrative	5%	LS		$ 40,962
Capitol Implementation Cost Total				**$ 1,024,049**

C-M: E Third St. Improvements

Drainage	Hess Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	28 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding. To completely remove flooding in the area, coordination is needed with ODOT to upsize the pipes in 1st street to 18".



Cost Estimate:

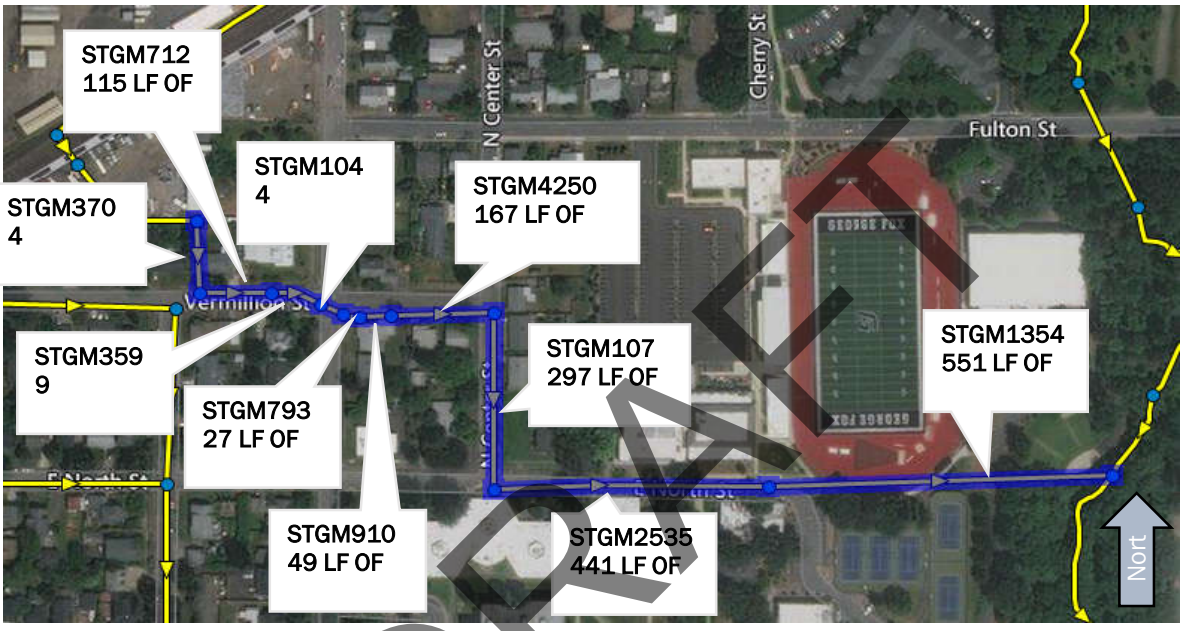
Description	Quantity	Unit	Unit Cost	Total Costs
12" PVC Pipeline	100	LF	$ 87	$ 8,700
15" PVC Pipeline	502	LF	$ 121	$ 60,742
18" PVC Pipeline	1846	LF	$ 147	$ 271,362
Capital Expenses Subtotal				**$ 340,804**
Mobilization/Demobilization	10%	LS		$ 34,080
Traffic Control	5%	LS		$ 17,040
Erosion Control	2%	LS		$ 6,816
Construction Cost Subtotal				**$ 398,741**
Construction Contingency	30%	LS		$ 119,622
Capital Expense Total				**$ 518,363**
Engineering	20%	LS		$ 103,673
Legal and Administrative	5%	LS		$ 25,918
Capitol Implementation Cost Total				**$ 647,954**

C-N: N Ellitiot Rd. Improvements

Drainage	Hess Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	25 acres
Objective(s) Addressed	Flood Control & Pipe Material

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.



Cost Estimate:

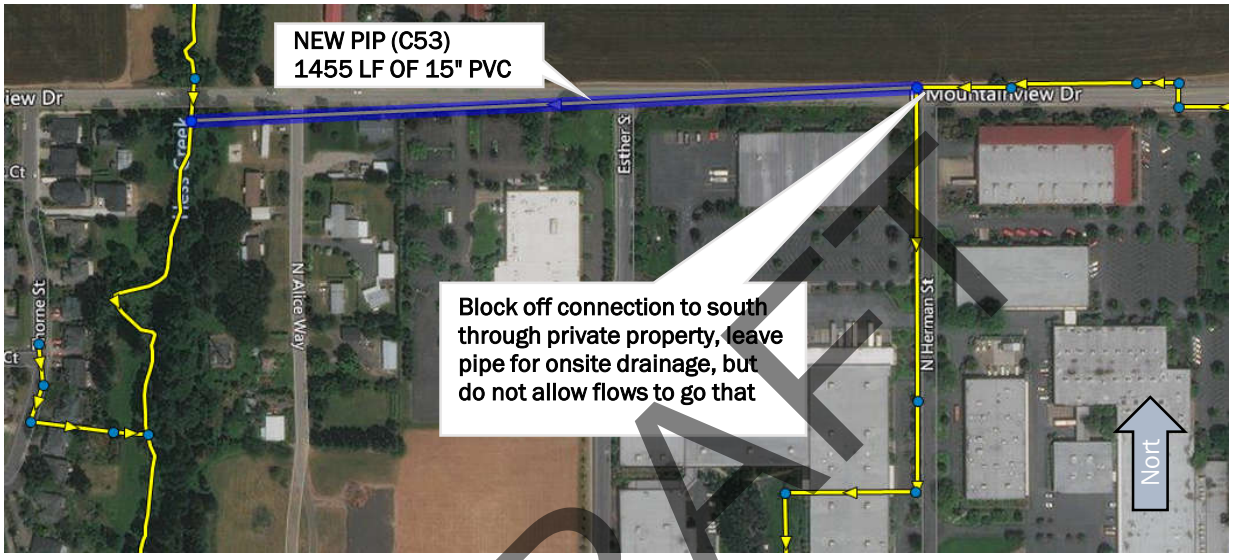
Description	Quantity	Unit	Unit Cost	Total Costs
18" PVC Pipeline	435	LF	$ 147	$ 63,945
24" PVC Pipeline	1456	LF	$ 191	$ 278,096
Capital Expenses Subtotal				**$ 342,041**
Mobilization/Demobilization	10%	LS		$ 34,204
Traffic Control	5%	LS		$ 17,102
Erosion Control	2%	LS		$ 6,841
Construction Cost Subtotal				**$ 400,188**
Construction Contingency	30%	LS		$ 120,056
Capital Expense Total				**$ 520,244**
Engineering	20%	LS		$ 104,049
Legal and Administrative	5%	LS		$ 26,012
Capitol Implementation Cost Total				**$ 650,305**

C-O: Mountainview Dr. Improvements

Drainage	Hess Creek
Flooding Occcurs	10 year event
Contributing Drainage Area	78 acres
Objective(s) Addressed	Flood Control

Project Description:

There is flooding because major upland flows come through lines on private property, so it is proposed they will be rerouted west Mountianview Dr.



Cost Estimate:

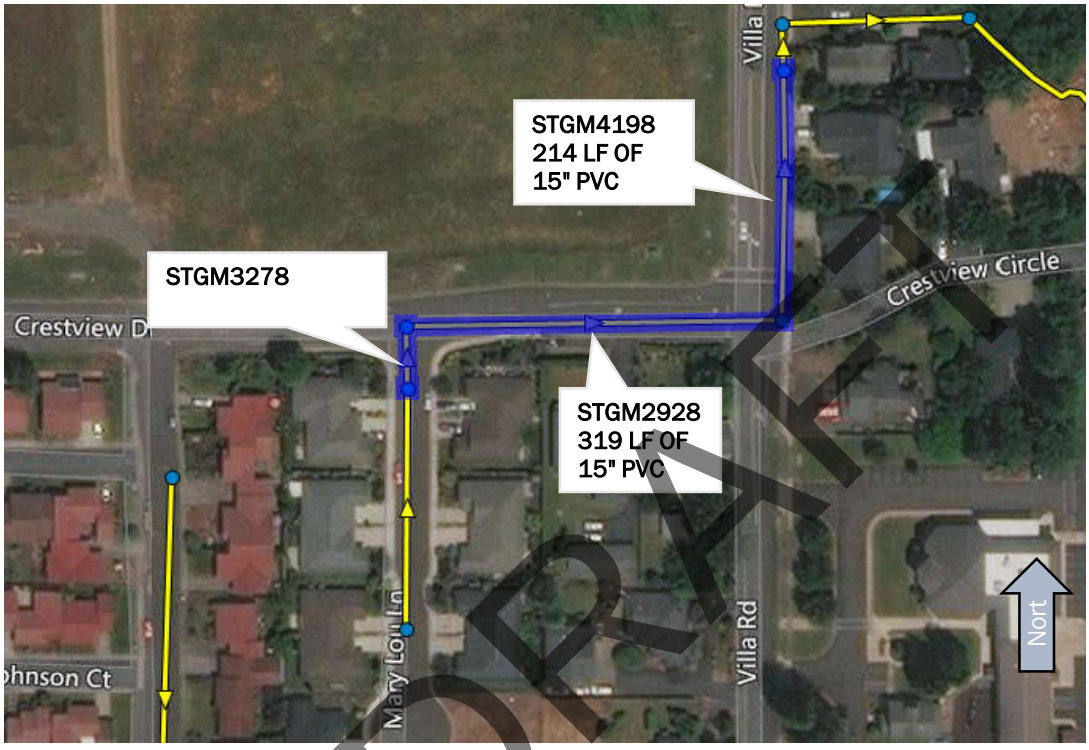
Description	Quantity	Unit	Unit Cost	Total Costs
15" PVC Pipeline	1455	LF	$ 121	$ 176,055
Capital Expenses Subtotal				**$ 176,055**
Mobilization/Demobilization	10%	LS		$ 17,606
Traffic Control	5%	LS		$ 8,803
Erosion Control	2%	LS		$ 3,521
Construction Cost Subtotal				**$ 205,984**
Construction Contingency	30%	LS		$ 61,795
Capital Expense Total				**$ 267,780**
Engineering	20%	LS		$ 53,556
Legal and Administrative	5%	LS		$ 13,389
Capitol Implementation Cost Total				**$ 334,725**

C-P: Crestview Dr. Improvements

Drainage	Hess Creek
Flooding Occcurs	10 year event
Contributing Drainage Area	29 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.



Cost Estimate:

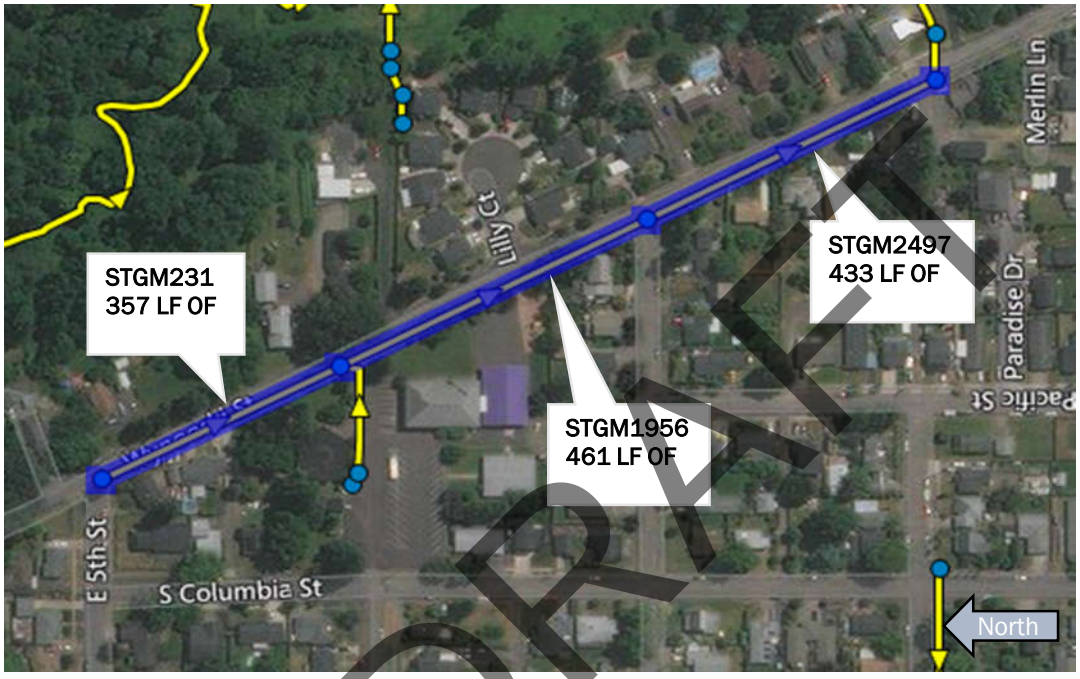
Description	Quantity	Unit	Unit Cost	Total Costs
15" PVC Pipeline	573	LF	$ 121	$ 69,333
Capital Expenses Subtotal				**$ 69,333**
Mobilization/Demobilization	10%	LS		$ 6,933
Traffic Control	5%	LS		$ 3,467
Erosion Control	2%	LS		$ 1,387
Construction Cost Subtotal				**$ 81,120**
Construction Contingency	30%	LS		$ 24,336
Capital Expense Total				**$ 105,455**
Engineering	20%	LS		$ 21,091
Legal and Administrative	5%	LS		$ 5,273
Capitol Implementation Cost Total				**$ 131,819**

C-Q: Wynooski St. Improvements

Drainage	Hess Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	21 acres
Objective(s) Addressed	Flood Control & Pipe Material

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding. Some of the pipes are anticipated to be annexed from the County.



Cost Estimate:

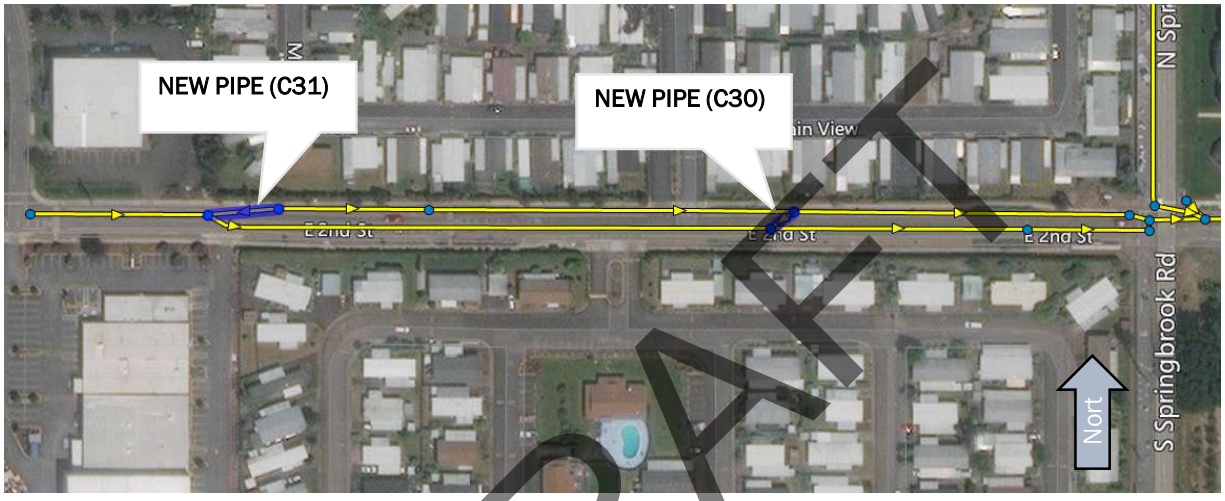
Description	Quantity	Unit	Unit Cost	Total Costs
15" PVC Pipeline	818	LF	$ 121	$ 98,978
18" PVC Pipeline	433	LF	$ 147	$ 63,651
Capital Expenses Subtotal				**$ 162,629**
Mobilization/Demobilization	10%	LS		$ 16,263
Traffic Control	5%	LS		$ 8,131
Erosion Control	2%	LS		$ 3,253
Construction Cost Subtotal				**$ 190,276**
Construction Contingency	30%	LS		$ 57,083
Capital Expense Total				**$ 247,359**
Engineering	20%	LS		$ 49,472
Legal and Administrative	5%	LS		$ 12,368
Capitol Implementation Cost Total				**$ 309,198**

C-R: 2nd St. Crossing

Drainage	Hess Creek
Flooding Occcurs	2 year event
Contributing Drainage Area	10.5 acres
Objective(s) Addressed	Flood Control

Project Description:

The city reports that the houses along mountain view have undersized laterals, so the properties flood before the mainlines flood, but the mainlines are still undersized. The easiest fix is to redirect flows from one line in 2nd St, to the other line in 2nd St.



Cost Estimate:

Description	Quantity	Unit	Unit Cost	Total Costs
18" PVC Pipeline	113	LF	$ 147	$ 16,611
Capital Expenses Subtotal				**$ 16,611**
Mobilization/Demobilization	10%	LS		$ 1,661
Traffic Control	5%	LS		$ 831
Erosion Control	2%	LS		$ 332
Construction Cost Subtotal				**$ 19,435**
Construction Contingency	30%	LS		$ 5,830
Capital Expense Total				**$ 25,265**
Engineering	20%	LS		$ 5,053
Legal and Administrative	5%	LS		$ 1,263
Capitol Implementation Cost Total				**$ 31,582**

C-S: E 2nd St. @ River St. Improvements

Drainage	Hess Creek
Flooding Occcurs	10 year event
Contributing Drainage Area	6 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.

Cost Estimate:

Description	Quantity	Unit	Unit Cost	Total Costs
15" PVC Pipeline	526	LF	$ 121	$ 63,646
Capital Expenses Subtotal				**$ 63,646**
Mobilization/Demobilization	10%	LS		$ 6,365
Traffic Control	5%	LS		$ 3,182
Erosion Control	2%	LS		$ 1,273
Construction Cost Subtotal				**$ 74,466**
Construction Contingency	30%	LS		$ 22,340
Capital Expense Total				**$ 96,806**
Engineering	20%	LS		$ 19,361
Legal and Administrative	5%	LS		$ 4,840
Capitol Implementation Cost Total				**$ 121,007**

C-T: E 2nd St. @ Ardus St. Improvements

Drainage	Hess Creek
Flooding Occcurs	10 year event
Contributing Drainage Area	13.6 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.

Cost Estimate:

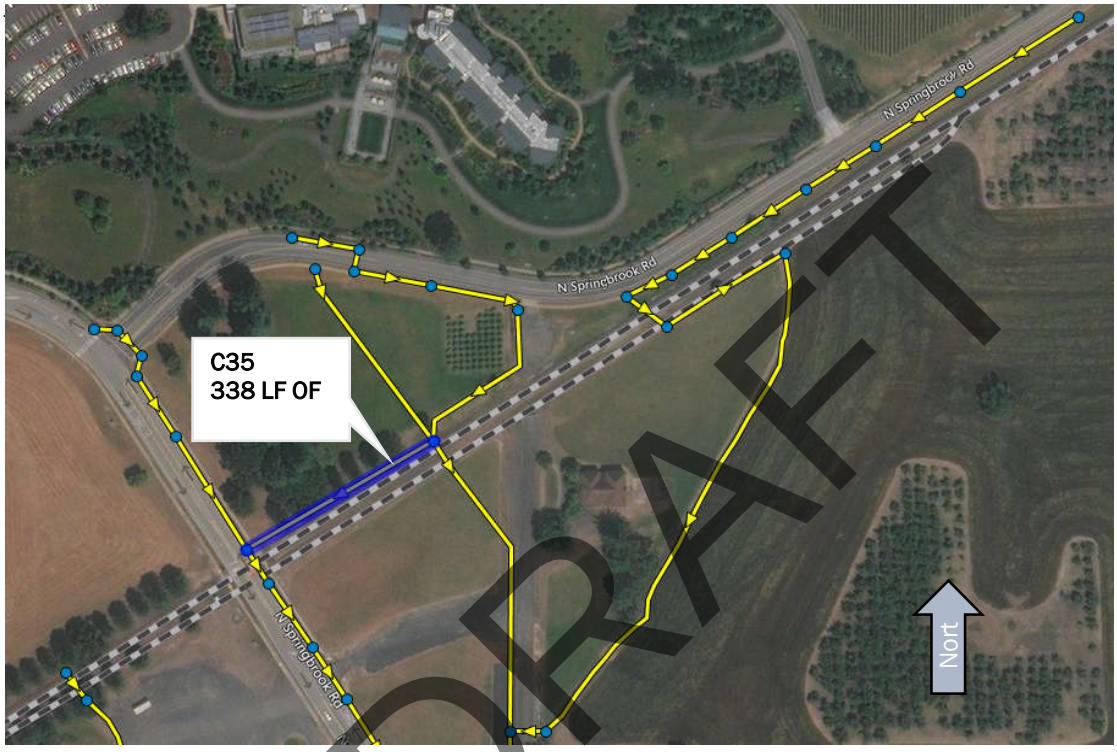
Description	Quantity	Unit	Unit Cost	Total Costs
18" PVC Pipeline	775	LF	$ 147	$ 113,925
Capital Expenses Subtotal				**$ 113,925**
Mobilization/Demobilization	10%	LS		$ 11,393
Traffic Control	5%	LS		$ 5,696
Erosion Control	2%	LS		$ 2,279
Construction Cost Subtotal				**$ 133,292**
Construction Contingency	30%	LS		$ 39,988
Capital Expense Total				**$ 173,280**
Engineering	20%	LS		$ 34,656
Legal and Administrative	5%	LS		$ 8,664
Capitol Implementation Cost Total				**$ 216,600**

C-U.A: N Springbrook Rd. Improvements - Section 1

Drainage	Spring Brook
Flooding Occcurs	2 year event
Contributing Drainage Area	173 acres
Objective(s) Addressed	Flood Control

Project Description:

Modeling shows flooding problems along N Springbrook Rd during the current and future conditions 10-year storm event. Upsize the stormwater pipes along N Springbrook Rd to 30" diameter and connect the system to the existing system to the south. It also includes a new pipe on the north end that distributes



Cost Estimate:

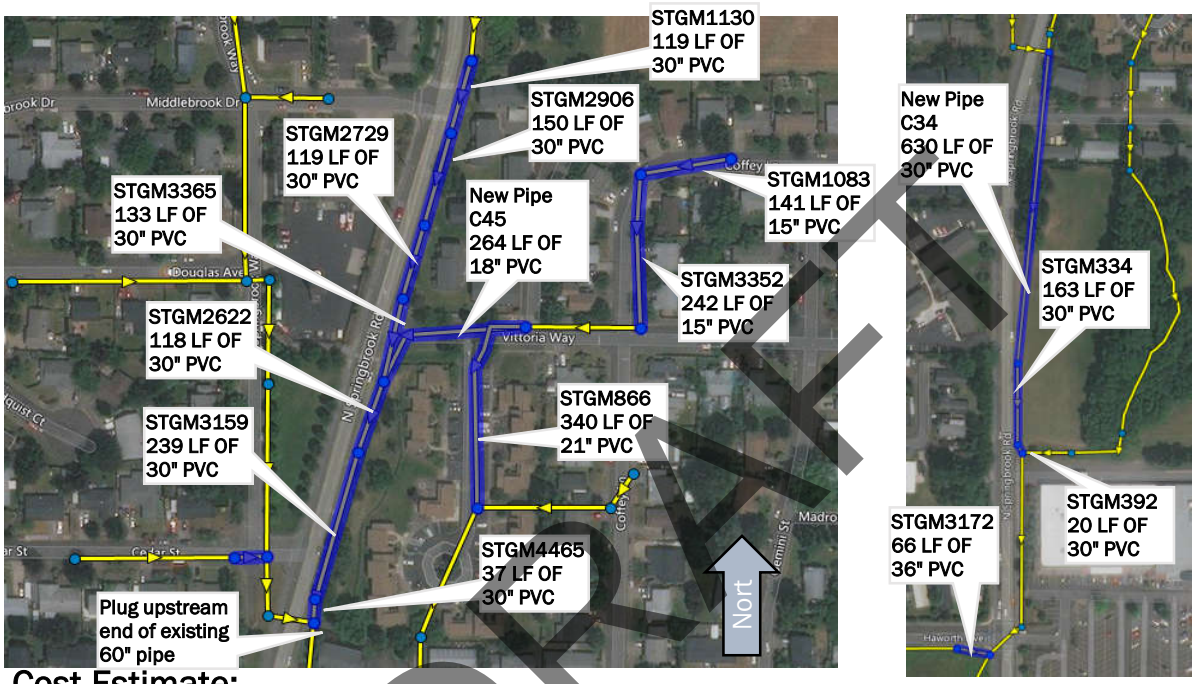
Description	Quantity	Unit	Unit Cost	Total Costs
18" PVC Pipeline	338	LF	$ 147	$ 49,686
Capital Expenses Subtotal				**$ 49,686**
Mobilization/Demobilization	10%	LS		$ 4,969
Traffic Control	5%	LS		$ 2,484
Erosion Control	2%	LS		$ 994
Construction Cost Subtotal				**$ 58,133**
Construction Contingency	30%	LS		$ 17,440
Capital Expense Total				**$ 75,572**
Engineering	20%	LS		$ 15,114
Legal and Administrative	5%	LS		$ 3,779
Capitol Implementation Cost Total				**$ 94,466**

C-U.B: N Springbrook Rd. Improvements - Section 2

Drainage	Spring Brook
Flooding Occcurs	2 year event
Contributing Drainage Area	173 acres
Objective(s) Addressed	Flood Control

Project Description:

Modeling shows flooding problems along N Springbrook Rd during the current and future conditions 10-year storm event. Upsize the stormwater pipes along N Springbrook Rd to 30" diameter and connect the system to the existing system to the south.



Cost Estimate:

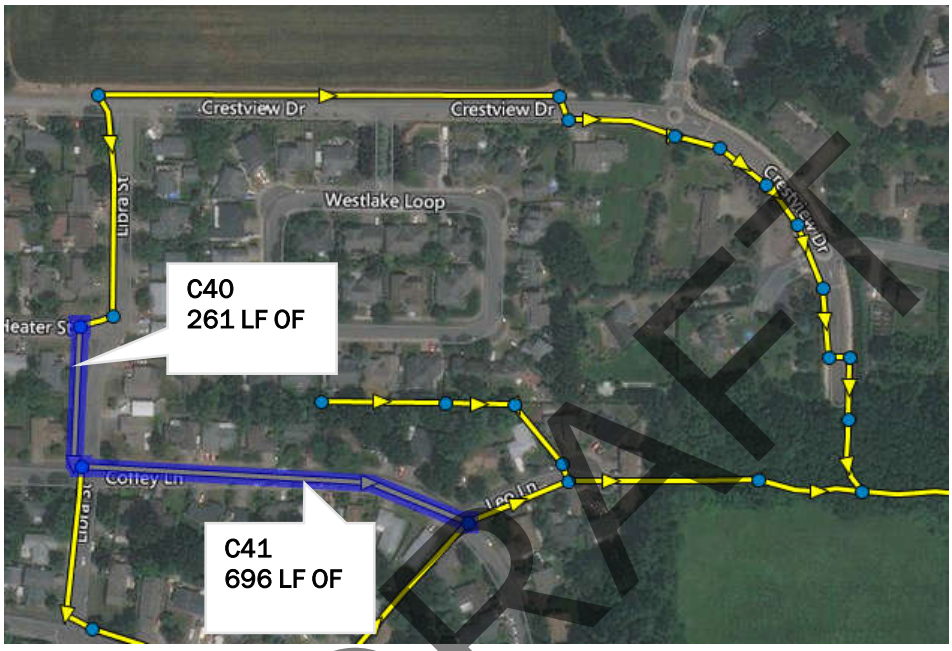
Description	Quantity	Unit	Unit Cost	Total Costs
15" PVC Pipeline	383	LF	$ 121	$ 46,343
21" PVC Pipeline	340	LF	$ 176	$ 59,840
30" PVC Pipeline	1728	LF	$ 241	$ 416,448
36" PVC Pipeline	66	LF	$ 292	$ 19,272
Capital Expenses Subtotal				**$ 541,903**
Mobilization/Demobilization	10%	LS		$ 54,190
Traffic Control	5%	LS		$ 27,095
Erosion Control	2%	LS		$ 10,838
Construction Cost Subtotal				**$ 634,027**
Construction Contingency	30%	LS		$ 190,208
Capital Expense Total				**$ 824,234**
Engineering	20%	LS		$ 164,847
Legal and Administrative	5%	LS		$ 41,212
Capitol Implementation Cost Total				**$ 1,030,293**

C-V: Libra St. Improvements

Drainage	Spring Brook
Flooding Occcurs	2 year event
Contributing Drainage Area	33 acres
Objective(s) Addressed	Flood control, Reduce Maintenance Frequency

Project Description:

Modeling shows flooding problems along Libra St during the current and future conditions 10-year storm event. This system needs frequent maintenance to address silt accumulation. This project works with a project that is currently underway in Crestview Dr.



Cost Estimate:

Description	Quantity	Unit	Unit Cost	Total Costs
15" PVC Pipeline	957	LF	$ 121	$ 115,797
Capital Expenses Subtotal				**$ 115,797**
Mobilization/Demobilization	10%	LS		$ 11,580
Traffic Control	5%	LS		$ 5,790
Erosion Control	2%	LS		$ 2,316
Construction Cost Subtotal				**$ 135,482**
Construction Contingency	30%	LS		$ 40,645
Capital Expense Total				**$ 176,127**
Engineering	20%	LS		$ 35,225
Legal and Administrative	5%	LS		$ 8,806
Capitol Implementation Cost Total				**$ 220,159**

C-W: BruTscher St. Improvements

Drainage	Spring Brook
Flooding Occcurs	10 year event
Contributing Drainage Area	19 acres
Objective(s) Addressed	Flood Control

Project Description:

Flow is currently restricted by undersized pipes that are upsized to reduce flooding.

Cost Estimate:

Description	Quantity	Unit	Unit Cost	Total Costs
18" PVC Pipeline	260	LF	$ 147	$ 38,220
Capital Expenses Subtotal				**$ 38,220**
Mobilization/Demobilization	10%	LS		$ 3,822
Traffic Control	5%	LS		$ 1,911
Erosion Control	2%	LS		$ 764
Construction Cost Subtotal				**$ 44,717**
Construction Contingency	30%	LS		$ 13,415
Capital Expense Total				**$ 58,133**
Engineering	20%	LS		$ 11,627
Legal and Administrative	5%	LS		$ 2,907
Capitol Implementation Cost Total				**$ 72,666**

Appendix E: Soils and Land Use from 2014 Master Plan

LEGEND

HYDROLOGIC SOIL GROUP (HSG)

- A (HIGHEST INFILTRATION)
- B
- C
- D (LOWEST INFILTRATION)
- WATER
- URBAN GROWTH BOUNDARY (UGB)
- STREAMS
- STREETS

N

0 0.25 0.5 1 Miles

STORMWATER MASTER PLAN UPDATE

FIGURE 2-3. SOILS MAP

NEWBERG, OREGON

City of Newberg

Brown AND Caldwell

JUNE 2014

LEGEND

IMPERVIOUS AREAS

- BUILDINGS
- HOMES
- PAVEMENT
- GENERAL ROW
- CITY CENTER/HWY 99 ROW
- TAXLOTS
- URBAN GROWTH BOUNDARY (UGB)
- CITY LIMIT
- STREETS
- STREAMS

Tangen Creek
Hess Creek
Harvey Creek
Spring Brook
Willamette River
Chehalem Creek

N

0 0.25 0.5 1 Miles

STORMWATER MASTER PLAN UPDATE

FIGURE 2-4. EXISTING IMPERVIOUS AREAS

NEWBERG, OREGON

City of Newberg

Brown AND Caldwell

JUNE 2014

LEONARD A. RYDELL, P.E., P.L.S., W.R.E. **Consulting Civil Engineer - Land Surveyor**

601 PINEHURST DRIVE, NEWBERG, OREGON 97132-1625
(503) 538-5700 Mobile: (503) 781-4138
LARydell@Teleport.com

9 February 2021

Newberg Ad-Hoc Committee
414 E. First Street
Newberg, Oregon 97132

Re: Water Quality Facility Costs

Dear Committee Members,

I have not had any response from the City regarding their proposed changes to the Storm Water Master Plan, but I do have a small update to my last letter.

First, while the construction cost ($20,000) for the concrete water storm water facilities for the Habitat Fifth Street was used in the financial calculation that I provided, it DID NOT include the engineering design cost. Habitat's design cost was $1,350.00. This cost will have to be financed over the life of the loan. Please note this cost will prohibit ANYONE in Newberg that wants to get City approval for a rain garden in their yard, and if we cannot correct past problems, we have no hope of making any improvement in our stream corridors.

Second, THERE WAS NO UTILITY EASEMENT on the Habitat lot. The City REQUIRED a ten foot utility easement, and then, they would not approve a water quality facility in the easement. This is contradictory to a rain garden in a existing utility easement for one of my clients that I designed that the City of Newberg Engineer approved.

Add to that, from the comments made at our first Storm Water Meeting, it appears that the City's consultant is reluctant to suggest and recommend storm water treatment and environmentally friendly design options.

Therefore, I recommend that **before we approve** the Storm Water Plan that we ensure that it adopts the following:

1. The City adopts the design standards "Low Impact Development in Western Oregon: A Practical Guide for Watershed Health". As stated in the standards, *"DEQ, OEC, and USFS, and ODF endorse the recommendations included in this template and encourage local governments to prepare manuals based on the template. DEQ, OEC, and USFS, and ODF do not support the use of techniques that are inconsistent with the recommendations in the template."*

2. Allows the use for rain gardens and infiltration as the preferred storm water disposal per the design procedure that was outlined in my slide show presentation. This procedure has been approved by the City of Newberg, used and has been successful for the Habitat Restore and the "Village at Sherman Oaks". The design

procedure meets the 2, 5, 10 and 25 year design standards.

3. Encourage on site disposal of storm water, and only allow neighborhood facilities as a last resort based on a demonstrated inability to provide on-site storage/infiltraton.

4. Current City Policies only control the rate of runoff to historic levels. It does not control the volumes. One of the best ways to reduce storm water runoff volumes is to reduce or eliminate impervious surfaces. This can be done by:

    a. Revising our street width standards. I suggest 12 foot driveways up to four lots, 20' wide streets up to 16 lots (dead end) or residential only streets, and the use of perpendicular parking bays. This results in smaller areas for perpendicular parking and driveway frontages. Refer to the booklet, "Neighborhood Street Guidelines" that Newberg helped prepare.
    b. Eliminate our 96' Diameter Cul-de-Sac standard. Use "T" Turnarounds that take less land.
    c. Reduce parking impervious areas by using perpendicular paver parking bays instead of parallel parking.
    d. Require paver streets for all public streets residential streets with a 25 mile per hour speed limit.
    e. Require all parking lots to use pavers or grass-crete.

5. Require that the City of Newberg has a Professional Engineer from the Engineering Department as an active member on the Greater Yamhill Watershed Council. This will keep the City informed of grant opportunities and the latest standards of practice.

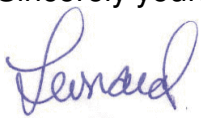
6. Allow curbside water quality swales in street right-of-ways and water quality facilities in Public Utility Easements.

7. Includes a stated policy that, "The City of Newberg encourages and requires, whenever possible, that all storm water runoff created by new development be retained on site."

8. Includes a stated policy that, "The City of Newberg encourages the construction of rain/infilatration gardens on all existing lots and street frontages in right-of-ways.

Again, thank you all. We made great progress!

Sincerely yours,



Leonard A. Rydell, P.E., P.LS., W.R.E., M.A.S.C.E.
LAR/lar

Newberg City Hall
Tel: 503.537.1240
www.newbergoregon.gov

City Engineer's Office
Tel: 503.537.1273

ENGINEERING SERVICES

P.O. Box 970 • 414 E. First Street • Newberg, Oregon 97132 • 503.537.1273 • Fax 503.537.1277

TO: **AD HOC STORMWATER, WASTEWATER AND WATER CITIZENS ADVISORY COMMITTEE**

FROM: **BRETT MUSICK, PE, SENIOR ENGINEER**

SUBJECT: **Staff Notes Related to Recommendations in the Rydell Letter of 2/09/2021**

DATE: **FEBRUARY 17, 2021**

To assist with your continued discussion about potential stormwater drainage policy changes staff was asked to provide notes related to recommendations included within the Rydell letter of February 9, 2021 (Letter to Committee No. 5). Below are the recommendations followed by notes assembled by staff. The recommendations below are nearly the same as those included in a subsequent letter (Letter to Committee No. 6) dated February 13, 2021. The February 13, 2021 letter includes some wording for recommendations 1, 4, 4a, 4d and 4e that differs from the February 9, 2021 letter.

1. The City adopts the design standards "Low Impact Development in Western Oregon: A Practical Guide for Watershed Health". As stated in the standards, *"DEQ, OEC, and USFS, and ODF endorse the recommendations included in this template and encourage local governments to prepare manuals based on the template. DEQ, OEC, and USFS, and ODF do not support the use of techniques that are inconsistent with the recommendations in the template."*

   Staff Notes:

   - *The referenced document is a template that needs to be adapted to any particular jurisdiction prior to use. Below is a link to where the referenced document and associated guidance tools can be downloaded from.*

     https://www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-LID.aspx

     The full document and guidance tool consists of multiple files. There are two options presented that a jurisdiction needs to decide between during the process to adapt this template and guidance document to most closely meet its community and development needs. These template guidance document files have been downloaded and combined into one PDF for reference. Here is a link to the combined PDF: LID Guidance Template

     Throughout the template document there are notes describing the steps and actions that need to be completed by the jurisdiction in adapting this template for use. The many steps include determining consistency with Codes and Comprehensive Plans.

   - *Section 4 of the current 2015 City of Newberg Public Works Design and Construction Standards (PWD&C Standards) contains many of the concepts and techniques described in the template guidance documents.*

2. Allows the use for rain gardens and infiltration as the preferred storm water disposal per the design procedure that was outlined in my slide show presentation. This procedure has been approved by the City of Newberg, used and has been successful for the Habitat Restore and the "Village at Sherman Oaks". The design procedure meets the 2, 5, 10 and 25 year design standards.

Staff Notes:

- *Current Public Works Design and Construction Standards (PWD&C Standards) includes a Facility Selection Hierarchy that allows the use of LIDA facilities such as rain gardens and infiltration planters. See Section 4.6.8 and Figure 4.5 of the PWD&C Standards.*

4.6.8 Facility Selection Hierarchy

The hierarchy of preference for public and or private water quantity and/or water quality facilities is listed below in the order of preference by the City Engineer and Public Works Maintenance Department. The highest technically feasible option must be used (1=highest, 4=lowest). Applicants must provide the appropriate technical analysis and evaluation and demonstrate the need to move from a higher option to a lower option as reviewed & approved by the City during the land use application or permit review application process.

Detention Facilities	Water Quality Facilities
LIDA Facilities/Regional Facility	LIDA Facilities/Regional Facility
Surface Pond	Swale
Underground Tanks/Pipes	Proprietary Treatment Systems
Fee in lieu of construction payment	Fee in lieu of construction payment

Figure 4.5 Approvable Low Impact Development Approaches

Application	Green Roof	Porous Pavement/Pavers	Flow-through Planter	Infiltration Planter[1] / Rain Garden	Vegetated Filter Strip	Swale
Quantity Control	✓	✓	✓	✓		
Quality Control	✓	✓	✓	✓	✓	✓
Impervious Area Reduction	✓	✓				
Infiltrate		✓		✓	✓	✓
Private Property	✓	✓	✓	✓	✓	✓
Public Street/ROW			✓		✓	✓
Steep Slope	✓		✓			
Soils with Low Infiltration Rate[2]	✓	✓	✓		✓	✓
High GW Table	✓		✓		✓	✓
Contaminated Soils	✓		✓			

[1] Water proofing maybe required for the building, foundation or a crawlspace.
[2] Infiltration testing is required to determine rate.

- *Current Public Works Design and Construction Standards (PWD&C Standards) include LIDA facility design steps, a LIDA sizing form and standard LIDA details for use with developments creating less than 2877 square feet of impervious surface. See Section 4.9.1 and Standard Drawings 450 through 469 of the PWD&C Standards. For developments creating less than 2877 square feet of impervious surface these forms and details are intended for use without requiring an engineered design. Exceptions to the standards, designed by a registered design professional, are made on a case by case basis.*

4.9.1 LIDA Design Considerations

I. LIDA may be used in combination with standard water quantity and quality facilities to meet the requirements of this Chapter. The engineer shall maximize LIDA to the extent practicable.

II. The applicant shall provide an analysis in the drainage report of the ability of any proposed LIDA to meet the water quantity and quality requirements for a project.

III. For developers creating less than 2877 square feet of impervious surface Drawing No. 451, LIDA Sizing Form may be used. Projects creating more than 2877 square feet of impervious area shall be designed by registered design professional in accordance with the Standards.

IV. The applicant shall provide a report from a registered design professional providing infiltration rates of existing soils for LIDA facilities that are proposed to fully discharge into existing soils.

V. Maintenance access shall be provided for all LIDA facilities adjacent to collector or arterial roadways as approved by the City Engineer.

VI. Approval of use of a LIDA by the City does not eliminate the need for the applicant to secure approval from other appropriate agencies for use of LIDA on their project. A potential example maybe DEQ's underground injection control (UIC) permit.

VII. LIDA facility planting shall follow the guidelines in Appendix A of this Design Manual.

3. Encourage on site disposal of storm water, and only allow neighborhood facilities as a last resort based on a demonstrated inability to provide on-site storage/infiltration.

Staff Notes:

- *Current Public Works Design and Construction Standards (PWD&C Standards) includes a Facility Selection Hierarchy. See Section 4.6.8 of the PWD&C Standards.*

4.6.8 Facility Selection Hierarchy

The hierarchy of preference for public and or private water quantity and/or water quality facilities is listed below in the order of preference by the City Engineer and Public Works Maintenance Department. The highest technically feasible option must be used (1=highest, 4=lowest). Applicants must provide the appropriate technical analysis and evaluation and demonstrate the need to move from a higher option to a lower option as reviewed & approved by the City during the land use application or permit review application process.

Detention Facilities	Water Quality Facilities
LIDA Facilities/Regional Facility	LIDA Facilities/Regional Facility
Surface Pond	Swale
Underground Tanks/Pipes	Proprietary Treatment Systems
Fee in lieu of construction payment	Fee in lieu of construction payment

4. Current City Policies only control the rate of runoff to historic levels. It does not control the volumes. One of the best ways to reduce storm water runoff volumes is to reduce or eliminate impervious surfaces. This can be done by:

   a. Revising our street width standards. I suggest 12 foot driveways up to four lots, 20' wide streets up to 16 lots (dead end) or residential only streets, and the use of perpendicular parking bays. This results in smaller areas for perpendicular parking and driveway frontages. Refer to the booklet, "Neighborhood Street Guidelines" that Newberg helped prepare
   b. Eliminate our 96' Diameter Cul-de-Sac standard. Use "T" Turnarounds that take less land.
   c. Reduce parking impervious areas by using perpendicular paver parking bays instead of parallel parking.
   d. Require paver streets for all public streets residential streets with a 25 mile per hour speed limit.
   e. Require all parking lots to use pavers or grass-crete.

Staff Notes:

- *Revising street and parking standards would require City Council action and approval.*

- *Current fire access requirements would have to be considered with any proposed revisions to street width standards. The TVF&R New Construction Fire Code Applications Guide indicates fire access roads are to be not less than 20-feet wide with 26-feet of width adjacent to fire hydrants.*

- *The current 96-foot diameter cul-de-sac standard is based on the fire access road turnaround requirement. See the TVF&R New Construction Fire Code Applications Guide. This guide shows other turnaround options include hammerhead and "Y".*

- *The current City of Newberg Municipal Code (NMC) Section 15.505.030 on street standards and the City of Newberg Transportation System Plan (TSP) were developed more recently than the referenced document "Neighborhood Street Guidelines" dated November 2000. The NMC allows for limited residential streets with a width of 26-feet. Section 15.505.030(G)(6) provides criteria for when limited residential streets are allowed.*

  Below is an excerpt from Table 15.505.030(G) of the NMC with current street design standards.

Local Streets						
Local residential	54 – 60 feet	32 feet	2 lanes	None	No	Yes
Limited residential, parking both sides	44 – 50 feet	28 feet	2 lanes	None	No	Yes
Limited residential, parking one side	40 – 46 feet	26 feet	2 lanes	None	No	One side

- *Staff suggests that recommendation 4c clarify if this is intended to be public or private parking bays. Approximately 95% of issues addressed by the Traffic Safety Commission are related to there being a limited amount of parking.*

- *City of Newberg Municipal Code (NMC) Section 15.440.06 (A) includes provisions for the use of pavers on private parking lots.*

  A. All parking areas and service drives shall have surfacing of asphaltic concrete or Portland cement concrete or other hard surfacing such as brick or concrete pavers. Other durable and dust-free surfacing materials may be approved by the director for infrequently used parking areas. All parking areas and service drives shall be graded so as not to drain stormwater over the public sidewalk or onto any abutting public or private property.

- *Current Public Works Design and Construction Standards (PWD&C Standards) allows the use of pavers on private property. Figure 4.5 of the PWD&C Standards.*

Figure 4.5 Approvable Low Impact Development Approaches

Application	Green Roof	Porous Pavement/Pavers	Flow-through Planter	Infiltration Planter[1] / Rain Garden	Vegetated Filter Strip	Swale
Quantity Control	✓	✓	✓	✓		
Quality Control	✓	✓	✓	✓	✓	✓
Impervious Area Reduction	✓	✓				
Infiltrate		✓		✓	✓	✓
Private Property	✓	✓	✓	✓	✓	✓
Public Street/ROW			✓		✓	✓
Steep Slope	✓		✓			
Soils with Low Infiltration Rate[2]	✓	✓	✓		✓	✓
High GW Table	✓		✓		✓	✓
Contaminated Soils	✓		✓			

[1] Water proofing maybe required for the building, foundation or a crawlspace.
[2] Infiltration testing is required to determine rate.

- *Pavers are not allowed on public residential streets due to maintenance costs. Other pervious pavements might be allowed. Current Public Works Design and Construction Standards (PWD&C Standards) includes a process for approval of alternate materials, methods, or design. See Section 1.11 of the PWD&C Standards.*

1.11 Approval of Alternate Materials, Methods, or Design

Any substitute material or alternate method not explicitly approved herein will be considered for approval as set forth in this section. Persons seeking such approvals shall make application in writing. Approval of any major deviation from these Public Works Design and Construction Standards will be in written form. Approval of minor matters will be made in writing if requested.

Any alternate must meet or exceed the minimum requirements set in these Public Works Design and Construction Standards.

The written application for an alternate approval is to include, but is not limited to, the manufacturer's specifications and testing results, Public Works Design and Construction Standards, design drawings, calculations, and other pertinent information.

1.11.1 General

The City Engineer may approve a design exception request so long as it does not conflict with the City Development and/or Municipal Codes, the County or City Land Development Permit Decision, or any other relevant approvals, except as expressly provided herein. If the requested exception involves public safety, the City will rule in the direction of safety.

1.11.2 Submittal

All requests shall state the applicable standard, the desired exception, the reason for the request and a comparison between the applicable specification or standard and the exception as to function, performance and safety. If an exception is requested due to economic hardship, the request shall contain a statement on the impact to project cost with and without the exception. The request for exception shall be prepared by an Engineer and shall be stamped and signed by the Engineer. Multiple design exception requests shall be separated, individually prepared, and submitted to the City as separate requests.

Any approved exception to these Standards shall be documented and should reference nationally accepted guidelines, specifications, or standards. The approval of an exception shall not compromise public safety or the intent of these standards. An exception shall be approved only if the City Engineer finds that the alternative proposed by the Engineer meets the criteria addressed in this section and will provide equivalent or better function, performance, and safety.

Each exception shall be reviewed on a case by case basis and approved or denied by the City Engineer. All exception requests granted are considered unique to each request and project, do not set a precedent, and are not uniformly applicable.

When requested by the City, complete full size plans and design calculations shall be submitted for review with the request for approval.

5. Require that the City of Newberg has a Professional Engineer from the Engineering Department as an active member on the Greater Yamhill Watershed Council. This will keep the City informed of grant opportunities and the latest standards of practice.

   Staff Notes:
   - *Assignment of resources to additional tasks would require City Council action and approval.*

6. Allow curbside water quality swales in street right-of-ways and water quality facilities in Public Utility Easements.

   Staff Notes:
   - *Current Public Works Design and Construction Standards (PWD&C Standards) allow flow through planters, vegetated filter strips and swales for Public Street/ Right-of-way applications. See Figure 4.5 in Section 4 of the PWD&C Standards.*
   - *The committee has already made a recommendation regarding water quality facilities within Public Utility Easements.*

Figure 4.5 Approvable Low Impact Development Approaches

Application	Green Roof	Porous Pavement/Pavers	Flow-through Planter	Infiltration Planter[1] / Rain Garden	Vegetated Filter Strip	Swale
Quantity Control	✓	✓	✓	✓		
Quality Control	✓	✓	✓	✓	✓	✓
Impervious Area Reduction	✓	✓				
Infiltrate		✓		✓	✓	✓
Private Property	✓	✓	✓	✓	✓	✓
Public Street/ROW			✓		✓	✓
Steep Slope	✓		✓			
Soils with Low Infiltration Rate[2]	✓	✓	✓		✓	✓
High GW Table	✓		✓		✓	✓
Contaminated Soils	✓		✓			

[1] Water proofing maybe required for the building, foundation or a crawlspace.
[2] Infiltration testing is required to determine rate.

7. Includes a stated policy that, "The City of Newberg encourages and requires, whenever possible, that all storm water runoff created by new development be retained on site.

Staff Notes:

- *Policy statements require City Council action and approval.*
- *Current Public Works Design and Construction Standards (PWD&C Standards) includes a Facility Selection Hierarchy. See Section 4.6.8 of the PWD&C Standards.*

4.6.8 Facility Selection Hierarchy

The hierarchy of preference for public and or private water quantity and/or water quality facilities is listed below in the order of preference by the City Engineer and Public Works Maintenance Department. The highest technically feasible option must be used (1=highest, 4=lowest). Applicants must provide the appropriate technical analysis and evaluation and demonstrate the need to move from a higher option to a lower option as reviewed & approved by the City during the land use application or permit review application process.

Detention Facilities	Water Quality Facilities
LIDA Facilities/Regional Facility	LIDA Facilities/Regional Facility
Surface Pond	Swale
Underground Tanks/Pipes	Proprietary Treatment Systems
Fee in lieu of construction payment	Fee in lieu of construction payment

8. Includes a stated policy that, "The City of Newberg encourages the construction of rain/infiltration gardens on all existing lots and street frontages in right-of-ways.

   Staff Notes:
   - *Policy statements require City Council action and approval.*
   - *Staff suggests that the recommendation clarify if this is intended to apply only to new construction.*