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Limitations:

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Table of Contents

Section 1 Introduction/Background	1
Section 2 Retrofit Strategy Summary	2
2.1 What was included in the Retrofit Strategy and how has it been used, considered, or implemented since 2014?	2
2.2 What progress has been made toward completion of projects identified in the Retrofit Strategy priority list, and what have been the benefits of those projects?	3
2.3 What are the new goals, tools, priorities and planned or potential projects for improving retrofit planning to address water quality impacts resulting from historical development/infrastructure?	9
2.3.1 Property Acquisition	9
2.3.2 Updated Retrofit Tool	9
2.3.3 Stormwater Master Plan Update	9
Section 3 2014 Hydromodification Assessment Summary	10
3.1 What were the results of the Hydromodification Assessment? How has it been used, considered, or implemented?	10
3.2 Were there any identified gaps in the hydromodification information or data related to waterbodies within the City’s jurisdiction and, if so, what progress has been made in addressing gaps?	11
3.3 What further actions have been taken as a result of the Hydromodification Assessment, and what was the rationale for those actions?	12
3.4 What are the City’s new goals, tools, priorities, and planned or potential projects for addressing ongoing hydromodification?	12

List of Tables

Table 1. Retrofit and Hydromodification Assessment Documents	2
Table 2. City of Salem Retrofit and Hydromodification Projects	5



List of Abbreviations

CIP	capital improvement project
City	The City of Salem
FY	fiscal year
GSI	Green Stormwater Infrastructure
H/H	hydrology and hydraulic
MS4	Municipal separate storm sewer system
NPDES	National Pollutant Discharge Elimination System
NSRR	Numeric Stormwater Retention Requirement
O&M	operation and maintenance
SRC	Salem Revised Code
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
VBA	Visual Basic for Applications
WQ	water quality



Section 1 Introduction/Background

The City of Salem’s (City) 2010 Phase 1 National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer system (MS4) permit (Permit), Schedule A.5, required the City to conduct a hydromodification assessment to examine the City’s hydromodification impacts related to MS4 discharges, including erosion, sedimentation and/or alteration to stormwater flow, volume, and duration that may cause or contribute to water quality degradation. The assessment and accompanying report were required to “identify strategies and priorities for preventing or reducing hydromodification impacts related to the permittees MS4 discharges... and identify or develop effective tools to reduce hydromodification.” The report was required for submittal to DEQ by November 1, 2014.

Also included in the 2010 Permit, in Schedule A.6, the City was required to develop a stormwater quality retrofit strategy applicable to developed areas of the City identified as impacting water quality and underserved or lacking stormwater controls. The strategy and resulting plan were required to include “a retrofit control measure project or approach priority list, including rationale, identification and map of potential stormwater retrofit locations where appropriate, and an estimated timeline and cost for implementation of each project or approach.” As with the hydromodification assessment, the plan was also due to DEQ by November 1, 2014.

Schedule A.3.h of the City’s 2021 NPDES MS4 Permit requires permittees, by November 1, 2023, to “consider the impacts of policy, capital improvements, and retrofit projects on MS4 discharges to receiving waters, considering the goals and proposed actions described in the 2010 permit’s Hydromodification Assessment and Stormwater Retrofit Strategy reports (i.e., the 2014 submittals). Specifically, permittees are required to prepare “an assessment of any outcomes related to the Hydromodification Assessment and Stormwater Retrofit Strategy Reports.” This assessment is required to include the following:

1. An assessment of how the Hydromodification Assessment and Stormwater Retrofit Strategy have been used, considered, or implemented since the time the reports were completed (see Sections 2.1 and 3.1);
2. Progress toward or completion of projects identified in the Retrofit Strategy priority list, and a qualitative assessment of the benefits of those projects (see Section 2.2);
3. Description of any further actions taken as a result of the Hydromodification Assessment, and a rationale for those actions since the writing of the reports (see Section 3.3);
4. Narrative describing progress toward addressing gaps in the hydromodification information or data related to waterbodies within the permittees’ jurisdiction as identified in the Hydromodification Assessment (see Section 3.2); and,
5. New goals, tools, priorities, and planned or potential projects for addressing ongoing hydromodification and/or water quality impacts resulting from historical development/infrastructure, and for improving retrofit planning, considering information gathered in the time since the completion of the reports (see Sections 2.3 and 3.4).

The Permit requires the permittees to document this assessment in the third annual report (i.e., the 2023 annual report) as an appendix or subsection. This documented assessment was prepared to fulfill this requirement. Information used to compile this summary is outlined in Table 1 and findings and results are based on the City’s review of completed and in-progress projects, historic code implementation and pending programmatic and regulatory activities.

Table 1. Retrofit and Hydromodification Assessment Documents		
Title	Author	Date
Stormwater Retrofit Plan	City of Salem Public Works Department	October 1, 2014
City of Salem Hydromodification Assessment	ESA	January 2013
Salem Hydromodification Technical Memo	ESA	July 2013
Salem Hydromodification - Review of City Codes and Design Standards	ESA	January 2014
Personal Communication, City of Salem staff	N/A	August-September 2023

In this assessment, Section 2 provides a summary of the previous retrofit strategy, progress made since the strategy was submitted in 2014, and goals for moving forward. Section 3 provides a summary of the previous hydromodification assessment, progress made since the assessment was submitted in 2014, and goals for moving forward.

Section 2 Retrofit Strategy Summary

2.1 What was included in the Retrofit Strategy and how has it been used, considered, or implemented since 2014?

Incorporating water quality facilities into the existing stormwater system is known as a stormwater treatment retrofit. The 2014 Salem Stormwater Retrofit Plan (Retrofit Plan) established retrofit strategies and identified retrofit opportunities (projects) for future implementation.

The City’s Retrofit Plan identified the following strategies:

- Incorporate stormwater treatment control measures into existing stormwater CIP projects whenever possible.
- Employ treatment retrofits with stormwater operation and maintenance (O&M) projects whenever possible.
- Develop treatment retrofits on City-owned detention basins, parks, and drainage ditches.
- Pursue a partnership with the Salem-Keizer School District for retrofit opportunities on school properties.

These strategies aim to reduce pollutants of concern, reduce hydromodification impacts, demonstrate and educate residents, and alleviate chronic flooding problems. As documented in the Retrofit Plan, retrofit projects will be ranked in accordance with the following criteria:

1. Location in TMDL Drainage Basin
2. Potential for pollutant reduction
3. Potential for reducing hydromodification impacts
4. Potential for reducing localized flooding
5. Potential for outreach and education
6. Ownership
7. Ease/cost of construction

To develop the 2014 Retrofit Plan, the City conducted an initial GIS desktop analysis, using the prioritization criteria listed above, to identify a preliminary list of retrofit sites for further investigation. Field investigations were conducted in conjunction with preferred retrofit structural control measures established by retrofit site



(i.e., city-owned property, public schools, private property). A final priority retrofit project list and map were documented in the Retrofit Plan, and projects were organized based on incorporation into existing stormwater CIP projects (6 projects), installation on City-owned property (6 projects), and installation on public school property (3 projects). The order of implementation ultimately depends on the immediate needs of the community and available funding.

With implementation of the 2014 Retrofit Plan, tracking project opportunities presented difficulties for the City. Project opportunities were often identified by a variety of sources or departments. Field investigations and GIS desktop analysis conducted by different departments often resulted in inconsistent information being collected and tracked. Therefore, in 2018, the City developed a Stormwater Retrofit Prioritization Tool (Retrofit Tool), an Excel-based tool using Visual Basic for Applications (VBA), to track and prioritize stormwater retrofit opportunities associated with implementation of an existing capital improvement project (CIP) or associated with ongoing operational activities.

The City's Retrofit Tool provides a mechanism for the City to consistently track project opportunities, record baseline project information, and prioritize projects for implementation. One unique feature of the Tool is its ability to automatically identify pollutants of concern and hydromodification risks based on the proposed project location and receiving water. This information is based on DEQ's 2012 303(d) list, which identifies impaired water bodies under the federal Clean Water Act, and findings from the City's hydromodification assessment. This information is automatically populated by the Tool when the receiving water is identified for a specified retrofit project. Project prioritization criteria were expanded from the 2014 Retrofit Plan, although major categories remain consistent. Cost was intentionally not included, so that the Retrofit Tool would provide an independent evaluation and prioritization of project opportunities based solely on water quality objectives.

The status of project implementation is provided in Section 2.2.

2.2 What progress has been made toward completion of projects identified in the Retrofit Strategy priority list, and what have been the benefits of those projects?

As detailed in the 2014 Retrofit Plan, a total of 15 potential retrofit projects were identified that reflect the City's objectives to 1) incorporate water quality into existing stormwater CIPs; 2) install new water quality projects on city-owned property; and 3) integrate projects on school property. At the time, no projects were identified to integrate water quality into O&M activities. Projects timeframes ranged from fiscal year (FY) 2014-15 to FY 2017-18, but eight projects had an unspecified timeframe.

City staff reviewed the retrofit project list per the 2014 Retrofit Plan and three identified projects were completed, although the scope for some varied from what was originally defined. These included:

- 12th Street Stormwater Improvements. Completed during FY 2017-18. Included the addition of piped detention; mechanical WQ treatment; the replacement of a corrugated culvert with a box culvert and bank restoration; and 8 water quality planters as part of a street widening project.
- Eola Ridge Park Detention Basin. Completed during FY 2015-16. Included the addition of a pretreatment hydrodynamic separator and subsurface flow wetland.
- Woodmansee Park East Detention Basin. Completed during FY 2020-21. Project reflected installation of swales and raingardens in conjunction with park improvements instead of retrofitting of the existing detention basin.

Some originally-identified projects were discontinued due to site constraints (i.e., infiltration rates were lower than anticipated, alternative treatment installations conducted by private development [Woodscape Park



East]; etc.). Other projects were not completed because of schedule and/or budget constraints. Projects identified in conjunction with public schools presented challenges because of the need external stakeholder coordination and City staff availability. The City has implemented a Watershed Protection and Preservation grant program since 2001 (approx. \$50,000/year) in support of water quality or natural resource enhancement projects. These grants can be applied for by the school district for retrofits and other projects on school property even if dedicated retrofit projects are not identified in accordance with the City's retrofit strategy. The Watershed Protection and Preservation grant is also a strategy identified in the Public Involvement Section (PI-2) of the 2022 DEQ-approved Stormwater Management Plan (SWMP) Document.

However, the City has constructed 27 retrofit projects since 2014, as detailed in Table 2. These projects include 1) incorporation of water quality into existing stormwater CIPs—specifically transportation-related projects as well as projects where application of the City's stormwater design standards prompts the addition of treatment for public properties¹; 2) the employment of a stormwater retrofit in conjunction with a O&M need; and 3) installation of new water quality projects on city-owned property.

Projects detailed in Table 2 also include projects that provide hydromodification benefit, as discussed in Section 3.

¹ Salem Revised Code (SRC) Section 71.100 (a)(2) provides water quality treatment exemptions for road maintenance projects, including those that replace impervious surface to earth materials. As such, installation of water quality treatment would qualify as a retrofit in select applications where the exemption is not applied.



Table 2. City of Salem Retrofit and Hydromodification Projects

Project Name	Anticipated Construction Date	Actual Construction Date	Project Description	Project Benefit	Additional Water Quality Treatment? (Y/N)	Hydromodification Mitigation? (Y/N)	City Notes
Retrofit Strategy: Integration of Water Quality into Existing CIPs							
Center/Marion St Bridge Stormwater Retrofit Phase 1-3		2013-2015	Retrofit to treat runoff from the ODOT bridges and provide detention	Water Quality (WQ), infiltration, detention	Y	Y	Work done in partnership with ODOT Retrofit Program Grant
Hawthorne/Hyacinth Ave NE Corridor Improvements		2014	Stormwater quality and detention were included	WQ, infiltration, detention	Y	Y	Mitigation work with culvert replacement
Waln Creek at Woodside Culvert replacement		2014	Undersized galvanized culvert replaced with a box culvert and 3 WQ swales were added	WQ, infiltration, flow control	Y	Y	
Rosemont/Edgewater Off-ramp improvements		2014	Addition of two rain gardens	WQ, detention, infiltration	Y	Y	
Skyline Corridor Improvements		2015	Added stormwater planters and mechanical treatment	WQ, detention	Y	Y	
Eola Drive Improvements		2015	Added stormwater quality and detention	WQ, detention	Y	N	
Market/Swedge NE Corridor Improvements		2015	Stormwater planters and WQ detention basins added, Filterra bioretention units	WQ, infiltration, detention	Y	Y	
Glenn Creek Rd NW at Wallace Street Widening		2015	Addition of on small planter and several Filterra treatment boxes to treat stormwater	WQ, infiltration	Y	Y	
Winter Street Bridge Replacement over Shelton Ditch		2015-2016	Stormwater planters added with bridge replacement	WQ, detention	Y	N	
Kuebler Widening and Kuebler and Commercial intersection		2016	Added pervious concrete sidewalks on north side and Filterra bioretention units	WQ, detention, infiltration	Y	Y	
Madrona & 25 th re-alignment and widening		2016	1,000 feet of water quality swales, 2 rain gardens, 6 water quality planters, 1 hydro-upflo, 4 Contech catch basins, one detention pipe and culvert replacement and creek realignment.	WQ, detention, infiltration	Y	Y	



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Project Name	Anticipated Construction Date	Actual Construction Date	Project Description	Project Benefit	Additional Water Quality Treatment? (Y/N)	Hydromodification Mitigation? (Y/N)	City Notes
Clark Creek at Summer Street Culvert Replacement		2017	City staff designed and constructed the replacement of an existing culvert and added several stormwater planters	WQ	Y	Y	
Union Street NE @ Commercial		2017-2018	Intersection improvements including the installation of two stormwater planters	WQ, detention	Y	N	
Brown Road NE		2019	Retrofit of existing roadside ditches into 19 planters within City limits, as well as pervious concrete sidewalks and several WQ vaults.	WQ, detention, infiltration	Y	Y	
Fisher Rd extension at Market St.		2021	Addition of combination detention and water quality swale, as well as a mechanical treatment, as part of the extension of the road	WQ, detention, infiltration	Y	Y	
Gaia St extension		2023	Addition of combination detention and water quality swale as part of the extension of the road	WQ, detention, infiltration	Y	Y	
2 nd Street Improvements	2023	2023-2024	Addition of planters along 2 nd street with a road expansion project	WQ	Y	N	This project is in progress
Retrofit Strategy: Employ with O&M Projects							
Doaks Ferry HOA Retrofit		2018	Retrofit of existing back up detention basin into a flow through detention basin with a water quality swale	WQ, detention, infiltration	Y	Y	
Marion and 13 th Stormwater Improvements		2018	Retrofit existing piped storm system with new neighborhood rain garden	WQ, detention, infiltration, educational outreach	Y	Y	\$210,000 1,000 SF rain garden and 125 LF of 10-inch pipe. Outfalls to Mill Creek after the rain garden
Mossy Ridge Retrofit		2019	Retrofit and alteration of orifice and perf pipe to meet new storm standards and prevent basin from being in bypass frequently	Detention, infiltration	Y	Y	
15 th and Marion St NE Rain Garden		2020	Retrofit existing storm system with new rain garden	WQ, detention, infiltration	Y	Y	



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Project Name	Anticipated Construction Date	Actual Construction Date	Project Description	Project Benefit	Additional Water Quality Treatment? (Y/N)	Hydromodification Mitigation? (Y/N)	City Notes
Kuebler and Stroh		2021-2022	A detention basin had soil removed and replaced with water quality media and was planted to address water quality	WQ, infiltration, detention	Y	N	
Retrofit Strategy: Projects on City-owned Property							
Eola Ridge Park Detention Basin	FY 2014-15	2015/2016	Retrofit existing surface detention basin with a hydrodynamic separator and subsurface flow wetland treatment train	Target the removal of bacteria in a residential neighborhood.	Y	Y	Completed October 30, 2015
City Operations Complex Retrofit		2016-2017	In order to control sediment from storage bins and prevent from entering the storm system a collection trench with 3 baffles, settling chambers, a catch basin, and an oil/water separator added	WQ	Y	N	
Fire Station 6 Retrofit		2018-2019	Installation of 300 LF of 8-inch sanitary sewer pipe, 2 additional manholes, 1 catch basin, and a grass swale were added so that runoff from the airport fire station training facility could be diverted to the sanitary sewer system for training foam, and so hydrant water would go into a grassy swale	WQ, infiltration	Y	N	Project done to also address issues as part of the City's 1200-Z permit
2020 Stormwater Improvements Package		2021	Retrofit existing piped storm drain system at Salem Airport with area rain garden	WQ, detention, infiltration	Y	Y	\$300,000
Other Hydromodification Related Projects							
Geren Island Bank Stabilization project		2016-2017	Project included 180 feet of bioengineering along the North Channel at Geren Island		N	Y	
Pringle Creek Restoration (Boise Site Demo)		2019-2020	This project daylighted the lower section of Pringle Creek under the Commercial St bridge and removed stream barriers and an old fish ladder. Banks were restored and vegetated and it is an active mitigation project	Educational outreach, stream bank improvements, addressing hydromod	Y	Y	



Table 2. City of Salem Retrofit and Hydromodification Projects

Project Name	Anticipated Construction Date	Actual Construction Date	Project Description	Project Benefit	Additional Water Quality Treatment? (Y/N)	Hydromodification Mitigation? (Y/N)	City Notes
Mill Creek Corporate Wetlands- North and South		South complex completed in 2022	2 large wetlands projects were completed to offset large development projects that added fill in the floodplain	WQ, detention, infiltration, habitat	Y	Y	
Goldcrest Brook Hydromodification Plan		2023	A study/modeling was first completed, and a separate hydromodification plan with specific designs/improvements was prepared.	Educational outreach, stream bank improvements, addressing hydromod	N	Y	Phase 1 improvements to stabilize the creek are in design.
Shelton Ditch Bank Stabilization Plan	2024-2025		This is a bank stabilization project with some habitat improvements that will address erosion issues on Shelton Ditch. An initial collection of data and assessment memo was done to determine priority areas, and then they were programmed into the CIP program. The first sections will be done in 2024.	Educational outreach, stream bank improvements, addressing hydromod	N	Y	
Clark Creek/Ratcliff/Salem Heights Culvert & Habitation Enhancement	2025-2026		Creek channel has been temporarily stabilized but is insufficient. Culvert replaced.	Stabilize creek channel.	N	Y	Project has been delayed. Previously anticipated 2014-15. Currently funded in CIP in FY 25-26
Waller Dam/Mill Creek Restoration		Undetermined	Project is in the evaluation phase and may include replacement or removal of Waller Dam and associated fish ladder. Stream restoration work would be incorporated.	Restoration and potential dam removal	N	Y	
Chambers Swale Stabilization in Bailey Ridge Park		Undetermined	Priority project in the Parks Master Plan to address stream downcutting and sedimentation.	Hydromodification	N	Y	
W Middle Fork Pringle Creek Enhancement at Fairview Park		Undetermined	Priority project in the Parks Master Plan to address local flooding potential and improve stream habitat	Capacity, Hydromod	N	Y	



2.3 What are the new goals, tools, priorities and planned or potential projects for improving retrofit planning to address water quality impacts resulting from historical development/infrastructure?

The City anticipates continuation of its retrofit strategy in conjunction with the following drivers and activities. In-progress and pending, future projects are also identified in Table 2.

2.3.1 Property Acquisition

Since FY 2022, funding has been allocated in the City's Capital Improvement Plan (CIP) for the purpose of purchasing property that may be needed for stormwater and surface water benefits.

Such property acquisition can be used to support projects that provide additional treatment, retention/storage, and improve connectivity the floodplain. Current funding is \$100,000 in FY 2024.

2.3.2 Updated Retrofit Tool

Although the Retrofit Tool was calibrated in 2018 using identified capital improvement projects, City staff report the scoring system for the Tool varies from prioritization criteria set for other CIPs. As such, this made the tool difficult for Engineering staff to use, and inclusion of retrofit projects with existing CIPs continues to be one of the primary ways retrofits are funded.

Retrofits currently completed using Operations funding are limited to very small projects. Over the past several years \$100,000 per year has been added to the City's CIP specifically for Stormwater Retrofit projects.

The City anticipates updates to the Retrofit Tool to 1) integrate more efficiently with the Engineering Department project scoring needs; 2) prioritize hydromodification projects in consideration of water quality objectives; and 3) reflect stream restoration project potential in conjunction with temperature TMDL (WQ drivers) as well as hydromodification. The City also anticipates updates to the Engineering-based CIP prioritization process to better reflect water quality and hydromodification initiatives. Intra-departmental coordination on updates to the prioritization approaches may ensure that multi-objective project needs are better promoted within Engineering and Public Works Operations.

2.3.3 Stormwater Master Plan Update

The City updated their Stormwater Master Plan (Master Plan) in 2020, integrating updated hydrologic and hydraulic (H/H) modeling and identifying stormwater capital improvement projects (CIPs) to accommodate current condition/capacity deficiencies, as well as account for future growth. Updating the Stormwater Master Plan is a continuous process. It is being conducted in a rotating series of three basin planning projects. The Battle, Mill and Pringle Creek Basin Master Plans were completed in 2020. Glenn-Gibson, Upper Claggett, and West Bank Basin Master Plans are anticipated to be complete in 2023. The next set of Basin Master Plans for Croisan, East Bank, and Little Pudding will be completed in 2025. Then the basin planning work will return to Battle, Mill, and Pringle Creek Basin Plans for updates.

Each basin plan describes the drainage basin characteristics, modeling methodologies, and facilities/projects identified to accommodate current conditions and future growth. Existing and built-out hydrology for a range of design storm events was developed in support of modeling efforts. The Basin Plans to date have considered data from the Hydromodification Assessment Report and Retrofit Plan, as well as collected survey information from these basins to create project lists. Projects include stream restoration/channel enhancement CIPs, as well as detention facilities that may be constructed with water quality features.



Per the 2020 Master Plan, stormwater projects are prioritized based on various criteria, including the following that support retrofit initiatives:

- Provides multiple benefits from a single facility, such as managing stormwater flows, reducing stormwater pollutants, enhancing environmental conditions, providing aesthetic qualities, and incorporating park and recreation activities;
- Reduces pollutant loadings to assist with meeting applicable Total Maximum Daily Load waste load allocations; and
- Meets state or federal regulatory requirements.

Capital projects, when identified per the Stormwater Master Plan, will continually be prioritized, and scheduled, and additional criteria supporting water quality and hydromodification objectives will be added to future Basin planning efforts.

Section 3 2014 Hydromodification Assessment Summary

3.1 What were the results of the Hydromodification Assessment? How has it been used, considered, or implemented?

The City's Hydromodification Assessment (January 2013) used landscape-level geologic and land cover characteristics, in combination with current stream conditions, to assess channel condition and channel susceptibility to hydromodification.

The observations and analyses confirm that hydromodification impacts have occurred and continue to occur throughout the City's network of streams. The impacts vary and locations with the highest risk featured bedrock-dominated slopes that transition to lower, more erodible landscape. Direct hydromodification impacts (instream armoring, diversion, etc.) are most notable on Mill Creek and Pringle Creek. Locations susceptible to indirect hydromodification risk, specifically bed and bank erosion as a function of altered rainfall-runoff activities, are specifically listed in the Hydromodification Assessment, Section 6.3. Overall, the rate of channel adjustment is reported to be low throughout the study area, likely due to the relatively small contributing drainage area for many of the stream channels and cohesive nature of the bank sediment (Hydromodification Assessment, p 45). Battle, Croisan, and Glenn-Gibson Basins, which have less urban development in the upper watershed, are also located in areas with soils that are more amendable to infiltration and thus use of infiltration-related BMPs may help avoid future hydromodification impacts in the channels.

The Hydromodification Assessment included a variety of recommendations that centered on: 1) continued physical condition/geomorphic monitoring; 2) implementation of capital projects that include floodplain connectivity to improve flow attenuation, channel stability, reduced flood risk, and improved habitat; 3) implementation of design standards that require infiltration BMPs and detention requirements that include flow duration matching at thresholds applicable to Salem's streams; and 4) refinement to code and policies to address riparian protection and setbacks, forest cover, soil health, and wetland protection.

Following completion of the Hydromodification Assessment, two supplemental Technical Memorandums (TMs) were prepared for the City to provide additional supporting information. The Salem Hydromodification Technical Memo (June 2013) provides additional background on hydromodification as a concept and highlights various high-level strategies that address hydrology, coarse sediment supply, and stream resilience. The Salem Hydromodification Review of City Codes and Design Standards TM (January 2014), reviewed current city code excerpts, identifying those with potential to influence hydromodification and recommendations for code/policy changes. Reviewed code excerpts with the highest potential to influence



hydromodification include the Design Standards (Administrative Rules 109-004), Stormwater Code (SRC Chapter 71), and Floodplain Overlay Zone (SRC Chapter 601).

Outcomes from the Hydromodification Assessment and supporting TMs have been used to inform the identification and prioritization of capital projects as part of the existing capital improvement program, in the context of the City's 2020 Stormwater Master Plan update and associated Basin Master Plans (see Table 2 and Section 2.3.3), and in updates to design standards and code/policies. Additional details on the updates to design standards and code/policies is provided in Section 3.3 of this assessment.

3.2 Were there any identified gaps in the hydromodification information or data related to waterbodies within the City's jurisdiction and, if so, what progress has been made in addressing gaps?

The City's Hydromodification Assessment (Section 7.1.1) identified data gaps that could help inform findings. These data gaps are primarily related to ongoing monitoring and include:

1. The rates of geomorphic channel change in these strong, fine-grained, cohesive sediment are not well understood. City monitoring of selected channel sections could inform this question over time.
2. The fate of stream gravels in the Mill Creek system being delivered to the series of impoundments is not clear. If the Mill Creek channel is aggrading or scouring in these reaches, it would have significant implications that are not captured in the 2014 assessment.
3. Further integration of the stream crew data collection effort will improve knowledge of existing conditions.
4. The City's network of stream gauges is providing valuable information that could be used to calibrate hydrologic runoff models to cover ungauged streams and potentially support a BMP design tool.
5. To inform flow duration thresholds, perform a hydraulic sensitivity analysis on typical channel cross sections from each landscape position. This analysis would investigate the potential for altered runoff rates to mobilize the channel bed and determine appropriate flow control standards that would be effective for drainage and hydromodification.

Related to data gaps #1-3 above, the City's Stream Crew has been working since 2016 to collect and map stream cross section survey data that can be used for future hydromodification monitoring efforts. The Stream Crew Channel Morphology Monitoring document was created for collecting data in 2017. Mapped data includes areas with observed streambank erosion, stream substrate changes, streambed erosion (head cuts), and other points of interest. Specific survey locations have included:

- 2016 - All of Pringle and Mill Basins – including Clark Creek and Shelton Ditch, 2016
- 2017 - Clark Creek Park
- 2020 - Waln Creek from Woodside to Madras
- 2020 - All of Goldcrest Brook
- 2022 - All of Turnage, Anchor Brook, Glenn, Wilark, Gibson, Claggett
- 2022 - Waln Mitigation Area - south of Madras, and West Middle Fork Pringle off Old Strong Rd from Reed Rd to Fairview.

Continued monitoring will be conducted to expand coverage of the physical/geomorphic condition mapping to aid in the identification of future capital project needs.

Per data gap #4 above, in 2016-2017, the City installed additional stream gauges, rain gauges, and new software/hardware to provide a robust community early flood warning system and also provides additional flow and rainfall data for use in future stream modeling efforts.

Finally, related to data gap #5, design standards that support a flow duration matching standard were recommended to be included in the City's 2014 and 2020 update to the Salem Revised Code (SRC) Chapter 71 and the City's 2014 update to the Public Works Design Standards (Administrative Rule Chapter 109, Division 004). However, SRC 71 and the Public Works Design Standards ultimately established a detention standard based on peak flow matching, which is intended more to reduce risks of flooding than to address potential hydromodification impacts. Therefore, continued evaluation of the mobilization of channel bed sediment and reach-specific channel forming flow thresholds was not needed.

3.3 What further actions have been taken as a result of the Hydromodification Assessment, and what was the rationale for those actions?

The City established stormwater design standards in 2014, as outlined in SRC Chapter 71 as well as Administrative Rules Chapter 109, Division 004, both of which prioritize the use of Green Stormwater Infrastructure (GSI). Per Salem's code, GSI is defined as stormwater facilities that mimic natural surface hydrologic functions through infiltration or evapotranspiration. In addition, the City established flow control detention standards that require peak flow matching from ½ of the 2-year, pre-development flow to the 10-year predevelopment flow. This was done to help mitigate peak flow associated with the range of potential channel forming flows. Development of the City's stormwater design standards considered recommendations in the Hydromodification Assessment, specifically to require infiltration BMPs where feasible.

The City is currently (2023) updating and refining its stormwater design standards for consistency with the City's current NPDES MS4 permit. This work will further clarify the use of infiltration-based facilities (i.e., GSI) to meet the Numeric Stormwater Retention Requirement (NSRR), as well as adhere to a reduced impervious area threshold for large projects. The update will be completed by November 1, 2024, to meet the 2021 NPDES MS4 Permit deadline.

In conjunction with other code and policy recommendations, the City has begun work related to Statewide Planning Goal 5 specific to waterways and riparian areas. Phase 1 is underway and includes an inventory (approximately 100 stream-miles in total) of fish-bearing waterways and their non-fish-bearing tributaries. Once the inventory is done, Phase 2 will commence which will be to establish/revise codes related to setbacks. The City's current intention is to use the "Safe Harbor" approach which is a consistent 50-foot setback for most waterways and connected wetlands and 75-foot setback for the Willamette River.

3.4 What are the City's new goals, tools, priorities, and planned or potential projects for addressing ongoing hydromodification?

Ongoing and new goals to address hydromodification impacts specific to design standards and code/policy are outlined in Section 3.3 above.

In addition, in conjunction with Basin Master Planning efforts, the City anticipates that additional hydromodification-related project needs will continue to be identified and prioritized (see Table 2). The City's Retrofit Tool (2018) includes hydromodification risk as an evaluation criterion, and future updates to the Retrofit Tool will continue to build upon monitoring information to inform hydromodification risk as well as project prioritization based on hydromodification criteria.

