COUNCIL REGULAR SESSION

Wednesday, November 17, 2021 at 7:00 PM

COUNCIL MEMBERS:

Mayor Rick Scholl
Council President Doug Morten
Councilor Patrick Birkle
Councilor Stephen R. Topaz
Councilor Jessica Chilton

LOCATION & CONTACT:

HYBRID: Council Chambers and Zoom (details below)
Website | www.sthelensoregon.gov
Email | kpayne@sthelensoregon.gov
Phone | 503-397-6272
Fax | 503-397-4016

AGENDA

CALL REGULAR SESSION TO ORDER

PLEDGE OF ALLEGIANCE

VISITOR COMMENTS – *Limited to five (5) minutes per speaker*

ORDINANCES – *First Reading*

1. **Ordinance No. 3272:** An Ordinance to Annex and Designate the Zone of Certain Property at 58241 South Division Road
2. **Ordinance No. 3273:** An Ordinance to Annex and Designate the Zone of Certain Property at 35285 Millard Road

RESOLUTIONS

3. **Resolution No. 1939:** A Resolution Adopting the St. Helens Stormwater Master Plan
4. **Resolution No. 1940:** A Resolution Adopting the St. Helens Wastewater Master Plan

APPROVE AND/OR AUTHORIZE FOR SIGNATURE

5. Infrastructure Design Work Order #1 with Mackenzie for St. Helens Industrial Business Park
6. Contract Payments

CONSENT AGENDA FOR ACCEPTANCE

7. Amendment No. 2 to Mayer/Reed, Inc. Agreement to include Archaeological Survey
8. Library Board Minutes dated October 11, 2021
9. Planning Commission Minutes dated October 12, 2021

CONSENT AGENDA FOR APPROVAL

10. Council Work Session, Executive Session, Public Hearings, and Regular Session Minutes dated November 3, 2021
11. Animal Facility Licenses
12. Accounts Payable Bill Lists

WORK SESSION ACTION ITEMS

MAYOR SCHOLL REPORTS

COUNCIL MEMBER REPORTS

OTHER BUSINESS

ADJOURN

VIRTUAL MEETING DETAILS

Join Zoom: https://us06web.zoom.us/j/89526764764
Meeting ID: 895 2676 4764
Call In: 213 338 8477

The St. Helens City Council Chambers are handicapped accessible. If you wish to participate or attend the meeting and need special accommodation, please contact City Hall at 503-397-6272 in advance of the meeting.

Be a part of the vision…Get involved with your City…Volunteer for a City of St. Helens Board or Commission!

For more information or for an application, stop by City Hall or call 503-366-8217.

City of St. Helens

ORDINANCE NO. 3272

AN ORDINANCE TO ANNEX AND DESIGNATE THE ZONE OF CERTAIN PROPERTY AT 58241 SOUTH DIVISION ROAD

WHEREAS, applicant Michael McPherson has requested to annex to the City of St. Helens certain property at 58241 South Division Road. This property is also described per **Exhibit A** and depicted per **Exhibit B**; and

WHEREAS, the applicant has consented in writing to the proposed annexation; and

WHEREAS, the applicant constitutes 1) all the owners of the property to be annexed, and 2) more than half of the owners of the property to be annexed own more than half of such property representing more than half of the assessed value pursuant to ORS 222.170(1); and

WHEREAS, the City Council must determine the incorporated Comprehensive Plan Map designation and the Zone Map designation; and

WHEREAS, appropriate notice has been given and a public hearing was held November 3, 2021 on the annexation proposal; and

WHEREAS, the Council has considered findings of compliance with criteria and law applicable to the proposal.

NOW, THEREFORE, THE CITY OF ST. HELENS DOES ORDAIN AS FOLLOWS:

Section 1. The above recitations are true and correct and are incorporated herein by this reference.

Section 2. The property described **Exhibit A** and depicted in **Exhibit B** is hereby accepted for annexation to the City of St. Helens.

Section 3. The St. Helens Zoning Ordinance Map is hereby amended to reflect that the property described herein shall be zoned Moderate Residential, R7.

Section 4. The St. Helens Comprehensive Plan Map is hereby amended to reflect that the property described herein shall be designated as Suburban Residential (Incorporated).

Section 5. The land is classified as "Developing" in accordance with Chapter 17.112 of the St. Helens Community Development Code (SHMC Title 17) and OAR 660-08-0005.

Section 6. In support of the above annexation and amendments described herein, the Council hereby adopts the Annexation A.4.21 Findings of Fact and Conclusions of Law, attached hereto as **Exhibit C** and made part of this reference.

Section 7. The effective date of this Ordinance shall be 30 days after approval, in accordance with the City Charter and other applicable laws.

Read the first time: November 17, 2021
Read the second time: December 1, 2021

APPROVED AND ADOPTED this 1st day of December 2021 by the following vote:

Ayes:

Nays:

____
Rick Scholl, Mayor

ATTEST:

____
Kathy Payne, City Recorder

EXHIBIT A

LEGAL DESCRIPTION

A parcel of land located in the NW ¼ of the SW ¼, of Section 8, Township 4 N., Range 1 W., Willamette Meridian, Columbia County, Oregon, more specifically described as follows:

Beginning at a point at the Northwest corner of the intersection of Millard Road and Division Road also the **True Point of Beginning**;

Thence, North 88º15'06" West along the North right-of-way line of Millard Road a distance of 95.13 feet;

Thence, North 1º33'00" West a distance of 161.55 feet;

Thence, North 88º15'06" West a distance of 131.20 feet;

Thence, North 1º33'00" West a distance of 268.57 feet;

Thence, South 83º46'16" East a distance of 30 feet;

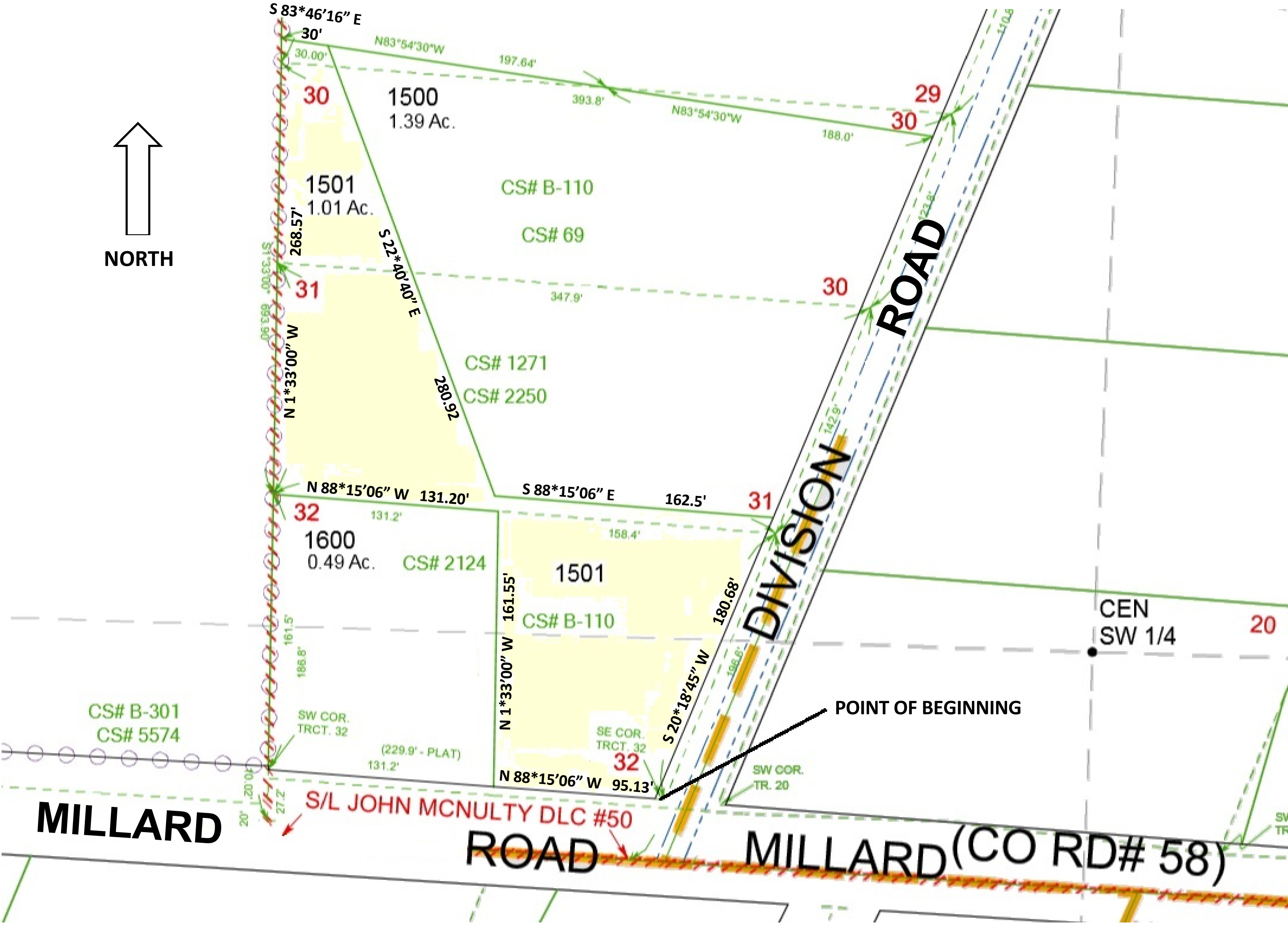
Thence, South 22º40'40" East a distance of 280.92 feet;

Thence, South 88º15'06" East a distance of 162.5 feet to the West right-of-way line of Division Road;

Thence, South 20º18'45" West along said West right-of-way line a distance of 180.68 feet to the **True Point of Beginning.**

ORDINANCE NO. 3272 EXHIBIT B

N.W.1/4 S.W.1/4 SEC.8 T.4N. R.1W. W.M.
COLUMBIA COUNTY



CITY OF ST. HELENS PLANNING DEPARTMENT
FINDINGS OF FACT AND CONCLUSIONS OF LAW
Annexation A.4.21

APPLICANT: Michael McPherson
OWNER: Same

ZONING: Columbia County's Single-Family Residential (R-10)
LOCATION: 58241 South Division Road; 4N1W-8CB-1501
PROPOSAL: The property owner filed a consent to annex because they desired to connect to City utilities and to use our development regulations for the undeveloped "back half" of the subject property

SITE INFORMATION / BACKGROUND

The subject property is a 1.01-acre site developed with a detached single-family dwelling (manufactured home). In 2014, this property was sold by the Calvary Lutheran Church (which abuts the property to the north and west) to the applicant. The property abuts both South Division Road to the east and Millard Road to the south. Access to the dwelling is off South Division Road with a paved driveway approach. The site is connected to McNulty water, but not connected to City sewer, although it is available within Millard Road. Both Millard Road and South Division Road do not have sufficient right-of-way to meet our minimum width standards, and they lack frontage improvements abutting this property. Should this property be the subject of a development proposal in the future, some or all of these requirements may be warranted as part of the approval.

PUBLIC HEARING & NOTICE

Public hearing before the Planning Commission for *recommendation to the City Council*: October 12, 2021. Public hearing before the City Council: November 3, 2021.

Notice of this proposal was sent to the Oregon Department of Land Conservation and Development on September 7, 2021 through their PAPA Online Submittal website.

Notice of this proposal was sent to surrounding property owners within 300 feet of the subject property on September 17, 2021 via first class mail. Notice was sent to agencies by mail or e-mail on the same date.

Notice was published on September 29, 2021 in The Chronicle newspaper.

AGENCY REFERRALS & COMMENTS

The Columbia County Public Works Department had no comments or concerns for the annexation.

APPLICABLE CRITERIA, ANALYSIS & FINDINGS

SHMC 17.08.040 (1) – Quasi-judicial amendment and standards criteria

(a) A recommendation or a decision to approve, approve with conditions, or to deny an application for a quasi-judicial amendment shall be based on all of the following standards:
   (i) The applicable comprehensive plan policies and map designation; and that the change will not adversely affect the health, safety, and welfare of the community; and
   (ii) The applicable Oregon Statewide Planning Goals adopted under ORS Chapter 197, until acknowledgment of the comprehensive plan and ordinances; and
   (iii) The standards applicable of any provision of this code or other applicable implementing ordinance.

(b) Consideration may also be given to:
   (i) Any applicable evidence of change in the neighborhood or community or a mistake or inconsistency in the comprehensive plan or zoning map as it relates to the property which is the subject of the development application.

Discussion: **(a)(i)** The Comprehensive Plan designation for the subject property is Rural Suburban Unincorporated Residential (RSUR). Applicable designation and zoning district for annexation are discussed later.

There is no known conflict with the general Comprehensive Plan policies identified in Chapter 19.08 SHMC. Note that SHMC 19.08.030 discusses public services and facilities and includes utility provisions (e.g., water and sewer) as well as services such as police and library. In sum, all services are intertwined; the consent to annexation allows connection to City sewer to support existing and future development on the subject property, and, once annexed, all other City services/facilities. By this process, the proposal complies with this aspect of the Comprehensive Plan.

There is no known conflict with the specific Comprehensive Plan policies identified in Chapter 19.12 SHMC.

There is no known conflict with the addendums to the Comprehensive Plan which includes Economic Opportunities Analysis (Ord. No. 3101), Waterfront Prioritization Plan (Ord. No. 3148), the Transportation Systems Plan (Ord. No. 3150), the Corridor Master Plan (Ord. No 3181), the Parks & Trails Master Plan (Ord. No. 3191), the Riverfront Connector Plan (Ord. No. 3241), and the Housing Needs Analysis (Ord. No. 3244).

Finally, there is no evidence that this proposal will be contrary to the health, safety and welfare of the community.

(a)(ii) The City's Comprehensive Plan has been adopted by the State, thus, the applicable Oregon Statewide Planning Goals adopted under ORS Chapter 197 do not need to be analyzed per this section.

(a)(iii) In addition, Section 3 of the City's Charter states that "annexation, delayed or otherwise, to the City of St. Helens, may only be approved by a prior majority vote among the electorate." However, during the 2016 Legislative Assembly, Senate Bill 1578 was passed. It states that a City shall annex the territory without submitting the proposal to the electors if certain criteria are met:

1. Property is within the UGB
2. Property will be subject to the City's Comprehensive Plan
3. Property is contiguous to the City limits or is separated by only a public right of way or body of water
4. Property conforms to all other City requirements

As this proposal meets these criteria, this property will **not** be subject to a majority vote among the electorate.

Other provisions applicable to this proposal are discussed elsewhere herein.

(b) There is no evidence of a change in neighborhood, or mistake or inconstancy in the Comprehensive Plan or Zoning Map.

Finding: The quasi-judicial amendment and standards criteria are met.

SHMC 17.08.060 – Transportation planning rule compliance

(1) Review of Applications for Effect on Transportation Facilities. A proposed comprehensive plan amendment, zone change or land use regulation change, whether initiated by the city or by a private interest, shall be reviewed to determine whether it significantly affects a transportation facility, in accordance with OAR 660-012-0060 (the Transportation Planning Rule ("TPR")). "Significant" means the proposal would:

- (a) Change the functional classification of an existing or planned transportation facility (exclusive of correction of map errors in an adopted plan);
- (b) Change standards implementing a functional classification system; or
- (c) As measured at the end of the planning period identified in the adopted transportation system plan:
  - (i) Allow land uses or levels of development that would result in types or levels of travel or access that are inconsistent with the functional classification of an existing or planned transportation facility;
  - (ii) Reduce the performance of an existing or planned transportation facility below the minimum acceptable performance standard identified in the TSP; or
  - (iii) Worsen the performance of an existing or planned transportation facility that is otherwise projected to perform below the minimum acceptable performance standard identified in the TSP or comprehensive plan.

(2) Amendments That Affect Transportation Facilities. Comprehensive plan amendments, zone changes or land use regulations that significantly affect a transportation facility shall ensure that allowed land uses are consistent with the function, capacity, and level of service of the facility identified in the TSP. This shall be accomplished by one or a combination of the following:

- (a) Adopting measures that demonstrate allowed land uses are consistent with the planned function, capacity, and performance standards of the transportation facility.
- (b) Amending the TSP or comprehensive plan to provide transportation facilities, improvements or services adequate to support the proposed land uses consistent with the requirements of OAR 660-012-0060.
- (c) Altering land use designations, densities, or design requirements to reduce demand for vehicle travel and meet travel needs through other modes of transportation.
- (d) Amending the TSP to modify the planned function, capacity or performance standards of the transportation facility.

(3) Traffic Impact Analysis. A traffic impact analysis shall be submitted with a plan amendment or zone change application, as applicable, pursuant to Chapter 17.156 SHMC.

Discussion: This section reflects State law regarding the Transportation Planning Rule (TPR): Transportation Planning Rule (TPR), OAR 660, Division 12. The TPR requires that where an amendment to a functional plan, an acknowledged comprehensive plan, or a land use regulation would significantly affect an existing or planned transportation facility, the local government shall put in place measures to assure that allowed land uses are consistent with the identified function, capacity, and performance standards of the facility. **Current zoning of the property is Columbia County's Single-Family Residential (R-10) and the City's zoning options are Suburban Residential (R10) or Moderate Residential (R7).**

Generally, when comparing potential land use impact on transportation facilities, the ***reasonable worst case scenario*** for the existing and proposed designation/zone are considered. The potential land uses are very similar for both the City and County. The City's zoning is comparable to the County with regards to the possible intensity of uses allowed and potential vehicular trips generated. Thus, this proposal will not affect an existing or planned transportation facility.

Finding: No transportation facility will be significantly affected by this proposal. No traffic impact analysis is warranted.

SHMC 17.28.030 (1) – Annexation criteria

(a) Adequate public facilities are available to the area and have sufficient capacity to provide service for the proposed annexation area; and
(b) Comply with comprehensive plan amendment standards and zoning ordinance amendment standards and not be in conflict with applicable comprehensive plan policies and implementing ordinances; and
(c) Complies with state laws; and
(d) Abutting roads must meet city standards or property owner will be required to sign and record an irrevocable consent to local improvement district; and
(e) Property exceeding 10 acres in gross size must show a need on the part of the city for such land if it is designated residential (e.g., less than five years' supply of like designated lands in current city limits).

Discussion: (a) Water – The site is currently connected to McNulty Water. The nearest City water line is at Les Schwab on Highway 30 (+2,500 feet away).

Sewer – The site is not currently connected to City sewer. With regards to capacity, the City's wastewater treatment plant currently has a daily limit (physically and as permitted by DEQ) to handle over 50,000 pounds of Biochemical Oxygen Demand (BOD) and a monthly average limit of 26,862 pounds. This is the "loading" or potency of the wastewater received by the plant. The average daily BOD is well below this at only 1,500 pounds. Therefore, existing and future uses that could occur on the subject property can be accommodated by the City's sanitary sewer system.

Transportation – As described above, this proposal poses no significant impact on a transportation facility.

Finding: Adequate public facilities are available to the area and have sufficient capacity to provide service for the proposed annexation area.

(b) The land use of the subject property is a detached single-family dwelling. This is a permitted use in the corresponding zoning districts.

Finding: There is no known conflict with the Comprehensive Plan and implementing ordinances.

(c) With regards to Oregon Revised Statutes (ORS), city annexations of territory must be undertaken consistent with ORS 222.111 to 222.183.

Pursuant to ORS 222.111(1), a City may only annex territory that is not within another City, and the territory must either be contiguous to the annexing City or be separated from the City only by a body of water or public right-of-way. The subject property is not within another City's jurisdiction and City of St. Helens corporate limits lies on the west side of the subject property. Although undertaking an annexation is authorized by state law, the manner in which a city proceeds with annexation is also dictated in the city charter. ORS 222.111(1) references a city's charter as well as other ORS. St. Helens' Charter requirements pertaining to annexations are noted above.

Per ORS 222.111(2) an annexation may be initiated by the owner of real property or the city council. This annexation request was initiated by the property owner. Further, ORS 222.125 requires that that all property owners of the subject property to be annexed and at least half of the electors residing on the property consent in writing to the annexation. These documents were submitted with the annexation application.

ORS 197.175(1) suggests that all annexations are subject to the statewide planning goals. The statewide planning goals that could technically apply or relate to this proposal are Goals 1, 2, 11 and 12.

- ***Statewide Planning Goal 1: Citizen Involvement.***
  Goal 1 requires the development of a citizen involvement program that is widespread, allows two-way communication, provides for citizen involvement through all planning phases, and is understandable, responsive, and funded.

Generally, Goal 1 is satisfied when a local government follows the public involvement procedures set out in the statutes and in its acknowledged comprehensive plan and land use regulations.

The City's Development Code is consistent with State law with regards to notification requirements. Pursuant to SHMC 17.20.080 at least one public hearing before the Planning Commission and City Council is required. Legal notice in a newspaper of general circulation is also required. The City has met these requirements and notified DLCD of the proposal.

- ***Statewide Planning Goal 2: Land Use Planning.***
  This goal requires that a land use planning process and policy framework be established as a basis for all decisions and actions relating to the use of land. All local governments and state agencies involved in the land use action must coordinate with each other. City,

county, state and federal agency and special districts plans and actions related to land use must be consistent with the comprehensive plans of cities and counties and regional plans adopted under Oregon Revised Statues (ORS) Chapter 268.

Generally, Goal 2 requires that actions related to land use be consistent with acknowledged Comprehensive Plans and coordination with affected governments and agencies and be based on an adequate factual base. The City has an adopted Comprehensive Plan, compliance of this proposal which is addressed herein. Moreover, explanation and proof of coordination with affected agencies and factual base are described herein, as well, including inventory, needs, etc.

- ***Statewide Planning Goal 11: Public Facilities and Services.***
  Goal 11 requires cities and counties to plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development. The goal requires that urban and rural development be "guided and supported by types and levels of urban and rural public facilities and services appropriate for, but limited to, the needs and requirements of the urban, urbanizable and rural areas to be served."

The subject property is served by McNulty water. Should the applicant desire a connection to the City sewer, capacities are adequate to serve the subject property. This is explained above. The existing development is adequately served.

- ***Statewide Planning Goal 12: Transportation.***
  Goal 12 requires cities, counties, metropolitan planning organizations, and ODOT to provide and encourage a "safe, convenient and economic transportation system." This is accomplished through development of Transportation System Plans based on inventories of local, regional and state transportation needs. Goal 12 is implemented through OAR 660, Division 12, also known as the Transportation Planning Rule ("TPR"). The TPR contains numerous requirements governing transportation planning and project development.

Traffic impacts and the City's provisions that address the TPR are explained above. This proposal will not significantly affect an existing or planned transportation facility.

(d) The subject property abuts South Division Road and Millard Road.

South Division Road is a local street without sidewalks on either side. The existing right-of-way is also not 50' wide, which is the minimum for local streets.

Millard Road is classified as a minor arterial without sidewalks on either side. The existing right-of-way is also not 60' wide, which is the minimum for minor arterials.

However, this property is not the subject of a current development land use review, which provides the legal nexus and proportionality to require such improvements, right-of-way dedications, or other requirements. As such, no improvements are warranted with this proposal.

(e) The subject property is not greater than 10 acres in gross size. Thus a needs analysis is not necessary.

Finding: The annexation approval criteria are met for this proposal.

SHMC 17.28.030 (2) – Annexation criteria

> The plan designation and the zoning designation placed on the property shall be the city's zoning district which most closely implements the city's comprehensive plan map designation.

Discussion: The Comprehensive Plan designation is currently Rural Suburban Unincorporated Residential (RSUR). The City's zoning options given annexation are Moderate Residential (R7) or Suburban Residential (R10). The Comprehensive Plan designation would thus be Suburban Residential (Incorporated) (SR). **City Council funds R7 zoning in this case to be consistent with the surrounding zoning.**

Finding: Upon annexation, the subject property's Comprehensive Plan designation shall be Suburban Residential (Incorporated) and be zoned Moderate Residential (R7).

SHMC 17.112.020 – Established & Developed Area Classification criteria

(1) Established Area.
- (a) An "established area" is an area where the land is not classified as buildable land under OAR 660-08-0005;
- (b) An established area may include some small tracts of vacant land (tracts less than an acre in size) provided the tracts are surrounded by land which is not classified as buildable land; and
- (c) An area shown on a zone map or overlay map as an established area.

(2) Developing Area. A "developing area" is an area which is included in the city's buildable land inventory under the provisions of OAR except as provided by subsection (1)(b) of this section.

Discussion: OAR 660-008-0005 classifies *buildable land* as:

> Residentially designated land within the urban growth boundary, including both vacant and developed land likely to be redeveloped, that is suitable, available and necessary for residential uses. Publicly owned land is generally not considered available for residential uses. Land is generally considered "suitable and available" unless it:
> (a) Is severely constrained by natural hazards as determined under Statewide Planning Goal 7;
> (b) Is subject to natural resource protection measures determined under Statewide Planning Goals 5, 6, 15, 16, 17 or 18;
> (c) Has slopes of 25 percent or greater;
> (d) Is within the 100-year flood plain; or
> (e) Cannot be provided with public facilities.

Discussion: OAR 660-008-0005 generally defines "Buildable Land" as vacant residential property not constrained by natural hazards or resources, and typically not publicly owned. The subject property is zoned residential and is classified as buildable.

Finding: The subject property should be designated as "developing" in accordance with SHMC 17.112.

CONCLUSION & DECISION

Based upon the facts and findings herein, and the recommendations of staff and the Planning Commission, the City Council approves of this annexation and that upon annexation, the subject property have a Comprehensive Plan designation of Suburban Residential (Incorporated) SR, be zoned Moderate Residential (R7), and designated as "developing."

*This annexation will **not** be subject to voter approval subsequent to this land use process.*

______________________________________ ______________________

Rick Scholl, Mayor Date

City of St. Helens
ORDINANCE NO. 3273

AN ORDINANCE TO ANNEX AND DESIGNATE THE ZONE OF CERTAIN PROPERTY AT 35285 MILLARD ROAD

WHEREAS, applicant Columbia Soil & Water Conservation District has requested to annex to the City of St. Helens certain property at 35285 Millard Road. This property is also described per **Exhibit A** and depicted per **Exhibit B**; and

WHEREAS, the applicant has consented in writing to the proposed annexation; and

WHEREAS, the applicant constitutes 1) all the owners of the property to be annexed, and 2) more than half of the owners of the property to be annexed own more than half of such property representing more than half of the assessed value pursuant to ORS 222.170(1); and

WHEREAS, the City Council must determine the incorporated Comprehensive Plan Map designation and the Zone Map designation; and

WHEREAS, appropriate notice has been given and a public hearing was held November 3, 2021 on the annexation proposal; and

WHEREAS, the Council has considered findings of compliance with criteria and law applicable to the proposal.

NOW, THEREFORE, THE CITY OF ST. HELENS DOES ORDAIN AS FOLLOWS:

Section 1. The above recitations are true and correct and are incorporated herein by this reference.

Section 2. The property described **Exhibit A** and depicted in **Exhibit B** is hereby accepted for annexation to the City of St. Helens.

Section 3. The St. Helens Zoning Ordinance Map is hereby amended to reflect that the property described herein shall be zoned Moderate Residential, R7.

Section 4. The St. Helens Comprehensive Plan Map is hereby amended to reflect that the property described herein shall be designated as Suburban Residential (Incorporated).

Section 5. The land is classified as "Developing" in accordance with Chapter 17.112 of the St. Helens Community Development Code (SHMC Title 17) and OAR 660-08-0005.

Section 6. In support of the above annexation and amendments described herein, the Council hereby adopts the Annexation A.2.11 Findings of Fact and Conclusions of Law, attached hereto as **Exhibit C** and made part of this reference.

Section 7. The effective date of this Ordinance shall be 30 days after approval, in accordance with the City Charter and other applicable laws.

Read the first time: November 17, 2021
Read the second time: December 1, 2021

APPROVED AND ADOPTED this 1st day of December 2021 by the following vote:

Ayes:

Nays:

____
Rick Scholl, Mayor

ATTEST:

____
Kathy Payne, City Recorder

EXHIBIT A

LEGAL DESCRIPTION

A parcel of land located in the NE ¼ of the SW ¼, of Section 8, Township 4 N., Range 1 W., Willamette Meridian, Columbia County, Oregon, more specifically described as follows:

Beginning at a point at the Northeast corner of the intersection of Millard Road and Division Road also the **True Point of Beginning**;

Thence, Northerly along the East right-of-way line of Division Road to the North line of Tract 20, McNulty Heights, Columbia County, Oregon;

Thence, Easterly along the North line of said Tract 20 to the Northeast corner of said Tract 20;

Thence, Southerly along the East line of said Tract 20 a distance of 51.08 feet;

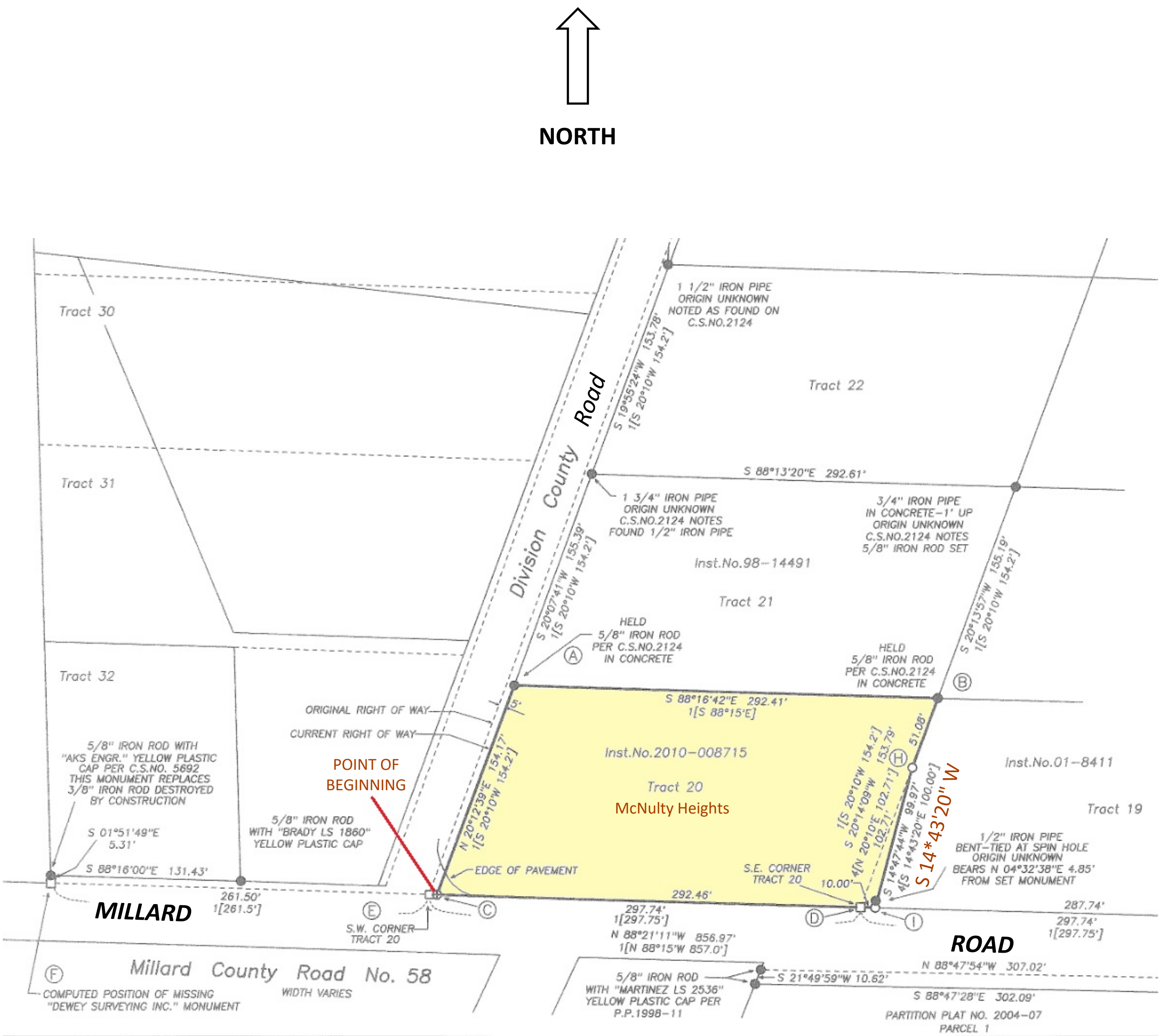
Thence, South 14º43’20” West to the North right-of-way line of Millard Road;

Thence, Westerly along said North right-of-way line to the **True Point of Beginning.**

ORDINANCE NO. 3273 EXHIBIT B

N.E. 1/4 S.W. 1/4 SEC.8 T.4N. R.1W. W.M.

COLUMBIA COUNTY



CITY OF ST. HELENS PLANNING DEPARTMENT
FINDINGS OF FACT & CONCLUSIONS OF LAW
Annexation A.2.11

APPLICANT: Columbia Soil & Water Conservation District (CSWCD)
OWNER: Same

ZONING: Columbia County's Single-Family Residential (R-10)
LOCATION: 35285 Millard Road; 4N1W-8CA-2800
PROPOSAL: The property owner filed a consent to annex in May 2011 because they desired to connect to City sewer. They completed their connection to City sewer, but the annexation was on hold until the subject property abutted City limits. In conjunction with Annexation A.4.21 (58241 South Division Road), this property will abut City limits and be eligible for annexation.

SITE INFORMATION / BACKGROUND

The subject property is 1.05 acres and was the former location of the Warren Grange and Calvary Chapel Fellowship Church. In 2011, the County approved a Determination of Similar Use permit (DSU 11-01) to convert the building into space for Columbia Soil & Water Conservation District (CSWCD) facilities. The approval allowed the "non-conforming Warren Grange, Community Service Institutional Use" to be modified for CSWCD use. CSWCD also leases a portion of the building to the National Resource Conservation Service (NRCS), a wing of the US Department of Agriculture (USDA). Between 2012 and 2013, a two-story garage was built on the property adjacent to the parking lot for NRCS vehicles and general storage. The subject property abuts South Division to the east and Millard Road to the south. Both roads are deficient in their right-of-way widths and lack frontage improvements, although a portion of Millard Road is improved with sidewalks abutting the property. The property is accessed from Millard Road into a fully developed, paved parking lot.

PUBLIC HEARING & NOTICE

Public hearing before the Planning Commission for *recommendation to the City Council*: October 12, 2021. Public hearing before the City Council: November 3, 2021.

Notice of this proposal was sent to the Oregon Department of Land Conservation and Development on September 7, 2021 through their PAPA Online Submittal website.

Notice of this proposal was sent to surrounding property owners within 300 feet of the subject property on September 17, 2021 via first class mail. Notice was sent to agencies by mail or e-mail on the same date.

Notice was published on September 29, 2021 in The Chronicle newspaper.

AGENCY REFERRALS & COMMENTS

The Columbia County Public Works Department had no comments or concerns with the annexation.

APPLICABLE CRITERIA, ANALYSIS & FINDINGS

SHMC 17.08.040 (1) – Quasi-judicial amendment and standards criteria

(a) A recommendation or a decision to approve, approve with conditions, or to deny an application for a quasi-judicial amendment shall be based on all of the following standards:
(i) The applicable comprehensive plan policies and map designation; and that the change will not adversely affect the health, safety, and welfare of the community; and
(ii) The applicable Oregon Statewide Planning Goals adopted under ORS Chapter 197, until acknowledgment of the comprehensive plan and ordinances; and
(iii) The standards applicable of any provision of this code or other applicable implementing ordinance.

(b) Consideration may also be given to:
(i) Any applicable evidence of change in the neighborhood or community or a mistake or inconsistency in the comprehensive plan or zoning map as it relates to the property which is the subject of the development application.

Discussion: **(a)(i)** The Comprehensive Plan designation for the subject property is Rural Suburban Unincorporated Residential (RSUR). Applicable designation and zoning district for annexation are discussed later.

There is no known conflict with the general Comprehensive Plan policies identified in Chapter 19.08 SHMC. Note that SHMC 19.08.030 discusses public services and facilities and includes utility provisions (e.g., water and sewer) as well as services such as police and library. In sum, all services are intertwined; the consent to annexation allows connection to City sewer to support existing and future development on the subject property, and, once annexed, all other City services/facilities. By this process, the proposal complies with this aspect of the Comprehensive Plan.

There is no known conflict with the specific Comprehensive Plan policies identified in Chapter 19.12 SHMC.

There is no known conflict with the addendums to the Comprehensive Plan which includes Economic Opportunities Analysis (Ord. No. 3101), Waterfront Prioritization Plan (Ord. No. 3148), the Transportation Systems Plan (Ord. No. 3150), the Corridor Master Plan (Ord. No 3181), the Parks & Trails Master Plan (Ord. No. 3191), the Riverfront Connector Plan (Ord. No. 3241), and the Housing Needs Analysis (Ord. No. 3244).

Finally, there is no evidence that this proposal will be contrary to the health, safety and welfare of the community.

(a)(ii) The City's Comprehensive Plan has been adopted by the State, thus, the applicable Oregon Statewide Planning Goals adopted under ORS Chapter 197 do not need to be analyzed per this section.

(a)(iii) In addition, Section 3 of the City's Charter states that "annexation, delayed or otherwise, to the City of St. Helens, may only be approved by a prior majority vote among the electorate." However, during the 2016 Legislative Assembly, Senate Bill 1578 was passed. It states that a City shall annex the territory without submitting the proposal to the electors if certain criteria are met:

1. Property is within the UGB
2. Property will be subject to the City's Comprehensive Plan
3. Property is contiguous to the City limits or is separated by only a public right of way or body of water
4. Property conforms to all other City requirements

With the condition that Annexation (A.4.21) at 58241 South Division Road is approved, this proposal meets these criteria, and will **not** be subject to a majority vote among the electorate.

Other provisions applicable to this proposal are discussed elsewhere herein.

(b) There is no evidence of a change in neighborhood, or mistake or inconstancy in the Comprehensive Plan or Zoning Map.

Finding: The quasi-judicial amendment and standards criteria are met.

SHMC 17.08.060 – Transportation planning rule compliance

(1) Review of Applications for Effect on Transportation Facilities. A proposed comprehensive plan amendment, zone change or land use regulation change, whether initiated by the city or by a private interest, shall be reviewed to determine whether it significantly affects a transportation facility, in accordance with OAR 660-012-0060 (the Transportation Planning Rule ("TPR")). "Significant" means the proposal would:

- (a) Change the functional classification of an existing or planned transportation facility (exclusive of correction of map errors in an adopted plan);
- (b) Change standards implementing a functional classification system; or
- (c) As measured at the end of the planning period identified in the adopted transportation system plan:
  - (i) Allow land uses or levels of development that would result in types or levels of travel or access that are inconsistent with the functional classification of an existing or planned transportation facility;
  - (ii) Reduce the performance of an existing or planned transportation facility below the minimum acceptable performance standard identified in the TSP; or
  - (iii) Worsen the performance of an existing or planned transportation facility that is otherwise projected to perform below the minimum acceptable performance standard identified in the TSP or comprehensive plan.

(2) Amendments That Affect Transportation Facilities. Comprehensive plan amendments, zone changes or land use regulations that significantly affect a transportation facility shall ensure that allowed land uses are consistent with the function, capacity, and level of service of the facility identified in the TSP. This shall be accomplished by one or a combination of the following:

- (a) Adopting measures that demonstrate allowed land uses are consistent with the planned function, capacity, and performance standards of the transportation facility.
- (b) Amending the TSP or comprehensive plan to provide transportation facilities, improvements or services adequate to support the proposed land uses consistent with the requirements of OAR 660-012-0060.

(c) Altering land use designations, densities, or design requirements to reduce demand for vehicle travel and meet travel needs through other modes of transportation.
(d) Amending the TSP to modify the planned function, capacity or performance standards of the transportation facility.

(3) Traffic Impact Analysis. A traffic impact analysis shall be submitted with a plan amendment or zone change application, as applicable, pursuant to Chapter 17.156 SHMC.

Discussion: This section reflects State law regarding the Transportation Planning Rule (TPR): Transportation Planning Rule (TPR), OAR 660, Division 12. The TPR requires that where an amendment to a functional plan, an acknowledged comprehensive plan, or a land use regulation would significantly affect an existing or planned transportation facility, the local government shall put in place measures to assure that allowed land uses are consistent with the identified function, capacity, and performance standards of the facility. **Current zoning of the property is Columbia County's Single-Family Residential (R-10), and the City's zoning options are Suburban Residential (R10) or Moderate Residential (R7).**

Generally, when comparing potential land use impact on transportation facilities, the ***reasonable worst case scenario*** for the existing and proposed designation/zone are considered. The potential land uses are very similar for both the City and County. The City's zoning is comparable to the County with regards to the possible intensity of uses allowed and potential vehicular trips generated. Thus, this proposal will not affect an existing or planned transportation facility.

Finding: No transportation facility will be significantly affected by this proposal. No traffic impact analysis is warranted.

SHMC 17.28.030 (1) – Annexation criteria

(a) Adequate public facilities are available to the area and have sufficient capacity to provide service for the proposed annexation area; and
(b) Comply with comprehensive plan amendment standards and zoning ordinance amendment standards and not be in conflict with applicable comprehensive plan policies and implementing ordinances; and
(c) Complies with state laws; and
(d) Abutting roads must meet city standards or property owner will be required to sign and record an irrevocable consent to local improvement district; and
(e) Property exceeding 10 acres in gross size must show a need on the part of the city for such land if it is designated residential (e.g., less than five years' supply of like designated lands in current city limits).

Discussion: (a) Water – The site is currently connected to McNulty Water. The nearest City water line is near Les Schwab on Highway 30 (2,500+ feet away).

Sewer – The site is currently connected to City sewer. With regards to capacity, the City's wastewater treatment plant currently has a daily limit (physically and as permitted by DEQ) to handle over 50,000 pounds of Biochemical Oxygen Demand (BOD) and a monthly average limit of 26,862 pounds. This is the "loading" or potency of the wastewater received by the plant. The average daily BOD is well below this at only 1,500 pounds. Therefore, existing and future uses that could occur on the subject property can be accommodated by the City's sanitary sewer system.

Transportation – As described above, this proposal poses no significant impact on a transportation facility.

Finding: Adequate public facilities are available to the area and have sufficient capacity to provide service for the proposed annexation area.

(b) This use would be considered a public facility (major) which is a conditionally allowed use in the Moderate Residential (R7) and Suburban Residential (R10) zoning districts.

Finding: There is no known conflict with the Comprehensive Plan and implementing ordinances.

(c) With regards to Oregon Revised Statutes (ORS), city annexations of territory must be undertaken consistent with ORS 222.111 to 222.183.

Pursuant to ORS 222.111(1), a City may only annex territory that is not within another City, and the territory must either be contiguous to the annexing City or be separated from the City only by a body of water or public right-of-way. The subject property is not within another City's jurisdiction and, **with the condition that Annexation (A.4.21) at 58241 South Division Road is approved**, City of St. Helens corporate limits will lie on the west side of the subject property.

Although undertaking an annexation is authorized by state law, the manner in which a city proceeds with annexation is also dictated in the city charter. ORS 222.111(1) references a city's charter as well as other ORS. St. Helens' Charter requirements pertaining to annexations are noted above.

Per ORS 222.111(2) an annexation may be initiated by the owner of real property or the city council. This annexation request was initiated by the property owner. Further, ORS 222.125 requires that that all property owners of the subject property to be annexed and at least half of the electors residing on the property consent in writing to the annexation. These documents were submitted with the annexation application.

ORS 197.175(1) suggests that all annexations are subject to the statewide planning goals. The statewide planning goals that could technically apply or relate to this proposal are Goals 1, 2, 11 and 12.

- ***Statewide Planning Goal 1: Citizen Involvement.***
  Goal 1 requires the development of a citizen involvement program that is widespread, allows two-way communication, provides for citizen involvement through all planning phases, and is understandable, responsive, and funded.

Generally, Goal 1 is satisfied when a local government follows the public involvement procedures set out in the statutes and in its acknowledged comprehensive plan and land use regulations.

The City’s Development Code is consistent with State law with regards to notification requirements. Pursuant to SHMC 17.20.080 at least one public hearing before the Planning Commission and City Council is required. Legal notice in a newspaper of general circulation is also required. The City has met these requirements and notified DLCD of the proposal.

- ***Statewide Planning Goal 2: Land Use Planning.***
  This goal requires that a land use planning process and policy framework be established as a basis for all decisions and actions relating to the use of land. All local governments and state agencies involved in the land use action must coordinate with each other. City, county, state and federal agency and special districts plans and actions related to land use must be consistent with the comprehensive plans of cities and counties and regional plans adopted under Oregon Revised Statues (ORS) Chapter 268.

Generally, Goal 2 requires that actions related to land use be consistent with acknowledged Comprehensive Plans and coordination with affected governments and agencies and be based on an adequate factual base. The City has an adopted Comprehensive Plan, compliance of this proposal which is addressed herein. Moreover, explanation and proof of coordination with affected agencies and factual base are described herein, as well, including inventory, needs, etc.

- ***Statewide Planning Goal 11: Public Facilities and Services.***
  Goal 11 requires cities and counties to plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development. The goal requires that urban and rural development be "guided and supported by types and levels of urban and rural public facilities and services appropriate for, but limited to, the needs and requirements of the urban, urbanizable and rural areas to be served."

The subject property is served by McNulty water. The subject property is served by City sewer, which is explained above. The existing development is adequately served.

- ***Statewide Planning Goal 12: Transportation.***
  Goal 12 requires cities, counties, metropolitan planning organizations, and ODOT to provide and encourage a “safe, convenient and economic transportation system.” This is accomplished through development of Transportation System Plans based on inventories of local, regional and state transportation needs. Goal 12 is implemented through OAR 660, Division 12, also known as the Transportation Planning Rule (“TPR”). The TPR contains numerous requirements governing transportation planning and project development.

Traffic impacts and the City’s provisions that address the TPR are explained above. This proposal will not significantly affect an existing or planned transportation facility.

(d) The subject property abuts South Division Road and Millard Road.

South Division Road is a local street without sidewalks on either side. The existing right-of-way is also not 50’ wide, which is the minimum for local streets.

Millard Road is classified as a minor arterial with sidewalks that abut only a portion of the subject property. The existing right-of-way is also not 60' wide for the entire right-of-way that abuts the property, which is the minimum for minor arterials.

However, this property is not the subject of a current development land use review, which provides the legal nexus and proportionality to require such improvements, right-of-way dedications, or other requirements. As such, no improvements are warranted with this proposal.

(e) The subject property is not greater than 10 acres in gross size. Thus a needs analysis is not necessary.

Finding: The annexation approval criteria are met for this proposal.

SHMC 17.28.030 (2) – Annexation criteria

> The plan designation and the zoning designation placed on the property shall be the city's zoning district which most closely implements the city's comprehensive plan map designation.

Discussion: The Comprehensive Plan designation is currently Rural Suburban Unincorporated Residential (RSUR). The City's zoning options given annexation are Moderate Residential (R7) or Suburban Residential (R10). The Comprehensive Plan designation would thus be Suburban Residential (Incorporated) (SR). **City Council recommends R7 zoning to be consistent with the surrounding zoning.**

Finding: Upon annexation, the subject property's Comprehensive Plan designation shall be Suburban Residential (Incorporated) and be zoned Moderate Residential (R7).

SHMC 17.112.020 – Established & Developed Area Classification criteria

(1) Established Area.
- (a) An "established area" is an area where the land is not classified as buildable land under OAR 660-08-0005;
- (b) An established area may include some small tracts of vacant land (tracts less than an acre in size) provided the tracts are surrounded by land which is not classified as buildable land; and
- (c) An area shown on a zone map or overlay map as an established area.

(2) Developing Area. A "developing area" is an area which is included in the city's buildable land inventory under the provisions of OAR except as provided by subsection (1)(b) of this section.

Discussion: OAR 660-008-0005 classifies *buildable land* as:

> Residentially designated land within the urban growth boundary, including both vacant and developed land likely to be redeveloped, that is suitable, available and necessary for residential uses. Publicly owned land is generally not considered available for residential uses. Land is generally considered "suitable and available" unless it:
> (a) Is severely constrained by natural hazards as determined under Statewide Planning Goal 7;
> (b) Is subject to natural resource protection measures determined under Statewide Planning Goals 5, 6, 15, 16, 17 or 18;
> (c) Has slopes of 25 percent or greater;
> (d) Is within the 100-year flood plain; or
> (e) Cannot be provided with public facilities.

Discussion: OAR 660-008-0005 generally defines "Buildable Land" as vacant residential property not constrained by natural hazards or resources, and typically not publicly owned. The subject property is publicly owned.

Finding: The subject property should be designated as "established" in accordance with SHMC 17.112.

CONCLUSION & RECOMMENDATION

Based upon the facts and findings herein, and the recommendations of staff and the Planning Commission, City Council approves of this annexation and that upon annexation, the subject property have a Comprehensive Plan designation of Suburban Residential (Incorporated) SR, be zoned Moderate Residential (R7), and designated as "established" with the condition that:

This annexation shall only be processed if Annexation A.4.21 at 58241 South Division Road is also approved.

*This annexation will **not** be subject to voter approval subsequent to this land use process.*

__________________________________ _____________________

Rick Scholl, Mayor Date

City of St. Helens
RESOLUTION NO. 1939

A RESOLUTION ADOPTING THE ST. HELENS STORMWATER MASTER PLAN

WHEREAS, the last update to the City's Stormwater Master Plan was in August 1999; and

WHEREAS, ORS 197.712(2)(e) requires a city to develop and adopt public facility plans for areas within their urban growth boundary containing a population greater than 2,500 persons; and

WHEREAS, the City of St. Helens Municipal Code 19.08.030 Public Services And Facilities Goals promote the development of an orderly arrangement of public facilities and services to serve as a framework for urban development, and the designing and locating public facilities so that capacities are related to future as well as present demands, that ample land is available for building and plant expansion, and that public works plants and utility structures reflect due regard for their environmental impact; and

WHEREAS, an updated St. Helens Stormwater Master Plan is needed to provide for growth and planning for future development; and

WHEREAS, Engineering consultant, Keller Associates, has prepared an updated St. Helens Stormwater Master Plan, attached as Exhibit A, and has presented said plan to the Planning Commission on October 12, 2021 and to the City Council at the November 3, 2021 Work Session; and

WHEREAS, consultant has prepared the St. Helens Stormwater Master Plan after extensive review and analysis of existing plans, policies, studies and other information, and has afforded all interested parties opportunity to review the plan.

NOW, THEREFORE, the City of St. Helens resolves that the St. Helens Stormwater Master Plan, attached as Exhibit A, is adopted and shall be used as a guide for the development and implementation of a complete, stormwater system.

APPROVED AND ADOPTED by the City Council on November 17, 2021 by the following vote:

Ayes:

Nays:

____
Rick Scholl, Mayor

ATTEST:

____
Kathy Payne, City Recorder

SECTION 1 - EXECUTIVE SUMMARY

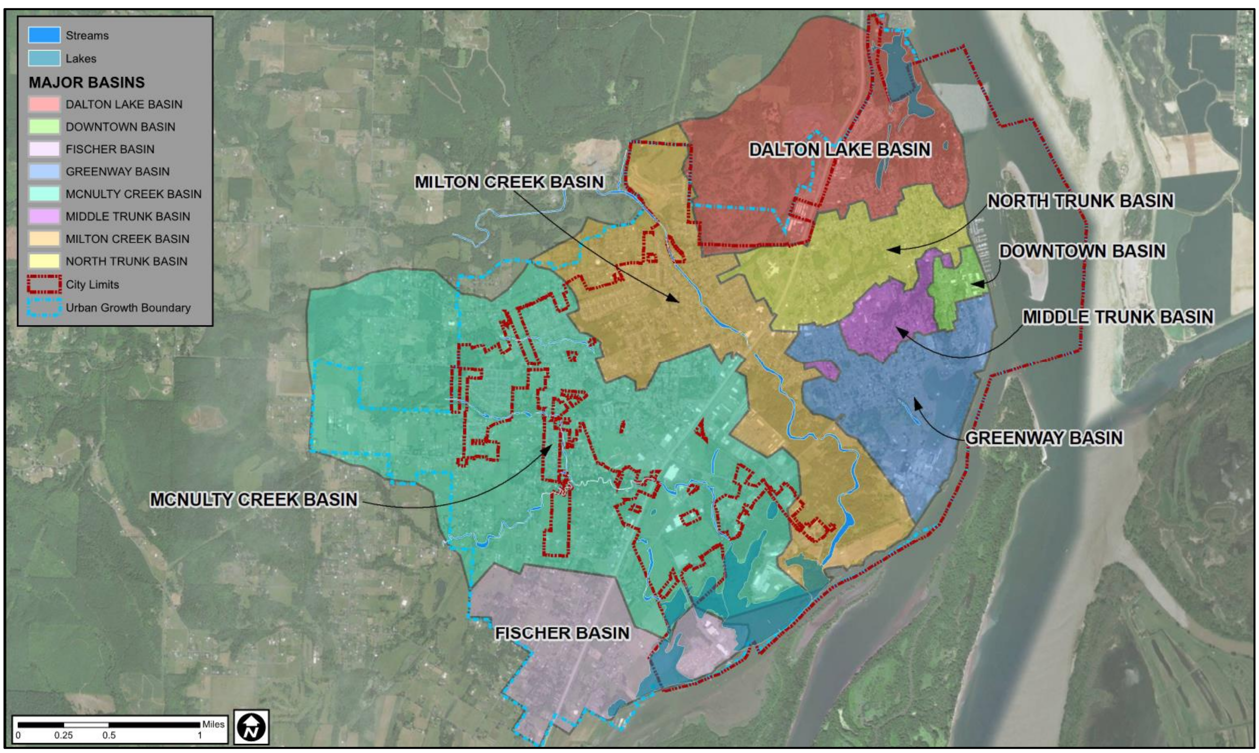
The City of St. Helens contracted with Keller Associates, Inc. to complete a stormwater master plan for the City's municipal stormwater system. This report was commissioned by the City in an effort to assess the current state of the stormwater system and plan for future needs. This section includes a summary of the stormwater planning criteria, existing system capacities, recommended improvements, and a capital improvement plan.

1.1 STUDY AREA

The study area within St. Helens is comprised of the areas within the City limits, the Urban Growth Boundary (UGB), and additional area outside of these two boundaries where stormwater runoff collects before it drains into the City's stormwater system. The City's UGB is made up of approximately 5,300 acres of land; approximately 600 acres of which is part of the Columbia River. Adding outside drainage area brings the total study area to approximately 6,000 acres and a total drainage area (excluding the Columbia River) of approximately 5,400 acres.

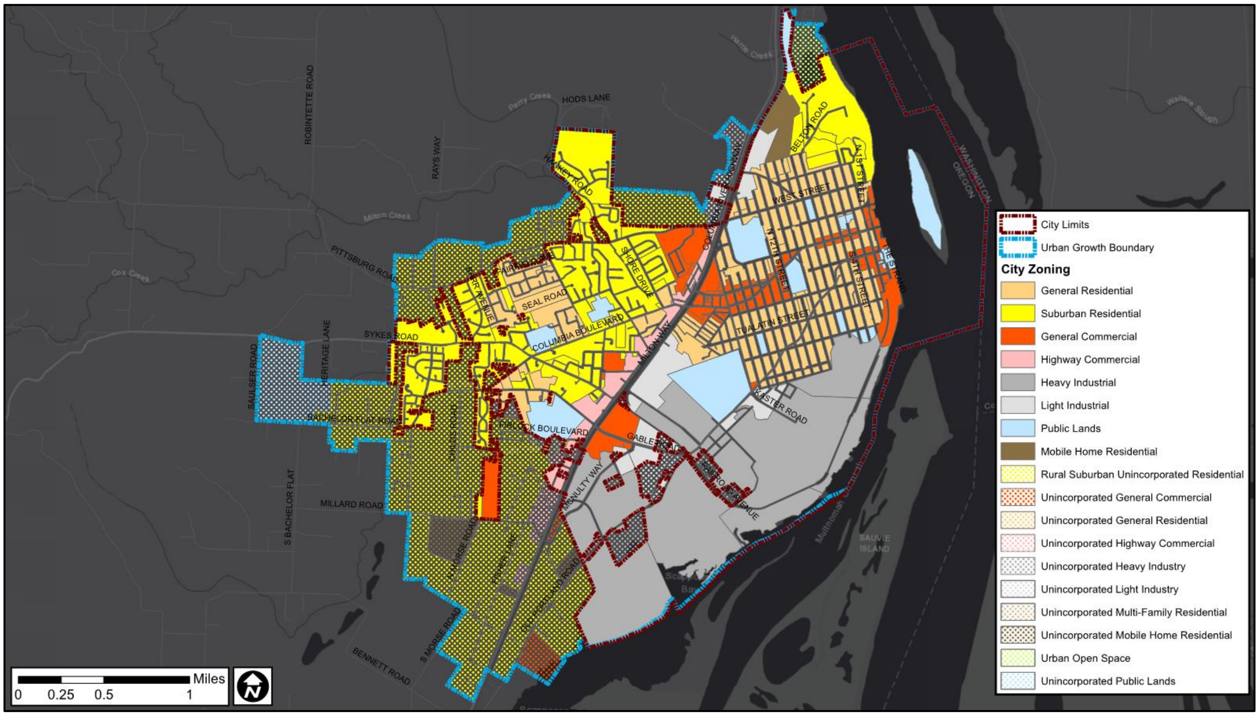
Stormwater from the study area drains into eight major drainage basins: Dalton Lake, North Trunk, Middle Trunk, Downtown, Greenway, Milton Creek, McNulty Creek, and Fischer Basin. The water collected from these major basins eventually drains into the Columbia River. The watersheds that drain across land within the UGB, as shown in Figure 1-1, are the focus in this study area.

FIGURE 1-1: STUDY AREA AND MAJOR DRAINAGE BASINS



The City's zoning areas include residential, commercial, industrial, and public zoning within City Limits. Approximately half of the zoning within City Limits is residential. Heavy and light industrial zones are concentrated in the southern portion of the City, and most commercial areas surround US Highway 30 or are located in the Houlton Business District or Riverfront District. A zoning map for the study area is shown in Figure 1-2.

FIGURE 1-2: STUDY AREA AND ZONING



1.2 PLANNING CRITERIA

Certain planning criteria were established with input incorporated from City staff. It is recommended that stormwater conveyance components be capable of passing runoff from the 25-year storm event (equal to 3.5 inches within 24-hours) without flooding or surcharging to within 0.5 feet of the rim elevation of any structure. It is also recommended that detention ponds be designed so the post-development peak release rates equal the pre-development release rates for their matching design storm event up to the 10-year design storm. The 25-year storm event peak release rate should not exceed the 10-year pre-development peak release rate.

Review and evaluation of water quality standards were not included in the scope of this study; however, water quality standards should be a consideration in any new stormwater facility. St. Helens is required to comply with the Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP) in the Willamette Basin and any future requirements set forth by the Oregon Department of Environmental Quality (DEQ). The City was recently named a designated management agency (DMA) for the Revised Willamette Basin Mercury TMDL and WQMP (2019). In conjunction with this stormwater master plan, the City is also developing an implementation plan to meet the revised TMDL requirements. Additionally, while the City of St. Helens is not currently regulated under a municipal separate storm sewer system (MS4) permit by the DEQ, the City will likely fall under an MS4 permit in the future. The city of St. Helens would be regulated under a MS4 Phase II General Permit which covers cities with a population of less than 100,000 people.

1.3 MODEL DEVELOPMENT

The stormwater modeling software InfoSWMM (Suite 14.7, Update #2) was used to assess stormwater runoff from the study area using the Natural Resources Conservation Service (NRCS) Unitless Hydrograph Method. Moreover, InfoSWMM was used to dynamically route the hydrologic model runoff through a hydraulic model representing the existing stormwater network of major trunklines (generally 12-

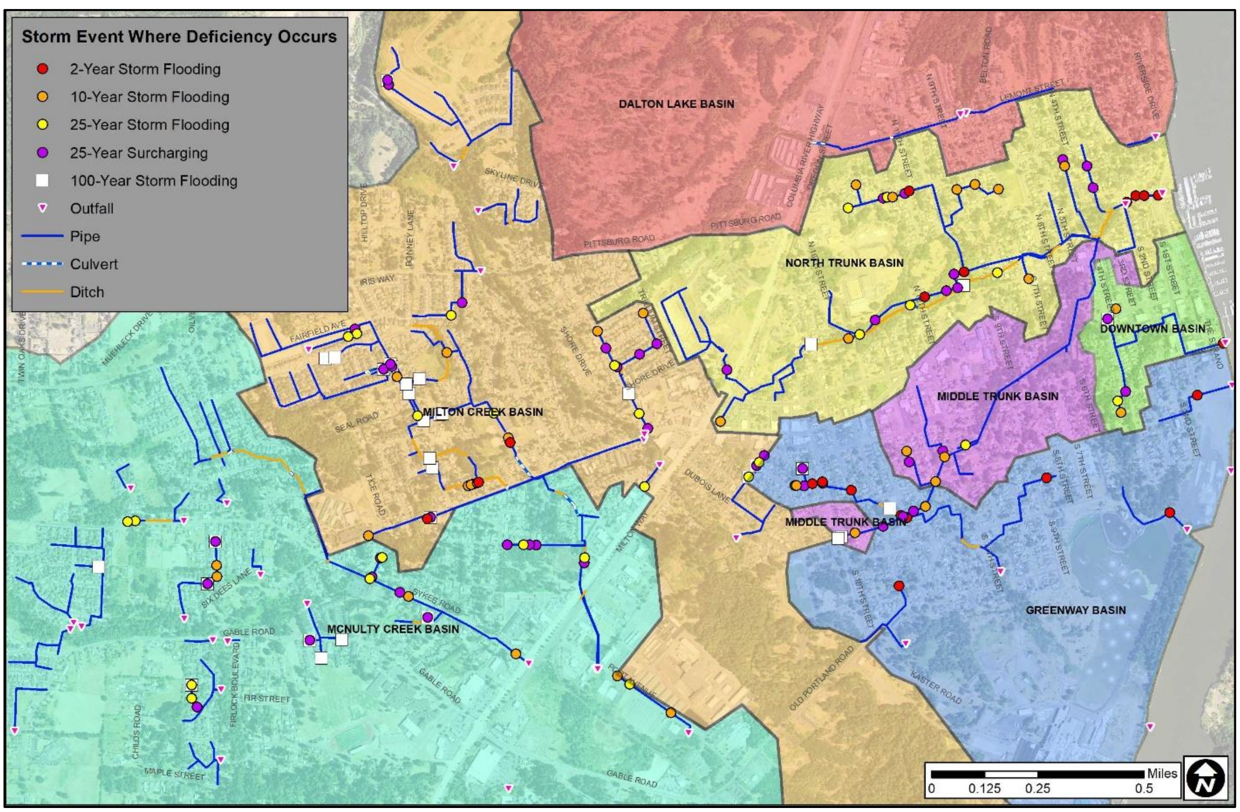
inch and larger in diameter) and connected open channels and detention facilities. Gaps in the City's GIS data were filled by surveying key stormwater structures throughout the system to develop a representative hydraulic model. The survey resulted in locating approximately 200 stormwater structures and 2,500 LF of open channel ditches, which are included in the model. The computer model was calibrated using flow monitor data collected in January 2021.

1.4 EXISTING SYSTEM EVALUATION

St. Helens' existing stormwater system includes approximately 45 miles of closed-conduit pipe ranging in diameter from 2-inches to 66-inches and approximately 6.5 miles of open channel within the study area. The system also includes about 800 manholes and 1,500 catch basins. The pipelines were evaluated based on both existing condition and capacity to convey the design storm event. Multiple pipe segments were identified as greater than 50 years old and it is recommended that these pipes be inspected and either replaced or upsized. Additional pipes were found to be aligned underneath existing building structures based on the GIS data. If the pipes are running underneath existing structures, these areas should need to be field verified and re-aligned.

Capacity related deficiencies were identified both by City staff's historical observations and by the stormwater model. Deficiencies in the model were identified for the 2-, 10-, 25-, and 100-year storm events and were used to prioritize improvements, which are included in the capital improvement plan. Flooding and surcharging were identified in each of the major drainage basins excluding the Dalton Lake Basin and Fischer Basin. A summary of the modeled flooding and surcharging within 0.5 feet of rim elevation for each storm event is shown in Figure 1-3.

FIGURE 1-3: EXISTING SYSTEM FLOODING AND SURCHARGING



1.5 STAFFING EVALUATION

A high-level evaluation of existing stormwater staffing levels, deficiencies in existing staffing levels, and staffing recommendations was completed as part of this study. The City Public Works (PW) Operations staff, who are responsible for the operations and maintenance (O&M) of the stormwater system, were interviewed to collect information on existing staffing levels, annual O&M activities, and level of service (LOS) goals for the City stormwater infrastructure. In general, St. Helens' public works staff provide support for many City activities that are not directly related to public utility O&M (i.e. building maintenance, building remodels, City events, etc.), which reduces time and O&M activities they can spend on utility infrastructure. It is recommended that either additional full-time equivalent (FTE) be budgeted for the PW staff to complete the existing workload requested, or the responsibilities of the PW staff be reduced to focus solely on utility O&M. Additionally, it is advised that staffing needs be re-evaluated every two to three years.

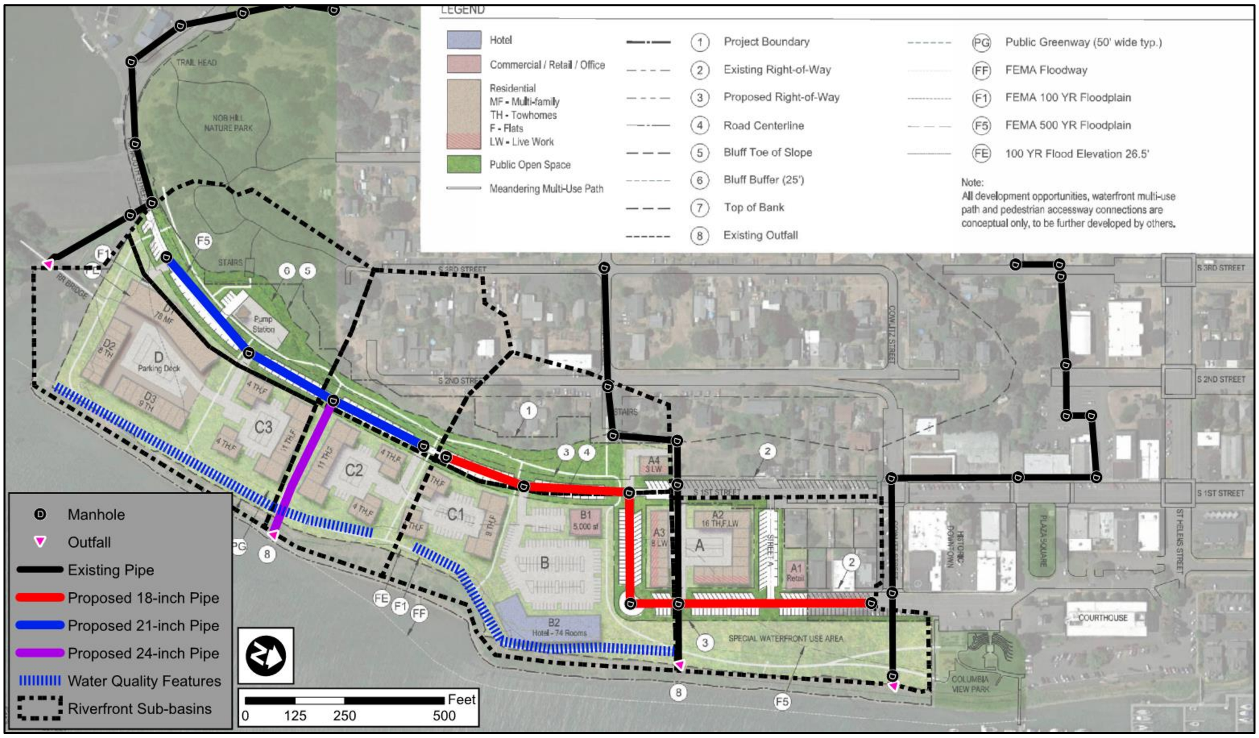
1.6 ALTERNATIVES ANALYSIS

Multiple alternatives were evaluated to address the deficiencies identified in the existing stormwater system. Some of the alternatives included rerouting flows, detaining flows, and upsizing existing pipes. The natural topography of the City was utilized where available to develop alternatives which would provide detention storage, reduce peak flows, and allow opportunities for water quality facilities. Pipes were recommended to be upsized where detention storage was not a viable option. The pros and cons of each alternative were evaluated, and a recommended alternative project was presented to the City to be included in the CIP.

1.7 FUTURE SYSTEM

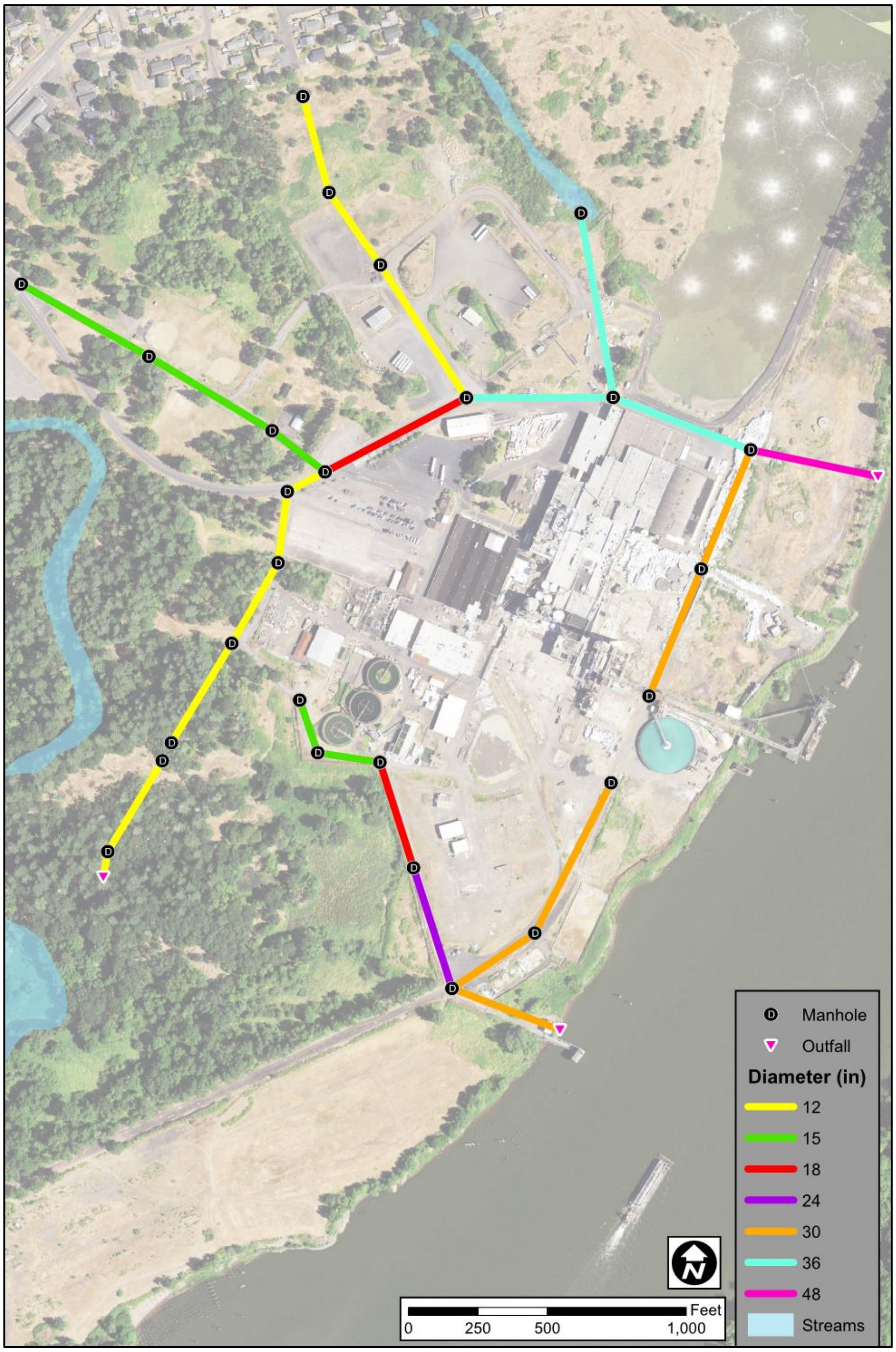
Development driven stormwater infrastructure was evaluated at a high level and drainage sub-basins for the 20-year development areas were delineated. A number of the proposed developments will likely drain to the existing stormwater network while others may drain to a new outfall location at one of the bodies of water within the study area. Stormwater conveyance infrastructure was evaluated in more detail for the City's Riverfront Development and Industrial Business Park. Stormwater piping alignment and sizes were recommended for the Riverfront Development as shown in Figure 1-4.

FIGURE 1-4: RIVERFRONT DEVELOPMENT PROPOSED STORMWATER INFRASTRUCTURE



Recommended pipe alignments and sizing for the City's Industrial Business Park are shown in Figure 1-5. The pipe alignments were based on the City's parcellation plan and pipes were aligned within the proposed rights-of-way.

FIGURE 1-5: INDUSTRIAL BUSINESS PARK PROPOSED STORMWATER INFRASTRUCTURE



1.8 ENGINEERING DESIGN STANDARDS, CODE, & COMPREHENSIVE PLAN REVIEW

The City's existing development code (Title 17), engineering design standards (Title 18), and comprehensive plan (Title 19) were reviewed as they pertain to stormwater conveyance and treatment for new development to identify potential deficiencies and provide recommendations for updates. The primary recommendations for review, updates, and additions include the following:

- Clear triggers and requirements for water quality
- Promote best management practices (BMPs) and low impact development (LID)
- Specifics of required drainage report elements and City engineering process for review and approval of plans
- Detention facility requirements
- Hydrologic analysis requirements

The City should review and assess these recommended changes to these sections to City code, standards, and comprehensive plans to match current best practices in the industry. The City should then initiate the process of proposing changes to associated City documents to maintain consistency.

1.9 CAPITAL IMPROVEMENT PLAN (CIP)

Improvements were suggested to alleviate the flooding and surcharging identified in the existing system evaluation. The capital improvement plan (CIP) was categorized into three priorities. The criteria for each priority are shown in Table 1-1.

TABLE 1-1: CAPITAL IMPROVEMENT PLAN PRIORITIZATION CRITERIA

Priority	Criteria	Implementation Timeline
1	Alleviate historically known flooding identified by the City and some 2-year flooding.	0-5 Years
2	Alleviate additional 2-year flooding identified in the model or age identified replacement.	5-10 Years
3	Alleviate deficiencies identified in 10-year and 25-year storm events.	10-20 Years

System development charge (SDC) eligibility was evaluated for each of the improvement projects recommended. The SDC improvement amount is based on the percentage of future development area within the capital improvement's contributing drainage basin. The SDC eligibility for each project is summarized in Table 1-2.

TABLE 1-2: CAPITAL IMPROVEMENT PLAN SUMMARY

Priority	Project Description	Estimated Cost	SDC Eligibility	SDC Improvement Amount	City Amount
Priority 1 Improvements					
1A	Campbell Park Detention Pond (Milton Creek)	$300,000	0%	$0	$300,000
1B	Columbia Boulevard Detention Pond (Milton Creek)	$1,100,000	66%	$727,000	$373,000
1C	Columbia Boulevard Upsize (Milton Creek)	$2,800,000	14%	$392,000	$2,408,000
1D	Middle Trunk Detention Ponds and Piping	$2,000,000	5%	$103,000	$1,897,000
1E	Upsize and Realign Tualatin Street (Middle Trunk)	$5,000,000	14%	$677,000	$4,323,000
1F	Detention Pond and Piping Between N 12th and N 7th Street (North Trunk)	$1,600,000	17%	$269,000	$1,331,000
1G	Ridgeway Loop Pipe Installation	$60,000	0%	$0	$60,000
	Total Priority 1 Improvement Costs	$12,900,000	-	$2,200,000	$10,700,000
Priority 2 Improvements					
2A	Upsize Pipes along West Street and N 10th Street (North Trunk)	$1,400,000	0%	$0	$1,400,000
2B	S 4th Street to Outfall CCTV Inspection (Downtown)	$20,000	0%	$0	$20,000
2C	Heinie Huemann Park Detention Pond (Greenway)	$200,000	26%	$52,000	$148,000
2D	Upsize from S 20th Street to Heinie Huemann Park (Greenway)	$1,100,000	29%	$318,000	$782,000
2E	Nob Hill Park CIP lining (Greenway)	$400,000	0%	$0	$400,000
2F	Franz Street (Milton Creek)	$400,000	0%	$0	$400,000
2G	Mayfair Drive CIP lining and Upsize (Milton Creek)	$400,000	0%	$0	$400,000
2H	Riverfront Development Stormwater Infrastructure	$3,300,000	100%	$3,300,000	$0
2I	Industrial Business Park Stormwater Infrastructure	$8,600,000	100%	$8,600,000	$0
2J	S 16th Street to Old Portland Road Upsize (Greenway)	$500,000	0%	$0	$500,000
2K	Stormwater Master Plan Update	$200,000	0%	$0	$0
	Total Priority 2 Improvement Costs	$16,500,000	-	$12,300,000	$4,100,000
Priority 3 Improvements					
3A	Upsize N 13th Street to West Street (North Trunk)	$200,000	0%	$0	$200,000
3B	Upsize from 6th Street Ball Park to N 10th Street (North Trunk)	$900,000	0%	$0	$900,000
3C	Upsize Milton Way at Street Helens Street (North Trunk)	$600,000	75%	$450,000	$150,000
3D	Upsize N 7th Street from Columbia Boulevard to Trunkline (North Trunk)	$400,000	0%	$0	$400,000
3E	Upsize N 4th Street south of West Street (North Trunk)	$1,400,000	0%	$0	$1,400,000
3F	Upsize and Regrade along S 14th Street (Middle Trunk)	$600,000	50%	$298,000	$302,000
3G	Upsize existing pipes from Heinie Huemann to Tualatin Street (Middle Trunk)	$400,000	0%	$0	$400,000
3H	Street Helens Street to South 4th Street Upsizing (Downtown)	$500,000	0%	$0	$500,000
3I	S 4th Street to Outfall Pipe Upsizing (Downtown)	$2,400,000	0%	$0	$2,400,000
3J	Crouse Way Upsize (Milton Creek)	$1,000,000	14%	$137,000	$863,000
3K	Eilertson Street (Milton Creek)	$100,000	0%	$0	$100,000
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	Total Priority 3 Improvement Costs	$16,500,000	-	$900,000	$15,600,000
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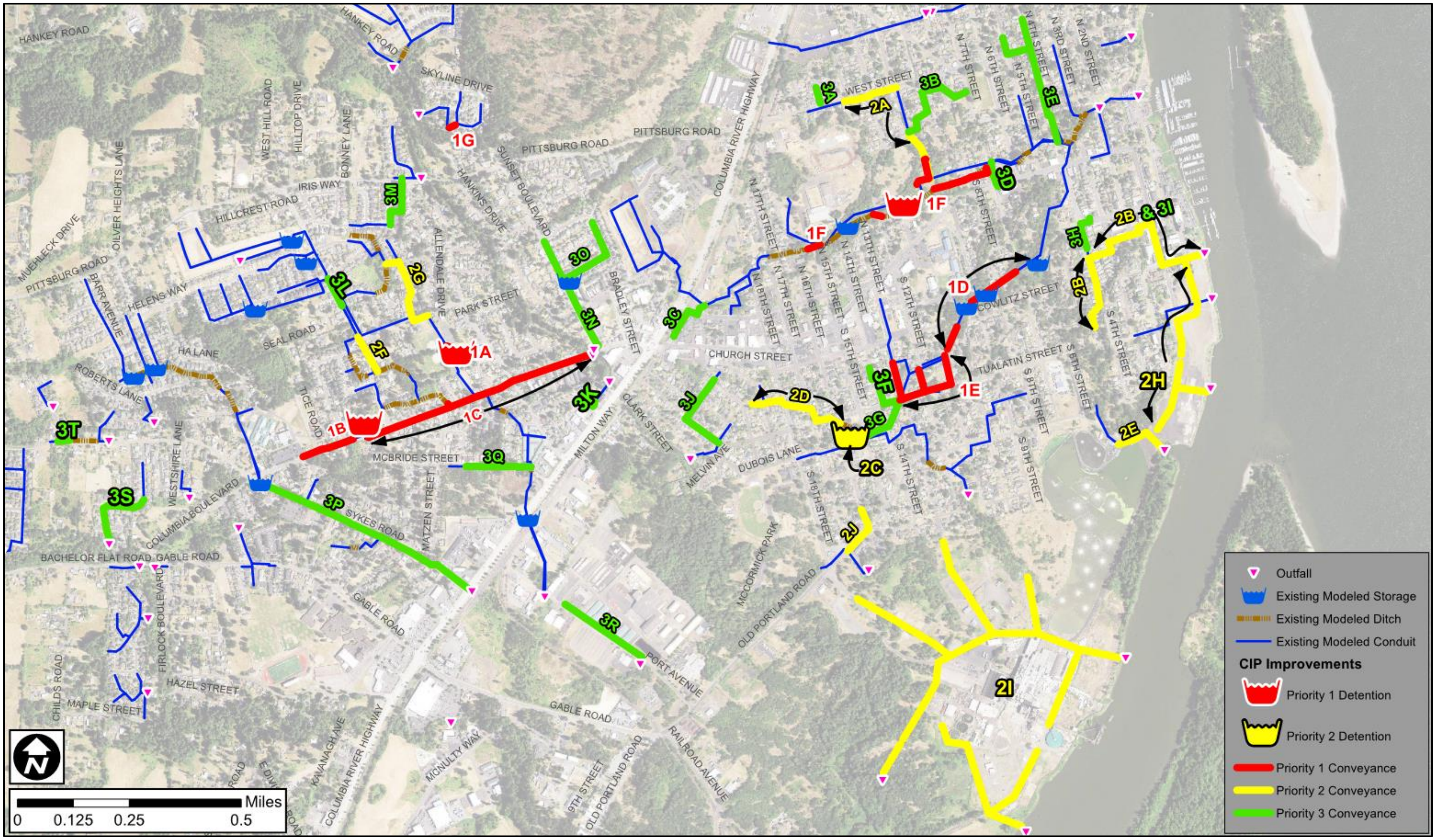
The cost estimate herin is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, 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 cost presented herein.

FIGURE 1-6: CAPITAL IMPROVEMENT PLAN



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It is recommended that the City update their planning documents every five years because updates to the planning documents and models would allow the City to re-assess needs and properly allocate budgets to address system deficiencies. A Master Plan Update for the stormwater system has been included as a Priority 2 improvement in the CIP (Table 1-2).

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The stormwater conveyance system requires regular maintenance to ensure that pipelines, catch basins, and detention facilities flow freely during the storm events. Additional stormwater facilities continue to age and will eventually need to be rehabilitated or replaced.

The replacement program is based on the total amount of existing City stormwater infrastructure and its estimated useful life. The City facilities include approximately 45 miles of storm pipes, 800 manholes, and 1,500 catch basins. Assuming an average useful life of 75-years remaining life, the replacement program should target approximately 3,000 feet of pipe, 30 catch basins, and 16 manholes per year. Assuming an average pipe replacement cost of $190 per foot, a catch basin cost of $3,500 each, and a manhole cost of $11,000, the City would need an annual replacement budget of approximately $900,000. Table 1-3 summarizes the annual replacement program targets and associated costs.

TABLE 1-3: SUMMARY OF ANNUAL REPLACEMENT COSTS

Item	Lifespan	Total Quantity	Annual Cost[1] (rounded)
Lineal Feet of Storm Lines	75 Years	237,000	$600,000
Number of Catch Basins	50 Years	1,500	$110,000
Number of Manholes	50 Years	800	$180,000
		Total (Rounded)	$900,000

1) Storm pipes unit price equal to average unit price of 12" to 30". Manhole unit price equal to average of 48" and 60" manhole.

Additionally, as part of the City's maintenance program, the locations indicated in the existing evaluation as being underneath a structure should be investigated and abandoned if it is determined the pipes are actually underneath existing structures.

Currently, additional projects and work the PW staff are requested to complete will significantly decrease the budgeted FTE that can be spent on stormwater O&M. It is estimated that approximately 4.25-4.5 FTE are needed to meet the current recommended level of O&M to meet the City's LOS goals. It is recommended that either additional FTE be budgeted for the PW staff to complete the extra workload requested, or the responsibilities of the PW staff be reduced to focus solely on utility O&M. In addition, the recommended CIP projects would increase workload of the engineering division. The engineering division may need additional staff to update and maintain the GIS database, coordinate CCTV inspection and resulting work orders, and manage capital improvements. Additional workload on the engineering and PW operations divisions should be included in planning for any of the recommended improvements and projects. Generally, it is advised that staffing needs be reevaluated every two to three years.

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DRAFT

CITY OF ST. HELENS, OR
STORMWATER MASTER PLAN

SEPTEMBER 2021

KA PROJECT NO. 220060-001 | CITY PROJECT NO. P-511

PREPARED BY:

KELLER ASSOCIATES

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APPENDICES

ACRONYMS AND ABBREVIATIONS

AACE	Associate for the Advancement of Cost Engineering
AC	Acres
BMP	Best Management Practice
CCTV	Closed-Circuit-Television
CFS	Cubic Feet per Second
CIP	Capital Improvement Plan
CIPP	Cured-in-Place Pipe
CMP	Corrugated Metal Pipe
CWSRF	Clean Water State Revolving Fund
DEQ	Department of Environmental Quality
DI	Ductile Iron
DL	Dalton Lake Basin
DMA	Dedicated Management Agency
DOGAMI	Department of Geology and Mineral Industries
DSL	Department of State Lands
DT	Downtown Basin
d/D	Maximum depth divided by full depth
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FTE	Full Time Equivalent
GIS	Geographical Information System
GPM	Gallons per Minute
GW	Greenway Basin
HDPE	High-Density Polyethylene
HGL	Hydraulic Grade Line
LF	Linear Feet
LID	Low Impact Development
LOS	Level of Service
LWI	Local Wetlands Inventory
MI	Milton Creek Basin
MN	McNulty Creek Basin
MS4	Municipal Separate Storm Sewer System
MT	Middle Trunk Basin
NAVD88	North American Vertical Datum of 1988
NGVD29	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Administration

NRCS	Natural Resources Conservation Service
NT	North Trunk Basin
ODOT	Oregon Department of Transportation
ODSL	Oregon Department of State Lands
O&M	Operations and Maintenance
PVC	Polyvinyl Chloride
PW	Public Works
ROW	Right-of-Way
SBUH	Santa Barbara Unit Hydrograph Method
SCS	Soil Conservation Service
SDC	System Development Charge
SHMC	St. Helens Municipal Code
SWMM	Stormwater Management Model
TMDL	Total Maximum Daily Load
UGB	Urban Growth Boundary
USACE	United States Army Corp of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VCP	Vitrified Clay Pipe
WQMP	Water Quality Management Plan
WWTP	Wastewater Treatment Plant

SECTION 1 - EXECUTIVE SUMMARY

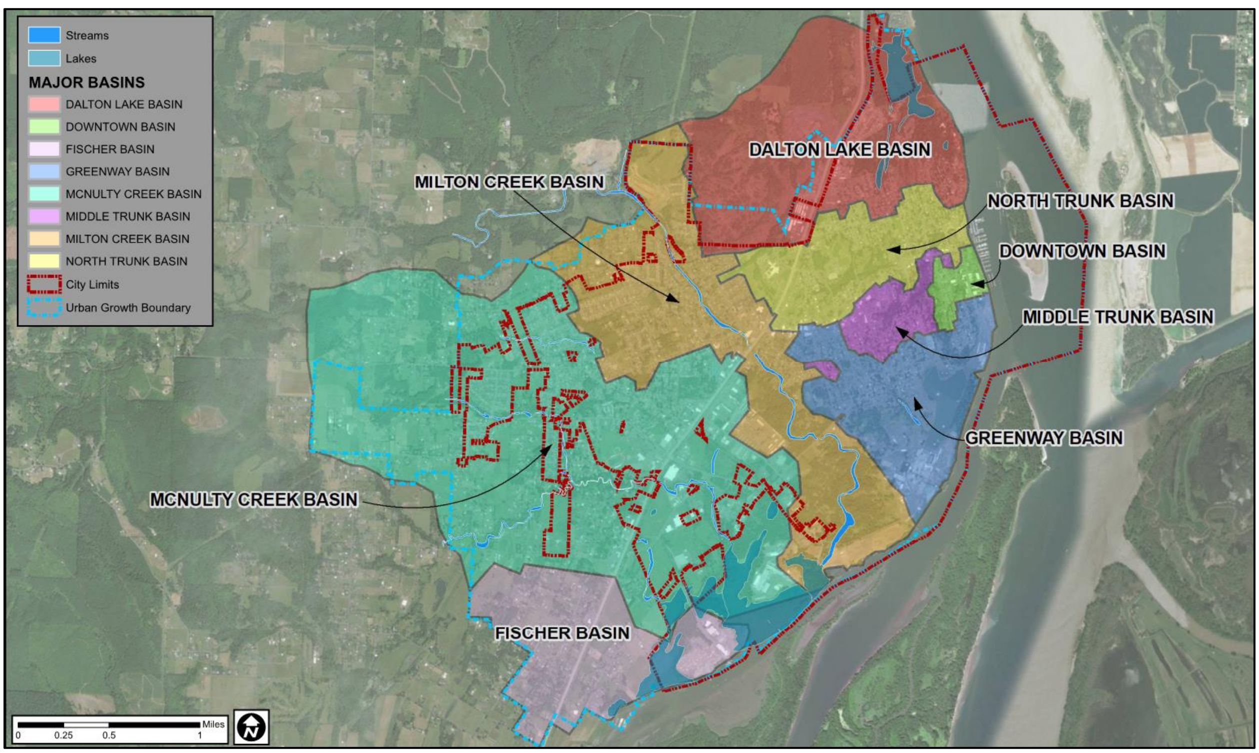
The City of St. Helens contracted with Keller Associates, Inc. to complete a stormwater master plan for the City's municipal stormwater system. This report was commissioned by the City in an effort to assess the current state of the stormwater system and plan for future needs. This section includes a summary of the stormwater planning criteria, existing system capacities, recommended improvements, and a capital improvement plan.

1.1 STUDY AREA

The study area within St. Helens is comprised of the areas within the City limits, the Urban Growth Boundary (UGB), and additional area outside of these two boundaries where stormwater runoff collects before it drains into the City's stormwater system. The City's UGB is made up of approximately 5,300 acres of land; approximately 600 acres of which is part of the Columbia River. Adding outside drainage area brings the total study area to approximately 6,000 acres and a total drainage area (excluding the Columbia River) of approximately 5,400 acres.

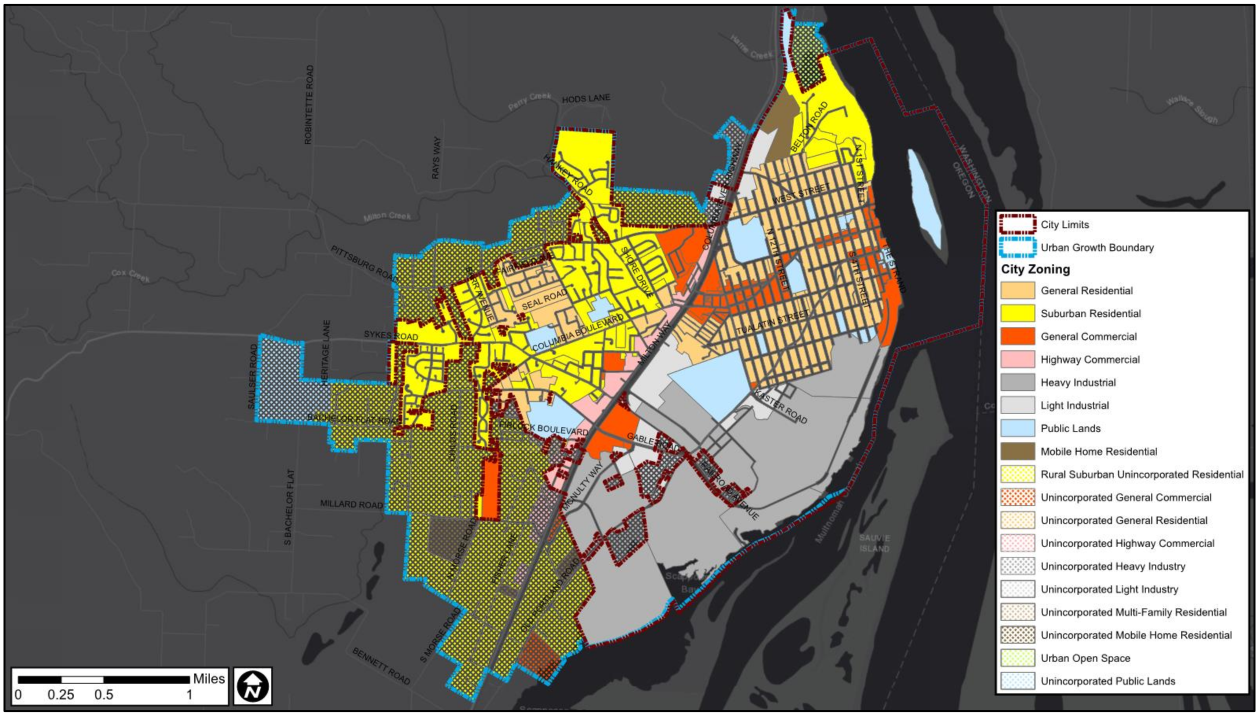
Stormwater from the study area drains into eight major drainage basins: Dalton Lake, North Trunk, Middle Trunk, Downtown, Greenway, Milton Creek, McNulty Creek, and Fischer Basin. The water collected from these major basins eventually drains into the Columbia River. The watersheds that drain across land within the UGB, as shown in Figure 1-1, are the focus in this study area.

FIGURE 1-1: STUDY AREA AND MAJOR DRAINAGE BASINS



The City's zoning areas include residential, commercial, industrial, and public zoning within City Limits. Approximately half of the zoning within City Limits is residential. Heavy and light industrial zones are concentrated in the southern portion of the City, and most commercial areas surround US Highway 30 or are located in the Houlton Business District or Riverfront District. A zoning map for the study area is shown in Figure 1-2.

FIGURE 1-2: STUDY AREA AND ZONING



1.2 PLANNING CRITERIA

Certain planning criteria were established with input incorporated from City staff. It is recommended that stormwater conveyance components be capable of passing runoff from the 25-year storm event (equal to 3.5 inches within 24-hours) without flooding or surcharging to within 0.5 feet of the rim elevation of any structure. It is also recommended that detention ponds be designed so the post-development peak release rates equal the pre-development release rates for their matching design storm event up to the 10-year design storm. The 25-year storm event peak release rate should not exceed the 10-year pre-development peak release rate.

Review and evaluation of water quality standards were not included in the scope of this study; however, water quality standards should be a consideration in any new stormwater facility. St. Helens is required to comply with the Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP) in the Willamette Basin and any future requirements set forth by the Oregon Department of Environmental Quality (DEQ). The City was recently named a designated management agency (DMA) for the Revised Willamette Basin Mercury TMDL and WQMP (2019). In conjunction with this stormwater master plan, the City is also developing an implementation plan to meet the revised TMDL requirements. Additionally, while the City of St. Helens is not currently regulated under a municipal separate storm sewer system (MS4) permit by the DEQ, the City will likely fall under an MS4 permit in the future. The city of St. Helens would be regulated under a MS4 Phase II General Permit which covers cities with a population of less than 100,000 people.

1.3 MODEL DEVELOPMENT

The stormwater modeling software InfoSWMM (Suite 14.7, Update #2) was used to assess stormwater runoff from the study area using the Natural Resources Conservation Service (NRCS) Unitless Hydrograph Method. Moreover, InfoSWMM was used to dynamically route the hydrologic model runoff through a hydraulic model representing the existing stormwater network of major trunklines (generally 12-

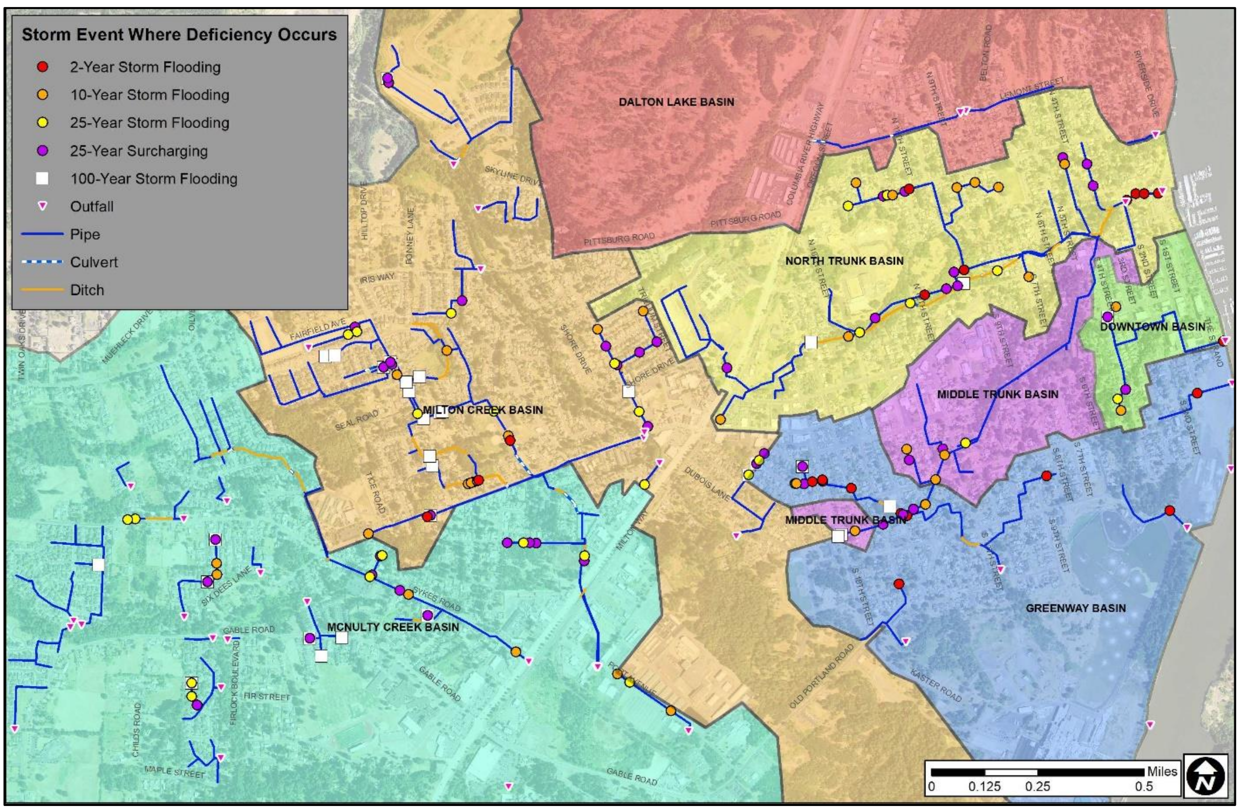
inch and larger in diameter) and connected open channels and detention facilities. Gaps in the City's GIS data were filled by surveying key stormwater structures throughout the system to develop a representative hydraulic model. The survey resulted in locating approximately 200 stormwater structures and 2,500 LF of open channel ditches, which are included in the model. The computer model was calibrated using flow monitor data collected in January 2021.

1.4 EXISTING SYSTEM EVALUATION

St. Helens' existing stormwater system includes approximately 45 miles of closed-conduit pipe ranging in diameter from 2-inches to 66-inches and approximately 6.5 miles of open channel within the study area. The system also includes about 800 manholes and 1,500 catch basins. The pipelines were evaluated based on both existing condition and capacity to convey the design storm event. Multiple pipe segments were identified as greater than 50 years old and it is recommended that these pipes be inspected and either replaced or upsized. Additional pipes were found to be aligned underneath existing building structures based on the GIS data. If the pipes are running underneath existing structures, these areas should need to be field verified and re-aligned.

Capacity related deficiencies were identified both by City staff's historical observations and by the stormwater model. Deficiencies in the model were identified for the 2-, 10-, 25-, and 100-year storm events and were used to prioritize improvements, which are included in the capital improvement plan. Flooding and surcharging were identified in each of the major drainage basins excluding the Dalton Lake Basin and Fischer Basin. A summary of the modeled flooding and surcharging within 0.5 feet of rim elevation for each storm event is shown in Figure 1-3.

FIGURE 1-3: EXISTING SYSTEM FLOODING AND SURCHARGING



1.5 STAFFING EVALUATION

A high-level evaluation of existing stormwater staffing levels, deficiencies in existing staffing levels, and staffing recommendations was completed as part of this study. The City Public Works (PW) Operations staff, who are responsible for the operations and maintenance (O&M) of the stormwater system, were interviewed to collect information on existing staffing levels, annual O&M activities, and level of service (LOS) goals for the City stormwater infrastructure. In general, St. Helens' public works staff provide support for many City activities that are not directly related to public utility O&M (i.e. building maintenance, building remodels, City events, etc.), which reduces time and O&M activities they can spend on utility infrastructure. It is recommended that either additional full-time equivalent (FTE) be budgeted for the PW staff to complete the existing workload requested, or the responsibilities of the PW staff be reduced to focus solely on utility O&M. Additionally, it is advised that staffing needs be re-evaluated every two to three years.

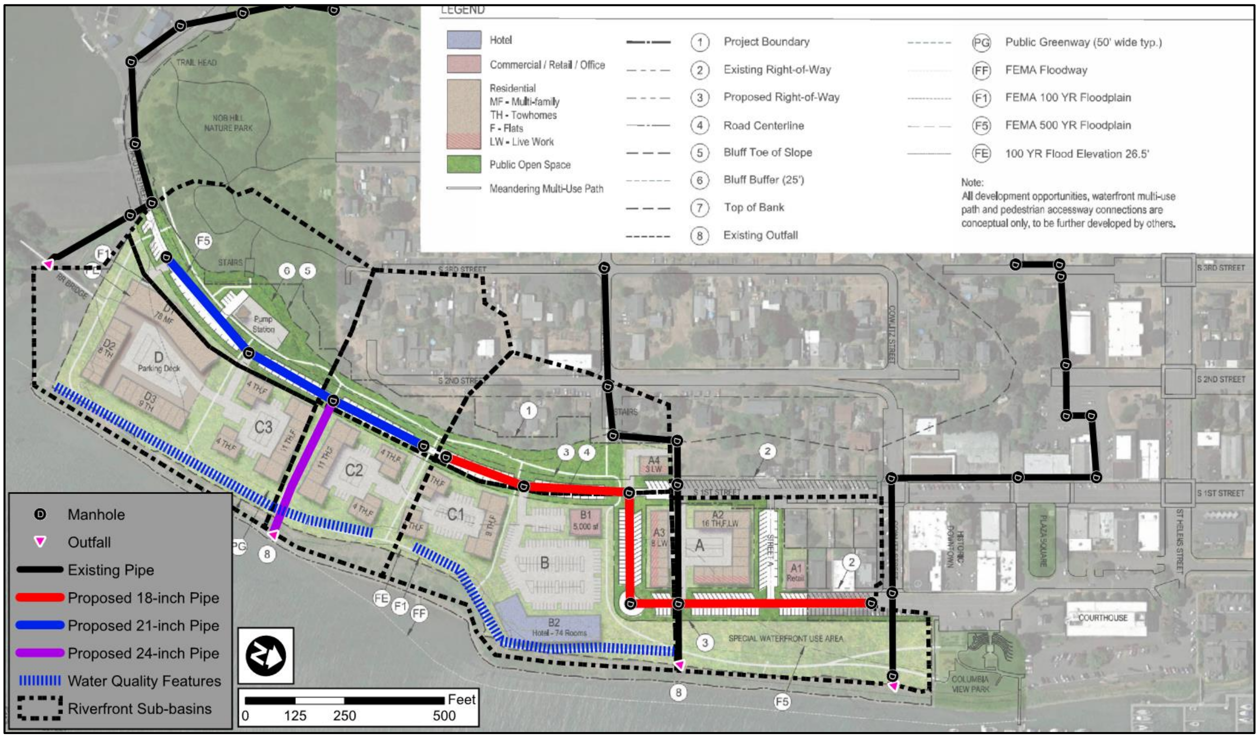
1.6 ALTERNATIVES ANALYSIS

Multiple alternatives were evaluated to address the deficiencies identified in the existing stormwater system. Some of the alternatives included rerouting flows, detaining flows, and upsizing existing pipes. The natural topography of the City was utilized where available to develop alternatives which would provide detention storage, reduce peak flows, and allow opportunities for water quality facilities. Pipes were recommended to be upsized where detention storage was not a viable option. The pros and cons of each alternative were evaluated, and a recommended alternative project was presented to the City to be included in the CIP.

1.7 FUTURE SYSTEM

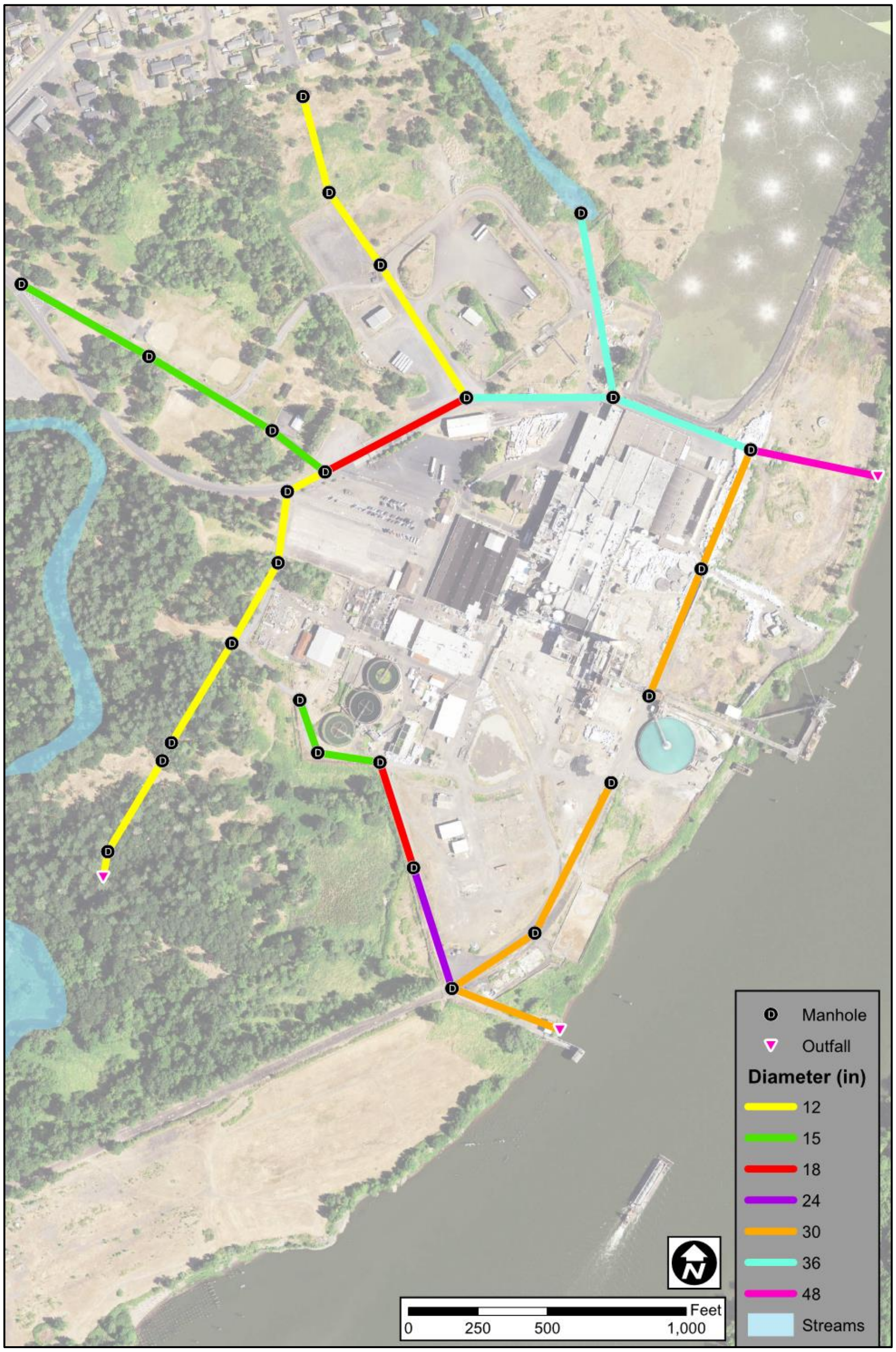
Development driven stormwater infrastructure was evaluated at a high level and drainage sub-basins for the 20-year development areas were delineated. A number of the proposed developments will likely drain to the existing stormwater network while others may drain to a new outfall location at one of the bodies of water within the study area. Stormwater conveyance infrastructure was evaluated in more detail for the City's Riverfront Development and Industrial Business Park. Stormwater piping alignment and sizes were recommended for the Riverfront Development as shown in Figure 1-4.

FIGURE 1-4: RIVERFRONT DEVELOPMENT PROPOSED STORMWATER INFRASTRUCTURE



Recommended pipe alignments and sizing for the City's Industrial Business Park are shown in Figure 1-5. The pipe alignments were based on the City's parcellation plan and pipes were aligned within the proposed rights-of-way.

FIGURE 1-5: INDUSTRIAL BUSINESS PARK PROPOSED STORMWATER INFRASTRUCTURE



1.8 ENGINEERING DESIGN STANDARDS, CODE, & COMPREHENSIVE PLAN REVIEW

The City's existing development code (Title 17), engineering design standards (Title 18), and comprehensive plan (Title 19) were reviewed as they pertain to stormwater conveyance and treatment for new development to identify potential deficiencies and provide recommendations for updates. The primary recommendations for review, updates, and additions include the following:

- Clear triggers and requirements for water quality
- Promote best management practices (BMPs) and low impact development (LID)
- Specifics of required drainage report elements and City engineering process for review and approval of plans
- Detention facility requirements
- Hydrologic analysis requirements

The City should review and assess these recommended changes to these sections to City code, standards, and comprehensive plans to match current best practices in the industry. The City should then initiate the process of proposing changes to associated City documents to maintain consistency.

1.9 CAPITAL IMPROVEMENT PLAN (CIP)

Improvements were suggested to alleviate the flooding and surcharging identified in the existing system evaluation. The capital improvement plan (CIP) was categorized into three priorities. The criteria for each priority are shown in Table 1-1.

TABLE 1-1: CAPITAL IMPROVEMENT PLAN PRIORITIZATION CRITERIA

Priority	Criteria	Implementation Timeline
1	Alleviate historically known flooding identified by the City and some 2-year flooding.	0-5 Years
2	Alleviate additional 2-year flooding identified in the model or age identified replacement.	5-10 Years
3	Alleviate deficiencies identified in 10-year and 25-year storm events.	10-20 Years

System development charge (SDC) eligibility was evaluated for each of the improvement projects recommended. The SDC improvement amount is based on the percentage of future development area within the capital improvement's contributing drainage basin. The SDC eligibility for each project is summarized in Table 1-2.

TABLE 1-2: CAPITAL IMPROVEMENT PLAN SUMMARY

Priority	Project Description	Estimated Cost	SDC Eligibility	SDC Improvement Amount	City Amount
Priority 1 Improvements					
1A	Campbell Park Detention Pond (Milton Creek)	$300,000	0%	$0	$300,000
1B	Columbia Boulevard Detention Pond (Milton Creek)	$1,100,000	66%	$727,000	$373,000
1C	Columbia Boulevard Upsize (Milton Creek)	$2,800,000	14%	$392,000	$2,408,000
1D	Middle Trunk Detention Ponds and Piping	$2,000,000	5%	$103,000	$1,897,000
1E	Upsize and Realign Tualatin Street (Middle Trunk)	$5,000,000	14%	$677,000	$4,323,000
1F	Detention Pond and Piping Between N 12th and N 7th Street (North Trunk)	$1,600,000	17%	$269,000	$1,331,000
1G	Ridgeway Loop Pipe Installation	$60,000	0%	$0	$60,000
	Total Priority 1 Improvement Costs	$12,900,000	-	$2,200,000	$10,700,000
Priority 2 Improvements					
2A	Upsize Pipes along West Street and N 10th Street (North Trunk)	$1,400,000	0%	$0	$1,400,000
2B	S 4th Street to Outfall CCTV Inspection (Downtown)	$20,000	0%	$0	$20,000
2C	Heinie Huemann Park Detention Pond (Greenway)	$200,000	26%	$52,000	$148,000
2D	Upsize from S 20th Street to Heinie Huemann Park (Greenway)	$1,100,000	29%	$318,000	$782,000
2E	Nob Hill Park CIP lining (Greenway)	$400,000	0%	$0	$400,000
2F	Franz Street (Milton Creek)	$400,000	0%	$0	$400,000
2G	Mayfair Drive CIP lining and Upsize (Milton Creek)	$400,000	0%	$0	$400,000
2H	Riverfront Development Stormwater Infrastructure	$3,300,000	100%	$3,300,000	$0
2I	Industrial Business Park Stormwater Infrastructure	$8,600,000	100%	$8,600,000	$0
2J	S 16th Street to Old Portland Road Upsize (Greenway)	$500,000	0%	$0	$500,000
2K	Stormwater Master Plan Update	$200,000	0%	$0	$0
	Total Priority 2 Improvement Costs	$16,500,000	-	$12,300,000	$4,100,000
Priority 3 Improvements					
3A	Upsize N 13th Street to West Street (North Trunk)	$200,000	0%	$0	$200,000
3B	Upsize from 6th Street Ball Park to N 10th Street (North Trunk)	$900,000	0%	$0	$900,000
3C	Upsize Milton Way at Street Helens Street (North Trunk)	$600,000	75%	$450,000	$150,000
3D	Upsize N 7th Street from Columbia Boulevard to Trunkline (North Trunk)	$400,000	0%	$0	$400,000
3E	Upsize N 4th Street south of West Street (North Trunk)	$1,400,000	0%	$0	$1,400,000
3F	Upsize and Regrade along S 14th Street (Middle Trunk)	$600,000	50%	$298,000	$302,000
3G	Upsize existing pipes from Heinie Huemann to Tualatin Street (Middle Trunk)	$400,000	0%	$0	$400,000
3H	Street Helens Street to South 4th Street Upsizing (Downtown)	$500,000	0%	$0	$500,000
3I	S 4th Street to Outfall Pipe Upsizing (Downtown)	$2,400,000	0%	$0	$2,400,000
3J	Crouse Way Upsize (Milton Creek)	$1,000,000	14%	$137,000	$863,000
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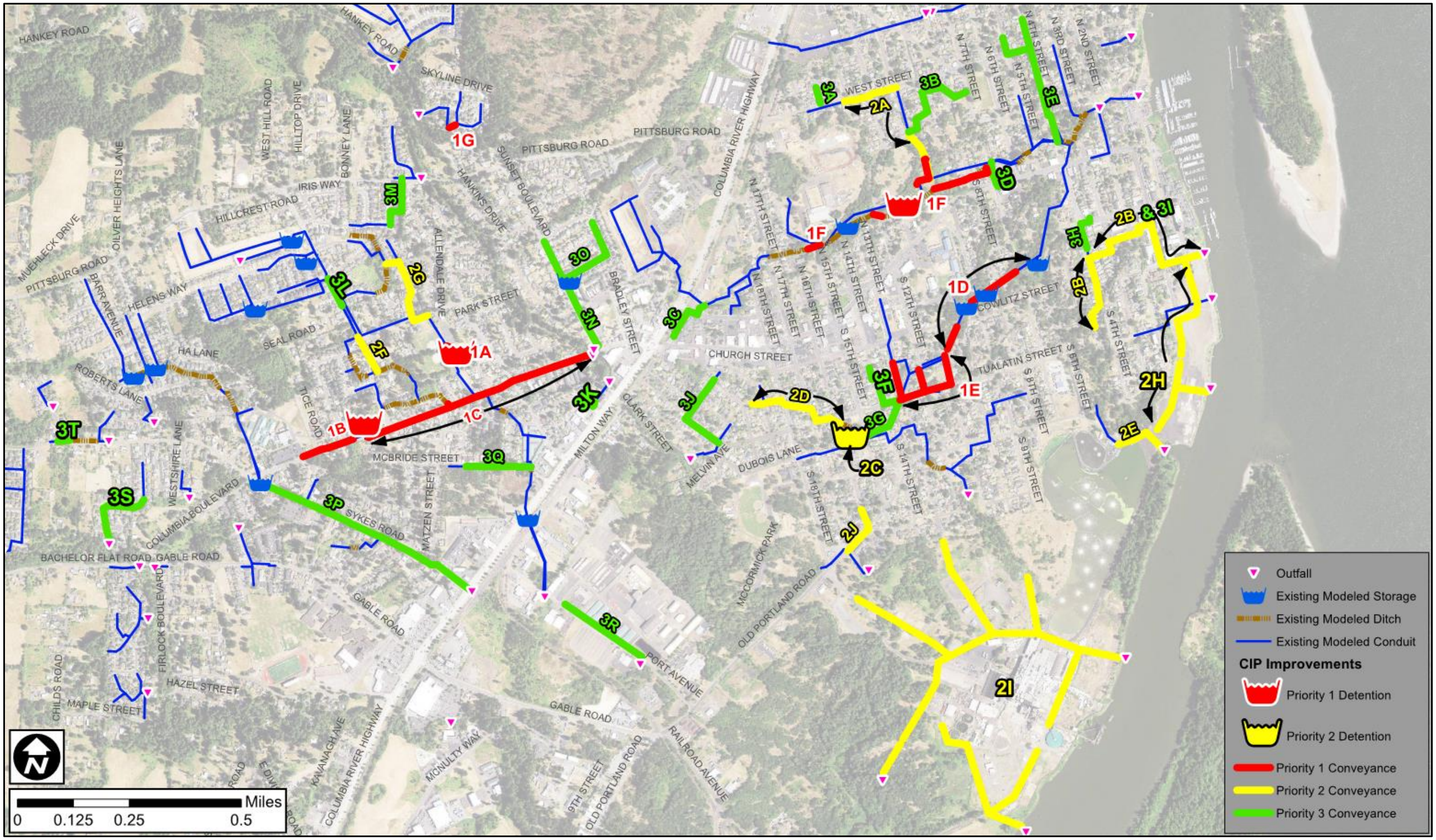

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SECTION 2 - PROJECT PLANNING

This section discusses the general study area and its physical characteristics. A summary of the major drainage basins and the existing and future land use is covered as well.

2.1 LOCATION AND STUDY AREA

The study area is comprised of the areas within the City limits, the Urban Growth Boundary (UGB), and additional area outside of these two boundaries where stormwater runoff collects before it drains into the City's stormwater system. The City's UGB is made up of 5,280 acres of land; approximately 565 acres of which is over the Columbia River. Adding outside drainage area brings the total study area to approximately 6,000 acres and a total drainage area (excluding the Columbia River) of 5,435 acres. Figure 1 in Appendix A illustrates the City limits, the UGB, and the study area.

2.2 ENVIRONMENTAL RESOURCES PRESENT

The following section describes the existing environmental resources present in this area that might be impacted by stormwater facilities. The components analyzed below include land use, prime farmland, floodplains, wetlands, cultural resources, coastal resources, and socio-economic conditions. Discussion of environmental impacts on specific alternatives is covered later in the report.

2.2.1 LAND USE

The City's zoning areas include residential, commercial, industrial, and public zoning within the city limits. Approximately half of the zoning within City limits is residential. Heavy and light industrial zones are concentrated in the southern portion of the City, and most commercial areas surround US Highway 30 or are located in the Houlton Business District or Riverfront District. A zoning map for the study area is shown in Figure 2 in Appendix A.

2.2.2 FLOODPLAINS

Information on the floodplains within the study area is available from the Federal Emergency Management Agency (FEMA) Map Service Center. These maps show portions of the planning area which lie within the 100-year floodplain adjacent to the floodway of the Columbia River and several other small drainages. Figure 3 in Appendix A shows the flood areas within the study area obtained from the FEMA website. The figure is for display purposes only. For specific projects in these areas, the individual FEMA Flood Insurance Rate Map (FIRM) Panels should be referenced.

2.2.3 WETLANDS

The City completed a Local Wetlands Inventory (LWI) in 1999 that was accepted by the Department of State Lands (DSL) and is referenced in the City's Comprehensive Plan as of May 2020. In the Comprehensive Plan, the City takes inventory and maps their wetlands to assess their functions in order to determine "Locally Significant Wetlands" that contribute to wildlife habitat, fish habitat, water quality, floodwater retention, recreational opportunities, and/or educational opportunities. The Comprehensive Plan lists the following wetlands as Locally Significant Wetlands: Dalton Lake, McNulty Creek, Frogmore Slough, Jackass Canyon, Milton Creek, Unnamed Creek A, and Unnamed Creek B.

Approximately 443 acres of wetlands were identified within the study area and were classified into the following wetland types and is shown as Figure 4 in Appendix A.

- ► Palustrine Forested Wetland – A wetland with soil that is saturated and often inundated and is dominated by woody plants taller than 20 feet. Water-tolerant shrubs and herbaceous plants are often beneath the forest canopy.
- ► Palustrine Scrub/Shrub Wetland – A wetland dominated by shrubs and woody plants less than 20 feet tall. Water levels can range from permanent to intermittent flooding.

- Palustrine Emergent Wetland – Wetlands dominated by erect, rooted herbaceous plants that can tolerate flooded soil conditions, but cannot tolerate being submerged for extended periods, e.g., cattails, reeds, and pickerelweeds.
- Palustrine Rock Bottom Wetland – Wetlands with substrates having an aerial cover of stones, boulders, or bedrock 75% or greater and vegetative cover less than 30%. Water regimes are restricted to subtidal, permanently flooded, interment exposed, and semipermanent flooded.
- Lacustrine Littoral Wetland – Wetlands situated in a topographic depression or a dammed river channel and lack trees and shrubs. Wetlands are permanently flooded with extensive areas of deep water.
- Riverine Upper Perennial Wetland – Water is flowing throughout the year and includes wetlands contained within a channel unless the wetland is dominated by trees, shrubs, and emergent, or habitats with water containing ocean derived alts in excess of 0.5%. The gradient of the channel is high, and velocity is fast.
- Riverine Intermittent Wetland – Similar to Riverine Upper Perennial Wetland, except water only flows for parts of the year.

Definitions for the wetland types were retrieved from the U.S. Fish and Wildlife Service (USFWS) Classification of Wetlands and Deepwater Habitats of the United States. Additionally, to protect riparian areas of locally significant wetlands, including McNulty and Milton Creek, designated upland protection zones have been established where construction is limited or prohibited.

2.2.4 HISTORIC SITES, STRUCTURES, AND LANDMARKS

The National Register of Historic Places lists one historic site for St. Helens: The St. Helens Downtown Historic District, which is composed of approximately 101 buildings. Additionally, 23 areas and structures within the City limits which hold local significance were identified as “designated landmarks” by City Ordinance Number 3250. A map of the Downtown Historic District and locally designated landmarks can be found in Figure 5 in Appendix A.

2.2.5 BIOLOGICAL RESOURCES

The USFWS produces a database that lists endangered and threatened plants throughout the United States. A database search for Columbia County returned several types of plants and species listed as endangered or threatened. A few of these listed species are shown below and the full list can be found in Appendix B.

- Bull Trout (Fish)
- Burrington Jumping-Slug (Snails)
- Golden Paintbrush (Flowering Plant)
- Marbeled Murrelet (Bird)
- Willamette Daisy (Flowering Plant)
- Streaked Horned lark (Bird)
- Bradshaw’s Desert-Parsley (Flowering Plant)
- Water Howellia (Flowering Plant)
- Columbian White-Tailed Deer (Mammal)
- Yellow-Billed Cuckoo (Bird)
- Kincaid’s Lupine (Flowering Plant)
- Red Tree Vole (Mammal)
- Northern Spotted Owl (Bird)
- Nelson’s Checker-Mallow (Flowering Plant)

2.2.6 WATER RESOURCES

The Columbia River, Jackass Canyon, Milton Creek, McNulty Creek, the Frogmore Slough, and two unnamed creeks flow through the study area. Section 303(d) of the Clean Water Act establishes a list of impaired waters and total maximum daily load (TMDL) for pollutants in each water body. Jackass Canyon is 303(d) listed for sedimentation and has a TMDL for temperature. McNulty Creek is 303(d) listed for biological criteria. The Lower Columbia River is 303(d) listed for arsenic, DDE4, 4, fecal coliforms, and PCBs and has a TMDL for dioxins, temperature.

2.2.7 COASTAL RESOURCES

There are no coastal areas within the study area.

2.2.8 SOCIO-ECONOMIC CONDITIONS

According to the City's Housing Needs Assessment, completed in May 2019, the City has experienced a steady growth and anticipates growth to continue into the future. The median household income is $45,789, which is 33% less than the 2019 national average according to census.gov. 31.7% of the City is considered to be low-income or earning less than $30,000 per year. The assessment states that approximately 25% of households are "severely rent burdened", meaning they spend more than 50% of income on rent and utilities. Higher rates can be a challenge for economic growth.

2.2.9 CLIMATE, GEOLOGIC HAZARDS, AND SOILS

The climate of St. Helens is characterized by dry temperate summers and cool wet winters. Table 2-1 summarizes the climate data for St. Helens. The National Oceanic and Atmosphere Administration (NOAA) Monthly Normals for St. Helens were used for the mean temperatures. NOAA data for precipitation was not available for St. Helens, as such, climate normals were taken from the nearby weather station in Scappoose, Oregon.

TABLE 2-1: CLIMATOLOGICAL DATA (2006-2020)

	Jan	Feb	Mar	Apr	May	Jun	July
Precipitation (in)	6.04	4.27	4.81	2.95	2.23	1.41	0.30
Mean Temp (F)	40.2	42.2	46.1	50.3	57.6	62.2	68.2
	Aug	**Sep**	**Oct**	**Nov**	**Dec**	**Sum / Average**	
Precipitation (in)	0.43	1.78	3.84	6.28	6.70	41.04	
Mean Temp (F)	68.6	63.1	53.3	45.1	39.2	53.0	

Potential geologic hazards in the St. Helens area include landslides and earthquakes. There are no known volcanoes in the direct vicinity of this area to cause a volcanic hazard. The Oregon Department of Geology and Mineral Industries (DOGAMI) categorizes St. Helens in the low-to-high susceptibility range for landslides. This is corroborated by the Multi-Hazard Mitigation Plan for Columbia County. Additionally, City provided GIS shapefiles which reflect the DOGAMI findings on landslide susceptibility; only a small area bordering the northern City limits are considered high susceptibility for landslides. Figure 6 in Appendix A depicts the landslide hazard zones. The Multi-Hazard Mitigation Plan also reveals that in the past, seismic activity was fairly low, but because of more recent earthquakes, awareness of a potential problem has increased. The Multi-Hazard Mitigation Plan simulated earthquake damage produced by a magnitude 9 Cascadia Earthquake, and St. Helens fell into the light to moderate damage category. Local hazard maps show the area within City limits fall within zones A through D, with zone A indicating a very small probability of experiencing damaging earthquake effects and zone D indicating the possibility of very strong shaking, which can cause considerable damage to structures lacking special design. Figure 7 in Appendix A depicts a hazard map for seismic activity. Additional details and discussion of geologic hazards is included in the Geotechnical Planning Report completed by Shannon & Wilson, Inc. in Appendix C.

In general, the soils within the St. Helens area are either rock complex or silty loam, and the slopes vary from zero to thirty percent, according to the NRCS website. Typically, surface soil is very shallow in St. Helens, and sits on top of unfractured basalt rock. This is often a challenge for utility construction and can be a significant cost factor, particularly in pipeline projects. Figure 8 in Appendix A shows the soil map for St. Helens. See Appendix C for more details on the geology of the study area and the geologic hazards completed by Shannon & Wilson, Inc..

2.2.10 AIR QUALITY

The City does not currently lie within an Environmental Protection Agency (EPA) non-attainment area. No permanent impacts to air quality are anticipated from the recommended improvements, and best management construction practices should be employed during construction to minimize dust.

2.3 STORMWATER BASIN CHARACTERISTICS

2.3.1 VEGETATION

Vegetation is a natural method of reducing peak stormwater runoff in an urbanized area and is a potential method for low impact development because vegetation plays a significant role in the conversion of rainfall to stormwater runoff. The City of St. Helens is located in an area which historically has consisted of relatively thick vegetation with species including fir, oak, and willows with understories of brush. Developed areas have reduced the amounts of area covered with vegetation while undeveloped areas remain similar to its historical state.

2.3.2 MAJOR DRAINAGE BASINS

Stormwater from the study area generally drains into eight major drainage basins: Dalton Lake, North Trunk, Middle Trunk, Downtown, Greenway, Milton Creek, McNulty Creek, and Fischer Basin. The water collected from these major basins eventually drains into the Columbia River. See Figure 9 in Appendix A for reference. The full aerial extent of the Milton Creek and McNulty Creek watersheds extend northwest of the drainage basins shown in Figure 9. The full extent of the two watershed boundaries encompasses a total of approximately 28,000 acres of predominantly unincorporated land within Columbia County. Runoff from the watersheds outside of the drainage basins in Figure 9, drain to the creeks prior to the City UGB. The focus of this study was on the area of the watersheds that drain across land within the UGB. The existing stormwater system in each major basin can be found in Figures 9A – 9F in Appendix A. Fischer Basin does not have any existing stormwater infrastructure and only the hydrologic model will be developed. Table 2-2 shows the contributing drainage area of each basin and the percentage of the total drainage area they encompass.

TABLE 2-2: PERCENT OF TOTAL DRAINAGE AREA FOR EACH MAJOR BASIN

	Dalton Lake	North Trunk	Middle Trunk	Downtown	Greenway	Milton Creek[1]	McNulty Creek[1]	Fischer
Area (ac)	880	333	132	59	404	970	2,181	507
Percentage of Total Drainage Area	16%	6%	2%	1%	7%	18%	40%	9%

1) Acreage only includes areas of the watersheds that drain across land within the UGB.

SECTION 3 - BASIS OF PLANNING

Stormwater system planning criteria establishes fundamental principles and performance standards to evaluate the existing system and future improvements. The planning criteria includes defining the design storm event(s), hydrologic methods, and hydraulic calculation methods. The planning criteria in this evaluation were chosen by reviewing neighboring communities, industry standards, and state and federal stormwater regulations to choose the criteria that best fit the City of St. Helens. The City's existing stormwater policies, design standards, and construction standards were reviewed, and several changes were recommended.

3.1 DESIGN STORM

Design storms were established to evaluate the existing stormwater system performance, and to assist in the design of future improvements. Characteristics of a design storm are defined by recurrence intervals, the total depth of rainfall, and duration of the storm event. Recurrence intervals are the average intervals between successive storm events and can be expressed in annual probability of occurrence. For example, a 50-year storm has a 2% chance of occurring in any given year. The total depth of rainfall will vary depending on the recurrence interval and duration of the design storm. The specific recurrence intervals and total depth of rainfall used in the evaluation of this stormwater system are shown in Table 3-1; the storm event duration was assumed to be 24-hours, which is typical of the region. The total rainfall depth for each recurrence interval and duration was taken from the National Oceanic and Atmospheric Administration (NOAA) isopluvial charts. These charts show the rainfall depths for each of the design storms used in this evaluation.

TABLE 3-1: DESIGN STORM DEPTHS (24-HOUR DURATION)

Storm Event	Precipitation (in)[1]
2-Year	2.0
10-Year	3.0
25-Year	3.5
100-Year	4.0

1) From NOAA Atlas 2, Volume 10.

The temporal distribution of the design storm is an additional characteristic that was considered because the temporal distribution is how the given amount of precipitation is distributed over the duration of the storm. The Natural Resource Conservation Service (NRCS) has developed synthetic hyetographs for regions across the United States as shown in Figure 3-1. These hyetographs are based on historical data collection and extrapolation. The Type 1A theoretical rainfall distribution (Figure 3-2) is used to approximate storm events for the St. Helens region. It should be noted that the hyetographs are an acceptable method for approximating the distribution of the design storm, however, because it is an approximation, a real storm may not have the same uniform distribution and maximum intensity shown in Figure 3-2.

FIGURE 3-1: GEOGRAPHICAL BOUNDARIES FOR NRCS (SCS) RAINFALL DISTRIBUTION

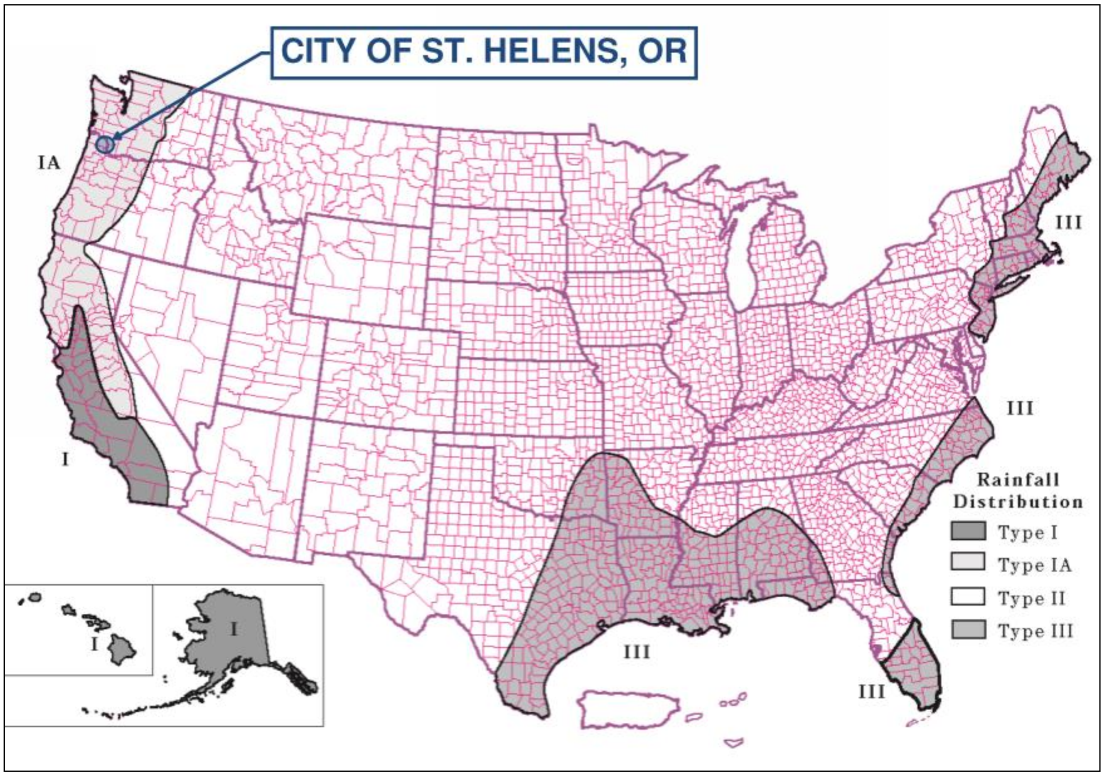
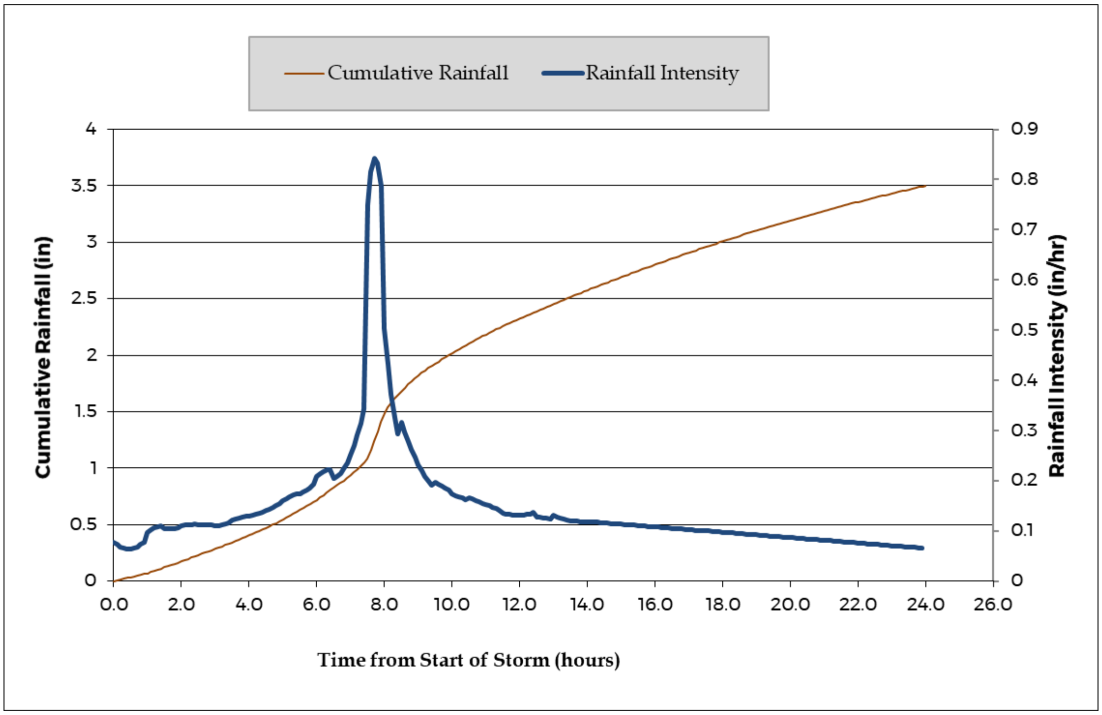


FIGURE 3-2: ST. HELENS 25-YEAR STORM HYETOGRAPH



Selection of a design storm is a matter of balancing level of service with economic feasibility. The City's existing design standard recommends that the stormwater drainage system be capable of passing runoff from the 25-year storm event without flooding or damage to existing infrastructure. For this evaluation, a system is considered flooded if the hydraulic grade line exceeds the ground elevation (rim elevation) at any point during the storm event. Detention facilities are recommended to be designed to store the runoff volume from a 25-year storm and provide safe overflow during a 100-year storm event. It is recommended that detention ponds be designed so the post-development peak release rates equal the pre-development release rates for their matching design storm event up to the 10-year design storm. The 25-year storm event peak release rate should not exceed the 10-year pre-development peak release rate.

3.2 HYDROLOGIC METHODOLOGY

The hydrologic portion of the stormwater system involves how a given area or "basin" will react to the design storm event. Hydrologic parameters are analyzed in each basin, which are then used to estimate how much rainfall from the design storm event is converted to runoff, where the runoff drains to, and how long it takes the runoff to drain to inlets in the drainage conveyance system. The hydrologic calculations are then used to put "loads" or demands into the hydraulic portion of the stormwater system.

Several hydrologic methods exist for defining basin characteristics and there is no single methodology or procedure that is universally accepted. The selection of which methodology to use in the evaluation depends on a number of factors, including geography, project area (size), and the overall purpose of the evaluation. The most common methods used in this region include the following:

- Natural Resources Conservation Service (NRCS) TR-20
- Hydrologic Modeling System (HEC-HMS)
- NRCS Soil Conservation Service (SCS) Urban Hydrograph Method (TR-55)
- Santa Barbara Urban Hydrograph Method (SBUH)
- Rational Method
- EPA Storm Water Management Model (SWMM)

These hydrologic methods have their own varying applications. NRCS TR-20 is an older methodology to the NRCS TR-55. The SBUH method is similar to the NRCS method but uses a different process to develop the hydrograph. The rational method is appropriate for smaller urban watersheds less than 200 acres in area. The HEC-HMS and EPA SWMM methodologies are not as widely used as the NRCS TR-55 method for assigning basin characteristics. It should be noted that the list of methods provided above are not independent of each other. For example, the EPA SWMM methodology used the same NRCS hyetographs as used in the NRCS TR-55 method to assign rainfall distribution throughout the design storm event.

It is recommended that the NRCS TR-55 methodology be used in the characterization of the basins because it is commonly used in the region and the characteristics of the study area fit within the methods limitations. The NRCS TR-55 method is only used in the defining hydrologic characteristics of the basins and not the hydraulic components of the model. The parameters calculated using the NRCS TR-55 method will be input into the computer modeling software, InfoSWMM. InfoSWMM uses the calculated parameters of the hydrologic basins to place "loads" or demands on the hydraulic portion of the model.

3.3 POLICIES AND STANDARDS

The policies and standards established in this evaluation will serve as the basis by which future storm drainage systems will be constructed. It will also provide guidance to developers building within St. Helens' urban growth boundary. The City's existing stormwater policies, design standards, and construction standards were reviewed as part of the master plan effort because it is imperative for these documents to be consistent with the City's goals for effective stormwater management. Deficiencies identified and recommended updates are summarized in a technical memorandum, included in Appendix F for reference.

Additional policies and standards were reviewed for neighboring communities to provide further validation of the recommended policies and standards. The following summary, shown in Table 3-2, of recommended revisions to the policies and design standards have been developed to meet the City's goal of being prepared to meet future stormwater regulatory requirements and target the specific needs of the City based on its geographic location and hydrologic conditions.

TABLE 3-2: SUMMARY OF LOCAL PLANNING CRITERIA

Planning Criteria	St. Helens Recommended	St. Helens (Existing)	ODOT	Scappoose	Newberg
Runoff Model Approach	NRCS TR-55	SBUH	NRCS TR-55	King County	NRCS TR-55
Storm Distribution	NRCS 1A	NRCS 1A	NRCS 1A	NRCS 1A	NRCS 1A
Min. T_c	5 minutes	5 minutes	NS	NS	5 minutes
24 hr. Storm Precipitation	NOAA	NOAA	NOAA	NS	NOAA
PVC "n" Value	0.013	0.013	NS	0.013	0.013
Min. Pipe Diameter	12"	12"	12"	12"	NS
Minimum Freeboard in Open Channels (ft)	1	NS	NS	NS	1
Minimum Freeboard in Detention Facility (ft)	1	1	1	NS	1
Surcharging Allowed	To within 0.5 feet of the rim elevation	NS	To within 0.5 feet of the rim elevation	To below roadway subgrade	To within 2 feet of the rim elevation
Design Storm for Conveyance	25-Year	25-Year	10-Year	50-Year	50-Year
Design Standards for Detention facilities on new developments	25-Year with overflow to bypass 100-Year	25-year with overflow to bypass 100-year	50-Year with overflow to bypass 100-year	25-Year with overflow to bypass 100-Year	25-Year

1) NS = none specified , SBUH = Santa Barbara Unit Hydrograph, ODOT = Oregon Department of Transportation.

3.3.1 PIPE SLOPES

The 10 States Standards are generally accepted in the industry when calculating minimum pipe slopes, and Keller Associates recommends adhering to these standards which account for a minimum velocity of 2 feet per second for a full pipe (assuming a roughness of 0.013). On the other hand, St. Helens Engineering Design Standards require a minimum pipe velocity of 3 feet per second when flowing full. As shown in Table 3-3, the minimum slopes defined by the 10 State Standards and City of St. Helens are equal, suggesting that the discrepancy in minimum pipe velocity originates from differing roughness values used to calculate minimum slope.

TABLE 3-3: MINIMUM SLOPE OF PIPES

Pipe Diameter (in)	10 State Standards Minimum Slope (per 100 feet)	City of St. Helens Minimum Slope (per 100 feet)
12	0.22	0.22
15	0.15	0.15
18	0.12	0.12
21" and Larger	0.10	0.10

3.3.2 ADDITIONAL POLICIES AND STANDARDS

Stormwater discharged into Waters of the State (e.g., rivers, streams, wetlands) is regulated by the DEQ and U.S. EPA. Due to the City's stormwater system consisting of outfalls to Waters of the

State, the City is required to comply with the TMDL and water quality management plan (WQMP) in the Willamette Basin and any future water quality related requirements set forth by the DEQ. The City was recently named a designated management agency (DMA) for the Revised Willamette Basin Mercury TMDL and WQMP (2019). In conjunction with this stormwater master plan, the City is also developing an implementation plan to meet the revised TMDL requirements. Additionally, while the City of St. Helens is not currently regulated under a municipal separate storm sewer system (MS4) permit by the DEQ, the City will likely fall under an MS4 permit in the future. The City will be regulated under a MS4 Phase II General Permit which covers cities with a population of less than 100,000 people. Effective as of March 1, 2019, the MS4 Phase II General Permit conditions include the following:

- Stormwater Management Program – a comprehensive plan designed to reduce pollutants from the MS4 to the maximum extent practical to protect water quality and satisfy the appropriate water quality requirements of the Clean Water Act.
- Adopt, update, and maintain adequate legal authority through ordinance(s), code(s), interagency agreement(s), contract(s), and/or other mechanisms to control pollutant discharges into and discharges from its MS4 to implement and enforce the conditions of this permit to the extent allowable pursuant to the respective authority granted under state law
- Stormwater Management Program Implementation which includes implementation of:
  - Public education and outreach
  - Public involvement and participation
  - Illicit discharge detection and elimination
  - Construction site runoff control
  - Post-construction site runoff for new development and redevelopment
  - Pollution prevention and good housekeeping for municipal operations
- Annual report evaluating the registrant's compliance with the requirements of the permit.
- Monitoring of stormwater establishing compliance with established TMDLs.

Review and evaluation of the conditions listed above are not included in the scope of this study. The study does not include any evaluation of the existing system's water quality facilities. Water quality was included as a consideration in the proposed stormwater infrastructure proposed in this study.

The City's current stormwater design standards do not require an evaluation of stormwater quality. It is recommended that the City review existing water quality standards and Stormwater Management Programs of surrounding local jurisdictions to assess what resources may be best suited to guide the City's water quality criteria requirements for future developments and stormwater infrastructure. Additional review and recommendations of the City's stormwater design standards and code are included in Appendix F.

SECTION 4 - MODEL DEVELOPMENT

An accurate computer model of the stormwater system serves as a planning tool and provides the basis for a solid storm water master plan. In addition, the model provides insight into potential improvements to address existing deficiencies and can be used to effectively plan for future development within the study area. A stormwater model correlates interactions of natural events with natural and manmade systems. A well-coordinated and strategic data collection effort is required along with practical assumptions and good judgement for data that cannot be feasibly obtained because there are countless variables with broad ranges of reasonable values in each system. The software modeling package InfoSWMM (Suite 14.7, Update #2) was utilized to model the City's stormwater system. InfoSWMM is a fully dynamic model which operates in conjunction with Esri ArcGIS and allows for evaluation of complex hydraulic flow patterns.

The stormwater model consists of two components: a hydrologic model and a hydraulic model. The hydrologic model involves drainage basins, or geographic areas that drain to a specific point, and a temporal distribution of storm events (hyetograph, as discussed in Section 2). Input parameters such as area, surface slope, soil infiltration, and percent impervious surface define each of these basins. Input parameters determine how much rainfall is converted to runoff and when the runoff reaches the outlet point. The hydraulic model then routes the hydrologic model's runoff through the storm drain network of pipelines, open channels, detention ponds, and other structures. Each component of the stormwater model requires numerous input parameters to adequately simulate actual rainfall events and the resulting effects on the storm drain network. This section outlines the model construction process, including data collection and how key assumptions were incorporated to develop St. Helens existing stormwater system model.

4.1 KEY ASSUMPTIONS

Due to the nature and uncertainty of stormwater, numerous assumptions and "what if" scenarios go into the creation of a stormwater master plan. The following sections summarize the assumptions and boundary conditions that were applied to this stormwater model.

4.1.1 BASINS AND BOUNDARY CONDITIONS

The area within the St. Helens urban growth boundary was delineated into eight major drainage basins. These eight major basins were further divided into sub-basins to incorporate into the model. The major basins and sub-basins are shown in Figure 9 through 9F in Appendix A. The following assumptions were made for the basins and boundary conditions:

- All upland stormwater not draining to known storm system components in the McNulty and Milton Creek basins was assumed to drain directly to the creeks and was therefore not included in the model.
- Dalton Lake, McNulty Creek, Milton Creek, and other branches not specifically included in the modeled collection system were assumed to have sufficient capacity to handle all runoff discharged from the model outfalls. Flooding of these features was not evaluated. All outfalls to these bodies of water were modeled as free discharge (no backwater).
- Detention ponds disconnected from any downstream collection networks are assumed to have sufficient capacity to handle all runoff discharged from the model outfalls.
- Pipe networks with outfalls to the Columbia River were modeled with a fixed stage elevation of 28.34 feet above sea level (North American Vertical Datum of 1988 (NAVD88) datum). This flood elevation is equal to the high-water mark measured in February 1996. This "extraordinary high-water event (during January 15 – February 28, 1996) was the result of an atmospheric river rain period and the associated rapid increase in temperature following prolonged snow accumulation at high elevations," (United States Geological Survey's (USGS) Scientific Investigations Report 2018-5161, Assessment of Columbia, and Willamette River Flood Stage

on the Columbia Corridor Levee System at Portland Oregon, in a Future Climate). Four modeled outfalls across the North Trunk, Middle Trunk, and Downtown Basins were affected by modeling a submerged outfall. The Columbia River was not modeled, and capacity was not evaluated.

4.1.2 PIPES, PONDS, AND CHANNELS

The following assumptions were made for pipes, ponds, and channels:

- All pipes are in good repair
- All pipes and channels are free of debris
- Manning's n values for pipes are 0.013
- Manning's n values for open channels are 0.030
- All channels have been maintained on a regular schedule and reflect the sizes documented in site surveys and photos
- Natural channels have been mowed to remove excess vegetation, with only the plants intended to be used as water quality features remaining
- The ravine in the Middle Trunk Basin between South 11th Street and South 4th Street does not have any direct connections to the trunkline running through the bottom of the ravine
- Open channels and storage ponds located within areas classified as hydrologic soil group D are assumed to have no infiltration. Open channels and storage ponds located within hydrologic soil group C were given hydraulic conductivities of 1.3 inches (from NRCS Soil Survey)

4.2 DATA COLLECTION

Prior to this study, much of the stormwater system was mapped, but had significant data gaps in elevations for pipes, manholes, catch basins, channels, and other storm structures. The City GIS data base served as the basis for the hydraulic model. As a part of this project, a sub-consultant collected field survey data to supplement the City GIS data and better define modeled features. Features to be surveyed were prioritized by their importance toward developing a more accurate hydraulic model and identifying deficiencies within the stormwater system. The following criteria were used for prioritization of the stormwater structures including pipes inverts, pipe diameters, manhole and catch basin rims and inverts, pipe outlet, and outfalls:

- ► Priority 1 – No existing knowledge or reference material of elevations and serves as a critical component of the model.
- ► Priority 2 – Elevations or diameters can be estimated by using surrounding data points or does not serve as a critical component of the model.
- ► Priority 3 – Elevations or diameters can be estimated with confidence or does not serve as a critical component of the model.

In addition to the stormwater components listed above, the City's collection system also includes approximately 6,000 linear feet (LF) of open channels, which contribute to the connectivity of the stormwater system. Open channels which do not drain toward any modeled stormwater components were not considered to be surveyed. The open channels to be included in the model were also prioritized for surveying as follows:

- ► Priority 1 – Identified by the City to have capacity issues and serves as a critical component of the model.

- ► Priority 2 – Not identified by the City to have capacity issues and does not serve as a critical component of the model.
- ► Priority 3 – Not identified by the City to have capacity issues and ditch dimensions approximated by Keller Associates during site visits.

Priority 1 stormwater components were surveyed as part of this study, however the scope of surveying for the study did not cover Priority 2 and Priority 3 components. These component parameters were estimated with reasonable assumptions or excluded from the model.

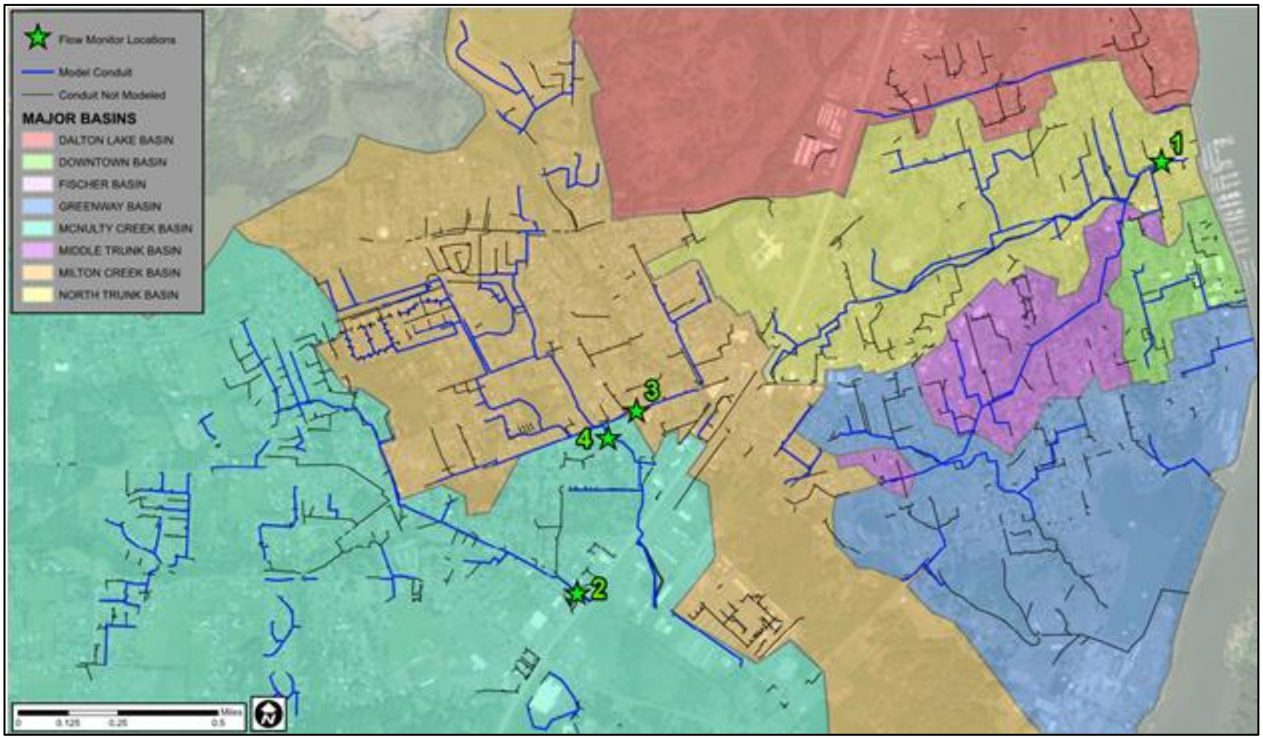
Where elevation data was available from construction drawings or previous surveys, the vertical datums for the majority of drawings and surveys were not specified. The two most common vertical datums used are National Geodetic Vertical Datum 1929 (NGVD29) and NAVD88 and the difference between the two datums in St. Helens is +3.34 feet from NGVD29 to NAVD88. Existing City GIS elevation data showed significant drops across manholes and catch basins, adverse grades in pipes, and steep slopes in pipes. Where these shifts in elevation data could not be confirmed by record drawings, survey data was collected to compare with existing elevation data. A rim elevation was surveyed for each of the referenced construction drawing sets where the datum was unknown. If the difference between the existing elevation data and the recorded survey point was approximately +3.34 feet, then the datum of the construction drawing set could be confirmed, and the elevations shifted into a single datum in the model. The stormwater model elevations are in the NAVD88 vertical datum.

4.3 FLOW MONITORING

The intent of flow monitoring is to help calibrate model parameters to reflect observed conditions for storm events. Temporary flow meters with data loggers were installed in the stormwater system to observe runoff resulting from actual storm events. Locations of flow meters were selected to isolate basins and land use types, and to better understand the interaction of the surface runoff and open channel flow with the City's pipe network. The monitors were installed in four locations and were placed at strategic points in the stormwater system to capture flows on the larger pipe networks in different basins as shown in Figure 4-1 below or see Figure 10 in Appendix A for the full size figure.

The monitoring was performed during winter months when larger storm events typically occur. The monitors were installed on December 29th and 30th, 2020 and monitored flows for three weeks before being removed in January 2021. Hach FL900AV flow monitors were used and recorded depth, velocity, and flow in 5-minute increments. The cumulative rainfall was also recorded in 15-minute increments at the wastewater treatment plant (WWTP) for the duration of the monitoring period.

FIGURE 4-1: FLOW MONITORING LOCATIONS



4.4 CALIBRATION

The goal of model calibration is to adjust model parameters, so the model results reflect observed system response during storm events. The quality and usefulness of flow monitoring data for a stormwater model is highly dependent on the magnitude of captured rain events during the monitoring period. There was a total of 9.7 inches of rainfall during the monitoring period, with two events each over 2 inches. These storms probably fall somewhere between a 2- and 10-year event as introduced in Section 3 (Table 3-1). The higher of these two events (referred to as Event 1) was used to calibrate the model with a total cumulative rainfall of 2.2 inches and the second highest storm event (referred to as Event 2) was used as a secondary source of verification that the model is calibrated and robust (able to reflect the storm system response for various rain events). These storm events provided quality flow data and system responses, which led to a high level of confidence in the successful calibration of the model. The 15-minute increment rainfall data recorded was inputted into the model to replicate the precipitation time distribution during each event. The model flows at each monitor location were compared with the observed flows.

The three main parameters adjusted in the calibration process were the initial abstraction, the curve numbers of the sub-basins, and baseflows into the pipe network. Initial abstraction is typically calculated and is dependent on the curve number. The initial abstraction in this study was calculated using the TR-55 method and then reduced by about 75%. This reduction was based on observed system response in the flow monitoring data as well as the knowledge that large storm events in St. Helens typically occur during the wet season when surface voids and depressions that contribute to initial abstraction are mostly full of previous storm events. As shown below in Table 4-1, the curve numbers were reduced for most of the flow monitoring sites by 5% to match the observed flows. Baseflows, which represent continuous groundwater infiltration during the wet season, were assigned to each of the monitoring sites based on the collected flow monitoring data. The baseflows were assigned to the pipe network upstream of flow monitoring sites that indicated base groundwater infiltration during the monitoring period.

Resulting model base flows and their relationship to the observed flows by monitoring site are shown in Table 4-1. Event 1 data was used to calibrate model parameters initially and Event 2 data was used as a second source to assess if the model calibration was robust and representative of the actual stormwater system. Peak flows in the model from Event 1 are all slightly higher than the observed values for conservative evaluation. The peak flows in the model from Event 2 are higher at Sites 1, 2, and 3, but slightly lower at Sites 4. Graphs of modeled flows versus observed flows for each flow monitor site for Events 1 and 2 can be found in Appendix D.

TABLE 4-1: CALIBRATION ADJUSTMENTS

Flow Monitor Site	CN Adjustment	Baseflow for Site (gpm)
Site 1 (Middle Trunk)	Reduce 7.5%	175
Site 2 (Sykes Road)	Reduce 5%	800
Site 3 (Harris Street)	Reduce 5%	200
Site 4 (Columbia Boulevard)	Reduce 5%	0
1) Positive value indicates modeled peak flow is higher than observed peak flows.		

Figure 4-2 and Figure 4-3, show the difference between the initial model and the calibrated model results at Site 3. The magnitude of the calibrated modeled peak flows (shown in blue) line up with the observed peak flows (shown in green) during the storm event. It should be noted that the overall volume of runoff during a rain event in the model (volume under the flow curve) is less than the observed volumes because the model does not account for the prolonged infiltration and inflow in the pipe network after the rain event (typically for 24-48 hours after peak flows). The lower volumes in the model are due to limitations of the TR-55 hydrologic method which only accounts for direct surface runoff, not subsurface infiltration, and inflow to pipe networks. Peak flows are used as the primary criteria to evaluate stormwater pipe capacities, so the difference in volume over a storm event will not impact stormwater system capacity evaluations. Should regional detention facilities be evaluated as an alternative improvement, the difference in observed volume will be included in sizing considerations. Additionally, the difference in volumes will have limited impact on proposed detention ponds because they are designed primarily to reduce the impact of peak flows and not prolonged infiltration, which occurs after peak flows.

FIGURE 4-2: MODELED FLOWS VERSUS OBSERVED FLOWS PRE-CALIBRATION

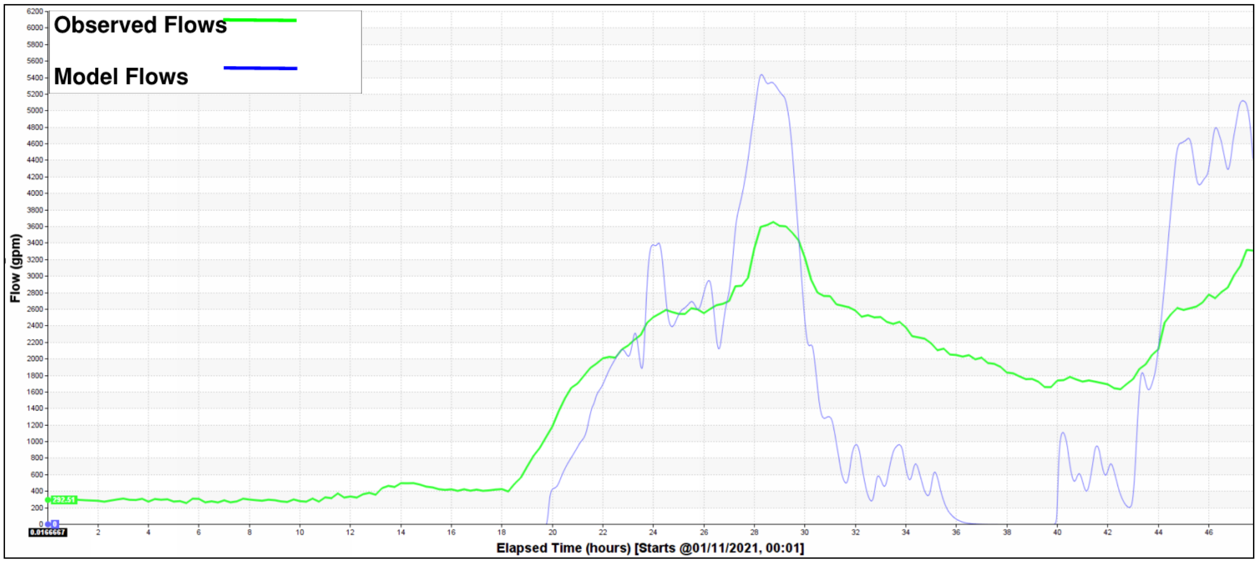
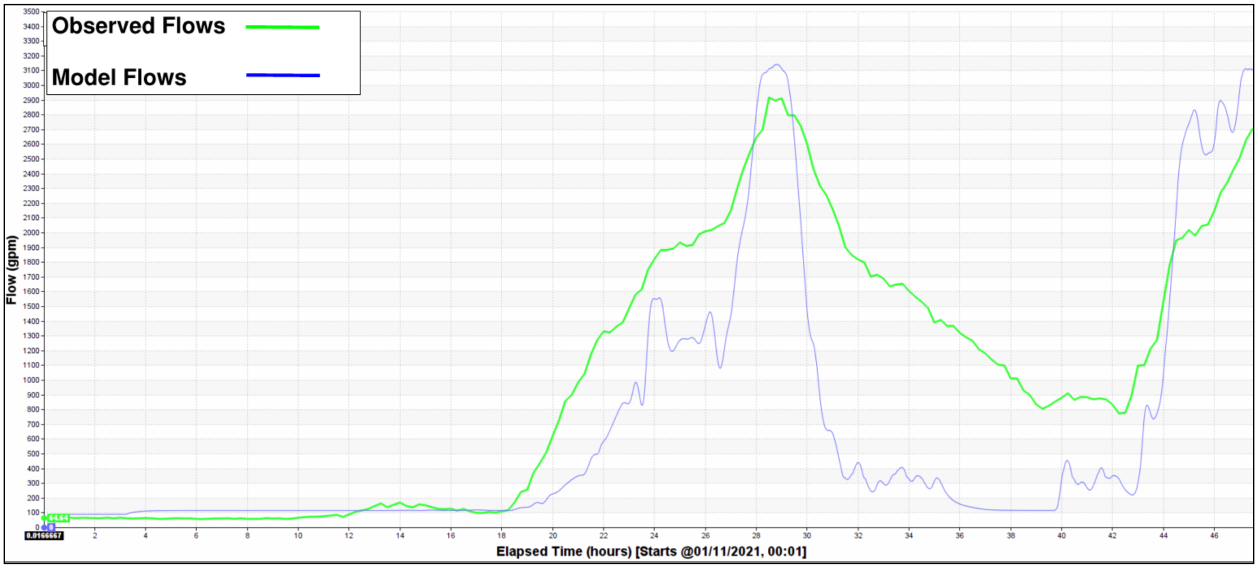


FIGURE 4-3: MODELED FLOWS VERSUS OBSERVED FLOWS POST-CALIBRATION



To calibrate the remaining sub-basins which do not contribute runoff to a flow monitor site, the characteristics were adjusted similar to the calibrated sub-basins as discussed above; CN's were reduced by 2.5% and initial abstractions were reduced to 75% of the TR-55 method value. The final step in calibrating the stormwater system model was to incorporate City staff knowledge and experience with their system. The 2-year and 10-year storm events were simulated in the model to identify areas with flooding and surcharging within the system. The areas within the system which experienced flooding were reviewed by the City to compare with the staff's historical knowledge of flooding in these areas. The final calibration produced modeled peak flows slightly higher than observed peak flows to provide a conservative evaluation of the stormwater system.

SECTION 5 - EXISTING SYSTEM EVALUATION

The stormwater system in St. Helens generally consists of stormwater surface flow to catch basins, a subsurface network of pipes, manholes, detention facilities, open channels, culverts, and outfalls. Frequent rains combined with the natural drainage characteristics of the City, result in high runoff volumes which can overwhelm the existing system. As a result, the existing system evaluation indicated flooding and ponding as common occurrences. The majority of runoff conveyed by the system drains to Milton Creek, McNulty Creek, Dalton Lake, or the Columbia River. The evaluation of the stormwater system was conducted based upon the planning criteria and model parameters established in the previous sections.

5.1 EXISTING CONVEYANCE SYSTEM CONDITIONS

The City's existing stormwater system includes approximately 45 miles of closed-conduit pipe ranging in diameter from 2-inches to 66-inches. The stormwater pipes serve multiple purposes with some being catch basin connector pipes while others serve as trunklines which convey stormwater from multiple areas throughout the City. Stormwater pipe materials in the City consist of concrete, perforated, ductile iron (DI), polyvinyl chloride (PVC), high-density polyethylene (HDPE), corrugated metal pipe (CMP), vitrified clay (VCP), and unknown materials. The City's GIS database was used to create an inventory of the existing stormwater pipe diameters and materials and is summarized in Table 5-1. The table includes both lateral and main pipelines denoted as owned by the City.

TABLE 5-1: STORMWATER PIPE INVENTORY (UNITS IN FEET)

		Pipe Material									
		Concrete	Perforated	Ductile Iron	PVC	HDPE	CMP	VCP	Unknown	Total	% of Total
Diameter (in)	≤6	600	1,330	170	380	500	0	0	1,640	**4,620**	**1.9%**
	8	1,960	60	2,660	980	1,280	100	210	4,590	**11,850**	**5.0%**
	10	2,150	0	2,130	450	2,170	250	0	3,350	**10,500**	**4.4%**
	12	10,440	500	9,410	8,320	17,380	960	160	11,800	**58,950**	**24.9%**
	15	6,370	0	1,230	2,500	1,370	0	0	2,620	**14,100**	**5.9%**
	18	4,670	0	600	1,960	3,010	0	0	1,960	**12,190**	**5.1%**
	21	2,320	0	0	0	450	0	0	350	**3,120**	**1.3%**
	24	5,820	0	1,270	720	2,780	250	0	3,170	**14,020**	**5.9%**
	30	1,060	0	0	420	180	100	0	660	**2,430**	**1.0%**
	36	730	0	190	60	630	140	0	1,300	**3,050**	**1.3%**
	>36	330	0	660	0	0	1,730	0	880	**3,590**	**1.5%**
	Unknown	260	1,650	0	130	0	0	0	96,400	**98,450**	**41.5%**
	Total	**36,720**	**3,540**	**18,310**	**15,920**	**29,740**	**3,530**	**360**	**128,730**	**237,000**	**100%**
	% of Total	**15.5%**	**1.5%**	**7.7%**	**6.7%**	**12.5%**	**1.5%**	**0.2%**	**54.3%**	**100%**	

As shown in the table, approximately 54% of the existing pipes are of an unknown material and approximately 42% of the existing pipes are of an unknown diameter. It is recommended the City continue to update their GIS database to reflect the known parameters of the stormwater system as development, surveys, and improvement projects are completed. Approximately 360 feet of VCP was converted from sanitary sewer pipelines to stormwater pipelines. The sections of VCP, which were a common material around the turn of the 20th century, are likely reaching the end of their useful life and the pipeline conditions should be evaluated.

Additionally, the age of existing stormwater pipes was summarized to assess the need for pipes to be replaced as they reach the end of their useful life. The City's GIS database was used to develop a summary of pipeline age throughout the system as shown in Table 5-2.

TABLE 5-2: PIPELINE AGE

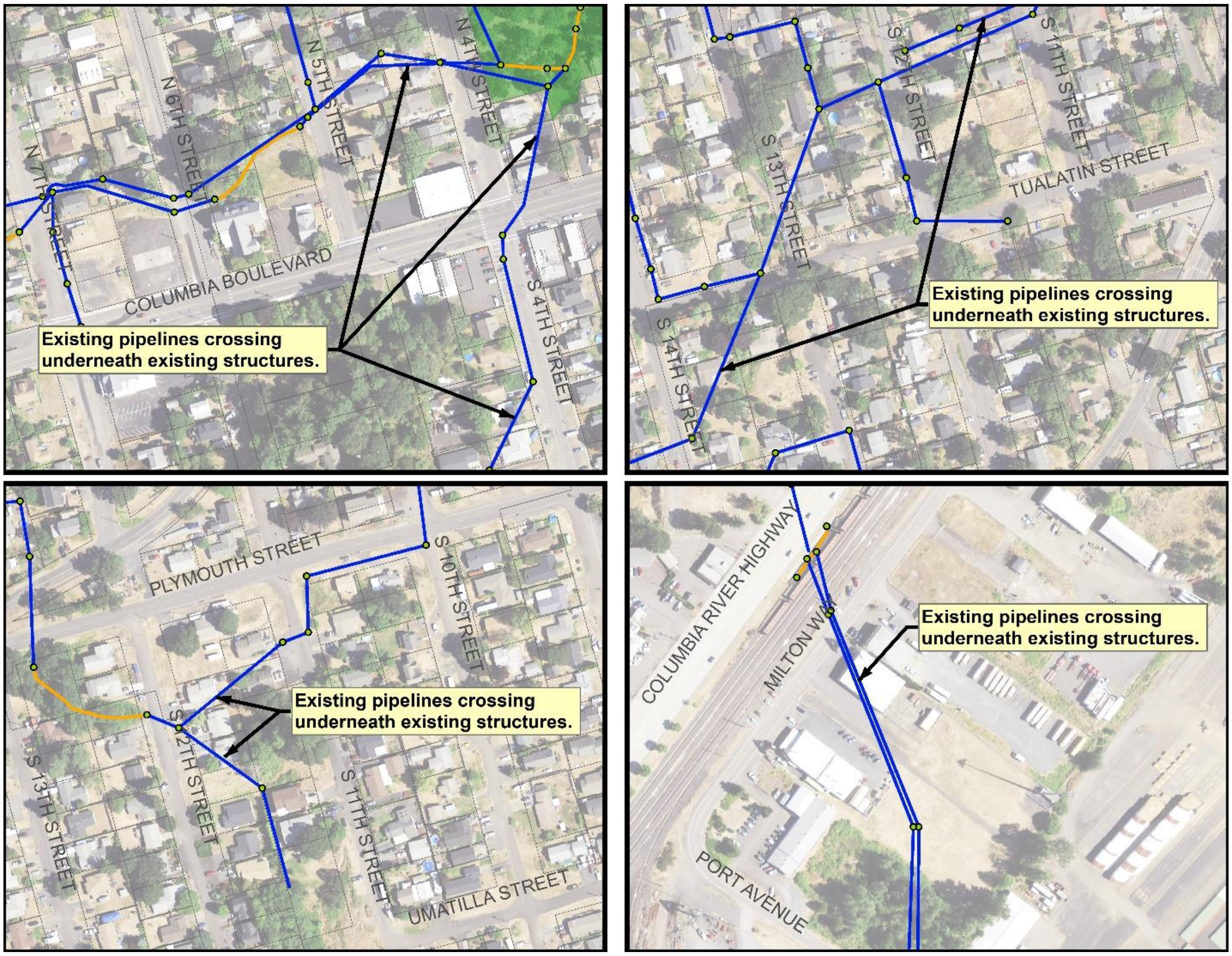
Decade Installed	Length of Pipe (ft)	% of Total
1910s	160	0.1%
1920s	0	0.0%
1930s	0	0.0%
1940s	610	0.3%
1950s	0	0.0%
1960s	5,600	2.4%
1970s	2,500	1.1%
1980s	4,100	1.7%
1990s	42,500	17.9%
2000s	34,200	14.4%
2010s	18,300	7.7%
Unknown	129,000	54.4%
Total	**237,000**	**100.0%**

Similar to the pipeline material and size, the installation date of approximately 54% of the City's stormwater system is unknown according to the current GIS database. The GIS database would benefit from being updated to reflect pipeline age and can be done by utilizing existing record drawings and historical conditions assessments. Figure 12 in Appendix A shows the existing pipeline ages. Typically, pipelines should be inspected and possibly replaced as they reach 50 years in age. For this study, pipelines installed before the 1980s should be inspected and replaced or repaired. A summary of the trunklines recommended to be inspected is provided below:

- Downtown Basin – From Parkway draining north to South 4th Street
- Downtown Basin – From South 3rd Street draining east to the outfall
- Milton Creek – Columbia Boulevard from North Vernonia Road to Milton Creek
- Milton Creek – Mayfair Drive from Sherwood Drive to Campbell Park

Deficiencies were also identified throughout the existing stormwater system where stormwater pipes appear to cross underneath existing structures. Stormwater pipes installed beneath existing structures poses a significant risk to both the City and the owner of the structures. It is recommended that any pipelines underneath structures be properly abandoned and re-aligned in the right-of-way or along property lines away from existing structures. Figure 5-1 shows eight locations where the GIS reveals pipes crossing underneath existing structures. The City should survey the existing stormwater system to assess the need to re-align these pipes.

FIGURE 5-1: EXISTING PIPELINES CROSSING UNDERNEATH STRUCTURES



5.2 DRAINAGE BASIN ASSESSMENTS

This section discusses the general capacities of the stormwater infrastructure in the City's eight major drainage basins. These assessments were based on input from City staff operators and computer modeling results of the design storm. Staff identified specific problem areas where flooding has historically occurred consisting of surcharging and flooding of existing stormwater pipes and overflowing of open channels. These problem areas typically occur where there is older stormwater infrastructure that may have been undersized or in areas where there is a lack of proper stormwater infrastructure.

Four design storm events were simulated in the model and include the 2-year, 10-year, 25-year, and 100-year storms. The following sections identify the specific areas where flooding or surcharging to within two feet of the rim elevation occur in a given storm event. The following sections also summarize historical problem areas in each major drainage basin, identify areas with projected deficiencies, and explain the reason for the deficiency. Each problem area was given a unique identifier and is listed in Tables 5-3 through 5-8 and shown in Figures 5-2 through 5-7 below. Additional model results showing which storm event first causes flooding at each identified location are shown in Figures 11A through 11F in Appendix A.

The scope of this study was to identify deficiencies and propose solutions to problems in major pipeline networks. Additional localized flooding challenges may need to be addressed as part of the City's ongoing stormwater maintenance program or as updates to the list of capital improvement projects identified later in this report.

5.2.1 DALTON LAKE BASIN

Dalton Lake Basin is located toward the northern boundary of the city limits. The land use consists mainly of residential housing with some industrial users along the east side of the Columbia River Highway. There is limited stormwater infrastructure within this drainage basin with only three modeled pipe networks.

The City reported occasional historical flooding across N 11th Street, but recent improvements were carried out to eliminate the issues. The model results do not show flooding occurring in this area with the improvements installed. Flooding or surcharging was not identified in either of the two additional modeled trunklines in Dalton Lake Basin.

5.2.2 NORTH TRUNK BASIN

Land use within the North Trunk Basin consists of a mix of residential, commercial, and public facilities. This basin relies on a significant number of open channels to convey stormwater runoff to the outfall on the Columbia River. One of the large open channels between N 15th Street and N 12th Street was modeled with natural detention as the surveyed channel ranges from 10 feet wide to approximately 100 feet wide with a low point about halfway between N 15th Street and N 12th Street.

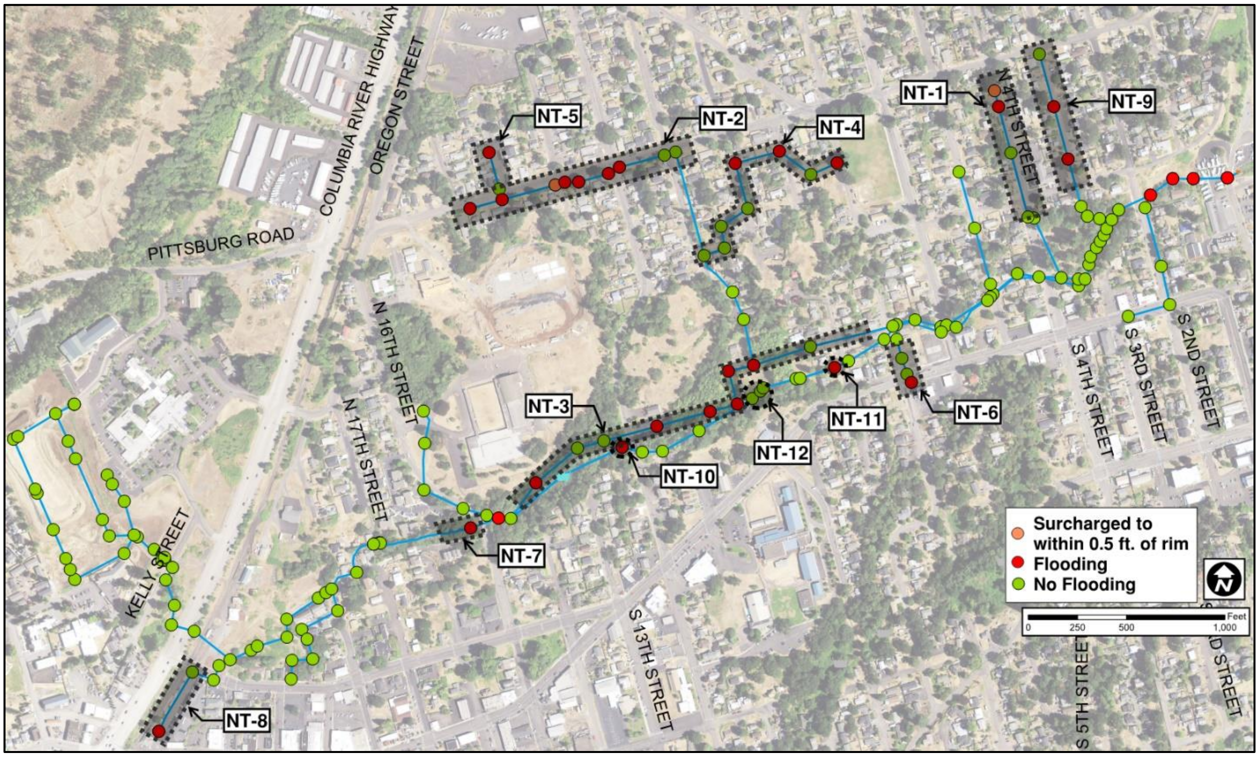
The Godfrey Park Ravine has historically had some issues with flooding and surcharging but recent improvements have replaced the existing pipeline with open channels and check dams which have relieved some of the flooding. City staff reported the open channels at N 7th and N 8th Streets as a problem area. Staff has seen flooding at this location, but upon further investigation, staff have found it is likely due to debris build up in the channels and not a capacity deficiency. The model did not project flooding in this area until the 25-year storm, confirming City staff knowledge of the problem area. Note, flooding was shown downstream of Godfrey Park as a result of backwater from the Columbia River water surface level. The flooding is not a result of undersized pipe capacities. Table 5-3 summarizes the deficiencies shown in the model from the 25-year storm event and Figure 5-2 shows where surcharging and flooding is projected.

TABLE 5-3: NORTH TRUNK BASIN SUMMARY OF EXISTING DEFICIENCIES

Problem Area ID	Location Description	First Storm Event with Surcharging[1,2]	First Storm Event with Flooding
NT-1	N. 4th Street	-	10-Year
NT-2	West Street to N. 10th Street	-	2-Year
NT-3	N. 14th Street to 7th Street	-	2-Year
NT-4	6th Street Park to N. 10th Street	2-Year	10-Year
NT-5	N. 13th Street to West Street	-	10-Year
NT-6	N. 7th Street and Columbia Boulevard	-	10-Year
NT-7	N. 17th Street to N. 15th Street Ditch	-	10-Year
NT-8	Milton Way	-	10-Year
NT-9	N. 3rd Street to Wyeth Street	25-Year	-
NT-10	N. 12th Street Culvert	-	25-Year
NT-11	N. 8th Street Culvert	-	25-Year
NT-12	N. 10th Street Culvert	-	100-Year

1) First storm event with surcharging only includes where the hydraulic grade reaches within 0.5 feet of the rim elevation.
2) If left blank, surcharging was not projected before the flooding event.

FIGURE 5-2: NORTH TRUNK BASIN 25-YEAR MODEL RESULTS



Explanation of Deficiencies:

- **NT-1, NT-2, NT-4, NT-5, NT-6, NT-8, and NT-9**: Downstream capacity limitations cause flooding and/or surcharging in the upstream pipe networks. The hydraulic grade line (HGL) in these pipe networks is steeper than the pipe slope, which indicates the pipes are undersized for the existing peak flows.
- **NT-3:** Flow splits just east of N 15th Street where water drains through open channels and enters a 24-inch trunkline, which runs parallel to the open channels. The inlet to the trunkline could not be found in the field, therefore it is unknown how the flow splits between the two networks. It was assumed the inlet elevation to the 24-inch trunkline was one-half foot higher than the open channel invert which results in about 2/3rds of the runoff draining to the open channel and about 1/3rd draining into the 24-inch trunkline. The inlet to the trunkline should be surveyed, and the evaluation updated before moving forward with any improvements in the connected network.
- **NT-7, NT-10, and NT-11**: Culverts draining the Columbia Boulevard ditch are backing up and ponding at the inlet. Flooding of these culverts is defined as once the culvert becomes submerged (hydraulic grade line (HGL) exceeds top of pipe elevation).

5.2.3 MIDDLE TRUNK BASIN

The Middle Trunk Basin is south of the North Trunk Basin and runoff converges with the North Trunk Basin just upstream of Godfrey Park. The Middle Trunk Basin consists mainly of residential land use with various commercial facilities along the Columbia River Highway and Columbia Boulevard. The main trunkline flows to the northeast through the bottom of a large ravine. The ravine slowly contributes runoff to the trunkline through infiltration, but the peak runoff flows are reduced through natural detention in the ravine.

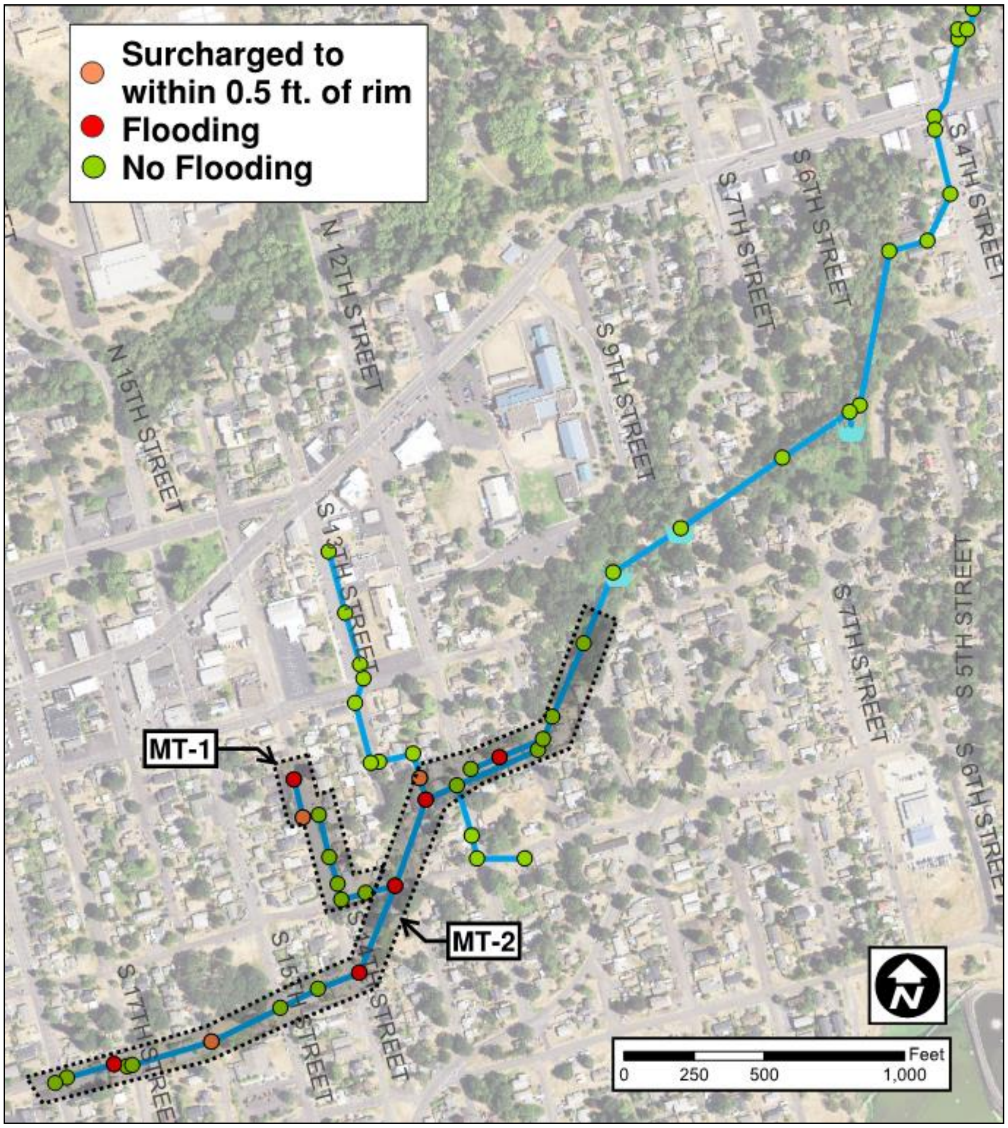
The City has identified two areas along the trunkline that have had historical flooding. The model outputs are consistent with the City observations and shows surcharging and flooding at locations MT-1 and MT-2. Table 5-4 and Figure 5-3 summarize the deficiencies and when the first flooding and surcharging will occur.

TABLE 5-4: MIDDLE TRUNK BASIN SUMMARY OF EXISTING DEFICIENCIES

Problem Area ID	Location Description	First Storm Event with Surcharging[1,2]	First Storm Event with Flooding
MT-1	S. 14th Street to Tualatin Street	2-Year	10-Year
MT-2	S. 18th Street to S. 10th Street	2-Year	10-Year

1) First storm event with surcharging only includes where the hydraulic grade reaches within 0.5 feet of the rim elevation.
2) If left blank, surcharging was not projected before the flooding event.

FIGURE 5-3: MIDDLE TRUNK 25-YEAR MODEL RESULTS



Explanation of Deficiencies:

- **MT-1:** The pipes just south of Cowlitz Street are relatively flat (0.1% – 0.2%), and water is backing up into the manholes. There are three segments of pipe that do not meet the recommended minimum pipe slopes in the City standards.
- **MT-2:** The flooding in these areas was attributed to undersized pipes for peak modeled flows. Water backs up from the 18-inch pipe crossing Cowlitz Street to the most upstream modeled manhole on S 18th Street.

5.2.4 DOWNTOWN BASIN

The Downtown Basin is the smallest of the major drainage basins in area and consists of only one modeled pipe network. The City is not aware of any drainage issues within this basin. The Downtown Basin is a mix of residential and commercial land use. Similar to the North Trunk Basin, there is flooding in the manhole upstream due to outfall because of backwater from the Columbia River water surface elevation. Deficiencies observed in the model are summarized below in Table 5-5 and labeled in Figure 5-4.

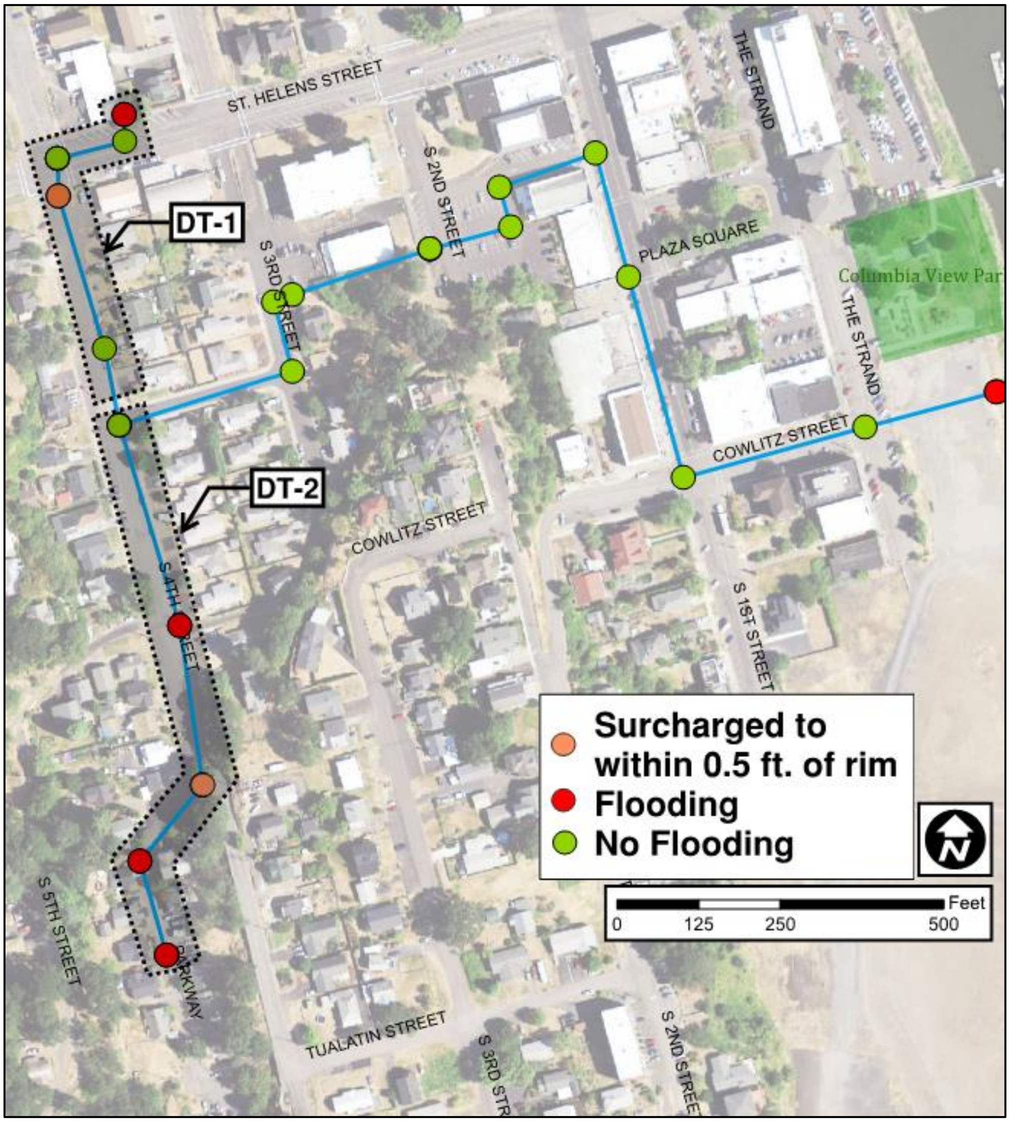
TABLE 5-5: SUMMARY OF DOWNTOWN BASIN EXISTING DEFICIENCIES

Problem Area ID	Location Description	First Storm Event with Surcharging[1,2]	First Storm Event with Flooding
DT-1	St Helens Street and S. 4th Street	-	10-Year
DT-2	Park Way to S. 4th Street	-	10-Year

1) First storm event with surcharging only includes where the hydraulic grade reaches within 0.5 feet of the rim elevation.

2) If left blank, surcharging was not projected before the flooding event.

FIGURE 5-4: DOWNTOWN BASIN 25-YEAR STORM EVENT MODEL RESULTS



Explanation of Deficiencies:

► **DT-1, DT-2:** Most of the surcharging and flooding appears to be caused by the undersized 24-inch pipeline draining east from S 4th Street to the outfall. The HGL suggests resolving this capacity deficiency would alleviate the existing flooding and surcharging identified in the model results.

5.2.5 GREENWAY BASIN

The Greenway Basin is located toward the southeast corner of the City and consists of almost all residential land use. The main pipe network drains into an open channel which drains toward the wastewater treatment pond. An earthen dam is located in the channel to keep stormwater from draining into the treatment pond and into a piped outlet which routes stormwater around the pond and into the Columbia River. In addition, three modeled pipe networks also drain to the Columbia River.

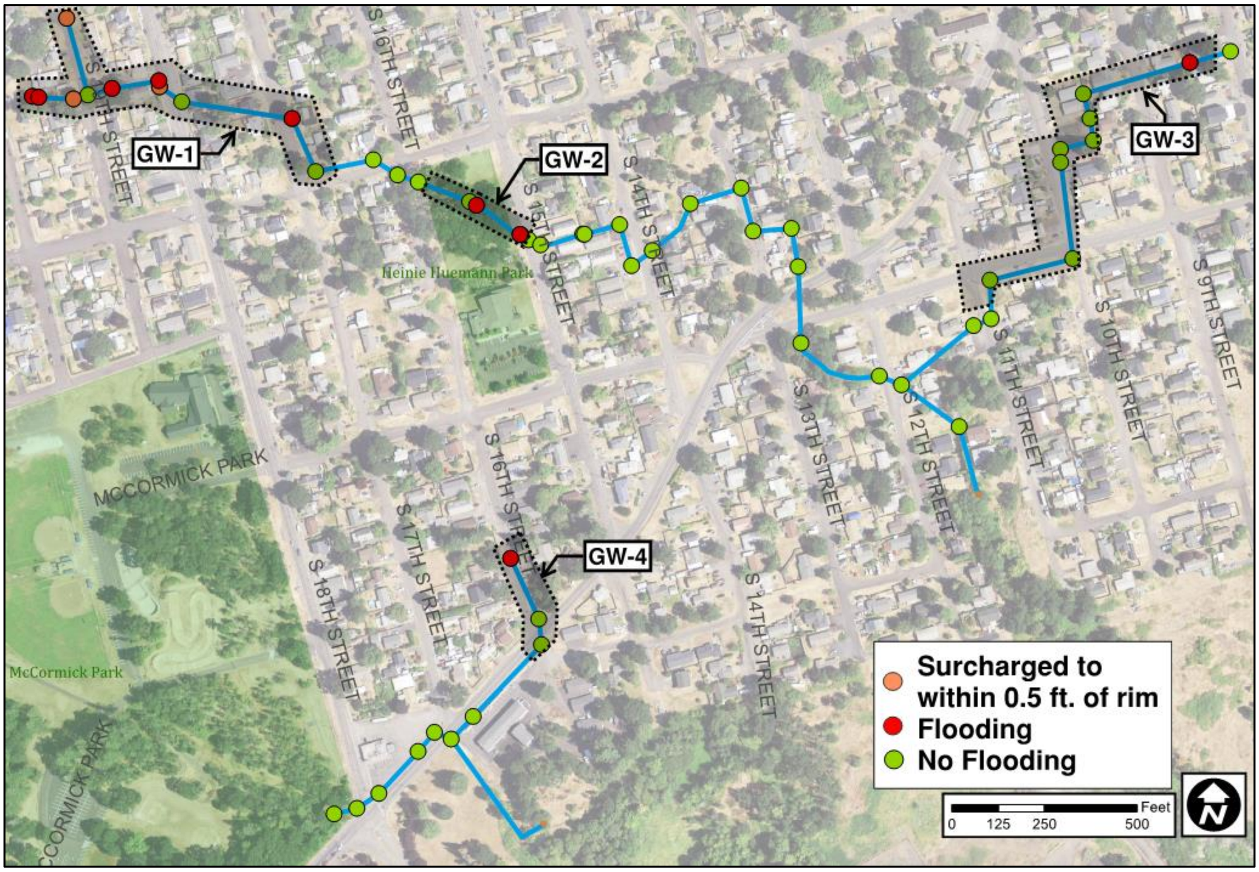
The City reported one known problem area within the Greenway basin, where a stormwater pump station was not able to keep up with peak flows. The pump station has recently been removed, and gravity pipelines now drain stormwater to the outfall, however, flooding is seen in the model upstream of the improvements. Furthermore, the City has reported several square junction boxes, which are preventing normal channelized flows, and it is recommended that each junction box be replaced with standard manholes or manholes with grated lids. It is important to note how two of the three additional modeled pipe networks from the intersection of S 3rd Street and Tualatin Street, as well as the pipe network at Nob Hill Park, are not shown in the figure extents below because flooding only occurs due to backwater from the Columbia River. The current pipe networks are not undersized for the design storm peak runoff flows, and the modeled networks can be seen in Figure 11D in Appendix A. Table 5-6 and Figure 5-5 summarize the identified deficiencies in the basin.

TABLE 5-6: SUMMARY OF GREENWAY BASIN EXISTING DEFICIENCIES

Problem Area ID	Location Description	First Storm Event with Surcharging[1,2]	First Storm Event with Flooding
GW-1	S 20th Street to Heinie Huemann Park	-	2-Year
GW-2	Heinie Huemann Park	-	2-Year
GW-3	S 8th Street to S 9th Street	-	2-Year
GW-4	S 16th Street	-	2-Year

1) First storm event with surcharging only includes where the hydraulic grade reaches within 0.5 feet of the rim elevation.
2) If left blank, surcharging was not projected before the flooding event.

FIGURE 5-5: GREENWAY BASIN 25-YEAR STORM EVENT MODEL RESULTS



Explanation of Deficiencies:

- **GW-1:** Flooding in this area is likely because of undersized pipes. Specifically, the 15-inch pipe parallel to S 17th Street, and the Tualatin Street intersection, is undersized and produces a bottleneck in the network.
- **GW-2:** Heinie Huemann Park acts as a natural detention pond with a slide gate at the east end of the park restricting discharge flows. Flooding in this park is intentional and is known by City staff, however, during the 25-year storm, there was approximately 300,000 gallons that flooded at the slide gate. A detailed survey of the whole park was not completed for this project.
- **GW-3:** At this catch basin, a significant amount of stormwater drains to the area and it is a local low point. The catch basin measures to be about 4 feet deep and on residential property. The pipe segments upstream of the recent stormwater improvements were not installed at recommended minimum pipe slopes according to the invert data provided by the City GIS. Undersized downstream pipes at this low and shallow catch basin end up causing backwater and flooding. It is important to mention that the City has not observed historical flooding in this area.
- **GW-4:** The highest upstream modeled manhole is where three un-modeled pipelines combine into a 12-inch pipe. The downstream pipes are undersized, which in return causes flooding at the upstream manhole.

5.2.6 MILTON CREEK BASIN

The Milton Creek Basin boundary expands north past the City's UGB and consists of a significant number of residential developments. The developments' stormwater infrastructure either discharges directly into Milton Creek or connects with the City's stormwater system which also drains into Milton Creek.

The City indicated two problem areas within this drainage basin, and both were confirmed with model results. The first problem area is located along North Vernonia Road between Oakview Drive and Eddies Way, which the City recently completed a project to improve the sidewalk and stormwater drainage on the west side of North Vernonia Road in hopes to improve stormwater drainage and reduce flooding. To improve drainage and reduce flooding, the open channels and culverts along this stretch of road were replaced with 18-inch pipe. There are multiple residential developments contributing flows to this segment of stormwater pipes, and each development has detention facilities to limit the peak flow along North Vernonia Road. The peak discharges from each of the detention facilities were compared to the peak flows from the detention pond design reports and are relatively similar.

The second area where there is known flooding indicated, is near the intersection of Columbia Boulevard and Cherrywood Drive. There is a low-lying area south of Columbia Boulevard which drains to the east and enters the stormwater system through a concrete headwall. The model projects flooding in this area because the downstream pipe network does not have sufficient capacity for peak runoff flows draining to this section of the stormwater system. Table 5-7 and Figure 5-6 summarize the deficiencies observed in the model.

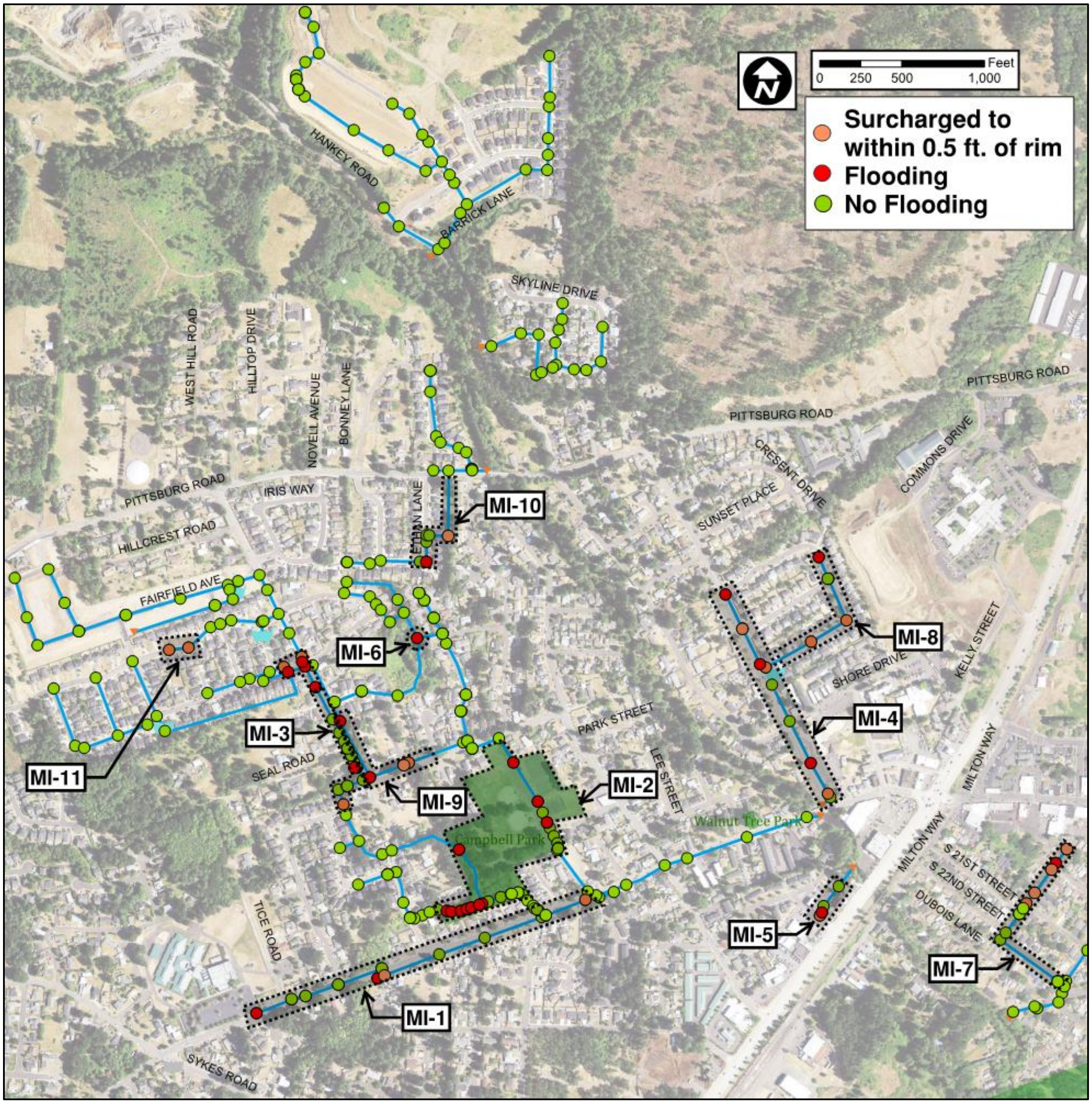
TABLE 5-7: MILTON CREEK BASIN SUMMARY OF EXISTING DEFICIENCIES

Problem Area ID	Location Description	First Storm Event with Surcharging[1,2]	First Storm Event with Flooding
MI-1	Columbia Boulevard	-	2-Year
MI-2	Campbell Park	-	2-Year
MI-3	North Vernonia Road (West Side)	-	10-Year
MI-4	Sunset Boulevard	-	10-Year
MI-5	Eilerston Street	-	25-Year
MI-6	West of Mayfair Drive	-	10-Year
MI-7	Crouse Way	-	25-Year
MI-8	Trillium Street to Salmon Street	-	10-Year
MI-9	Jakobi Street and Ethan Lane	-	25-Year
MI-10	Helens Way	25-Year	100-Year

1) First storm event with surcharging only includes where the hydraulic grade reaches within 0.5 feet of the rim elevation.

2) If left blank, surcharging was not projected before the flooding event.

FIGURE 5-6: MILTON CREEK 25-YEAR MODEL RESULTS



Explanation of Deficiencies:

- **MI-1:** The 15-inch and 18-inch pipes along Columbia Boulevard do not have sufficient capacity to drain peak runoff flows, and junctions are either backing up or flooding. The City identified the problem area as the local low point where majority of the flooding occurs.
- **MI-2:** Campbell Park floods and acts as a natural detention pond. There is a slide gate in the inlet to the pipe system which restricts flow and backs up stormwater in the park. The open channel to the west of the park is also undersized and floods that side of the park.
- **MI-3:** The pipe system north of Seal Road is too undersized to convey peak flows resulting in floods south of Oakview Drive. Significant runoff drains from the residential development

areas north of these pipe segments. The residential developments have detention ponds designed to reduce peak flows, but the outflows from the ponds still overwhelm the downstream pipe network. The new pipe system south of Seal Road and parallel with Edie's Way, to the pipe draining south under Edie's Way, both appear to be too undersized for the model predicted flows.

- **MI-4:** The pipe network south of Salmon Street is undersized and was originally intended to back up into the detention pond at the corner of Sunset Boulevard and Salmon Street, however, the City has not seen any detained water in this pond. In order to properly detain the water, the outlet control structure should be inspected and retrofitted as needed. Another pipe is present with an adverse grade south of Shore Drive, and there are pipes with 0% slope to the outfall, which causes stormwater to back-up within the trunkline.
- **MI-6:** At this catch basin, the stormwater drains to an open area south of Oakwood Road. Runoff enters through the catch basin and drains east to the trunkline along Mayfair Drive. The pipe appears to have an adverse grade and flows back toward the open area.
- **MI-5, MI-7, MI-8, MI-9, and MI-10:** These locations all have undersized pipes when it comes to peak flows. Since the pipes are too small, stormwater backs-up in upstream pipes and surcharging or flooding can occur because of the undersized pipes downstream.

5.2.7 MCNULTY CREEK BASIN

McNulty Creek Basin also extends north, outside of the UGB, and is primarily comprised of residential developments on the north half of the basin as well as commercial and industrial land use toward the southern half. Many of the residential developments have independent stormwater systems which discharge directly into McNulty Creek or into large channels that lead to McNulty Creek. There is only one long pipe network draining from Pittsburg Road in the north to a large wetland area on the eastern side of the Columbia River Highway. The City identified two areas in McNulty Creek Basin where historical flooding has previously occurred.

The first area where flooding occurred took place south of Columbia Boulevard and Sykes Road intersection. Model evaluation demonstrates how the trunkline was surcharged and flooded locally at a low point in the system. This historical flooding reportedly decreased after the outfall east of the Columbia River Highway was recently cleared out. However, the model projects flooding occurring in this area even with free discharge at the outfall.

The second area where flooding has occurred was between Harris Street and Elm Street, which in this area, stormwater is discharged from a pipe network, through an open channel, and back into the pipe network. Overall, flooding was not projected in the model and both the open channel and pipe network appear to be adequately sized for peak flows. Table 5-8 and Figure 5-7 show the observed deficiencies.

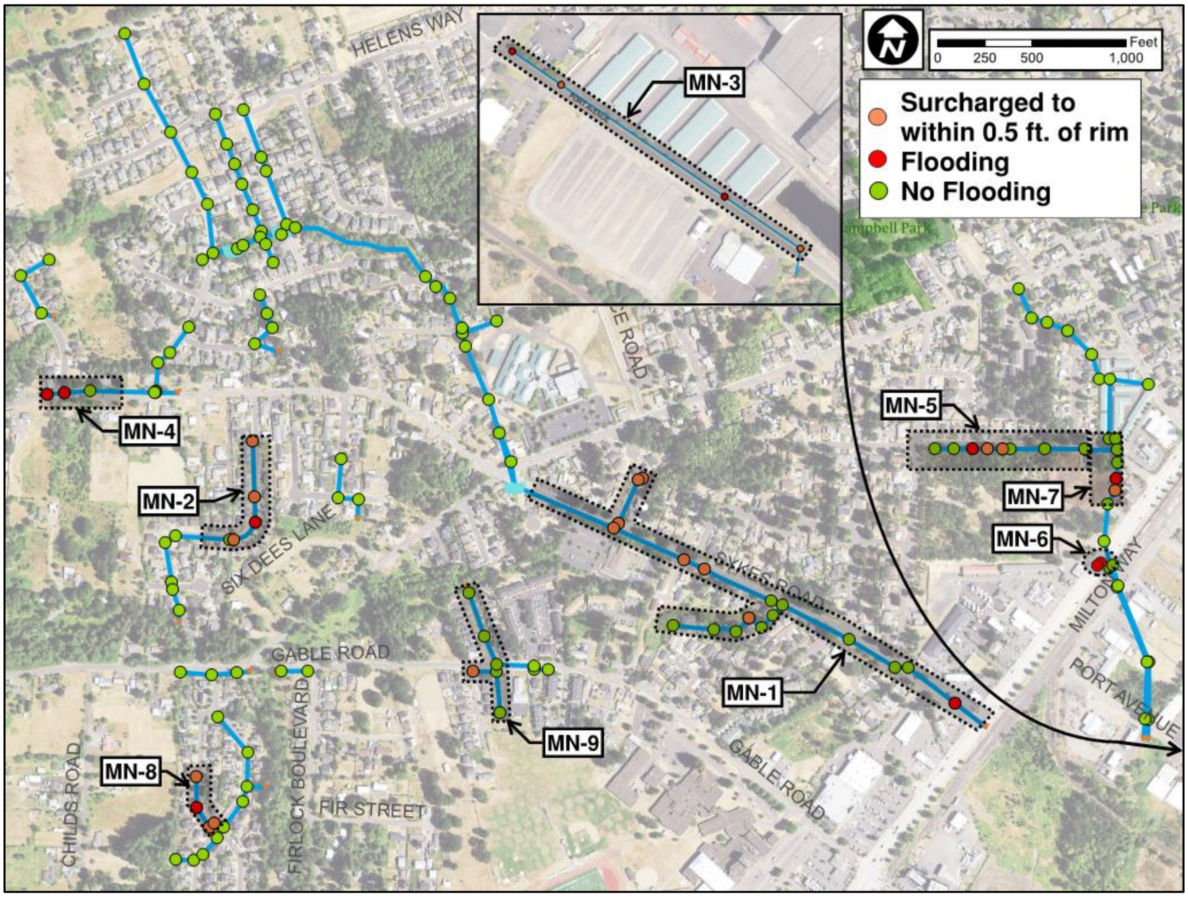
TABLE 5-8: SUMMARY OF MCNULTY CREEK BASIN EXISTING DEFICIENCIES

Problem Area ID	Location Description	First Storm Event with Surcharging[1,2]	First Storm Event with Flooding
MN-1	Sykes Road	-	10-Year
MN-2	Whitetail Avenue	-	10-Year
MN-3	Port Avenue	-	10-Year
MN-4	Sykes Road and Mountain View Drive	-	25-Year
MN-5	McBride Street	-	25-Year
MN-6	Columbia River HWY Ditch	-	25-Year
MN-7	McBride Street and Columbia River HWY		25-Year
MN-8	Evergreen Loop	-	25-Year
MN-9	Gable Road and Elizabeth Lane	25-Year	100-Year
MN-10	Ridgecrest Subdivision	-	100-Year

1) First storm event with surcharging only includes where the hydraulic grade reaches within 0.5 feet of the rim elevation.

2) If left blank, surcharging was not projected before the flooding event.

FIGURE 5-7: MCNULTY CREEK BASIN 25-YEAR MODEL RESULTS



Explanation of Deficiencies:

- **MN-1:** The Sykes Road stormwater pipes are 24-inch in diameter south of Columbia Boulevard intersection and increase after to 27-inch in diameter near Matzen Street intersection. The pipeline then reduces to a 24-inch diameter pipe right before its outfall on the east side of the Columbia River Highway. The 24-inch diameter pipes are undersized, causing flooding through the whole pipe network, including its smaller branches.
- **MN-2, MN-3, MN-4, MN-7, and MN-9:** These pipes are undersized for peak flows and causes both surcharging and flooding in the upstream pipe network to occur.
- **MN-5:** The first two pipes east of the McBride Street and Matzen Street intersection were installed as detention storage and the model indicates the existing storage volume is not sufficient. Surcharging and flooding occurs at the manholes with the lowest rim elevations.
- **MN-6:** Upstream pipes discharge into an open channel on the southeast side of the Columbia River Highway and drain along the road for approximately 100 feet before entering the pipe network through two 24-inch inlets. This open channel is relatively flat and is overtopping its approximately 3-foot channel walls.
- **MN-8:** An adverse grade in a small segment of pipes crossing Evergreen Loop restricts flow and causes surcharging in the upstream pipe network.

5.3 STAFFING EVALUATION

The following section summarizes existing stormwater staffing levels, identifies deficiencies in existing staffing levels, and provides staffing recommendations for the City of St. Helens.

5.3.1 GENERAL

The City Public Works (PW) Operations staff are responsible for the operations and maintenance (O&M) of the stormwater system in St. Helens. On February 25th, 2021, PW Operations staff was interviewed by Keller Associates to assess existing levels of stormwater staffing and annual O&M activities, identify deficiencies in staffing and equipment, and provide recommendations to assist the City in meeting level of service (LOS) goals for the local stormwater system. To summarize, the PW Operations staff currently provide support for many City activities that are not directly related to public utility O&M (i.e., building maintenance, building remodels, City events, etc.). The sections below provide more detail regarding existing stormwater system staffing and recommendations based on the findings from the PW Operations staff interviews.

5.3.2 EXISTING STORMWATER STAFFING

During staff interviews, the general roles and responsibilities of PW Operations for the stormwater system O&M was reviewed. A list of O&M activities and approximate time, frequency, and size of crew was developed to evaluate the approximate annual labor hours spent on stormwater O&M. The primary O&M activities include responding to areas of historical flooding during large rain events, cleaning facilities, maintaining ditches and detention facilities, in-house stormline replacement or extensions, street sweeping, responding to reported problems, and construction permitting and inspections. It is estimated that approximately 3.0 full time employee (FTE) is spent annually on stormwater collection O&M activities.

The current budgeted FTE for stormwater collection systems O&M is approximately 4.20 FTE, which includes 0.75 FTE from the engineering department for construction, inspection, and permitting support, as well as in-house replacement and extension project support. Additional discussions with the PW Operations and engineering staff made clear the fact that they are being requested to complete significant tasks and projects outside of utility O&M. Some of these tasks include, but are not limited to, building maintenance; building remodels and renovations; City events setup, takedown, and traffic control; park projects and maintenance; and groundwork for City projects. It is estimated that the PW Operations staff spend 30%-40% or more of their time completing work that is not directly related to utility O&M. These additional tasks pull the PW staff away from utility maintenance activities and prevent them from spending the allocated FTE on utility O&M. Existing maintenance practices on the stormwater system tend to be reactive because of the additional projects the PW Operations staff must complete, and as a result, the time they can spend on utility O&M is minimized.

5.3.3 RECOMMENDED STORMWATER O&M AND STAFFING

LOS goals were discussed with PW Operations staff for the stormwater system. The desired LOS goals are summarized below.

- No excessive flooding in stormwater system
- No property damage from stormwater
- Address reported problems in a timely manner to prevent interruptions to service
- Complete regular maintenance, repairs, and replacements to minimize interruptions and failures (perform proactive O&M in lieu of reactive O&M)

A summary of recommended general O&M activities to achieve these LOS goals and follow industry good practices are listed below.

- Clean and CCTV inspect storm lines once every two years (approximately 1/2 system annually)
- Repair or replace defects as identified
- Clean catch basins and manholes every two years (approximately 1/2 of system annually)
- Clean and inspect 100% of ditches and inlet/outlet grates annually
- Sweep all roadways approximately twice per year
- Perform general detention facility maintenance annually
- Respond to problems as they are identified or reported
- Install minor in-house storm line replacements and extensions (similar to existing practice)
- Facilitate public education and outreach
- Complete construction inspection and permitting
- Comply with new Mercury TMDL implementation plan and complete annual reporting

Using similar expected labor hours for activities as the existing staffing evaluation, it is estimated that approximately 4.25-4.5 FTE are needed to meet the O&M and LOS goals described above. A mercury TMDL implementation plan is being developed parallel to this master plan and staffing needs should be re-evaluated after DEQ approval of the implementation plan for the developed mitigation strategies.

As budgeted, the existing stormwater FTE staff appears to be adequate. However, the additional projects and work the PW Operations staff are currently requested to complete, significantly decreases the budgeted FTE that can be spent on stormwater O&M. The recommendation would be that either additional FTE be budgeted for the PW Operations staff to complete the existing workload requested, or the responsibilities of the PW Operations staff be reduced to focus solely on utility O&M. The staffing evaluation for this report is a high-level, initial estimate. The City would benefit from tracking the number of hours the PW Operations staff spend on various activities and utilities throughout the year to assess how best to budget and allocate resources in order to provide recommended O&M on utilities. It is also recommended that staffing needs be reevaluated every two to three years.

In addition to annual O&M discussed above, an annual replacement program should be maintained. Stormwater infrastructure replacement and rehabilitation needs will increase as the system ages, so it would be beneficial for CCTV inspection reports to be reviewed to prioritize rehabilitation and replacement efforts. An annual replacement program is an important part of proactively maintaining the stormwater system. Staffing FTE and construction cost for an annual replacement program were not included in the staffing evaluation, but construction costs are discussed and estimated in Section 8. If the PW Operations staff are asked to be responsible for and complete some of the rehabilitation or replacement work, the budgeted FTE for the PW Operations staff would be increased.

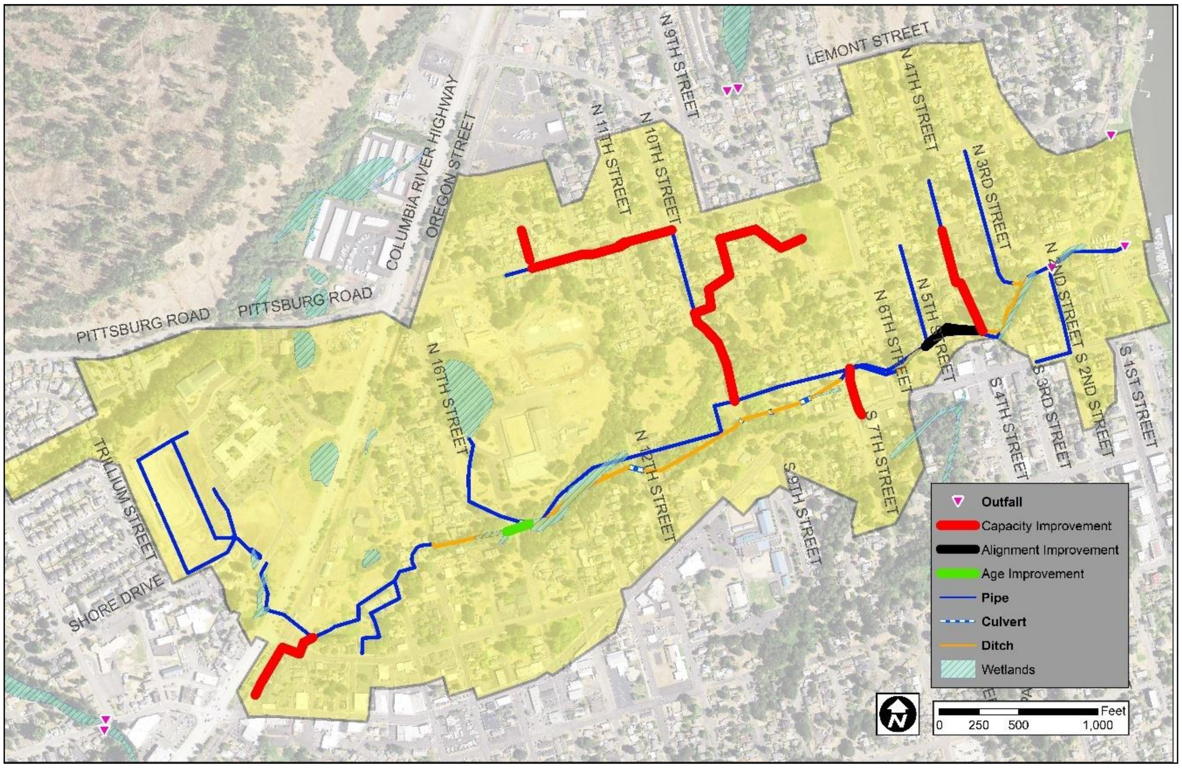
SECTION 6 - ALTERNATIVES ANALYSIS

The following section discusses solutions intended to resolve system deficiencies identified in Section 5. To summarize, one to two alternatives were evaluated for each of the identified problem areas. A detailed description of the recommended solutions for areas with only one alternative considered were not included in this section, however, a description of the proposed solution is provided in Section 7. Alternatives considered in this evaluation included parallel or replacement of conveyance systems, flow rerouting, and detention or retention storage facilities. While the primary focus of this alternatives analysis was to address deficiencies in the existing system's condition and capacity, improvements to address water quality were also considered at a conceptual level. Detailed cost estimates for the proposed alternatives can be found in Appendix C. Also included in this section, is the recommended alignment of the City's future stormwater system incorporating the new riverfront development property and future growth areas as identified by the City for the 20-year planning period.

6.1 NORTH TRUNK BASIN ALTERNATIVES

The deficiencies identified in the North Trunk Basin included surcharging and flooding in the upstream pipe networks due to undersized pipes. The majority of these deficiencies are to be resolved by increasing the capacity of the pipe networks and no additional alternatives were identified as feasible or cost saving. Additionally, a section of pipes between N 5th Street and N 4th Street appear to have been installed underneath existing structures and it is recommended to confirm the alignment of these pipes. If the pipes are located beneath existing structures, it is recommended to abandon and realign these pipes out from under existing structures. As discussed in Section 5, pipes installed before the 1980s are likely reaching the end of their useful life and should be inspected and replaced or inspected and repaired. Multiple alternatives for these pipes were not evaluated in the North Trunk Basin. The pipes recommended to be replaced to increase capacity (shown in red), adjusted location and alignment (shown in black), or to be replaced due to age (green) are highlighted below in Figure 6-1.

FIGURE 6-1: NORTH TRUNK REPLACEMENT PIPES



The primary focus area in the North Trunk Basin alternatives analysis was from N 17th Street, draining northeast, to Godfrey Park. The existing stormwater system is comprised of two parallel stormwater networks which split on the east side of N 15th Street between a 21-inch and 24-inch pipeline (to be referred to as Columbia Boulevard Trunkline) and a network consisting of closed pipe (varying in diameter), open ditches, and culverts (to be referred to as Columbia Boulevard Ditch Network). Both systems run from N15th Street to Godfrey Park. Deficiencies were identified in the Columbia Boulevard Trunkline in the existing system evaluation and the trunkline appears to be too undersized for the projected model flows because the hydraulic grade line overtops the rim elevation. Deficiencies were also identified in the Columbia Boulevard Ditch Network and include four undersized culverts. The Columbia Boulevard Ditch Network drains through an existing wetland between N 16th Street to N 5th Street as shown in the City's LWI (1999). The wetlands were identified as Palustrine Forested Wetlands and are characterized by steep side slopes with a broad flat area between N 15th Street and N 12th Street.

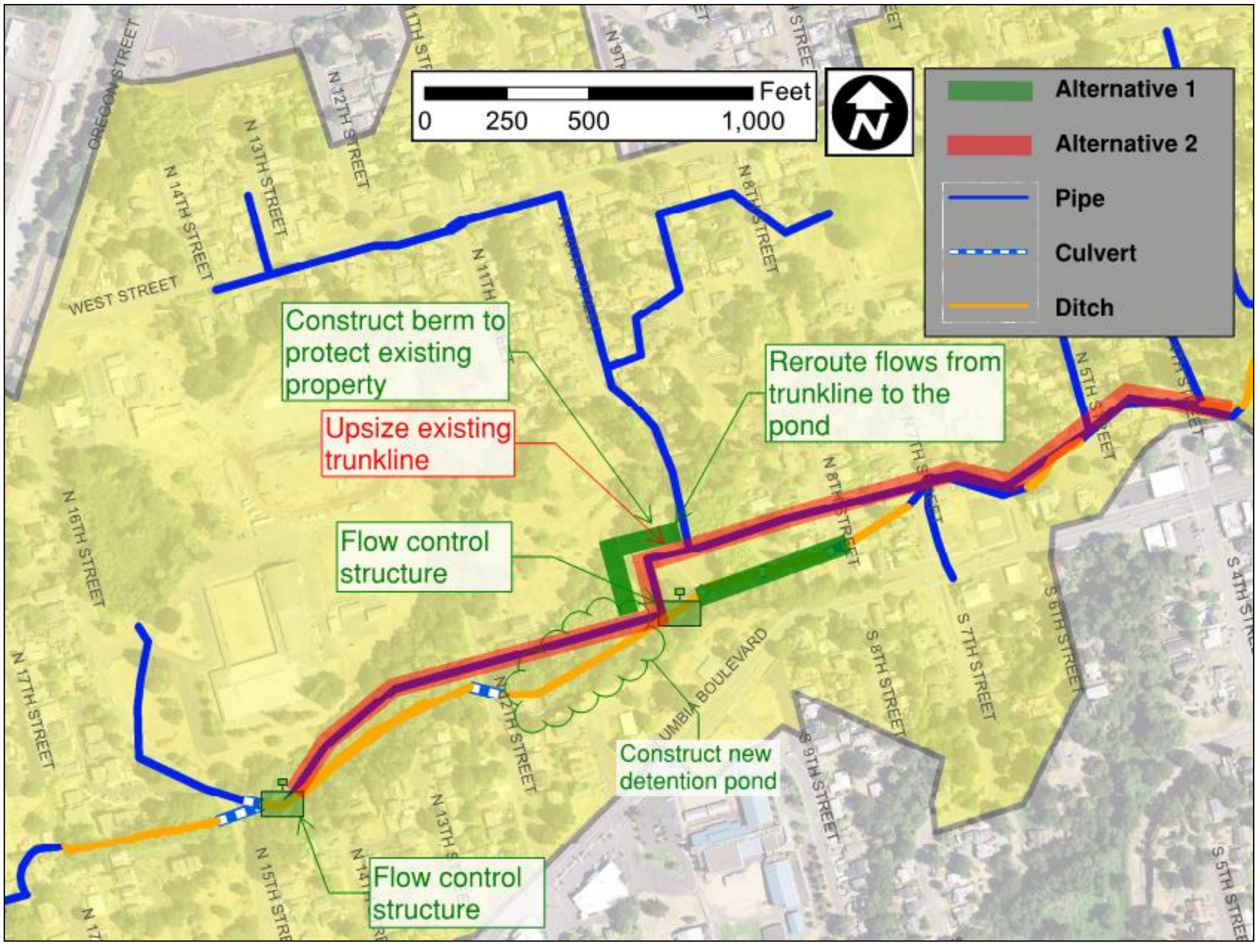
Two alternatives were considered to address the deficiencies north of Columbia Boulevard which are illustrated in Figure 6-2 and summarized below:

- ► Alternative 1: Install a flow control structure on the east side of N15th Street to control the flow split between Columbia Boulevard Trunkline and Columbia Boulevard Ditch Network. The flow control structure will divert most of the flows to the Columbia Boulevard Ditch Network. Alternative 1 utilizes open space and natural topography allowing for a new detention storage to be constructed in the area between N 12th Street and N 10th Street by installing a new flow control structure at the outlet culvert on the west side of N 10th Street. The purpose of this flow control structure is to detain water in the new detention pond and limit peak flows to the downstream network. The detention pond would need a storage volume of approximately 7 acre-feet. Note, a berm will likely need to be constructed at the northeast border of the pond to prevent stormwater from draining across the existing property within the ravine. The flows from the existing trunklines draining south along N

10th Street would need to be rerouted to discharge into the new detention pond, which would relieve flooding in the Columbia Boulevard Trunkline.

- Alternative 2: Install a flow control structure on the east side of N 15th Street (similar to Alternative 1) and direct most of the flows down the Columbia Boulevard Trunkline. Upsize the existing Columbia Boulevard Trunkline from 21- and 24-inches to 36-inches from North 15th Street to Godfrey Park.

FIGURE 6-2: NORTH TRUNK ALTERNATIVES



Both Alternatives 1 and 2 are viable options to address deficiencies identified in the North Trunk Basin. Alternative 1 utilizes the natural topography and available open space to reduce stormwater impacts downstream and also provides the City with opportunities to install features to improve water quality. Alternative 2 may eliminate the need to replace the existing culverts on the Columbia Boulevard Ditch Network but in response, it will increase peak flows at Godfrey Park and Alternative 2 does not provide any easy options for addressing water quality. A summary of the pros and cons to each of the alternatives is provided in Table 6-1.

TABLE 6-1: NORTH TRUNK BASIN ALTERNATIVES COMPARISON

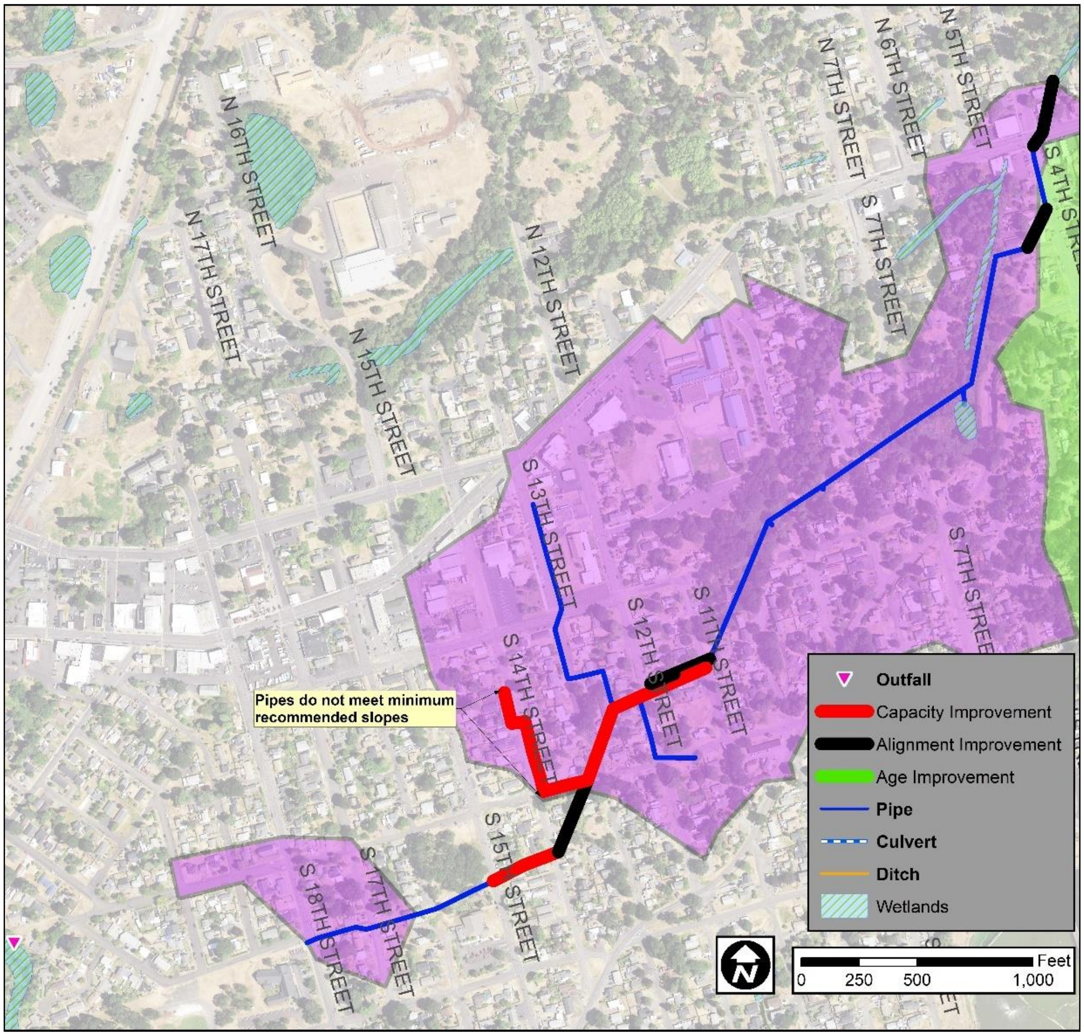
	Pros	Cons	Estimated Cost
Alternative 1	- Utilizes natural detention - Opportunities to increase water quality - Minimal pipelines to be upsized	- Requires acquisition of property to detain flows - Neighborhood impacts - Requires wetland delineation	$1,200,000
Alternative 2	- Lower maintenance - No wetland delineation - Reduces flows through existing Ditch Network	- Higher capital costs - Potential bedrock excavation - Increases peak flows at Godfrey Park	$2,800,000

► Recommendation: Alternative 1 is recommended based on the information provided above. Alternative 1 utilizes natural detention and topography to reduce peak flows to the downstream network and increases water quality discharging into the Columbia River. Alternative 1 also has lower capital costs to Alternative 2 as seen in Appendix E.

6.2 MIDDLE TRUNK BASIN

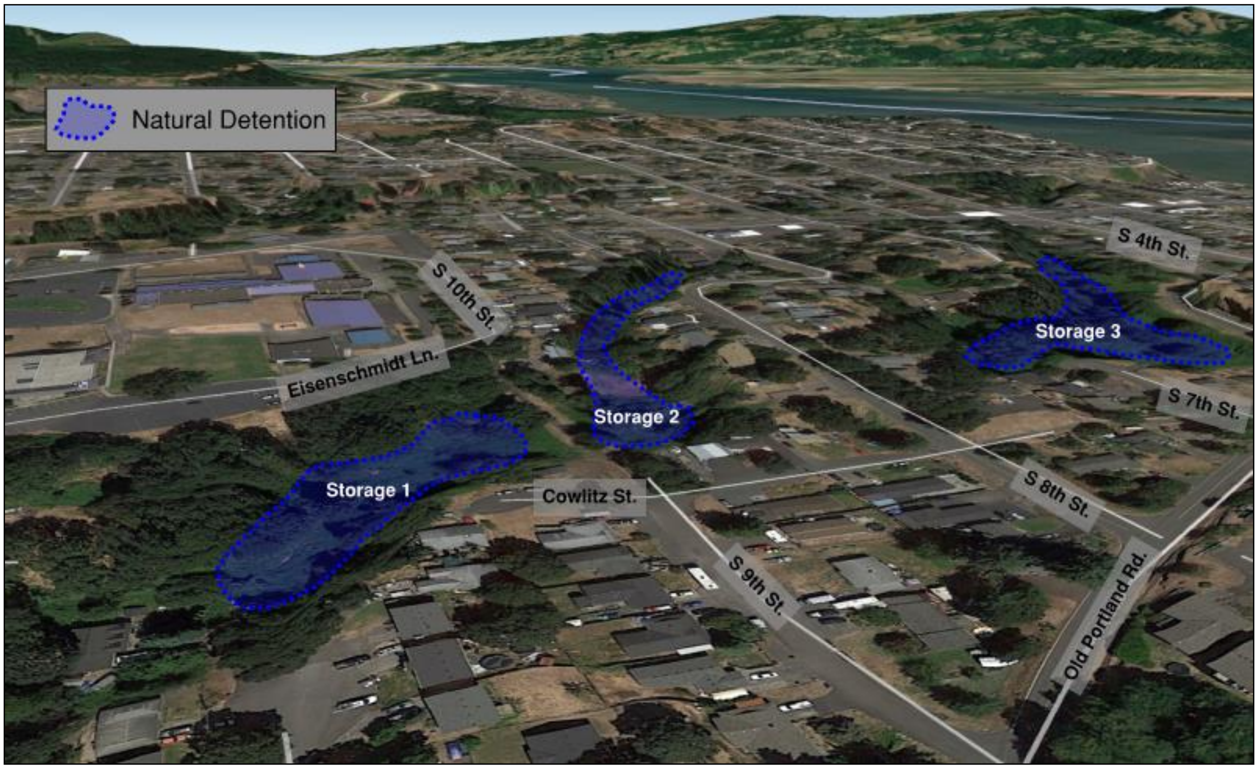
Deficiencies identified in the Middle Trunk Basin include surcharging and flooding of the main trunkline running from N 18th Street to Godfrey Park as well as the trunkline draining from N 14th Street and connecting to the main trunkline. There are pipes in the basin that do not meet the recommended minimum pipe slopes. It is recommended that these pipes be replaced to provide minimum pipe slopes to reduce localized flooding and surcharging. Additionally, there were multiple pipes identified where the GIS alignment indicated pipes crossing underneath existing structures, and the pipe alignments should be investigated. If the alignments are found to cross under existing structures, it is recommended the City abandon or remove and relocate any pipes from underneath those existing structures. The pipes identified to be upsized would benefit from being realigned in order to reduce the number of crossings through private property and eliminate crossings underneath existing structures. Figure 6-3 highlights the pipes recommended to be replaced.

FIGURE 6-3: MIDDLE TRUNK BASIN REPLACEMENT PIPES



Alternatives considered in the Middle Trunk Basin focused on solutions to alleviate flooding in the trunkline starting at N 18th Street and ending at Godfrey Park. This trunkline conveys stormwater from southwest to northeast where it discharges into Godfrey Park. The trunkline runs through three ravines which could potentially serve as natural detention and provide a solution to the existing flooding and surcharging. The first natural storage location (Storage 1) can be found between Cowlitz Street, the northeast side of S 10th Street, and Eisenschmidt Lane from S 10th Street to S 9th Street. Part of the natural ravine is located south of Cowlitz Street between S 11th Street and S 10th Street. There are existing residential structures located within the ravine. These dwellings reduce the usable detention storage volume in the ravine, although use of the natural topography for detention storage is still an option. The second natural storage location (Storage 2) is located between S 9th Street and S 8th Street. The third storage location (Storage 3) is east of S 8th Street and west of S 4th Street. Storage 3 consists of two identified wetlands: an approximately 0.3-acre Palustrine Scrub-shrub wetland and an approximately 0.8-acre Palustrine Forested wetland. The three potential storage locations are shown in Figure 6-4.

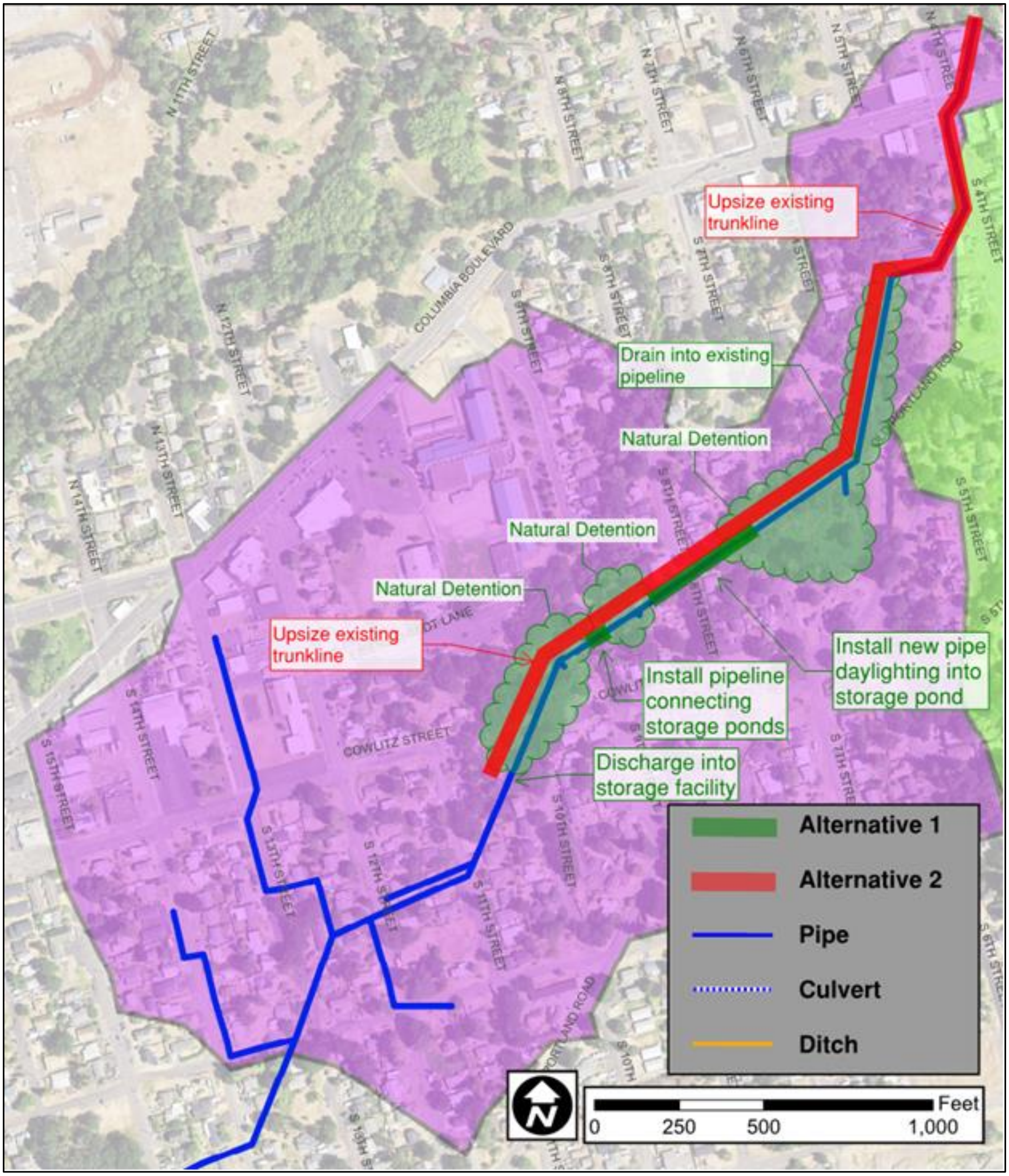
FIGURE 6-4: MIDDLE TRUNK NATURAL DETENTION STORAGE LOCATIONS



Two alternatives were evaluated to address the deficiencies, and descriptions of the two alternatives considered are included below. Figure 6-5 shows the two evaluated alternatives.

- Alternative 1: Upsize the existing 18-inch pipe to 36-inch pipe along S 13th Street to a new outlet at Storage 1. A berm should be constructed, or Storage 1 should be excavated down to protect the existing structures in the ravine because Storage 1 needs approximately 3 acre-feet of available volume. Install an outlet under S 9th Street from Storage 1 to Storage 2, and Storage 2 would need a volume of approximately 3 acre-feet. Install a new pipe to drain water from Storage 2 to Storage 3. Water quality will need to be addressed before discharging to Storage 3 because the area is identified as a wetland. Additional efforts will be required to incorporate the wetlands into Storage 3 and will likely include wetland delineation, permitting from United States Army Corps of Engineers (USACE) and DSL, and a hydrologic study on the impact of additional flows discharging to the wetlands. Storage 3 needs approximately 8 acre-feet of storage. Install an inlet to the existing 18-inch pipeline which drains to S 4th Street and Godfrey Park.
- Alternative 2: Upsize the existing pipeline from 18-inches to 36-inches from S 13th Street to the outlet at Godfrey Park.

FIGURE 6-5: MIDDLE TRUNK ALTERNATIVES



The pros and cons for the two alternatives are relatively similar to the alternative comparison in the North Trunk Basin. Alternative 1 provides stormwater detention which decreases downstream peak flows and increases water quality. Alternative 2 has lower capital costs but will likely increase the existing flows through Godfrey Park. The two alternatives' pros and cons are summarized in Table 6-2.

TABLE 6-2: MIDDLE TRUNK BASIN ALTERNATIVES COMPARISON

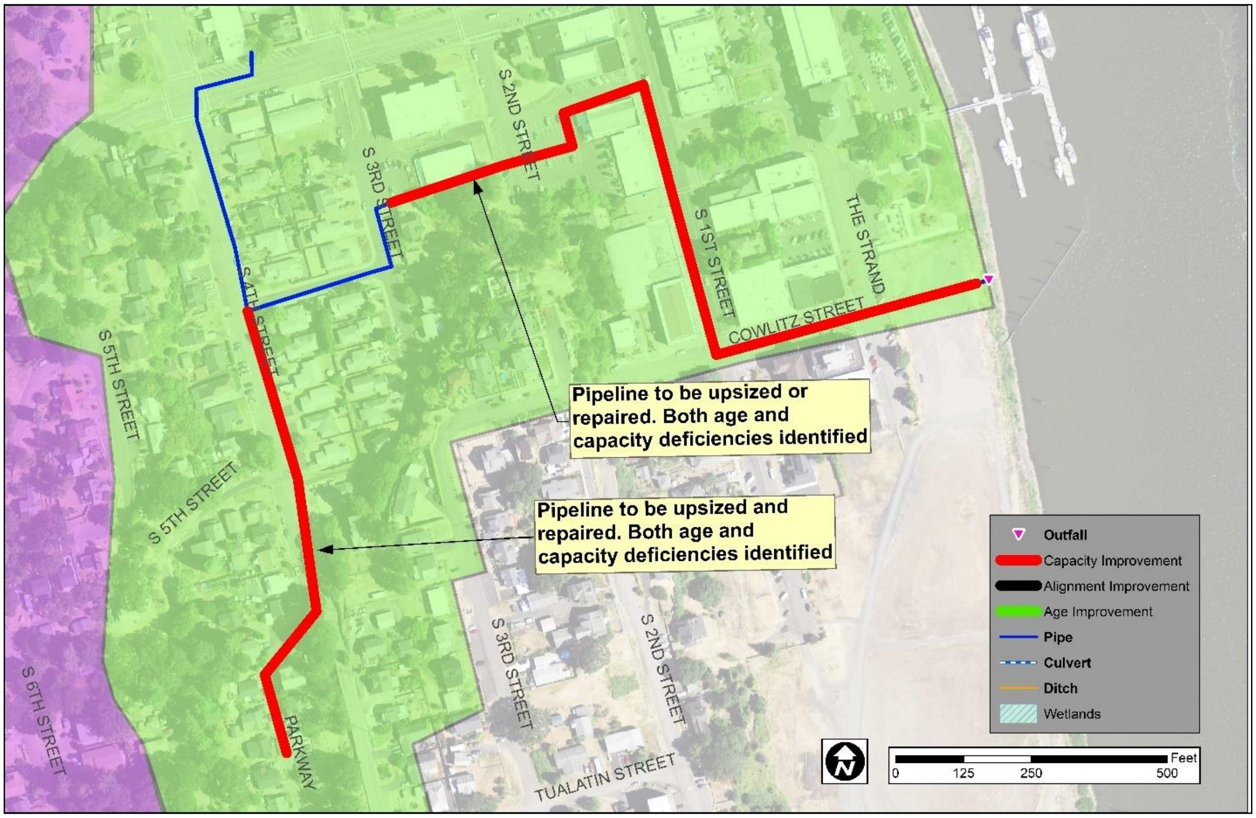
	Pros	Cons	Estimated Cost
Alternative 1	- Utilizes natural detention and wetlands - Opportunities to increases water quality - Minimal pipelines to be upsized	- Requires acquisition of property to detain flows - Requires enviromental permitting and analysis - Additional maintenance efforts	$2,000,000
Alternative 2	- Lower maintenance - Simplified construction	- Potential bedrock excavation - Increases peak flows at Godfrey Park	$3,400,000

► Recommendation: Given the opportunities for detention provided by the natural topography throughout the Middle Trunk Basin, Alternative 1 is recommended and will result in lower peak flows through Godfrey Park, provide opportunities to increase water quality, and minimize the amount of pipe to be replaced or upsized.

6.3 DOWNTOWN BASIN

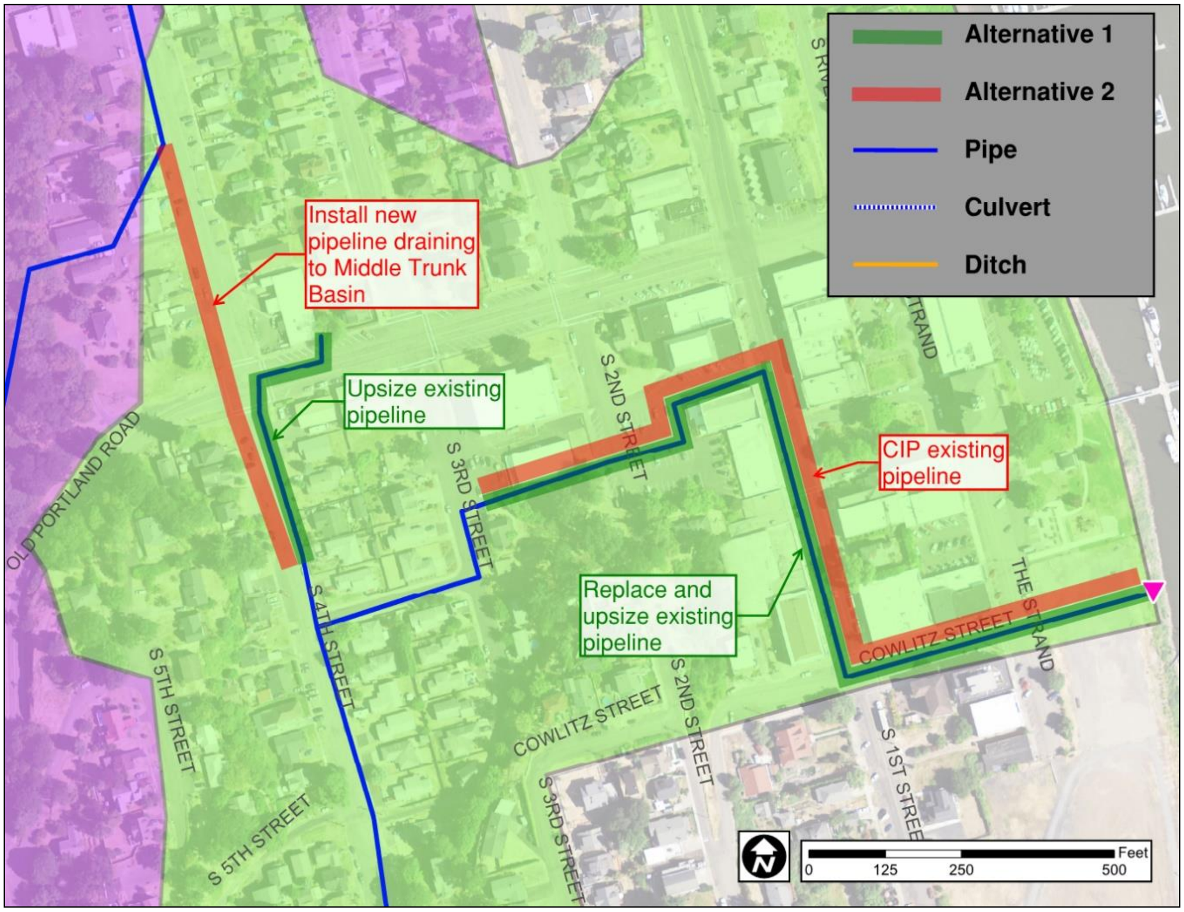
The City is not currently aware of any surcharging or flooding in the Downtown Basin. The model evaluation identified two deficiencies (details in Section 5) where flooding and surcharging occurred in the upstream branches of the pipe network. One of the deficiencies identified (DT-2) included multiple segments of concrete pipe, which were installed in the late 1960s, and only one alternative was evaluated for this segment of pipeline: replace pipeline as it reaches the end of its useful life. Additionally, the 24-inch pipeline from S 3rd Street to the outfall was concrete installed around the same time. The upper segments of this pipeline were also identified as being undersized and should be upsized at the time of replacement. Pipe condition assessments will need to be completed in order to provide information on pipe segments in the area that should be replaced based on physical condition. Two alternatives were considered to address the identified deficiencies and are discussed later in this section. Figure 6-6 shows the two pipe segments that are advised to be inspected and replaced or repaired.

FIGURE 6-6: DOWNTOWN BASIN REPLACEMENT PIPES



The two alternatives evaluated in this basin are targeted toward alleviating flooding in the pipe network along S 4th Street, which was identified through modeling, and to address the aged 24-inch pipes draining east to the outfall. The two alternatives considered are illustrated in Figure 6-7 and the improvement descriptions are provided below. Both alternatives include upsizing the pipe along Parkway as shown in Figure 6-7.

FIGURE 6-7: DOWNTOWN BASIN ALTERNATIVES



- Alternative 1: Replace the 24-inch concrete pipeline with 36-inch pipe from S 3rd Street to the outfall. Upsize the existing 12-inch pipeline from the north side of Old Portland Road to the existing 24-inch pipe to the south. Note, this alternative will require acquiring additional permitting (USACE 404 Permit and DSL Removal-Fill Permit) for the replacement of pipelines at the outfall to the Columbia River.
- Alternative 2: Install cured-in-place pipe (CIPP) through the existing 24-inch concrete pipe from S 3rd Street to the outfall. Install new 18-inch pipeline along S 4th Street draining north and connect to the existing 18-inch trunkline discharging to Godfrey Park.

Alternative 1 increases the capacity of the trunkline draining to the outfall which would provide the City with an opportunity to connect additional connector pipelines through this outfall. However, as discussed above, this alternative will result in a need for additional environmental permitting. Alternative 2 utilizes CIPP to reduce the overall capital costs of repairing the old pipeline, but it could result in minor capacity reduction of the trunkline. Alternative 2 requires the installation of a new pipeline along S 4th Street, and a new connection to the Middle Trunk Basin draining to Godfrey Park, therefore, the improvements to the Middle Trunk Basin must be completed before making this connection. The hydrologic impact of adding stormwater flows to Godfrey Park should also be evaluated in this Alternative. Lastly, Alternative 2 would include a conditions assessment of the existing outfall, and if outfall improvements are needed, the additional environmental permitting required for Alternative 1 would also be required for Alternative 2. The pros and cons of the two alternatives are summarized below in Table 6-3.

TABLE 6-3: DOWNTOWN BASIN ALTERNATIVES COMPARISON

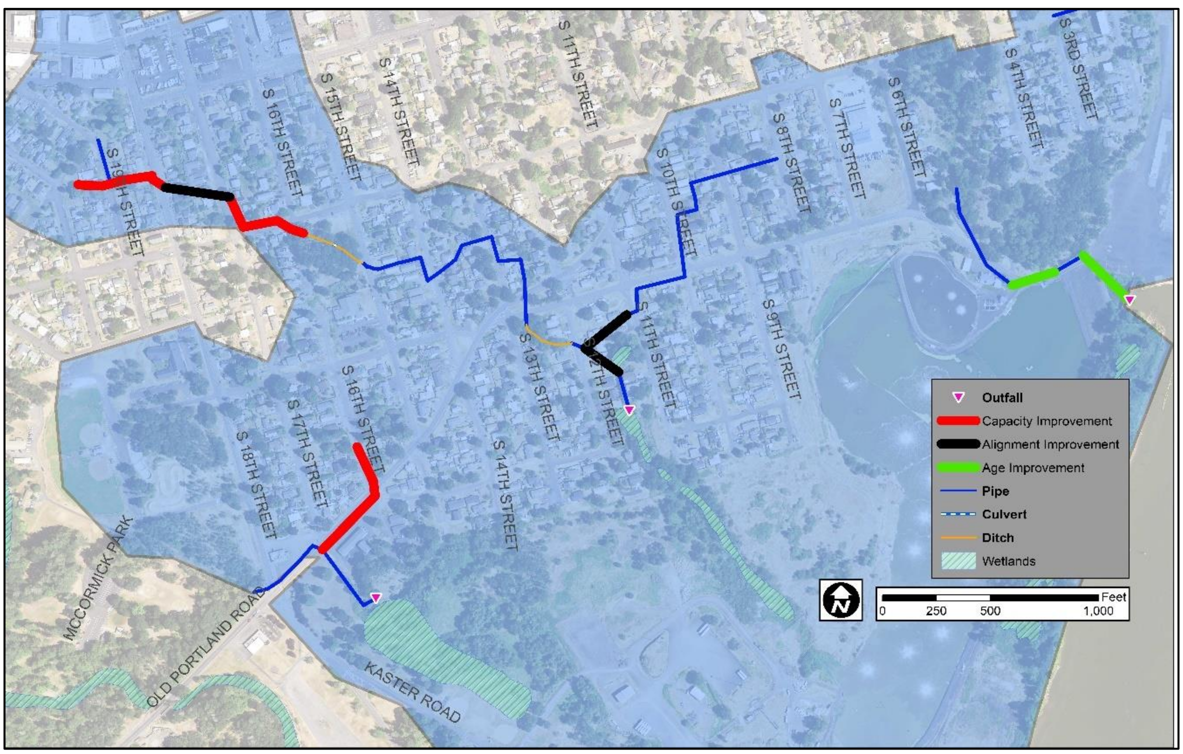
	Pros	Cons	Estimated Cost
Alternative 1	- Keeps existing stormwater drainage in the same basin - Increases capacity of trunkline	- Requires environmental permitting - Higher capital costs	$2,400,000
Alternative 2	- Lower Capital Costs - Minimize pipeline upsizing	- Requires upsizing of Middle Trunk pipes - Reduces capacity of the existing trunkline	$1,200,000

► Recommendation: Alternative 1 is recommended over Alternative 2 because it would provide the City with more of an opportunity to both collect stormwater and convey stormwater through existing pipeline to the outfall location.

6.4 GREENWAY BASIN

Deficiencies in the Greenway Basin were identified in four locations throughout the existing stormwater system. Two of the four deficiencies were evaluated with only one alternative, which consisted of upsizing the existing pipe. There are also two CMP segments that were installed in the early 1970s near Plymouth Street outfall. It is recommended that these pipelines be evaluated and replaced if the pipe conditions require it. Figure 6-8 shows the pipes recommended to be replaced based on capacity or age deficiencies.

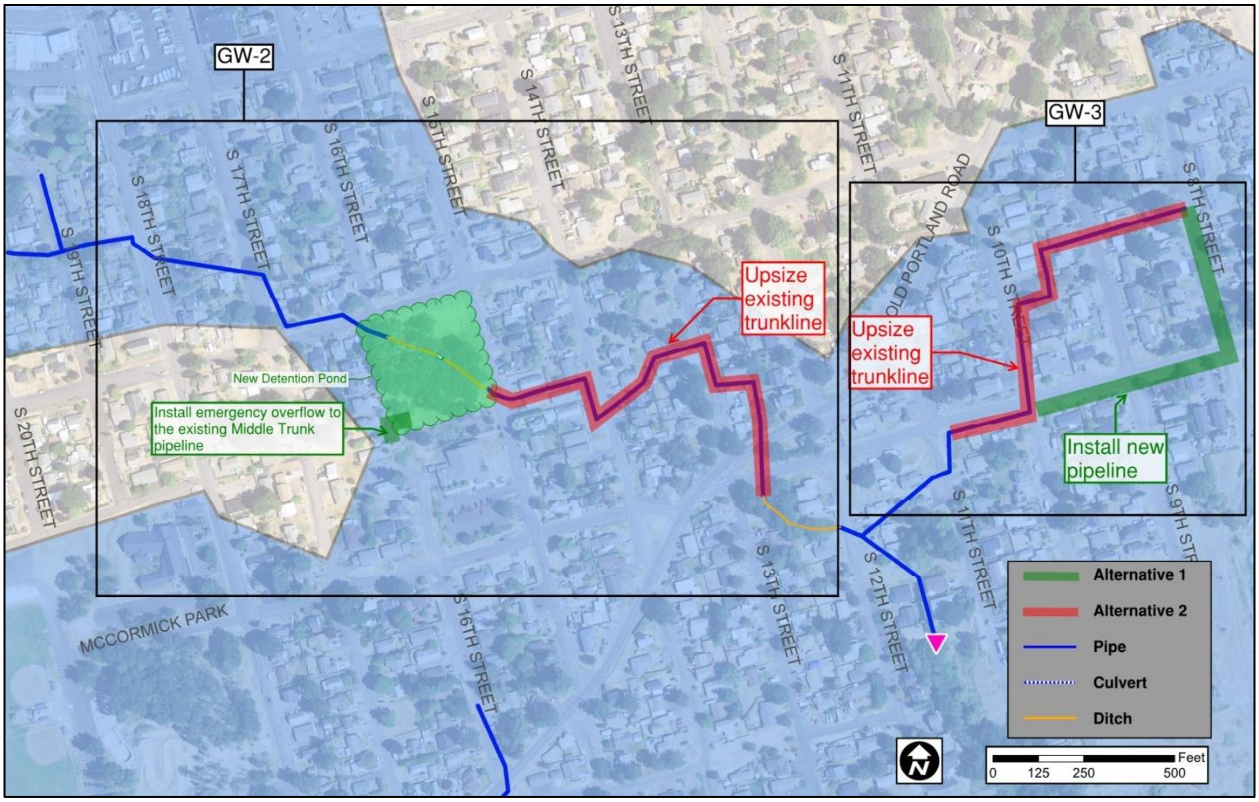
FIGURE 6-8: GREENWAY BASIN REPLACEMENT PIPES



Two alternatives were evaluated for the remaining two deficiencies identified in the Greenway Basin (GW-2 and GW-3). GW-2 consisted of flooding at Heinie Huemann Park because stormwater flows back up into the park causing unofficial detention before discharging downstream. A detailed survey was not completed of Heinie Huemann Park, but it is assumed the park contains the volume of detention required to handle the 25-year storm because according to the model, the required storage to pass the 25-year storm is approximately 1.7 acre-foot. GW-3 includes a 12-inch pipeline in lieu of a stormwater pump station, and the 12-inch line does not have the capacity to convey the design storms. Two alternatives were evaluated to address the identified deficiency. Two alternatives for each deficiency are described in the paragraphs and Figure 6-9 below.

- Alternative 1 (GW-2): Improve the existing detention pond in Heinie Huemann Park designed to pass the 25-year storm event. Improvements would include installing an outlet control structure at the southeast end of the park and construction of a berm on the south and west borders to prevent the detained volume from flowing onto S 16th Street or causing damage to the St. Helens Senior Center. Recommended improvements also include installing a sediment forebay to collect sediment and leaves from the oak trees throughout the park. Based on model calculations, the storage pond would need to have a peak storage of approximately 1.7 acre-feet to prevent upsizing pipes downstream.
- Alternative 2 (GW-2): Upsize the existing pipelines to 36 inches downstream of Heinie Huemann Park to discharge into a ditch south of Plymouth Street and east of S 13th Street.
- Alternative 1 (GW-3): Install a new pipeline to drain flows from S 8th Street to Plymouth Street and southwest along Plymouth Street to connect to an existing manhole at the S 10th Street Intersection Abandon the pipe segment through private property between South 8th Street and South 9th Street.
- Alternative 2 (GW-3): Upsize the existing pipeline from 12 inches to 18 inches for S 8th Street to Plymouth Street.

FIGURE 6-9: GREENWAY BASIN ALTERNATIVES



(GW-2): The two alternatives shown above are both potential solutions. Alternative 1 eliminates the need to upsize downstream pipes and the detention pond could provide aesthetic qualities to Henie Huemann Park as well as water quality functions. However, constructing a pond in the park could decrease usable space and increase maintenance requirements. Alternative 2 would provide the City with the option to realign the pipelines to reduce the length of pipe draining through private property as well as allow for piped to be moved away from existing structures. Alternative 2 would increase peak flows at the outfall but would not result in additional maintenance efforts or reduce usable space at Heinie Huemann Park.

(GW-3): Alternative 1 provides additional opportunity to capture stormwater runoff along Plymouth Street but would likely require installing curb and gutter along S 8th Street and Plymouth Street resulting in higher capital costs. Alternative 2 addresses pipes installed at lower than recommended minimum slopes and results in a slight reduction in pipe length to maintain. The pros and cons of the alternatives are summarized below in Table 6-4.

TABLE 6-4: GREENWAY BASIN ALTERNATIVES COMPARISON

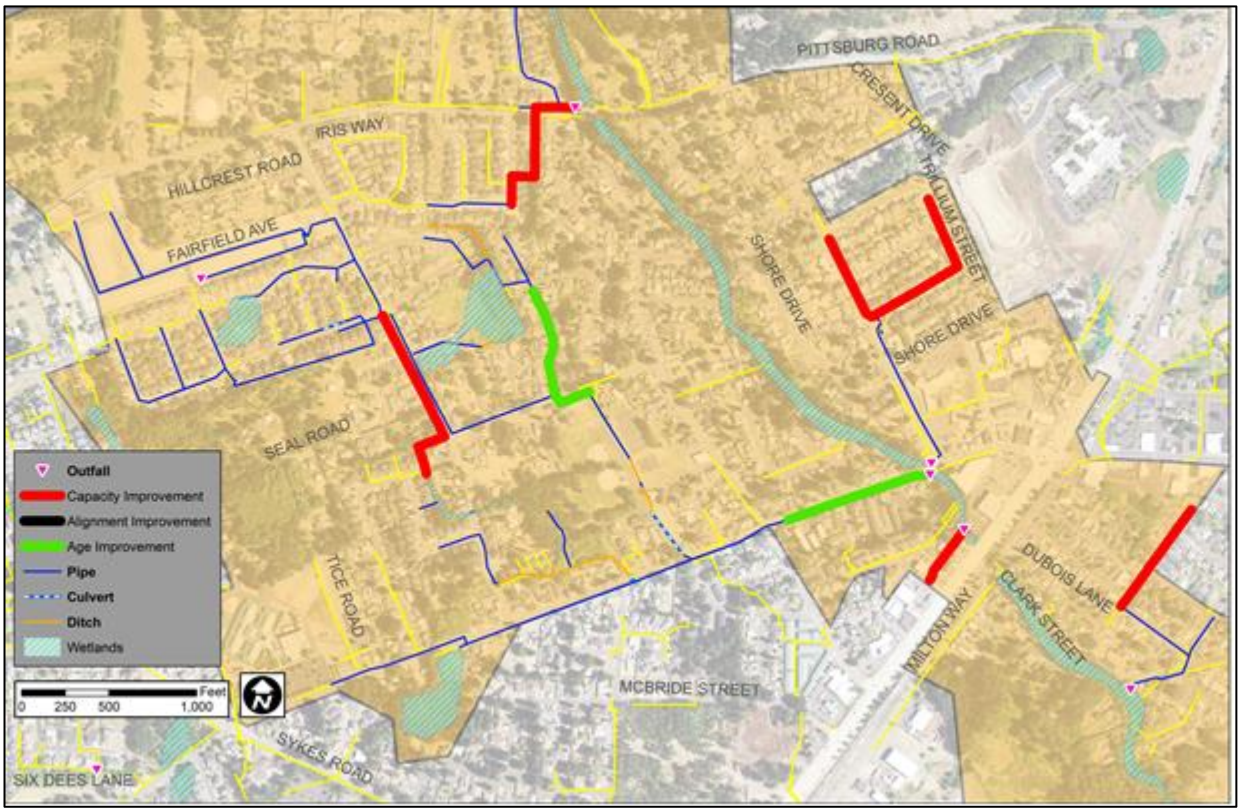
	GW-2		GW-3		
	Pros	Cons	Pros	Cons	Estimated Cost
Alternative 1	- Minimal pipe upsizing - Increased water quality - Opportunity for public park improvements	- Additional maintenance efforts - Reduced useable park area	- Additional opportunity to capture and convey runoff - Pipeline installed in right-of-way	- Additional curb and gutter recommended - Higher capital costs	$1,200,000
Alternative 2	- Lower Maintenance - Opportunity to adjust pipe alignment away from structures	- Higher capital costs - Replacement of relatively new pipe	- Less pipeline to maintain - Re-grade to recommended minimum pipe slopes	- Replacement of relatively new pipe - Construction through private property	$1,900,000

- Recommendation: Alternative 1 for GW-2 is recommended to address the deficiencies discussed above. Heinie Huemann Park is located at a strategic point in the Greenway Basin that would allow for storage to be provided, water quality to be improved, and impacts of stormwater downstream to be reduced. Neither alternatives will be recommended for GW-3 because the pipeline was recently installed to alleviate historical flooding in the area, which resolved the deficiency according to City staff. Therefore, no improvements are recommended at this time.

6.5 MILTON CREEK

Milton Creek Basin consists of multiple pipe networks which outfall into Milton Creek. Several pipe networks were identified as undersized and are recommended to be replaced with larger pipes. There are also two segments of existing pipe network that are recommended to be replaced because each are reaching the end of their useful life. The pipes recommended to be replaced or repaired are shown in Figure 6-10.

FIGURE 6-10: MILTON CREEK BASIN REPLACEMENT PIPES

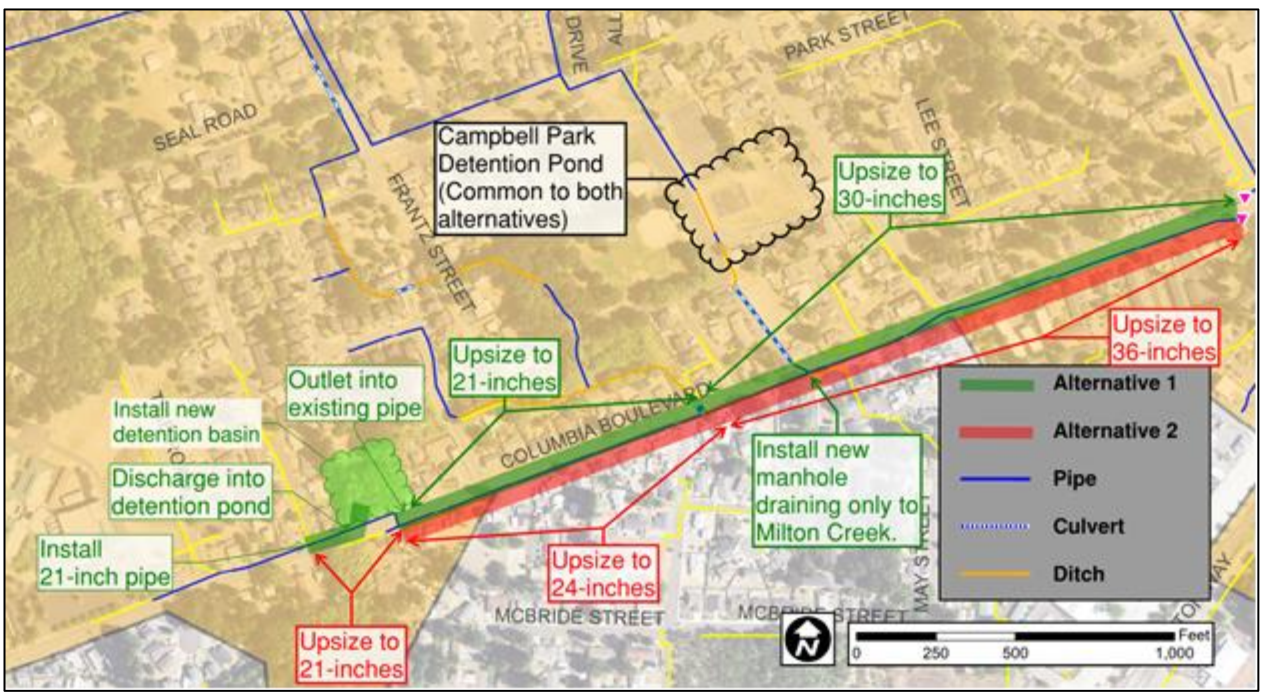


Milton Creek Basin provides opportunity for stormwater detention and storage in order to address the deficiencies not included in Figure 6-11. Two potential locations for stormwater detention were identified in this basin. The first location, Campbell Park, has already been identified by the City for a future detention pond and preliminary design of the pond is currently underway. The second location is north of Columbia Boulevard and east of Cherrywood Drive. An area south of the second location was identified by the City as a problem area because flooding occurs at the inlet to the trunkline along Columbia Boulevard. Improvements here could alleviate flooding at the inlet and reduce peak stormwater flows downstream in the trunkline.

Two alternatives were evaluated to address the deficiencies: one utilizes both the Campbell Park Detention Pond and the detention pond north of Columbia Boulevard and east of Cherrywood drive while the other alternative uses only Campbell Park to detain stormwater flows. Model calculations show the proposed detention pond at Campbell Park to be approximately 2.0 acre-feet and assumes a 0.65-acre footprint with two feet of water operating depth and an outlet structure. Pipelines installed in place of the existing ditch through Campbell Park are assumed to have the same slopes and invert elevations as the surveyed ditches. The alternatives are summarized below and illustrated in Figure 6-11.

- Alternative 1: Install a new 21-inch pipeline from Cherrywood Drive draining east and discharging off of Columbia Boulevard into a new storage pond north of Columbia Boulevard. Construct an outlet structure to drain into the existing trunkline and install an orifice to limit flows downstream. Upsize the downstream pipes on the south side of Columbia Boulevard to 21-inches from the new detention pond to the existing junction box at the intersection of Matzen Street and Columbia Boulevard. Upsize the pipes from the junction box to the outfall at Milton Creek to 30-inch pipes. Additionally, replace the existing junction box south of Campbell Park, where flows split between Milton Creek and McNulty Creek, with a manhole and then cap the pipe draining to McNulty Creek to alleviate downstream deficiencies in McNulty Creek Basin. Model calculations project the storage pond along Columbia Boulevard to be a similar approximate volume of 2.0 acre-feet with a 1.0-acre footprint, two feet of operating depth, and an orifice outlet structure. It is assumed the bottom of the detention pond is at least three feet below the road surface elevation and approximately equal to the existing invert elevation of the 18-inch pipeline crossing to the south of Columbia Boulevard. A detailed survey of this area is recommended to assess the actual natural storage volume and bottom of pond elevation. The open area south of Columbia Boulevard could be considered for additional detention if the proposed location does not provide sufficient storage. The detention pond should be designed to limit peak flows discharged to Milton Creek to be equal to the existing peak flows with the flow split.
- Alternative 2: Upsize the trunkline along Columbia Boulevard to 24-inch pipes from Cherrywood Drive to Matzen Street. Upsize the existing pipes from Matzen Street to the outfall at Milton Creek with 36-inch pipes. Similarly, install a new manhole at the flow split of Milton Creek Basin and McNulty Creek Basin then cap the pipeline draining south to McNulty Creek Basin.

FIGURE 6-11: MILTON CREEK ALTERNATIVES



Alternative 1 will add two additional detention ponds to the City's stormwater system requiring additional maintenance efforts. However, by installing these ponds, the City would be provided with opportunities to implement water quality features. Also, the pipes along Columbia Boulevard will not require as large of upsizing compared to alternatives without detention. Alternative 1 provides the City with an opportunity to upsize the existing pipelines using trenchless methods such as pipe bursting. Alternative 2 requires less long-term maintenance and does not add pipe length to the system. A summary of the pros and cons of the two alternatives is provided below in Table 6-5.

TABLE 6-5: MILTON CREEK ALTERNATIVES COMPARISON

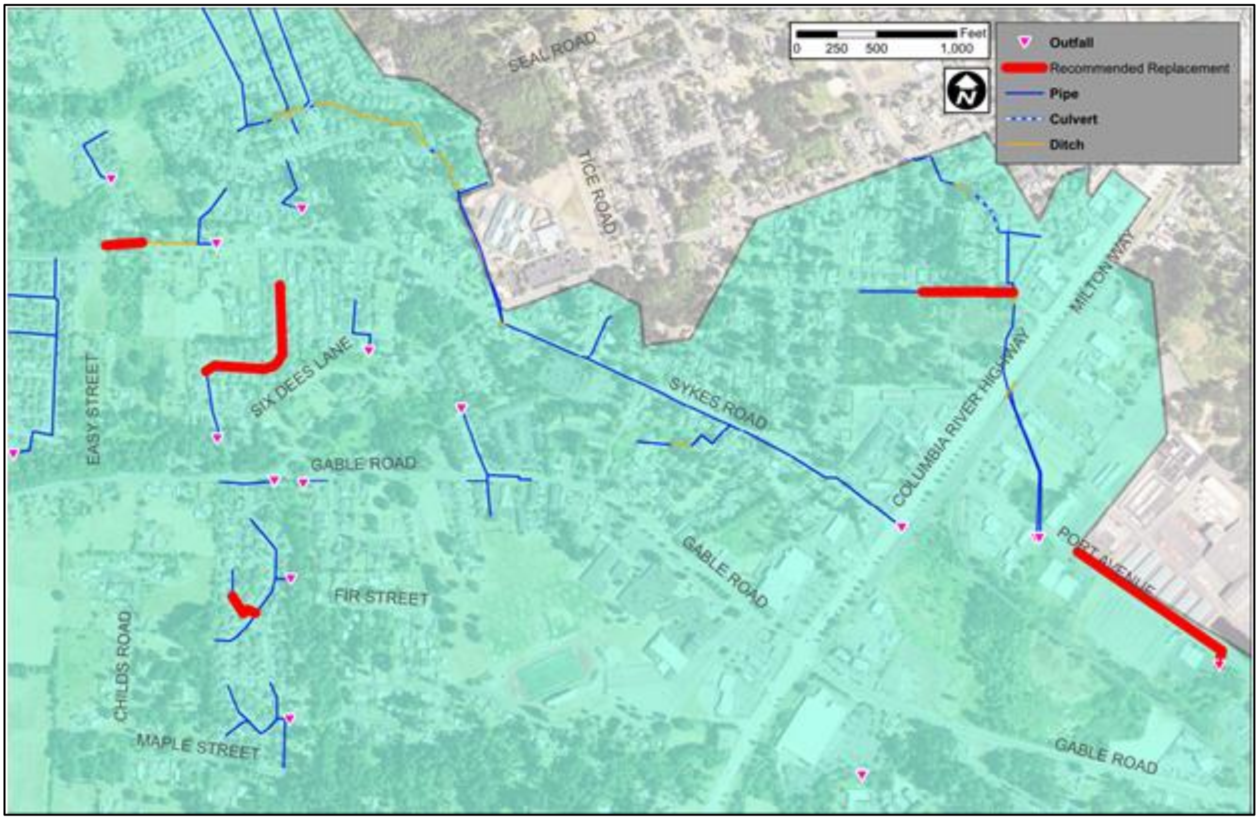
	Pros	Cons	Estimated Cost
Alternative 1	- Utilizes natural detention and wetlands - Increases water quality at Milton Creek - Alleviates flooding downstream in McNulty Creek Basin	- Requires acquisition of property to detain flows - Neighborhood impacts - Additional maintenance efforts	$3,500,000
Alternative 2	- Lower maintenance - Decreased need for additional environmental permitting	- More length of pipeline to be replaced - Higher capital costs	$3,600,000

- ► Recommendation: Alternative 1 provides options to complete both capacity and water quality improvements to the existing stormwater system. The available open area in the Milton Creek Basin is a unique part of the stormwater system and can be utilized using Alternative 1.

6.6 MCNULTY CREEK

McNulty Creek Basin has five locations with observed deficiencies recommended for upsized piping. Note, the flooding identified at the Columbia River Highway Ditch (MN-6) and between McBride Street and Columbia River Highway (MN-7) are alleviated based on the recommended alternative in Milton Creek Basin. No pipes were identified for replacement because of age, however, the trunkline along Sykes Road was installed in the 1980s and may need to be replaced or repaired in the next 10-15 years.

FIGURE 6-12: MCNULTY CREEK REPLACEMENT PIPES

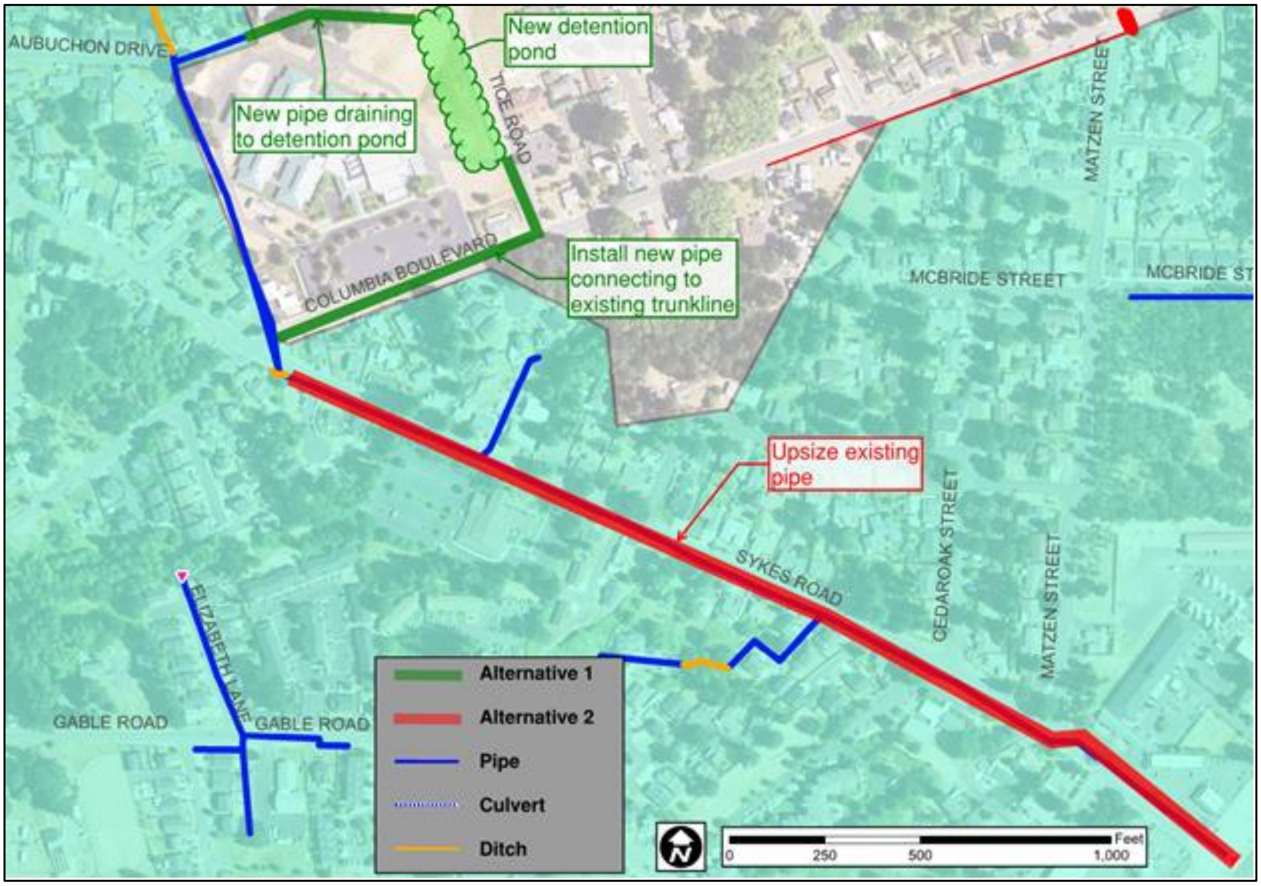


There are several developments within McNulty Creek Basin with on-site detention facilities, however, deficiencies in the capacity of the Sykes Road trunkline were identified. An opportunity is present here to provide regional detention that would reduce peak flows through this trunkline. One of the alternatives described below outlines the installation of a regional detention facility at McBride Elementary School, which it is important to note how schools can be a strategic location to consider the construction of a detention pond as they are publicly owned and often have enough open space. Generally, ponds can be designed for multiple uses in these situations, so the school can still utilize the space during dry seasons. The second alternative would be to increase the capacity of the trunkline along Sykes Road. The two alternatives are described below and illustrated in Figure 6-13.

- Alternative 1: Reroute flows from the existing conveyance system at the intersection of Douglas Drive and Aubuchon Drive to a new detention pond at McBride Elementary School. Install new pipe draining south from McBride Elementary School to Columbia Boulevard. Install pipe draining west along Columbia Boulevard and connect it to the existing trunkline along Sykes Road.

- Alternative 2: Upsize the existing pipeline along Sykes Road to 30 inches from Columbia Boulevard to Mango Street. Upsize the remaining pipeline to 36 inches from Mango Street to the outfall.

FIGURE 6-13: MCNULTY CREEK ALTERNATIVES



Alternative 1 uses the open space at McBride Elementary school, providing detention, which mitigates the need to upsize the Sykes Road trunkline and also provides an opportunity to address water quality. However, the approximate volume required to alleviate surcharging and flooding is not likely feasible given the estimated footprint of the detention pond at the McBride Elementary School property. Alternative 2 provides the City with the opportunity to replace infrastructure reaching the end of its useful life. Additionally, upsizing the pipe could provide the City with opportunities to connect future stormwater networks to the trunkline. A summary of the pros and cons of the two alternatives is provided in Table 6-6.

TABLE 6-6: MCNULTY CREEK BASIN ALTERNATIVES COMPARISON

	Pros	Cons
Alternative 1	- Opportunities to increase water quality	- Additional maintenance efforts
Alternative 2	- Opportunties to connect to new trunkline - Replaces aged pipelines	- More length of pipeline to be replaced - Higher capital costs

- Recommendation: Alternative 12 is recommended because the approximate storage volume needed to alleviate flooding along Sykes Road without upsizing the pipes is not likely achievable at the McBride Elementary School proposed site location.

6.7 FUTURE INFRASTRUCTURE

The City identified anticipated growth areas in the 20-year planning period (Figures 6-14 and 6-15). Major basin boundaries were assessed with the proposed development locations to identify potential boundary modifications from development. Each of the future development locations identified by the City were reviewed and the area draining to the development property was delineated. The likely connection to the existing infrastructure or new outfall locations were identified for each of the developments and are shown by the black arrows in the figures below.

Figure 6-14 shows the identified development areas and the area draining onto the development property (white boundary) in the northern part of the City and UGB. The developments will not result in major basin boundary changes and the post-development flows will be routed to the nearest existing trunkline or a future outfall location if no existing trunklines are present. Development in the Houlton Business District (east of U.S. Highway 30 along Columbia Boulevard) could result in drainage boundary modifications. The Houlton Business District sits on the boundary of Milton Creek, Greenway, Middle Trunk, and North Trunk Basins. Depending on the details of the development, the flows could be routed to any one of the major basins listed. However, it is likely development on the north side of Columbia Boulevard will be routed to the North Trunk Basin while the development on the south side of Columbia Boulevard will be routed to either the Greenway or Middle Trunk Basin as shown in Figure 6-14.

FIGURE 6-14: FUTURE DEVELOPMENT BASINS (NORTH)

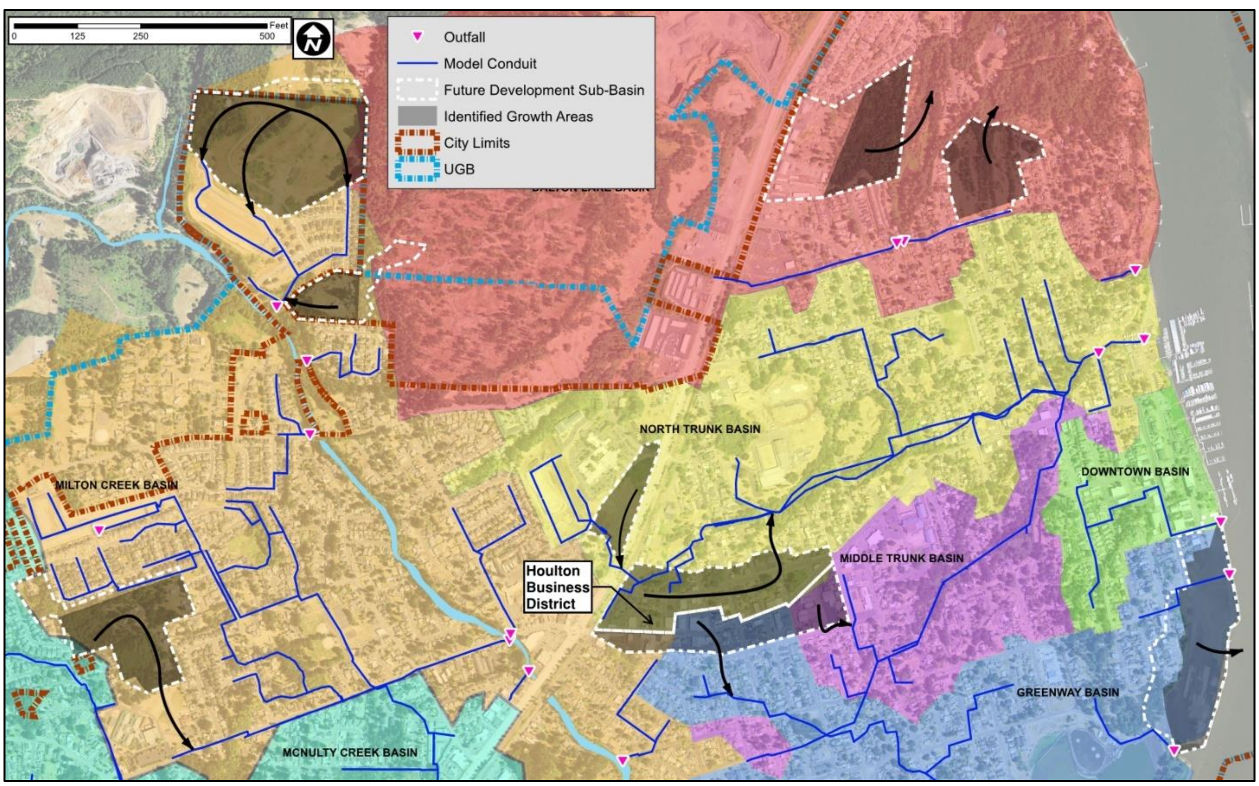
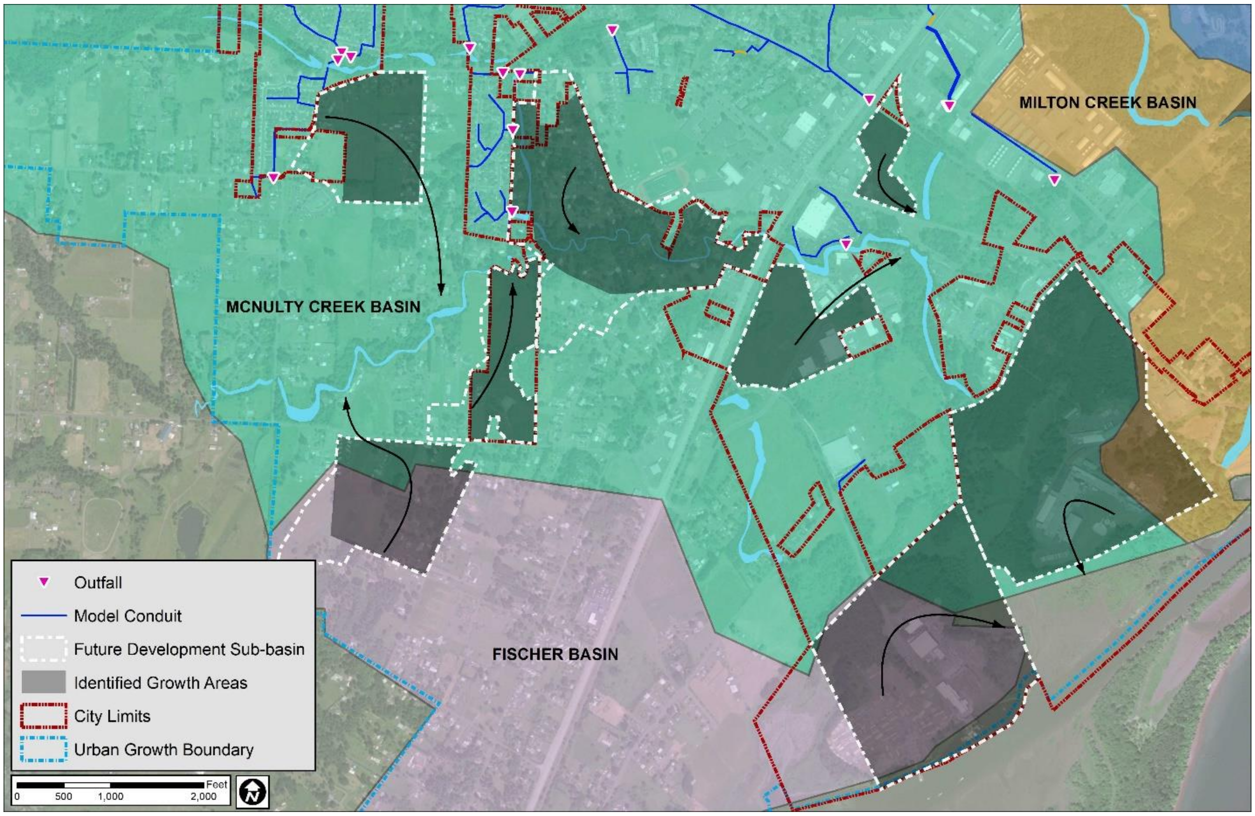


Figure 6-15 illustrates the future developments in the southern part of the City and UGB. The majority of developments shown below are in areas that lack existing stormwater infrastructure, and the developments will likely discharge to new outfalls. The boundary between McNulty Creek and Fisher Basin may be modified by the two developments located on the border of the two basins. Additionally, the industrial development on the border of Milton Creek and McNulty Creek Basin may adjust drainage basins as facilities are constructed.

FIGURE 6-15: FUTURE DEVELOPMENT BASINS (SOUTH)



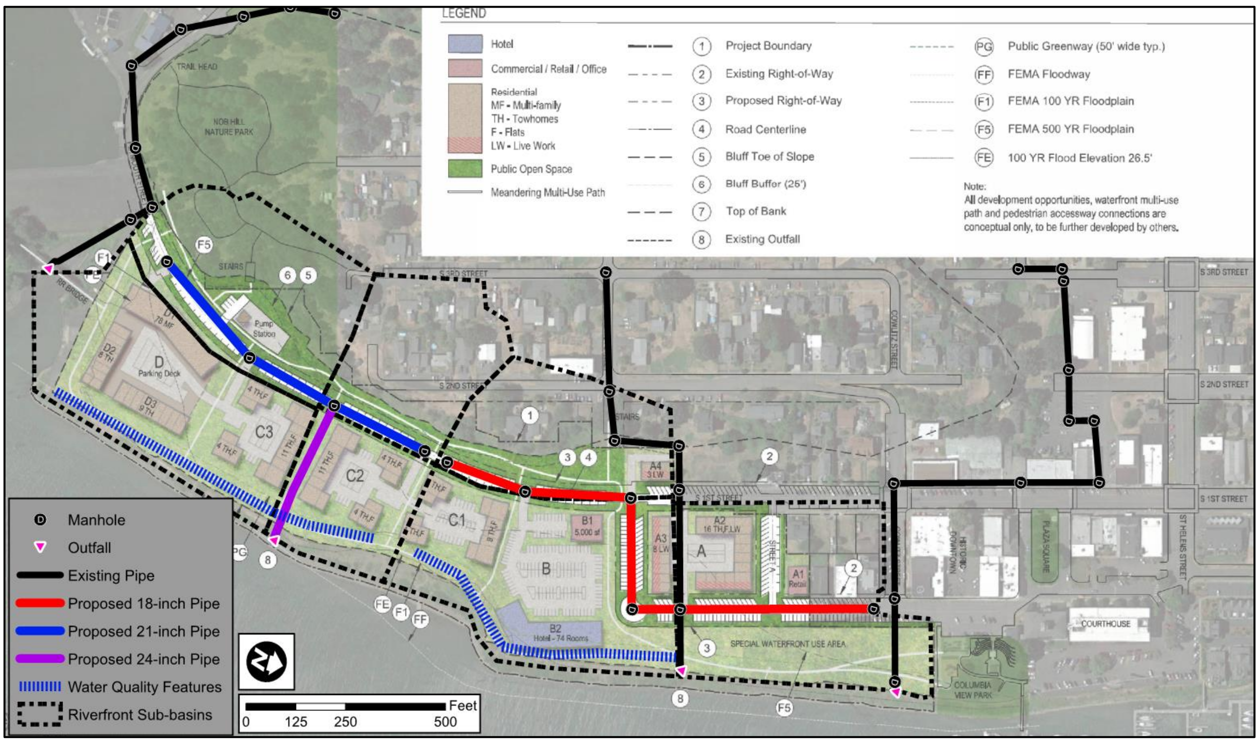
6.8 RIVERFRONT DEVELOPMENT

The Riverfront Development is a commercial and residential development property situated on the bank of the Columbia River. The conceptual layout of the development property is illustrated below in Figure 6-16. The property is divided into seven sub-basins, each ultimately draining to existing outfalls. The northern basins drain to an existing 20-inch trunkline which outfalls to the Columbia River and note that this existing pipe may need to be upsized. Further evaluation would be required during development planning and predesign. The southern sub-basins drain to an existing outfall of unknown diameter and elevation. The proposed pipe diameters and sub-basin boundaries are shown in Figure 6-16 (full size figure in Appendix A).

Curb and gutter should be installed on each side of Plymouth Street and South 1st Street to route runoff into the proposed trunklines. Catch basins should be installed at the corner of each of the major intersections and where appropriate in order to meet City design standards. The runoff from the impervious surfaces on the east side of Plymouth Street and S 1st Street should be captured by water quality conveyance features on the east side of the development while curb and gutter should be constructed to capture and direct flows to the proposed features. These water quality features limit the amount of overland flow discharging directly into the Columbia River and provides the ability to include water quality facilities before discharging to the river. These water quality facilities are to be designed and installed at the time of development and should be the responsibility of the developer. A significant portion of the development is located within the 100-year and 500-year floodplain. Based on contour information, the stormwater manhole rim elevations are below the fixed stage flood elevation of the Columbia River. As discussed in Section 4, the fixed stage flood elevation in the model is equal to the high-water mark measured from February 1996, which was described as an "extraordinary high-water event." For initial modeling and sizing purposes, the outfalls were assumed to be free flowing.

It is assumed the property will be developed in accordance with the City's development code regarding stormwater conveyance, treatment, and detention requirements and that the post-development flows for the design storm will not exceed the pre-development peak flows for the 10-year storm event. This would likely be achieved by installing detention facilities such as new detention basins with outlet control structures, underground detention piping, or other low impact development approaches. The Riverfront development area provides opportunities to address water quality upstream of the two existing outfalls. Water quality opportunities and requirements should be coordinated with the developer to achieve a mutually beneficial stormwater system for the new waterfront development.

FIGURE 6-16: RIVERFRONT DEVELOPMENT PROPOSED PIPE DIAMETERS



6.9 INDUSTRIAL BUSINESS PARK

The City's Industrial Business Park is situated along the Columbia River and has historically been used by industries for wood products (formerly the Boise White Paper, LLC mill operations site). The City has acquired the 225-acre property and is seeking new opportunities for the business park. Stormwater infrastructure should be planned for appropriately to implement effective and strategic facilities to manage runoff from the development.

There is an existing Stormwater Pollution Control Plan dividing the site into four quadrants (shown in Figure 6-17). Quadrant 1 does not contain any mill process area and drains to an outfall in the Multnomah Channel. There is reported to be a pipe from the bottom of the earthen dam at the end of the northeast wetlands in Quadrant 1 that connects to the main pipeline in the quadrant. Flows from this pipe are largely unquantified and should be evaluated for a complete assessment of the existing stormwater infrastructure capacity. The full contributing drainage area for the two main ditches in Quadrant 1 extend beyond the site boundary, and as a result, the full Greenway drainage basin area draining to the site should be included in the stormwater analysis. Quadrant 2 does not contain any mill process area and drains to an outfall in Milton Creek. Quadrants 3 and 4 are process areas and are treated onsite prior to discharging to the Columbia River.

Existing stormwater infrastructure is collected and conveyed through a series of ditches, catch basins, and stormwater pipes onsite. Majority of the stormwater pipe network is assumed to be privately owned, and the City will install new pipes within the proposed rights-of-way. Stormwater infrastructure was mainly modeled within the proposed right-of-way. The condition and suitability of existing private infrastructure should be evaluated further during the preliminary design stages. Stormwater pipe alignments were modeled based on the City's Industrial Park Industrial Business Parcellation plan and the proposed pipes are shown in Figure 6-18 below and in Figure 15 in Appendix A. A total of approximately 10,000 linear feet of trunklines ranging in size from 12-inches to 48-inches in diameter were modeled within the business park. The trunklines were modeled to convey the pre-development 25-year storm event runoff. A total of three new outfalls are proposed; One would drain a small area and discharge into Milton Creek. The second proposed outfall would drain Quadrant 3 and discharge into the Multnomah Channel. The third outfall would be near an unknown/private existing outfall draining the Greenway Basin, Quadrant 1, and Quadrant 4 and discharge into the Multnomah Channel. A significant portion of the development is located within the 100-year and 500-year floodplain. Based on contour information, ground elevations at the proposed stormwater manholes are below the fixed stage flood elevation of the Columbia River. For initial modeling purposes, the outfalls were assumed to be free flowing. This assumption should be re-evaluated at the predesign phases.

As shown below, some of the modeled sub-basins naturally drain away from any proposed right-of-way and drain directly into Milton Creek or into the Multnomah Channel. Developers will be responsible for complying with the City's design standards, including peak discharge flow rates and stormwater treatment prior to discharging into the waters. Stormwater treatment for future development could be handled by individual parcels or with a regional stormwater treatment facility. Providing a regional stormwater treatment facility could help facilitate proper and regular maintenance of stormwater facilities and make parcels more attractive to developers. A regional facility located near the waterfront would allow existing drainage patterns to be utilized without the addition of a stormwater pump station.

FIGURE 6-18: INDUSTRIAL BUSINESS PARK STORMWATER QUADRANTS

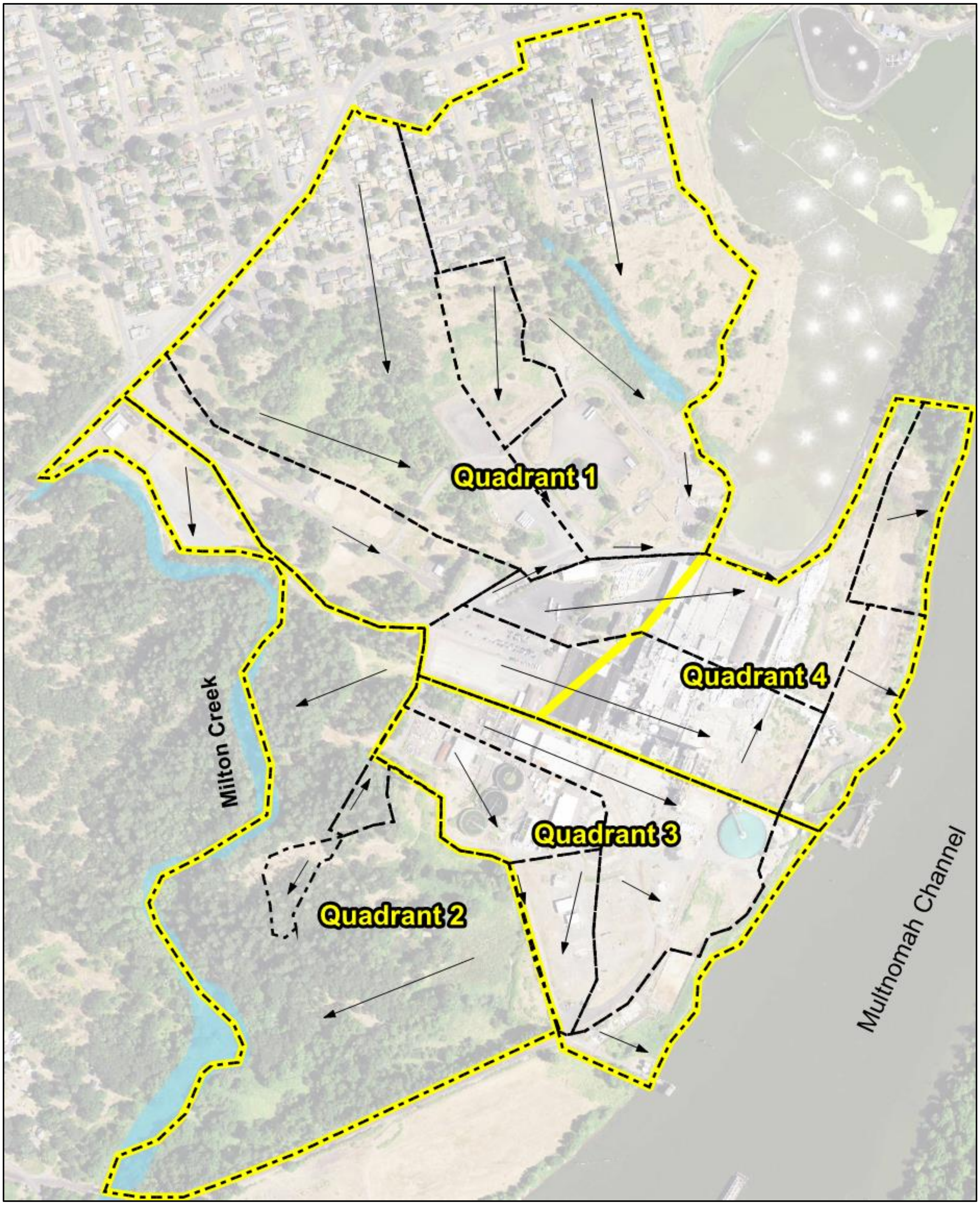
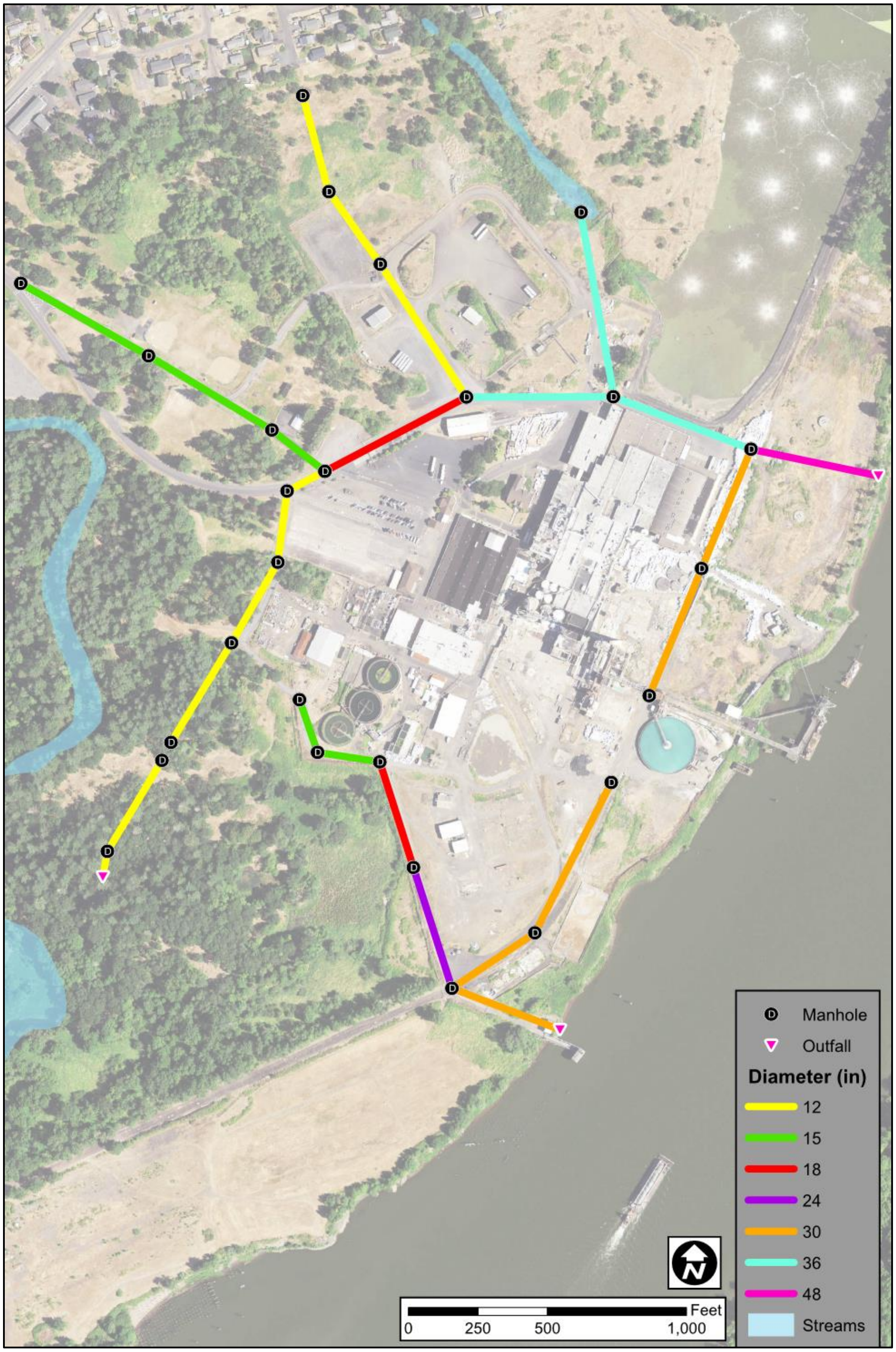


FIGURE 6-17: INDUSTRIAL PARK PROPOSED STORMWATER INFRASTRUCTURE



SECTION 7 - ENGINEERING DESIGN STANDARDS AND COMPREHENSIVE PLAN

The City's existing development code (Title 17), engineering design standards (Title 18), and comprehensive plan (Title 19) were reviewed for new development as they pertain to stormwater conveyance and treatment to identify potential deficiencies and provide recommendations for updates.

7.1 ENGINEERING STANDARDS & COMPREHENSIVE PLAN REVIEW

The following documents were examined during this review effort.

- St. Helens Municipal Code (SHMC) Title 17 Community Development Code
- St. Helens Municipal Code (SHMC) Title 18 Engineering Standards Manual
- St. Helens Municipal Code (SHMC) Title 19 Comprehensive Plan

General observations and recommendations to update the City's policies and standards are summarized in the technical memorandum in Appendix F. The City should review the recommendations presented in the memo and assess if they agree with the proposed changes and additions to City Municipal Code, standards, and comprehensive plan. If the City agrees with some or all of the recommendations, the process to propose changes to the documents listed above should be initiated.

SECTION 8 - CAPITAL IMPROVEMENT PLAN

This section summarizes recommended capital improvements with associated planning level cost estimates. Recommended improvements are illustrated in Figure 16 in Appendix A, and the details of each improvement are presented in Appendix H. This section also summarizes system development charge (SDC) eligibility of each of the projects and the annual operation and maintenance impacts for the proposed improvements.

8.1 BASIS FOR ESTIMATE OF PROBABLE COST

Capital costs developed for the recommended improvements are Class 4 estimates as defined by the Association for the Advancement of Cost Engineering (AACE). Actual construction costs may differ from the estimates presented, depending on specific design requirements and the economic climate when a project is bid. An AACE Class 4 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 4 cost estimate is broad, but these are typical accuracy levels for planning work.

The costs are based on experience with similar recent stormwater system improvement projects. Equipment pricing from manufactures of the flow measuring equipment items was also used to develop the estimates. The total estimated probable project costs include contractor markups and 30% contingencies, which is typical of a planning-level estimate. Overall project costs include total construction costs, costs for engineering design, permitting, construction management services, inspection, as well as administrative costs. For the system projects, the contractor’s overhead and profit are worked into the line items.

8.2 SUMMARY OF COSTS (20-YEAR CIP)

The capital improvement plan (CIP) consists of improvements necessary to alleviate identified flooding and surcharging in the 25-year storm event. The projects identified in this study were prioritized by their urgency to mitigate the identified deficiencies. The prioritization criteria are shown in Table 8-1.

TABLE 8-1: CIP PRIORITIZATION CRITERIA

Priority	Criteria	Implementation Timeline
1	Alleviate historically known flooding identified by the City and some 2-year flooding.	0-5 Years
2	Alleviate additional 2-year flooding identified in the model or age identified replacement.	5-10 Years
3	Alleviate deficiencies identified in 10-year and 25-year storm events.	10-20 Years

8.2.1 PRIORITY 1 IMPROVEMENTS

Priority 1 improvements consist of areas where both the City and the model have identified flooding in storm events with lower recurrence intervals (e.g., 2-year storm event). These projects are recommended to be implemented within 0-5 years of the completion of this study.

Campbell Park Detention Pond (Milton Creek): 1A – Construct a new detention pond in Campbell Park with a footprint of approximately 0.65 acres and storage volume of 2.0 acre-feet. This results in approximately two feet of operating depth. An outlet structure should be installed to control the peak flows discharged downstream.

Columbia Boulevard Detention Pond (Milton Creek): 1B - Install a new 21-inch pipeline from Tice Road draining east and discharging off Columbia Boulevard to a new detention storage pond north of Columbia Road. Construct an outlet structure to drain into the existing trunkline and install an orifice to limit flows downstream. The storage pond should have a footprint of approximately 1-acre and storage volume of approximately 2.0 acre-feet. It is assumed the bottom of the detention pond is at least three feet below the road surface elevation and approximately equal to the existing invert elevation of the 18-inch pipeline crossing to the south of Columbia Boulevard. A detailed survey of this area is recommended to assess the actual natural storage volume and bottom of pond elevation. The open area south of Columbia Boulevard could be considered for additional detention if the proposed location does not provide sufficient storage.

Columbia Boulevard Upsize (Milton Creek): 1C- Upsize the pipes on the south side of Columbia Boulevard to 21-inches from the new detention pond (CIP Project 1C) to the existing junction box at the intersection of Matzen Street and Columbia Boulevard. Upsize the pipes from this junction box to the outfall at Milton Creek to 30-inch pipes. Additionally, replace the existing junction box south of Campbell Park where flows split between Milton Creek and McNulty Creek with a manhole and then cap the pipe draining to McNulty Creek to alleviate downstream deficiencies in McNulty Creek Basin.

Middle Trunk Detention Ponds and Piping: 1D – Utilize naturally occurring detention through the Middle Trunk Basin, and construct three new detention storage ponds along the existing stormwater pipe alignment from Cowlitz Street to S 4th Street. Storage 1 is located from Cowlitz Street to S 9th Street, Storage 2 is located from S 9th Street to S 8th Street, and Storage 3 is located from S 7th Street to S 4th Street. A berm should be constructed, or Storage 1 should be excavated down to protect the existing structures in the ravine. Storage 1 needs approximately 3 acre-feet of available volume. Install an outlet under S 9th Street from Storage 1 to Storage 2. Storage 2 needs a volume of approximately 3 acre-feet. Install a new pipe to drain water from Storage 2 to Storage 3. Additional efforts will likely be required to assess impact to any existing wetlands within the proposed storage locations. The project will likely include wetland delineation, permitting from USACE and DSL, and an analysis to show improvements will not damage the function of any existing wetlands. Storage 3 needs approximately 8 acre-feet of storage. Install an inlet to the existing 18-inch pipeline which drains to S 4th Street and Godfrey Park. A detailed survey of each of the proposed storage locations should be completed to assess the potential storage volume in each of the natural ravines.

Upsize and Realign Tualatin Street (Middle Trunk): 1E– The pipes in the Middle Trunk Basin from Tualatin Street to S 11th Street are currently shown in the GIS as draining underneath existing structures, and these pipes are also hydraulically undersized. This project assumes the pipes are underneath the structures and should be realigned, the true alignment of these pipes should be field verified. Abandon the existing 15-inch pipes and install new 36-inch pipes from the intersection of Tualatin Street and S 13th Street draining east and then north along S 11th Street where it discharges into the new natural detention off Cowlitz Street (CIP Project 2C). Install a new 12-inch pipe along S 13th Street to drain into the new 36-inch pipe along Tualatin Street.

Detention Pond and Piping Between N 12th Street and N 10th Street (North Trunk): 1F- Replace the existing 28-inch rectangular culvert with a 36-inch culvert or similar because the 28-inch culvert is reaching the end of its useful life and is hydraulically undersized. Install a flow control structure on the east side of N 15th Street to control the flow split between the Columbia Boulevard Trunkline and the Columbia Boulevard Ditch Network. The flow control structure will divert most of the flows to the Columbia Boulevard Ditch Network. This alternative utilizes open space and natural topography to construct a new detention storage in the area between N 12th Street and N 10th Street by installing a new flow control structure at the outlet culvert on the west side of N 10th Street. The purpose of this flow control structure is to detain water in the new detention pond and limit peak flows to the downstream network. The detention pond will need a storage volume of approximately 7 acre-feet. Note, a berm will likely need to be constructed at the northeast border of the pond to prevent stormwater from draining across the existing property within the ravine. The flows from the existing trunklines draining south along N 10th Street should be rerouted to discharge into the new detention pond, which would relieve flooding in the Columbia Boulevard Trunkline.

Replace Ridgeway Loop Ditch with Pipe: 1G – Install a new 12-inch pipe off of Ridgecrest Loop where an existing ditch/grassy swale flood adjacent property.

8.2.2 PRIORITY 2 IMPROVEMENTS

Priority 2 improvements include areas where flooding was identified in the model during the lower recurrence intervals (e.g., 2-year storm event) but the City has not historically seen flooding in yet. The following projects are recommended to be implemented within 5-10 years of this study.

Upsize Pipes along West Street and N 10th Street (North Trunk): 2A – Upsize the existing pipes along West Street from N 12th Street to the new detention pond along Columbia Boulevard (CIP Project 1A). There is an existing bottleneck from N 11th Street to N 10th Street where pipes go from 21-inches to 18-inches. This project replaces the 21-inch and 18-inch pipes with 30-inch pipes from N 12th Street to N 10th Street. The existing 24-inch pipe along N 10th Street should also be upsized to 30-inches and discharge into the new detention pond along Columbia Boulevard (CIP Project 1A). Some flow should be diverted away from the detention pond and into the existing 24-inch trunkline draining toward Godfrey Park.

S 4th Street to Outfall (Downtown): 2B – The pipes in the main Downtown Basin Trunkline are reaching the end of their useful life and should be inspected with CCTV to assess their condition. If the pipes show significant deterioration, the pipes should be replaced. CIP Project 3I should be considered if the condition assessment recommends that the pipes need to be repaired or replaced.

Heinie Huemann Park Detention Pond (Greenway): 2C – Improve the existing detention pond in Heinie Huemann Park to be capable of passing the 25-year storm event. Improvements would include installing an outlet control structure at the southeast end of the park and constructing a berm on the south and west borders of the park to prevent the detained volume from flowing onto S 16th Street or causing damage to the St. Helens Senior Center. Improvements should also include installing gates to catch debris and leaves from the oak trees throughout the park. Based on model calculations, the storage pond would need to have a peak storage of approximately 1.7 acre-feet to prevent upsizing pipes downstream. Any existing junction boxes downstream of Heinie Huemann Park should be replaced with standard manholes.

Upsize from S 20th Street to Heinie Huemann Park (Greenway): 2D – Upsize the existing 12-inch, 15-inch, and 18-inch pipes from S 20th Street and Cowlitz Street to Heinie Huemann Park. The upsized pipes should be 18-inches from S 20th Street to S 19th Street, 21-inches from S 19th Street to S 18th Street, and 30-inches from S 18th Street to Heinie Huemann Park. Replace any existing junction boxes along this trunkline with standard manholes.

Nob Hill Nature Park CIP lining (Greenway): 2E – The 48-inch pipes along Plymouth Street near the wastewater treatment plan have reached the end of their useful life. The pipes should be inspected to determine the actual conditions of the pipe. The pipes are likely submerged part of the year from the Columbia River water surface level. The brackish water from the Columbia River may increase the deterioration of the pipe.

Franz Street (Milton Creek): 2F – Install a new 18-inch pipe at the intersection of North Vernonia Road and Franz Street draining south along Franz Street and discharging on the east side of Alderwood Court in the ditch draining through Campbell Park. Divert flows from North Vernonia Road to this new pipe and away from the existing pipes along Edie's Way.

Mayfair Drive CIP lining and Upsize (Milton Creek): 2G– The 12-inch pipe to the west of Mayfair Drive should be upsized to 18-inches and the pipe segment of 12-inch pipe along Mayfair Drive near Sherwood Drive should also be upsized to 18-inches. The existing 18-inch pipeline along Mayfair Drive from Sherwood Drive to Campbell Park has reached the end of its useful life and should be inspected to determine the actual condition of the pipe. CIP lining of this pipe needs to be completed if the inspection determines the pipe is in need of repairs.

Riverfront Development Stormwater Infrastructure: 2H – As discussed in Section 6, install approximately 3,000 LF of stormwater pipe to drain the proposed Riverfront Development. Pipe diameters range in size from 18-inches to 24-inches. See Section 6 and Figure 13 in Appendix A for pipe alignment.

Industrial Business Park Stormwater Infrastructure: 2I – As discussed in Section 6, install approximately 10,000 LF of stormwater pipe to drain the proposed Industrial Business Park. Pipe diameters range in size from 12-inches to 48-inches. See Section 6 and Figure 15 in Appendix A for pipe alignment.

S 16th Street to Old Portland Road Upsize (Greenway): 2J – Upsize the existing 12-inch and 15-inch pipes along S 16th Street to Old Portland Road to 18-inches and 21-inches.

Stormwater Master Plan Update: 2K – Update the stormwater master plan to re-assess needs and properly allocate budgets to address system deficiencies.

8.2.3 PRIORITY 3 IMPROVEMENTS

Priority 3 improvements include areas where flooding was identified in the model during the 10-year and 25-year storm event and where the City has not historically seen flooding. These projects are recommended to be completed within 10-20 years of this study.

Upsize N 13th Street to West Street (North Trunk): 3A – Upsize the existing 12-inch pipe along N 13th Street (north of West Street) to 21-inches.

Upsize from 6th Street Ball Park to N 10th Street (North Trunk): 3B – Upsize the existing 12-inch and 15-inch trunkline from 6th Street Park to N 10th Street. The pipes should be upsized to 18-inches from 6th Street Park to N 8th Street and upsize to 21-inches from N 8th Street to N 10th Street.

Upsize Milton Way at St. Helens Street (North Trunk): 3C – Upsize the pipes along Milton Way from 12-inches to 18-inches from Columbia Boulevard to north of St. Helens Street.

Upsize N 7th Street from Columbia Boulevard to Trunkline (North Trunk): 3D – Upsize the existing 12-inch pipes to 21-inches from the intersection of Columbia Boulevard and N 7th Street to the existing 36-inch trunkline draining to Godfrey Park.

Upsize N 4th Street south of West Street (North Trunk): 3E – Install new 15-inch pipes along N 4th Street between Lemont Street and West Street to drain localized ponding. Also install new 15-inch pipe along West Street and on N 5th Street (between West Street and Lemont Street) to drain the localized low point. The capacity of the downstream network should be evaluated further with the increased runoff, which would be captured by the new stormwater network. The existing 12-inch pipe network will likely need to be upsized along N 4th Street (south of West Street) to 18-inches along the outlet into Godfrey Park

Upsize and Regrade along S 14th Street (Middle Trunk): 3F – Upsize the existing 12-inch pipes along S 14th Street (south of Cowlitz Street) to 18-inches and re-install at recommended minimum slopes.

Upsize existing pipes from Heinie Huemann to Tualatin Street (Middle Trunk): 3G – Upsize the existing 12-inch pipes from Heinie Huemann Park to Tualatin Street with 15-inch pipes. Trenchless pipe installations, such as pipe bursting, could be considered here because the pipes are increasing only one nominal pipe size.

St. Helens Street to S 4th Street Upsizing (Downtown): 3H – Upsize the existing 12-inch trunkline to 18-inches from St. Helens Street and S 3rd Street to where the pipe increases to 24-inches along S 4th Street.

S 4th Street to Outfall Pipe Upsizing: 3I - Upsize the existing 24-inch pipes in the main Downtown Basin Trunkline from S 4th Street to the outfall off Strand Street because these pipes are undersized and cause flooding in the upstream pipe networks. Upsize the existing 12-inch and 18-inch pipes along Parkway, since the pipes are undersized, from Tualatin Street to between Cowlitz Street and St. Helens Way where pipes increase to 30-inches (CIP Project 2E).

Crouse Way Upsize (Milton Creek): 3J – Upsize the existing 16-inch pipes along Crouse Way to 18-inches. Trenchless pipe installation could be considered for this upsizing. Upsize the existing 18-inch pipe to 21-inches along S 22nd Street from Crouse Way to Cowlitz Street.

Eilertson Street (Milton Creek): 3K – Upsize the existing 8-inch pipes off Eilertson Street (near Little Street) to 12-inches and connect to the existing 12-inch pipes.

N Vernonia Road from Oakwood Drive to Ava Court (Milton Creek): 3L – Upsize the existing 15-inch pipes to 18-inches along N Vernonia Road from Oakview Drive to the recently upsized 18-inch pipes (south of Ava Court). Trenchless pipe installation could be considered for this upsizing.

Ethan Lane Upsizing (Milton Creek): 3M – Upsize the existing 18-inch pipe to 21-inches along Ethan Lane from Jakobi Street to Sykes Road. Trenchless pipe installation could be considered for this upsizing.

Sunset Boulevard. to Outfall Upsize (Milton Creek): 3N – Upsize the existing 15-inch and 18-inch pipes to 21-inches along Sunset Boulevard from Salmon Street to the outfall near Sykes Road. The 18-inch pipes along Sunset Boulevard were surveyed at an adverse grade, so the upsized pipes should be installed at minimum recommended pipe slopes.

Sunset Boulevard, Trillium Street and Salmon Street upsize (Milton Creek): 3O – Upsize the existing 12-inch pipe to 15-inches along Sunset Boulevard from Red Cedar Street to Salmon Drive. Also, upsize the existing 12-inch pipes along Trillium Street and Salmon Street to 15-inches. Trenchless pipe installations could be considered for this project.

Sykes Road. Upsize from Columbia Boulevard to Outfall (McNulty Creek): 3P – Upsize the existing 24-inch trunkline along Sykes Road to 30-inches from Columbia Boulevard to the outfall south of Highway 30.

McBride Street Upsize (McNulty Creek): 3Q – Upsize the existing 12-inch pipe along McBride Street (east of Matzen Street) to the existing 30-inch pipeline draining south toward Highway 30.

Port Ave. Upsize (McNulty Creek): 3R – Upsize the existing pipes along Port Avenue to 15-inches and 21-inches to the outfall.

Whitetail Avenue Upsize (McNulty Creek): 3S – Upsize the existing 12-inch pipe to 18-inches along Whitetail Avenue (southwest of Archer Drive) to the outfall.

Sykes Road Culvert near Mountain View Drive Upsize (McNulty Creek): 3T – Upsize the existing 12-inch pipe along Sykes Road (east of Mountain View Drive) to 15-inches.

A summary of the recommended improvements and associated capital costs are organized by priority in Table 8-2. Planning level cost estimates were developed using 2021 dollars. A detailed summary sheet for each improvement is provided in Appendix H.

TABLE 8-2: CAPITAL IMPROVEMENT PLAN

Priority	Project Description	Estimated Cost	SDC Eligibility	SDC Improvement Amount	City Amount
Priority 1 Improvements					
1A	Campbell Park Detention Pond (Milton Creek)	$300,000	0%	$0	$300,000
1B	Columbia Boulevard Detention Pond (Milton Creek)	$1,100,000	66%	$727,000	$373,000
1C	Columbia Boulevard Upsize (Milton Creek)	$2,800,000	14%	$392,000	$2,408,000
1D	Middle Trunk Detention Ponds and Piping	$2,000,000	5%	$103,000	$1,897,000
1E	Upsize and Realign Tualatin Street (Middle Trunk)	$5,000,000	14%	$677,000	$4,323,000
1F	Detention Pond and Piping Between N 12th and N 7th Street (North Trunk)	$1,600,000	17%	$269,000	$1,331,000
1G	Ridgeway Loop Pipe Installation	$60,000	0%	$0	$60,000
	Total Priority 1 Improvement Costs	$12,900,000	-	$2,200,000	$10,700,000
Priority 2 Improvements					
2A	Upsize Pipes along West Street and N 10th Street (North Trunk)	$1,400,000	0%	$0	$1,400,000
2B	S 4th Street to Outfall CCTV Inspection (Downtown)	$20,000	0%	$0	$20,000
2C	Heinie Huemann Park Detention Pond (Greenway)	$200,000	26%	$52,000	$148,000
2D	Upsize from S 20th Street to Heinie Huemann Park (Greenway)	$1,100,000	29%	$318,000	$782,000
2E	Nob Hill Park CIP lining (Greenway)	$400,000	0%	$0	$400,000
2F	Franz Street (Milton Creek)	$400,000	0%	$0	$400,000
2G	Mayfair Drive CIP lining and Upsize (Milton Creek)	$400,000	0%	$0	$400,000
2H	Riverfront Development Stormwater Infrastructure	$3,300,000	100%	$3,300,000	$0
2I	Industrial Business Park Stormwater Infrastructure	$8,600,000	100%	$8,600,000	$0
2J	S 16th Street to Old Portland Road Upsize (Greenway)	$500,000	0%	$0	$500,000
2K	Stormwater Master Plan Update	$200,000	0%	$0	$0
	Total Priority 2 Improvement Costs	$16,500,000	-	$12,300,000	$4,100,000
Priority 3 Improvements					
3A	Upsize N 13th Street to West Street (North Trunk)	$200,000	0%	$0	$200,000
3B	Upsize from 6th Street Ball Park to N 10th Street (North Trunk)	$900,000	0%	$0	$900,000
3C	Upsize Milton Way at Street Helens Street (North Trunk)	$600,000	75%	$450,000	$150,000
3D	Upsize N 7th Street from Columbia Boulevard to Trunkline (North Trunk)	$400,000	0%	$0	$400,000
3E	Upsize N 4th Street south of West Street (North Trunk)	$1,400,000	0%	$0	$1,400,000
3F	Upsize and Regrade along S 14th Street (Middle Trunk)	$600,000	50%	$298,000	$302,000
3G	Upsize existing pipes from Heinie Huemann to Tualatin Street (Middle Trunk)	$400,000	0%	$0	$400,000
3H	Street Helens Street to South 4th Street Upsizing (Downtown)	$500,000	0%	$0	$500,000
3I	S 4th Street to Outfall Pipe Upsizing (Downtown)	$2,400,000	0%	$0	$2,400,000
3J	Crouse Way Upsize (Milton Creek)	$1,000,000	14%	$137,000	$863,000
3K	Eilertson Street (Milton Creek)	$100,000	0%	$0	$100,000
3L	N Vernonia Road from Oakwood to Ava Court (Milton Creek)	$400,000	0%	$0	$400,000
3M	Ethan Lane Upsizing (Milton Creek)	$600,000	0%	$0	$600,000
3N	Sunset Boulevard to Outfall Upsize (Milton Creek)	$800,000	0%	$0	$800,000
3O	Sunset Boulevard, Trillium Street and Salmon Street upsize (Milton Creek)	$1,100,000	0%	$0	$1,100,000
3P	Sykes Road Upsize from Columbia Boulevard to Outfall (McNulty Creek)	$2,700,000	0%	$0	$2,700,000
3Q	McBride Street Upsize (McNulty Creek)	$600,000	0%	$0	$600,000
3R	Port Avenue Upsize (McNulty Creek)	$900,000	0%	$0	$900,000
3S	Whitetail Avenue Upsize (McNulty Creek)	$800,000	0%	$0	$800,000
3T	Sykes Road Cuvert near Mountain View Drive Upsize (McNulty Creek)	$80,000	0%	$0	$80,000
	Total Priority 3 Improvement Costs	$16,500,000	-	$900,000	$15,600,000
	Total Capital Improvement Costs	$45,900,000	-	$15,400,000	$30,400,000

The cost estimate herin 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 cost presented herein.

8.3 SYSTEM DEVELOPMENT CHARGES

The City of St. Helens establishes stormwater SDCs per Resolution 1796 effective August 2017. The current improvement SDCs for single family residences, duplexes, non-residential, and commercial developments are based every 2,500 square feet of impervious surface area. The current SDC amount per 2,500 square feet of impervious surface is $821.

The proposed improvement projects were allocated a percentage of the total cost that is eligible for funding by collected SDC funds. Each capital improvement project that will service areas identified by the City as anticipated growth within the 20-year planning period were reviewed. The SDC improvement amount is based on the percentage of future development area within the capital improvement's contributing drainage basin. The SDC eligibility for each project is summarized in Table 8-2.

8.4 PLANNING RECOMMENDATIONS

It is recommended that the City update their planning documents every five to ten years because updates to the planning documents and models allow the City to re-assess needs, priorities, and properly allocate budgets to address system deficiencies. A Master Plan Update for the stormwater system has been included as a Priority 2 improvement in the CIP with an estimated cost of $200,000.

8.5 OTHER ANNUAL COSTS

The stormwater conveyance system requires regular maintenance to ensure that pipelines, catch basins, and detention facilities flow freely during the storm events. Additional stormwater facilities continue to age and will eventually need to be rehabilitated or replaced. The sections below summarize recommended maintenance as well as replacement activities and budgets.

8.5.1 MAINTENANCE PROGRAM AND STAFFING

The recommended level of service, O&M, and staffing for the stormwater system is summarized in Section 5. As discussed in Section 5, it is estimated that approximately 4.25-4.5 FTE are needed to meet the recommended level of O&M to meet the City's LOS goals. As budgeted, the existing stormwater FTE staff appears to be adequate. However, the additional projects and work the PW Operations staff are currently requested to complete significantly decreases the budgeted FTE that can be spent on stormwater O&M. It is recommended that either additional FTE be budgeted for the PW Operations staff to complete the extra workload requested, or the responsibilities of the PW Operations staff be reduced to focus solely on utility O&M. In addition, the recommended CIP projects would increase workload of the engineering division. The engineering division may need additional staff update and maintain the GIS database, coordinate CCTV inspection and resulting work orders, and manage capital improvements. Additional workload on the engineering and PW operations divisions should be included in planning for any of the recommended improvements and projects. Generally, it is advised that staffing needs be reevaluated every two to three years.

8.5.2 STORMWATER REPLACEMENT PROGRAM

In addition to regular maintenance, it is suggested that an annual pipeline replacement program be established because stormwater infrastructure and rehabilitation needs will only increase as the stormwater conveyance system ages.

The replacement program is based on the total amount of existing City stormwater infrastructure and its estimated useful life. The City facilities include approximately 45 miles of storm pipes, 800 manholes, and 1,500 catch basins. Assuming an average useful life of 75-years remaining life, the replacement program should target approximately 3,000 feet of pipe, 30 catch basins, and 16 manholes per year. Assuming an average pipe replacement cost of $190 per foot, a catch basin cost of $3,500 each, and a manhole cost of $11,000, the City would need an annual replacement budget of approximately $900,000. Table 8-3 summarizes the annual replacement program targets and associated costs.

TABLE 8-3: SUMMARY OF ANNUAL REPLACEMENT COSTS

Item	Lifespan	Total Quantity	Annual Cost[1] (rounded)
Lineal Feet of Storm Lines	75 Years	237,000	$600,000
Number of Catch Basins	50 Years	1,500	$110,000
Number of Manholes	50 Years	800	$180,000
		Total (Rounded)	$900,000

1) Storm pipes unit price equal to average unit price of 12" to 30". Manhole unit price equal to average of 48" and 60" manhole.

Additionally, as part of the City's maintenance program, the locations indicated in Section 5 as being located underneath existing structures should be investigated and abandoned if it is determined the pipes, are beneath existing structures.

8.6 OTHER FINANCIAL CONSIDERATIONS

The City is recommended to complete a full-rate study for the stormwater utility to evaluate the potential user rate and SDC impacts of the recommended CIP. Estimated SDC eligibility for each identified capital improvement is included in Table 8-2 for use in completing a full rate study. The City is advised to actively pursue opportunities for grant funds, low-interest loans, or principal forgiveness funding sources to mitigate user rate impacts. As the City begins to prepare and proceed on CIP projects, if outside funding is desired, it is recommended the City setup a one-stop meeting with Business Oregon to identify and assess potential funding sources for the stormwater projects. Another funding source for the City to explore is the federal-state partnership Clean Water State Revolving Fund (CWSRF).

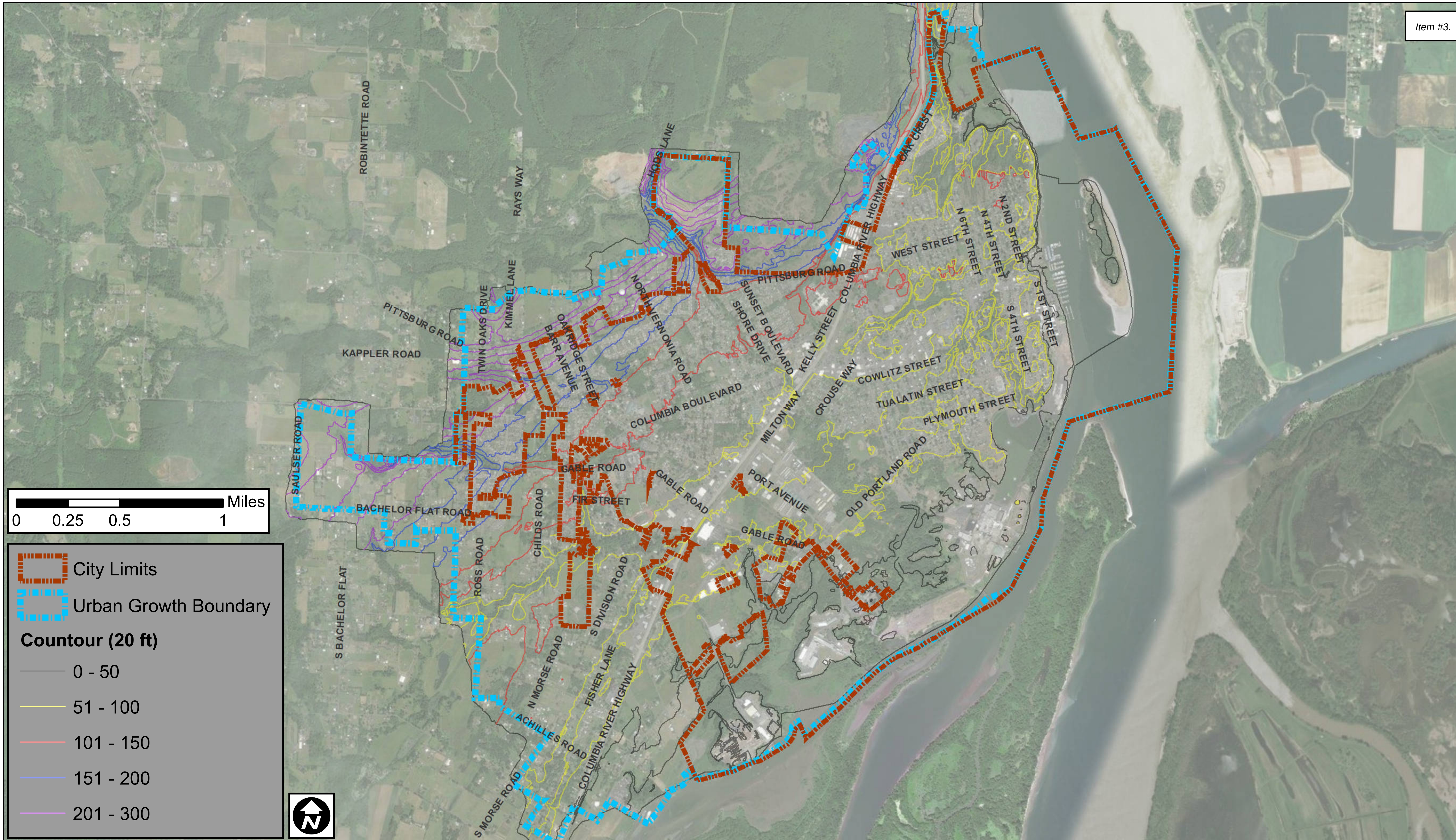
APPENDIX A

Figures

LIST OF FIGURES

KELLER ASSOCIATES

Item #3.



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City Limits, UGB, and Topography

Stormwater Master Plan

City of St. Helens
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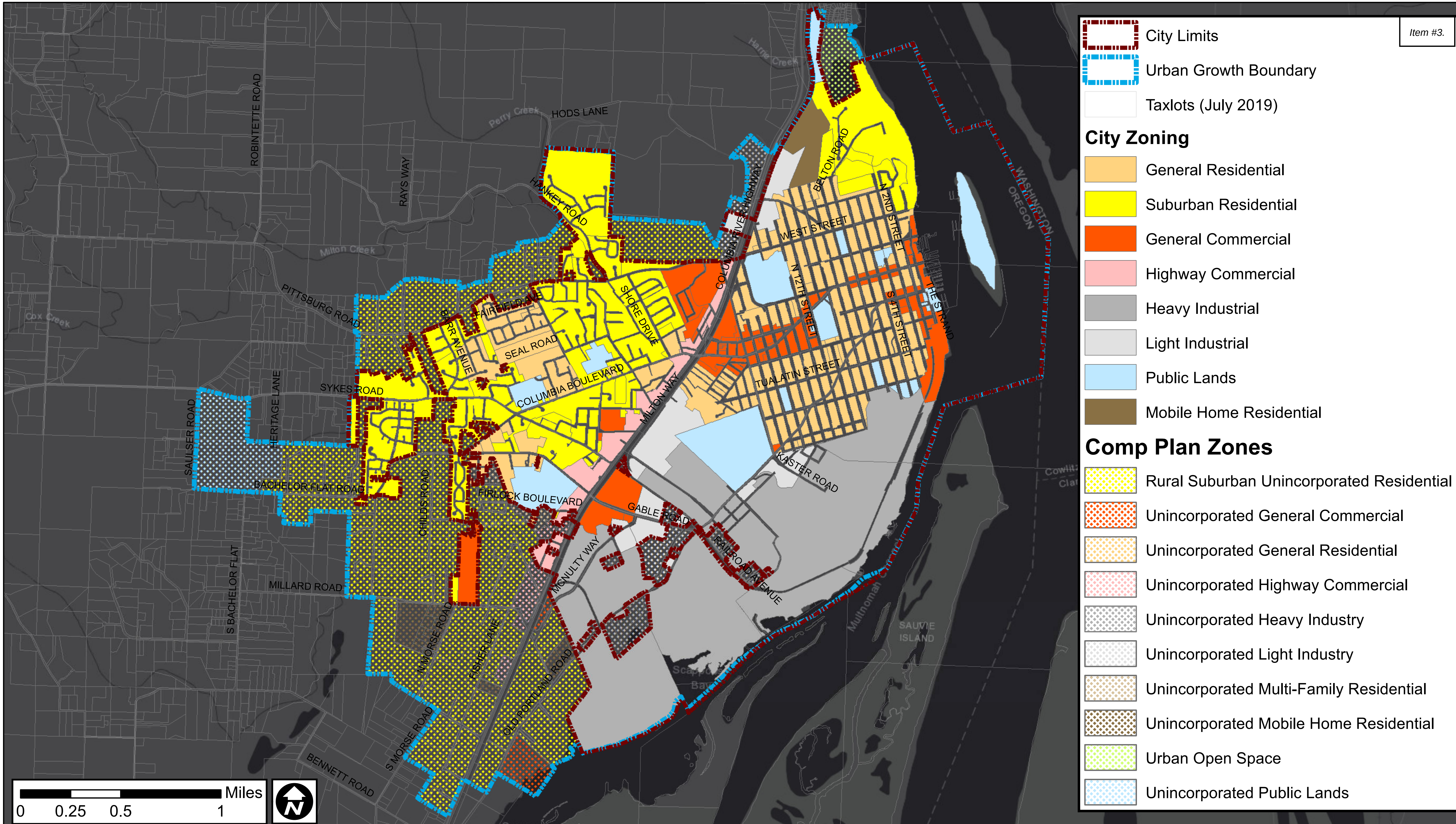
Oregon

Figure 1

City of St. Helens



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Zoning

Stormwater Master Plan

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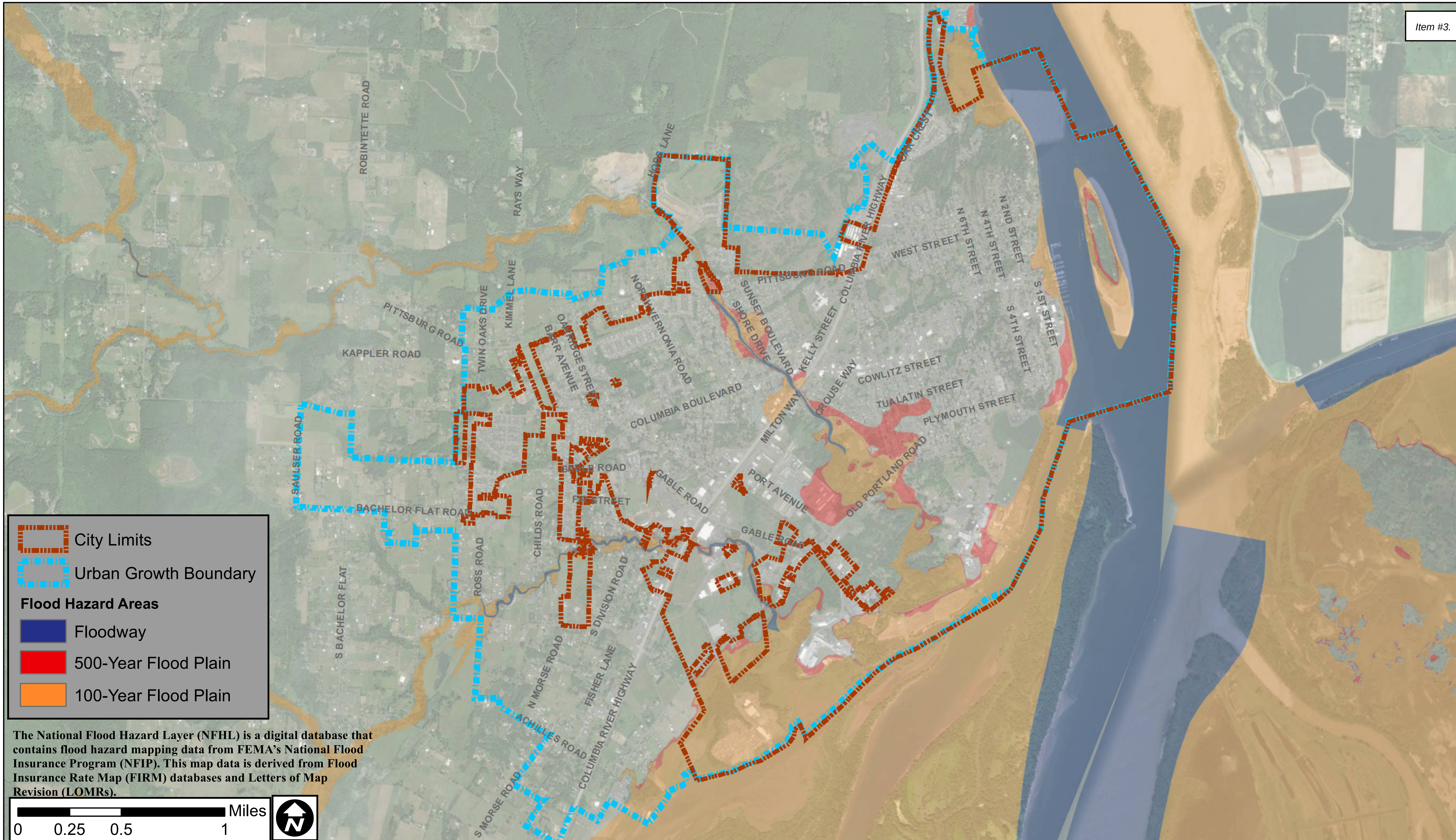
Figure 2

City of St. He



The National Flood Hazard Layer (NFHL) is a digital database that contains flood hazard mapping data from FEMA's National Flood Insurance Program (NFIP). This map data is derived from Flood Insurance Rate Map (FIRM) databases and Letters of Map Revision (LOMRs).

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Flood Hazard Zones

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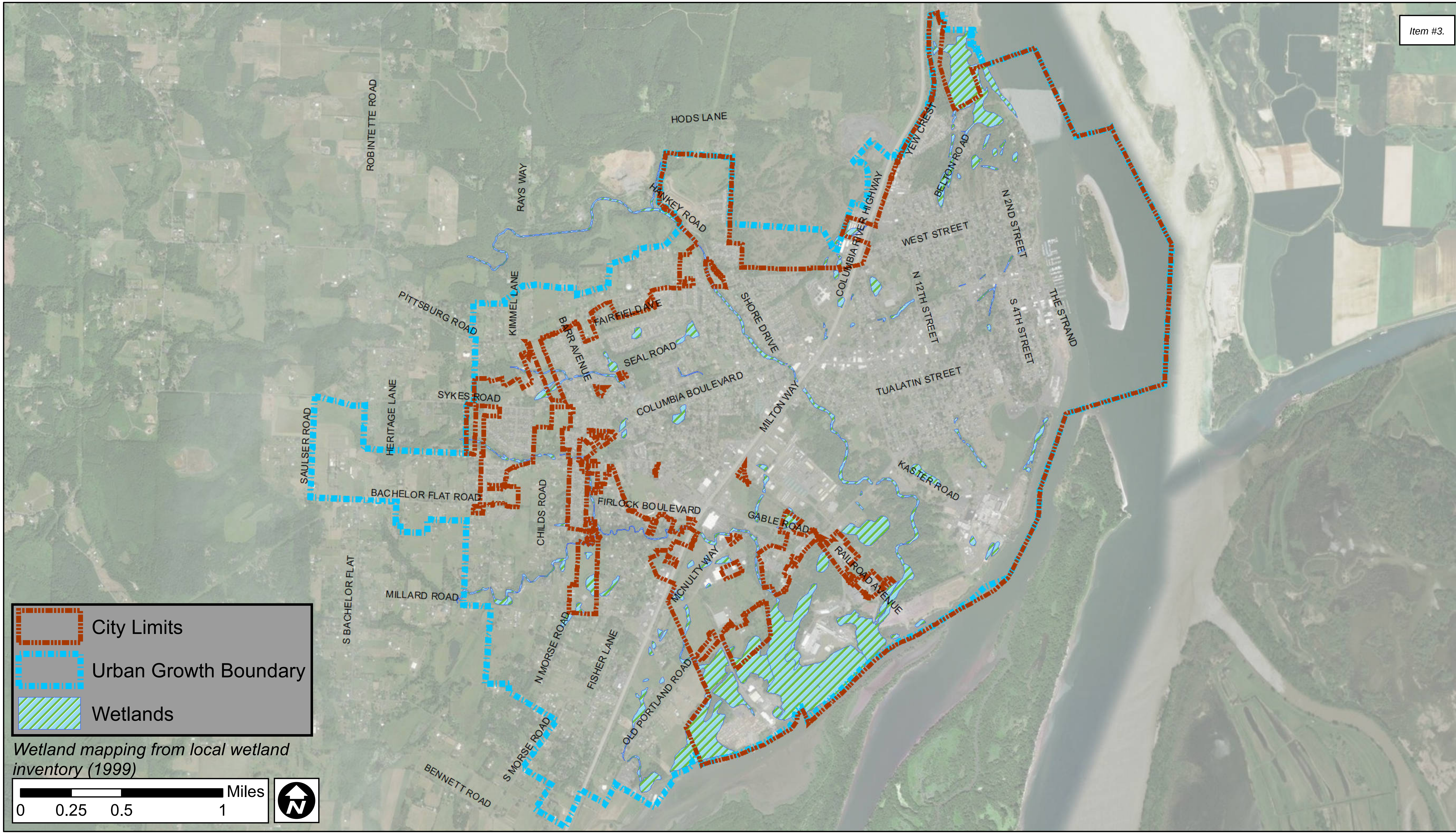
Figure 3

City of St. Helens



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Wetlands

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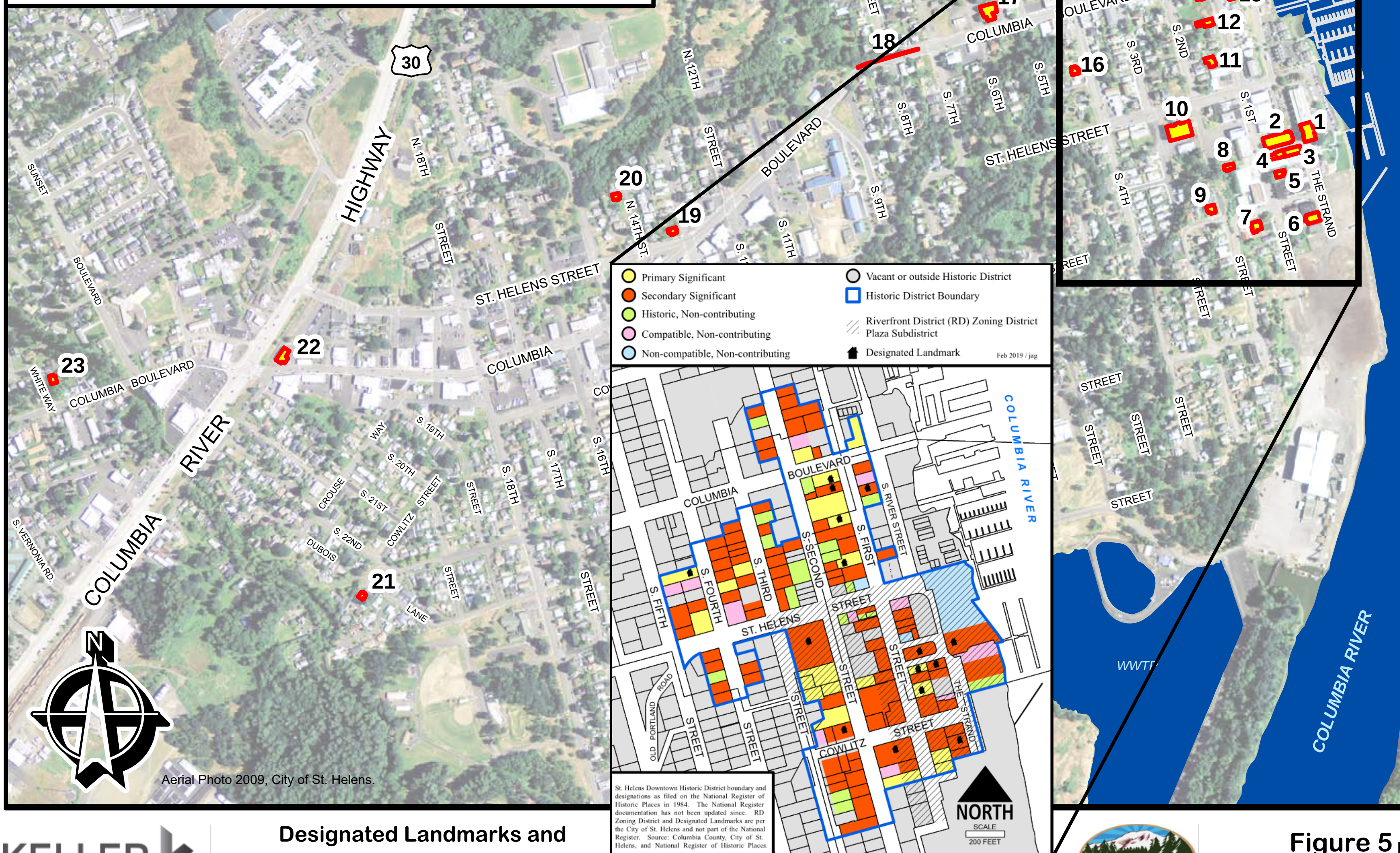
Figure 4

City of St. Hel

City of St. Helens
Designated Landmarks Regsiter Map
Ordinance No. 3250 Aerial Exhibit
SHMC 19.20.030



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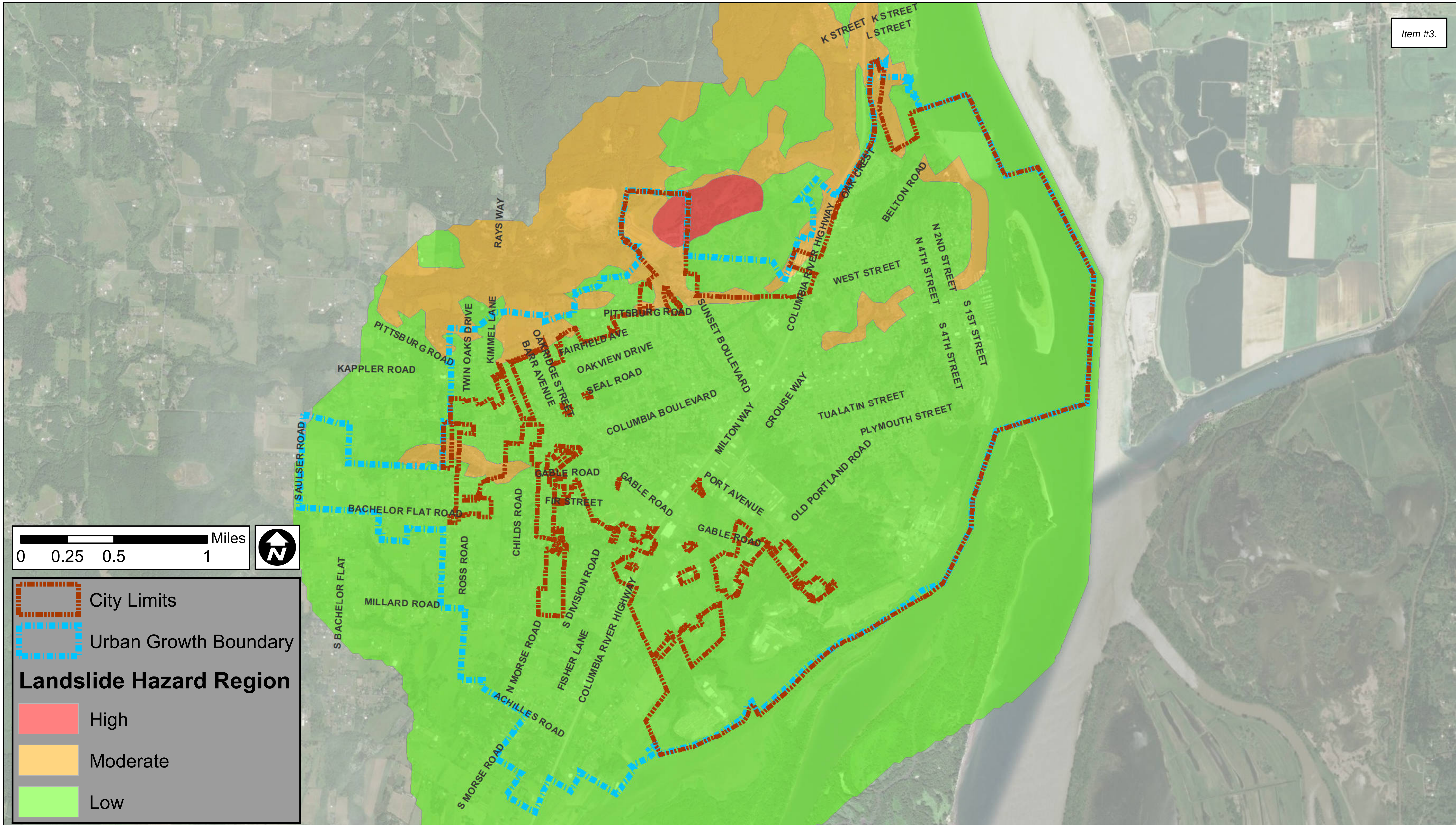
Designated Landmarks and Downtown Historic District

Stormwater Master Plan

Figure 5

City of St. Helens



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Landslide Hazards

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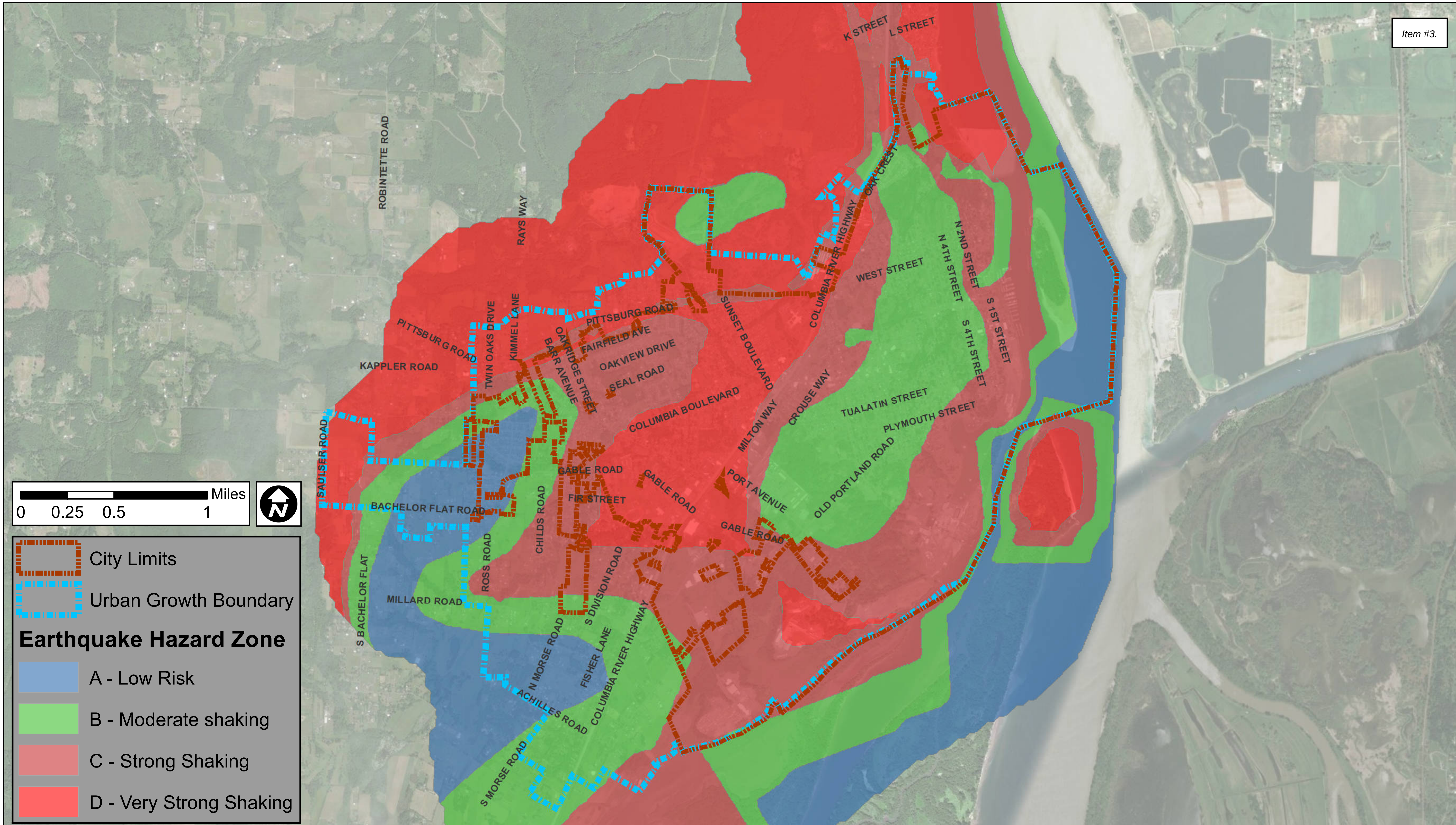
Figure 6

City of St. Helens

Item #3.



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Earthquake Hazards

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Figure 7

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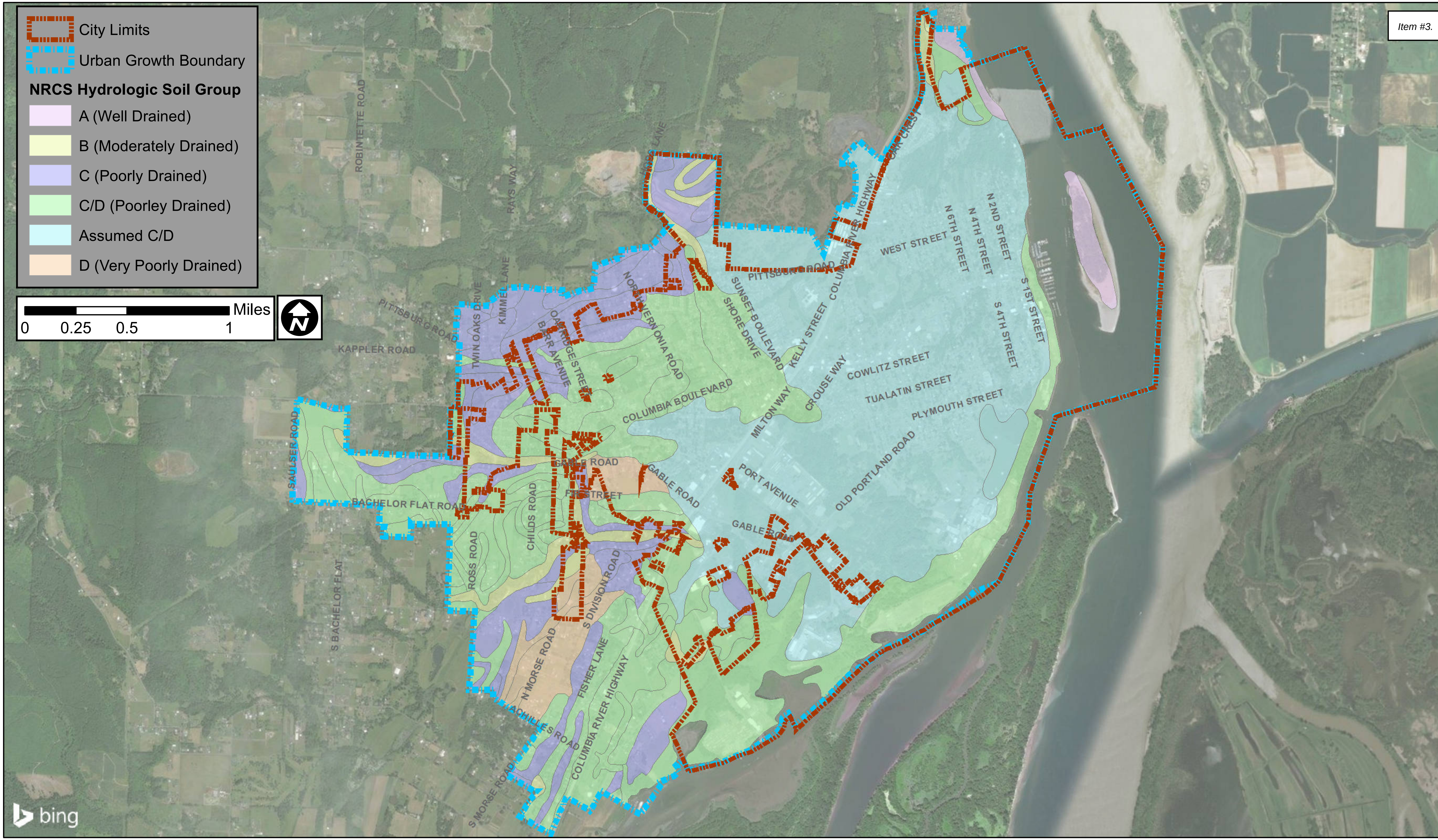

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NRCS Hydrologic Soil Categories

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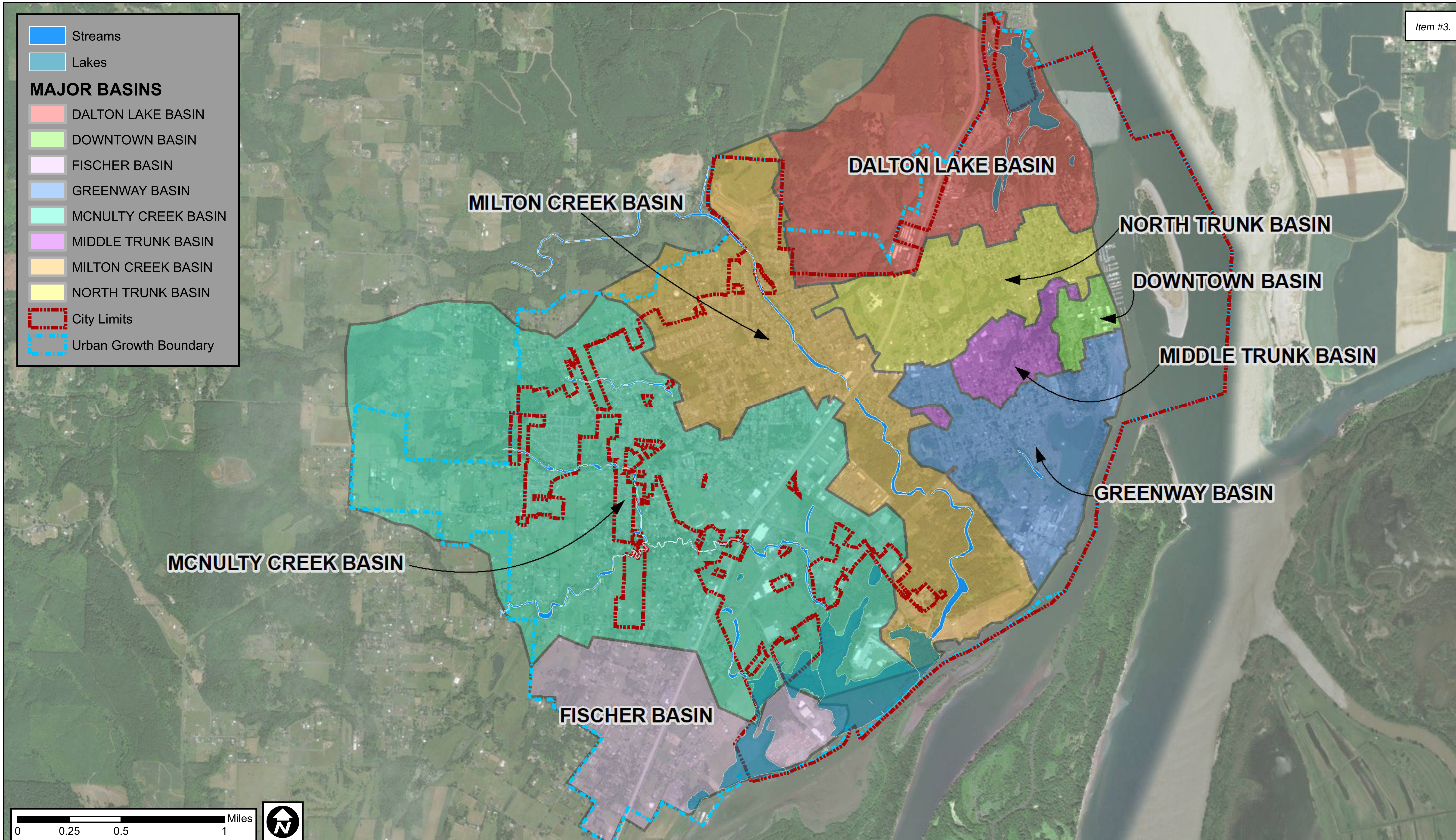
Figure 8

City of St. Helens



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Major Stormwater Basins

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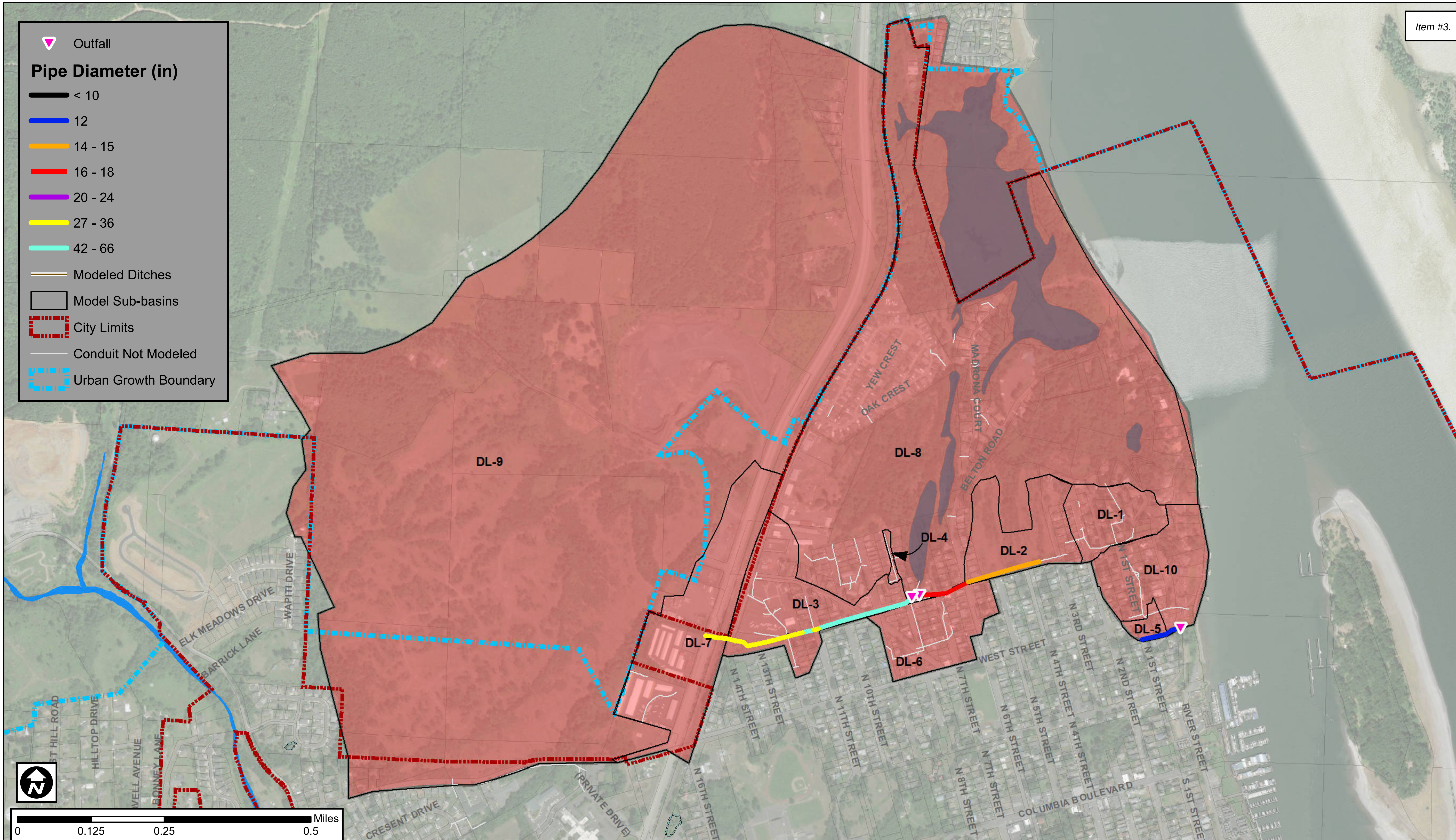
Figure 9

City of St. Helens



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Dalton Lake Basin Modeled Pipes

Stormwater Master Plan

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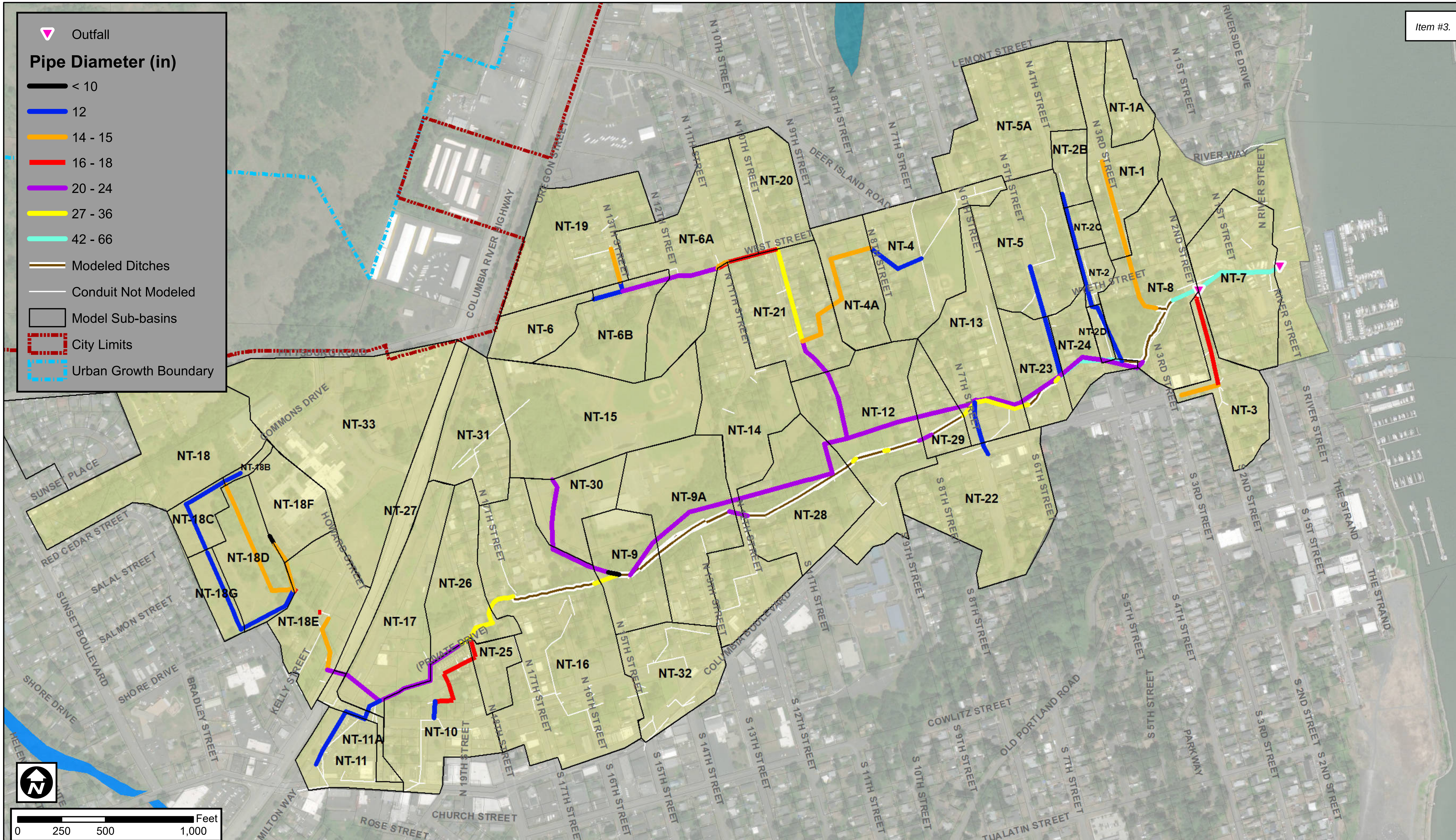
Figure 9A

City of St. Helens



North Trunk Basin Modeled Pipes

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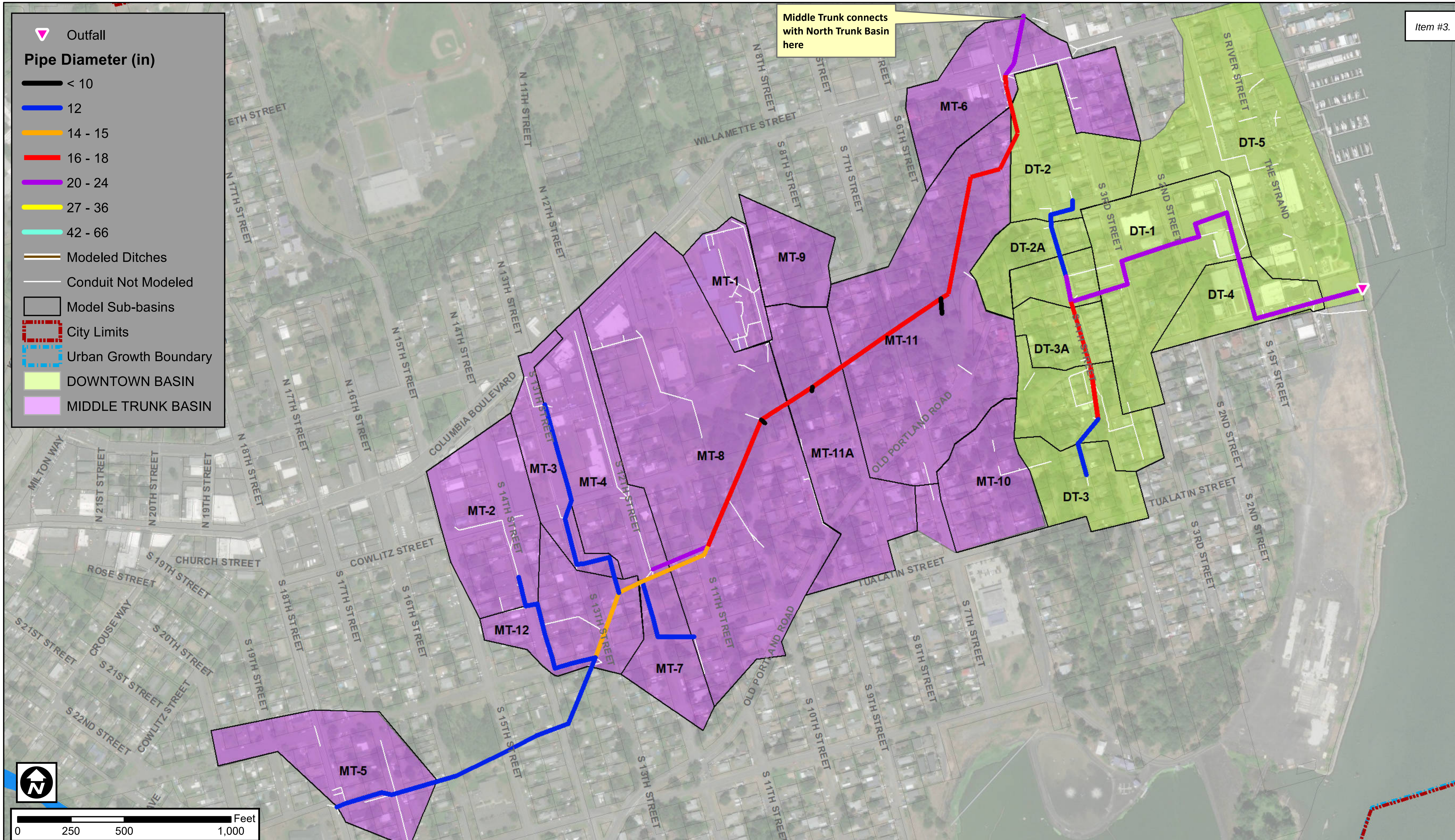
Figure 9B

City of St. Helens



Middle Trunk and Downtown Basin Modeled Pipes

Stormwater Master Plan

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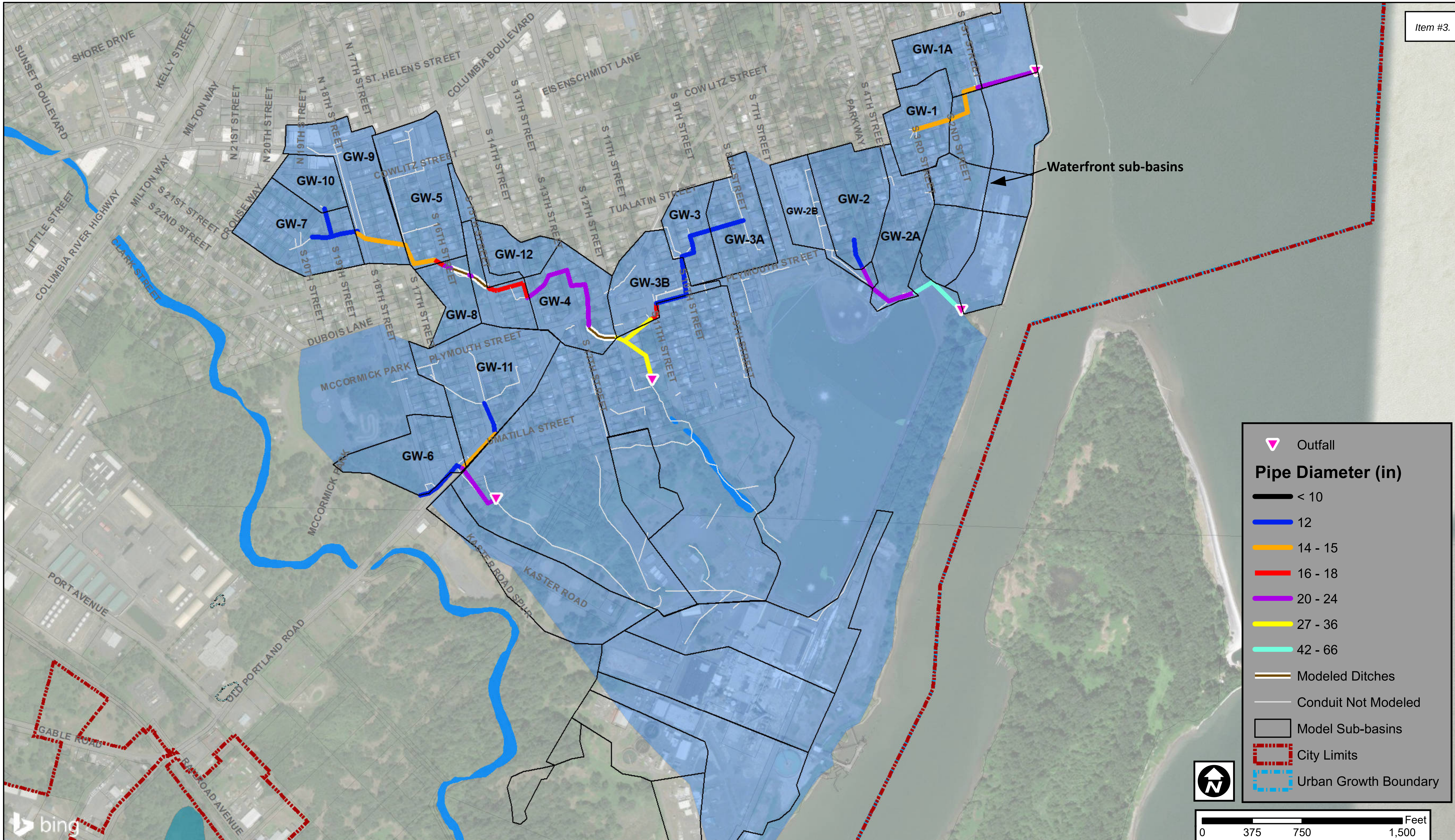
Figure 9C

City of St. Helens



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Greenway Basin Modeled Pipes

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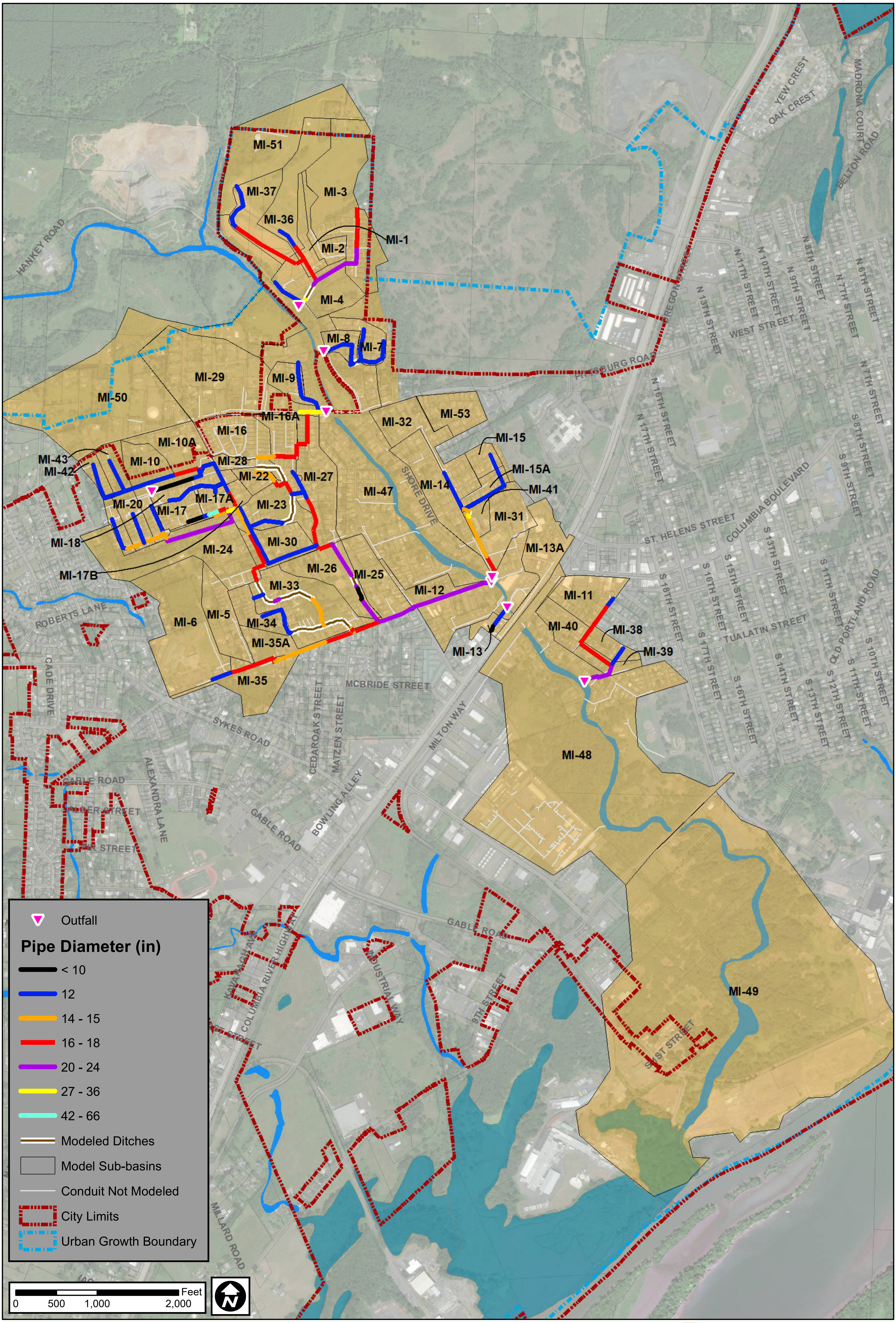
Figure 9D

City of St. Helen



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Milton Creek Basin Modeled Pipes

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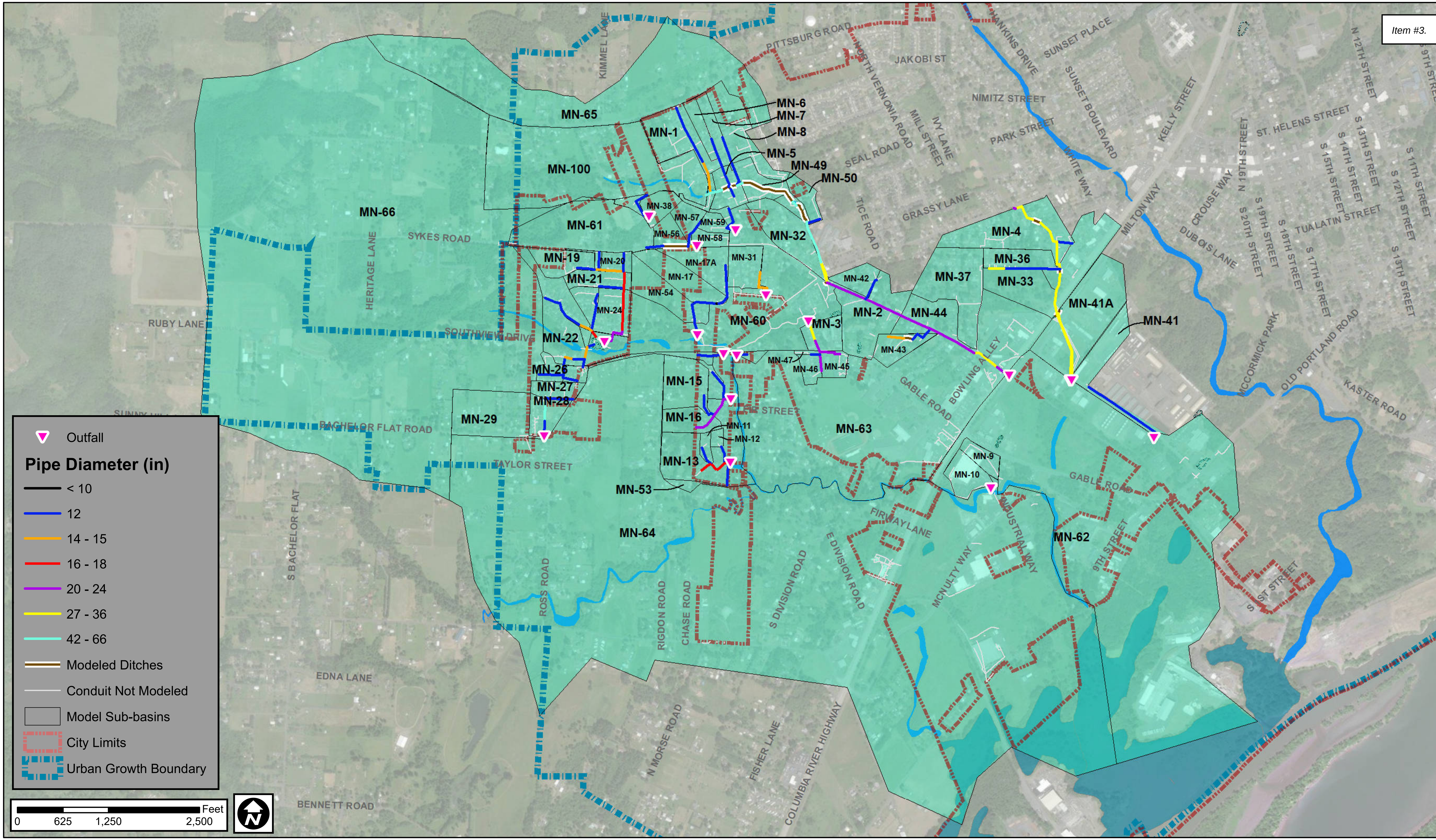
Figure 9E

City of St. Helens



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McNulty Creek Basin Modeled Pipes

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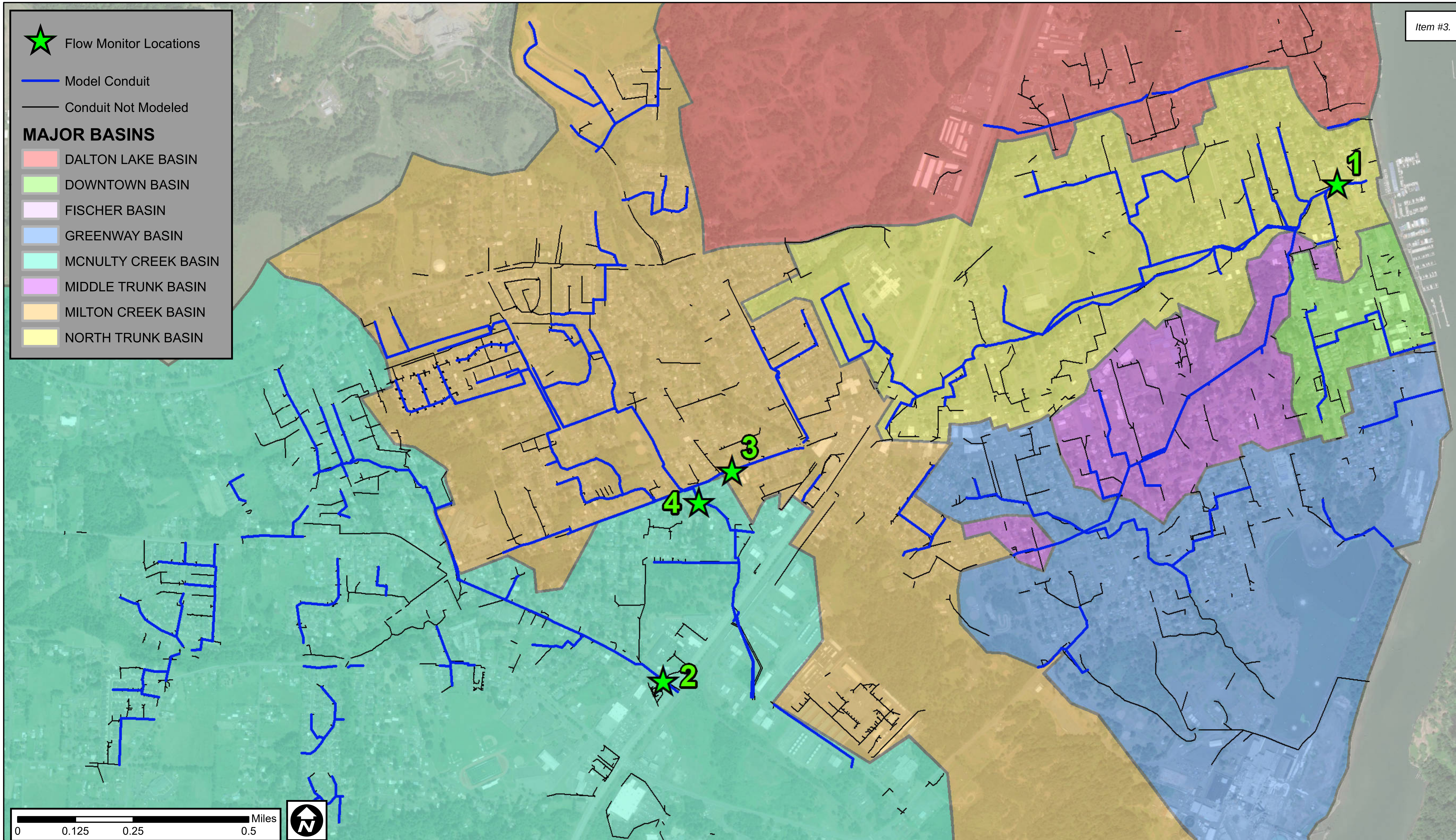
Figure 9F

City of St. H



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Stormwater Flow Meter Locations

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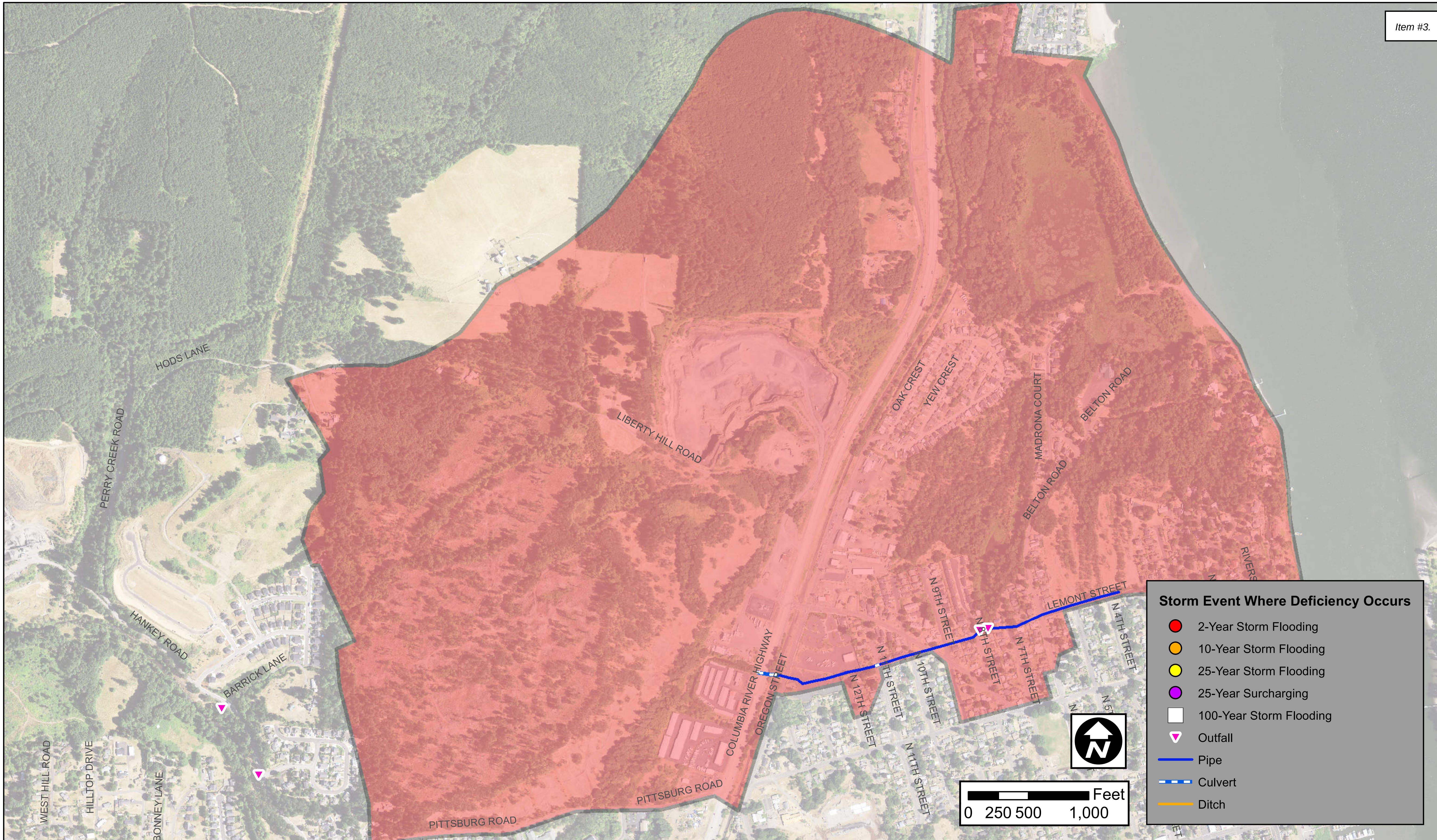
Figure 10

City of St. Helens



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Dalton Lake Basin - Existing Conditions

Stormwater Master Plan

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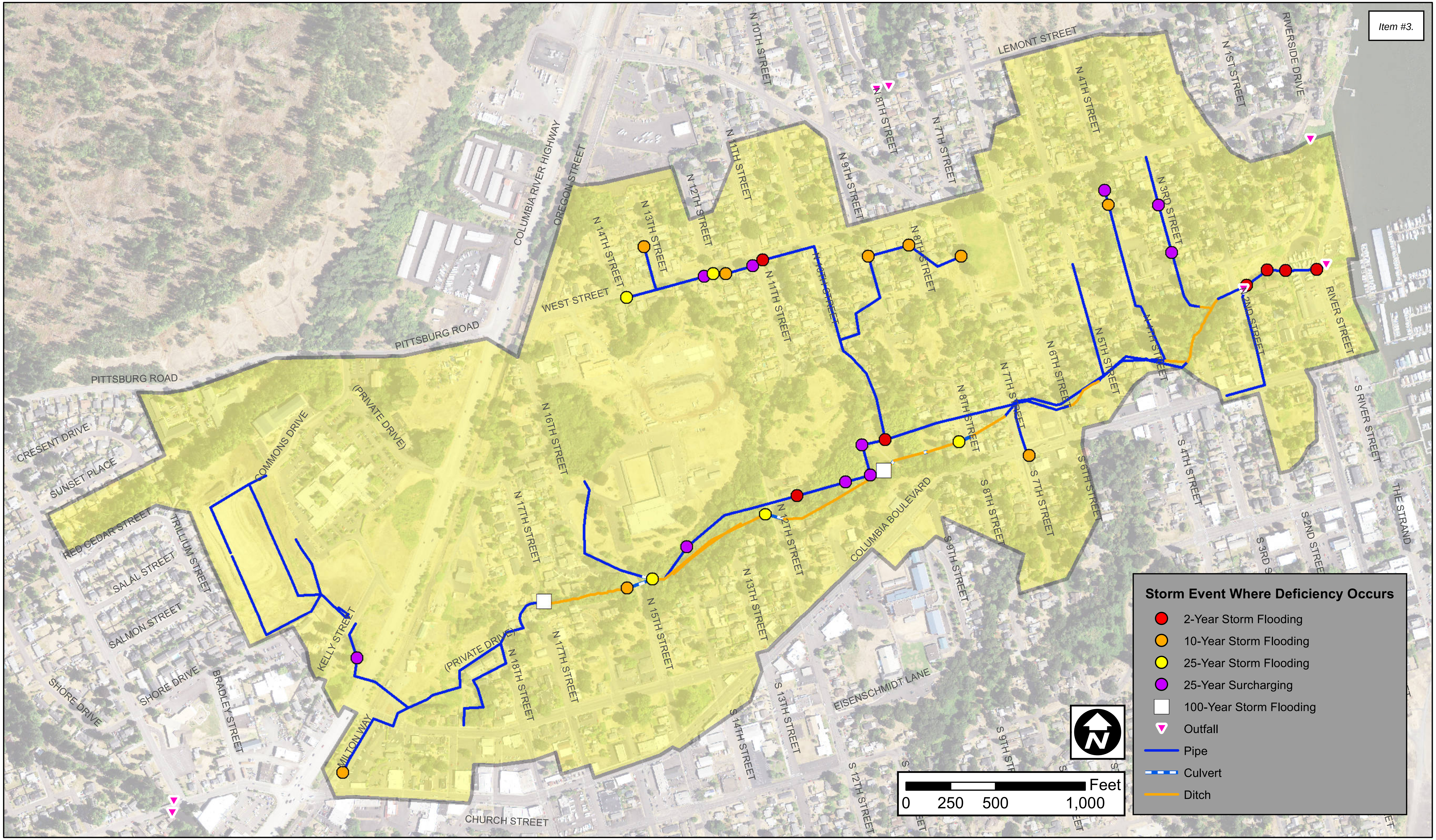
Figure 11A

City of St. Helens



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North Trunk Basin - Existing Conditions

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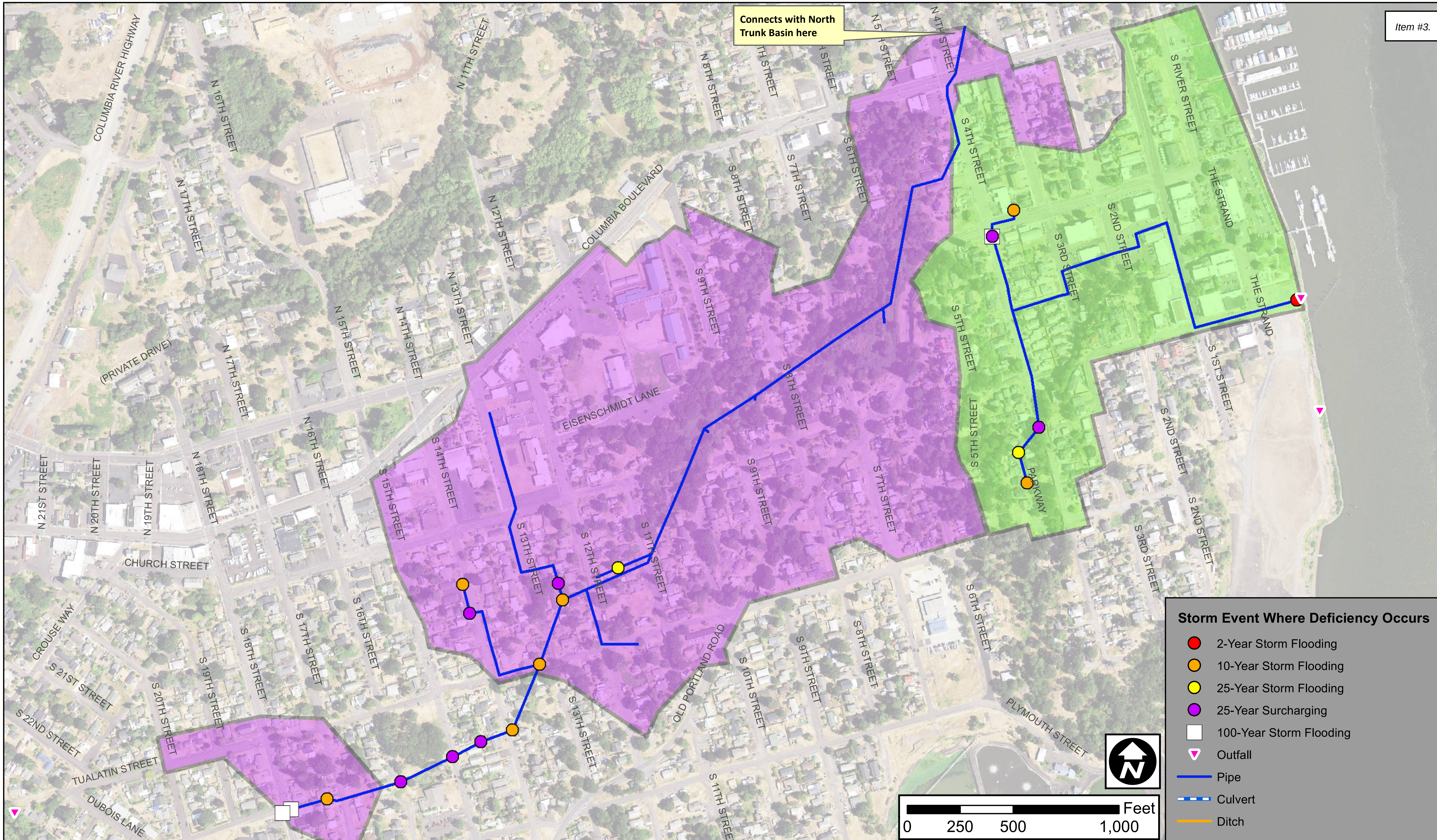
Figure 11B

City of St. Helens



Middle Trunk and Downtown Basins - Existing Conditions

Stormwater Master Plan

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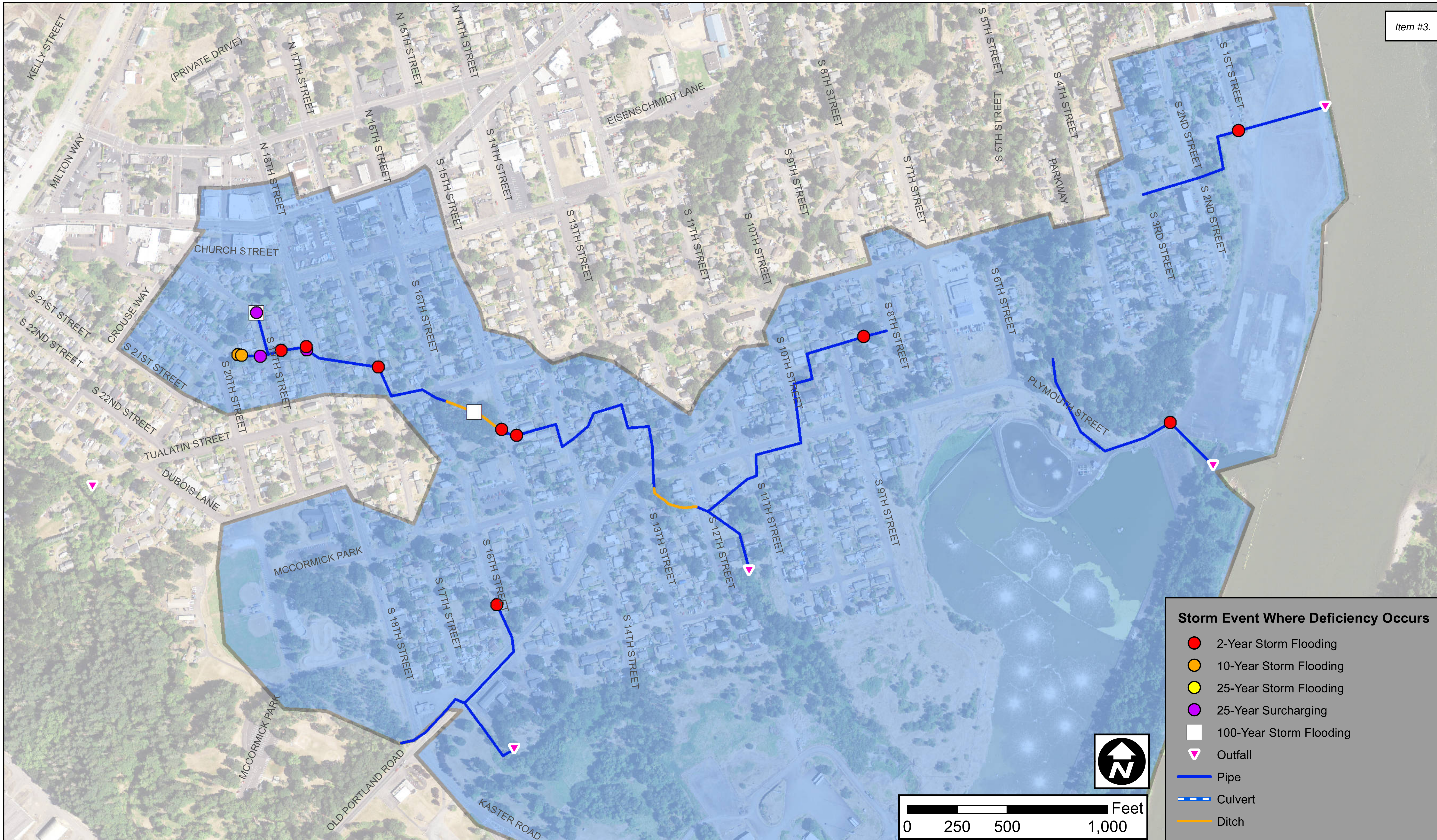
City of St. Helens

Figure 11C

City of St. Helens

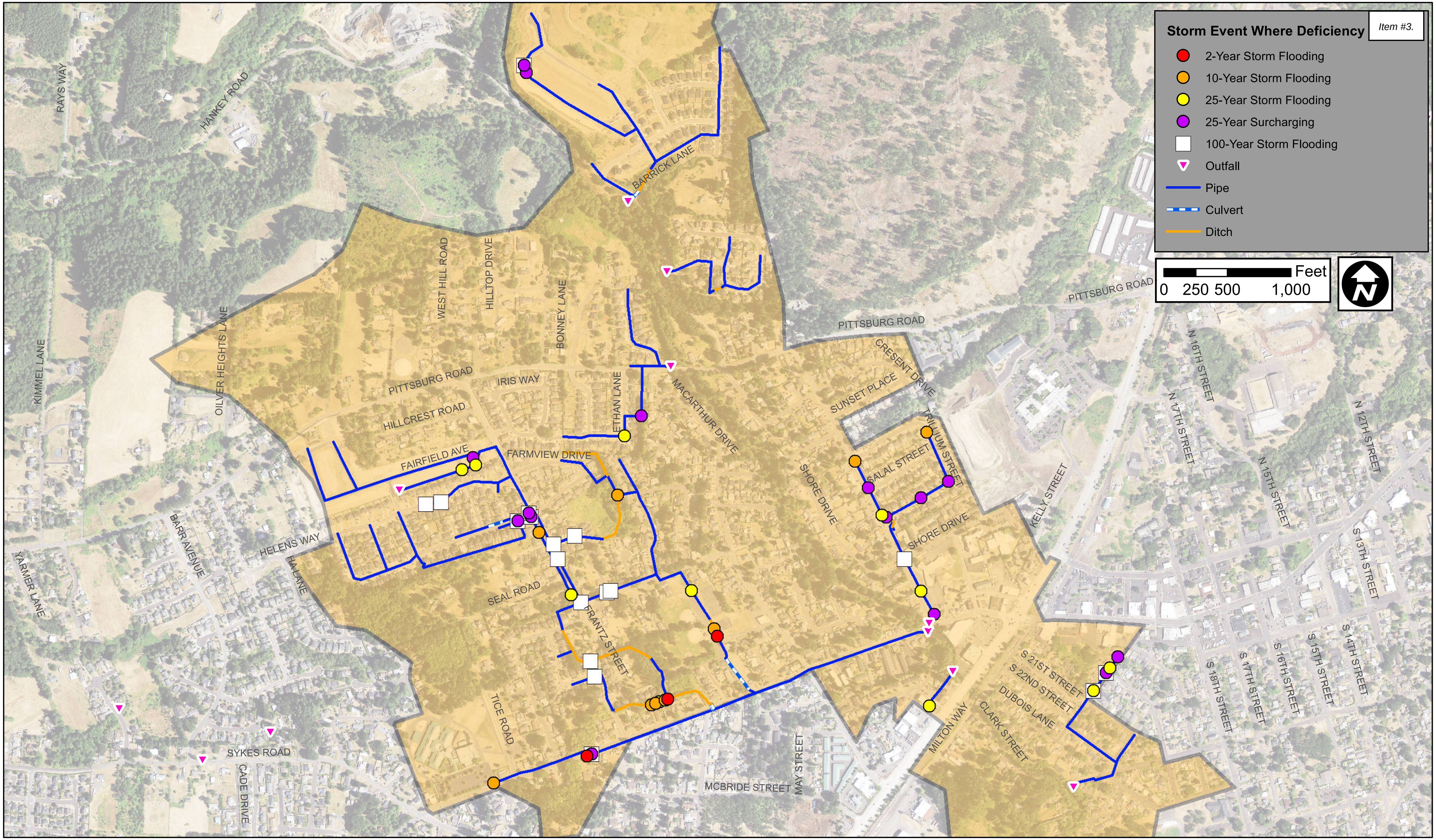


Greenway Basin - Existing Conditions

Stormwater Master Plan

Figure 11D

City of St. Helens



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Milton Creek Lake Basin - Existing Conditions

Stormwater Master Plan

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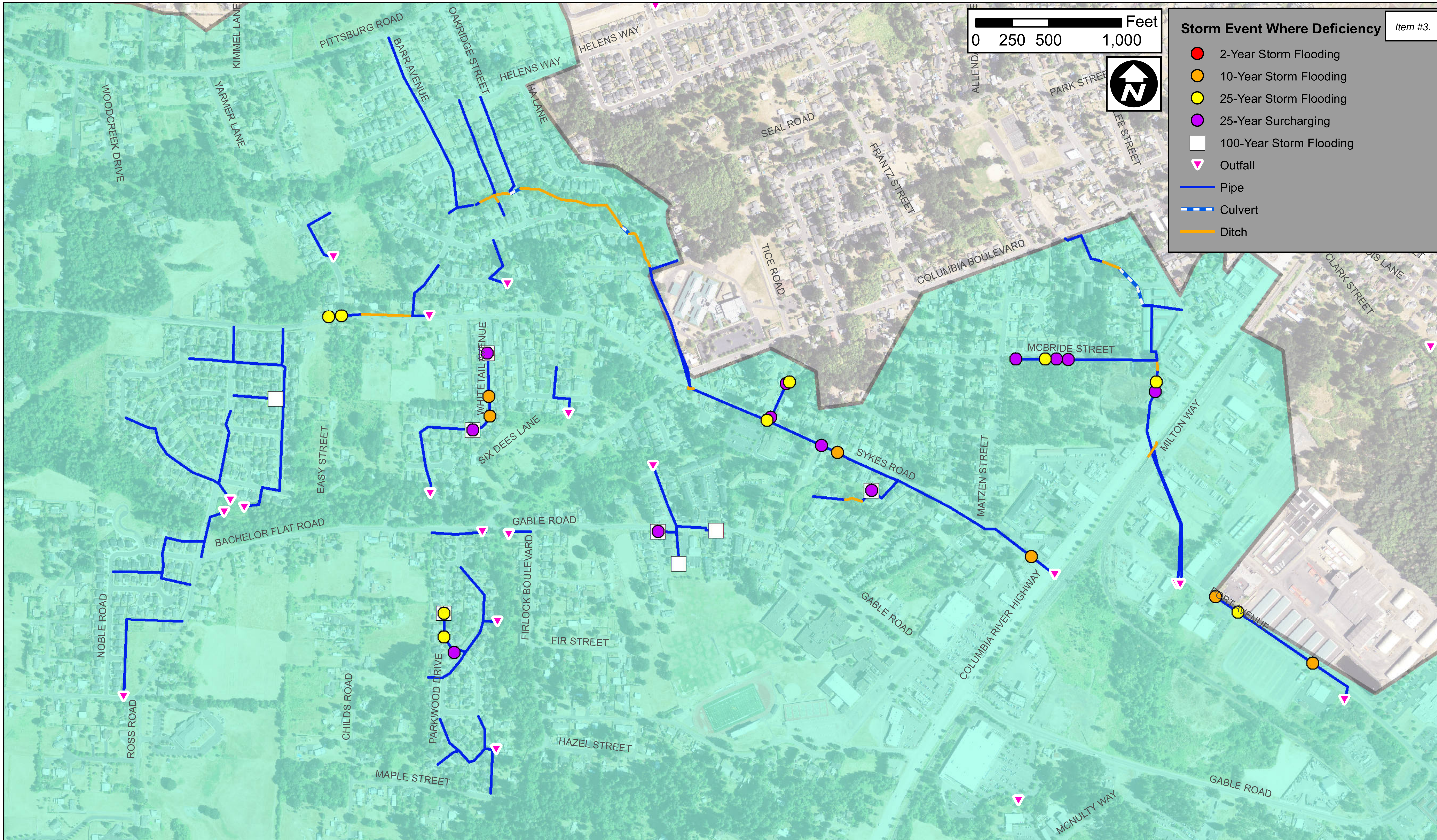
Figure 11E

City of St. Helens



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McNulty Creek Basin - Existing Conditions

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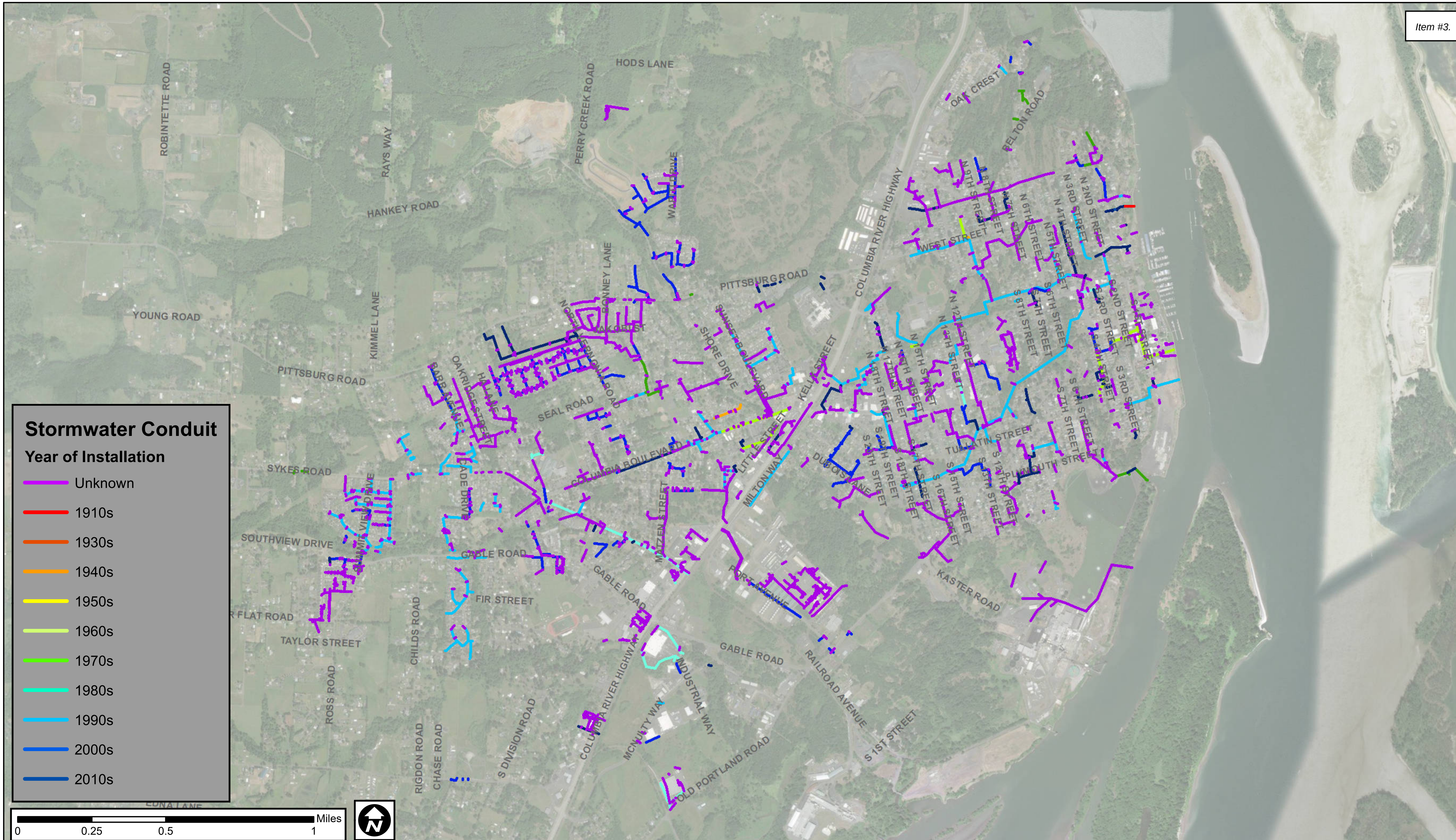
Figure 11F

City of St. Helens



Pipelines by Age

Stormwater Master Plan

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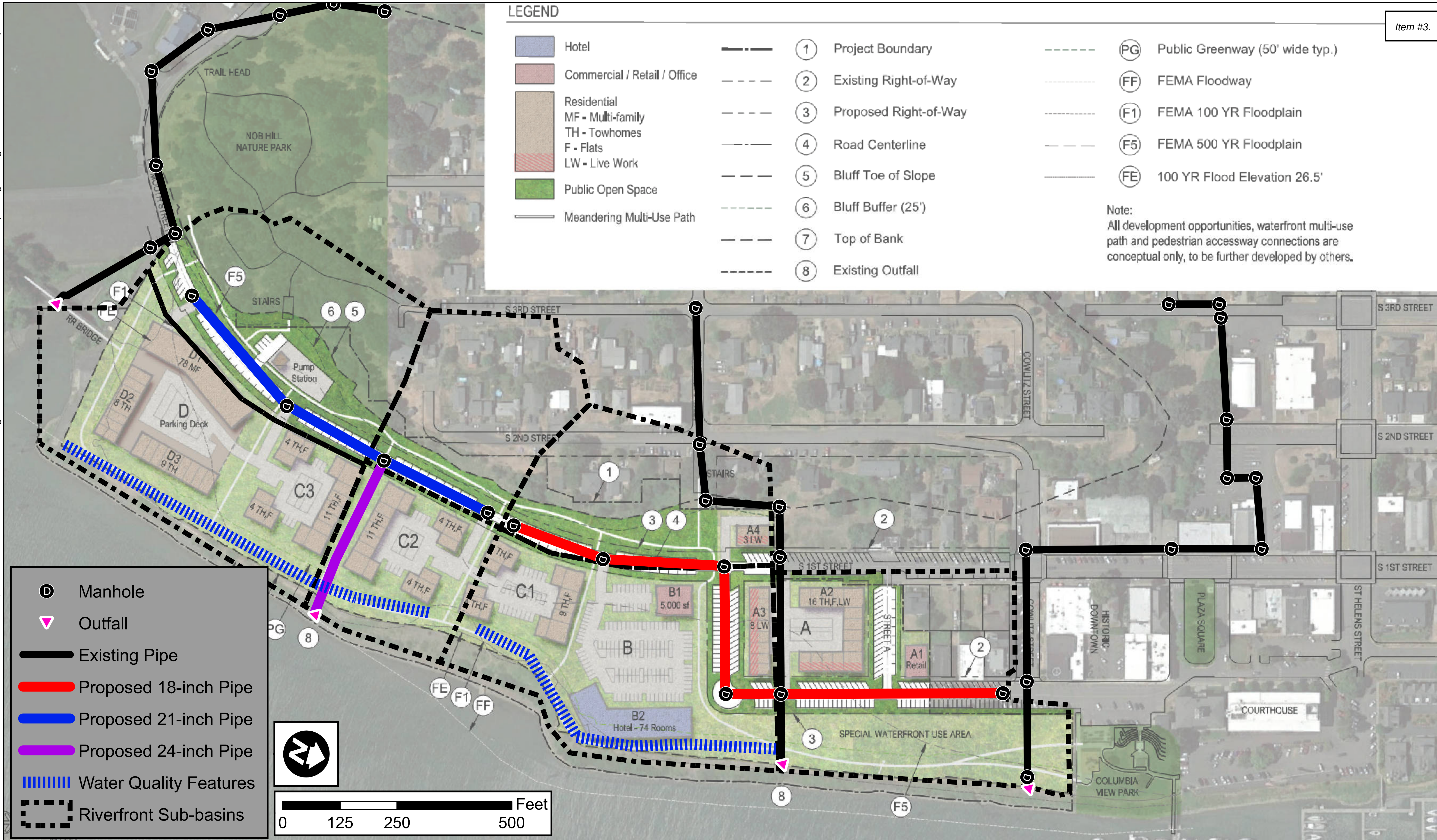
Figure 12

City of St. Helens

Item #3.



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Riverfront Development Property Proposed Alignment

Stormwater Master Plan

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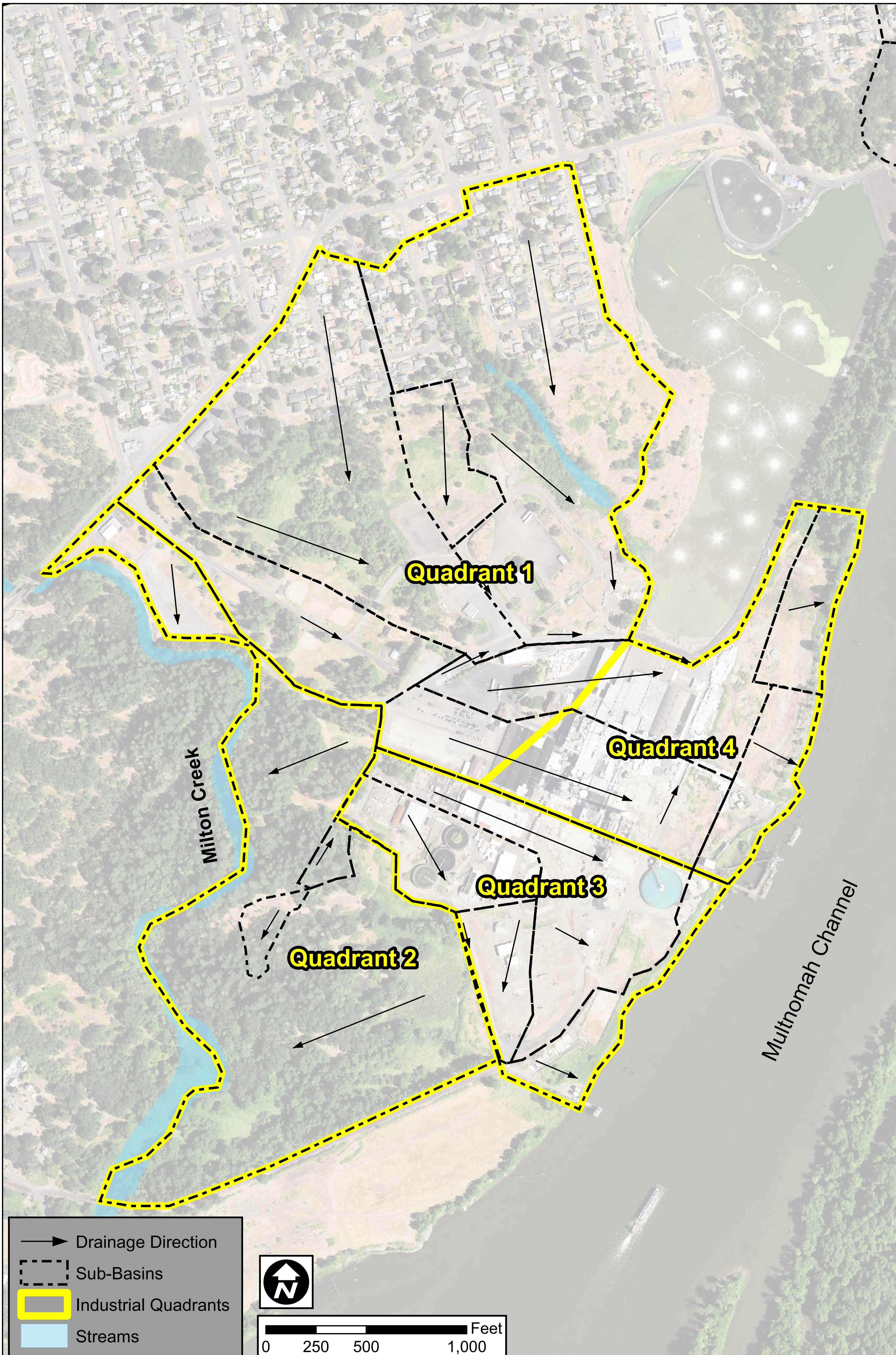
Figure 13

City of St. Hele



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Industrial Business Park Drainage

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Figure 14

City of St. Helens

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Industrial Business Park Proposed Alignment

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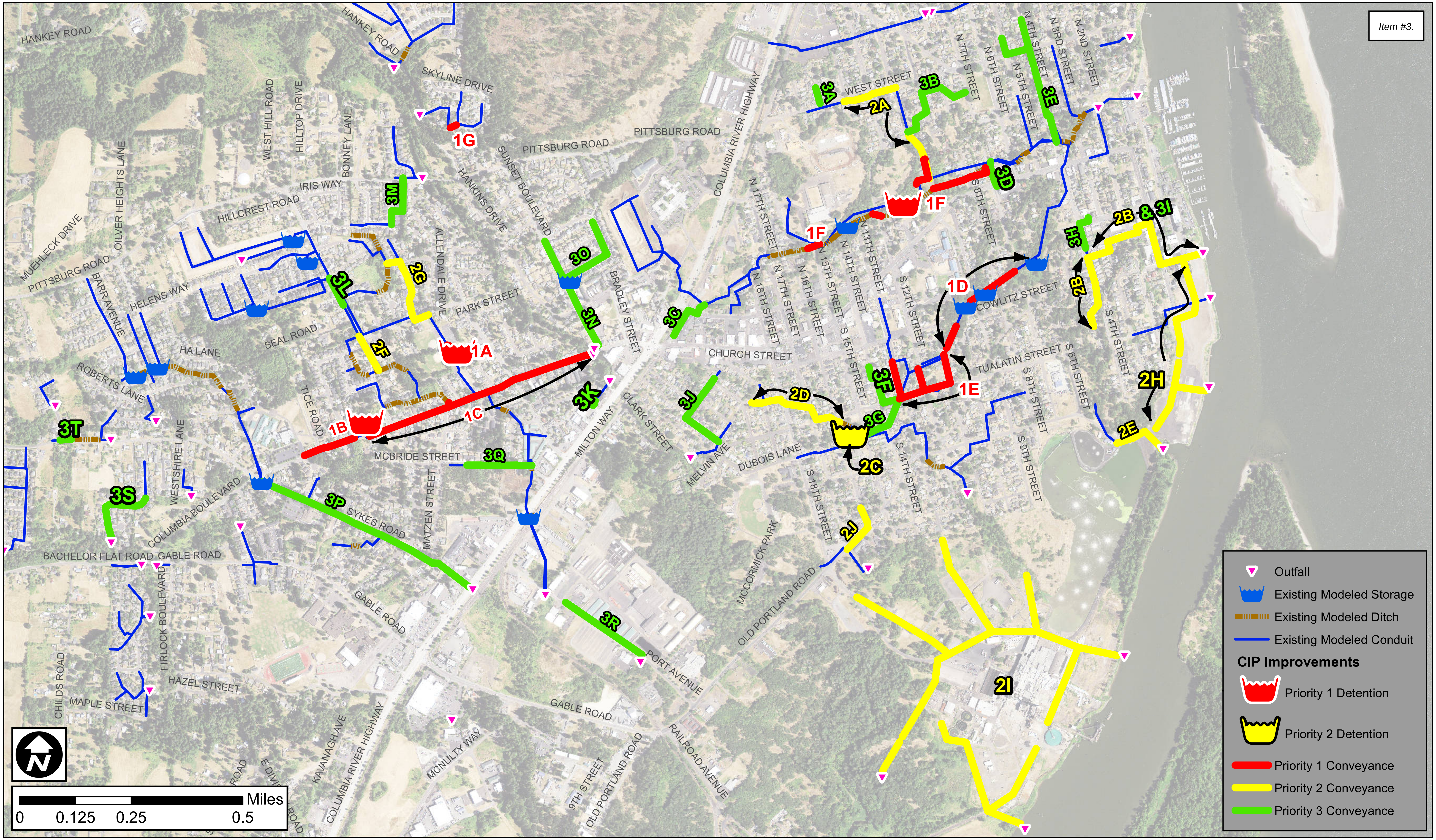
Figure 15

City of St. Helens



Capital Improvement Plan

Stormwater Master Plan

KELLER ASSOCIATES

City of St. Helens FOUNDED 1850 Oregon

Figure 16

City of St. Helens

APPENDIX B

Planning Documents

KELLER
ASSOCIATES

Columbia County Endangered Species

Source: Oregon Fish and Wildlife IPaC Online Database

Item #3.

Group	Name	Population	Status	Lead Office	Recovery Plan	Recovery Plan Action Status
Snails	Burrington jumping-slug (Hemphillia burringtoni)	Wherever found	Under Review	1		
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Coastal Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Columbia Headwaters Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Klamath Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Mid-Columbia Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Recovery Plan for the Coterminous United States Population of Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	St. Mary Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Upper Snake Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Mammals	red tree vole (Arborimus longicaudus)	North Oregon Coast population	Resolved Taxon	1		
Birds	Northern spotted owl (Strix occidentalis caurina)	Wherever found	Threatened	1	Revised Recovery Plan for the Northern Spotted Owl	Implementation Progress
Flowering Plants	Nelson's checker-mallow (Sidalcea nelsoniana)	Wherever found	Threatened	1	Final Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington	Implementation Progress
Flowering Plants	Kincaid's Lupine (Lupinus sulphureus ssp. kincaidii)	Wherever found	Threatened	1	Final Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington	Implementation Progress
Flowering Plants	golden paintbrush (Castilleja levisecta)	Wherever found	Threatened	1	Recovery Plan for the Golden Paintbrush (Castilleja levisecta)	Implementation Progress
Birds	Marbled murrelet (Brachyramphus marmoratus)	U.S.A. (CA, OR, WA)	Threatened	1	Recovery Plan for the Threatened Marbled Murrelet (Brachyramphus marmoratus) in Washington, Oregon, and California	Implementation Progress
Flowering Plants	Willamette daisy (Erigeron decumbens)	Wherever found	Endangered	1	Final Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington	Implementation Progress
Birds	Streaked Horned lark (Eremophila alpestris strigata)	Wherever found	Threatened	1	Draft Recovery Plan for the Streaked Horned Lark	Implementation Progress
Flowering Plants	Bradshaw's desert-parsley (Lomatium bradshawii)	Wherever found	Endangered	1	Final Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington	Implementation Progress
Flowering Plants	Water howellia (Howellia aquatilis)		Threatened	6	Water Howellia (Howellia aquatilis) Recovery Plan, Public and Agency Review Draft	Implementation Progress
Mammals	Columbian white-tailed deer (Odocoileus virginianus leucurus)	Columbia River (Clark, Cowliz, Pacific, Skamania, and Wahkiakum Counties, WA., and Clatsop, Columbia, and Multnomah Counties, OR.)	Threatened	1	Columbian White-tailed Deer Revised Recovery Plan	Implementation Progress
Birds	Yellow-billed Cuckoo (Coccyzus americanus)	Western DPS: U.S.A. (AZ, CA, CO (western), ID, MT (western), NM (western), NV, OR, TX (western), UT, WA, WY (western)); Canada (British Columbia (southwestern); Mexico (Baja California, Baja California Sur, Chihuahua, Durango (western), Sinaloa, Sonora)	Threatened	2		

APPENDIX C

Geotechnical Report

KELLER ASSOCIATES

Item #3.

SUBMITTED TO:
Keller Associates
245 Commercial St SE,
Suite 210
Salem, Oregon, 97301

BY:
Shannon & Wilson, Inc.
3990 SW Collins Way, Ste 100
Portland, Oregon,

503-210-4764
www.shannonwilson.com

DRAFT

GEOTECHNICAL PLANNING REPORT

St. Helens Wastewater and Stormwater Master Plan Update

ST. HELENS, OREGON

SHANNON & WILSON

September 2021

Shannon & Wilson No

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Submitted To: Keller Associates
245 Commercial St SE,
Suite 210
Salem, Oregon, 97301
Attn: Peter Olsen, PE

Subject: DRAFT GEOTECHNICAL PLANNING REPORT, ST. HELENS WASTEWATER AND STORMWATER MASTER PLAN UPDATE, ST. HELENS, OREGON

Shannon & Wilson prepared this report and participated in this project as a subconsultant to Keller Associates. Our scope of services was specified in our contracted dated March 18, 2021 for Keller project number 220060. This report presents the geotechnical planning-related findings based on a review of publicly available documents and was prepared by the undersigned.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON, INC.

Elliott Mecham, PE Senior Associate	David Jacobson Geologic Staff

DSJ:ECM:JLJ/:myw

CONTENTS

Figures

CONTENTS

1 GENERAL

The City of St. Helens provides sanitary sewer collection services to businesses and residences within the City limits. The sanitary sewer collection system is a combination of 60 miles of gravity and force mains, 9 lift stations, and over 1,700 sanitary sewer manholes, vaults, and cleanouts. All sewage flows are conveyed to the City's wastewater treatment facility. The last complete update to the City's sanitary sewer master plan was in 1989.

The intent of the sanitary sewer master plan is to perform an assessment of the existing sewer system; evaluate the sewer system for its capacity to convey existing and future waste discharges; identify deficiencies, capacity issues, areas for improvement, and identify resiliency issues for critical facilities; and determine and propose solutions.

2 SCOPE OF SERVICES

The purpose of Shannon & Wilson’s task is to prepare and provide GIS maps of the service area with the mapped site geology and the State of Oregon Department of Geology and Mineral Industries' (DOGAMI) mapped seismic hazards, and document the findings in a brief report. The backbone wastewater and stormwater facilities selected and digitized into GIS format by others will be shown on the maps. Our specific scope of work includes the following:

- Mapped site geology;
- Mapped landslides included in DOGAMI’s landslide inventory (if any) along the proposed pipeline alignments or at the treatment plant sites;
- Mapped United States Geology Survey (USGS) Class A or Class B faults that cross pipeline alignments or are located within a 5-mile radius of treatment plant locations;
- Mapped relative earthquake liquefaction hazard based on DOGAMI maps (high, medium, or low hazard);
- Mapped relative landslide risk based on DOGAMI maps (very high, high, moderate, or low hazard); and
- Submitting a brief memo or letter report presenting the geologic maps and a brief discussion summarizing our findings, including a discussion on probable areas where rock excavation could be required, and the potential need to mitigate seismic hazards. The discussions will be limited by the uncertainties and assumptions made during the development of the geologic maps and DOGAMI hazard layers.

3 DESCRIPTION OF PROVIDED MAPS

3.1 Provided Data

Shannon & Wilson was provided GIS files for the City of St. Helens stormwater and wastewater facilities. An overview map of these facilities can be found on Figure 2, Site Plan. Within the files provided were attributes which allowed for the identification of vulnerable assets. The vulnerable pipelines can be found on Figure 3, Pipeline Vulnerabilities.

3.2 Available Mapping

DOGAMI has developed several publications which were used in our assessments related to the stormwater and wastewater facilities. These included site geology, landslide hazard, and peak ground accelerations associated with a Cascadia Subduction Zone earthquake. Datasets of interest for this project include the following:

- Geology: Oregon Geologic Data Compilation release 6 (OGDC-6);
- Landslide Hazard: DOGAMI Open-File Report O-16-02; and
- Cascadia Peak Ground Accelerations: DOGAMI Open-File Report O-13-06.

3.3 Geology

The City of St. Helens is at the northern end of the Portland Basin, a structural depression created by complex folding and faulting of the basement rocks. The most prevalent basement rock of the Portland Basin is a sequence of lava flows called the Columbia River Basalt Group (CRBG), which flowed into the area between about 17 million and 6 million years ago (Beeson and others, 1991). Due to the wet and mild climate of the Pacific Northwest, intense chemical weathering of the geologic units has taken place (Evarts, 2004). This has resulted in the development of soil horizons as thick as 10 m. In some instances, the rocks of the CRBG have been completely converted to soil, destroying all primary rock textures.

The Columbia and Willamette Rivers converge within the Portland Basin and, with their tributaries, have contributed to an extensive sedimentary fill which overlies the basement rock formations. Beeson and others (1991) mapped the local Portland Basin fill sediments as Sandy River Mudstone, overlain by Troutdale Formation. The Troutdale Formation locally consists of well-consolidated friable to moderately well-cemented conglomerate and sandstone, deposited in the Miocene to Pliocene epochs (about 12.5 million to 1.6 million years ago).

The Troutdale Formation is locally overlain by sediments deposited during a series of catastrophic glacial outburst floods. During the late stages of the last great ice age, between about 18,000 and 15,000 years ago, a lobe of the continental ice sheet repeatedly blocked and dammed the Clark Fork River in western Montana, which then formed an immense glacial lake called Lake Missoula. The lake grew until its depth was sufficient to buoyantly lift and rupture the ice dam, which allowed the entire massive lake to empty catastrophically. Once the lake had emptied, the ice sheet again gradually dammed the Clark Fork Valley and the lake refilled, leading to 40 or more repetitive outburst floods at intervals of decades (Allen and others, 2009). During each short-lived episode, floodwaters washed across the Idaho panhandle, through the eastern Washington scablands, and through the Columbia River Gorge. When the floodwater emerged from the western end of the gorge, it spread out over the Portland Basin and up the Willamette Valley as far south as Junction City, depositing a tremendous load of sediment (O'Conner and others, 2001).

The geologic map presented on Figure 4 comes directly from the Oregon Geologic Data Compilation release 6 (OGDC-6).

3.3.1 Regional Seismological Setting

Earthquakes in the Pacific Northwest occur largely as a result of the subduction of the Juan de Fuca plate beneath the North American plate along the Cascadia Subduction Zone (CSZ). The CSZ is located approximately parallel to the coastline from northern California to southern British Columbia. The compressional forces that exist between these two colliding plates cause the oceanic Juan de Fuca plate to descend, or subduct, beneath the continental plate at a rate of about 1.5-inches per year (DeMets and others, 1990). This process leads to volcanism in the North American plate and stresses and faulting in both plates throughout much of the western regions of southern British Columbia, Washington, Oregon, and northern California. Stress between the colliding plates is periodically relieved through great earthquakes at the CSZ plate interface.

Within the regional tectonic framework and historical seismicity, three broad earthquake sources are identified:

- Subduction Zone Interface Earthquakes originate along the CSZ, which is located 25 miles beneath the coastline. Paleoseismic evidence and historic tsunami records from Japan indicate that the most recent subduction zone interface event was in 1700 AD and was an approximately magnitude 9 earthquake that likely ruptured the full length of the CSZ.
- Deep-Focus, Intraplate Earthquakes originate from within the subducting Juan de Fuca oceanic plate as a result of the downward bending and tension in the subducted plate. These earthquakes typically occur 28 to 38 miles beneath the surface. Such events on the

CSZ are estimated to be as large as magnitude 7.5. Historic earthquakes include the 1949 magnitude 7.1 Olympia earthquake, the 1965 magnitude 6.5 earthquake between Tacoma and Seattle, and the magnitude 6.8 2001 Nisqually earthquake. The highest rate of CSZ intraslab activity is beneath the Puget Sound area, with much lower rates observed beneath western Oregon.

- Shallow-Focus Crustal Earthquakes are typically located within the upper 12 miles of the earth's surface. The relative plate movements along the CSZ cause not only east-west compressive strain but dextral shear, clockwise rotation, and north-south compression of the leading edge of the North American Plate (Wells and others, 1998), which is the cause of much of the shallow crustal seismicity of engineering significance in the region. The largest known crustal earthquake in the Pacific Northwest is the 1872 North Cascades earthquake with an estimated magnitude of about 7. Other examples include the 1993 magnitude 5.6 Scotts Mill earthquake and magnitudes 5.9 and 6.0 Klamath Falls earthquakes. According to the USGS Quaternary Fault and Fold database (USGS, 2021), there are no Class A features within approximately 5 miles of the project site.

3.4 Liquefaction Hazard

The statewide liquefaction map of the state is a compilation of liquefaction susceptibility maps from other DOGAMI publications. Within the St. Helens area, this is IMS-7 (Madin and Wang, 1999). While this is a purpose-made liquefaction hazard map for the area, it was based primarily on aerial photo interpretation, geologic mapping from 1946, and water well data. Since the development of IMS-7, new geologic mapping was conducted (Evarts, 2004). In order to allow for a liquefaction hazard map based on the updated geologic mapping, we employed the Youd and Perkins 1978 methodology to convert the mapped geology to liquefaction susceptibility. The resulting map can be seen on Figure 5.

3.5 Landslide Hazard

The landslide hazard map presented on Figure 6 comes from the DOGAMI Open-File Report O-16-02. This overview map encompasses the entire state of Oregon and was designed to be used for regional planning. Susceptibility categories are broken into four categories (low, moderate, high, and very high), where very high denotes areas of mapped landslides.

The relative landslide hazard risk was developed by DOGAMI by creating a generalized geology-landslide intersect map and a percent slope map. Spatial statistics were then used to determine the mean and standard deviation of slope angles within landslides per geologic unit. Thirty percent of the area within the statewide hazard map consists of High or Very High hazard slopes and 80 percent of the landslides are located within this area.

Limitations of the input and modeling mean that the map should only be used for general planning purposes, and the map cannot be used as a substitute for geotechnical explorations, laboratory testing, and detailed site-specific analyses.

4 SUMMARY OF FINDINGS

The majority of the pipelines in need of replacement are located in areas mapped as rock. However, pipeline assets on the western portion of the basin are also mapped in Missoula Flood Deposits with small areas of alluvium. Assets within approximately 500 to 600 feet of the Willamette River pipeline, are located in recent alluvium and fill. The primary geologic hazard in the areas mapped as rock is strong ground motions.

Potential seismic hazards outside of the areas mapped as rock are expected to be related to liquefaction, and liquefaction-related phenomena such as settlement, lateral spreading, and post-seismic soil strength reduction. The risk of other seismic hazards, such as fault rupture, is low within the study area. Additionally, the potential need for rock excavation will be discussed in the following sections.

4.1 Landslides

According to the Department of Geology and Mineral Industries (DOGAMI), the existing pipelines are located within zones of low to high landslide hazard. While none of the mapped facilities are located within a mapped landslide, select stormwater facilities at the northernmost extent of the project area are adjacent to areas of very high landslide hazard indicating there are existing landslides.

4.2 Liquefaction and Lateral Spread

Soil liquefaction occurs in susceptible subsurface soils below the groundwater level. It is a phenomenon in which excess pore water pressure of loose to medium dense, saturated, granular soils increases during ground shaking to a level near the initial effective stress. The increased excess pore pressure results in a reduction of soil shear strength. Given that sands were observed at the ground surface and likely underlie a large portion of the project area, liquefaction is a potential hazard within the project area. A map of liquefaction susceptibility prepared using the Oregon Geologic Data Compilation release 6 (OGDC-6) and the Youd and Perkins, 1978 methodology, and included as Figure 5, indicates that much of the project area has no liquefaction hazard as the area is mapped as rock. However, select pipelines at the westernmost extent of the project area and on the eastern outfalls have moderate to high liquefaction risks. Again, the effects of liquefaction typically include lateral spreading, slope instability, ground settlement, and strength reductions, such as lower allowable soil bearing.

We note that this hazard assessment is based solely on soil type and does not consider ground water presence or the absence of groundwater. If groundwater is not present at the site, the DOGAMI hazard map is likely overestimating the liquefaction potential. The relative density also impacts the liquefaction potential of the sands. Obtaining site specific borings or Cone Penetrometer Tests (CPTs) and laboratory tests on collected soil samples to assess the density of the sand was outside the scope of this study, but we recommend that they be performed during design to further assess the extent of the liquefaction hazard.

Lateral spreading hazards can exist in areas with mild slopes adjacent to a much steeper slope or vertical face. Lateral spreading failure can occur if soil liquefaction develops during a seismic event and the ground acceleration (inertial force) briefly surpasses the yield acceleration (shear strength) of the liquefied soil. This can cause both the liquefied soil and an overlying non-liquefied crust of soil to displace laterally down mild slopes towards an embankment face, or the banks of streams, rivers, and other bodies of water. The displacements are cumulative and permanent in nature. If liquefaction occurs there is risk of post seismic slope instability and potential lateral displacement towards the existing slope to the northeast.

4.2.1 Liquefaction Induced Post-Seismic Settlement

Settlement will likely occur in cohesionless soil below the groundwater table that undergo liquefaction and pore pressure development during ground shaking. The settlement is related to densification and rearrangement of particles during ground shaking, as well as volume change, as the excess pore pressure dissipates after ground shaking. Seismic ground settlement does not typically occur uniformly over an area, and differential settlement may impact existing or proposed structures and infrastructure supported by liquefied soil and/or within the liquified zones. Differential settlement is often estimated to range between 50 and 80 percent of the total settlement. Consequences of seismic-induced settlement would be subsequent settlement of shallow foundations overlying the liquefied soil.

4.2.2 Fault Rupture

Quaternary crustal faults and folds throughout Oregon and Washington have been located and characterized by the United States Geological Survey (USGS). The USGS provides approximate fault locations and a detailed summary of available fault information in the USGS Quaternary Fault and Fold Database. The database defines four categories of faults, Class A through D, based on evidence of tectonic movement known or presumed to be associated with large earthquakes during Quaternary time (within the last 2.58 million years). For Class A faults, geologic evidence demonstrates that a tectonic fault exists and that it has likely been active within the Quaternary period. For Class B faults, there is equivocal geologic evidence of Quaternary tectonic deformation, or the fault may not extend deep enough to be considered a source of significant earthquakes. Class C and D faults lack convincing geologic evidence of Quaternary tectonic deformation or have been studied carefully enough to determine that they are not likely to generate significant earthquakes.

The closest Class A or Class B fault to the site is the Portland Hills Fault, mapped more than 5 miles from the project location, and is shown on the Fault Vicinity Map, Figure 7. In our opinion the risk of fault rupture at the site is low.

4.3 Rock Excavation

Rock excavation may be necessary where buried improvements are located outside or deeper than the existing utility trenches that are planned in areas mapped as rock. In the past, the City of St. Helen's has successfully used pipe bursting. However, the effectiveness and ease of pipe bursting has been a function of the existing trench width, pipe upsize, and depth of cover. We understand the City does not recommend pipe bursting for any pipes with less than 5-6 feet of cover. The City's historical experience with pipe bursting has been successful for increases of 1 to 2 pipe size diameters. The City has also reported successfully using Horizontal Directional Drilling (HDD) in solid basalt rock at depths over 16 feet below ground surface.

Pipe bursting to replace existing pipe where sewer lines are constructed over the top of shallow rock may not be feasible if adequate cover is not present. Additionally, rock or decomposed rock is relatively incompressible. If pipe bursting is performed in areas where pipes are buried in rock, any change in the density of the material surrounding the pipe that is required for upsizing will need to occur within the trench backfill. As was presented in Figure 4, Geologic Map, the majority of city assets are constructed within areas mapped as basalt. Where pipe bursting is considered as a possible remediation or where new sewers will be constructed outside of the existing trench, a review of as-built construction information, historic geotechnical information, or new geotechnical explorations should be considered to identify and mitigate the potential risk of rock related constructability issues in areas mapped as rock.

5 LIMITATIONS

This letter report was prepared for the exclusive use of the Keller and the City of St. Helens and their representatives for the purpose of planning-related geotechnical site evaluation for wastewater facilities. The assessments contained in this letter are based on the information and data provided to us, and information that is publicly available. This letter report should not be viewed as a warranty of conditions described in this report, such as those interpreted from published maps. The maps should be used for planning level purposes only and not a substitute for geotechnical explorations and laboratory testing that will be required for design. Our findings are based on the limitations of our approved scope, schedule, and budget; and our understanding of the project and information provided by Keller Associates.

For any site located on or near a slope, there are slope instability risks that are present and future owners have to accept, including, but not limited to:

- Natural factors: soil and groundwater conditions, steep topography, heavy rainfall events, erosion, and vegetation conditions; and
- Human-related factors: water leaks, pipe breaks, improper drainage, lack of maintenance of vegetation or drainage facilities, fill or debris placement, excavation and/or removal of trees/vegetation.

Similar circumstances or other unknown conditions may also affect slope stability. Our evaluation and planning level assessments described herein are not a guarantee or warranty of slope stability conditions, nor current and future risks.

Please note that our scope of services did not include any environmental assessment or evaluation regarding the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below the site.

Shannon & Wilson has prepared the attached, “Important Information About Your Geotechnical/Environmental Report,” to assist you and others in understanding the use and limitations of our reports.

6 REFERENCES

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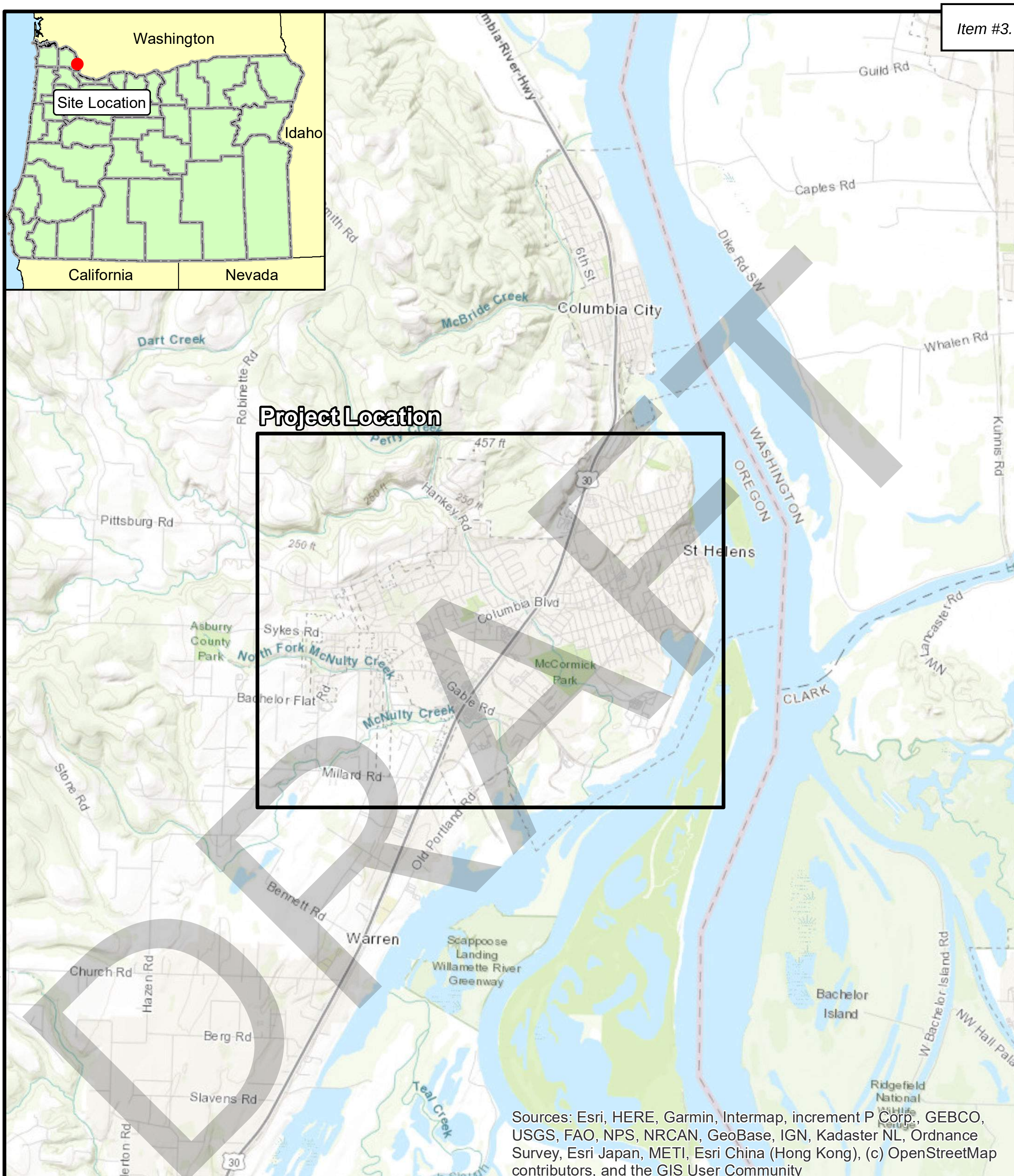

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

0 0.5 1 2

Scale in Miles

N

St. Helen's Wastewater and Stormwater Master Plan Update
St. Helens, Oregon

VICINITY MAP

September 2021 104961

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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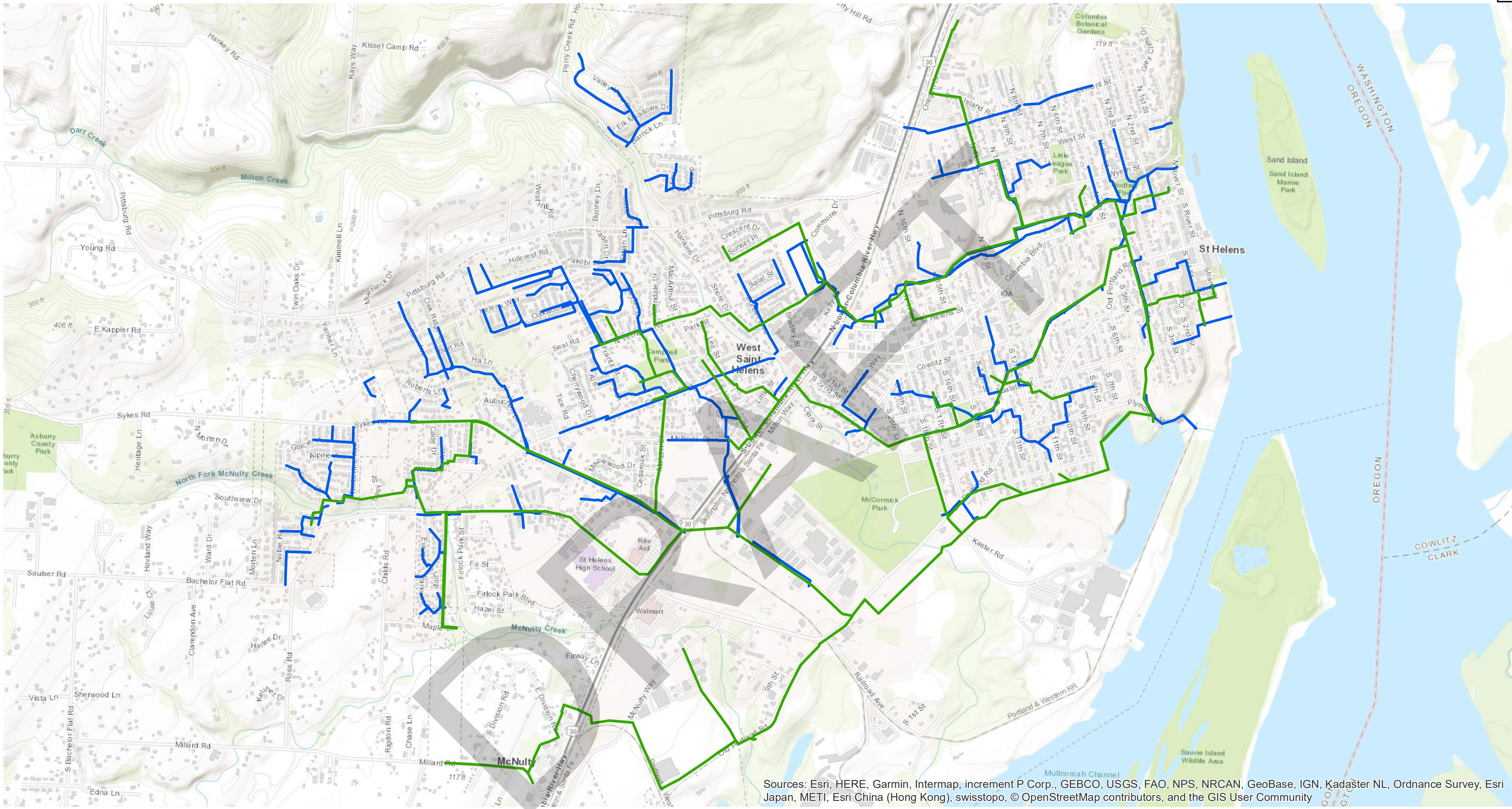
Filename: I:\EF\PDX\104000s\104961 St. Helen's Sto\GIS Files\2015 Vicinity Map_OR.mxd Date: 6/28/2021 Login: ECM



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

LEGEND

Sewer Pipelines

Stormwater Conduits

0 800 1,600 3,200

Scale in Feet

NOTES

1. Stormwater and sewer assets provided by Keller Associates on June 14, 2021.

St. Helens Wastewater and Stormwater Master Plan Update
St. Helens, Oregon

SITE PLAN

September 2021 104961

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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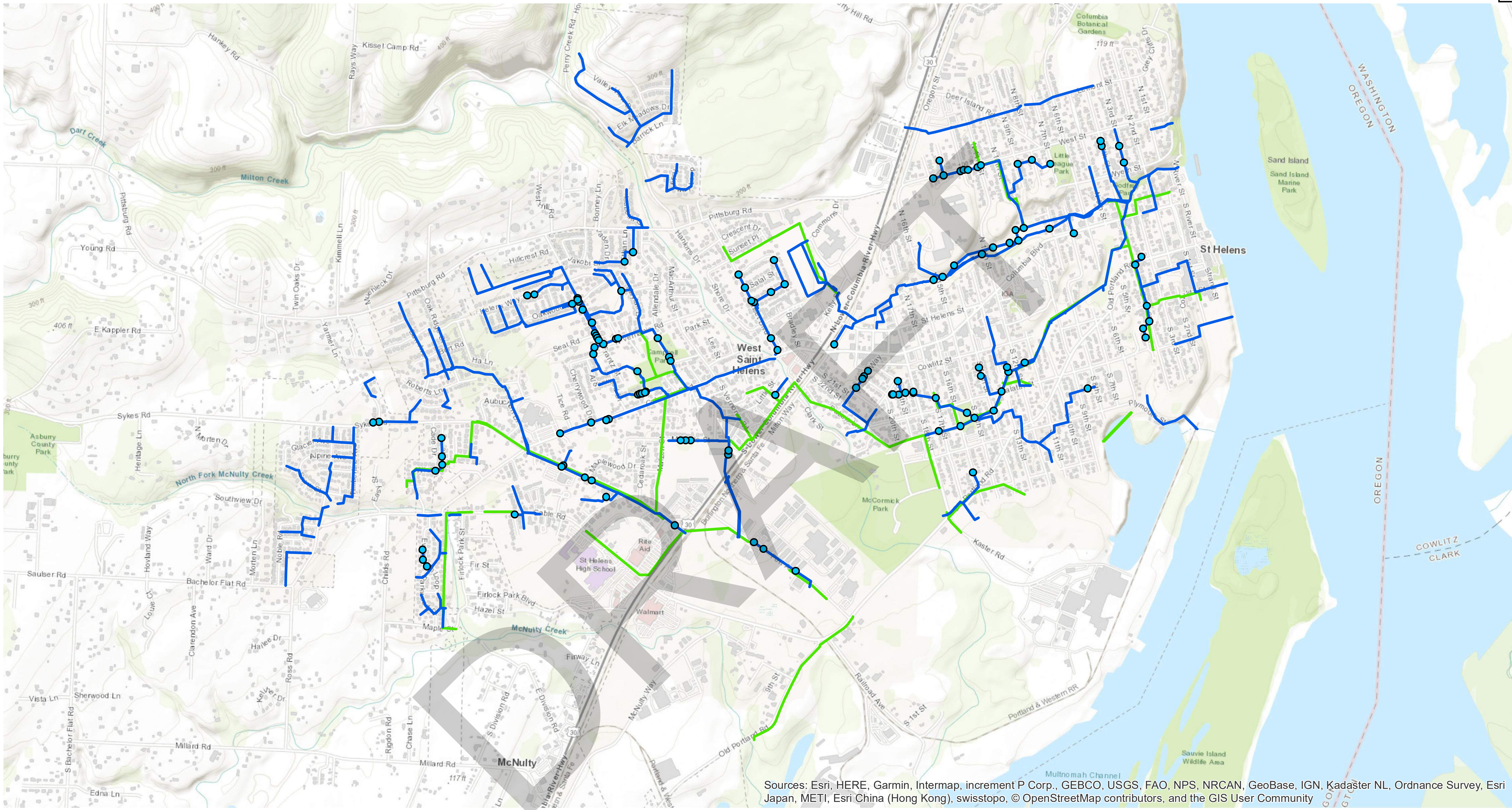

LEGEND

- Stormwater Junctions Indicating Need of Improvement
- Sewers in need of Improvement
- Stormwater Conduits

0 800 1,600 3,200

Scale in Feet

NOTES

1. Stormwater and sewer assets provided by Keller Associates on June 14, 2021.

St. Helens Stormwater and Wastewater Master Plan Update
St. Helens, Oregon

PIPELINE VULNERABILITIES

September 2021 104961

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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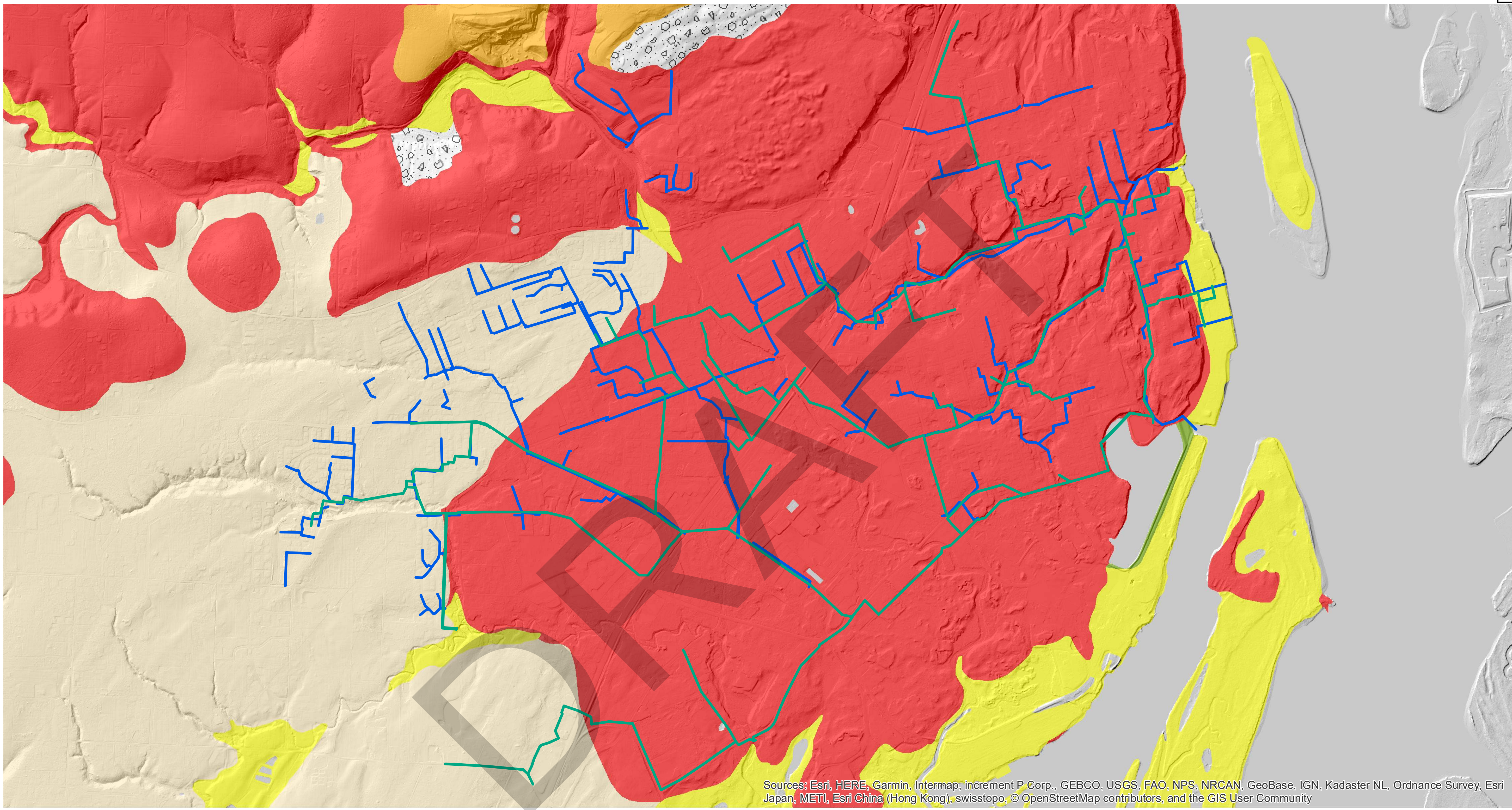

LEGEND

Geologic Map Unit

- Alluvial deposits
- Grande Ronde Basalt
- Landslide deposits
- Man-made fill deposits
- Missoula Flood deposits
- Troutdale Formation

- Sewer Pipelines
- Stormwater Conduits

0 800 1,600 3,200

Scale in Feet

NOTES

1. Geologic map from Oregon Geologic Data Compilation release 6 (OGDC-6).
2. LiDAR hillshade from Oregon Lidar Consortium (OLC)

St. Helens Wastewater and Stormwater Master Plan Update
St. Helens, Oregon

GEOLOGIC MAP

September 2021 104961

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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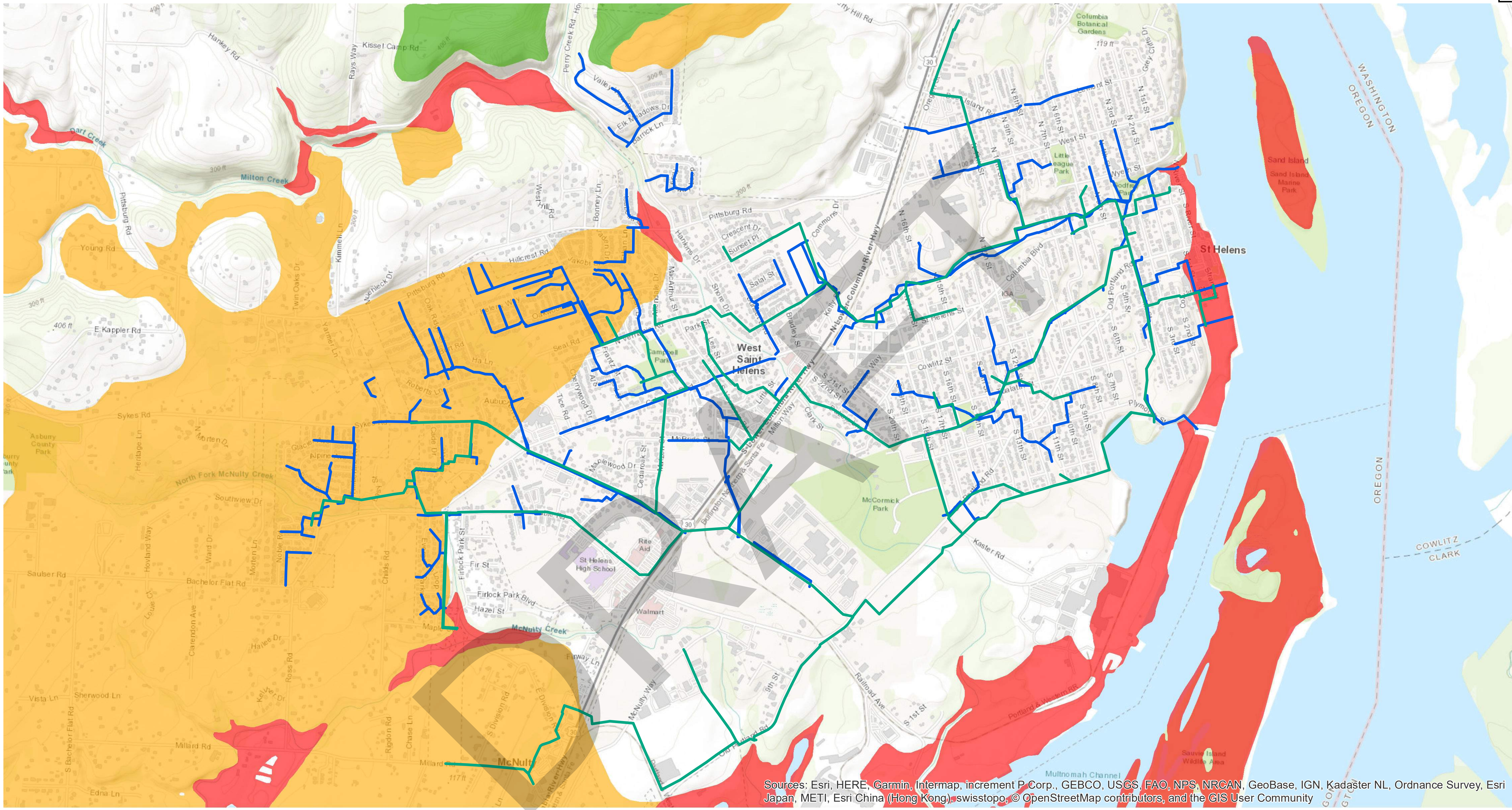

LEGEND

Liquefaction Hazard

- Low
- Moderate
- High

- Sewer Pipelines
- Stormwater Conduits

0 800 1,600 3,200

Scale in Feet

NOTES

1. Liquefaction hazard developed from data provided with OGDC-6, the Youd and Perkins, 1978 metodology, and knowledge of regional liquefaction hazards.
2. Stormwater and sewer assets provided by Keller Associates on June 14, 2021.

St. Helens Wastewater and Stormwater Master Plan Update
St. Helens, Oregon

LIQUEFACTION HAZARD

September 2021 104961

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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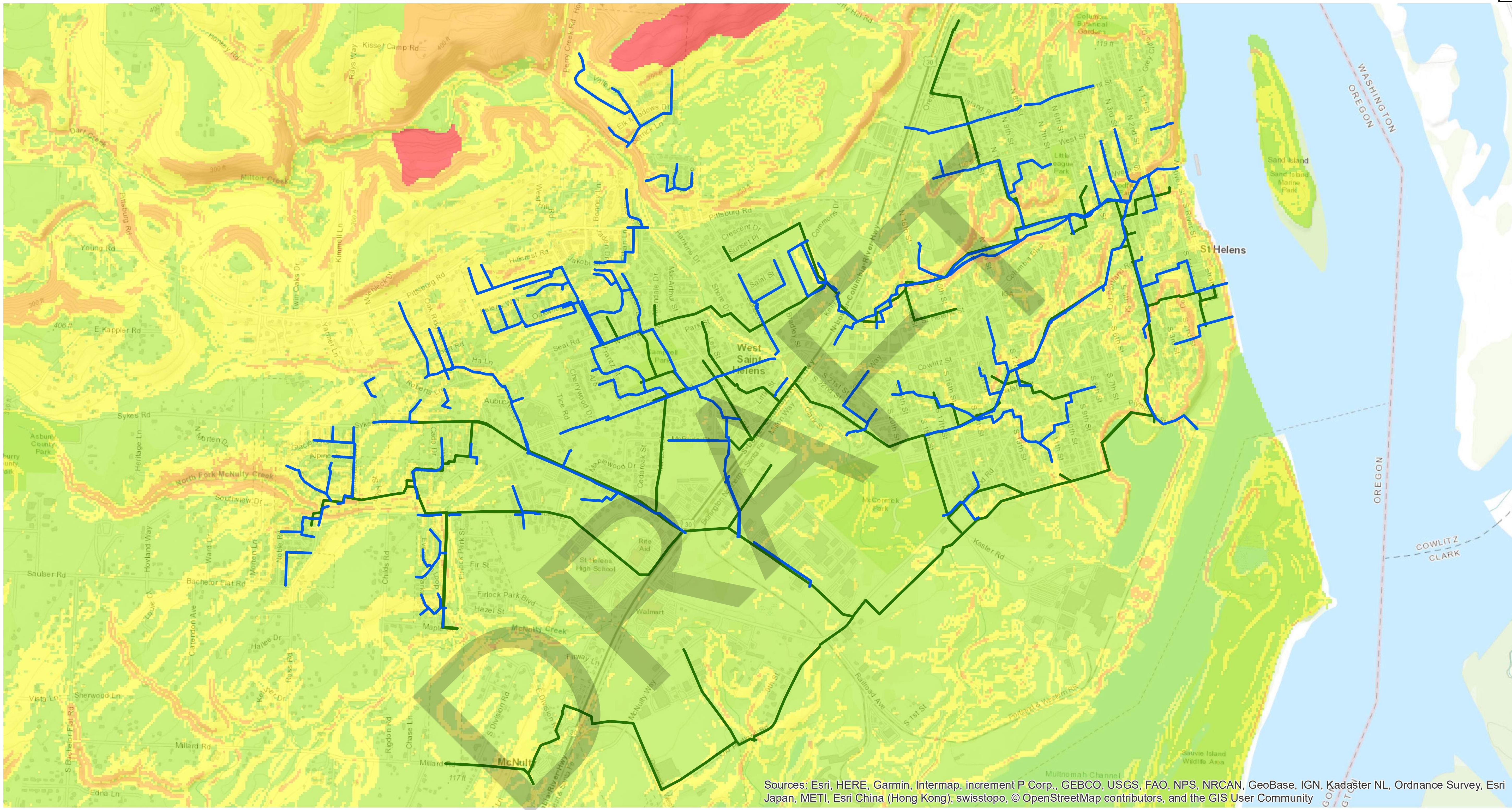
Filename: T:\Projects\PDX\104000s\104961 - St Helens\Liquefaction2.mxd Date: 6/30/2021 Login: DSJ



LEGEND

Landslide Susceptibility

- Low
- Moderate
- High
- Very High

- Stormwater Conduits
- Sewer Pipelines

0 800 1,600 3,200

Scale in Feet

NOTES

1. Stormwater and sewer assets provided by Keller Associates on June 14, 2021.
2. Landslide susceptibility from DOGAMI Open-File Report O-16-02.

St. Helens Wastewater and Stormwater Master Plan Update
St. Helens, Oregon

LANDSLIDE SUSCEPTIBILITY

September 2021 104961

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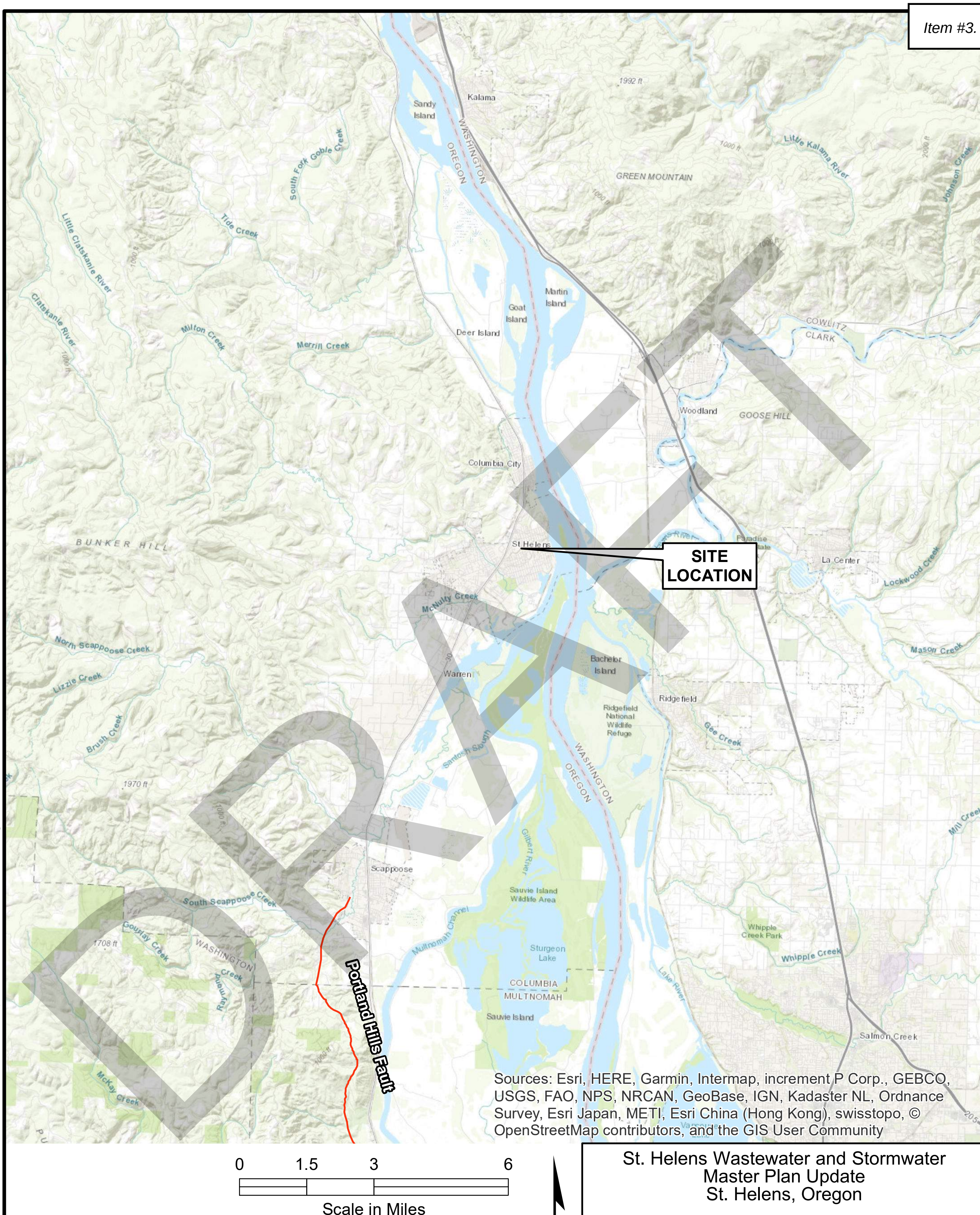
Filename: T:\Projects\PDX\104000s\104961 - St Helens\Landslide Susceptibility.mxd Date: 6/30/2021 Login: DSJ



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

St. Helens Wastewater and Stormwater
Master Plan Update
St. Helens, Oregon

FAULT MAP

September 2021 104961

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Filename: T:\Projects\PDX\104000s\104961 - St Helens\Fault Map.mxd Date: 6/30/2021 Login: DSJ

ATTACHMENT A

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

SHANNON & WILSON
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Attachment to and part of Report: 104961
Date: September 2021
To: Peter Olsen
Keller Associates

Important Information About Your Geotechnical/Environmental Report

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the GBA, Silver Spring, Maryland

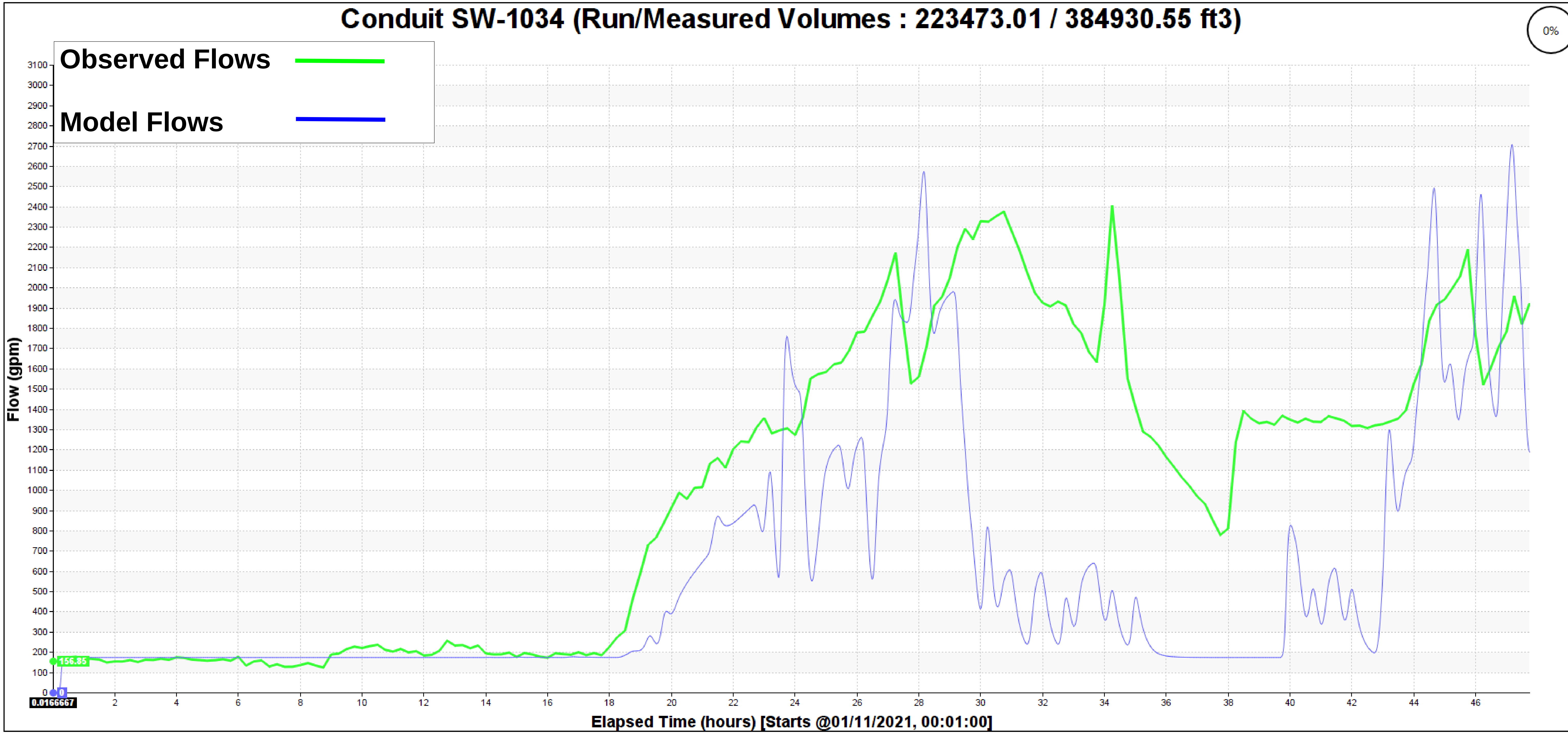
APPENDIX D

Calibration Summary

KELLER
ASSOCIATES

Storm Event: January 11th - 12th.
Site 1 - SW-1034

Reduction of CN's by 7.5%
The storage nodes invert is set to the contour elevation
The connecting pipe has 0% slope and inverts equal to the rim elevation of the manholes.
Baseflow of 175 gpm upstream of ravine

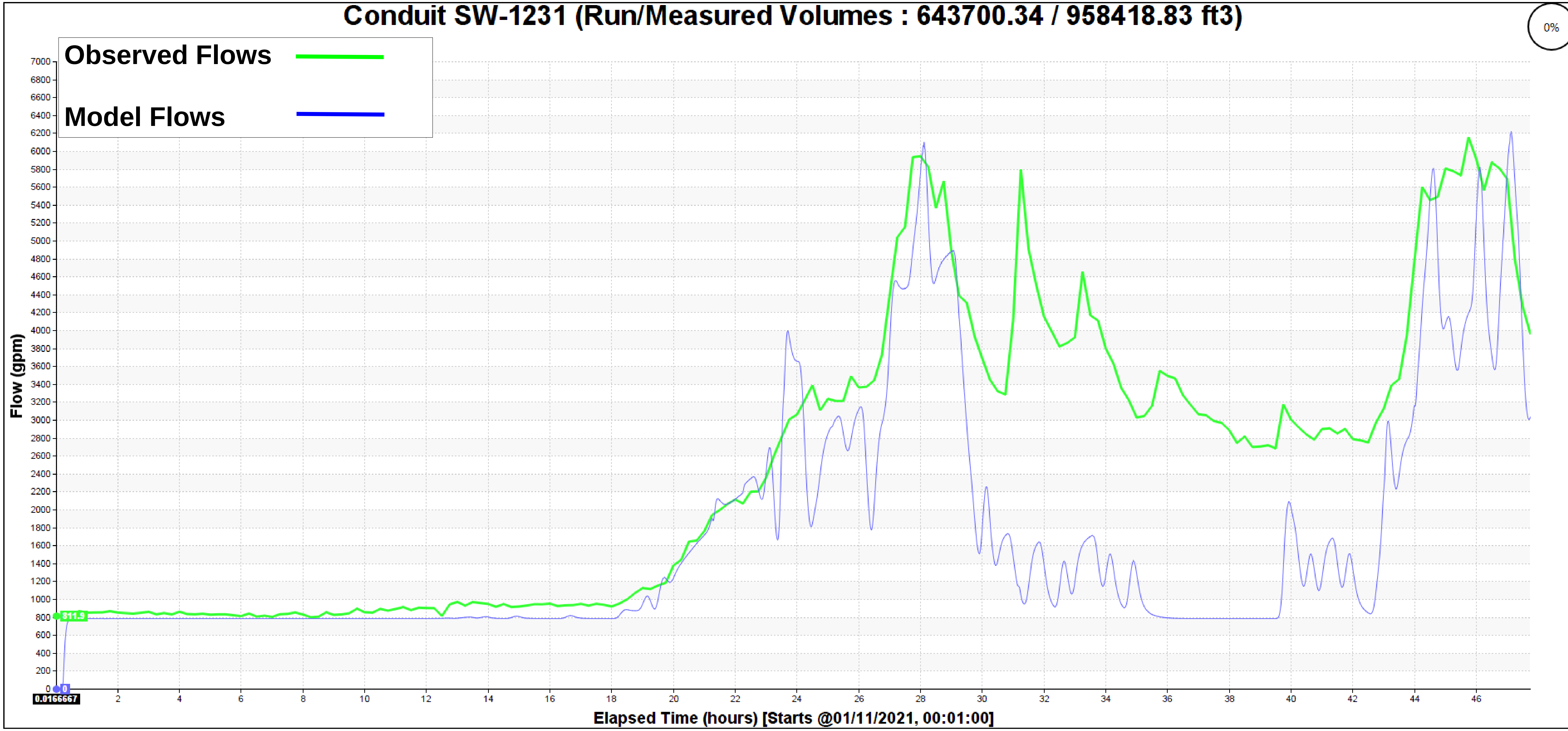


Flow Monitor Site	CN Adjustment	Baseflow for Event 1 (gpm)	Percent difference between model and recorded flows	
			Event 1: Jan 11th - 12th	Event 2: Jan 2nd - 4th
Site 1 (Middle Trunk)	Reduce 7.5%	175	7%	33%
Site 2 (Sykes Road)	Reduce 5%	800	3%	16%
Site 3 (Harris Street)	Reduce 5%	200	7%	2%
Site 4 (Columbia Boulevard)	Reduce 5%	0	5%	-2%

1) Positive value indicated model flows are higher than observed flows

Storm Event: January 11th - 12th.
Site 2 - SW-1231

Reduction of CN's by 5%
Base flow of 800 gpm

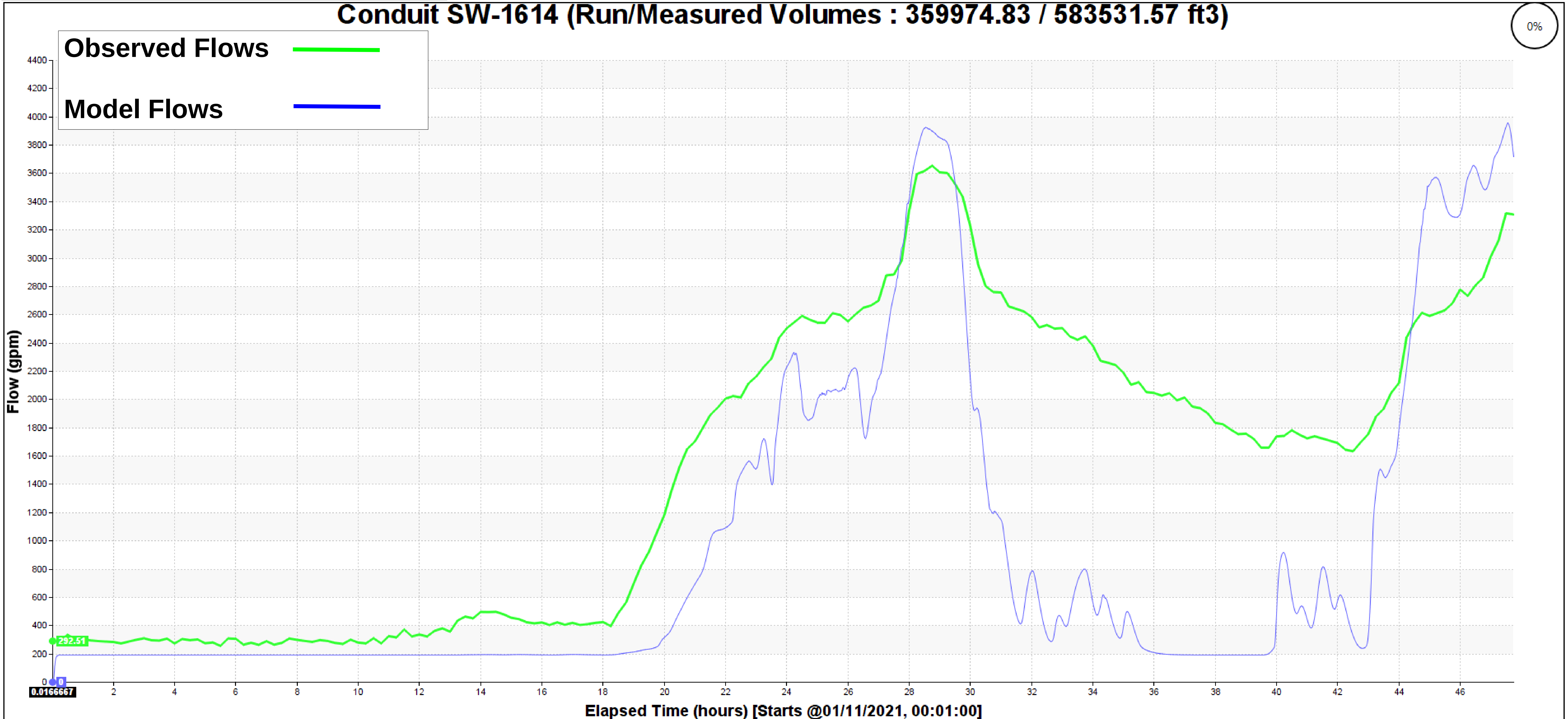


Flow Monitor Site	CN Adjustment	Baseflow for Event 1 (gpm)	Percent difference between model and recorded flows	
			Event 1: Jan 11th – 12th	Event 2: Jan 2nd – 4th
Site 1 (Middle Trunk)	Reduce 7.5%	175	7%	33%
Site 2 (Sykes Road)	Reduce 5%	800	3%	16%
Site 3 (Harris Street)	Reduce 5%	200	7%	2%
Site 4 (Columbia Boulevard)	Reduce 5%	0	5%	-2%

1) Positive value indicated model flows are higher than observed flows

Storm Event: January 11th - 12th.
Site 3 - SW-1614

Reduction of CN's by 7.5%
Base flow of 200 gpm downstream of flow split

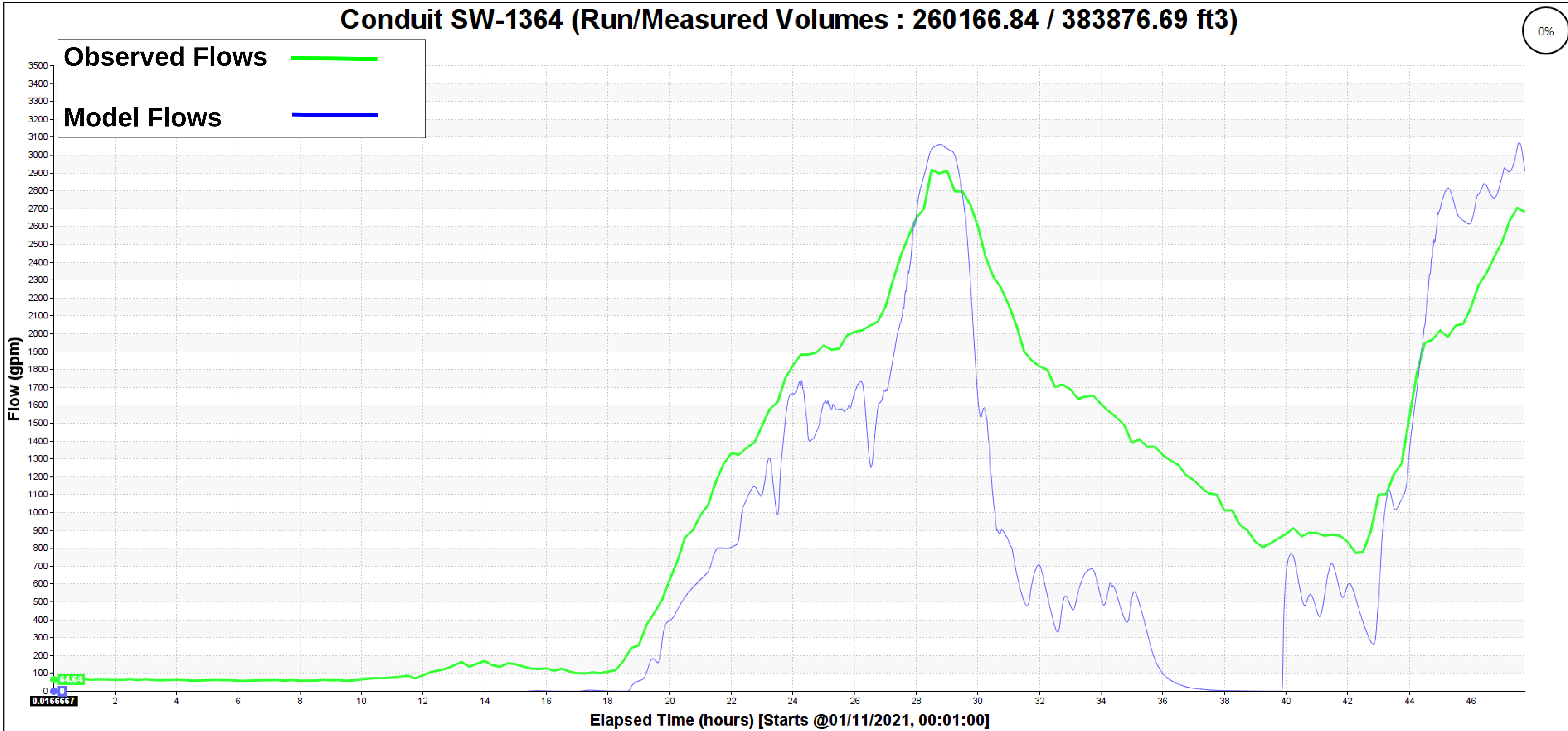


Flow Monitor Site	CN Adjustment	Baseflow for Event 1 (gpm)	Percent difference between model and recorded flows	
			Event 1: Jan 11th – 12th	Event 2: Jan 2nd – 4th
Site 1 (Middle Trunk)	Reduce 7.5%	175	7%	33%
Site 2 (Sykes Road)	Reduce 5%	800	3%	16%
Site 3 (Harris Street)	Reduce 5%	200	7%	2%
Site 4 (Columbia Boulevard)	Reduce 5%	0	5%	-2%

1) Positive value indicated model flows are higher than observed flows

Storm Event: January 11th - 12th.
Site 4 - SW-1364

Reduction in CN's by 7.5%
No base flow

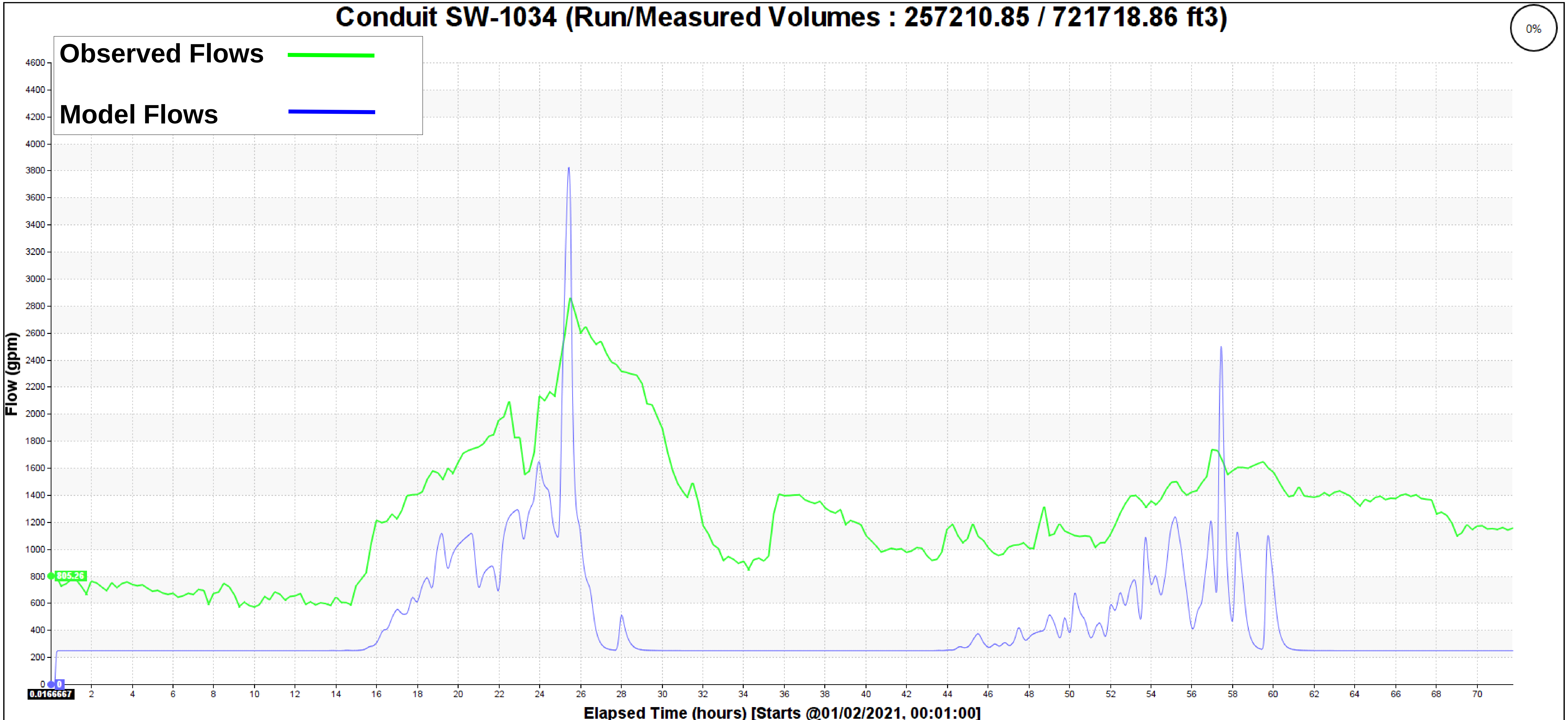


Flow Monitor Site	CN Adjustment	Baseflow for Event 1 (gpm)	Percent difference between model and recorded flows	
			Event 1: Jan 11th - 12th	Event 2: Jan 2nd - 4th
Site 1 (Middle Trunk)	Reduce 7.5%	175	7%	33%
Site 2 (Sykes Road)	Reduce 5%	800	3%	16%
Site 3 (Harris Street)	Reduce 5%	200	7%	2%
Site 4 (Columbia Boulevard)	Reduce 5%	0	5%	-2%

1) Positive value indicated model flows are higher than observed flows

Storm Event: January 2nd - 4th.
Site 1 - SW-1034

Reduction of CN's by 7.5%
The storage nodes invert is set to the contour elevation
The connecting pipe has 0% slope and inverts equal to the rim elevation of the manholes.

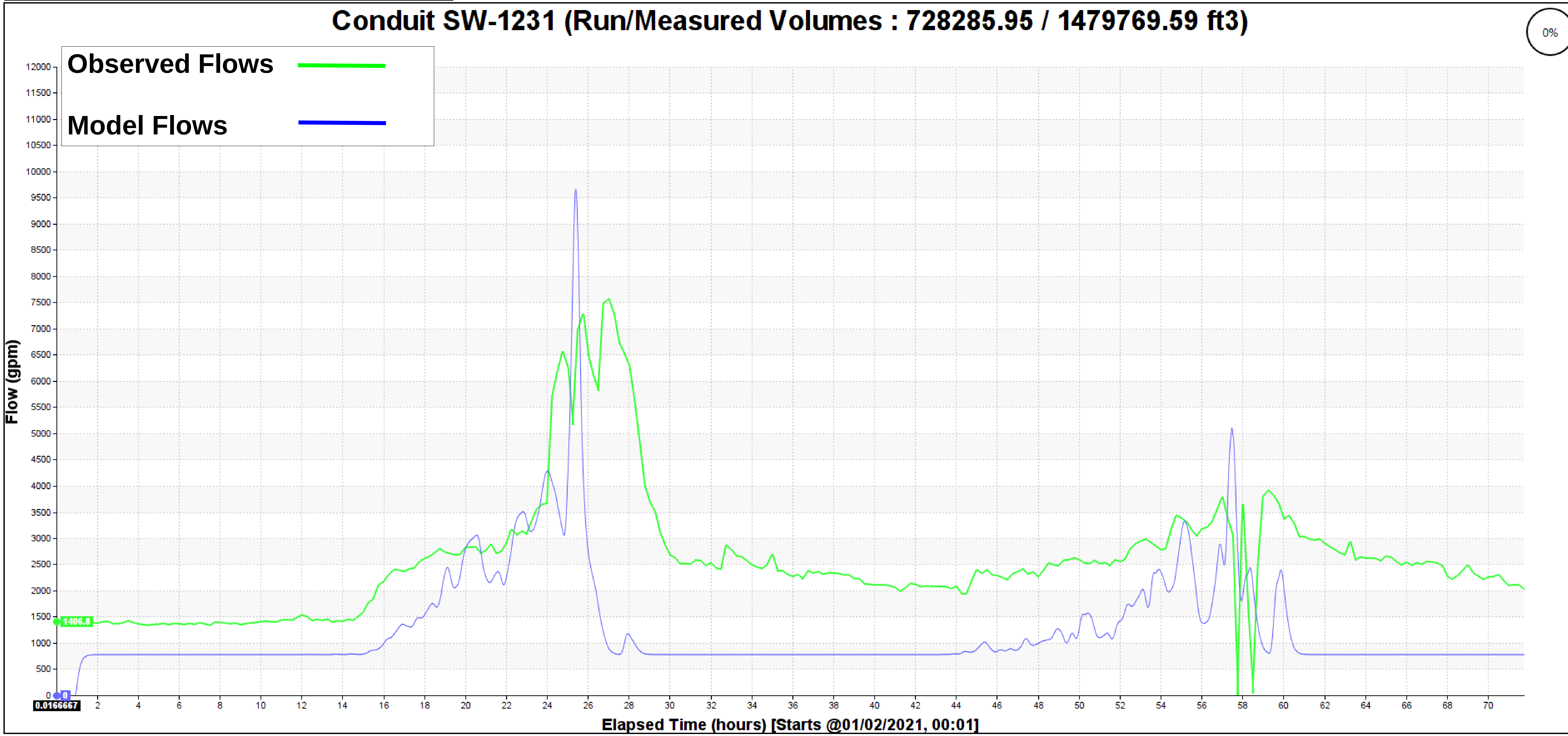


Flow Monitor Site	CN Adjustment	Baseflow for Event 1 (gpm)	Percent difference between model and recorded flows	
			Event 1: Jan 11th - 12th	Event 2: Jan 2nd - 4th
Site 1 (Middle Trunk)	Reduce 7.5%	175	7%	33%
Site 2 (Sykes Road)	Reduce 5%	800	3%	16%
Site 3 (Harris Street)	Reduce 5%	200	7%	2%
Site 4 (Columbia Boulevard)	Reduce 5%	0	5%	-2%

1) Positive value indicated model flows are higher than observed flows

Storm Event: January 2nd - 4th.
Site 2 - SW-1231

Reduction in CN's by 5%
Base flow of 800 gpm



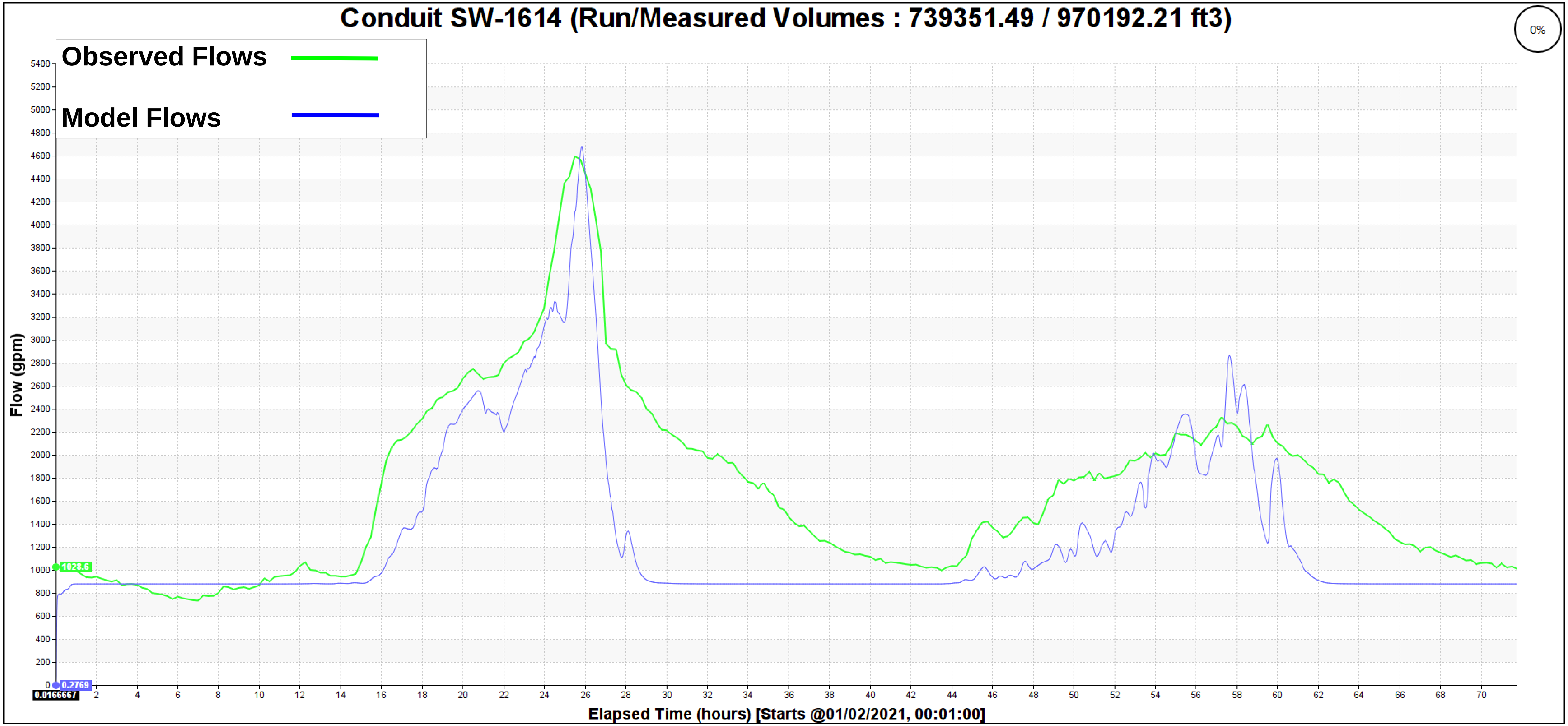
Flow Monitor Site	CN Adjustment	Baseflow for Event 1 (gpm)	Percent difference between model and recorded flows	
			Event 1: Jan 11th - 12th	Event 2: Jan 2nd - 4th
Site 1 (Middle Trunk)	Reduce 7.5%	175	7%	33%
Site 2 (Sykes Road)	Reduce 5%	800	3%	16%
Site 3 (Harris Street)	Reduce 5%	200	7%	2%
Site 4 (Columbia Boulevard)	Reduce 5%	0	5%	-2%

1) Positive value indicated model flows are higher than observed flows

Item #3.

Storm Event: January 2nd - 4th.
Site 3 - SW-1614

Reduction of CN's by 7.5%
Base flow of 800 gpm downstream of flow split

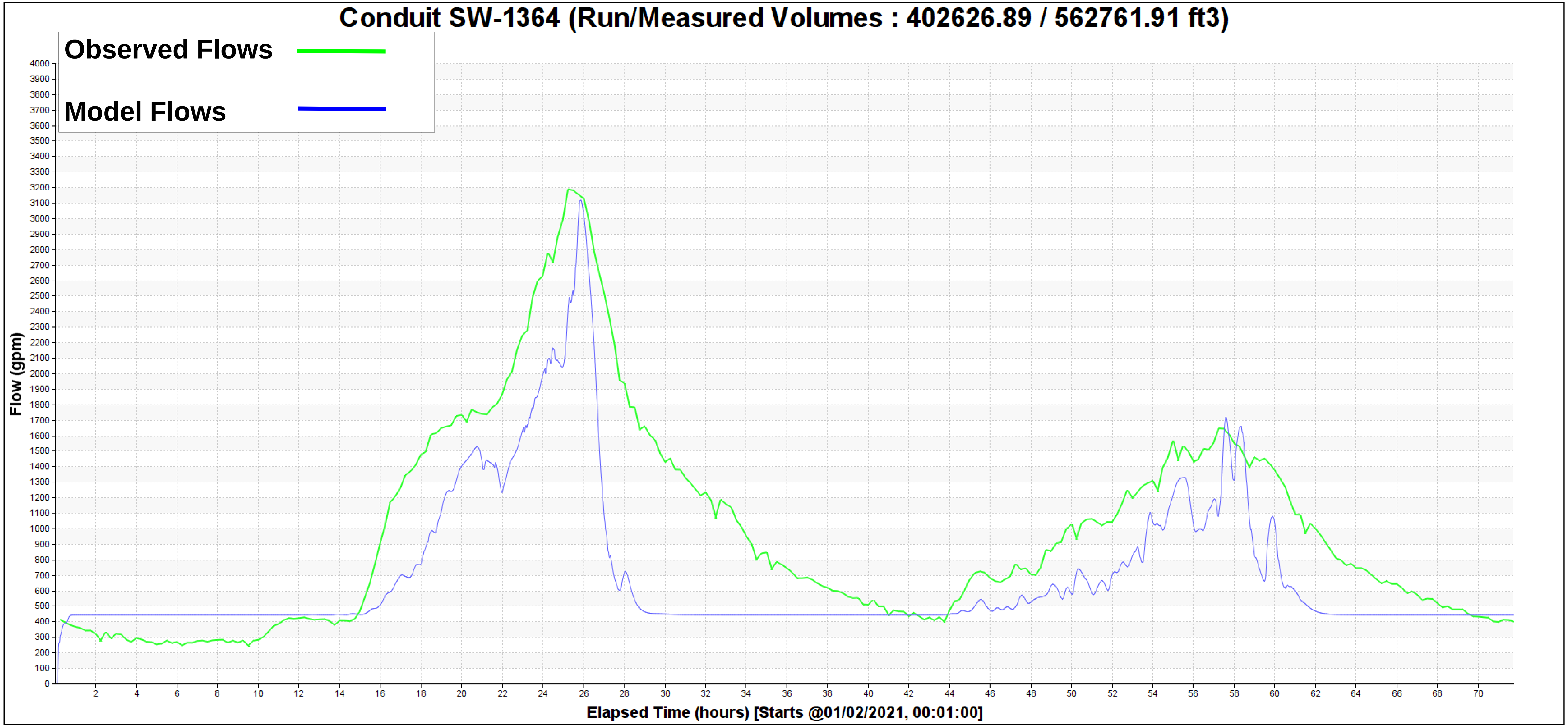


Flow Monitor Site	CN Adjustment	Baseflow for Event 1 (gpm)	Percent difference between model and recorded flows	
			Event 1: Jan 11th - 12th	Event 2: Jan 2nd - 4th
Site 1 (Middle Trunk)	Reduce 7.5%	175	7%	33%
Site 2 (Sykes Road)	Reduce 5%	800	3%	16%
Site 3 (Harris Street)	Reduce 5%	200	7%	2%
Site 4 (Columbia Boulevard)	Reduce 5%	0	5%	-2%

1) Positive value indicated model flows are higher than observed flows

Storm Event: January 2nd - 4th.
Site 4 - SW-1364

Reduction of CN's by 7.5%
Base flow of 450 gpm upstream of split



Flow Monitor Site	CN Adjustment	Baseflow for Event 1 (gpm)	Percent difference between model and recorded flows	
			Event 1: Jan 11th - 12th	Event 2: Jan 2nd - 4th
Site 1 (Middle Trunk)	Reduce 7.5%	175	7%	33%
Site 2 (Sykes Road)	Reduce 5%	800	3%	16%
Site 3 (Harris Street)	Reduce 5%	200	7%	2%
Site 4 (Columbia Boulevard)	Reduce 5%	0	5%	-2%

1) *Positive value indicated model flows are higher than observed flows*

APPENDIX E

Alternative Cost Estimates

KELLER ASSOCIATES

St. Helens Stormwater Master Plan
Alternative Cost Estimates

North Trunk Alternative 1				
Item	**Unit**	**Unit Price**	**Est. Qty**	**Cost (2021)**
30-inch Pipe - Excavation, Backfill	LF	$230	420	$96,600
36-inch Culvert - Excavation, Backfill (>10' Depth)	LF	$384	160	$61,440
36-inch Culvert - Excavation, Backfill	LF	$202	220	$44,352
72-Inch, Standard Manhole	EA	$16,500	3	$49,500
Pond Clearing, Grubbing, and Earthwork as Necessary	LS	$15,000	1	$15,000
Berm Construction	LF	$30	470	$14,100
Concrete Outlet Flow Control Structure, 72-inch	EA	$15,000	1	$15,000
Flow Control Manhole	EA	$15,000	1	$15,000
Soil Surface Repair, Seeding, and Stabilization	LF	$5	420	$2,100
Rock Excavation	CY	$300	210	$63,000
Roadway Restoration (Full Lane)	LF	$75	220	$16,500
Traffic Control With Flagging	LS	$14,000	1	$14,000
Existing Utility Protection	LF	$4	800	$3,200
ADA Ramp Reconstruction (Compliance)	EA	$4,600	2	$9,200
			Subtotal (Rounded)	**$419,000**
Mobilization	LS	5%	1	$20,950
Contingency	LS	30%	1	$125,700
			Construction Subtotal (Rounded)	**$566,000**
Property Acquisition	SF	$10	43,560	$435,600
Permitting (Field work, JPA, and application. Assumes SLOPES V)	LS	$50,000	1	$50,000
Geotechnical (assume 8% of total)	LS	$45,000	1	$45,000
Surveying	LS	$8,000	1	$8,000
Engineering and CMS	LS	20%	1	$113,200
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$1,223,000**

North Trunk Alternative 2				
Item	**Unit**	**Unit Price**	**Est. Qty**	**Cost (2021)**
36-inch Pipe - Excavation, Backfill	LF	$245	3,400	$833,000
72-Inch, Standard Manhole	EA	$16,500	16	$264,000
Soil Surface Repair	LF	$5	2,750	$13,750
Rock Excavation	CY	$300	1,322	$396,667
Local Road Full Lane Asphalt Repair	LF	$75	640	$48,000
Traffic Control - Without Flagging	LS	$40,000	1	$40,000
			Subtotal (Rounded)	**$1,595,000**
Mobilization	LS	5%	1	$79,750
Contingency	LS	30%	1	$478,500
			Construction Subtotal (Rounded)	**$2,153,000**
Permitting (Field work, JPA, and application. Assumes SLOPES V)	LS	$50,000	1	$50,000
Geotechnical (assume 8% of total)	LS	$172,000	1	$172,000
Surveying	LS	$8,000	1	$8,000
Engineering and CMS	LS	20%	1	$430,600
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$2,819,000**

St. Helens Stormwater Master Plan
Alternative Cost Estimates

Middle Trunk Alternative 1				
Item	**Unit**	**Unit Price**	**Est. Qty**	**Cost (2021)**
24-inch Pipe - Excavation, Backfill	LF	$205	430	$88,150
36-inch Pipe - Excavation, Backfill	LF	$245	300	$73,500
60-Inch, Standard Manhole	EA	$14,000	1	$14,000
72-Inch, Standard Manhole	EA	$16,500	1	$16,500
Abandonment of existing pipeline	LF	$25	800	$20,000
Pond Clearing, Grubbing, and Earthwork as Necessary	LS	$24,000	1	$24,000
Concrete Outlet Flow Control Structure, Grated Inlet	EA	$15,000	3	$45,000
Berm Construction	LF	$30	490	$14,700
Rock Excavation	CY	$300	541	$162,300
Roadway Restoration (Full Lane)	LF	$75	50	$3,750
Traffic Control With Flagging	LS	$1,000	1	$1,000
Soil Surface Repair, Seeding, and Stabilization	LF	$5	680	$3,400
Existing Utility Protection	LF	$4	730	$2,920
			Subtotal (Rounded)	**$469,200**
Mobilization	LS	5%	1	$23,460
Contingency	LS	30%	1	$140,760
			Construction Subtotal (Rounded)	**$633,400**
Property Acquisition	SF	$10	106,000	$1,060,000
Permitting (Field work, JPA, and application. Assumes SLOPES V)	LS	$30,000	1	$30,000
Geotechnical (Assume 4% of total)	LS	$25,000	1	$25,000
Surveying	LS	$50,000	1	$50,000
Engineering and CMS	LS	20%	1	$126,680
Wetland Hydroperiod and Ecological Assessment	LS	$20,000	1	$20,000
Legal and Admin	LS	$15,000	1	$15,000
			Total Project Cost (Rounded)	**$1,960,000**

Middle Trunk Alternative 2				
Item	**Unit**	**Unit Price**	**Est. Qty**	**Cost (2021)**
36-inch Pipe - Excavation, Backfill	LF	$245	2,800	$686,000
72-Inch, Standard Manhole	EA	$16,500	12	$198,000
Soil Surface Repair	LF	$5	2,300	$11,500
Rock Excavation	CY	$300	3,267	$980,000
Local Road Full Lane Asphalt Repair	LF	$75	440	$33,000
Traffic Control - Without Flagging	LS	$30,000	1	$30,000
			Subtotal (Rounded)	**$1,938,500**
Mobilization	LS	5%	1	$96,925
Contingency	LS	30%	1	$581,550
			Construction Subtotal (Rounded)	**$2,617,000**
Permitting (Field work, JPA, and application. Assumes SLOPES V)	LS	$30,000	1	$30,000
Geotechnical (Assume 4% of total)	LS	$105,000	1	$105,000
Surveying	LS	$50,000	1	$50,000
Engineering and CMS	LS	20%	1	$523,400
Wetland Hydroperiod and Ecological Assessment	LS	$20,000	1	$20,000
Legal and Admin	LS	$15,000	1	$15,000
			Total Project Cost (Rounded)	**$3,360,000**

St. Helens Stormwater Master Plan
Alternative Cost Estimates

Downtown Alternative 1				
Item	Unit	Unit Price	Est. Qty	Cost (2021)
18-inch Pipe - Excavation, Backfill	LF	$185	150	$27,750
21-inch Pipe - Excavation, Backfill	LF	$195	720	$140,400
30-inch Pipe - Excavation, Backfill	LF	$230	2,020	$464,600
48-Inch, Standard Manhole	EA	$8,000	1	$8,000
60-Inch, Standard Manhole	EA	$14,000	11	$154,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	28	$98,000
Outfall Restoration	EA	$6,000	1	$6,000
Rock Excavation	CY	$300	572	$171,600
Roadway Restoration (Half Lane)	LF	$45	2,890	$130,050
Traffic Control With Flagging	LS	$82,000	1	$82,000
Existing Utility Protection	LF	$4	1	$4
ADA Ramp Reconstruction (Compliance)	EA	$4,600	26	$119,600
			Subtotal (Rounded)	$1,402,000
Mobilization	LS	5%	1	$70,100
Contingency	LS	30%	1	$420,600
			Construction Subtotal (Rounded)	$1,893,000
Permitting	LS	$45,000	1	$45,000
Geotechnical (Assume 2% of total)	LS	$38,000	1	$38,000
Surveying	LS	$29,000	1	$29,000
Engineering and CMS	LS	20%	1	$378,600
Legal and Admin	LS	$15,000	1	$15,000
			Total Project Cost (Rounded)	$2,399,000

Downtown Alternative 2				
Item	Unit	Unit Price	Est. Qty	Cost (2021)
24-inch, CIP Pipeline Repair	LF	$160	1,600	$256,000
18-inch Pipe - Excavation, Backfill	LF	$185	720	$133,200
21-inch Pipe - Excavation, Backfill	LF	$195	720	$140,400
Rock Excavation	CY	$300	240	$72,000
Local Road Full Lane Asphalt Repair	LF	$75	630	$47,250
Soil Surface Repair	LF	$5	90	$450
Traffic Control - Without Flagging	LF	$4	1,140	$4,560
Traffic Control - With Flagging	LF	$8	190	$1,520
			Subtotal (Rounded)	$655,000
Mobilization	LS	5%	1	$32,750
Contingency	LS	30%	1	$196,500
			Construction Subtotal (Rounded)	$884,000
Permitting	LS	$45,000	1	$45,000
Geotechnical (Assume 2% of total)	LS	$18,000	1	$18,000
Surveying	LS	$29,000	1	$29,000
Engineering and CMS	LS	20%	1	$176,800
Legal and Admin	LS	$15,000	1	$15,000
			Total Project Cost (Rounded)	$1,168,000

St. Helens Stormwater Master Plan
Alternative Cost Estimates

Greenway Alternative 1				
Item	**Unit**	**Unit Price**	**Est. Qty**	**Cost (2021)**
Pond Clearing, Grubbing, and Earthwork as Necessary	LS	$20,000	1	$20,000
Concrete Outlet Flow Control Structure, 60-inch	EA	$15,000	1	$15,000
Berm Construction	LF	$30	500	$15,000
Sediment Forebay	EA	$20,000	1	$20,000
15-inch Pipe - Rock Excavation, Backfill	LF	$340	960	$326,400
Abandonment of existing pipeline	LF	$25	400	$10,000
Traffic Control - With Flagging	LF	$20,000	550	$20,000
48-Inch, Standard Manhole	EA	$8,000	2	$16,000
Rock Excavation	CY	$300	267	$80,000
Local Road Full Lane Asphalt Repair	LF	$75	960	$72,000
			Subtotal (Rounded)	**$594,400**
Mobilization	LS	5%	1	$29,720
Contingency	LS	30%	1	$178,320
			Construction Subtotal (Rounded)	**$802,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 8% of total)	LS	$64,000	1	$64,000
Surveying	LS	$15,000	1	$15,000
Engineering and CMS	LS	40%	1	$320,800
Legal and Admin	LS	$8,000	1	$8,000
			Total Project Cost (Rounded)	**$1,220,000**

Greenway Alternative 2				
Item	**Unit**	**Unit Price**	**Est. Qty**	**Cost (2021)**
30-inch Pipe - Excavation, Backfill	LF	$230	1,330	$305,900
18-inch Pipe - Excavation, Backfill	LF	$185	927	$171,495
60-Inch, Standard Manhole	EA	$14,000	9	$126,000
48-Inch, Standard Manhole	EA	$8,000	7	$56,000
Soil Surface Repair	LF	$5	1,468	$7,340
Rock Excavation	CY	$300	752	$225,700
Local Road Full Lane Asphalt Repair	LF	$75	800	$60,000
Traffic Control - With Flagging	LF	$8	137	$1,096
Traffic Control - Without Flagging	LF	$4	436	$1,744
			Subtotal (Rounded)	**$955,000**
Mobilization	LS	5%	1	$47,750
Contingency	LS	30%	1	$286,500
			Construction Subtotal (Rounded)	**$1,289,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 8% of total)	LS	$103,000	1	$103,000
Surveying	LS	$15,000	1	$15,000
Engineering and CMS	LS	40%	1	$515,600
Legal and Admin	LS	$8,000	1	$8,000
			Total Project Cost (Rounded)	**$1,941,000**

St. Helens Stormwater Master Plan
Alternative Cost Estimates

Milton Creek Alternative 1				
Item	**Unit**	**Unit Price**	**Est. Qty**	**Cost (2021)**
24-inch Pipe - Excavation, Backfill	LF	$205	40	$8,200
Concrete Outlet Flow Control Structure, 60-inch	EA	$15,000	1	$15,000
Hydroseeding, Planting, and Other Restoration Features	AC	$5,000	0.7	$3,500
Berm Construction	LF	$30	1,030	$30,900
Detention Pond Excavation, removal, and grading	CY	$31	3,200	$99,200
21-inch Pipe - Excavation, Backfill	LF	$195	1,020	$198,900
30-inch Pipe - Excavation, Backfill	LF	$230	1,800	$414,000
60-Inch, Standard Manhole	EA	$14,000	3	$42,000
72-Inch, Standard Manhole	EA	$16,500	5	$82,500
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	16	$56,000
Outfall Restoration	EA	$6,000	1	$6,000
Rock Excavation	CY	$300	1,717	$515,178
Roadway Restoration (Half Lane)	LF	$45	2,820	$126,900
Traffic Control - With Flagging	LF	$70,000	1	$70,000
18-inch Pipe - Excavation, Backfill	LF	$185	710	$131,350
48-Inch, Standard Manhole	EA	$8,000	3	$24,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	4	$14,000
Pond Clearing, Grubbing, and Earthwork as Necessary	LS	$10,000	1	$10,000
Concrete Outlet Flow Control Structure, Ditch Inlet	EA	$15,000	1	$15,000
Berm Construction	LF	$30	400	$12,000
Rock Excavation	CY	$300	216	$64,804
Roadway Restoration (Half Lane)	LF	$45	710	$31,950
Traffic Control With Flagging	LS	$20,000	1	$20,000
Existing Utility Protection	LF	$4	710	$2,840
ADA Ramp Reconstruction (Compliance)	EA	$4,600	5	$23,000
			Subtotal (Rounded)	**$2,017,000**
Mobilization	LS	5%	1	$100,850
Contingency	LS	30%	1	$605,100
			Construction Subtotal (Rounded)	**$2,723,000**
Permitting	LS	$5,000	1	$5,000
Geotechnical (Assumes 8% of total)	LS	$218,000	1	$218,000
Surveying	LS	$10,000	1	$10,000
Engineering and CMS	LS	20%	1	$544,600
Legal and Admin	LS	$8,000	1	$8,000
			Total Project Cost (Rounded)	**$3,509,000**

Milton Creek Alternative 2				
Item	**Unit**	**Unit Price**	**Est. Qty**	**Cost (2021)**
24-inch Pipe - Excavation, Backfill	LF	$205	1,022	$209,510
36-inch Pipe - Excavation, Backfill	LF	$245	1,821	$446,145
Rock Excavation	CY	$300	3,317	$995,050
Local Road Full Lane Asphalt Repair	LF	$75	2,843	$213,225
72-Inch, Standard Manhole	EA	$16,500	6	$99,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	20	$92,000
			Subtotal (Rounded)	**$2,055,000**
Mobilization	LS	5%	1	$102,750
Contingency	LS	30%	1	$616,500
			Construction Subtotal (Rounded)	**$2,774,000**
Permitting	LS	$5,000	1	$5,000
Geotechnical (Assumes 8% of total)	LS	$222,000	1	$222,000
Surveying	LS	$20,000	1	$20,000
Engineering and CMS	LS	20%	1	$554,800
Legal and Admin	LS	$8,000	1	$8,000
			Total Project Cost (Rounded)	**$3,584,000**

APPENDIX F

Engineering Standards and Comp Plan Review

KELLER ASSOCIATES

DRAFT *TECHNICAL MEMORANDUM*

TO: City of St. Helens

FROM: Peter Olsen, PE
Emily Flock, PE

DATE: 09/13/2021

SUBJECT: ST. HELENS MUNICIPAL DEVELOPMENT CODE, ENGINEERING STANDARDS MANUAL, AND COMPREHENSIVE PLAN REVIEW – STORMWATER

1. GENERAL

The City of St. Helen's existing engineering design standards (Title 18), development code (Title 17), and comprehensive plan (Title 19) were reviewed for new development as they pertain to stormwater conveyance and treatment to identify potential deficiencies and provide recommendations for updates. This effort was part of the Stormwater Master Plan (SWMP) process. Stormwater system design criteria developed for the SWMP encompass the fundamental principles applied in evaluating the existing system and planning for future expansion of the system. The criteria applied in the SWMP come from sources such as neighboring communities, industry standards, and state and federal stormwater regulations and are detailed in Section 3 of the SWMP. The aim of the criteria is to accurately assess the system demands to mitigate existing deficiencies and prevent future problems. Design criteria address design storm events, hydrologic methods, hydraulic calculation methods, and stormwater quality and quantity.

The following documents were examined during this review effort.

- St. Helens Municipal Code (SHMC) Title 17 Community Development Code
- St. Helens Municipal Code (SHMC) Title 18 Engineering Standards Manual
- St. Helens Municipal Code (SHMC) Title 19 Comprehensive Plan

Note that the recommendations below do not include legal services. Developing draft language and development details for revisions to the Municipal comprehensive plan, development code, and City standards is not included in the scope of this review. Any language provided in this section is intended to assist the City in revising standards and is not intended to be directly incorporated into any City Municipal Code.

2. COMMUNITY DEVELOPMENT CODE

This section discusses the results of reviewing SHMC Title 17 Community Development Code.

2.1 GENERAL AND LAND USE DEFINITIONS (17.16.010)

Title 17 of the SHMC defines specific infrastructure as "Public Facility, Minor" with all undefined infrastructure being a "Public Facility, Major." Keller Associates recommends that energy dissipaters and water flow measurement/monitoring/telemetry devices be excluded from the list of minor public facilities. These facilities should require special review and approval.

2.2 STORM DRAINAGE (17.152.100)

In numerous sections throughout Title 17 of the SHMC, the City's adopted master drainage plan is referenced. Following adoption of the updated 2021 Stormwater Master Plan, it is recommended that the City update each of these references.

Note 5 requires that any stormwater facility be designed by a registered professional engineer. It is recommended that the City revise this note to state that "the City Engineer shall approve all storm drainage plans and proposed systems prior to issuance of development permits. Such plans and systems shall be designed by a registered professional engineer." Additionally, a Drainage Report should be a requirement of proposed storm drainage plans and systems.

Note 6 discusses private storm water facility ownership. Where private stormwater facilities are approved, the developer shall be required to execute a maintenance agreement for private facilities that is satisfactory as determined by the City Engineer.

3. ENGINEERING STANDARDS MANUAL

This section discusses the results of reviewing St. Helens Municipal Code Title 18 Engineering Standards Manual.

3.1 GENERAL (18.16.005)

It is recommended that the City add a reference to Oregon Drainage Law: Oregon has adopted the civil law doctrine of drainage. Under this doctrine, adjoining landowners are entitled to have the normal course of natural drainage maintained. The landowner must accept water which naturally comes to their land from above, but they are entitled not to have the normal drainage changed or substantially increased. The lower landowner may not obstruct the run-off from the upper land if the upper landowner is properly discharging the water.

The St. Helens Engineering Standards Manual requires that roof and foundation drains for all multi-family, residential, commercial, or industrial developments be piped directly to the storm drain system. It is recommended the City revise this section to encourage best management practices (BMPs) of stormwater runoff. This can result in a lower runoff quantity and higher water quality. For example, runoff from the roof of industrial development may be reduce by having flows enter a swale with an overflow to the City's storm drain system.

An additional provision should be added stating that "stormwater; including street, parking lot, roof, or footing drainage; shall not be discharged into the sewer system. Stormwater shall be conveyed, treated, and controlled by a system of storm facilities separate from the sanitary sewer system in accordance with all applicable design standards."

In conformance with the City of St. Helens draft Mercury Total Maximum Daily Load (TMDL) tracking matrix, this section could also be used to prohibit any cross connections (the discharge of non-stormwater flows into the stormwater system). Title 17 of the SHMC states that "the stormwater drainage system or stormwater facilities shall be separate and independent of any sanitary sewerage systems", but the stormwater section should be used to explicitly prohibit any non-stormwater discharges to the system.

3.2 DRAINAGE REPORT (18.16.070)

Requirement number 9 listed under drainage report requires a hydrological analysis. It is recommended that the City modify this requirement to be more specific. Some general guidelines for a hydrological analysis are listed below:

- A stamped certificate of investigation stating that the developer has taken downstream impacts into consideration is required for each development constructing, collecting, or discharging more than 5,000 square feet of new impervious area.
- Projects that receive approval for a fee in lieu of construction and/or install partial or no stormwater quantity control facilities must extend the analysis downstream to a point in the storm system where the additional flow from the proposed development site constitutes 10 percent or less of the total tributary drainage flow.
- When the downstream analysis does not continue for at least one-quarter (1/4) mile, the design engineer shall provide a stamped certification of investigation that states the developer has visually investigated the downstream system for at least one-quarter (1/4) mile downstream and is aware of no downstream impacts to the conveyance system.
- For privately maintained water quantity or quality facilities or conveyance systems, a maintenance plan that clearly identifies maintenance activities and frequency is required in a form that can be easily understood by the person(s) responsible for maintenance.

3.3 DRAINAGE PLANS (18.16.080)

It is recommended that the City make the additional requirements mandatory on all Drainage Plans: The consulting firm's name, address, and contact information; the project's township, range, and section; and the vertical datum being referenced.

Additionally, the section may be used to demonstrate compliance with Item 5. a. of the draft St. Helens Mercury TMDL matrix, which states "for projects that disturb one or more acres, refer engineers/developers to the DEQ for 1200-C permit requirements." This note in Title 18 of the SHMC could read, "when a proposed site disturbs one or more acres, it is the policy of the City of St. Helens to refer engineers and developers to the DEQ for 1200-C permit requirements." This recommendation should be reviewed after DEQ approval of the Mercury TMDL matrix for any revisions from the draft matrix.

3.4 GENERAL (18.16.090)

City standards describe criteria that require on-site detention in multiple places. Section 18.16.090 states that "all development on sites within the McNulty Creek Drainage Basin that are one-half acre or greater in area shall be required to provide on-site detention. For sites smaller than one-half acre in area or where storm detention would have an adverse effect upon the receiving storm drainage system, as determined by the City Engineer, a system development charge will be assessed in lieu of a constructed facility. Detention for sites within the Milton Creek Drainage Basin or other basins shall be provided when proposed development will cause increased flows that could overwhelm downstream facilities in a large storm event." Section 18.16.110 section 2 dictates that "Some criteria for requiring on-site detention facilities include, but are not limited to:

(a) There is an identified downstream deficiency, and detention rather than conveyance system enlargement is determined to be the more effective solution;

(b) There is an identified regional detention site within the boundary of the development;

(c) There is a site within the boundary of the development which would qualify as a regional detention site under criteria or capital plan adopted by the City;

(d) Water quantity facilities are required by City-adopted storm water management master plans."

It is recommended that the City reevaluate whether it is necessary to have differing requirements for different basins. The requirements for on-site detention should all be listed in one section. Additionally, it is not typical to require detention based on site size. Usually, this would be based on the proposed additional impervious area at the site. In conformance with the draft City of St. Helens Mercury TMDL tracking matrix, it is recommended that the City require the use of stormwater controls, site-specific stormwater management, and long-term O&M for projects that create or replace one quarter (1/4) acre of impervious area. The requirement details should be reviewed after DEQ approval of the Mercury TMDL matrix to incorporate any revisions from the draft matrix

This section also dictates that "Storm detention facilities shall be designed to provide storage using a 25-year event, with the safe overflow conveyance of the 100-year storm." It is recommended that the post-development peak release rates equal the pre-development release rates for their matching design storm event up to the 10-year design storm. The 25-year storm event peak release rate should not exceed the 10-year pre-development peak release rate.

3.5 HYDROLOGIC ANALYSIS (18.16.100)

Hydrologic methodology refers to the method applied to define how an area or "basin" will react to the design storm. Some items of particular concern are how much of the rainfall over the basin will be converted to runoff, where that runoff will go, and how quickly it will get there.

There are several acceptable hydrological methods for defining basin characteristics. In researching hydrological methodology, three design documents are widely used in the region. These documents are as follows:

- 2005 Oregon Department of Transportation (ODOT) Hydraulics Manual
- 2007 City of Portland Sewer and Drainage Facilities Design Manual
- 2007 Clean Water Services (CWS) Design and Construction Standards

The following is a list of acceptable hydrologic methods compiled from the above-mentioned design manuals:

- Natural Resources Conservation Service (NRCS) TR-20
- Hydrologic Modeling System (HEC-HMS)
- NRCS Urban Hydrograph Method (TR-55/SCS)
- Santa Barbara Urban Hydrograph (SBUH) Method
- Rational Method
- Environmental Protection Agency (EPA) Stormwater Management Model (SWMM)
- Flood Insurance Studies (FIS)
- Statistical Analysis of Stream Gage Data and USGS Regression Equations

Each of these methods have varying applications. The hydrological methodologies currently permitted by the City of St. Helen's are the Rational Method and the Unit Hydrograph Method. The rational method is only permitted for predicting a conservative peak flow rate to be used in determining the required capacity for conveyance elements. The unit hydrograph method is the primary permitted analysis method. A summary of restrictions with each method are summarized in Table 3-1.

TABLE 3-1: PERMITTED HYDROLOGICAL METHODOLOGIES

Rational Method	
Maximum Drainage Subbasin Area	25 Acres
Minimum Time of Concentration (TC)	5 Minutes
Rainfall Intensity	ODOT IDR Curves, Zone 8
Unit Hydrograph Methods	
Preferred Methodology	SBUH
Curve Number (CN)	NRCS
Maximum Sheet Flow Length	300 feet

ODOT: Oregon Department of Transportation
IDR: Intensity-Duration-Curve(s)
NRCS: National Resource Conservation Services
SBUH: Santa Barbara Urban Hydrograph

It is recommended that several modifications be made to section 18.16.100 Hydrological Analysis. The following list summarizes the recommendations.

- Reduce the maximum sheet flow distance from 300 feet to 100 feet.
- Establish acceptable Manning's "n" values for calculations. Acceptable Manning's "n" values for sheet flow can be found in the Oregon Department of Transportation (ODOT) Hydraulics Manual Chapter 7, Appendix F, page 5 (7-F-5). Additionally, acceptable Manning's "n" values for channel flow can be found in the ODOT Hydraulics Manual Chapter 8 (8-A-1). It is recommended that the City either provide their own table of Manning's "n" values or reference the ODOT Hydraulics Manual.
- Add a discussion of the design storm to be used in calculations. Some municipalities reference the current SWMP and the design storms outlined in the planning criteria. Selection of a design storm is a matter that balances level of service with economic feasibility. It is recommended that storm drainage conveyance system be capable of passing runoff from the 25-yr storm event without flooding as presented in the current SWMP. For detention facilities, the post-development maximum runoff rate from the 25-yr storm event should not exceed the pre-development runoff from the 10-yr storm event. In addition to the 25-yr storm, the detention facility should serve the same function for smaller storm events such as the 2-, 5-, and 10-yr events. In short, this means that when development occurs, the peak runoff rate must be less than or equal to the pre-existing conditions through the 25-year storm event. Detention facilities must have a means to safely bypass the 100-yr storm event without damage to property, endangering human life, or public health.

3.6 WATER QUANTITY FACILITY DESIGN (18.16.110)

The City's current design standards dictate that each new development is responsible for mitigating its impacts on the public stormwater system. This may be done by construction of permanent on-site stormwater quantity detention facilities or enlargement or improvement of the downstream conveyance system. It is recommended that the City refine the list to include implementing best management practices (BMPs) to reduce the proposed impervious area.

HydroCAD should be added to the list of approved software programs for calculating storm conditions.

It is recommended that flows be pretreated be a water quality manhole before entering a stormwater detention facility.

It is recommended that the post-development peak release rates be clarified to not exceed the 10-year pre-development peak release rate for the 25-year design storm event. It should also be added that the post-development peak release rates for the 2-, 5, and 10-year storms must be equal to or less than the pre-development peak release rates for their corresponding storm event.

City standards should dictate that storm detention facilities are not allowed to be constructed within any floodplain unless otherwise approved.

City standards refer to King County, Washington, "Surface Water Design Manual" for more complete guidelines to design criteria regarding stormwater detention facilities. It is recommended that the City consider adding a reference to the Portland Stormwater Management Manual (SWMM) and Clean Water Services (CWS) Design and Construction Standards.

Where orifice plates are to be used, a minimum size of ½ inch shall be used. Current City standards do not dictate a minimum size.

3.7 GENERAL CONCEPTS AND PRINCIPALS (18.16.120)

City standards do not currently dictate any trigger for when stormwater pollution reduction facilities are required. One possibility is to require stormwater quality design standards whenever stormwater quantity controls are triggered.

3.8 STORM MANHOLE AND PIPE DESIGN STANDARDS (18.16.200)

It is recommended that a Manning's "n" value of 0.013 shall be used for PVC pipe calculations.

Current City standards dictate that a manhole shall be provided at least every 500 feet. It is recommended that this distance be reduced to 300 feet.

3.9 CULVERT DESIGN STANDARDS (18.16.230)

It is recommended that the City require structural calculations be provided for the design of all box culverts, pipe arch culverts, structural plate culverts, culverts that are not standard, and culverts that require special design.

3.10 ADDITIONAL RECOMMENDATIONS

The current SHMC does little to promote the implementation of Low Impact Development (LID) and Best Management Practices (BMP). LID and BMPs are measures or controls that reduce pollutants and runoff volume at the source. It is recommended that the City move stormwater design towards encouraging LID and the implementation of BMPs. Oregon Department of Environmental Quality (DEQ) has published a resource on BMPs titled "Construction Stormwater Best Management Practices Manual." Additionally, many of the surrounding municipalities and service districts have Stormwater Management Manuals with varying levels of discussions of BMPs. It is recommended the City either 1) adopt one of these (or similar) documents or 2) draw inspiration from these documents to revise their Engineering Standards Manual.

Generally, it is recommended that the City move toward encouraging Green Stormwater Infrastructure (GSI) to the Maximum Extent Feasible (MEF).

- Green Storm Water Infrastructure (GSI) means a stormwater facility that mimics natural surface hydrologic functions through infiltration or evapotranspiration, or that involves stormwater reuse.
- Maximum Extent Feasible (MEF) means the extent to which a requirement or standard must be compiled with as constrained by the physical limitations of the site, practical considerations of engineering design, and reasonable considerations of financial costs and environmental impacts.

4. COMPREHENSIVE PLAN

There are no recommendations for storm sewer provisions in the SHMC Title 19 Comprehensive Plan.

APPENDIX G

Model Parameters

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Subcatchment Parameters and 25-Year Storm Event Results

Sub-Basin ID	Load Placement (ID)	Area (acres)	Average Slope (%)	Characteristic Length (ft)	NRCS Composite CN	Depression Storage (in)	25-Year Storm Event: Total Precipitation (in)	25-Year Storm Event: Total Runoff Depth (in)	25-Year Storm Event: Peak Runoff (gpm)	25-Year Storm Event: Time of Concentration (minutes)
DL-2	I9-37	8.1	1.3	1,059	76.3	0.08	3.5	1.8	1,369	32
DL-3	H9-1	21.8	1.1	1,644	90.8	0.04	3.5	2.6	6,160	31
DL-5	J9-14	1.8	6.6	301	86.5	0.06	3.5	2.3	819	4
DL-7	KJ-290	34.0	2.4	1,648	91.3	0.03	3.5	2.7	11,428	20
DT-1	J11-5	14.7	13.2	410	89.4	0.05	3.5	2.5	7,450	3
DT-2	I10-114	3.7	0.6	66	89.3	0.05	3.5	2.5	1,857	3
DT-2A	I10-98	2.8	4.3	419	85.0	0.05	3.5	2.5	1,238	6
DT-3	I11-71	4.1	5.8	451	86.3	0.06	3.5	2.3	1,721	6
DT-3A	J11-21	10.1	5.4	407	86.3	0.06	3.5	2.3	4,303	5
DT-4	J10-33	4.1	13.2	500	90.4	0.04	3.5	2.6	2,102	3
GW-1	J11-22	6.5	8.4	670	88.2	0.05	3.5	2.5	2,884	6
GW-10	H11-181	3.7	2.1	571	89.3	0.08	3.5	2.5	1,467	10
GW-11	I12-30	14.1	2.6	816	88.5	0.05	3.5	2.5	5,090	13
GW-12	I12-5	5.2	3.1	962	88.2	0.06	3.5	2.5	1,839	13
GW-1A	J11-29	5.6	8.5	869	88.2	0.05	3.5	2.5	2,359	7
GW-2	J11-63	9.1	2.2	819	84.7	0.36	3.5	2.0	2,378	16
GW-2A	J12-8	7.8	4.4	1,091	84.7	0.36	3.5	2.0	2,109	14
GW-2B	J12-3	5.3	4.3	836	84.7	0.36	3.5	2.0	1,554	11
GW-3	I11-89	5.0	2.9	558	88.7	0.07	3.5	2.5	2,030	9
GW-3A	I11-93	7.1	3.5	808	88.7	0.05	3.5	2.5	2,749	11
GW-3B	I12-93	7.2	2.0	707	88.7	0.08	3.5	2.5	2,604	13
GW-4	I12-4	12.8	4.9	487	87.2	0.03	3.5	2.4	5,420	6
GW-5	H11-124	11.9	3.6	412	89.9	0.05	3.5	2.6	5,645	6
GW-6	H12-65	7.5	1.3	1,510	80.0	0.13	3.5	1.9	1,312	38
GW-7	H11-103	9.7	3.2	497	88.3	0.05	3.5	2.5	4,092	8
GW-8	H12-10	4.1	2.0	489	84.7	0.09	3.5	2.2	1,357	11
GW-9	H11-107	9.9	3.1	828	91.7	0.09	3.5	2.7	4,227	10
MI-1	G9-19	3.9	11.7	1,178	83.4	0.09	3.5	2.1	1,274	9
MI-10	F11-234	3.9	8.8	820	82.9	0.07	3.5	2.1	1,320	8
MI-10A	F10-21	8.2	6.5	1,269	82.9	0.07	3.5	2.1	2,376	14
MI-11	H11-164	8.9	1.7	715	80.0	0.07	3.5	2.0	2,094	19
MI-12	G11-91	4.5	0.9	447	88.2	0.09	3.5	2.4	1,578	13
MI-13	KJ-699	1.7	1.0	360	92.2	0.05	3.5	2.8	783	9
MI-15	H10-13	3.2	0.6	320	89.5	0.10	3.5	2.5	1,232	12
MI-15A	H10-16	3.3	0.6	320	89.5	0.10	3.5	2.5	1,267	12
MI-16	G10-105	9.5	5.2	675	87.9	0.07	3.5	2.4	3,882	8
MI-16A	G10-66	4.6	5.2	675	87.9	0.07	3.5	2.4	1,895	8
MI-17	F11-207	4.0	3.5	406	87.4	0.06	3.5	2.4	1,665	6
MI-17A	F11-211	3.0	3.5	406	87.4	0.06	3.5	2.4	1,248	6
MI-17B	G11-143	1.4	3.5	406	87.4	0.06	3.5	2.4	588	6
MI-18	F11-1	6.2	4.6	476	84.0	0.12	3.5	2.1	2,259	7
MI-19	F11-25	2.5	5.5	362	83.4	0.03	3.5	2.2	962	5
MI-20	F11-37	4.4	6.3	347	82.9	0.03	3.5	2.2	1,727	5
MI-21	F11-50	2.7	4.1	339	83.9	0.04	3.5	2.2	1,058	6
MI-22	G10-92	2.4	3.9	311	84.6	0.05	3.5	2.3	975	5
MI-23	G11-160	8.6	1.6	882	78.4	0.06	3.5	1.9	1,767	24
MI-24	G11-70	22.8	2.9	2,306	76.6	0.07	3.5	1.8	3,612	40
MI-25	G11-132	9.1	1.1	923	83.0	0.07	3.5	2.1	2,094	26
MI-26	G11-9	9.7	1.2	1,330	79.9	0.08	3.5	1.9	1,770	36
MI-27	G11-9	12.1	2.1	1,691	80.0	0.08	3.5	1.9	2,292	34
MI-28	G10-89	2.9	4.1	563	81.9	0.08	3.5	2.1	911	9
MI-29	G10-118	31.3	9.1	1,634	81.3	0.06	3.5	2.0	8,380	15
MI-3	G9-46	25.2	10.6	1,718	78.8	0.08	3.5	1.9	6,084	16
MI-30	G11-159	6.3	1.5	593	81.9	0.08	3.5	2.1	1,671	16
MI-31	H11-62	8.8	2.1	745	90.0	0.12	3.5	2.5	3,342	12
MI-32	G10-57	11.7	0.5	600	87.2	0.12	3.5	2.3	3,199	23
MI-33	KJ-131	18.1	1.4	1,332	77.9	0.07	3.5	1.8	3,098	37
MI-34	G11-109	5.2	1.6	637	81.4	0.09	3.5	2.0	1,314	17
MI-35	G12-75	9.2	0.7	730	78.9	0.04	3.5	1.9	1,761	31

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Subcatchment Parameters and 25-Year Storm Event Results

Sub-Basin ID	Load Placement (ID)	Area (acres)	Average Slope (%)	Characteristic Length (ft)	NRCS Composite CN	Depression Storage (in)	25-Year Storm Event: Total Precipitation (in)	25-Year Storm Event: Total Runoff Depth (in)	25-Year Storm Event: Peak Runoff (gpm)	25-Year Storm Event: Time of Concentration (minutes)
MI-35A	F12-170	6.2	0.1	732	78.9	0.12	3.5	1.8	827	69
MI-36	KJ-255	11.7	8.3	1,862	76.4	0.07	3.5	1.8	2,392	20
MI-37	KJ-268	10.0	15.5	761	83.9	0.09	3.5	2.2	3,861	6
MI-38	H12-21	3.3	1.2	489	87.2	0.05	3.5	2.4	1,137	13
MI-39	H12-62	3.2	1.8	454	89.5	0.05	3.5	2.6	1,321	9
MI-4	G9-13	11.2	10.1	594	78.1	0.03	3.5	1.9	3,475	7
MI-40	H11-183	5.1	0.8	651	89.2	0.06	3.5	2.5	1,641	19
MI-41	G11-42	2.5	2.4	496	89.1	0.04	3.5	2.5	1,025	8
MI-42	F10-31	2.6	6.2	453	82.9	0.05	3.5	2.1	945	6
MI-43	F10-34	4.0	6.8	515	81.0	0.06	3.5	2.0	1,345	7
MI-44	F11-223	0.4	2.4	411	98.0	0.05	3.5	3.2	246	5
MI-45	KJ-120	1.4	2.6	511	82.2	0.05	3.5	2.1	427	11
MI-45A	X-809	0.8	2.6	245	86.6	0.05	3.5	2.1	300	5
MI-46	G10-88	2.8	5.9	320	81.9	0.06	3.5	2.1	1,039	5
MI-5	G12-113	8.5	1.5	1,416	80.5	0.09	3.5	2.0	1,628	34
MI-6	F12-182	24.9	2.5	1,593	78.7	0.10	3.5	1.9	4,659	30
MI-7	I12-30	4.7	0.5	400	90.0	0.06	3.5	2.6	1,690	15
MI-8	G10-29	3.2	6.3	301	79.1	0.08	3.5	1.9	1,098	5
MI-9	G10-47	4.0	12.3	506	85.4	0.08	3.5	2.3	1,685	4
MN-1	F11-58	11.3	5.5	877	82.9	0.06	3.5	2.1	3,530	11
MN-11	F13-30	1.4	2.5	202	88.3	0.04	3.5	2.5	646	4
MN-12	F13-37	0.9	1.5	260	89.5	0.06	3.5	2.5	429	6
MN-13	F13-25	11.6	4.6	747	80.7	0.09	3.5	2.0	3,288	12
MN-14	F13-17	2.0	5.3	263	86.6	0.07	3.5	2.3	886	4
MN-15	F13-9	9.6	2.2	781	84.8	0.09	3.5	2.2	2,856	15
MN-16	F13-1	5.5	2.1	559	82.0	0.14	3.5	2.0	1,548	13
MN-17	F12-44	8.5	5.0	1,087	76.7	0.08	3.5	1.8	1,870	17
MN-17A	F12-48	7.6	5.0	1,087	76.7	0.08	3.5	1.8	1,663	17
MN-18	E12-30	0.8	4.8	415	90.5	0.06	3.5	2.6	372	5
MN-19	E12-19	6.1	4.4	735	84.7	0.04	3.5	2.3	2,081	10
MN-2	STOR-27	16.1	0.7	591	82.6	0.05	3.5	2.1	3,846	23
MN-20	E12-32	2.6	2.3	345	87.7	0.05	3.5	2.4	1,100	7
MN-21	E12-52	4.8	4.0	352	87.3	0.06	3.5	2.4	2,097	5
MN-22	E12-84	6.4	4.5	838	84.5	0.07	3.5	2.2	2,109	11
MN-23	E12-113	3.0	4.9	573	88.0	0.03	3.5	2.5	1,288	7
MN-24	E12-46	6.7	4.2	575	87.5	0.06	3.5	2.4	2,713	8
MN-25	E12-137	0.7	3.0	336	85.8	0.06	3.5	2.3	268	6
MN-26	E13-24	2.6	5.7	211	89.9	0.09	3.5	2.6	1,331	3
MN-27	E13-15	3.6	4.1	266	89.7	0.08	3.5	2.5	1,792	4
MN-28	E13-26	5.3	1.5	796	87.3	0.07	3.5	2.4	1,652	17
MN-3	F12-190	5.0	0.9	217	88.4	0.05	3.5	2.5	2,157	7
MN-30	E11-3	1.4	5.8	274	89.0	0.07	3.5	2.5	701	3
MN-31	F12-59	6.0	2.3	774	88.8	0.07	3.5	2.5	2,195	13
MN-32	F12-17	11.1	3.9	1,014	82.9	0.08	3.5	2.1	3,121	15
MN-33	KJ-134	22.0	0.4	1,542	87.7	0.06	3.5	2.4	4,399	55
MN-36	KJ-847	6.9	1.9	482	87.0	0.03	3.5	2.4	2,572	10
MN-37	G12-48	17.6	0.4	941	86.1	0.05	3.5	2.3	3,913	38
MN-39	F12-111	1.0	1.6	256	86.5	0.10	3.5	2.3	395	7
MN-4	G11-83	19.3	0.6	1,690	81.7	0.06	3.5	2.0	3,074	60
MN-40	F12-112	2.3	2.7	1,528	90.4	0.08	3.5	2.6	782	19
MN-41	G13-26	8.8	1.4	1,150	91.4	0.09	3.5	2.7	2,954	20
MN-42	F12-71	4.1	0.5	589	83.8	0.04	3.5	2.2	998	26
MN-43	F12-118	5.2	0.4	269	82.7	0.08	3.5	2.1	1,387	17
MN-44	G12-34	9.2	1.3	480	83.8	0.06	3.5	2.2	2,758	14
MN-45	F12-186	3.0	1.2	260	90.0	0.06	3.5	2.6	1,341	7
MN-46	F13-22	2.4	2.5	358	89.8	0.08	3.5	2.5	1,115	6
MN-47	F12-104	0.5	0.5	364	93.3	0.05	3.5	2.8	197	12
MN-48	KJ-277	1.6	2.3	432	86.1	0.06	3.5	2.3	588	9
MN-49	F11-187	5.6	5.6	518	81.0	0.07	3.5	2.0	1,825	8

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Subcatchment Parameters and 25-Year Storm Event Results

							25-Year Storm Event			
Sub-Basin ID	Load Placement (ID)	Area (acres)	Average Slope (%)	Characteristic Length (ft)	NRCS Composite CN	Depression Storage (in)	Total Precipitation (in)	Total Runoff Depth (in)	Peak Runoff (gpm)	Time of Concentration (minutes)
MN-5	F11-80	4.9	2.9	345	82.9	0.04	3.5	2.2	1,774	7
MN-50	F11-94	3.4	5.5	506	80.4	0.04	3.5	2.0	1,115	8
MN-51	F11-186	2.1	9.1	265	80.3	0.06	3.5	2.0	761	4
MN-52	F13-5	0.8	2.8	390	85.2	0.08	3.5	2.3	317	8
MN-53	KJ-117	1.3	0.5	851	85.9	0.05	3.5	2.3	305	33
MN-54	F12-35	9.3	4.7	1,269	74.5	0.05	3.5	1.7	1,786	21
MN-55	E13-11	1.7	1.8	221	88.6	0.07	3.5	2.5	765	5
MN-56	E12-6	3.7	4.4	544	81.6	0.06	3.5	2.1	1,183	9
MN-57	F12-8	3.4	2.9	415	81.1	0.04	3.5	2.1	1,071	9
MN-59	F12-11	2.1	4.6	415	87.5	0.06	3.5	2.4	918	6
MN-6	F11-105	3.1	7.4	680	81.3	0.07	3.5	2.0	999	8
MN-61	KJ-100	24.9	2.3	2,659	82.0	0.04	3.5	2.1	4,603	43
MN-7	F11-163	3.9	7.0	1,062	84.9	0.06	3.5	2.3	1,315	11
MN-8	F11-186	11.4	15.6	1,676	81.7	0.04	3.5	2.1	3,400	12
MT-1	MT-8	3.5	8.0	611	86.7	0.08	3.5	2.3	1,447	6
MT-10	DT-3	5.2	8.3	432	83.8	0.07	3.5	2.2	2,057	5
MT-11	I11-40	20.8	4.4	1,002	83.7	0.10	3.5	2.1	6,195	13
MT-11A	MT-9	9.7	3.5	908	83.7	0.10	3.5	2.1	2,853	14
MT-12	I11-16	6.4	5.6	628	83.3	0.10	3.5	2.1	2,175	8
MT-2	I11-108	7.8	1.7	475	86.5	0.08	3.5	2.3	2,756	11
MT-3	I11-55	3.8	1.5	527	86.5	0.08	3.5	2.3	1,264	12
MT-4	I11-23	7.9	1.9	647	86.0	0.08	3.5	2.3	2,553	13
MT-5	H12-26	8.0	1.0	836	83.9	0.10	3.5	2.1	1,917	25
MT-6	I10-73	8.2	5.6	860	87.1	0.05	3.5	2.4	3,130	9
MT-7	I11-21	3.8	2.1	756	81.6	0.11	3.5	2.0	970	17
MT-8	I11-36	31.1	4.0	1,365	85.9	0.08	3.5	2.3	9,275	17
MT-9	NT-22	3.6	8.8	588	84.0	0.05	3.5	2.2	1,362	6
NT-1	I9-52	6.4	2.8	632	88.3	0.05	3.5	2.5	2,495	10
NT-10	H11-211	8.0	2.6	303	89.2	0.07	3.5	2.5	3,713	5
NT-11	H11-43	4.0	1.3	309	93.0	0.07	3.5	2.8	2,004	7
NT-11A	H11-231	1.2	1.3	309	93.0	0.07	3.5	2.8	603	7
NT-12	KJ-221	11.6	6.9	777	83.9	0.05	3.5	2.2	4,054	9
NT-13	I10-57	8.7	6.7	599	88.1	0.02	3.5	2.5	3,822	6
NT-14	X-804	13.6	1.0	1,346	86.8	0.08	3.5	2.3	3,305	31
NT-15	H10-24	13.6	0.8	1,018	87.1	0.05	3.5	2.4	3,494	29
NT-16	H11-58	20.8	7.2	692	88.1	0.06	3.5	2.4	8,915	7
NT-17	H11-23	8.2	0.7	1,069	88.0	0.06	3.5	2.4	2,143	29
NT-19	X-711	9.5	3.3	680	86.7	0.05	3.5	2.4	3,456	10
NT-2	I10-153	1.2	4.3	421	89.1	0.06	3.5	2.5	546	6
NT-20	X-800	5.0	0.9	325	87.1	0.06	3.5	2.4	1,816	11
NT-21	I10-14	8.5	3.2	378	86.1	0.06	3.5	2.3	3,412	7
NT-22	I10-94	11.4	3.3	908	86.8	0.07	3.5	2.4	3,846	13
NT-23	X-773	3.9	2.8	566	86.9	0.06	3.5	2.4	1,471	9
NT-24	I10-33	2.9	5.6	567	85.5	0.06	3.5	2.3	1,125	7
NT-25	H11-34	1.9	5.4	443	86.8	0.07	3.5	2.4	824	6
NT-26	H11-27	6.1	3.4	816	86.2	0.06	3.5	2.3	2,065	12
NT-27	H11-23	4.5	0.5	2,008	94.2	0.07	3.5	2.9	1,189	46
NT-28	X-804	9.1	1.7	326	83.4	0.02	3.5	2.2	3,164	9
NT-29	X-807	2.9	13.6	470	87.7	0.08	3.5	2.4	1,376	4
NT-3	I10-91	4.5	4.8	372	89.1	0.06	3.5	2.5	2,148	5
NT-30	H10-24	4.3	3.1	653	88.9	0.05	3.5	2.5	1,742	9
NT-4	I10-31	8.8	5.2	498	87.2	0.06	3.5	2.4	3,704	6
NT-4A	I10-28	4.8	5.7	560	87.2	0.06	3.5	2.4	2,001	7
NT-5	I10-64	8.6	1.3	700	86.7	0.06	3.5	2.4	2,644	17
NT-6	H10-1	3.1	3.3	735	87.9	0.05	3.5	2.5	1,175	10
NT-6A	H10-2	17.1	1.4	677	87.9	0.05	3.5	2.4	5,748	15
NT-7	KJ-114	9.0	12.7	668	88.0	0.05	3.5	2.5	4,137	5
NT-8	KJ-270	10.2	5.9	641	84.8	0.08	3.5	2.2	3,747	8
NT-9	KJ-240	5.6	9.1	394	84.8	0.08	3.5	2.2	2,332	4

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Subcatchment Parameters and 25-Year Storm Event Results

Sub-Basin ID	Load Placement (ID)	Area (acres)	Average Slope (%)	Characteristic Length (ft)	NRCS Composite CN	Depression Storage (in)	25-Year Storm Event: Total Precipitation (in)	Total Runoff Depth (in)	Peak Runoff (gpm)	Time of Concentration (minutes)
NT-9A	STOR-30	10.6	7.1	617	84.8	0.08	3.5	2.2	4,011	7

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
E11-2	215.67	209.37	0.30	6.00	0.000	0.00
E11-3	212.87	210.17	0.66	2.04	0.000	0.00
E11-6	202.08	197.98	0.35	3.75	0.000	0.00
E12-101	175.94	171.48	0.56	3.90	0.000	0.00
E12-104	174.34	169.94	0.70	3.70	0.000	0.00
E12-105	177.84	173.74	0.39	3.71	0.000	0.00
E12-108	192.04	186.84	0.43	4.77	0.000	0.00
E12-112	192.23	189.73	0.51	1.99	0.000	0.00
E12-113	193.74	190.72	0.94	2.08	0.000	0.00
E12-131	177.74	168.80	0.99	7.95	0.000	0.00
E12-132	182.04	173.48	0.57	7.99	0.000	0.00
E12-135	176.84	168.03	1.12	7.69	0.000	0.00
E12-136	170.44	165.97	0.64	3.83	0.000	0.00
E12-137	166.56	161.60	0.38	4.58	0.000	0.00
E12-19	213.14	208.52	0.55	4.07	0.000	0.00
E12-21	206.64	201.44	0.64	4.56	0.000	0.00
E12-24	202.64	197.97	0.63	4.04	0.000	0.00
E12-27	203.14	196.65	0.68	5.81	0.000	0.00
E12-30	212.04	209.14	0.23	2.67	0.000	0.00
E12-32	199.14	193.75	0.75	4.64	0.000	0.00
E12-36	193.64	187.54	0.94	5.16	0.000	0.00
E12-37	193.34	188.52	0.00	4.82	0.000	0.00
E12-40	203.44	198.34	0.00	5.10	0.000	0.00
E12-42	192.74	186.90	0.76	5.08	0.000	0.00
E12-44	190.24	184.78	0.75	4.71	0.000	0.00
E12-46	186.54	182.10	1.21	3.23	0.000	0.00
E12-49	185.74	182.83	1.52	1.39	0.000	0.00
E12-52	195.24	188.94	0.75	5.55	0.000	0.00
E12-6	191.59	187.49	4.12	-0.02	0.013	2.64
E12-64	183.34	178.67	1.22	3.45	0.000	0.00
E12-66	179.94	175.24	1.10	3.60	0.000	0.00
E12-71	176.24	170.53	1.02	4.69	0.000	0.00
E12-72	167.54	160.06	1.34	6.14	0.000	0.00
E12-75	168.04	159.56	1.25	7.23	0.000	0.00

Client: City of St. Helens
Project: Stormwater Master Plan
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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
E12-79	174.37	158.08	1.28	15.01	0.000	0.00
E12-82	161.34	156.68	1.24	3.42	0.000	0.00
E12-84	214.14	209.65	0.48	4.01	0.000	0.00
E12-87	200.24	196.64	1.61	1.99	0.000	0.00
E12-88	199.64	196.28	0.58	2.78	0.000	0.00
E12-94	195.14	192.14	0.57	2.43	0.000	0.00
E12-95	190.54	187.44	0.57	2.53	0.000	0.00
E12-96	189.24	185.83	0.53	2.88	0.000	0.00
E12-99	179.44	174.76	0.63	4.05	0.000	0.00
E13-10	179.94	174.93	2.89	2.12	0.000	0.00
E13-11	183.34	176.16	0.82	6.36	0.000	0.00
E13-15	181.34	173.95	4.05	3.34	0.000	0.00
E13-16	178.14	173.75	2.66	1.73	0.000	0.00
E13-17	178.04	172.60	1.39	4.05	0.000	0.00
E13-23	179.84	172.08	1.44	6.32	0.000	0.00
E13-24	183.93	178.28	0.69	4.96	0.000	0.00
E13-25	177.34	172.90	1.36	3.08	0.000	0.00
E13-26	179.44	171.53	1.94	5.97	0.000	0.00
E13-3	177.14	171.17	0.00	5.97	0.000	0.00
E13-30	177.54	169.91	3.56	4.07	0.000	0.00
E13-7	179.74	174.09	2.22	3.43	0.000	0.00
E13-8	179.54	174.52	2.96	2.06	0.000	0.00
F10-1	173.87	169.17	3.84	0.86	0.000	0.00
F10-21	179.72	173.14	6.58	0.00	0.000	0.00
F10-23	182.02	174.84	5.61	1.57	0.000	0.00
F10-26	182.98	174.84	0.00	8.14	0.000	0.00
F10-27	182.86	176.55	2.43	3.88	0.000	0.00
F10-31	253.31	249.04	0.32	3.95	0.000	0.00
F10-34	250.82	246.14	0.36	4.32	0.000	0.00
F11-1	177.13	171.41	5.43	0.29	0.000	0.00
F11-105	212.00	208.90	0.34	2.76	0.000	0.00
F11-110	201.00	198.22	0.34	2.44	0.000	0.00
F11-111	194.40	190.95	0.34	3.11	0.000	0.00
F11-112	189.35	183.79	0.37	5.19	0.000	0.00

Client: City of St. Helens
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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
F11-113	180.50	177.29	0.36	2.85	0.000	0.00
F11-114	175.50	171.20	0.31	3.99	0.000	0.00
F11-115	174.00	168.50	0.88	4.62	0.000	0.00
F11-117	173.88	170.54	0.00	3.34	0.000	0.00
F11-118	179.34	171.04	0.00	8.30	0.000	0.00
F11-12	171.06	163.06	5.05	2.95	0.000	0.00
F11-15	167.59	157.69	6.61	3.29	0.000	0.00
F11-15_DUMMY	170.93	161.52	2.35	7.06	0.000	0.00
F11-163	211.39	205.19	0.40	5.80	0.000	0.00
F11-164	191.39	184.25	0.42	6.72	0.000	0.00
F11-165	176.14	168.44	0.91	6.79	0.000	0.00
F11-17	167.08	159.78	5.17	2.13	0.000	0.00
F11-185	149.00	145.00	0.87	3.13	0.000	0.00
F11-186	149.00	145.70	1.22	2.29	0.000	0.00
F11-187	172.85	165.00	1.32	6.53	0.000	0.00
F11-188	169.50	165.50	0.94	3.11	0.000	0.00
F11-2	174.44	169.69	4.75	0.00	0.000	0.00
F11-20	161.05	154.75	0.85	5.45	0.000	0.00
F11-207	165.68	160.74	0.68	4.26	0.000	0.00
F11-21	152.99	148.74	4.25	0.00	0.000	0.00
F11-211	159.97	154.84	0.62	4.51	0.000	0.00
F11-214	158.45	148.84	1.83	7.78	0.000	0.00
F11-217	154.07	148.95	1.69	3.43	0.000	0.00
F11-219	151.29	146.74	3.76	0.79	0.000	0.00
F11-220	150.59	145.10	5.49	0.00	0.000	0.00
F11-221	150.10	144.34	5.79	-0.03	0.022	0.86
F11-223	155.31	152.60	0.18	2.53	0.000	0.00
F11-230	150.80	148.04	2.76	0.00	0.001	0.02
F11-233	180.04	174.34	0.00	5.70	0.000	0.00
F11-234	188.99	184.44	0.72	3.83	0.000	0.00
F11-237	196.90	192.33	0.77	3.80	0.000	0.00
F11-239	212.20	206.34	0.59	5.27	0.000	0.00
F11-242	221.76	215.78	0.39	5.59	0.000	0.00
F11-243	236.40	230.71	0.32	5.37	0.000	0.00

Client: City of St. Helens
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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
F11-247	229.05	224.64	0.36	4.05	0.000	0.00
F11-25	195.57	185.62	0.61	9.34	0.000	0.00
F11-29	175.75	169.18	0.54	6.03	0.000	0.00
F11-34	175.88	166.81	0.90	8.17	0.000	0.00
F11-37	187.68	180.33	0.54	6.81	0.000	0.00
F11-42	170.32	164.62	0.78	4.92	0.000	0.00
F11-43	170.10	163.22	0.82	6.06	0.000	0.00
F11-5	174.57	167.79	3.07	3.71	0.000	0.00
F11-50	184.46	174.21	0.43	9.82	0.000	0.00
F11-58	265.74	256.92	0.80	8.02	0.000	0.00
F11-6	173.44	164.59	5.15	3.70	0.000	0.00
F11-61	246.35	242.17	0.63	3.55	0.000	0.00
F11-64	222.22	215.24	0.69	6.29	0.000	0.00
F11-75	205.53	197.80	0.58	7.15	0.000	0.00
F11-76	194.09	183.34	8.13	2.62	0.000	0.00
F11-80	187.50	174.36	0.65	12.49	0.000	0.00
F11-94	136.04	133.80	0.91	1.33	0.000	0.00
F11-98	165.75	161.65	0.00	4.10	0.000	0.00
F11-99	173.70	168.90	0.00	4.80	0.000	0.00
F12-104	122.66	119.50	3.11	0.05	0.000	0.00
F12-105	123.59	119.20	1.36	3.03	0.000	0.00
F12-11	162.05	156.10	0.44	5.51	0.000	0.00
F12-110	118.00	115.80	0.20	2.00	0.000	0.00
F12-111	121.80	118.30	0.33	3.17	0.000	0.00
F12-112	137.79	134.79	0.30	2.70	0.000	0.00
F12-113	131.51	122.66	0.54	8.31	0.000	0.00
F12-114	125.95	121.35	0.48	4.12	0.000	0.00
F12-118	113.84	110.75	0.94	2.15	0.000	0.00
F12-133	126.38	123.20	0.44	4.16	0.000	0.00
F12-134	129.20	124.80	1.11	3.29	0.000	0.00
F12-14	161.60	157.50	0.00	4.10	0.000	0.00
F12-15	138.94	132.46	1.64	4.84	0.000	0.00
F12-16	137.29	132.29	1.23	3.77	0.000	0.00
F12-17	136.84	131.84	1.13	3.87	0.000	0.00

Client: City of St. Helens
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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
F12-170	122.35	119.10	0.86	2.39	0.000	0.00
F12-171	122.48	119.40	0.97	2.11	0.000	0.00
F12-182	123.09	120.20	3.03	-0.14	0.101	4.89
F12-186	123.34	118.24	2.55	2.55	0.000	0.00
F12-188	124.10	117.99	2.79	3.32	0.000	0.00
F12-189	124.30	118.08	2.66	3.56	0.000	0.00
F12-190	125.38	117.77	2.76	4.85	0.000	0.00
F12-2	171.26	166.75	0.91	3.60	0.000	0.00
F12-23	131.28	125.50	2.06	3.72	0.000	0.00
F12-25	133.24	126.45	0.70	6.09	0.000	0.00
F12-26	138.84	130.14	0.82	7.88	0.000	0.00
F12-30	140.54	130.85	1.99	7.70	0.000	0.00
F12-34	146.64	135.51	4.48	6.65	0.000	0.00
F12-35	147.34	136.04	5.85	5.45	0.000	0.00
F12-38	144.24	137.67	5.61	0.96	0.000	0.00
F12-4	171.09	167.09	0.52	3.48	0.000	0.00
F12-41	143.54	138.43	5.11	0.00	0.000	0.00
F12-44	144.24	140.64	3.66	-0.06	0.044	1.80
F12-45	145.74	141.98	3.76	0.00	0.000	0.11
F12-48	150.09	147.21	2.88	0.00	0.000	0.01
F12-53	136.96	132.99	1.18	2.79	0.000	0.00
F12-56	137.90	133.64	1.10	3.16	0.000	0.00
F12-59	138.84	134.66	1.23	2.95	0.000	0.00
F12-6	175.76	172.25	0.41	3.10	0.000	0.00
F12-67	119.53	114.33	5.20	0.00	0.000	0.00
F12-68	119.95	114.75	5.20	0.00	0.000	0.00
F12-69	121.89	116.59	4.03	1.27	0.000	0.00
F12-7	177.39	173.89	0.53	2.97	0.000	0.00
F12-71	121.90	116.90	3.83	1.17	0.000	0.00
F12-8	179.10	175.66	0.61	2.83	0.000	0.00
F12-91	123.94	117.36	3.00	3.58	0.000	0.00
F12-95	125.05	117.50	2.85	4.70	0.000	0.00
F13-1	128.50	125.57	0.47	2.46	0.000	0.00
F13-11	118.88	114.28	0.76	3.84	0.000	0.00

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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
F13-13	119.37	108.67	0.93	9.77	0.000	0.00
F13-15	125.81	122.39	0.35	3.07	0.000	0.00
F13-17	134.08	130.33	0.38	3.37	0.000	0.00
F13-2	128.25	123.95	0.48	3.82	0.000	0.00
F13-22	123.19	119.59	1.03	2.57	0.000	0.00
F13-25	103.89	100.71	1.00	2.18	0.000	0.00
F13-26	108.25	99.40	0.81	8.04	0.000	0.00
F13-27	106.11	98.85	1.11	6.15	0.000	0.00
F13-28	112.92	109.62	0.23	3.07	0.000	0.00
F13-3	127.09	122.97	0.42	3.70	0.000	0.00
F13-30	125.11	121.84	0.27	3.00	0.000	0.00
F13-32	102.19	97.55	0.94	3.70	0.000	0.00
F13-34	102.04	97.03	1.12	3.89	0.000	0.00
F13-35	100.92	95.72	0.71	4.49	0.000	0.00
F13-36	114.89	111.99	0.19	2.71	0.000	0.00
F13-37	122.75	119.70	0.21	2.84	0.000	0.00
F13-4	123.90	119.87	0.39	3.64	0.000	0.00
F13-40	98.45	93.87	1.58	3.00	0.000	0.00
F13-43	96.84	94.44	1.02	1.38	0.000	0.00
F13-44	103.34	99.84	0.19	3.31	0.000	0.00
F13-5	122.15	117.70	0.79	3.66	0.000	0.00
F13-6	122.45	118.68	2.19	1.58	0.000	0.00
F13-7	123.00	118.56	3.29	1.15	0.000	0.00
F13-8	125.50	122.19	3.31	0.00	0.000	0.12
F13-9	130.61	126.91	3.70	0.00	0.000	0.07
G10-10	223.74	217.74	0.32	5.68	0.000	0.00
G10-105	159.24	154.40	0.95	3.89	0.000	0.00
G10-11	222.14	218.03	0.06	4.05	0.000	0.00
G10-114	148.56	142.70	4.08	1.78	0.000	0.00
G10-115	149.50	142.30	4.50	2.70	0.000	0.00
G10-116	145.99	141.50	4.49	0.00	0.000	0.00
G10-117	148.42	138.90	2.16	7.36	0.000	0.00
G10-118	155.14	149.64	0.71	4.79	0.000	0.00
G10-119	149.25	142.30	4.49	2.46	0.000	0.00

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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
G10-14	222.14	218.53	0.00	3.61	0.000	0.00
G10-15	223.84	219.14	0.00	4.70	0.000	0.00
G10-18	227.34	223.14	0.00	4.20	0.000	0.00
G10-22	195.24	189.53	0.40	5.31	0.000	0.00
G10-25	217.54	213.04	0.28	4.22	0.000	0.00
G10-28	227.14	216.09	0.42	10.63	0.000	0.00
G10-29	223.34	217.29	0.78	5.27	0.000	0.00
G10-3	236.24	232.24	0.00	4.00	0.000	0.00
G10-31	221.34	217.64	0.43	3.27	0.000	0.00
G10-35	142.42	137.84	1.26	3.32	0.000	0.00
G10-36	142.21	138.44	0.86	2.91	0.000	0.00
G10-37	142.18	138.64	0.54	3.00	0.000	0.00
G10-38	143.55	140.36	0.74	2.45	0.000	0.00
G10-4	233.84	230.21	0.00	3.63	0.000	0.00
G10-41	145.64	141.24	0.76	3.64	0.000	0.00
G10-42	153.01	148.09	0.46	4.46	0.000	0.00
G10-43	157.33	152.94	0.40	3.99	0.000	0.00
G10-45	171.96	167.44	0.48	4.04	0.000	0.00
G10-47	172.24	168.19	2.41	1.64	0.000	0.00
G10-5	232.24	227.64	0.00	4.60	0.000	0.00
G10-57	126.14	123.14	3.04	-0.04	0.029	1.54
G10-64	146.96	143.20	3.77	-0.01	0.006	0.23
G10-66	156.00	149.56	1.16	5.28	0.000	0.00
G10-67	158.00	151.27	0.88	5.85	0.000	0.00
G10-8	230.14	225.34	0.00	4.80	0.000	0.00
G10-88	141.57	133.80	0.44	7.33	0.000	0.00
G10-89	160.00	155.75	0.33	3.92	0.000	0.00
G10-9	224.24	217.57	0.51	6.16	0.000	0.00
G10-92	157.00	153.00	0.36	3.64	0.000	0.00
G11-102	112.90	107.80	0.91	4.19	0.000	0.00
G11-109	121.64	118.68	0.72	2.24	0.000	0.00
G11-11	127.34	120.82	3.11	3.41	0.000	0.00
G11-113	119.84	116.34	1.61	1.89	0.000	0.00
G11-115	118.04	115.64	0.84	1.56	0.000	0.00

Client: City of St. Helens
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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
G11-116	119.24	116.97	1.38	0.89	0.000	0.00
G11-119	117.24	114.61	1.38	1.25	0.000	0.00
G11-12	126.84	121.12	3.36	2.36	0.000	0.00
G11-122	138.19	135.26	2.93	0.00	0.000	0.00
G11-128	115.34	112.84	2.98	1.60	0.000	0.00
G11-132	113.98	109.68	1.28	3.02	0.000	0.00
G11-136	111.46	106.30	1.01	4.15	0.000	0.00
G11-138	151.44	147.44	0.43	3.57	0.000	0.00
G11-139	149.27	145.27	0.26	3.74	0.000	0.00
G11-14	130.49	122.20	2.19	6.10	0.000	0.00
G11-143	147.56	145.70	3.64	0.70	0.000	0.00
G11-144	145.00	140.00	0.28	4.72	0.000	0.00
G11-145	137.04	134.10	0.50	2.50	0.000	0.00
G11-146	145.90	139.43	0.41	6.06	0.000	0.00
G11-147	140.14	137.57	0.34	2.23	0.000	0.00
G11-159	138.71	136.07	2.64	0.00	0.000	0.16
G11-160	140.52	135.90	4.49	0.13	0.000	0.00
G11-17	132.93	130.60	0.68	1.65	0.000	0.00
G11-18	134.52	131.54	0.67	2.31	0.000	0.00
G11-19	137.14	132.34	0.76	4.04	0.000	0.00
G11-2	129.93	127.70	2.23	0.00	0.000	0.00
G11-21	123.74	120.44	3.30	0.00	0.000	0.01
G11-26	120.84	118.34	2.50	0.00	0.000	0.20
G11-28	120.89	117.84	2.63	0.42	0.000	0.00
G11-3	130.04	126.60	3.44	0.00	0.000	0.00
G11-41	115.15	112.95	0.98	1.22	0.000	0.00
G11-42	119.24	115.34	1.10	2.80	0.000	0.00
G11-6	125.80	123.50	0.41	1.89	0.000	0.00
G11-7	126.07	120.45	2.86	2.76	0.000	0.00
G11-70	128.38	125.10	3.31	-0.03	0.025	1.39
G11-71	124.70	123.20	0.46	11.54	0.000	0.00
G11-72	122.82	122.82	0.20	11.80	0.000	0.00
G11-73	127.24	123.19	0.00	4.05	0.000	0.00
G11-78	115.54	111.67	1.51	2.36	0.000	0.00

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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
G11-79	115.51	111.60	1.11	2.80	0.000	0.00
G11-8	125.58	120.34	2.63	2.61	0.000	0.00
G11-80	114.13	110.21	1.50	2.42	0.000	0.00
G11-81	113.77	110.10	1.16	2.51	0.000	0.00
G11-83	113.60	108.90	1.34	3.36	0.000	0.00
G11-84	113.31	108.36	1.07	3.88	0.000	0.00
G11-85	131.94	129.76	3.05	-0.05	0.038	2.49
G11-9	122.84	119.92	1.12	1.80	0.000	0.00
G11-91	114.48	108.88	1.87	3.73	0.000	0.00
G11-98	113.59	108.48	1.72	3.39	0.000	0.00
G12-1	117.33	114.39	2.75	0.19	0.000	0.00
G12-111	118.15	115.40	1.84	0.91	0.000	0.00
G12-113	120.15	117.20	2.41	0.54	0.000	0.00
G12-122	116.50	109.90	6.60	0.00	0.000	0.00
G12-123	109.34	106.43	2.61	0.30	0.000	0.00
G12-124	109.82	106.57	3.26	-0.01	0.004	0.33
G12-125	111.40	106.50	4.11	0.79	0.000	0.00
G12-129	112.12	105.55	4.99	1.58	0.000	0.00
G12-14	104.53	101.90	0.48	2.15	0.000	0.00
G12-17	104.93	98.69	1.04	5.20	0.000	0.00
G12-19	104.77	98.27	1.89	4.61	0.000	0.00
G12-2	119.59	113.80	1.93	3.86	0.000	0.00
G12-23	101.37	97.42	1.72	2.23	0.000	0.00
G12-25	99.20	93.88	5.32	0.00	0.000	0.00
G12-26	99.34	93.87	4.29	1.18	0.000	0.00
G12-27	99.34	92.34	3.92	3.08	0.000	0.00
G12-3	117.53	113.34	1.25	2.95	0.000	0.00
G12-34	115.49	109.00	6.49	0.00	0.000	0.00
G12-39	112.84	105.34	5.67	1.83	0.000	0.00
G12-43	106.84	101.84	3.41	1.59	0.000	0.00
G12-46	112.87	104.70	5.59	2.58	0.000	0.00
G12-48	105.52	93.34	7.29	4.89	0.000	0.00
G12-49	100.84	92.94	6.74	1.16	0.000	0.00
G12-51	96.74	91.30	1.00	4.44	0.000	0.00

Item #3.

Client: City of St. Helens
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Junction Parameters and 25-Year Storm Event Results

Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	25-Year Storm Event: Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
G12-52	92.52	87.00	0.91	4.61	0.000	0.00
G12-53	96.75	91.00	1.05	4.70	0.000	0.00
G12-54	92.56	87.30	0.92	4.34	0.000	0.00
G12-55	113.00	106.38	4.45	2.17	0.000	0.00
G12-7	106.75	101.46	1.43	3.86	0.000	0.00
G12-75	116.34	114.80	2.34	-0.80	0.602	17.15
G12-79	111.34	107.01	4.07	0.26	0.000	0.00
G12-80	113.34	108.49	2.92	1.93	0.000	0.00
G12-9	106.09	101.29	1.08	3.72	0.000	0.00
G13-1	95.34	91.46	4.04	-0.16	0.120	1.89
G13-26	80.00	77.33	2.69	-0.02	0.012	0.69
G13-27	78.00	75.00	3.00	0.00	0.000	0.00
G13-3	88.76	83.00	1.14	4.62	0.000	0.00
G13-4	88.58	82.50	1.43	4.65	0.000	0.00
G9-13	212.34	205.34	0.79	6.21	0.000	0.00
G9-14	240.57	234.23	0.56	5.78	0.000	0.00
G9-15	241.61	235.51	1.12	4.98	0.000	0.00
G9-16	253.34	246.89	0.63	5.82	0.000	0.00
G9-18	195.34	193.34	1.63	1.37	0.000	0.00
G9-19	269.31	262.76	0.47	6.08	0.000	0.00
G9-2	193.45	164.29	1.03	28.13	0.000	0.00
G9-20	270.13	264.01	0.76	5.36	0.000	0.00
G9-26	235.34	229.14	0.90	5.30	0.000	0.00
G9-28	233.23	227.03	1.13	5.07	0.000	0.00
G9-29	235.10	225.56	0.72	8.82	0.000	0.00
G9-4	171.34	168.34	0.85	2.15	0.000	0.00
G9-42	241.38	232.18	0.83	8.37	0.000	0.00
G9-44	257.35	250.95	0.73	5.67	0.000	0.00
G9-45	261.67	255.47	0.75	5.45	0.000	0.00
G9-46	286.68	280.48	0.68	5.52	0.000	0.00
G9-5	198.25	190.89	0.00	7.36	0.000	0.00
G9-9	201.14	198.34	0.00	2.80	0.000	0.00
H10-1	97.04	94.82	2.25	-0.03	0.024	0.76
H10-10	113.62	105.59	0.71	7.32	0.000	0.00

Client: City of St. Helens
Project: Stormwater Master Plan
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Junction Parameters and 25-Year Storm Event Results

Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	25-Year Storm Event: Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
H10-11	102.64	97.74	0.92	3.98	0.000	0.00
H10-12	99.35	94.70	0.99	3.66	0.000	0.00
H10-13	129.24	125.29	3.96	-0.01	0.007	0.51
H10-16	130.64	124.66	5.25	0.73	0.000	0.00
H10-19	69.23	63.33	5.90	0.00	0.000	0.01
H10-2	97.34	93.90	3.44	0.00	0.001	0.17
H10-24	113.34	108.82	0.85	3.67	0.000	0.00
H11-103	87.66	84.69	2.98	-0.01	0.007	0.34
H11-104	87.52	84.33	3.21	-0.02	0.014	0.61
H11-105	87.66	84.06	3.15	0.45	0.000	0.00
H11-106	88.89	83.81	3.24	1.84	0.000	0.00
H11-107	85.67	82.73	3.03	-0.09	0.064	2.57
H11-108	85.71	82.70	2.94	0.07	0.000	0.00
H11-124	81.30	78.75	2.75	-0.20	0.151	4.57
H11-13	124.74	121.58	3.16	0.00	0.000	0.00
H11-145	85.54	81.60	3.25	0.69	0.000	0.00
H11-16	127.64	123.64	4.00	0.00	0.000	0.00
H11-162	106.80	103.60	1.30	1.90	0.000	0.00
H11-163	94.62	91.87	2.75	0.00	0.002	0.21
H11-164	98.83	93.38	5.45	0.00	0.000	0.00
H11-165	94.15	90.94	3.21	0.00	0.000	0.02
H11-168	86.21	83.33	2.94	-0.06	0.042	1.71
H11-181	88.91	85.84	3.00	0.07	0.000	0.00
H11-183	94.98	89.63	4.51	0.84	0.000	0.00
H11-185	94.76	90.10	4.13	0.53	0.000	0.00
H11-187	94.86	91.63	3.23	0.00	0.000	0.00
H11-2	72.00	67.30	2.13	2.57	0.000	0.00
H11-211	107.14	102.14	0.82	4.18	0.000	0.00
H11-22	103.31	94.65	0.75	7.91	0.000	0.00
H11-224	106.20	101.11	0.00	5.09	0.000	0.00
H11-23	111.68	97.20	0.78	13.70	0.000	0.00
H11-231	109.50	100.90	3.33	5.27	0.000	0.00
H11-232	108.71	100.50	1.86	6.35	0.000	0.00
H11-233	107.24	98.80	1.27	7.17	0.000	0.00

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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
H11-24	106.64	91.63	1.46	13.55	0.000	0.00
H11-25	106.34	91.47	1.42	13.45	0.000	0.00
H11-26	100.44	90.89	1.36	8.19	0.000	0.00
H11-27	103.64	90.36	1.60	11.68	0.000	0.00
H11-29	92.94	86.71	1.36	4.87	0.000	0.00
H11-30	90.34	86.34	1.64	2.36	0.000	0.00
H11-33	91.34	86.00	1.29	4.05	0.000	0.00
H11-34	94.64	88.68	1.61	4.35	0.000	0.00
H11-37	94.34	89.86	1.52	2.96	0.000	0.00
H11-38	95.54	90.29	1.37	3.88	0.000	0.00
H11-40	95.84	90.91	1.35	3.58	0.000	0.00
H11-41	102.93	92.04	1.05	9.84	0.000	0.00
H11-43	107.13	102.50	4.63	0.00	0.002	0.20
H11-55	90.67	82.76	1.39	6.52	0.000	0.00
H11-58	83.50	80.50	2.68	0.32	0.000	0.00
H11-6	103.34	98.71	0.00	4.63	0.000	0.00
H11-60	109.92	107.40	0.72	1.80	0.000	0.00
H11-61	109.80	107.40	2.13	0.27	0.000	0.00
H11-62	111.86	106.40	5.47	-0.01	0.007	0.36
H12-10	79.19	74.60	1.53	3.06	0.000	0.00
H12-11	78.98	75.08	1.49	2.41	0.000	0.00
H12-17	88.93	85.34	1.42	2.17	0.000	0.00
H12-18	90.15	85.61	1.30	3.24	0.000	0.00
H12-21	91.59	87.50	0.97	3.12	0.000	0.00
H12-26	84.41	80.41	1.63	2.37	0.000	0.00
H12-27	83.95	76.15	5.19	2.61	0.000	0.00
H12-28	78.65	72.19	6.47	-0.01	0.008	0.78
H12-30	79.41	71.68	6.68	1.05	0.000	0.00
H12-48	64.84	62.92	1.13	0.79	0.000	0.00
H12-49	64.69	61.99	1.61	1.09	0.000	0.00
H12-51	88.02	84.56	1.51	1.95	0.000	0.00
H12-55	91.95	85.08	1.48	5.39	0.000	0.00
H12-56	88.07	84.50	1.45	2.12	0.000	0.00
H12-57	88.87	83.95	1.19	3.73	0.000	0.00

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Junction Parameters and 25-Year Storm Event Results

Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	25-Year Storm Event: Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
H12-62	95.44	88.73	3.66	3.05	0.000	0.00
H12-64	95.74	88.93	4.00	2.81	0.000	0.00
H12-65	66.00	63.60	0.74	1.66	0.000	0.00
H12-7	89.45	86.18	1.77	1.50	0.000	0.00
H12-74	79.19	71.14	7.08	0.97	0.000	0.00
H12-8	90.15	86.24	0.81	3.10	0.000	0.00
H12-9	81.03	77.73	1.35	1.95	0.000	0.00
H13-70	67.00	63.10	3.91	-0.01	0.007	0.92
H13-72	66.00	62.00	1.31	2.69	0.000	0.00
H9-1	106.00	99.00	1.75	6.19	0.000	0.00
H9-2	111.29	106.39	0.00	4.90	0.000	0.00
I10-1	95.14	91.96	2.90	0.28	0.000	0.00
I10-114	54.74	48.54	5.88	0.32	0.000	0.00
I10-115	56.65	48.82	3.75	4.08	0.000	0.00
I10-116	51.35	49.10	2.27	-0.02	0.015	0.60
I10-119	64.40	61.40	1.51	1.76	0.000	0.00
I10-126	62.30	59.30	0.94	2.06	0.000	0.00
I10-132	73.09	69.70	0.56	2.83	0.000	0.00
I10-136	73.97	69.20	1.11	3.66	0.000	0.00
I10-138	62.52	49.00	0.99	12.53	0.000	0.00
I10-139	64.72	54.30	5.05	5.37	0.000	0.00
I10-14	91.93	87.40	0.92	3.61	0.000	0.00
I10-141	89.90	85.76	0.18	3.96	0.000	0.00
I10-142	86.10	79.64	0.23	6.23	0.000	0.00
I10-143	67.60	64.54	0.66	2.40	0.000	0.00
I10-153	92.90	86.48	0.69	5.73	0.000	0.00
I10-154	28.96	23.46	4.47	7.53	0.000	0.00
I10-17	84.00	80.70	1.64	1.66	0.000	0.00
I10-2	94.64	91.55	2.79	0.30	0.000	0.00
I10-20	83.87	77.43	1.03	5.41	0.000	0.00
I10-21	84.34	81.74	1.90	0.70	0.000	0.00
I10-22	85.24	82.44	2.10	0.70	0.000	0.00
I10-24	87.84	84.71	1.00	2.13	0.000	0.00
I10-26	88.24	85.53	2.71	0.00	0.000	0.01

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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
I10-28	90.34	86.43	3.92	-0.01	0.005	0.43
I10-30	94.34	90.55	2.88	0.91	0.000	0.00
I10-31	93.84	91.39	2.47	-0.02	0.018	0.78
I10-33	65.17	57.26	2.39	5.52	0.000	0.00
I10-34	54.93	52.43	0.41	2.09	0.000	0.00
I10-42	88.78	83.48	5.30	0.00	0.000	0.00
I10-44	96.78	82.91	0.36	13.51	0.000	0.00
I10-45	68.38	61.48	2.64	4.26	0.000	0.00
I10-46	61.38	61.38	0.15	1.10	0.000	0.00
I10-47	71.28	62.74	5.46	3.08	0.000	0.00
I10-48	70.09	62.40	4.78	2.91	0.000	0.00
I10-5	93.54	90.98	2.58	-0.02	0.013	0.69
I10-51	65.19	60.93	4.75	-0.49	0.370	3.79
I10-52	66.40	60.40	5.35	0.65	0.000	0.00
I10-53	66.37	60.30	5.35	0.72	0.000	0.00
I10-54	65.61	59.50	5.90	0.21	0.000	0.00
I10-55	65.25	59.00	6.32	-0.07	0.049	1.79
I10-56	67.80	57.90	6.25	3.65	0.000	0.00
I10-57	64.49	60.80	2.15	1.54	0.000	0.00
I10-58	66.43	53.70	4.61	8.12	0.000	0.00
I10-59	70.63	52.50	4.70	13.43	0.000	0.00
I10-6	92.78	89.87	2.57	0.34	0.000	0.00
I10-60	70.66	52.30	4.68	13.68	0.000	0.00
I10-61	68.68	50.70	3.92	14.06	0.000	0.00
I10-62	69.39	61.40	1.88	6.11	0.000	0.00
I10-63	85.61	74.97	1.52	9.12	0.000	0.00
I10-64	90.09	76.21	8.69	5.19	0.000	0.00
I10-66	63.44	50.00	2.45	10.99	0.000	0.00
I10-67	42.31	37.31	2.90	2.10	0.000	0.00
I10-72	56.71	44.49	0.95	11.27	0.000	0.00
I10-73	56.21	45.70	2.41	8.10	0.000	0.00
I10-74	66.80	60.61	1.97	4.22	0.000	0.00
I10-8	91.89	87.90	4.10	-0.11	0.082	1.65
I10-83	55.60	46.90	2.96	5.74	0.000	0.00

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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
I10-84	56.19	47.70	3.55	4.94	0.000	0.00
I10-85	57.69	48.34	3.97	5.38	0.000	0.00
I10-91	61.80	55.37	2.20	4.23	0.000	0.00
I10-93	73.45	70.17	2.08	1.20	0.000	0.00
I10-94	73.06	71.10	1.99	-0.03	0.019	0.85
I10-98	54.27	48.35	5.92	0.00	0.000	0.00
I11-10	54.84	46.14	8.70	0.00	0.000	0.00
I11-104	74.44	70.84	0.39	3.21	0.000	0.00
I11-104A	68.24	65.43	2.81	0.00	0.000	0.00
I11-105	95.24	90.17	0.40	4.67	0.000	0.00
I11-108	93.32	89.65	3.69	-0.02	0.013	0.82
I11-115	103.58	100.26	0.44	2.88	0.000	0.00
I11-116	85.27	81.55	0.33	3.39	0.000	0.00
I11-117	93.31	88.70	1.66	2.95	0.000	0.00
I11-118	92.58	88.91	2.79	0.88	0.000	0.00
I11-119	92.37	89.27	2.93	0.17	0.000	0.00
I11-127	73.86	67.14	4.23	2.49	0.000	0.00
I11-129	91.70	88.47	0.37	2.86	0.000	0.00
I11-16	70.36	63.64	6.78	-0.06	0.042	2.01
I11-17	67.34	62.06	5.64	-0.36	0.266	15.11
I11-18	68.10	61.03	6.39	0.68	0.000	0.00
I11-19	73.19	66.96	0.96	5.27	0.000	0.00
I11-20	74.19	67.28	0.96	5.95	0.000	0.00
I11-21	75.69	67.73	1.13	6.83	0.000	0.00
I11-23	75.26	64.00	2.24	9.02	0.000	0.00
I11-33	65.58	63.60	2.64	-0.64	0.476	16.72
I11-34	72.19	59.41	6.97	5.81	0.000	0.00
I11-35	66.00	58.56	7.53	-0.09	0.074	12.82
I11-36	66.19	58.02	8.25	-0.08	0.063	1.20
I11-37	66.19	56.33	8.19	2.17	0.000	0.00
I11-39	66.19	55.07	7.62	4.00	0.000	0.00
I11-40	59.69	52.75	7.18	-0.24	0.181	15.21
I11-41	56.19	51.35	5.77	-0.43	0.318	16.85
I11-42	56.69	50.28	6.47	-0.06	0.048	8.82

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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
I11-55	111.44	106.74	3.05	1.65	0.000	0.00
I11-56	108.54	106.10	0.57	1.87	0.000	0.00
I11-58	104.49	102.85	1.03	0.61	0.000	0.00
I11-59	104.23	102.28	0.53	1.42	0.000	0.00
I11-6	58.34	46.11	8.63	3.60	0.000	0.00
I11-69	56.43	50.34	6.09	0.00	0.001	0.11
I11-70	71.16	58.70	7.54	4.92	0.000	0.00
I11-71	56.43	53.82	2.62	-0.01	0.010	0.32
I11-81	95.16	91.41	0.50	3.25	0.000	0.00
I11-89	77.62	68.88	5.23	3.51	0.000	0.00
I11-91	78.51	68.69	4.99	4.84	0.000	0.00
I11-92	73.82	69.53	4.34	-0.05	0.034	1.50
I11-93	85.82	69.90	6.39	9.53	0.000	0.00
I12-10	69.50	63.44	0.98	5.08	0.000	0.00
I12-11	73.30	67.42	0.73	5.15	0.000	0.00
I12-12	69.00	66.98	0.73	1.29	0.000	0.00
I12-13	68.40	64.42	0.74	3.24	0.000	0.00
I12-15	67.70	59.39	0.66	7.65	0.000	0.00
I12-16	70.60	63.09	0.96	6.55	0.000	0.00
I12-18	64.40	57.90	1.09	5.41	0.000	0.00
I12-2	77.26	74.54	0.84	1.88	0.000	0.00
I12-21	58.50	57.50	1.29	1.71	0.000	0.00
I12-3	74.42	72.76	2.05	0.31	0.000	0.00
I12-30	69.15	63.70	5.55	-0.10	0.072	2.19
I12-34	65.87	60.95	3.70	1.22	0.000	0.00
I12-35	63.78	59.90	2.99	0.89	0.000	0.00
I12-36	63.30	58.80	0.72	3.78	0.000	0.00
I12-37	76.34	70.73	5.35	0.26	0.000	0.00
I12-38	75.34	66.97	7.14	1.23	0.000	0.00
I12-39	73.98	66.55	6.49	0.94	0.000	0.00
I12-4	73.99	72.55	2.25	-0.06	0.047	11.17
I12-40	71.83	65.72	6.13	-0.02	0.016	1.62
I12-49	68.04	58.77	0.94	8.33	0.000	0.00
I12-5	72.80	70.90	3.89	-1.70	1.282	19.28

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Junction Parameters and 25-Year Storm Event Results

			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
I12-5_DUMMY	72.80	70.90	0.83	1.07	0.000	0.00
I12-50	68.04	55.47	0.97	11.60	0.000	0.00
I12-53	64.78	54.00	2.07	8.71	0.000	0.00
I12-54	58.00	55.50	0.50	2.50	0.000	0.00
I12-58	59.03	54.30	0.94	3.79	0.000	0.00
I12-6	73.95	70.25	0.68	3.02	0.000	0.00
I12-7	72.21	69.91	1.15	1.15	0.000	0.00
I12-74	72.70	69.43	0.84	2.43	0.000	0.00
I12-76	63.81	61.60	0.57	1.64	0.000	0.00
I12-77	63.18	60.30	0.50	2.38	0.000	0.00
I12-78	62.78	59.40	1.38	2.00	0.000	0.00
I12-8	72.52	69.61	0.76	2.15	0.000	0.00
I12-88	78.40	68.33	4.95	5.12	0.000	0.00
I12-89	74.60	68.02	5.13	1.45	0.000	0.00
I12-9	72.40	68.68	0.84	2.88	0.000	0.00
I12-92	82.59	65.82	10.47	6.30	0.000	0.00
I12-93	73.89	63.89	1.15	8.85	0.000	0.00
I12-97	74.92	67.85	5.72	1.35	0.000	0.00
I9-27	90.20	87.60	0.00	2.60	0.000	0.00
I9-32	102.39	94.70	0.89	6.80	0.000	0.00
I9-34	104.00	95.05	1.02	7.93	0.000	0.00
I9-35	102.00	96.25	0.89	4.86	0.000	0.00
I9-36	100.10	97.15	0.84	2.11	0.000	0.00
I9-37	106.00	102.23	0.42	3.35	0.000	0.00
I9-52	104.18	93.68	0.61	9.89	0.000	0.00
I9-54	91.48	84.48	6.77	0.23	0.000	0.00
I9-65	89.60	87.21	0.00	2.39	0.000	0.00
I9-83	102.81	98.67	1.23	2.91	0.000	0.00
I9-84	101.95	96.99	1.43	3.53	0.000	0.00
J10-11	62.43	53.60	1.01	7.82	0.000	0.00
J10-12	62.58	54.24	1.28	7.06	0.000	0.00
J10-15	64.75	54.73	1.26	8.76	0.000	0.00
J10-22	60.84	45.24	7.04	8.56	0.000	0.00
J10-24	50.00	44.46	5.03	0.51	0.000	0.00

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			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
J10-27	50.84	44.21	4.24	2.39	0.000	0.00
J10-29	50.34	43.92	4.35	2.07	0.000	0.00
J10-30	49.84	43.24	1.14	5.46	0.000	0.00
J10-33	45.34	38.06	1.27	6.01	0.000	0.00
J10-57	25.86	14.56	2.83	8.47	0.000	0.00
J10-58	21.70	7.84	2.66	11.20	0.000	0.00
J11-10	35.76	23.34	7.38	5.04	0.000	0.00
J11-15	26.34	21.24	4.31	0.79	0.000	0.00
J11-19	54.75	48.48	6.27	0.00	0.001	0.09
J11-2	59.04	45.39	7.63	6.02	0.000	0.00
J11-21	56.86	50.32	6.54	0.00	0.000	0.00
J11-22	81.34	74.04	5.30	2.00	0.000	0.00
J11-27	84.84	73.39	0.36	11.09	0.000	0.00
J11-28	38.84	30.34	1.41	7.09	0.000	0.00
J11-29	36.14	28.94	0.78	6.42	0.000	0.00
J11-30	32.60	21.84	8.19	2.57	0.000	0.00
J11-5	56.34	45.65	8.44	2.25	0.000	0.00
J11-63	50.64	42.25	4.27	4.12	0.000	0.00
J11-8	37.34	29.54	1.37	6.43	0.000	0.00
J12-10	34.62	16.33	0.66	17.63	0.000	0.00
J12-11	22.92	12.40	0.60	9.92	0.000	0.00
J12-2	49.14	40.67	3.36	5.11	0.000	0.00
J12-3	45.18	38.18	1.38	5.62	0.000	0.00
J12-8	42.89	37.80	0.57	4.52	0.000	0.00
J12-9	38.60	18.90	1.06	18.64	0.000	0.00
J9-14	89.94	87.69	0.69	1.56	0.000	0.00
J9-17	88.74	86.32	0.29	2.13	0.000	0.00
J9-18	83.38	81.05	0.19	2.14	0.000	0.00
KJ-100	194.10	193.10	1.09	-0.09	0.063	2.37
KJ-101	98.84	95.10	3.74	0.00	0.001	0.00
KJ-107	101.56	96.81	1.65	3.10	0.000	0.00
KJ-113	104.94	100.29	1.67	2.98	0.000	0.00
KJ-114	22.12	16.62	1.90	3.65	0.000	0.00
KJ-115	18.64	13.14	1.55	3.95	0.000	0.00

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			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
KJ-116	94.52	90.22	3.99	0.31	0.000	0.00
KJ-117	105.34	103.34	0.26	1.74	0.000	0.00
KJ-118	174.98	168.39	0.56	6.03	0.000	0.00
KJ-119	179.34	173.85	0.00	5.49	0.000	0.00
KJ-120	139.76	136.97	0.83	1.96	0.000	0.00
KJ-122	132.83	131.57	1.26	0.00	0.000	0.11
KJ-125	91.00	89.46	0.30	1.45	0.000	0.00
KJ-127	83.66	80.66	2.54	0.46	0.000	0.00
KJ-131	115.40	114.36	1.46	-0.24	0.189	16.17
KJ-133	103.03	98.82	2.62	1.59	0.000	0.00
KJ-134	101.83	98.18	1.69	1.96	0.000	0.00
KJ-135	167.95	166.95	2.08	0.92	0.000	0.00
KJ-136	185.78	184.78	0.66	2.34	0.000	0.00
KJ-137	61.74	56.07	2.24	3.43	0.000	0.00
KJ-138	137.23	134.42	0.89	1.92	0.000	0.00
KJ-139	135.49	133.05	1.24	1.20	0.000	0.00
KJ-141	132.87	131.40	1.19	0.31	0.000	0.00
KJ-143	132.18	130.22	1.40	0.56	0.000	0.00
KJ-144	131.09	129.42	1.53	0.14	0.000	0.00
KJ-145	130.53	128.86	1.75	-0.08	0.062	3.29
KJ-146	129.98	126.70	2.93	0.35	0.000	0.00
KJ-147	130.65	126.40	2.76	1.49	0.000	0.00
KJ-152	116.96	114.71	1.11	1.33	0.000	0.00
KJ-153	116.60	115.02	0.80	1.64	0.000	0.00
KJ-154	115.91	114.89	0.93	0.19	0.000	0.00
KJ-155	115.82	114.97	0.85	0.27	0.000	0.00
KJ-156	115.58	114.60	1.22	-0.10	0.076	12.47
KJ-157	115.43	114.52	1.30	-0.18	0.138	15.32
KJ-158	115.24	114.54	1.28	-0.06	0.046	9.38
KJ-159	115.58	114.48	1.34	-0.12	0.092	13.24
KJ-160	115.28	114.16	1.54	1.14	0.000	0.00
KJ-161	114.89	113.73	1.87	0.81	0.000	0.00
KJ-162	115.28	113.90	1.64	0.28	0.000	0.00
KJ-163	114.95	113.68	1.80	0.32	0.000	0.00

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			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
KJ-164	115.11	113.75	1.55	0.57	0.000	0.00
KJ-165	115.00	113.45	1.65	0.47	0.000	0.00
KJ-166	115.29	113.38	1.49	0.63	0.000	0.00
KJ-167	114.93	112.99	1.69	0.43	0.000	0.00
KJ-168	115.00	112.97	1.52	0.60	0.000	0.00
KJ-169	114.61	112.80	1.40	0.72	0.000	0.00
KJ-170	116.55	114.50	1.32	1.12	0.000	0.00
KJ-175	143.39	138.53	0.76	4.34	0.000	0.00
KJ-182	119.01	117.21	2.02	-0.02	0.011	0.54
KJ-187	116.40	116.01	0.88	1.12	0.000	0.00
KJ-188	115.93	115.33	1.01	-0.13	0.098	14.85
KJ-189	115.57	114.74	1.55	-0.65	0.490	17.94
KJ-189_DUMMY	115.57	114.74	0.71	1.29	0.000	0.00
KJ-190	117.22	114.55	0.65	2.02	0.000	0.00
KJ-191	116.62	114.24	0.61	1.79	0.000	0.00
KJ-192	116.20	113.85	0.53	1.87	0.000	0.00
KJ-193	115.27	113.47	0.52	1.88	0.000	0.00
KJ-194	115.58	113.38	0.44	1.96	0.000	0.00
KJ-209	69.21	65.55	1.27	2.39	0.000	0.00
KJ-213	66.99	64.38	1.67	0.94	0.000	0.00
KJ-219	65.48	63.72	1.91	0.27	0.000	0.00
KJ-220	66.84	63.84	1.59	1.41	0.000	0.00
KJ-221	66.59	63.59	1.77	1.23	0.000	0.00
KJ-225	65.56	62.56	2.44	0.56	0.000	0.00
KJ-226	65.52	62.52	2.08	0.92	0.000	0.00
KJ-240	69.48	67.38	2.36	-0.03	0.020	0.40
KJ-254	286.45	275.25	0.53	10.67	0.000	0.00
KJ-255	292.53	287.13	0.49	4.91	0.000	0.00
KJ-258	253.83	248.03	0.85	4.95	0.000	0.00
KJ-259	264.88	249.54	1.07	14.27	0.000	0.00
KJ-260	262.23	250.93	1.03	10.27	0.000	0.00
KJ-261	256.19	252.99	1.02	2.18	0.000	0.00
KJ-262	256.96	254.06	2.38	0.52	0.000	0.00
KJ-263	259.38	254.98	3.88	0.52	0.000	0.00

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			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
KJ-264	262.21	256.11	5.16	0.94	0.000	0.00
KJ-265	274.77	268.27	0.49	6.01	0.000	0.00
KJ-266	285.24	277.74	0.53	6.97	0.000	0.00
KJ-267	291.62	281.02	4.22	6.38	0.000	0.00
KJ-268	286.27	282.65	3.63	-0.01	0.006	0.28
KJ-269	112.00	110.04	1.39	1.61	0.000	0.00
KJ-270	39.30	32.27	3.40	11.63	0.000	0.00
KJ-271	37.52	30.97	2.96	11.59	0.000	0.00
KJ-272	35.79	29.42	2.75	11.62	0.000	0.00
KJ-273	34.85	28.17	3.06	11.62	0.000	0.00
KJ-274	33.71	27.31	2.77	11.63	0.000	0.00
KJ-275	32.34	26.21	2.54	11.59	0.000	0.00
KJ-276	25.59	24.58	3.39	11.56	0.000	0.00
KJ-277	179.17	175.67	0.24	3.26	0.000	0.00
KJ-278	103.13	99.01	2.54	1.58	0.000	0.00
KJ-284	104.81	100.56	2.04	2.21	0.000	0.00
KJ-285	105.66	100.96	2.04	2.66	0.000	0.00
KJ-286	105.79	101.09	1.95	2.75	0.000	0.00
KJ-287	106.95	103.60	0.70	2.65	0.000	0.00
KJ-290	107.21	104.21	2.57	0.43	0.000	0.00
KJ-300	176.00	171.58	0.75	3.67	0.000	0.00
KJ-301	176.00	170.92	0.81	4.27	0.000	0.00
KJ-302	165.32	157.97	2.95	4.40	0.000	0.00
KJ-303	106.70	102.70	2.61	1.39	0.000	0.00
KJ-304	106.20	102.20	3.06	0.94	0.000	0.00
KJ-305	116.00	115.00	1.48	-0.45	0.349	9.87
KJ-306	95.25	92.25	2.02	0.98	0.000	0.00
KJ-307	95.54	92.54	2.01	0.99	0.000	0.00
KJ-308	112.90	99.75	0.00	13.15	0.000	0.00
KJ-308_DUMMY	112.90	99.75	0.00	13.15	0.000	0.00
KJ-309	118.10	104.04	0.00	14.06	0.000	0.00
KJ-310	112.50	102.42	0.00	10.08	0.000	0.00
KJ-311	115.41	102.42	0.00	12.99	0.000	0.00
KJ-312	116.30	103.00	0.00	13.30	0.000	0.00

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			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
KJ-313	118.63	107.62	0.00	11.01	0.000	0.00
KJ-314	118.39	111.89	0.00	6.50	0.000	0.00
KJ-315	120.27	113.32	0.00	6.95	0.000	0.00
KJ-316	123.95	115.23	0.00	8.72	0.000	0.00
KJ-317	122.57	116.01	0.00	6.56	0.000	0.00
KJ-318	123.88	116.90	0.00	6.98	0.000	0.00
KJ-319	121.81	118.37	0.00	3.44	0.000	0.00
KJ-320	116.42	108.38	0.00	8.04	0.000	0.00
KJ-321	116.03	111.59	0.00	4.44	0.000	0.00
KJ-322	121.01	114.52	0.00	6.49	0.000	0.00
KJ-323	123.13	118.98	0.00	4.15	0.000	0.00
KJ-324	126.46	122.79	0.00	3.67	0.000	0.00
KJ-325	131.18	127.97	0.00	3.21	0.000	0.00
KJ-326	131.34	127.91	0.00	3.43	0.000	0.00
KJ-327	127.64	124.40	0.00	3.24	0.000	0.00
KJ-328	127.74	123.48	0.00	4.26	0.000	0.00
KJ-329	118.26	116.21	0.00	2.05	0.000	0.00
KJ-330	119.79	114.32	0.00	5.47	0.000	0.00
KJ-331	118.28	113.62	0.00	4.66	0.000	0.00
KJ-628	108.02	103.40	1.00	3.62	0.000	0.00
KJ-699	101.58	99.94	1.10	0.54	0.000	0.00
KJ-700	100.50	99.51	0.99	0.00	0.001	0.27
KJ-701	100.50	99.41	0.54	0.55	0.000	0.00
KJ-702	100.00	98.67	0.51	0.82	0.000	0.00
KJ-720	108.60	106.09	2.10	0.41	0.000	0.00
KJ-786	195.00	188.80	0.44	5.76	0.000	0.00
KJ-844	130.22	127.50	2.72	0.00	0.000	0.00
KJ-845	109.25	101.66	2.07	5.52	0.000	0.00
KJ-846	109.59	105.49	2.27	1.83	0.000	0.00
KJ-847	111.40	106.50	4.30	0.60	0.000	0.00
X-696	100.20	97.69	0.00	2.51	0.000	0.00
X-711	98.66	96.40	2.27	-0.01	0.010	0.47
X-773	63.65	60.65	1.60	1.40	0.000	0.00
X-781	69.45	67.50	3.04	-0.04	0.027	0.35

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			25-Year Storm Event			
Junction ID (Char)	Rim Elevation (ft)	Invert Elevation (ft)	Maximum Depth (ft)	Freeboard (ft)	Total Flood Volume (MG)	Total Flood Time (hrs)
X-799	98.00	96.20	1.80	0.00	0.000	0.00
X-800	92.00	87.50	2.72	1.78	0.000	0.00
X-804	68.19	66.52	0.88	1.05	0.000	0.00
X-805	68.37	66.70	1.96	0.19	0.000	0.00
X-806	64.07	62.41	1.97	0.03	0.000	0.00
X-807	64.18	62.51	1.65	1.62	0.000	0.00
X-808	38.40	34.40	1.25	10.75	0.000	0.00
X-809	144.00	141.27	2.87	-0.14	0.105	2.72
X-810	135.50	134.50	0.78	2.22	0.000	0.00
X-811	115.66	113.00	0.65	2.01	0.000	0.00
X-812	113.61	110.80	0.72	2.09	0.000	0.00
X-835	121.41	119.41	2.30	9.70	0.000	0.00
X-836	121.28	119.28	0.80	1.20	0.000	0.00
X-837	115.14	112.40	1.55	1.19	0.000	0.00
X-838	108.00	105.10	1.09	1.81	0.000	0.00
X-839	107.57	104.64	1.25	1.68	0.000	0.00

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Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1004	244	0.013	117.50	F12-95	117.39	F12-91	30	3908.9	3641.1	0.0	0.9	1.00
SW-1005	36	0.013	117.36	F12-91	117.35	F12-90	12	266.5	3634.7	0.0	13.6	1.00
SW-1006	335	0.013	122.40	G11-14	121.12	G11-12	18	2915.9	2390.6	0.4	0.8	1.00
SW-1007	106	0.013	121.12	G11-12	120.82	G11-11	18	2511.3	2350.1	0.3	0.9	1.00
SW-1008	185	0.013	120.82	G11-11	120.45	G11-7	18	2124.4	2349.2	0.2	1.1	1.00
SW-1009	142	0.013	48.34	I10-85	47.70	I10-84	18	3165.2	4313.8	0.5	1.4	1.00
SW-1010	114	0.013	182.10	E12-46	178.77	E12-64	18	8059.5	7967.3	2.9	1.0	0.81
SW-1011	116	0.013	178.67	E12-64	175.34	E12-66	18	7989.9	7959.8	2.9	1.0	0.82
SW-1012	42	0.013	160.06	E12-72	159.64	E12-75	24	10154.1	7962.9	1.0	0.8	0.67
SW-1013	123	0.013	159.56	E12-75	158.08	E12-79	24	11138.3	7962.0	1.2	0.7	0.63
SW-1014	196	0.013	213.04	G10-25	189.73	G10-22	12	5536.3	963.3	12.0	0.2	0.28
SW-1015	126	0.013	170.14	E12-104	159.42	O-10	18	13750.9	3287.0	8.5	0.2	0.33
SW-1016	119	0.013	158.08	E12-79	156.68	E12-82	24	11013.6	7972.2	1.2	0.7	0.63
SW-1017	93	0.013	156.68	E12-82	155.54	E12-83	24	11242.2	7967.6	1.2	0.7	0.62
SW-1018	96	0.013	161.60	E12-137	144.34	E12-142	12	6836.4	2095.1	18.3	0.3	0.38
SW-1019	97	0.013	190.72	E12-113	190.23	E12-112	12	1135.2	1278.6	0.5	1.1	0.83
SW-1020	57	0.013	189.73	E12-112	188.34	E12-108	12	2494.9	1278.2	2.4	0.5	0.51
SW-1021	110	0.013	171.17	E13-3	166.17	E12-136	12	3412.0	0.0	4.6	0.0	0.22
SW-1022	172	0.013	165.97	E12-136	161.60	E12-137	15	4623.4	1838.1	2.5	0.4	0.41
SW-1027	158	0.013	66.55	I12-39	65.76	I12-40	12	1132.5	1361.9	0.5	1.2	1.00
SW-1028	295	0.013	71.14	H12-74	70.73	I12-37	12	596.5	1361.5	0.1	2.3	1.00
SW-1029	122	0.013	62.06	I11-17	61.18	I11-18	15	2466.0	1569.9	0.7	0.6	1.00
SW-1030	168	0.013	63.60	I11-33	60.90	I11-70	24	12877.9	3236.3	1.6	0.3	1.00
SW-1031	296	0.013	75.84	I10-63	61.74	I10-62	12	3491.6	2641.9	4.8	0.8	0.83
SW-1032	52	0.013	61.54	I10-62	60.90	I10-61	12	1780.1	2642.8	1.2	1.5	0.97
SW-1033	57	0.013	48.55	I10-114	48.35	I10-98	12	943.2	1387.3	0.3	1.5	1.00
SW-1034	185	0.013	47.70	I10-84	47.00	I10-83	18	2900.0	4313.8	0.4	1.5	1.00
SW-1035	235	0.013	46.90	I10-83	45.70	I10-73	18	3366.4	4313.8	0.5	1.3	1.00
SW-1036	295	0.013	44.49	I10-72	37.31	I10-67	24	15831.7	7193.9	2.4	0.5	0.74
SW-1037	181	0.013	122.39	F13-15	114.47	F13-13	12	3346.6	877.0	4.4	0.3	0.35
SW-1038	83	0.013	114.48	F13-11	108.67	F13-13	24	26897.2	4590.5	7.0	0.2	0.37
SW-1039	169	0.013	117.70	F13-5	114.28	F13-11	24	14445.6	4591.0	2.0	0.3	0.39
SW-1040	67	0.013	119.87	F13-4	117.70	F13-5	24	18277.9	1546.8	3.2	0.1	0.29
SW-1041	247	0.013	130.33	F13-17	122.41	F13-15	12	2864.2	878.4	3.2	0.3	0.38
SW-1042	98	0.013	108.67	F13-13	107.38	F13-14	24	11649.9	5123.4	1.3	0.4	0.46
SW-1043	29	0.013	93.87	F13-40	93.90	F13-42	18	1520.0	4247.5	0.1	2.8	0.90
SW-1044	116	0.013	122.97	F13-3	119.87	F13-4	24	16601.6	1547.2	2.7	0.1	0.20
SW-1045	57	0.013	123.95	F13-2	123.09	F13-3	24	12472.7	1547.2	1.5	0.1	0.24
SW-1046	97	0.013	125.57	F13-1	124.04	F13-2	24	12752.9	1547.6	1.6	0.1	0.24
SW-1047	40	0.013	130.85	F12-30	130.34	F12-26	12	1815.2	2905.7	1.3	1.6	1.00

Item #3.

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1048	116	0.013	130.14	F12-26	126.65	F12-25	12	2772.3	3158.0	3.0	1.1	0.91
SW-1049	62	0.013	126.45	F12-25	123.34	F12-24	12	3595.6	3014.5	5.1	0.8	0.70
SW-1050	287	0.013	256.92	F11-58	242.37	F11-61	12	3602.9	3526.3	5.1	1.0	0.80
SW-1051	188	0.013	197.80	F11-75	183.44	F11-76	15	8024.8	3520.6	7.7	0.4	0.73
SW-1052	293	0.013	242.17	F11-61	215.47	F11-64	12	4838.7	3523.6	9.2	0.7	0.63
SW-1053	240	0.013	215.24	F11-64	198.00	F11-75	12	4291.4	3520.8	7.2	0.8	0.69
SW-1054	212	0.013	106.40	H11-62	107.40	H11-61	18	3235.1	4971.5	0.5	1.5	1.00
SW-1055	26	0.013	107.40	H11-61	107.40	H11-60	18	293.3	4973.3	0.0	17.0	0.74
SW-1056	71	0.013	107.40	H11-60	103.70	H11-59	18	10790.4	4971.5	5.2	0.5	0.48
SW-1059	59	0.013	82.91	I10-44	64.98	I10-45	15	16374.9	2877.9	31.9	0.2	0.29
SW-1060	296	0.013	76.48	I10-64	76.04	I10-63	12	616.3	2643.7	0.1	4.3	0.97
SW-1061	115	0.013	175.24	E12-66	170.53	E12-71	18	9535.1	7963.7	4.1	0.8	0.71
SW-1062	240	0.013	170.53	E12-71	160.06	E12-72	18	9857.1	7960.5	4.4	0.8	0.79
SW-1063	157	0.013	78.75	H11-124	77.83	H12-9	15	2220.6	3757.9	0.6	1.7	1.00
SW-1064	43	0.013	59.41	I11-34	58.70	I11-70	15	3737.9	1801.8	1.7	0.5	1.00
SW-1065	78	0.013	62.41	X-806	62.51	X-807	20	4567.0	13527.3	0.1	1.5	1.00
SW-1067	48	0.013	71.10	I10-94	70.19	I10-93	12	2211.8	2159.9	1.9	1.0	1.00
SW-1068	402	0.013	57.26	I10-33	56.07	KJ-137	42	24569.0	19808.2	0.3	0.8	0.66
SW-1069	174	0.013	91.63	H11-187	91.06	H11-165	16	1972.8	2248.7	0.3	1.1	1.00
SW-1070	431	0.013	88.73	H12-62	86.18	H12-7	18	3628.4	4512.3	0.6	1.2	1.00
SW-1071	205	0.013	89.86	H11-37	88.83	H11-34	18	3340.5	3585.4	0.5	1.1	0.99
SW-1072	56	0.013	90.29	H11-38	90.01	H11-37	18	3327.3	3657.8	0.5	1.1	0.91
SW-1073	105	0.013	90.91	H11-40	90.39	H11-38	18	3324.7	3673.0	0.5	1.1	0.86
SW-1074	107	0.013	92.04	H11-41	91.11	H11-40	18	4405.0	3685.7	0.9	0.8	0.73
SW-1075	95	0.013	102.14	H11-211	97.84	H11-41	12	3402.4	3947.4	4.5	1.2	0.91
SW-1076	115	0.013	88.68	H11-34	88.00	H11-33	18	3629.6	4357.5	0.6	1.2	0.90
SW-1077	35	0.013	86.34	H11-30	86.02	H11-33	30	17621.6	58327.2	0.9	3.3	0.56
SW-1078	47	0.013	86.71	H11-29	86.54	H11-30	30	11063.8	6407.9	0.4	0.6	0.53
SW-1079	194	0.013	90.36	H11-27	89.54	H11-29	24	6606.2	6407.9	0.4	1.0	0.74
SW-1080	105	0.013	59.39	I12-15	58.40	I12-18	24	9846.4	2301.9	0.9	0.2	0.33
SW-1081	104	0.013	63.09	I12-16	62.86	I12-15	24	4771.0	2301.9	0.2	0.5	0.44
SW-1082	92	0.013	90.89	H11-26	90.56	H11-27	24	6081.1	4810.9	0.4	0.8	0.69
SW-1083	158	0.013	91.47	H11-25	90.99	H11-26	24	5596.4	4811.5	0.3	0.9	0.67
SW-1084	38	0.013	91.63	H11-24	91.58	H11-25	24	3683.2	4820.8	0.1	1.3	0.69
SW-1085	117	0.013	94.65	H11-22	91.63	H11-24	24	16312.4	4829.0	2.6	0.3	0.55
SW-1086	170	0.013	94.82	H10-1	94.45	H10-2	12	746.0	1667.4	0.2	2.2	1.00
SW-1087	174	0.013	108.82	H10-24	105.84	H10-10	21	9310.9	4440.6	1.7	0.5	0.49
SW-1088	238	0.013	105.59	H10-10	97.89	H10-11	21	12799.2	4440.5	3.2	0.3	0.42
SW-1089	220	0.013	97.74	H10-11	94.85	H10-12	21	8148.4	4439.1	1.3	0.5	0.53
SW-1090	125	0.013	94.70	H10-12	89.46	KJ-125	21	14591.1	4439.1	4.2	0.3	0.37

Client: City of St. Helens
Project: Stormwater Master Plan
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Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1091	221	0.013	67.80	H11-2	63.48	H10-19	21	9941.7	5582.7	2.0	0.6	0.97
SW-1092	275	0.013	63.33	H10-19	62.78	I10-47	21	3182.3	5583.1	0.2	1.8	1.00
SW-1093	281	0.013	60.93	I10-51	60.50	I10-52	24	3971.1	5849.8	0.2	1.5	1.00
SW-1094	141	0.013	108.88	G11-91	108.48	G11-98	21	3783.4	4561.0	0.3	1.2	0.99
SW-1096	233	0.013	97.20	H11-23	94.65	H11-22	24	10614.5	3229.8	1.1	0.3	0.37
SW-1097	144	0.013	60.40	I10-52	60.30	I10-53	24	2674.7	5834.3	0.1	2.2	1.00
SW-1098	545	0.013	87.40	I10-14	80.90	I10-17	26	25389.3	9165.2	1.2	0.4	0.54
SW-1100	242	0.013	80.70	I10-17	77.52	I10-20	24	11634.3	12578.3	1.3	1.1	0.86
SW-1101	383	0.013	107.80	G11-102	103.60	H11-162	24	10629.1	4555.8	1.1	0.4	0.55
SW-1102	83	0.013	103.60	H11-162	103.32	H11-144	24	5905.8	4552.7	0.3	0.8	0.61
SW-1103	386	0.013	108.48	G11-98	107.80	G11-102	24	4264.3	4558.4	0.2	1.1	0.66
SW-1104	140	0.013	62.74	I10-47	62.50	I10-48	24	4204.0	5584.1	0.2	1.3	1.00
SW-1105A	279	0.013	62.40	I10-48	61.13	I10-51	24	6851.9	5846.4	0.5	0.9	1.00
SW-1106	62	0.013	89.46	KJ-125	67.38	KJ-240	0	73616.0	4439.0	38.3	0.1	0.62
SW-1107	174	0.013	60.30	I10-53	59.70	I10-54	24	5962.5	5627.6	0.3	0.9	1.00
SW-1108	132	0.013	59.50	I10-54	59.00	I10-55	24	6244.2	5627.8	0.4	0.9	1.00
SW-1109	304	0.013	59.00	I10-55	58.10	I10-56	24	5527.3	9547.0	0.3	1.7	1.00
SW-1110	432	0.013	57.90	I10-56	54.40	I10-139	24	9138.6	9546.5	0.8	1.0	1.00
SW-1111	126	0.013	54.30	I10-139	53.70	I10-58	24	7007.8	9549.2	0.5	1.4	1.00
SW-1112	137	0.013	53.70	I10-58	52.50	I10-59	24	9497.8	9554.2	0.9	1.0	1.00
SW-1113	106	0.013	48.82	I10-115	48.54	I10-114	12	821.1	2052.7	0.3	2.5	1.00
SW-1114	41	0.013	49.10	I10-116	48.90	I10-115	12	1121.1	2053.7	0.5	1.8	1.00
SW-1115	29	0.013	52.50	I10-59	52.50	I10-60	24	592.3	9556.6	0.0	16.1	1.00
SW-1116	165	0.013	86.00	H11-33	82.84	H11-55	30	25461.3	18584.8	1.9	0.7	0.57
SW-1117	285	0.013	52.30	I10-60	50.80	I10-61	24	7369.1	9547.7	0.5	1.3	1.00
SW-1118	161	0.013	50.70	I10-61	50.00	I10-66	24	6692.0	11786.3	0.4	1.8	1.00
SW-1119	111	0.013	50.00	I10-66	49.10	I10-138	24	9135.7	11786.3	0.8	1.3	0.95
SW-1120	280	0.013	93.90	H10-2	92.04	I10-1	21	5796.4	6922.3	0.7	1.2	1.00
SW-1121	51	0.013	91.96	I10-1	91.87	I10-2	21	2991.4	6926.3	0.2	2.3	1.00
SW-1122	158	0.013	90.98	I10-5	89.99	I10-6	21	5632.7	6198.4	0.6	1.1	1.00
SW-1123	70	0.013	91.55	I10-2	90.98	I10-5	21	6417.4	6924.2	0.8	1.1	1.00
SW-1124	258	0.013	111.60	G11-79	110.60	G11-80	18	2933.4	5247.3	0.4	0.9	0.74
SW-1125	238	0.013	85.53	I10-26	84.81	I10-24	15	1594.7	2853.7	0.3	1.8	0.91
SW-1126	145	0.013	91.39	I10-31	90.65	I10-30	12	1140.6	1978.3	0.5	1.7	1.00
SW-1127	199	0.013	90.65	I10-30	86.73	I10-28	12	2244.6	2047.3	2.0	0.9	1.00
SW-1128	162	0.013	84.71	I10-24	82.54	I10-22	15	3355.8	2861.8	1.3	0.9	0.90
SW-1129	112	0.013	82.44	I10-22	81.84	I10-21	15	2122.1	2860.9	0.5	1.3	1.00
SW-1130	111	0.013	81.74	I10-21	81.04	I10-17	15	2306.2	2860.8	0.6	1.2	1.00
SW-1131	235	0.013	94.70	I9-32	94.21	I9-31	18	2153.0	1361.0	0.2	0.6	0.52
SW-1132	234	0.013	95.05	I9-34	94.80	I9-32	18	1542.2	1363.4	0.1	0.9	0.61

Item #3.

Client: City of St. Helens
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Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1133	141	0.013	102.23	I9-37	97.15	I9-36	15	5501.8	1368.9	3.6	0.2	0.51
SW-1134	255	0.013	97.15	I9-36	96.25	I9-35	15	1723.2	1367.1	0.4	0.8	0.69
SW-1135	267	0.013	96.25	I9-35	95.35	I9-34	15	1684.3	1365.9	0.3	0.8	0.64
SW-1136	67	0.013	89.87	I10-6	88.70	I10-8	18	6235.8	3840.6	1.7	0.6	1.00
SW-1137	237	0.013	87.90	I10-8	87.50	X-800	18	1938.2	4441.3	0.2	2.3	1.00
SW-1138	59	0.013	87.50	X-800	87.40	I10-14	18	1936.3	5840.8	0.2	3.0	0.81
SW-1139	69	0.013	60.95	I12-34	59.90	I12-35	12	1967.8	2591.0	1.5	1.3	1.00
SW-1140	181	0.013	63.70	I12-30	60.95	I12-34	12	1972.4	2590.2	1.5	1.3	1.00
SW-1141	288	0.011	29.54	J11-8	23.54	J11-10	24	17312.3	14085.8	2.1	0.8	0.84
SW-1142	209	0.011	23.34	J11-10	21.34	J11-15	24	11747.8	14086.5	1.0	1.2	1.00
SW-1143	24	0.011	21.24	J11-15	20.64	J11-16	24	18976.2	14087.2	2.5	0.7	0.82
SW-1144	318	0.011	38.06	J10-33	29.74	J11-8	24	19403.2	14091.0	2.6	0.7	0.63
SW-1145	197	0.011	43.24	J10-30	38.06	J10-33	24	19466.3	12043.6	2.6	0.6	0.60
SW-1146	156	0.011	43.92	J10-29	43.44	J10-30	24	6660.1	12051.6	0.3	1.8	0.95
SW-1147	63	0.011	44.21	J10-27	44.02	J10-29	24	6590.0	12051.4	0.3	1.8	1.00
SW-1148	128	0.011	44.46	J10-24	44.21	J10-27	24	5303.2	12048.0	0.2	2.3	1.00
SW-1149	222	0.011	45.24	J10-22	44.56	J10-24	24	6635.6	12046.2	0.3	1.8	1.00
SW-1151	247	0.013	50.32	J11-21	49.38	J11-19	18	2910.4	4471.2	0.4	1.5	1.00
SW-1152	151	0.013	50.34	I11-69	50.38	J11-21	12	260.3	1952.6	0.0	7.5	1.00
SW-1153	149	0.013	53.82	I11-71	52.18	I11-69	12	1675.1	1952.2	1.1	1.2	1.00
SW-1154	291	0.013	124.80	F12-134	119.65	STOR-27	36	39809.0	11610.3	1.8	0.3	0.68
SW-1155	129	0.013	123.20	F12-133	119.65	STOR-27	36	49717.7	2316.9	2.8	0.0	0.57
SW-1156	244	0.013	48.35	I10-98	46.21	I11-6	12	1496.2	1886.7	0.9	1.3	1.00
SW-1157	216	0.013	82.76	H11-55	80.66	KJ-127	30	18155.1	10238.6	1.0	0.6	0.77
SW-1158	30	0.013	80.66	KJ-127	80.50	H11-58	36	21861.0	10325.0	0.5	0.5	0.87
SW-1162	277	0.011	46.14	I11-10	45.75	J11-5	24	4499.1	5711.5	0.1	1.3	1.00
SW-1163	110	0.011	45.65	J11-5	45.49	J11-2	24	4572.9	12047.5	0.1	2.6	1.00
SW-1164	30	0.011	45.39	J11-2	45.24	J10-22	24	8473.0	12045.4	0.5	1.4	1.00
SW-1165	298	0.013	74.04	J11-22	73.59	J11-27	15	1126.7	2884.0	0.2	2.6	0.91
SW-1166	124	0.013	73.39	J11-27	34.34	J11-28	15	16700.9	2879.9	33.2	0.2	0.28
SW-1167	162	0.013	30.34	J11-28	29.14	J11-29	15	2495.4	2828.1	0.7	1.1	0.90
SW-1168	110	0.013	28.94	J11-29	22.04	J11-30	15	7268.8	5172.5	6.3	0.7	0.81
SW-1169	452	0.013	21.84	J11-30	21.17	J11-32	20	2404.0	5172.5	0.1	2.2	0.88
SW-1171	66	0.013	136.04	F12-35	135.71	F12-34	12	1129.9	2905.9	0.5	2.6	1.00
SW-1172	287	0.013	137.67	F12-38	136.24	F12-35	12	1129.0	1784.4	0.5	1.6	1.00
SW-1173	213	0.013	135.51	F12-34	131.05	F12-30	12	2316.0	2905.5	2.1	1.3	1.00
SW-1174	262	0.013	183.34	F11-76	180.49	F11-80	15	3023.0	3526.3	1.1	1.2	0.94
SW-1176	162	0.013	209.65	E12-84	196.84	E12-87	12	4501.8	2108.5	7.9	0.5	0.74
SW-1177	52	0.013	196.64	E12-87	196.38	E12-88	12	1126.6	2110.4	0.5	1.9	0.95
SW-1178	303	0.013	186.84	E12-108	173.84	E12-105	12	3312.3	1272.1	4.3	0.4	0.43

Client: City of St. Helens
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Conduit Parameters and 25-Year Storm Event Results

								25-Year Storm Event				
Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1179	55	0.013	173.74	E12-105	170.34	E12-104	12	3978.6	1271.9	6.2	0.3	0.39
SW-1180	43	0.013	171.48	E12-101	170.14	E12-104	15	5117.4	2107.8	3.1	0.4	0.45
SW-1181	151	0.013	174.76	E12-99	171.68	E12-101	15	4136.0	2107.8	2.0	0.5	0.51
SW-1182	191	0.013	185.83	E12-96	174.96	E12-99	12	3816.5	2109.0	5.7	0.6	0.53
SW-1183	30	0.013	187.44	E12-95	186.03	E12-96	12	3492.0	2109.4	4.8	0.6	0.56
SW-1184	158	0.013	77.73	H12-9	75.48	H12-11	15	3455.0	3700.3	1.4	1.1	0.95
SW-1185	100	0.013	192.14	E12-94	187.64	E12-95	12	3400.8	2108.5	4.5	0.6	0.57
SW-1186	94	0.013	196.28	E12-88	192.34	E12-94	12	3282.6	2109.2	4.2	0.6	0.58
SW-1187	312	0.013	92.94	G12-49	91.46	G13-1	27	9571.1	15720.2	0.5	1.6	1.00
SW-1188	71	0.013	93.34	G12-48	92.94	G12-49	27	10456.1	15725.6	0.6	1.5	1.00
SW-1189	109	0.013	216.09	G10-28	213.24	G10-25	12	2590.2	964.1	2.6	0.4	0.42
SW-1190	60	0.013	189.53	G10-22	187.56	G10-21	12	2898.3	963.2	3.3	0.3	0.40
SW-1191	245	0.013	217.29	G10-29	216.19	G10-28	12	1070.9	964.9	0.4	0.9	0.70
SW-1192	205	0.013	91.46	G13-1	90.49	G13-2	24	6984.5	12705.8	0.5	1.8	0.96
SW-1193	572	0.013	119.14	STOR-27	114.34	F12-67	24	9298.4	9444.7	0.8	1.0	1.00
SW-1194	276	0.013	93.68	I9-52	84.68	I9-54	15	5237.0	2493.6	3.3	0.5	0.74
SW-1195	276	0.013	84.48	I9-54	83.68	I10-42	15	1561.0	2494.2	0.3	1.6	1.00
SW-1196	250	0.013	83.48	I10-42	83.11	I10-44	15	1115.4	3388.7	0.1	3.0	0.94
SW-1197	63	0.013	61.48	I10-45	61.38	I10-46	15	1155.2	2487.9	0.2	2.2	0.56
SW-1198	199	0.013	54.74	J10-15	54.44	J10-12	18	1831.2	2120.7	0.2	1.2	0.77
SW-1199	309	0.013	54.24	J10-12	53.80	J10-11	18	1779.1	1982.3	0.1	1.1	0.70
SW-1200	43	0.013	53.60	J10-11	53.54	J10-10	18	1761.1	1970.5	0.1	1.1	0.60
SW-1201	42	0.013	51.35	I11-41	50.28	I11-42	18	7526.3	4432.6	2.5	0.6	1.00
SW-1202	109	0.013	97.03	F13-34	95.72	F13-35	18	5168.7	3696.8	1.2	0.7	0.61
SW-1203	273	0.013	58.02	I11-36	56.33	I11-37	18	3709.5	3880.9	0.6	1.0	1.00
SW-1204	287	0.013	56.33	I11-37	55.07	I11-39	18	3123.9	3802.8	0.4	1.2	1.00
SW-1205	51	0.013	95.72	F13-35	93.87	F13-40	18	8970.3	4049.1	3.6	0.5	0.74
SW-1210	304	0.013	87.30	G12-54	83.20	G13-3	36	34785.8	7173.4	1.4	0.2	0.31
SW-1211	427	0.013	91.00	G12-53	87.50	G12-54	36	27089.3	7174.9	0.8	0.3	0.35
SW-1212	112	0.013	92.25	KJ-306	91.40	G12-53	36	26038.3	7213.5	0.8	0.3	0.52
SW-1213	104	0.013	82.50	G13-4	82.36	X-660	36	10954.8	5990.1	0.1	0.5	0.43
SW-1214	113	0.013	92.54	KJ-307	91.40	G12-51	30	18493.7	6047.1	1.0	0.3	0.60
SW-1215	441	0.013	55.07	I11-39	52.75	I11-40	18	3419.6	3776.4	0.5	1.1	1.00
SW-1216	290	0.013	52.75	I11-40	51.35	I11-41	18	3275.8	4889.5	0.5	1.5	1.00
SW-1217	72	0.013	132.29	F12-16	131.84	F12-17	60	92176.6	10906.3	0.6	0.1	0.24
SW-1218	121	0.013	63.44	I12-10	63.19	I12-16	24	4618.4	2301.9	0.2	0.5	0.46
SW-1219	168	0.013	66.98	I12-12	65.92	I12-13	24	8065.7	2301.9	0.6	0.3	0.37
SW-1220	558	0.013	50.28	I11-42	48.34	I10-85	18	2779.9	4313.8	0.3	1.6	1.00
SW-1221	284	0.013	58.56	I11-35	58.02	I11-36	18	2055.7	2447.8	0.2	1.2	1.00
SW-1222	86	0.013	58.70	I11-70	58.56	I11-35	18	1897.6	2372.7	0.2	1.3	1.00

Item #3.

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event: Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1223	51	0.013	102.85	I11-58	102.74	I11-59	12	740.3	1256.9	0.2	1.7	0.86
SW-1224	190	0.013	106.10	I11-56	103.11	I11-58	12	2005.2	1260.2	1.6	0.6	0.67
SW-1225	226	0.013	107.09	I11-55	106.10	I11-56	12	1057.7	1264.0	0.4	1.2	0.79
SW-1226	315	0.013	61.03	I11-18	59.41	I11-34	15	2078.1	1800.2	0.5	0.9	1.00
SW-1227	325	0.013	63.64	I11-16	62.06	I11-17	15	2020.1	2775.5	0.5	1.4	1.00
SW-1228	334	0.013	65.72	I12-40	64.14	I11-16	12	1099.1	1058.3	0.5	1.0	1.00
SW-1229	150	0.013	66.97	I12-38	66.61	I12-39	12	783.4	1362.0	0.2	1.7	1.00
SW-1230	273	0.013	70.73	I12-37	66.97	I12-38	12	1875.1	1361.5	1.4	0.7	1.00
SW-1231	398	0.013	104.70	G12-46	101.94	G12-43	24	8456.4	12431.1	0.7	1.5	1.00
SW-1232	285	0.013	101.84	G12-43	96.84	G12-48	24	13438.2	12373.6	1.8	0.9	1.00
SW-1233	394	0.013	109.00	G12-34	105.44	G12-39	24	9657.3	11452.8	0.9	1.2	1.00
SW-1234	125	0.013	90.27	I11-105	70.84	I11-104	12	6343.2	1255.0	15.7	0.2	0.35
SW-1235	90	0.013	70.84	I11-104	65.43	I11-104A	12	3924.1	1254.8	6.0	0.3	0.69
SW-1236	233	0.013	86.43	I10-28	85.73	I10-26	15	1589.2	2834.6	0.3	1.8	1.00
SW-1237	296	0.013	147.21	F12-48	142.18	F12-45	12	2084.0	1929.7	1.7	0.9	1.00
SW-1238	136	0.013	141.98	F12-45	140.84	F12-44	12	1464.0	1667.0	0.8	1.1	1.00
SW-1239	23	0.013	138.43	F12-41	138.24	F12-38	10	900.7	1785.0	0.8	2.0	1.00
SW-1240	156	0.013	140.64	F12-44	138.43	F12-41	12	1901.4	1784.2	1.4	0.9	1.00
SW-1241	110	0.013	131.54	G11-18	130.80	G11-17	12	1311.5	1019.7	0.7	0.8	0.66
SW-1242	120	0.013	132.34	G11-19	131.74	G11-18	12	1130.7	1023.9	0.5	0.9	0.70
SW-1243	63	0.013	130.60	G11-17	128.20	G11-14	12	3112.1	2496.0	3.8	0.8	0.68
SW-1244	103	0.013	140.36	G10-38	138.94	G10-37	12	1876.5	1673.7	1.4	0.9	0.74
SW-1245	54	0.013	141.14	G10-41	140.56	G10-38	12	1801.7	1677.0	1.3	0.9	0.76
SW-1246	116	0.013	148.09	G10-42	141.44	G10-41	12	3835.9	1680.7	5.8	0.4	0.51
SW-1247	6	0.013	138.44	G10-36	138.33	G10-35	12	2150.9	1700.8	1.8	0.8	0.77
SW-1248	6	0.013	138.64	G10-37	138.44	G10-36	12	2922.5	1673.7	3.3	0.6	0.70
SW-1249	46	0.013	152.94	G10-43	148.29	G10-42	12	5091.2	1681.0	10.1	0.3	0.40
SW-1250	272	0.013	167.44	G10-45	153.14	G10-43	12	3666.2	1681.4	5.3	0.5	0.48
SW-1251	127	0.013	168.19	G10-47	167.64	G10-45	12	1053.0	1685.3	0.4	1.6	0.91
SW-1252	40	0.013	142.70	G10-114	142.50	G10-115	18	3322.4	4959.6	0.5	1.5	1.00
SW-1253	115	0.013	142.30	G10-119	141.70	G10-116	18	3405.6	4934.9	0.5	1.4	1.00
SW-1254	396	0.013	141.50	G10-116	139.30	G10-117	18	3514.3	4638.4	0.6	1.3	1.00
SW-1255	92	0.013	149.64	G10-118	143.50	G10-117	30	47492.4	8377.4	6.7	0.2	0.28
SW-1256	142	0.013	138.90	G10-117	138.33	G10-35	30	11647.5	12733.1	0.4	1.1	0.80
SW-1257	87	0.013	137.84	G10-35	135.96	X-813	30	27062.4	13767.4	2.2	0.5	0.51
SW-1258	207	0.013	57.90	I12-18	57.50	I12-21	24	4468.7	2301.9	0.2	0.5	0.60
SW-1259	69	0.013	67.42	I12-11	66.98	I12-12	24	8103.0	2301.9	0.6	0.3	0.37
SW-1260	101	0.013	69.91	I12-7	69.70	I12-8	18	2150.4	2301.9	0.2	1.1	0.67
SW-1261	18	0.013	70.25	I12-6	70.01	I12-7	18	5497.3	2301.9	1.4	0.4	0.58
SW-1263	92	0.013	102.28	I11-59	100.41	I11-115	12	2281.8	1256.5	2.0	0.6	0.53

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1264	220	0.013	100.26	I11-115	91.49	I11-81	12	3190.6	1255.1	4.0	0.4	0.44
SW-1265	30	0.013	91.41	I11-81	90.12	I11-105	12	3270.7	1255.1	4.2	0.4	0.45
SW-1266	108	0.013	67.14	I11-127	66.98	I11-16	12	616.6	1485.5	0.1	2.4	1.00
SW-1267	99	0.013	88.70	I11-117	88.61	I11-129	12	481.6	1485.6	0.1	3.1	0.89
SW-1268	155	0.013	88.91	I11-118	88.64	I11-117	12	588.6	1485.7	0.1	2.5	1.00
SW-1269	58	0.013	89.27	I11-119	89.11	I11-118	12	841.0	1486.1	0.3	1.8	1.00
SW-1271	236	0.013	60.80	I10-57	60.61	I10-74	36	8489.2	18100.9	0.1	1.1	0.69
SW-1273	97	0.013	61.40	I10-119	60.80	I10-57	36	23560.7	14154.5	0.6	0.3	0.61
SW-1275	80	0.013	60.61	I10-74	60.65	X-773	36	6699.2	18064.8	0.1	1.3	0.59
SW-1276	54	0.013	88.93	H12-64	88.73	H12-62	16	2089.0	3527.2	0.4	1.7	1.00
SW-1277	140	0.013	89.63	H11-183	88.93	H12-64	16	2433.1	3527.0	0.5	1.4	1.00
SW-1278	50	0.013	90.10	H11-185	89.67	H11-183	16	3204.4	2247.4	0.9	0.7	1.00
SW-1279	80	0.013	90.94	H11-165	90.22	KJ-116	16	3259.3	2244.6	0.9	0.7	1.00
SW-1280	107	0.013	93.38	H11-164	91.89	H11-163	12	1890.0	2094.0	1.4	1.1	1.00
SW-1281	51	0.013	86.18	H12-7	86.07	H12-18	18	2183.7	4512.5	0.2	2.1	0.91
SW-1282	35	0.013	86.24	H12-8	86.20	H12-18	16	1166.1	1146.6	0.1	1.0	0.56
SW-1283	43	0.013	85.61	H12-18	85.37	H12-17	24	7574.6	5647.7	0.6	0.7	0.67
SW-1284	226	0.013	87.50	H12-21	86.57	H12-8	12	1025.2	1120.1	0.4	1.1	0.82
SW-1285	60	0.013	85.34	H12-17	85.08	H12-55	24	6711.8	5647.7	0.4	0.8	0.72
SW-1286	136	0.013	85.08	H12-55	84.56	H12-51	24	6283.1	5616.1	0.4	0.9	0.75
SW-1287	135	0.013	84.50	H12-56	83.95	H12-57	24	6480.5	5593.2	0.4	0.9	0.66
SW-1288	44	0.013	83.96	H12-57	83.65	H12-58	24	8566.9	5576.5	0.7	0.7	0.59
SW-1289	42	0.013	114.80	G12-75	114.58	G12-1	16	2503.5	2369.8	0.5	0.9	1.00
SW-1290	22	0.013	59.30	I10-126	57.26	I10-33	36	90529.1	19092.2	9.1	0.2	0.55
SW-1293	121	0.013	143.20	G10-64	142.70	G10-114	18	3037.0	4978.2	0.4	1.6	1.00
SW-1294	278	0.013	149.56	G10-66	143.40	G10-64	18	7015.3	5752.5	2.2	0.8	0.89
SW-1295	67	0.013	151.27	G10-67	149.56	G10-66	15	4626.1	3877.6	2.5	0.8	0.81
SW-1296	138	0.013	154.40	G10-105	151.27	G10-67	15	4365.9	3881.3	2.3	0.9	0.73
SW-1297	171	0.013	208.90	F11-105	198.42	F11-110	12	3965.6	997.7	6.1	0.3	0.34
SW-1298	114	0.013	198.22	F11-110	191.05	F11-111	12	4015.0	997.2	6.3	0.2	0.34
SW-1299	114	0.013	190.95	F11-111	183.89	F11-112	12	3984.1	996.7	6.2	0.3	0.34
SW-1300	147	0.013	183.79	F11-112	177.39	F11-113	12	3335.1	995.8	4.3	0.3	0.37
SW-1301	123	0.013	177.29	F11-113	171.30	F11-114	12	3538.1	995.2	4.9	0.3	0.36
SW-1302	32	0.013	171.20	F11-114	168.50	F11-115	12	4638.8	995.1	8.4	0.2	0.59
SW-1309	42	0.013	168.44	F11-165	168.24	STOR-24	12	1102.0	1310.0	0.5	1.2	0.82
SW-1310	303	0.013	184.25	F11-164	168.64	F11-165	12	3630.0	1310.4	5.2	0.4	0.56
SW-1311	269	0.013	205.19	F11-163	189.00	KJ-786	12	3928.2	1311.1	6.0	0.3	0.40
SW-1315	165	0.013	124.80	F12-133	123.30	F12-134	36	737.9	2317.2	0.0	3.1	0.30
SW-1316	409	0.013	114.24	F12-67	110.00	G12-122	24	10451.4	9622.5	1.1	0.9	1.00
SW-1317	309	0.013	131.84	F12-17	125.60	F12-23	40	56372.2	13999.8	2.0	0.2	0.46

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1318	187	0.013	125.50	F12-23	124.80	F12-134	40	24265.1	13953.7	0.4	0.6	0.47
SW-1319	150	0.013	77.43	I10-20	69.40	I10-136	24	23517.8	12246.8	5.4	0.5	0.51
SW-1320	238	0.013	69.20	I10-136	59.60	I10-55	24	20396.9	12189.3	4.0	0.6	0.78
SW-1322	252	0.013	55.47	I12-50	54.30	I12-53	36	20400.5	4649.7	0.5	0.2	0.46
SW-1323	192	0.013	54.00	I12-53	54.30	I12-58	36	11821.2	6474.2	0.2	0.5	0.50
SW-1324	191	0.013	54.50	I12-58	49.40	I12-60	36	48953.4	6471.9	2.7	0.1	0.25
SW-1325	144	0.013	64.42	I12-13	63.54	I12-10	24	7935.7	2301.9	0.6	0.3	0.41
SW-1326	119	0.013	46.11	I11-6	46.14	I11-10	24	1611.2	1990.8	0.0	1.2	1.00
SW-1329	146	0.013	198.34	G9-9	194.34	G9-5	12	2651.7	0.0	2.7	0.0	0.00
SW-1330	276	0.013	190.89	G9-5	182.87	G9-2	12	2726.2	0.0	2.9	0.0	0.00
SW-1331	67	0.013	205.34	G9-13	193.34	G9-18	24	43317.8	14377.4	18.2	0.3	0.60
SW-1332	152	0.013	234.23	G9-14	205.84	G9-13	18	20531.4	5993.4	19.0	0.3	0.37
SW-1333	55	0.013	235.51	G9-15	234.43	G9-14	18	6596.3	5993.5	2.0	0.9	0.75
SW-1334	93	0.013	246.89	G9-16	235.71	G9-15	18	16449.0	5994.0	12.2	0.4	0.52
SW-1335	57	0.013	264.01	G9-20	263.46	G9-19	18	4644.2	2390.9	1.0	0.5	0.51
SW-1336	145	0.013	262.76	G9-19	247.09	G9-16	18	15535.0	3319.6	10.9	0.2	0.31
SW-1337	131	0.013	227.03	G9-28	225.76	G9-29	24	9988.5	6079.6	1.0	0.6	0.56
SW-1338	415	0.013	225.56	G9-29	205.84	G9-13	24	22140.7	6074.7	4.8	0.3	0.36
SW-1339	91	0.013	229.14	G9-26	227.23	G9-28	24	14694.7	6082.1	2.1	0.4	0.46
SW-1343	101	0.013	232.18	G9-42	229.34	G9-26	24	17011.1	6082.2	2.8	0.4	0.41
SW-1344	193	0.013	250.95	G9-44	236.79	G9-42	18	12783.1	6082.4	7.4	0.5	0.49
SW-1345	57	0.013	255.47	G9-45	251.56	G9-44	18	12346.3	6082.9	6.9	0.5	0.50
SW-1346	249	0.013	280.48	G9-46	256.67	G9-45	18	14623.9	6082.8	9.6	0.4	0.45
SW-1350	98	0.013	69.43	I12-74	68.78	I12-9	18	3833.8	2301.9	0.7	0.6	0.56
SW-1351	115	0.013	68.68	I12-9	67.92	I12-11	18	3828.7	2301.9	0.7	0.6	0.56
SW-1352	71	0.013	110.21	G11-80	110.37	G11-81	18	2252.1	5247.3	0.2	1.2	0.81
SW-1354	28	0.013	111.67	G11-78	112.00	G11-79	18	5158.3	5247.3	1.2	0.5	0.75
SW-1357	367	0.013	113.34	G12-3	112.84	G11-78	18	1740.2	1814.9	0.1	1.0	0.67
SW-1358	294	0.013	113.80	G12-2	113.34	G12-3	15	1146.2	1814.9	0.2	1.6	1.00
SW-1359	360	0.013	114.39	G12-1	113.90	G12-2	15	1069.8	1814.9	0.1	1.7	1.00
SW-1360	207	0.013	49.00	I10-138	37.66	I10-67	24	23778.5	11786.3	5.5	0.5	0.75
SW-1361	58	0.013	88.47	I11-129	82.40	I11-116	12	5181.0	1484.9	10.5	0.3	0.37
SW-1362	90	0.013	81.55	I11-116	67.44	I11-127	12	6382.2	1484.7	15.9	0.2	0.66
SW-1363	48	0.013	91.87	H11-163	91.69	H11-187	16	2105.0	2246.0	0.4	1.1	1.00
SW-1364	193	0.013	110.15	G11-81	109.77	G11-132	24	4501.4	2706.4	0.2	0.6	0.52
SW-1365	99	0.013	69.70	I10-132	64.79	I10-143	12	3555.3	2159.0	4.9	0.6	0.56
SW-1366	85	0.013	70.17	I10-93	69.78	I10-132	12	1085.6	2159.5	0.5	2.0	0.95
SW-1367	75	0.013	64.54	I10-143	62.27	I10-57	12	2784.0	2158.8	3.0	0.8	0.67
SW-1368	437	0.013	91.30	G12-51	87.20	G12-52	30	17842.4	6000.0	0.9	0.3	0.40
SW-1369	307	0.013	87.00	G12-52	83.00	G13-4	30	21021.4	5998.0	1.3	0.3	0.37

Item #3.

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1370	105	0.013	83.00	G13-3	82.36	X-659	36	23380.2	7169.7	0.6	0.3	0.38
SW-1371	110	0.013	64.00	I11-23	63.60	I11-33	24	6118.7	2552.8	0.4	0.4	1.00
SW-1373	321	0.013	48.48	J11-19	46.64	I11-10	18	3567.4	4669.5	0.6	1.3	1.00
SW-1374	333	0.013	79.64	I10-142	56.07	KJ-137	12	4257.7	509.6	7.1	0.1	0.62
SW-1375	31	0.013	85.76	I10-141	79.64	I10-142	12	7173.8	511.1	20.1	0.1	0.21
SW-1376	64	0.013	86.32	J9-17	81.25	J9-18	12	4506.4	797.4	7.9	0.2	0.28
SW-1377	221	0.013	87.69	J9-14	86.78	J9-17	12	1026.1	797.7	0.4	0.8	0.63
SW-1378	79	0.013	81.05	J9-18	49.64	O-14	12	10488.1	797.2	43.0	0.1	0.19
SW-1382	337	0.013	86.48	I10-153	85.76	I10-141	12	739.7	511.8	0.2	0.7	0.43
SW-1383	83	0.013	87.60	I9-27	87.41	I9-65	12	764.7	0.0	0.2	0.0	0.00
SW-1387	244	0.013	87.21	I9-65	86.48	I10-153	12	875.0	0.0	0.3	0.0	0.34
SW-1388	120	0.013	109.90	G12-122	109.10	G12-34	24	8301.6	9624.2	0.7	1.2	1.00
SW-1390	46	0.013	37.31	I10-67	34.40	X-808	24	25479.1	18720.4	6.3	0.7	0.81
SW-1391	178	0.013	23.90	I10-154	16.67	KJ-114	66	303879.9	42822.1	4.1	0.1	0.53
SW-1392	173	0.013	13.14	KJ-115	7.97	J10-58	66	260596.7	44954.5	3.0	0.2	0.37
SW-1393	62	0.013	7.84	J10-58	7.35	J9-58O	66	134466.7	44917.3	0.8	0.3	0.44
SW-1394	141	0.013	16.67	KJ-114	14.56	J10-57	66	184386.7	45061.2	1.5	0.2	0.43
SW-1395	105	0.013	14.46	J10-57	13.14	KJ-115	66	175298.6	44984.9	1.4	0.3	0.40
SW-1396	64	0.013	55.50	I12-54	54.20	I12-53	30	26189.1	2301.9	2.0	0.1	0.46
SW-1397	268	0.013	59.90	I12-35	59.50	I12-78	15	1120.4	2590.4	0.1	2.3	1.00
SW-1398	138	0.013	89.65	I11-108	89.27	I11-119	12	839.7	1485.4	0.3	1.8	1.00
SW-1400	112	0.013	99.00	H9-1	98.67	I9-83	30	10014.4	17309.7	0.3	0.9	0.60
SW-1401	25	0.013	106.39	H9-2	106.11	H9-1	10	1041.4	0.0	1.1	0.0	0.00
SW-1405	264	0.013	109.68	G11-132	108.93	G11-91	24	5413.7	3431.4	0.3	0.6	0.77
SW-1406	80	0.013	65.43	I11-104A	63.79	I11-17	12	2292.8	1255.7	2.1	0.5	1.00
SW-1407	140	0.013	98.67	KJ-702	97.90	X-802	12	1185.9	606.4	0.6	0.5	0.50
SW-1408	151	0.013	99.41	KJ-701	98.70	KJ-702	12	1096.5	606.4	0.5	0.6	0.52
SW-1409	40	0.013	99.51	KJ-700	99.41	KJ-701	8	271.1	606.4	0.2	2.2	0.91
SW-1410	21	0.013	99.94	KJ-699	99.51	KJ-700	8	774.1	783.8	2.0	1.0	1.00
SW-1411	35	0.011	68.02	I12-89	67.91	I12-97	12	1072.3	2062.0	0.3	1.9	1.00
SW-1412	263	0.011	67.85	I12-97	66.02	I12-92	12	1578.3	2062.1	0.7	1.3	1.00
SW-1413	231	0.011	65.82	I12-92	64.13	I12-93	12	1616.5	2062.2	0.7	1.3	0.95
SW-1414	105	0.011	63.89	I12-93	63.05	I12-49	18	4987.9	4653.4	0.8	0.9	0.77
SW-1415	51	0.011	58.77	I12-49	57.64	I12-50	18	8277.3	4651.6	2.2	0.6	0.58
SW-1418	110	0.013	98.67	I9-83	97.73	I9-84	38	59263.1	17311.6	0.9	0.3	0.39
SW-1421	42	0.013	115.40	G12-111	114.53	G12-1	18	6746.9	4085.9	2.0	0.6	1.00
SW-1423	59	0.013	98.27	G12-19	98.18	KJ-134	30	7194.0	10418.7	0.2	1.4	0.71
SW-1426	101	0.013	115.64	G11-115	114.66	G11-119	12	1575.3	1297.3	1.0	0.8	0.92
SW-1428	191	0.013	116.34	G11-113	115.74	G11-115	12	896.9	1320.3	0.3	1.5	0.87
SW-1429	189	0.013	118.68	G11-109	116.97	G11-116	12	1519.3	1314.0	0.9	0.9	0.86

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1430	53	0.013	117.09	G11-116	116.54	G11-113	12	1626.8	1320.0	1.0	0.8	1.00
SW-1431	26	0.013	114.61	G11-119	114.64	KJ-170	12	544.0	1298.2	0.1	2.4	1.00
SW-1432	124	0.013	123.19	G11-73	122.82	G11-72	12	873.5	0.0	0.3	0.0	0.10
SW-1434	53	0.013	182.83	E12-49	182.30	E12-46	12	1599.1	2087.0	1.0	1.3	1.00
SW-1435	289	0.013	188.94	E12-52	182.93	E12-49	12	2306.3	2086.9	2.1	0.9	0.87
SW-1436	124	0.013	184.78	E12-44	182.20	E12-46	18	6801.4	3389.7	2.1	0.5	0.62
SW-1437	98	0.013	186.90	E12-42	184.98	E12-44	18	6599.9	3390.0	2.0	0.5	0.51
SW-1438	135	0.013	196.65	E12-27	193.95	E12-32	15	4100.7	2368.4	2.0	0.6	0.55
SW-1439	24	0.013	187.54	E12-36	187.10	E12-42	18	6384.1	3391.0	1.8	0.5	0.57
SW-1440	201	0.013	193.75	E12-32	187.74	E12-36	15	5018.8	3393.5	3.0	0.7	0.60
SW-1441	30	0.013	188.52	E12-37	187.94	E12-36	12	2223.7	0.0	1.9	0.0	0.27
SW-1442	214	0.013	198.34	E12-40	188.72	E12-37	12	3392.2	0.0	4.5	0.0	0.00
SW-1443	115	0.013	173.48	E12-132	169.00	E12-131	12	3161.2	1958.0	3.9	0.6	0.68
SW-1444	170	0.013	67.73	I11-21	67.48	I11-20	12	612.7	970.2	0.1	1.6	0.88
SW-1445	56	0.013	118.68	F13-6	117.70	F13-5	12	2115.6	2788.8	1.8	1.3	0.89
SW-1446	34	0.013	118.56	F13-7	119.12	F13-6	12	2052.4	2789.9	1.6	1.4	1.00
SW-1447	126	0.013	122.19	F13-8	119.52	F13-7	12	2328.1	2788.9	2.1	1.2	1.00
SW-1448	164	0.013	126.91	F13-9	122.20	F13-8	12	2710.5	2822.7	2.9	1.0	1.00
SW-1449	179	0.013	121.84	F13-30	109.67	F13-28	12	4174.4	644.8	6.8	0.2	0.27
SW-1450	84	0.013	109.62	F13-28	99.07	F13-27	12	5689.7	644.8	12.7	0.1	0.54
SW-1451	106	0.013	99.04	F13-27	97.69	F13-32	18	5320.9	3699.4	1.3	0.7	0.61
SW-1452	34	0.013	97.55	F13-32	97.14	F13-34	18	5164.5	3699.3	1.2	0.7	0.65
SW-1453	37	0.013	99.40	F13-26	98.85	F13-27	18	5748.6	3283.6	1.5	0.6	0.64
SW-1454	137	0.013	100.71	F13-25	99.40	F13-26	18	4608.2	3285.3	1.0	0.7	0.61
SW-1455	193	0.013	133.80	F11-94	133.00	F12-16	12	1029.8	1092.9	0.4	1.1	0.79
SW-1457	66	0.013	125.10	G11-70	123.20	G11-71	18	8000.7	6323.4	2.9	0.8	0.65
SW-1459	174	0.013	76.15	H12-27	72.63	H12-28	12	2273.8	1917.2	2.0	0.8	1.00
SW-1460	173	0.013	210.17	E11-3	209.57	E11-2	12	940.7	685.8	0.3	0.7	0.59
SW-1461	227	0.013	209.37	E11-2	198.58	E11-6	12	3492.0	683.9	4.8	0.2	0.30
SW-1462	68	0.013	197.98	E11-6	197.00	E11-9	18	5676.5	683.7	1.4	0.1	0.23
SW-1463	238	0.013	209.14	E12-30	199.14	E12-27	12	3279.3	369.1	4.2	0.1	0.23
SW-1464	57	0.013	197.97	E12-24	196.85	E12-27	15	4064.7	2076.3	2.0	0.5	0.51
SW-1465	104	0.013	201.44	E12-21	198.17	E12-24	12	2836.2	2076.9	3.1	0.7	0.64
SW-1466	208	0.013	134.66	F12-59	133.74	F12-56	15	1928.3	2188.5	0.4	1.1	0.89
SW-1467	110	0.013	133.64	F12-56	133.09	F12-53	15	2050.2	2180.3	0.5	1.1	0.87
SW-1468	104	0.013	132.99	F12-53	132.57	F12-52	15	1846.6	2178.0	0.4	1.2	0.83
SW-1469	317	0.013	121.58	H11-13	118.34	G11-28	12	1616.4	1943.5	1.0	1.2	1.00
SW-1470	251	0.013	123.64	H11-16	121.78	H11-13	12	1376.4	1789.6	0.7	1.3	1.00
SW-1471	274	0.013	124.66	H10-16	123.84	H11-16	12	874.3	1854.3	0.3	2.1	1.00
SW-1472	39	0.013	118.34	G11-26	117.94	G11-28	12	1623.1	1903.2	1.0	1.2	1.00

Client: City of St. Helens
Project: Stormwater Master Plan
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Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1473	241	0.013	120.44	G11-21	118.44	G11-26	12	1456.8	1903.9	0.8	1.3	1.00
SW-1474	59	0.013	117.84	G11-28	117.80	STOR-28	15	754.6	3707.9	0.1	4.9	1.00
SW-1475	232	0.013	123.14	G10-57	121.14	G11-21	12	1484.5	1906.4	0.9	1.3	1.00
SW-1476	145	0.013	125.29	H10-13	124.66	H10-16	12	1054.6	1104.8	0.4	1.0	1.00
SW-1477	95	0.013	108.90	G11-83	108.41	G11-84	30	13206.1	7402.9	0.5	0.6	0.54
SW-1478	21	0.013	110.45	G11-81	109.40	G11-83	24	22595.8	5126.5	5.0	0.2	0.36
SW-1479	169	0.013	108.36	G11-84	106.30	G11-136	30	20314.7	7402.9	1.2	0.4	0.42
SW-1480	57	0.013	110.80	X-812	110.37	G11-81	18	4095.7	1921.9	0.8	0.5	0.53
SW-1483	150	0.013	67.50	X-781	67.38	KJ-240	28	5510.2	14372.7	0.1	2.6	1.00
SW-1485	56	0.013	96.20	X-799	95.28	H10-2	12	2041.4	3026.0	1.6	0.7	1.00
SW-1490	207	0.013	101.90	G12-14	101.29	G12-9	12	867.1	42.8	0.3	0.0	0.74
SW-1491	316	0.013	101.29	G12-9	98.69	G12-17	36	27166.2	7391.4	0.8	0.3	0.35
SW-1492	34	0.013	98.69	G12-17	98.37	G12-19	36	28907.8	7420.3	0.9	0.3	0.47
SW-1493	56	0.013	101.46	G12-7	101.29	G12-9	36	16565.1	7388.9	0.3	0.4	0.42
SW-1494	83	0.013	67.28	I11-20	67.16	I11-19	12	608.6	964.4	0.1	1.6	0.86
SW-1495	186	0.013	66.96	I11-19	61.23	I11-18	12	2804.5	954.8	3.1	0.3	0.98
SW-1496	59	0.013	74.60	H12-10	74.54	I12-2	24	3226.3	4982.9	0.1	1.5	0.59
SW-1497	87	0.013	106.30	G11-136	105.09	X-838	30	21646.1	7402.9	1.4	0.3	0.42
SW-1498	83	0.013	93.88	G12-25	93.87	G12-26	30	2020.8	20913.1	0.0	10.3	1.00
SW-1499	198	0.013	93.87	G12-26	92.34	G12-27	30	16183.3	15213.1	0.8	0.9	1.00
SW-1500	300	0.011	69.53	I11-92	69.08	I11-89	12	732.0	1429.2	0.2	2.0	1.00
SW-1501	70	0.011	68.88	I11-89	68.77	I11-91	12	751.8	2062.3	0.2	2.7	1.00
SW-1502	120	0.013	40.67	J12-2	40.48	J12-3	12	636.4	2377.8	0.2	3.7	0.96
SW-1503	115	0.013	166.75	F12-2	163.91	F12-3	15	4548.9	3989.4	2.5	0.9	0.73
SW-1504	138	0.013	208.52	E12-19	201.64	E12-21	12	3572.7	2078.2	5.0	0.6	0.55
SW-1505	115	0.013	168.79	E12-131	168.23	E12-135	15	2042.3	1941.0	0.5	1.0	0.74
SW-1506	219	0.013	55.28	I10-91	54.94	J10-15	15	1283.5	2148.8	0.2	1.7	0.92
SW-1507	133	0.013	111.99	F13-36	95.93	F13-35	12	5577.6	429.1	12.2	0.1	0.34
SW-1508	103	0.013	119.70	F13-37	112.05	F13-36	12	4364.0	429.1	7.4	0.1	0.21
SW-1509	220	0.013	119.89	F13-22	119.20	F12-105	24	5686.4	1118.3	0.3	0.2	0.51
SW-1510	37	0.013	119.20	F12-105	118.86	F12-190	15	2762.9	1270.1	0.9	0.5	1.00
SW-1511	124	0.013	119.50	F12-104	119.20	F12-105	12	786.5	376.7	0.2	0.5	1.00
SW-1512	163	0.013	103.34	KJ-117	99.84	F13-44	12	2340.3	305.1	2.1	0.1	0.22
SW-1513	87	0.013	99.84	F13-44	94.44	F13-43	12	3982.0	305.1	6.2	0.1	0.58
SW-1514	48	0.013	94.44	F13-43	93.87	F13-40	12	1735.0	315.7	1.2	0.2	1.00
SW-1527	101	0.013	98.71	H11-6	97.69	X-696	15	2919.7	0.0	1.0	0.0	0.00
SW-1528	137	0.013	101.11	H11-224	98.79	H11-6	15	3779.7	0.0	1.7	0.0	0.00
SW-1529	27	0.013	132.46	F12-15	132.29	F12-16	60	92753.9	9984.2	0.6	0.1	0.29
SW-1531	128	0.013	92.34	G12-27	92.24	STOR-29	36	8149.9	15418.7	0.1	1.9	1.00
SW-1532	84	0.013	97.42	G12-23	95.20	KJ-101	30	29882.6	43336.7	2.6	1.5	0.84

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Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1534	83	0.013	174.09	E13-7	173.68	E12-132	12	1126.2	1959.0	0.5	1.7	0.94
SW-1535	48	0.013	174.52	E13-8	174.29	E13-7	12	1106.9	1959.1	0.5	1.8	1.00
SW-1536	218	0.013	110.75	F12-118	110.04	KJ-269	15	1655.8	1389.4	0.3	0.8	0.87
SW-1539	119	0.013	171.41	F11-1	169.74	F11-2	12	1893.6	2259.2	1.4	1.2	1.00
SW-1540	182	0.013	169.69	F11-2	167.99	F11-5	12	1544.4	2259.2	0.9	1.5	1.00
SW-1541	61	0.013	167.79	F11-5	165.64	F11-6	12	3005.8	2259.2	3.5	0.8	1.00
SW-1542	71	0.013	164.59	F11-6	163.21	F11-12	12	2224.9	2259.6	1.9	1.0	1.00
SW-1543	186	0.013	163.06	F11-12	161.62	F11-15	12	1407.9	2260.2	0.8	1.6	1.00
SW-1544	112	0.013	161.52	11-15_DUMM	160.98	F11-17	12	1111.9	931.6	0.5	0.8	1.00
SW-1545	372	0.013	185.87	F11-25	169.33	F11-29	12	3374.9	956.2	4.5	0.3	0.38
SW-1546	56	0.013	169.18	F11-29	168.59	KJ-118	12	1646.6	946.4	1.1	0.6	0.54
SW-1547	218	0.013	168.39	KJ-118	167.06	F11-34	15	2263.0	943.6	0.6	0.4	0.49
SW-1548	190	0.013	166.81	F11-34	164.82	F11-42	15	2963.5	2574.6	1.0	0.9	0.72
SW-1549	76	0.013	164.62	F11-42	163.42	F11-43	15	3639.6	2573.4	1.6	0.7	0.62
SW-1550	375	0.013	180.33	F11-37	167.06	F11-34	12	3008.4	1719.7	3.5	0.6	0.59
SW-1551	363	0.013	173.21	F11-50	163.32	F11-43	12	2770.5	1052.2	3.0	0.4	0.57
SW-1552	160	0.013	169.17	F10-1	160.98	F11-17	12	3619.9	3889.3	5.1	1.1	1.00
SW-1553	133	0.013	159.78	F11-17	154.95	F11-20	12	3045.6	3890.8	3.6	1.3	1.00
SW-1554	47	0.013	72.19	H12-28	71.96	H12-30	12	1118.4	1362.9	0.5	1.2	1.00
SW-1557	215	0.013	85.84	H11-181	83.81	H11-106	12	1553.1	1467.1	0.9	0.9	1.00
SW-1558	129	0.013	83.33	H11-168	82.82	H11-107	12	1007.1	2067.6	0.4	1.0	1.00
SW-1559	17	0.013	82.73	H11-107	82.70	H11-108	12	679.4	3083.5	0.2	2.3	1.00
SW-1560	157	0.013	153.00	G10-92	147.44	G11-138	15	5454.4	972.6	3.5	0.2	0.32
SW-1561	61	0.013	147.44	G11-138	145.27	G11-139	15	5481.9	969.5	3.6	0.2	0.28
SW-1562	44	0.013	145.27	G11-139	139.68	G11-146	15	10383.8	968.6	12.8	0.1	0.21
SW-1563	103	0.013	137.57	G11-147	134.10	G11-145	18	8639.9	968.1	3.4	0.1	0.28
SW-1564	174	0.013	134.10	G11-145	129.76	G11-85	18	7439.9	1788.8	2.5	0.2	0.67
SW-1565	336	0.013	178.28	E13-24	174.92	E13-8	12	1598.7	1324.3	1.0	0.8	0.85
SW-1566	171	0.013	173.75	E13-16	172.90	E13-25	12	1126.5	1793.6	0.5	1.6	1.00
SW-1567	63	0.013	172.60	E13-17	172.28	E13-23	12	1135.4	1795.1	0.5	1.6	0.99
SW-1568	41	0.013	174.93	E13-10	174.92	E13-8	12	250.8	848.9	0.0	3.4	1.00
SW-1569	203	0.013	176.16	E13-11	175.13	E13-10	12	1138.0	842.6	0.5	0.7	0.91
SW-1570	126	0.013	173.95	E13-15	173.75	E13-16	12	637.9	1792.6	0.2	2.8	1.00
SW-1571	20	0.013	172.90	E13-25	172.80	E13-17	12	1133.5	1794.9	0.5	1.6	1.00
SW-1572	30	0.013	172.08	E13-23	171.93	E13-26	12	1130.7	1792.8	0.5	1.6	1.00
SW-1573	286	0.013	171.53	E13-26	170.11	E13-30	48	45442.8	3159.9	0.5	0.1	0.65
SW-1575	216	0.013	169.91	E13-30	169.34	O-13	12	821.5	1986.0	0.3	2.4	0.94
SW-1576	68	0.013	61.60	I12-76	60.40	I12-77	12	2119.8	1311.3	1.8	0.6	0.57
SW-1588	281	0.013	117.20	G12-113	115.50	G12-111	18	3665.6	4079.3	0.6	1.1	1.00
SW-1589	301	0.013	81.60	H11-145	78.80	H11-124	15	2794.2	3078.1	0.9	1.1	1.00

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1590	72	0.013	82.70	H11-108	81.70	H11-145	15	3422.7	3080.0	1.4	0.9	1.00
SW-1591	71	0.013	62.92	H12-48	62.09	H12-49	12	1723.2	1312.0	1.2	0.8	1.00
SW-1592	155	0.013	61.99	H12-49	61.70	I12-76	12	691.0	1311.8	0.2	1.9	0.87
SW-1593	79	0.013	100.50	H11-232	99.50	H11-233	12	1802.8	2147.7	1.3	1.2	0.95
SW-1594	115	0.013	100.90	H11-231	100.60	H11-232	12	815.1	2147.9	0.3	2.6	1.00
SW-1595	346	0.013	102.50	H11-43	101.00	H11-231	12	1052.9	1666.1	0.4	1.6	1.00
SW-1599	193	0.013	96.40	X-711	96.20	X-799	15	934.4	2601.2	0.1	2.8	1.00
SW-1601	45	0.013	45.70	I10-73	45.60	I10-72	18	2229.2	7200.5	0.2	3.2	0.97
SW-1602	47	0.013	80.41	H12-26	78.75	H12-27	12	3017.8	1918.3	3.6	0.6	1.00
SW-1603	39	0.013	96.99	I9-84	96.81	KJ-107	36	37389.2	17311.5	0.5	0.5	0.51
SW-1604	49	0.013	60.30	I12-77	59.00	I12-36	12	2609.4	1311.2	2.7	0.5	0.51
SW-1605	64	0.013	63.60	H12-65	62.94	H12-48	12	1626.3	1311.4	1.0	0.8	0.87
SW-1607	154	0.013	168.03	E12-135	166.27	E12-136	12	1711.4	1842.2	1.1	1.1	0.93
SW-1608	82	0.013	165.55	F11-188	165.00	F11-187	48	97795.1	4319.5	0.7	0.0	0.28
SW-1609	78	0.013	145.71	F11-186	145.04	F11-185	42	101079.2	10332.3	0.9	0.1	0.29
SW-1610	72	0.013	163.22	F11-43	161.34	STOR-22	15	4673.1	3604.8	2.6	0.8	0.73
SW-1611	53	0.013	112.71	X-837	112.59	G11-78	15	1385.7	1570.5	0.2	1.1	0.80
SW-1612	49	0.013	112.71	X-837	112.69	G11-78	18	947.8	1862.0	0.0	2.0	0.67
SW-1614	179	0.013	104.64	X-839	103.50	KJ-628	30	14677.1	7388.6	0.6	0.5	0.50
SW-1615	137	0.013	103.40	KJ-628	101.46	G12-7	30	21938.5	7388.6	1.4	0.3	0.49
SW-1616	75	0.013	118.24	F12-186	117.99	F12-188	24	5862.2	1473.1	0.3	0.3	1.00
SW-1617	17	0.013	117.99	F12-188	118.08	F12-189	24	7387.9	1493.9	0.5	0.2	1.00
SW-1618	200	0.013	118.08	F12-189	117.77	F12-190	24	3995.9	1539.8	0.2	0.4	1.00
SW-1621	160	0.013	152.60	F11-223	147.10	F11-220	15	5377.1	245.5	3.4	0.0	0.57
SW-1622	163	0.013	154.84	F11-20	149.44	F11-21	16	6261.2	3890.7	3.3	0.6	0.79
SW-1623	30	0.013	148.74	F11-21	148.08	F11-230	16	5108.7	5836.1	2.2	1.1	1.00
SW-1624	32	0.013	148.04	F11-230	146.31	F11-221	16	7964.3	4904.4	5.3	0.6	1.00
SW-1625	81	0.013	106.43	G12-123	106.19	KJ-720	12	870.4	1649.9	0.3	1.9	1.00
SW-1626	78	0.013	106.57	G12-124	106.43	G12-123	12	677.5	1649.5	0.2	2.4	1.00
SW-1627	100	0.013	106.50	G12-125	106.57	G12-124	30	4870.8	2720.9	0.1	0.6	1.00
SW-1628	100	0.013	106.50	G12-125	106.50	KJ-847	36	946.7	2633.7	0.0	2.8	1.00
SW-1632	74	0.013	105.55	G12-129	105.10	G12-46	12	1246.0	1214.0	0.6	1.0	1.00
SW-1633	63	0.013	105.40	G12-39	104.70	G12-46	24	10729.9	11454.0	1.1	1.1	1.00
SW-1634	90	0.013	106.38	G12-55	105.55	G12-129	12	1535.7	1214.3	0.9	0.8	1.00
SW-1635	84	0.013	107.01	G12-79	106.58	G12-55	12	1144.1	1214.6	0.5	1.1	1.00
SW-1636	100	0.013	108.49	G12-80	107.21	G12-79	12	1811.8	1215.3	1.3	0.7	1.00
SW-1638	134	0.013	174.84	F10-23	173.34	F10-21	12	1692.0	2212.4	1.1	1.3	1.00
SW-1639	63	0.013	174.84	F10-26	174.34	F11-233	12	1429.8	0.0	0.8	0.0	0.00
SW-1640	103	0.013	173.14	F10-21	169.54	F10-1	12	2987.8	4348.2	3.5	1.5	1.00
SW-1642	57	0.013	176.55	F10-27	176.34	STOR-10	18	2867.5	3546.4	0.4	1.2	1.00

Item #3.

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1643	346	0.013	192.33	F11-237	184.64	F11-234	12	2385.8	2241.0	2.2	0.9	0.77
SW-1644	251	0.013	249.04	F10-31	230.91	F11-243	12	4305.5	943.5	7.2	0.2	0.32
SW-1645	67	0.013	177.34	STOR-10	174.84	F10-23	12	3092.1	2212.5	3.7	0.7	1.00
SW-1646	300	0.013	184.44	F11-234	176.74	F10-27	18	7549.8	3548.2	2.6	0.5	0.74
SW-1647	225	0.013	246.14	F10-34	224.84	F11-247	12	4928.4	1340.7	9.5	0.3	0.36
SW-1648	266	0.013	215.78	F11-242	206.54	F11-239	12	2981.1	941.8	3.5	0.3	0.39
SW-1649	181	0.013	230.71	F11-243	218.62	F11-242	12	4135.1	942.9	6.7	0.2	0.32
SW-1652	193	0.013	224.64	F11-247	207.34	F11-239	12	4799.7	1338.5	9.0	0.3	0.36
SW-1654	307	0.013	12.40	J12-11	1.00	X-803	48	124335.5	5952.8	3.7	0.0	0.15
SW-1655	206	0.013	18.90	J12-9	16.53	J12-10	24	10891.4	5955.6	1.2	0.5	0.53
SW-1656	154	0.013	37.80	J12-8	20.80	J12-9	24	33867.4	5958.7	11.1	0.2	0.28
SW-1657	160	0.013	38.18	J12-3	37.90	J12-8	24	4247.7	3852.0	0.2	0.9	0.61
SW-1658	92	0.011	68.33	I12-88	68.05	I12-89	12	1033.2	2062.4	0.3	2.0	1.00
SW-1659	59	0.011	68.69	I11-91	68.40	I12-88	12	1326.8	2062.3	0.5	1.6	1.00
SW-1660	154	0.013	16.33	J12-10	12.60	J12-11	48	100223.1	5954.4	2.4	0.1	0.17
SW-1663	77	0.013	75.08	H12-11	74.80	H12-10	18	2836.4	3700.3	0.4	1.3	0.94
SW-1667	68	0.013	83.92	H11-106	83.60	H11-168	12	1100.7	3451.4	0.5	1.6	1.00
SW-1668	254	0.013	116.59	F12-69	114.85	F12-68	12	1324.5	1013.7	0.7	0.8	1.00
SW-1669	288	0.013	63.10	H13-70	62.00	H13-72	12	988.3	1921.4	0.4	1.9	1.00
SW-1670	189	0.013	77.33	G13-26	75.00	G13-27	12	1775.1	2373.1	1.2	1.3	1.00
SW-1671	68	0.013	230.21	G10-4	227.84	G10-5	12	2995.5	0.0	3.5	0.0	0.00
SW-1672	80	0.013	227.64	G10-5	225.54	G10-8	12	2593.2	0.0	2.6	0.0	0.00
SW-1673	25	0.013	217.86	G10-9	217.74	G10-10	12	1107.9	60.2	0.5	0.1	0.27
SW-1674	136	0.013	225.34	G10-8	218.06	G10-9	12	3698.0	0.0	5.3	0.0	0.01
SW-1675	113	0.013	218.03	G10-11	217.57	G10-9	12	1022.4	19.2	0.4	0.0	0.28
SW-1676	75	0.013	218.53	G10-14	218.23	G10-11	12	1014.5	0.0	0.4	0.0	0.00
SW-1677	102	0.013	219.14	G10-15	218.73	G10-14	12	1011.6	0.0	0.4	0.0	0.00
SW-1678	211	0.013	223.14	G10-18	219.34	G10-15	12	2147.9	0.0	1.8	0.0	0.00
SW-1679	97	0.013	232.24	G10-3	230.41	G10-4	12	2200.6	0.0	1.9	0.0	0.00
SW-1680	168	0.013	175.66	F12-8	173.89	F12-7	12	1641.4	1069.0	1.1	0.7	0.57
SW-1681	84	0.013	173.89	F12-7	172.25	F12-6	12	2234.6	1067.8	2.0	0.5	0.47
SW-1682	150	0.013	172.25	F12-6	167.09	F12-4	12	2969.5	1067.0	3.4	0.4	0.47
SW-1685	132	0.013	156.10	F12-11	153.50	F12-13	12	2244.5	913.7	2.0	0.4	0.44
SW-1686	127	0.013	157.50	F12-14	156.20	F12-11	12	1617.9	0.0	1.0	0.0	0.17
SW-1687	81	0.013	161.65	F11-98	157.60	F12-14	12	3578.0	0.0	5.0	0.0	0.00
SW-1688	106	0.013	168.90	F11-99	161.75	F11-98	12	4157.8	0.0	6.8	0.0	0.00
SW-1689	105	0.013	171.04	F11-118	170.54	F11-117	12	1104.2	0.0	0.5	0.0	0.00
SW-1691	138	0.013	187.49	E12-6	184.78	KJ-136	12	2241.4	2964.2	2.0	1.3	0.83
SW-1692	167	0.013	134.79	F12-112	125.01	F12-113	12	3873.1	781.6	5.9	0.2	0.30
SW-1693	133	0.013	122.66	F12-113	121.70	F12-114	12	1358.6	781.2	0.7	0.6	0.54

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1694	69	0.013	121.35	F12-114	120.60	F12-115	12	1667.2	781.1	1.1	0.5	0.48
SW-1695	141	0.013	118.30	F12-111	115.80	F12-110	12	2129.5	394.4	1.8	0.2	0.26
SW-1696	35	0.013	115.80	F12-110	113.00	X-840	12	4553.1	393.7	8.1	0.1	0.20
SW-1697	212	0.013	119.10	F12-170	117.40	G12-113	18	4222.8	2639.7	0.8	0.6	0.78
SW-1698	87	0.013	119.40	F12-171	119.20	F12-170	18	2264.3	1818.6	0.2	0.8	0.58
SW-1699	229	0.013	120.20	F12-182	119.50	F12-171	12	883.7	1818.6	0.3	2.1	0.93
SW-1700	221	0.013	135.26	G11-122	134.50	X-810	12	937.7	1779.0	0.3	1.9	0.89
SW-1701	179	0.013	135.90	G11-160	135.26	G11-122	12	956.2	1767.5	0.4	1.8	1.00
SW-1702	378	0.013	149.04	G11-143	136.07	G11-159	12	2961.5	586.2	3.4	0.2	0.65
SW-1704	385	0.013	136.07	G11-159	131.57	KJ-122	12	1727.8	2108.2	1.2	1.2	1.00
SW-1705	354	0.013	126.60	G11-3	123.60	G11-6	12	1471.7	1915.5	0.8	1.3	0.93
SW-1706	34	0.013	127.70	G11-2	127.00	G11-3	12	2285.6	1956.7	2.0	0.9	1.00
SW-1707	175	0.013	120.34	G11-8	119.92	G11-9	18	2312.5	4040.7	0.2	1.7	0.87
SW-1708	172	0.013	119.92	G11-9	117.21	KJ-182	24	12757.1	7672.6	1.6	0.6	0.78
SW-1712	105	0.013	66.70	X-805	66.52	X-804	20	2584.1	8045.2	0.2	1.6	0.77
SW-1714	19	0.013	84.56	H12-51	84.53	H12-56	24	4081.6	5600.1	0.2	1.4	0.73
SW-1715	20	0.013	71.68	H12-30	71.17	H12-74	12	2573.3	1362.6	2.6	0.5	1.00
SW-1716	5	0.013	69.61	I12-8	69.53	I12-74	18	6117.3	2301.9	1.7	0.4	0.48
SW-1718	40	0.013	84.10	H11-105	83.84	H11-106	12	1288.3	2357.4	0.6	0.9	1.00
SW-1719	17	0.013	84.69	H11-103	84.42	H11-104	12	1995.3	2872.6	1.6	0.7	1.00
SW-1723	57	0.013	133.80	G10-88	132.34	G11-19	12	2560.1	1038.0	2.6	0.4	0.60
SW-1724	24	0.013	117.10	F12-71	116.69	F12-69	12	2101.3	1007.2	1.7	0.5	1.00
SW-1725	35	0.013	114.75	F12-68	114.46	F12-67	12	1457.8	1017.3	0.8	0.7	1.00
SW-1726	164	0.013	117.77	F12-190	117.50	F12-95	24	4124.4	3815.3	0.2	0.9	1.00
SW-1727	63	0.013	164.29	G9-2	161.34	G9-3	36	65018.1	14342.1	4.7	0.2	0.33
SW-1728	29	0.013	90.24	KJ-116	90.20	H11-185	16	1286.7	2246.7	0.1	1.7	1.00
SW-1729	114	0.011	69.90	I11-93	69.73	I11-92	12	729.8	2749.8	0.1	3.8	1.00
SW-1731	107	0.013	174.36	F11-80	171.58	STOR-26	42	72680.7	5473.8	2.6	0.1	0.47
SW-1732	67	0.013	175.67	KJ-277	174.36	F11-80	42	63353.0	586.6	2.0	0.0	0.13
SW-1733	54	0.013	168.34	G9-4	164.29	G9-2	36	81848.5	14370.0	7.5	0.2	0.31
SW-1734	73	0.013	161.42	STOR-16	161.42	F11-15	12	59.3	1925.5	0.0	32.5	1.00
SW-1735	155	0.013	130.26	G11-85	130.60	G11-17	12	748.3	1477.6	0.2	2.0	0.84
SW-1737	16	0.013	142.30	G10-115	142.30	G10-119	18	367.2	4942.2	0.0	13.5	1.00
SW-1738	9	0.013	167.09	F12-4	166.95	F12-2	12	1997.7	1066.0	1.6	0.5	0.61
SW-1739	35	0.013	217.64	G10-31	217.49	G10-29	12	1046.9	102.9	0.4	0.1	0.50
SW-1744	311	0.013	113.00	X-811	110.90	X-812	24	8348.6	1921.9	0.7	0.2	0.33
SW-1745	85	0.013	119.54	STOR-28	115.64	G11-42	15	6225.9	544.4	4.6	0.1	0.42
SW-1747	246	0.013	115.34	G11-42	112.95	G11-41	15	2858.5	2866.1	1.0	1.0	0.79
SW-1748	286	0.013	112.95	G11-41	108.90	H11-62	15	3449.2	2865.5	1.4	0.8	0.89
SW-1750	79	0.013	188.80	KJ-786	185.39	F11-164	12	3332.2	1311.0	4.3	0.4	0.44

Client: City of St. Helens
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Conduit Parameters and 25-Year Storm Event Results

								25-Year Storm Event				
Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-1751	300	0.013	206.34	F11-239	192.53	F11-237	12	3432.3	2263.9	4.6	0.7	0.59
SW-1752	33	0.013	180.04	STOR-10	174.84	F10-26	12	6366.9	0.0	15.9	0.0	0.00
SW-1753	210	0.013	160.74	F11-207	154.94	F11-211	10	1633.7	1731.2	2.8	1.1	0.89
SW-1754	60	0.013	154.84	F11-211	150.74	F11-214	12	4177.0	2944.0	6.8	0.7	0.62
SW-1755	128	0.013	148.95	F11-214	148.95	F11-217	38	1790.3	2996.4	0.0	1.7	0.53
SW-1756	92	0.013	148.95	F11-217	146.84	F11-219	16	5209.9	2903.1	2.3	0.6	1.00
SW-1757	40	0.013	146.74	F11-219	146.60	F11-220	16	2031.2	2904.4	0.3	1.4	1.00
SW-1758	108	0.013	145.10	F11-220	144.81	F11-221	36	15512.7	4615.0	0.3	0.3	1.00
SW-1759	141	0.013	144.34	F11-221	141.27	X-809	15	4285.6	6037.8	2.2	1.4	1.00
SW-1760	62	0.013	119.41	X-835	119.28	X-836	24	4688.4	6163.8	0.2	1.3	0.70
SW-1761	120	0.013	98.20	X-696	97.20	H11-23	24	9278.5	0.0	0.8	0.0	0.20
SW-1763	40	0.013	106.09	KJ-720	105.59	KJ-846	12	1781.2	1649.8	1.2	0.9	1.00
SW-1764	183	0.013	105.49	KJ-846	104.94	KJ-845	12	876.8	1648.8	0.3	1.9	0.91
SW-1765	91	0.013	193.10	KJ-100	188.59	E12-6	12	3552.9	2890.9	4.9	0.8	1.00
SW-1766	92	0.013	139.43	G11-146	137.57	G11-147	18	6692.5	968.9	2.0	0.1	0.25
SW-1767	64	0.013	95.10	KJ-101	93.98	G12-25	30	24412.6	18795.8	1.8	0.8	1.00
SW-1769	891	0.013	96.81	KJ-107	91.72	X-797	48	48720.0	17277.2	0.6	0.4	0.41
SW-1776	208	0.013	100.29	KJ-113	99.00	H9-1	30	14504.2	11404.2	0.6	0.8	0.68
SW-1777	62	0.030	61.38	I10-46	23.46	KJ-276	0	0.0	2487.9	73.9	-1.0	-1.00
SW-1778	21	0.013	72.76	I12-3	72.55	I12-4	24	10195.3	4968.5	1.0	0.5	1.00
SW-1779	76	0.030	217.74	G10-10	217.64	G10-31	0	4994.1	72.6	0.1	0.0	0.12
SW-1781	115	0.013	174.34	F11-233	173.85	KJ-119	12	1043.4	0.0	0.4	0.0	0.00
SW-1782	518	0.013	173.85	KJ-119	173.84	O-11	8	23.8	0.0	0.0	0.0	0.00
SW-1783	222	0.013	141.27	X-809	136.97	KJ-120	15	4033.8	4308.8	1.9	1.1	0.83
SW-1786	422	0.030	134.50	X-810	128.60	G11-85	0	14546.6	1762.0	1.1	0.1	0.63
SW-1787	216	0.013	131.51	KJ-122	127.70	G11-2	12	2138.6	2013.4	1.8	0.9	1.00
SW-1788	54	0.013	120.45	G11-7	120.34	G11-8	18	2081.3	4037.9	0.2	1.9	1.00
SW-1789	26	0.013	123.50	G11-6	120.46	G11-7	12	5497.8	1915.4	11.8	0.3	0.70
SW-1793	85	0.013	59.40	I12-78	58.80	I12-36	15	2432.0	2589.8	0.7	1.1	0.79
SW-1794	392	0.013	58.80	I12-36	51.20	I12-86	24	14130.6	3900.8	1.9	0.3	0.36
SW-2000	94	0.013	84.33	H11-104	84.06	H11-105	12	856.9	2354.0	0.3	1.4	1.00
SW-2001	10	0.013	99.01	KJ-278	98.99	KJ-133	12	729.6	1653.3	0.2	2.3	1.00
SW-2002	120	0.013	104.21	KJ-290	102.70	KJ-303	36	33548.6	11427.2	1.3	0.3	0.86
SW-2003	72	0.013	102.70	KJ-303	102.20	KJ-304	36	25016.6	11430.9	0.7	0.5	0.94
SW-2004	81	0.013	102.20	KJ-304	103.70	KJ-287	30	46309.9	11431.2	1.8	0.2	0.68
SW-2005	75	0.013	103.60	KJ-287	101.09	KJ-286	30	33645.9	11431.0	3.3	0.2	0.53
SW-2006	50	0.013	101.09	KJ-286	100.96	KJ-285	30	9412.6	11411.4	0.3	0.6	0.80
SW-2007	103	0.013	100.96	KJ-285	100.56	KJ-284	30	11463.3	11408.0	0.4	1.0	0.82
SW-2008	88	0.013	100.56	KJ-284	100.29	KJ-113	30	10172.2	11407.3	0.3	1.1	0.74
SW-2009	67	0.013		I10-6	88.90	I10-8	15	3489.4	2361.0	1.4	0.7	1.00

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Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-2012	64	0.013	98.80	H11-233	98.00	H11-22	12	1789.2	2146.9	1.3	1.2	0.95
SW-2013	34	0.030	52.43	I10-34	34.40	X-808	0	0.0	20218.0	63.1	-1.0	-1.00
SW-2014	69	0.013	56.19	I11-40S	56.19	I11-41	6	9.6	0.0	0.0	0.0	0.50
SW-2015	18	0.013	66.19	I11-39S	66.19	I11-39	6	19.0	0.0	0.0	0.0	0.00
SW-2017	22	0.013	66.19	I11-37ST	66.19	I11-37	6	17.0	0.0	0.0	0.0	0.00
SW-2019	113	0.013	42.25	J11-63	40.87	J12-2	12	1768.6	2378.1	1.2	1.3	1.00
SW-2021	35	0.013	114.74	J-189_DUMM	114.55	KJ-190	24	7515.7	1931.3	0.5	0.3	0.34
SW-2022	279	0.013	117.21	KJ-182	116.01	KJ-187	24	6655.8	6938.7	0.4	1.0	0.72
SW-2025	22	0.013	167.09	STOR-24	165.50	F11-188	48	36784.4	1168.7	7.2	0.0	0.21
SW-2026	34	0.030	171.58	KJ-300	170.92	KJ-301	42	27199.6	2712.6	1.9	0.1	0.22
SW-2028	101	0.030	170.92	KJ-301	168.50	F11-115	0	21298.5	2709.8	2.4	0.1	0.28
SW-2029	977	0.013	160.43	KJ-302	145.10	F11-220	24	12722.4	1707.7	1.6	0.1	0.62
SW-2030	44	0.013	163.85	STOR-22	160.43	KJ-302	15	8073.4	0.0	7.8	0.0	0.20
SW-2032	370	0.030	115.00	KJ-305	114.36	KJ-131	12	4296.0	4460.3	0.2	1.0	1.00
SW-2034	72	0.013	101.86	J-308_DUMM	101.11	H11-224	15	2957.1	0.0	1.0	0.0	0.00
SW-2035	16	0.013	102.42	KJ-310	102.34	KJ-308	18	3359.5	0.0	0.5	0.0	0.00
SW-2036	171	0.013	104.04	KJ-309	102.42	KJ-310	96	398438.5	0.0	0.9	0.0	0.00
SW-2037	21	0.013	102.42	KJ-311	102.42	KJ-310	96	28376.9	0.0	0.0	0.0	0.00
SW-2038	66	0.013	103.00	KJ-312	102.42	KJ-311	96	384306.9	0.0	0.9	0.0	0.00
SW-2039	19	0.013	107.62	KJ-313	107.45	KJ-309	18	4409.7	0.0	0.9	0.0	0.00
SW-2040	106	0.013	118.37	KJ-319	117.67	KJ-318	12	1299.6	0.0	0.7	0.0	0.00
SW-2041	154	0.013	116.90	KJ-318	116.14	KJ-317	15	2038.1	0.0	0.5	0.0	0.00
SW-2042	96	0.013	116.01	KJ-317	115.39	KJ-316	15	2324.2	0.0	0.6	0.0	0.00
SW-2043	338	0.013	115.23	KJ-316	113.43	KJ-315	15	2114.8	0.0	0.5	0.0	0.00
SW-2044	90	0.013	113.32	KJ-315	112.11	KJ-314	15	3361.1	0.0	1.3	0.0	0.00
SW-2045	126	0.013	111.89	KJ-314	110.36	KJ-313	15	3190.3	0.0	1.2	0.0	0.00
SW-2046	203	0.013	127.97	KJ-325	123.05	KJ-324	12	2487.8	0.0	2.4	0.0	0.00
SW-2047	160	0.013	122.79	KJ-324	119.78	KJ-323	12	2196.6	0.0	1.9	0.0	0.00
SW-2048	60	0.013	118.98	KJ-323	118.24	KJ-322	12	1772.2	0.0	1.2	0.0	0.00
SW-2049	55	0.013	114.52	KJ-322	112.89	KJ-321	12	2748.0	0.0	3.0	0.0	0.00
SW-2050	283	0.013	111.59	KJ-321	110.20	KJ-320	12	1120.6	0.0	0.5	0.0	0.00
SW-2051	107	0.013	108.38	KJ-320	107.82	KJ-313	12	1157.1	0.0	0.5	0.0	0.00
SW-2052	277	0.013	127.91	KJ-326	124.62	KJ-327	12	1744.3	0.0	1.2	0.0	0.00
SW-2053	26	0.013	124.40	KJ-327	123.98	KJ-328	12	2026.6	0.0	1.6	0.0	0.00
SW-2054	224	0.013	123.48	KJ-328	120.71	KJ-318	12	1776.6	0.0	1.2	0.0	0.00
SW-2055	53	0.013	116.21	KJ-329	115.38	KJ-330	10	1226.8	0.0	1.6	0.0	0.00
SW-2056	106	0.013	114.32	KJ-330	113.77	KJ-331	14	1736.8	0.0	0.5	0.0	0.00
SW-2057	179	0.013	113.62	KJ-331	109.81	KJ-313	15	4230.4	0.0	2.1	0.0	0.00
SW-2058	63	0.013	71.00	I12-5_DUMMY	70.35	I12-6	18	4799.4	2301.9	1.0	0.5	0.49
SW-612	143	0.030	72.55	I12-4	70.90	I12-5	0	26337.8	10138.9	1.2	0.4	1.00

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Conduit Parameters and 25-Year Storm Event Results

								25-Year Storm Event				
Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-613	148	0.030	74.54	I12-2	72.76	I12-3	0	39371.1	4970.7	1.2	0.1	0.58
SW-626	488	0.030	80.48	H11-58	67.10	X-781	0	22401.3	18558.5	2.7	0.8	0.95
SW-635	120	0.030	110.04	KJ-269	108.49	G12-80	0	15580.6	1222.7	1.3	0.1	0.72
SW-638	786	0.030	165.00	F11-187	145.71	F11-186	0	21503.0	5589.7	2.5	0.3	0.42
SW-640	115	0.030	145.00	F11-185	138.53	KJ-175	0	162360.7	10133.9	5.6	0.1	0.28
SW-642	366	0.030	155.00	G10-89	140.00	G11-144	0	28469.9	899.3	4.3	0.0	0.10
SW-643	87	0.030	140.00	G11-144	134.10	G11-145	0	35709.2	892.5	6.8	0.0	0.13
SW-644	177	0.030	123.20	G11-71	122.82	G11-72	144	1545262.8	6248.4	0.2	0.0	0.03
SW-645	191	0.030	122.82	G11-72	119.41	X-835	144	4465355.0	6165.4	1.8	0.0	0.10
SW-646	51	0.030	114.50	KJ-170	114.71	KJ-152	0	68670.9	1313.8	0.4	0.0	0.50
SW-647	280	0.030	114.98	G11-128	114.89	KJ-154	0	2525.1	1055.7	0.0	0.4	0.79
SW-648	450	0.030	119.28	X-836	115.00	KJ-305	12	10072.0	6115.8	1.0	0.6	0.89
SW-649	396	0.030	114.36	KJ-131	114.16	KJ-160	0	5001.4	3908.4	0.1	0.8	1.00
SW-655	118	0.030	105.10	X-838	104.64	X-839	0	33832.5	7389.3	0.4	0.2	0.51
SW-718	252	0.030	57.50	I12-21	55.50	I12-54	0	12232.7	2301.9	0.8	0.2	0.30
SW-764	103	0.030	66.52	X-804	65.55	KJ-209	0	50788.3	11904.4	0.9	0.2	0.56
SW-811	78	0.030	34.40	X-808	32.27	KJ-270	144	5525780.0	39208.6	2.7	0.0	0.19
SW-814	342	0.030	67.30	H11-2	66.86	STOR-30	0	9279.3	13321.7	0.1	1.4	1.00
SW-818	116	0.030	168.50	F11-115	165.55	F11-188	24	21897.3	3155.0	2.5	0.1	0.29
SW-820	212	0.013	101.66	KJ-845	99.08	KJ-278	12	1764.4	1651.1	1.2	0.9	1.00
SW-821	69	0.013	98.18	KJ-134	97.47	G12-23	30	18704.8	69397.9	1.0	3.7	0.68
SW-822	165	0.013	98.92	KJ-133	98.63	KJ-134	12	671.2	1651.3	0.2	2.5	1.00
SW-823	342	0.030	184.78	KJ-136	166.95	KJ-135	0	31345.4	2954.1	5.2	0.1	0.46
SW-824	6	0.030	166.95	KJ-135	166.95	F12-2	12	90.1	2954.1	0.0	32.8	1.00
SW-826	47	0.030	170.54	F11-117	168.50	F11-115	0	28491.5	0.0	4.3	0.0	0.15
SW-829	621	0.013	75.00	G13-27	63.30	H13-70	12	2195.1	2123.7	1.9	1.0	1.00
SW-830	92	0.013	62.00	H13-72	61.00	O-12	12	1666.3	1875.2	1.1	1.1	0.93
SW-831	87	0.030	56.07	KJ-137	52.43	I10-34	30	30150.8	20218.1	4.2	0.7	0.53
SW-832	90	0.013	136.97	KJ-120	134.42	KJ-138	18	7932.6	4732.6	2.8	0.6	0.58
SW-833	60	0.013	134.42	KJ-138	133.05	KJ-139	18	7131.7	4732.5	2.3	0.7	0.69
SW-835	56	0.013	133.05	KJ-139	131.40	KJ-141	16	5889.8	5412.4	2.9	0.9	0.80
SW-836	40	0.013	131.40	KJ-141	130.68	KJ-143	18	6348.6	13643.0	1.8	2.1	0.72
SW-838	44	0.013	130.22	KJ-143	129.42	KJ-144	18	6393.0	7382.3	1.8	1.2	0.87
SW-839	39	0.013	129.42	KJ-144	128.86	KJ-145	18	5642.4	5583.4	1.4	1.0	1.00
SW-840	83	0.013	128.86	KJ-145	127.60	KJ-844	18	5822.3	4492.1	1.5	0.8	1.00
SW-841	105	0.013	127.50	KJ-844	126.70	KJ-146	18	4123.7	4471.4	0.8	1.1	1.00
SW-842	56	0.013	126.70	KJ-146	126.50	KJ-147	18	2807.7	4471.5	0.4	1.6	1.00
SW-843	94	0.013	126.40	KJ-147	125.10	G11-70	18	5535.1	4471.5	1.4	0.8	1.00
SW-847	151	0.030	114.71	KJ-152	115.02	KJ-153	0	48259.1	1191.8	0.2	0.0	0.39
SW-848	52	0.030	115.02	KJ-153	114.98	G11-128	0	29503.6	1128.5	0.1	0.0	0.34

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Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-849	280	0.030	114.89	KJ-154	114.97	KJ-155	0	2380.6	992.7	0.0	0.4	0.79
SW-850	280	0.030	114.97	KJ-155	114.60	KJ-156	0	5119.8	939.5	0.1	0.2	0.88
SW-851	280	0.030	114.60	KJ-156	114.52	KJ-157	0	2380.6	878.7	0.0	0.4	1.00
SW-852	280	0.030	114.52	KJ-157	114.54	KJ-158	0	873.2	815.0	0.0	0.9	1.00
SW-853	280	0.030	114.54	KJ-158	114.48	KJ-159	0	3257.5	883.1	0.0	0.3	1.00
SW-854	280	0.030	114.48	KJ-159	114.36	KJ-131	0	4606.8	1449.6	0.0	0.3	1.00
SW-855	396	0.030	114.16	KJ-160	113.73	KJ-161	0	20635.5	3853.9	0.1	0.2	0.64
SW-856	396	0.030	113.73	KJ-161	113.90	KJ-162	0	7885.4	3789.7	0.0	0.5	0.91
SW-857	396	0.030	113.90	KJ-162	113.68	KJ-163	0	8970.4	3726.2	0.1	0.4	0.89
SW-858	396	0.030	113.68	KJ-163	113.75	KJ-164	0	4045.9	3682.0	0.0	0.9	0.79
SW-859	396	0.030	113.75	KJ-164	113.45	KJ-165	0	8375.9	3639.4	0.1	0.4	0.75
SW-860	396	0.030	113.45	KJ-165	113.38	KJ-166	0	4045.9	3597.4	0.0	0.9	0.74
SW-861	396	0.030	113.38	KJ-166	112.99	KJ-167	0	9550.0	3555.0	0.1	0.4	0.75
SW-862	396	0.030	112.99	KJ-167	112.97	KJ-168	0	2162.6	3512.3	0.0	1.6	0.76
SW-863	396	0.030	112.97	KJ-168	112.80	KJ-169	0	6305.1	3472.5	0.0	0.6	0.69
SW-864	396	0.030	112.80	KJ-169	112.40	X-837	0	9671.6	3432.5	0.1	0.4	0.70
SW-869	170	0.030	138.53	KJ-175	132.46	F12-15	0	262207.8	10046.2	3.6	0.0	0.24
SW-881	72	0.030	116.01	KJ-187	115.33	KJ-188	0	7135.8	6919.1	0.9	1.0	1.00
SW-882	65	0.030	115.33	KJ-188	114.74	KJ-189	0	6992.7	5830.7	0.9	0.8	1.00
SW-884	56	0.030	114.55	KJ-190	114.24	KJ-191	0	32659.0	1927.6	0.6	0.1	0.26
SW-885	49	0.030	114.24	KJ-191	113.85	KJ-192	0	39169.0	1924.6	0.8	0.0	0.24
SW-886	27	0.030	113.85	KJ-192	113.47	KJ-193	0	51955.3	1923.0	1.4	0.0	0.22
SW-887	6	0.030	113.47	KJ-193	113.38	KJ-194	0	55070.4	1922.6	1.6	0.0	0.20
SW-888	12	0.030	113.38	KJ-194	113.00	X-811	0	78823.7	1921.9	3.3	0.0	0.23
SW-903	213	0.030	65.55	KJ-209	64.38	KJ-213	26	35684.2	11902.7	0.5	0.3	0.67
SW-908	317	0.030	64.38	KJ-213	63.72	KJ-219	0	22003.5	11900.4	0.2	0.5	0.82
SW-913	56	0.030	63.72	KJ-219	63.84	KJ-220	0	15849.9	11920.5	0.2	0.8	0.85
SW-914	21	0.030	63.84	KJ-220	63.59	KJ-221	36	24184.8	11929.4	1.2	0.5	0.56
SW-915	173	0.030	63.59	KJ-221	62.56	KJ-225	0	22884.0	13543.0	0.6	0.6	1.00
SW-919	20	0.030	62.56	KJ-225	62.52	KJ-226	36	5750.5	13534.2	0.2	2.4	0.75
SW-920	185	0.030	62.52	KJ-226	62.41	X-806	0	9678.7	13533.3	0.1	1.4	0.99
SW-926	213	0.030	62.51	X-807	61.40	I10-119	0	63654.2	13971.9	0.5	0.2	0.48
SW-931	216	0.030	60.65	X-773	59.30	I10-126	0	31823.1	19111.4	0.6	0.6	0.68
SW-934	63	0.030	67.38	KJ-240	67.30	H11-2	0	8818.6	19089.6	0.1	2.2	1.00
SW-946	336	0.030	66.22	STOR-30	66.70	X-805	0	16468.6	8070.8	0.1	0.5	0.96
SW-948	102	0.013	283.34	KJ-268	281.12	KJ-267	12	2364.9	2756.0	2.2	1.2	1.00
SW-949	163	0.013	281.02	KJ-267	278.04	KJ-266	12	2161.5	2676.0	1.8	1.2	0.98
SW-950	97	0.013	277.74	KJ-266	268.57	KJ-265	12	4921.9	2675.7	9.5	0.5	0.53
SW-951	97	0.013	268.27	KJ-265	256.71	KJ-264	12	5531.8	2675.8	12.0	0.5	0.75
SW-952	26	0.013	256.11	KJ-264	255.38	KJ-263	12	2677.8	2696.2	2.8	1.0	1.00

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Conduit Parameters and 25-Year Storm Event Results

Conduit ID	LENGTH (ft)	Manning's N	Upstream Invert (ft)	Upstream Node ID	Downstream Invert (ft)	Downstream Node ID	Max Depth (ft)	25-Year Storm Event Full Flow (gpm)	Maximum Flow	Percent Slope (%)	Max.Flow/ Full Flow	Max.Depth/ Full Depth
SW-953	60	0.013	254.98	KJ-263	254.26	KJ-262	12	1757.2	2727.2	1.2	1.6	1.00
SW-954	57	0.013	254.06	KJ-262	253.29	KJ-261	12	1864.9	2754.2	1.4	1.5	0.98
SW-955	361	0.013	252.99	KJ-261	251.13	KJ-260	18	3383.4	2675.4	0.5	0.8	0.66
SW-956	244	0.013	250.93	KJ-260	249.69	KJ-259	18	3359.9	2675.3	0.5	0.8	0.66
SW-957	259	0.013	249.54	KJ-259	248.33	KJ-258	18	3222.7	2675.2	0.5	0.8	0.67
SW-958	112	0.013	248.03	KJ-258	247.09	G9-16	18	4328.0	2675.2	0.8	0.6	0.57
SW-961	120	0.013	287.13	KJ-255	275.45	KJ-254	12	5005.6	2391.8	9.8	0.5	0.49
SW-962	150	0.013	275.25	KJ-254	264.21	G9-20	12	4341.6	2391.7	7.4	0.6	0.55
SW-963	204	0.030	193.34	G9-18	168.34	G9-4	0	48271.0	14370.2	12.4	0.3	0.41
SW-964	41	0.030	35.30	KJ-270	30.97	KJ-271	0	#########	42190.8	10.7	0.0	0.14
SW-965	58	0.030	33.52	KJ-271	29.42	KJ-272	0	8911917.0	41957.5	7.1	0.0	0.13
SW-966	39	0.030	31.79	KJ-272	28.17	KJ-273	0	#########	41899.6	9.4	0.0	0.14
SW-967	39	0.030	30.85	KJ-273	27.31	KJ-274	0	#########	41847.0	9.2	0.0	0.13
SW-968	36	0.030	29.71	KJ-274	26.21	KJ-275	0	#########	41800.4	9.9	0.0	0.12
SW-969	53	0.030	28.34	KJ-275	24.58	KJ-276	0	8939560.0	41752.5	7.2	0.0	0.16
SW-970	62	0.030	27.53	KJ-276	23.46	I10-154	0	8550136.0	43854.0	6.6	0.0	0.20

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

Storage Parameters and 25-Year Storm Event Results

ID	Invert Elevation (ft)	Maximum Depth (ft)	25-Year Storm Event	
			Total Inflow Volume (MG)	Average Percent Full (%)
I11-37ST	62	6	0.00	0
I11-39S	64	6	0.00	0
I11-40S	52	6	0.00	0
STOR-10	176	6	0.59	14
STOR-16	161	4	0.07	23
STOR-22	161	4	0.57	10
STOR-24	167	4	0.24	9
STOR-26	172	6	1.04	11
STOR-27	119	4	5.22	18
STOR-28	117	4	1.19	7
STOR-29	92	3	8.17	46
STOR-30	66	6	4.10	12

Appendix H

Capital Improvement Plan

KELLER ASSOCIATES

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060-001

CIP Summary Table

Priority	Project Description	Estimated Cost	SDC Eligibility	SDC Improvement Amount	City Amount
Priority 1 Improvements					
1A	Campbell Park Detention Pond (Milton Creek)	$300,000	0%	$0	$300,000
1B	Columbia Boulevard Detention Pond (Milton Creek)	$1,100,000	66%	$727,000	$373,000
1C	Columbia Boulevard Upsize (Milton Creek)	$2,800,000	14%	$392,000	$2,408,000
1D	Middle Trunk Detention Ponds and Piping	$2,000,000	5%	$103,000	$1,897,000
1E	Upsize and Realign Tualatin Street (Middle Trunk)	$5,000,000	14%	$677,000	$4,323,000
1F	Detention Pond and Piping Between N 12th and N 7th Street (North Trunk)	$1,600,000	17%	$269,000	$1,331,000
1G	Ridgeway Loop Pipe Installation	$60,000	0%	$0	$60,000
	Total Priority 1 Improvement Costs	$12,900,000	-	$2,200,000	$10,700,000
Priority 2 Improvements					
2A	Upsize Pipes along West Street and N 10th Street (North Trunk)	$1,400,000	0%	$0	$1,400,000
2B	S 4th Street to Outfall CCTV Inspection (Downtown)	$20,000	0%	$0	$20,000
2C	Heinie Huemann Park Detention Pond (Greenway)	$200,000	26%	$52,000	$148,000
2D	Upsize from S 20th Street to Heinie Huemann Park (Greenway)	$1,100,000	29%	$318,000	$782,000
2E	Nob Hill Park CIP lining (Greenway)	$400,000	0%	$0	$400,000
2F	Franz Street (Milton Creek)	$400,000	0%	$0	$400,000
2G	Mayfair Drive CIP lining and Upsize (Milton Creek)	$400,000	0%	$0	$400,000
2H	Riverfront Development Stormwater Infrastructure	$3,300,000	100%	$3,300,000	$0
2I	Industrial Business Park Stormwater Infrastructure	$8,600,000	100%	$8,600,000	$0
2J	S 16th Street to Old Portland Road Upsize (Greenway)	$500,000	0%	$0	$500,000
2K	Stormwater Master Plan Update	$200,000	0%	$0	$0
	Total Priority 2 Improvement Costs	$16,500,000	-	$12,300,000	$4,100,000
Priority 3 Improvements					
3A	Upsize N 13th Street to West Street (North Trunk)	$200,000	0%	$0	$200,000
3B	Upsize from 6th Street Ball Park to N 10th Street (North Trunk)	$900,000	0%	$0	$900,000
3C	Upsize Milton Way at Street Helens Street (North Trunk)	$600,000	75%	$450,000	$150,000
3D	Upsize N 7th Street from Columbia Boulevard to Trunkline (North Trunk)	$400,000	0%	$0	$400,000
3E	Upsize N 4th Street south of West Street (North Trunk)	$1,400,000	0%	$0	$1,400,000
3F	Upsize and Regrade along S 14th Street (Middle Trunk)	$600,000	50%	$298,000	$302,000
3G	Upsize existing pipes from Heinie Huemann to Tualatin Street (Middle Trunk)	$400,000	0%	$0	$400,000
3H	Street Helens Street to South 4th Street Upsizing (Downtown)	$500,000	0%	$0	$500,000
3I	S 4th Street to Outfall Pipe Upsizing (Downtown)	$2,400,000	0%	$0	$2,400,000
3J	Crouse Way Upsize (Milton Creek)	$1,000,000	14%	$137,000	$863,000
3K	Eilertson Street (Milton Creek)	$100,000	0%	$0	$100,000
3L	N Vernonia Road from Oakwood to Ava Court (Milton Creek)	$400,000	0%	$0	$400,000
3M	Ethan Lane Upsizing (Milton Creek)	$600,000	0%	$0	$600,000
3N	Sunset Boulevard to Outfall Upsize (Milton Creek)	$800,000	0%	$0	$800,000
3O	Sunset Boulevard, Trillium Street and Salmon Street upsize (Milton Creek)	$1,100,000	0%	$0	$1,100,000
3P	Sykes Road Upsize from Columbia Boulevard to Outfall (McNulty Creek)	$2,700,000	0%	$0	$2,700,000
3Q	McBride Street Upsize (McNulty Creek)	$600,000	0%	$0	$600,000
3R	Port Avenue Upsize (McNulty Creek)	$900,000	0%	$0	$900,000
3S	Whitetail Avenue Upsize (McNulty Creek)	$800,000	0%	$0	$800,000
3T	Sykes Road Cuvert near Mountain View Drive Upsize (McNulty Creek)	$80,000	0%	$0	$80,000
	Total Priority 3 Improvement Costs	$16,500,000	-	$900,000	$15,600,000
	Total Capital Improvement Costs	$45,900,000	-	$15,400,000	$30,400,000

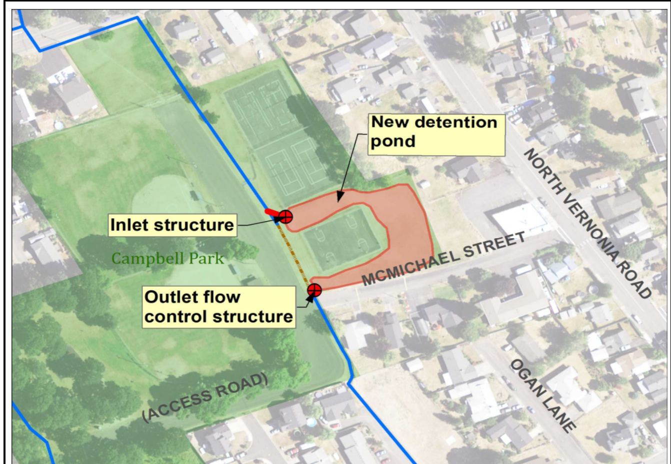
The cost estimate herin is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, 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 cost presented herein.

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Campbell Park Detention Pond (Milton Creek)

Location: Campbell Park



Project Identifier: 1A

Objective: Construct a new 2.0 acre-feet detention pond to reduce peak flows during the 25-year storm event and reduce required upsizing along Columbia Boulevard.

Design Considerations:

- Construct pond with appropriate freeboard (minimum one foot).

- Consider implementing water treatment features (not included in cost estimates). Adding water quality topsoil and plantings and sizing orificies to retain 1/2 the 2-year storm event could be an relatively easy addition to this facility.

SDC Eligibility: 0%

Item	Unit	Unit Price	Est. Qty	Cost (2021)
24-inch Pipe - Excavation, Backfill	LF	$205	40	$8,200
Concrete Outlet Flow Control Structure, 60-inch	EA	$15,000	1	$15,000
Hydroseeding, Planting, and Other Restoration Features	AC	$5,000	0.7	$3,500
Berm Construction	LF	$30	1,030	$30,900
Detention Pond Excavation, removal, and grading	CY	$31	3,200	$99,200
			Subtotal (Rounded)	**$157,000**
Mobilization	LS	5%	1	$7,850
Contingency	LS	30%	1	$47,100
			Construction Subtotal (Rounded)	**$212,000**
Permitting	LS	$5,000	1	$5,000
Geotechnical (Assumes 8% of total)	LS	$17,000	1	$17,000
Surveying	LS	$10,000	1	$10,000
Engineering and CMS	LS	20%	1	$42,400
Legal and Admin	LS	$8,000	1	$8,000
			Total Project Cost (Rounded)	**$300,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Columbia Boulevard Detention Pond (Milton Creek)

Project Identifier: 1B

Objective: Construct a new 2.0 acre-feet detention pond to reduce peak flows during the 25-year storm event and reduce required upsizing along Columbia Boulevard.

Design Considerations:

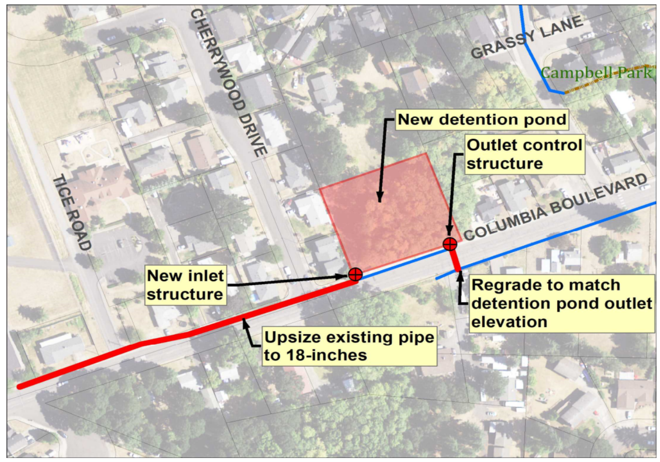
- Construct pond with appropriate freeboard (minimum one foot) during 25-year storm event and approximate storage volume of 2.0 acre-feet.

- Consider implementing water treatment features (not included in cost estimates).

- Must purchase private property north of Columbia Boulevard.

SDC Eligibility: 66%

Location: Columbia Boulevard and Cherrywood Drive



Item	Unit	Unit Price	Est. Qty	Cost (2021)
18-inch Pipe - Excavation, Backfill	LF	$185	710	$131,350
48-Inch, Standard Manhole	EA	$8,000	3	$24,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	4	$14,000
Pond Clearing, Grubbing, and Earthwork as Necessary	LS	$10,000	1	$10,000
Concrete Outlet Flow Control Structure, Ditch Inlet	EA	$15,000	1	$15,000
Berm Construction	LF	$30	400	$12,000
Rock Excavation	CY	$300	216	$64,804
Roadway Restoration (Half Lane)	LF	$45	710	$31,950
Traffic Control With Flagging	LS	$20,000	1	$20,000
Existing Utility Protection	LF	$4	710	$2,840
ADA Ramp Reconstruction (Compliance)	EA	$4,600	5	$23,000
			Subtotal (Rounded)	**$349,000**
Mobilization	LS	5%	1	$17,450
Contingency	LS	30%	1	$104,700
			Construction Subtotal (Rounded)	**$471,000**
Property Acquisition	SF	$10	43,000	$430,000
Permitting (Field work, JPA, and application. Assumes SLOPES V)	LS	$50,000	1	$50,000
Geotechnical (assume 8% of total)	LS	$38,000	1	$38,000
Surveying	LS	$10,000	1	$10,000
Engineering and CMS	LS	20%	1	$94,200
Legal and Admin	LS	$15,000	1	$15,000
			Total Project Cost (Rounded)	**$1,100,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Columbia Boulevard Upsize (Milton Creek)	**Location:** Columbia Boulevard from Alderwood Court to Milton Creek

Project Identifier: 1C

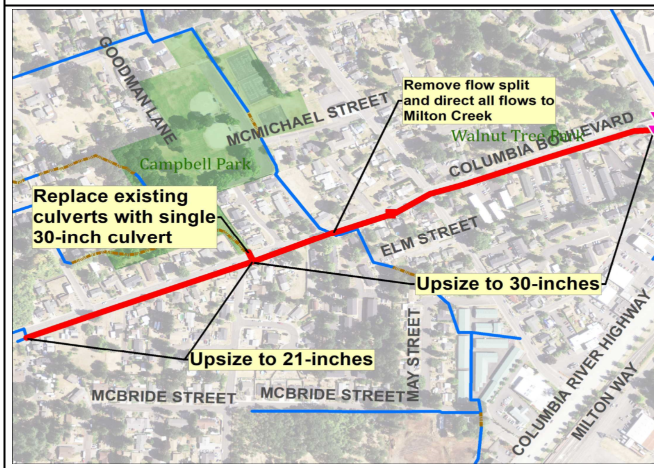
Objective: Upsize the existing pipes along Columbia Boulevard and eliminate flow split with McNulty Creek Basin

Design Considerations:

- Environmental permitting likely necessary because improvments are recommended at the outfall.

- Confirm adequate capacity in Milton Creek to eliminate the flow split with McNulty Creek Basin.

SDC Eligibility: 14%



Item	Unit	Unit Price	Est. Qty	Cost (2021)
21-inch Pipe - Excavation, Backfill	LF	$195	1,020	$198,900
30-inch Pipe - Excavation, Backfill	LF	$230	1,800	$414,000
60-Inch, Standard Manhole	EA	$14,000	3	$42,000
72-Inch, Standard Manhole	EA	$16,500	5	$82,500
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	16	$56,000
Outfall Restoration	EA	$6,000	1	$6,000
Rock Excavation	CY	$300	1,717	$515,178
Roadway Restoration (Half Lane)	LF	$45	2,820	$126,900
Traffic Control - With Flagging	LF	$70,000	1	$70,000
Existing Utility Protection	LF	$4	2,820	$11,280
ADA Ramp Reconstruction (Compliance)	EA	$4,600	22	$101,200
			Subtotal (Rounded)	**$1,624,000**
Mobilization	LS	5%	1	$81,200
Contingency	LS	30%	1	$487,200
			Construction Subtotal (Rounded)	**$2,192,000**
Permitting (Field work, JPA, and application. Assumes SLOPES V)	LS	$50,000	1	$50,000
Geotechnical (Assume 4% of total)	LS	$88,000	1	$88,000
Surveying	LS	$30,000	1	$30,000
Engineering and CMS	LS	20%	1	$438,400
Legal and Admin	LS	$10,000	1	$10,000
			Total Project Cost (Rounded)	**$2,800,000**

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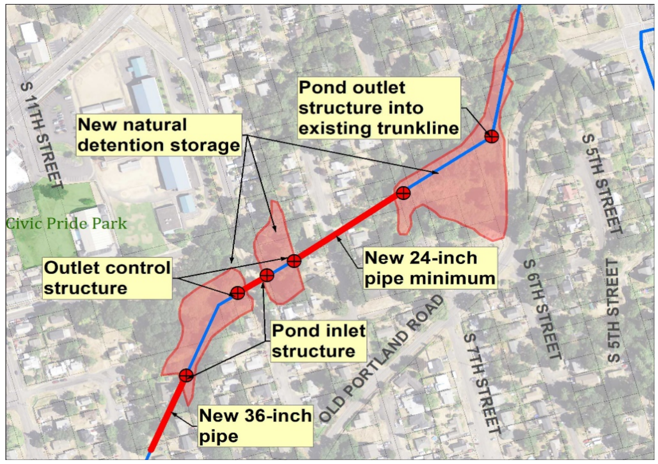
Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Middle Trunk Detention Ponds and Piping

Location: Middle Trunk From Cowlitz Street to South 4th Street



Project Identifier: 1D

Objective: Improve natural detention within the Middle Trunk Basin to hold approximately 14 acre-feet of storage and reduce peak flows in the 25-year storm event

Design Considerations:

- Utilize natural detention within Middle Trunk Ravine. Purchase property as necessary.

- Abandon existing 18-inch pipes draining through each storage location

- Detailed analysis on any existing wetland impacts within proposed storage locations.

SDC Eligibility: 5%

Item	Unit	Unit Price	Est. Qty	Cost (2021)
24-inch Pipe - Excavation, Backfill	LF	$205	430	$88,150
36-inch Pipe - Excavation, Backfill	LF	$245	300	$73,500
60-Inch, Standard Manhole	EA	$14,000	1	$14,000
72-Inch, Standard Manhole	EA	$16,500	1	$16,500
Abandonment of existing pipeline	LF	$25	800	$20,000
Pond Clearing, Grubbing, and Earthwork as Necessary	LS	$24,000	1	$24,000
Concrete Outlet Flow Control Structure, Grated Inlet	EA	$15,000	3	$45,000
Berm Construction	LF	$30	490	$14,700
Rock Excavation	CY	$300	541	$162,333
Roadway Restoration (Full Lane)	LF	$75	50	$3,750
Traffic Control With Flagging	LS	$1,000	1	$1,000
Soil Surface Repair, Seeding, and Stabilization	LF	$5	680	$3,400
Existing Utility Protection	LF	$4	730	$2,920
			Subtotal (Rounded)	**$469,300**
Mobilization	LS	5%	1	$23,465
Contingency	LS	30%	1	$140,790
			Construction Subtotal (Rounded)	**$633,600**
Property Acquisition	SF	$10	106,000	$1,060,000
Permitting (Field work, JPA, and application. Assumes SLOPES V)	LS	$30,000	1	$30,000
Geotechnical (Assume 4% of total)	LS	$25,000	1	$25,000
Surveying	LS	$50,000	1	$50,000
Engineering and CMS	LS	20%	1	$126,720
Wetland Hydroperiod and Ecological Assessment	LS	$20,000	1	$20,000
Legal and Admin	LS	$15,000	1	$15,000
			Total Project Cost (Rounded)	**$2,000,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Upsize and Realign Tualatin Street (Middle Trunk)

Location: Tualatin Street to South 11th Street

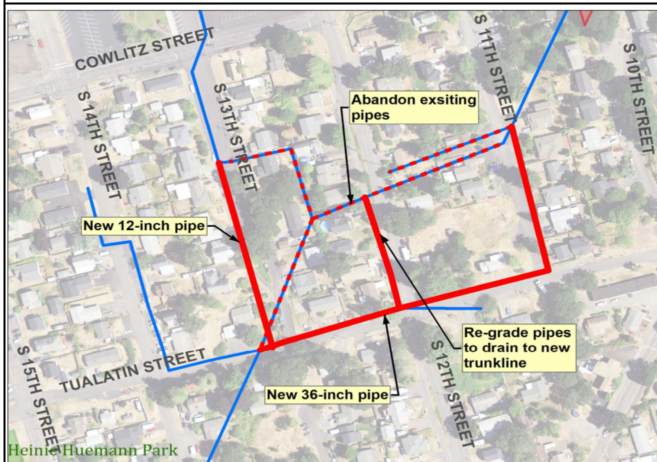
Project Identifier: 1E

Objective: Abandon existing pipes and install a new trunkline from Tualatin St. to new detention pond

Design Considerations:

-Existing pipelines to be abandoned may be underneath existing structures.

SDC Eligibility: 14%



Item	Unit	Unit Price	Est. Qty	Cost (2021)
12-inch Pipe - Excavation, Backfill	LF	$160	720	$115,200
36-inch Pipe - Excavation, Backfill	LF	$245	970	$237,650
48-Inch, Standard Manhole	EA	$8,000	2	$16,000
72-Inch, Standard Manhole	EA	$16,500	5	$82,500
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	14	$49,000
Abandonment of existing manholes	EA	$4,000	8	$32,000
Abandonment of existing pipeline	LF	$25	1,420	$35,500
Filling Abandoned Structures	EA	$3,000	5	$15,000
Rock Excavation	CY	$300	1,574	$472,222
Roadway Restoration (Full Lane)	LF	$75	1,690	$126,750
Existing Utility Protection	LF	$4	1,690	$6,760
Traffic Control With Flagging	LS	$96,000	1	$96,000
			Subtotal (Rounded)	**$1,285,000**
Mobilization	LS	5%	1	$64,250
Contingency	LS	30%	1	$385,500
			Construction Subtotal (Rounded)	**$2,666,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 2% of total)	LS	$53,000	1	$53,000
Surveying	LS	$17,000	1	$17,000
Engineering and CMS	LS	20%	1	$533,200
Legal and Admin	LS	$10,000	1	$10,000
			Total Project Cost (Rounded)	**$5,000,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Detention Pond and Piping Between N 12th and N 7th Street (North Trunk)

Project Identifier: 1F

Objective: Construct a 7 acre-feet detention pond to reduce peak flows during the 25-year storm event.

Design Considerations:

- Flow control structure near N. 15th Street is within designated wetlands. Removal and fill permit likely required.

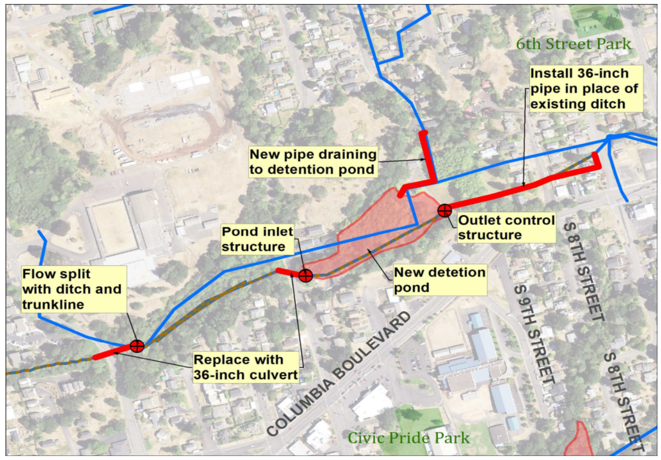
- Berms should be constructed as needed to protect existing structures nearby the detention pond.

- A detailed survey should be completed to confirm the capacity of the proposed detention pond area.

- Consider phasing project as needed.

SDC Eligibility: 17%

Location: North 15th to North 10th Street



Item	Unit	Unit Price	Est. Qty	Cost (2021)
30-inch Pipe - Excavation, Backfill	LF	$230	420	$96,600
36-inch Pipe - Excavation, Backfill	LF	$245	740	$181,300
36-inch Culvert - Excavation, Backfill (>10' Depth)	LF	$384	160	$61,440
72-Inch, Standard Manhole	EA	$16,500	7	$115,500
Pond Clearing, Grubbing, and Earthwork as Necessary	LS	$15,000	1	$15,000
Berm Construction	LF	$30	470	$14,100
Concrete Outlet Flow Control Structure, 72-inch	EA	$15,000	1	$15,000
Flow Control Manhole	EA	$15,000	1	$15,000
Soil Surface Repair, Seeding, and Stabilization	LF	$5	420	$2,100
Rock Excavation	CY	$300	210	$63,000
Roadway Restoration (Full Lane)	LF	$75	320	$24,000
Traffic Control With Flagging	LS	$25,000	1	$25,000
Existing Utility Protection	LF	$4	1,320	$5,280
ADA Ramp Reconstruction (Compliance)	EA	$4,600	2	$9,200
			Subtotal (Rounded)	**$643,000**
Mobilization	LS	5%	1	$32,150
Contingency	LS	30%	1	$192,900
			Construction Subtotal (Rounded)	**$868,000**
Property Acquisition	SF	$10	43,560	$435,600
Permitting (Field work, JPA, and application. Assumes SLOPES V)	LS	$50,000	1	$50,000
Geotechnical (assume 8% of total)	LS	$69,000	1	$69,000
Surveying	LS	$13,000	1	$13,000
Engineering and CMS	LS	20%	1	$173,600
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$1,600,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Ridgeway Loop Pipe Installation	**Location:** 59995 Ridgeway Loop

Project Identifier: 1G

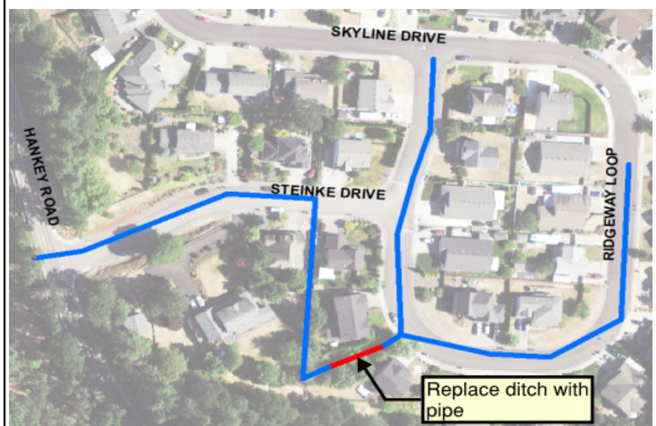
Objective: Install a 12-inch pipe in place of an existing ditch/grassy swale to alleviate flooding of nearby properties.

Design Considerations:

- Replace existing inlet/outlets with manholes.

- Existing ditch/grassy swale will be filled in.

SDC Eligibility: 0%



Item	Unit	Unit Price	Est. Qty	Cost (2021)
12-inch Pipe - Excavation, Backfill	LF	$160	100	$16,000
48-Inch, Standard Manhole	EA	$8,000	2	$16,000
Soil Surface Repair, Seeding, and Stabilization	LF	$5	100	$500
Existing Utility Protection	LF	$4	100	$400
			Subtotal (Rounded)	**$33,000**
Mobilization	LS	5%	1	$1,650
Contingency	LS	30%	1	$9,900
			Construction Subtotal (Rounded)	**$45,000**
Permitting	LS	$0	1	$0
Geotechnical (Assume 2% of total)	LS	$0	1	$0
Surveying	LS	$1,000	1	$1,000
Engineering and CMS	LS	20%	1	$9,000
Legal and Admin	LS	$2,000	1	$2,000
			Total Project Cost (Rounded)	**$60,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Upsize Pipes along West Street and N 10th Street (North Trunk)

Project Identifier: 2A

Objective: Upsize existing pipes along West Street and North 10th Street

Design Considerations:

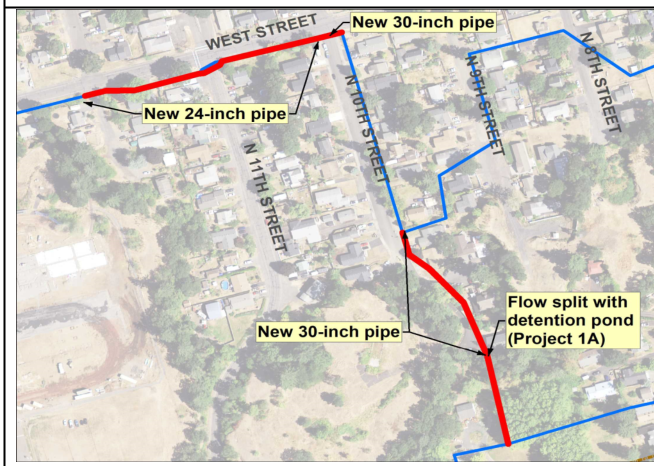
- Protect existing 26"x42" arch pipe along North 10th Street.

- Coordinate with CIP Project 1A to determine flow split south of 10th Street.

- Re-grade pipes along West Street to maintain mimimum cover with upsized pipes and use reinforced piping material.

SDC Eligibility: 0%

Location: West Street and North 10th Street



Item	Unit	Unit Price	Est. Qty	Cost (2021)
24-inch Pipe - Excavation, Backfill	LF	$205	600	$123,000
30-inch Pipe - Excavation, Backfill	LF	$230	420	$96,600
60-Inch, Standard Manhole	EA	$14,000	3	$42,000
72-Inch, Standard Manhole	EA	$16,500	3	$49,500
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	12	$42,000
Flow Control Manhole	EA	$15,000	1	$15,000
Rock Excavation	CY	$300	581	$174,304
Roadway Restoration (Half Lane)	LF	$45	760	$34,200
Rock Excavation	CY	$300	581	$174,304
Soil Surface Repair, Seeding, and Stabilization	LF	$5	260	$1,300
Traffic Control With Flagging	LS	$36,000	1	$36,000
Existing Utility Protection	LF	$4	1,020	$4,080
ADA Ramp Reconstruction (Compliance)	EA	$4,600	10	$46,000
			Subtotal (Rounded)	**$838,000**
Mobilization	LS	5%	1	$41,900
Contingency	LS	30%	1	$251,400
			Construction Subtotal (Rounded)	**$1,131,000**
Permitting	LS	$5,000	1	$5,000
Geotechnical (Assume 4% of total)	LS	$45,000	1	$45,000
Surveying	LS	$10,000	1	$10,000
Engineering and CMS	LS	20%	1	$226,200
Legal and Admin	LS	$8,000	1	$8,000
			Total Project Cost (Rounded)	**$1,400,000**

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Item #3.

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: S 4th Street to Outfall CCTV Inspection (Downtown)

Project Identifier: 2B

Objective: Determine condition of existing pipelines within the Downtown Basin

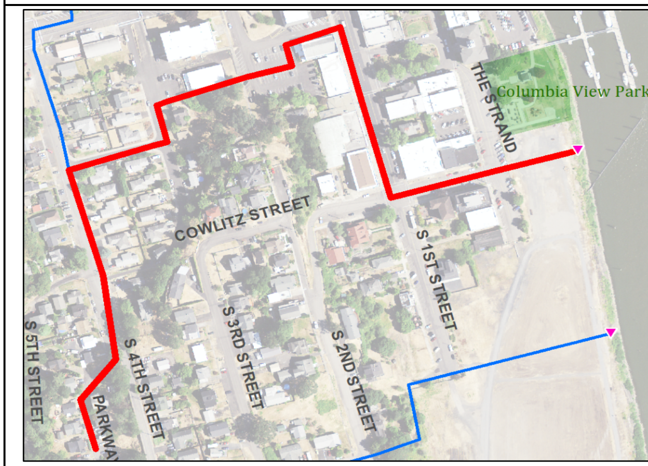
Design Considerations:

- Capacity of the trunkline should be evaluated futher if improvements are needed based on the inspection.

- SWMP CIP Project 3I should be considered if pipes are in poor condition and in need of replacement

SDC Eligibility: 0%

Location: South 4th Street to Cowlitz Street and Outfall



Item	Unit	Unit Price	Est. Qty	Cost (2021)
Cleaning and CCTV Pipelines	LF	$3	2,890	$8,670
			Subtotal (Rounded)	**$9,000**
Mobilization	LS	5%	1	$450
Contingency	LS	30%	1	$2,700
			Construction Subtotal (Rounded)	**$12,000**
Permitting	LS	$0	1	$0
Geotechnical (Assume 2% of total)	LS	$0	1	$0
Surveying	LS	$0	1	$0
Engineering and CMS	LS	20%	1	$2,400
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$20,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Heinie Huemann Park Detention Pond (Greenway)

Project Identifier: 2C

Objective: Improve detention at Heinie Huemann Park by restricting downstream flows to back up water during the 25-year storm event to hold about 1.7 acre-feet of storage.

Design Considerations:

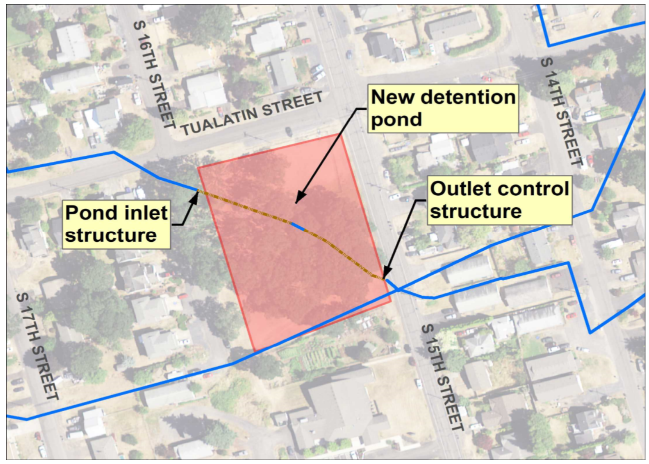
- Install sediment forebay to prevent clogging at the pond outlet and concentrate sediment build-up to assist with maintenance.

- Consider water quality features.

- Minimal improvements needed because the park currently acts as a detention pond, resulting in higher percentage of engineering and CMS costs.

SDC Eligibility: 26%

Location: Heinie Huemann Park



Item	Unit	Unit Price	Est. Qty	Cost (2021)
Pond Clearing, Grubbing, and Earthwork as Necessary	LS	$20,000	1	$20,000
Concrete Outlet Flow Control Structure, 60-inch	EA	$15,000	1	$15,000
Berm Construction	LF	$30	500	$15,000
Sediment Forebay	EA	$20,000	1	$20,000
			Subtotal (Rounded)	**$70,000**
Mobilization	LS	5%	1	$3,500
Contingency	LS	30%	1	$21,000
			Construction Subtotal (Rounded)	**$95,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 8% of total)	LS	$8,000	1	$8,000
Surveying	LS	$15,000	1	$15,000
Engineering and CMS	LS	40%	1	$38,000
Legal and Admin	LS	$8,000	1	$8,000
			Total Project Cost (Rounded)	**$200,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Upsize from S 20th Street to Heinie Huemann Park (Greenway)

Project Identifier: 2D

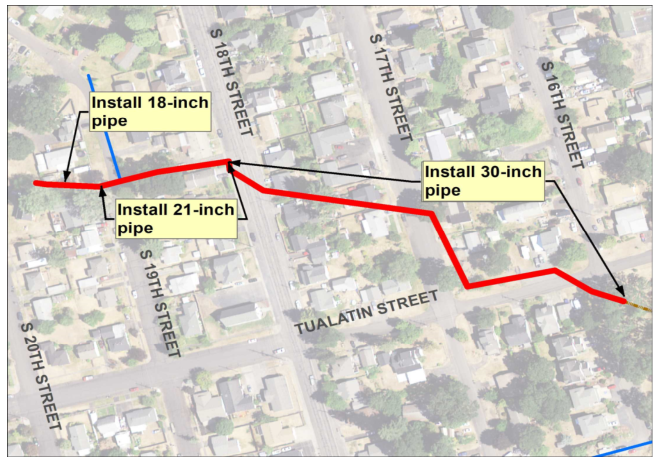
Objective: Upsize existing trunkline from South 19th Street to Heinie Huemann Park

Design Considerations:

- Assumes existing pipes are not located beneath existing structures

SDC Eligibility: 29%

Location: South 19th Street to Heinie Hueman Park



Item	Unit	Unit Price	Est. Qty	Cost (2021)
18-inch Pipe - Excavation, Backfill	LF	$185	120	$22,200
21-inch Pipe - Excavation, Backfill	LF	$195	230	$44,850
30-inch Pipe - Excavation, Backfill	LF	$230	840	$193,200
48-Inch, Standard Manhole	EA	$8,000	1	$8,000
60-Inch, Standard Manhole	EA	$14,000	6	$84,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	8	$28,000
Rock Excavation	CY	$300	782	$234,672
Roadway Restoration (Full Lane)	LF	$75	280	$21,000
Soil Surface Repair, Seeding, and Stabilization	LF	$5	910	$4,550
Existing Utility Protection	LF	$4	1,190	$4,760
Traffic Control With Flagging	LS	$37,000	1	$37,000
			Subtotal (Rounded)	**$682,000**
Mobilization	LS	5%	1	$34,100
Contingency	LS	30%	1	$204,600
			Construction Subtotal (Rounded)	**$921,000**
Permitting	LS	$10,000	1	$10,000
Surveying	LS	$12,000	1	$12,000
Engineering and CMS	LS	20%	1	$184,200
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$1,100,000**

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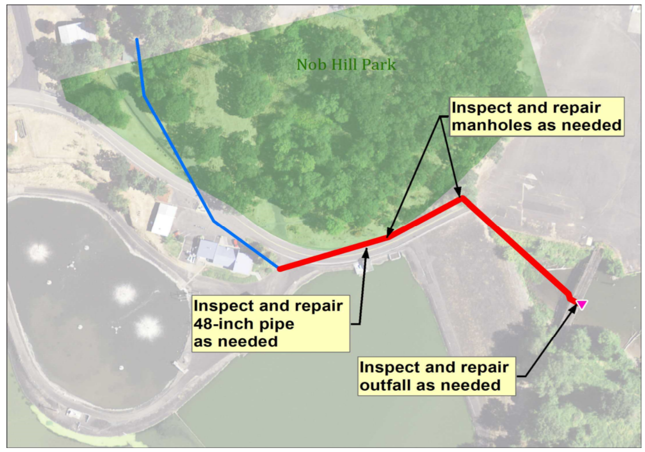
Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Nob Hill Park CIP lining (Greenway)

Location: Near Nob Hill Park



Project Identifier: 2E

Objective: Repair the existing 48-inch pipes along Plymouth Street near Nob Hill Park

Design Considerations:

- Inspect pipes, manholes, and outfall before improvements are made.

- Outfall pipe was submerged during 2020 survey for this project.

SDC Eligibility: 0%

Item	Unit	Unit Price	Est. Qty	Cost (2021)
Cleaning and CCTV Pipelines	LF	$3	670	$2,010
Line existing manhole (discharge manhole)	EA	$5,000	2	$10,000
48-inch, CIP Pipeline Repair	LF	$320	670	$214,400
Outfall Restoration	EA	$6,000	1	$6,000
			Subtotal (Rounded)	**$232,000**
Mobilization	LS	5%	1	$11,600
Contingency	LS	30%	1	$69,600
			Construction Subtotal (Rounded)	**$313,000**
Permitting (Field work, JPA, and application. Assumes SLOPES V)	LS	$50,000	1	$50,000
Surveying	LS	$5,000	1	$5,000
Engineering and CMS	LS	20%	1	$62,600
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$400,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Franz Street (Milton Creek)

Project Identifier: 2F

Objective: Upsize existing pipelines along Edie's Way and culvert under Alderwood Court

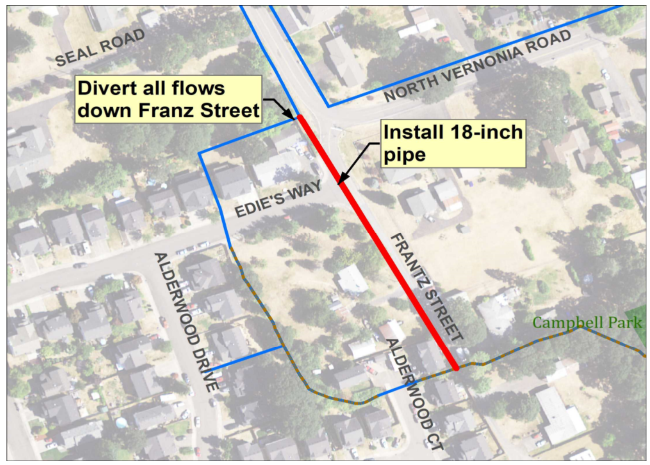
Design Considerations:

- Inspect open channel between Edie's Way and Alderwood Court and improve as needed.

- Consider arch culvert under Alderwood Court if not enough cover can be achieved.

SDC Eligibility: 0%

Location: Edie's Way and Alderwood Court



Item	Unit	Unit Price	Est. Qty	Cost (2021)
18-inch Pipe - Excavation, Backfill	LF	$185	470	$86,950
48-Inch, Standard Manhole	EA	$8,000	3	$24,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	4	$14,000
Outfall Restoration	EA	$6,000	1	$6,000
Rock Excavation	CY	$300	152	$45,694
Roadway Restoration (Half Lane)	LF	$45	470	$21,150
Existing Utility Protection	LF	$4	470	$1,880
Traffic Control With Flagging	LS	$13,539	1	$13,539
Existing Utility Protection	LF	$4	470	$1,880
			Subtotal (Rounded)	**$215,000**
Mobilization	LS	5%	1	$10,750
Contingency	LS	30%	1	$64,500
			Construction Subtotal (Rounded)	**$290,000**
Permitting	LS	$5,000	1	$5,000
Geotechnical (Assume 4% of total)	LS	$12,000	1	$12,000
Surveying	LS	$4,700	1	$4,700
Engineering and CMS	LS	20%	1	$58,000
Legal and Admin	LS	$2,000	1	$2,000
			Total Project Cost (Rounded)	**$400,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Mayfair Drive CIP lining and Upsize (Milton Creek)

Project Identifier: 2G

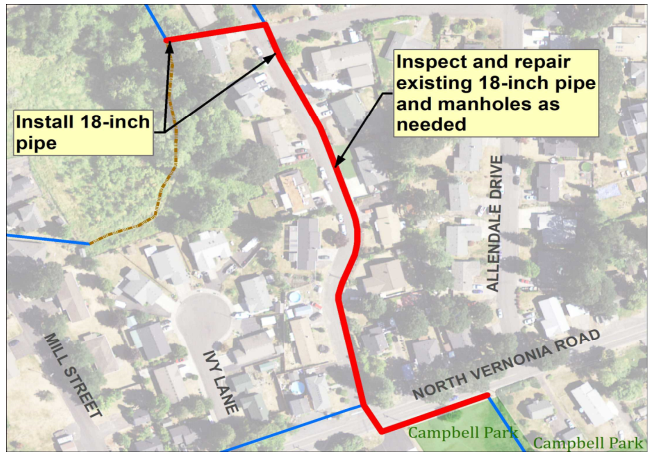
Objective: Upsize pipes draining to Mayfair Drive and CIP line the existing 18-inch pipes.

Design Considerations:

- Inspect pipes and manholes along Mayfair Drive before improvements are made

SDC Eligibility: 0%

Location: Mayfair Drive



Item	Unit	Unit Price	Est. Qty	Cost (2021)
18-inch Pipe - Excavation, Backfill	LF	$185	200	$37,000
48-Inch, Standard Manhole	EA	$8,000	2	$16,000
Concrete Inlet, Standard Side Inlet	EA	$2,100	1	$2,100
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	2	$7,000
Rock Excavation	CY	$300	61	$18,255
Roadway Restoration (Full Lane)	LF	$75	120	$9,000
Existing Utility Protection	LF	$4	200	$800
Cleaning and CCTV Pipelines	LF	$3	860	$2,580
Line existing manhole (discharge manhole)	EA	$5,000	5	$25,000
18-inch, CIP Pipeline Repair	LF	$110	860	$94,600
Traffic Control With Flagging	LS	$8,000	1	$8,000
			Subtotal (Rounded)	**$220,000**
Mobilization	LS	5%	1	$11,000
Contingency	LS	30%	1	$66,000
			Construction Subtotal (Rounded)	**$297,000**
Permitting (Field work, JPA, and application. Assumes SLOPES V)	LS	$50,000	1	$50,000
Geotechnical (Assume 8% of total)	LS	$24,000	1	$24,000
Surveying	LS	$12,000	1	$12,000
Engineering and CMS	LS	20%	1	$59,400
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$400,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Riverfront Development Stormwater Infrastructure

Location: Riverfront Development

Project Identifier: 2H

Objective: Install stormwater infrastructure within the proposed riverfront development.

Design Considerations:

- Coordinate with WWMP CIP Project XX.

- Project is within 100-year and 500-year floodplain.

- Assumes existing outfall pipe to be replaced with 24-inch pipe.

SDC Eligibility: 100%

Item	Unit	Unit Price	Est. Qty	Cost (2021)
18-inch Pipe - Excavation, Backfill	LF	$185	1,250	$231,250
21-inch Pipe - Excavation, Backfill	LF	$195	840	$163,800
24-inch Pipe - Excavation, Backfill	LF	$205	940	$192,700
48-Inch, Standard Manhole	EA	$8,000	5	$40,000
60-Inch, Standard Manhole	EA	$14,000	6	$84,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	36	$126,000
Outfall Restoration	EA	$6,000	2	$12,000
Roadway Restoration (Full Lane)	LF	$75	3,030	$227,250
Concrete Curbs, Curb and Gutter	LF	$50	6,060	$303,000
Rock Excavation	CY	$300	1,263	$378,750
ADA Ramp Reconstruction (Compliance)	EA	$4,600	23	$105,800
Existing Utility Protection	LF	$4	3,030	$12,120
Traffic Control With Flagging	LS	$82,000	1	$82,000
			Subtotal (Rounded)	**$1,959,000**
Mobilization	LS	5%	1	$97,950
Contingency	LS	30%	1	$587,700
			Construction Subtotal (Rounded)	**$2,645,000**
Permitting	LS	$50,000	1	$50,000
Geotechnical (Assume 4% of total)	LS	$106,000	1	$106,000
Surveying	LS	$10,000	1	$10,000
Engineering and CMS	LS	20%	1	$529,000
Legal and Admin	LS	$8,000	1	$8,000
			Total Project Cost (Rounded)	**$3,300,000**

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Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Industrial Business Park Stormwater Infrastructure	**Location:** 1300 Kaster Road
Project Identifier: 2I **Objective:** Install stormwater infrastructure within the proposed industrial business park development. **Design Considerations:** - Project is within 100-year and 500-year floodplain. - Assumes existing stormwater infrastructure is not suitable and new infrastructure will be installed throughout the development **SDC Eligibility: 100%**	

Item	Unit	Unit Price	Est. Qty	Cost (2021)
12-inch Pipe - Excavation, Backfill	LF	$160	2,900	$464,000
15-inch Pipe - Excavation, Backfill	LF	$170	1,700	$289,000
18-inch Pipe - Excavation, Backfill	LF	$185	1,000	$185,000
24-inch Pipe - Excavation, Backfill	LF	$205	500	$102,500
30-inch Pipe - Excavation, Backfill	LF	$230	2,300	$529,000
36-inch Pipe - Excavation, Backfill	LF	$245	1,700	$416,500
48-inch Pipe - Excavation, Backfill	LF	$300	500	$150,000
48-Inch, Standard Manhole	EA	$8,000	14	$112,000
60-Inch, Standard Manhole	EA	$14,000	8	$112,000
72-Inch, Standard Manhole	EA	$16,500	4	$66,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	84	$294,000
Outfall Restoration	EA	$6,000	3	$18,000
Roadway Restoration (Full Lane)	LF	$75	10,600	$795,000
Rock Excavation	CY	$300	4,700	$1,410,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	10	$46,000
Existing Utility Protection	LF	$4	10,600	$42,400
Traffic Control With Flagging	LS	$49,000	1	$49,000
			Subtotal (Rounded)	**$5,080,000**
Mobilization	LS	5%	1	$254,000
Contingency	LS	30%	1	$1,524,000
			Construction Subtotal (Rounded)	**$6,858,000**
Permitting	LS	$50,000	1	$50,000
Geotechnical (Assume 2% of total)	LS	$137,000	1	$137,000
Surveying	LS	$106,000	1	$106,000
Engineering and CMS	LS	20%	1	$1,371,600
Legal and Admin	LS	$50,000	1	$50,000
			Total Project Cost (Rounded)	**$8,600,000**

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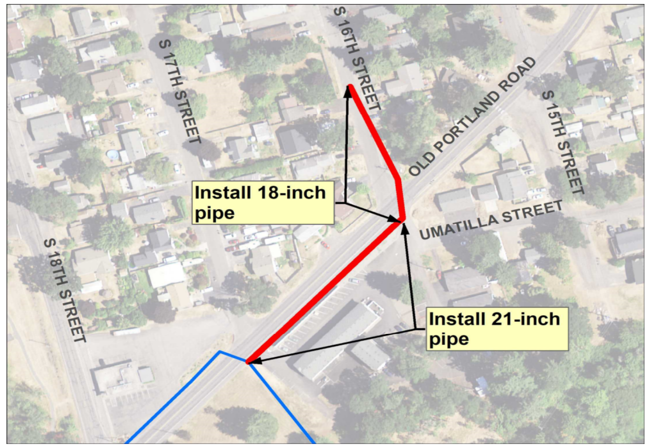
Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: S 16th Street to Old Portland Road Upsize (Greenway)	**Location:** South 16th Street to Old Portland Road
Project Identifier: 2J	
Objective: Upsize existing trunkline from South 16th Street to Old Portland Road	
Design Considerations:	
- Trenchless pipe installation could be considered.	
SDC Eligibility: 0%	

Item	Unit	Unit Price	Est. Qty	Cost (2021)
18-inch Pipe - Excavation, Backfill	LF	$185	250	$46,250
21-inch Pipe - Excavation, Backfill	LF	$195	360	$70,200
48-Inch, Standard Manhole	EA	$8,000	2	$16,000
60-Inch, Standard Manhole	EA	$14,000	2	$28,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	6	$21,000
Rock Excavation	CY	$300	210	$63,000
Roadway Restoration (Half Lane)	LF	$45	610	$27,450
Existing Utility Protection	LF	$4	610	$2,440
Traffic Control With Flagging	LS	$21,000	1	$21,000
			Subtotal (Rounded)	**$295,000**
Mobilization	LS	5%	1	$14,750
Contingency	LS	30%	1	$88,500
			Construction Subtotal (Rounded)	**$398,000**
Permitting	LS	$5,000	1	$5,000
Surveying	LS	$6,000	1	$6,000
Engineering and CMS	LS	20%	1	$79,600
Legal and Admin	LS	$3,000	1	$3,000
			Total Project Cost (Rounded)	**$500,000**

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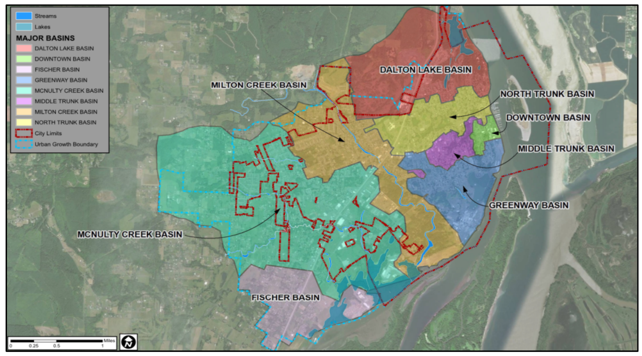
Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Title: Stormwater Master Plan Update	**Location: Whole System**
Project Identifier: 2K **Objective:** Update the stormwater master plan **Design Considerations:** - New areas built-out since previous planning studies. **SDC Eligibility: 0%**	

Item	Unit	Unit Price	Est. Qty	Cost (2021)
Stormwater Master Plan Update	LS	$200,000	1	$200,000
			Total Project Cost (Rounded)	**$200,000**

The cost estimate herin 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 cost presented herein.

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Identifier - 3A: Upsize N 13th Street to West Street (North Trunk)				
General Line Item	Unit	Unit Price	Estimated Quantity	Item Cost
21-inch Pipe - Excavation, Backfill	LF	$195	200	$39,000
48-Inch, Standard Manhole	EA	$8,000	2	$16,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	4	$14,000
Rock Excavation	CY	$300	74	$22,200
Roadway Restoration (Half Lane)	LF	$45	200	$9,000
Existing Utility Protection	LF	$4	200	$800
Traffic Control With Flagging	LS	$9,000	1	$9,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	2	$9,200
			Subtotal (Rounded)	**$119,000**
Mobilization	LS	5%	1	$6,000
Contingency	LS	30%	1	$35,700
			Construction Subtotal (Rounded)	**$161,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 4% of total)	LS	$6,000	1	$6,000
Surveying	LS	$12,000	1	$12,000
Engineering and CMS	LS	20%	1	$32,200
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$200,000**

Project Identifier - 3B: Upsize from 6th Street Ball Park to N 10th Street (North Trunk)				
General Line Item	Unit	Unit Price	Estimated Quantity	Item Cost
18-inch Pipe - Excavation, Backfill	LF	$185	350	$64,800
21-inch Pipe - Excavation, Backfill	LF	$195	860	$167,700
48-Inch, Standard Manhole	EA	$8,000	2	$16,000
60-Inch, Standard Manhole	EA	$14,000	5	$70,000
Connect to Existing Manhole	EA	$1,750	1	$1,800
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	8	$28,000
Rock Excavation	CY	$300	448	$134,400
Roadway Restoration (Full Lane)	LF	$75	390	$29,300
Soil Surface Repair, Seeding, and Stabilization	LF	$5	820	$4,100
Existing Utility Protection	LF	$4	1,210	$4,800
Traffic Control With Flagging	LS	$18,000	1	$18,000
			Construction Subtotal (Rounded)	**$539,000**
Mobilization	LS	5%	1	$27,000
Contingency	LS	30%	1	$161,700
			Construction Subtotal (Rounded)	**$728,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 4% of total)	LS	$29,000	1	$29,000
Surveying	LS	$12,000	1	$12,000
Engineering and CMS	LS	20%	1	$145,600
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$900,000**

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Identifier - 3C: Upsize Milton Way at Street Helens Street (North Trunk)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
18-inch Pipe - Excavation, Backfill	LF	$185	620	$114,700
48-Inch, Standard Manhole	EA	$8,000	4	$32,000
Connect to Existing Manhole	EA	$1,750	1	$1,800
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	6	$21,000
Rock Excavation	CY	$300	230	$68,900
Roadway Restoration (Full Lane)	LF	$75	620	$46,500
Existing Utility Protection	LF	$4	620	$2,500
Traffic Control With Flagging	LS	$22,000	1	$22,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	3	$13,800
			Construction Subtotal (Rounded)	**$323,000**
Mobilization	LS	5%	1	$16,200
Contingency	LS	30%	1	$96,900
			Construction Subtotal (Rounded)	**$436,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 4% of total)	LS	$17,000	1	$17,000
Surveying	LS	$12,000	1	$12,000
Engineering and CMS	LS	20%	1	$87,200
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$600,000**

Project Identifier - 3D: Upsize N 7th Street from Columbia Boulevard to Trunkline (North Trunk)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
21-inch Pipe - Excavation, Backfill	LF	$195	310	$60,500
60-Inch, Standard Manhole	EA	$14,000	3	$42,000
Connect to Existing Manhole	EA	$1,750	1	$1,800
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	4	$14,000
Rock Excavation	CY	$300	115	$34,400
Roadway Restoration (Full Lane)	LF	$75	310	$23,300
Existing Utility Protection	LF	$4	310	$1,200
Traffic Control With Flagging	LS	$14,000	1	$14,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	3	$13,800
			Construction Subtotal (Rounded)	**$205,000**
Mobilization	LS	5%	1	$10,300
Contingency	LS	30%	1	$61,500
			Construction Subtotal (Rounded)	**$277,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 4% of total)	LS	$11,000	1	$11,000
Surveying	LS	$12,000	1	$12,000
Engineering and CMS	LS	20%	1	$55,400
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$400,000**

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Identifier - 3E: Upsize N 4th Street south of West Street (North Trunk)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
15-inch Pipe - Excavation, Backfill	LF	$170	770	$130,900
18-inch Pipe - Excavation, Backfill	LF	$185	1,230	$227,600
48-Inch, Standard Manhole	EA	$8,000	8	$64,000
Connect to Existing Manhole	EA	$1,750	1	$1,800
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	14	$49,000
Rock Excavation	CY	$300	741	$222,200
Roadway Restoration (Full Lane)	LF	$75	940	$70,500
Existing Utility Protection	LF	$4	940	$3,800
Traffic Control With Flagging	LS	$53,000	1	$53,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	3	$13,800
			Construction Subtotal (Rounded)	**$837,000**
Mobilization	LS	5%	1	$41,900
Contingency	LS	30%	1	$251,100
			Construction Subtotal (Rounded)	**$1,130,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 4% of total)	LS	$45,000	1	$45,000
Surveying	LS	$12,000	1	$12,000
Engineering and CMS	LS	20%	1	$226,000
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$1,400,000**

Project Identifier - 3F: Upsize and Regrade along S 14th Street (Middle Trunk)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
18-inch Pipe - Excavation, Backfill	LF	$185	700	$129,500
48-Inch, Standard Manhole	EA	$8,000	5	$40,000
Connect to Existing Manhole	EA	$1,750	1	$1,800
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	6	$21,000
Rock Excavation	CY	$300	259	$77,800
Roadway Restoration (Full Lane)	LF	$75	700	$52,500
Existing Utility Protection	LF	$4	700	$2,800
Traffic Control With Flagging	LS	$26,000	1	$26,000
			Construction Subtotal (Rounded)	**$351,000**
Mobilization	LS	5%	1	$17,600
Contingency	LS	30%	1	$105,300
			Construction Subtotal (Rounded)	**$474,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 4% of total)	LS	$19,000	1	$19,000
Surveying	LS	$12,000	1	$12,000
Engineering and CMS	LS	20%	1	$94,800
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$600,000**

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Identifier - 3G: Upsize existing pipes from Heinie Huemann to Tualatin Street (Middle Trunk)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
15-inch Pipe - Excavation, Backfill	LF	$170	650	$110,500
48-Inch, Standard Manhole	EA	$8,000	3	$24,000
Connect to Existing Manhole	EA	$1,750	1	$1,800
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	4	$14,000
Rock Excavation	CY	$300	241	$72,200
Roadway Restoration (Full Lane)	LF	$75	110	$8,300
Soil Surface Repair, Seeding, and Stabilization	LF	$5	540	$2,700
Existing Utility Protection	LF	$4	650	$2,600
Traffic Control With Flagging	LS	$10,000	1	$10,000
			Construction Subtotal (Rounded)	**$246,000**
Mobilization	LS	5%	1	$12,300
Contingency	LS	30%	1	$73,800
			Construction Subtotal (Rounded)	**$332,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 4% of total)	LS	$13,000	1	$13,000
Surveying	LS	$12,000	1	$12,000
Engineering and CMS	LS	20%	1	$66,400
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$400,000**

Project Identifier - 3H: Street Helens Street to South 4th Street Upsizing (Downtown)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
18-inch Pipe - Excavation, Backfill	LF	$185	460	$85,100
48-Inch, Standard Manhole	EA	$8,000	3	$24,000
Concrete Inlet, Standard Side Inlet	EA	$2,100	1	$2,100
Connect to Existing Manhole	EA	$1,750	1	$1,800
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	4	$14,000
Rock Excavation	CY	$300	170	$51,100
Roadway Restoration (Full Lane)	LF	$75	460	$34,500
Existing Utility Protection	LF	$4	460	$1,800
Traffic Control With Flagging	LS	$16,000	1	$16,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	8	$36,800
			Construction Subtotal (Rounded)	**$267,000**
Mobilization	LS	5%	1	$13,400
Contingency	LS	30%	1	$80,100
			Construction Subtotal (Rounded)	**$361,000**
Permitting	LS	$10,000	1	$10,000
Geotechnical (Assume 4% of total)	LS	$14,000	1	$14,000
Surveying	LS	$12,000	1	$12,000
Engineering and CMS	LS	20%	1	$72,200
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	**$500,000**

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Identifier - 3I: S 4th Street to Outfall Pipe Upsizing (Downtown)				
General Line Item	Unit	Unit Price	Estimated Quantity	Item Cost
18-inch Pipe - Excavation, Backfill	LF	$185	150	$27,800
21-inch Pipe - Excavation, Backfill	LF	$195	720	$140,400
30-inch Pipe - Excavation, Backfill	LF	$230	2,020	$464,600
48-Inch, Standard Manhole	EA	$8,000	1	$8,000
60-Inch, Standard Manhole	EA	$14,000	11	$154,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	28	$98,000
Outfall Restoration	EA	$6,000	1	$6,000
Rock Excavation	CY	$300	572	$171,600
Roadway Restoration (Half Lane)	LF	$45	2,890	$130,100
Traffic Control With Flagging	LS	$82,000	1	$82,000
Existing Utility Protection	LF	$4	2,890	$11,600
ADA Ramp Reconstruction (Compliance)	EA	$4,600	26	$119,600
			Construction Subtotal (Rounded)	$1,414,000
Mobilization	LS	5%	1	$70,700
Contingency	LS	30%	1	$424,200
			Construction Subtotal (Rounded)	$1,909,000
Permitting	LS	$50,000	1	$50,000
Geotechnical (Assume 2% of total)	LS	$38,000	1	$38,000
Surveying	LS	$29,000	1	$29,000
Engineering and CMS	LS	20%	1	$381,800
Legal and Admin	LS	$15,000	1	$15,000
			Total Project Cost (Rounded)	$2,400,000

Project Identifier - 3J: Crouse Way Upsize (Milton Creek)				
General Line Item	Unit	Unit Price	Estimated Quantity	Item Cost
18-inch Pipe - Excavation, Backfill	LF	$185	580	$107,300
21-inch Pipe - Excavation, Backfill	LF	$195	480	$93,600
48-Inch, Standard Manhole	EA	$8,000	5	$40,000
60-Inch, Standard Manhole	EA	$14,000	3	$42,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	8	$28,000
Rock Excavation	CY	$300	393	$117,800
Roadway Restoration (Full Lane)	LF	$75	1,060	$79,500
Existing Utility Protection	LF	$4	1,060	$4,200
Traffic Control With Flagging	LS	$40,000	1	$40,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	11	$50,600
			Construction Subtotal (Rounded)	$603,000
Mobilization	LS	5%	1	$30,200
Contingency	LS	30%	1	$180,900
			Construction Subtotal (Rounded)	$814,000
Permitting	LS	$5,000	1	$5,000
Geotechnical (Assume 4% of total)	LS	$33,000	1	$33,000
Surveying	LS	$10,000	1	$10,000
Engineering and CMS	LS	20%	1	$162,800
Legal and Admin	LS	$5,000	1	$5,000
			Total Project Cost (Rounded)	$1,000,000

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Identifier - 3K: Eilertson Street (Milton Creek)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
12-inch Pipe - Excavation, Backfill	LF	$160	60	$9,600
48-Inch, Standard Manhole	EA	$8,000	3	$24,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	4	$14,000
Rock Excavation	CY	$300	22	$6,700
Roadway Restoration (Half Lane)	LF	$45	60	$2,700
Existing Utility Protection	LF	$4	60	$200
Traffic Control With Flagging	LS	$9,000	1	$9,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	2	$9,200
			Construction Subtotal (Rounded)	**$75,000**
Mobilization	LS	5%	1	$3,800
Contingency	LS	30%	1	$22,500
			Construction Subtotal (Rounded)	**$101,000**
Permitting	LS	$1,000	1	$1,000
Geotechnical (Assume 4% of total)	LS	$4,000	1	$4,000
Surveying	LS	$2,000	1	$2,000
Engineering and CMS	LS	20%	1	$20,200
Legal and Admin	LS	$1,000	1	$1,000
			Total Project Cost (Rounded)	**$100,000**

Project Identifier - 3L: N Vernonia Road from Oakwood to Ava Court (Milton Creek)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
18-inch Pipe - Excavation, Backfill	LF	$185	360	$66,600
48-Inch, Standard Manhole	EA	$8,000	3	$24,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	4	$14,000
Rock Excavation	CY	$300	133	$40,000
Roadway Restoration (Half Lane)	LF	$45	360	$16,200
Existing Utility Protection	LF	$4	360	$1,400
Traffic Control With Flagging	LS	$14,000	1	$14,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	10	$46,000
			Construction Subtotal (Rounded)	**$222,000**
Mobilization	LS	5%	1	$11,100
Contingency	LS	30%	1	$66,600
			Construction Subtotal (Rounded)	**$300,000**
Permitting	LS	$2,000	1	$2,000
Geotechnical (Assume 4% of total)	LS	$12,000	1	$12,000
Surveying	LS	$3,000	1	$3,000
Engineering and CMS	LS	20%	1	$60,000
Legal and Admin	LS	$2,000	1	$2,000
			Total Project Cost (Rounded)	**$400,000**

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Identifier - 3M: Ethan Lane Upsizing (Milton Creek)				
General Line Item	Unit	Unit Price	Estimated Quantity	Item Cost
21-inch Pipe - Excavation, Backfill	LF	$195	700	$136,500
60-Inch, Standard Manhole	EA	$14,000	4	$56,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	6	$21,000
Rock Excavation	CY	$300	259	$77,800
Roadway Restoration (Half Lane)	LF	$45	220	$9,900
Soil Surface Repair, Seeding, and Stabilization	LF	$5	480	$2,400
Existing Utility Protection	LF	$4	700	$2,800
Traffic Control With Flagging	LS	$21,000	1	$21,000
			Construction Subtotal (Rounded)	**$327,000**
Mobilization	LS	5%	1	$16,400
Contingency	LS	30%	1	$98,100
			Construction Subtotal (Rounded)	**$442,000**
Permitting	LS	$2,000	1	$2,000
Geotechnical (Assume 4% of total)	LS	$18,000	1	$18,000
Surveying	LS	$3,000	1	$3,000
Engineering and CMS	LS	20%	1	$88,400
Legal and Admin	LS	$2,000	1	$2,000
			Total Project Cost (Rounded)	**$600,000**

Project Identifier - 3N: Sunset Boulevard to Outfall Upsize (Milton Creek)				
General Line Item	Unit	Unit Price	Estimated Quantity	Item Cost
21-inch Pipe - Excavation, Backfill	LF	$195	840	$163,800
60-Inch, Standard Manhole	EA	$14,000	4	$56,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	6	$21,000
Rock Excavation	CY	$300	311	$93,300
Roadway Restoration (Half Lane)	LF	$45	840	$37,800
Outfall Restoration	EA	$6,000	1	$6,000
Existing Utility Protection	LF	$4	840	$3,400
Traffic Control With Flagging	LS	$25,000	1	$25,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	10	$46,000
			Construction Subtotal (Rounded)	**$452,000**
Mobilization	LS	5%	1	$22,600
Contingency	LS	30%	1	$135,600
			Construction Subtotal (Rounded)	**$610,000**
Permitting	LS	$2,000	1	$2,000
Geotechnical (Assume 4% of total)	LS	$24,000	1	$24,000
Surveying	LS	$3,000	1	$3,000
Engineering and CMS	LS	20%	1	$122,000
Legal and Admin	LS	$2,000	1	$2,000
			Total Project Cost (Rounded)	**$800,000**

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Identifier - 3O: Sunset Boulevard, Trillium Street and Salmon Street upsize (Milton Creek)				
General Line Item	Unit	Unit Price	Estimated Quantity	Item Cost
15-inch Pipe - Excavation, Backfill	LF	$170	1,580	$268,600
48-Inch, Standard Manhole	EA	$8,000	7	$56,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	12	$42,000
Rock Excavation	CY	$300	585	$175,600
Roadway Restoration (Half Lane)	LF	$45	1,580	$71,100
Existing Utility Protection	LF	$4	1,580	$6,300
Traffic Control With Flagging	LS	$46,000	1	$46,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	6	$27,600
			Construction Subtotal (Rounded)	**$666,000**
Mobilization	LS	5%	1	$33,300
Contingency	LS	30%	1	$199,800
			Construction Subtotal (Rounded)	**$899,000**
Permitting	LS	$2,000	1	$2,000
Geotechnical (Assume 4% of total)	LS	$36,000	1	$36,000
Surveying	LS	$3,000	1	$3,000
Engineering and CMS	LS	20%	1	$179,800
Legal and Admin	LS	$2,000	1	$2,000
			Total Project Cost (Rounded)	**$1,100,000**

Project Identifier - 3P: Sykes Road Upsize from Columbia Boulevard to Outfall (McNulty Creek)				
General Line Item	Unit	Unit Price	Estimated Quantity	Item Cost
30-inch Pipe - Excavation, Backfill	LF	$230	1,570	$361,100
36-inch Pipe - Excavation, Backfill	LF	$245	1,300	$318,500
72-Inch, Standard Manhole	EA	$16,500	5	$82,500
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	12	$42,000
Concrete Headwall	EA	$10,000	1	$10,000
Rock Excavation	CY	$300	1,544	$463,300
Roadway Restoration (Full Lane)	LF	$75	2,870	$215,300
Existing Utility Protection	LF	$4	2,870	$11,500
Traffic Control With Flagging	LS	$63,000	1	$63,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	13	$59,800
			Construction Subtotal (Rounded)	**$1,627,000**
Mobilization	LS	5%	1	$81,400
Contingency	LS	30%	1	$488,100
			Construction Subtotal (Rounded)	**$2,197,000**
Permitting	LS	$2,000	1	$2,000
Geotechnical (Assume 4% of total)	LS	$88,000	1	$88,000
Surveying	LS	$3,000	1	$3,000
Engineering and CMS	LS	20%	1	$439,400
Legal and Admin	LS	$2,000	1	$2,000
			Total Project Cost (Rounded)	**$2,700,000**

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Identifier - 3Q: McBride Street Upsize (McNulty Creek)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
18-inch Pipe - Excavation, Backfill	LF	$185	770	$142,500
48-Inch, Standard Manhole	EA	$8,000	4	$32,000
Connect to Existing Manhole	EA	$1,750	1	$1,800
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	6	$21,000
Rock Excavation	CY	$300	285	$85,600
Roadway Restoration (Half Lane)	LF	$45	770	$34,700
Existing Utility Protection	LF	$4	770	$3,100
Traffic Control With Flagging	LS	$24,000	1	$24,000
			Construction Subtotal (Rounded)	**$345,000**
Mobilization	LS	5%	1	$17,300
Contingency	LS	30%	1	$103,500
			Construction Subtotal (Rounded)	**$466,000**
Permitting	LS	$2,000	1	$2,000
Geotechnical (Assume 4% of total)	LS	$19,000	1	$19,000
Surveying	LS	$3,000	1	$3,000
Engineering and CMS	LS	20%	1	$93,200
Legal and Admin	LS	$2,000	1	$2,000
			Total Project Cost (Rounded)	**$600,000**

Project Identifier - 3R: Port Avenue Upsize (McNulty Creek)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
15-inch Pipe - Excavation, Backfill	LF	$170	810	$137,700
18-inch Pipe - Excavation, Backfill	LF	$185	380	$70,300
Outfall Restoration	EA	$6,000	1	$6,000
48-Inch, Standard Manhole	EA	$8,000	4	$32,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	6	$21,000
Rock Excavation	CY	$300	441	$132,200
Roadway Restoration (Half Lane)	LF	$45	1,190	$53,600
Existing Utility Protection	LF	$4	1,190	$4,800
Traffic Control With Flagging	LS	$31,000	1	$31,000
ADA Ramp Reconstruction (Compliance)	EA	$4,600	6	$27,600
			Construction Subtotal (Rounded)	**$516,000**
Mobilization	LS	5%	1	$25,800
Contingency	LS	30%	1	$154,800
			Construction Subtotal (Rounded)	**$697,000**
Permitting	LS	$2,000	1	$2,000
Geotechnical (Assume 4% of total)	LS	$28,000	1	$28,000
Surveying	LS	$3,000	1	$3,000
Engineering and CMS	LS	20%	1	$139,400
Legal and Admin	LS	$2,000	1	$2,000
			Total Project Cost (Rounded)	**$900,000**

Client: City of St. Helens
Project: Stormwater Master Plan
Project No.: 220060

CIP Project Sheets

Project Identifier - 3S: Whitetail Avenue Upsize (McNulty Creek)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
18-inch Pipe - Excavation, Backfill	LF	$185	970	$179,500
48-Inch, Standard Manhole	EA	$8,000	6	$48,000
ODOT Type G-2, Catch Basin with Connector Pipe	EA	$3,500	10	$35,000
Outfall Restoration	EA	$6,000	1	$6,000
Rock Excavation	CY	$300	359	$107,800
Roadway Restoration (Half Lane)	LF	$45	970	$43,700
Existing Utility Protection	LF	$4	970	$3,900
Traffic Control With Flagging	LS	$33,000	1	$33,000
			Construction Subtotal (Rounded)	**$457,000**
Mobilization	LS	5%	1	$22,900
Contingency	LS	30%	1	$137,100
			Construction Subtotal (Rounded)	**$617,000**
Permitting	LS	$2,000	1	$2,000
Geotechnical (Assume 4% of total)	LS	$25,000	1	$25,000
Surveying	LS	$3,000	1	$3,000
Engineering and CMS	LS	20%	1	$123,400
Legal and Admin	LS	$2,000	1	$2,000
			Total Project Cost (Rounded)	**$800,000**

Project Identifier - 3T: Sykes Road Cuvert near Mountain View Drive Upsize (McNulty Creek)				
General Line Item	**Unit**	**Unit Price**	**Estimated Quantity**	**Item Cost**
15-inch Pipe - Excavation, Backfill	LF	$170	140	$23,800
48-Inch, Standard Manhole	EA	$8,000	1	$8,000
Concrete Headwall	EA	$10,000	1	$10,000
Soil Surface Repair, Seeding, and Stabilization	LF	$5	140	$700
Existing Utility Protection	LF	$4	140	$600
			Construction Subtotal (Rounded)	**$43,000**
Mobilization	LS	5%	1	$2,200
Contingency	LS	30%	1	$12,900
			Construction Subtotal (Rounded)	**$58,000**
Permitting	LS	$2,000	1	$2,000
Geotechnical (Assume 4% of total)	LS	$2,000	1	$2,000
Surveying	LS	$3,000	1	$3,000
Engineering and CMS	LS	20%	1	$11,600
Legal and Admin	LS	$2,000	1	$2,000
			Total Project Cost (Rounded)	**$80,000**

City of St. Helens

RESOLUTION NO. 1940

A RESOLUTION ADOPTING THE ST. HELENS WASTEWATER MASTER PLAN

WHEREAS, the last complete update to the City's Wastewater Collection System Master Plan was in April 1989; and

WHEREAS, ORS 197.712(2)(e) requires a city to develop and adopt public facility plans for areas within their urban growth boundary containing a population greater than 2,500 persons; and

WHEREAS, the City of St. Helens Municipal Code 19.08.030 Public Services And Facilities Goals promote the development of an orderly arrangement of public facilities and services to serve as a framework for urban development, and the designing and locating public facilities so that capacities are related to future as well as present demands, that ample land is available for building and plant expansion, and that public works plants and utility structures reflect due regard for their environmental impact; and

WHEREAS, an updated Wastewater Collection System Master Plan is needed to provide for growth and planning for future development; and

WHEREAS, Engineering consultant, Keller Associates, has prepared an updated Wastewater Collection System Master Plan, attached as Exhibit A, and has presented said plan to the Planning Commission on October 12, 2021 and to the City Council at the November 3, 2021 Work Session; and

WHEREAS, consultant has prepared the St. Helens Wastewater Collection System Master Plan after extensive review and analysis of existing plans, policies, studies and other information, and has afforded all interested parties opportunity to review the plan.

NOW, THEREFORE, THE CITY OF ST. HELENS RESOLVES that the St. Helens Wastewater Collection System Master Plan, attached as Exhibit A, is adopted and shall be used as a guide for the development and implementation of a complete, wastewater collection system.

APPROVED AND ADOPTED by the City Council on November 17, 2021 by the following vote:

Ayes:

Nays:

____
Rick Scholl, Mayor

ATTEST:

____
Kathy Payne, City Recorder

SECTION 1 - EXECUTIVE SUMMARY

In 2020, the City of St. Helens, Oregon (City), contracted with Keller Associates, Inc. (Keller) to complete a wastewater master plan (WWMP) for the City's wastewater collection system. The study area consists of all areas within the City's Urban Growth Boundary (UGB). This section summarizes the major findings of the wastewater master plan, including brief discussions of alternatives considered and final recommendations.

1.1 PLANNING CRITERIA

City-defined goals and objectives, Public Works Design Standards (PWDS), engineering best practices, and regulatory requirements form the basis for evaluation and planning within this study. Applicable regulatory requirements include the Oregon Department of Environmental Quality (DEQ) Pump Station Regulatory Requirements, Capacity Management, Operation and Maintenance (CMOM) Guidance, Land Use and Comprehensive Plan Requirements, and City Municipal Code.

The capacity of the City's conveyance system is based on the ability of the system to convey projected 20-year peak instantaneous flow rates associated with the 5-year, 24-hour storm event. For the collection system model evaluation, pipes are considered at capacity when peak flows exceed 85% of full depth in accordance with industry standards. When sizing gravity collection systems, pipelines shall be sized to convey 20-year, projected peak flows at 85% or less depth to diameter ratio (d/D). Pump stations will be evaluated and sized (if necessary) to handle these peak flows with the largest pump out of service (defined as firm capacity).

1.2 PLANNING CONDITIONS

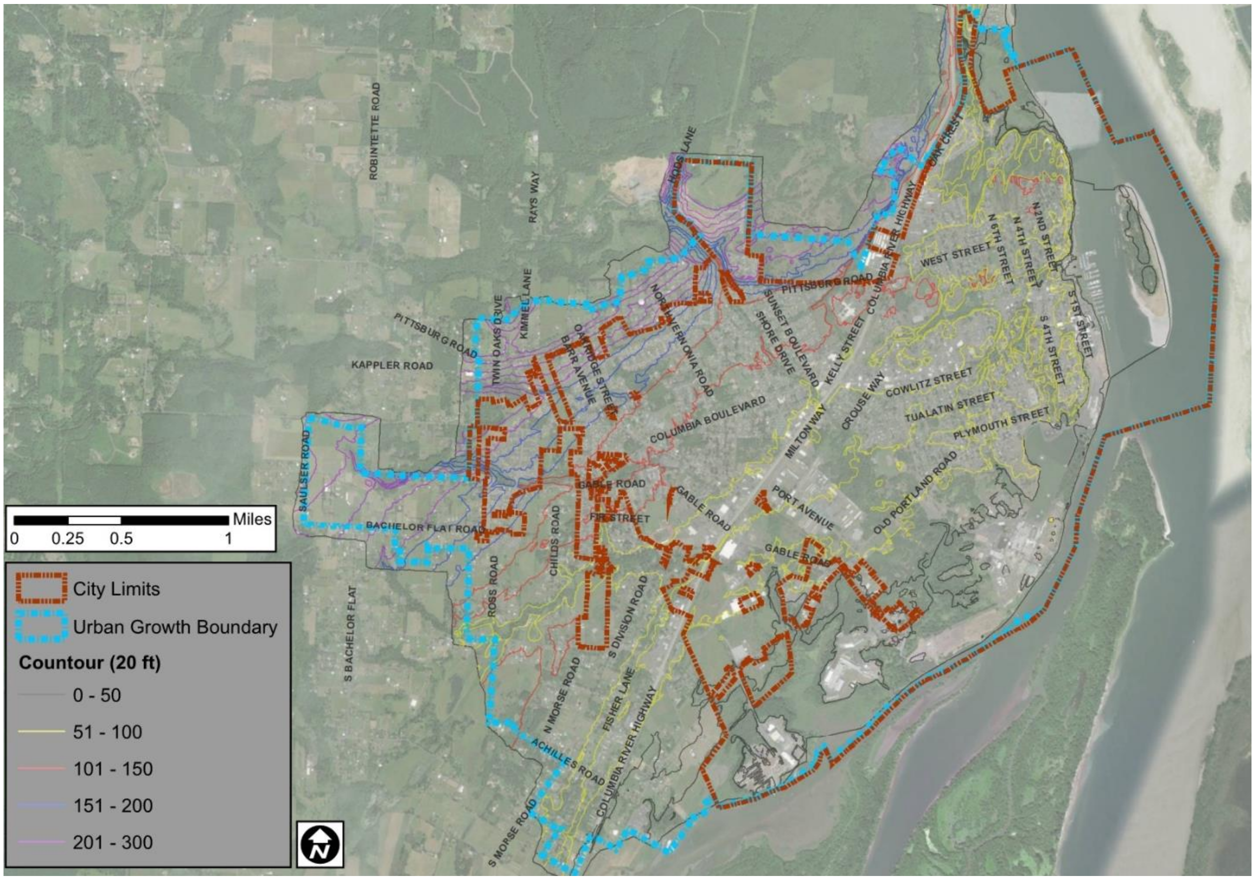
1.2.1 STUDY AREA AND LAND USE

The study area, consisting of the City's UGB and general topography, are shown in Figure 1-1. The study area slopes to the south and east toward the Columbia River. The City of St. Helens owns and operates a wastewater collection system within its UGB. Columbia City's wastewater collection system discharges to and flows through the St. Helens collection system to the City's Wastewater Treatment Plant (WWTP) for treatment. Evaluation of the Columbia City system, aside from the impacts of population growth and infiltration and inflow (I/I) on the St. Helens system, is not included in the scope of this study. The wastewater system currently serves only areas within the St. Helens and Columbia City UGBs. Further expansion of the UGB was not considered in this report.

1.2.2 DEMOGRAPHICS

The City's population has been increasing at a steady rate over the past few decades but has leveled out in recent years. Historical populations for the City of St. Helens and Columbia City were obtained from the U.S. Census and Columbia County in cooperation with Portland State University (PSU). PSU analyzes historical trends and anticipates growth patterns to develop growth rates for 5-year increments. The most current population estimate provided by PSU for the combined area of St. Helens and Columbia City was 15,895 in 2020. The PSU coordinated growth rates provide a population projection for 2040 to be 19,506, which is St. Helens and Columbia City combined. These growth rates were reviewed and approved by the technical advisory committee (TAC) for this planning study. The estimated average annual growth rate from 2019 to 2040 is approximately 1.1% for St. Helens and 0.5% for Columbia City.

FIGURE 1-1: CITY LIMITS, UGB, AND TOPOGRAPHY



1.2.3 WASTEWATER FLOWS

Historical wastewater flows were evaluated using statistical methods following DEQ guidance to develop planning flows and provide flow projections for the planning period. Observed flows for each year from 2015–2019 and planning flows are summarized in Table 1-1 below. During the system flow evaluation process, it was discovered that the current influent flow measurement at the WWTP may not reliably measure peak influent flows during high flow events. The City provided direction to review available data, use engineering judgement, and estimate system flow planning criteria values to reflect the current system demand. Modified planning criteria was established and is presented in Table 1-1.

TABLE 1-1: OBSERVED HISTORICAL FLOWS & PLANNING FLOWS

St. Helens Historical Flows (MGD[1])								
Year	**2015**	**2016**	**2017**	**2018**	**2019**	**5-Year Avg**	**Planning**	**Modified Planning**
Population	**15,050**	**15,085**	**15,225**	**15,225**	**15,395**		**15,895**	**15,895**
ADWF	0.98	1.31	1.25	0.95	1.09	1.11	1.11	1.11
$MMDWF_{10}$	2.71	2.56	2.87	3.03	2.79	2.79	3.03	3.03
AADF	2.35	2.43	2.64	1.92	1.85	2.24	2.24	2.24
AWWF	3.73	3.56	4.01	2.90	2.59	3.36	3.36	3.36
$MMWWF_5$	7.88	7.81	5.84	4.46	3.99	5.99	7.88	7.88
PWkF	14.19	7.54	8.93	5.90	8.86	9.08	14.19	14.19
$PDAF_5$	21.19	13.08	17.76	9.60	21.90	16.71	21.90	19.90
PIF_5	31.4	27.4	24.6	13.9	32.2	25.90	33.98	26.00
Yearly Total (MG[1])	856	889	955	700	669			
Total Rainfall (in/yr)	47	48	51	31	33			

1) MGD = million gallons per day; MG = million gallons

ADWF = Average Dry-Weather Flow
$MMDWF_{10}$ = Maximum Monthly Dry-Weather Flow
AADF = Average Annual Daily Flow
AWWF = Average Wet-Weather Flow
$MMWWF_5$ = Maximum Monthly Wet-Weather Flow
PWkF = Peak Week Flow
$PDAF_5$ = Peak Daily Average Flow
PIF_5 = Peak Instantaneous Flow

Comparison of the dry weather and wet weather system flows in Table 1-1 shows that the City of St. Helens experiences large increases in flow during wet weather events. The high wet weather flows are associated with large inflow and infiltration (I/I) influence in the system.

To project the planning flows derived from the analysis, a projected flow per capita (reported in gallons per capita per day, [gpcd]) was developed. Projected planning system flows (millions of gallons per day [MGD]) are based on 2019 modified planning flows with the addition of the product of projected unit flows (gpcd) and projected population increase shown in Table 1-2. Actual future flows will depend on several variables and could potentially be decreased through aggressive I/I reduction efforts.

TABLE 1-2: PROJECTED PLANNING FLOWS

	Planning Flow (MGD)	Planning Unit Flow (gpcd)	Projected Unit Flow (gpcd)	Projected Planning Flow (MGD)				
Year	2019	2019	2019	2020	2025	2030	2035	2040
Population	15,395	15,395	15,395	15,895	16,727	17,605	18,530	19,506
ADWF	1.11	72	72	1.15	1.21	1.28	1.34	1.41
$MMDWF_{10}$	3.03	197	197	3.12	3.29	3.46	3.64	3.83
AADF	2.24	145	145	2.31	2.43	2.56	2.69	2.83
AWWF	3.36	218	218	3.47	3.65	3.84	4.04	4.25
$MMWWF_5$	7.88	512	300	8.03	8.28	8.54	8.82	9.11
PWkF	14.19	922	325	14.35	14.62	14.91	15.21	15.53
$PDAF_5$	19.90	1293	375	20.09	20.40	20.73	21.08	21.44
PIF_5	26.00	1689	525	26.26	26.70	27.16	27.65	28.16

1.3 COLLECTION SYSTEM EVALUATION

The existing wastewater collection system consists of approximately 60 miles of gravity sewer mains, 2.5 miles of force main, and nine pump stations.

1.3.1 PUMP STATION EVALUATION

High level facility evaluations were completed in October of 2020 with City operations personnel to review conditions of the pump station facilities, current maintenance activities, and known operational problems encountered by City staff.

Each pump station is a duplex pump station with submersible pumps located in the wetwell, with the exception of Pump Station 2 (PS#2). PS#2 is a duplex self-priming pump station that operates on a variable frequency drive (VFD) with a high and low setting. Table 1-3 below provides a summary for the pump stations evaluated.

TABLE 1-3: PUMP STATION INVENTORY

Name	PS#1	PS#2	PS#3	PS#4	PS#5	PS#7	PS#8	PS#9	PS#11
Type	Duplex, Submersible	Duplex, Self-Priming	Duplex, Submersible	Duplex Submersible	Duplex, Submersible	Duplex, Submersible	Duplex, Submersible	Duplex, Submersible	Duplex, Submersible
Year Constructed	1950s	1990	1997	1995	1994	1986	1991	1994	1996
Pump Type	Paco / Hydromatic Submersible	Gorman Rupps VSP (High / Low)	Wilo Type FA 10.51A Submersible	FLYGT NP - 3085	ABS AFP AFP(K) 1049.1-M105/4FM	Wilo Submersible	ABS SJS10W	Barns 4SE3724L	Hydromatic S4HVX-1500JD
Pump hp	36 / 30	40 / 22.5	6.2	3	14	15.5	1	3.7	15
Design Flow (gpm)	550	700 / 250	500	130	145	390	Unknown	200	143
Design Head (ft)	110	82 / 52	10.7	22	98	83	4	24	74
Low Level Alarm (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.42	N/A
Pump Off Level (ft)	1.33	1.50	2	6.2	2.00	3.83	2.83	0.58	0.75
Lead On Level (ft)	2	3	3.5	8.9	4.00	10.00	4.93	1.167	1.65
Lag On Level (ft)	2.5	3.5	4.33	10.0	5.00	10.5	Unknown	2.75	2
High Level Alarm (ft)	6	7.5	5.83	11.8	5.00	11	5.45	3.75	3.1
Level Control Type	Ultrasonic Level Sensor	Ultrasonic Level Sensor	Ultrasonic Level Sensor	Float Relays	Ultrasonic Level Senor	Ultrasonic Level Sensor	Float Relays	Float Relays	Float Relays
Flow Meter	No	No	No	No	No	No	No	No	No
Pressure Gauge	Yes	No	No	No	No	No	No	No	No
Auxiliary Power Type	Portable Generator	On-Site Generator	Portable Generator	Portable Generator	On-site Generator	On-site Generator	Portable Generator	Portable Generator	Portable Generator
Transfer Switch	MTS	ATS	MTS	MTS	ATS	ATS	MTS	MTS	MTS
Bypass Piping	No	No	No	Yes	No	No	No	No	No
Oder Control	None	None	None	None	None	None	None	None	None
Wet Well Depth (ft)	18	9	15.5	20.6	10.5	16	4	13	6.15
Wet Well Diameter (ft)*	12.67	8	7	6	6	6	3	5	5
Force main Diameter (in)	6	6	6	4	4	6 / 8	3	6	4
Force Main Length (ft)**	1,010	1,050	20	610	1,700	2,620	260	70	2,500

*Pump Station 1 has a rectangular wetwell

**Estimated using City GIS data

The pump station evaluation presents general observations and recommendations, along with specific recommendations for individual pump station sites. The general recommendations are provided as a guideline to allow the City to maintain the pump stations for the 20-year planning period. Overall, the pump stations are in good condition and are well maintained with minor housekeeping items such as partial installation of redundant high-level alarms, lack of fall protection, and lack of up-to-date accurate pump station drawings and pump information. These housekeeping items were identified during observations and discussions with City staff. No significant deficiencies were identified in the overall pump station condition evaluation.

1.3.2 INFILTRATION & INFLOW

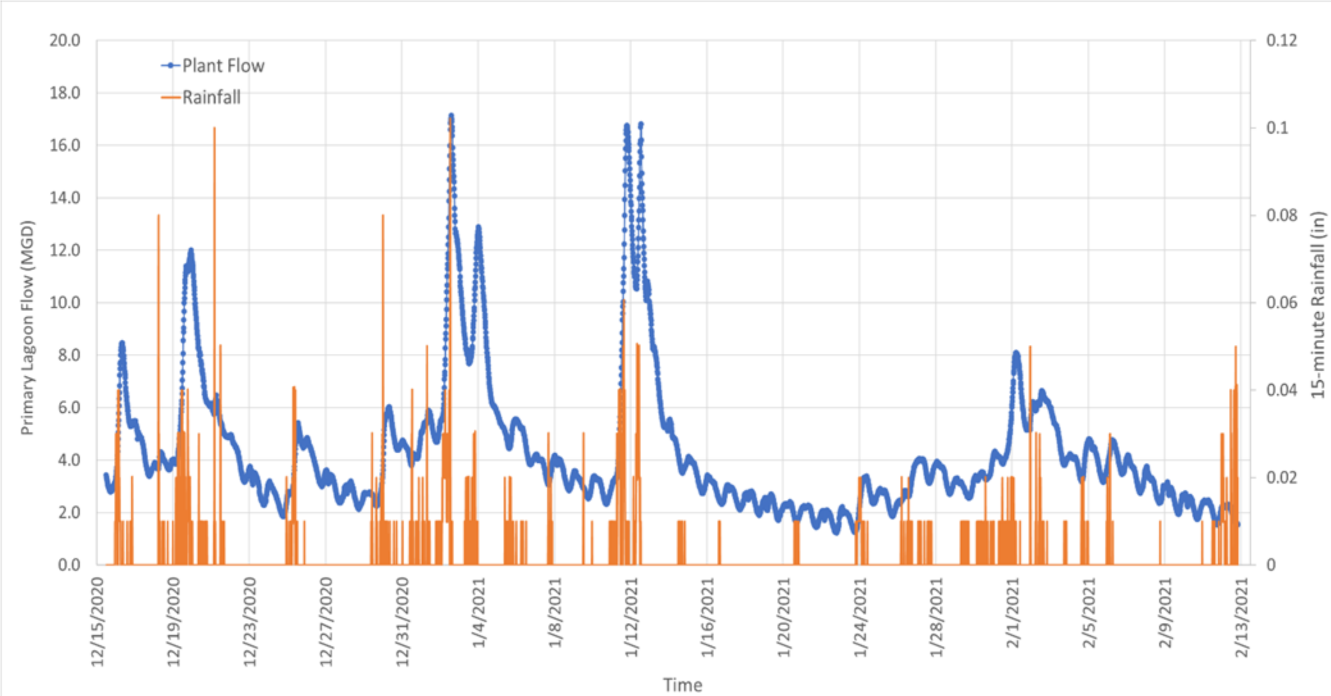
Infiltration and Inflow (I/I) is a concern in the St. Helens collection system. The rapid response between precipitation events and increased flows suggests that a significant component of peak flow is from storm water inflow. Estimated peak flows in the collection system are 20-25 times higher than annual dry weather flows. The sustained increase in flow over several days following a large storm event suggests that groundwater is also infiltrating into the City's wastewater collection system. Visual evidence of I/I influence in the system can be seen in Chart 1-1, which displays WWTP primary lagoon flow vs. 15-minute rainfall data for December 2020 through February 2021. The data is representative of typical wet weather seasonal response in the collection system.

Since the completion of the 2008 Wet Weather Capacity Evaluation, which documented I/I in St. Helens, the City has performed smoke testing and closed-circuit television (CCTV) inspections on the collection system. The City has also taken steps to address I/I in the system via pipeline replacement, pipe repair (including cure-in-place-pipe [CIPP] lining and spot repairs), and manhole rehabilitation and replacement. City staff have reported that the effort has produced noticeable I/I reduction (annual reported overflows have been reduced), but I/I still persists in the system.

This study included a high-level evaluation of I/I in the system. A preliminary evaluation to identify areas likely to experience the highest I/I was completed using available data. Pipeline age and material data, areas of suspected sump pump connections, City reported issues, and priority pipelines from the 2008 evaluation not addressed in the I/I reduction projects were compared to identify areas anticipated to have the highest I/I influence. The pipelines identified as highest risk for I/I should be considered as high priority for CCTV inspection and subsequent repair and/or replacement as needed. Overall, the evaluation identified approximately 8,000 feet of Priority 1 pipelines; 15,200 feet of Priority 2 pipelines; and 18,250 feet of Priority 3 pipelines for CCTV inspection. The primary area identified by City staff as likely to have improper stormwater sump pump connections was marked for additional investigations in order to locate and disconnect any stormwater sump pumps.

I/I prioritization and identification is an ongoing, evolving process. As the City collects more data, the prioritization evaluation needs to be updated to reflect the most recent data available. It is recommended the City work towards regular inspection of all system pipes and include this information in their ongoing I/I prioritization process.

CHART 1-1: DAILY FLOW AND PRECIPITATION DURING WET WEATHER



1.3.3 STAFFING EVALUATION

A high-level evaluation of existing wastewater staffing levels, deficiencies in existing staffing levels, and staffing recommendations was completed as part of this study. The City Public Works (PW) Operations staff, who are responsible for the operations and maintenance (O&M) of the wastewater collection system, and the WWTP staff, who are responsible for the O&M of the City's nine pump stations, were interviewed to collect information on existing staffing levels, annual O&M activities, and level of service (LOS) goals for the City wastewater infrastructure. In general, St. Helens' public works staff provide support for many City activities that are not directly related to public utility O&M (i.e. building maintenance, building remodels, City events, etc.), which reduces time and O&M activities they can spend and complete on utility infrastructure. It is recommended that either additional Full Time Employee (FTE) be budgeted for the PW Operations staff to complete the existing workload requested, or the responsibilities of the PW Operations staff be reduced to focus solely on utility O&M. Additionally, it is advised that staffing needs be re-evaluated every two to three years.

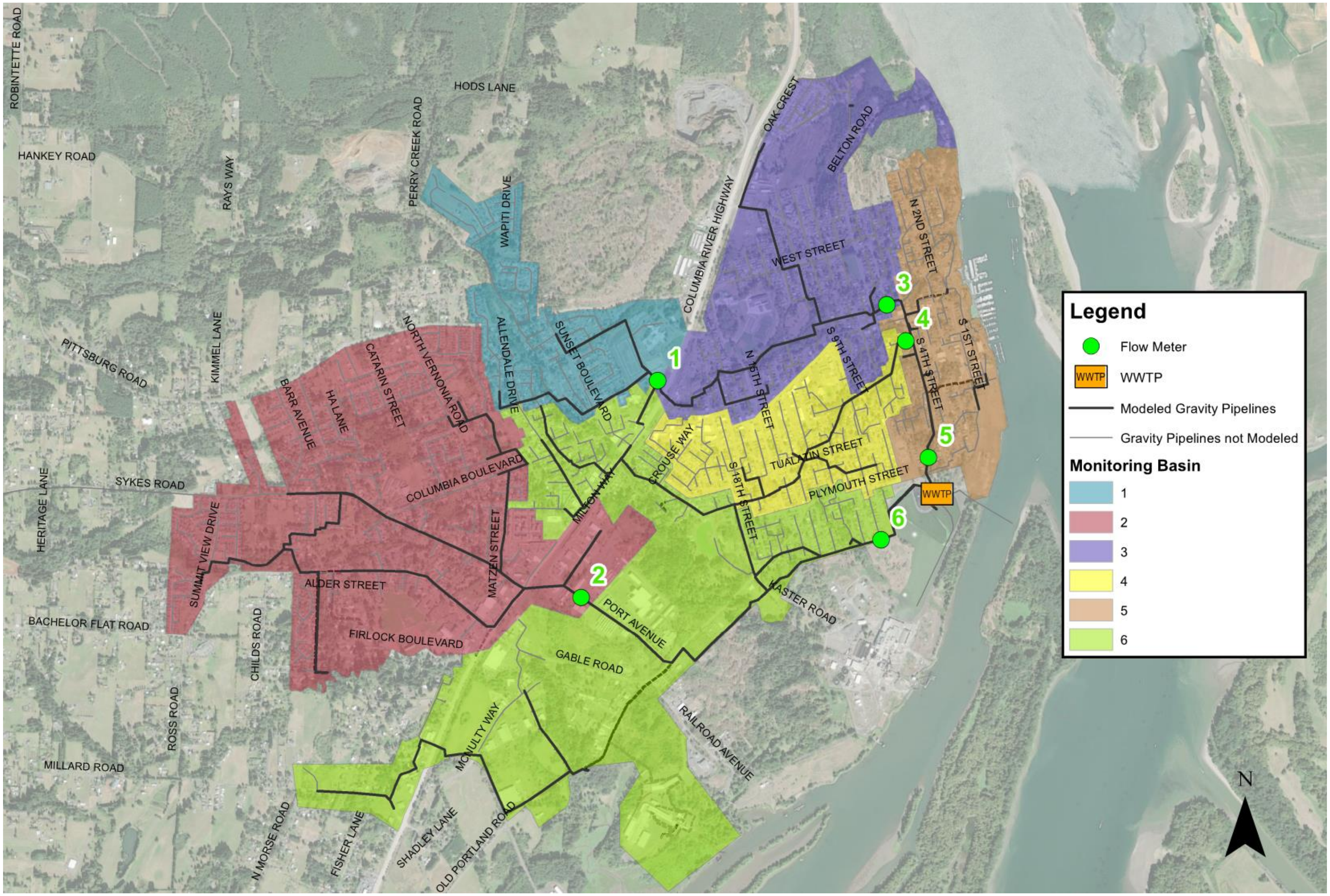
1.3.4 PIPELINE CAPACITY EVALUATION

A wastewater collection system model was developed using InfoSWMM software (Suite 14.7 Update #2) to evaluate existing and 20-year collection system capacity. Wastewater trunklines (10-inch diameter and larger) were included in the model as well as five pump stations. Some 8-inch pipelines were modeled to connect disparate areas that were served by 10-inch pipelines. Continuous flow monitoring was completed at six locations during the wet weather period between December of 2020 and January of 2021. The six flow monitoring locations divided the system into six monitoring basins, shown in Figure 1-2. The collected data was analyzed along with continuous precipitation data to establish typical 24-hour patterns, average base flows at each site, and gauge rainfall influence in the system. Both dry weather (minimal to no rain in days prior) and wet weather periods were used for base flows and calibration efforts.

Gravity pipelines were evaluated according to the City's Public Works Design Standards. Pipe capacity was assessed by evaluating the ratio of the depth of maximum flow to the diameter of the pipe (d/D), with pipes considered undersized if they exceed a ratio of 0.85. This planning criteria was established in meetings with City staff. Pump stations were evaluated based on the capacity to handle peak flows with the largest pump out of service (defined as firm capacity).

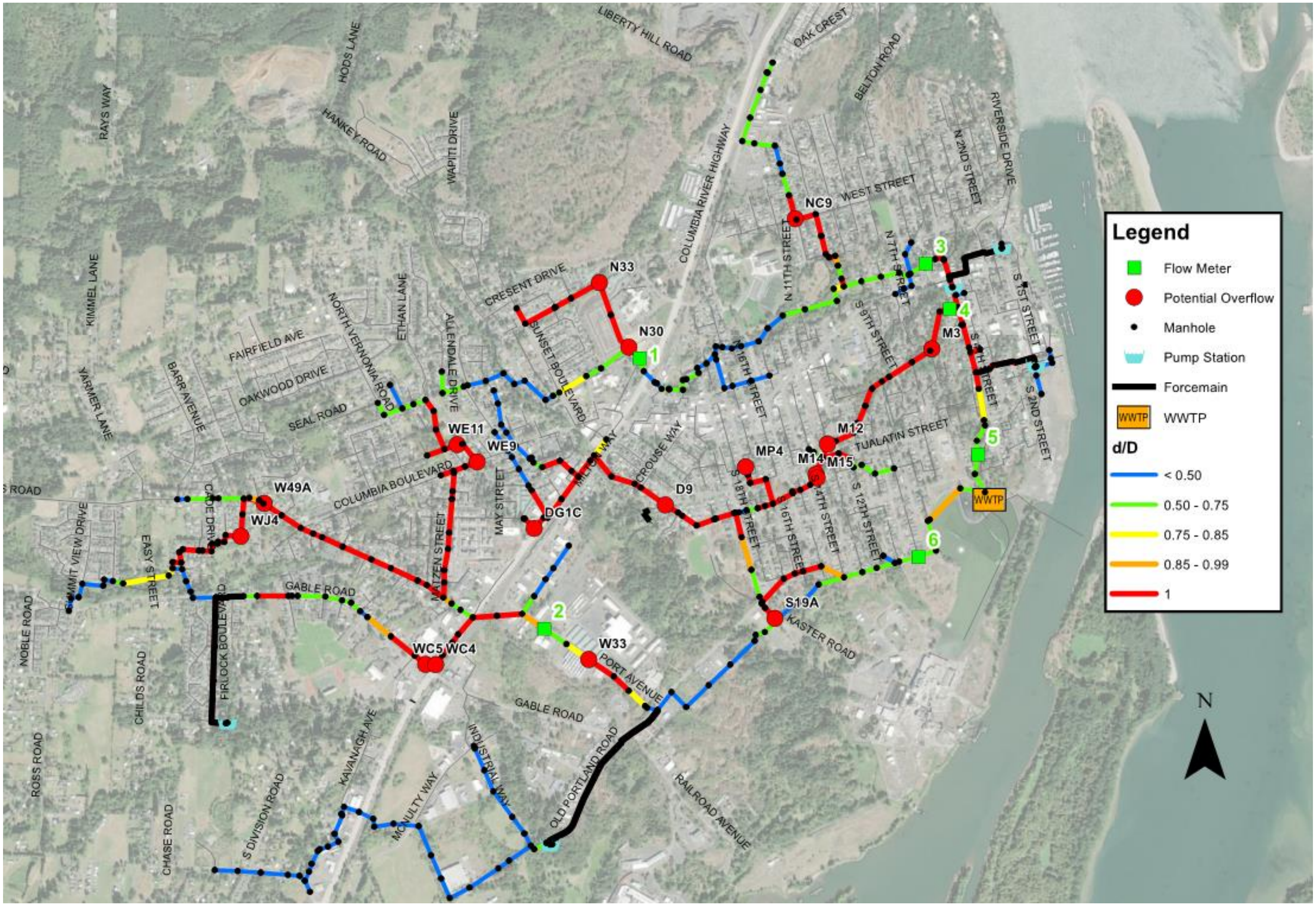
The calibrated model was used to assess the effects of a 5-year, 24-hour design storm event on the existing system. The existing system evaluation showed a significant portion of the modeled trunk lines operating at or above capacity. There are pipelines operating at or above capacity in each of the six monitoring basins, and almost all have manholes with the potential to overflow. The deficiencies found in the evaluation are caused by high peak flows and undersized trunklines. Figure 1-3 shows locations of over-capacity pipes in the existing system model, displayed in orange and red, with potential overflow locations marked with a red circle.

FIGURE 1-2: FLOW METER LOCATIONS AND MONITORING BASINS



Item #4.

FIGURE 1-3: EXISTING SYSTEM EVALUATION – D/D AND POTENTIAL OVERFLOW LOCATIONS



For the 20-year capacity evaluation, future loads were distributed based on PSU population projections and City anticipated future residential, commercial, and industrial growth areas, shown in Figure 1-4. A majority of the areas anticipated to develop have topography that would allow for gravity flow to the existing collection system, while four growth areas may require additional infrastructure. These four identified areas are the Riverfront District (Growth Area #2), the Business Industrial Park (Growth Area #17), and Growth Areas #1 and #9 located near Pump Station 11 (PS#11).

The City is currently evaluating development options for the Riverfront District, which includes the relocation of Pump Station 1 (PS#1). A 10-inch pipeline at minimum slope would have the capacity to convey the projected 20-year flows through the Riverfront District. The proposed pipeline would be routed underneath the proposed roadways depicted in the current City planning documents.

The City is seeking new opportunities for the Industrial Business Park and completed parcellation framework report for the site. To provide sewer service for the future development, a pump station will be required. The pump station will likely need to be located near the waterfront to follow existing topography. The gravity sewer piping will follow the proposed roadway alignments and drain to the proposed pump station location. The force main can be routed along existing and/or proposed roadways and discharge to the existing trunkline on Kaster Road. The existing gravity trunkline downstream on Old Portland Road has a section of parallel pipes which are capacity limited and should be included as part of the development process and project.

The City has expressed interest in relocating PS#11 further north, to the intersection of Firlok Park Street and Hazel Street. If relocated, the depth of the wetwell could be sized at predesign to receive flow via a gravity line from the northern portions of Growth Areas #1 and #9, which would involve a bore under McNulty Creek to serve Growth Area #1. The southern portion of both growth areas could be served by 8-inch pipelines conveyed to existing gravity trunklines. Grinder pumps might need to be installed at residences adjacent to McNulty Creek, as the relative elevation of these locations may make serving them via gravity pipeline not feasible.

Overall, problem areas identified in the 20-year evaluation reflect the same areas identified in the existing system analysis, with many of the deficiencies being caused by high peak flows and undersized trunklines exacerbated in the 20-year model. Figure 1-5 shows locations of over-capacity pipes in the 20-year model, displayed in orange and red, with potential overflow locations marked with a red circle.

FIGURE 1-4: ANTICIPATED 20-YEAR GROWTH LOCATIONS

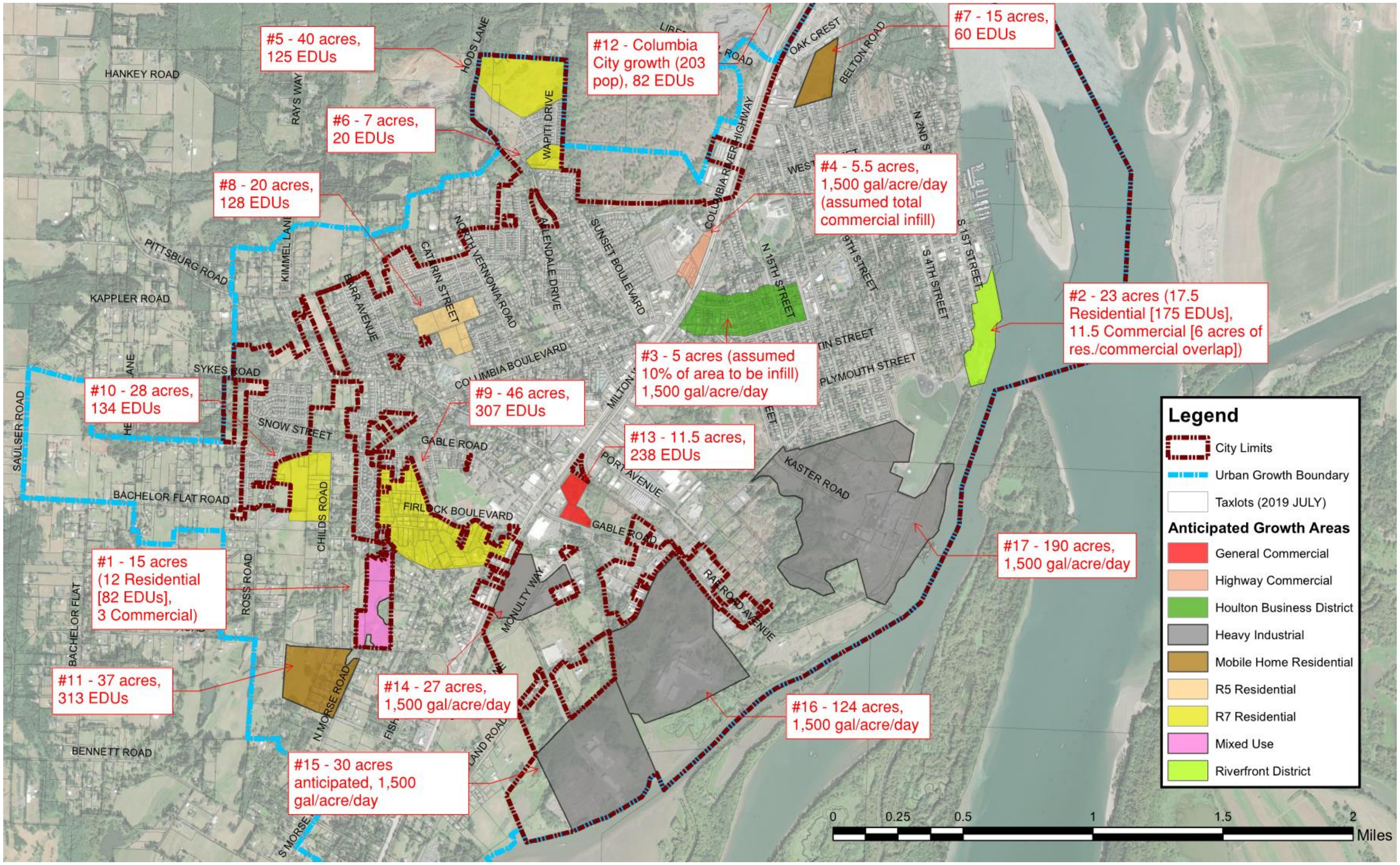
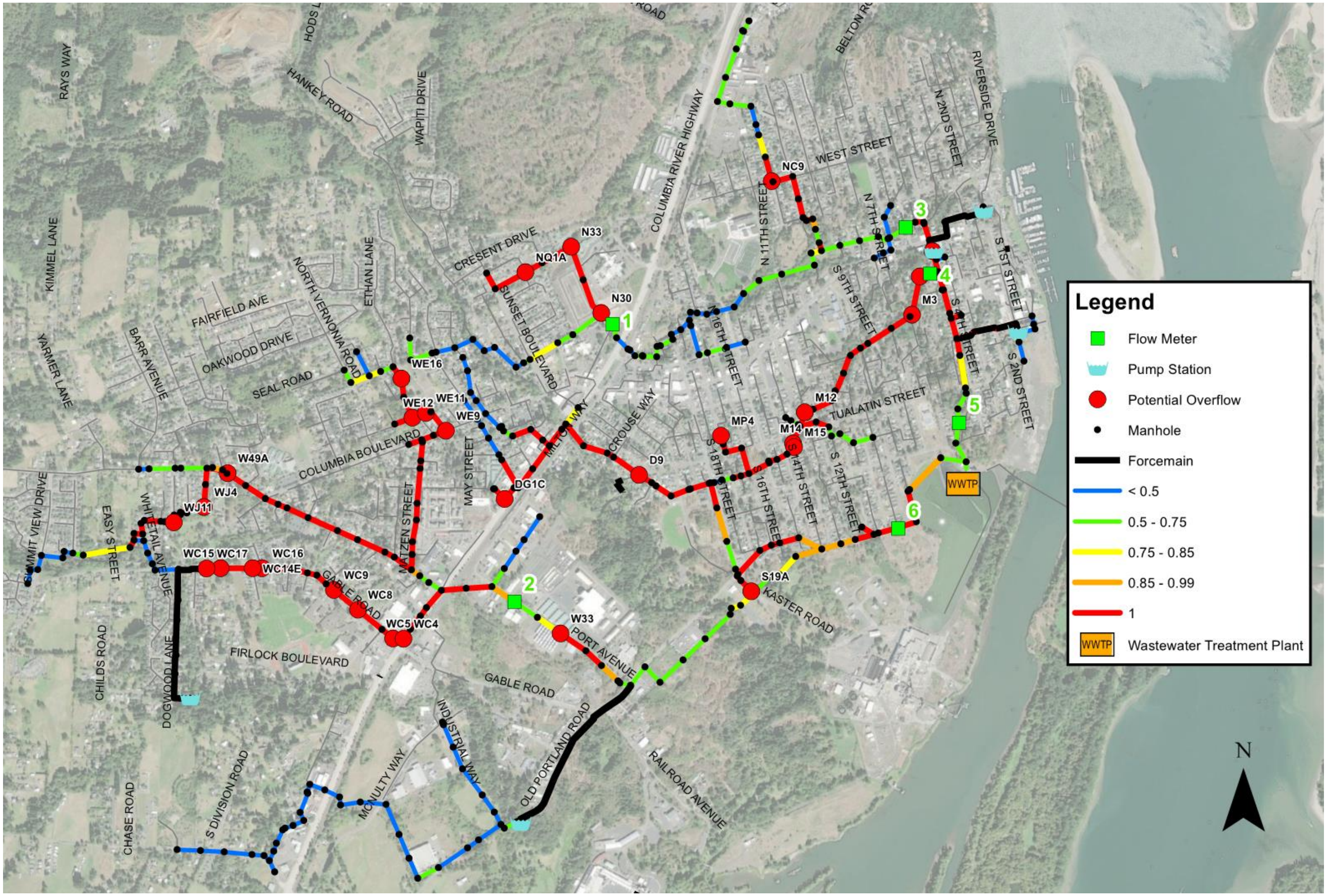


FIGURE 1-5: 20-YEAR SYSTEM EVALUATION – D/D AND POTENTIAL OVERFLOW LOCATIONS



1.3.5 PUMP STATION RESILIENCY

The compilation of this master plan included an assessment of pump station resiliency using a risk of failure evaluation. The risk of failure of an asset is a combination of the likelihood of failure and consequence of failure. Likelihood of failure is a measure of how likely an asset is to fail. An evaluation of the risks of failure can provide an importance, urgency, or priority to assets and provide guidance on the order in which asset deficiencies should be addressed. Assets with the highest risk of failure (product of likelihood of failure and consequence of failure) should be repaired or replaced first as they pose the largest threat to a system and community.

The analysis shows that PS#1 and PS#2 have the highest risks of failure. A failure at one of these pump stations would have the largest impact on the community and is most likely to happen based on the factors evaluated, indicating that deficiencies at these pump stations should be addressed soon after identified.

1.4 COLLECTION SYSTEM ALTERNATIVES

Alternatives to address collection system deficiencies discussed are summarized in the sections below. A few of the deficiencies identified do not have multiple, feasible, or cost-effective alternatives for improvements. Recommended improvements for these deficiencies are also included below.

1.4.1 SUMP PUMPS

Six alternatives were identified to address the presence of private sump pumps discharging into the collection system. The alternatives included: targeted distribution of educational material, smoke testing, dye testing and CCTV, visual inspection, point-of-sale inspection, and a reward-based disconnection incentive program. These alternatives were not considered mutually exclusive and could be performed in conjunction if the City chose to perform multiple projects at a time.

1.4.2 CONVEYANCE SYSTEM

Alternatives for conveyance were established for each flow metering basin. While some of the conveyance system deficiencies do not have multiple feasible alternatives, construction of new trunklines to redirect flow away from undersized pipelines or suspected points of overflow was considered by the City. The redirection of the conveyance system was considered a feasible alternative for Basins 2, 4, and 6. Upsizing the existing undersized trunklines to handle 20-year peak flows was considered a feasible alternative for each basin.

Additionally, the installation of parallel facilities or taking no action was presented to the City. The City could choose to construct parallel facilities in areas with limited remaining capacity, however this alternative was ultimately dismissed. Taking no action is not a viable option because surcharging and the potential for overflows would only worsen, which could result in negative impacts to human health and the environment, in addition to the increased risk of fines from the DEQ.

1.5 RECOMMENDED COLLECTION SYSTEM IMPROVEMENTS

To address the identified system deficiencies, the following improvements are recommended. Cost estimates for each of the recommended improvements are included in the section and incorporated in the Capital Improvement Plan (CIP).

1.5.11 WWTP INFLUENT FLOW METER

Priority 1 WWTP influent flow meter improvements address the suspected inaccurate influent peak flow measurement at the WWTP and would provide accurate measurement of influent peak flows during wet weather events. The total estimated cost for this improvement is $68,000.

1.5.2 PUMP STATIONS

Priority 1 pump station improvements address the continuation of upgrades the City of St. Helens is currently performing as well as the operations improvements, which include the installation of overflow alarms and adding a SCADA alarm to sound when both pumps in a pump station turn on. It is recommended that pump station runtimes continue to be recorded and reviewed by staff in conjunction with the recommended alarm data if both pumps are running to track as pump stations may be nearing firm capacity. Additionally, it is recommended that Pump Station 3 be equipped with an on-site generator to address its backup power deficiency and simplify portable generator operations during outages. The total estimated cost for these improvements is $100,000.

Priority 2 pump station improvements assume that the Riverfront District and Growth Areas #1 and #9 require the relocation of Pump Stations 1 and 11. Additionally, Priority 2 improvements address the general deficiencies, such as under-capacity pumps, fall protection provisions, level sensor redundancy, as well as flow and pressure monitoring. The total estimated costs for these improvements is $6,200,000.

Priority 3 pump station improvements include firm capacity increase of PS#7 as growth areas develop in the basin. The total estimated costs for these improvements is $2,200,000.

1.5.3 INFLOW AND INFILTRATION (I/I)

The City is advised to create an annual budget to fund an ongoing I/I reduction program, which would promote annual I/I improvement projects throughout the City. This type of work is anticipated to be a combination of sump pump identification and removal, lateral replacement, and mainline and manhole inspections and rehabilitation/replacement. System I/I reductions could reduce, delay, or eliminate the need for capacity-related pipeline upsizing projects and provide cost savings to the City over the planning period. Rather than have a separate replacement budget and I/I improvement budget, it is recommended the City adopt a combined fund of $500,000 annually for the 20-year planning period. This dollar amount is reflective of the estimated annual pipeline replacement cost, presented in Table 1-4.

1.5.4 SUMP PUMPS

It is recommended the City pursue a combination of educational material distribution, point-of-sale inspection, and a reward-based incentive program. A portion of the recommended I/I annual budget should be reserved for the printing and distribution of educational materials and to support a sump pump disconnection incentive program. Additionally, the City ought to update its code to include language requiring the seller to evaluate and disconnect any sump pumps from the sanitary sewer during inspection and before the property transfers ownership.

1.5.5 CONVEYANCE SYSTEM

Priority 1 improvements address potential overflows near the downtown and “tunnel” pipelines for the City (Basin 5), as well as deficiencies in Basin 4. Improvements include rerouting Basin 4’s trunkline along Tualatin Street to Basin 6, and upsizing gravity mains on S 4th Street, S 16th Street and S 17th Street. The annual I/I reduction projects could have significant impacts to the peak flows in Basin 5. It is recommended that flow monitoring be included in the concept design phase of this project to further define existing flows and compare the peak flows in Basin 5 following the I/I reduction work and Basin 4 improvements. The total estimated cost for these improvements is $8,100,000.

Priority 3 improvement projects will alleviate remaining existing and future capacity limitations in the collection system, but an intentional, ongoing I/I reduction program could reduce, delay, or eliminate the need for some of these improvements. These improvements include upsizing of existing undersized pipelines in Basins 1, 2, 3, and 6, and also involve construction of a new pipeline to reroute flow from Gable Road to Sykes Road, and reroute flow near Old Portland

Road and Kaster Road in Basin 6. The total estimated cost for these improvements is $22,700,000.

1.5.6 FUTURE INFRASTRUCTURE

There are four anticipated growth areas in the 20-year planning period that may require additional infrastructure to connect with the existing system, which include the Riverfront District (Growth Area #2), the Business Industrial Park (Growth Area #17), and Growth Areas #1 and #9 located near PS#11. Priority 2 improvements address the required infrastructure needed to serve the Riverfront District, Business Industrial Park, and Growth Areas #1 and #9. The costs for the proposed infrastructure at the Riverfront District are tied into the cost of the PS#1 relocation. The estimated cost of the proposed Riverfront District and Business Industrial Park infrastructure is $15,600,000. The proposed infrastructure for Growth Areas #1 and #9 is tied into the cost to relocate PS#11 and is estimated at $3,100,000.

1.5.7 OPERATIONS AND MAINTENANCE

In addition to regular maintenance, it is recommended that an annual pipeline replacement program be established. Typically, a budget for replacing the system components is based on average useful life. Average useful life of manholes and cleanouts are shown in Table 1-4.

It is recommended that the $500,000 amount presented in the I/I section above serve as a combined I/I reduction program budget and annual replacement budget. It should be noted that this is an interim amount presented for City budgeting purposes, with the purpose of increasing over time to the recommended $790,000 annual replacement budget for the system. Even after I/I improvements have significantly reduced peak flows in the system, the City should continue to maintain an annual replacement budget to fund ongoing O&M and meet the City's LOS goals.

Pipelines should be cleaned approximately every three to five years (frequency can be adjusted based on pipe material plus scour conditions and observations by City staff). Manhole rehabilitation and service line repairs should be coordinated with pipeline rehabilitation work. Emphasis should be placed on areas where pipe conditions pose the largest threat of sanitary sewer surcharging or more immediate threat of collapse.

TABLE 1-4: ANNUAL REPLACEMENT BUDGET

Item	Lifespan	Cost/Year
Pipelines	75 Years	$ 570,000
Manholes	50 Years	$ 210,000
Cleanouts	50 Years	$ 5,000
Total (rounded)		***$ 790,000***

1.5.8 PLANNING RECOMMENDATIONS

The City is recommended to update their planning documents every 5 years. Updates to the planning documents and models allow the City to re-assess needs and properly allocate budgets to address system deficiencies. The next update should include an evaluation of both the wastewater collection system and WWTP. A Master Plan Update for both the wastewater collection system and the treatment plant was included as a Priority 2 improvement, with an estimated cost of $300,000.

1.5.9 ENGINEERING DESIGN STANDARDS, CODE, AND COMPREHENSIVE PLAN REVIEW

The City's existing development code (Title 17), engineering design standards (Title 18), and comprehensive plan (Title 19) were reviewed for new development, as they pertain to wastewater conveyance, to identify potential deficiencies and provide recommendations for updates. The primary recommendations for review, updates, and additions include the following:

- Scheduling requirements
- Matching references to the Oregon Department of Transportation (ODOT)/ American Public Works Association (APWA) Oregon Standard Specifications for Construction (OSSC).
- Pipeline sizing, slope, cover, and utility spacing requirements
- Manhole design requirements
- Stream and creek crossing requirements

The City is advised to review and assess these recommended changes to these sections to City code, standards, and comprehensive plans to match current best practices in the industry. The City should then initiate the process of proposing changes to associated City documents to maintain consistency.

1.6 CAPITAL IMPROVEMENT PLAN

This section outlines the recommended plan to address the wastewater collection system deficiencies identified in previous sections. The alternative evaluation and recommended projects, with input from City staff, are the basis for the CIP for the wastewater collection system presented in this section.

1.6.1 SUMMARY OF COSTS

The cost summary of the 20-year CIP is listed in Table 1-5. Capital costs developed for the recommended improvements are Class 4 estimates as defined by the Association for the Advancement of Cost Engineering (AACE). Actual construction costs may differ from the estimates presented depending on specific design requirements and the economic climate when a project is at bid. An AACE Class 4 estimate is normally expected to be within -50 and +100 percent of the actual construction cost, which is typical for planning documents. As a result, the final project costs will vary from the estimated costs presented in this document. The costs are based on experience with similar recent collection system and WWTP upgrade projects. Equipment pricing from manufactures of the large equipment items was also used to develop the estimates. The total estimated probable project costs include contractor markups and 30% contingencies, which is typical of a planning-level estimate. Overall project costs include total construction costs, costs for engineering design, construction management services, inspection, as well as administrative costs. For the collection system projects, the contractor's overhead and profit are worked into the line items. Priorities are set for today and will be re-evaluated when there is a need for re-assessment. 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. An estimated schedule for the next six years is shown in Table 1-6. Locations of the CIP projects can be found in Figure 1-6.

FIGURE 1-6: 20-YEAR CAPITAL IMPROVEMENT PLAN

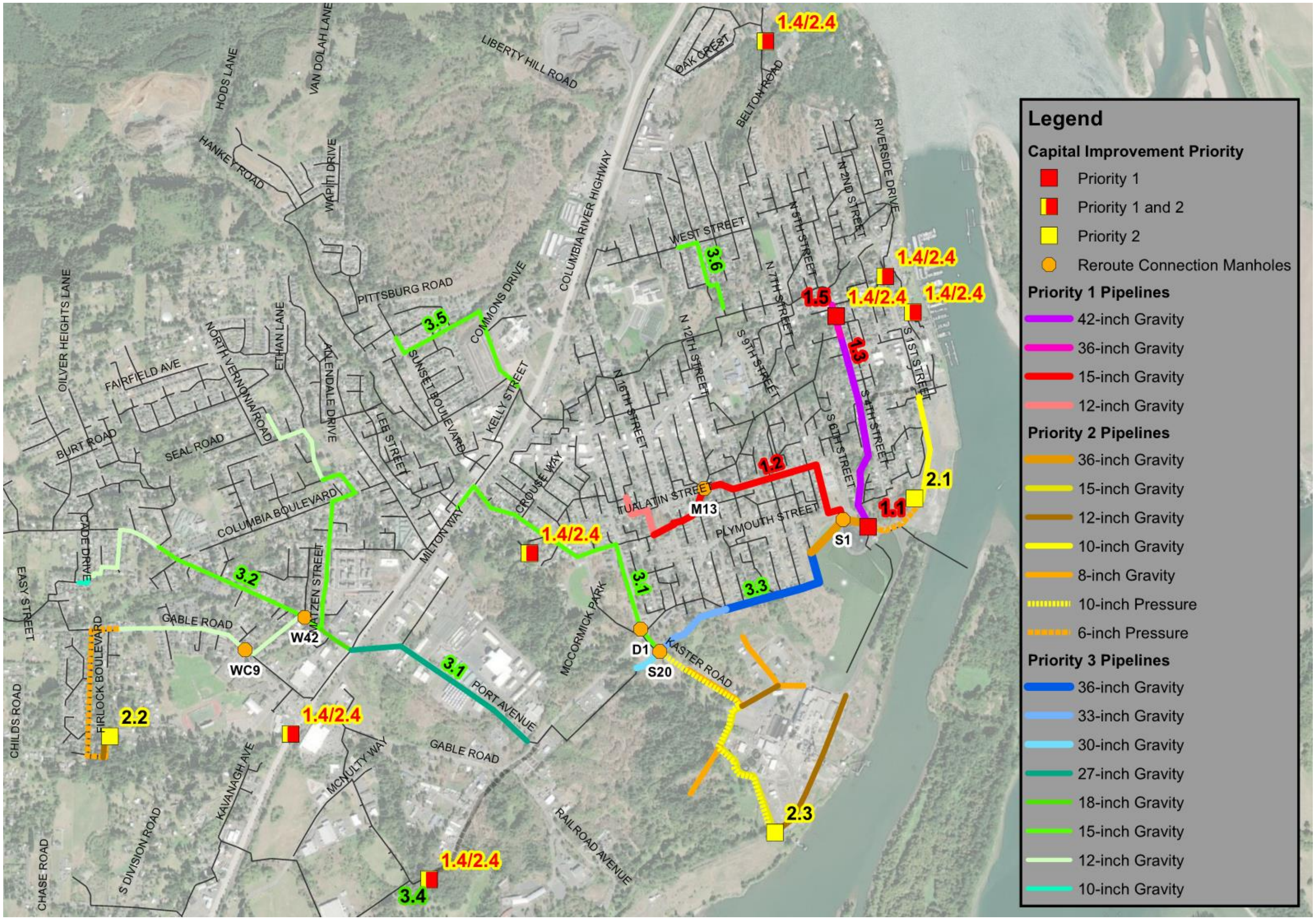


TABLE 1-5: 20-YEAR CAPITAL IMPROVEMENT PLAN (CIP)

Project No.	Project Name	Primary Purpose	Total Estimated Cost (2021)	SDC Growth Apportionment %	SDC Growth Apportionment Cost	City's Estimated Portion
Priority 1 Improvements						
1.1	WWTP Influent Flow Meter	Operations	$ 68,000	10%	$ 7,000	$ 61,000
1.2	Basin 4 Pipeline Upsize and Reroute	Capacity	$ 3,600,000	0%	$ -	$ 3,600,000
1.3	Basin 5 Pipeline Upsize	Capacity	$ 4,500,000	3%	$ 150,000	$ 4,350,000
1.4	Install Overflow Alarms	Operations	$ 9,000	20%	$ 2,000	$ 7,000
1.5	Pump Station 3 On-site Generator	Operations	$ 90,000	0%	$ -	$ 90,000
1.6	Annual I/I Reduction Program (6-Year)	Capacity	$ 3,000,000	20%	$ 590,000	$ 2,410,000
	Total Priority 1 Improvement Cost (rounded)		**$ 11,300,000**			**$ 10,500,000**
Priority 2 Improvements						
2.1	Riverfront District Trunkline and Pump Station 1 Relocation	Capacity, Operations	$ 2,400,000	18%	$ 440,000	$ 1,960,000
2.2	Relocate Pump Station 11	Capacity, Operations	$ 3,100,000	68%	$ 2,110,000	$ 990,000
2.3	Industrial Business Park Trunklines and Pump Station	Capacity, Operations	$ 13,200,000	100%	$ 13,200,000	$ -
2.4	Pump Station Upgrades	Operations, Safety	$ 700,000	20%	$ 140,000	$ 560,000
2.5	Master Plan Update	Operations	$ 300,000	100%	$ 300,000	$ -
2.6	Annual I/I Reduction Program (8-Year)	Capacity	$ 4,000,000	20%	$ 790,000	$ 3,210,000
	Total Priority 2 Improvement Cost (rounded)		**$ 23,700,000**			**$ 6,700,000**
Priority 3 Improvements						
3.1	Basin 6 Pipeline Upsize and Reroute	Capacity	$ 6,300,000	7%	$ 460,000	$ 5,840,000
3.2	Basin 2 Pipeline Upsize and Reroute	Capacity	$ 9,400,000	12%	$ 1,140,000	$ 8,260,000
3.3	Southern Trunkline Upsize	Capacity	$ 3,900,000	26%	$ 1,010,000	$ 2,890,000
3.4	Pump Station 7 Upgrades	Capacity	$ 2,200,000	65%	$ 1,430,000	$ 770,000
3.5	Basin 1 Pipeline Upsize	Capacity	$ 1,800,000	9%	$ 150,000	$ 1,650,000
3.6	Basin 3 Pipeline Upsize	Capacity	$ 1,200,000	3%	$ 40,000	$ 1,160,000
3.7	Annual I/I Reduction Program (6-year)	Capacity	$ 3,000,000	20%	$ 590,000	$ 2,410,000
	Total Priority 3 Improvement Cost (rounded)		**$ 27,900,000**			**$ 23,000,000**
	Total Collection System Improvement Costs (rounded)		**$ 62,900,000**			**$ 40,200,000**

Note:

The cost estimate 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.

TABLE 1-6: PRIORITY 1 CIP SCHEDULE

Project No.	Item	Cost (2021)	Opinion of Probable Costs 2022	2023	2024	2025	2026	2027
Priority 1 Improvements								
1.1	WWTP Influent Flow Meter	$ 68,000	$ 68,000					
1.2	Basin 4 Pipeline Upsize and Reroute	$ 3,600,000		$ 400,000	$ 3,200,000			
1.3	Basin 5 Pipeline Upsize	$ 4,500,000				$ 500,000	$ 4,000,000	
1.4	Install Overflow Alarms	$ 9,000	$ 9,000					
1.5	Pump Station 3 On-site Generator	$ 90,000	$ 90,000					
1.6	Annual I/I Reduction Program (6-Year)	$ 3,000,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000
	Total (Rounded)	$ 11,300,000	$ 700,000	$ 900,000	$ 3,700,000	$ 1,000,000	$ 4,500,000	$ 500,000

Note:

The cost estimate 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 any escalation. 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.

1.6.2 OTHER ANNUAL COSTS

In addition to the capital improvement costs presented in Table 1-5 and Table 1-6, 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 ideally budget a total of $790,000/year for pipeline replacement/rehabilitation. Currently, it is recommended the City should establish a $500,000 annual fund for system replacement/rehabilitation. I/I replacement and rehabilitation projects performed as part of the Annual I/I Reduction Program may offset a portion or majority of these recommended costs, as pipeline rehabilitation addresses defects and extends pipeline lifespan.

The City should target the infiltration and inflow (I/I) projects as a part of the annual pipeline replacement/rehabilitation budget. Prioritizing these projects should help to reduce I/I flows into the system and potentially delay capital improvements triggered by increased system flows.

It is recommended that the City maintenance staff develop a program to clean the entire collection system every three years, and CCTV the entire collection system every six years.

Annual O&M costs for the collection system may increase slightly if Priority 3 improvements are made, as they increase the total linear feet of pipeline in the system.

It is estimated that approximately 3.5-4.0 FTE are needed to meet the recommended level of O&M for the City's LOS goals. As budgeted, the existing wastewater collections FTE staff appears to be adequate. However, the additional projects and work the PW Operations staff are currently requested to complete significantly decreases the budgeted FTE hours that can be spent on wastewater collections O&M. It is recommended that either additional FTE be budgeted for the PW Operations staff to complete the existing workload requested, or the responsibilities of the PW Operations staff be reduced to focus solely on utility O&M. In addition, the recommended CIP projects would increase workload of the engineering division. The engineering division may need additional staff to manage any sump pump identification and removal program, update and maintain the GIS database, coordinate CCTV inspection and resulting work orders, and manage capital improvements. Additional workload on the engineering and PW operations divisions should be included in planning for any of the recommended improvements and projects. It is recommended that staffing needs be reevaluated every two to three years.

1.6.3 OTHER FINANCIAL CONSIDERATIONS

The City previously had several wastewater debts that were refinanced into a single debt service in 2020. The yearly transfer for this payment is $600,000 and is set to mature in 2034. The City is currently exploring options for paying off the sewer debt sooner, potentially between 2026 and 2031.

The City should complete a full-rate study for the wastewater utility in order to evaluate potential user rate and system development charge (SDC) impacts of the recommended CIP. Estimated SDC eligibility for each identified capital improvement is included in Table 1-5 for use in completing a full rate study. It is recommended the City actively pursue opportunities for grant funds, low-interest loans, or principal forgiveness funding sources to mitigate user rate impacts. As the City prepares to proceed on CIP projects, if outside funding is desired, it is recommended the City setup a one-stop meeting with Business Oregon to identify and assess potential funding sources for the sewer projects.

DRAFT

CITY OF ST. HELENS, OR WASTEWATER MASTER PLAN

OCTOBER 2021

KA PROJECT NO. 220060-001 | CITY PROJECT NO. P-511

PREPARED BY:

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ACRONYMS AND ABBREVIATIONS

AACE	Associate for the Advancement of Cost Engineering
AADF	Average Annual Daily Flow
ac	Acre
AC	Asbestos Cement
ADWF	Average Dry Weather Flow
AWWF	Average Wet Weather Flow
BLM	Bureau of Land Management
CCTV	Closed-Circuit-Television
CFS	Cubic Feet per Second
CIP	Capital Improvement Plan
CIPP	Cured-in-Place Pipe
CMOM	Capacity Management, Operation, and Maintenance
CMP	Corrugated Metal Pipe
C/O	Cleanouts
CWSRF	Clean Water State Revolving Fund
DEQ	Department of Environmental Quality
DI	Ductile Iron
DOGAMI	Department of Geology and Mineral Industries
DSL	Department of State Lands
DWF	Dry Weather Flow
d/D	Maximum Depth Divided by Full Depth
EDU	Equivalent Dwelling Unit
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FOG	Fats, Oils and Grease
fps	Feet per Second
FRP	Fiberglass Pipe
FTE	Full Time Equivalent
GIS	Geographical Information System
gpad	Gallons per Acre per Day
gpcd	Gallons per Capita per Day
gpd	Gallons per Day
GPM	Gallons per Minute
GW	Greenway Basin
HDPE	High-Density Polyethylene

HGL	Hydraulic Grade Line
HOA	Hand/Off/Auto
HVAC	Heating, Ventilation and Air Conditioning
I/I	Infiltration and Inflow
LF	Linear Feet
LID	Low Impact Development
LOS	Level of Service
LWI	Local Wetlands Inventory
MG	Million Gallons
MGD	Million Gallons per Day
MGY	Million Gallons per Year
MH	Manhole
MMDWF	Maximum Monthly Dry Weather Flow
MMWWF	Maximum Monthly Wet Weather Flow
MMF	Maximum Month Flow
MS4	Municipal Separate Storm Sewer System
NAVD88	North American Vertical Datum of 1988
NGVD29	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resources Conservation Service
OAR	Oregon Administrative Rules
ODOT	Oregon Department of Transportation
ODSL	Oregon Department of State Lands
O&M	Operations and Maintenance
OH&P	Overhead and Profit
ORS	Oregon Revised Statutes
PACP	Pipeline Assessment Certification Program
PDAF	Peak Daily Average Flow
PDF	Peak Day Flow
PF	Peak Factors
PHF	Peak Hour Flow
PIF	Peak Instant Flow
PLC	Programmable Logic Controller
PVC	Polyvinyl Chloride
PW	Public Works
PWDS	Public Works Design Standards
PWkF	Peak Week Flow
RCP	Reinforced Concrete Pipe

RDII	Rainfall-Derived Infiltration and Inflow
ROW	Right-of-Way
SBUH	Santa Barbara Unit Hydrograph Method
SCADA	Supervisory Control and Data Acquisition
SCS	Soil Conservation Service
SDC	System Development Charge
SHMC	St. Helens Municipal Code
SHPO	State Historic Preservation Office
SRF	State Revolving Fund
SWMM	Stormwater Management Model
TDH	Total Dynamic Head
TMDL	Total Maximum Daily Load
UGB	Urban Growth Boundary
USACE	United States Army Corp of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VCP	Vitrified Clay Pipe
VFD	Variable Frequency Drive
WQMP	Water Quality Management Plan
WWF	Wet Weather Flow
WWTP	Wastewater Treatment Plant

SECTION 1 - EXECUTIVE SUMMARY

In 2020, the City of St. Helens, Oregon (City), contracted with Keller Associates, Inc. (Keller) to complete a wastewater master plan (WWMP) for the City's wastewater collection system. The study area consists of all areas within the City's Urban Growth Boundary (UGB). This section summarizes the major findings of the wastewater master plan, including brief discussions of alternatives considered and final recommendations.

1.1 PLANNING CRITERIA

City-defined goals and objectives, Public Works Design Standards (PWDS), engineering best practices, and regulatory requirements form the basis for evaluation and planning within this study. Applicable regulatory requirements include the Oregon Department of Environmental Quality (DEQ) Pump Station Regulatory Requirements, Capacity Management, Operation and Maintenance (CMOM) Guidance, Land Use and Comprehensive Plan Requirements, and City Municipal Code.

The capacity of the City's conveyance system is based on the ability of the system to convey projected 20-year peak instantaneous flow rates associated with the 5-year, 24-hour storm event. For the collection system model evaluation, pipes are considered at capacity when peak flows exceed 85% of full depth in accordance with industry standards. When sizing gravity collection systems, pipelines shall be sized to convey 20-year, projected peak flows at 85% or less depth to diameter ratio (d/D). Pump stations will be evaluated and sized (if necessary) to handle these peak flows with the largest pump out of service (defined as firm capacity).

1.2 PLANNING CONDITIONS

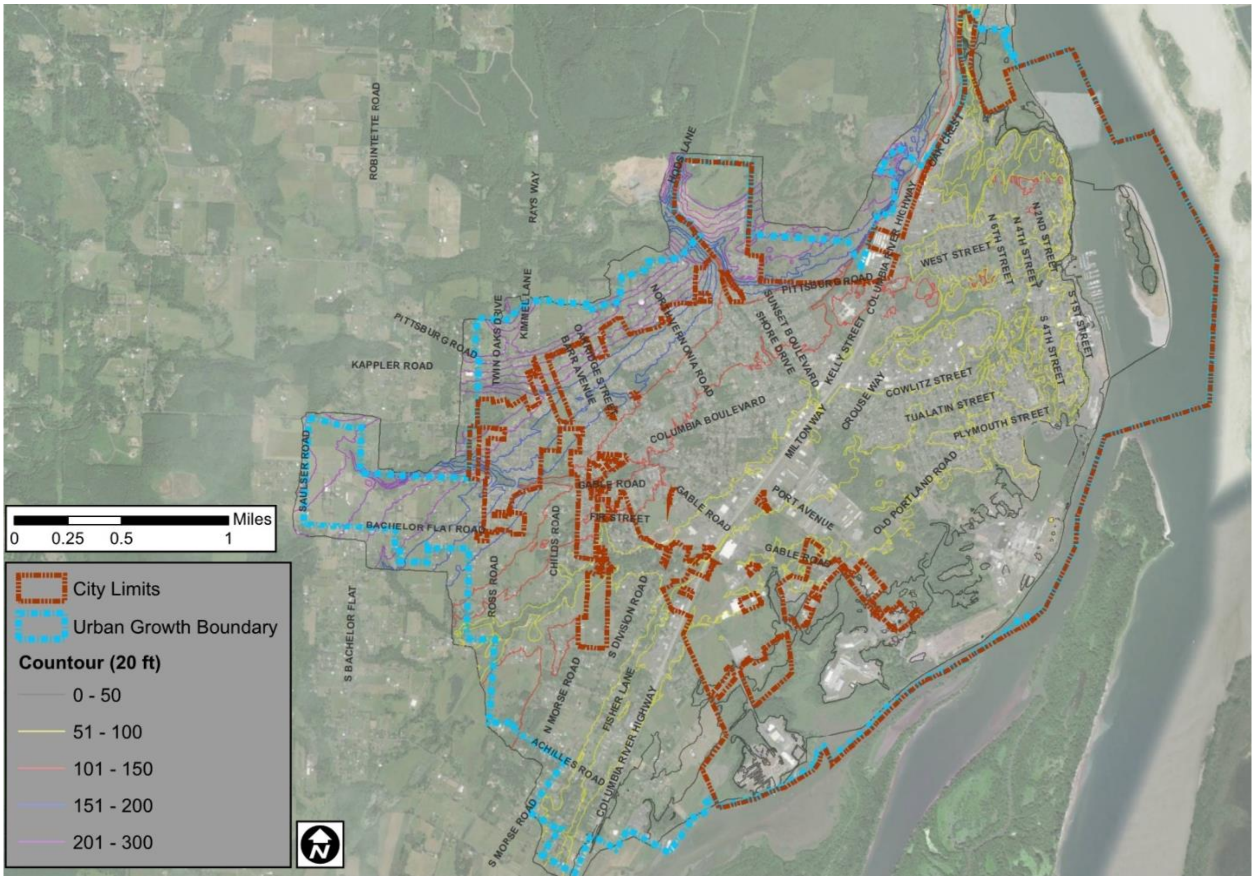
1.2.1 STUDY AREA AND LAND USE

The study area, consisting of the City's UGB and general topography, are shown in Figure 1-1. The study area slopes to the south and east toward the Columbia River. The City of St. Helens owns and operates a wastewater collection system within its UGB. Columbia City's wastewater collection system discharges to and flows through the St. Helens collection system to the City's Wastewater Treatment Plant (WWTP) for treatment. Evaluation of the Columbia City system, aside from the impacts of population growth and infiltration and inflow (I/I) on the St. Helens system, is not included in the scope of this study. The wastewater system currently serves only areas within the St. Helens and Columbia City UGBs. Further expansion of the UGB was not considered in this report.

1.2.2 DEMOGRAPHICS

The City's population has been increasing at a steady rate over the past few decades but has leveled out in recent years. Historical populations for the City of St. Helens and Columbia City were obtained from the U.S. Census and Columbia County in cooperation with Portland State University (PSU). PSU analyzes historical trends and anticipates growth patterns to develop growth rates for 5-year increments. The most current population estimate provided by PSU for the combined area of St. Helens and Columbia City was 15,895 in 2020. The PSU coordinated growth rates provide a population projection for 2040 to be 19,506, which is St. Helens and Columbia City combined. These growth rates were reviewed and approved by the technical advisory committee (TAC) for this planning study. The estimated average annual growth rate from 2019 to 2040 is approximately 1.1% for St. Helens and 0.5% for Columbia City.

FIGURE 1-1: CITY LIMITS, UGB, AND TOPOGRAPHY



1.2.3 WASTEWATER FLOWS

Historical wastewater flows were evaluated using statistical methods following DEQ guidance to develop planning flows and provide flow projections for the planning period. Observed flows for each year from 2015–2019 and planning flows are summarized in Table 1-1 below. During the system flow evaluation process, it was discovered that the current influent flow measurement at the WWTP may not reliably measure peak influent flows during high flow events. The City provided direction to review available data, use engineering judgement, and estimate system flow planning criteria values to reflect the current system demand. Modified planning criteria was established and is presented in Table 1-1.

TABLE 1-1: OBSERVED HISTORICAL FLOWS & PLANNING FLOWS

St. Helens Historical Flows (MGD[1])								
Year	**2015**	**2016**	**2017**	**2018**	**2019**	**5-Year Avg**	**Planning**	**Modified Planning**
Population	15,050	15,085	15,225	15,225	15,395		15,895	15,895
ADWF	0.98	1.31	1.25	0.95	1.09	1.11	1.11	1.11
$MMDWF_{10}$	2.71	2.56	2.87	3.03	2.79	2.79	3.03	3.03
AADF	2.35	2.43	2.64	1.92	1.85	2.24	2.24	2.24
AWWF	3.73	3.56	4.01	2.90	2.59	3.36	3.36	3.36
$MMWWF_5$	7.88	7.81	5.84	4.46	3.99	5.99	7.88	7.88
PWkF	14.19	7.54	8.93	5.90	8.86	9.08	14.19	14.19
$PDAF_5$	21.19	13.08	17.76	9.60	21.90	16.71	21.90	19.90
PIF_5	31.4	27.4	24.6	13.9	32.2	25.90	33.98	26.00
Yearly Total (MG[1])	856	889	955	700	669			
Total Rainfall (in/yr)	47	48	51	31	33			

1) MGD = million gallons per day; MG = million gallons

ADWF = Average Dry-Weather Flow
$MMDWF_{10}$ = Maximum Monthly Dry-Weather Flow
AADF = Average Annual Daily Flow
AWWF = Average Wet-Weather Flow
$MMWWF_5$ = Maximum Monthly Wet-Weather Flow
PWkF = Peak Week Flow
$PDAF_5$ = Peak Daily Average Flow
PIF_5 = Peak Instantaneous Flow

Comparison of the dry weather and wet weather system flows in Table 1-1 shows that the City of St. Helens experiences large increases in flow during wet weather events. The high wet weather flows are associated with large inflow and infiltration (I/I) influence in the system.

To project the planning flows derived from the analysis, a projected flow per capita (reported in gallons per capita per day, [gpcd]) was developed. Projected planning system flows (millions of gallons per day [MGD]) are based on 2019 modified planning flows with the addition of the product of projected unit flows (gpcd) and projected population increase shown in Table 1-2. Actual future flows will depend on several variables and could potentially be decreased through aggressive I/I reduction efforts.

TABLE 1-2: PROJECTED PLANNING FLOWS

	Planning Flow (MGD)	Planning Unit Flow (gpcd)	Projected Unit Flow (gpcd)	Projected Planning Flow (MGD)				
Year	2019	2019	2019	2020	2025	2030	2035	2040
Population	15,395	15,395	15,395	15,895	16,727	17,605	18,530	19,506
ADWF	1.11	72	72	1.15	1.21	1.28	1.34	1.41
$MMDWF_{10}$	3.03	197	197	3.12	3.29	3.46	3.64	3.83
AADF	2.24	145	145	2.31	2.43	2.56	2.69	2.83
AWWF	3.36	218	218	3.47	3.65	3.84	4.04	4.25
$MMWWF_5$	7.88	512	300	8.03	8.28	8.54	8.82	9.11
PWkF	14.19	922	325	14.35	14.62	14.91	15.21	15.53
$PDAF_5$	19.90	1293	375	20.09	20.40	20.73	21.08	21.44
PIF_5	26.00	1689	525	26.26	26.70	27.16	27.65	28.16

1.3 COLLECTION SYSTEM EVALUATION

The existing wastewater collection system consists of approximately 60 miles of gravity sewer mains, 2.5 miles of force main, and nine pump stations.

1.3.1 PUMP STATION EVALUATION

High level facility evaluations were completed in October of 2020 with City operations personnel to review conditions of the pump station facilities, current maintenance activities, and known operational problems encountered by City staff.

Each pump station is a duplex pump station with submersible pumps located in the wetwell, with the exception of Pump Station 2 (PS#2). PS#2 is a duplex self-priming pump station that operates on a variable frequency drive (VFD) with a high and low setting. Table 1-3 below provides a summary for the pump stations evaluated.

TABLE 1-3: PUMP STATION INVENTORY

Name	PS#1	PS#2	PS#3	PS#4	PS#5	PS#7	PS#8	PS#9	PS#11
Type	Duplex, Submersible	Duplex, Self-Priming	Duplex, Submersible	Duplex Submersible	Duplex, Submersible	Duplex, Submersible	Duplex, Submersible	Duplex, Submersible	Duplex, Submersible
Year Constructed	1950s	1990	1997	1995	1994	1986	1991	1994	1996
Pump Type	Paco / Hydromatic Submersible	Gorman Rupps VSP (High / Low)	Wilo Type FA 10.51A Submersible	FLYGT NP - 3085	ABS AFP AFP(K) 1049.1-M105/4FM	Wilo Submersible	ABS SJS10W	Barns 4SE3724L	Hydromatic S4HVX-1500JD
Pump hp	36 / 30	40 / 22.5	6.2	3	14	15.5	1	3.7	15
Design Flow (gpm)	550	700 / 250	500	130	145	390	Unknown	200	143
Design Head (ft)	110	82 / 52	10.7	22	98	83	4	24	74
Low Level Alarm (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.42	N/A
Pump Off Level (ft)	1.33	1.50	2	6.2	2.00	3.83	2.83	0.58	0.75
Lead On Level (ft)	2	3	3.5	8.9	4.00	10.00	4.93	1.167	1.65
Lag On Level (ft)	2.5	3.5	4.33	10.0	5.00	10.5	Unknown	2.75	2
High Level Alarm (ft)	6	7.5	5.83	11.8	5.00	11	5.45	3.75	3.1
Level Control Type	Ultrasonic Level Sensor	Ultrasonic Level Sensor	Ultrasonic Level Sensor	Float Relays	Ultrasonic Level Senor	Ultrasonic Level Sensor	Float Relays	Float Relays	Float Relays
Flow Meter	No	No	No	No	No	No	No	No	No
Pressure Gauge	Yes	No	No	No	No	No	No	No	No
Auxiliary Power Type	Portable Generator	On-Site Generator	Portable Generator	Portable Generator	On-site Generator	On-site Generator	Portable Generator	Portable Generator	Portable Generator
Transfer Switch	MTS	ATS	MTS	MTS	ATS	ATS	MTS	MTS	MTS
Bypass Piping	No	No	No	Yes	No	No	No	No	No
Oder Control	None	None	None	None	None	None	None	None	None
Wet Well Depth (ft)	18	9	15.5	20.6	10.5	16	4	13	6.15
Wet Well Diameter (ft)*	12.67	8	7	6	6	6	3	5	5
Force main Diameter (in)	6	6	6	4	4	6 / 8	3	6	4
Force Main Length (ft)**	1,010	1,050	20	610	1,700	2,620	260	70	2,500

*Pump Station 1 has a rectangular wetwell
**Estimated using City GIS data

The pump station evaluation presents general observations and recommendations, along with specific recommendations for individual pump station sites. The general recommendations are provided as a guideline to allow the City to maintain the pump stations for the 20-year planning period. Overall, the pump stations are in good condition and are well maintained with minor housekeeping items such as partial installation of redundant high-level alarms, lack of fall protection, and lack of up-to-date accurate pump station drawings and pump information. These housekeeping items were identified during observations and discussions with City staff. No significant deficiencies were identified in the overall pump station condition evaluation.

1.3.2 INFILTRATION & INFLOW

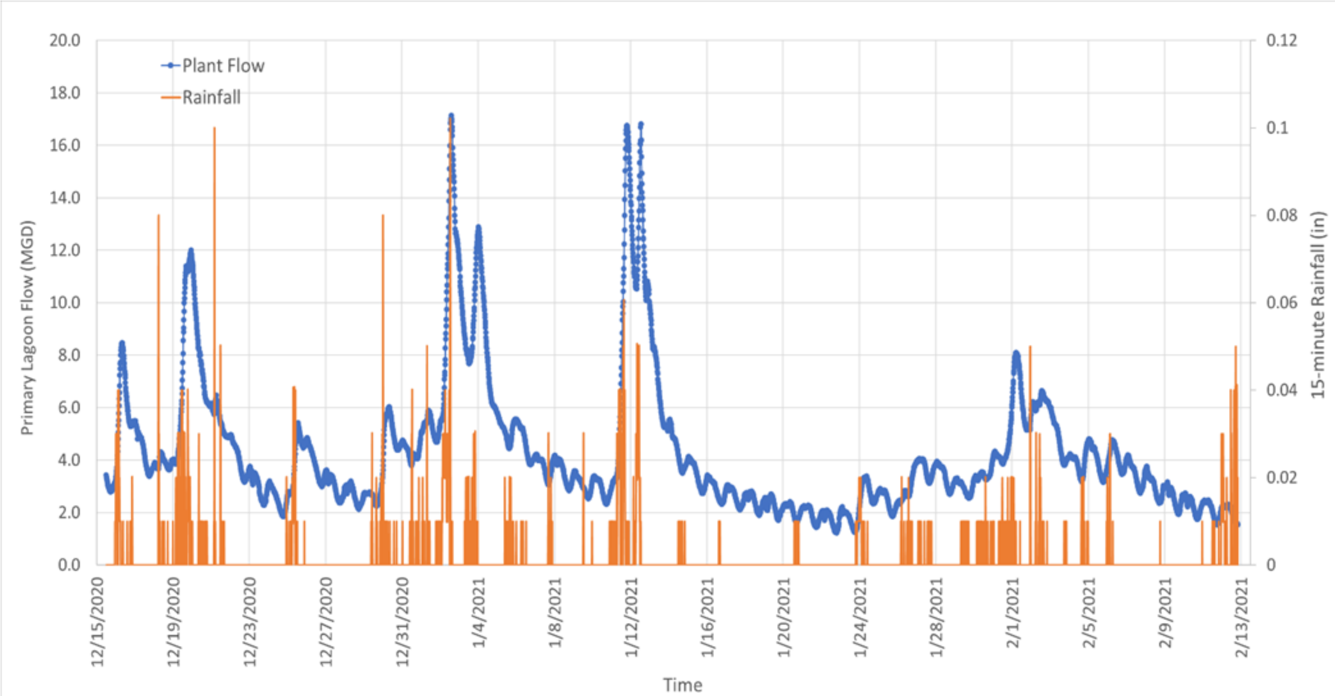
Infiltration and Inflow (I/I) is a concern in the St. Helens collection system. The rapid response between precipitation events and increased flows suggests that a significant component of peak flow is from storm water inflow. Estimated peak flows in the collection system are 20-25 times higher than annual dry weather flows. The sustained increase in flow over several days following a large storm event suggests that groundwater is also infiltrating into the City's wastewater collection system. Visual evidence of I/I influence in the system can be seen in Chart 1-1, which displays WWTP primary lagoon flow vs. 15-minute rainfall data for December 2020 through February 2021. The data is representative of typical wet weather seasonal response in the collection system.

Since the completion of the 2008 Wet Weather Capacity Evaluation, which documented I/I in St. Helens, the City has performed smoke testing and closed-circuit television (CCTV) inspections on the collection system. The City has also taken steps to address I/I in the system via pipeline replacement, pipe repair (including cure-in-place-pipe [CIPP] lining and spot repairs), and manhole rehabilitation and replacement. City staff have reported that the effort has produced noticeable I/I reduction (annual reported overflows have been reduced), but I/I still persists in the system.

This study included a high-level evaluation of I/I in the system. A preliminary evaluation to identify areas likely to experience the highest I/I was completed using available data. Pipeline age and material data, areas of suspected sump pump connections, City reported issues, and priority pipelines from the 2008 evaluation not addressed in the I/I reduction projects were compared to identify areas anticipated to have the highest I/I influence. The pipelines identified as highest risk for I/I should be considered as high priority for CCTV inspection and subsequent repair and/or replacement as needed. Overall, the evaluation identified approximately 8,000 feet of Priority 1 pipelines; 15,200 feet of Priority 2 pipelines; and 18,250 feet of Priority 3 pipelines for CCTV inspection. The primary area identified by City staff as likely to have improper stormwater sump pump connections was marked for additional investigations in order to locate and disconnect any stormwater sump pumps.

I/I prioritization and identification is an ongoing, evolving process. As the City collects more data, the prioritization evaluation needs to be updated to reflect the most recent data available. It is recommended the City work towards regular inspection of all system pipes and include this information in their ongoing I/I prioritization process.

CHART 1-1: DAILY FLOW AND PRECIPITATION DURING WET WEATHER



1.3.3 STAFFING EVALUATION

A high-level evaluation of existing wastewater staffing levels, deficiencies in existing staffing levels, and staffing recommendations was completed as part of this study. The City Public Works (PW) Operations staff, who are responsible for the operations and maintenance (O&M) of the wastewater collection system, and the WWTP staff, who are responsible for the O&M of the City's nine pump stations, were interviewed to collect information on existing staffing levels, annual O&M activities, and level of service (LOS) goals for the City wastewater infrastructure. In general, St. Helens' public works staff provide support for many City activities that are not directly related to public utility O&M (i.e. building maintenance, building remodels, City events, etc.), which reduces time and O&M activities they can spend and complete on utility infrastructure. It is recommended that either additional Full Time Employee (FTE) be budgeted for the PW Operations staff to complete the existing workload requested, or the responsibilities of the PW Operations staff be reduced to focus solely on utility O&M. Additionally, it is advised that staffing needs be re-evaluated every two to three years.

1.3.4 PIPELINE CAPACITY EVALUATION

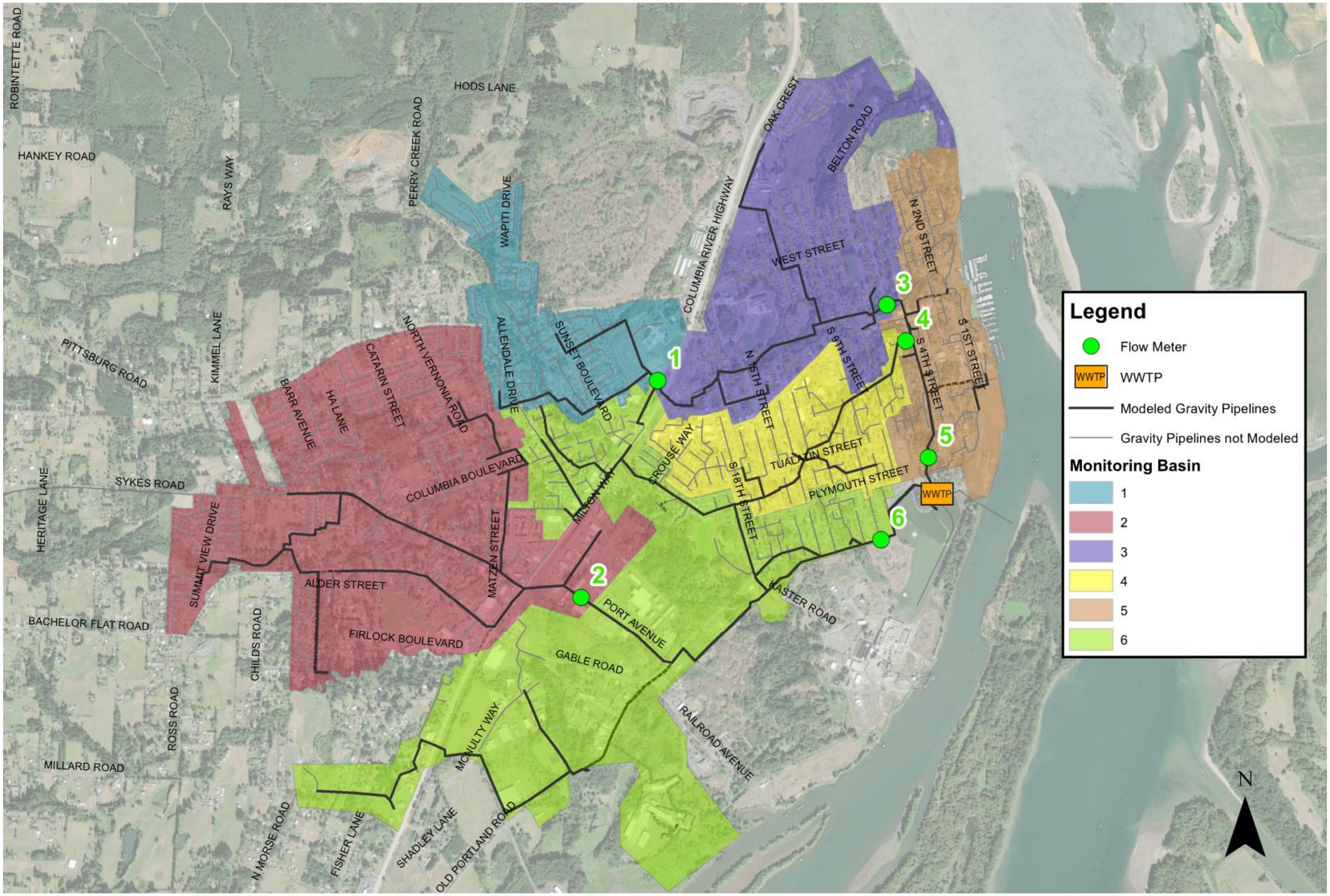
A wastewater collection system model was developed using InfoSWMM software (Suite 14.7 Update #2) to evaluate existing and 20-year collection system capacity. Wastewater trunklines (10-inch diameter and larger) were included in the model as well as five pump stations. Some 8-inch pipelines were modeled to connect disparate areas that were served by 10-inch pipelines. Continuous flow monitoring was completed at six locations during the wet weather period between December of 2020 and January of 2021. The six flow monitoring locations divided the system into six monitoring basins, shown in Figure 1-2. The collected data was analyzed along with continuous precipitation data to establish typical 24-hour patterns, average base flows at each site, and gauge rainfall influence in the system. Both dry weather (minimal to no rain in days prior) and wet weather periods were used for base flows and calibration efforts.

Gravity pipelines were evaluated according to the City's Public Works Design Standards. Pipe capacity was assessed by evaluating the ratio of the depth of maximum flow to the diameter of the pipe (d/D), with pipes considered undersized if they exceed a ratio of 0.85. This planning criteria was established in meetings with City staff. Pump stations were evaluated based on the capacity to handle peak flows with the largest pump out of service (defined as firm capacity).

The calibrated model was used to assess the effects of a 5-year, 24-hour design storm event on the existing system. The existing system evaluation showed a significant portion of the modeled trunk lines operating at or above capacity. There are pipelines operating at or above capacity in each of the six monitoring basins, and almost all have manholes with the potential to overflow. The deficiencies found in the evaluation are caused by high peak flows and undersized trunklines. Figure 1-3 shows locations of over-capacity pipes in the existing system model, displayed in orange and red, with potential overflow locations marked with a red circle.

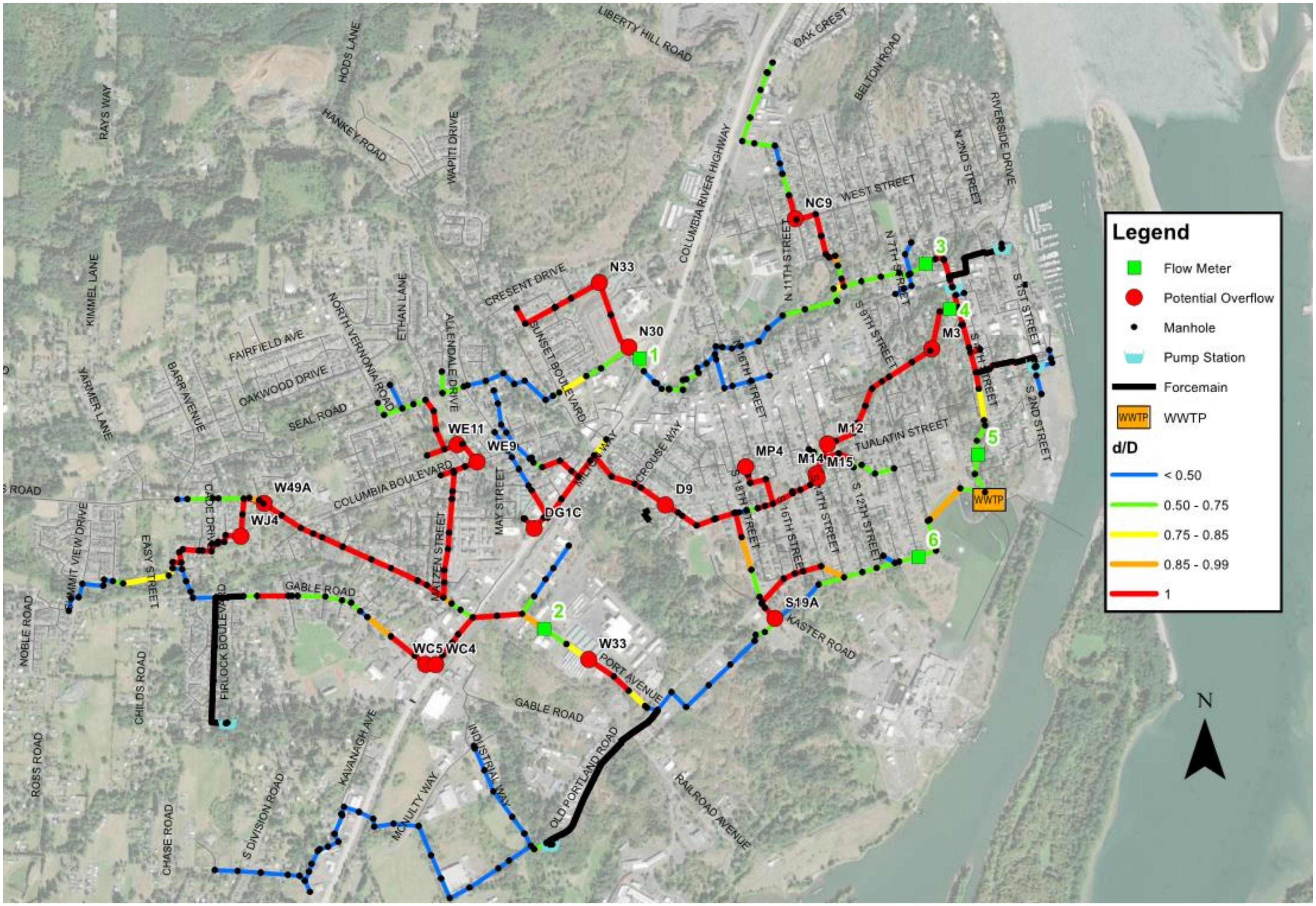
Item #4.

FIGURE 1-2: FLOW METER LOCATIONS AND MONITORING BASINS



Item #4.

FIGURE 1-3: EXISTING SYSTEM EVALUATION – D/D AND POTENTIAL OVERFLOW LOCATIONS



For the 20-year capacity evaluation, future loads were distributed based on PSU population projections and City anticipated future residential, commercial, and industrial growth areas, shown in Figure 1-4. A majority of the areas anticipated to develop have topography that would allow for gravity flow to the existing collection system, while four growth areas may require additional infrastructure. These four identified areas are the Riverfront District (Growth Area #2), the Business Industrial Park (Growth Area #17), and Growth Areas #1 and #9 located near Pump Station 11 (PS#11).

The City is currently evaluating development options for the Riverfront District, which includes the relocation of Pump Station 1 (PS#1). A 10-inch pipeline at minimum slope would have the capacity to convey the projected 20-year flows through the Riverfront District. The proposed pipeline would be routed underneath the proposed roadways depicted in the current City planning documents.

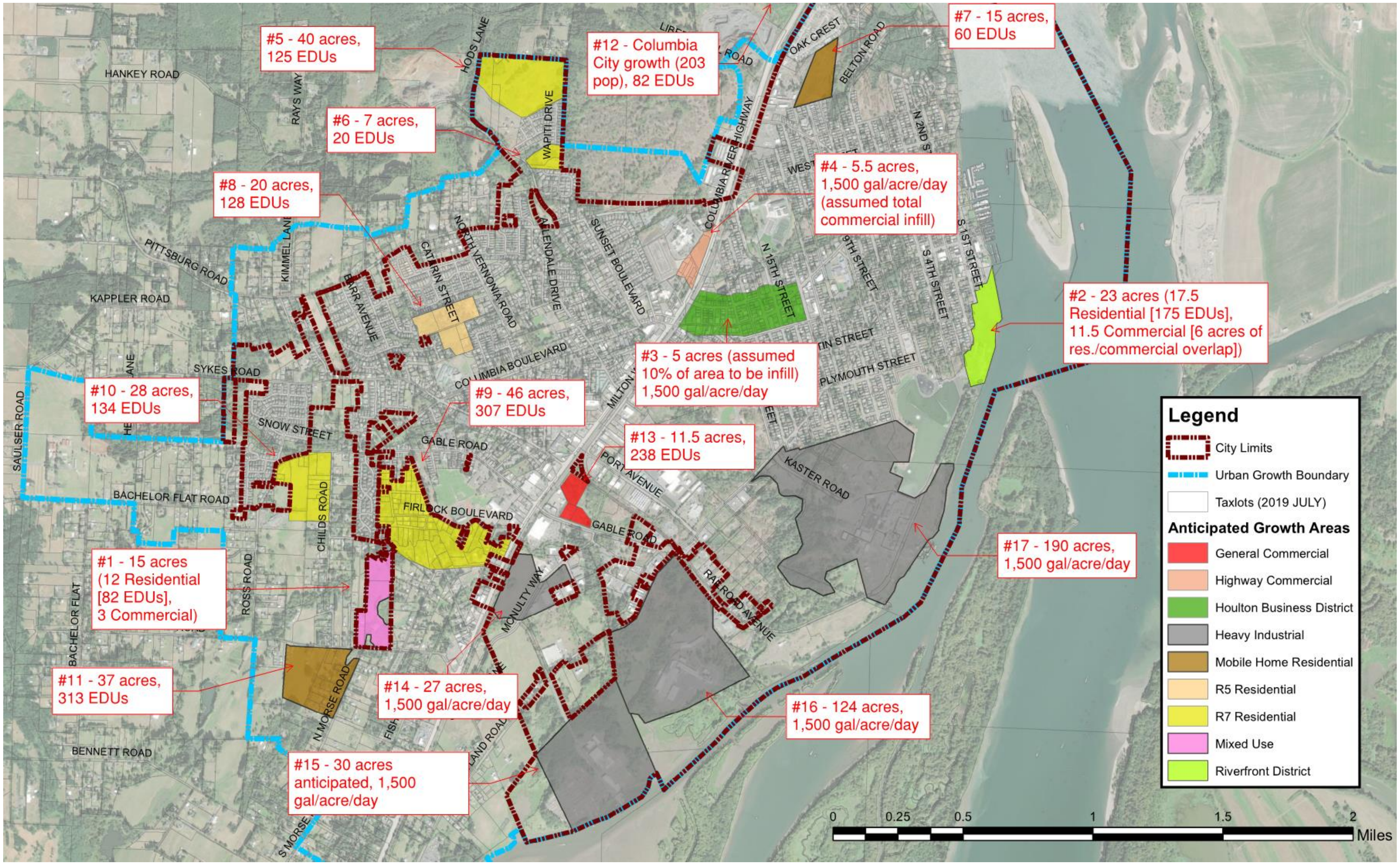
The City is seeking new opportunities for the Industrial Business Park and completed parcellation framework report for the site. To provide sewer service for the future development, a pump station will be required. The pump station will likely need to be located near the waterfront to follow existing topography. The gravity sewer piping will follow the proposed roadway alignments and drain to the proposed pump station location. The force main can be routed along existing and/or proposed roadways and discharge to the existing trunkline on Kaster Road. The existing gravity trunkline downstream on Old Portland Road has a section of parallel pipes which are capacity limited and should be included as part of the development process and project.

The City has expressed interest in relocating PS#11 further north, to the intersection of Firlok Park Street and Hazel Street. If relocated, the depth of the wetwell could be sized at predesign to receive flow via a gravity line from the northern portions of Growth Areas #1 and #9, which would involve a bore under McNulty Creek to serve Growth Area #1. The southern portion of both growth areas could be served by 8-inch pipelines conveyed to existing gravity trunklines. Grinder pumps might need to be installed at residences adjacent to McNulty Creek, as the relative elevation of these locations may make serving them via gravity pipeline not feasible.

Overall, problem areas identified in the 20-year evaluation reflect the same areas identified in the existing system analysis, with many of the deficiencies being caused by high peak flows and undersized trunklines exacerbated in the 20-year model. Figure 1-5 shows locations of over-capacity pipes in the 20-year model, displayed in orange and red, with potential overflow locations marked with a red circle.

Item #4.

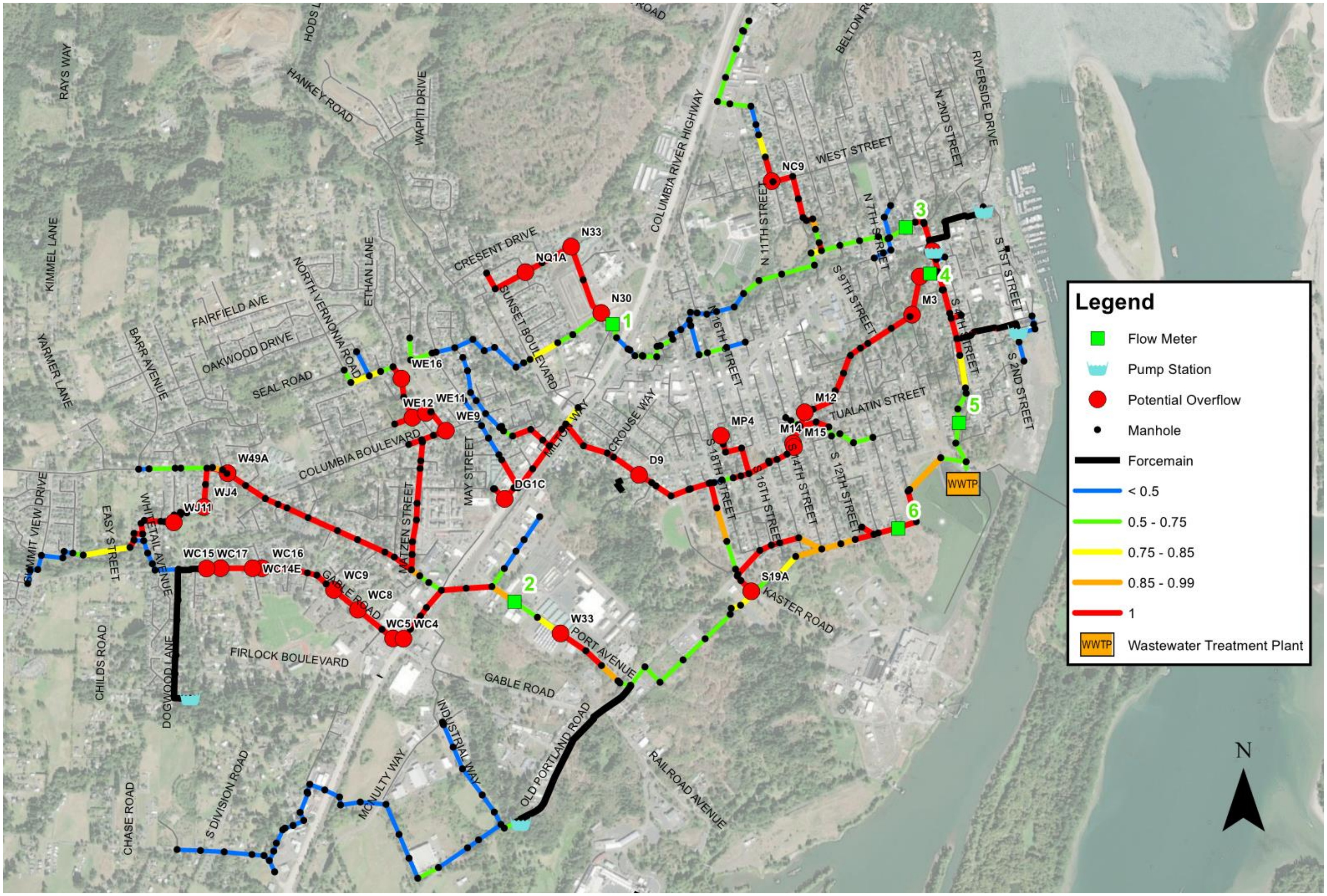
FIGURE 1-4: ANTICIPATED 20-YEAR GROWTH LOCATIONS



KELLER ASSOCIATES

Item #4.

FIGURE 1-5: 20-YEAR SYSTEM EVALUATION – D/D AND POTENTIAL OVERFLOW LOCATIONS



1.3.5 PUMP STATION RESILIENCY

The compilation of this master plan included an assessment of pump station resiliency using a risk of failure evaluation. The risk of failure of an asset is a combination of the likelihood of failure and consequence of failure. Likelihood of failure is a measure of how likely an asset is to fail. An evaluation of the risks of failure can provide an importance, urgency, or priority to assets and provide guidance on the order in which asset deficiencies should be addressed. Assets with the highest risk of failure (product of likelihood of failure and consequence of failure) should be repaired or replaced first as they pose the largest threat to a system and community.

The analysis shows that PS#1 and PS#2 have the highest risks of failure. A failure at one of these pump stations would have the largest impact on the community and is most likely to happen based on the factors evaluated, indicating that deficiencies at these pump stations should be addressed soon after identified.

1.4 COLLECTION SYSTEM ALTERNATIVES

Alternatives to address collection system deficiencies discussed are summarized in the sections below. A few of the deficiencies identified do not have multiple, feasible, or cost-effective alternatives for improvements. Recommended improvements for these deficiencies are also included below.

1.4.1 SUMP PUMPS

Six alternatives were identified to address the presence of private sump pumps discharging into the collection system. The alternatives included: targeted distribution of educational material, smoke testing, dye testing and CCTV, visual inspection, point-of-sale inspection, and a reward-based disconnection incentive program. These alternatives were not considered mutually exclusive and could be performed in conjunction if the City chose to perform multiple projects at a time.

1.4.2 CONVEYANCE SYSTEM

Alternatives for conveyance were established for each flow metering basin. While some of the conveyance system deficiencies do not have multiple feasible alternatives, construction of new trunklines to redirect flow away from undersized pipelines or suspected points of overflow was considered by the City. The redirection of the conveyance system was considered a feasible alternative for Basins 2, 4, and 6. Upsizing the existing undersized trunklines to handle 20-year peak flows was considered a feasible alternative for each basin.

Additionally, the installation of parallel facilities or taking no action was presented to the City. The City could choose to construct parallel facilities in areas with limited remaining capacity, however this alternative was ultimately dismissed. Taking no action is not a viable option because surcharging and the potential for overflows would only worsen, which could result in negative impacts to human health and the environment, in addition to the increased risk of fines from the DEQ.

1.5 RECOMMENDED COLLECTION SYSTEM IMPROVEMENTS

To address the identified system deficiencies, the following improvements are recommended. Cost estimates for each of the recommended improvements are included in the section and incorporated in the Capital Improvement Plan (CIP).

1.5.11 WWTP INFLUENT FLOW METER

Priority 1 WWTP influent flow meter improvements address the suspected inaccurate influent peak flow measurement at the WWTP and would provide accurate measurement of influent peak flows during wet weather events. The total estimated cost for this improvement is $68,000.

1.5.2 PUMP STATIONS

Priority 1 pump station improvements address the continuation of upgrades the City of St. Helens is currently performing as well as the operations improvements, which include the installation of overflow alarms and adding a SCADA alarm to sound when both pumps in a pump station turn on. It is recommended that pump station runtimes continue to be recorded and reviewed by staff in conjunction with the recommended alarm data if both pumps are running to track as pump stations may be nearing firm capacity. Additionally, it is recommended that Pump Station 3 be equipped with an on-site generator to address its backup power deficiency and simplify portable generator operations during outages. The total estimated cost for these improvements is $100,000.

Priority 2 pump station improvements assume that the Riverfront District and Growth Areas #1 and #9 require the relocation of Pump Stations 1 and 11. Additionally, Priority 2 improvements address the general deficiencies, such as under-capacity pumps, fall protection provisions, level sensor redundancy, as well as flow and pressure monitoring. The total estimated costs for these improvements is $6,200,000.

Priority 3 pump station improvements include firm capacity increase of PS#7 as growth areas develop in the basin. The total estimated costs for these improvements is $2,200,000.

1.5.3 INFLOW AND INFILTRATION (I/I)

The City is advised to create an annual budget to fund an ongoing I/I reduction program, which would promote annual I/I improvement projects throughout the City. This type of work is anticipated to be a combination of sump pump identification and removal, lateral replacement, and mainline and manhole inspections and rehabilitation/replacement. System I/I reductions could reduce, delay, or eliminate the need for capacity-related pipeline upsizing projects and provide cost savings to the City over the planning period. Rather than have a separate replacement budget and I/I improvement budget, it is recommended the City adopt a combined fund of $500,000 annually for the 20-year planning period. This dollar amount is reflective of the estimated annual pipeline replacement cost, presented in Table 1-4.

1.5.4 SUMP PUMPS

It is recommended the City pursue a combination of educational material distribution, point-of-sale inspection, and a reward-based incentive program. A portion of the recommended I/I annual budget should be reserved for the printing and distribution of educational materials and to support a sump pump disconnection incentive program. Additionally, the City ought to update its code to include language requiring the seller to evaluate and disconnect any sump pumps from the sanitary sewer during inspection and before the property transfers ownership.

1.5.5 CONVEYANCE SYSTEM

Priority 1 improvements address potential overflows near the downtown and “tunnel” pipelines for the City (Basin 5), as well as deficiencies in Basin 4. Improvements include rerouting Basin 4’s trunkline along Tualatin Street to Basin 6, and upsizing gravity mains on S 4th Street, S 16th Street and S 17th Street. The annual I/I reduction projects could have significant impacts to the peak flows in Basin 5. It is recommended that flow monitoring be included in the concept design phase of this project to further define existing flows and compare the peak flows in Basin 5 following the I/I reduction work and Basin 4 improvements. The total estimated cost for these improvements is $8,100,000.

Priority 3 improvement projects will alleviate remaining existing and future capacity limitations in the collection system, but an intentional, ongoing I/I reduction program could reduce, delay, or eliminate the need for some of these improvements. These improvements include upsizing of existing undersized pipelines in Basins 1, 2, 3, and 6, and also involve construction of a new pipeline to reroute flow from Gable Road to Sykes Road, and reroute flow near Old Portland

Road and Kaster Road in Basin 6. The total estimated cost for these improvements is $22,700,000.

1.5.6 FUTURE INFRASTRUCTURE

There are four anticipated growth areas in the 20-year planning period that may require additional infrastructure to connect with the existing system, which include the Riverfront District (Growth Area #2), the Business Industrial Park (Growth Area #17), and Growth Areas #1 and #9 located near PS#11. Priority 2 improvements address the required infrastructure needed to serve the Riverfront District, Business Industrial Park, and Growth Areas #1 and #9. The costs for the proposed infrastructure at the Riverfront District are tied into the cost of the PS#1 relocation. The estimated cost of the proposed Riverfront District and Business Industrial Park infrastructure is $15,600,000. The proposed infrastructure for Growth Areas #1 and #9 is tied into the cost to relocate PS#11 and is estimated at $3,100,000.

1.5.7 OPERATIONS AND MAINTENANCE

In addition to regular maintenance, it is recommended that an annual pipeline replacement program be established. Typically, a budget for replacing the system components is based on average useful life. Average useful life of manholes and cleanouts are shown in Table 1-4.

It is recommended that the $500,000 amount presented in the I/I section above serve as a combined I/I reduction program budget and annual replacement budget. It should be noted that this is an interim amount presented for City budgeting purposes, with the purpose of increasing over time to the recommended $790,000 annual replacement budget for the system. Even after I/I improvements have significantly reduced peak flows in the system, the City should continue to maintain an annual replacement budget to fund ongoing O&M and meet the City's LOS goals.

Pipelines should be cleaned approximately every three to five years (frequency can be adjusted based on pipe material plus scour conditions and observations by City staff). Manhole rehabilitation and service line repairs should be coordinated with pipeline rehabilitation work. Emphasis should be placed on areas where pipe conditions pose the largest threat of sanitary sewer surcharging or more immediate threat of collapse.

TABLE 1-4: ANNUAL REPLACEMENT BUDGET

Item	Lifespan	Cost/Year
Pipelines	75 Years	$ 570,000
Manholes	50 Years	$ 210,000
Cleanouts	50 Years	$ 5,000
Total (rounded)		***$ 790,000***

1.5.8 PLANNING RECOMMENDATIONS

The City is recommended to update their planning documents every 5 years. Updates to the planning documents and models allow the City to re-assess needs and properly allocate budgets to address system deficiencies. The next update should include an evaluation of both the wastewater collection system and WWTP. A Master Plan Update for both the wastewater collection system and the treatment plant was included as a Priority 2 improvement, with an estimated cost of $300,000.

1.5.9 ENGINEERING DESIGN STANDARDS, CODE, AND COMPREHENSIVE PLAN REVIEW

The City's existing development code (Title 17), engineering design standards (Title 18), and comprehensive plan (Title 19) were reviewed for new development, as they pertain to wastewater conveyance, to identify potential deficiencies and provide recommendations for updates. The primary recommendations for review, updates, and additions include the following:

- Scheduling requirements
- Matching references to the Oregon Department of Transportation (ODOT)/ American Public Works Association (APWA) Oregon Standard Specifications for Construction (OSSC).
- Pipeline sizing, slope, cover, and utility spacing requirements
- Manhole design requirements
- Stream and creek crossing requirements

The City is advised to review and assess these recommended changes to these sections to City code, standards, and comprehensive plans to match current best practices in the industry. The City should then initiate the process of proposing changes to associated City documents to maintain consistency.

1.6 CAPITAL IMPROVEMENT PLAN

This section outlines the recommended plan to address the wastewater collection system deficiencies identified in previous sections. The alternative evaluation and recommended projects, with input from City staff, are the basis for the CIP for the wastewater collection system presented in this section.

1.6.1 SUMMARY OF COSTS

The cost summary of the 20-year CIP is listed in Table 1-5. Capital costs developed for the recommended improvements are Class 4 estimates as defined by the Association for the Advancement of Cost Engineering (AACE). Actual construction costs may differ from the estimates presented depending on specific design requirements and the economic climate when a project is at bid. An AACE Class 4 estimate is normally expected to be within -50 and +100 percent of the actual construction cost, which is typical for planning documents. As a result, the final project costs will vary from the estimated costs presented in this document. The costs are based on experience with similar recent collection system and WWTP upgrade projects. Equipment pricing from manufactures of the large equipment items was also used to develop the estimates. The total estimated probable project costs include contractor markups and 30% contingencies, which is typical of a planning-level estimate. Overall project costs include total construction costs, costs for engineering design, construction management services, inspection, as well as administrative costs. For the collection system projects, the contractor's overhead and profit are worked into the line items. Priorities are set for today and will be re-evaluated when there is a need for re-assessment. 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. An estimated schedule for the next six years is shown in Table 1-6. Locations of the CIP projects can be found in Figure 1-6.

FIGURE 1-6: 20-YEAR CAPITAL IMPROVEMENT PLAN

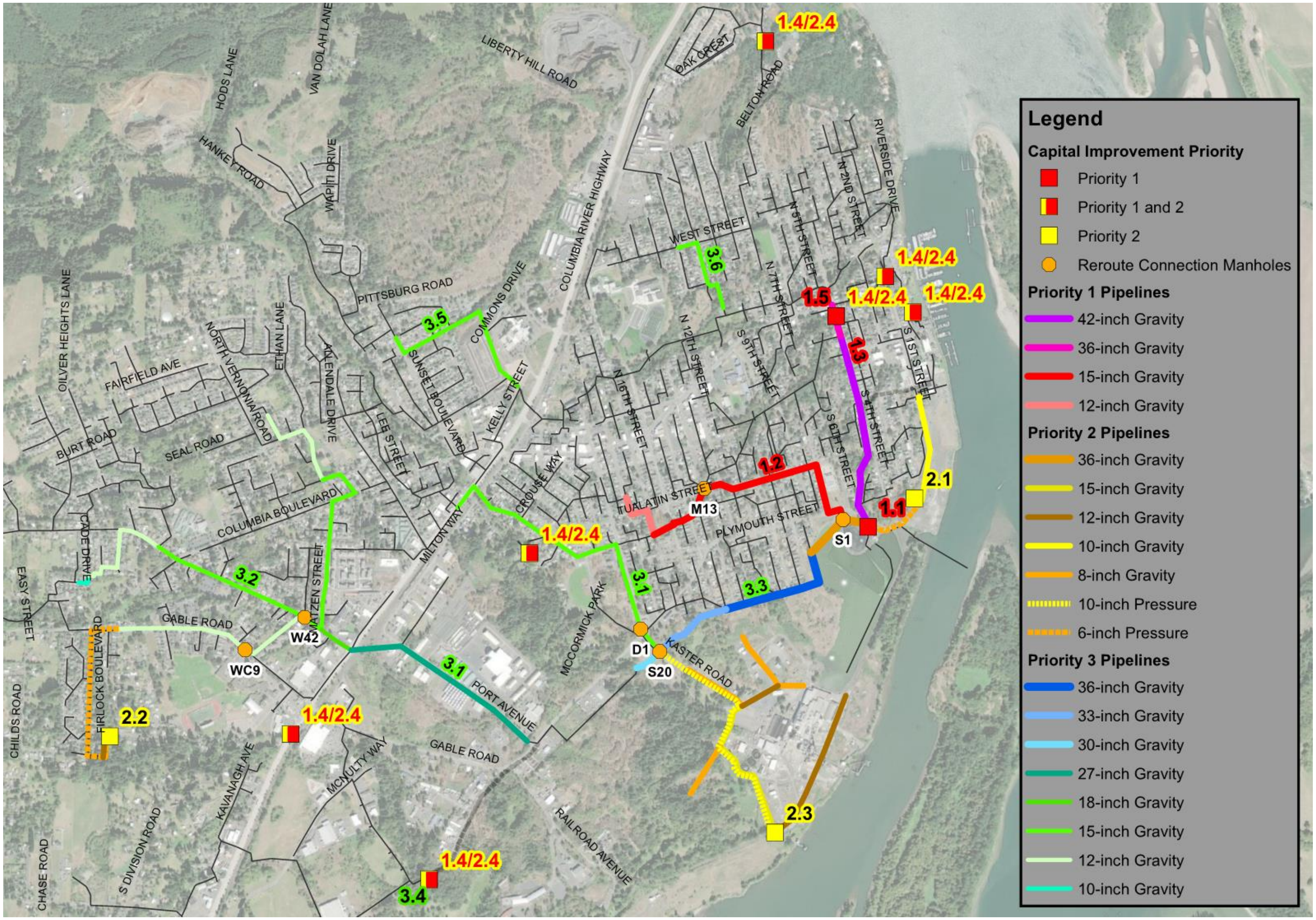


TABLE 1-5: 20-YEAR CAPITAL IMPROVEMENT PLAN (CIP)

Project No.	Project Name	Primary Purpose	Total Estimated Cost (2021)	SDC Growth Apportionment %	SDC Growth Apportionment Cost	City's Estimated Portion
Priority 1 Improvements						
1.1	WWTP Influent Flow Meter	Operations	$ 68,000	10%	$ 7,000	$ 61,000
1.2	Basin 4 Pipeline Upsize and Reroute	Capacity	$ 3,600,000	0%	$ -	$ 3,600,000
1.3	Basin 5 Pipeline Upsize	Capacity	$ 4,500,000	3%	$ 150,000	$ 4,350,000
1.4	Install Overflow Alarms	Operations	$ 9,000	20%	$ 2,000	$ 7,000
1.5	Pump Station 3 On-site Generator	Operations	$ 90,000	0%	$ -	$ 90,000
1.6	Annual I/I Reduction Program (6-Year)	Capacity	$ 3,000,000	20%	$ 590,000	$ 2,410,000
	Total Priority 1 Improvement Cost (rounded)		**$ 11,300,000**			**$ 10,500,000**
Priority 2 Improvements						
2.1	Riverfront District Trunkline and Pump Station 1 Relocation	Capacity, Operations	$ 2,400,000	18%	$ 440,000	$ 1,960,000
2.2	Relocate Pump Station 11	Capacity, Operations	$ 3,100,000	68%	$ 2,110,000	$ 990,000
2.3	Industrial Business Park Trunklines and Pump Station	Capacity, Operations	$ 13,200,000	100%	$ 13,200,000	$ -
2.4	Pump Station Upgrades	Operations, Safety	$ 700,000	20%	$ 140,000	$ 560,000
2.5	Master Plan Update	Operations	$ 300,000	100%	$ 300,000	$ -
2.6	Annual I/I Reduction Program (8-Year)	Capacity	$ 4,000,000	20%	$ 790,000	$ 3,210,000
	Total Priority 2 Improvement Cost (rounded)		**$ 23,700,000**			**$ 6,700,000**
Priority 3 Improvements						
3.1	Basin 6 Pipeline Upsize and Reroute	Capacity	$ 6,300,000	7%	$ 460,000	$ 5,840,000
3.2	Basin 2 Pipeline Upsize and Reroute	Capacity	$ 9,400,000	12%	$ 1,140,000	$ 8,260,000
3.3	Southern Trunkline Upsize	Capacity	$ 3,900,000	26%	$ 1,010,000	$ 2,890,000
3.4	Pump Station 7 Upgrades	Capacity	$ 2,200,000	65%	$ 1,430,000	$ 770,000
3.5	Basin 1 Pipeline Upsize	Capacity	$ 1,800,000	9%	$ 150,000	$ 1,650,000
3.6	Basin 3 Pipeline Upsize	Capacity	$ 1,200,000	3%	$ 40,000	$ 1,160,000
3.7	Annual I/I Reduction Program (6-year)	Capacity	$ 3,000,000	20%	$ 590,000	$ 2,410,000
	Total Priority 3 Improvement Cost (rounded)		**$ 27,900,000**			**$ 23,000,000**
	Total Collection System Improvement Costs (rounded)		**$ 62,900,000**			**$ 40,200,000**

Note:

The cost estimate 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.

TABLE 1-6: PRIORITY 1 CIP SCHEDULE

Project No.	Item	Cost (2021)	Opinion of Probable Costs 2022	2023	2024	2025	2026	2027
Priority 1 Improvements								
1.1	WWTP Influent Flow Meter	$ 68,000	$ 68,000					
1.2	Basin 4 Pipeline Upsize and Reroute	$ 3,600,000		$ 400,000	$ 3,200,000			
1.3	Basin 5 Pipeline Upsize	$ 4,500,000				$ 500,000	$ 4,000,000	
1.4	Install Overflow Alarms	$ 9,000	$ 9,000					
1.5	Pump Station 3 On-site Generator	$ 90,000	$ 90,000					
1.6	Annual I/I Reduction Program (6-Year)	$ 3,000,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000
	Total (Rounded)	$ 11,300,000	$ 700,000	$ 900,000	$ 3,700,000	$ 1,000,000	$ 4,500,000	$ 500,000

Note:

The cost estimate 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 any escalation. 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.

1.6.2 OTHER ANNUAL COSTS

In addition to the capital improvement costs presented in Table 1-5 and Table 1-6, 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 ideally budget a total of $790,000/year for pipeline replacement/rehabilitation. Currently, it is recommended the City should establish a $500,000 annual fund for system replacement/rehabilitation. I/I replacement and rehabilitation projects performed as part of the Annual I/I Reduction Program may offset a portion or majority of these recommended costs, as pipeline rehabilitation addresses defects and extends pipeline lifespan.

The City should target the infiltration and inflow (I/I) projects as a part of the annual pipeline replacement/rehabilitation budget. Prioritizing these projects should help to reduce I/I flows into the system and potentially delay capital improvements triggered by increased system flows.

It is recommended that the City maintenance staff develop a program to clean the entire collection system every three years, and CCTV the entire collection system every six years.

Annual O&M costs for the collection system may increase slightly if Priority 3 improvements are made, as they increase the total linear feet of pipeline in the system.

It is estimated that approximately 3.5-4.0 FTE are needed to meet the recommended level of O&M for the City's LOS goals. As budgeted, the existing wastewater collections FTE staff appears to be adequate. However, the additional projects and work the PW Operations staff are currently requested to complete significantly decreases the budgeted FTE hours that can be spent on wastewater collections O&M. It is recommended that either additional FTE be budgeted for the PW Operations staff to complete the existing workload requested, or the responsibilities of the PW Operations staff be reduced to focus solely on utility O&M. In addition, the recommended CIP projects would increase workload of the engineering division. The engineering division may need additional staff to manage any sump pump identification and removal program, update and maintain the GIS database, coordinate CCTV inspection and resulting work orders, and manage capital improvements. Additional workload on the engineering and PW operations divisions should be included in planning for any of the recommended improvements and projects. It is recommended that staffing needs be reevaluated every two to three years.

1.6.3 OTHER FINANCIAL CONSIDERATIONS

The City previously had several wastewater debts that were refinanced into a single debt service in 2020. The yearly transfer for this payment is $600,000 and is set to mature in 2034. The City is currently exploring options for paying off the sewer debt sooner, potentially between 2026 and 2031.

The City should complete a full-rate study for the wastewater utility in order to evaluate potential user rate and system development charge (SDC) impacts of the recommended CIP. Estimated SDC eligibility for each identified capital improvement is included in Table 1-5 for use in completing a full rate study. It is recommended the City actively pursue opportunities for grant funds, low-interest loans, or principal forgiveness funding sources to mitigate user rate impacts. As the City prepares to proceed on CIP projects, if outside funding is desired, it is recommended the City setup a one-stop meeting with Business Oregon to identify and assess potential funding sources for the sewer projects.

SECTION 2 - PROJECT PLANNING

The City of St. Helens (City) owns and operates a municipal wastewater collection system and wastewater treatment plant (WWTP). The purpose of this study is to assess the City's wastewater collection system needs, evaluate if the City's existing collection system can meet those needs, and provide a long-term plan to implement improvements so the needs of the City can be met. This study describes the conditions, flows, and problems in the existing system, analyzes the hydraulic flow data, and provides recommendations for improvements to the collection system over the 20-year planning period.

2.1 LOCATION AND STUDY AREA

The City of St. Helens, Oregon is located adjacent to the Columbia River, approximately 25 miles northwest of Portland on US Highway 30. The City of St. Helens owns and operates a wastewater collection system within its Urban Growth Boundary (UGB). Figure 1 in Appendix A illustrates the study area and UGB for reference. Figure 1 also displays the topography within the City's UGB.

The City of Columbia City also owns and operates a wastewater collection system within its UGB. The Columbia City collection system discharges to and flows through the collection system in St. Helens to the St. Helens WWTP for treatment. No evaluation of the Columbia City system, aside from the impacts of population growth and existing flows on the St. Helens system, are included in the scope of this study.

2.2 ENVIRONMENTAL RESOURCES PRESENT

This section describes the existing environmental resources present in this area that might be impacted by wastewater facilities. The components analyzed in this section include land use, prime farmland, floodplains, wetlands, cultural resources, coastal resources, and socio-economic conditions. Discussion of environmental impacts of specific alternatives is covered later in the report.

2.2.1 LAND USE

The City of St. Helens zoning includes residential, commercial, industrial, and public zoning within the city limits. A zoning map for the study area is in Figure 2 in Appendix A. Approximately half of the zoning within the city limits is residential. Heavy and light industrial zones are concentrated in the southern portion of the City, while most commercial areas surround the highway or are located in the Houlton Business District or Riverfront District.

2.2.2 FLOODPLAINS

Information on the floodplains in the study area is available from the Federal Emergency Management Agency (FEMA) Map Service Center. These maps show portions of the planning area which lie within the 100-year floodplain adjacent to the floodway of the Columbia River and several other small drainages. Figure 3 in Appendix A shows the flood areas within the study area obtained from the FEMA website. This figure is for display purposes only. For specific projects in these areas, the individual FEMA Flood Insurance Rate Map (FIRM) Panels should be referenced.

2.2.3 WETLANDS

St. Helens completed a Local Wetlands Inventory (LWI) in 1999 that was accepted by the Department of State Lands (DSL) and is referenced in the City's Comprehensive Plan as of May 2020. In the Comprehensive Plan, the City takes inventory and maps their wetlands to assess their functions in order to determine "Locally Significant Wetlands" that contribute to wildlife habitat, fish habitat, water quality, floodwater retention, recreational opportunities, and/or educational opportunities. The Comprehensive Plan lists the following wetlands as Locally Significant Wetlands: Dalton Lake, McNulty Creek, Frogmore Slough, Jackass Canyon, Milton Creek, Unnamed Creek A, and Unnamed Creek B.

Approximately 443 acres of wetlands were identified within the study area, and were classified into the following wetland types, also shown in Figure 4 in Appendix A:

- Forested Wetland - A wetland with soil that is saturated and often inundated, and is dominated by woody plants taller than 20 feet. Water-tolerant shrubs and herbaceous plants are often beneath the forest canopy.
- Scrub/Shrub Wetland - A wetland dominated by shrubs and woody plants less than 20 feet. Water levels can range from permanent to intermittent flooding.
- Emergent Wetland - Wetlands dominated by erect, rooted herbaceous plants that can tolerate flooded soil conditions, but cannot tolerate being submerged for extended periods, e.g. cattails, reeds, and pickerelweeds.
- Rock Bottom Wetland - Wetlands with substrates having an areal cover of stones, boulders, or bedrock 75% or greater and vegetative cover less than 30%. Water regimes are restricted to subtidal, permanently flooded, interment exposed, and semipermanent flooded.
- Littoral Wetland - Wetlands situated in a topographic depression or a dammed river channel and lack trees and shrubs. Wetlands are permanently flooded with extensive areas of deep water.
- Upper Perennial Wetland - Water is flowing throughout the year and includes wetlands contained within a channel unless the wetland is dominated by trees, shrubs, and emergent, or habitats with water containing ocean derived alts in excess of 0.5%. The gradient of the channel is high, and velocity is fast.
- Intermittent Wetland - Similar to Riverine Upper Perennial Wetland, except water only flows for parts of the year.

Additionally, to protect the riparian areas and locally significant wetlands, including McNulty and Milton Creek, designated upland protection zones have been established where construction is limited or prohibited. Additional details on upland protection zones near recommended improvements are discussed in section 7.8.3.

2.2.4 HISTORIC SITES, STRUCTURES, AND LANDMARKS

The National Register of Historic Places lists one historic site for St. Helens: the St. Helens Downtown Historic District, which is composed of approximately 101 buildings. Additionally, 23 areas and structures within city limits which hold local significance were identified as “designated landmarks” by City Ordinance Number 3250. Many of these landmarks are located within the St. Helens Downtown Historic District. A map of the Downtown Historic District and the designated landmarks can be found in Figure 5 in Appendix A.

2.2.5 BIOLOGICAL RESOURCES

The U.S. Fish and Wildlife Service (USFWS) produces a database that lists endangered and threatened plants throughout the country. A database search for Columbia County study area returned seven types of plants and several species listed as endangered or threatened (see Appendix B for the October 30, 2020 summary).

2.2.6 WATER RESOURCES

The Columbia River, Jackass Canyon, Milton Creek, McNulty Creek, the Frogmore Slough, and two unnamed creeks flow through the study area. The WWTP outfalls to the Columbia River. Section 303(d) of the Clean Water Act establishes a list of impaired waters and total maximum daily loads (TMDL) for pollutants in each water body. Jackass Canyon is 303(d) listed for sedimentation and has a TMDL for temperature. McNulty Creek is 303(d) listed for biological criteria. The Lower Columbia River is 303(d) listed for arsenic, DDE 4,4, fecal coliforms, and PCBs, and has a TMDL for dioxins and temperature.

2.2.7 COASTAL RESOURCES

There are no coastal areas within the study area.

2.2.8 SOCIO-ECONOMIC CONDITIONS

According to the City's Housing Needs Assessment, completed in May of 2019, the City has been experiencing a steady growth and anticipates to experience more steady growth in the future. The median household income is $45,789, which is 33% less than the 2019 national average according to census.gov. 31.7% of the City is considered to be low-income, or earning less than $30,000 per year. The assessment states that approximately 25% of households are "severely rent burdened", meaning they spend more than 50% of income on rent and utilities. Higher rates can be a challenge for economic growth.

All areas in the City have access to the City collection system, which delivers the City's designated level of service to all users. Recommended improvements in this plan will help achieve the same level of service throughout the collection system for all users. City Council holds a public meeting to review and adopt the Wastewater Master Plan.

2.2.9 CLIMATE, GEOLOGIC HAZARDS, AND SOILS

Climate

The climate in St. Helens is characterized by dry and temperate summers and cool and wet winters. Table 2-1 summarizes the climate data for St. Helens. The National Oceanic and Atmosphere Administration (NOAA) Monthly Normals for St. Helens were used for the mean temperatures. NOAA data for precipitation was not available for St. Helens, as such, climate normals were taken from the nearby weather station in Scappoose, OR.

TABLE 2-1 CLIMATOLOGICAL DATA (2006-2020)

	Jan	Feb	Mar	Apr	May	Jun	July
Precipitation (in)	6.04	4.27	4.81	2.95	2.23	1.41	0.3
Mean Temp (F)	40.2	42.2	46.1	50.3	57.6	62.2	68.2
	Aug	**Sep**	**Oct**	**Nov**	**Dec**	**Sum / Average**	
Precipitation (in)	0.43	1.78	3.84	6.28	6.7	41.04	
Mean Temp (F)	68.6	63.1	53.3	45.1	39.2	53	

Geologic Hazards

Potential geologic hazards in the St. Helens area include landslides and earthquakes. There are no known volcanoes in the direct vicinity that would cause a volcanic hazard. The Oregon Department of Geology and Mineral Industries (DOGMI) categorizes St. Helens in the low-to-high susceptibility range for landslides, and this is corroborated by the Multi-Hazard Mitigation Plan for Columbia County. Additionally, the City provided GIS shapefiles which reflect the DOGAMI findings on landslide susceptibility; only a small area bordering the northern City limits are considered high susceptibility for landslides. Figure 6 in Appendix A depicts the landslide hazard zones. The Multi-Hazard Mitigation Plan also reveals that in the past, seismic activity was fairly low, but because of more recent earthquakes, awareness of a potential problem has increased. The Multi-Hazard Mitigation Plan simulated earthquake damage produced by a magnitude 9 Cascadia Earthquake, and St. Helens fell into the light to moderate damage category. Local hazard maps show the area within City limits fall within zones A through D, with zone A indicating a very small probability of experiencing damaging earthquake effects and zone D indicating the possibility of very strong shaking that can cause considerable damage in structures lacking special design. Figure 7 in Appendix A depicts a hazard map for seismic activity/earthquake hazards. Additional details and discussion of geologic hazards is included in the Geotechnical Planning Report (Shannon & Wilson, 2021) in Appendix B.

Soils

In general, the soils within the St. Helens area are either rock complex or silty loam, and the slopes vary from zero to thirty percent, according to the NRCS website. Typically, surface soil is very shallow in St. Helens, and sits on top of unfractured basalt rock. This is often a challenge for utility construction and can be a significant cost factor, particularly in pipeline projects. Figure 8 in Appendix A shows the soil map for the study area. See Appendix B for more details on the study area geology and geologic hazards completed by Shannon & Wilson Geologic Investigation.

2.2.10 AIR QUALITY

Currently, the City does not lie within an Environmental Protection Agency (EPA) non-attainment area. No permanent impacts to air quality are anticipated from the recommended improvements. Best management construction practices are advised to be employed during construction to minimize dust.

2.3 POPULATION TRENDS

The official population projections for the City of St. Helens and the City of Columbia City reflect the collaborative efforts of Columbia County and Portland State University (PSU). These agencies published a document in June 2020, establishing the official coordinated population rates for all the cities in Columbia County. The document is titled “Coordinated Population Forecast for Columbia County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2020-2070”, and includes a summary of historical populations from the U.S. Census. Table 2-2 presents the historical populations from the referenced document.

Each year, PSU establishes a preliminary population estimate in November, which is sent to state and local jurisdictions and community partners. PSU then sends a certified population estimate in December. For this wastewater master plan, the base starting point for population projections is the July 2019 certified population estimate. The average annual growth rate (AAGR) from the PSU referenced document provided the future population estimates in this report. The overall estimated population growth from 2019 to 2040 for the City of St. Helens (from 13,464 to 17,318) reflects an AAGR of 1.1%. This percentage closely resembles the 1.0% growth rate reported in the Housing Needs Assessment. The estimated growth from 2019 to 2040 for the City of Columbia City (1,985 to 2,188) reflects an AAGR of 0.5%. As a result, the total population for the two cities is anticipated to be 19,506 in 2040.

TABLE 2-2 POPULATION HISTORY AND PROJECTIONS

Year	St. Helens	Columbia City	Sum	Source
1990	7,535	1,003	8,538	US Census Bureau
2000	11,857	1,571	13,428	2020-2070 PSU Coordinate Population Forecast: US Census Bureau
2010	14,839	1,946	16,785	2020-2070 PSU Coordinate Population Forecast: US Census Bureau
2015	13,095	1,955	15,050	PSU Certified July 1, 2015
2019	13,410	1,985	15,395	PSU Certified July 1, 2019
2020	13,915	1,980	15,895	PSU Certified July 1, 2020
2025	14,697	2,030	16,727	Projected Using AAGR of 1.1% for St. Helens, 0.5% for Columbia
2030	15,524	2,081	17,605	Projected Using AAGR of 1.1% for St. Helens, 0.5% for Columbia
2035	16,396	2,134	18,530	Projected Using AAGR of 1.1% for St. Helens, 0.5% for Columbia
2040	17,318	2,188	19,506	Projected Using AAGR of 1.1% for St. Helens, 0.5% for Columbia

Note: Coordinated Growth Rates (AAGR) from PSU Coordinated Population Forecast 2020-2070 Marion County

2.4 FLOWS

The wastewater flows analysis reviews historical wastewater flows and provides projected flows for the planning period. This section summarizes the results of the analysis. The City's projected flows were estimated using the methods recommended by the Oregon Department of Environmental Quality (DEQ) in "Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon." A few of the values developed from the DEQ methods were adjusted based on observed flow events at the WWTP. Adjustments are noted in the individual sections below.

2.4.1 AVERAGE ANNUAL DAILY FLOW (AADF)

The average annual daily flow (AADF) is the average daily flow for the entire year. An AADF was calculated for each year of data. Years with a complete data set (2015 – 2019) were averaged to obtain the AADF.

2.4.2 AVERAGE DRY-WEATHER FLOW (ADWF)

The average dry-weather flow (ADWF) is the average daily flow for the period of May 1 through October 31. An ADWF was calculated for each year of data. Years with a complete data set (2015 – 2019) were averaged to obtain the ADWF.

2.4.3 AVERAGE WET-WEATHER FLOW (AWWF)

The average wet-weather flow (AWWF) is the average daily flow for the periods encompassing January 1 through April 30 and November 1 through December 31 of the calendar year. An AWWF was calculated for each year of data. Years with a complete data set (2015 – 2019) were averaged to obtain the AWWF.

2.4.4 MAXIMUM MONTHLY DRY-WEATHER FLOW ($MMDWF_{10}$)

The maximum monthly dry-weather flow ($MMDWF_{10}$) represents the month with the highest flow during the summer months. DEQ's method for calculating the $MMDWF_{10}$ is to graph the January through May monthly average flows for the most recent years against the total precipitation for each month. DEQ states that May is typically the maximum monthly flow for the dry-weather period (May through October). Selecting the May 90% precipitation exceedance most likely corresponds to the maximum monthly flow during the dry-weather period for a 10-year event. The May 90% precipitation exceedance value (3.90 inches for Scappoose, as no data was available for St. Helens) is extrapolated from the NOAA Summary of Monthly Normals from 2006-2020.

Data from 2015–2019 was used according to the DEQ guidance to produce Chart 2-1. Table 2-3 summarizes the data points illustrated in the chart.

2.4.5 MAXIMUM MONTHLY WET-WEATHER FLOW ($MMWWF_5$)

The maximum monthly wet-weather flow ($MMWWF_5$) represents the highest monthly average during the winter period. DEQ's method for calculating the $MMWWF_5$ is to graph the January through May average daily flows against the monthly precipitation. DEQ states that January is typically the maximum monthly flow for wet weather (November through April). Selecting the January 80% precipitation exceedance value (7.73 inches as obtained from the NOAA Summary of Monthly Normals for Scappoose as data was not available for St. Helens) most likely corresponds to the maximum monthly flow during the wet-weather period for a 5-year event. The DEQ method and $MMWWF_5$ result are illustrated in Chart 2-1 and summarized in Table 2-3.

CHART 2-1: MONTHLY AVERAGE FLOW VS. RAINFALL ($MMDWF_{10}$ AND $MMWWF_5$)

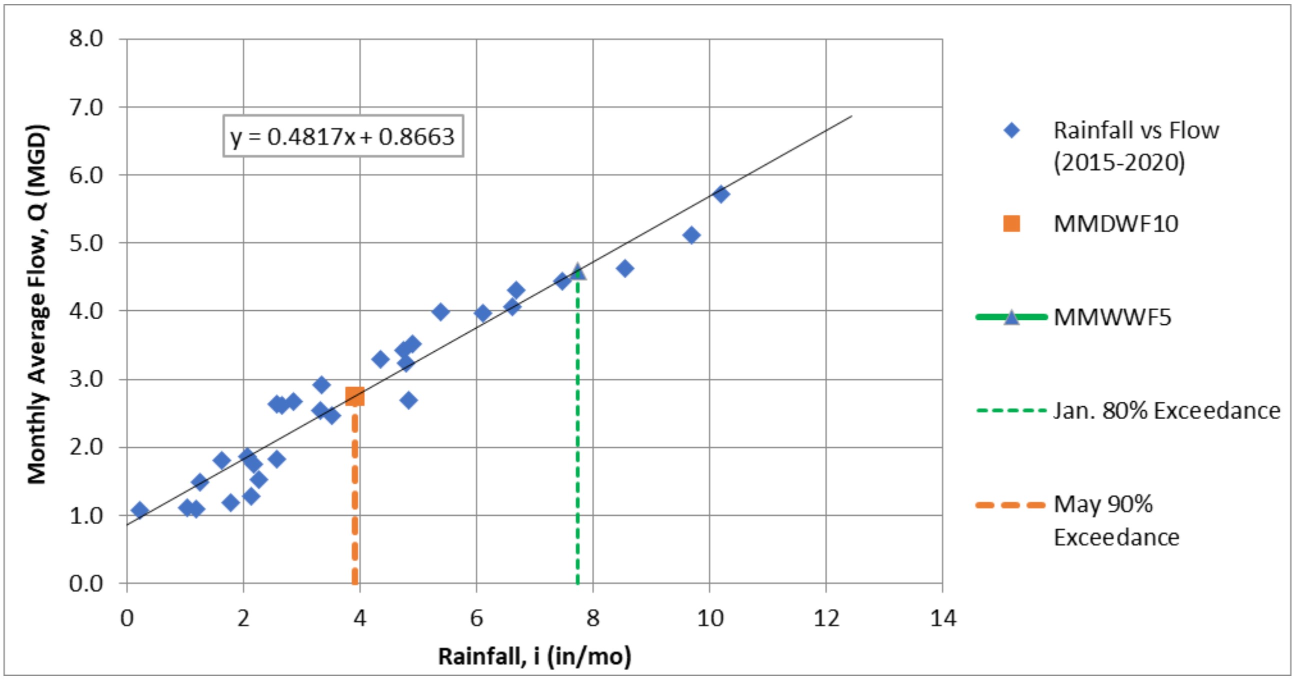


TABLE 2-3: MONTHLY AVLERAGE FLOW VS. RAINFALL ($MMDWF_{10}$ AND $MMWWF_5$)

Month	Monthly Average Flow (MGD)						Rainfall (in/mo)					
	2015	2016	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020
January	3.29	4.44	3.99	4.31	2.67	5.12	4.36	7.47	5.39	6.69	2.85	9.70
February	3.51	3.42	5.72	2.92	4.07	2.62	4.91	4.74	10.19	3.34	6.62	2.66
March	2.68	3.96	4.63	2.64	1.81	1.83	4.83	6.10	8.55	2.56	1.62	2.56
April	1.76	1.52	3.23	2.54	2.47	1.49	2.17	2.27	4.80	3.32	3.51	1.26
May	1.10	1.18	1.87	1.06	1.09	1.28	1.04	1.78	2.06	0.22	1.19	2.12
$MMDWF_{10}$	2.75						3.90					
$MMWWF_5$	4.59						7.73					

To confirm the validity of the DEQ method, a 30-day rolling average of the available flow data (January 1, 2015, through December 31, 2019) was evaluated. The maximum observed 30-day rolling average flow was 7.88 MGD and occurred from December 1, 2015 through December 30, 2015. An $MMWWF_5$ of 7.88 MGD was used because the observed flow was higher than the DEQ estimated flow.

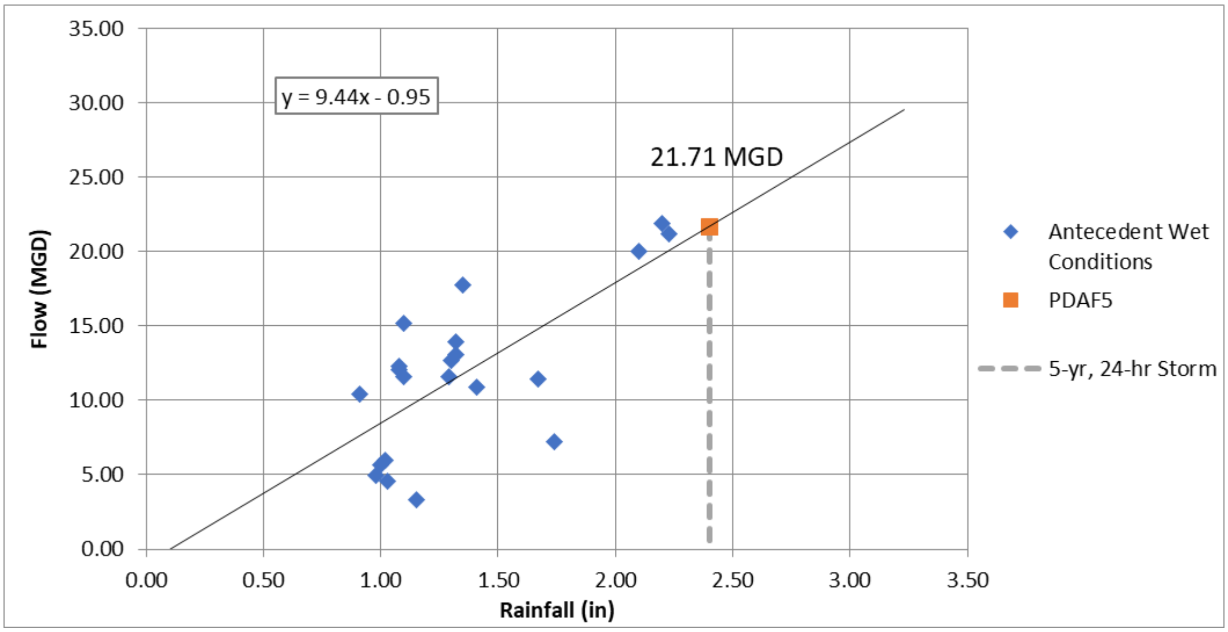
2.4.6 PEAK WEEK FLOW (PWKF)

The PWkF was calculated using a 7-day rolling average for each year. The maximum of all the year PWkF values was used as the PWkF.

2.4.7 PEAK DAILY AVERAGE FLOW ($PDAF_5$)

As outlined by the DEQ, the peak daily average flow ($PDAF_5$) corresponds with a 5-year storm event. The DEQ's method for determining $PDAF_5$ involves plotting daily plant flow against daily precipitation for significant storm events, while only using data for wet-weather seasons when groundwater is high. For this method, only significant storm events with antecedent wet conditions were plotted. A trendline was fitted to the data; the $PDAF_5$ was the resultant flowrate associated with the rainfall produced by the 5-year, 24-hour storm event (2.4 inches per the NOAA isopluvial maps for Oregon). A significant storm event was considered more than 1-inch of rainfall in 24-hours. Antecedent conditions were evaluated on a case-by-case basis, and wet conditions were assumed if any day in the preceding three had a storm event of 0.5-inches or larger. Data was also considered based on cumulative rainfall for 30 days before the storm event. No consistent, observable pattern between 30-day prior rainfall and flow conditions was discovered. As such, no cutoff for 30-day cumulative rainfall was used for purposes of this analysis. Chart 2-2 below shows the results of the DEQ analysis.

CHART 2-2: FLOW VS. RAINFALL (PDAF$_5$)



In analyzing the data, peak flows at the WWTP occurred on the same day or the following day as storm events. The PDAF$_5$ developed, using DEQ's method, was compared with the top five peak day flow events from 2015-2019 with antecedent wet conditions (see Table 2-4 below). The PDAF$_5$ observed in 2019 was selected as the planning value for this study because it is higher than the PDAF$_5$ flow developed using DEQ's method and is a more conservative planning value.

TABLE 2-4: TOP FIVE FLOW EVENTS

Date	DMR Flow (MGD)	Rain (in/day)	Peak Inst. Flow (MGD)	60 day rainfall (in)
12-Feb-19	21.90	2.20	32.2	12.56
8-Dec-15	21.19	2.23	31.4	17.75
7-Dec-15	20.06	2.10	29.3	15.52
18-Jan-17	17.76	1.35	24.6	13.96
16-Feb-17	13.94	1.32	19.1	13.16

2.4.8 PEAK INSTANTANEOUS FLOW (PIF_5)

The peak instantaneous flow (PIF_5) represents the peak flow recorded at the WWTP. The DEQ recommends evaluating hourly or instantaneous flow data for high-flow days if available. The peaking factor (peak instantaneous to average daily ratio) is often less during heavy flows than during normal flow rates because of infiltration influence from high groundwater. The City provided continuous flow data for high-flow days in the last five years to evaluate this peaking factor. The average peaking factor was 1.55 (data summarized in Appendix B). Using a peaking factor of 1.55 and the $PDAF_5$, a PIF_5 of 33.98 MGD was selected.

2.4.9 INFILTRATION AND INFLOW (I/I)

I/I is an issue in the collection system, and results in the high peak flows experienced at the WWTP during wet weather (Appendix B). The City has been working to characterize and evaluate I/I throughout the collection system. The I/I work completed previously, and for this study, is discussed in Section 3. The City's ongoing efforts to reduce I/I in its collection system will reduce flows to the treatment plant.

2.4.10 OBSERVED HISTORICAL FLOWS AND PROJECTED PLANNING FLOWS

Table 2-5 summarizes the observed flows for each year from 2015-2019. The historical flows were derived as described in the preceding paragraphs.

During the system evaluation process, it was discovered that the City's method of flow measurement at the WWTP may not reliably measure peak influent flows during high flow events. The City's WWTP influent flow is measured at the primary lagoon effluent weir with an ultrasonic level sensor. From the primary lagoon weir, effluent flows through a 36-inch pipe to the chlorine contact basins (CCB). During high flows, operators open the headworks bypass channel, which allow flow to bypass the headworks screens and the primary lagoon. The bypass channel flows directly into the CCB. The CCB has a similar flow measurement setup as the primary lagoon. Flow is measured at the effluent weirs with ultrasonic level sensors. When the bypass channel is open, operators record the CCB effluent flow as the plant influent flow. This flow is recorded because the bypass channel flow is not accounted for in the primary lagoon effluent flow measurement. Operators report that the primary lagoon depth fluctuates more than one foot during higher flow events. Review of the recorded plant data indicates that the WWTP influent flow measurements do not reflect peak flows from the collection system. Historical influent trends were reviewed for the highest recorded WWTP daily flows, which show both the recorded primary lagoon effluent and the CCB effluent. The trends show a sharp increase in the CCB flow, which corresponds to the bypass channel being opened. When the bypass channel is opened, the depth of the primary lagoon begins to equalize (decrease) and results in primary lagoon effluent flows that continue to discharge to the CCB. The lagoon effluent also results in CCB flow measurements that are higher than the headworks influent. This is due to the continued discharge from the primary lagoon adding to the bypass flows flowing directly to the CCB. There is not evidence that the weir measurements are inaccurate, but that they do not accurately reflect the peak flows at the headworks due to attenuation and compounding flows.

The hydraulic model of the collection system further confirms this assessment as the hydraulic capacity of the collection system is lower than historical WWTP discharge monitoring report (DMR) flows. The City completed an I/I Reduction Program project in 2008. The technical memorandum from this project (2008, Brown and Caldwell) summarizes the hydraulic evaluation of the collection system and supports that the collection system capacity is lower than the peak influent flow criteria developed at that time. City staff have indicated that no improvements to increase pipeline capacity in the collection system, except for projects addressing inflow and infiltration, have been completed since the 2008 study. These two evaluations were completed independently. Both evaluations of the collection system capacity support the assessment that the WWTP CCB effluent flows do not reflect the influent peak flows at the WWTP headworks. Additional discussion on the development and calibration of the hydraulic model is included in Section 4.

These findings and assessment were discussed with City staff. The City directed Keller to review available data, use engineering judgement, and estimate system flow planning criteria values to reflect the current system demand. These values are estimates due to the unknowns and limited data available. The PIF_5 and $PDAF_5$ planning criteria were modified. These two criteria are most likely to be impacted by the flow measurement process at the existing WWTP. The PIF_5 was reduced to 26 MGD to reflect the estimated flow influence from a 5-year storm event based on review of treatment plant flow trends, collection system capacities, and model responses. The $PDAF_5$ was reduced by 2 MGD to 19.9 MGD. This reduction was estimated from the daily WWTP trend data of historical peak events where the trends indicate the bypass channel was opened (sharp increase in the CCB flow data). Comparison of the primary lagoon effluent data and CCB data provided an estimate for peak day flows during the high events. Table 2-5 summarizes the observed, historical flows and planning criteria as described in previous sections, as well as the modified planning criteria described in this section.

It is recommended the City add influent flow measurement to the headworks facilities to more accurately track system flows and I/I over time. This planning criteria should be reviewed and updated as additional flow data is collected. Additional discussion on WWTP flow measurement improvements is included in the alternatives discussion in Section 5.

TABLE 2-5: OBSERVED HISTORICAL FLOWS & PLANNING CRITERIA

St. Helens Historical Flows (MGD[1])								
Year	**2015**	**2016**	**2017**	**2018**	**2019**	**5-Year Avg**	**Planning**	**Modified Planning**
Population	**15,050**	**15,085**	**15,225**	**15,225**	**15,395**		**15,895**	**15,895**
ADWF	0.98	1.31	1.25	0.95	1.09	1.11	1.11	1.11
$MMDWF_{10}$	2.71	2.56	2.87	3.03	2.79	2.79	3.03	3.03
AADF	2.35	2.43	2.64	1.92	1.85	2.24	2.24	2.24
AWWF	3.73	3.56	4.01	2.90	2.59	3.36	3.36	3.36
$MMWWF_5$	7.88	7.81	5.84	4.46	3.99	5.99	7.88	7.88
PWkF	14.19	7.54	8.93	5.90	8.86	9.08	14.19	14.19
$PDAF_5$	21.19	13.08	17.76	9.60	21.90	16.71	21.90	19.90
PIF_5	31.4	27.4	24.6	13.9	32.2	25.90	33.98	26.00
Yearly Total (MG[1])	856	889	955	700	669			
Total Rainfall (in/yr)	47	48	51	31	33			
1) MGD = million gallons per day; MG = million gallons								

To project the planning flows for future populations, projected flow per capita (reported in gallons per capita per day, gpcd) was developed. As shown in Table 2-6, projected unit flows are lower than the planning unit flows of the existing system. Projected unit flows were developed to recognize the existing effects of I/I on the current system, and assume reduced I/I influence on wet-weather flows in the future as new construction with better construction methods and materials are built. Projected future flows using the projected unit flows are shown in Table 2-6. Actual future flows will depend on several factors and could potentially decrease through aggressive I/I reduction efforts. It is recommended that flows be reviewed periodically, and future capital projects phased where practical.

TABLE 2-6: PROJECTED FLOWS WITH I/I REDUCTION

	Planning Flow (MGD)	Planning Unit Flow (gpcd)	Projected Unit Flow (gpcd)	Projected Planning Flow (MGD)				
Year	2019	2019	2019	2020	2025	2030	2035	2040
Population	15,395	15,395	15,395	15,895	16,727	17,605	18,530	19,506
ADWF	1.11	72	72	1.15	1.21	1.28	1.34	1.41
$MMDWF_{10}$	3.03	197	197	3.12	3.29	3.46	3.64	3.83
AADF	2.24	145	145	2.31	2.43	2.56	2.69	2.83
AWWF	3.36	218	218	3.47	3.65	3.84	4.04	4.25
$MMWWF_5$	7.88	512	300	8.03	8.28	8.54	8.82	9.11
PWkF	14.19	922	325	14.35	14.62	14.91	15.21	15.53
$PDAF_5$	19.90	1293	375	20.09	20.40	20.73	21.08	21.44
PIF_5	26.00	1689	525	26.26	26.70	27.16	27.65	28.16

2.4.11 FUTURE FLOW PROJECTIONS & MODEL SCENARIOS

Future loads were distributed based on PSU population projections and City projected future residential, commercial, and industrial growth. Flows per capita for projected population growth were assumed to be similar to existing flows per capita. Flowrates anticipated in the 20-year planning period are identified in Table 2-6. Growth areas identified by the City can be found in Figure 9 in Appendix A. Residential flows were projected using future growth areas, City zoning, projected number of equivalent dwelling units, and ADWF per capita. Projected industrial and commercial development is anticipated to grow within the industrial and commercial areas identified by the City, with both zoning designations assumed to contribute 1,500 gallons per acre per day (gpad) to the wastewater system. Residential, commercial and industrial loading calculations for the growth areas can be found in Appendix B.

2.5 PLANNING CRITERIA

2.5.1 COLLECTION SYSTEM

The City's conveyance system will be sized for the projected 20-year peak instantaneous flow rates associated with the 5-year, 24-hour storm event. For the collection system model evaluation, pipes will be considered at capacity when peak flows exceed 85% of full depth in accordance with industry standards. When sizing gravity collection systems, pipelines will be sized according to planning criteria established in meetings with the City. Pipelines shall be sized to convey 20-year, peak flows at 85% or less depth to diameter ratio (d/D). Where appropriate, major trunklines and new lines may be sized one nominal pipe size larger than hydraulically required for areas that may not be at buildout by the end of the planning period. Additionally, it should be noted, efforts to reduce I/I in the collection system could further extend the service population. Sewage pump stations will be designed to handle these flows with the largest pump out of service (defined as firm capacity).

The City's existing sanitary sewer policies, design standards, and construction standards were reviewed as part of the master plan effort. Deficiencies identified and recommended updates are summarized in a technical memorandum, included in Appendix C for reference.

The evaluations performed as part of this planning study are used to prioritize recommended improvements to address deficiencies in the collection system. These improvements are organized into the Capital Improvement Plan (CIP).

2.6 REGULATORY REQUIREMENTS & GUIDANCE

Regulations, existing constraints, and water quality impacts directly affect the requirements and guidance for wastewater infrastructure, as discussed below.

2.6.1 COLLECTION SYSTEM

Pump Station Regulatory Requirements

Pump stations lift wastewater and convey it to a discharge point. Pump stations must meet the DEQ's requirements, such as the following:

Redundant Pumping Capacity – The DEQ design criteria requires the pump station firm capacity to be capable of conveying the larger of the 10-year dry-weather or 5-year wet-weather event. For St. Helens, due to the I/I, this means that the pump stations must pump the 5-year, 24-hour storm event peak instantaneous flows with the largest pump out of service.

Hydrogen Sulfide Control – Hydrogen sulfide can be corrosive (especially to concrete materials) and lead to odor problems. Where septic conditions may occur, provisions for addressing hydrogen sulfide should be in place.

Alarms – The alarm system should include high level, overflow, power, and pump fail conditions. The DEQ also requires an alarm condition when all pumps are called on (loss of redundancy alarm) to keep up with inflow into the pump station.

Standby Power – Standby power is required for every pump station because extended power outages may lead to wastewater backing up into homes and sanitary sewer overflows. Mobile generators or portable trash pumps may be acceptable for pump stations, depending on the risk of overflow, available storage in the wet well and pipelines, alarms, and response time.

The DEQ has also established guidelines for wet well volumes, overflows, maximum force main velocities, and location/elevation relative to mapped floodplains.

Pipeline Guidelines (CMOM Guidance)

CMOM refers to Capacity Management, Operation, and Maintenance of the entire wastewater conveyance system. The vast majority of all sanitary sewer overflows originate from three sources in the collection system: 1) I/I, 2) roots, and 3) fats, oil, and grease (FOG). I/I problems are best addressed through a program of regular flow monitoring, T.V. monitoring, and pipeline rehabilitation and replacement. Blockages from roots or FOG are also addressed via a routine cleaning program. A FOG control program may also involve public education and City regulations (e.g. requirements for installation and regular maintenance of grease interceptors). All new facilities believed to contribute FOG should be equipped with grease interceptors.

The DEQ prohibits all sanitary sewer overflows. The Oregon sanitary sewer overflow rules include both wet-weather and dry-weather design criteria. The DEQ has indicated that they have enforcement discretion and that fines will not occur for overflow resulting from storm events that exceed the DEQ design criteria (i.e. greater than a winter 5-year storm event or a summer 10-year storm event).

In December 2009, the DEQ developed a Sanitary Sewer Overflow Enforcement Internal Management Directive that provides guidance for preventing, reporting, and responding to sanitary sewer overflows. The DEQ updated this document in November 2010.

Excessive Infiltration and Inflow

EPA defines excessive I/I as the quantity that can be economically eliminated from a sewer system by rehabilitation. Some guidelines for determining excessive I/I were developed in 1985 by EPA based on a survey of 270 standard metropolitan statistical area cities (EPA Infiltration/Inflow Analysis and Project Certification, 1985). Non-excessive numeric criteria for infiltration was defined as average daily dry-weather flows that are below 120 gallons per capita day (gpcd). Similarly, a guideline of 275 gpcd average wet-weather flow was established as an indicator below which is considered non-excessive storm water inflow. According to the flow evaluation completed as part of this study (Section 2.4), flows at the St. Helens treatment plan show excessive I/I in the collection system per these guidelines.

Pipeline Surcharging

Pipeline surcharging occurs as flows exceed the capacity of a full pipe, causing wastewater to back up into manholes and services. Surcharging of gravity pipelines is generally discouraged because of: 1) the increased potential for backing up into residents' homes, 2) the increased potential of exfiltration, and 3) health risks associated with sanitary sewer overflows.

Illicit Cross Connections

Cross-connections to the stormwater system are prohibited by City Code, Section 13.14.090. This prohibition includes discharges to the sewer system via connecting roof downspouts, exterior foundation drains, areaway drains, and sump pumps. Any illicit cross connections from the City's stormwater system should be removed. Based on the rapid and significant I/I response in the City collection system, City staff expect there are sump pumps connected to the sewer system in several areas. Further discussion on sump pumps can be found in Sections 3 and 5 of this report.

2.7 COMMUNITY ENGAGEMENT

The City provided several opportunities for community engagement with the wastewater master planning process through a City Council workshop, a Planning Commission meeting presentation, and City Council adoption process. These meetings provided members of the community spaces to engage in the planning process and a platform provide comments.

SECTION 3 - COLLECTION SYSTEM EXISTING FACILITIES

3.1 SYSTEM DESCRIPTION

The City of St. Helens owns and operates a wastewater collection system consisting of approximately 60 miles of gravity pipeline, 2.5 miles of force main pipeline, and nine pump stations. The pipelines range from 4-inch to 33-inch in diameter. Figure 10 (Appendix A) illustrates the pipe diameters, and Figure 11 (Appendix A) illustrates the pipe material in the City's collection system. The wastewater collection system contains more than 1,300 manholes. Pump station locations and their basins are shown in Figure 12 (Appendix A).

3.2 PUMP STATIONS

The City owns and operates nine pump stations throughout the wastewater collection system that are listed by number: Pump Station(s) #1, #2, #3, #4, #5, #7, #8, #9, and #11. The locations of the pump stations are shown in Figure 3-1. Each pump station is equipped with two submersible, constant speed pumps with the exception of PS#2, which has variable frequency drives (VFDs) for both pumps. Each of the pump stations are equipped with Mission Cellular that connects them to the City's supervisory control and data acquisition (SCADA) system. Three of the pump stations are equipped with an onsite generator and an automatic transfer switch, while the remainder are serviced via manual transfer switches and two portable generators kept onsite at the WWTP.

On October 6, 2020, Keller Associates visited each pump station with City staff to observe visual equipment condition and document any known issues. A comprehensive condition evaluation nor pump tests of the pump stations were included in the scope of this master plan. This section presents general observations and recommendations, along with specific recommendations for individual pump station sites. General observations and some recommendations are presented first for the pump station sites. General recommendations are provided as a guideline to allow the City to maintain the pump stations for the 20-year planning period. Any items of concern observed during the onsite evaluation are also noted. Pump station specific observations and recommendations follow. A summary of each pump station's equipment is presented in Table 3.1.

FIGURE 3-1 – EXISTING PUMP STATION BASINS

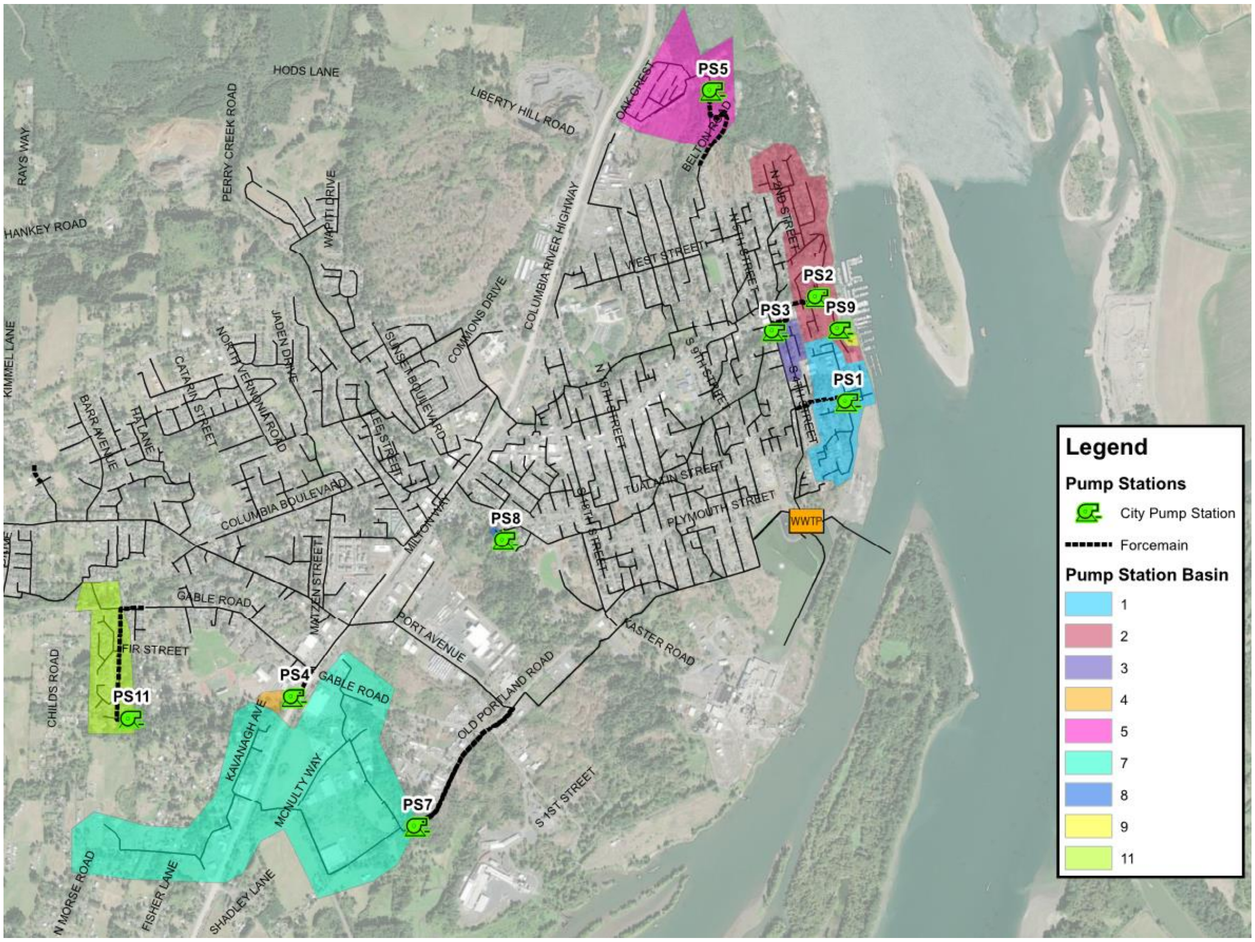


TABLE 3-1 – PUMP STATION SUMMARY

Name	PS#1	PS#2	PS#3	PS#4	PS#5	PS#7	PS#8	PS#9	PS#11
Type	Duplex, Submersible	Duplex, Self-Priming	Duplex, Submersible	Duplex Submersible	Duplex, Submersible	Duplex, Submersible	Duplex, Submersible	Duplex, Submersible	Duplex, Submersible
Year Constructed	1950s	1990	1997	1995	1994	1986	1991	1994	1996
Pump Type	Paco / Hydromatic Submersible	Gorman Rupps VSP (High / Low)	Wilo Type FA 10.51A Submersible	FLYGT NP - 3085	ABS AFP AFP(K) 1049.1-M105/4FM	Wilo Submersible	ABS SJS10W	Barns 4SE3724L	Hydromatic S4HVX-1500JD
Pump hp	36 / 30	40 / 22.5	6.2	3	14	15.5	1	3.7	15
Design Flow (gpm)	550	700 / 250	500	130	145	390	Unknown	200	143
Design Head (ft)	110	82 / 52	10.7	22	98	83	4	24	74
Low Level Alarm (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.42	N/A
Pump Off Level (ft)	1.33	1.50	2	6.2	2.00	3.83	2.83	0.58	0.75
Lead On Level (ft)	2	3	3.5	8.9	4.00	10.00	4.93	1.167	1.65
Lag On Level (ft)	2.5	3.5	4.33	10.0	5.00	10.5	Unknown	2.75	2
High Level Alarm (ft)	6	7.5	5.83	11.8	5.00	11	5.45	3.75	3.1
Level Control Type	Ultrasonic Level Sensor	Ultrasonic Level Sensor	Ultrasonic Level Sensor	Float Relays	Ultrasonic Level Senor	Ultrasonic Level Sensor	Float Relays	Float Relays	Float Relays
Flow Meter	No	No	No	No	No	No	No	No	No
Pressure Gauge	Yes	No	No	No	No	No	No	No	No
Auxiliary Power Type	Portable Generator	On-Site Generator	Portable Generator	Portable Generator	On-site Generator	On-site Generator	Portable Generator	Portable Generator	Portable Generator
Transfer Switch	MTS	ATS	MTS	MTS	ATS	ATS	MTS	MTS	MTS
Bypass Piping	No	No	No	Yes	No	No	No	No	No
Oder Control	None	None	None	None	None	None	None	None	None
Wet Well Depth (ft)	18	9	15.5	20.6	10.5	16	4	13	6.15
Wet Well Diameter (ft)*	12.67	8	7	6	6	6	3	5	5
Force main Diameter (in)	6	6	6	4	4	6 / 8	3	6	4
Force Main Length (ft)**	1,010	1,050	20	610	1,700	2,620	260	70	2,500

*Pump Station 1 has a rectangular wetwell
**Estimated using City GIS data

3.2.1 GENERAL OBSERVATIONS

Sites and Security

The pump stations are easily accessible from streets throughout the City. At the time of the site visit, four of the pump stations were equipped with some type of security fence, building, or enclosure (i.e. clam shell). Generally, electrical panels and access hatches were locked, however, some manhole access to wetwells or valve vaults were not locked. No intrusion alarm system nor video equipment were observed at the sites. Use of video security provides a deterrent to vandalism, improved public safety, and a higher level of confidence in the reliability of the system. If the City experiences issues with vandalism or tampering, additional security barriers, such as fences or buildings, should be installed to prevent system tampering.

Telemetry

All pump stations are connected to the Mission cellular SCADA system. Operators receive pump station data (such as runtime, etc.) through Mission SCADA, and the City has not had problems with this system. During the most recent power outage, the City did not have any problems and continued to receive data, alarm notifications, etc. during the outage.

Operations

At the time of site visits, no odor control devices were reported on any of the pump stations and no odor issues were noted by staff at this time either. Although, if the City does receive odor complaints, it would be recommended to evaluate if odor control is needed at the pump stations.

The pump stations do not have flow meters or pressure gauges installed on the force main discharge piping. Pressure gauges on discharge piping can provide information to assess pump performance. Flow meters and pressure gauges on pump station discharge piping are not required but should be considered with each pump station upgrade and construction of new pump stations. Monitoring flow at pump stations is recommended for maintenance and operational benefits. A record of flow from a pump station can provide information on pump, sewer, and inflow conditions; unauthorized inflow; and future planning for expansion or replacement.

Housekeeping/Maintenance

Overall, the pump stations are kept in clean and orderly condition. Most of the pump stations have access to wash-down water onsite for regular maintenance. The City visually inspects pump stations approximately twice a week. Fats, oils, and grease (FOG) buildup in wetwells are cleaned out with the vactor truck twice a year and more regularly if needed.

The City does not have accurate/up-to-date record drawings or pump information for several of the pump stations. It is recommended that accurate/up-to-date record drawings and pump information be kept on-site as well as at City maintenance shop to aid in future facility upgrades and ongoing system maintenance. Available pump curves for the pump stations can be found in Appendix D.

Safety Equipment

At the time of the site visits, all but two of the pump stations (PS#7 and PS#9) lacked adequate fall protection for the wetwell and valve vaults. It is recommended the City install fall protection to protect the safety of its operators.

Emergency Generators and Backup Power

Three pump stations, PS#2, PS#5, and PS#7, have permanent, onsite generators with automatic transfer switches. The permanent generators are located outside in weatherproof enclosures and run on diesel fuel stored in an above-ground tank at each generator. The fuel tanks are located under the generator frame skid (referred to as a sub-base fuel tank with double wall containment) and fuel is pumped directly from the tank. The generators receive regular maintenance about once per year and are exercised weekly.

In the case of a power outage, the remaining pump stations have connections for portable generators that are stored at the WWTP. City staff report having two portable diesel generators, one that is sized for PS#1 and one sized for the remainder of the pump stations. In the event of a total power blackout, the City does not have the capacity to provide backup power to all of its pump stations at once. Lack of backup power could lead to sanitary sewer overflows, which are both a major environmental and public health issue.

Bypass Pumping Provisions

Only one of the pump stations, PS#4, was noted to have a bypass piping connection. Bypass piping allows for pump connection and conveyance of wastewater out of the wetwell during improvement work and is recommended to be installed for ease of maintenance. The City has one wastewater vactor trunk that can be used to pump out a wetwell if there is an equipment or pipe failure, power outage, or other issue preventing pump station operation. Lack of bypass piping complicates the operators' ability to pump out wetwells for maintenance or to prevent overflows.

Sensor and Alarm Redundancy

Currently, approximately half of the City's pump stations have level sensor redundancy; they are equipped with both ultrasonic level sensors and backup floats. Levels in PS#4, PS#8, PS#9, and PS#11 are only monitored via level floats. Lack of level measurement redundancy increases risk of overflows in the case of sensor malfunction, so level measurement redundancy is recommended on all pump stations. Each of the pump stations is equipped with a high-level alarm that is connected to the City's SCADA system, and as mentioned, City staff have reported no issues with receiving notifications or alarms during power outages.

The City is in the process of adding overflow alarms at each of their pump stations per DEQ guidance. Additional recommendations on alarms are discussed in Section 7 of this report.

Firm Capacity

Firm Capacity refers to the capacity of a pump station with its largest pump offline. An evaluation of the existing pump stations' firm capacities can be found in Section 4.

3.2.2 PUMP STATION #1

PS#1 is located on the east end of the City, within the sidewalk on S 1st Street near Cowlitz Street, and was constructed during the 1950s. Primarily serving the Riverfront district, wastewater is collected in a 9-foot x 14-foot rectangular, concrete wetwell. The pump station discharges to a 6-inch diameter forcemain that conveys water to the trunkline on S 4th Street.

The pump station has a drywell which contains the controls and manual transfer switch for the pump station. The drywell requires a confined space entry during power outages to transfer power. Additionally, the wetwell has an overflow pipe that is currently plugged but can be opened manually. The level is recorded via an ultrasonic level sensor with backup floats, however there is no fall protection installed at the pump station.

During the site visit, City staff reported some FOG buildup in the wetwell. Excessive FOG can cause blockages in pipelines and pumps, reducing conveyance capacity. The City experiences moderate

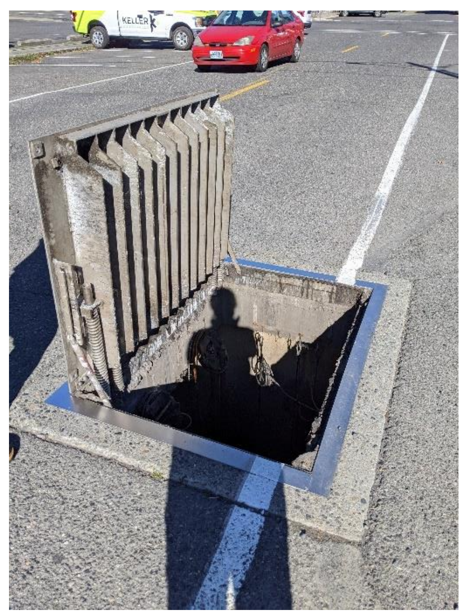
I/I influence at the pump station. In the future, this pump station may be abandoned and relocated as the City's waterfront property develops.

3.2.3 PUMP STATION #2

PS#2 was constructed in 1991 and is located on the east side of town, between N. River Street and N 2nd Street, north of Columbia Boulevard. The station is housed in a brick building and collects wastewater in a concrete, 8-foot diameter wetwell. PS #9 discharges into the PS #2 basin, and a manhole outside of the building provides access to the wetwell. The duplex, self-priming pumps deliver flow west through a 6-inch diameter forcemain, which is approximately 1,050 feet in length, to the trunkline on S 4th Street. There is no easy bypass connection on the discharge piping for maintenance. An onsite generator is located in the building. There is no fall protection installed at the pump station.

During the site visit, City staff reported that historically this station experienced significant I/I, which resulted in capacity issues. After the City's I/I Reduction Program from 2012 to 2014, the pump station has seen a significant decrease in flow and no capacity issues have been noted in the last few years. A single I-beam with a crane is available for pump removal, but there are no beams for pump motor removal. No other major issues were noted during the site visit; the pump station appears to be in good working order.

3.2.4 PUMP STATION #3



PS#3 pumps and wetwell are located within the drive lanes of S 4th Street, which is south of Columbia Boulevard. The electrical and controls box is located to the side of the road and protected from traffic by four bollards. Wastewater is collected in the 7-foot diameter wetwell under the road and pumped via a 4-inch forcemain to the trunkline on the opposite side of the road. Both the wetwell and valve vault are located in the drive lanes; traffic control is needed for pump station maintenance.

The wetwell is monitored with an ultrasonic level sensor and backup floats. City staff have reported some grease buildup, but not enough to require frequent maintenance. The upstream area is reported to have a moderate level of I/I. The inlet tee in the wetwell has to be removed to remove either pump for maintenance. There is no fall protection installed at the pump station.

An overflow pipe is located in the wetwell, which drains to the storm system upstream of Godfrey Park.

3.2.5 PUMP STATION #4

PS#4 is located on the southwest side of City limits, at the Firlock Boulevard and Columbia River Highway intersection. The pump station was constructed in 1991 and reconstructed in 2013. It is believed this pump station serves the local shopping center and portions of the high school. The pump station is located adjacent to a parking lot with no traffic protection. Wastewater is collected in a 6ft diameter wetwell and conveyed via a 4-inch forcemain to the trunkline at the intersection of Gable Road and the Columbia River Highway. There is no fall protection installed at the pump station.

The level in the wetwell is monitored via floats. A bypass connection is located within the valve vault. During the site visit, City staff said the pump station does not have FOG, I/I, or other major problems. The runtimes of this station are very low, as its collection area is believed to only be the local shopping center and portions of the high school.

3.2.6 PUMP STATION #5

PS#5 is located in the northeast corner of the City, on Madrona Court, and was constructed in 1994. Wastewater flows are collected in a 6-foot wetwell and pumped through a 4-inch forcemain to the gravity line on N 6th Street. The pump station is equipped with an onsite generator and an automatic transfer switch in case of power loss. There is no fall protection installed at the pump station.

Ultrasonic level sensors, with backup floats, monitor levels in the wetwell. If the pump station were to overflow, it would overflow at the wetwell lid and onto the site. The station is reported to have high I/I, with City staff confirming that it is normal to have an overflow event once every two years. Additionally, it was reported that a high amount of non-flushable items tend to accumulate in the wetwell, resulting in City staff needing to use a vacuum truck to empty the contents out of the wetwell approximately once every quarter.

The valve vault is equipped with a port for pipe pigging, an operation that clears the force main of excess debris. There is also an onsite 6,000-gallon storage tank. The onsite manhole has a gate valve which is used to backup flow into the tank during periods of high I/I. The tank can then discharge at a slower rate into the wetwell, which provides some mitigation of overflow events during smaller I/I events.

3.2.7 PUMP STATION #7

PS#7 is located adjacent to Old Portland Road in the southern portion of the City, and was originally constructed in 1986. In 2014/2015 the pump station was upgraded to a 6-foot wetwell with submersible pumps. Wastewater is pumped through a 6-inch forcemain to the trunkline at the intersection of Port Avenue and Old Portland Road. An 8-inch forcemain runs parallel to the 6-inch forcemain, which was used as an overflow from the Armstrong property to PS#7. The 8-inch forcemain is not currently in use.

The pump station has an on-site generator with an automatic transfer switch. City staff exercises the generator on a weekly basis. The wetwell is equipped with ultrasonic level sensors with backup level floats. There is no piped overflow, however, if there was an overflow, flooding would first occur at the wetwell lid. City staff reported that this pump station operates well with no major issues. A portion of the collection system upstream of this pump station reaches outside of City limits. There is an existing connection to a restaurant outside of City Limits that is currently closed, and there may be a few additional connections on properties that have yet to be annexed into City limits.

3.2.8 PUMP STATION #8

PS#8 is located on Clark Street and was constructed in 1991. Wastewater is collected into a 3-foot diameter wetwell and is pumped into a 4-inch diameter force main, which is 261 feet long, that discharges to the gravity sewer along Tualatin Street. The wetwell is equipped with level floats. There is no fall protection installed at the pump station.

During the site visit, it was noted that the pump station was in overall good condition, with no recurring problems reported by the operating staff. This is likely because the pump station currently only serves one home and has very low run times while the remaining houses in the area are served by septic tanks. According to staff, one of the pumps was replaced in 2005.

3.2.9 PUMP STATION #9

PS#9 is located on S River Street and serves a small area next to the marina. The pump station collects wastewater in a 5-foot diameter wetwell, and discharges across the street to a gravity line in S River Street, which flows to PS#2. The pump station was upgraded in 2018 and the electrical panel is protected from the parking lot with bollards.

The level within the wetwell is monitored via level floats. During the site visit, City staff noted that this pump station has had issues with rags and non-flushable items. The City is working with the local Homeowners' Association (HOA) to prevent this issue from occurring again in the future.

3.2.10 PUMP STATION #11

PS#11 was constructed in 1998, and is located in the western portion of the City on Maple Street. Wastewater is collected in the 5-foot wetwell and conveyed through a 4-inch force main to the trunkline on Gable Road. The pump station is enclosed with a Hydronix clam shell. This site has no on-site water available and no permanent light fixture. City staff have to use trunks, flashlights, etc. to illuminate this area during maintenance, and bring a water truck for cleaning. There is no fall protection installed at this pump station.

Currently, the City is considering moving the pump station north along Maple Street to collect additional wastewater from development to the east, which are currently on septic systems. These houses are located outside of City limits on County property, and with aging septic systems, these properties will likely require sewer connection in the future. PS#11 could serve the area if relocated north.

During the site visit, City staff reported that this pump station experiences a significant amount of FOG. Normally, the staff has to clear the FOG from the wetwell quarterly.

3.3 GRAVITY MAINS

Generally, the most efficient way to evaluate the condition of the wastewater collection system is through routine CCTV inspections. The City has not performed a significant length of CCTV inspection in the last 5 years. Without CCTV inspection data, the condition of the collection system is typically analyzed by reviewing pipeline age and material to identify pipe segments more likely to have potential defects. Section 3.4 provides additional discussion about pipeline age and material, in addition to other factors that are indicative of the collection system's condition. Section 4 includes a modeled system evaluation to identify system capacity limitations.

3.4 INFILTRATION AND INFLOW

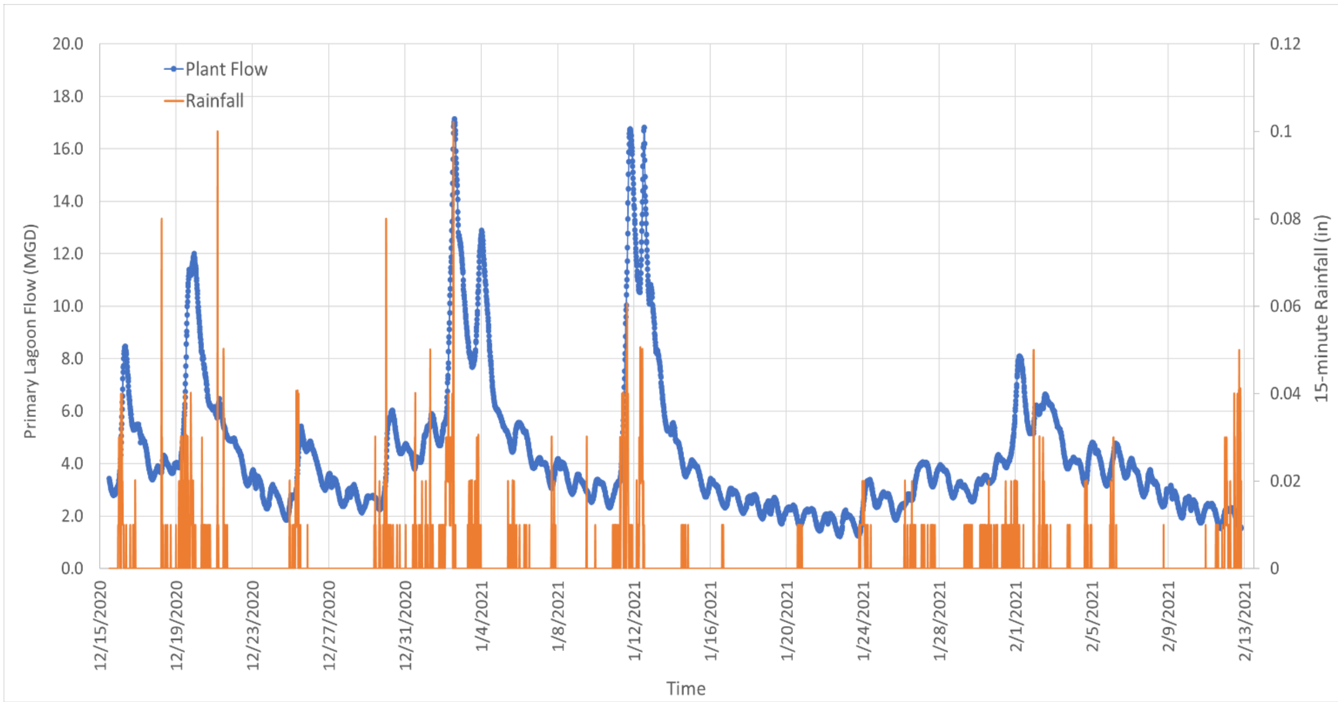
3.4.1 BACKGROUND

In 2008, Brown and Caldwell performed a Wet Weather Capacity Evaluation which documented infiltration and inflow (I/I) in St. Helens. The project included model creation and a capacity analysis. The results showed major I/I influence on peak system flows, for instance, peak hour flow events produced 25 MGD, 24 MG of which was I/I.

Since the completion of the study, the City has performed smoke testing and CCTV inspections on the collection system. The City has also taken steps to address I/I in the system via pipeline replacement, pipe repair (including CIPP lining and spot repairs), and manhole rehabilitation and replacement. City staff have reported that the effort has produced noticeable I/I reduction. For example, the City has confirmed that there have been fewer overflows at the pump stations, and has seen a significant decrease in the number of overflows that is reported to DEQ. While some reduction in I/I has been seen, there is still evidence of significant I/I influence in the system. This master plan included a high-level evaluation of I/I in the system.

Visual evidence of I/I influence in the system can be seen in Chart 3-1, which displays WWTP primary lagoon flow vs. 15-minute rainfall data for mid-December 2020 through mid-February 2021. The rapid response between precipitation events and high WWTP flows reinforces that a significant component of peak flow is from stormwater I/I. Flows for winter 2020/2021 are representative of previous years.

CHART 3-1 – WWTP FLOW VS. 15-MINUTE RAINFALL



A preliminary evaluation to identify areas likely to experience the highest I/I was completed using available data. Pipeline age and material data, areas of suspected sump pump connections, City reported issues, and priority pipelines from the 2008 evaluation not addressed in the I/I reduction projects were compared to identify areas anticipated to have the highest I/I influence. Additional details on each set of data are summarized in the following sections.

3.4.2 PIPE AGE

The City GIS database included pipeline installation date. According to this data, the City has pipes that were installed as early as 1911. The GIS installation data appears to have been updated as the City performed replacement and rehabilitation efforts. A breakdown of the pipelines by decade is shown in Table 3.2. Pipeline ages are also displayed in Figure 13 in Appendix A.

TABLE 3-2 – PIPELINE AGE BREAKDOWN BY DECADE

Decade Installed	Length of Pipe (ft)	% of Total
1910s	2,300	0.7%
1930s	7,700	2.4%
1940s	1,600	0.5%
1950s	6,800	2.2%
1960s	15,500	4.9%
1970s	37,500	11.9%
1980s	51,800	16.5%
1990s	64,500	20.5%
2000s	47,900	15.2%
2010s	58,300	18.5%
Unknown	20,400	6.5%
Total	314,300	100.0%

Typically, sanitary sewer pipelines have an expected service life of 50 to 100 years. The longer a pipe remains in the ground, the more likely the pipe is to experience cracks, root intrusion, breaks, and such defects that increase I/I into the system. As such, pipelines over 70 years old, those installed before the 1950s (about 3.7% of the City's pipelines), should be the highest priority to CCTV inspect. Those over 50 years old, installed prior to the 1970s (about 10.8% of the City's pipelines), should be the second priority. Pipelines of unknown installation date should be considered for secondary priority for inspection because they represent an unknown risk to the system and have the potential to be past their service life.

3.4.3 PIPE MATERIAL

The City GIS database includes pipeline material data. Pipeline material within the City consists of ductile Iron (DI), polyvinyl chloride (PVC), high-density polyethylene (HDPE), polyethylene (PE), concrete, cast iron, steel, and vitrified clay (VCP). The City has updated this data as they performed pipeline repair and rehabilitation efforts. The pipe material of pipes rehabilitated with cure-in-place-pipe (CIPP) lining has been updated within the GIS database to CIPP. Table 3.3 provides a full breakdown of pipelines by diameter and material. Figure 11 in Appendix A shows the locations of the pipelines by material.

TABLE 3-3 – PIPELINE SIZE AND MATERIAL BREAKDOWN (ALL LENGTHS IN FEET)

		Material								
		DI	PVC/ HDPE / PE	Concrete	Cast Iron/Steel	CIPP Restored	VCP	Unknown	Total	% of Total
Size	4" , 5"	0	5,500	200	50	0	0	0	5,750	1.8%
	6"	3,800	20,300	12,900	200	24,300	700	2,400	64,600	20.6%
	8"	2,600	93,900	34,800	0	16,500	100	10,300	158,200	50.3%
	10"	550	8,400	7,000	0	7,100	250	2,300	25,600	8.1%
	12"	450	8,000	10,600	0	2,800	0	0	21,850	7.0%
	15"	0	4,000	6,200	400	0	0	2,100	12,700	4.0%
	16"	0	2,800	0	650	0	0	0	3,450	1.1%
	18"	0	1,400	600	650	0	0	0	2,650	0.8%
	21"	0	1,400	450	0	0	0	0	1,850	0.6%
	24"	0	3,300	1,000	0	0	0	0	4,300	1.4%
	27"	0	0	1,200	0	0	0	350	1,550	0.5%
	30"	300	0	5,100	0	0	0	0	5,400	1.7%
	33"	0	0	1,900	0	0	0	0	1,900	0.6%
	Unknown	0	0	200	0	0	0	4,300	4,500	1.4%
	Total	7,700	149,000	82,150	1,950	50,700	1,050	21,750	314,300	100.0%
	% of Total	2.4%	47.4%	26.1%	0.6%	16.1%	0.3%	6.9%	100.0%	

Pipe material can be used as a rough estimation of pipeline age based on the historical materials of choice for sanitary sewer construction. For example, vitrified clay was the pipeline of choice around the turn of the 20th century. Cast iron and steel pipes are also often associated with older installations and are not widely used in recent sanitary sewer construction. As discussed in Section 3.3.2, older pipelines are at greater risk for deterioration or defects that allow I/I as well as increased risk of pipe failure. It is recommended these pipe materials be higher priority for CCTV inspections. As shown in Table 3.3, approximately 1,000 feet of the City's pipeline is vitrified clay, and about 2,000 feet is cast iron or steel.

Concrete pipes are still used for larger diameter pipelines but have the potential to be older installations. Concrete pipes as well as pipe with unknown material data should be considered as second priority. It is recommended that the City should update the GIS database with unknown pipes' material as CCTV inspection takes place.

3.4.4 CITY-IDENTIFIED SUMP PUMP AREAS

Sump pumps are used to remove water that has accumulated in a sump basin, most commonly found in the basements of homes. Generally, sump pumps handle stormwater and/or groundwater and are connected to the stormwater system. Sump pumps are not allowed to discharge to the sewer system per Section 13.14.090 of the City Municipal Code. The rapid and significant rainfall response observed by City staff in some of the major sewer trunklines suggests there may be stormwater sump pumps improperly connected to the sewer system. The City identified three areas of town which staff believed are likely to have active sump pumps improperly connected to the sewer.

The three areas are overlayed in Figure 14 in Appendix A. Recommendations on identifying and addressing sump pumps connected to the sewer are presented in Section 5.

3.4.5 REVIEW OF PREVIOUS STUDIES AND PROJECTS

As part of this planning effort, the previous Wet Weather Capacity Analysis (2008, Brown and Caldwell) was reviewed by Keller Associates. The study identified 62,300 feet of sanitary sewer pipelines as potential sources of high I/I. These priority pipelines and connected manholes were prioritized for CCTV inspection and rehabilitation/repair if necessary. The City subsequently performed CCTV on all identified pipelines and performed I/I rehabilitation and repair projects on the majority of the pipelines. These efforts were documented in the City's GIS database and record drawings.

Based on the City GIS database, 29 lengths of pipelines identified by the study were CCTV inspected, but did not have any repair or rehabilitation performed. Presumably, this is because no defects were found during inspections. As the most recent CCTV effort concluded in 2014, these pipes may have developed defects in the last 6-7 years. It is recommended that these 29 segments be considered a secondary priority for inspection and rehabilitation as necessary. These pipelines are shown in Figure 14 in Appendix A.

3.4.6 CITY-KNOWN PROBLEMS

The City provided Keller Associates with a list of known sewer problems that included historically reported capacity issues, sewer backups, and overflows. The full list with locations is shown in Appendix E, and the issues are also noted on Figure 14 in Appendix A. The areas with issues identified by the City are considered high priority for I/I identification as they have a known and significant effect on the populace of St. Helens.

3.4.7 I/I PRIORITIZATION AND SUMMARY

Each of these criteria were overlayed spatially using GIS data. Pipe segments which contained the intersection of multiple criteria were considered higher risk for I/I and high priority for CCTV inspection. For example, a vitrified clay pipe installed in the 1930s and in an identified sump pump area would be given high priority.

According to the City's GIS, several of the pipeline sections with City-identified issues have been replaced or repaired within the last 10 years. It is unlikely that the repaired or replaced pipe lengths contribute significant I/I to the system. If a pipe identified as a City-known problem was shown to have been repaired but the problems persisted, the collection system surrounding City-identified problem area was considered high priority for additional I/I investigation.

Figure 15 in Appendix A displays the prioritized pipes within the system. These pipelines should be considered as high priority for CCTV inspection and subsequent repair and/or replacement as needed. Overall, this evaluation identified 8,000 feet of Priority 1 pipelines; 15,200 feet of Priority 2 pipelines; and 18,250 feet of Priority 3 pipelines for CCTV inspection.

I/I prioritization and identification is an ongoing, evolving process. As the City collects more data, the prioritization evaluation should be updated to reflect the most recent data available. It should be noted that CCTV inspections are one of the most commonly used and telling methods to identify both structural and O&M (including I/I) defects in the system. The City does not currently maintain a regular CCTV inspection program, so it is recommended that the City work towards regular inspection of all system pipes and include this information in their ongoing I/I prioritization process. Additional discussion on recommended O&M is included in Section 5.

Future prioritization evaluation could incorporate additional criteria or information, such as consequence of failure. Risk is a function of both the likelihood of failure (pipeline condition) and the consequence of failure. Including consequence of failure to the prioritization process could involve adding criteria that characterizes the scale of impacts a pipeline failure would have. For example, a pipeline that services a small residential cul-de-sac would have a much smaller impact than a larger interceptor that services a business district or school/hospital. Adding consequence of failure or other criteria would allow the City to further prioritize sewer work to reduce risk within the collection system.

3.5 STAFFING EVALUATION

This section summarizes the City of St. Helens existing sanitary wastewater staffing levels, identifies deficiencies in existing staffing levels, and provides staffing recommendations.

3.5.1 GENERAL

Multiple divisions of the City Public Works (PW) Operations staff are responsible for the operations and maintenance (O&M) of the wastewater collection system. The PW Operations staff are responsible for the O&M of the gravity pipelines and associated structures (i.e. manholes and cleanouts). The WWTP staff are responsible for the O&M of the nine pump stations throughout the system. On February 25th, 2021, public works staff from both divisions were interviewed by Keller Associates to assess existing levels of wastewater staffing and annual O&M activities, to identify deficiencies in staffing and equipment, and provide recommendations to assist the City in meeting level of service (LOS) goals for the wastewater collection system. In general, the public works staff in St Helens provide support for many City activities that are not directly related to public utility O&M (i.e. building maintenance, building remodels, City events, etc.). The sections below provide more detail regarding existing wastewater collection system staffing and recommendations.

3.5.2 EXISTING WASTEWATER COLLECTION SYSTEM STAFFING

During staff interviews, the general roles and responsibilities of the PW Operations staff and WWTP staff for wastewater collection system O&M was summarized. A list of O&M activities and approximate time, frequency, and size of crew was developed to evaluate the approximate annual labor hours spent on wastewater collection O&M. The primary O&M activities include cleaning and CCTV inspection of pipelines and manholes, I/I investigation and flooding mitigation, responding to problematic areas or reports, regular pump station cleaning and maintenance, and pump station mechanical repairs or replacements (including pump plugs, etc.). It is estimated that approximately 2.0 full time employee (FTE) is spent annually on wastewater collection O&M activities.

The current, budgeted FTE for wastewater collection systems O&M is approximately 4.5 FTE. This includes 0.5 FTE from the engineering department for construction inspection and permitting support. Additional discussions with the PW and engineering staff show that the PW Operations staff are requested to complete significant tasks and projects outside of utility O&M. Some of these tasks include, but are not limited to, building maintenance; building remodels and renovations; City events setup, takedown, and traffic control; park projects and maintenance; and groundwork for City projects. It is estimated that the PW Operations staff spend 50% or more of their time completing work that is not directly related to utility O&M. These additional tasks pull the PW Operations staff away from utility maintenance activities and prevent them from spending the allocated FTE on utility O&M. Of the four utilities that the PW Operations staff operate and maintain, staff reports being pulled off of wastewater collections work more frequently than stormwater or water O&M activities. Existing maintenance practices on the gravity collection system tend to be reactive because the additional projects the PW Operations staff complete minimizes the time they can spend on utilities O&M, and especially wastewater collections O&M.

3.5.3 RECOMMENDED COLLECTION SYSTEM O&M AND STAFFING

Level of service (LOS) goals were discussed with PW Operations staff for the wastewater collection system. The desired LOS goals are summarized below.

- Gravity collection system
  - No overflows
  - Address reported problems in a timely manner to prevent interruptions to service
  - Complete regular maintenance, repairs, and replacements to minimize interruptions and failures (perform proactive O&M in lieu of reactive O&M)

- Pump stations and forcemains
  - No overflows
  - Onsite generators turn on automatically and provide reliable backup power
  - Clear, safe access to pump stations
  - Trained for emergency preparedness
  - Complete regular maintenance, repairs, and replacements to minimize interruptions and failures (perform proactive O&M in lieu of reactive O&M)

A summary of general recommended O&M activities to achieve these LOS goals and follow industry good practice is listed below.

- Clean the collection system pipelines and structures once every three years (clean approximately 1/3 system annually)
- CCTV inspect the collection system pipelines and structures once every six years (inspect approximately 1/6 of system annually)
- Repair or replace defects as identified
- Investigate sources of I/I during the wet season
- Respond to problems that are identified or reported
- Complete routine weekly, monthly, and quarterly cleaning and inspections of pump stations and equipment
- Repair/replace miscellaneous mechanical equipment as identified
- Respond to pump plugs as needed
- Complete annual staff training
- Facilitate public education and outreach
- Complete construction inspection and permitting

Using similar expected labor hours for O&M as the existing staffing evaluation, it is estimated that approximately 3.5-4.0 FTE are needed to meet the LOS goals and O&M activities described above.

As budgeted, the existing wastewater collections FTE staff appears to be adequate. However, the additional projects and work the PW Operations staff are currently requested to complete significantly decreases the budgeted FTE that can be spent on wastewater collection O&M. It is recommended that either additional FTE be budgeted for the PW Operations staff to complete the existing workload requested, or the responsibilities of the PW Operations staff be reduced to focus solely on utility O&M. This staffing evaluation is a high-level, initial estimate. It may be helpful for the City to track the number of hours the PW Operations staff spend on various activities and utilities throughout the year to assess how best to budget and allocate City resources and provide recommended O&M on the utilities. It is recommended that staffing needs be reevaluated every two to three years.

In addition to annual O&M discussed above, an annual replacement program should be maintained. Wastewater infrastructure replacement and rehabilitation needs will increase as the collection system ages. It is recommended that CCTV inspection reports be reviewed to prioritize rehabilitation and replacement efforts. An annual replacement program is an important part of proactively maintaining the wastewater collection system. Staffing FTE and construction cost for an annual replacement program were not included in the staffing evaluation, but construction costs are discussed and estimated in Section 8. If the PW Operations staff are asked to be responsible for and complete some of the rehabilitation or replacement work, this would increase the budgeted FTE for the PW Operations staff.

SECTION 4 - COLLECTION SYSTEM HYDRAULIC EVALUATION

4.1 COLLECTION SYSTEM COMPUTER MODEL

This section summarizes the wastewater collection system model development process and existing and 20-year collection system analysis. This section also outlines the model construction and calibration process, and document identified deficiencies. Alternatives to address these deficiencies are discussed in Section 5.

4.1.1 MODEL CONSTRUCTION

InfoSWMM Suite 14.7 Update #2 was selected as the modeling software for this project. InfoSWMM is a fully dynamic model which operates in conjunction with Esri ArcGIS and allows for evaluation of complex hydraulic flow patterns.

The City maintains a GIS database of City wastewater infrastructure, and from this database, pipe diameter and invert elevation data were populated for the model. Available record drawings and input from City staff were also used to populate the model. As part of model construction, 27 spot elevation locations along trunklines were surveyed throughout the City to compare GIS database elevations with existing field elevations. In places where survey data was unable to be collected, record drawings were referenced.

During the survey process, it was discovered that the majority of the City's GIS was on the NGVD29 vertical datum, while the most recent survey data was collected in the NAV88 vertical datum. The surveyor recorded an average 3.34-foot elevation difference between the two vertical datums in the St. Helens area, and the model was built on the NAV88 vertical datum. City GIS and record drawing elevation data on NGVD29 datum was shifted to NAV88 datum for further model development.

Pipelines with diameters of 10-inches and larger were included in the model. Additionally, approximately 7,500 linear feet of 8-inch pipelines were modeled to connect disparate areas that were served by 10-inch pipelines. Figure 16 in Appendix A shows the modeled pipelines by size. After the manholes and pipes were created, and elevation data was populated in the model, several queries were conducted to reveal anomalies in the data. Anomalies included reverse slope pipes, unusual changes in pipe size, and uncommon configurations in the pipe network. Anomalies were also discussed with City personnel and appropriate changes were made to the model.

Five of the nine pump stations were included in the existing system model (PS#1, PS#2, PS#3, PS#7, and PS#11). Pump station wetwell dimensions and operational set points were provided by the system operators or taken from the operations and maintenance (O&M) manuals or record drawings. Pump station pumps were characterized by the O&M manual pump curves when available. Pump field tests were not performed as part of this planning effort. All pump stations were modeled as duplex pump stations. Pump station capacities were evaluated using firm capacities (capacity with largest pump offline).

It is important to note that one of the basic assumptions of the hydraulic model is that all pipelines 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 capacities assuming the wastewater collection lines are in good working order.

4.1.2 MODEL CALIBRATION

Model loads refer to the wastewater flows that enter the wastewater collection system and are comprised of wastewater collected from individual services (base flows), plus groundwater infiltration (GWI) and stormwater infiltration and inflow (I/I). As part of this study, flow monitoring was completed during the wet weather period from December 29th, 2020 to January 20th, 2021. Flow monitoring data was collected at six manholes throughout the system for model calibration.

The six monitoring sites divided the system into six basins. Figure 17 in Appendix A shows flow monitoring locations and basins used for model calibration. The collected data was analyzed along with continuous precipitation data to establish typical diurnal patterns, average base flows and GWI, and gauge rainfall influence at each site. Both dry weather and wet weather periods were used for loading and calibration efforts. Loads for the model were developed and calibrated in several stages as described below.

Base Flow Calibration

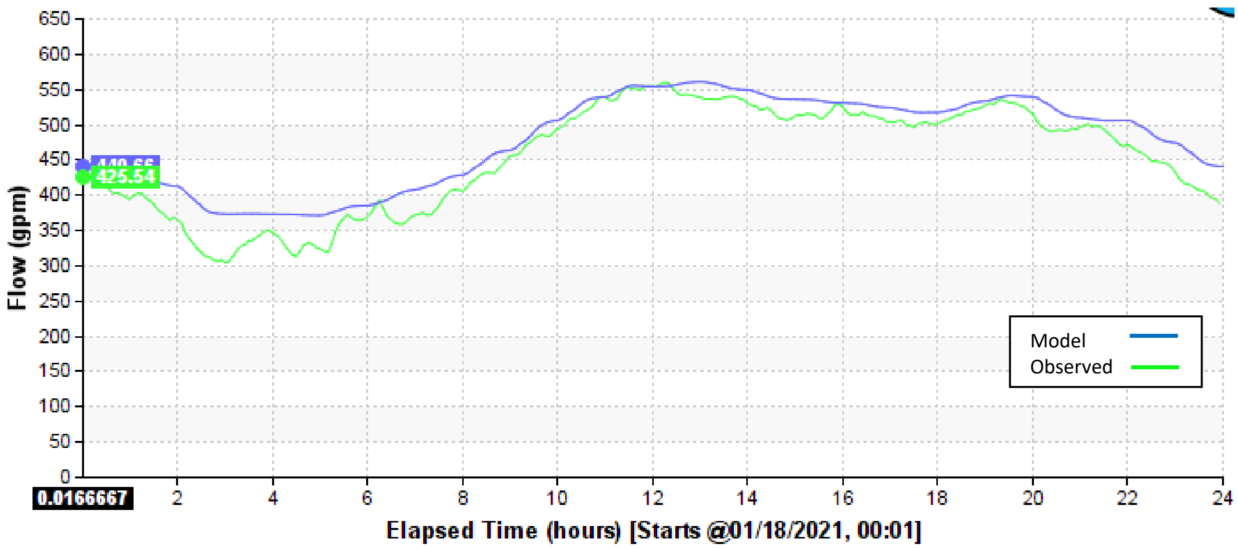
As a starting point, base flows were estimated using water consumption data from December 2019 to February 2020. Wintertime water consumption data was used to minimize any influence from irrigation usage. Total consumption for each user was provided in excel format by the City, and an average consumption for each user was calculated. Individual water meter locations for customers in St. Helens were linked to the wastewater model using GIS to provide a highly accurate distribution of wastewater loads. An average flow was assigned to each modeled manhole based on spatial allocation of the wastewater loads. Loads from pipelines not modeled were assigned to the first downstream, modeled manhole. Figure 4-1 depicts an example of load allocation from pipelines that were not modeled. Water consumption for the City of Columbia City is recorded by one meter in the St. Helens water consumption data. The average base flows for Columbia City were loaded as a single load on the manhole where the Columbia City collection system discharges to the St. Helens' system. The allocation process described yielded a total system base flow of 0.9 MGD.

FIGURE 4-1: LOAD ALLOCATION EXAMPLE

Diurnal patterns for each flow monitoring basin were developed from monitoring data of a representative dry day (day with trace amounts or no rainfall and antecedent dry conditions). Diurnal patterns for each monitoring basin were assigned to all base flows within the basin.

The model was calibrated at the flow monitoring locations within the collection system and total modeled influent flow at the Wastewater Treatment Plant (WWTP) was compared to the targeted planning average dry weather flow. Appendix F contains a summary of the data and analysis used for modeling purposes. An example of base flow calibration results are shown below in Chart 4-1. The blue line shows the model results and the green line show flow monitoring data collected.

CHART 4-1: SAMPLE BASE FLOW CALIBRATION SITE 3



During the calibration process, flow monitor data from Sites #5 and #6 was found to be unreliable and did not match flows from upstream flow monitor locations. Alternative calibration methods for these two basins were developed. For location purposes, Site #5 is downstream of Sites #3 and #4 and the primary contributing flows to Basin 5 downstream of Basins 3 and 4 are flows from PS#1, PS#2, and PS#3. Historical pump runtime data was compared with WWTP discharge monitoring report (DMR) flow to estimate the percent of system flows conveyed through PS#1, PS#2, and PS#3. Base flow contributions from Basin 5 were estimated to be 5% of the system flows. Flows from Sites #5 and #6 combine downstream and enter the WWTP headworks, and there are very few base loads added to the system downstream of Sites #5 and #6. A modified calibration curve for Site #6 was developed based on the recorded flow at the WWTP minus the modified calibration curve for Site #5.

Modeled pump station flow and runtimes were reviewed and compared to pump station data provided by the City. Additional pump station information can be found in Section 3. Generally, modeled pump station flows were within 15% of the stations' reported capacities. PS#2 runs with high and low settings. A summary of modeled pump station flows can be found in Appendix F.

Wet Weather Flow (WWF) Calibration

The RTK method was used for rainfall-derived infiltration and inflow (RDII) prediction. Rainfall data for two 72-hour periods with the highest cumulative rainfalls during the period of flow monitoring was utilized to calibrate wet weather flows (January 2nd through 4th with 2.15 inches and January 11th through 13th with 2.30 inches). The storm event rainfall was entered into InfoSWMM and RTK parameters were then adjusted to calibrate the model with flow monitoring data. Again, total modeled flows at the WWTP were compared to the targeted average daily flow and WWTP influent flow data, in addition to calibrating the model at various locations within the collection system. An example of wet weather flow calibration results is shown below in Chart 4-2 and Chart 4-3. RTK values were adjusted to calibrate the model to meet the higher peaks between the two storm events. Generally, the first flow period of January 2nd through January 4th presented a larger response to rainfall than the second flow period, resulting in calibrated flows tending to be slightly higher than observed data for the second calibration period. Sites #1 and #3 had equipment issues overlapping a portion of the January 2nd-4th event and data was not recorded for a portion of the 4th at the sites. Data for the first rainfall event on the 3rd was still captured by both sites, so the calibration efforts for the Jan 2nd – 4th focused on matching the first rainfall response. Wet weather calibration curves for Basins 5 and 6 were developed using the same method as their base flow calibration counterparts. Calibration information on the remaining flow meters can be found in Appendix F. Pump runtime data was used to inform RTK values upstream of pump stations.

CHART 4-2: SAMPLE WET WEATHER CALIBRATION SITE 3, JAN 2ND - 4TH

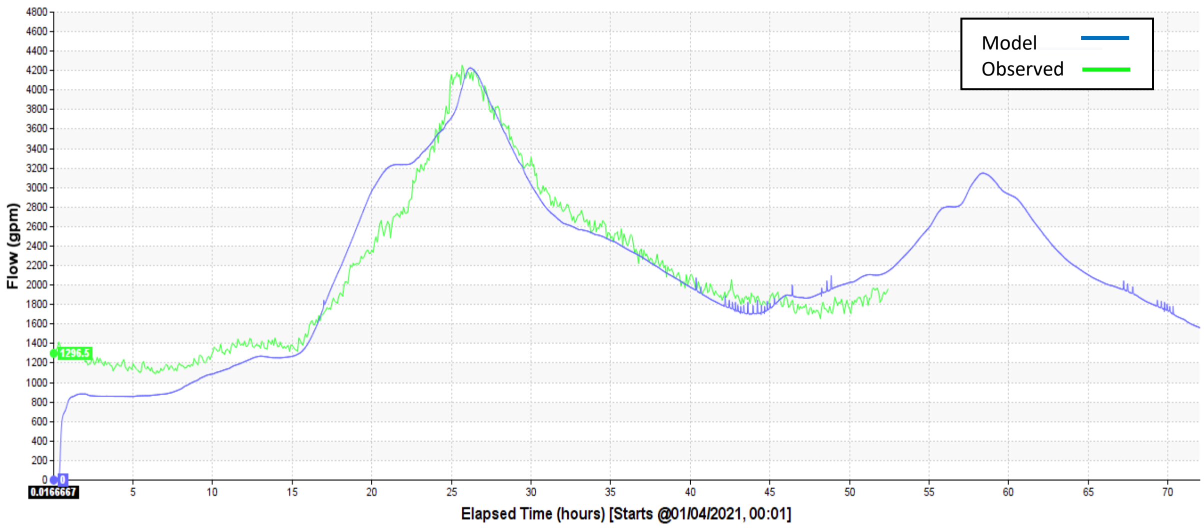
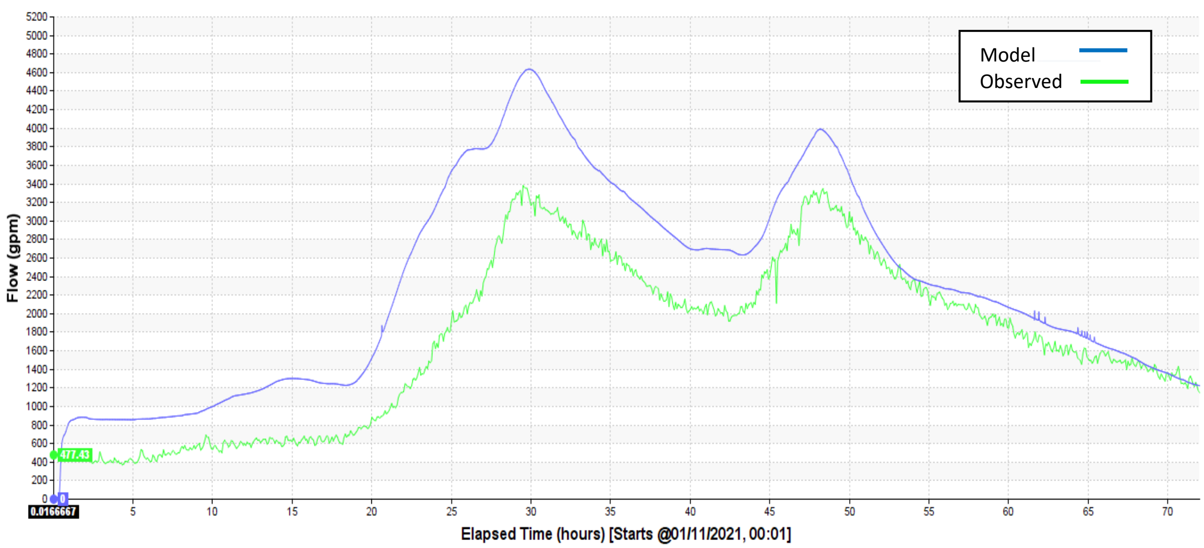


CHART 4-3: SAMPLE WET WEATHER CALIBRATION SITE 3, JAN 11TH - 13TH



Columbia City wastewater discharges to the collection system in St. Helens through a 6-inch forcemain. Two separate pump stations and the water treatment plant (WTP), also in St. Helens, discharge to the same forcemain. Modeling of Columbia City's pump stations was not included in the scope of this study. A maximum discharge estimate of 500 gpm from the Columbia City forcemain was taken from the 2013 Columbia City Master Plan. I/I contributions from Columbia City could result in an increase of pump starts and runtime but would not result in an increase to the peak pumping capacity. An assumed constant point load of 575 gpm (500 gpm plus a 15% safety factor to account for unknowns in pumping fluctuations) was used to model flows from Columbia City during wet weather.

Design Storm

The design storm used for model evaluation was the 5-year, 24-hour storm event. A standard 24-hour Natural Resources Conservation Service rainfall distribution for a Type 1A storm was used. The rainfall for the 5-year, 24-hour storm event from National Oceanic and Atmospheric Administration isopluvial maps is 2.4 inches. This was used as the multiplier for the Type 1A storm hyetograph. The existing system calibrated model was run with the design storm event.

The modeled peak instantaneous (PIF_5) and peak day ($PDAF_5$) flows at the WWTP were compared to the modified PIF_5 and $PDAF_5$ planning criteria (Table 4-1). The modeled peak instantaneous flows and peak day at the plant were lower than the planning criteria. These low peak flows were primarily due to surcharging and flooding throughout the system. The flow comparison is summarized in Table 4-1. The model was also ran with increased pipe capacities to review system flows if capacity limitations in the system were alleviated. These flows are summarized in Table 4-1 as Unconstrained Model Outflow. The calibrated model flow, with capacity limitations eliminated, is within 10% of the modified planning criteria flows. Additional discussion and details of existing system capacity limitations are summarized in the following section.

TABLE 4-1: PLANNING CRITERIA VS. MODELED PEAK FLOWS

Flow	Modified Planning Critieria (MGD)	Model Outflow (MGD)	Unconstrained Model Outflow (MGD)
$PDAF_5$	19.9	16.2	17.8
PIF_5	26.0	23.2	26.9

4.1.3 EXISTING SYSTEM EVALUATION

The calibrated model was used to assess the existing system capacity during a 5-year, 24-hour design storm event. Figure 18 in Appendix A illustrates the potential overflow sites and pipe capacity limitations identified during the existing system peak instantaneous flow model evaluation. The figure is color-coded to show a gradation of pipes based on utilized capacity (e.g., red = flowing at >100% capacity, orange = flowing at 85-99% of capacity, yellow = flowing at 75-84% capacity, etc.). As stated in Section 2, the planning criteria for undersized pipelines is if the flow is equal or greater than 85% of full capacity based on maximum depth of flow (d/D). The figure also displays manholes which experience surcharging and have the potential to overflow according to the model analysis. As stated in Section 2, the Department of Environmental Quality prohibits sanitary sewer overflows, and surcharging in wastewater systems is generally discouraged.

The existing system evaluation shows a significant portion of the modeled trunk lines operating at or above capacity. There are pipelines operating at or above capacity in each of the six basins, with most basins having manholes with the potential to overflow. Several of the deficiencies are caused by undersized trunklines. There are a few areas, where a downstream bottleneck is causing the upstream surcharging. Additional discussion of each deficiency location and alternatives to address the issue are discussed in Section 5.

Table 4-2 shows a list of modeled manholes that may experience potential overflows during peak flow conditions. Each of these locations experience surcharging due to downstream capacity constraints. A few of the listed manholes have abnormally shallow depths (under 4 feet). The elevation data is from the City's GIS database. The City may want to field measure the shallow manholes to assess accuracy of recorded depth data.

TABLE 4-2: POTENTIAL OVERFLOW LOCATIONS

Basin	Manhole Name	Manhole Depth (ft)
1	N30	2.5
1	N33	4.2
2	WC4	2.0
2	WC5	3.5
2	WE11	4.6
2	WE9	4.3
2	W49A	5.6
2	WJ4	4.6
3	NC9	6.0
4	M3	4.0
4	M12	3.8
4	M14	3.5
4	M15	3.4
4	MP4	4.4
6	DG1C	4.4
6	D9	6.3
6	S19A	4.9
6	W33	4.2

4.1.4 CRITICAL SLOPE AREAS

The City's 2003 Engineering Department Public Facilities Construction Standards Manual provides minimum pipe slopes for sanitary wastewater gravity mains (Table 4-3). Modeled gravity main slopes were compared with the recommended minimum slopes, and pipes that are less than their recommended minimum slope are highlighted with different colors based on pipe diameter in Figure 19 in Appendix A. Low slopes can cause capacity issues and require higher than normal O&M. These mains should be monitored for capacity, odor, and solids buildup problems. Pipes with low slopes may need to be cleaned more frequently to prevent solids buildup and flow disruption. The City currently cleans approximately 3% to 5% (10,000 to 15,000 ft) of the pipes in the collection system every year, with approximately 5% of the cleaned pipes CCTV inspected annually (~0.25% of the system). It is recommended the City perform a regular maintenance schedule of inspecting and cleaning approximately 17-20% of the pipes in the collection system per year. It should be noted if areas have consistent solids buildup or flow disruption issues, they may need to be cleaned more frequently.

Additionally, during review of the City's GIS, several areas through the City appeared to have trunklines beneath private property and potentially beneath private structures. While GIS map imagery may not be perfectly accurate, it provides reasonable proof of trunkline locations. Generally, it is advised that collection system pipelines, especially larger trunklines, do not cross under private structures, as it can cause additional liability in the case of pipe breaks or defects. Figure 19 in Appendix A displays the location of pipe segments whose location is suspected to be beneath established private structures. It is recommended these pipelines be relocated into the road right-of-way if improvements are completed.

TABLE 4-3: MINIMUM PIPE SLOPES

Pipe Size (inches)	Minimum Slope in Percent (feet per 100 feet)
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06

Source: City of St. Helens Engineering Department Public Facilities Construction Standards Manual, 540.2.3

4.1.5 PUMP STATION RESILIENCY

The scope of work included assessing pump station resiliency via a comparison of peak hour inflows to firm capacity and a review of emergency power. The existing system's emergency power deficiencies are recorded in Section 3, and recommendations to resolve the deficiencies can be found in Section 7.

Concerning firm capacity, both the model and pump runtime data were reviewed for inadequate firm capacity. For the modeled pump stations, peak inflows to pump stations were estimated using the calibrated model. During the model evaluation, both pumps at PS#7 and PS#11 had to run during peak flows, indicating that peak flows had exceeded the pump stations' firm capacities.

Additionally, City-provided available pump runtime data from 2016 to 2020 was reviewed by Keller Associates. The date range of available data varied between pump stations, with PS#1, PS#2, PS#5, and PS#11 only having data as early as mid-2017. Data provided the number of starts per pump per hour and hourly runtime. The runtime data was analyzed to evaluate if the data indicated that all pumps had run at the same time (indication of nearing or exceeding firm capacity). A summary of the results is listed below.

- Data for PS#5 shows the station exceeding its firm capacity during large wet weather events, with the station having two or more days where the combined pump runtime was over 60 minutes per hour, which indicates both pumps were running together.
- PS#2 runs on a VFD with a high and low setting. The high setting VFD turns on after both pumps are running and the level exceeds the second high water setting. The pump station turns off one pump when the other pump operates in the high setting, which makes it difficult to assess potential exceedance of firm capacity. However, there were two instances during the largest rain event on 2/12/2019 where one pump ran on the high setting for 60 minutes on the hour, indicating that inflows may have exceeded firm capacity.
- PS#1 and PS#3 show that both pumps ran during the largest rain event on 2/12/2019. This rain event may have been larger than a 5-year storm event, as the City's anticipated 5-year storm is 2.4 inches and this rainfall event had two consecutive days of 1.8- and 2.2-inch rainfall.
- PS#4 shows day periods where one pump ran for 24 hours but the second did not turn on. This may be an indication of a malfunctioning pump or reporting software. The City should review this data to assess if a potential capacity deficiency is indicated.
- Due to the nature of the data received, it was not possible to decern if PS#4 and PS#7 ran over their firm capacities. However, they both displayed higher runtimes over 10 hours a day

during wet weather events, which may indicate both pumps running and/or that the stations are nearing firm capacity.

- It is recommended that the City continue to monitor runtimes for PS#1, PS#2, PS#3, PS#4, PS#5, and PS#7, and configure the SCADA system to alarm when both are running, which is indicative of a lack of firm capacity.

Generally, a lack of firm capacity presents potential risk to the system. Pump stations are evaluated at their firm capacity to build a level of redundancy into a system's pumping capacity. Firm capacity accounts for one pump to breakdown or be offline. Inadequate firm capacity increases risks of overflows in the system. It is recommended for the City to include an alarm at all pump stations to notify operators if all pumps turn on. This alerts operators to the potential of inadequate firm capacity at a station and can serve as a trigger for improvements. Pump station alternatives and recommendations can be found in Sections 5 and 7 of this report.

4.1.6 PUMP STATION RISK OF FAILURE

The risk of failure of an asset is a combination of the likelihood of failure and consequence of failure. Likelihood of failure is a measure of how likely an asset is to fail. Components of likelihood of failure for a pump station include items such as age, redundancy, alarms, condition, etc. Consequence of failure is a measure of the impacts a failure would have on the system and surrounding community. Components of consequence of failure for a pump station include items such as proximity to wetlands and waterways, number of homes served by pump station, industrial or commercial entities served by pump station, etc. An evaluation of the risks of failure can provide an importance, urgency, or priority to assets and provide guidance on the order in which asset deficiencies should be addressed. Assets with the highest risk of failure (product of likelihood of failure and consequence of failure) should be repaired or replaced first as they pose the largest threat to a system and community.

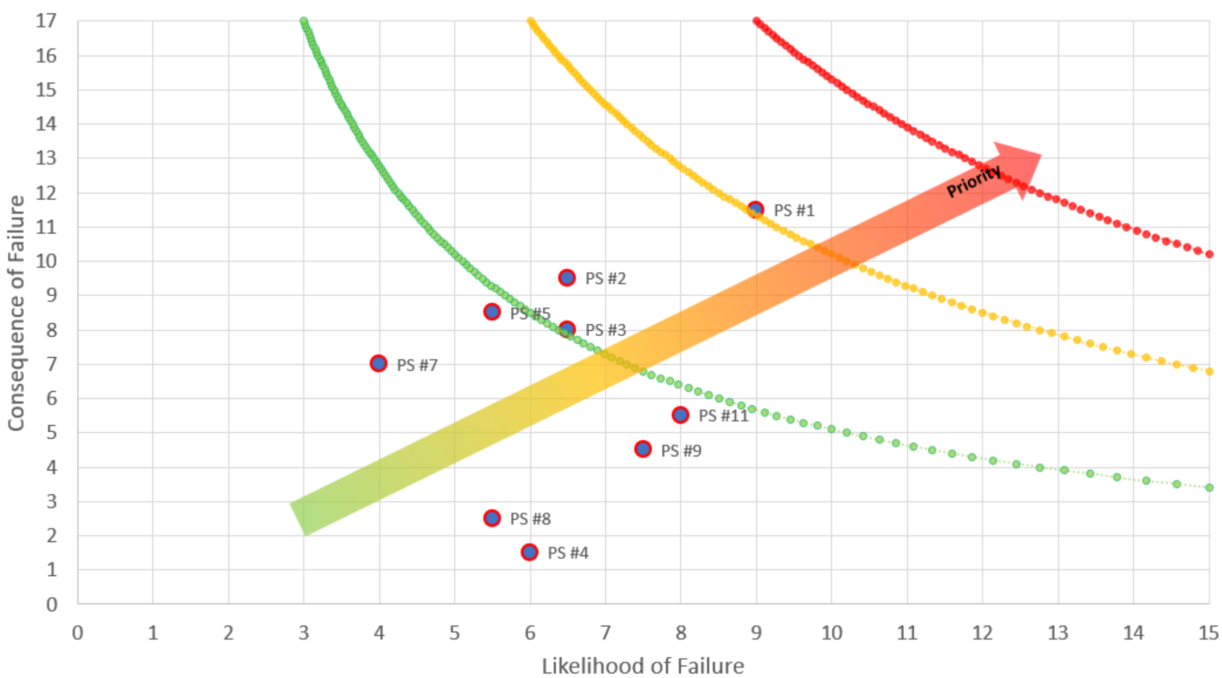
A high-level risk of failure evaluation was completed for the City-owned pump stations. A set of factors for likelihood of failure and consequence of failure were developed with input from City staff. These factors are summarized below.

- Likelihood of failure factors
    - Liquification hazard
    - Landslide susceptibility
    - Backup power
    - Capacity vs. demand
    - Wetwell and piping condition
    - Safety, security, and access
    - Age
    - Sensor and alarm redundancy
    - Influence from flooding (100-year floodplain)
- Consequence of failure factors
    - Capacity of pump station
    - Environmentally sensitive areas (proximity to wetlands/waterways or stormwater system)
    - Type of development served (i.e. hospitals, schools, emergency services, historical sites, industrial zone, or commercial zone)
    - Proximity for flooding private property
    - Portion of community served
    - Estimate of time to overflow

Each pump station was then assigned a score for each factor. For example, the consequence of failure factor “Portion of community served” was assigned a score of 0-3 for each pump station based on the number of EDUs served by the pump station. Pump stations serving less than 5 EDUs were given a score of 0. Those serving 5-50 EDUs were assigned a score of 1, 50-100 EDUs a score of 2, and over 100 EDUs a score of 3. The range of scores for each factor can be found in Appendix G.

After each pump station received a score for each factor, the likelihood of failure scores were totaled and the consequence of failure scores were totaled. The risk of failure for an asset is the product of its likelihood of failure and consequence of failure scores. This risk of failure can be represented graphically as shown in Figure 4-2. The arrow shows increasing risk of failure while the red, yellow, and green dotted lines are equipotential risk lines (all points on the line have equal risk of failure scores). The analysis shows that PS#1 and PS#2 have the highest risks of failure. A failure at one of these pump stations would have the largest impact on the community and is most likely to happen based on the factors evaluated. This analysis indicates that deficiencies at these pump stations should be addressed soon after identified. The risk of failure assessment can be used as a tool to prioritize recommended improvements described in Section 7, as well as provide guidance on importance, urgency, or priority to address any deficiencies identified in the future.

FIGURE 4-2: PUMP STATION RISK OF FAILURE ANALYSIS



4.2 FUTURE COLLECTION SYSTEM PERFORMANCE

This section summarizes future flow projections, the model evaluation of future system expansion, and documents anticipated future deficiencies for the 20-year planning period. Alternative improvements to address these deficiencies are presented in Section 5.

4.2.1 FUTURE FLOW PROJECTIONS & MODEL SCENARIOS

Future loads were distributed based on PSU population projections and City projected future residential, commercial, and industrial growth (additional details in Section 2.4.11). Flows per capita for projected population growth were assumed to be similar to existing flows per capita. Flowrates anticipated in the 20-year planning period are identified in Table 2-6 in Section 2. Growth areas identified by the City can be found in Figure 9 in Appendix A. Residential flows were projected using future growth areas, City zoning, projected number of equivalent dwelling units, and ADWF per capita. Projected industrial and commercial development is anticipated to grow within the industrial and commercial areas identified by the City, with both zoning designations assumed to contribute 1,500 gallons per acre per day (gpad) to the wastewater system. Residential, commercial and industrial loading calculations for the growth areas can be found in Appendix B.

A 20-year $PDAF_5$ model was created, using the calibrated $PDAF_5$ existing system with the addition of the 20-year flows calculated for each growth area. The dry weather loads were applied to the trunkline manhole best fit to receive loads from each growth area. For the RDII loading on the 20-year growth areas, the RTK method was once again utilized. Based on direction from the City, Keller Associates assumed that the growth areas would have reduced RDII influence, as defects and I/I are less likely in new development. RDII flows were estimated to be equal to approximately 80% of the lowest existing RDII of the flow monitoring basins.

After applying the 20-year loads and RDII, the modeled peak instantaneous (PIF_5) and peak day ($PDAF_5$) flows at the WWTP were compared to the modified PIF_5 and $PDAF_5$ planning criteria (Table 4-4). Similar to the existing system, the 20-year modeled peak instantaneous flows and peak day at the plant were lower than the planning criteria, primarily due to surcharging and flooding throughout the system. The 20-year model was also ran with increased pipe capacities to review system flows if capacity limitations in the system were alleviated. These flows are summarized in Table 4-4 as Unconstrained 20-year Model Outflow. The calibrated model flow, with capacity limitations eliminated, is within 10% of the modified planning criteria flows.

TABLE 4-4: 20-YEAR PLANNING CRITERIA VS. MODELED PEAK FLOWS

Flow	Modified 2040 Planning Critieria (MGD)	20-Year Model Outflow (MGD)	Unconstrained 20-Year Model Outflow (MGD)
$PDAF_5$	21.4	18.3	21.0
PIF_5	28.2	25.5	31.7

4.2.2 20-YEAR SYSTEM EVALUATION

The 20-year model was used to assess the existing system capacity during a 5-year, 24-hour design storm event with 2040 flow projections. Peak 20-year flows exceed existing firm capacity of PS#7 and #11. PS#7 and #11 modeled capacities were increased to handle peak 20-year flows and assess potential downstream trunkline capacity limitations. Figure 20 in Appendix A illustrates the potential overflow sites and pipe capacity limitations identified during the 20-year system peak instantaneous flow model evaluation, using the same color-coded criteria established in the existing system evaluation. The same planning criteria as the existing system evaluation for pipelines and manholes was utilized in the analysis (d/D of 85% or higher indicates undersized pipelines, and no sanitary overflows allowed at manholes).

The 20-year system evaluation tells a similar story to the existing system evaluation: each of the six basins show a portion of the modeled trunk lines operating at or above capacity, with most basins having manholes with the potential to overflow. Problems exhibited in the existing system evaluation are exacerbated in the 20-year evaluation and many of the deficiencies are caused by undersized trunklines. The largest increases in additional surcharging and potential overflow locations in the 20-year evaluation occur on Gable Road and Old Portland Road from Kaster Road east. Additional discussion of each deficiency location and alternatives to address the issue are discussed in Section 5. The manholes that have the potential for overflow during peak conditions in the 20-year model overlap are presented in Table 4-5. It should be recognized that the potential overflow locations present in the existing system (Table 4-2) are still overflow locations in the 20-year model but have not been duplicated in Table 4-5.

TABLE 4-5: POTENTIAL OVERFLOW LOCATIONS IN THE 20-YEAR MODEL

Basin	Manhole Name	Manhole Depth (ft)
1	NQ1A	3.6
2	WC8	6.9
2	WJ11	4.1
2	WC15	5.7
2	WE12	4.8
2	WC17	6.6
2	WE16	4.4
2	WC14E	5.9
2	WC16	6.3
2	WC9	8.6
4	M2	8.0
5	I9A	7.6

SECTION 5 - COLLECTION SYSTEM IMPROVEMENT ALTERNATIVES

This section describes alternatives considered to address the collection system deficiencies presented in Sections 3 and 4.

5.1 PLANNING CRITERIA

The planning criteria used for this collection system facilities plan are outlined in Section 2 and summarized as follows for reference. The City's conveyance system will be evaluated for the projected 2040 peak instantaneous flow rates associated with the 5-year, 24-hour storm event (PIF_5 in Table 2-6). Criteria for requiring improvements is when the maximum flow depth/full depth (d/D) of a pipe is greater than 85%. Collection systems pipeline improvements will be sized to achieve d/D of less than 85% during the 2040 PIF_5 flow. 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.

5.2 PUMP STATIONS

Pump station existing conditions were summarized in Section 3 and existing capacity limitations in Section 4. The deficiencies highlighted in Section 3 require relatively minor improvements to resolve. Capacity limitations identified in Section 4 show PS#7 and #11 are undersized for expected peak 20-year flows. No feasible alternatives were identified for pump station capacity improvements. Recommended short- and long-term pump station condition and capacity improvements are summarized in Section 7. The collection system alternatives below in Section 5.4 were evaluated with the assumption that PS#7 and #11 firm capacities were increased to meet expected peak 20-year flows.

5.3 SUMP PUMP ALTERNATIVES

As mentioned in Section 3, the rapid and significant rainfall response in certain sewer trunklines observed by City staff suggests that a number of areas within the City have illegal sump pump connections to the wastewater system. These areas are highlighted in Figure 14 in Appendix A. The City would like to identify and disconnect sump pumps in these areas to reduce I/I to the sewer system. The following alternatives have been identified to aid the City in this goal.

5.3.1 ALTERNATIVE SP1 – EDUCATIONAL MATERIAL

In other municipalities with illegal sump pump connections, targeted educational campaigns have been used to inform customers about sump pumps. This generally includes distribution of flyers or a page on the City's website providing information to customers. The information includes a description of what sump pumps are, visual aid on identifying them in the home, and information regarding the local law regarding sump pumps. In municipalities where sump pump connection to the wastewater system is against code, it is important to notify residents that the cross-connection is a code violation and should be disconnected from the wastewater system. Examples of flyers used in other municipalities with a similar ban on sump pump cross-connections can be found in Appendix H.

In addition to providing educational materials, some cities and municipalities offer assistance with disconnection of sump pumps. This generally involves including a phone number on the educational material that customers can call and receive aid from City staff on disconnecting their sump pump.

5.3.2 ALTERNATIVE SP2 – SMOKE TESTING

Smoke testing is a standard method used in I/I studies to identify defects in trunklines and service laterals, as well as illegal cross-connections. Smoke testing involves using smoker equipment to pump smoke into a collection system via a manhole, and then monitor the area served by the upstream system.

For identifying sump pump connections, houses with sump pumps or cross-connections may see smoke rising from around the foundation of the house. By visual inspection, houses are identified and the residents informed that they likely have an illegal sump pump connection. If the City decides to perform a more in-depth I/I study for the areas identified, then the City can perform smoke testing to both identify system defects in trunklines/laterals and the location of sump pumps simultaneously. Similar to alternative SP1, the City may offer staff support in helping customers disconnect their sump pump systems to ensure the disconnection is completed properly.

5.3.3 ALTERNATIVE SP3 – DYE TESTING AND CCTV

Dye testing and CCTV are also typical methods that can be used to detect cross-connections in a collection system. Dye testing involves dropping colored dye at or above a suspected cross-connection point (a basement drain, or area drain) and monitoring the collection system downstream, either through visual inspection in a manhole or cleanout, or via CCTV rover placed in the collection system. If dye is observed in the flow, it is indicative of a cross-connection.

The drawback of this alternative for identifying sump pump cross-connections, is the dye would have to be placed at the inlet of the sump pump. The location of the pumps is what is posing to be the biggest challenge for City staff. As such, this alternative is not recommended for identifying sump pump locations.

5.3.4 ALTERNATIVE SP4 – VISUAL INSPECTION

Another alternative is visual inspection. This involves City staff going to each property and inspecting the homes for potential cross connections. Primarily, storm drains and downspouts on the outside of the house that disappear into the ground and do not discharge to the yard are primary candidates for a cross connection.

The drawback of this method is that, in general, sump pumps are located within a basement or the foundation of a home and may not be visible from exterior inspection alone.

5.3.5 ALTERNATIVE SP5 – POINT-OF-SALE INSPECTION

The next alternative is Point-of-Sale Inspection. City staff can include a code requirement or ordinance to inspect each home for sump pump connections prior to sale. This type of inspection would require private homeowners/inspectors to identify and report to the City about which homes are equipped with sump pumps. From there, enforcement of disconnecting the pump can occur. The drawback to this method is that only homes going through inspection and sale will be affected.

5.3.6 ALTERNATIVE SP6 – REWARD-BASED DISCONNECT INCENTIVE

The City has also considered a reward-based incentive program, whereby owners of sump pumps would be incentivized to voluntarily disconnect their system from the sewer system. This reward could come in the form of direct monetary payment, or a credit on future sewer bills to the customer. The City currently has an annual budget directed to I/I projects, a portion of which City staff has expressed could be used for this incentive program.

Similar to Alternative SP1, the City could offer assistance in disconnecting the sump pumps. This would ensure a proper disconnect from the system, and staff could present the reward to the customer in a single trip. Alternative SP6 could be used in conjunction with Alternative SP1, as the educational material distributed can also serve as an advertisement for the incentive program.

See Table 5-1 below for a summary of the benefits and drawbacks of each alternative. A discussion on updates to the City's code to address sump pumps can be found in Section 6.

TABLE 5-1: SUMMARY OF SUMP PUMP ALTERNATIVES

Alternative	Benefits	Drawbacks
SP1: Educational Material	• Cost efficient • Relatively easy to develop and distribute information	• No guarantee customers will disconnect sump pumps when informed.
SP2: Smoke Testing	• Effective at identifying cross connections, defects, and some sump pump locations • Can reduce overall cost by performing in conjunction with established I/I effort	• More expensive than alternative SP1 or SP4
SP3: Dye Testing and CCTV	• Effective at identifying system cross-connections	• Need to place dye at inlet of sump pumps, doesn't aid in identifying locations of pumps
SP4: Visual Inspection	• Can identify cross-connections to the collection system • Can be performed in conjunction with typical staff inspections/routine	• May be difficult to locate sump pumps on visual inspection alone (without entering the property or structure)
SP5: Point-of-Sale Inspection	• Puts responsibility on homeowner to identify and disconnect sump pump during home sales	• Only affects homes going through the selling process
SP6: Reward-Based Disconnect Incentive	• Provides additional incentive for users to disconnect sump pumps • Potential for more disconnects than SP1	• Increased cost to City for monetary payout or decreased revenue for billing credit

5.4 COLLECTION SYSTEM ALTERNATIVES

Collection system deficiencies discussed in Section 4 (Figure 20) reflect potential overflow locations and capacity issues. Alternatives for addressing system deficiencies in the following sections are organized by each of the six flow monitoring basins (Figure 16). Some of the deficiencies identified in Section 4 do not have multiple, feasible alternatives for improvements. These improvements are included in the following sections and are the recommended method to address the deficiency.

Preliminary cost estimates were evaluated for alternatives comparisons. Preliminary cost estimates are summarized in Table 5-2 at the end of this section. Advantages and disadvantages of alternatives, including capital cost and operations and maintenance (O&M) considerations, are also discussed below. Additional cost estimate details can be found in Appendix I. It should be noted that I/I reduction efforts undertaken by the City may decrease peak flows in the collection system, and could delay or eliminate the need for some of the capital improvements.

5.4.1 BASIN 1

1.a - Upsize Existing System:

Modeling depicts that most of the pipeline downstream and upstream of Kindre Street is undersized. The existing 10-inch pipeline should be upsized to a 15-inch pipeline and the pipeline segment between Kindre Street and Kelly Street should be upsized to an 18-inch pipeline to handle the projected 2040 PIF5 flows. Other methods of redirecting flow or adding additional parallel pipelines are not deemed cost effective for this area.

5.4.2 BASIN 2

The alternatives below were evaluated with the assumption that PS#11 firm capacity was increased to handle expected peak 20-year flows. Additional details on recommended pump station improvements are in Section 7.

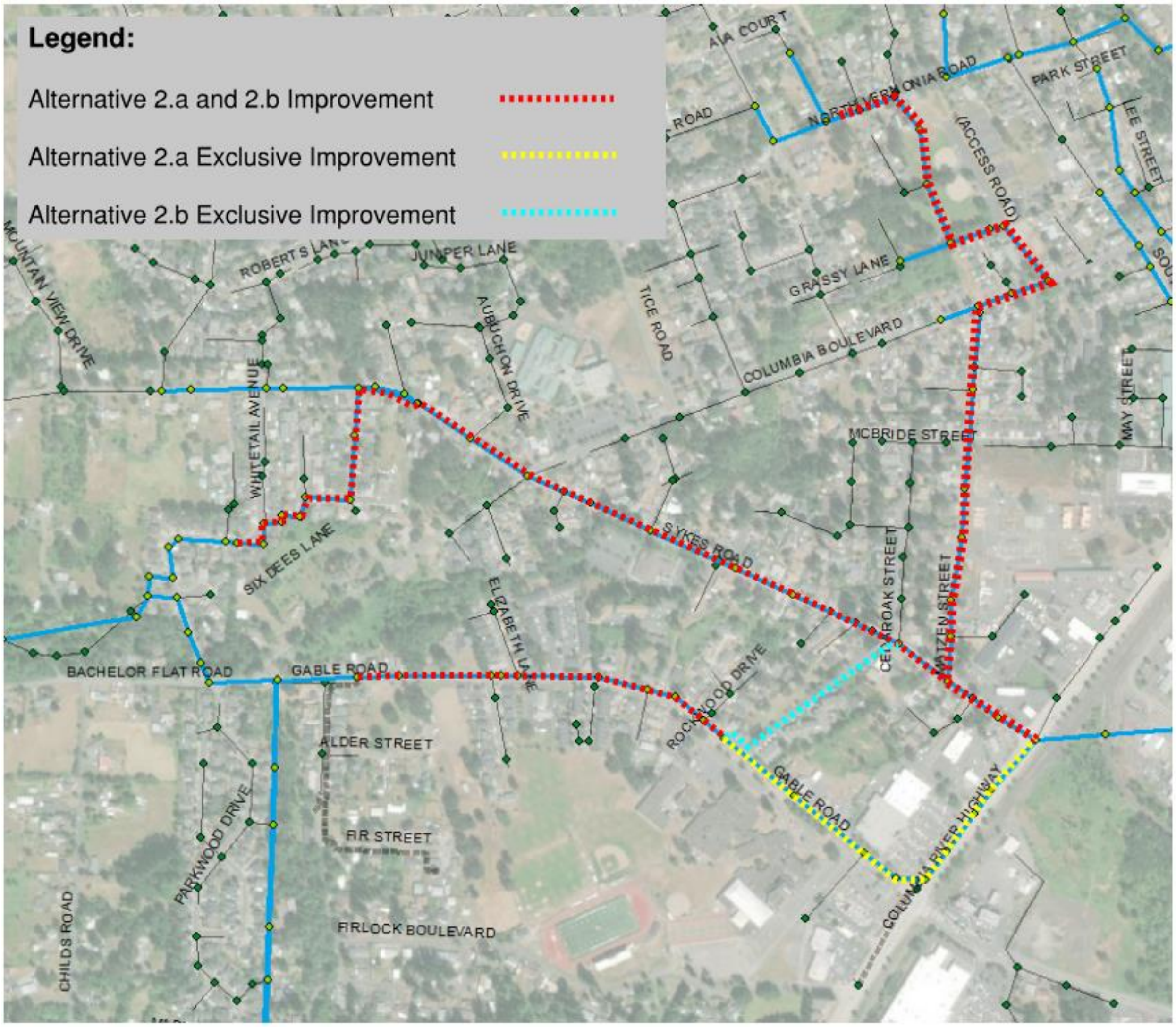
2.a - Upsize Existing System:

Many pipelines in Basin 2 are undersized for the projected flows. Pipeline size increases to handle 20-year PIF_5 flows include the trunkline along Gable Road, the trunkline along Sykes Road, the trunkline along Matzen Street, and the 8-inch line along Westshire Lane as shown in Figure 5-1. Typically, all these trunklines require two nominal pipe size increases to meet the 0.85 d/D criteria for the pipeline during PIF_5.

2.b - Upsize Existing System and Redirect flow from Gable Rd. to Sykes Rd.

Alternatively, flow down the Gable Road trunkline could be redirected to Skyes Road via a 12-inch pipeline from manhole WC9 to manhole W42. This would alleviate the need for improvements downstream on Gable Road. The rest of the pipeline upsizing outlined in Alternative 2.a would also be required for this alternative. The preliminary cost comparison between the two alternatives is depicted in Table 5-2 (located in Section 5.4.6), and no significant difference in O&M efforts could be distinguished when comparing these alternatives. The visual depiction of the two alternatives can be found in Figure 5-1.

FIGURE 5-1: BASIN 2 IMPROVEMENT ALTERNATIVE COMPARISON



5.4.3 BASIN 3

3.a - Upsize Existing System:

Only a few segments of the existing system in Basin 3 are considered to be undersized. If the pipe segment along N 10th Street to West Street is upsized from 12-inch to 15-inch in diameter, the pipeline will have adequate capacity to handle 20-year PIF_5 flows. Other methods of redirecting flow or adding additional pipelines are not deemed cost effective for this area.

5.4.4 BASIN 4

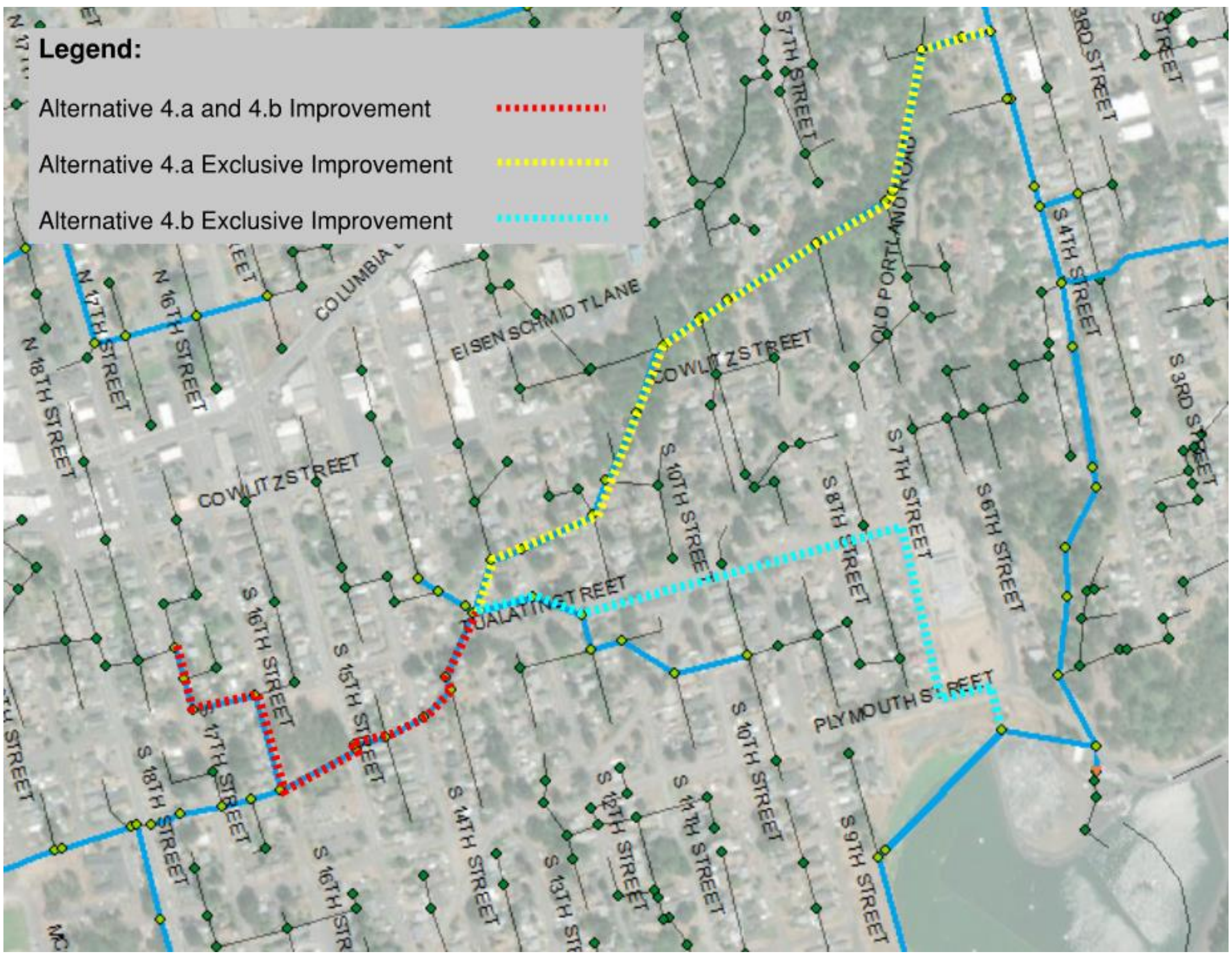
4.a - Upsize Existing System:

The majority of the 12-inch to 18-inch trunkline segments within Basin 4 are undersized for 20-year flows. To alleviate this, the majority of the pipeline segments from the Basin 5 trunkline to S 17th Street needs to be increased by one nominal pipe size, 15- to 21-inch segments.

4.b – Upsize Existing System and Redirect flow from Tualatin Street to Basin 6:

Alternatively, basin flow west of S 13th Street could be redirected down Tualatin Road and S 7th Street to alleviate the eastern portion of the basin and convey flow directly to manhole S1 in Basin 6, which has adequate capacity to handle 20-year flows from both Basin 6 and Basin 4 west of S 13th Street. This alternative would involve capping the existing pipe on S 13th Street, replacing the pipelines along Tualatin Street with a 15-inch trunkline sloped west to east, and construction of a new 15-inch trunkline from along Tualatin Street and S 7th Street to manhole S1 (south of S 6th Street). The main trunkline west of S 13th Street would still require upsizing from 10 and 12-inch to 12 and 15-inch (one nominal pipe diameter) to handle 20-year flows. No significant difference in O&M efforts could be distinguished when comparing these alternatives. Alternative 4.b opts to construct 2,760 feet of new pipe instead of upsizing the 3,220 feet of pipe east of S 13th Street. The cost comparison between the alternatives is presented in Table 5-2 (located in Section 5.4.6). A visual depiction of these alternatives is shown in Figure 5-2.

FIGURE 5-2: BASIN 4 IMPROVEMENT ALTERNATIVE COMPARISON



5.4.5 BASIN 5

5.a - Upsize Existing System:

The main 30-inch trunkline through Basin 5 is undersized for 20-year flows from Tualatin Street to Columbia Boulevard. An upsize to 36-inch pipelines north of manhole I9 (the inlet of basin 4) and 42-inch pipelines south of manhole I9 would be sufficient to handle 20-year PIF5 flows. The City's tunnel, adjacent to S 4th Street, consists of stacked 20 and 21-inch pipelines which are too undersized to handle peak flows. Upsizing each of the pipelines individually is not feasible due to their stacked nature. Thus, these pipelines should be replaced by a singular 42-inch pipeline. Open trenching may not be possible due to the nature of the tunnel; additional costs have been assumed to account for pipe removal and horizontal drilling.

Basin 5 also includes PS#1, which is expected to be relocated with the Riverfront development and will cause flows captured by this pump station to be discharged south of the tunnel near the WWTP, rather than north of the tunnel where the station currently discharges. This change does not re-direct enough flow to resolve capacity issues in the basin. Other methods of redirecting flow or adding additional pipelines were not deemed cost effective for this area.

5.4.6 BASIN 6

The alternatives below were evaluated with the assumption that PS#7 firm capacity and the southern trunkline capacity from west of Kaster Road to Plymouth Street were increased to handle expected peak 20-year flows upsized to 30-, 33-, and 36-inch pipeline. Additional details on recommended pump station and southern trunkline improvements are provided in Section 7. Cost estimate for the southern trunkline improvements is included in the Basin 6 alternatives cost estimates in Table 5-2.

6.a – Upsize Existing System

Basin 6 has several undersized pipelines, including trunklines along Port Avenue, Columbia River Highway, Dubois Lane, S 18th Street, Old Portland Road, and south of Umatilla Street. Pipe diameter increases are required ranging from one to three nominal sizes to convey the 20-year peak flows.

6.b – Upsize Existing System and Redirect Flow from Old Portland Rd. to Kaster Rd.

Rather than upsizing the length of pipeline between manhole S17 and S12 (along Old Portland Road and Umatilla Street), a new 15-inch pipeline can be constructed from manhole D1 (north of Portland Road) to manhole S20 on Kaster Road to convey flows directly to the 27-inch trunkline in Basin 6. The connection to the manhole on Portland Road can be capped, which would eliminate the need for upsizing the approximately 1,400 feet of pipe along Old Portland Road and Umatilla Street. The remainder of the pipeline upsizing presented in Alternative 6.a would still need to be completed in this alternative. A visual comparison of the alternatives can be found in Figure 5-3. The cost comparison between the two alternatives is presented in Table 5-2. No significant difference in O&M efforts could be distinguished when comparing these alternatives.

FIGURE 5-3: BASIN 6 IMPROVEMENT ALTERNATIVE COMPARISON

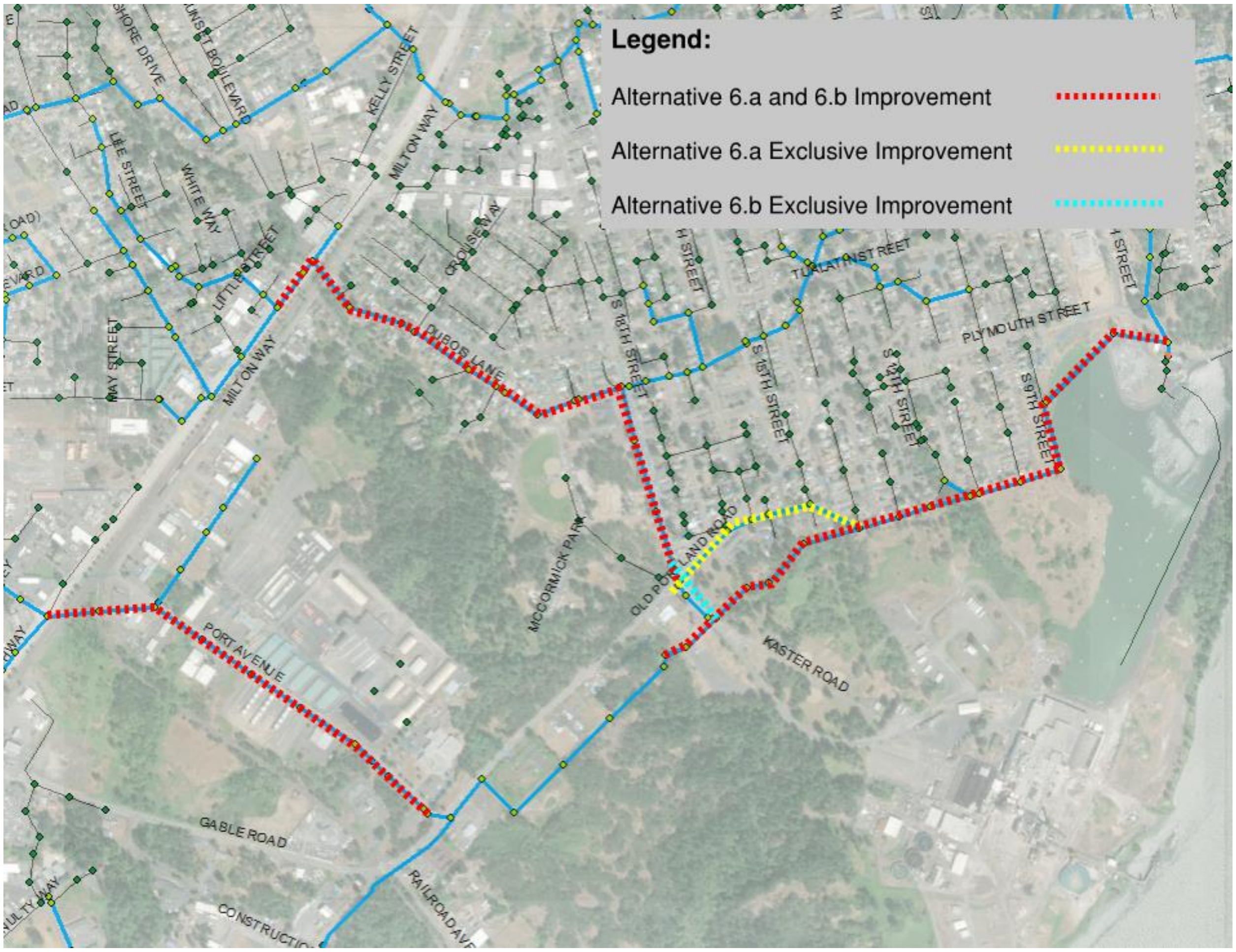


TABLE 5-2: SUMMARY OF COSTS FOR COLLECTION SYSTEM ALTERNATIVES

Alternative No.	Alternative	Estimated Total Project Cost (rounded)
1.a	Basin 1 - Pipeline Upsize	$1,800,000
2.a	Basin 2 - Pipeline Upsize	$9,400,000
2.b	Basin 2 - Pipeline Upsize and Redirect from Gable Rd. to Sykes Rd.	$9,100,000
3.a	Basin 3 - Pipeline Upsize	$1,200,000
4.a	Basin 4 - Pipeline Upsize	$3,700,000
4.b	Basin 4 - Pipeline Upsize and Redirect from Tualatin St. to Basin 6	$3,600,000
5.a	Basin 5 - Pipeline Upsize	$4,500,000
6.a	Basin 6 - Pipeline Upsize	$12,300,000
6.b	Basin 6 - Pipeline Upsize and Redirect from Old Portland Rd to Kaster Rd.	$11,500,000

In addition to these alternatives, installation of parallel facilities or taking no action could be considered. Parallel facilities could be constructed in areas with limited remaining capacity. This alternative would increase the system's capacity and generally costs less than full replacements. Another advantage of constructing parallel facilities is that existing infrastructure could be left in service while the parallel facilities are constructed. The disadvantages of this alternative include the long-term increase in maintenance costs associated with maintaining parallel facilities and the potential higher life-cycle costs associated with the eventual replacement or rehabilitation of the original pipeline. Additionally, the City has shallow bedrock throughout the majority of city limits, and the additional cost of rock excavation may make the prospect of parallel pipelines less desirable than upsizing pipelines within established trenches. City staff generally prefer to upsize existing gravity pipelines over the construction of parallel pipelines. This preference has been reflected in Table 5-2 above and in the recommended alternatives in Section 7.

Taking no action is not a viable option because surcharging and the potential for overflows would only worsen. This could result in negative impacts to human health and the environment, in addition to potential fines from the DEQ.

I/I reduction improvements to the system may mitigate the need for large scale capital improvements. The City acknowledges that the I/I shown in the existing system flows is uniquely large compared to municipalities of similar size. Lowering peak flows decreases the likelihood of surcharged pipes or overflows to occur within the system. See Section 7 for additional discussion on recommended steps to reduce system I/I.

Section 7 summarizes the recommended alternatives to resolve the collection system deficiencies.

5.5 FUTURE INFRASTRUCTURE

5.5.1 RIVERFRONT DISTRICT

The City is currently evaluating development options for the Riverfront District, which includes relocation of PS#1. Currently, manhole IA7A acts as the terminal manhole upstream of PS#1 in S 1st Street. Preliminary calculations were performed by Keller Associates for routing a gravity pipeline from manhole IA7A to the anticipated pump station location adjacent to the S 1st Street/Plymouth Street extension. A 10-inch pipeline at minimum slope would have the capacity to convey the projected 20-year flows through the Riverfront District. Routing the pipeline through the District along the S 1st Street extension would be feasible, with manhole inverts along the corridor ranging from 5 to 10 feet in depth. Refer to Figure 21 in Appendix A for a depiction of a potential route of the collection trunkline overlayed with City planning figures.

5.5.2 INDUSTRIAL BUSINESS PARK

The City's industrial business park is situated along the Columbia River and has historically been used by industries for wood products (formerly the Boise White Paper, LLC mill operations site) until the City acquired the 225-acre property. The City is seeking new opportunities for the business park and wastewater infrastructure should be planned for appropriately.

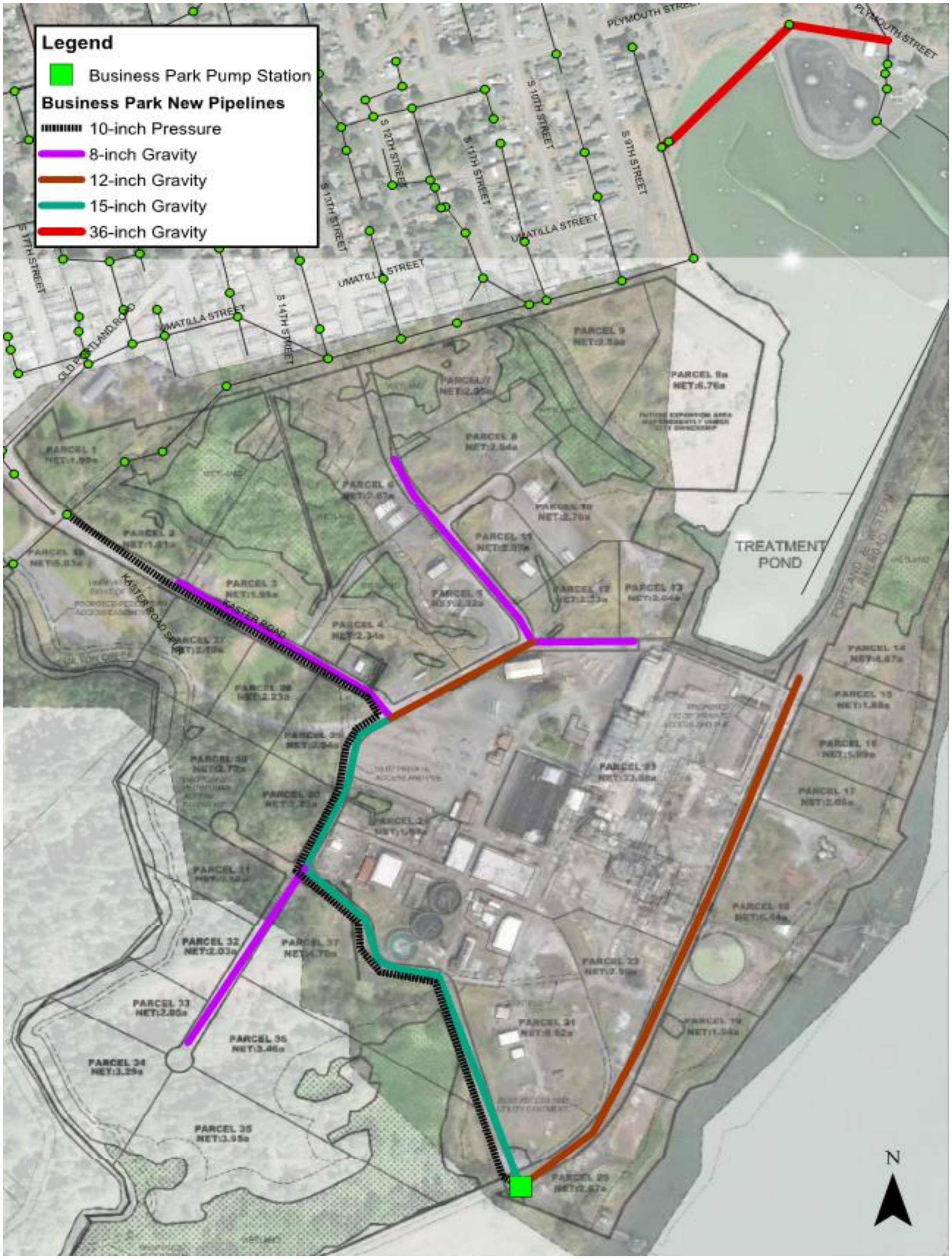
The City completed the St. Helens Industrial Business Park Parcellation Framework Report in July of 2020, which details the parcellation plan for the site and the existing infrastructure on the site (available on the City's website).

The topography of the site generally shows the ground elevation sloping down from northeast to southwest. The majority of the site cannot be served by gravity with the existing trunklines which border the north end of the property. To provide sewer service to most of the future development, a pump station will be needed. The pump station will likely need to be located near the waterfront to follow existing topography. The gravity sewer piping will follow the proposed roadway alignments and drain to the proposed pump station location. The force main can be routed along existing and/or proposed roadways and discharge to the existing trunkline on Kaster Road. The existing gravity trunkline downstream south of Umatilla Street and extending east has a section of parallel pipes which are capacity limited. The pipes exceed a d/D of 0.85, but do not surcharge above top of pipe during peak design flows.

The anticipated loading for the site matches the other projected industrial developments in the 20-year planning period. Flow was allocated to the property based on a 1,500 gpad base rate, which matches the allocations for the other industrial and commercial growth areas (details shown in Appendix B). The site is expected to flow by gravity to the proposed pump station. The pump station force main is proposed to discharge to the existing system in Kaster Road south of the intersection of Old Portland Road. The pump station firm capacity should be sized to handle the estimated 20-year peak flow for the development of approximately 1,300 gpm. Proposed pipelines are sized to handle peak flows at 85% full depth. The proposed wastewater pipe alignment, pump station, and force main are shown in Figure 5-4 (see Figure 22 in Appendix A for full sized figure). It is recommended that the existing parallel pipelines and pipeline segment downstream be upsized to 36-inch pipeline as part of the improvements to accommodate the additional flows from the Industrial Business Park (Figure 5-4). The flow rate assumptions made in this plan and subsequent infrastructure sizing should be re-evaluated once more information is known on the specific industries the development will serve and during the predesign phase.

Cost estimates for the proposed wastewater infrastructure for the business park can be found in Section 7.

FIGURE 5-4: INDUSTRIAL BUSINESS PARK PROPOSED WASTEWATER INFRASTRUCTURE



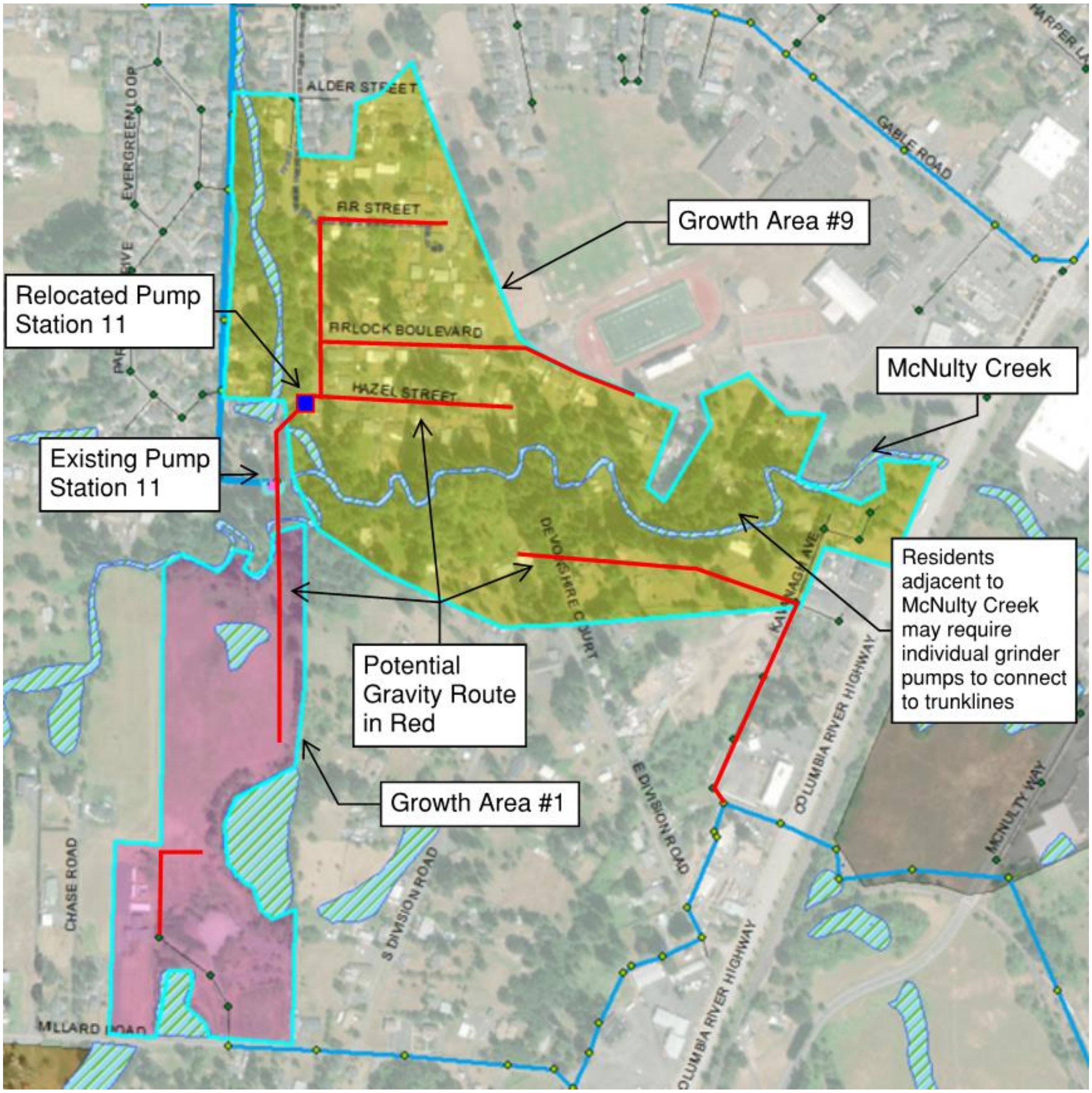
5.5.3 GROWTH AREA #1 AND #9 INFRASTRUCTURE

Within the 20-year period, the areas anticipated to take on residential, commercial, and industrial growth are documented in Figure 9 in Appendix A. Most of these areas have topography that allow for gravity flow into the existing collection system. There are some growth areas, however, that may require additional infrastructure. Growth Areas #1 and #9, highlighted in Figure 5-5, present challenging topography, primarily due to the wetlands in the area. Provided City GIS and topology information utilized in this study are accurate, it is feasible that southern portions of Growth Area #1, in pink, and of Growth Area #9, in yellow, can be served by 8-inch gravity lines from Basin 6 (upstream of PS#7). The northern portion of Growth Area #1 is anticipated to flow by gravity north to PS#11. This alignment assumes a boring under McNulty Creek.

The City has expressed interest in relocating PS#11 further north, to the intersection of Firlok Park Street and Hazel Street. If done, the depth of the wetwell can be sized at predesign to receive flow via gravity line from the northern portions of Growth Areas #1 and #9. Again, this would assume a bore under McNulty Creek to serve the portion of Growth Area #1. A potential layout for the pipelines is depicted in Figure 5-5. Grinder pumps may need to be installed at residences adjacent to McNulty Creek, as the relative elevation of these locations may make serving them via gravity pipeline not feasible.

The anticipated peka 20-year flows to Pump Station#11 are approximately 550 gpm. This includes estimated flows from Growth Area #10, located to northwest of the pump station, which is expected to flow by gravity to PS#11. PM#11 will require firm capacity improvements when it is relocated, in addition to increasing the depth of the wetwell. PS#7 is anticipated to need firm capacity improvements as additional growth areas develop in the basin. Cost estimates for the recommended infrastructure are summarized in Section 7.

FIGURE 5-5: GROWTH AREAS #1 AND #9 PROPOSED WASTEWATER INFRASTRUCTURE



SECTION 6 - ENGINEERING STANDARDS & COMPREHENSIVE PLAN REVIEW

The City's existing development code (Title 17), engineering design standards (Title 18), and comprehensive plan (Title 19) were reviewed for new development as they pertain to wastewater conveyance to identify potential deficiencies and provide recommendations for updates.

6.1 ENGINEERING STANDARDS & COMPREHENSIVE PLAN REVIEW

The following documents were examined during this review effort.

- St. Helens Municipal Code (SHMC) Title 17 Community Development Code
- St. Helens Municipal Code (SHMC) Title 18 Engineering Standards Manual
- St. Helens Municipal Code (SHMC) Title 19 Comprehensive Plan

General observations and recommendations to update the City's policies and standards are summarized in the technical memorandum in Appendix C. The City should review the recommendations presented in the memo and assess if they agree with the proposed changes and additions to City Municipal Code, standards, and comprehensive plan. If the City agrees with some or all of the recommendations, the process to propose changes to the documents listed above should be initiated.

SECTION 7 - RECOMMENDED COLLECTION SYSTEM IMPROVEMENTS

This section consists of the recommended plan to address the wastewater collection system deficiencies. The recommended projects presented here have been incorporated into the St. Helens Capital Improvement Plan (CIP) in Section 8.

7.1 INFLUENT FLOW MONITORING IMPROVEMENTS

As discussed in Section 2, the current method of measuring wastewater influent flow may not reliably capture peak influent flows during high flow events, particularly when the headworks bypass is active. A Parshall flume, partially-full pipe electromagnetic flowmeter, and non-contact (above flow) sensor were considered for the application. Based on footprint, vertical drop available, and general capital costs, it is recommended that the City install a non-contact flow sensor in a new manhole along the 42" trunkline upstream of the City's headworks. One such sensor is the Hach Flo-Dar sensor that is mounted in a manhole just above the crown of the pipe and uses ultrasonic and radar technology to measure level, velocity, and calculate flow rate. The sensor could be connected to and recorded by the City's Supervisory Control and Data Acquisition (SCADA) system. Costs for the improvement are estimated below in Table 7-1, with additional details in Appendix J.

TABLE 7-1: PRIORITY 1 INFLUENT FLOW MONITORING IMPROVEMENTS

Project Name	Improvement Cost (rounded)
WWTP Influent Flowmeter	$68,000

7.2 RECOMMENDED PUMP STATION IMPROVEMENTS

Recommended pump station improvements summarized here address deficiencies summarized in Sections 3.2 and 4, including the relocation and improvements of PS#1 and PS#11. Costs presented in the following tables are planning level estimates and are in 2021 dollars. 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.

7.2.1 PRIORITY 1 – COMPLETE CURRENT AND URGENT UPGRADES

As stated in Section 3, the City is currently installing overflow alarms at each of its pump stations. This effort was undertaken as a proactive approach to anticipated DEQ guidance requiring installation of overflow alarms on new pump stations. As of this report, six stations have yet to receive the upgrade. Priority 1 pump station improvements address completion of this installation effort, including SCADA integration, and should be completed in the next six years. It is assumed that this effort for PS#1 and PS#11 will be completed with their Priority 2 upgrades, discussed in Section 7.2.2.

Additionally, it is recommended that the City add alarms on all pump stations that indicate when all pumps are running. The City should track when the alarm is triggered. If this alarm is frequent (more than once every 5 years), then it may indicate the pump station is running at or over its firm capacity and needs to be upgraded.

PS#2 is currently served by two pumps operating on VFDs. Both pumps operate with a high setting of 750 gpm and a low setting of 250 gpm. Currently, in the event of high inflow into the station, the station runs both pumps at low setting prior to switching one to the high setting. Generally, one pump switching to the high setting while the other pump continues to run indicates a lack of firm capacity. It is recommended the station be equipped with an alarm that indicates when one or both pumps switch into their high setting. The alarm should be integrated into SCADA, and a log should be kept of high setting incidents. Multiple alarms a year may be indication of a lack of firm capacity and a need for an upgrade.

Currently, during power outages, City staff alternates use of its portable generators at the multiple pump stations which lack on-site backup power. City staff have to prioritize which stations to supply emergency power to with the two available portable generators. It is recommended an on-site generator be installed at PS#3 to increase the City's backup power capabilities and simplify portable generator operations during outages.

It is assumed that adding firm capacity alarms for the pump stations incurs minimal cost to the City and can be completed in conjunction with installation of the overflow alarms. Improvement costs are summarized in Table 7-2. Cost estimate details can be found in Appendix J.

TABLE 7-2: PRIORITY 1 PUMP STATION IMPROVEMENTS

Project Name	Improvement Cost (rounded)
Install Overflow Alarms	$9,000
Install On-site Generator at Pump Station 3	$90,000
Total Project Costs (rounded)	***$100,000***

7.2.2 PRIORITY 2 – ADDRESS NOTED DEFICIENCIES

Table 7-3 (at end of section) summarizes recommended Priority 2 improvements by pump station. These projects are identified as Priority 2 projects as they are not urgent to address significant deficiencies, but are recommended to address anticipated growth, as well as redundancy, safety, and O&M concerns reported in Sections 3 and 4. Relocation of both PS#1 and PS#11 accommodate anticipated future growth. General, minor improvements to remaining stations address redundancy, safety, and O&M concerns. The recommended pump station improvements include:

PS#1 Relocation

The City is currently evaluating development options for the Riverfront development, located adjacent to Columbia River and downtown. The development will need a pump station to provide sewer service to the area due to the topography. As part of this process, it is recommended the City relocate PS#1 to the south, adjacent to a planned S. 1st Street extension in the Riverfront District. This relocation would allow PS#1 to serve both the Riverfront development and its existing sewer basin. The existing sewer basin would be connected to the new trunkline in the Riverfront development and flow by gravity to the new PS#1. All new pump stations are recommended to include an on-site backup generator and. It is recommended that the firm capacity of the pump station be increased from 550 gpm to approximately 700 gpm to accommodate the anticipated 20-year flows from the existing sewer basin and the Riverfront development.

Due to this project's proximity to the Columbia River, this project may encounter a high water table in the Riverfront development area. An estimate for dewatering groundwater has been included in the planning level costs. It was assumed that construction of the new roadway within the Riverfront development was not a part of this project. Additional information on the Riverfront Development can be found in the City's Riverfront Connector Plan, dated 2019, and the St. Helens Waterfront Framework Plan, dated December 2016. A copy of each is available on the City's website.

PS#11 Relocation

As described in Section 5.5.3, PS#11 is proposed to be relocated north to serve homes in the Firlock area basin. Improvements are recommended to increase the firm capacity to approximately 550 gpm, including a new 6-inch force main, to handle anticipated peak flows in the 20-year planning period.

City staff also noted pump station safety and access concerns with the current pump station location in the middle of a bend in the road that does not have a wide shoulder or permanent lighting. City staff are currently using headlights and flashlights if servicing the station in the dark. Relocating and upgrading the pump station would address the access and safety concerns for this station while also providing the option to serve additional growth areas.

The proposed location of the new PS#11 is on the east side of McNulty Creek. The connection of the new pump station to the existing collection system (located on the west side of McNulty Creek) will require crossing over or under a McNulty Creek culvert. Open trench construction may disturb the existing culvert, which in turn may prompt environmental investigations into fish passage, additional permitting efforts, and additional construction costs. As such, it is recommended that a trenchless bore be utilized around the existing culvert for the pipeline extensions to minimize impact to the culvert. Due to the prevalence of bedrock in St. Helens, which may interfere with boring progress, a 40% contingency was assumed for this project.

General Pump Station Improvements

Additionally, safety, redundancy, capacity, and operations concerns at the remaining pump stations are recommended to be resolved via the following improvements:

- Based on the hydraulic evaluation and pump runtime analysis (Section 4.1.5), PIF_5 flows into PS#1, PS#2, PS#3, PS#4, PS#5, PS#7, and PS#11 may exceed the stations' firm capacities. It is recommended that pump station runtimes continue to be recorded and reviewed by staff in conjunction with the recommended alarm data if both pumps are running. If the runtimes depict a station running both pumps, and I/I improvements do not reduce flows into the pump stations, then the station firm capacity should be increased to handle peak influent flows. PS#5 had multiple instances of exceeding firm capacity. It is recommended that this station have its pumps upgraded to handle peak influent flows. PS#2 has a VFD and operates on both a high and low setting. When the station experiences near 60 minutes running on the hour in its high setting, it is a likely indicator that it' exceeding firm capacity and requires upgrades. It should be noted that I/I reduction efforts described in section 7.3 could delay or eliminate the need for this improvement.
- It is recommended to install pressure gauges and flow monitors at each pump station when they are undergoing upgrades or pump replacements. This allows City staff to record information on pump and influent conditions and assess pump station capacity in real time.
- It is recommended that each pump station currently lacking adequate fall protection be equipped with adequate fall protection. This applies to PS#2, PS#3, PS#4, PS#5, and PS#8. Additionally, it is recommended that each pump station without redundant level sensors be equipped with a redundant level monitoring device, such as an ultrasonic level sensor or backup floats.

Cost estimates for each of the Priority 2 Pump Station improvements are shown in Table 7-3. Cost details can be found in Appendix J.

TABLE 7-3: PRIORITY 2 PUMP STATION IMPROVEMENTS

Project Name	Improvement Cost (rounded)
Pump Station 1 Relocation	$2,400,000
Pump Station 11 Relocation	$3,100,000
Pump Stations 2 - 9 Upgrades	$700,000
Total Project Costs (rounded)	***$6,200,000***

7.2.3 PRIORITY 3 – ACCOMMODATE GROWTH

The Priority 3 recommended improvement accommodates anticipated growth. As described in Section 4, PS#7 is undersized for anticipated, 20-year growth. Two industrial areas, a mobile home park, and a portion of mixed use residential growth are anticipated to develop in the PS#7 basin. It is recommended the pump station firm capacity be increased to approximately 1,400 gpm to accommodate the growth. There is an existing 8-inch force main at the pump station that is currently inactive. It is anticipated that PS#7 will utilize both the existing 6-inch and 8-inch parallel force mains when the firm capacity is increased. The PS#7 improvements are estimated to cost $2,200,000. Cost details can be found in Appendix J.

7.3 RECOMMENDED I/I IMPROVEMENTS

7.3.1 PRIORITY 1 – REDUCE I/I TO REDUCE RISK OF OVERFLOW/SURCHARGING

I/I Reduction

As discussed in Section 3, the City of St. Helens experiences large amounts of I/I. Estimated peak flows in the collection system are 20-25 times higher than annual dry weather flows. The collection system requires significantly increased capacities to handle these peak wet weather flows. They cause much of the surcharging and reported overflows in the collection system. In addition to the surcharging and reported overflows within the collection system, the peak I/I flows also put strain on the City's pump stations and WWTP. While not considered reliable for recording peak flows, the existing WWTP influent flowmeter has recorded peak flows in excess of 25 MGD. An evaluation of the WWTP was not included in the scope of this study. However, in discussion with City staff, the WWTP influent bypass channel is typically used multiple times a year during the wet weather season. It is recommended the City track peak influent flows at the WWTP and assess if they exceed the rated capacity of WWTP unit processes. If I/I in the system is not addressed, the City may need WWTP upgrades to handle peak flows. I/I reduction throughout the system could delay or eliminate the need for many capacity-related improvements throughout the wastewater collection system and WWTP and provide cost savings to the City.

Using the methodology described in Section 3, priority pipelines for inspection and I/I improvements were identified and are displayed in Figure 15 of Appendix A. It is recommended that the City utilize Figure 15 and the table in Appendix K, which highlight the recommended pipelines to begin I/I efforts. Projects that had been replaced or rehabilitated recently were not included in these I/I recommendations. It should be noted that because recent CCTV data was unavailable, specific improvement recommendations for each pipe are not included in this report. Instead, it is recommended that the City utilize this figure and table to inform initial CCTV inspection efforts. Inspection reports can be utilized to identify specific defects in pipelines and manholes to help inform the least intrusive and most cost-effective improvement to rectify defects. Improvements can include pipeline and manhole replacement, slip-lining of existing pipelines, or spot repairs. The City has reported significant I/I issues in defective manholes, and improvements should take special consideration to address manhole as well as pipeline defects. I/I improvements can also include repair and/or replacement of service laterals along the improvement corridor.

It is recommended that the City create an annual budget to fund I/I improvement projects throughout the City. The City currently has an adopted annual replacement budget of $200,000 per year. Rather than have a separate replacement budget and I/I improvement budget, it is recommended the City adopt a combined fund of $500,000 annually. This dollar amount is reflective of the estimated annual pipeline replacement cost discussed in Section 7.8. This annual I/I reduction program would allow City staff to proactively identify and address deficiencies throughout the collection system. The recommended work is anticipated to be a combination of sump pump identification and removal, lateral replacement program, as well as mainline and manhole inspections and rehabilitation/replacement. I/I reductions could delay or eliminate the need for capacity-related pipeline upsizing projects discussed later in the section and provide cost savings to the City over the planning period.

Sump Pump Disconnection

The alternatives for addressing sump pump cross-connections to the wastewater system were presented in Section 5. Based on City staff input, it is recommended the City pursue a combination of Alternatives SP1 (Educational Material), SP5 (Point-of-Sale Inspection), and SP6 (Reward-Based Disconnect Incentives) as presented in Section 5 of this report. The combination of these alternatives will make up the City's initial Sump Pump Disconnection Program.

A portion of the recommended I/I annual budget should be reserved for the Sump Pump Disconnection Program. The incentive portion of the Disconnection Program may include a direct monetary reward or a billing credit for those who have proven their sump pump has been disconnected.

Concerning the point-of-sale inspection, it is recommended that the City update its code to include language requiring the seller to evaluate and disconnect any sump pumps from the sanitary sewer during inspection and before the property transfers ownership.

7.4 RECOMMENDED CONVEYANCE IMPROVEMENTS

This section summarizes the recommended pipeline improvements to address deficiencies identified in Section 4. All existing system deficiencies are present, with some issues exacerbated, in the 20-year scenario. The improvements presented alleviate potential wastewater overflow and surcharging through the 20-year planning period. Pipeline improvements are sized based on the planning criteria to achieve a d/D of less than 0.85 for the projected 20-year peak flows. All pipelines that are replaced, at a minimum, match the upstream pipeline size and do not exceed the size of the downstream pipeline unless otherwise noted in the descriptions below. This is considered an industry good practice. The pipeline replacements also described below assume open cut construction unless otherwise stated. Alternatively, the City could utilize trenchless rehabilitation technologies such as pipe bursting, cured-in-place-pipe installation, or slip lining. The City has described having success with pipe bursting in projects in the past under certain conditions. The City has also reported having success with horizontal directional drilling (HDD) when installing deeper pipes in the solid basalt rock. These trenchless approaches can be less costly than the open cut construction approach. Evaluation of the appropriate installation method should be completed as a part of the concept or pre-design phase of pipeline replacement projects.

Improvements are organized by priority and are shown in Figure 23 in Appendix A. More detailed planning level cost estimates for recommended improvements can be found in Appendix J.

7.4.1 PRIORITY 1 – ELIMINATE KNOWN OVERFLOWS AND SURCHARGING

The improvements assigned to Priority 1 have been marked as areas of concern by the City and have been reported to have overflows or significant surcharging during wet weather events, which is confirmed by the model. The pre-design and design phases of these projects should be performed in conjunction with Priority 1 I/I improvement projects to assess need and appropriate pipeline sizing for each project as I/I reductions are achieved. It should be noted that if I/I projects significantly reduce peak wet weather flows, the need for these conveyance projects could be reduced, delayed, or eliminated. Costs for these improvements can be found in Table 7-4 (at the end of this section).

Basin 4 Pipeline Upsize and Reroute

It is recommended that the pipeline in Basin 4 west of S 13th Street be upsized to a 12-inch pipeline, and then construct a 15-inch trunkline that reroutes flow from S 13th Street (Manhole M13), along Tualatin and S 7th Street, and to the existing Basin 6 interceptor south of Plymouth Street (Manhole S1). Basin 4 is considered the highest priority of the Priority 3 projects, as this basin contains the largest concentration of potential overflow locations and contributes to the surcharging in Basin 5. By rerouting flow away from Basin 5, the Basin 5 trunkline may experience reduced surcharging.

As such, it is recommended that this improvement be constructed prior to the Basin 5 pipeline upsize project.

Basin 5 Pipeline Upsize

The City has reported significant surcharging and overflows in the main trunkline through Basin 5 along S 4th Street. As noted above, the Basin 4 improvements will reduce flows going to Basin 5. In addition, Basin 5 has been reported to have some of the highest I/I in the system. The annual I/I reduction projects could have significant impacts to the peak flows in Basin 5. It is recommended that flow monitoring be included in the concept design phase of this project to evaluate the peak flows in Basin 5 following I/I reduction work and Basin 4 improvements. The model evaluation of Basin 5 improvements, including Basin 4 improvements and assuming no I/I flow reductions, indicates that the trunkline north of the Basin 4 interceptor should be upsized to a 36-inch pipe and the remainder of the trunkline be upsized to a 42-inch pipe.

7.4.2 PRIORITY 2 – NO RECOMMENDATIONS

No conveyance improvements were placed in Priority 2. More immediate concerns for surcharging and overflows are Priority 1. Improvements where City staff have not seen historical flooding or where risk of overflows is lower are included in Priority 3. Consistent I/I mitigation projects could reduce, delay, or eliminate the need for some conveyance improvements. Refer to Section 7.4.1 and 7.4.3 for additional details on conveyance improvement projects.

7.4.3 PRIORITY 3 – REDUCE RISK OF OVERFLOW AND SURCHARGING

The improvements assigned to Priority 3 include areas where the City has reported infrequent or no observations of historical overflows or surcharging, but the hydraulic modeling evaluation identified as areas with capacity limitations within the 20-year planning period. Annual I/I reductions could reduce peak flows in each area resulting in reduction, delay, or elimination of improvements required for capacity limitations. Predesign phases should include updating the design flows and documenting observed I/I reductions. It is generally recommended that downstream improvements occur before upstream improvements within a sewer basin. Upstream improvements can increase peak flows to downstream infrastructure. Downstream impacts should be evaluated for all projects during the pre-design phase. The improvements have been separated by flowmeter basin and arranged based on risk considerations and recommended construction sequence. Costs for the improvements are estimated below in Table 7-4 and in Appendix J.

Basin 6 Pipeline Upsize and Reroute

In the model, Basin 6 is shown to have several potential overflow locations, and the majority of its trunklines along Port Avenue, S 18th Street, Dubois Lane, Kaster Road, and Old Portland Road are shown to be undersized and surcharged during peak flows.

It is recommended that the trunkline along Port Avenue be upsized to a 27-inch pipe, and the pipeline along the Columbia River Highway, Dubois Lane, and S 18th Street be upsized to an 15-inch trunkline. Additionally, a new 15-inch pipe should be constructed that conveys flow from Manhole D1 on S 18th Street to Manhole S20 on Kaster Road, and the connecting pipe from Manhole D1 to Manhole S17 on Old Portland Road should be abandoned. It should be noted that the existing trunkline recommended for upsizing along the Columbia River Highway is believed to cross under Milton Creek. Should this pipeline be scheduled for upsizing, a trenchless technology such as pipe bursting or boring is recommended for the segments beneath the Columbia River Highway. The trenchless technology will also minimize work within the highway right-of-way.

The southern trunkline parallel to Old Portland Road is recommended to be upsized to 30-, 33-, and 36-inch pipeline from Kaster Road east to just past the end of Umatilla Street, upstream of parallel pipes over the lagoon. This pipeline upsize is recommended to accommodate anticipated growth in the 20-year planning period, including significant industrial growth in the southern portion of the City.

The City has not reported observations of historical overflows within the pipelines in Basin 6. A master plan update is anticipated prior to Priority 3 projects being completed and would update planning flow criteria and reassess extents of improvements needed.

Basin 2 Pipeline Upsize and Reroute

Basin 2 is shown by the model to have several potential overflow locations and surcharging along Gable Road, Westshire Lane, Matzen Street, and Sykes Road. As mentioned previously, pre-design phase should include evaluation of potential downstream trunkline impacts to mitigate increasing surcharging or potential overflows in the system. It is recommended that the trunkline along Sykes Road from Matzen Street to Columbia River Highway be upsized to an 18-inch pipeline. The Sykes Road trunkline from Matzen Street to Westshire Lane be upsized to a 15-inch pipeline with a 12-inch connection to the Westshire Lane pipeline. The existing pipelines along Westshire Lane, Archer Drive, and Whitetail Avenue should be upsized to 12-inch pipelines. It is recommended that the Matzen Street trunkline be upsized to a 15-inch from Sykes Road to Campbell Park, and the remainder of the trunkline to the north should be upsized to a 12-inch pipeline.

It is recommended the existing pipeline within Gable Road, upstream of manhole WC9 (located south of Rockwood Drive intersection), be upsized to a 12-inch pipeline. A new 12-inch pipeline should be constructed to reroute flow from manhole WC9 to Manhole W42 at the intersection of Sykes Road and Cedaroak Street.

Basin 1 Pipeline Upsize

Basin 1 has modeled surcharging and potential overflow locations. The City has not observed capacity issues along this line and a new development is being constructed along a portion of the trunkline. Based on the hydraulic evaluation, it would be recommended that the existing trunkline that branches from the north of Manhole N30 (located north of Kelly Street) be upsized to a 15-inch pipeline, and the pipe segment between Manhole N30 and Kelley Street be upsized to an 18-inch pipeline. A master plan update, or concept design phase, is anticipated to occur prior to Priority 3 improvements and would update planning flow criteria and reassess extents of improvements needed at the time the project moves forward.

Basin 3 Pipeline Upsize

The hydraulic evaluation shows Basin 3 with the lowest amount of surcharging. The trunkline along N 10th Street and West Street experiences surcharging. The City has not observed capacity issues along this line, but based on the hydraulic evaluation, it would be recommended this trunkline be upsized to a 15-inch pipeline to address the deficiency identified. A master plan update, or concept design phase, is anticipated to occur prior to Priority 3 improvements and would update planning flow criteria and reassess extents of improvements needed at the time the project moves forward.

TABLE 7-4: RECOMMENDED CONVEYANCE IMPROVEMENTS

Project Name	Improvement Cost (rounded)
Priority 1 Improvments	
Basin 4 Pipeline Upsize and Reroute	$3,600,000
Basin 5 Pipeline Upsize	$4,500,000
Total Priority 1 Costs (rounded)	***$8,100,000***
Priority 3 Improvments	
Basin 6 Pipeline Upsize and Reroute	$6,300,000
Basin 2 Pipeline Upsize and Reroute	$9,400,000
Southern Trunkline Upsize	$3,900,000
Basin 1 Pipeline Upsize	$1,800,000
Basin 3 Pipeline Upsize	$1,200,000
Total Priority 3 Costs (rounded)	***$22,600,000***

It should be noted that these cost estimates include rock excavation contingencies for pipelines being upsized. Due to the unknown field condition of the existing trenches, it was assumed that the trench directly encompassing the existing pipeline would need to be re-excavated to accommodate the upsized pipe. Additionally, when re-constructing roads through existing intersections with sidewalks and pedestrian crossings, the Oregon Department of Transportation (ODOT) and federal law require that ramps be reconstructed to be compliant with the American Disabilities Act (ADA) requirements. The above cost estimates in Table 7-4 account for reconstruction of crosswalk ramps at intersections with existing sidewalk.

7.5 FUTURE SYSTEM IMPROVEMENTS

7.5.1 PRIORITY 2 – PROVIDE WASTEWATER INFRASTRUCTURE FOR PLANNED NEW DEVELOPMENT

As discussed in Section 5.5, the City of St. Helens owns two primary properties and have completed significant planning efforts for potential developments on both. The two properties are the Riverfront District and the Industrial Business District. Locations and summaries for these developments can be found in Section 5.5. This section summarizes the proposed wastewater infrastructure to serve both of these development properties.

Wastewater loading for these developments was established in Section 2 of this report and can be found in Appendix B. Pipeline improvements are sized based on the planning criteria established in Section 2.

Riverfront District

The City of St. Helens has plans to develop the Riverfront District on the eastern edge of the City, adjacent to the Columbia River. To address the wastewater infrastructure need for this development, refer to Section 7.2.2, which details the proposed trunkline and pump station relocation that would serve this development. Costs for this trunkline and pump station are shown in Table 7-5 below and detailed in Appendix J.

Industrial Business Park

As discussed in Section 5.5.2 of this report, the City is seeking new opportunities to develop its industrial business park and requires wastewater infrastructure to serve the development. A series of 8- to 15-inch diameter gravity trunklines, a pump station with a firm capacity of approximately

1,300 gpm, and a 10-inch force main are proposed to serve the development. The proposed layout for the gravity lines, pump station, and force main are shown in Figure 22 in Appendix A. It is recommended that two segments on the downstream trunkline near the WWTP be upsized to 36-inch pipeline as part of the improvements to accommodate the additional flows from the Industrial Business Park. Costs for the proposed wastewater infrastructure are shown in Table 7-5 and detailed in Appendix J.

TABLE 7-5: FUTURE DEVELOPMENT PROPOSED INFRASTRUCTURE

Project Name	Improvement Cost (rounded)
Riverfront District Trunkline and Pump Station 1 Relocation	$2,400,000
Industrial Business Park Trunklines and Pump Station	$13,200,000
Total Project Costs (rounded)	***$15,600,000***

7.6 PLANNING RECOMMENDATIONS

It is recommended that the City update their planning documents every five (5) years. Updates to the planning documents and models allow the City to re-assess needs and properly allocate budgets to address system deficiencies. The next update should include an evaluation of both the wastewater collection system and WWTP. The previous plan for both systems was completed in 1989, and as a result, a Master Plan Update for both the wastewater collection system and the treatment plant has been included in the CIP as a Priority 2 improvement, with an estimated cost of $300,000.

7.7 MAPS

Maps of the existing collection system are provided in Figures 10 and 11 of Appendix A. The recommended I/I improvement locations are shown in Figure 15 in Appendix A. The recommended capital improvements are shown in Figure 23 in Appendix A.

7.8 ENVIRONMENTAL IMPACTS

Potential impacts of the alternatives to environmental resources presented in Section 2 are described below.

7.8.1 LAND USE / PRIME FARMLAND / FORMALLY CLASSIFIED LANDS

No area within the City limits is classified as prime farmland. All recommended improvements occur within previously disturbed or developed land.

7.8.2 FLOODPLAINS

As shown in Figure 3 in Appendix A, a few portions of the study area (including the wastewater treatment plant) are located inside the 100- and 500-year floodplains of the Columbia River, McNulty Creek, and Milton Creek. None of the alternatives would create new obstructions to these floodplains. Construction that occurs within the 100-year floodplain will require permitting and safeguards against potential flood hazards.

7.8.3 WETLANDS

Improvements to PS#5, PS#8 and PS#11 occur adjacent to wetlands. PS#11 is located adjacent to Wetland MC-9 (from LWI) and McNulty Creek. MC-9 is a type 1 significant wetland to St. Helens and includes a 75’ upland protection zone. McNulty Creek is a locally significant riparian area, with a 50’ upland protection zone. PS#11 should be relocated to a location outside of the upland protection zones of MC-9 and McNulty Creek. PS#11 relocation is anticipated to cross under a connecting culvert of McNulty Creek. Special precautions should be taken not to disturb McNulty Creek, wetland MC-9, or the creek culvert during construction. As stated in Section 7.2, disturbing culverts with active or historic fish populations may trigger additional environmental permitting and construction constraints. It is recommended that boring or another trenchless method be evaluated during concept or pre-design for pipeline installation across the McNulty Creek. PS#8 is near Milton Creek, also a locally significant riparian area, with a 50' upland protection zone. Upgrades to PS#5 and PS#8 are not expected to impact the adjacent wetlands, streams, or upland protection zones.

Additionally, the upsizing projects in Basin 6 may cross by existing Milton Creek culverts beneath the Columbia River Highway. Similar to the PS#11 improvement, trenchless technology such as pipe bursting is recommended for these sections to avoid disturbing existing culverts.

7.8.4 CULTURAL RESOURCES

None of the recommended improvements are anticipated to impact the above-ground cultural resources identified by the National Register of Historic Places or Ordinance No. 3250 (local historic landmarks). The relocation of PS#1 would involve the abandonment of the existing pump station, which is within the Historic Downtown District. However, the abandonment and construction of the new pump station and gravity pipeline is not anticipated to affect any of the listed historic landmarks or existing structures within the Historic Downtown District.

7.8.5 BIOLOGICAL RESOURCES

For a summary of threatened or endangered plants in the planning area, please see Appendix B. It is important to note that the likelihood of any of these plants existing on the proposed project sites is low because the areas have been previously disturbed, paved, or landscaped.

It is not anticipated that the improvement projects will impact creeks or wetlands where ODFW-listed aquatic species may reside and it is advised that trenchless technology be utilized for pipe installation or upsizing when in proximity to wetlands so impacts to aquatic species or habitat are limited.

7.8.6 WATER RESOURCES

Modifications to the collection system would reduce the risk of overflows and potential to spill into waterways. Design for the PS#11 relocation and force main extension could include boring under the McNulty Creek culvert to minimize impacts. It is recommended that sections of the pipeline upsizing projects on the Columbia River Highway (Basin 6 improvements) be bored, or pipe burst so that impacts to Milton Creek are minimized. There are no other alternatives that involve stream crossings.

7.8.7 SOCIO-ECONOMIC CONDITIONS

None of the alternatives would have a disproportionate effect on any segment of the population. Equitable wastewater facilities would be provided to all people within the City, limited only by physical geography and overall City budget – rather than by economic, social, or cultural status of any individual or neighborhood.

7.9 LAND REQUIREMENTS

The pipeline rerouting improvements for Basin 2 may require easements through the Avamere parking lot.

7.10 POTENTIAL CONSTRUCTION PROBLEMS

The depth of the water table and rock may affect construction of the improvements. The majority of the city has shallow bedrock that will increase the level of effort and cost of conveyance upgrades. The planning level costs have assumed that new construction will encounter bedrock within three (3) feet of the surface, and that upsizing existing pipelines may require more rock excavation than anticipated due to variable or unknown field conditions of the existing trenches. To provide contingency, it was assumed that the trench volume around the length of upsized pipe will need to be re-excavated. Each project should evaluate the potential use of trenchless technology for construction purposes and cost savings during the predesign and design phases.

Additionally, a portion of the gravity pipelines and the force main for the PS#1 relocation may encounter shallow groundwater. In this case, provisions for dewatering should be anticipated prior to construction. Gravels and sands combined with high groundwater may require extensive dewatering. However, subsurface investigations to better understand these impacts were not within the scope of this planning study.

Construction plans for any of the alternatives would also include provisions to control dust, erosion and sediment, and runoff.

7.11 SUSTAINABILITY CONSIDERATIONS

Sustainable utility management practices include environmental, social, and economic benefits that aid in creating a resilient utility.

7.11.1 WATER AND ENERGY EFFICIENCY

Installation of an influent flow monitor may minimally increase energy usage at the WWTP. The recommended increase in capacity of PS#1and PS#11 may increase energy use. Alternatively, the incorporation of VFD pumps at the stations may lead to more efficient energy usage when pumping wastewater. The general improvements for the remaining pump stations may minimally increase energy usage to monitor flow, pressure, and level sensors.

Reducing I/I in the collection system would have the largest impact and would result in a decrease in water and energy usage at the pump stations and the WWTP due to an overall reduction in flow needing to be conveyed and treated.

7.11.2 GREEN INFRASTRUCTURE

No new green infrastructure has been proposed with the collection system improvements.

7.12 OPERATION AND MAINTENANCE RECOMMENDATIONS

7.12.1 MAINTENANCE PROGRAM AND STAFFING

The recommended level of service (LOS), O&M, and staffing for the wastewater collection system is summarized in Section 3. As discussed in Section 3, it is estimated that approximately 3.5-4.0 Full Time Equivalent (FTE) are needed to meet the recommended level of O&M to meet the City's LOS goals. As budgeted, the existing wastewater collections FTE staff appears to be adequate, however, the additional projects and work the PW Operations staff are currently requested to complete significantly decreases the budgeted FTE that can be spent on wastewater collections O&M. It is recommended that either additional FTE be budgeted for the PW Operations staff to complete the existing workload requested, or the responsibilities of the PW Operations staff be reduced to focus solely on utility O&M. In addition, the recommended CIP projects would increase workload of the engineering division. The engineering division may need additional staff to manage any sump pump identification and removal program, update and maintain the GIS database, coordinate CCTV inspection and resulting work orders, and manage capital improvements. Additional workload on the engineering and PW operations divisions should be included in planning for any of the recommended improvements and projects. Generally, it is recommended that staffing needs be reevaluated every two to three years.

7.12.2 PIPELINE REPLACEMENT PROGRAM

In addition to regular maintenance, it is recommended that an annual pipeline replacement program be established. As degrading pipe sections and I/I problems are identified through CCTV monitoring and flow monitoring, these areas should be corrected. Pipeline and manhole replacement and rehabilitation needs are likely to increase as the sanitary sewer collection system ages.

Typically, it is recommended to budget for replacing 1/75th of system pipelines annually, assuming average useful life of pipelines is 75 years. For St. Helens, this would lead to a recommendation of the City budgeting for replacement/rehabilitation of an average of 4,200 feet of the collection pipeline system each year. Average useful life of manholes and cleanouts are shown in Table 7-6 below.

As mentioned in Section 7.3, it is recommended that the City budget an annual $500,000 dollars for I/I related replacements, rehabilitation, and sump pump efforts. It is recommended that this amount serve as a combined I/I improvement budget and annual replacement budget. It should be noted that this is an interim amount presented for City budgeting purposes, with the purpose of increasing over time to the recommended $790,000 annual replacement budget for the system. After I/I improvements have sufficiently reduced peak flows to the City's satisfaction, it is recommended the following annual replacement budget be adopted to keep the City's system free of defects.

A reference for the costs associated with funding an on-going replacement and rehabilitation program are summarized in Table 7-6.

TABLE 7-6: REPLACEMENT BUDGETS

Item	Lifespan	Cost/Year
Pipelines	75 Years	$ 570,000
Manholes	50 Years	$ 210,000
Cleanouts	50 Years	$ 5,000
Total (rounded)		***$ 790,000***

Concrete pipes in the system should be replaced first. The linear feet of pipeline and number of manholes replaced annually is an average and should be adjusted based on future CCTV and other maintenance records.

Manhole rehabilitation and service line repairs should be coordinated with pipeline rehabilitation work. Priority pipeline replacements/rehabilitation work identified in the CCTV inspections could be funded from this program. Emphasis should be placed on areas where pipe conditions pose the largest threat of sanitary sewer surcharging or a more immediate threat of collapse. Wherever possible, coordinate construction activities with planned roadway projects and other utilities to maximize cost sharing between utilities.

SECTION 8 - CAPITAL IMPROVEMENT PLAN (CIP)

This section outlines the recommended plan to address the wastewater collection system deficiencies identified in previous sections. The alternative evaluation conducted in Section 5 and recommended projects summarized in Section 7 with input from City staff are the basis for the capital improvement plan (CIP) for the wastewater collection system presented in this section.

8.1 BASIS FOR ESTIMATE OF PROBABLE COST

Capital costs developed for the recommended improvements are Class 4 estimates as defined by the Association for the Advancement of Cost Engineering (AACE). Actual construction costs may differ from the estimates presented, depending on specific design requirements and the economic climate when a project is bid. An AACE Class 4 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 4 cost estimate is broad, but these are typical accuracy levels for planning work.

The costs are based on experience with similar recent collection system improvement projects. Equipment pricing from manufactures of the flow measuring equipment items was also used to develop the estimates. The total estimated probable project costs include contractor markups and 30% contingencies, which is typical of a planning-level estimate. Overall project costs include total construction costs, costs for engineering design, permitting, construction management services, inspection, as well as administrative costs. For the collection system projects, the contractor's overhead and profit are worked into the line items.

8.2 SUMMARY OF COSTS (20-YEAR CIP)

The cost summary of the 20-year CIP projects is listed in Table 8-1. The system development charge (SDC) eligibility for each project was factored using the expected growth of the existing peak flow to the projected 2040 peak flow. The amount of capacity that can be utilized for future connections up to the projected 20-year planning period is used as the percentage for SDC eligibility. Priority 1 projects are the short-term projects to be completed in the next six years. Costs shown are planning-level estimates and can vary depending on market conditions. These costs should be updated as the project is further refined in the pre-design and design phases. Individual project sheets for Priority 1 projects are included in Appendix J. Each project sheet consists of a project objective, description, location map, and cost estimate.

The primary driver/s for each CIP project is identifed in the third column of Table 8-1. Priorities are set based on modeling performed as part of this facilities planning study and discussions with City staff. Priority 1 collection system improvements address reducing collection system I/I, WWTP influent flow metering, suspected overflows, and more immediate needs of the existing pump stations. Priority 2 collection system projects address identified deficiencies at pump stations or involve the relocation of existing pump stations. Priority 3 collection system projects address surcharging and potential overflows if peak flows are not reduced by Priority 1 or 2 projects.

TABLE 8-1: SUMMARY OF COSTS (20-YEAR CIP)

Project No.	Project Name	Primary Purpose	Total Estimated Cost (2021)	SDC Growth Apportionment		City's Estimated Portion
				%	Cost	
Priority 1 Improvements						
1.1	WWTP Influent Flow Meter	Operations	$ 68,000	10%	$ 7,000	$ 61,000
1.2	Basin 4 Pipeline Upsize and Reroute	Capacity	$ 3,600,000	0%	$ -	$ 3,600,000
1.3	Basin 5 Pipeline Upsize	Capacity	$ 4,500,000	3%	$ 150,000	$ 4,350,000
1.4	Install Overflow Alarms	Operations	$ 9,000	20%	$ 2,000	$ 7,000
1.5	Pump Station 3 On-site Generator	Operations	$ 90,000	0%	$ -	$ 90,000
1.6	Annual I/I Reduction Program (6-Year)	Capacity	$ 3,000,000	20%	$ 590,000	$ 2,410,000
		Total Priority 1 Improvement Cost (rounded)	**$ 11,300,000**			**$ 10,500,000**
Priority 2 Improvements						
2.1	Riverfront District Trunkline and Pump Station 1 Relocation	Capacity, Operations	$ 2,400,000	18%	$ 440,000	$ 1,960,000
2.2	Relocate Pump Station 11	Capacity, Operations	$ 3,100,000	68%	$ 2,110,000	$ 990,000
2.3	Industrial Business Park Trunklines and Pump Station	Capacity, Operations	$ 13,200,000	100%	$ 13,200,000	$ -
2.4	Pump Station Upgrades	Operations, Safety	$ 700,000	20%	$ 140,000	$ 560,000
2.5	Master Plan Update	Operations	$ 300,000	100%	$ 300,000	$ -
2.6	Annual I/I Reduction Program (8-Year)	Capacity	$ 4,000,000	20%	$ 790,000	$ 3,210,000
		Total Priority 2 Improvement Cost (rounded)	**$ 23,700,000**			**$ 6,700,000**
Priority 3 Improvements						
3.1	Basin 6 Pipeline Upsize and Reroute	Capacity	$ 6,300,000	7%	$ 460,000	$ 5,840,000
3.2	Basin 2 Pipeline Upsize and Reroute	Capacity	$ 9,400,000	12%	$ 1,140,000	$ 8,260,000
3.3	Southern Trunkline Upsize	Capacity	$ 3,900,000	26%	$ 1,010,000	$ 2,890,000
3.4	Pump Station 7 Upgrades	Capacity	$ 2,200,000	65%	$ 1,430,000	$ 770,000
3.5	Basin 1 Pipeline Upsize	Capacity	$ 1,800,000	9%	$ 150,000	$ 1,650,000
3.6	Basin 3 Pipeline Upsize	Capacity	$ 1,200,000	3%	$ 40,000	$ 1,160,000
3.7	Annual I/I Reduction Program (6-year)	Capacity	$ 3,000,000	20%	$ 590,000	$ 2,410,000
		Total Priority 3 Improvement Cost (rounded)	**$ 27,900,000**			**$ 23,000,000**
		Total Collection System Improvement Costs (rounded)	**$ 62,900,000**			**$ 40,200,000**

Note: The cost estimate 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.

8.3 OTHER ANNUAL COSTS

In addition to the capital improvement costs presented in Table 8-1, 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 set a goal to budget a total of $790,000/year for pipeline replacement/rehabilitation (to be either contracted out or completed using City crews). I/I replacement and rehabilitation projects performed as part of the Annual I/I Reduction Program may offset a portion or majority of these recommended costs, as pipeline rehabilitation addresses defects and extends pipeline lifespan. For budgeting purposes, $500,000/year has been recommended as an interim amount. It is recommended this amount increase over time to reach the replacement budget goal of $790,000/year.

The City should target the infiltration and inflow (I/I) projects discussed in Section 5 as a part of the annual pipeline replacement/rehabilitation budget. Prioritizing these projects should help to reduce I/I flows into the system and potentially delay capital improvements triggered by increased system flows.

Collection system cleaning and CCTV needs: It is recommended that the City maintenance staff develop a program to clean the entire collection system every three years, and CCTV the entire collection system every six years. Annual O&M costs for the collection system may increase slightly if Priority 3 improvements are made, as they increase the total linear feet of pipeline in the system.

Overall, if peak inflows from I/I are left unaddressed, the projected increase in influent flows and loadings will increase the total O&M of the system. However, should the Annual I/I Reduction program decrease peak flows, the O&M required to keep the pump stations and WWTP equipment in good working condition is anticipated to decrease by these improvements.

Staffing needs: As recommended in Section 7, the PW Operations division budgeted FTE should be increased or the responsibilities of the division outside of utility maintenance should be decreased. In addition, as the recommended I/I Reduction Program and other CIP projects are implemented, the engineering division will likely require additional staff to manage the program and projects.

8.4 SCHEDULE

An estimated schedule for the next six years is shown in Table 8-2. Again, the costs presented here are planning-level estimates using current (2021) dollar values. The actual cost for each project should be further refined in the pre-design and design phases.

TABLE 8-2: 6-YEAR CIP SCHEDULE

Project No.	Item	Cost (2021)	Opinion of Probable Costs					
			2022	2023	2024	2025	2026	2027
Priority 1 Improvements								
1.1	WWTP Influent Flow Meter	$ 68,000	$ 68,000					
1.2	Basin 4 Pipeline Upsize and Reroute	$ 3,600,000		$ 400,000	$ 3,200,000			
1.3	Basin 5 Pipeline Upsize	$ 4,500,000				$ 500,000	$ 4,000,000	
1.4	Install Overflow Alarms	$ 9,000	$ 9,000					
1.5	Pump Station 3 On-site Generator	$ 90,000	$ 90,000					
1.6	Annual I/I Reduction Program (6-Year)	$ 3,000,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000
	Total (Rounded)	$ 11,300,000	$ 700,000	$ 900,000	$ 3,700,000	$1,000,000	$ 4,500,000	$ 500,000

Note: The cost estimate 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 any escalation.. 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.

8.5 OTHER FINANCIAL CONSIDERATIONS

The City previously had several wastewater debts that were refinanced into a single debt service in 2020. The payment comes out of the enterprise fund as a transfer and pays into a Debt Service Fund that is combined with water and street fund monies. The yearly transfer for this payment is $600,000, and is set to mature in 2034.

The schedule of payments is displayed in Table 8-3 and best correlates with the required payments had the refinance not been done. The City is currently exploring options to paying off the sewer debt sooner, potentially between 2026 and 2031.

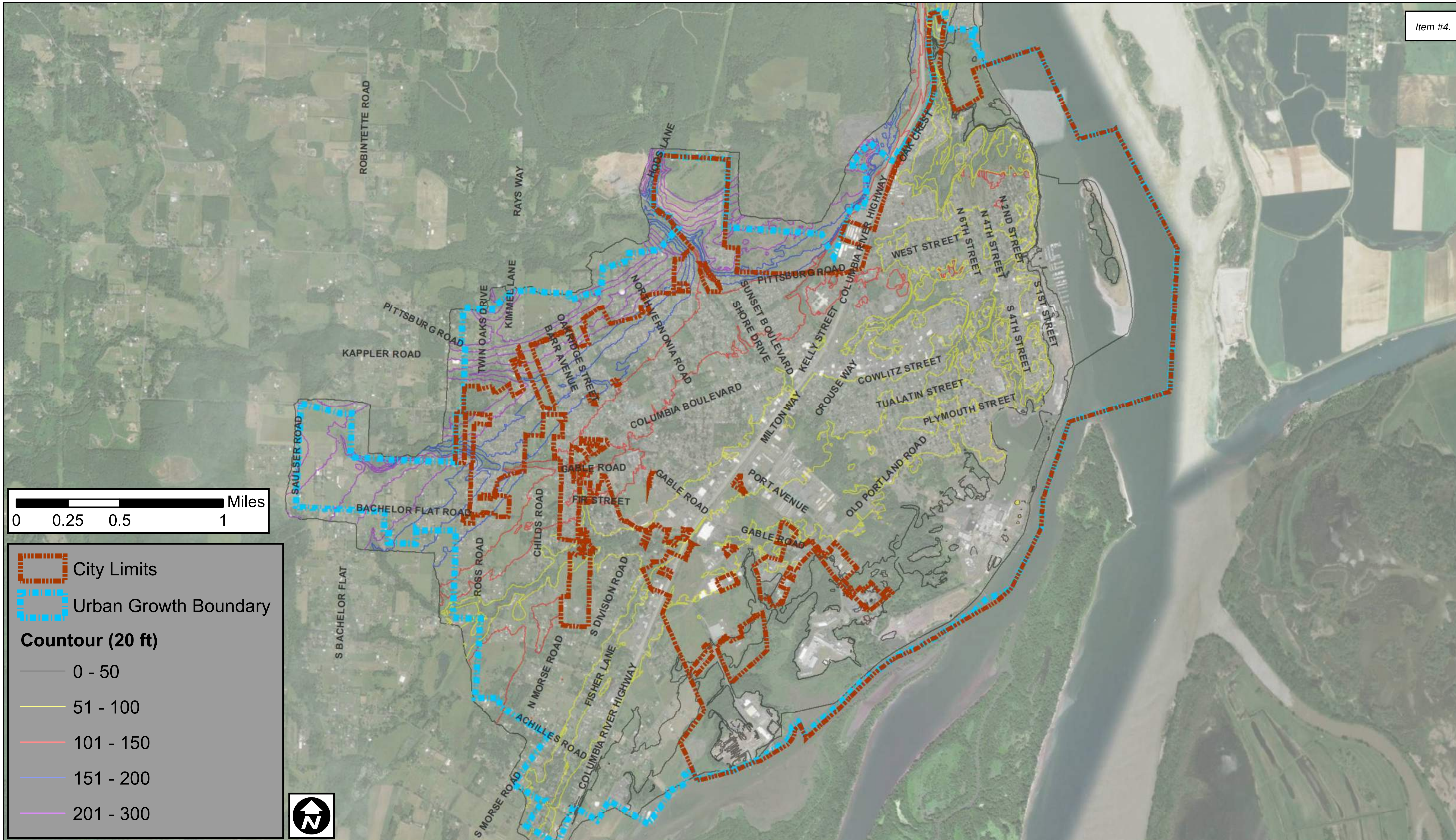
TABLE 8-3: CITY WASTEWATER DEBT CURRENT PAYMENT SCHEDULE

Year of Payment	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34
Payment Amount	600k	600k	600k	600k	600k	600k	420k	420k	420k	420k	420k	360k	310k	100k

It is recommended the City complete a full-rate study for the wastewater utility to evaluate the potential user rate and system development charge (SDC) impacts of the recommended CIP. Estimated SDC eligibility for each identified capital improvement was included in Table 8-1 above for use in completing a full rate study. It is recommended the City actively pursue opportunities for grant funds, low-interest loans, or principal forgiveness funding sources to mitigate user rate impacts. As the City begins to prepare and proceed on CIP projects, if outside funding is desired, it is recommended the City setup a one-stop meeting with Business Oregon to identify and assess potential funding sources for the sewer projects.

APPENDIX A

Figures



KELLER ASSOCIATES

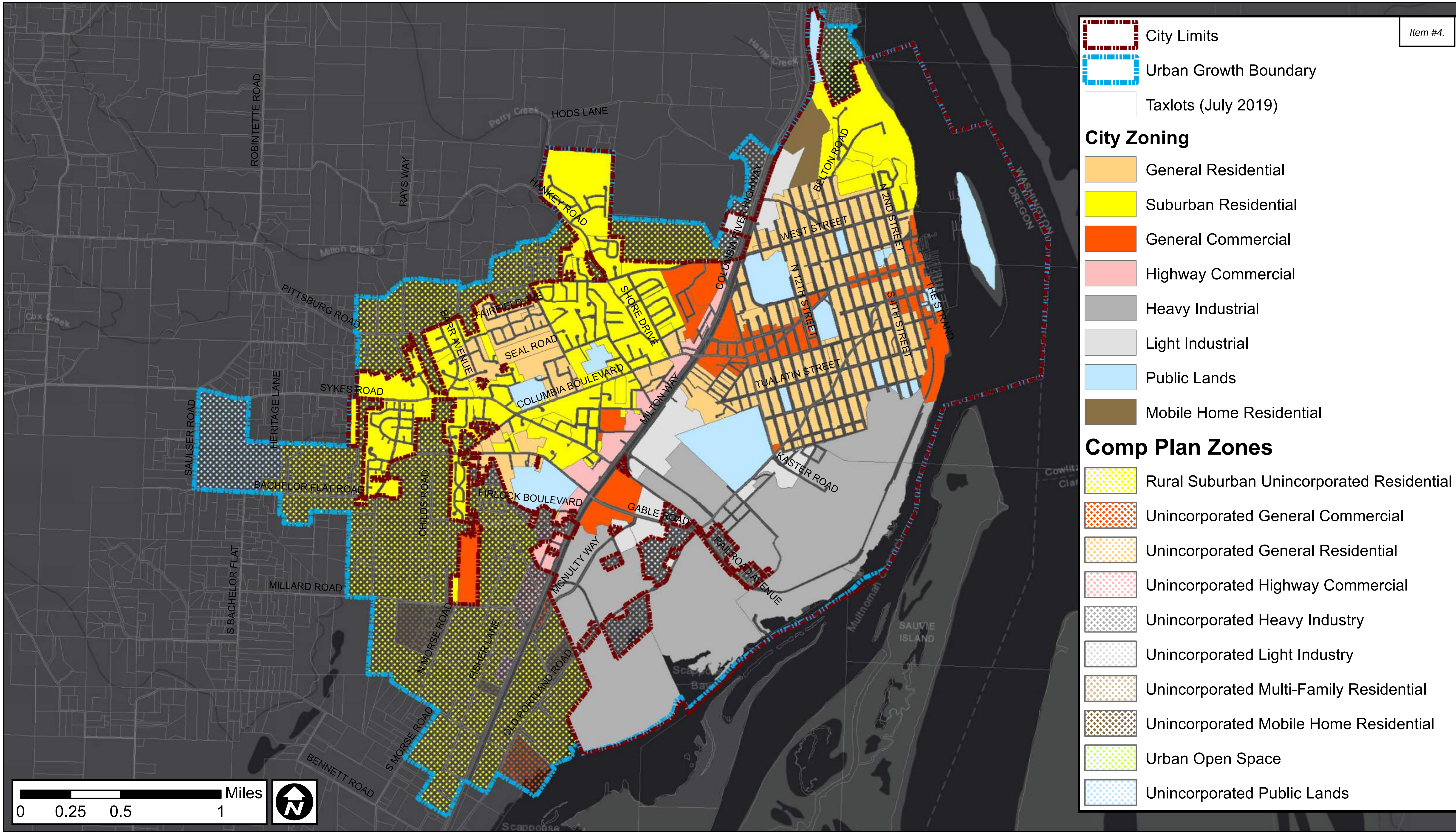
City Limits, UGB, and Topography

Wastewater Master Plan

City of St. Helens
FOUNDED 1850
Oregon

Figure 1

City of St. Helens

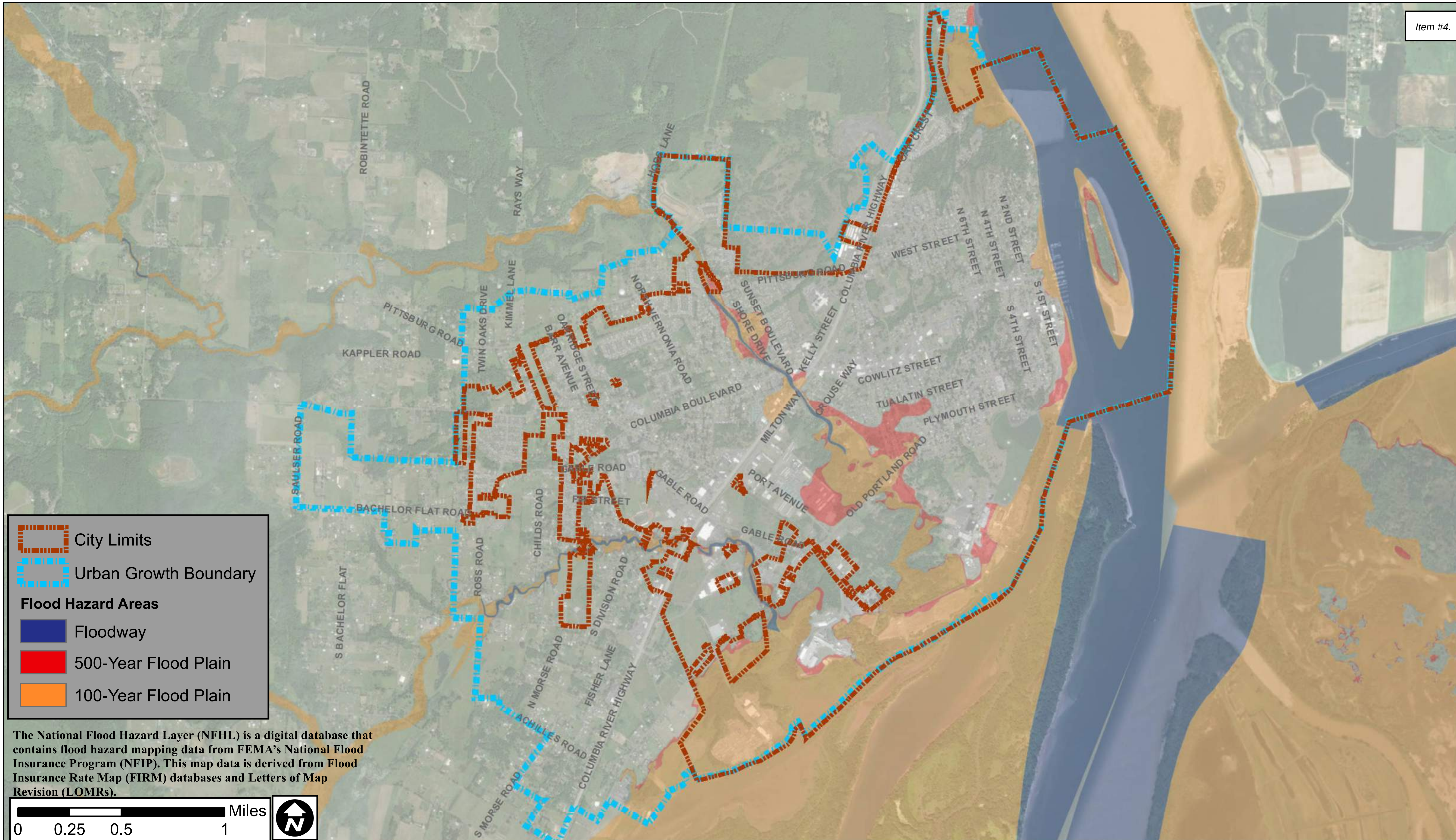


Zoning

Wastewater Master Plan

Figure 2

City of St. He



The National Flood Hazard Layer (NFHL) is a digital database that contains flood hazard mapping data from FEMA's National Flood Insurance Program (NFIP). This map data is derived from Flood Insurance Rate Map (FIRM) databases and Letters of Map Revision (LOMRs).

KELLER ASSOCIATES

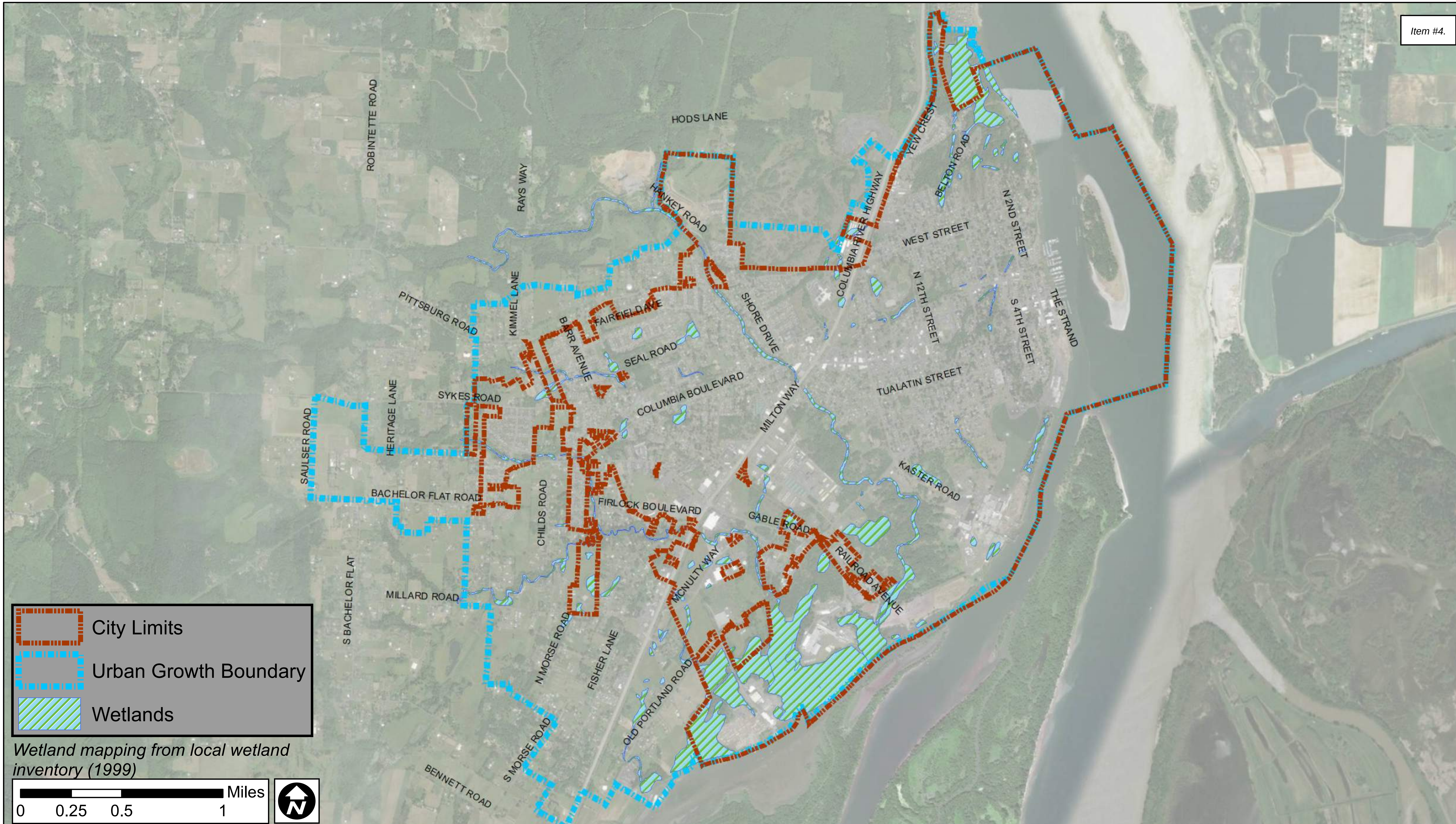
Flood Hazard Zones

Wastewater Master Plan

City of St. Helens
Founded 1850
Oregon

Figure 3

City of St. Helens



Wetland mapping from local wetland inventory (1999)

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Wetlands

Wastewater Master Plan

City of St. Helens FOUNDED 1850 Oregon

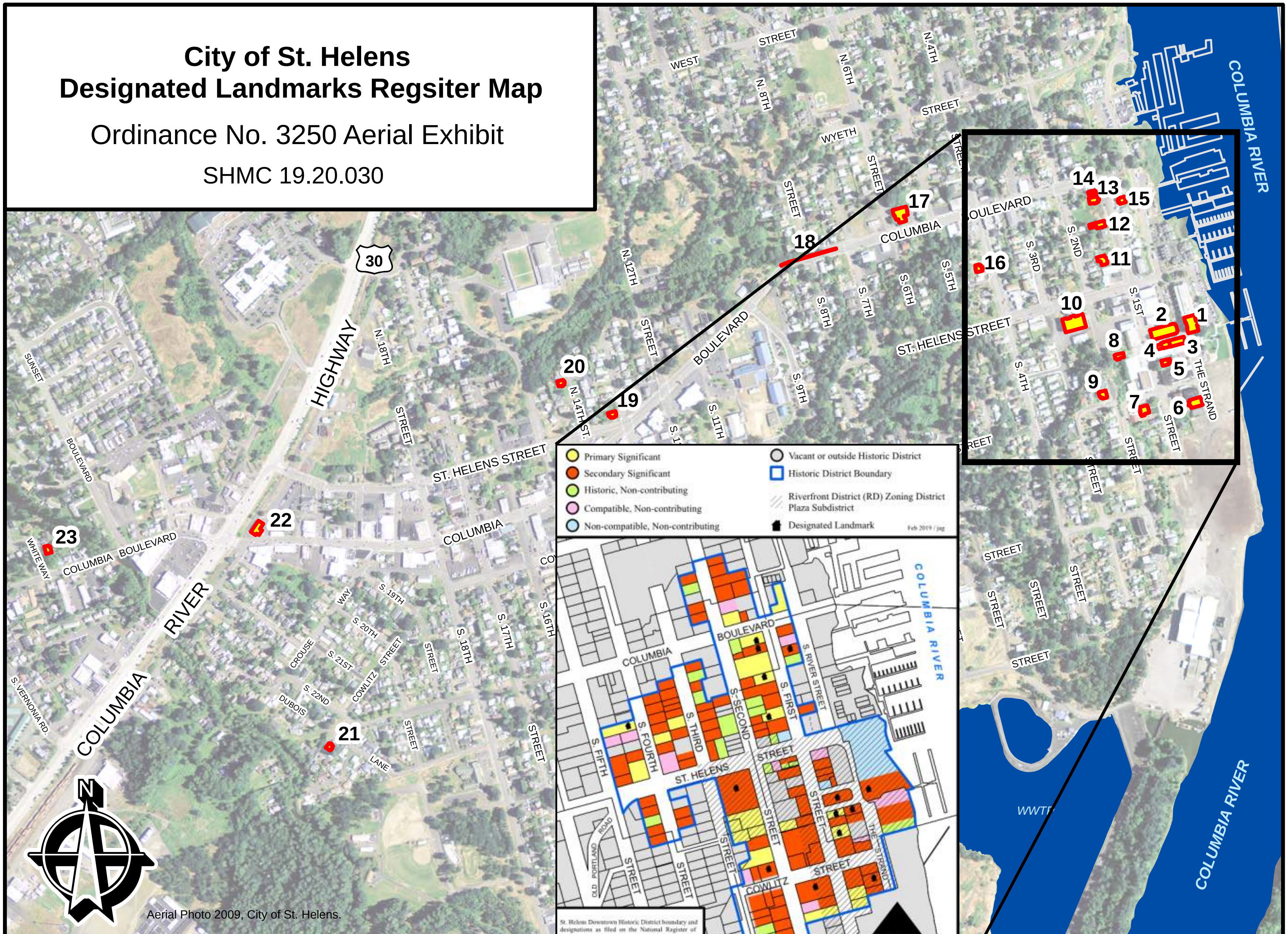
Figure 4

City of St. Hel

City of St. Helens
Designated Landmarks Regsiter Map

Ordinance No. 3250 Aerial Exhibit

SHMC 19.20.030

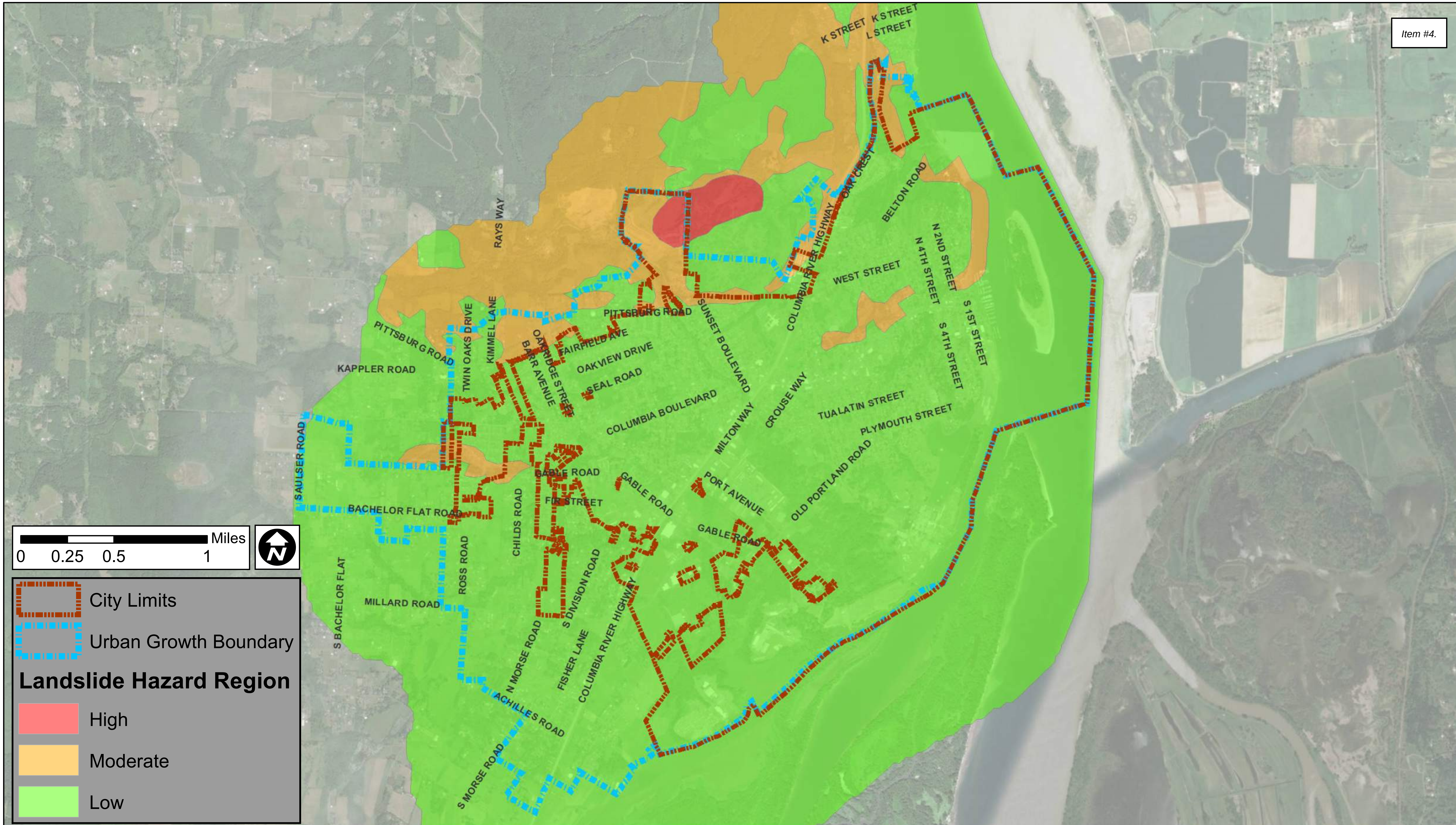


Designated Landmarks and Downtown Historic District

Wastewater Master Plan

Figure 5

City of St. Helens, OR



KELLER ASSOCIATES

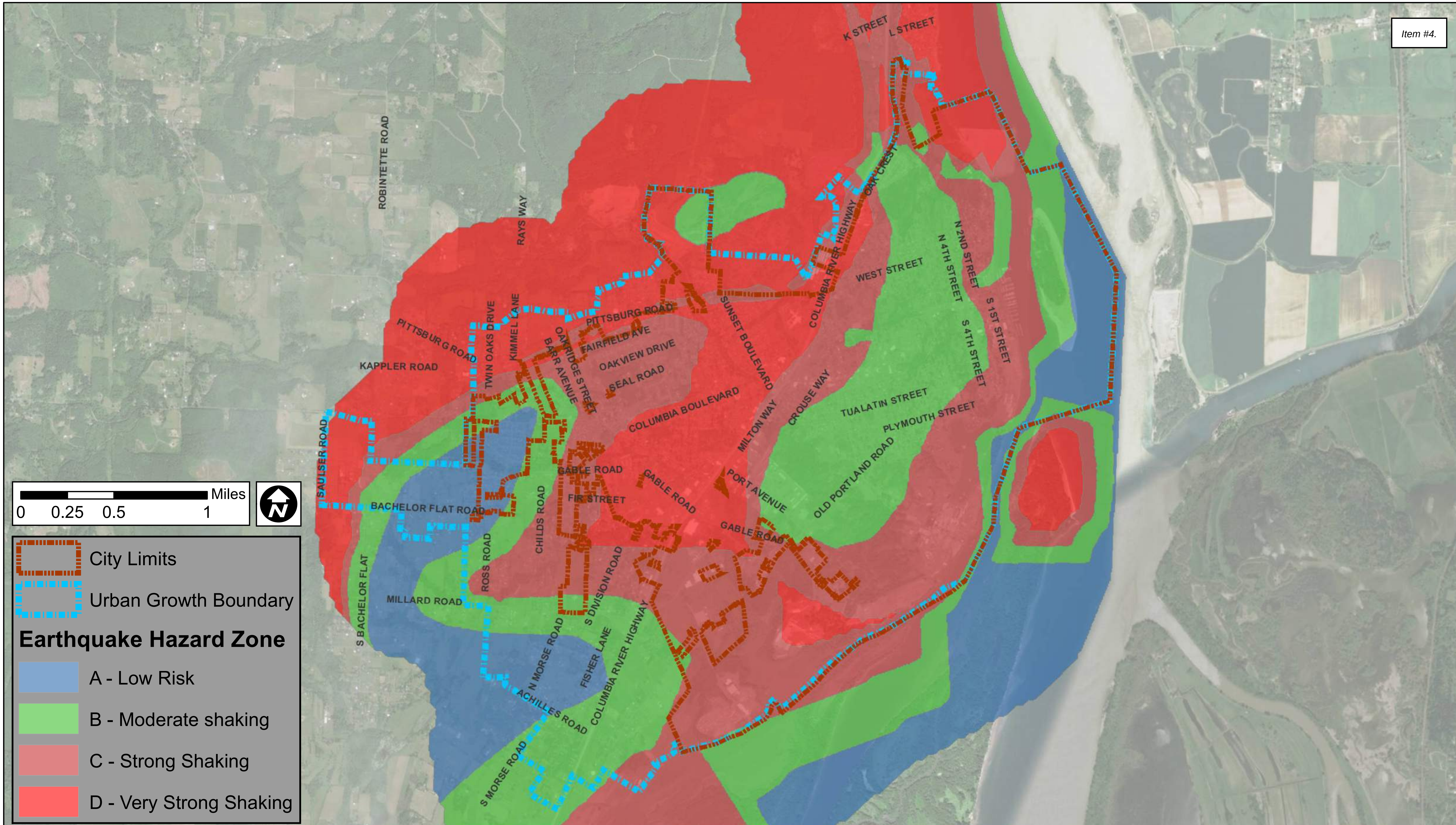
Landslide Hazards

Wastewater Master Plan

City of St. Helens FOUNDED 1850 Oregon

Figure 6

City of St. Helens



KELLER ASSOCIATES

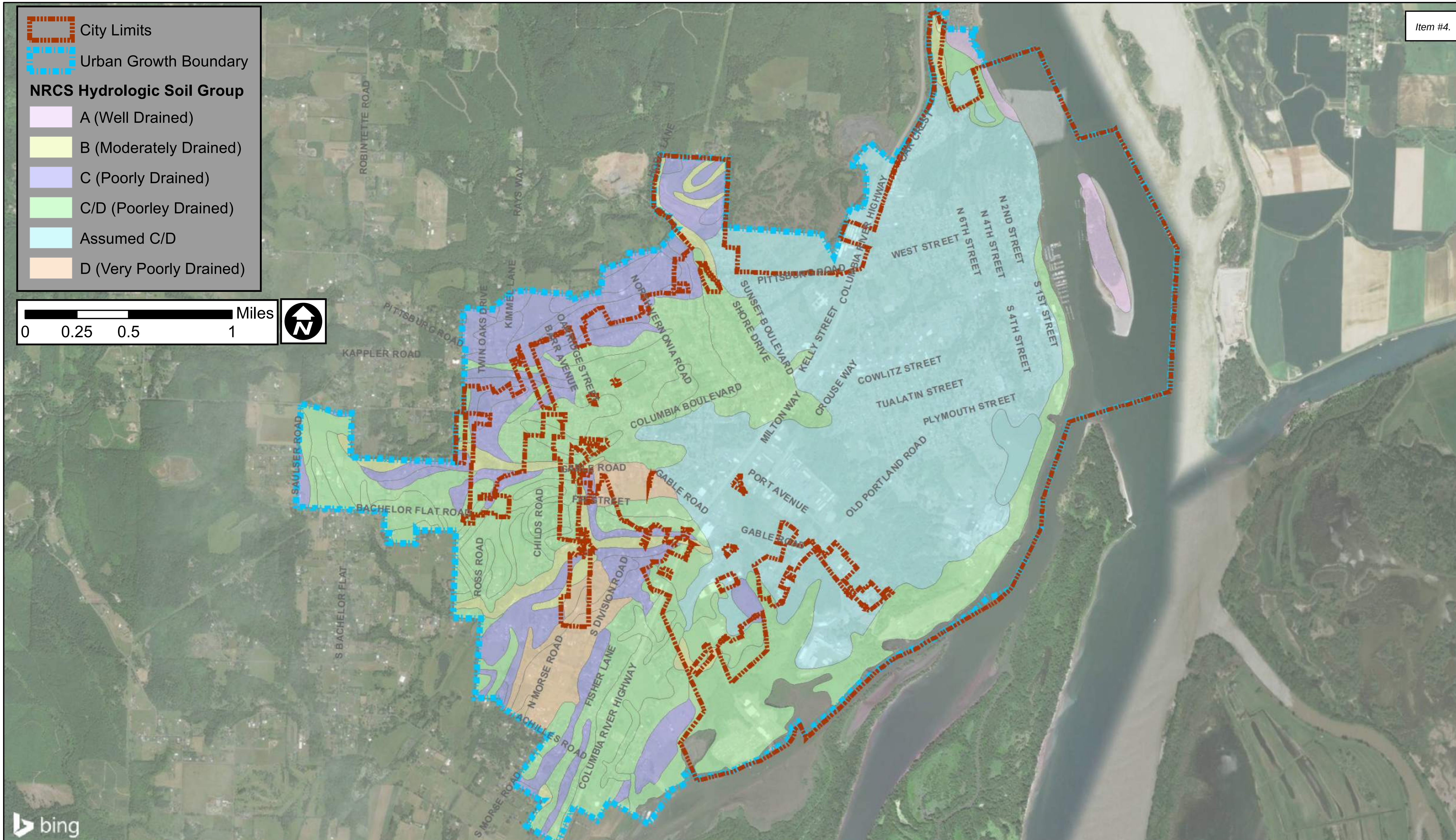
Earthquake Hazards

Wastewater Master Plan

City of St. Helens FOUNDED 1850 Oregon

Figure 7

City of St. Helens

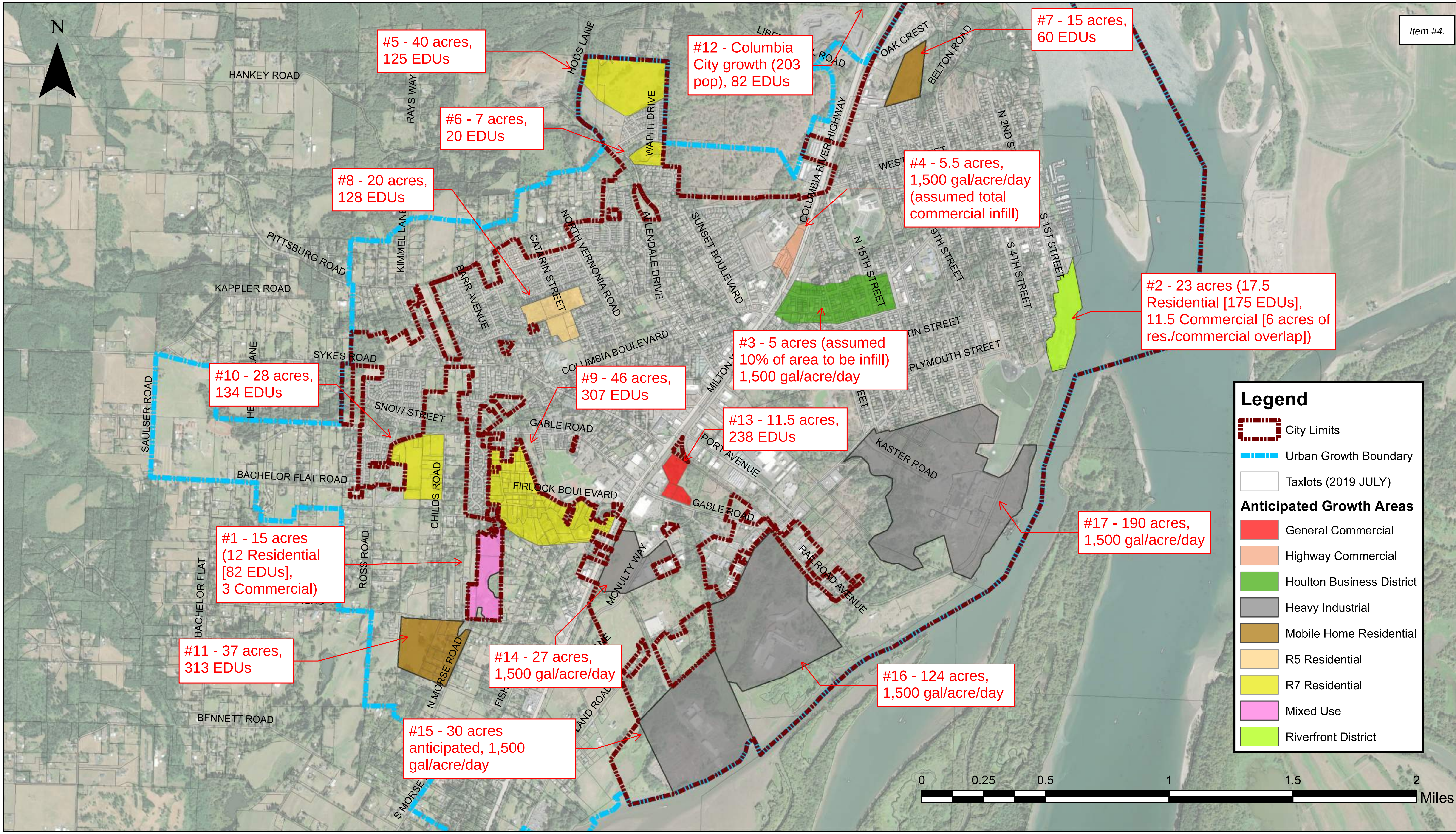


NRCS Hydrologic Soil Categories

Wastewater Master Plan

Figure 8

City of St. Helens



Anticipated Growth Areas (20-Year)

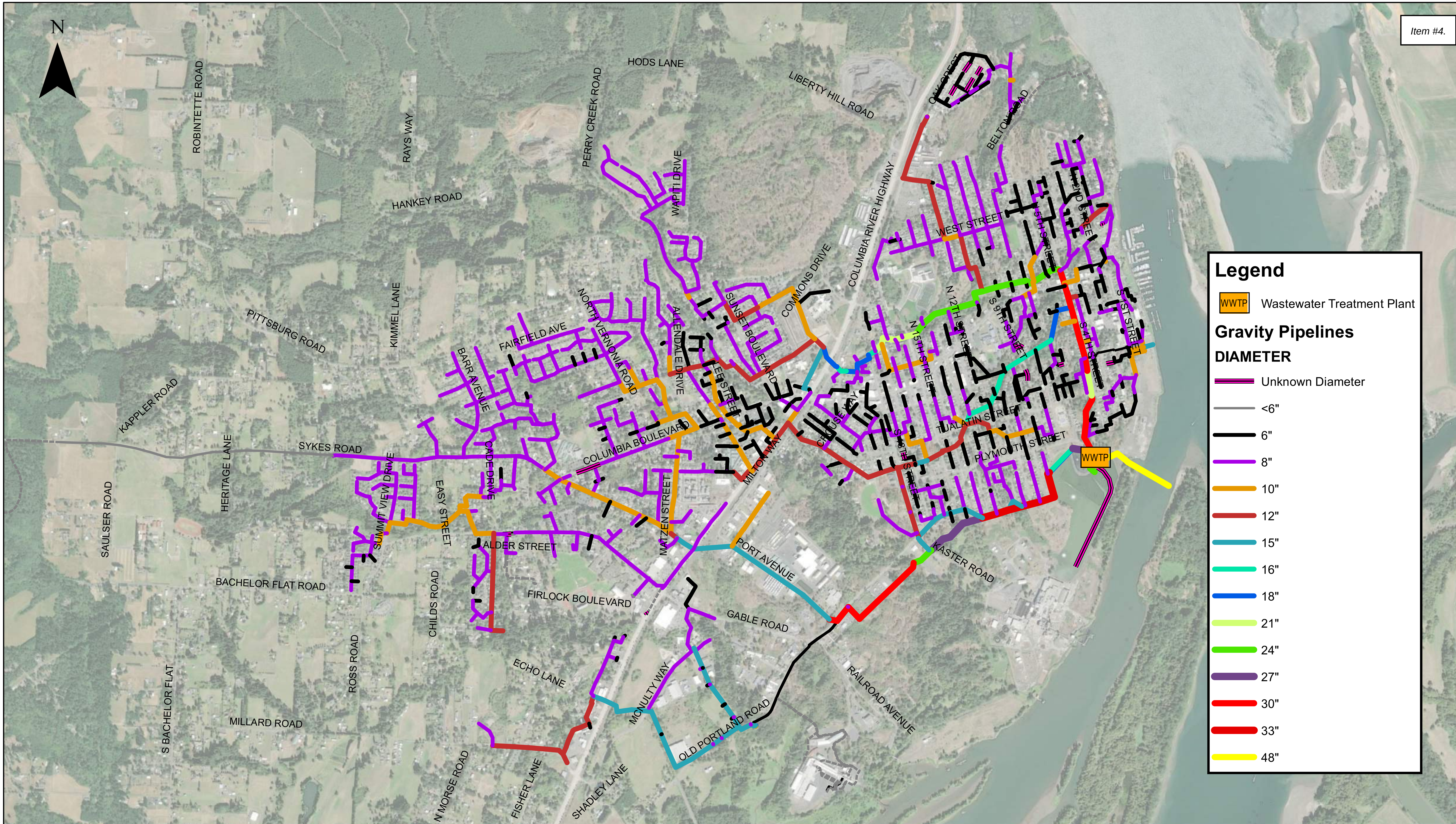
Wastewater Master Plan

KELLER ASSOCIATES

City of St. Helens FOUNDED 1850 Oregon

Figure 9

City of St. Helens, OR



Pipelines by Size

Wastewater Master Plan

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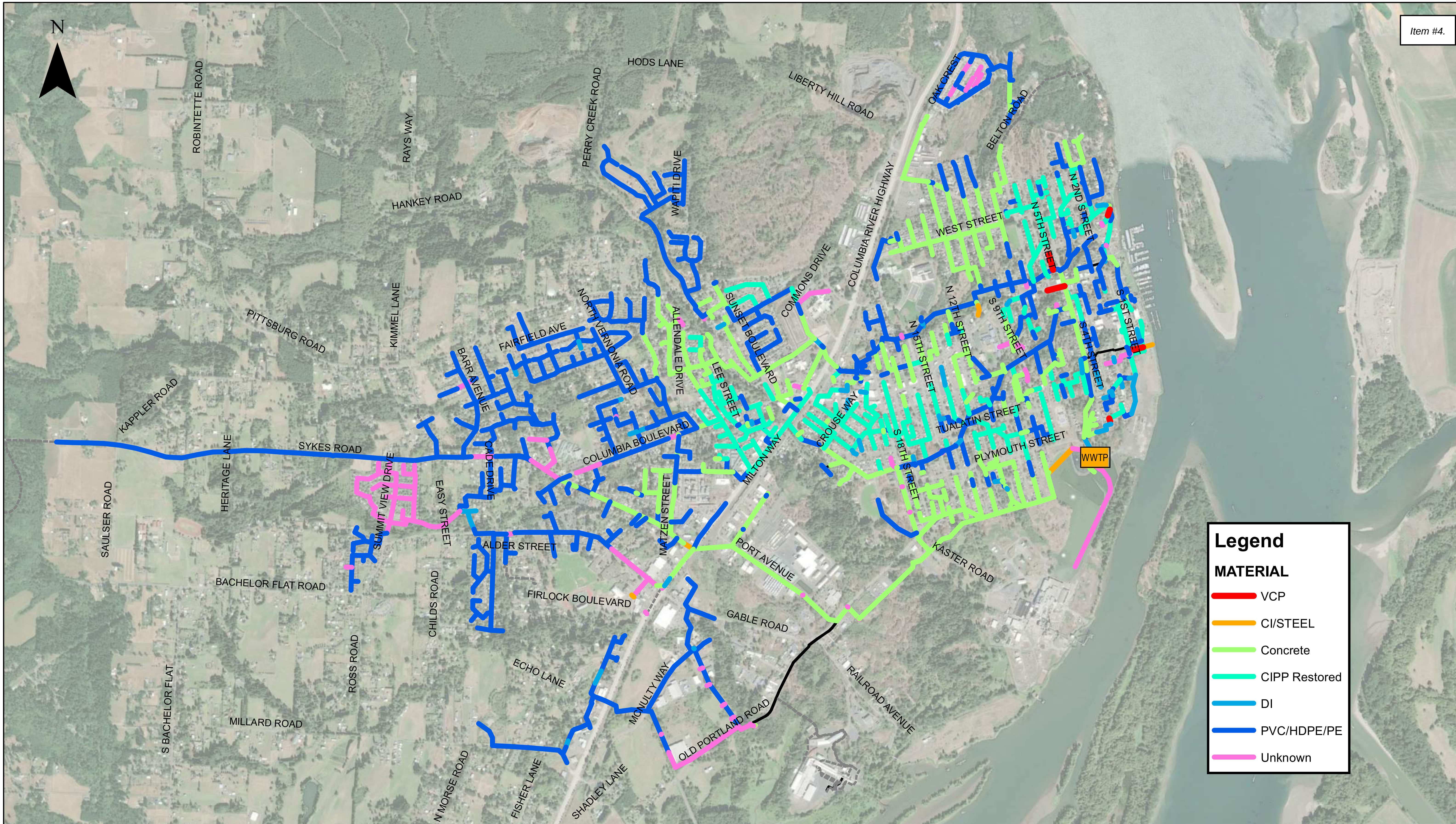
City of St. Helens FOUNDED 1850 Oregon

Figure 10

City of St. Helens, OR



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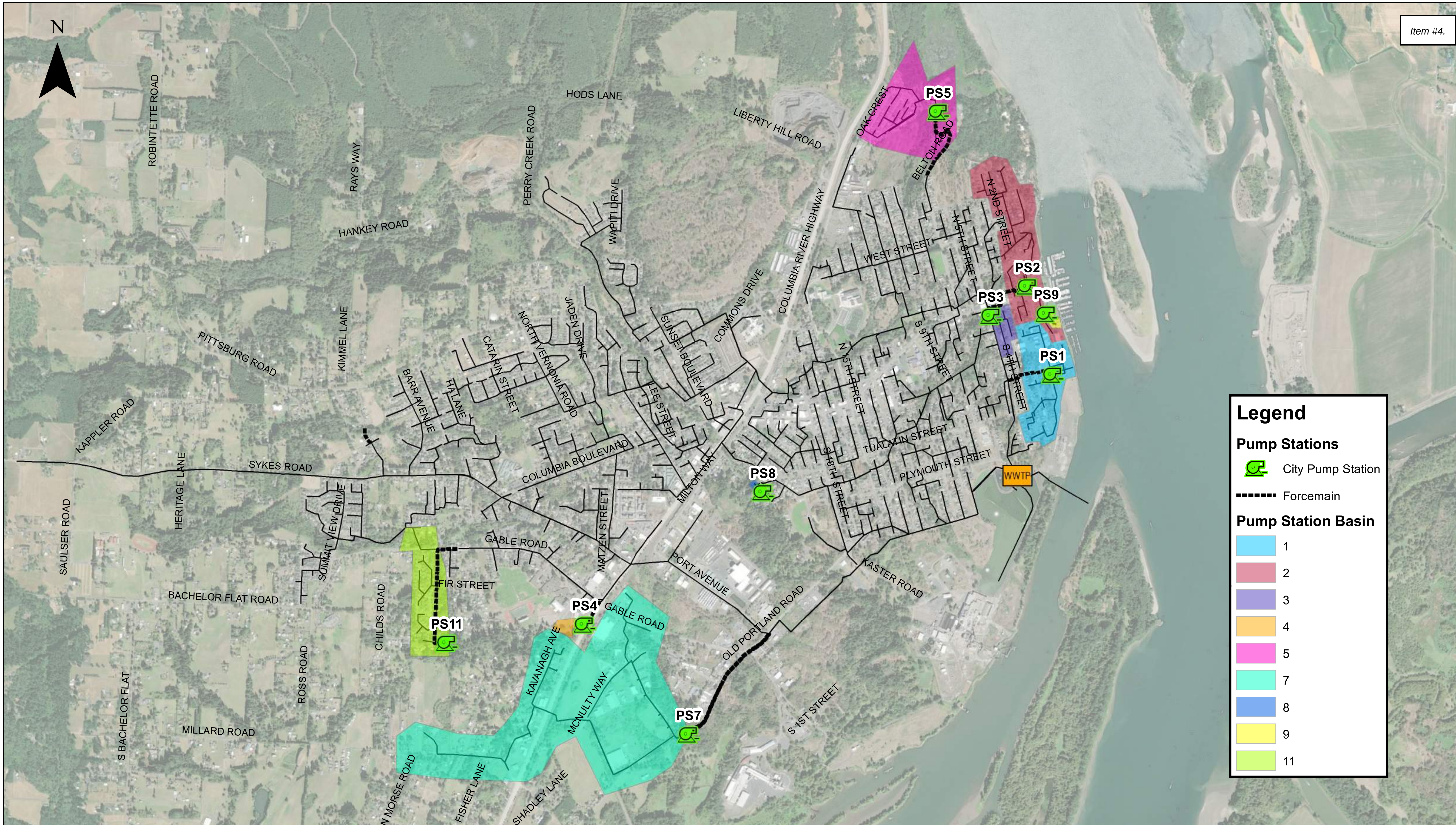
Pipelines by Material

Wastewater Master Plan

City of St. Helens FOUNDED 1850 Oregon

Figure 11

City of St. Helens, OR



KELLER ASSOCIATES

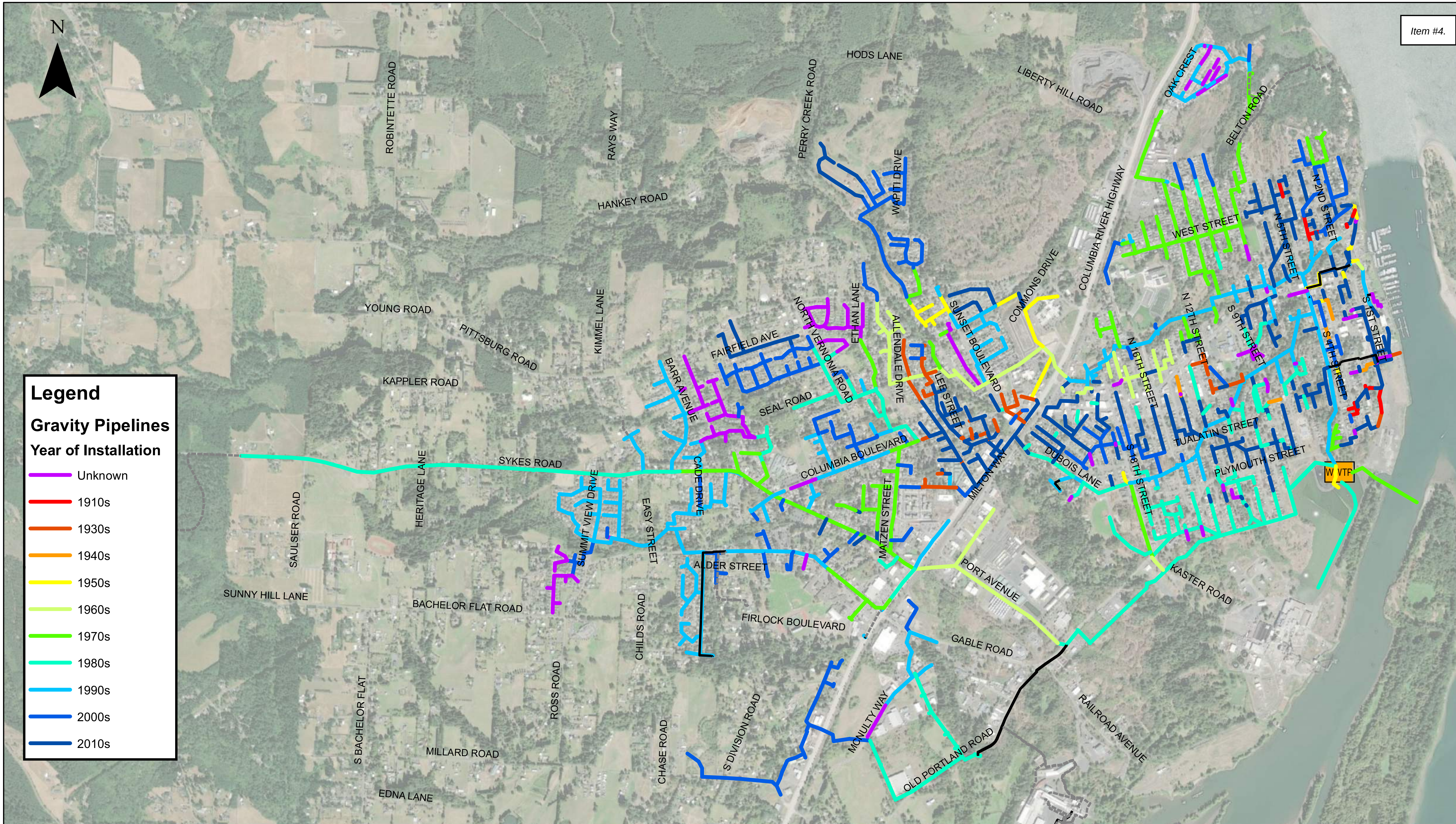
Pump Station Basins

Wastewater Master Plan

City of St. Helens FOUNDED 1850 Oregon

Figure 12

City of St. Helens, OR

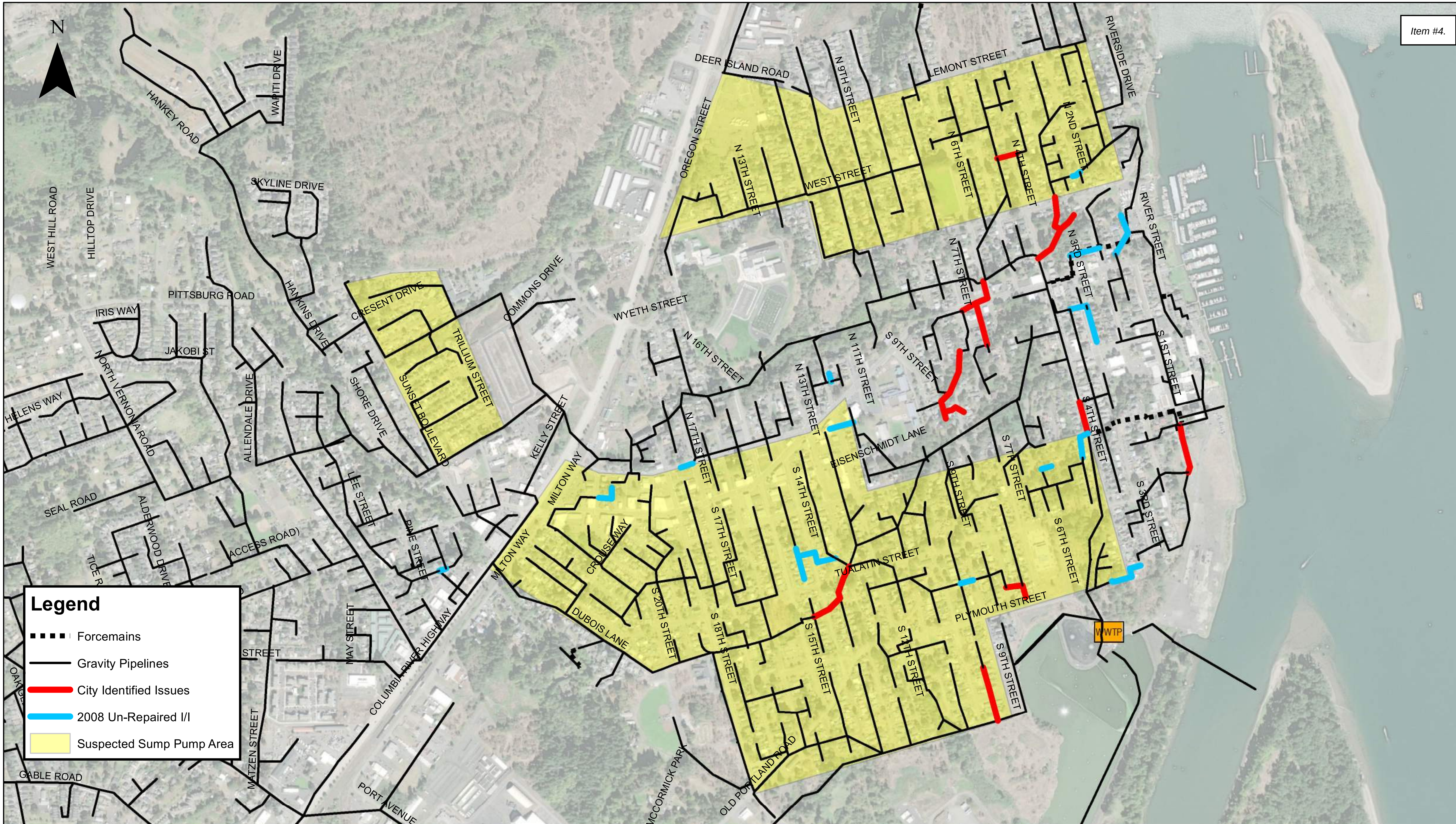


Infiltration and Inflow (I/I) - Pipeline Age

Wastewater Master Plan

Figure 13

City of St. Helens, OR



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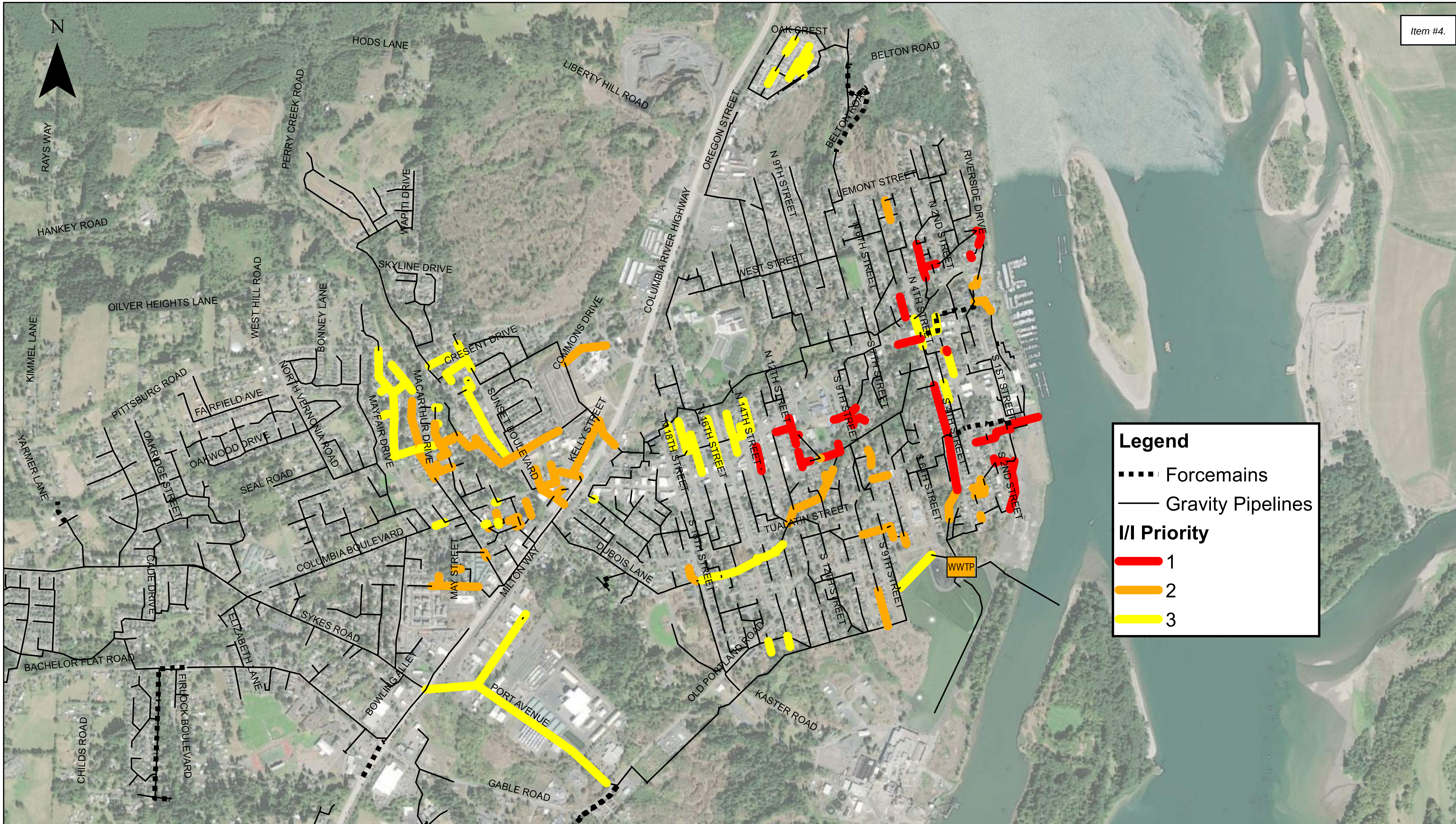
Infiltration and Inflow (I/I) - Suspected Sump Pump Areas, City Identified Issues, Unrepaired Priority Pipelines from 2008 Study

Wastewater Master Plan

City of St. Helens FOUNDED 1850 Oregon

Figure 14

City of St. Helens, OR



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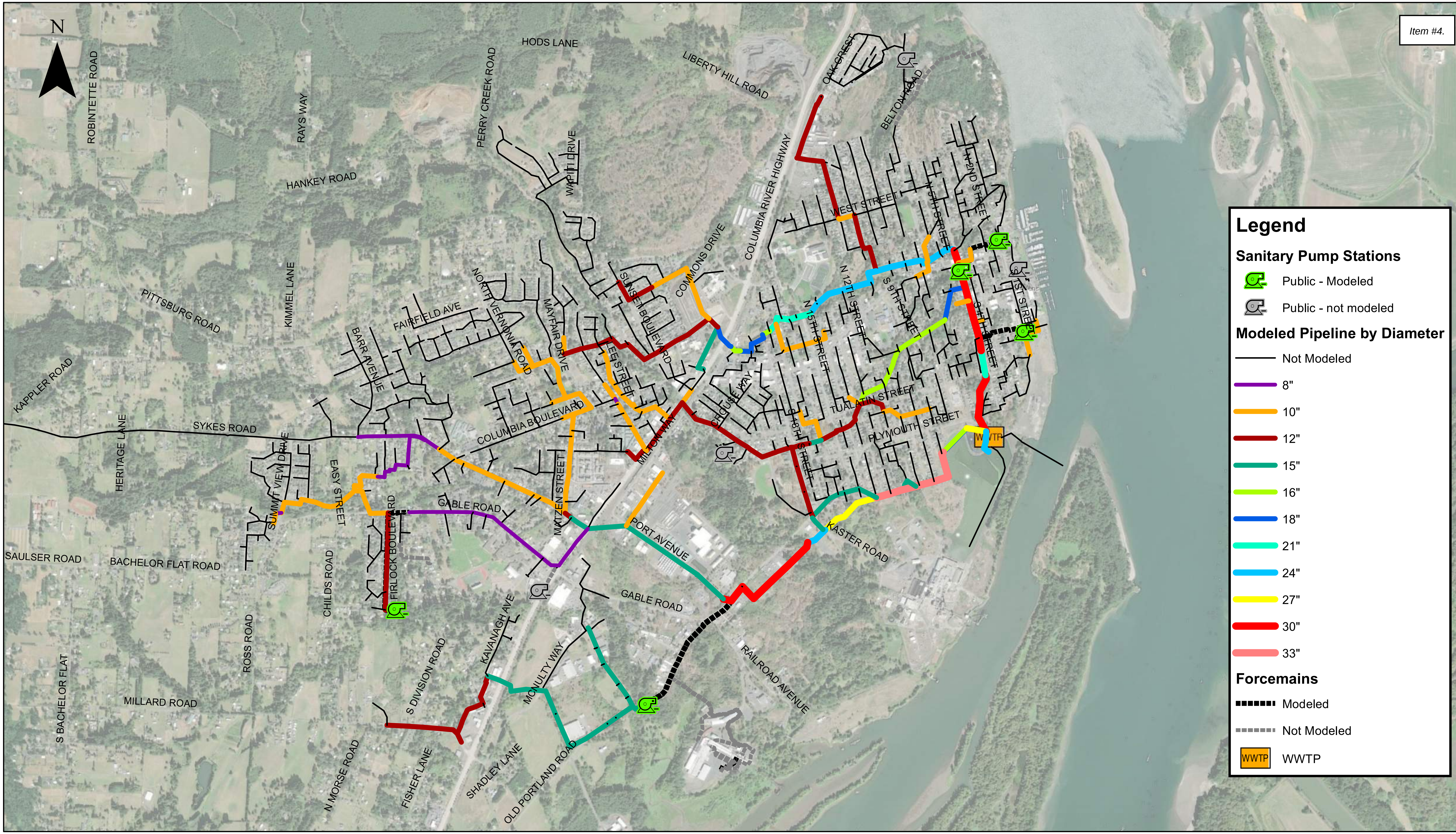
Inflow and Infiltration (I/I) - Priority Pipelines

Wastewater Master Plan

City of St. Helens
FOUNDED 1850
Oregon

Figure 15

City of St. Helens, OR



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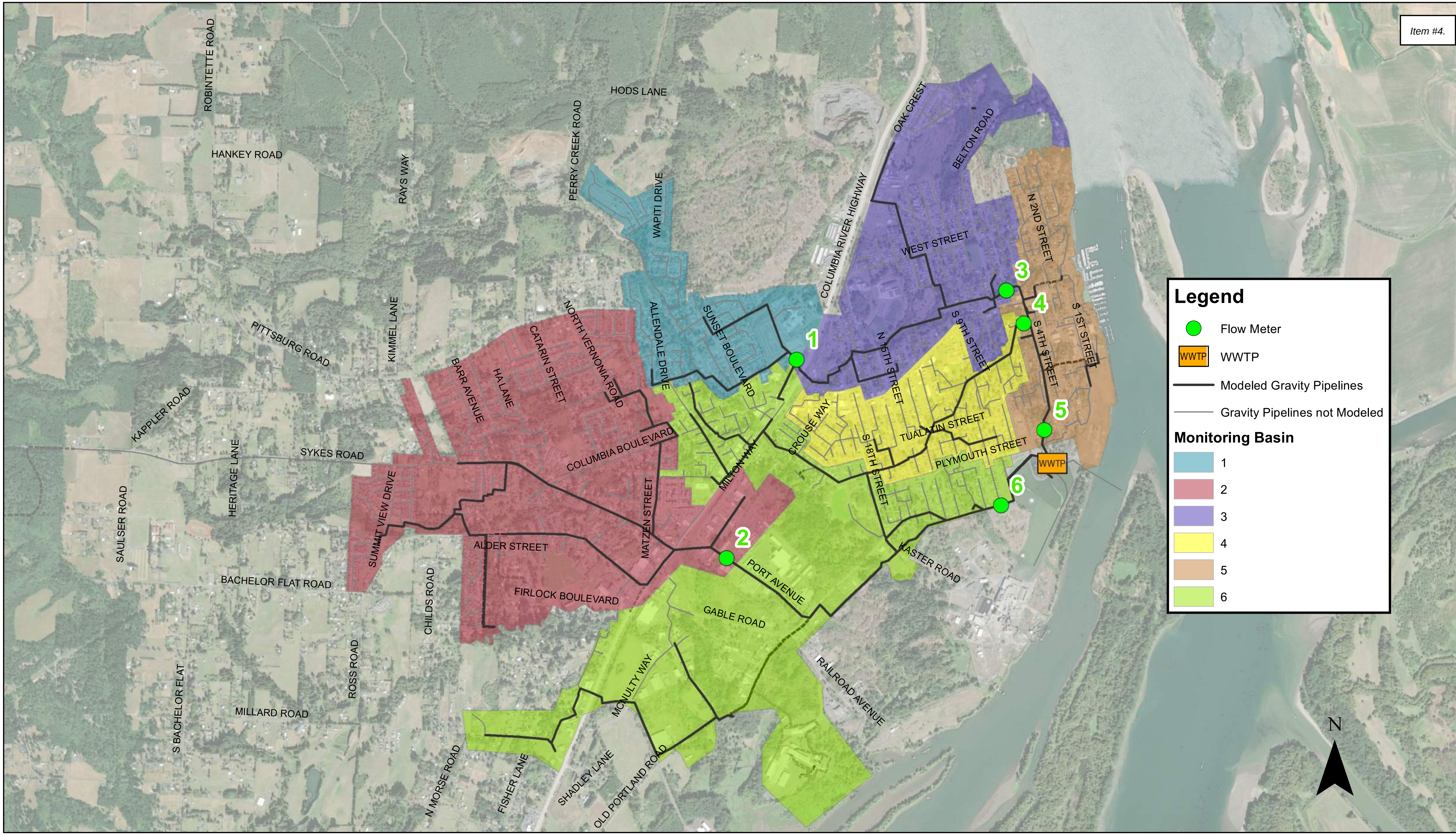
Modeled Pipelines by Size

Wastewater Master Plan

City of St. Helens
FOUNDED 1850
Oregon

Figure 16

City of St. Helens, OR



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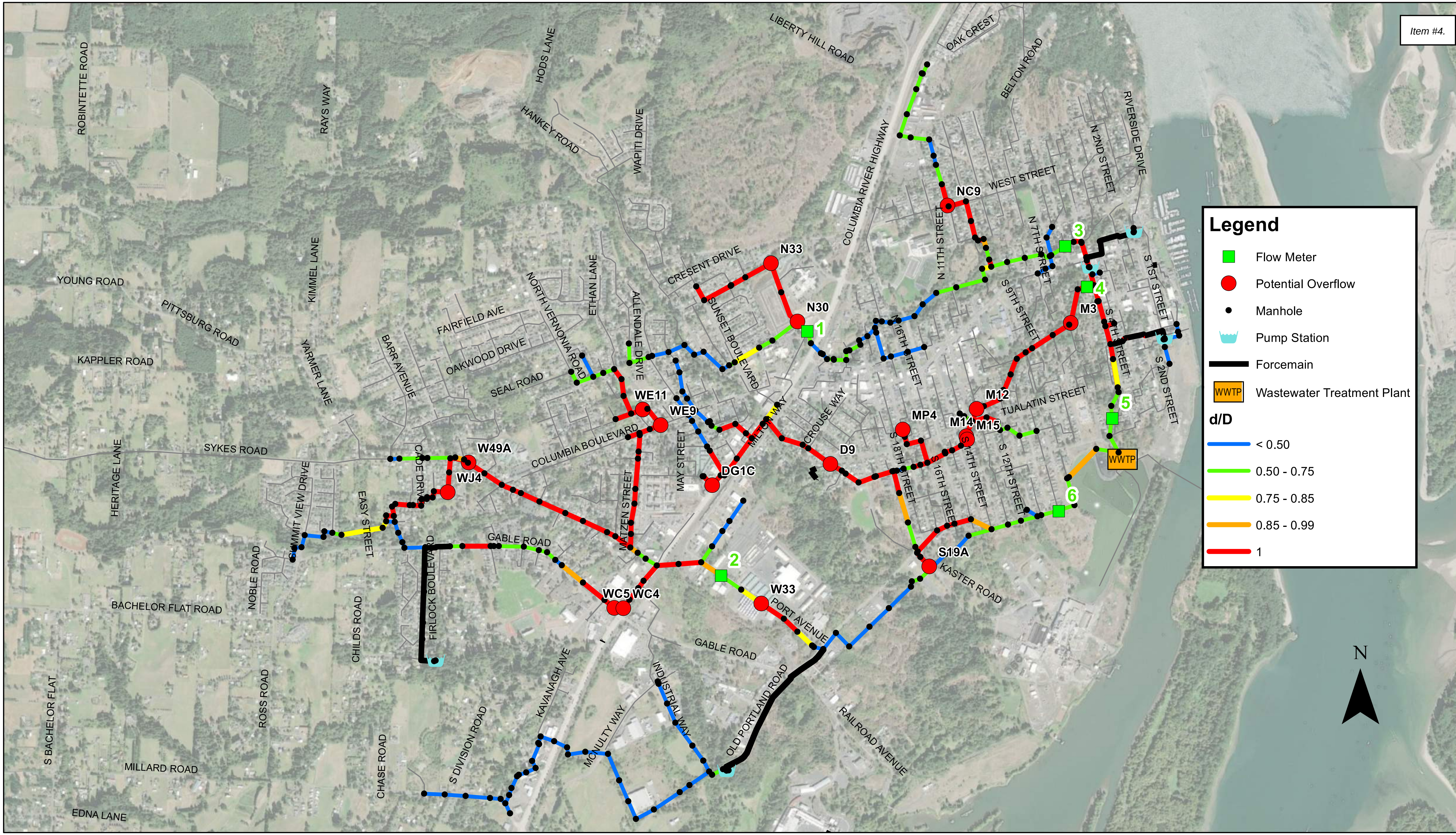
Flow Meter Locations and Basins

Wastewater Master Plan

City of St. Helens FOUNDED 1850 Oregon

Figure 17

City of St. Helens, OR



Existing System Evaluation - d/D and Potential Overflow Locations

Wastewater Master Plan

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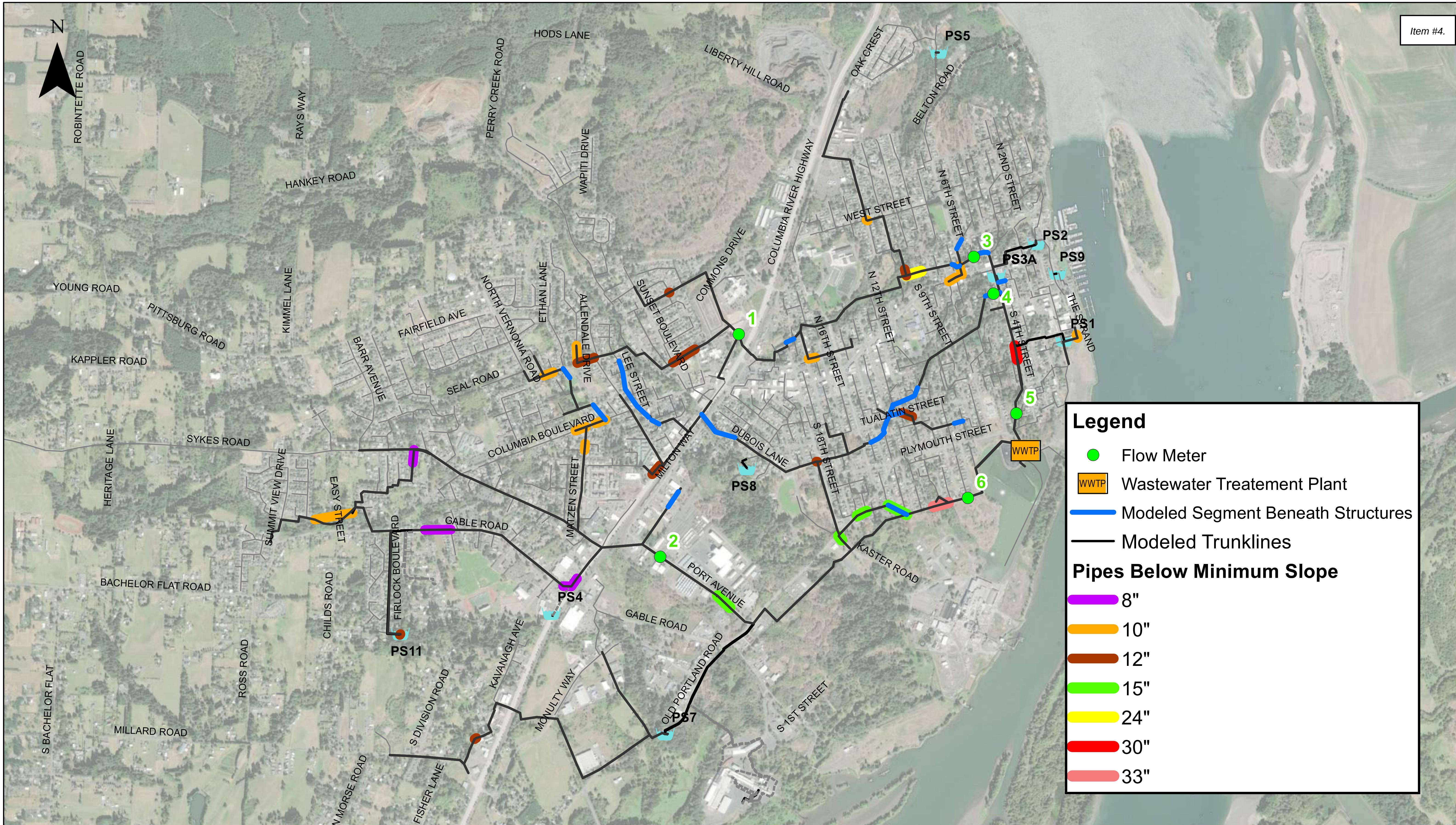
City of St. Helens FOUNDED 1850 Oregon

Figure 18

City of St. Helens, OR



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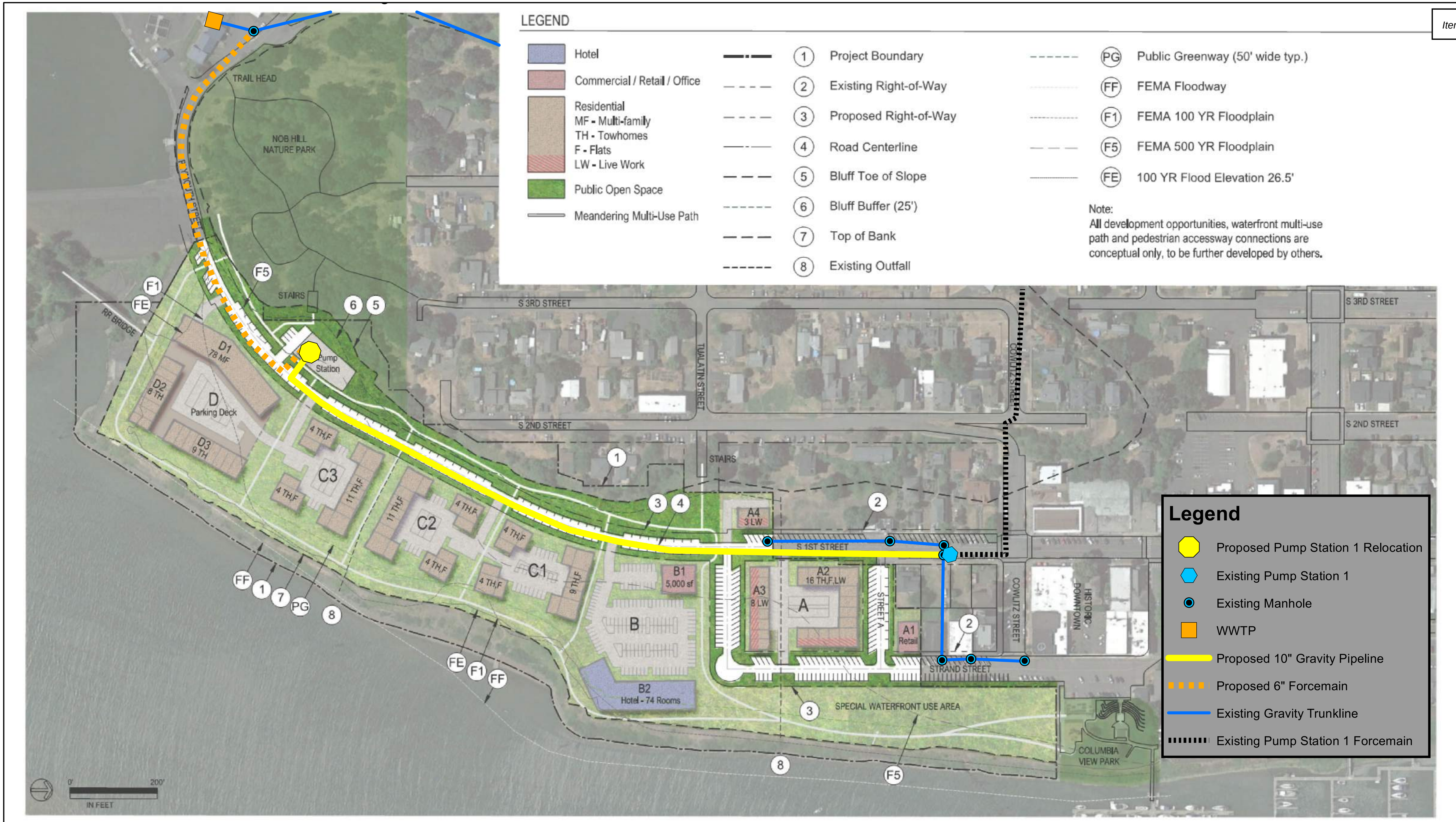
Existing System - Critical Slope Locations and Pipeline Segments Potentially Beneath Structures

Wastewater Master Plan

City of St. Helens FOUNDED 1850 Oregon

Figure 19

City of St. Helens, OR

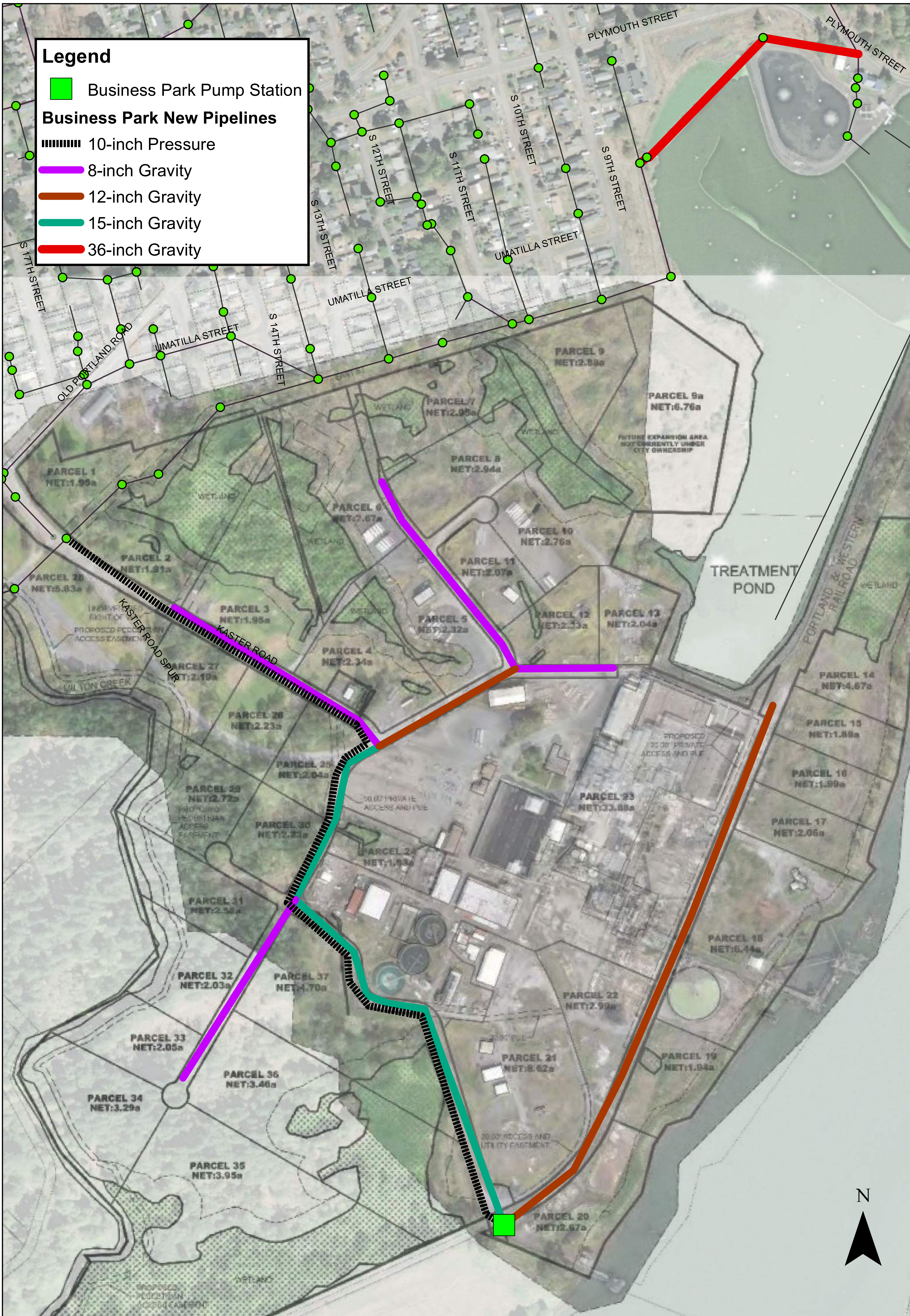


Riverfront District Proposed Infrastructure

Wastewater Master Plan

Figure 21

City of St. Helens,

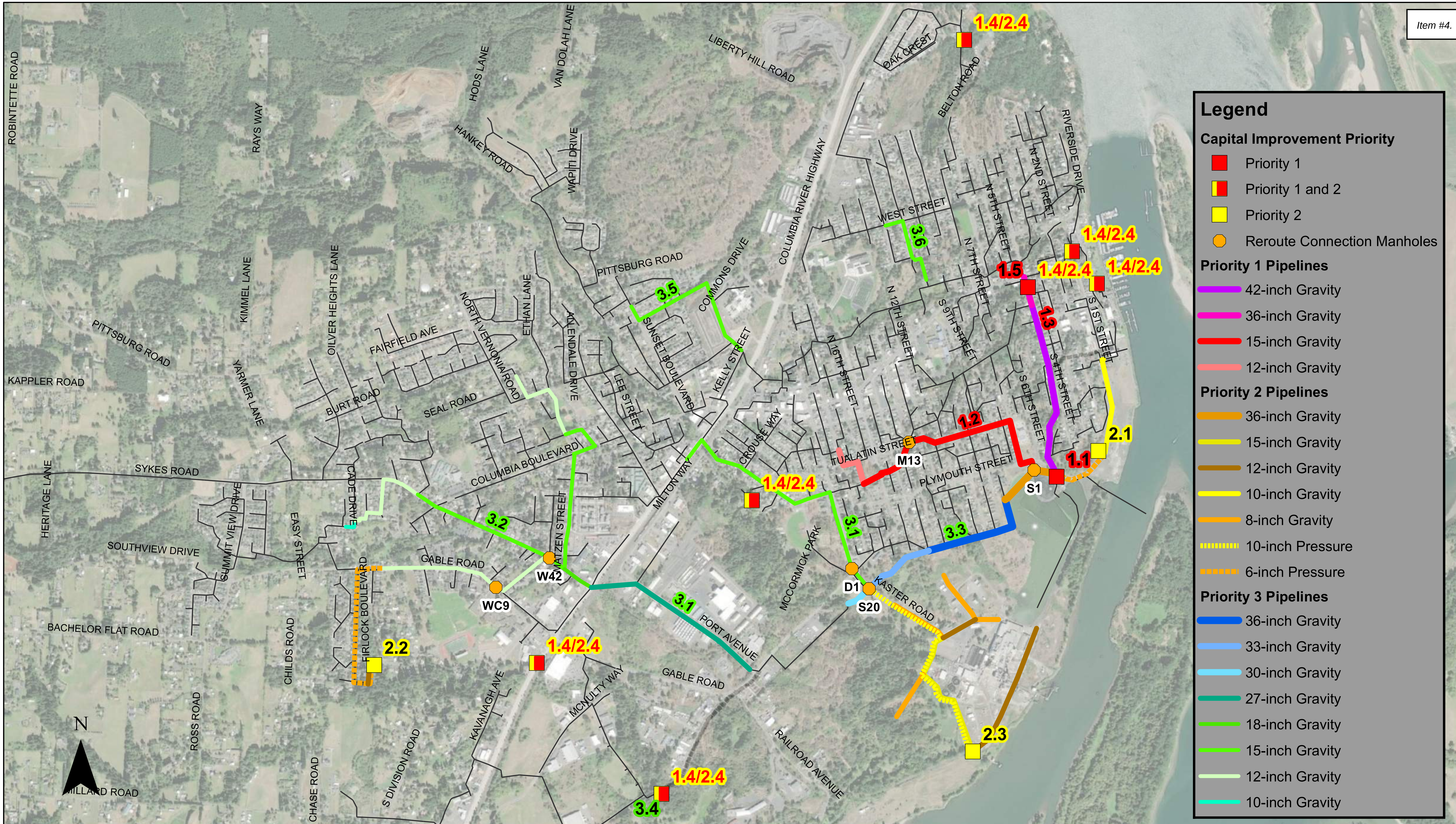


Industrial Business Park Proposed Infrastructure

Wastewater Master Plan

Figure 22

City of St. Helens, OR



Capital Improvement Plan

Wastewater Master Plan

Figure 23

City of St. Helens, OR

KELLER ASSOCIATES

City of St. Helens FOUNDED 1850 Oregon

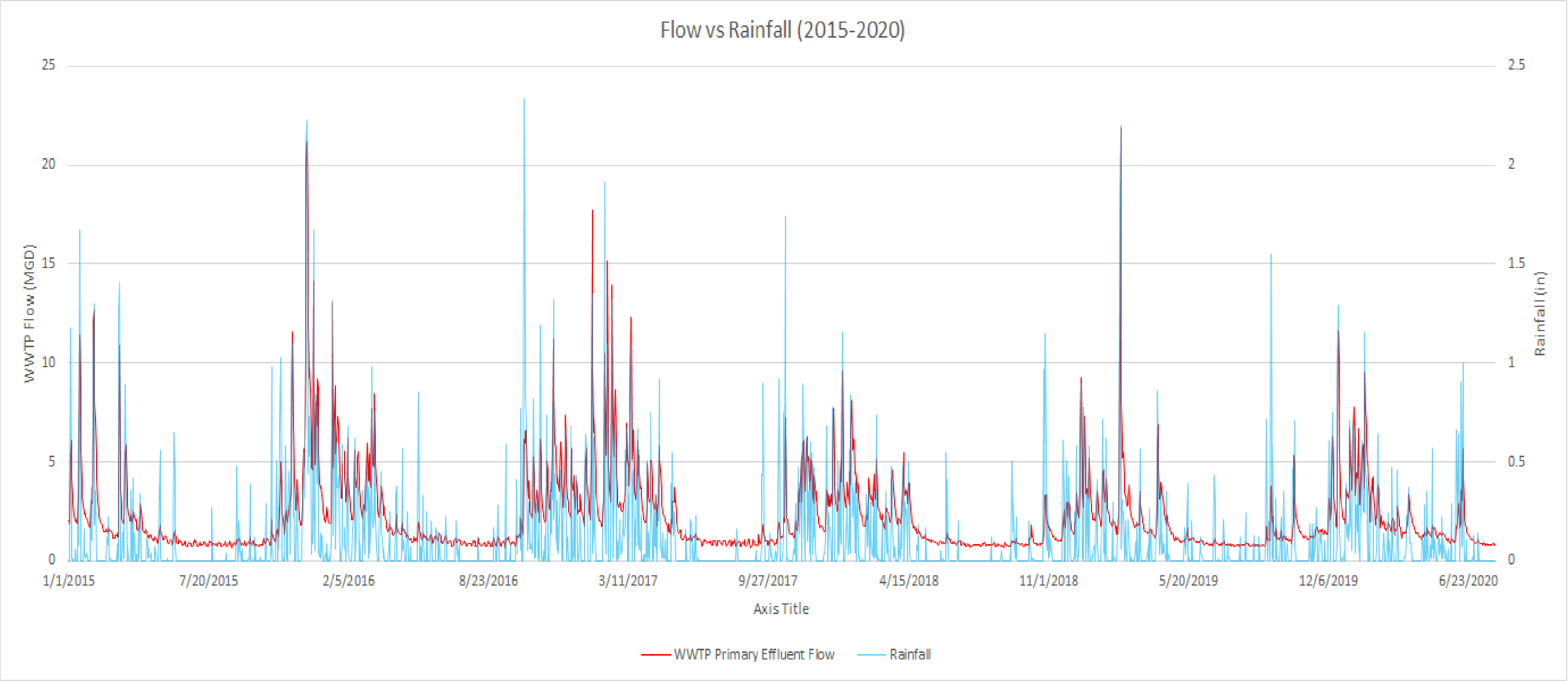
APPENDIX B

Planning Criteria

KELLER
ASSOCIATES

Columbia County Endangered Species List

Group	Name	Population	Status	Lead Office	Recovery Plan	Recovery Plan Action Status
Snails	Burrington jumping-slug (Hemphillia burringtoni)	Wherever found	Under Review	1		
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Coastal Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Columbia Headwaters Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Klamath Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Mid-Columbia Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Recovery Plan for the Coterminous United States Population of Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	St. Mary Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Fishes	Bull Trout (Salvelinus confluentus)	U.S.A., conterminous, (lower 48 states)	Threatened	1	Upper Snake Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	Implementation Progress
Mammals	red tree vole (Arborimus longicaudus)	North Oregon Coast population	Resolved Taxon	1		
Birds	Northern spotted owl (Strix occidentalis caurina)	Wherever found	Threatened	1	Revised Recovery Plan for the Northern Spotted Owl	Implementation Progress
Flowering Plants	Nelson's checker-mallow (Sidalcea nelsoniana)	Wherever found	Threatened	1	Final Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington	Implementation Progress
Flowering Plants	Kincaid's Lupine (Lupinus sulphureus ssp. kincaidii)	Wherever found	Threatened	1	Final Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington	Implementation Progress
Flowering Plants	golden paintbrush (Castilleja levisecta)	Wherever found	Threatened	1	Recovery Plan for the Golden Paintbrush (Castilleja levisecta)	Implementation Progress
Birds	Marbled murrelet (Brachyramphus marmoratus)	U.S.A. (CA, OR, WA)	Threatened	1	Recovery Plan for the Threatened Marbled Murrelet (Brachyramphus marmoratus) in Washington, Oregon, and California	Implementation Progress
Flowering Plants	Willamette daisy (Erigeron decumbens)	Wherever found	Endangered	1	Final Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington	Implementation Progress
Birds	Streaked Horned lark (Eremophila alpestris strigata)	Wherever found	Threatened	1	Draft Recovery Plan for the Streaked Horned Lark	Implementation Progress
Flowering Plants	Bradshaw's desert-parsley (Lomatium bradshawii)	Wherever found	Endangered	1	Final Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington	Implementation Progress
Flowering Plants	Water howellia (Howellia aquatilis)		Threatened	6	Water Howellia (Howellia aquatilis) Recovery Plan, Public and Agency Review Draft	Implementation Progress
Mammals	Columbian white-tailed deer (Odocoileus virginianus leucurus)	Columbia River (Clark, Cowliz, Pacific, Skamania, and Wahkiakum Counties, WA., and Clatsop, Columbia, and Multnomah Counties, OR.)	Threatened	1	Columbian White-tailed Deer Revised Recovery Plan	Implementation Progress
Birds	Yellow-billed Cuckoo (Coccyzus americanus)	Western DPS: U.S.A. (AZ, CA, CO (western), ID, MT (western), NM (western), NV, OR, TX (western), UT, WA, WY (western)); Canada (British Columbia (southwestern); Mexico (Baja California, Baja California Sur, Chihuahua, Durango (western), Sinaloa, Sonora)	Threatened	2		


Flow vs Rainfall (2015-2020)
WWTP Flow (MGD)
Rainfall (in)
25
20
15
10
5
0
2.5
2
1.5
1
0.5
0
1/1/2015
7/20/2015
2/5/2016
8/23/2016
3/11/2017
9/27/2017
4/15/2018
11/1/2018
5/20/2019
12/6/2019
6/23/2020
Axis Title
WWTP Primary Effluent Flow
Rainfall

St. Helens Soils

Source: USDA Web Soil Survey (WSS)

Item #4.

Columbia County, Oregon (OR009)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1A	Aloha silt loam, 0 to 3 percent slopes	738.2	12.50%
1B	Aloha silt loam, 3 to 8 percent slopes	388.9	6.60%
2	Aloha variant silt loam	200.9	3.40%
6D	Bacona silt loam, 3 to 30 percent slopes	27.1	0.50%
10B	Cascade silt loam, 3 to 8 percent slopes	43.2	0.70%
10C	Cascade silt loam, 8 to 15 percent slopes	95.4	1.60%
10D	Cascade silt loam, 15 to 30 percent slopes	46	0.80%
14C	Cornelius silt loam, 8 to 15 percent slopes	114.8	1.90%
14D	Cornelius silt loam, 15 to 30 percent slopes	73.5	1.20%
16	Dayton silt loam	46.3	0.80%
18E	Dowde silt loam, 30 to 60 percent north slopes	22.8	0.40%
19E	Dowde silt loam, 30 to 60 percent south slopes	38.2	0.60%
27B	Latourell silt loam, 3 to 8 percent slopes	12.2	0.20%
31	McBee silt loam	6.6	0.10%

39B	Quafeno loam, 3 to 8 percent slopes	71.5	1.20%
40A	Quatama silt loam, 0 to 3 percent slopes	59.4	1.00%
40B	Quatama silt loam, 3 to 8 percent slopes	272	4.60%
40C	Quatama silt loam, 8 to 15 percent slopes	95.1	1.60%
45	Rock outcrop-Xerumbrepts complex, undulating	2,015.60	34.20%
46	Sauvie silt loam	417.8	7.10%
63	Wapato silt loam	10.9	0.20%
69	Wollent silt loam	404.2	6.90%
70E	Xerochrepts, steep	139	2.40%
71	Xeropsamments, nearly level	56.8	1.00%
W	Water	501.5	8.50%
Totals for Area of Interest		**5,897.80**	**100.00%**

Rainfall Events Requested	Peak Day (MGD)	PIF (MGD)	PIF/Peak Day Factor	Rainfall (in)
1/15/2015 - 1/17/2015	11.5	19.3	1.7	1.7
2/5/2015 - 2/7/2015	12.7	14.5	1.1	1.3
12/5/2015 - 12/8/2015	21.2	31.4	1.5	2.2
1/11/2016 - 1/13/2016	13.1	27.4	2.1	1.3
1/16/2017 - 1/18/2017	17.8	24.6	1.4	1.4
2/14/2017 - 2/16/2017	13.9	19.1	1.4	1.3
10/19/2017 - 10/21/2017	7.2	14.1	1.9	1.7
10/25/2018 - 10/27/2018	3.3	5.7	1.7	1.2
2/10/2019 - 2/12/2019	21.9	32.2	1.5	2.2
12/18/2019 - 12/20/2019	11.6	14.2	1.2	1.3
	Average		1.55	

St. Helens WWMP - Anticipated 20-Year Growth, Wet-Weather and Dry Weather Loading Application for Growth Areas 10/5/2021

Population Projection Summary

St. Helens Projected 20-Yr Pop. Growth	3,908
St. Helens Projected 20-Yr EDU Growth	1,569
Columbia City Projected 20-Yr Pop. Growth	203
Columbia City Projected 20-Yr EDU Growth	82
Total System Projected 20-Yr EDU Growth	**1,651**

Notes: 1. See associated figure for allocated growth locations (residential, commercial, and industrial areas shown). EDU = Equivalent Dwelling Unit

Overall System Flow Summary [1]

Existing ADWF (MGD)	**1.11**
Pop. Projected, 20-Year ADWF (MGD) [2]	**1.41**
Anticipated, 20-Year ADWF (MGD) [3]	**1.91**
Residential 20-Year Growth ADWF (MGD)	0.30
Commercial 20-Year Growth ADWF (MGD)	0.03
Industrial 20-Year Growth ADWF (MGD)	0.47

Notes: 1. ADWF = Average Dry Weather Flow
2. Based on PSU projected growth rates.
3. Includes industrial and commercial flows from growth anticipated by the City in the 20-year planning period.

St. Helens - Dry and Wet Weather Loading Application for 20-Year Model

Residential/Commercial Mix

Area Number	Site Name	Acreage	Zoning	Residential Density (assumed)	ROW %	Commercial %	Commercial Area (ac)	Res. EDU count (calculated) [1]	Flow, ADWF (gpd) [2,3]	Flow, ADWF (MGD)	Flow (gpm)	Manhole where DWF load applied	DWF Pattern Applied	Manhole where RDII Hydrograph Applied
1	Residential/Commercial Mix - 15 acres	15	Mixed Use	R5	15%	20%	3	82	18,541	0.019	12.88	PS11/SR1	FM6	SR15/PS11
2	Riverfront District (Mixed Use - 23 acres) [4]	23	Riverfront District	AR	15%	50%	11.5	175	46,247	0.046	32.12	IA9	FM5	IA8
3	Houlton Business District [5]	45	Houlton Business District	N/A	15%	10%	5	0	5,769	0.006	4.01	NI5	FM3	NI4
4	Currently Vacant Commercial Property	5.5	Highway Commercial	N/A	15%	100%	5.5	0	7,013	0.007	4.87	N29	FM1	N28
							Total	**257**	**77,569**	**0.078**				

Notes: 1. From HNA, 2.49 people per EDU assumed. R5 = 8 EDUs/acre, AR (Apartment Residential) = 14 EDUs/acre
2. ADWF = Average Dry Weather Flow
3. Assumed commercial flow rate of 1,500 gallons/acre/day (gpad).
4. Approximately 6 acres designated as mixed use with both commercial and residential flow.
5. The Houlton Business District is already developed, assumed 10% commercial infill.

Residential

Area Number	Site Name	Acreage	Zoning	EDU Count (City Delineated)	ROW %	EDU count (calculated) [1]	Flow, ADWF (gpd) [2]	Flow, ADWF (MGD)	Flow, ADWF (gpm)	Manhole where DWF load applied	DWF Pattern Applied	Manhole where RDII Hydrograph Applied
5	Residential (125 EDUs)	40	R7	125	N/A	125	22,542	0.023	15.7	N38	FM1	N38A
6	Residential (20 EDUs)	7	R7	20	N/A	20	3,607	0.004	2.5	N38	FM1	N38A
7	Residential (60 EDUs)	15	Mobile Home Residential	60	N/A	60	10,820	0.011	7.5	NC18	FM3	NC18
8	Residential (20 acres)	20	R5	N/A	20%	128	23,120	0.023	16.1	WE20	FM2	WE19
9	Residential (64 acres)	64	R7	N/A	20%	307	55,400	0.055	38.5	PS11/SR1	FM2	PS11/SR1
10	Residential (28 acres)	28	R7	N/A	20%	134	24,237	0.024	16.8	WCA3	FM2	WCA3
11	Mobile Home Park (37 acres)	37	Mobile Home Residential	N/A	15%	313	56,475	0.056	39.2	SR17	FM6	SR15
12	Columbia City Growth (203 additional pop.)	N/A	Residential	82	N/A	82	14,702	0.015	10.2	NC18	N/A	N/A
13	Gable Rd. Apartments	11.5	GC (AR)	238	N/A	238	42,920	0.043	29.8	SP5	FM6	SP4A
					Total	**1,407**	**253,824**	**0.254**				

Notes: 1. From HNA, 2.49 people per EDU assumed. R7 = 6 EDUs/acre, R5 = 8 EDUs/acre, Mobile Home Residential = 10 EDUs/acre, AR (Apartment Residential) = 14 EDUs/acre. Wetlands were excluded in area delineation.
2. ADWF = Average Dry Weather Flow

Industrial/Commercial

Area Number	Site Name	Acreage	Zoning	Acres Developed	ROW %	Flow, ADWF (gpd) [2,3]	Flow, ADWF (MGD)	Flow, ADWF (gpm)	Manhole where DWF load applied	DWF Pattern Applied	Manhole where RDII Hydrograph Applied
14	Industrial Site	27	Heavy Industrial	27	15%	34,959	0.035	24.3	SP5	INDUSTRY	SP4A
15	Multnomah Industrial Park [1]	98	Heavy Industrial	30	15%	38,250	0.038	26.6	S37A	INDUSTRY	S37A
16	Old Armstrong Site	124	Heavy Industrial	124	15%	157,588	0.158	109.4	S29	INDUSTRY	S28
17	Industrial Business Park	190	Heavy Industrial	190	15%	242,250	0.242	168.2	S20	INDUSTRY	S20
			Total	**371**	**Total**	**473,047**	**0.47**				

Notes: 1. City anticipates approximately 20-30 acres of this property to develop.
2. ADWF = Average Dry Weather Flow
3. Assumed medium/light industrial flow rate of 1,500 gallons/acre/day (gpad).

Item #4.

SUBMITTED TO:

Keller Associates
245 Commercial St SE,
Suite 210
Salem, Oregon, 97301

BY:

Shannon & Wilson, Inc.
3990 SW Collins Way, Ste 100
Portland, Oregon,

503-210-4764
www.shannonwilson.com

DRAFT

GEOTECHNICAL PLANNING REPORT

St. Helens Wastewater and Stormwater Master Plan Update

ST. HELENS, OREGON

SHANNON & WILSON

September 2021

Shannon & Wilson No

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Submitted To: Keller Associates
245 Commercial St SE,
Suite 210
Salem, Oregon, 97301
Attn: Peter Olsen, PE

Subject: DRAFT GEOTECHNICAL PLANNING REPORT, ST. HELENS WASTEWATER AND STORMWATER MASTER PLAN UPDATE, ST. HELENS, OREGON

Shannon & Wilson prepared this report and participated in this project as a subconsultant to Keller Associates. Our scope of services was specified in our contracted dated March 18, 2021 for Keller project number 220060. This report presents the geotechnical planning-related findings based on a review of publicly available documents and was prepared by the undersigned.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON, INC.

Elliott Mecham, PE
Senior Associate

David Jacobson
Geologic Staff

DSJ:ECM:JLJ/:myw

CONTENTS

Figures

CONTENTS

1 GENERAL

The City of St. Helens provides sanitary sewer collection services to businesses and residences within the City limits. The sanitary sewer collection system is a combination of 60 miles of gravity and force mains, 9 lift stations, and over 1,700 sanitary sewer manholes, vaults, and cleanouts. All sewage flows are conveyed to the City's wastewater treatment facility. The last complete update to the City's sanitary sewer master plan was in 1989.

The intent of the sanitary sewer master plan is to perform an assessment of the existing sewer system; evaluate the sewer system for its capacity to convey existing and future waste discharges; identify deficiencies, capacity issues, areas for improvement, and identify resiliency issues for critical facilities; and determine and propose solutions.

2 SCOPE OF SERVICES

The purpose of Shannon & Wilson’s task is to prepare and provide GIS maps of the service area with the mapped site geology and the State of Oregon Department of Geology and Mineral Industries' (DOGAMI) mapped seismic hazards, and document the findings in a brief report. The backbone wastewater and stormwater facilities selected and digitized into GIS format by others will be shown on the maps. Our specific scope of work includes the following:

- Mapped site geology;
- Mapped landslides included in DOGAMI’s landslide inventory (if any) along the proposed pipeline alignments or at the treatment plant sites;
- Mapped United States Geology Survey (USGS) Class A or Class B faults that cross pipeline alignments or are located within a 5-mile radius of treatment plant locations;
- Mapped relative earthquake liquefaction hazard based on DOGAMI maps (high, medium, or low hazard);
- Mapped relative landslide risk based on DOGAMI maps (very high, high, moderate, or low hazard); and
- Submitting a brief memo or letter report presenting the geologic maps and a brief discussion summarizing our findings, including a discussion on probable areas where rock excavation could be required, and the potential need to mitigate seismic hazards. The discussions will be limited by the uncertainties and assumptions made during the development of the geologic maps and DOGAMI hazard layers.

3 DESCRIPTION OF PROVIDED MAPS

3.1 Provided Data

Shannon & Wilson was provided GIS files for the City of St. Helens stormwater and wastewater facilities. An overview map of these facilities can be found on Figure 2, Site Plan. Within the files provided were attributes which allowed for the identification of vulnerable assets. The vulnerable pipelines can be found on Figure 3, Pipeline Vulnerabilities.

3.2 Available Mapping

DOGAMI has developed several publications which were used in our assessments related to the stormwater and wastewater facilities. These included site geology, landslide hazard, and peak ground accelerations associated with a Cascadia Subduction Zone earthquake. Datasets of interest for this project include the following:

- Geology: Oregon Geologic Data Compilation release 6 (OGDC-6);
- Landslide Hazard: DOGAMI Open-File Report O-16-02; and
- Cascadia Peak Ground Accelerations: DOGAMI Open-File Report O-13-06.

3.3 Geology

The City of St. Helens is at the northern end of the Portland Basin, a structural depression created by complex folding and faulting of the basement rocks. The most prevalent basement rock of the Portland Basin is a sequence of lava flows called the Columbia River Basalt Group (CRBG), which flowed into the area between about 17 million and 6 million years ago (Beeson and others, 1991). Due to the wet and mild climate of the Pacific Northwest, intense chemical weathering of the geologic units has taken place (Evarts, 2004). This has resulted in the development of soil horizons as thick as 10 m. In some instances, the rocks of the CRBG have been completely converted to soil, destroying all primary rock textures.

The Columbia and Willamette Rivers converge within the Portland Basin and, with their tributaries, have contributed to an extensive sedimentary fill which overlies the basement rock formations. Beeson and others (1991) mapped the local Portland Basin fill sediments as Sandy River Mudstone, overlain by Troutdale Formation. The Troutdale Formation locally consists of well-consolidated friable to moderately well-cemented conglomerate and sandstone, deposited in the Miocene to Pliocene epochs (about 12.5 million to 1.6 million years ago).

The Troutdale Formation is locally overlain by sediments deposited during a series of catastrophic glacial outburst floods. During the late stages of the last great ice age, between about 18,000 and 15,000 years ago, a lobe of the continental ice sheet repeatedly blocked and dammed the Clark Fork River in western Montana, which then formed an immense glacial lake called Lake Missoula. The lake grew until its depth was sufficient to buoyantly lift and rupture the ice dam, which allowed the entire massive lake to empty catastrophically. Once the lake had emptied, the ice sheet again gradually dammed the Clark Fork Valley and the lake refilled, leading to 40 or more repetitive outburst floods at intervals of decades (Allen and others, 2009). During each short-lived episode, floodwaters washed across the Idaho panhandle, through the eastern Washington scablands, and through the Columbia River Gorge. When the floodwater emerged from the western end of the gorge, it spread out over the Portland Basin and up the Willamette Valley as far south as Junction City, depositing a tremendous load of sediment (O'Conner and others, 2001).

The geologic map presented on Figure 4 comes directly from the Oregon Geologic Data Compilation release 6 (OGDC-6).

3.3.1 Regional Seismological Setting

Earthquakes in the Pacific Northwest occur largely as a result of the subduction of the Juan de Fuca plate beneath the North American plate along the Cascadia Subduction Zone (CSZ). The CSZ is located approximately parallel to the coastline from northern California to southern British Columbia. The compressional forces that exist between these two colliding plates cause the oceanic Juan de Fuca plate to descend, or subduct, beneath the continental plate at a rate of about 1.5-inches per year (DeMets and others, 1990). This process leads to volcanism in the North American plate and stresses and faulting in both plates throughout much of the western regions of southern British Columbia, Washington, Oregon, and northern California. Stress between the colliding plates is periodically relieved through great earthquakes at the CSZ plate interface.

Within the regional tectonic framework and historical seismicity, three broad earthquake sources are identified:

- Subduction Zone Interface Earthquakes originate along the CSZ, which is located 25 miles beneath the coastline. Paleoseismic evidence and historic tsunami records from Japan indicate that the most recent subduction zone interface event was in 1700 AD and was an approximately magnitude 9 earthquake that likely ruptured the full length of the CSZ.
- Deep-Focus, Intraplate Earthquakes originate from within the subducting Juan de Fuca oceanic plate as a result of the downward bending and tension in the subducted plate. These earthquakes typically occur 28 to 38 miles beneath the surface. Such events on the

CSZ are estimated to be as large as magnitude 7.5. Historic earthquakes include the 1949 magnitude 7.1 Olympia earthquake, the 1965 magnitude 6.5 earthquake between Tacoma and Seattle, and the magnitude 6.8 2001 Nisqually earthquake. The highest rate of CSZ intraslab activity is beneath the Puget Sound area, with much lower rates observed beneath western Oregon.

- Shallow-Focus Crustal Earthquakes are typically located within the upper 12 miles of the earth's surface. The relative plate movements along the CSZ cause not only east-west compressive strain but dextral shear, clockwise rotation, and north-south compression of the leading edge of the North American Plate (Wells and others, 1998), which is the cause of much of the shallow crustal seismicity of engineering significance in the region. The largest known crustal earthquake in the Pacific Northwest is the 1872 North Cascades earthquake with an estimated magnitude of about 7. Other examples include the 1993 magnitude 5.6 Scotts Mill earthquake and magnitudes 5.9 and 6.0 Klamath Falls earthquakes. According to the USGS Quaternary Fault and Fold database (USGS, 2021), there are no Class A features within approximately 5 miles of the project site.

3.4 Liquefaction Hazard

The statewide liquefaction map of the state is a compilation of liquefaction susceptibility maps from other DOGAMI publications. Within the St. Helens area, this is IMS-7 (Madin and Wang, 1999). While this is a purpose-made liquefaction hazard map for the area, it was based primarily on aerial photo interpretation, geologic mapping from 1946, and water well data. Since the development of IMS-7, new geologic mapping was conducted (Evarts, 2004). In order to allow for a liquefaction hazard map based on the updated geologic mapping, we employed the Youd and Perkins 1978 methodology to convert the mapped geology to liquefaction susceptibility. The resulting map can be seen on Figure 5.

3.5 Landslide Hazard

The landslide hazard map presented on Figure 6 comes from the DOGAMI Open-File Report O-16-02. This overview map encompasses the entire state of Oregon and was designed to be used for regional planning. Susceptibility categories are broken into four categories (low, moderate, high, and very high), where very high denotes areas of mapped landslides.

The relative landslide hazard risk was developed by DOGAMI by creating a generalized geology-landslide intersect map and a percent slope map. Spatial statistics were then used to determine the mean and standard deviation of slope angles within landslides per geologic unit. Thirty percent of the area within the statewide hazard map consists of High or Very High hazard slopes and 80 percent of the landslides are located within this area.

Limitations of the input and modeling mean that the map should only be used for general planning purposes, and the map cannot be used as a substitute for geotechnical explorations, laboratory testing, and detailed site-specific analyses.

4 SUMMARY OF FINDINGS

The majority of the pipelines in need of replacement are located in areas mapped as rock. However, pipeline assets on the western portion of the basin are also mapped in Missoula Flood Deposits with small areas of alluvium. Assets within approximately 500 to 600 feet of the Willamette River pipeline, are located in recent alluvium and fill. The primary geologic hazard in the areas mapped as rock is strong ground motions.

Potential seismic hazards outside of the areas mapped as rock are expected to be related to liquefaction, and liquefaction-related phenomena such as settlement, lateral spreading, and post-seismic soil strength reduction. The risk of other seismic hazards, such as fault rupture, is low within the study area. Additionally, the potential need for rock excavation will be discussed in the following sections.

4.1 Landslides

According to the Department of Geology and Mineral Industries (DOGAMI), the existing pipelines are located within zones of low to high landslide hazard. While none of the mapped facilities are located within a mapped landslide, select stormwater facilities at the northernmost extent of the project area are adjacent to areas of very high landslide hazard indicating there are existing landslides.

4.2 Liquefaction and Lateral Spread

Soil liquefaction occurs in susceptible subsurface soils below the groundwater level. It is a phenomenon in which excess pore water pressure of loose to medium dense, saturated, granular soils increases during ground shaking to a level near the initial effective stress. The increased excess pore pressure results in a reduction of soil shear strength. Given that sands were observed at the ground surface and likely underlie a large portion of the project area, liquefaction is a potential hazard within the project area. A map of liquefaction susceptibility prepared using the Oregon Geologic Data Compilation release 6 (OGDC-6) and the Youd and Perkins, 1978 methodology, and included as Figure 5, indicates that much of the project area has no liquefaction hazard as the area is mapped as rock. However, select pipelines at the westernmost extent of the project area and on the eastern outfalls have moderate to high liquefaction risks. Again, the effects of liquefaction typically include lateral spreading, slope instability, ground settlement, and strength reductions, such as lower allowable soil bearing.

We note that this hazard assessment is based solely on soil type and does not consider ground water presence or the absence of groundwater. If groundwater is not present at the site, the DOGAMI hazard map is likely overestimating the liquefaction potential. The relative density also impacts the liquefaction potential of the sands. Obtaining site specific borings or Cone Penetrometer Tests (CPTs) and laboratory tests on collected soil samples to assess the density of the sand was outside the scope of this study, but we recommend that they be performed during design to further assess the extent of the liquefaction hazard.

Lateral spreading hazards can exist in areas with mild slopes adjacent to a much steeper slope or vertical face. Lateral spreading failure can occur if soil liquefaction develops during a seismic event and the ground acceleration (inertial force) briefly surpasses the yield acceleration (shear strength) of the liquefied soil. This can cause both the liquefied soil and an overlying non-liquefied crust of soil to displace laterally down mild slopes towards an embankment face, or the banks of streams, rivers, and other bodies of water. The displacements are cumulative and permanent in nature. If liquefaction occurs there is risk of post seismic slope instability and potential lateral displacement towards the existing slope to the northeast.

4.2.1 Liquefaction Induced Post-Seismic Settlement

Settlement will likely occur in cohesionless soil below the groundwater table that undergo liquefaction and pore pressure development during ground shaking. The settlement is related to densification and rearrangement of particles during ground shaking, as well as volume change, as the excess pore pressure dissipates after ground shaking. Seismic ground settlement does not typically occur uniformly over an area, and differential settlement may impact existing or proposed structures and infrastructure supported by liquefied soil and/or within the liquified zones. Differential settlement is often estimated to range between 50 and 80 percent of the total settlement. Consequences of seismic-induced settlement would be subsequent settlement of shallow foundations overlying the liquefied soil.

4.2.2 Fault Rupture

Quaternary crustal faults and folds throughout Oregon and Washington have been located and characterized by the United States Geological Survey (USGS). The USGS provides approximate fault locations and a detailed summary of available fault information in the USGS Quaternary Fault and Fold Database. The database defines four categories of faults, Class A through D, based on evidence of tectonic movement known or presumed to be associated with large earthquakes during Quaternary time (within the last 2.58 million years). For Class A faults, geologic evidence demonstrates that a tectonic fault exists and that it has likely been active within the Quaternary period. For Class B faults, there is equivocal geologic evidence of Quaternary tectonic deformation, or the fault may not extend deep enough to be considered a source of significant earthquakes. Class C and D faults lack convincing geologic evidence of Quaternary tectonic deformation or have been studied carefully enough to determine that they are not likely to generate significant earthquakes.

The closest Class A or Class B fault to the site is the Portland Hills Fault, mapped more than 5 miles from the project location, and is shown on the Fault Vicinity Map, Figure 7. In our opinion the risk of fault rupture at the site is low.

4.3 Rock Excavation

Rock excavation may be necessary where buried improvements are located outside or deeper than the existing utility trenches that are planned in areas mapped as rock. In the past, the City of St. Helen's has successfully used pipe bursting. However, the effectiveness and ease of pipe bursting has been a function of the existing trench width, pipe upsize, and depth of cover. We understand the City does not recommend pipe bursting for any pipes with less than 5-6 feet of cover. The City's historical experience with pipe bursting has been successful for increases of 1 to 2 pipe size diameters. The City has also reported successfully using Horizontal Directional Drilling (HDD) in solid basalt rock at depths over 16 feet below ground surface.

Pipe bursting to replace existing pipe where sewer lines are constructed over the top of shallow rock may not be feasible if adequate cover is not present. Additionally, rock or decomposed rock is relatively incompressible. If pipe bursting is performed in areas where pipes are buried in rock, any change in the density of the material surrounding the pipe that is required for upsizing will need to occur within the trench backfill. As was presented in Figure 4, Geologic Map, the majority of city assets are constructed within areas mapped as basalt. Where pipe bursting is considered as a possible remediation or where new sewers will be constructed outside of the existing trench, a review of as-built construction information, historic geotechnical information, or new geotechnical explorations should be considered to identify and mitigate the potential risk of rock related constructability issues in areas mapped as rock.

5 LIMITATIONS

This letter report was prepared for the exclusive use of the Keller and the City of St. Helens and their representatives for the purpose of planning-related geotechnical site evaluation for wastewater facilities. The assessments contained in this letter are based on the information and data provided to us, and information that is publicly available. This letter report should not be viewed as a warranty of conditions described in this report, such as those interpreted from published maps. The maps should be used for planning level purposes only and not a substitute for geotechnical explorations and laboratory testing that will be required for design. Our findings are based on the limitations of our approved scope, schedule, and budget; and our understanding of the project and information provided by Keller Associates.

For any site located on or near a slope, there are slope instability risks that are present and future owners have to accept, including, but not limited to:

- Natural factors: soil and groundwater conditions, steep topography, heavy rainfall events, erosion, and vegetation conditions; and
- Human-related factors: water leaks, pipe breaks, improper drainage, lack of maintenance of vegetation or drainage facilities, fill or debris placement, excavation and/or removal of trees/vegetation.

Similar circumstances or other unknown conditions may also affect slope stability. Our evaluation and planning level assessments described herein are not a guarantee or warranty of slope stability conditions, nor current and future risks.

Please note that our scope of services did not include any environmental assessment or evaluation regarding the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below the site.

Shannon & Wilson has prepared the attached, “Important Information About Your Geotechnical/Environmental Report,” to assist you and others in understanding the use and limitations of our reports.

6 REFERENCES

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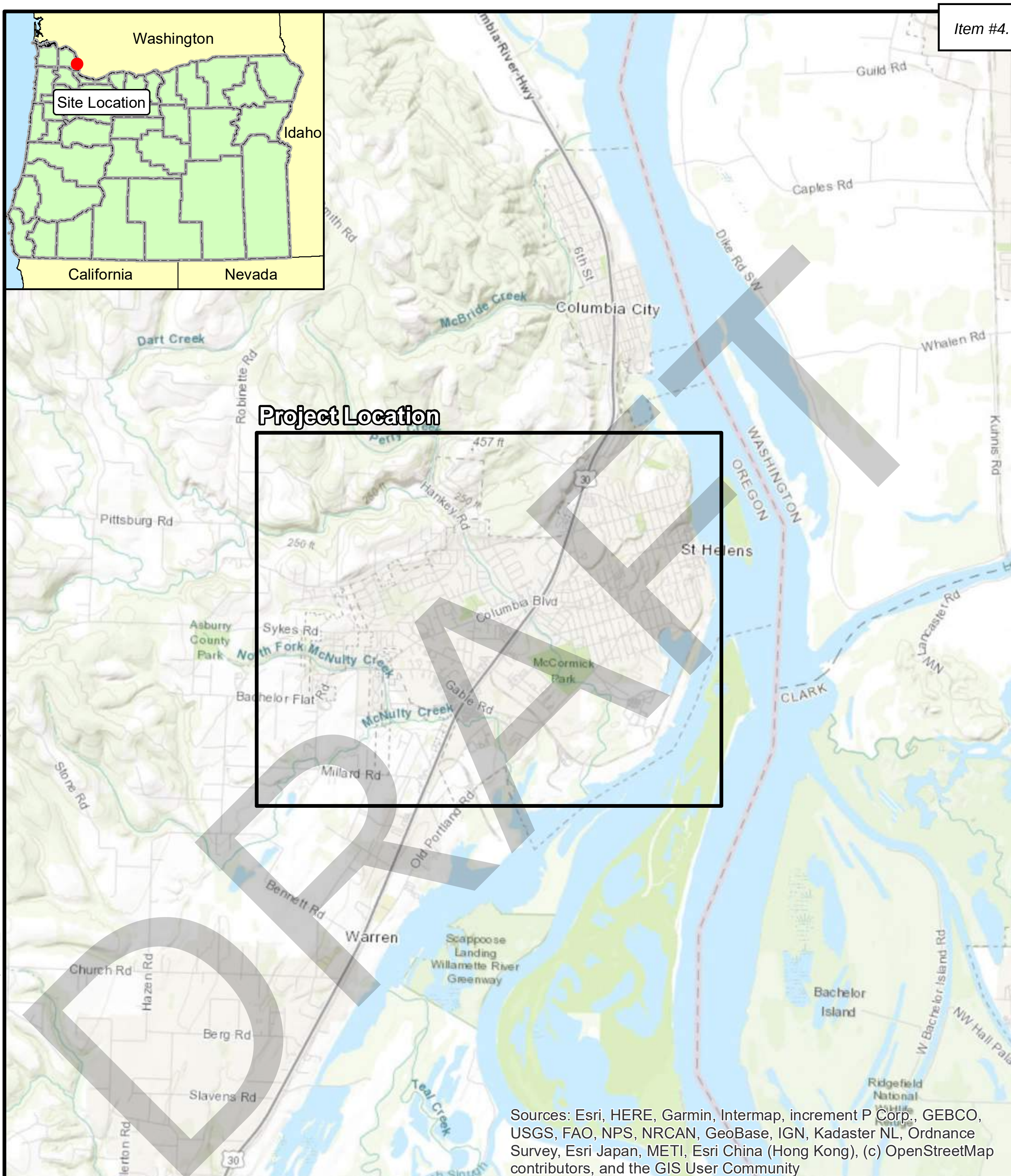
Item #4.



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

0 0.5 1 2

Scale in Miles

N

St. Helen's Wastewater and Stormwater Master Plan Update
St. Helens, Oregon

VICINITY MAP

September 2021 104961

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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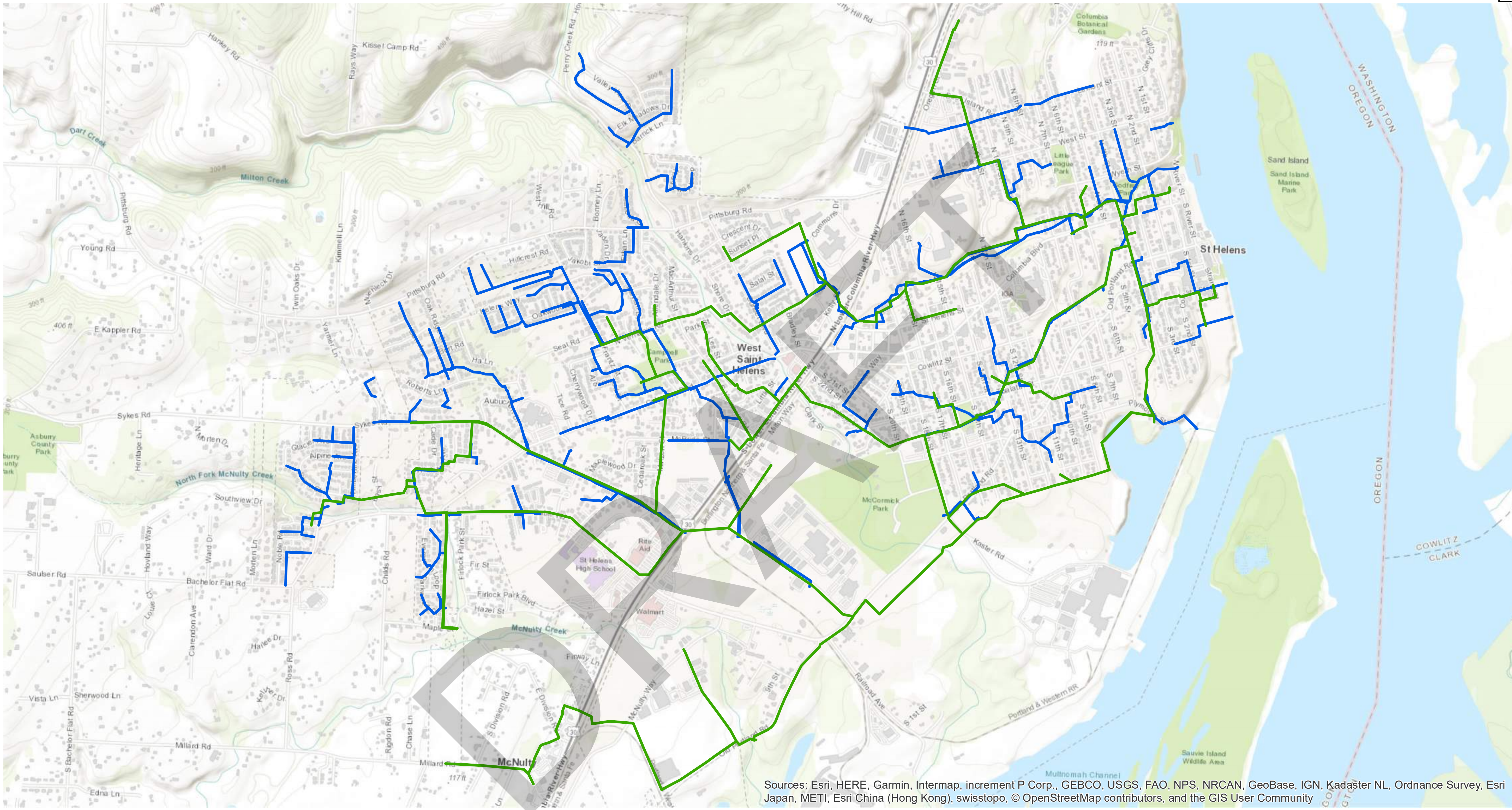

LEGEND

- Sewer Pipelines
- Stormwater Conduits

0 800 1,600 3,200

Scale in Feet

NOTES

1. Stormwater and sewer assets provided by Keller Associates on June 14, 2021.

St. Helens Wastewater and Stormwater Master Plan Update
St. Helens, Oregon

SITE PLAN

September 2021 104961

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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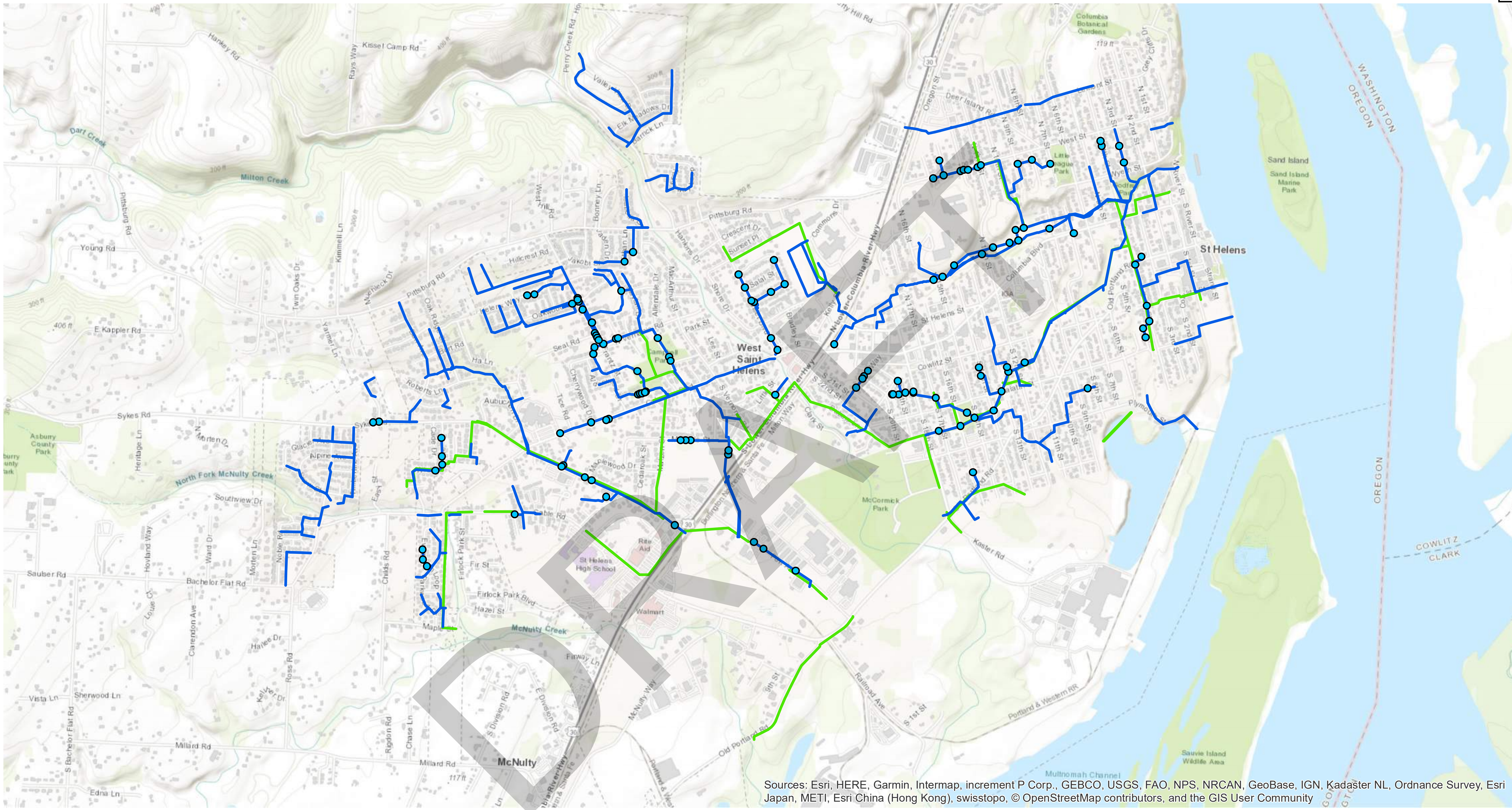

LEGEND

- Stormwater Junctions Indicating Need of Improvement
- Sewers in need of Improvement
- Stormwater Conduits

0 800 1,600 3,200

Scale in Feet

NOTES

1. Stormwater and sewer assets provided by Keller Associates on June 14, 2021.

St. Helens Stormwater and Wastewater Master Plan Update
St. Helens, Oregon

PIPELINE VULNERABILITIES

September 2021 104961

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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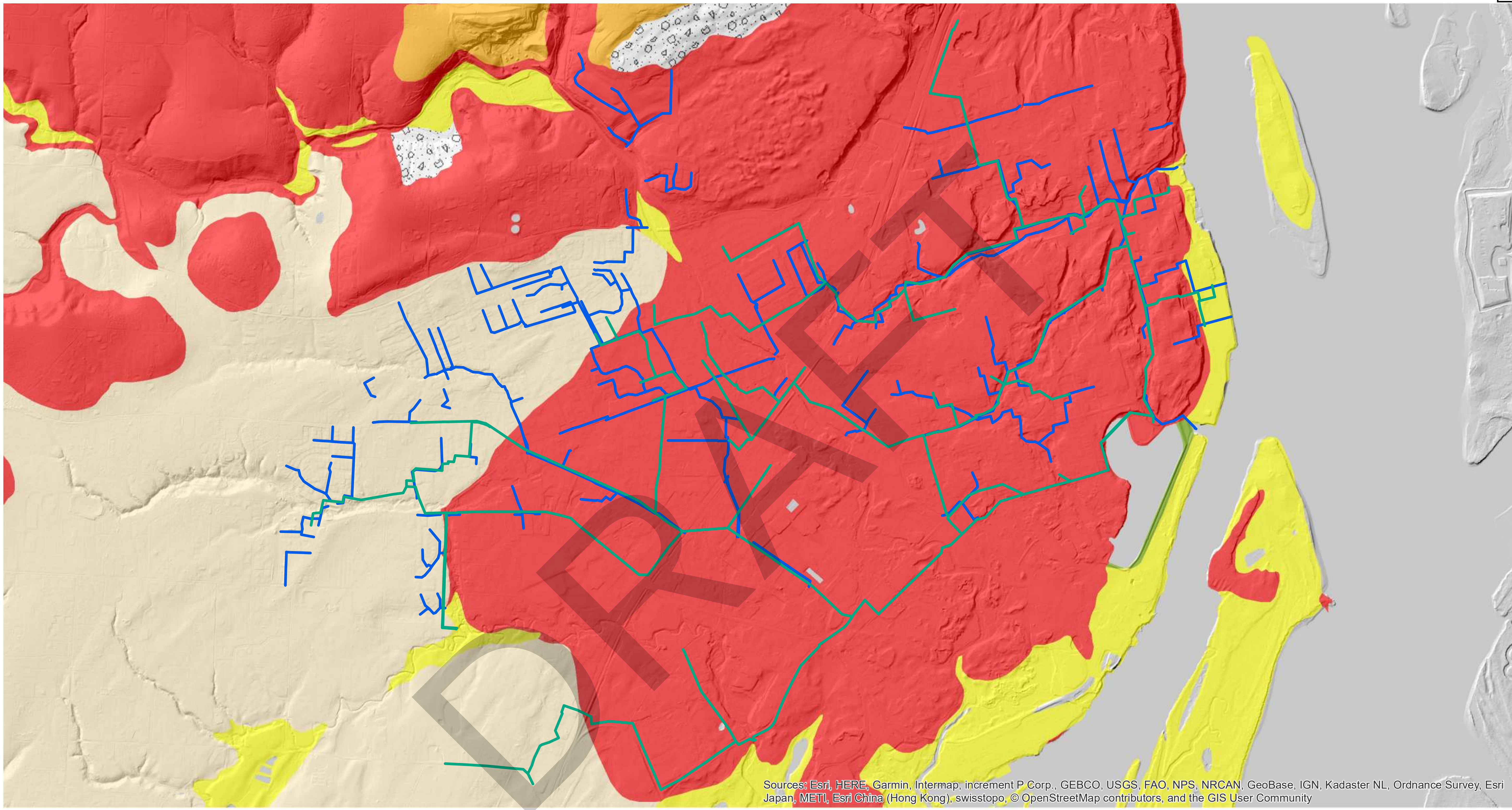

LEGEND

Geologic Map Unit

- Alluvial deposits
- Grande Ronde Basalt
- Landslide deposits
- Man-made fill deposits
- Missoula Flood deposits
- Troutdale Formation

- Sewer Pipelines
- Stormwater Conduits

0 800 1,600 3,200

Scale in Feet

NOTES

1. Geologic map from Oregon Geologic Data Compilation release 6 (OGDC-6).
2. LiDAR hillshade from Oregon Lidar Consortium (OLC)

St. Helens Wastewater and Stormwater Master Plan Update
St. Helens, Oregon

GEOLOGIC MAP

September 2021 104961

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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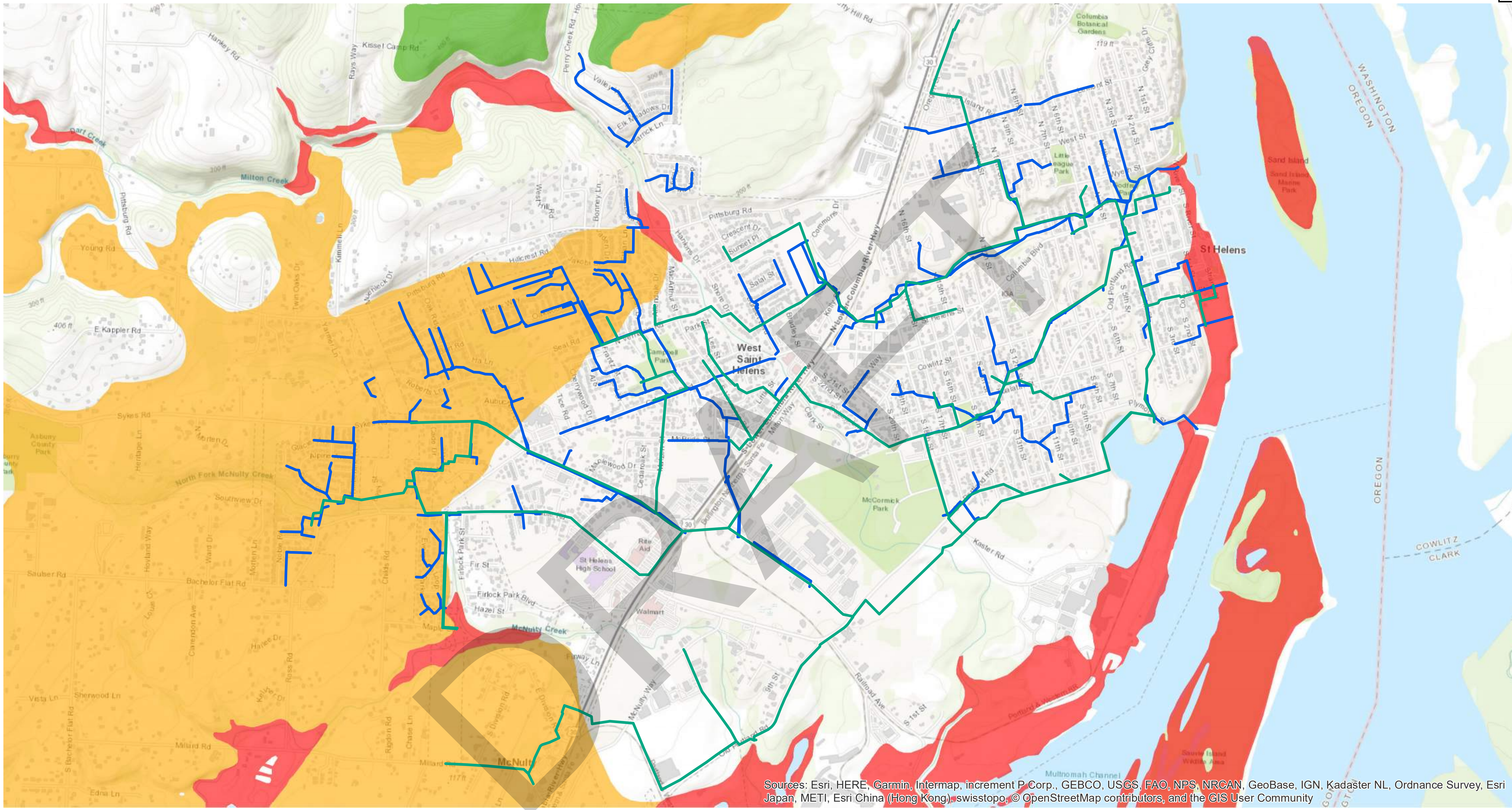
Filename: T:\Projects\PDX\104000s\104961 - St Helens\Geologic Map.mxd Date: 6/30/2021 Login: DSJ



LEGEND

Liquefaction Hazard

- Low
- Moderate
- High

- Sewer Pipelines
- Stormwater Conduits

0 800 1,600 3,200

Scale in Feet

NOTES

1. Liquefaction hazard developed from data provided with OGDC-6, the Youd and Perkins, 1978 metodology, and knowledge of regional liquefaction hazards.
2. Stormwater and sewer assets provided by Keller Associates on June 14, 2021.

St. Helens Wastewater and Stormwater Master Plan Update
St. Helens, Oregon

LIQUEFACTION HAZARD

September 2021 104961

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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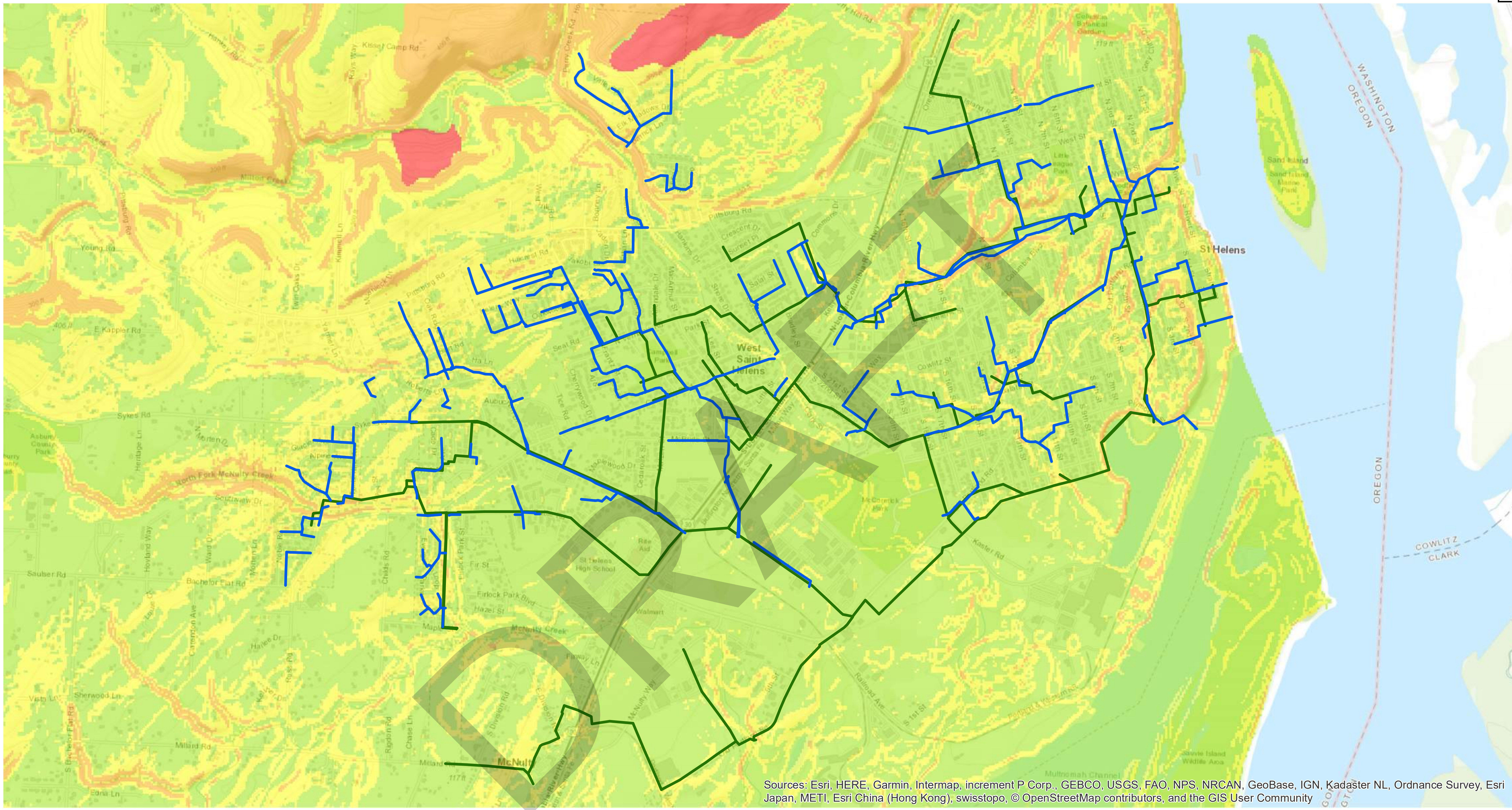

LEGEND

Landslide Susceptibility

- Low
- Moderate
- High
- Very High

- Stormwater Conduits
- Sewer Pipelines

0 800 1,600 3,200

Scale in Feet

NOTES

1. Stormwater and sewer assets provided by Keller Associates on June 14, 2021.
2. Landslide susceptibility from DOGAMI Open-File Report O-16-02.

St. Helens Wastewater and Stormwater Master Plan Update
St. Helens, Oregon

LANDSLIDE SUSCEPTIBILITY

September 2021 104961

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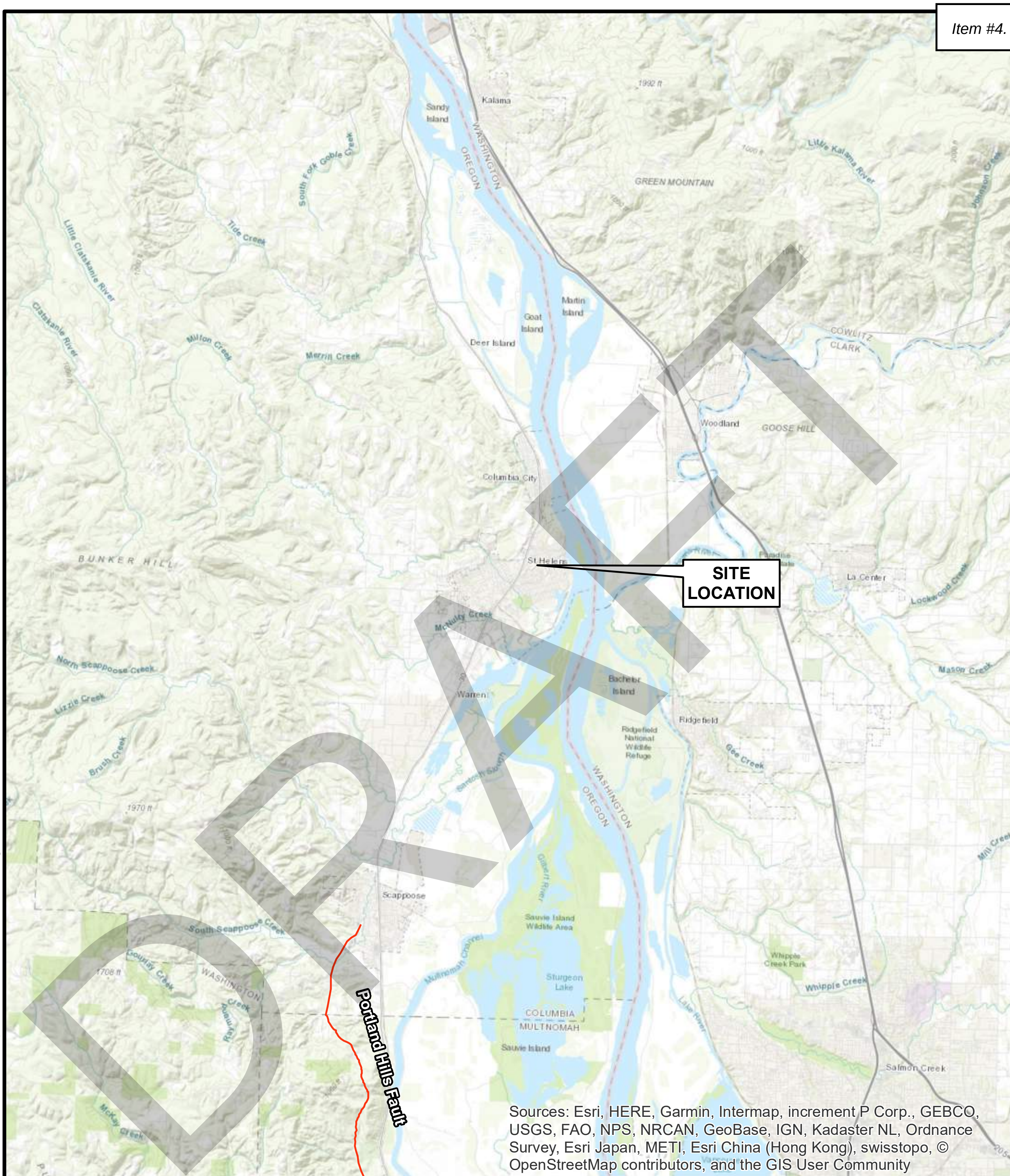

St. Helens Wastewater and Stormwater
Master Plan Update
St. Helens, Oregon

FAULT MAP

September 2021 104961

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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Filename: T:\Projects\PDX\104000s\104961 - St Helens\Fault Map.mxd Date: 6/30/2021 Login: DSJ

ATTACHMENT A

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

SHANNON & WILSON
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Attachment to and part of Report: 104961
Date: September 2021
To: Peter Olsen
Keller Associates

Important Information About Your Geotechnical/Environmental Report

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the GBA, Silver Spring, Maryland

APPENDIX C

Engineering Standard and Comp Plan Review Tech Memo

KELLER ASSOCIATES

DRAFT *TECHNICAL MEMORANDUM*

TO: City of St. Helens

FROM: Peter Olsen, PE
Emily Flock, PE

DATE: 09/13/2021

SUBJECT: ST HELENS MUNICIPAL DEVELOPMENT CODE, ENGINEERING STANDARDS MANUAL, AND COMPREHENSIVE PLAN REVIEW – SANITARY SEWER

1. GENERAL

The City of St. Helen's existing engineering design standards (Title 18), development code (Title 17), and comprehensive plan (Title 19) were reviewed for new development as they pertain to sanitary sewer conveyance and treatment to identify potential deficiencies and provide recommendations for updates. This effort was part of the Wastewater Master Plan (WWMP) process. Sanitary sewer system design criteria encompass the fundamental principles applied in evaluating the existing system and planning for future expansion of the system. The criteria applied in the WWMP come from sources such as neighboring communities, industry standards, and state and federal storm water regulations and are summarized in Section 2 of the WWMP. The aim of the criteria is to accurately define the system demands to mitigate existing deficiencies and prevent future problems. Design criteria addresses design flows, pipeline alignment and geometry, and hydraulic calculation methods.

The following documents were examined during this review effort.

- St. Helens Municipal Code (SHMC) Title 17 Community Development Code
- St. Helens Municipal Code (SHMC) Title 18 Engineering Standards Manual
- St. Helens Municipal Code (SHMC) Title 19 Comprehensive Plan

Note that the recommendations below do not include legal services. Developing draft language and development details for revisions to the Municipal comprehensive plan, development code, and City standards is not included in the scope of this review. Any language provided in this section is intended to assist the City in revising standards and is not intended to be directly incorporated into any City Municipal Code.

2. COMMUNITY DEVELOPMENT CODE

This section discusses the results of reviewing SHMC Title 17 Community Development Code.

2.1 GENERAL AND LAND USE DEFINITIONS (17.16.010)

Title 17 of the SHMC defines specific infrastructure as "Public Facility, Minor" with all undefined infrastructure being a "Public Facility, Major." It is recommended that sanitary sewer force mains and pump stations be excluded from the list of minor public facilities. Additionally, the City should refer to Section 3.10.2 for a list of facilities that are recommended to require special review and approval.

2.2 SANITARY SEWERS (17.152.090)

It is recommended that the City of St. Helen's include a provision at the end of 17.152.090 (2). The provision should require that all sanitary sewers be designed and constructed to meet the requirements of St. Helens Municipal Code Title 18 Engineering Standards Manual.

2.2.1 Oversizing (3)

Title 17 of the SHMC requires that proposed sewer systems consider additional development within the area as projected by the St. Helens comprehensive plan. It is recommended that the City include a reference to the current St. Helens Wastewater Master Plan in this section.

3. ENGINEERING STANDARDS MANUAL

This section discusses the results of reviewing St. Helens Municipal Code Title 18 Engineering Standards Manual.

3.1 SCHEDULING (18.24.010)

The scheduling section of St. Helen's Engineering Standards Manual recommends temporary diverting flow around a new structure "by installing a section of temporary pipe and 45-degree bends around the new manhole and backfilling until testing is completed to the City's satisfaction." It is recommended that the City remove this recommendation and replace it with "the design of wastewater diversion piping and/or bypass pumping shall be the responsibility of the Contractor subject to City approval."

3.2 INTERFERENCES AND OBSTRUCTIONS (18.24.030)

This section adequately defines precautions construction crews should take to retain and protect existing underground utilities during construction. It is recommended that the City use this section to define separation requirements between overhead utilities and the construction equipment or materials. The following separation between equipment and powerlines are required by the Occupational Safety and Health Administration (OSHA):

- < 50 kV line: 10 feet
- 50 – 200 kV line: 15 feet
- 200 – 350 kV line: 20 feet
- 350 – 500 kV line: 25 feet
- 500 – 759 kV line: 35 feet

3.3 PERMANENT SURVEY MONUMENTS (18.24.040)

For additional clarity, it is recommended that the City add a reference to Oregon Revised Statutes (ORS) 209.150 Removal or Destruction of Survey Monument.

3.4 MATERIALS (18.24.050)

The beginning of SHMC Title 18 Engineer Standards Manual states that all sewers shall be designed and constructed to conform to the requirements of the Oregon Department of Environmental Quality (DEQ), the American Public Works Association (APWA), and the City of St. Helens. It is recommended that the City use section 18.24.050 to direct the reader directly to the applicable APWA material specifications. These can be found in ODOT/APWA (Oregon Standard Specifications for Construction (OSSC)). Section 00405 contains specifications for trench excavation, bedding, and backfill.

3.5 GENERAL (18.24.080)

Similar to the recommendations made in the section above, It is recommended that the City add a reference to ODOT/APWA Specifications (OSSC), Section 00405.

3.6 SEWAGE FLOWS (18.24.100)

Requiring sewer facilities to be constructed for conveyance of projected peak flows is an important part of ensuring the City is prepared to handle future flows influenced by inflow and infiltration (I/I). In western Oregon, wastewater design flows are typically calculated in accordance with the DEQ document titled "*Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon: MMDWF, MMWWF, PDAF, and PIF*". These design flows serve as the basis for sizing collection, conveyance, and treatment facilities. The most recently adopted Wastewater Master Plan should provide the following design flows:

- Average Annual Daily Flow (AADF) – The average annual daily flow for the entire year
- Average Dry-Weather Flow (ADWF) – The average daily flow for the period of May 1 through October 31
- Average Wet-Weather Flow (AWWF) – The average daily flow for the period of November 1 through December 31
- Maximum Monthly Dry-Weather Flow ($MMDWF_{10}$) – The flows during the month with the highest flow during the summer months
- Maximum Monthly Wet-Weather Flow ($MMWF_5$) – The flows during the month with the highest flow during the winter months
- Peak Week Flow (PWkF) – The maximum of the average 7-day flow
- Peak Daily Average Flow ($PDAF_5$) – The peak daily average flow during a 5-year storm event
- Peak Instantaneous Flow (PIF_5) – The peak instantaneous flow recorded at the wastewater treatment plant (WWTP)

It is recommended that hydraulic calculations be performed to ensure that pipe size is adequate for conveying PIF_5 flows at full development of the drainage basin in accordance with the current adopted Wastewater Master Plan including all applicable amendments and updates. At the time of this technical memorandum, in accordance with the draft Wastewater Master Plan, pipe size should be adequate for conveying PIF_5 at full development of the basin with pipe flow no more than 85% full depth (d/D). Capacity shall be based on Manning's Equation with "n" = 0.013. This can be noted in SHMC Title 18, Section 18.24.100, which pertains to sewage flows.

3.7 PIPE DESIGN (18.24.110)

Recommendations regarding pipe design on steep slopes, pipe cover, and sanitary sewers in the vicinity of water supplies can be found below.

3.7.1 Steep Slopes (4)

The City's current design documents do not provide guidance on a gravity pipe's maximum velocity. It is recommended the City add a provision requiring pipes where the velocity is greater than 15 feet per second be ductile iron or other material as approved by the City Engineer. Special provisions should be made to protect manholes against erosion and displacement by hydraulic forces. This may include splitting a 90 degree horizontal direction change into two 45 degree incremental changes

3.7.2 Pipe Cover (5)

Current City standards dictate that minimum cover of pipes are as follows:

- Non-reinforced pipe – 36 inches
- Ductile iron – 18 inches

With the measurement points varying depending on the land use directly above the pipe. These requirements provide adequate cover to preserve a pipe's structural integrity; however, there are other items to consider.

It is recommended that all sewers be laid at a depth sufficient to drain (by gravity) the lowest elevation of existing, proposed, and future building sewers to protect against damage by frost or traffic. Depth is measured from the top of the pipe to finish grade at the sewer alignment. Under normal conditions, sewers in residential areas are recommended to be placed under the street with the following minimum depths:

- Main sewers – 6 feet
- Collector, trunk, and interceptor sewers – 8 feet

Sewer serving non-residential developments or residential developments where recommended depths are not attainable should be permitted on an as-approved basis by the City Engineer.

3.7.3 Sanitary Sewer in Vicinity of Water Supplies (6)

The City has published guidance on designing and constructing sanitary sewer lines in the vicinity of water supplies; however, some of the guideline's conflict with Oregon Administrative Rules (OAR) Chapter 333-061-0050. Per St. Helens Engineering Standards Manual, "No sanitary sewer shall be less than 10 feet from any well, spring, or other source of domestic water supply." Per OAR Chapter 333, "no gravity sewer line or septic tank shall be permitted within 50 feet of a well which serves a public water system." It is recommended that the City either 1) revise this section to be in accordance with OAR Chapter 333 or 2) delete this section and replace it with a reference to OAR 333.

3.8 MANHOLE DESIGN (18.24.120)

Manhole design provisions currently state that "manholes shall be provided at least every 400 feet, at every change in alignment, and at every grade change. A manhole shall be located at the upstream end of the pipe except as allowed in SHMC 18.24.130." It is recommended that the maximum distance be reduced from 400 feet to 300 feet. Additionally, it is recommended that the City amend this list to include "at every point where there is a change in pipe size, at each intersection or junction of a sewer, and at any point where an 8-inch diameter or larger private sewer intersects with the public sewer." In general, it is good practice to install manholes in street intersections whenever feasible.

The current minimum manhole size required by the City is 48-inches. It is recommended that minimum manhole diameters be sized based off the diameter of pipes entering the manhole, as shown in Table 3-1.

TABLE 3-1: MINIMUM MANHOLE SIZE

Manhole Interior Diameter (inches)	Maximum Pipe Size with 0 degrees deflection (inches)	Maximum Pipe Size with 90 degrees deflection (inches)
48	18	15
60	30	18
72	42	30
84	54	36

3.9 ADDITIONAL RECOMMENDATIONS

3.9.1 Stream and Creek Crossings – Engineering

The City's current standards provide provisions for contractors constructing stream and creek crossings, but do not provide provisions for designing stream and creek crossings.

It is recommended that, generally, the top of all sewers entering or crossing streams shall be a minimum of three feet below the stream bed and at a sufficient depth below the streambed to protect the sewer main. Inverted siphons shall not be allowed at stream or drainage crossings. Concrete encasement may be required in other cases dependent on soil types, depth of cover, and streambed characteristics.

Sewers located parallel to streams shall be located outside of the streambed and sufficiently removed from the streambed to provide for future possible stream channel widening and in accordance with applicable City code requirements for waterway and riparian area protection.

Sewers crossing streams or drainage channel shall be designed to cross the stream as nearly perpendicular to the stream channel as possible and at a uniform grade. Pipe material shall be DI class 50 with an 18-foot length of pipe centered on the stream or drainage channel centerline. The DI pipe shall extend to a point where a one-to-one slope, which begins at the top of the bank and slopes down from the bank away from the channel centerline, intersects the top of the pipe.

Pipes crossing larger streams or creeks shall be subject special review and approval.

3.9.2 Facilities Not Addressed in Standards

It is recommended that the City add a section to St. Helens Municipal Code Title 18 Engineering Standards Manual in which sanitary sewer 'special' facilities are defined. City engineer standards are generally not intended to address the requirements for all possible public or private facilities. Facilities not addressed in these standards are considered unique and must be designed to meet site specific criteria. For these types of facilities, the design engineer must request a pre-design meeting with the City to review the appropriate design and operation and maintenance (O&M) criteria that will apply to the specific project prior to submittal of any design reports or plans.

The following are examples of facilities that are recommended to require special review and approval:

- Sewer Force Mains
- Relining of Existing Sewers
- Internal Sealing of Existing Sewers
- Wastewater Regulatory Devices
- Wastewater Pump Stations

- Sewer Siphons
- Wastewater Treatment Plants
- Wastewater Flow Measurement/Monitoring Devices
- Stream Crossings
- Extension of Municipal Sewer Service Outside the Urban Growth Boundary

4. COMPREHENSIVE PLAN

There are no recommendations for sanitary sewer provisions in the SHMC Title 19 Comprehensive Plan.

APPENDIX D

Pump Station Pump Curves

PUMP STATION 1 PUMP CURVE

06/12/2007 14:20 503-241-0399 PACO PUMPS PORTLAND PAGE 06

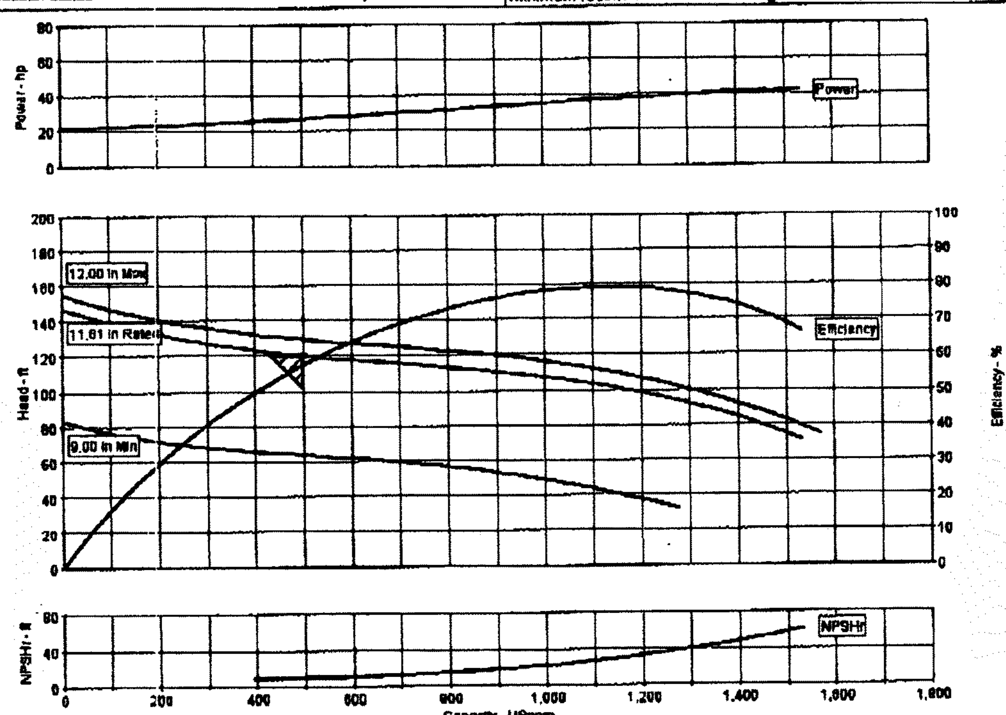
PACO. PUMPS Paco Express 5.0.9.127

Pump Performance Datasheet

Customer	:	Quote number	:
Customer reference	:	Pump size	: 401221 QDSC
Item number	:	Stages	: 1
Service	:	Based on curve number	: RC9869-2 Rev 0
Quantity of pumps	: 1	Date last saved	: 12 Jun 2007

Operating Conditions		Liquid	
Flow, rated	: 500 USgpm	Liquid type	: Water
Head, rated (requested)	: 120 ft	Additional liquid description	:
Head, rated (actual)	: 120 ft	Solids diameter, max	: 0.00 in
Suction pressure, rated / max	: 0.00 / 0.00 psi.g	Temperature, max	: 68.00 deg F
NPSH available, rated	: Ample	Fluid density, rated / max	: 0.998 / 0.998 SG
Frequency	: 60 Hz	Viscosity, rated	: 1.00 cP

Performance		Material	
Speed	: 1,750 rpm	Material requested	: Cast iron
Impeller diameter, rated	: 11.61 in	Material selected	: Cast iron
Impeller diameter, maximum	: 12.00 in	**Pressure Data**	
Impeller diameter, minimum	: 9.00 in	Maximum working pressure	: 63.42 psi.g
Efficiency	: 57.37 %	Maximum allowable working pressure	: 175.0 psi.g
NPSH required / margin required	: 8.60 / 0.00 ft	Maximum allowable suction pressure	: 175.0 psi.g
Specific speed / Suction specific speed	: 1,747 / 4,740 US units	Hydrostatic test pressure	: 263.0 psi.g
MCSF	: 144 USgpm	**Driver & Power Data**	
Head, maximum, rated diameter	: 147 ft	Driver sizing specification	: Rated power
Head rise to shutoff	: 22.12 %	Margin over specification	: 0.00 %
Flow, best eff. point (BEP)	: 1,134 USgpm	Service factor	: 1.00
Flow ratio (rated / BEP)	: 44.09 %	Power, hydraulic	: 15.1 hp
Diameter ratio (rated / max)	: 96.75 %	Power, rated	: 26.4 hp
Head ratio (rated dia / max dia)	: 92.82 %	Power, maximum, rated diameter	: 41.4 hp
Viscous coefficients (CQ / CH / CE)	: 1.00 / 1.00 / 1.00	Minimum recommended driver rating	: 30.0 hp / 22.4 kW
Selection status	: Acceptable		



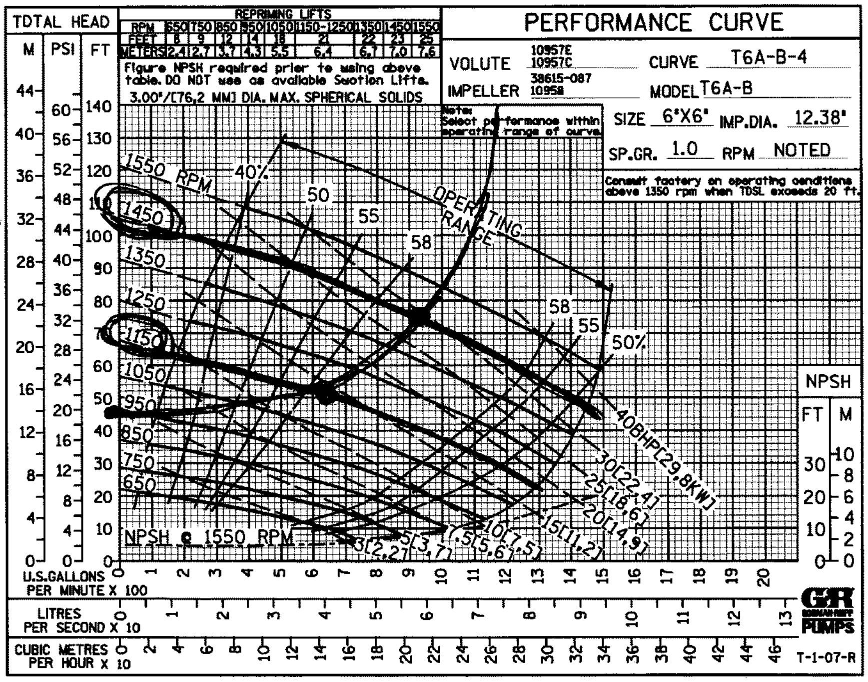
PUMP STATION 2 PUMP CURVE

Tested Pump #1 & #2 on 9/18/12

T SERIES OM—01046

PUMP MAINTENANCE AND REPAIR — SECTION E

MAINTENANCE AND REPAIR OF THE WEARING PARTS OF THE PUMP WILL MAINTAIN PEAK OPERATING PERFORMANCE.



* **STANDARD PERFORMANCE FOR PUMP MODEL T6A3-B, Including /F, /FM**

*Based on 70° F (21° C) clear water at sea level with minimum suction lift. Since pump installations are seldom identical, your performance may be difference due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

If your pump serial number is followed by an "N", your pump is **NOT** a standard production model.

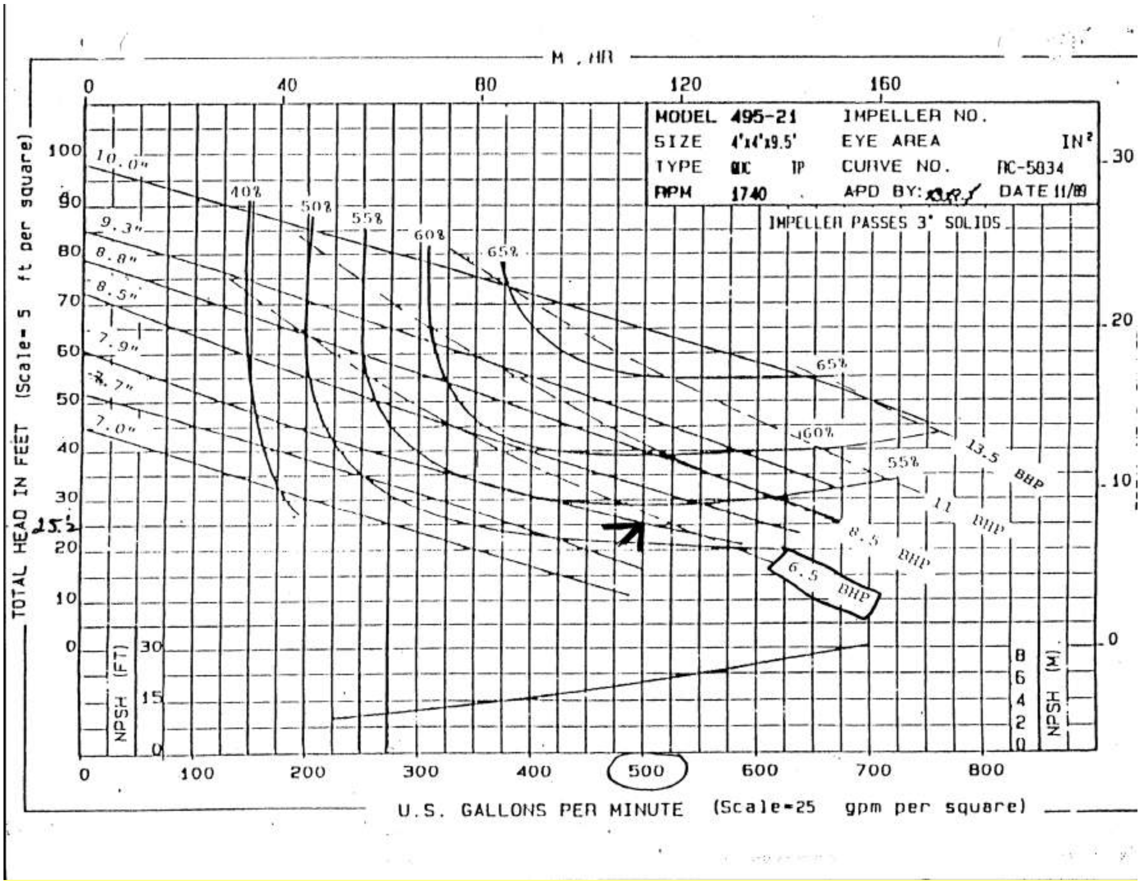
Contact the Gorman-Rupp Company to verify performance or part numbers.

CAUTION

Pump speed and operating condition points must be within the continuous performance range shown on the curve.

MAINTENANCE & REPAIR **PAGE E — 1**

PUMP STATION 3 PUMP CURVE

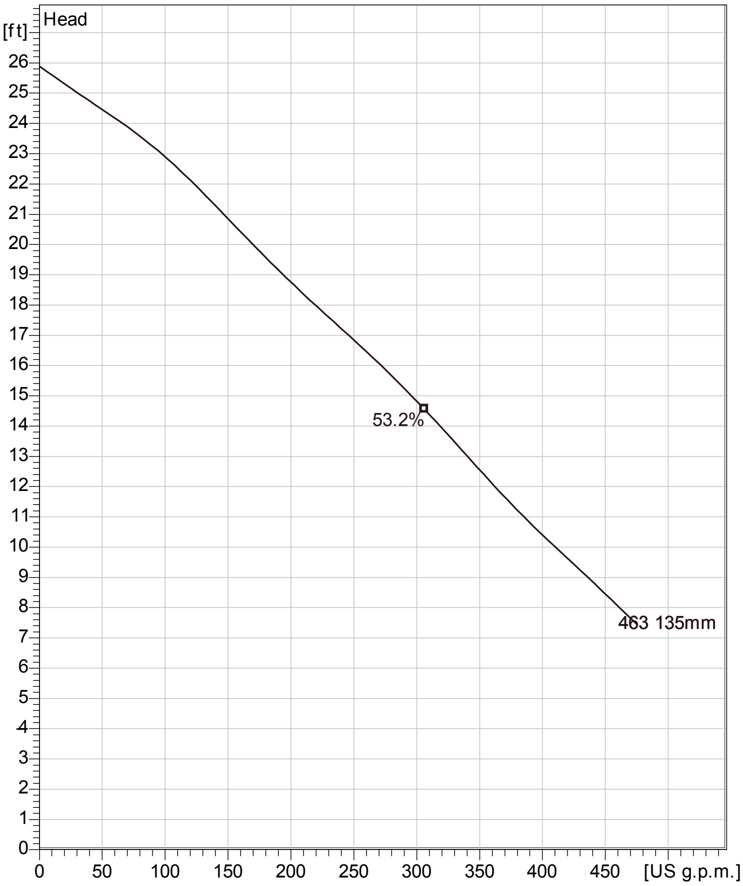


PUMP STATION 4 PUMP CURVE

See next page.

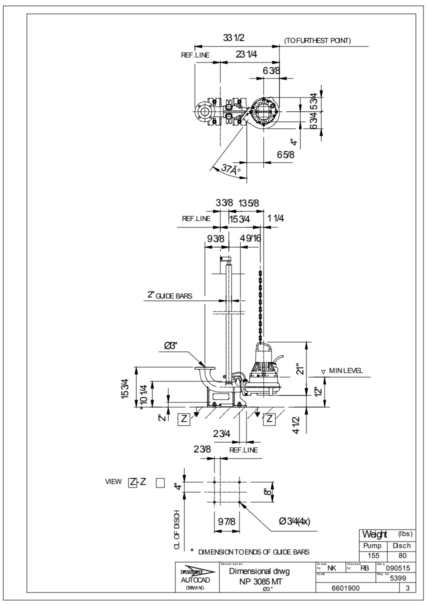
NP 3085 MT 3~ 463

Technical specification



Curve according to: ISO 9906

Installation: P - Semi permanent, Wet



Note: Picture might not correspond to the current configuration.

General

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.

Impeller

Impeller material	Grey cast iron
Outlet width	3 1/8 inch
Inlet diameter	111 mm
Impeller diameter	135 mm
Number of blades	2

Motor

Motor #	N3085.092 15-10-4AL-W
Stator variant	
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	3 hp
Rated current	4.3 A
Starting current	22 A
Rated speed	1700 rpm
Power factor	
1/1 Load	0.83
3/4 Load	0.77
1/2 Load	0.66
Efficiency	
1/1 Load	78.0 %
3/4 Load	79.0 %
1/2 Load	77.0 %

Configuration

Project	Project ID	Created by	Created on	Last update
			2012-05-18	

NP 3085 MT 3~ 463

Performance curve

Pump

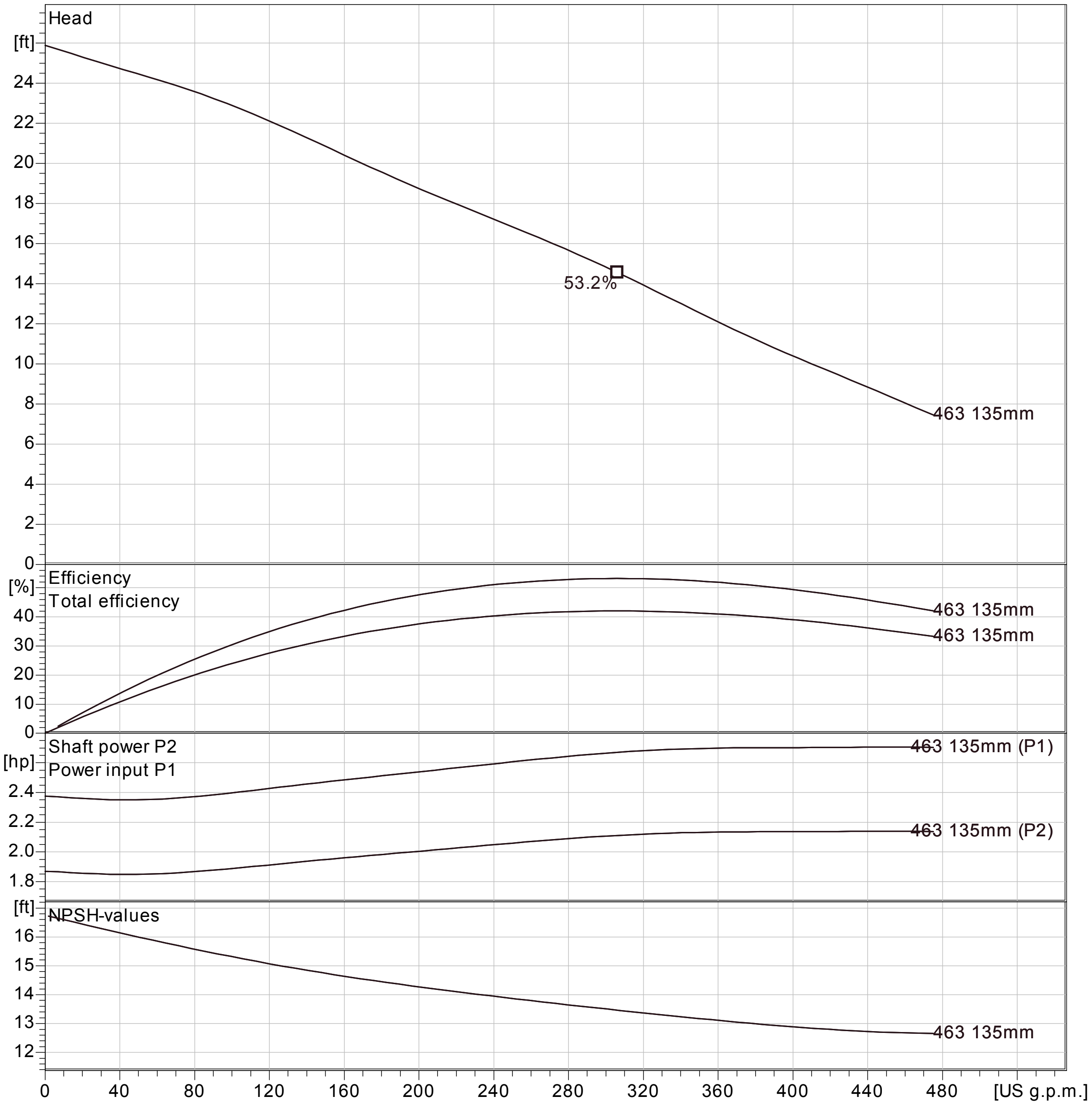
Outlet width	3 1/8 inch
Inlet diameter	111 mm
Impeller diameter	5 5/16"
Number of blades	2

Motor

Motor #	N3085.092 15-10-4AL-W
Stator variant	
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	3 hp
Rated current	4.3 A
Starting current	22 A
Rated speed	1700 rpm

Power factor	
1/1 Load	0.83
3/4 Load	0.77
1/2 Load	0.66

Efficiency	
1/1 Load	78.0 %
3/4 Load	79.0 %
1/2 Load	77.0 %

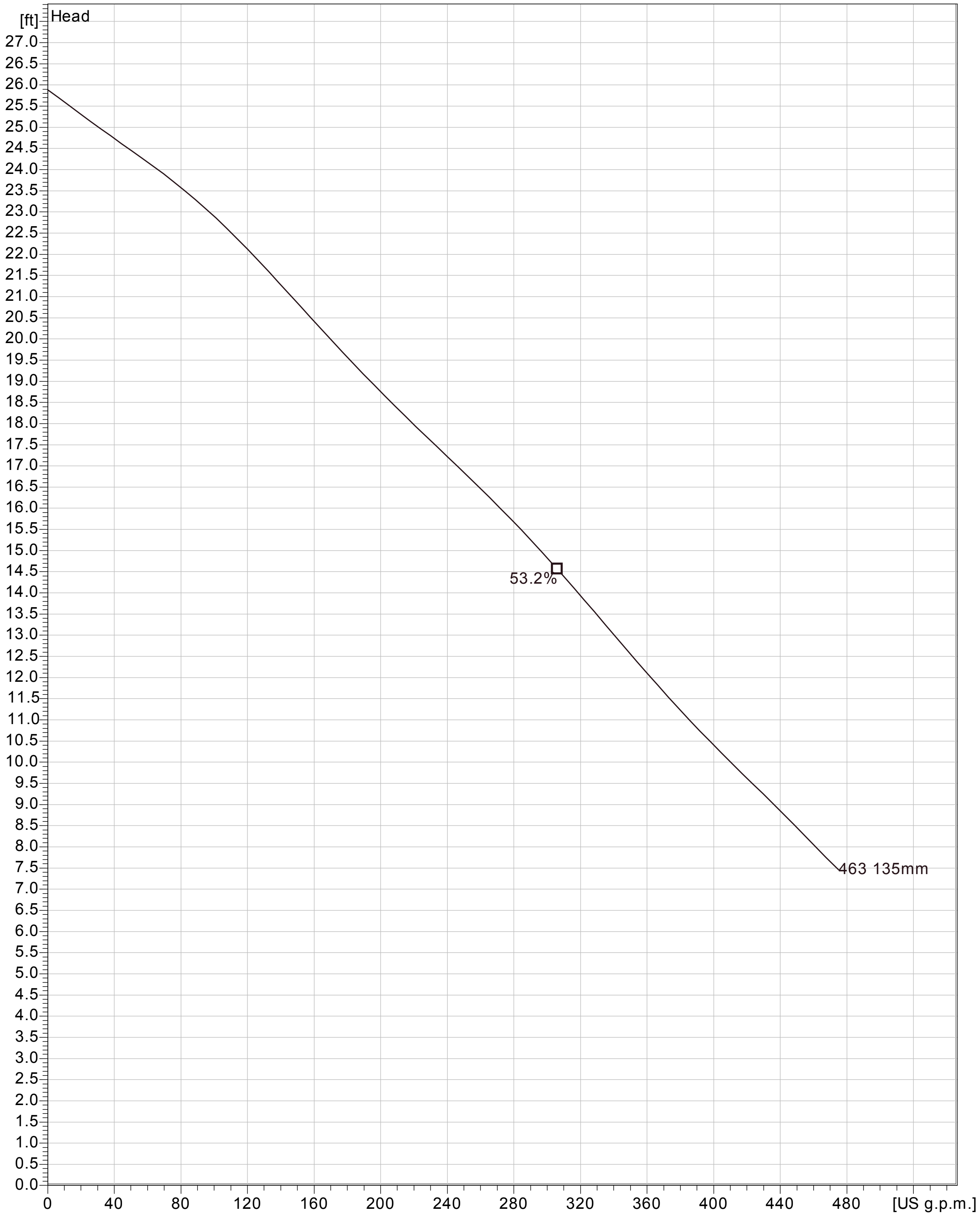


Curve according to: ISO 9906

Project	Project ID	Created by	Created on	Last update
			2012-05-18	

NP 3085 MT 3~ 463

Duty Analysis

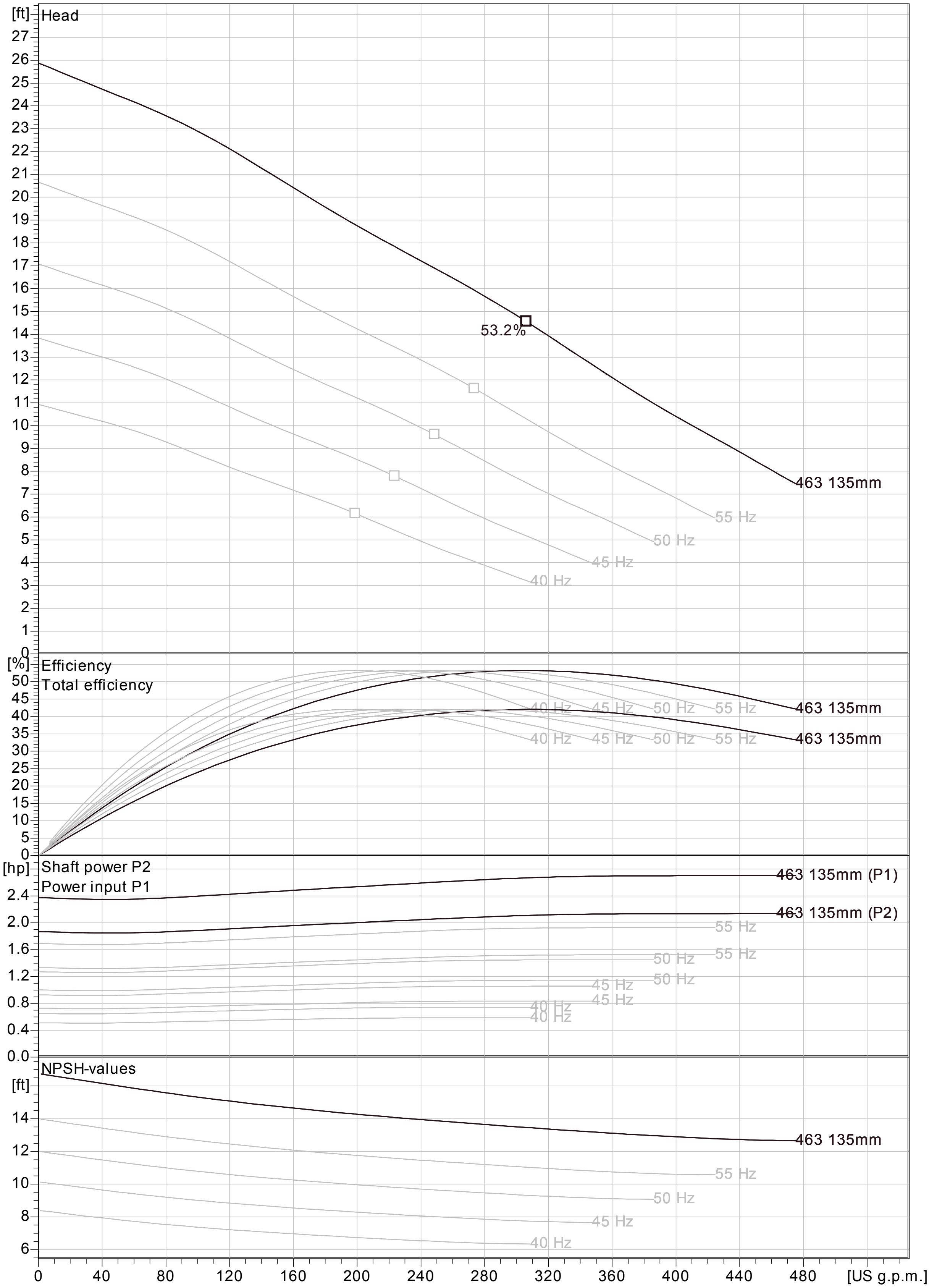


Curve according to: ISO 9906

Project	Project ID	Created by	Created on	Last update
			2012-05-18	

NP 3085 MT 3~ 463

VFD Curve

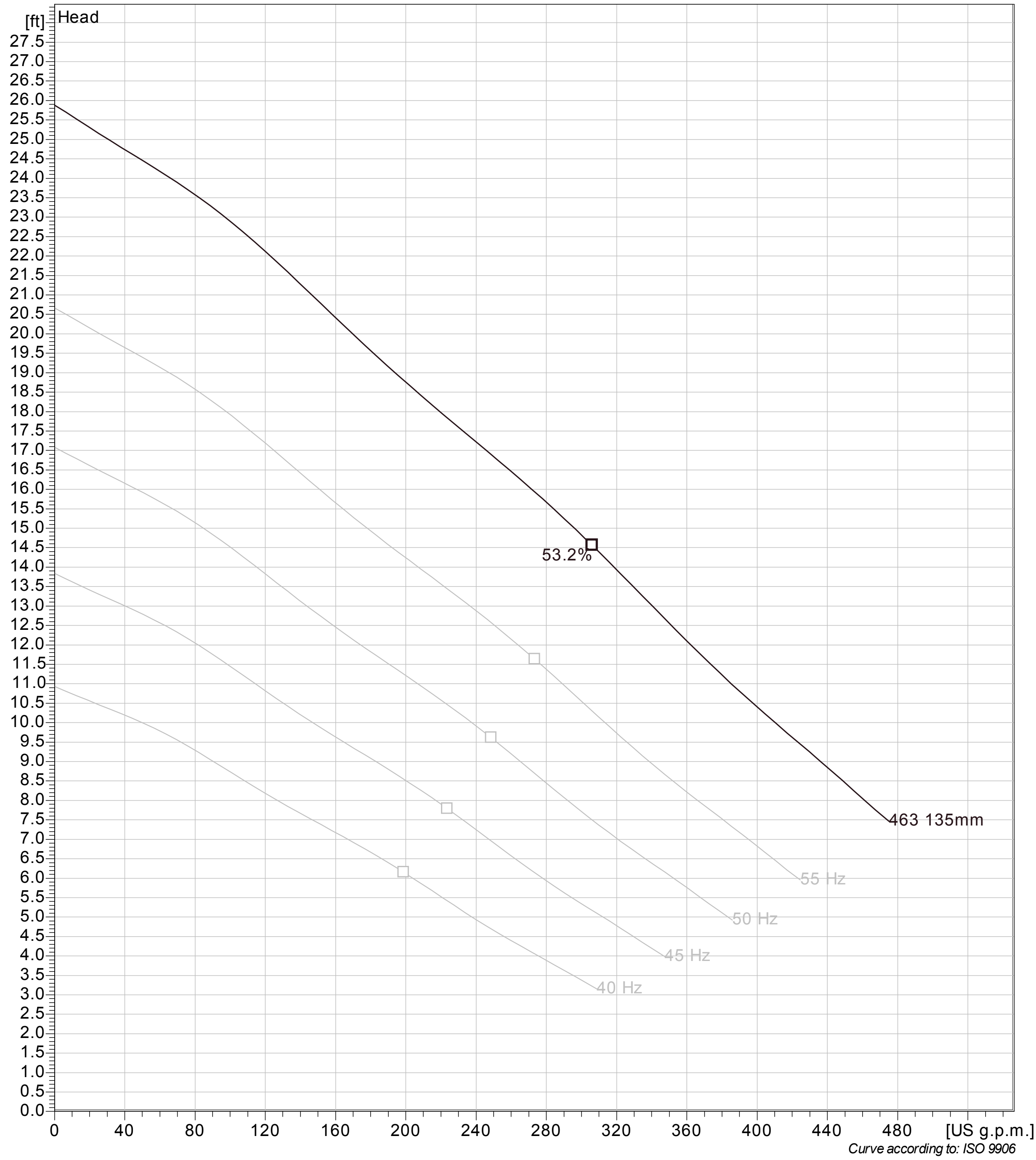


Curve according to: ISO 9906

Project	Project ID	Created by	Created on	Last update
			2012-05-18	

NP 3085 MT 3~ 463

VFD Analysis

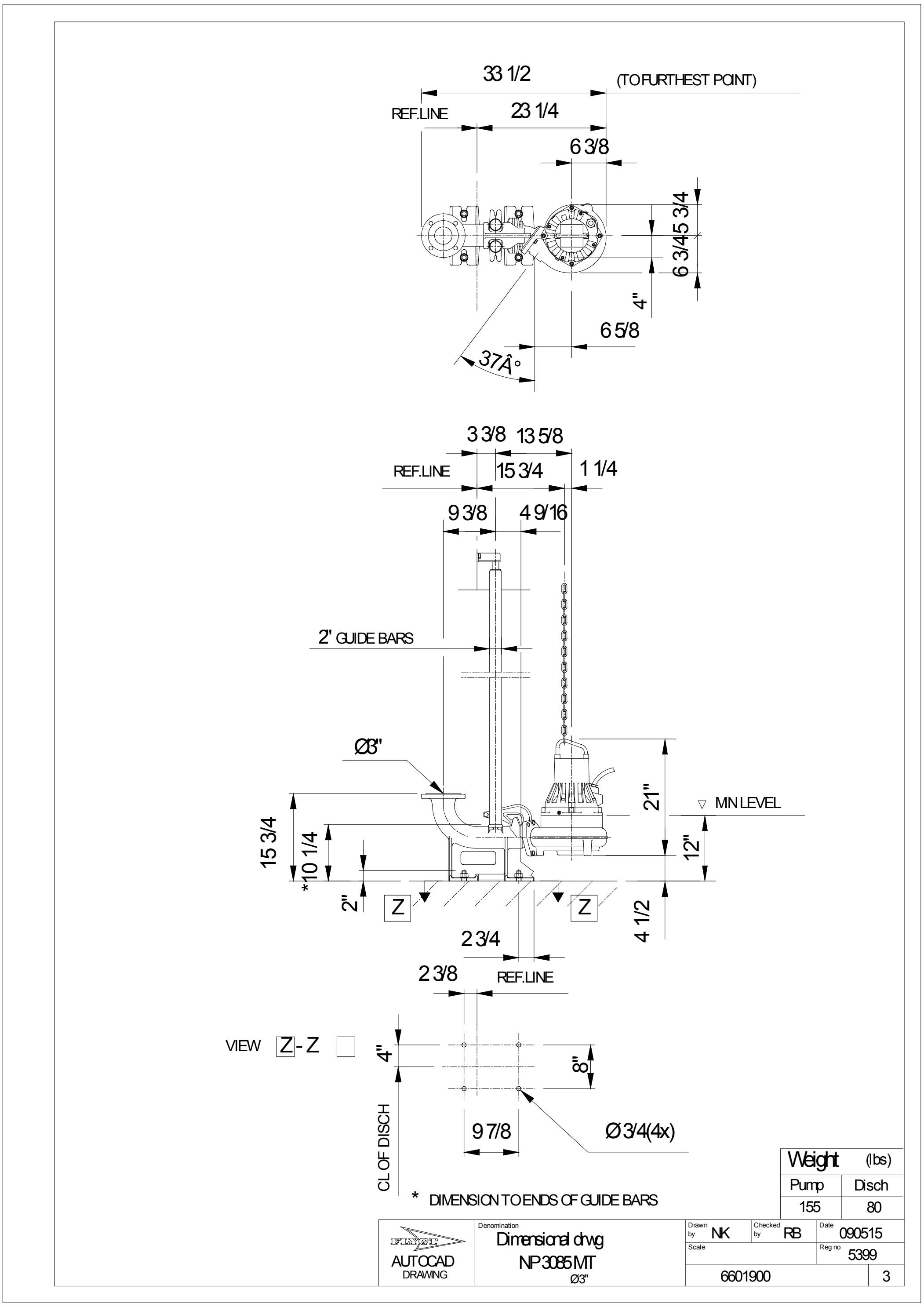


60 Hz 55 Hz 50 Hz 45 Hz 40 Hz

Project	Project ID	Created by	Created on	Last update
			2012-05-18	

NP 3085 MT 3~ 463

Dimensional drawing



Project	Project ID	Created by	Created on	Last update
			2012-05-18	

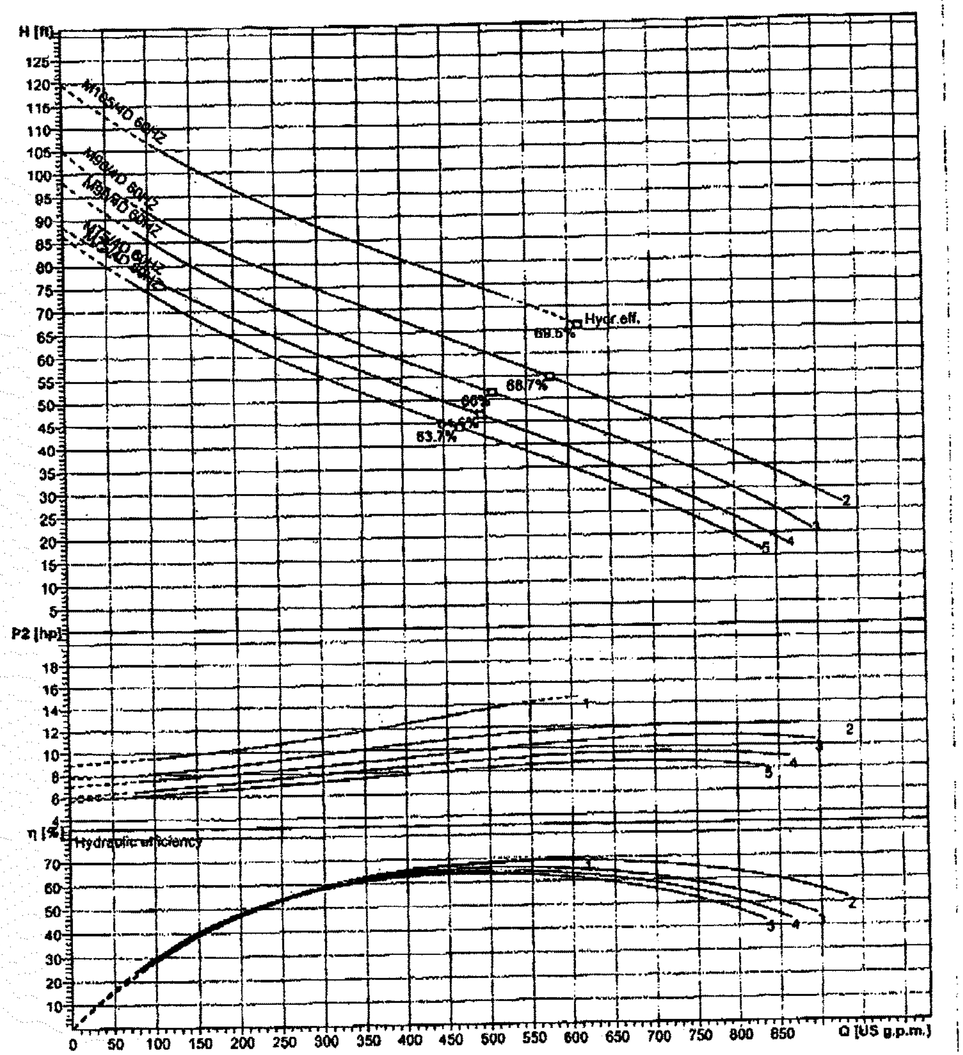
PUMP STATION 5 PUMP CURVE

12-07-'11 14:05 FROM-PUMPTECH, INC 503-659-8718 T-724 P0008/0008 F-006

ABS
COST-EFFECTIVE PUMPING

Pump performance curves
AFP 1049 60 HZ

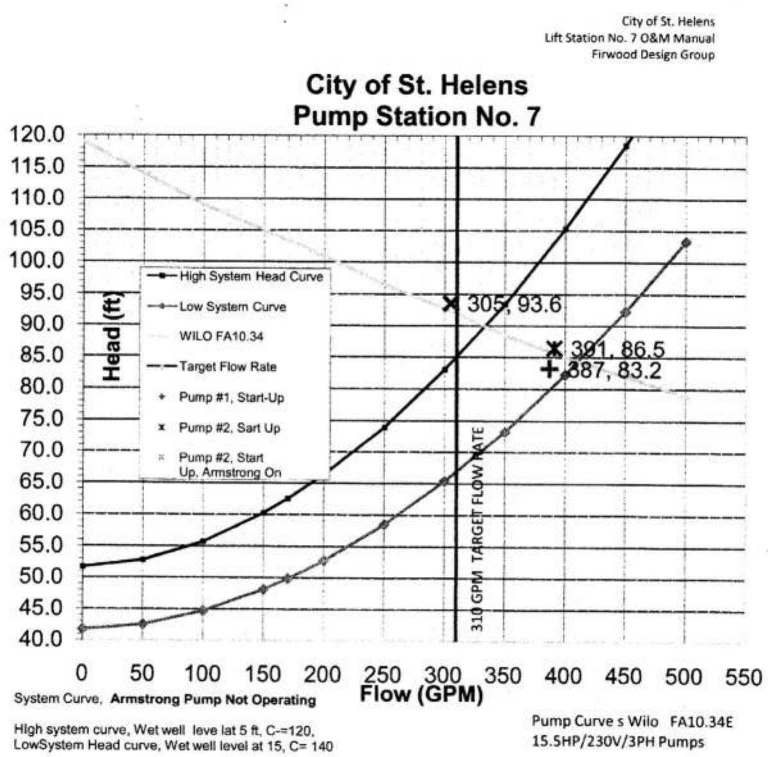
				Curve number
				Reference curve AFP 1049
			Discharge 4"	Frequency 60 Hz
Density 1 kg/dm³	Viscosity 1.562 cSt	Testnorm Hydraulic Institute	Rated speed 1735..1700 rpm	Date 2004-06-04
Flow	Head	Rated power	Hydraulic efficiency	NPSH



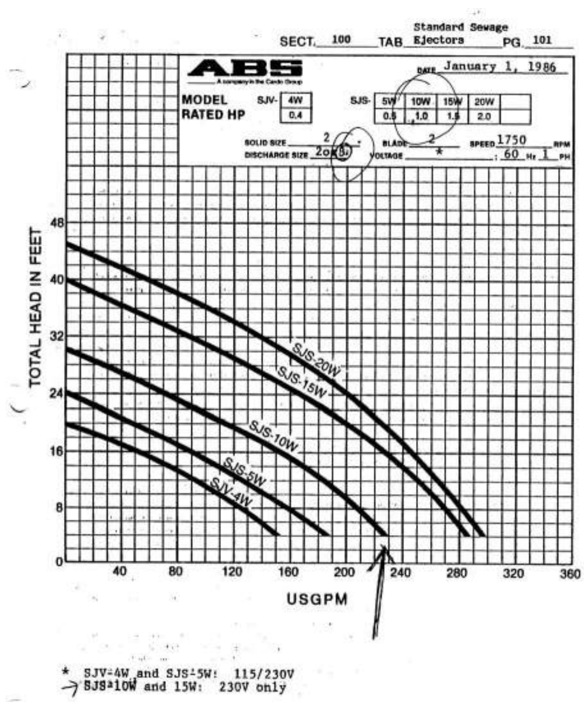
Impeller size 253..224 mm	N° of vanes 1	Impeller ContraBlock impeller, 1 vane	Solid size 3-1/8"	Revision 2002-12-10
				ABSELPRO 1.7.1 / 2004-03-08

ABS reserves the right to change any data and dimensions without prior notice and can not be held responsible for the use of information contained in this software.

PUMP STATION 7 PUMP CURVE



PUMP STATION 8 PUMP CURVE



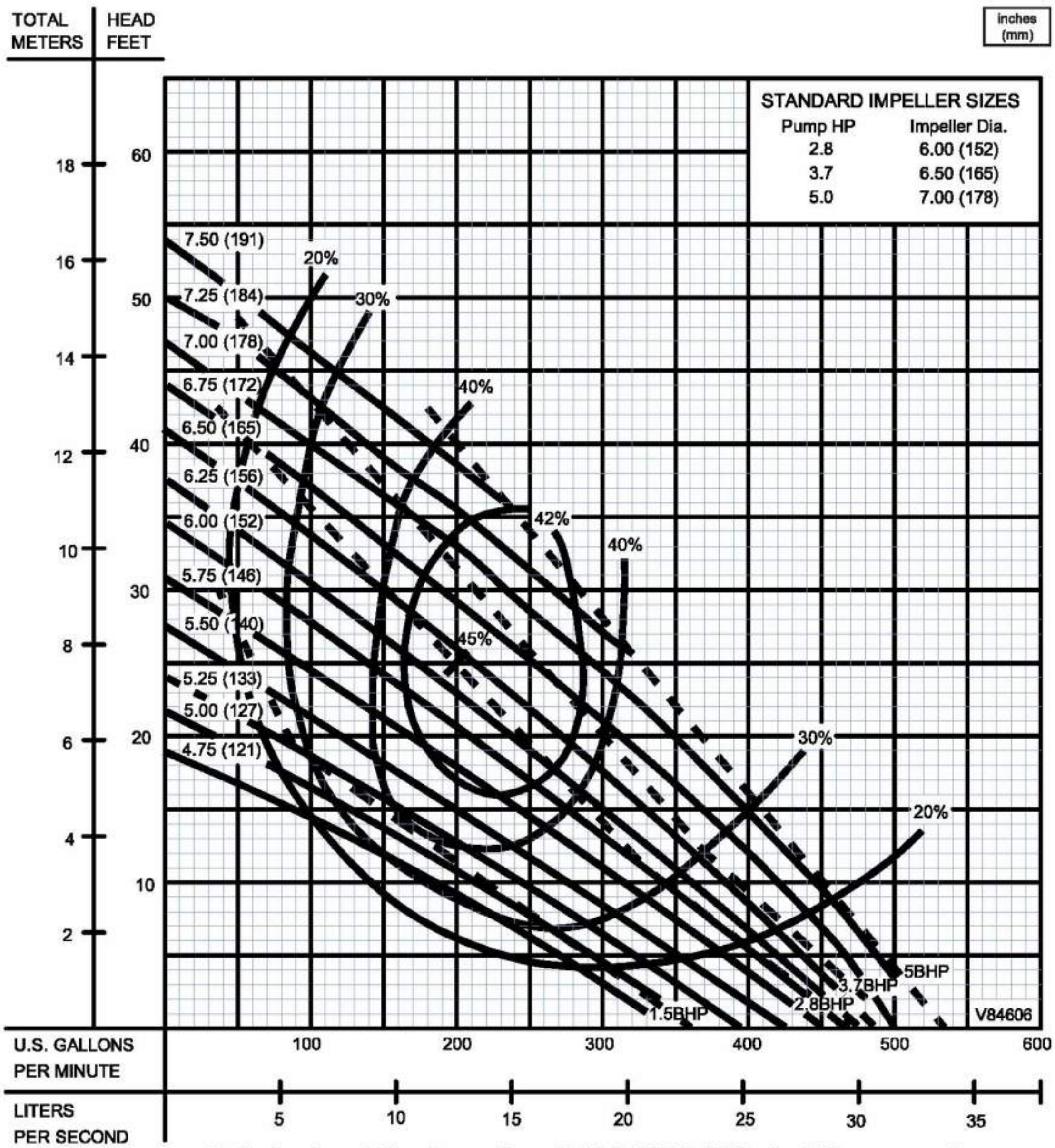
PUMP STATION 9 PUMP CURVE

Series 4SE-L

Performance Curve
2.8, 3.7 & 5.0HP, 1750RPM, 60Hz

BARNES®
www.cranepumps.com

4" Horizontal Discharge - Submersible Non-Clog Pumps



Testing is performed with water, specific gravity 1.0 @ 68° F @ (20°C), other fluids may vary performance

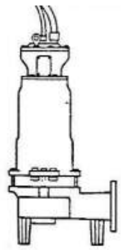
SECTION 1D
PAGE 10
DATE 1/05

CRANE®
A Crane Co. Company

PUMPS & SYSTEMS

USA: (937) 778-8947 • Canada: (905) 457-6223 • International: (937) 615-3598

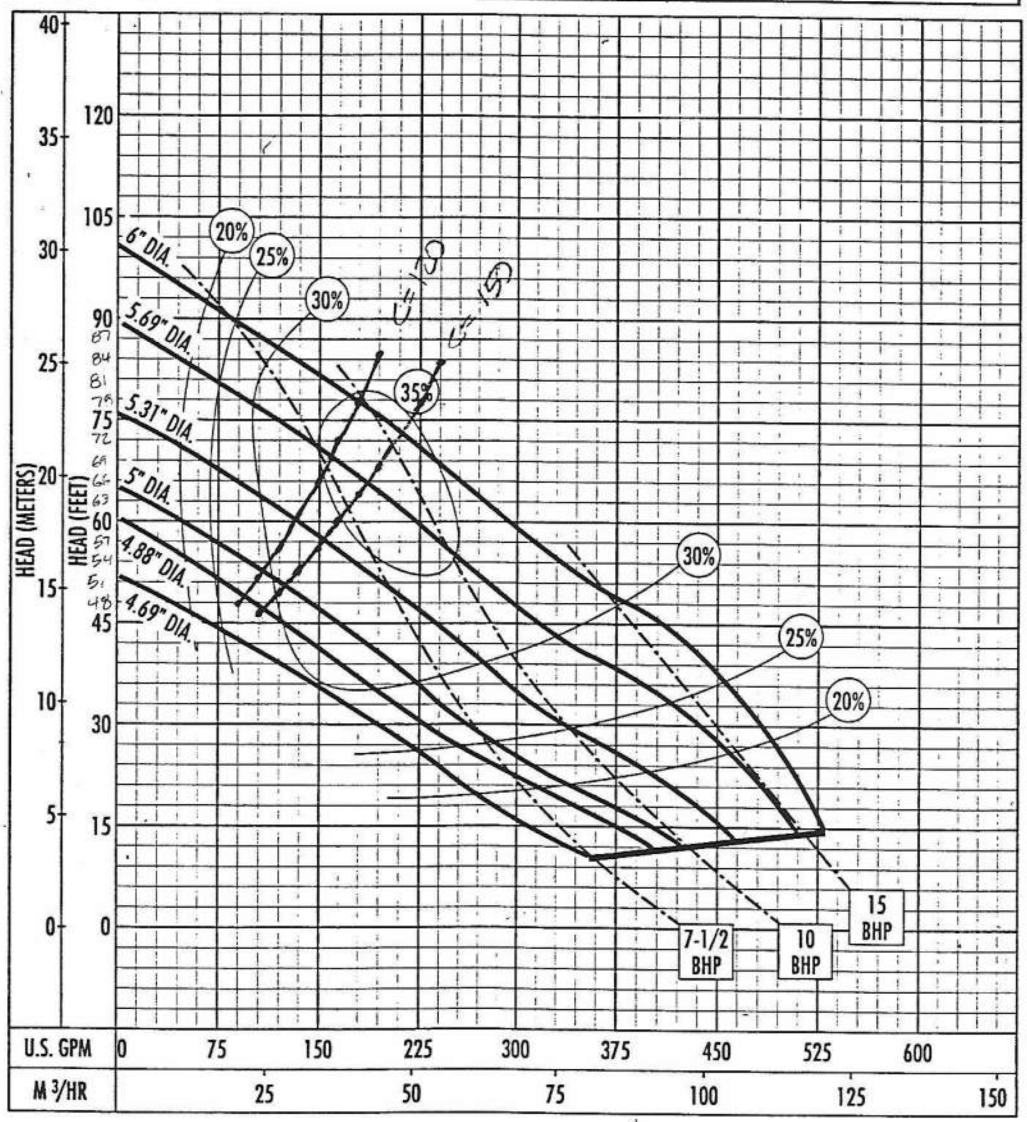
PUMP STATION 11 PUMP CURVE



Section VORTEX Page 103
Dated SEPTEMBER 1993

Performance Curve S4HRC/S4HVX

RPM: **3450** Discharge: **4"** Solids: **3"**



The curves reflect maximum performance characteristics without exceeding full load (Nameplate) horsepower. All pumps have a service factor of 1.2. Operation is recommended in the bounded area with operational point within the curve limit. Performance curves are based on actual tests with clear water at 70° F. and 1280 feet site elevation.

Conditions of Service:

GS AURORA PUMP A UNIT OF GENERAL SIGNAL

GPM: 143 TDH: 74

HYDROMATIC™ PUMPS

APPENDIX E

City Identified Wastewater Issues

KELLER ASSOCIATES

LIST OF KNOWN SEWER ISSUES:

- PLUG UP/ BACK UP AT 214 S 8TH ST & 791 ST. HELENS ST
- PLUG UP / BACK UP AT 275 S 4TH ST
- PLUG UP / BACK UP AT 285 N 4TH ST
- SEWER & STORM OVERFLOW ISSUES AT 314 S 14TH ST
- PLUG UP / BACK UP AT 495 S 7TH ST
- SEWER ISSUES AT GODFREY PARK
- SEWER ISSUES IN CANYON BEHIND 208 S 9TH ST

SEWER ISSUES AT 214 S 8TH ST & 791 ST. HELENS ST

SEWER ISSUES AT 275 S 4TH ST

SEWER ISSUES AT 285 N 4TH ST

SEWER ISSUES AT 314 S 4TH ST/ MIDDLE TRUNK


SEWER ISSUES AT
495 N 7TH ST
N
424
435
445
444
8" CIPP
455
8" PVC
465
464
467
469
8" PVC
8" PVC
8" PVC
475
474
6" CIPP
495
484
497
S 8TH STREET
S 7TH STREET
PLYMOUTH STREET
0
40
80 Feet


SEWER ISSUES AT GODFREY PARK
N
N 4TH STREET
WYETH STREET
N 2ND STREET
N 3RD STREET
S 3RD STREET
COLUMBIA BOULEVARD
LUTHERAN CHURCH
CCMH
Godfrey Park
GODFREY PARK
COLUMBIA RIVER FIRE & RESCUE
LIQUOR STORE
KOZY KORNER
225
214
280
204
221
197
261
196
174
164
165
155
145
137
135
134
125
124
115
230
185
127
114
310
380
400
440
271
105
8" PVC
6" PVC
6" HDPE
6" VCP
24" PVC
30" CP
10" CP
0
70
140 Feet

SEWER ISSUES IN SEWER IN CANYON

APPENDIX F

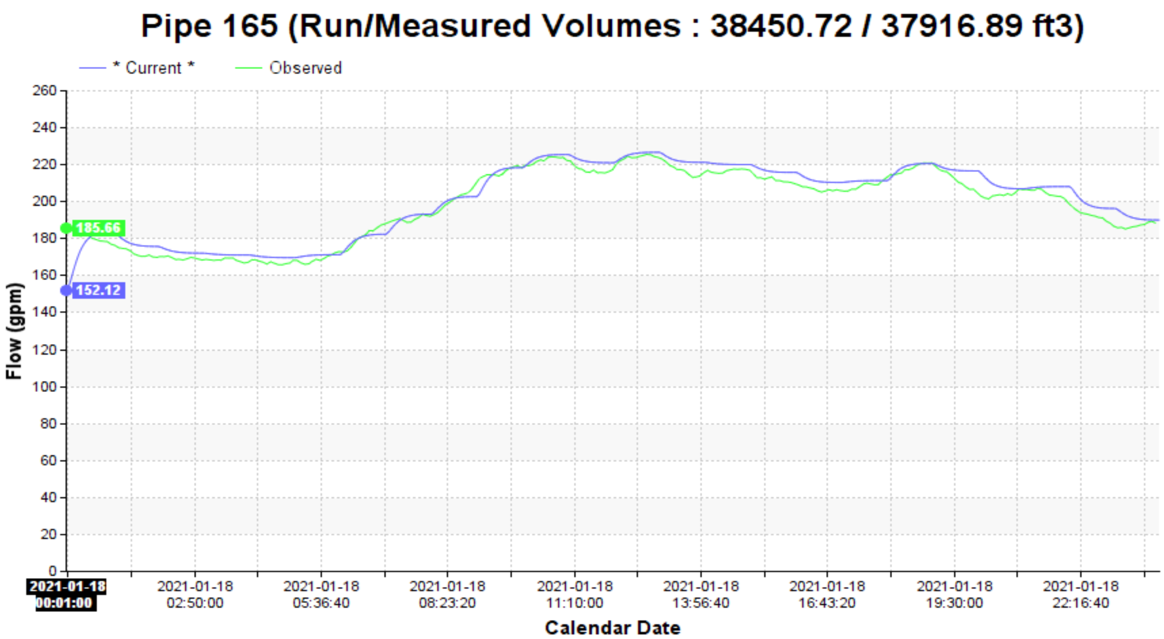
Calibration Information

KELLER ASSOCIATES

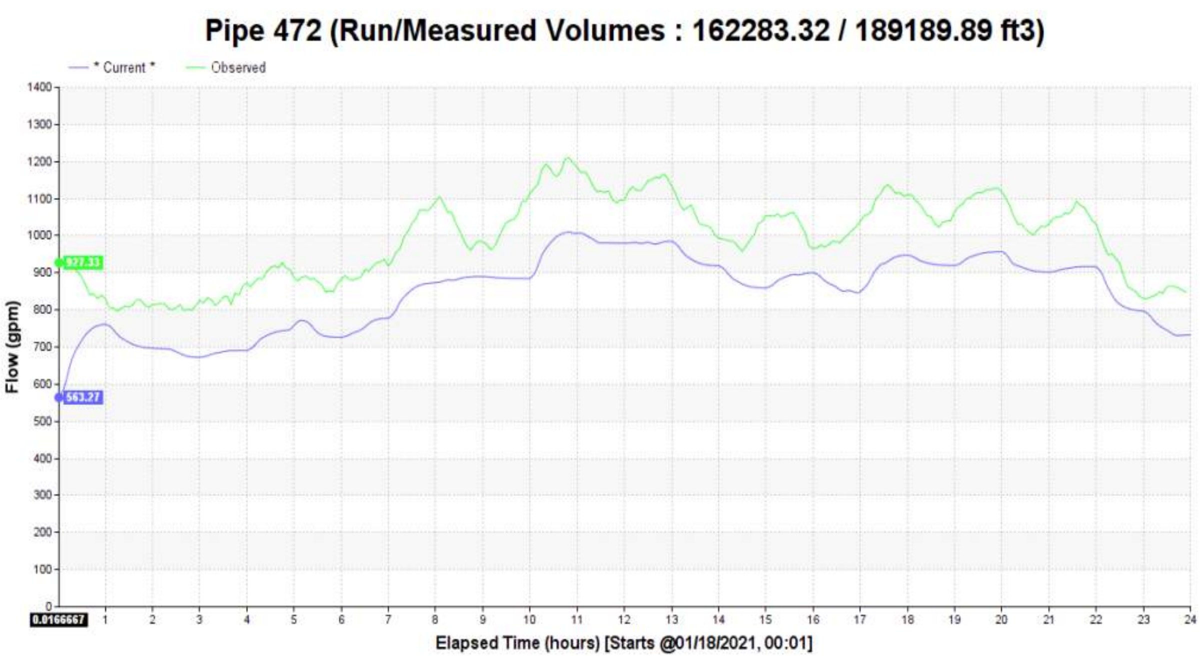
Note: For the following graphs, the green line represents observed flow data from the field, the blue line represents model output

Base Flow Calibration

Site 1 Calibration

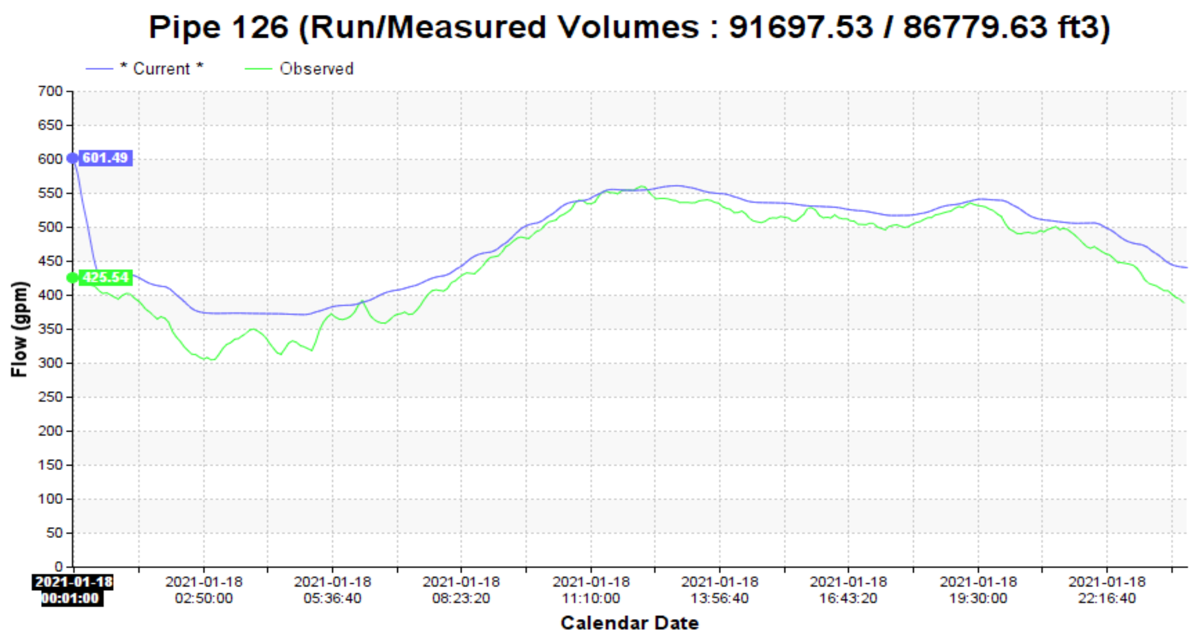


Site 2 Calibration



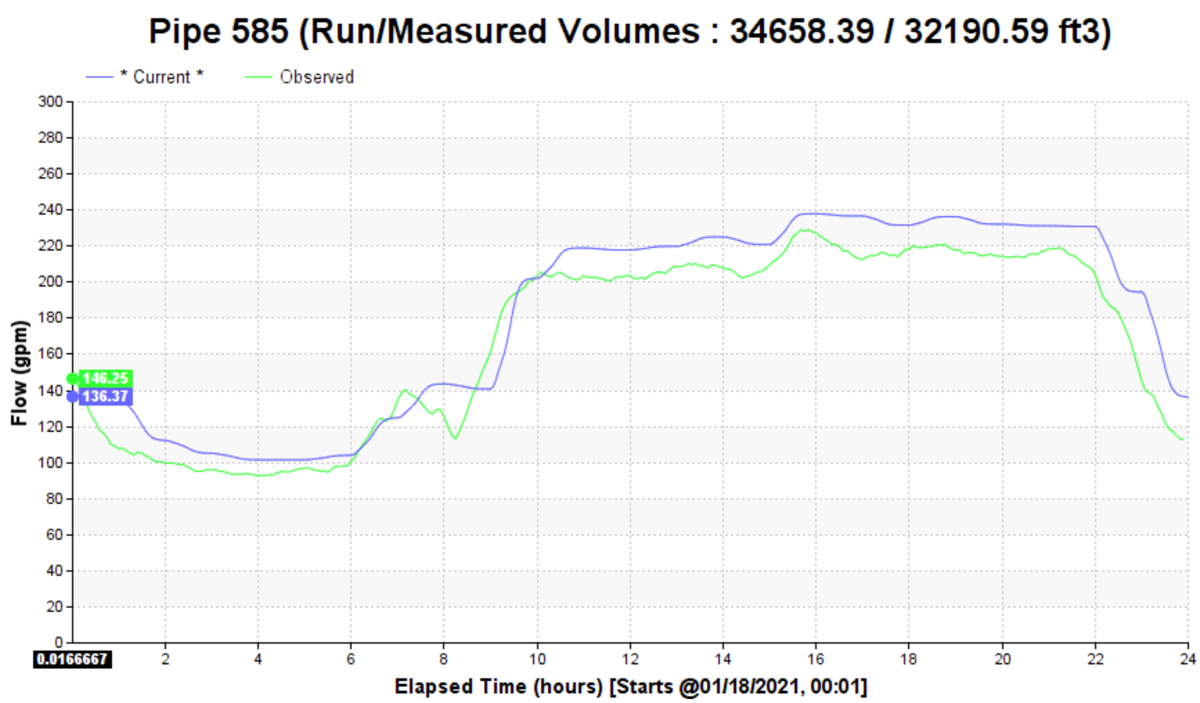
Base Flow Calibration

Site 3 Calibration



Base Flow Calibration

Site 4 Calibration

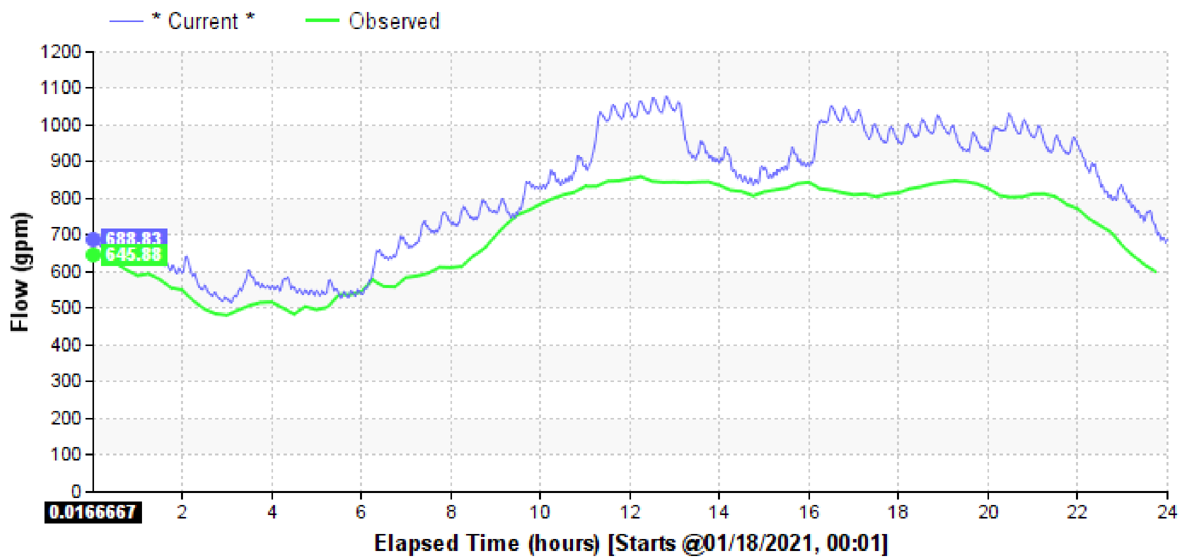


Base Flow Calibration

Site 5 Calibration

- Site 5 was calibrated to the modified calibration curve of site 3 + site 4 + 5% of WWTP flow

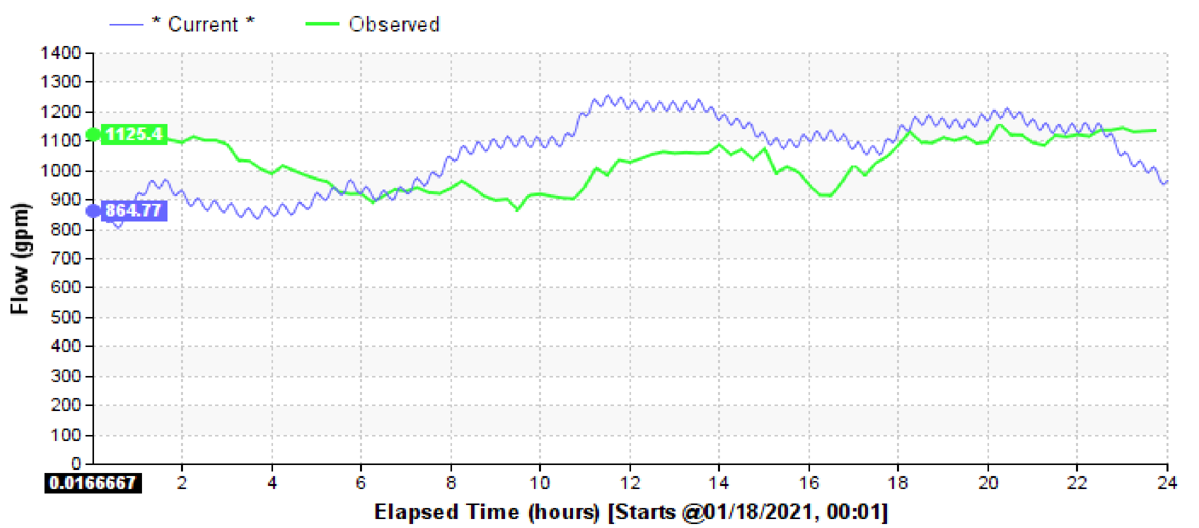
Pipe 260 (Run/Measured Volumes : 154056.26 / 133925.01 ft3)



Site 6 Calibration

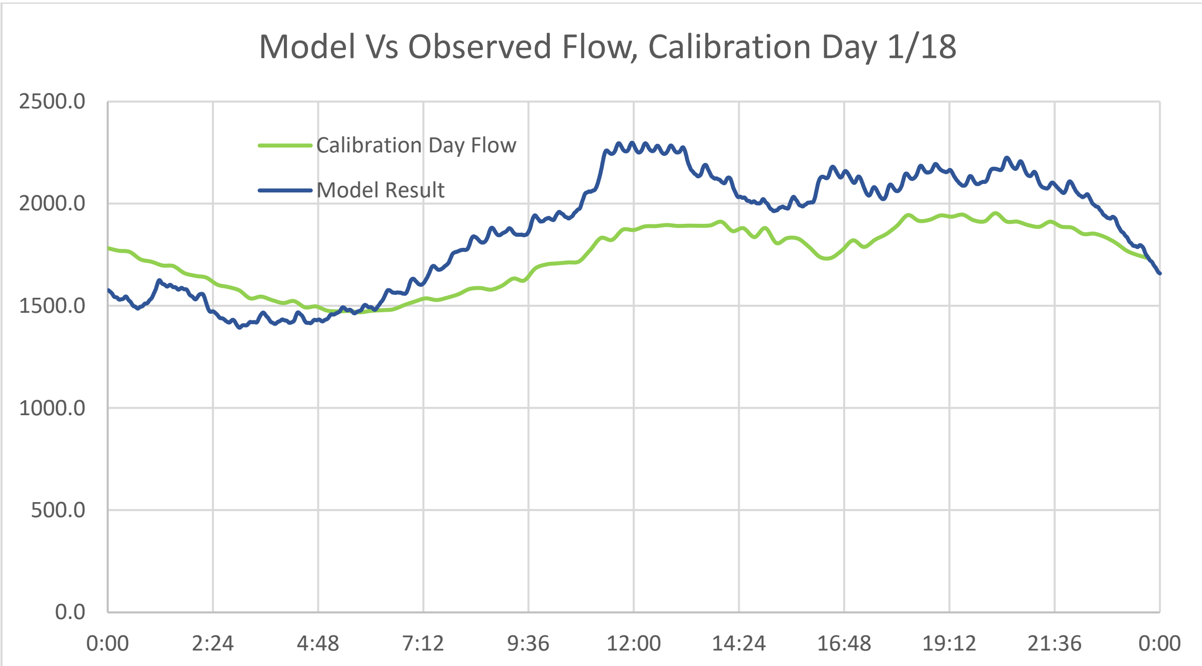
- Site 6 was calibrated to the modified curve of WWTP Flow minus Site 5 flow

Pipe 560 (Run/Measured Volumes : 200352.72 / 193682.04 ft3)



Base Flow Calibration

WWTP Calibration



Base Flow Calibration

Pump Station Calibration

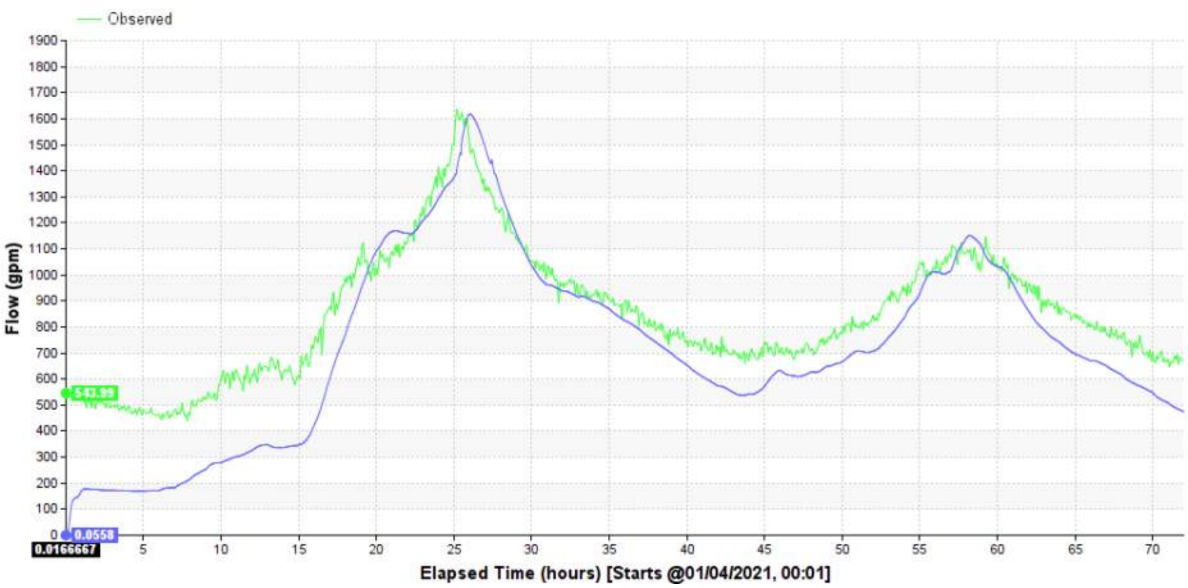
	Pump Station 1	Pump Station 2*	Pump Station 3	Pump Station 7	Pump Station 11
Pump Reported Capacity (gpm)	550	250	500	390	143
Model Average Flow (gpm)	627	275	550	440	133

* Pump Station 2 had its curve modified from the original curve to achieve this flow

Wet Weather Calibration

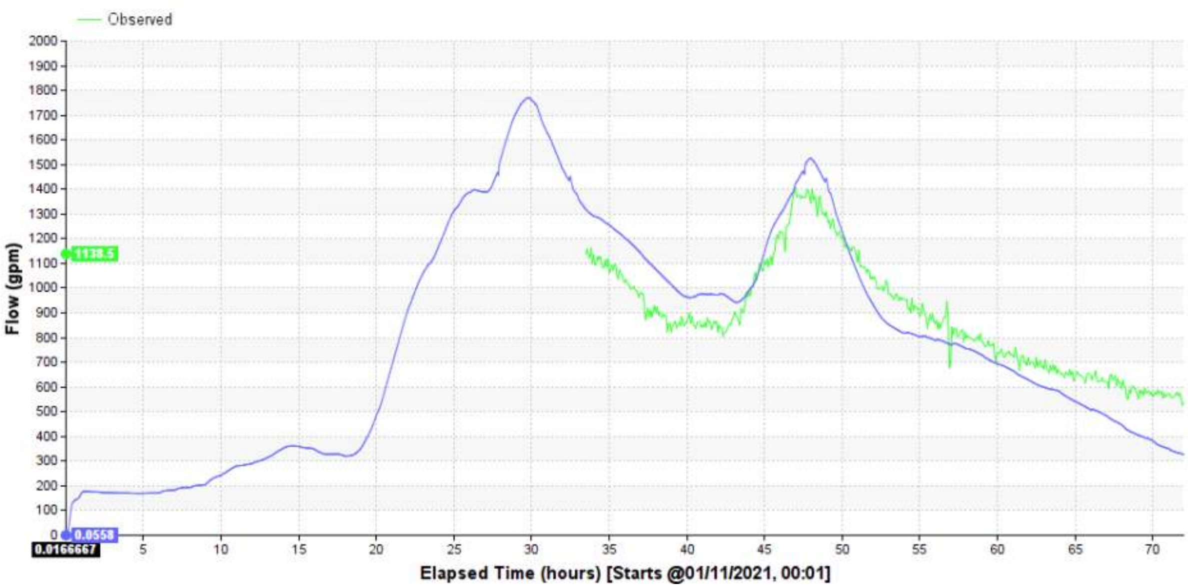
Flowmeter 1 – Calibration Period 1 (Jan 2nd – 4th)

Pipe 163 (Run/Measured Volumes : 414760.02 / 487033.77 ft3)



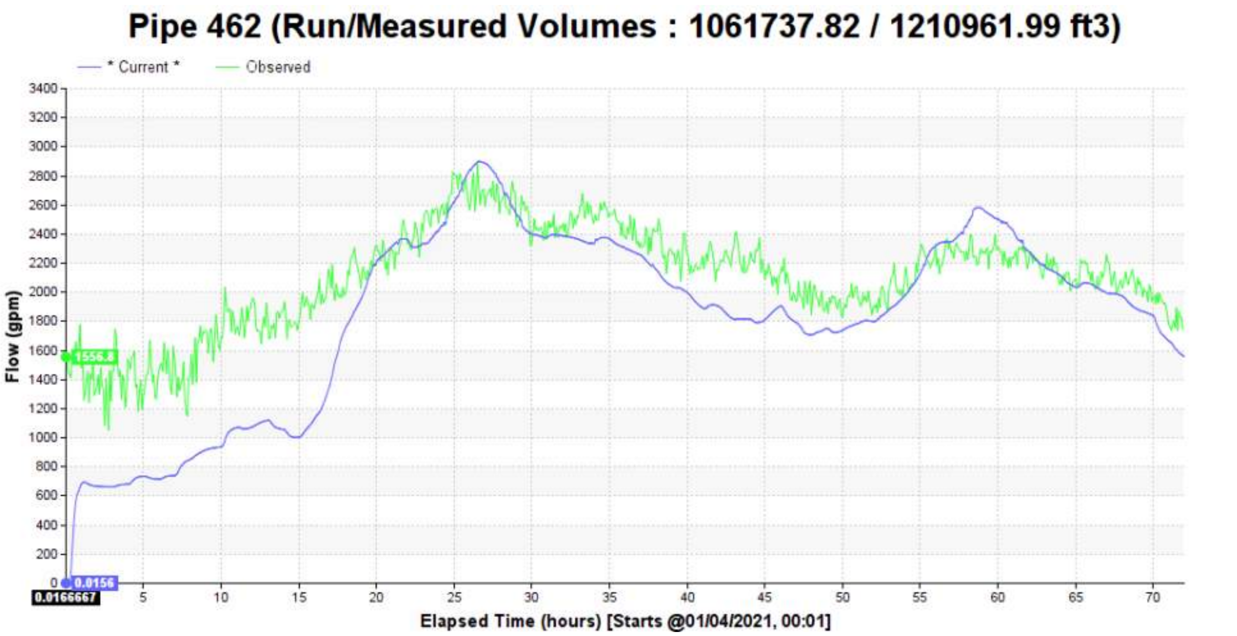
Flowmeter 1 – Calibration Period 2 (Jan 11th – 13th)

Pipe 163 (Run/Measured Volumes : 271438.95 / 274293.48 ft3)

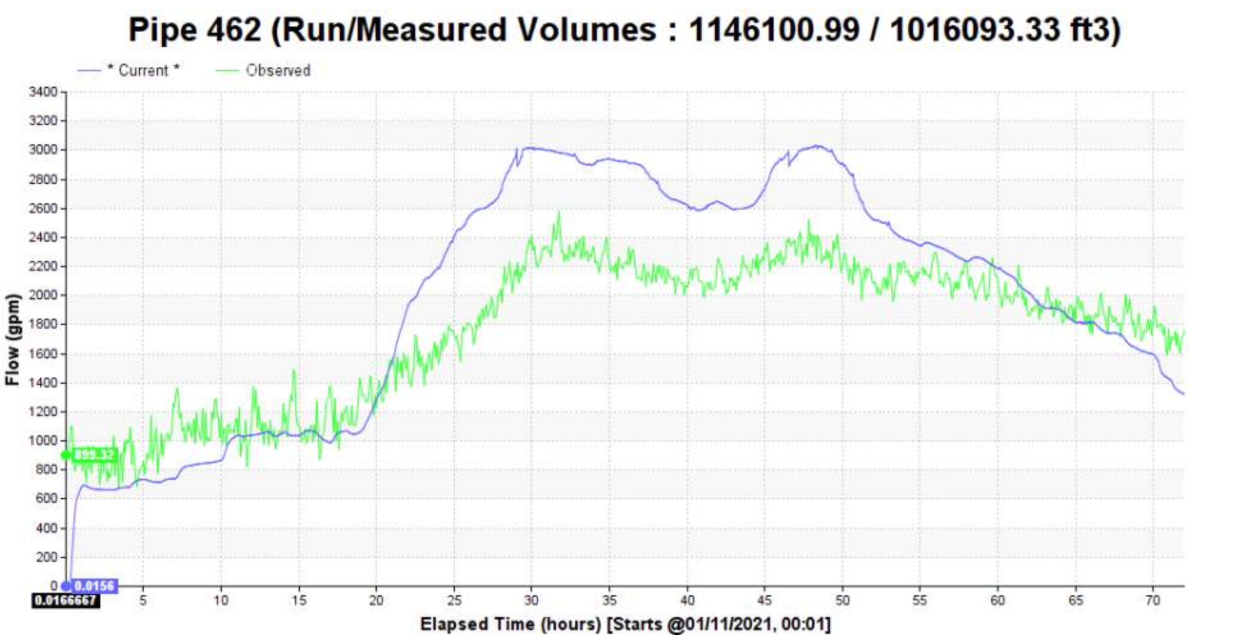


Wet Weather Calibration

Flowmeter 2 – Calibration Period 1 (Jan 2nd – 4th)

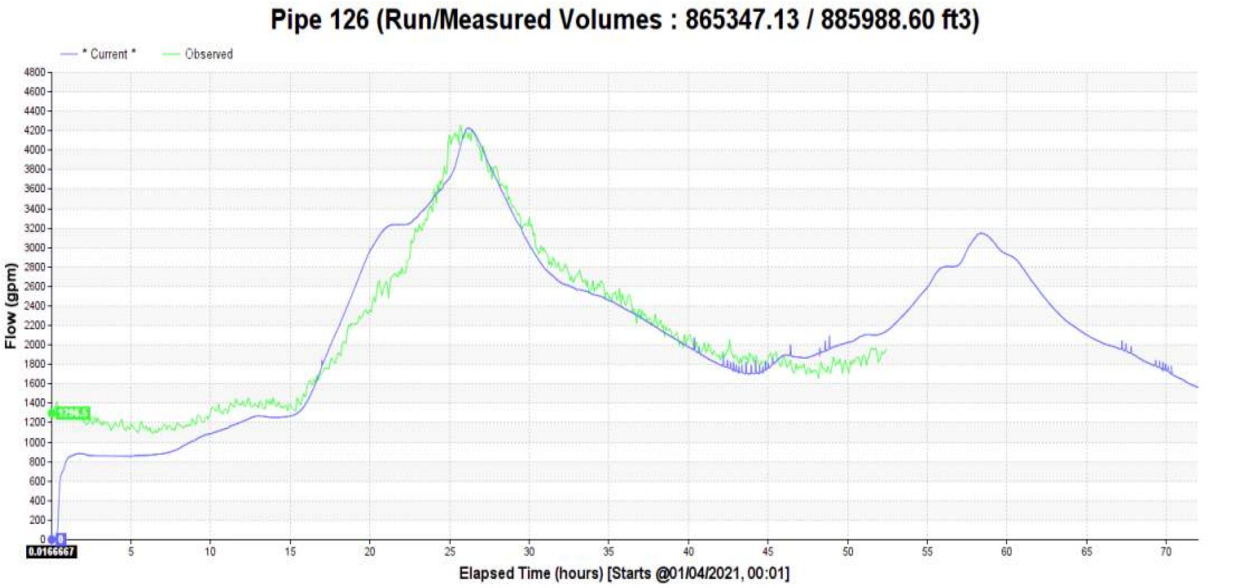


Flowmeter 2 – Calibration Period 2 (Jan 11th – 13th)

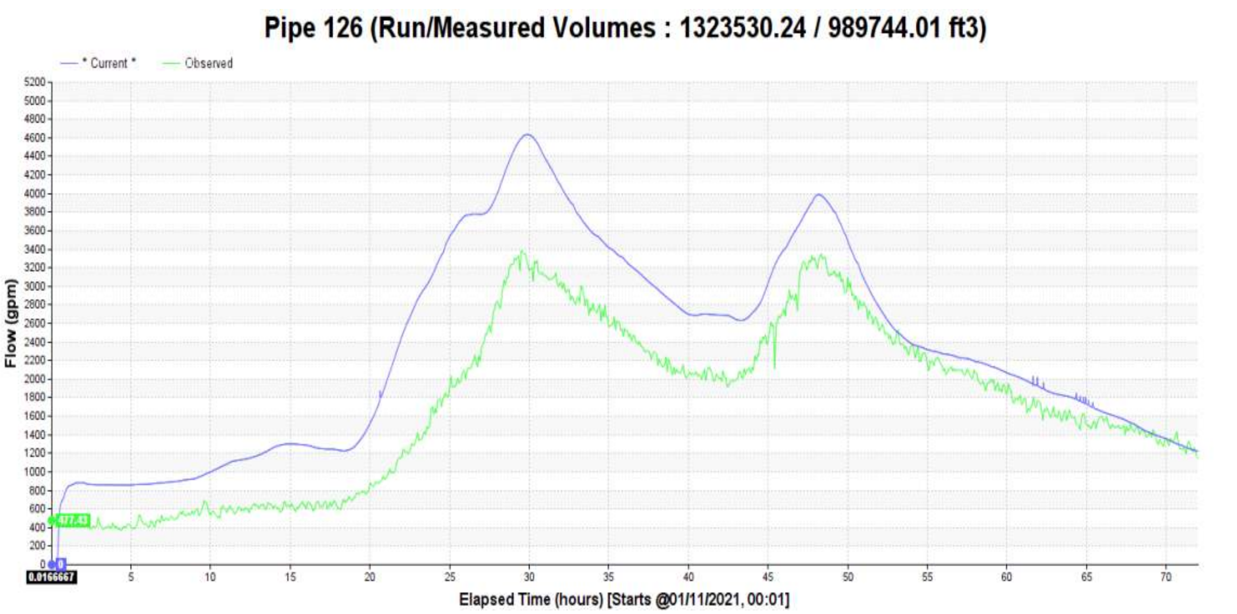


Wet Weather Calibration

Flowmeter 3 – Calibration Period 1 (Jan 2nd – 4th)

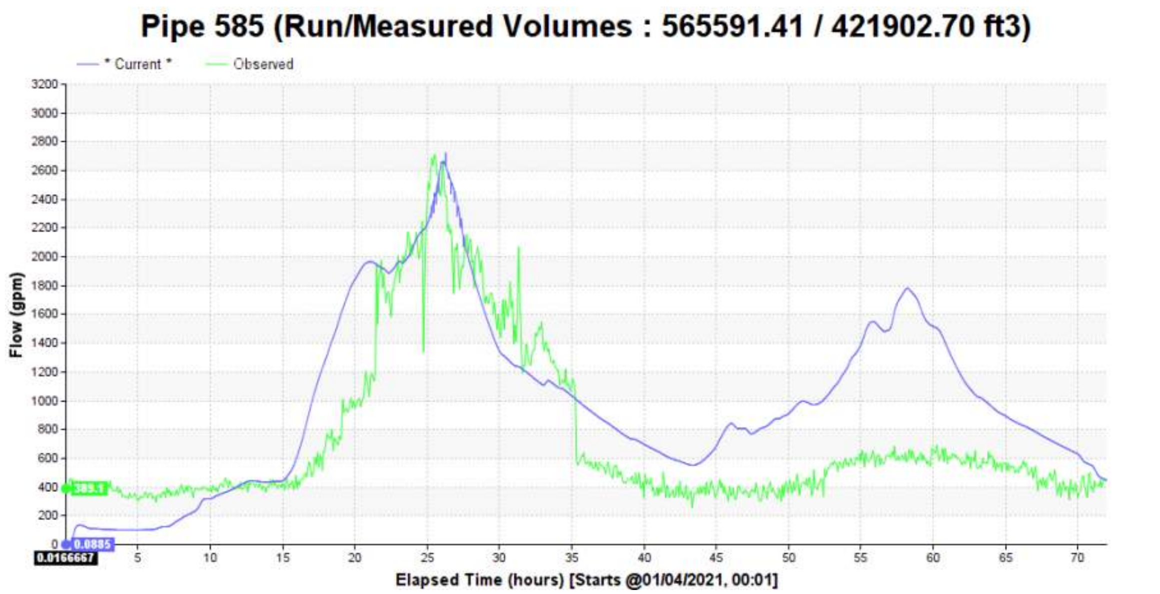


Flowmeter 3 – Calibration Period 2 (Jan 11th – 13th)

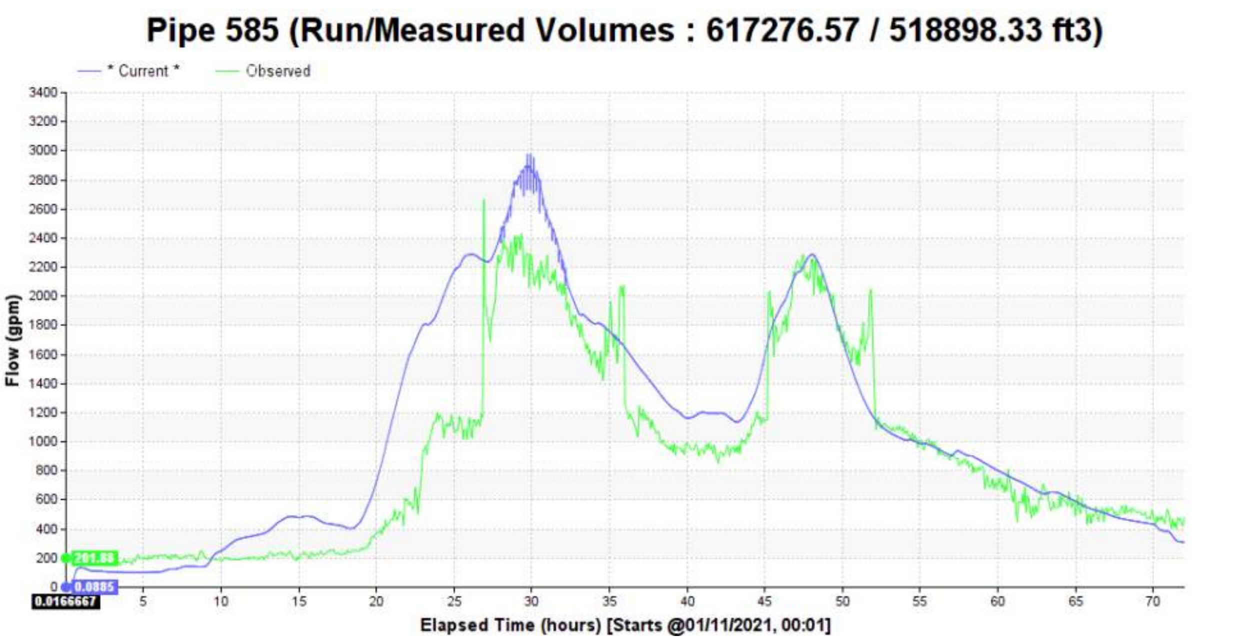


Wet Weather Calibration

Flowmeter 4 – Calibration Period 1 (Jan 2nd – 4th)



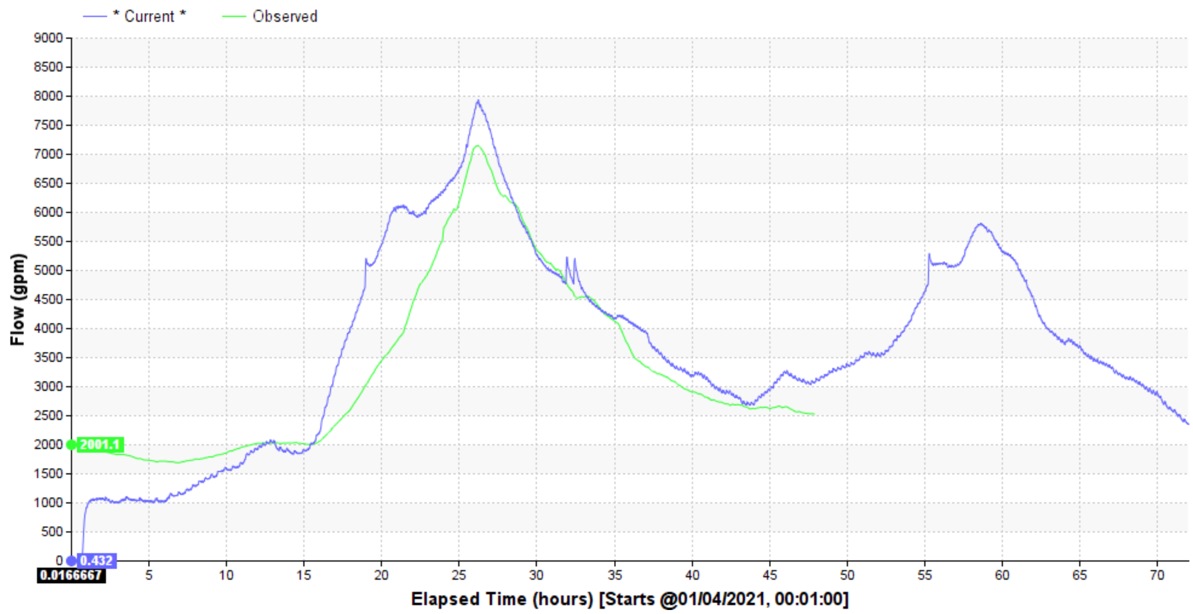
Flowmeter 4 – Calibration Period 2 (Jan 11th – 13th)



Wet Weather Calibration

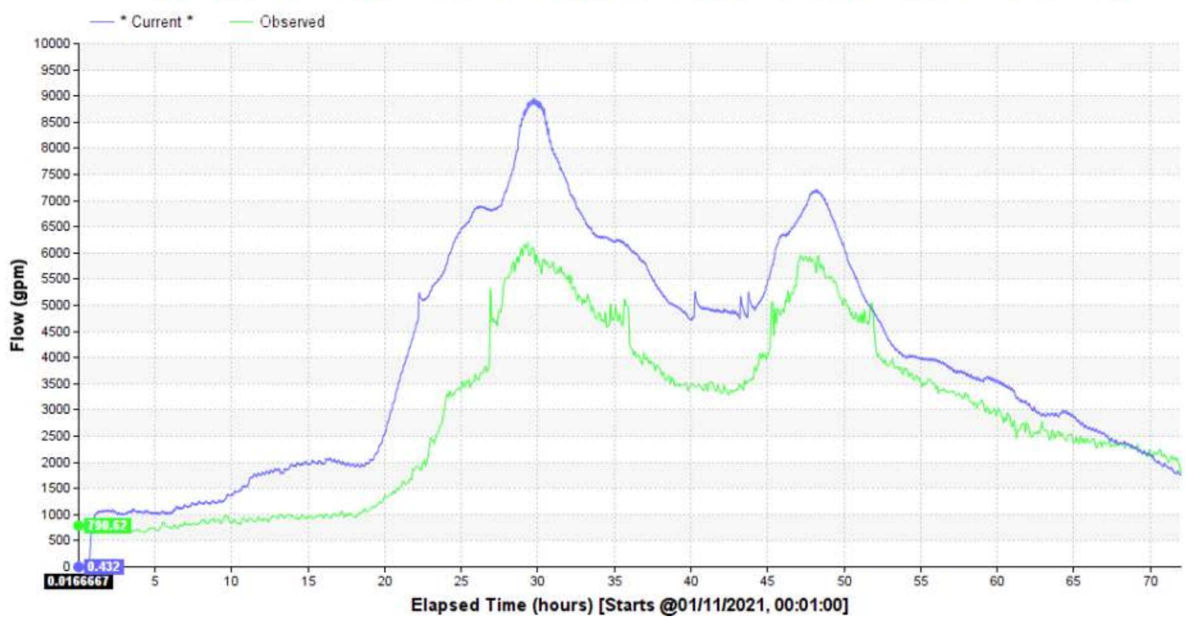
Flowmeter 5 – Calibration Period 1 (Jan 2nd – 4th)

Pipe 260 (Run/Measured Volumes : 1348438.43 / 1264557.30 ft3)



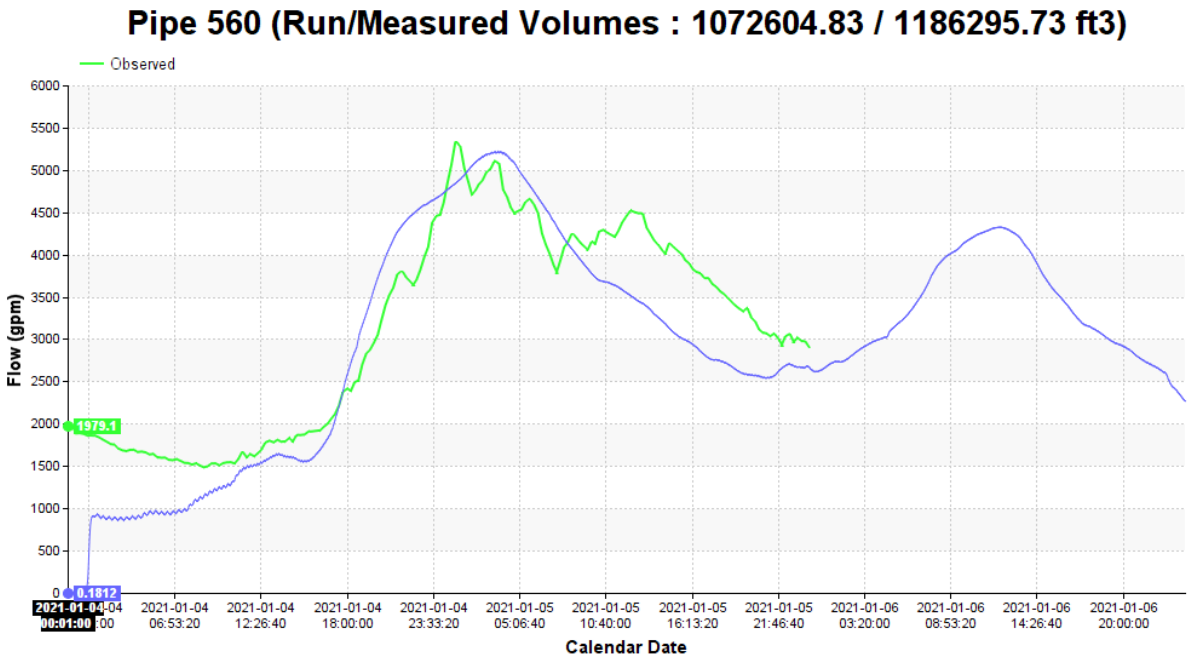
Flowmeter 5 – Calibration Period 2 (Jan 11th – 13th)

Pipe 260 (Run/Measured Volumes : 2286517.70 / 1683831.41 ft3)

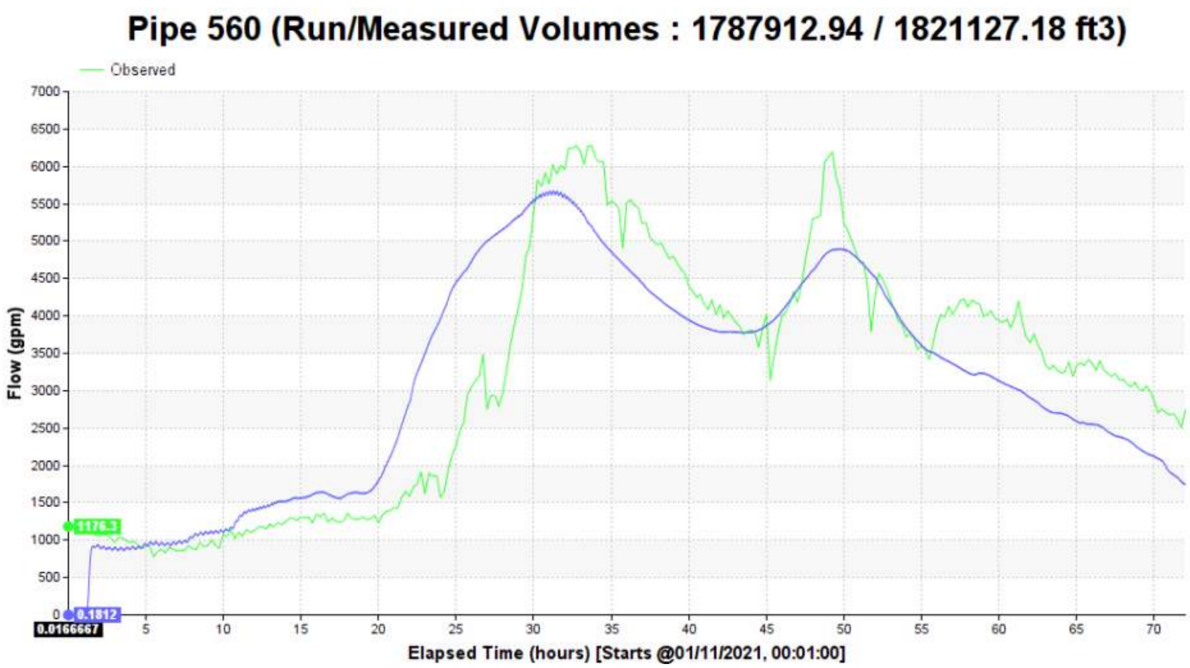


Wet Weather Calibration

Flowmeter 6 – Calibration Period 1 (Jan 2nd – 4th)



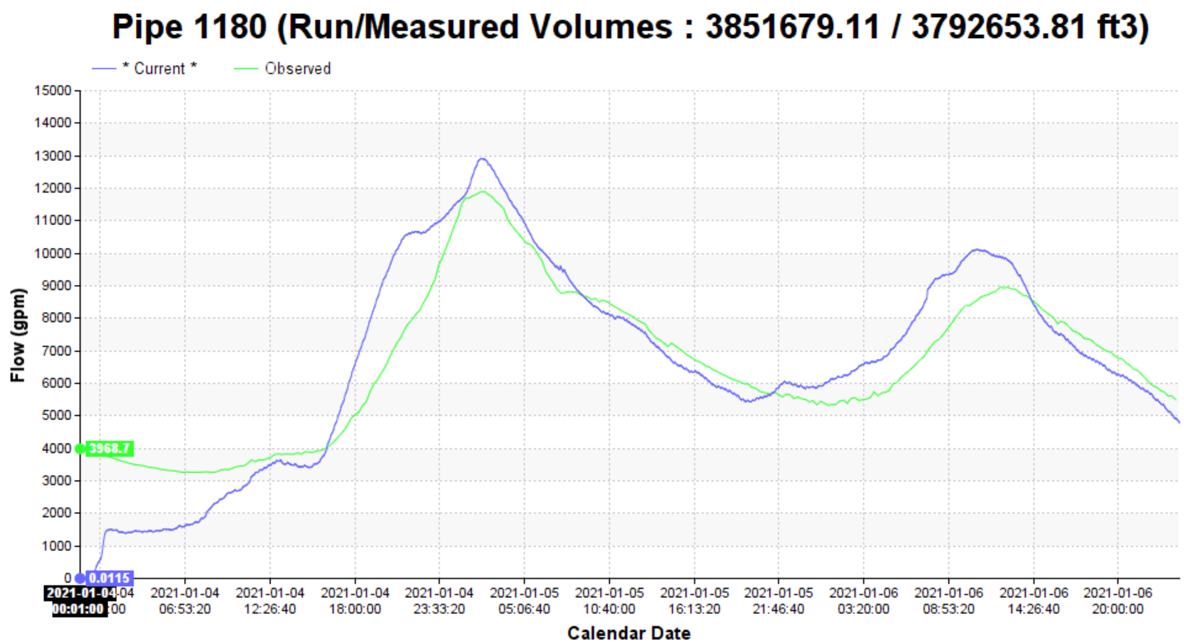
Flowmeter 6 – Calibration Period 2 (Jan 11th – 13th)



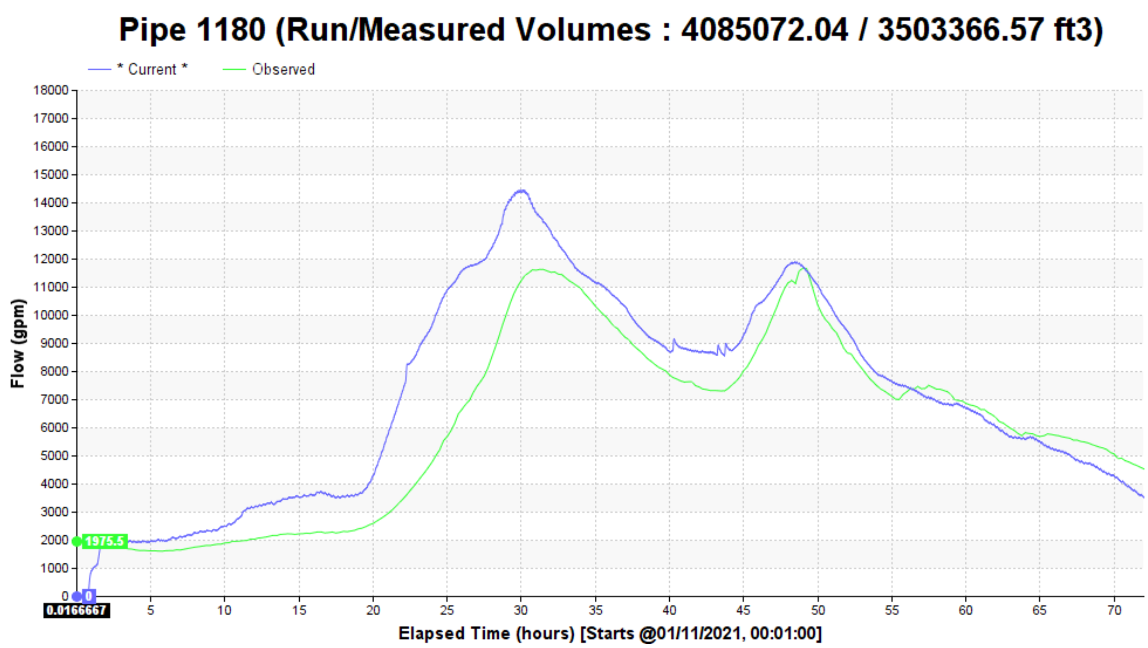
Wet Weather Calibration

WWTP Calibration

WWTP Flow – Calibration Period 1 (Jan 2nd – 4th)



WWTP flow – Calibration Period 2 (Jan 11th – 13th)



APPENDIX G

Consequence of Failure Analysis

KELLER ASSOCIATES

Consequence of Failure

Size of Lift Station	
Design Flow > 500 gpm	1.5
250 gpm < Design Flow < 500 gpm	1
Design Flow < 250 gpm	0.5

Environmentally Sensitive Areas	
Wetwell overflows to storm system	1
Wetwell located adjacent to wetland/overflows to wetland/creeks	2

Service Parameter	
Critical Government Infrastructure (emergency services/police/fire/etc.)	2
School/Hospital	2
Commercial/Industrial zone	1
Historic Site	1

Proximity to Private Property	
Within 100 feet of private property (high chance of flooding to private property)	2
Between 100 and 250 feet of private property	1
Greater than 250 feet (or low chance of flooding to private property)	0

Portion of Community Served	
>100 EDUs served	3
50-100 EDUs served	2
5-50 EDUs served	1
<5 EDUs served	0

Estimate of Time to Overflow	
Very High Risk (wetwell overflows before pipe surcharges)	3
High Risk (wetwell fills quickly)	2
Moderate Risk	1
Low Risk (wetwell fills slowly)	0

Likelihood of Failure

Liquification Hazard	
High	2
Medium	1
Low	0.5

Backup Power	
No on-site backup power available	1
On-site backup power available	0

Capacity vs. Demand	
Over firm capacity as indicated by runtime	2
Likely over firm capacity as indicated by runtime	1
Under firm capacity as indicated by runtime	0

Landslide Susceptibility	
Very High	3
High	2
Moderate	1
Low	0

Wetwell/ Pipe Condition	
Poor Condition (cracked/broken concrete, disconnected/broken pumps)	2
Moderate Condition (FOG buildup, wear on concrete/electronics/pumps)	1
Good Condition (no concrete damage, operable pipes, no root intrusion)	0

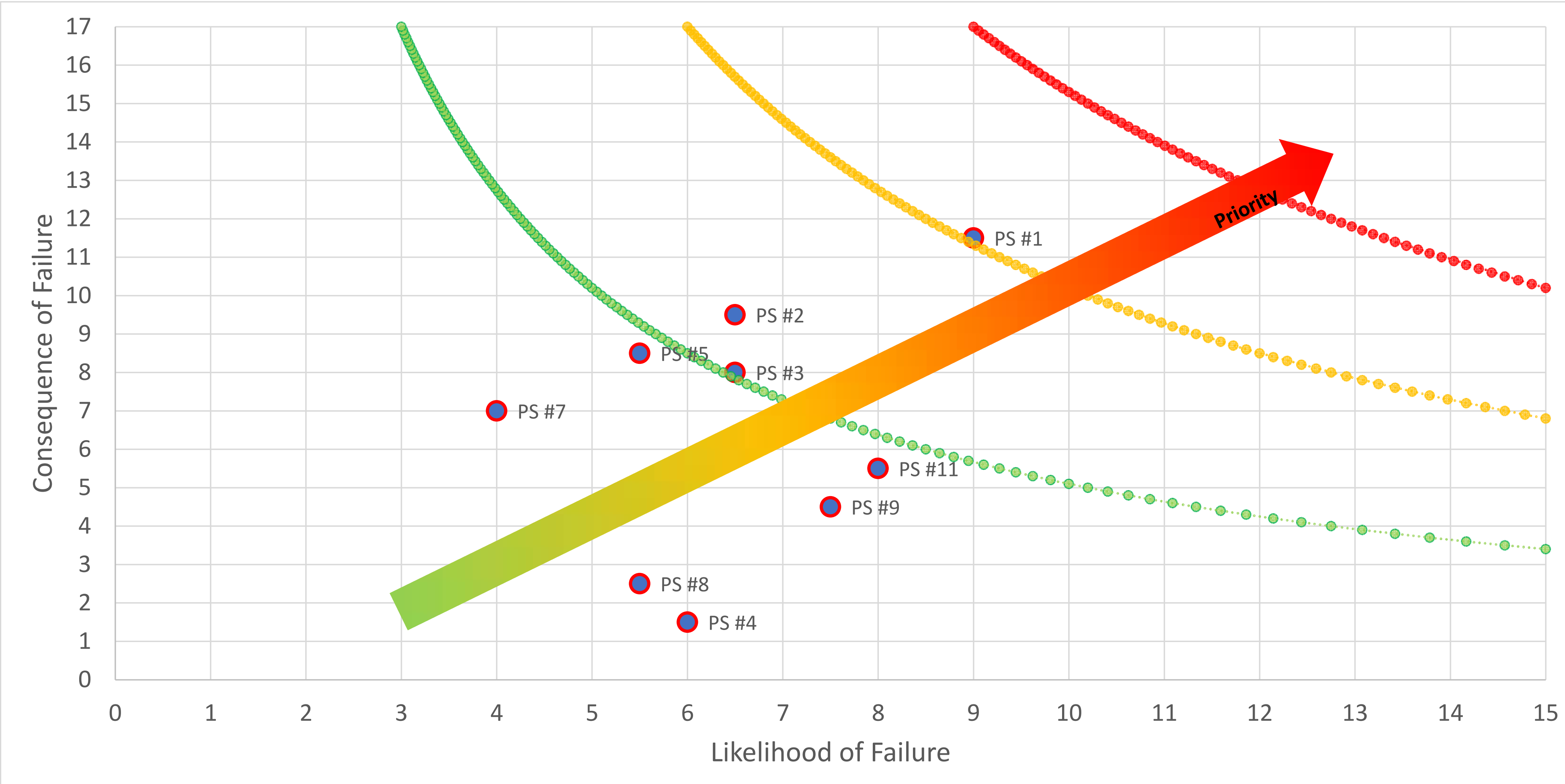
Safety/ Security/ Access	
No safety barrier/ fence	0.5
Difficult to access/repair in an emergency/susceptible to outside damage (traffic)	0.5
Lack of fall protection	0.5

Age	
If Age > 25 years old	2
If Age is between 10 and 25 years old, mechanical updated in last 10 years	1
If Age < 10 years old	0

Sensor and Alarm Redundancy	
No redundancy in level sensors	0.5
Level sensor redundancy	0

Influence from Flooding	
Within 100-year floodplain	1
Outside of 100-year floodplain	0

	Consequence of Failure									Likelihood of Failure										
PS Name	Size of Lift Station	Commercial/ Industry Zone?	School/ Hospital / Critical Gov. Infrastructure/ Historic Site	Portion of Community Served	Environmentally Sensitive Areas	Proximity to Private Property	Estimate of Time to Overflow	Consequence Sum	PS Name	Liquification Hazard	Landslide Susceptibility	Age	Backup Power	Wetwell/ Pipe Condition	Sensor and Alarm Redundancy	Capacity vs. Demand	Safety/ Security/ Access	Influence from Flooding	Likelihood Sum	Risk of Failure
PS #1	1.5	1	1	3	1	2	2	11.5	PS #1	2	0	2	1	1	0	2	1	0	9	104
PS #2	1.5	1	0	3	0	2	2	9.5	PS #2	2	1	2	0	0	0	1	0.5	0	6.5	62
PS #3	1	1	0	1	1	2	2	8	PS #3	0	0	1	1	1	0	2	1.5	0	6.5	52
PS #4	0.5	0	0	0	1	0	0	1.5	PS #4	0	0	1	1	1	0.5	1	1.5	0	6	9
PS #5	0.5	0	0	3	2	0	3	8.5	PS #5	0	1	2	0	0	0	2	0.5	0	5.5	47
PS #7	1	1	0	1	2	0	2	7	PS #7	0	1	1	0	0	0	1	0	1	4	28
PS #8	0.5	0	0	0	2	0	0	2.5	PS #8	0	0	2	1	0	0.5	0	1	1	5.5	14
PS #9	0.5	0	0	0	2	1	1	4.5	PS #9	2	1	1	1	1	0.5	0	0	1	7.5	34
PS #11	0.5	0	0	2	2	0	1	5.5	PS #11	2	1	1	1	1	0.5	0	1.5	0	8	44


17
16
15
14
13
12
11
10
9
8
7
6
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4
3
2
1
0
Consequence of Failure
0
1
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3
4
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7
8
9
10
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12
13
14
15
Likelihood of Failure
Priority
PS #1
PS #2
PS #5
PS #3
PS #7
PS #11
PS #9
PS #8
PS #4

APPENDIX H

Sump Pump Supplemental Material

KELLER
ASSOCIATES

Function of Sump Pumps & Downspouts

Rainwater can enter the basement through many sources. The job of a sump pump is to divert the water from inside your basement to a location outside of the house. A sump pump is usually installed in a sump pit which stores the water. When this water reaches a certain level, it triggers the sump pump which pumps the water back outside, away from the house. A downspout's purpose is to direct water from the roof gutters away from the house.

The Problem of Inflow

Inflow is caused by improperly connected foundation (footing) drains, sump pumps, and downspouts. Instead of directing the clear rain water outside and away from the house, it directs the water into the sanitary sewer system. Inflow is a problem because it creates an extra water burden for the sanitary sewer system, and when this system is overloaded, sewage can back up into our streets, buildings, and your home. It also means that our utility bills are higher because we are collectively paying for the unnecessary treatment of clean water!

Rules and Regulations

Inflow is a problem for all of Delaware County's communities and sanitary sewer systems. All municipalities have adopted ordinances which make it illegal to have improper connections to the sanitary sewer. Fees and other enforcement measures can be used to achieve compliance. To avoid fines make sure your sump pumps and downspouts discharge properly.

Homeowners have an impact on preventing or causing the problem of inflow. Your community and neighbors are relying on you to take responsibility for making sure that your connections are not contributing to the problem.

For more information regarding what is being done about inflow in your community, contact your local municipality or sewer authority.

DELCORA

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY
100 EAST FIFTH STREET
CHESTER, PA 19013
WWW.DELCORA.ORG
610-876-5523

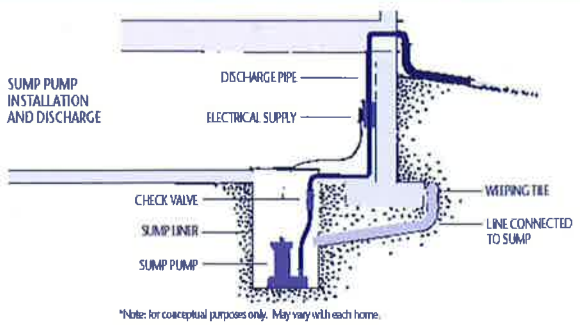
PRINTED WITH THANKS TO THE:
FARIBAULT COUNTY
SOIL AND WATER CONSERVATION DISTRICT
BLUE EARTH, MN 56013
www.faribaultcountyswcd.com

Disconnecting & Redirecting Your Sump Pump & Downspouts

In wet weather it only takes a few improperly connected sump pumps to cause a sanitary sewer backup into basements, streets and waterways.

How Do I Know If My Sump Pump Is Improperly Connected?

Your sump pump is improperly connected to the sanitary sewer if it is connected to the drain or sink in your basement. Unless you are sure your basement drain is not connected to the sanitary sewer, your sump pump is probably improperly connected.



Proper sump pump discharge connections are to the outside of the house only!

How Do I Know If My Downspout Is Improperly Connected?

If your downspouts disappear into the ground rather than discharging into your yard, they may be connected to the sanitary sewer. While connections to the *storm* sewer are permitted, connections to the *sanitary* sewer must be disconnected and redirected.

Downspouts that look like this could be connected to the sanitary sewer.

Disconnecting Your Sump Pump

If your sump pump discharges to the sanitary system in any way, the discharge must be re-directed out of the sanitary sewer system. The change could be as simple as directing the discharge outside the house through a hose. If you aren't familiar with the work, contact a plumbing professional, your local municipality, or your sewer authority for more information.

Each household or business that redirects their stormwater out of the sanitary sewer helps solve the problem of sewage backing up into basements, streets, and waterways.

Disconnecting Your Downs

Disconnecting your downspout from the sanitary sewer is easy to do yourself.

1. Cut the downspout, leaving enough space to insert the elbow.

2. Tightly cap the end of the pipe sticking out of the ground that leads to the sanitary sewer.

3. Attach an elbow to the end of the downspout and use an appropriate extension to direct the water away from your home.

Where Should I Direct the Flow of My Disconnected Sump Pump and Downspout?

Water should be discharged away from your house or it may seep back into your basement. It should flow to an area where it can seep into the ground or be stored for later use. Direct flow to:

Raingarden

Lawn

Trees

Rain Barrel

Never direct stormwater into a sanitary sewer or onto a neighboring pr

Code of the Town of Derry
Sewer Use Ordinance

<u>ARTICLE V</u> Use of Public Sewers

<u>§ 122-30.</u> Discharge of certain waters to sanitary sewer prohibited.

No person shall discharge or cause to be discharged any stormwater, surface water, groundwater, roof runoff, subsurface drainage, cooling water or unpolluted industrial process waters to any sanitary sewer.

<u>§ 122-31.</u> Discharge to storm sewer or natural outlet.

A. Stormwater and all other unpolluted drainage shall be discharged to drains or such sewers as are specifically designated as storm sewers or to a natural outlet approved by the Town.

COMPLIANCE The DPW conducts flow monitoring of areas in the sewer collection system throughout Town identifying suspected areas of sump pump connections. Once an area is identified, video inspection of the sewer mains may be conducted and random inspections made to locate source of stormwater inflow including illicit sump pump connections.

Residents who have any questions or need any assistance in disconnecting their sump pump may call the Derry DPW or their local plumber. By working together we can keep our costs down and reduce risk of damage to other homes and the Town's sanitary sewer facilities.

Town of Derry, NH

Department of Public Works
Derry Municipal Center

Michael A. Fowler, P.E. Director
Thomas A. Carrier, Deputy Director, Water and Sewer Divisions

Phone: 603-432-6144
Fax: 603-432-6130
E-mail: tomcarrier@derrynh.org

«Owner»
«Owner Addr»
« City», «St» «Zip»

TOWN OF DERRY, NH

Guide to Sump Pump Connections

SUMP PUMP CONNECTIONS TO THE MUNICPAL SEWER SYSTEM IS ILLEGAL!

Prepared by:
The Town of Derry
Department of Public Works

SUMP PUMP DISCHARGE REQUIREMENTS

Sump pumps remove groundwater from below building foundations to prevent water damage to the building. Groundwater collected by sump pumps must discharge to the ground surface outside of the building, to a stormwater drain, or to a natural outlet. If your sump pump is frequently operating, rains may have caused the groundwater to rise and flow into the sump pump pit. In some cases, the groundwater may remain high and cause the sump pump to run continually.

Town sewers are not designed to carry the additional flow from sump pumps. An overloaded sewer can create sewer backups in the streets and other homeowner's basements. Also, the groundwater from

the sump pumps would be pumped and treated at the Town's Wastewater treatment facility. The additional flow uses up plant capacity and increases the costs of treatment and in some cases can cause the plant to overflow.

PROHIBITED LOCATIONS FOR SUMP PUMP DISCHARGE

DO NOT connect your sump pump to the sanitary sewer pipes. <u>It is illegal to discharge groundwater from the sump pump to the sanitary sewer.</u> If your sump pump is connected to any other

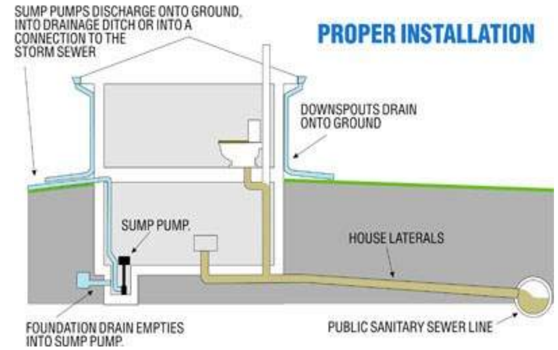
pipe in your home, it is most likely connected incorrectly to the Town sewer system. Such connections are a violation of local Ordinance.

DO NOT pump storm water onto sidewalks or streets. Sump pump water draining onto walkways and streets can cause icy, un-

safe conditions as well as reduce the life of the street surface and the curb increasing the Town's maintenance costs .

DO NOT pump storm water onto your neighbors property as this can be a nuisance and result in property damage.

ACCEPTABLE LOCATIONS FOR SUMP PUMP DISCHARGE



The pipe from your basement sump pump should always discharge directly into your yard or stormwater drainage system.

Water should be directed into your yard away from your home so that it doesn't puddle along the wall and seep back into your basement.

Sump Pump Discharge hoses may be connected to the Town's drainage system. Residents MUST FIRST contact the DPW for permission and guidance

Appendix I

Alternatives Cost Analysis

Collection System Project: Basin 1 - Pipeline Upsize
Project Identifier: 1.a

Objective: Resolve undersized pipeline in Basin 1. Construct gravity pipeline capable of conveying anticipated peak hour flows.

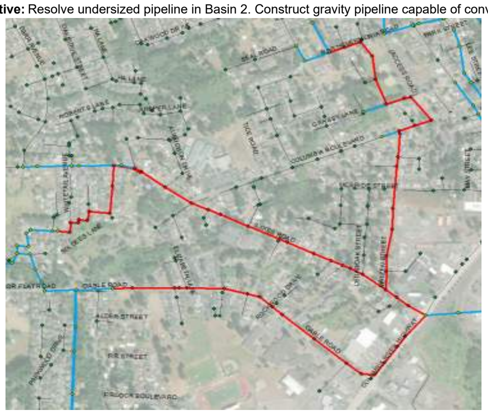
Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
18-inch Pipe - Excavation, Backfill	230	LF	$ 185	$ 42,550
15-inch Pipe - Excavation, Backfill	2,330	LF	$ 170	$ 396,100
Roadway Restoration (Half Lane)	1,315	LF	$ 45	$ 59,180
Landscape Restoration	1,245	LF	$ 20	$ 24,900
Traffic Control w/ Flagging	1	LS	$ 62,000	$ 62,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
48-inch Manhole	8	EA	$ 8,000	$ 64,000
Bypass Pumping - Pipes 24-inch and smaller	2,560	LF	$ 22	$ 56,810
ADA Ramp Reconstruction (Compliance)	6	EA	$ 4,600	$ 27,600
Rock Excavation	589	CY	$ 300	$ 176,770
Replace Service Laterals	18	EA	$ 1,500	$ 27,000
Existing Utility Protection	2,560	LF	$ 4	$ 10,240
			Subtotal (rounded)	***$ 951,000***
Mobilization	1	LS	5%	$ 48,000
Contingency	1	LS	30%	$ 300,000
			Construction Subtotal (rounded)	***$ 1,299,000***
Engineering and CMS	1	LS	20%	$ 260,000
Permitting (Assume 8% of total)	1	LS	$ 103,900	$ 103,900
Geotechnical (Assume 1% of total)	1	LS	$ 13,000	$ 13,000
Surveying	1	LS	$ 40,000	$ 40,000
Legal and Admin	1	LS	$ 20,000	$ 20,000
			Total Project Cost (rounded)	***$ 1,800,000***

The cost estimate herein is based on our perception of current conditions at the project location. This estimatereflects 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.

Item #4.

Collection System Project: Basin 2 - Pipeline Upsize
Project Identifier: 2.a

Objective: Resolve undersized pipeline in Basin 2. Construct gravity pipeline capable of conveying anticipated peak hour flows.



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Sykes Road - Gravity Upsize				
12-inch Pipe - Excavation, Backfill	315	LF	$ 160	$ 50,400
15-inch Pipe - Excavation, Backfill	2,645	LF	$ 170	$ 449,650
18-inch Pipe - Excavation, Backfill	522	LF	$ 185	$ 96,570
Roadway Restoration (Half Lane)	3,482	LF	$ 45	$ 156,690
Traffic Control w/ Flagging	1	LS	$ 65,000	$ 65,000
48-Inch, Standard Manhole	15	EA	$ 8,000	$ 120,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	3,482	LF	$ 22	$ 77,270
Rock Excavation	786	CY	$ 300	$ 235,760
ADA Ramp Reconstruction (Compliance)	11	EA	$ 4,600	$ 50,600
Replace Service Laterals	55	EA	$ 1,500	$ 82,500
Existing Utility Protection	2,960	LF	$ 4	$ 11,840
			Subtotal	***$ 1,400,000***
Matzen St. - Gravity Pipeline Upsize				
12-inch PVC gravity pipe	1,450	LF	$ 160	$ 232,000
15-inch PVC gravity pipe	2,600	LF	$ 170	$ 442,000
Roadway Restoration (Half Lane)	2,980	LF	$ 45	$ 134,100
Landscape Restoration	1,070	LF	$ 20	$ 21,400
Traffic Control w/ Flagging	1	LS	$ 110,000	$ 110,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	4,050	LF	$ 22	$ 89,880
Rock Excavation	792	CY	$ 300	$ 237,540
ADA Ramp Reconstruction (Compliance)	9	EA	$ 4,600	$ 41,400
Replace Service Laterals	42	EA	$ 1,500	$ 63,000
Existing Utility Protection	4,050	LF	$ 4	$ 16,200
			Subtotal	***$ 1,519,000***
Gable Rd. - Gravity Pipeline Upsize and Reroute to Sykes Rd.				
12-inch PVC gravity pipe	4,050	LF	$ 160	$ 648,000
Roadway Restoration (Half Lane)	4,050	LF	$ 45	$ 182,250
Traffic Control w/ Flagging	1	LS	$ 105,000	$ 105,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
48-Inch, Standard Manhole	13	EA	$ 8,000	$ 104,000
Existing Utility Protection	4,050	LF	$ 4	$ 16,200
Bypass Pumping - Pipes 24-inch and smaller	4,050	LF	$ 22	$ 89,880
ADA Ramp Reconstruction (Compliance)	11	EA	$ 4,600	$ 50,600
Replace Service Laterals	32	EA	$ 1,500	$ 48,000
Rock Excavation	593	CY	$ 300	$ 177,960
			Subtotal	***$ 1,425,000***
Westshire Ln. - Gravity Pipeline Upsize				
10-inch PVC gravity pipe	250	LF	$ 150	$ 37,500
12-inch PVC gravity pipe	2,300	LF	$ 160	$ 368,000
Roadway Restoration (Half Lane)	2,235	LF	$ 45	$ 100,580
Landscape Restoration	315	LF	$ 20	$ 6,300
Traffic Control w/ Flagging	1	LS	$ 87,000	$ 87,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	2,550	LF	$ 22	$ 56,590
Rock Excavation	381	CY	$ 300	$ 114,370
ADA Ramp Reconstruction (Compliance)	4	EA	$ 4,600	$ 18,400
Replace Service Laterals	25	EA	$ 1,500	$ 37,500
Existing Utility Protection	2,550	LF	$ 4	$ 10,200
			Subtotal	***$ 968,000***
			Subtotal (rounded)	***$ 5,312,000***
Mobilization	1	LS	5%	$ 266,000
Contingency	1	LS	30%	$ 1,674,000
			Construction Subtotal (rounded)	***$ 7,252,000***
Engineering and CMS	1	LS	20%	$ 1,451,000
Permitting (Assume 8% of total)	1	LS	$ 580,200	$ 580,200
Geotechnical (Assume 1% of total)	1	LS	$ 73,000	$ 73,000
Surveying	1	LS	$ 100,000	$ 100,000
Legal and Admin	1	LS	$ 40,000	$ 40,000
			Total Project Cost (rounded)	***$ 9,500,000***

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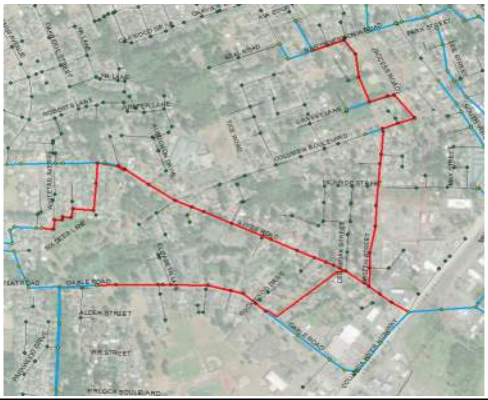
Collection System Project: Basin 2 - Pipeline Upsize and Reroute from Gable Rd. to Sykes Rd.
Project Identifier: 2.b

Objective: Resolve undersized pipeline in Basin 2. Construct gravity pipeline capable of conveying anticipated peak hour flows.



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Sykes Road - Gravity Upsize				
12-inch Pipe - Excavation, Backfill	315	LF	$ 160	$ 50,400
15-inch Pipe - Excavation, Backfill	2,645	LF	$ 170	$ 449,650
18-inch Pipe - Excavation, Backfill	522	LF	$ 185	$ 96,570
Roadway Restoration (Half Lane)	3,482	LF	$ 45	$ 156,690
Traffic Control w/ Flagging	1	LS	$ 65,000	$ 65,000
48-Inch, Standard Manhole	15	EA	$ 8,000	$ 120,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	3,482	LF	$ 22	$ 77,270
Rock Excavation	786	CY	$ 300	$ 235,760
ADA Ramp Reconstruction (Compliance)	11	EA	$ 4,600	$ 50,600
Replace Service Laterals	55	EA	$ 1,500	$ 82,500
Existing Utility Protection	2,960	LF	$ 4	$ 11,840
			Subtotal	***$ 1,400,000***
Matzen St. - Gravity Pipeline Upsize				
12-inch Pipe - Excavation, Backfill	1,450	LF	$ 160	$ 232,000
15-inch Pipe - Excavation, Backfill	2,600	LF	$ 170	$ 442,000
Roadway Restoration (Half Lane)	2,980	LF	$ 45	$ 134,100
Landscape Restoration	1,070	LF	$ 20	$ 21,400
Traffic Control w/ Flagging	1	LS	$ 110,000	$ 110,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	4,050	LF	$ 22	$ 89,880
Rock Excavation	792	CY	$ 300	$ 237,540
ADA Ramp Reconstruction (Compliance)	9	EA	$ 4,600	$ 41,400
Replace Service Laterals	42	EA	$ 1,500	$ 63,000
Existing Utility Protection	4,050	LF	$ 4	$ 16,200
			Subtotal	***$ 1,519,000***
Gable Rd. - Gravity Pipeline Upsize and Reroute to Sykes Rd.				
12-inch Pipe - Excavation, Backfill	3,000	LF	$ 160	$ 480,000
Roadway Restoration (Half Lane)	3,000	LF	$ 45	$ 135,000
Traffic Control w/ Flagging	1	LS	$ 87,000	$ 87,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
48-Inch, Standard Manhole	13	EA	$ 8,000	$ 104,000
Existing Utility Protection	3,000	LF	$ 4	$ 12,000
Bypass Pumping - Pipes 24-inch and smaller	3,000	LF	$ 22	$ 66,580
ADA Ramp Reconstruction (Compliance)	3	EA	$ 4,600	$ 13,800
Replace Service Laterals	23	EA	$ 1,500	$ 34,500
Rock Excavation	1,333	CY	$ 300	$ 400,000
			Subtotal	***$ 1,336,000***
Westshire Ln. - Gravity Pipeline Upsize				
10-inch Pipe - Excavation, Backfill	250	LF	$ 150	$ 37,500
12-inch Pipe - Excavation, Backfill	2,300	LF	$ 160	$ 368,000
Roadway Restoration (Half Lane)	2,235	LF	$ 45	$ 100,580
Landscape Restoration	315	LF	$ 20	$ 6,300
Traffic Control w/ Flagging	1	LS	$ 87,000	$ 87,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	2,550	LF	$ 22	$ 56,590
Rock Excavation	381	CY	$ 300	$ 114,370
ADA Ramp Reconstruction (Compliance)	4	EA	$ 4,600	$ 18,400
Replace Service Laterals	25	EA	$ 1,500	$ 37,500
Existing Utility Protection	2,550	LF	$ 4	$ 10,200
			Subtotal	***$ 968,000***
			Subtotal (rounded)	***$ 5,223,000***
Mobilization	1	LS	5%	$ 262,000
Contingency	1	LS	30%	$ 1,646,000
			Construction Subtotal (rounded)	***$ 7,131,000***
Engineering and CMS	1	LS	20%	$ 1,427,000
Permitting (Assume 8% of total)	1	LS	$ 570,500	$ 570,500
Geotechnical (Assume 1% of total)	1	LS	$ 71,000	$ 71,000
Surveying	1	LS	$ 100,000	$ 100,000
Legal and Admin	1	LS	$ 40,000	$ 40,000
			Total Project Cost (rounded)	***$ 9,400,000***

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Collection System Project: Basin 3 - Pipeline Upsize
Project Identifier: 3.a

Objective: Resolve undersized pipeline in Basin 3. Construct gravity pipeline capable of conveying anticipated peak hour flows.

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
15-inch Pipe - Excavation, Backfill	1,550	LF	$ 170	$ 263,500
Roadway Restoration (Half Lane)	922	LF	$ 45	$ 41,490
Soil Surface Repair	628	LF	$ 5	$ 3,140
Traffic Control w/ Flagging	1	LS	$ 47,000	$ 47,000
48-Inch, Standard Manhole	8	EA	$ 8,000	$ 64,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
ADA Ramp Reconstruction (Compliance)	4	EA	$ 4,600	$ 18,400
Replace Service Laterals	25	EA	$ 1,500	$ 37,500
Bypass Pumping - Pipes 24-inch and smaller	1,550	LF	$ 22	$ 34,400
Rock Excavation	332	CY	$ 300	$ 99,490
Existing Utility Protection	1,550	LF	$ 4	$ 6,200
			Subtotal (rounded)	***$ 619,000***
Mobilization	1	LS	5%	$ 31,000
Contingency	1	LS	30%	$ 195,000
			Construction Subtotal (rounded)	***$ 845,000***
Engineering and CMS	1	LS	20%	$ 169,000
Permitting (Assume 8% of total)	1	LS	$ 67,600	$ 67,600
Geotechnical (Assume 1% of total)	1	LS	$ 8,000	$ 8,000
Surveying	1	LS	$ 20,000	$ 20,000
Legal and Admin	1	LS	$ 10,000	$ 10,000
			Total Project Cost (rounded)	***$ 1,200,000***

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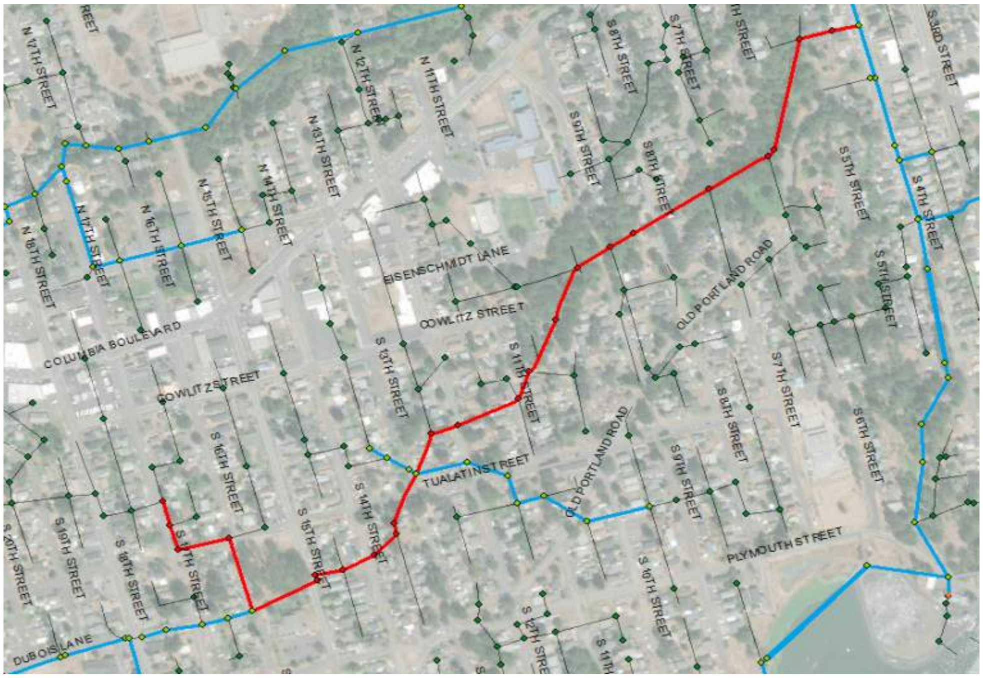
Collection System Project: Basin 4 - Pipeline Upsize
Project Identifier: 4.a

Objective: Resolve undersized pipeline in Basin 4. Construct gravity pipeline capable of conveying anticipated peak hour flows.



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
12-inch Pipe - Excavation, Backfill	860	LF	$ 160	$ 137,600
15-inch Pipe - Excavation, Backfill	1,100	LF	$ 170	$ 187,000
18-inch Pipe - Excavation, Backfill	2,400	LF	$ 185	$ 444,000
21-inch Pipe - Excavation, Backfill	830	LF	$ 195	$ 161,850
Roadway Restoration (Half Lane)	850	LF	$ 45	$ 38,250
Landscape Restoration	4,340	LF	$ 20	$ 86,800
Traffic Control w/out Flagging	4,090	LF	$ 6	$ 24,540
Traffic Control w/ Flagging	1	LS	$ 101,000	$ 101,000
48-Inch, Standard Manhole	30	EA	$ 8,000	$ 240,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Existing Utility Protection	5,190	LF	$ 4	$ 20,760
Replace Service Laterals	42	EA	$ 1,500	$ 63,000
Bypass Pumping - Pipes 24-inch and smaller	5,190	LF	$ 22	$ 115,180
Rock Excavation	1,417	CY	$ 300	$ 425,070
			Subtotal (rounded)	***$ 2,049,000***
Mobilization	1	LS	5%	$ 103,000
Contingency	1	LS	30%	$ 646,000
			Construction Subtotal (rounded)	***$ 2,798,000***
Engineering and CMS	1	LS	20%	$ 560,000
Permitting (Assume 8% of total)	1	LS	$ 223,800	$ 223,800
Geotechnical (Assume 1% of total)	1	LS	$ 28,000	$ 28,000
Surveying	1	LS	$ 50,000	$ 50,000
Legal and Admin	1	LS	$ 20,000	$ 20,000
			Total Project Cost (rounded)	***$ 3,700,000***

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Collection System Project: Basin 4 - Pipeline Upsize and Reroute from Tualatin St. to Basin 6
Project Identifier: 4.b

Objective: Resolve undersized pipeline in Basin 4. Construct gravity pipeline capable of conveying anticipated peak hour flows.

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
12-inch Pipe - Excavation, Backfill	860	LF	$ 160	$ 137,600
15-inch Pipe - Excavation, Backfill	3,830	LF	$ 170	$ 651,100
Roadway Restoration (Half Lane)	3,140	LF	$ 45	$ 141,300
Landscape Restoration	1,550	LF	$ 20	$ 31,000
Traffic Control w/out Flagging	860	LF	$ 6	$ 5,160
Traffic Control w/ Flagging	1	LS	$ 122,000	$ 122,000
48-Inch, Standard Manhole	17	EA	$ 8,000	$ 136,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Existing Utility Protection	4,690	LF	$ 4	$ 18,760
Replace Service Laterals	25	EA	$ 1,500	$ 37,500
Bypass Pumping - Pipes 24-inch and smaller	3,160	LF	$ 22	$ 70,130
Rock Excavation	2,114	CY	$ 300	$ 634,330
			Subtotal (rounded)	***$ 1,989,000***
Mobilization	1	LS	5%	$ 100,000
Contingency	1	LS	30%	$ 627,000
			Construction Subtotal (rounded)	***$ 2,716,000***
Engineering and CMS	1	LS	20%	$ 544,000
Permitting (Assume 8% of total)	1	LS	$ 217,300	$ 217,300
Geotechnical (Assume 1% of total)	1	LS	$ 27,000	$ 27,000
Surveying	1	LS	$ 50,000	$ 50,000
Legal and Admin	1	LS	$ 20,000	$ 20,000
			Total Project Cost (rounded)	***$ 3,600,000***

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Collection System Project: Basin 5 - Pipeline Upsize
Project Identifier: 5.a

Objective: Resolve undersized pipeline in Basin 5. Construct gravity pipeline capable of conveying anticipated peak hour flows.

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
36-inch Pipe - Excavation, Backfill	470	LF	$ 245	$ 115,150
42-inch Pipe - Excavation, Backfill	2,850	LF	$ 275	$ 783,750
Roadway Restoration (Full Lane)	2,185	LF	$ 75	$ 163,880
Landscape restoration	1,135	LF	$ 20	$ 22,700
Traffic Control w/ Flagging	1	LS	$ 92,000	$ 92,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
72-Inch, Standard Manhole	14	EA	$ 16,500	$ 231,000
Existing Utility Protection	3,320	LF	$ 4	$ 13,280
ADA Ramp Reconstruction (Compliance)	8	EA	$ 4,600	$ 36,800
Replace Service Laterals	27	EA	$ 1,500	$ 40,500
Bypass Pumping - Pipes larger than 24-inch	3,320	LF	$ 27	$ 91,020
Rock Excavation	2,906	CY	$ 300	$ 871,920
Tunnel Bore	475	LF	$ 400	$ 200,000
Subtotal (rounded)				***$ 2,666,000***
Mobilization	1	LS	5%	$ 134,000
Contingency	1	LS	30%	$ 840,000
Construction Subtotal (rounded)				***$ 3,640,000***
Engineering and CMS	1	LS	20%	$ 728,000
Permitting	1	LS	$ 15,000	$ 15,000
Geotechnical (Assume 1% of total)	1	LS	$ 36,400	$ 36,400
Surveying	1	LS	$ 30,000	$ 30,000
Legal and Admin	1	LS	$ 10,000	$ 10,000
Total Project Cost (rounded)				***$ 4,500,000***

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Collection System Project: Basin 6 - Pipeline Upsize
Project Identifier: 6.a

Objective: Resolve undersized pipeline in Basin 6. Construct gravity pipeline capable of conveying anticipated peak hour flows.

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Port Ave - Gravity Upsize				
27-inch Pipe - Excavation, Backfill	3,030	LF	$ 220	$ 666,600
Roadway Restoration (Half Lane)	2,775	LF	$ 45	$ 124,880
Landscape Restoration	255	LF	$ 20	$ 5,100
Traffic Control w/ Flagging	1	LS	$ 76,000	$ 76,000
60-Inch, Standard Manhole	9	EA	$ 14,000	$ 126,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Railroad Boring	140	LF	$ 900	$ 126,000
Highway Permitting	1	LS	$ 5,000	$ 5,000
Replace Service Laterals	8	EA	$ 1,500	$ 12,000
Bypass Pumping - Pipes 24-inch and smaller	3,030	LF	$ 22	$ 67,240
Rock Excavation	1,546	CY	$ 300	$ 463,680
Existing Utility Protection	3,030	LF	$ 4	$ 12,120
			Subtotal	***$ 1,688,000***
S 18th St, Dubois Lane, Columbia River HWY - Gravity Pipeline Upsize				
15-inch Pipe - Excavation, Backfill	4,220	LF	$ 170	$ 717,400
Roadway Restoration (Half Lane)	3,069	LF	$ 45	$ 138,110
Landscape Restoration	760	LF	$ 20	$ 15,200
Highway Permitting	1	LS	$ 5,000	$ 5,000
ODOT Roadway Restoration (Full Lane)	391	LF	$ 225	$ 87,980
Traffic Control w/ Flagging	1	LS	$ 114,000	$ 114,000
Railroad Boring	80	LF	$ 900	$ 72,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
ADA Ramp Reconstruction (Compliance)	10	EA	$ 4,600	$ 46,000
Replace Service Laterals	47	EA	$ 1,500	$ 70,500
Bypass Pumping - Pipes 24-inch and smaller	4,220	LF	$ 22	$ 93,650
Rock Excavation	903	CY	$ 300	$ 270,880
Existing Utility Protection	4,220	LF	$ 4	$ 16,880
			Subtotal	***$ 1,779,000***
Old Portland Rd., Umatilla St. - Gravity Pipeline Upsize				
21-inch Pipe - Excavation, Backfill	1,420	LF	$ 195	$ 276,900
Roadway Restoration (Half Lane)	1,420	LF	$ 45	$ 63,900
Landscape Restoration	375	LF	$ 20	$ 7,500
Traffic Control w/ Flagging	1	LS	$ 24,000	$ 24,000
48-Inch, Standard Manhole	4	EA	$ 8,000	$ 32,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Existing Utility Protection	1,420	LF	$ 4	$ 5,680
Rock Excavation	557	CY	$ 300	$ 167,010
			Subtotal	***$ 580,000***
Southern Trunkline - Gravity Pipeline Upsize				
30-inch Pipe - Excavation, Backfill	420	LF	$ 230	$ 96,600
33-inch Pipe - Excavation, Backfill	1,185	LF	$ 240	$ 284,400
36-inch Pipe - Excavation, Backfill	2,325	LF	$ 245	$ 569,600
36-inch Pipe - Excavation, Backfill, Structure over Lagoon	645	LF	$ 1,170	$ 754,700
Roadway Restoration (Half Lane)	50	LF	$ 45	$ 2,300
Traffic Control w/ Flagging	1	LS	$ 6,000	$ 6,000
72-Inch, Standard Manhole	15	EA	$ 16,500	$ 247,500
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes larger than 24-inch	4,575	LF	$ 27	$ 125,400
Rock Excavation	3,102	CY	$ 300	$ 930,600
Existing Utility Protection	4,575	LF	$ 4	$ 18,300
			Subtotal	***$ 3,039,000***
			Subtotal (rounded)	***$ 7,086,000***
Mobilization	1	LS	5%	$ 355,000
Contingency	1	LS	30%	$ 2,233,000
			Construction Subtotal (rounded)	***$ 9,674,000***
Engineering and CMS	1	LS	20%	$ 1,935,000
Permitting (Assume 5% of total)	1	LS	$ 483,700	$ 483,700
Geotechnical (Assume 1% of total)	1	LS	$ 96,740	$ 96,740
Surveying	1	LS	$ 60,000	$ 60,000
Legal and Admin	1	LS	$ 30,000	$ 30,000
			Total Project Cost (rounded)	***$ 12,300,000***

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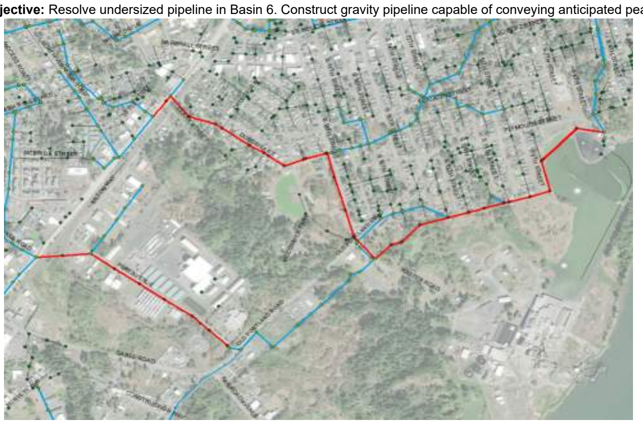
Item #4.

Collection System Project: Basin 6 - Pipeline Upsize and Reroute from Old Portland Rd to Kaster Rd.
Project Identifier: 6.b

Objective: Resolve undersized pipeline in Basin 6. Construct gravity pipeline capable of conveying anticipated peak hour flows.



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Port Ave - Gravity Upsize				
27-inch Pipe - Excavation, Backfill	3,030	LF	$ 220	$ 666,600
Roadway Restoration (Half Lane)	2,775	LF	$ 45	$ 124,880
Landscape Restoration	255	LF	$ 20	$ 5,100
Traffic Control w/ Flagging	1	LS	$ 76,000	$ 76,000
60-Inch, Standard Manhole	9	EA	$ 14,000	$ 126,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Railroad Boring	140	LF	$ 900	$ 126,000
Highway Permitting	1	LS	$ 5,000	$ 5,000
Replace Service Laterals	8	EA	$ 1,500	$ 12,000
Bypass Pumping - Pipes 24-inch and smaller	3,030	LF	$ 22	$ 67,240
Rock Excavation	1,546	CY	$ 300	$ 463,680
Existing Utility Protection	3,030	LF	$ 4	$ 12,120
			Subtotal	***$ 1,688,000***
S 18th St, Dubois Lane, Columbia River HWY - Gravity Pipeline Upsize				
15-inch Pipe - Excavation, Backfill	3,829	LF	$ 170	$ 650,930
15-inch Pipe - Excludes Excavation, Backfill	391	LF	$ 27	$ 10,480
Directional Bore - 24" Casing	391	LF	$ 573	$ 224,050
Roadway Restoration (Half Lane)	2,678	LF	$ 45	$ 120,510
Landscape Restoration	760	LF	$ 20	$ 15,200
Highway Permitting	1	LS	$ 5,000	$ 5,000
Traffic Control w/ Flagging	1	LS	$ 106,000	$ 106,000
Railroad Boring	80	LF	$ 900	$ 72,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
ADA Ramp Reconstruction (Compliance)	10	EA	$ 4,600	$ 46,000
Replace Service Laterals	47	EA	$ 1,500	$ 70,500
Bypass Pumping - Pipes 24-inch and smaller	3,829	LF	$ 22	$ 84,970
Rock Excavation	819	CY	$ 300	$ 245,780
Existing Utility Protection	3,829	LF	$ 4	$ 15,320
			Subtotal	***$ 1,798,000***
Old Portland Rd., Kaster Rd. - Gravity Pipeline Reroute to 27" Trunkline				
15-inch Pipe - Excavation, Backfill	425	LF	$ 170	$ 72,250
Roadway Restoration (Half Lane)	425	LF	$ 45	$ 19,130
Traffic Control w/ Flagging	1	LS	$ 7,000	$ 7,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Existing Utility Protection	425	LF	$ 4	$ 1,700
Rock Excavation	10	CY	$ 300	$ 3,070
			Subtotal	***$ 107,000***
Southern Trunkline - Gravity Pipeline Upsize				
30-inch Pipe - Excavation, Backfill	420	LF	$ 230	$ 96,600
33-inch Pipe - Excavation, Backfill	1,185	LF	$ 240	$ 284,400
36-inch Pipe - Excavation, Backfill	2,325	LF	$ 245	$ 569,600
36-inch Pipe - Excavation, Backfill, Structure over Lagoon	645	LF	$ 1,170	$ 754,700
Roadway Restoration (Half Lane)	50	LF	$ 45	$ 2,300
Traffic Control w/ Flagging	1	LS	$ 6,000	$ 6,000
72-Inch, Standard Manhole	15	EA	$ 16,500	$ 247,500
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes larger than 24-inch	4,575	LF	$ 27	$ 125,400
Rock Excavation	3,102	CY	$ 300	$ 930,600
Existing Utility Protection	4,575	LF	$ 4	$ 18,300
			Subtotal	***$ 3,039,000***
			Subtotal (rounded)	***$ 6,632,000***
Mobilization	1	LS	5%	$ 332,000
Contingency	1	LS	30%	$ 2,090,000
			Construction Subtotal (rounded)	***$ 9,054,000***
Engineering and CMS	1	LS	20%	$ 1,811,000
Permitting (Assume 5% of total)	1	LS	$ 452,700	$ 452,700
Geotechnical (Assume 1% of total)	1	LS	$ 90,540	$ 90,540
Surveying	1	LS	$ 60,000	$ 60,000
Legal and Admin	1	LS	$ 30,000	$ 30,000
			Total Project Cost (rounded)	***$ 11,500,000***

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Collection System Project: Basin 1 - Pipeline Upsize
Project Identifier: 1.a

Objective: Resolve undersized pipeline in Basin 1. Construct gravity pipeline capable of conveying anticipated peak hour flows.

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
18-inch Pipe - Excavation, Backfill	230	LF	$ 185	$ 42,550
15-inch Pipe - Excavation, Backfill	2,330	LF	$ 170	$ 396,100
Roadway Restoration (Half Lane)	1,315	LF	$ 45	$ 59,180
Landscape Restoration	1,245	LF	$ 20	$ 24,900
Traffic Control w/ Flagging	1	LS	$ 62,000	$ 62,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
48-inch Manhole	8	EA	$ 8,000	$ 64,000
Bypass Pumping - Pipes 24-inch and smaller	2,560	LF	$ 22	$ 56,810
ADA Ramp Reconstruction (Compliance)	6	EA	$ 4,600	$ 27,600
Rock Excavation	589	CY	$ 300	$ 176,770
Replace Service Laterals	18	EA	$ 1,500	$ 27,000
Existing Utility Protection	2,560	LF	$ 4	$ 10,240
			Subtotal (rounded)	***$ 951,000***
Mobilization	1	LS	5%	$ 48,000
Contingency	1	LS	30%	$ 300,000
			Construction Subtotal (rounded)	***$ 1,299,000***
Engineering and CMS	1	LS	20%	$ 260,000
Permitting (Assume 8% of total)	1	LS	$ 103,900	$ 103,900
Geotechnical (Assume 1% of total)	1	LS	$ 13,000	$ 13,000
Surveying	1	LS	$ 40,000	$ 40,000
Legal and Admin	1	LS	$ 20,000	$ 20,000
			Total Project Cost (rounded)	***$ 1,800,000***

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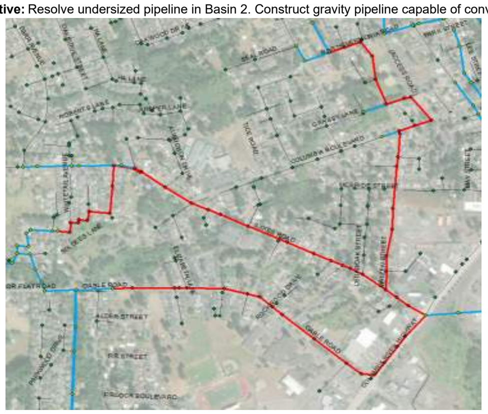
Collection System Project: Basin 2 - Pipeline Upsize
Project Identifier: 2.a

Objective: Resolve undersized pipeline in Basin 2. Construct gravity pipeline capable of conveying anticipated peak hour flows.



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Sykes Road - Gravity Upsize				
12-inch Pipe - Excavation, Backfill	315	LF	$ 160	$ 50,400
15-inch Pipe - Excavation, Backfill	2,645	LF	$ 170	$ 449,650
18-inch Pipe - Excavation, Backfill	522	LF	$ 185	$ 96,570
Roadway Restoration (Half Lane)	3,482	LF	$ 45	$ 156,690
Traffic Control w/ Flagging	1	LS	$ 65,000	$ 65,000
48-Inch, Standard Manhole	15	EA	$ 8,000	$ 120,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	3,482	LF	$ 22	$ 77,270
Rock Excavation	786	CY	$ 300	$ 235,760
ADA Ramp Reconstruction (Compliance)	11	EA	$ 4,600	$ 50,600
Replace Service Laterals	55	EA	$ 1,500	$ 82,500
Existing Utility Protection	2,960	LF	$ 4	$ 11,840
			Subtotal	***$ 1,400,000***
Matzen St. - Gravity Pipeline Upsize				
12-inch PVC gravity pipe	1,450	LF	$ 160	$ 232,000
15-inch PVC gravity pipe	2,600	LF	$ 170	$ 442,000
Roadway Restoration (Half Lane)	2,980	LF	$ 45	$ 134,100
Landscape Restoration	1,070	LF	$ 20	$ 21,400
Traffic Control w/ Flagging	1	LS	$ 110,000	$ 110,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	4,050	LF	$ 22	$ 89,880
Rock Excavation	792	CY	$ 300	$ 237,540
ADA Ramp Reconstruction (Compliance)	9	EA	$ 4,600	$ 41,400
Replace Service Laterals	42	EA	$ 1,500	$ 63,000
Existing Utility Protection	4,050	LF	$ 4	$ 16,200
			Subtotal	***$ 1,519,000***
Gable Rd. - Gravity Pipeline Upsize and Reroute to Sykes Rd.				
12-inch PVC gravity pipe	4,050	LF	$ 160	$ 648,000
Roadway Restoration (Half Lane)	4,050	LF	$ 45	$ 182,250
Traffic Control w/ Flagging	1	LS	$ 105,000	$ 105,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
48-Inch, Standard Manhole	13	EA	$ 8,000	$ 104,000
Existing Utility Protection	4,050	LF	$ 4	$ 16,200
Bypass Pumping - Pipes 24-inch and smaller	4,050	LF	$ 22	$ 89,880
ADA Ramp Reconstruction (Compliance)	11	EA	$ 4,600	$ 50,600
Replace Service Laterals	32	EA	$ 1,500	$ 48,000
Rock Excavation	593	CY	$ 300	$ 177,960
			Subtotal	***$ 1,425,000***
Westshire Ln. - Gravity Pipeline Upsize				
10-inch PVC gravity pipe	250	LF	$ 150	$ 37,500
12-inch PVC gravity pipe	2,300	LF	$ 160	$ 368,000
Roadway Restoration (Half Lane)	2,235	LF	$ 45	$ 100,580
Landscape Restoration	315	LF	$ 20	$ 6,300
Traffic Control w/ Flagging	1	LS	$ 87,000	$ 87,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	2,550	LF	$ 22	$ 56,590
Rock Excavation	381	CY	$ 300	$ 114,370
ADA Ramp Reconstruction (Compliance)	4	EA	$ 4,600	$ 18,400
Replace Service Laterals	25	EA	$ 1,500	$ 37,500
Existing Utility Protection	2,550	LF	$ 4	$ 10,200
			Subtotal	***$ 968,000***
			Subtotal (rounded)	***$ 5,312,000***
Mobilization	1	LS	5%	$ 266,000
Contingency	1	LS	30%	$ 1,674,000
			Construction Subtotal (rounded)	***$ 7,252,000***
Engineering and CMS	1	LS	20%	$ 1,451,000
Permitting (Assume 8% of total)	1	LS	$ 580,200	$ 580,200
Geotechnical (Assume 1% of total)	1	LS	$ 73,000	$ 73,000
Surveying	1	LS	$ 100,000	$ 100,000
Legal and Admin	1	LS	$ 40,000	$ 40,000
			Total Project Cost (rounded)	***$ 9,500,000***

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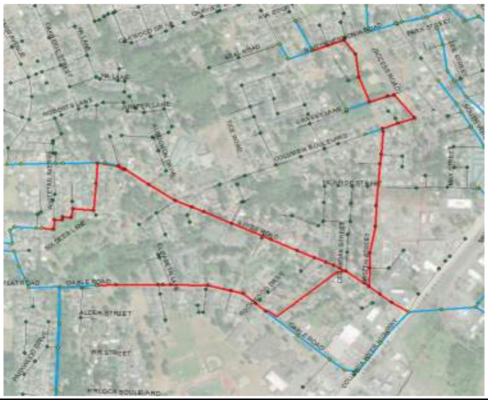
Item #4.

Collection System Project: Basin 2 - Pipeline Upsize and Reroute from Gable Rd. to Sykes Rd.
Project Identifier: 2.b

Objective: Resolve undersized pipeline in Basin 2. Construct gravity pipeline capable of conveying anticipated peak hour flows.



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Sykes Road - Gravity Upsize				
12-inch Pipe - Excavation, Backfill	315	LF	$ 160	$ 50,400
15-inch Pipe - Excavation, Backfill	2,645	LF	$ 170	$ 449,650
18-inch Pipe - Excavation, Backfill	522	LF	$ 185	$ 96,570
Roadway Restoration (Half Lane)	3,482	LF	$ 45	$ 156,690
Traffic Control w/ Flagging	1	LS	$ 65,000	$ 65,000
48-Inch, Standard Manhole	15	EA	$ 8,000	$ 120,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	3,482	LF	$ 22	$ 77,270
Rock Excavation	786	CY	$ 300	$ 235,760
ADA Ramp Reconstruction (Compliance)	11	EA	$ 4,600	$ 50,600
Replace Service Laterals	55	EA	$ 1,500	$ 82,500
Existing Utility Protection	2,960	LF	$ 4	$ 11,840
			Subtotal	***$ 1,400,000***
Matzen St. - Gravity Pipeline Upsize				
12-inch Pipe - Excavation, Backfill	1,450	LF	$ 160	$ 232,000
15-inch Pipe - Excavation, Backfill	2,600	LF	$ 170	$ 442,000
Roadway Restoration (Half Lane)	2,980	LF	$ 45	$ 134,100
Landscape Restoration	1,070	LF	$ 20	$ 21,400
Traffic Control w/ Flagging	1	LS	$ 110,000	$ 110,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	4,050	LF	$ 22	$ 89,880
Rock Excavation	792	CY	$ 300	$ 237,540
ADA Ramp Reconstruction (Compliance)	9	EA	$ 4,600	$ 41,400
Replace Service Laterals	42	EA	$ 1,500	$ 63,000
Existing Utility Protection	4,050	LF	$ 4	$ 16,200
			Subtotal	***$ 1,519,000***
Gable Rd. - Gravity Pipeline Upsize and Reroute to Sykes Rd.				
12-inch Pipe - Excavation, Backfill	3,000	LF	$ 160	$ 480,000
Roadway Restoration (Half Lane)	3,000	LF	$ 45	$ 135,000
Traffic Control w/ Flagging	1	LS	$ 87,000	$ 87,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
48-Inch, Standard Manhole	13	EA	$ 8,000	$ 104,000
Existing Utility Protection	3,000	LF	$ 4	$ 12,000
Bypass Pumping - Pipes 24-inch and smaller	3,000	LF	$ 22	$ 66,580
ADA Ramp Reconstruction (Compliance)	3	EA	$ 4,600	$ 13,800
Replace Service Laterals	23	EA	$ 1,500	$ 34,500
Rock Excavation	1,333	CY	$ 300	$ 400,000
			Subtotal	***$ 1,336,000***
Westshire Ln. - Gravity Pipeline Upsize				
10-inch Pipe - Excavation, Backfill	250	LF	$ 150	$ 37,500
12-inch Pipe - Excavation, Backfill	2,300	LF	$ 160	$ 368,000
Roadway Restoration (Half Lane)	2,235	LF	$ 45	$ 100,580
Landscape Restoration	315	LF	$ 20	$ 6,300
Traffic Control w/ Flagging	1	LS	$ 87,000	$ 87,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	2,550	LF	$ 22	$ 56,590
Rock Excavation	381	CY	$ 300	$ 114,370
ADA Ramp Reconstruction (Compliance)	4	EA	$ 4,600	$ 18,400
Replace Service Laterals	25	EA	$ 1,500	$ 37,500
Existing Utility Protection	2,550	LF	$ 4	$ 10,200
			Subtotal	***$ 968,000***
			Subtotal (rounded)	***$ 5,223,000***
Mobilization	1	LS	5%	$ 262,000
Contingency	1	LS	30%	$ 1,646,000
			Construction Subtotal (rounded)	***$ 7,131,000***
Engineering and CMS	1	LS	20%	$ 1,427,000
Permitting (Assume 8% of total)	1	LS	$ 570,500	$ 570,500
Geotechnical (Assume 1% of total)	1	LS	$ 71,000	$ 71,000
Surveying	1	LS	$ 100,000	$ 100,000
Legal and Admin	1	LS	$ 40,000	$ 40,000
			Total Project Cost (rounded)	***$ 9,400,000***

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Item #4.

Collection System Project: Basin 3 - Pipeline Upsize
Project Identifier: 3.a

Objective: Resolve undersized pipeline in Basin 3. Construct gravity pipeline capable of conveying anticipated peak hour flows.

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
15-inch Pipe - Excavation, Backfill	1,550	LF	$ 170	$ 263,500
Roadway Restoration (Half Lane)	922	LF	$ 45	$ 41,490
Soil Surface Repair	628	LF	$ 5	$ 3,140
Traffic Control w/ Flagging	1	LS	$ 47,000	$ 47,000
48-Inch, Standard Manhole	8	EA	$ 8,000	$ 64,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
ADA Ramp Reconstruction (Compliance)	4	EA	$ 4,600	$ 18,400
Replace Service Laterals	25	EA	$ 1,500	$ 37,500
Bypass Pumping - Pipes 24-inch and smaller	1,550	LF	$ 22	$ 34,400
Rock Excavation	332	CY	$ 300	$ 99,490
Existing Utility Protection	1,550	LF	$ 4	$ 6,200
			Subtotal (rounded)	***$ 619,000***
Mobilization	1	LS	5%	$ 31,000
Contingency	1	LS	30%	$ 195,000
			Construction Subtotal (rounded)	***$ 845,000***
Engineering and CMS	1	LS	20%	$ 169,000
Permitting (Assume 8% of total)	1	LS	$ 67,600	$ 67,600
Geotechnical (Assume 1% of total)	1	LS	$ 8,000	$ 8,000
Surveying	1	LS	$ 20,000	$ 20,000
Legal and Admin	1	LS	$ 10,000	$ 10,000
			Total Project Cost (rounded)	***$ 1,200,000***

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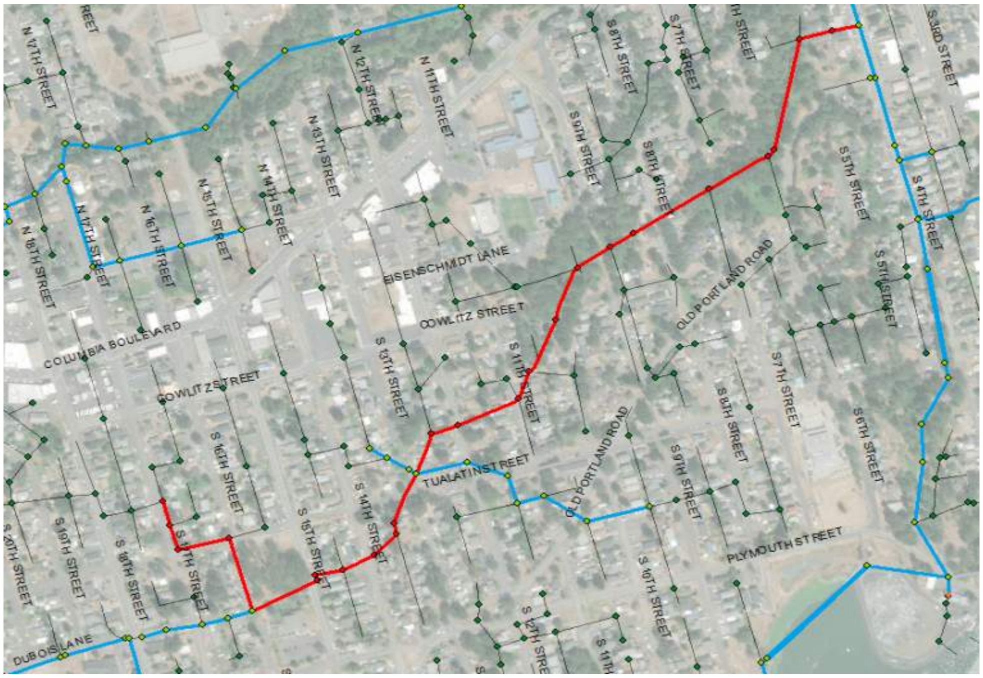
Collection System Project: Basin 4 - Pipeline Upsize
Project Identifier: 4.a

Objective: Resolve undersized pipeline in Basin 4. Construct gravity pipeline capable of conveying anticipated peak hour flows.



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
12-inch Pipe - Excavation, Backfill	860	LF	$ 160	$ 137,600
15-inch Pipe - Excavation, Backfill	1,100	LF	$ 170	$ 187,000
18-inch Pipe - Excavation, Backfill	2,400	LF	$ 185	$ 444,000
21-inch Pipe - Excavation, Backfill	830	LF	$ 195	$ 161,850
Roadway Restoration (Half Lane)	850	LF	$ 45	$ 38,250
Landscape Restoration	4,340	LF	$ 20	$ 86,800
Traffic Control w/out Flagging	4,090	LF	$ 6	$ 24,540
Traffic Control w/ Flagging	1	LS	$ 101,000	$ 101,000
48-Inch, Standard Manhole	30	EA	$ 8,000	$ 240,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Existing Utility Protection	5,190	LF	$ 4	$ 20,760
Replace Service Laterals	42	EA	$ 1,500	$ 63,000
Bypass Pumping - Pipes 24-inch and smaller	5,190	LF	$ 22	$ 115,180
Rock Excavation	1,417	CY	$ 300	$ 425,070
			Subtotal (rounded)	***$ 2,049,000***
Mobilization	1	LS	5%	$ 103,000
Contingency	1	LS	30%	$ 646,000
			Construction Subtotal (rounded)	***$ 2,798,000***
Engineering and CMS	1	LS	20%	$ 560,000
Permitting (Assume 8% of total)	1	LS	$ 223,800	$ 223,800
Geotechnical (Assume 1% of total)	1	LS	$ 28,000	$ 28,000
Surveying	1	LS	$ 50,000	$ 50,000
Legal and Admin	1	LS	$ 20,000	$ 20,000
			Total Project Cost (rounded)	***$ 3,700,000***

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Item #4.

Collection System Project: Basin 4 - Pipeline Upsize and Reroute from Tualatin St. to Basin 6
Project Identifier: 4.b

Objective: Resolve undersized pipeline in Basin 4. Construct gravity pipeline capable of conveying anticipated peak hour flows.

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
12-inch Pipe - Excavation, Backfill	860	LF	$ 160	$ 137,600
15-inch Pipe - Excavation, Backfill	3,830	LF	$ 170	$ 651,100
Roadway Restoration (Half Lane)	3,140	LF	$ 45	$ 141,300
Landscape Restoration	1,550	LF	$ 20	$ 31,000
Traffic Control w/out Flagging	860	LF	$ 6	$ 5,160
Traffic Control w/ Flagging	1	LS	$ 122,000	$ 122,000
48-Inch, Standard Manhole	17	EA	$ 8,000	$ 136,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Existing Utility Protection	4,690	LF	$ 4	$ 18,760
Replace Service Laterals	25	EA	$ 1,500	$ 37,500
Bypass Pumping - Pipes 24-inch and smaller	3,160	LF	$ 22	$ 70,130
Rock Excavation	2,114	CY	$ 300	$ 634,330
			Subtotal (rounded)	***$ 1,989,000***
Mobilization	1	LS	5%	$ 100,000
Contingency	1	LS	30%	$ 627,000
			Construction Subtotal (rounded)	***$ 2,716,000***
Engineering and CMS	1	LS	20%	$ 544,000
Permitting (Assume 8% of total)	1	LS	$ 217,300	$ 217,300
Geotechnical (Assume 1% of total)	1	LS	$ 27,000	$ 27,000
Surveying	1	LS	$ 50,000	$ 50,000
Legal and Admin	1	LS	$ 20,000	$ 20,000
			Total Project Cost (rounded)	***$ 3,600,000***

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Collection System Project: Basin 5 - Pipeline Upsize
Project Identifier: 5.a

Objective: Resolve undersized pipeline in Basin 5. Construct gravity pipeline capable of conveying anticipated peak hour flows.

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
36-inch Pipe - Excavation, Backfill	470	LF	$ 245	$ 115,150
42-inch Pipe - Excavation, Backfill	2,850	LF	$ 275	$ 783,750
Roadway Restoration (Full Lane)	2,185	LF	$ 75	$ 163,880
Landscape restoration	1,135	LF	$ 20	$ 22,700
Traffic Control w/ Flagging	1	LS	$ 92,000	$ 92,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
72-Inch, Standard Manhole	14	EA	$ 16,500	$ 231,000
Existing Utility Protection	3,320	LF	$ 4	$ 13,280
ADA Ramp Reconstruction (Compliance)	8	EA	$ 4,600	$ 36,800
Replace Service Laterals	27	EA	$ 1,500	$ 40,500
Bypass Pumping - Pipes larger than 24-inch	3,320	LF	$ 27	$ 91,020
Rock Excavation	2,906	CY	$ 300	$ 871,920
Tunnel Bore	475	LF	$ 400	$ 200,000
			Subtotal (rounded)	***$ 2,666,000***
Mobilization	1	LS	5%	$ 134,000
Contingency	1	LS	30%	$ 840,000
			Construction Subtotal (rounded)	***$ 3,640,000***
Engineering and CMS	1	LS	20%	$ 728,000
Permitting	1	LS	$ 15,000	$ 15,000
Geotechnical (Assume 1% of total)	1	LS	$ 36,400	$ 36,400
Surveying	1	LS	$ 30,000	$ 30,000
Legal and Admin	1	LS	$ 10,000	$ 10,000
			Total Project Cost (rounded)	***$ 4,500,000***

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Collection System Project: Basin 6 - Pipeline Upsize
Project Identifier: 6.a

Objective: Resolve undersized pipeline in Basin 6. Construct gravity pipeline capable of conveying anticipated peak hour flows.

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Port Ave - Gravity Upsize				
27-inch Pipe - Excavation, Backfill	3,030	LF	$ 220	$ 666,600
Roadway Restoration (Half Lane)	2,775	LF	$ 45	$ 124,880
Landscape Restoration	255	LF	$ 20	$ 5,100
Traffic Control w/ Flagging	1	LS	$ 76,000	$ 76,000
60-Inch, Standard Manhole	9	EA	$ 14,000	$ 126,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Railroad Boring	140	LF	$ 900	$ 126,000
Highway Permitting	1	LS	$ 5,000	$ 5,000
Replace Service Laterals	8	EA	$ 1,500	$ 12,000
Bypass Pumping - Pipes 24-inch and smaller	3,030	LF	$ 22	$ 67,240
Rock Excavation	1,546	CY	$ 300	$ 463,680
Existing Utility Protection	3,030	LF	$ 4	$ 12,120
			Subtotal	***$ 1,688,000***
S 18th St, Dubois Lane, Columbia River HWY - Gravity Pipeline Upsize				
15-inch Pipe - Excavation, Backfill	4,220	LF	$ 170	$ 717,400
Roadway Restoration (Half Lane)	3,069	LF	$ 45	$ 138,110
Landscape Restoration	760	LF	$ 20	$ 15,200
Highway Permitting	1	LS	$ 5,000	$ 5,000
ODOT Roadway Restoration (Full Lane)	391	LF	$ 225	$ 87,980
Traffic Control w/ Flagging	1	LS	$ 114,000	$ 114,000
Railroad Boring	80	LF	$ 900	$ 72,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
ADA Ramp Reconstruction (Compliance)	10	EA	$ 4,600	$ 46,000
Replace Service Laterals	47	EA	$ 1,500	$ 70,500
Bypass Pumping - Pipes 24-inch and smaller	4,220	LF	$ 22	$ 93,650
Rock Excavation	903	CY	$ 300	$ 270,880
Existing Utility Protection	4,220	LF	$ 4	$ 16,880
			Subtotal	***$ 1,779,000***
Old Portland Rd., Umatilla St. - Gravity Pipeline Upsize				
21-inch Pipe - Excavation, Backfill	1,420	LF	$ 195	$ 276,900
Roadway Restoration (Half Lane)	1,420	LF	$ 45	$ 63,900
Landscape Restoration	375	LF	$ 20	$ 7,500
Traffic Control w/ Flagging	1	LS	$ 24,000	$ 24,000
48-Inch, Standard Manhole	4	EA	$ 8,000	$ 32,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Existing Utility Protection	1,420	LF	$ 4	$ 5,680
Rock Excavation	557	CY	$ 300	$ 167,010
			Subtotal	***$ 580,000***
Southern Trunkline - Gravity Pipeline Upsize				
30-inch Pipe - Excavation, Backfill	420	LF	$ 230	$ 96,600
33-inch Pipe - Excavation, Backfill	1,185	LF	$ 240	$ 284,400
36-inch Pipe - Excavation, Backfill	2,325	LF	$ 245	$ 569,600
36-inch Pipe - Excavation, Backfill, Structure over Lagoon	645	LF	$ 1,170	$ 754,700
Roadway Restoration (Half Lane)	50	LF	$ 45	$ 2,300
Traffic Control w/ Flagging	1	LS	$ 6,000	$ 6,000
72-Inch, Standard Manhole	15	EA	$ 16,500	$ 247,500
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes larger than 24-inch	4,575	LF	$ 27	$ 125,400
Rock Excavation	3,102	CY	$ 300	$ 930,600
Existing Utility Protection	4,575	LF	$ 4	$ 18,300
			Subtotal	***$ 3,039,000***
			Subtotal (rounded)	***$ 7,086,000***
Mobilization	1	LS	5%	$ 355,000
Contingency	1	LS	30%	$ 2,233,000
			Construction Subtotal (rounded)	***$ 9,674,000***
Engineering and CMS	1	LS	20%	$ 1,935,000
Permitting (Assume 5% of total)	1	LS	$ 483,700	$ 483,700
Geotechnical (Assume 1% of total)	1	LS	$ 96,740	$ 96,740
Surveying	1	LS	$ 60,000	$ 60,000
Legal and Admin	1	LS	$ 30,000	$ 30,000
			Total Project Cost (rounded)	***$ 12,300,000***

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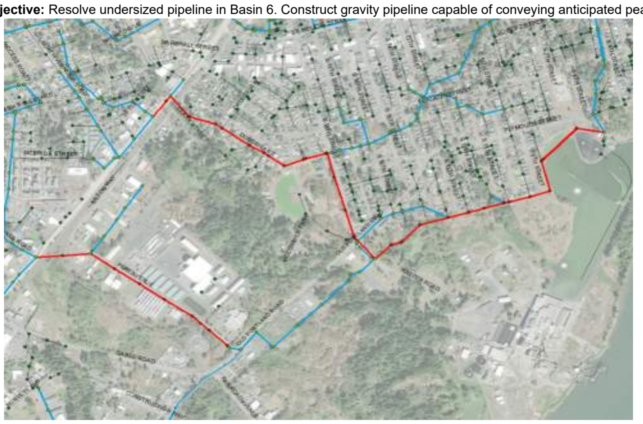
Collection System Project: Basin 6 - Pipeline Upsize and Reroute from Old Portland Rd to Kaster Rd.
Project Identifier: 6.b

Objective: Resolve undersized pipeline in Basin 6. Construct gravity pipeline capable of conveying anticipated peak hour flows.



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Port Ave - Gravity Upsize				
27-inch Pipe - Excavation, Backfill	3,030	LF	$ 220	$ 666,600
Roadway Restoration (Half Lane)	2,775	LF	$ 45	$ 124,880
Landscape Restoration	255	LF	$ 20	$ 5,100
Traffic Control w/ Flagging	1	LS	$ 76,000	$ 76,000
60-Inch, Standard Manhole	9	EA	$ 14,000	$ 126,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Railroad Boring	140	LF	$ 900	$ 126,000
Highway Permitting	1	LS	$ 5,000	$ 5,000
Replace Service Laterals	8	EA	$ 1,500	$ 12,000
Bypass Pumping - Pipes 24-inch and smaller	3,030	LF	$ 22	$ 67,240
Rock Excavation	1,546	CY	$ 300	$ 463,680
Existing Utility Protection	3,030	LF	$ 4	$ 12,120
			Subtotal	***$ 1,688,000***
S 18th St, Dubois Lane, Columbia River HWY - Gravity Pipeline Upsize				
15-inch Pipe - Excavation, Backfill	3,829	LF	$ 170	$ 650,930
15-inch Pipe - Excludes Excavation, Backfill	391	LF	$ 27	$ 10,480
Directional Bore - 24" Casing	391	LF	$ 573	$ 224,050
Roadway Restoration (Half Lane)	2,678	LF	$ 45	$ 120,510
Landscape Restoration	760	LF	$ 20	$ 15,200
Highway Permitting	1	LS	$ 5,000	$ 5,000
Traffic Control w/ Flagging	1	LS	$ 106,000	$ 106,000
Railroad Boring	80	LF	$ 900	$ 72,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
ADA Ramp Reconstruction (Compliance)	10	EA	$ 4,600	$ 46,000
Replace Service Laterals	47	EA	$ 1,500	$ 70,500
Bypass Pumping - Pipes 24-inch and smaller	3,829	LF	$ 22	$ 84,970
Rock Excavation	819	CY	$ 300	$ 245,780
Existing Utility Protection	3,829	LF	$ 4	$ 15,320
			Subtotal	***$ 1,798,000***
Old Portland Rd., Kaster Rd. - Gravity Pipeline Reroute to 27" Trunkline				
15-inch Pipe - Excavation, Backfill	425	LF	$ 170	$ 72,250
Roadway Restoration (Half Lane)	425	LF	$ 45	$ 19,130
Traffic Control w/ Flagging	1	LS	$ 7,000	$ 7,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Existing Utility Protection	425	LF	$ 4	$ 1,700
Rock Excavation	10	CY	$ 300	$ 3,070
			Subtotal	***$ 107,000***
Southern Trunkline - Gravity Pipeline Upsize				
30-inch Pipe - Excavation, Backfill	420	LF	$ 230	$ 96,600
33-inch Pipe - Excavation, Backfill	1,185	LF	$ 240	$ 284,400
36-inch Pipe - Excavation, Backfill	2,325	LF	$ 245	$ 569,600
36-inch Pipe - Excavation, Backfill, Structure over Lagoon	645	LF	$ 1,170	$ 754,700
Roadway Restoration (Half Lane)	50	LF	$ 45	$ 2,300
Traffic Control w/ Flagging	1	LS	$ 6,000	$ 6,000
72-Inch, Standard Manhole	15	EA	$ 16,500	$ 247,500
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes larger than 24-inch	4,575	LF	$ 27	$ 125,400
Rock Excavation	3,102	CY	$ 300	$ 930,600
Existing Utility Protection	4,575	LF	$ 4	$ 18,300
			Subtotal	***$ 3,039,000***
			Subtotal (rounded)	***$ 6,632,000***
Mobilization	1	LS	5%	$ 332,000
Contingency	1	LS	30%	$ 2,090,000
			Construction Subtotal (rounded)	***$ 9,054,000***
Engineering and CMS	1	LS	20%	$ 1,811,000
Permitting (Assume 5% of total)	1	LS	$ 452,700	$ 452,700
Geotechnical (Assume 1% of total)	1	LS	$ 90,540	$ 90,540
Surveying	1	LS	$ 60,000	$ 60,000
Legal and Admin	1	LS	$ 30,000	$ 30,000
			Total Project Cost (rounded)	***$ 11,500,000***

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APPENDIX J

Capital Improvement Plan (CIP) Project Sheets

KELLER ASSOCIATES

Project No.	Project Name	Primary Purpose	Total Estimated Cost (2021)	SDC Growth Apportionment		City's Estimated Portion
				%	Cost	
Priority 1 Improvements						
1.1	WWTP Influent Flow Meter	Operations	$ 68,000	10%	$ 7,000	$ 61,000
1.2	Basin 4 Pipeline Upsize and Reroute	Capacity	$ 3,600,000	0%	$ -	$ 3,600,000
1.3	Basin 5 Pipeline Upsize	Capacity	$ 4,500,000	3%	$ 150,000	$ 4,350,000
1.4	Install Overflow Alarms	Operations	$ 9,000	20%	$ 2,000	$ 7,000
1.5	Pump Station 3 On-site Generator	Operations	$ 90,000	0%	$ -	$ 90,000
1.6	Annual I/I Reduction Program (6-Year)	Capacity	$ 3,000,000	20%	$ 590,000	$ 2,410,000
		Total Priority 1 Improvement Cost (rounded)	**$ 11,300,000**			**$ 10,500,000**
Priority 2 Improvements						
2.1	Riverfront District Trunkline and Pump Station 1 Relocation	Capacity, Operations	$ 2,400,000	18%	$ 440,000	$ 1,960,000
2.2	Relocate Pump Station 11	Capacity, Operations	$ 3,100,000	68%	$ 2,110,000	$ 990,000
2.3	Industrial Business Park Trunklines and Pump Station	Capacity, Operations	$ 13,200,000	100%	$ 13,200,000	$ -
2.4	Pump Station Upgrades	Operations, Safety	$ 700,000	20%	$ 140,000	$ 560,000
2.5	Master Plan Update	Operations	$ 300,000	100%	$ 300,000	$ -
2.6	Annual I/I Reduction Program (8-Year)	Capacity	$ 4,000,000	20%	$ 790,000	$ 3,210,000
		Total Priority 2 Improvement Cost (rounded)	**$ 23,700,000**			**$ 6,700,000**
Priority 3 Improvements						
3.1	Basin 6 Pipeline Upsize and Reroute	Capacity	$ 6,300,000	7%	$ 460,000	$ 5,840,000
3.2	Basin 2 Pipeline Upsize and Reroute	Capacity	$ 9,400,000	12%	$ 1,140,000	$ 8,260,000
3.3	Southern Trunkline Upsize	Capacity	$ 3,900,000	26%	$ 1,010,000	$ 2,890,000
3.4	Pump Station 7 Upgrades	Capacity	$ 2,200,000	65%	$ 1,430,000	$ 770,000
3.5	Basin 1 Pipeline Upsize	Capacity	$ 1,800,000	9%	$ 150,000	$ 1,650,000
3.6	Basin 3 Pipeline Upsize	Capacity	$ 1,200,000	3%	$ 40,000	$ 1,160,000
3.7	Annual I/I Reduction Program (6-year)	Capacity	$ 3,000,000	20%	$ 590,000	$ 2,410,000
		Total Priority 3 Improvement Cost (rounded)	**$ 27,900,000**			**$ 23,000,000**
		Total Collection System Improvement Costs (rounded)	**$ 62,900,000**			**$ 40,200,000**

St. Helens Wastewater Master Plan
6-Year CIP

Item #4.

Project No.	Item	Cost (2021)	Opinion of Probable Costs					
			2022	2023	2024	2025	2026	2027
Priority 1 Improvements								
1.1	WWTP Influent Flow Meter	$ 68,000	$ 68,000					
1.2	Basin 4 Pipeline Upsize and Reroute	$ 3,600,000		$ 400,000	$ 3,200,000			
1.3	Basin 5 Pipeline Upsize	$ 4,500,000				$ 500,000	$ 4,000,000	
1.4	Install Overflow Alarms	$ 9,000	$ 9,000					
1.5	Pump Station 3 On-site Generator	$ 90,000	$ 90,000					
1.6	Annual I/I Reduction Program (6-Year)	$ 3,000,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000
	Total (Rounded)	$ 11,300,000	$ 700,000	$ 900,000	$ 3,700,000	$ 1,000,000	$ 4,500,000	$ 500,000

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Collection System Project: Install WWTP Influent Flowmeter
Project Identifier: 1.1

Objective: Provide the St. Helens WWTP with an accurate measurement of influent flows during wet-weather or high-flow periods

Design Considerations:

- Provide adequate upstream and downstream length on either side of flow meter to ensure accurate flow measurement (minimum 18 feet upstream, 35 feet downstream)

- Ensure installation does not prevent WWTP access or operations

SDC Growth Appointment: 10%

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Installation of Flowmeter				
Hach FLO-DAR AV Sensor and Rig	1	EA	$ 16,000	$ 16,000
60-Inch, Standard Manhole	1	LS	$ 14,000	$ 14,000
Roadway Restoration	20	LF	$ 45	$ 900
			Construction Subtotal (rounded)	***$ 31,000***
SCADA Integration	1	LS	25%	$ 7,750
Mobilization	1	LS	5%	$ 2,000
Contingency	1	LS	30%	$ 13,000
Engineering and CMS	1	LS	25%	$ 14,000
			Total Project Cost (rounded)	***$ 68,000***

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Collection System Project: Basin 4 - Pipeline Upsize and Reroute from Tualatin St. to Basin 6
Project Identifier: 1.2

Objective: Resolve undersized pipelines in Basin 4. Upsize and construct gravity pipeline capable of conveying anticipated 20-year peak hour flows.

Design Considerations:

- Rock excavation for the new pipeline down Tualatn and S 7th St. Assumed pipes to be upsized will require rock excavation from the new pipe crown to bedding.

- Trench modification, manhole modification, and reversing the slope of the existing pipeline in Tualatin St.

- Ensure wastewater service is maintained via bypass pumping during pipeline upsizing and use of existing trunkline during new construction

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
12-inch Pipe - Excavation, Backfill	860	LF	$ 160	$ 137,600
15-inch Pipe - Excavation, Backfill	3,830	LF	$ 170	$ 651,100
Roadway Restoration (Half Lane)	3,140	LF	$ 45	$ 141,300
Landscape Restoration	1,550	LF	$ 20	$ 31,000
Traffic Control w/out Flagging	860	LF	$ 6	$ 5,160
Traffic Control w/ Flagging	1	LS	$ 122,000	$ 122,000
48-Inch, Standard Manhole	17	EA	$ 8,000	$ 136,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Existing Utility Protection	4,690	LF	$ 4	$ 18,760
Replace Service Laterals	25	EA	$ 1,500	$ 37,500
Bypass Pumping - Pipes 24-inch and smaller	3,160	LF	$ 22	$ 70,130
Rock Excavation	2,114	CY	$ 300	$ 634,330
			Subtotal (rounded)	***$ 1,989,000***
Mobilization	1	LS	5%	$ 100,000
Contingency	1	LS	30%	$ 627,000
			Construction Subtotal (rounded)	***$ 2,716,000***
Engineering and CMS	1	LS	20%	$ 544,000
Permitting (Assume 8% of total)	1	LS	$ 217,300	$ 217,300
Geotechnical (Assume 1% of total)	1	LS	$ 27,000	$ 27,000
Surveying	1	LS	$ 50,000	$ 50,000
Legal and Admin	1	LS	$ 20,000	$ 20,000
			Total Project Cost (rounded)	***$ 3,600,000***

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Item #4.

Collection System Project: Basin 5 - Pipeline Upsize
Project Identifier: 1.3

Objective: Resolve undersized pipelines in Basin 5. Upsize existing gravity pipeline to be capable of conveying anticipated 20-year peak hour flows.

Design Considerations:

- Upsizing by 2 sizes may be larger than existing trench, assumed pipes to be upsized will require rock excavation from the new pipe crown to bedding.

- When upsizing the parallel pipes beneath the City's tunnel, replace the pipelines with a singular 42-inch pipeline. To re-evaluate flowrates and pipeline sizing after completion of Project 1.2.

- Ensure wastewater service is maintained via bypass pumping when upsizing existing line.

SDC Growth Appointment: 3%

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
36-inch Pipe - Excavation, Backfill	470	LF	$ 245	$ 115,150
42-inch Pipe - Excavation, Backfill	2,850	LF	$ 275	$ 783,750
Roadway Restoration (Full Lane)	2,185	LF	$ 75	$ 163,880
Landscape Restoration	1,135	LF	$ 20	$ 22,700
Traffic Control w/ Flagging	1	LS	$ 92,000	$ 92,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
72-Inch, Standard Manhole	14	EA	$ 16,500	$ 231,000
Existing Utility Protection	3,320	LF	$ 4	$ 13,280
ADA Ramp Reconstruction (Compliance)	8	EA	$ 4,600	$ 36,800
Replace Service Laterals	27	EA	$ 1,500	$ 40,500
Bypass Pumping - Pipes larger than 24-inch	3,320	LF	$ 27	$ 91,020
Rock Excavation	2,906	CY	$ 300	$ 871,920
Tunnel Bore	475	LF	$ 400	$ 200,000
			Subtotal (rounded)	***$ 2,666,000***
Mobilization	1	LS	5%	$ 134,000
Contingency	1	LS	30%	$ 840,000
			Construction Subtotal (rounded)	***$ 3,640,000***
Engineering and CMS	1	LS	20%	$ 728,000
Permitting	1	LS	$ 15,000	$ 15,000
Geotechnical (Assume 1% of total)	1	LS	$ 36,400	$ 36,400
Surveying	1	LS	$ 30,000	$ 30,000
Legal and Admin	1	LS	$ 10,000	$ 10,000
			Total Project Cost (rounded)	***$ 4,500,000***

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Collection System Project: Install Overflow Alarms at Pump Stations
Project Identifier: 1.4

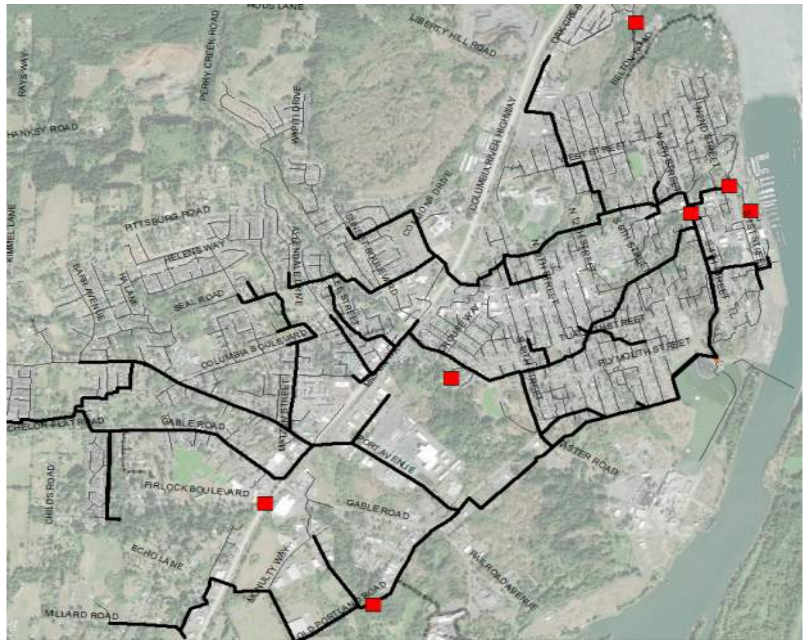
Objective: Provide all of the City's Pump Stations with overflow alarms

Design Considerations:

- Consider coordinating installation of overflow alarms with Priority 2 Pump Station Improvements (Project 2.3)

- Ensure installation doesn't interfere with pump station operations

SDC Growth Appointment: 20%



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Pump Station Overflow Alarms				
Install overflow alarm - labor and SCADA integration	4	EA	$ 1,000	$ 4,000
Construction Subtotal (rounded)				***$ 4,000***
Mobilization	1	LS	5%	$ 1,000
Contingency	1	LS	30%	$ 2,000
Engineering, SCADA integration, and CMS	1	LS	25%	$ 2,000
Total Project Cost (rounded)				***$ 9,000***

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Collection System Project: Install Pump Station 3 On-Site Generator
Project Identifier: 1.5

Objective: Provide Pump Station 3 with on-site backup power to increase City's

Design Considerations:

- Size generator to service pump station

- Assumed natural gas generator supplied by underground natural gas utility

- The pump station is located within a traffic lane. Traffic control not included in costs, but an increased contigency is included. Contractor to specify traffic control requirements prior to construction.

SDC Growth Appointment: 0%

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Pump Station On-site Generator				
Generator - Includes installation, labor	1	LS	$ 27,000	$ 27,000
Miscellaneous Electrical Materials	1	LS	$ 5,000	$ 5,000
Natural Gas Service	1	LS	$ 4,000	$ 4,000
Automatic Transfer Switch	1	LS	$ 3,500	$ 3,500
Equipment Pad	1	LS	$ 5,000	$ 5,000
Miscellaneous Site Improvements	1	LS	$ 7,000	$ 7,000
Construction Subtotal (rounded)				***$ 52,000***
Mobilization	1	LS	5%	$ 3,000
Contingency	1	LS	30%	$ 17,000
Engineering, SCADA integration, and CMS	1	LS	25%	$ 18,000
Total Project Cost (rounded)				***$ 90,000***

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Collection System Project: Riverfront District Trunkline and Pump Station 1 Relocation
Project Identifier: 2.1

Objective: Demolish existing Pump Station 1 and construct a new 700 gpm pump station to serve the existing basin and new development in the Riverfront District

Design Considerations:

- Connect to existing manhole and abandon/fill pipeline connection to old Pump Station 1 wetwell site. Construction of new road in Riverfront District not included in cost.

- Sequence the demolision/displacment of old Pump Station 1 after construction of new Pump Station 1 to ensure service to existing residents

- Construction of new pipe and pump station may encounter high groundwater table. Pothole to verify water table depth, provide dewatering measures as necessary. Groundwater level may be influenced by tidal changes.

SDC Growth Appointment: 18%

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Relocation of Pump Station 1				
Displace/Demolish Existing Pump Station	1	LS	$ 30,000	$ 30,000
Pump Station, 700 gpm	1	LS	$ 750,000	$ 750,000
10-inch Pipe - Excavation, Backfill, Shoring	1,700	LF	$ 150	$ 255,000
6-inch Force Main - Excavation, Backfill, Shoring	1,100	LF	$ 75	$ 82,500
Roadway Restoration (Half Lane)	1,100	LF	$ 45	$ 49,500
Traffic Control w/ Flagging	1	LS	$ 59,000	$ 59,000
48-Inch, Standard Manhole	6	EA	$ 8,000	$ 48,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping	1	LS	$ 25,000	$ 25,000
Grounwater Dewatering (Assume 2.5% of subtotal)	1	LS	$ 32,900	$ 32,900
Existing Utility Protection	2,800	LF	$ 4	$ 11,200
			Subtotal (rounded)	***$ 1,347,000***
Mobilization	1	LS	5%	$ 68,000
SCADA Integration	1	LS	$ 30,000	$ 30,000
Contingency	1	LS	30%	$ 434,000
			Construction Subtotal (rounded)	***$ 1,879,000***
Permitting	1	LS	$ 20,000	$ 20,000
Geotechnical	1	LS	$ 20,000	$ 20,000
Surveying	1	LS	$ 40,000	$ 40,000
Engineering and CMS	1	LS	20%	$ 376,000
Legal and Admin	1	LS	$ 20,000	$ 20,000
			Total Project Cost (rounded)	***$ 2,400,000***

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Collection System Project: Pump Station 11 Relocation
Project Identifier: 2.2

Objective: Demolish existing Pump Station 11 and construct a new 550 gpm pump station to serve the existing basin and new development

Design Considerations:

- Purchasing land and/or easement for new pump station and pipelines

- Trenchless bore or minimal impact construction over the McNulty Creek culvert crossing

- Assuming a trenchless directional bore is possible for installing both pipelines beneath McNulty; this avoids replacement of the existing McNulty Creek culvert. Included a 40% contigency and 10% geotechnical line item to account for unseen construction setbacks due to bedrock

SDC Growth Appointment: 68%

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Relocation of Pump Station 11				
Displace/Demolish Existing Pump Station	1	LS	$ 30,000	$ 30,000
Pump Station, 550 gpm	1	LS	$ 600,000	$ 600,000
12-inch Pipe - Trenchless Installation, includes launch and receiving pits, casing	400	LF	$ 595	$ 238,000
6-inch Force Main - Trenchless Installation, includes launch and receiving pits, casing	400	LF	$ 541	$ 216,500
6-inch Force Main - Excavation, Backfill	2,830	LF	$ 75	$ 212,300
Connect to Existing Manhole	2	LS	$ 1,750	$ 3,500
Roadway Restoration (Half Lane)	2,870	LF	$ 45	$ 129,150
Soil Surface Repair	800	LF	$ 30	$ 24,000
Connect to Existing Manhole	1	EA	$ 1,750	$ 1,750
Bypass Pumping	1	LS	$ 25,000	$ 25,000
Rock Excavation	121	BCY	$ 300	$ 36,200
Existing Utility Protection	3,630	LF	$ 4	$ 14,500
			Subtotal (rounded)	***$ 1,531,000***
Mobilization	1	LS	5%	$ 77,000
SCADA Integration	1	LS	$ 30,000	$ 30,000
Contingency	1	LS	40%	$ 656,000
			Construction Subtotal (rounded)	***$ 2,294,000***
Permitting	1	LS	$ 20,000	$ 20,000
Geotechnical (Assume 10% of total)	1	LS	$ 229,000	$ 229,000
Surveying	1	LS	$ 40,000	$ 40,000
Engineering and CMS	1	LS	20%	$ 459,000
Legal and Admin	1	LS	$ 20,000	$ 20,000
			Total Project Cost (rounded)	***$ 3,100,000***

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Collection System Project: Industrial Business Park Trunklines and Pump Station
Project Identifier: 2.3

Objective: Provide wastewater service to Industrial Business Park via new pipelines and pump station

Design Considerations:

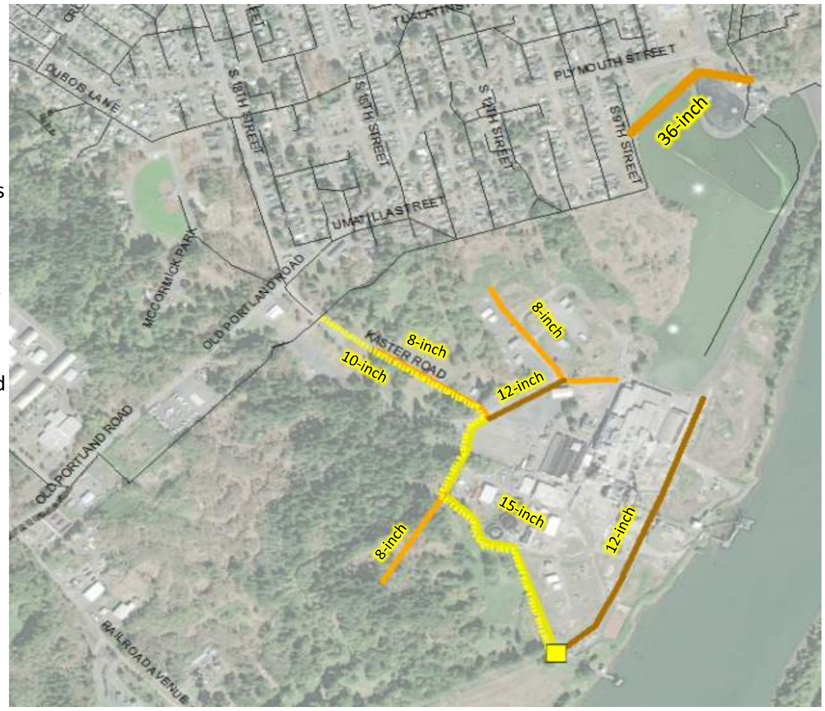
- Restoration of existing road in Industrial Business Park is included in cost. Roadway expansion or upgrades are not included in cost.

- Include construction of 36-inch pipe upstream of WWTP

- Pipelines must be designed to convey anticipated peak hour flows. Flowrates may vary depending on industry and rate of development. Appropriate pipe sizes to be re-evaluated during predesign.

- Costs assume open trench rock excavation for new pipelines. Construction may encounter high groundwater near the Columbia River, assumed 1% of subtotal for dewatering.

SDC Growth Appointment: 100%



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Construction of Business Industrial Park Infrastructure and Downstream Trunkline				
Pump Station, 1,300 gpm	1	LS	$1,200,000	$ 1,200,000
8-inch Pipe - Excavation, Backfill	3,070	LF	$ 135	$ 414,500
12-inch Pipe - Excavation, Backfill	2,900	LF	$ 160	$ 464,000
15-inch Pipe - Excavation, Backfill	2,210	LF	$ 170	$ 375,700
10-inch Force Main - Excavation, Backfill, Shoring	3,725	LF	$ 95	$ 353,900
36-inch Pipe - Excavation, Backfill, Structure over Lagoon	645	LF	$ 1,170	$ 754,700
36-inch Pipe - Excavation, Backfill	425	LF	$ 245	$ 104,100
Roadway Restoration (Half Lane)	11,905	LF	$ 45	$ 535,700
Traffic Control w/ Flagging	1	LS	$ 206,000	$ 206,000
48-Inch, Standard Manhole	27	EA	$ 8,000	$ 216,000
72-Inch, Standard Manhole	2	EA	$ 16,500	$ 33,000
Connect to Existing Manhole	3	EA	$ 1,750	$ 5,300
Bypass Pumping - Pipes 24-inch and smaller	11,905	LF	$ 22	$ 264,200
Grounwater Dewatering (Assume 1% of subtotal)	1	LS	$ 74,500	$ 74,500
Rock Excavation	8,289	CY	$ 300	$ 2,486,600
Existing Utility Protection	8,180	LF	$ 4	$ 32,700
			Subtotal (rounded)	***$ 7,521,000***
Mobilization	1	LS	5%	$ 377,000
SCADA Integration	1	LS	$ 30,000	$ 30,000
Contingency	1	LS	30%	$ 2,379,000
			Construction Subtotal (rounded)	***$ 10,307,000***
Permitting (Assumed 5% of total)	1	LS	$ 515,350	$ 515,400
Geotechnical (Assume 1% of total)	1	LS	$ 103,070	$ 103,100
Surveying	1	LS	$ 100,000	$ 100,000
Engineering and CMS	1	LS	20%	$ 2,062,000
Legal and Admin	1	LS	$ 40,000	$ 40,000
			Total Project Cost (rounded)	***$ 13,200,000***

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Collection System Project: Pump Station Upgrades
Project Identifier: 2.4

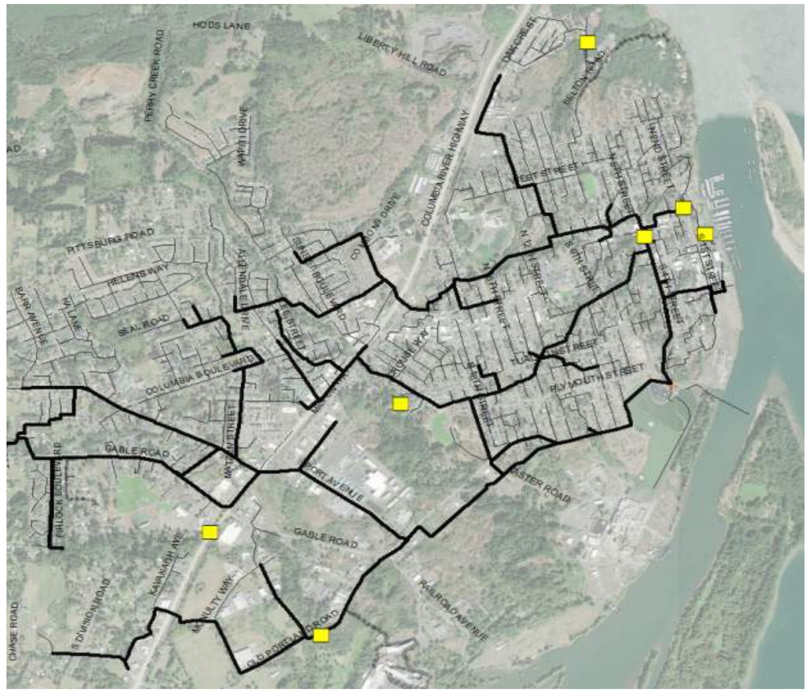
Objective: Provide required and recommended improvements to pump stations to improve operations, data collection, redundancy, and safety

Design Considerations:

- **I**ntegration of new meters and sensors with existing SCADA system

- Mechanical modifications to accomodate new flow monitors and pressure gauges

SDC Growth Appointment: 20%



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Pump Station 2				
Fall Protection	1	LS	$ 4,000	$ 4,000
Flow Meter (Includes Piping Modifications)	1	LS	$ 20,000	$ 20,000
Pressure Gauge	1	LS	$ 3,500	$ 3,500
			Subtotal	***$ 27,500***
SCADA Upgrades	1	LS	25%	$ 6,875
			Pump Station 2 Subtotal	***$ 34,400***
Pump Station 3				
Fall Protection	1	LS	$ 4,000	$ 4,000
Flow Meter	1	LS	$ 20,000	$ 20,000
Pressure Gauge	1	LS	$ 3,500	$ 3,500
			Subtotal	***$ 27,500***
SCADA Upgrades	1	LS	25%	$ 6,875
			Pump Station 3 Subtotal	***$ 34,400***
Pump Station 4				
Fall Protection	1	LS	$ 4,000	$ 4,000
Flow Meter	1	LS	$ 20,000	$ 20,000
Pressure Gauge	1	LS	$ 3,500	$ 3,500
Ultrasonic Level Sensor	1	LS	$ 5,000	$ 5,000
			Subtotal	***$ 28,500***
SCADA Upgrades	1	LS	25%	$ 7,125
			Pump Station 4 Subtotal	***$ 35,600***
Pump Station 5				
Fall Protection	1	LS	$ 4,000	$ 4,000
Flow Meter	1	LS	$ 20,000	$ 20,000
Pressure Gauge	1	LS	$ 3,500	$ 3,500
Pump Upgrade - 300 gpm	2	EA	$ 30,000	$ 60,000
Electrical Upgrades (Standby Power, Panel)	1	LS	$ 55,000	$ 55,000
			Subtotal	***$ 142,500***
SCADA Upgrades	1	LS	25%	$ 35,625
			Pump Station 5 Subtotal	***$ 178,100***

Pump Station 7				
Flow Meter	1	LS	$ 20,000	$ 20,000
Pressure Gauge	1	LS	$ 3,500	$ 3,500
			Subtotal	***$ 23,500***
SCADA Upgrades	1	LS	25%	$ 5,875
			Pump Station 7 Subtotal	***$ 29,400***
Pump Station 8				
Fall Protection	1	LS	$ 4,000	$ 4,000
Flow Meter	1	LS	$ 20,000	$ 20,000
Pressure Gauge	1	LS	$ 3,500	$ 3,500
Ultrasonic Level Sensor	1	LS	$ 5,000	$ 5,000
			Subtotal	***$ 32,500***
SCADA Upgrades	1	LS	25%	$ 8,125
			Pump Station 8 Subtotal	***$ 40,600***
Pump Station 9				
Flow Meter	1	LS	$ 20,000	$ 20,000
Pressure Gauge	1	LS	$ 3,500	$ 3,500
Ultrasonic Level Sensor	1	LS	$ 5,000	$ 5,000
			Subtotal	***$ 28,500***
SCADA Upgrades	1	LS	25%	$ 7,125
			Pump Station 9 Subtotal	***$ 35,600***
			Construction Subtotal (rounded)	***$ 389,000***
Mobilization	1	LS	5%	$ 20,000
Contingency	1	LS	30%	$ 123,000
Engineering and CMS	1	LS	25%	$ 133,000
			Total Project Cost (rounded)	***$ 700,000***

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Collection System Project: Master Plan Update
Project Identifier: 2.5

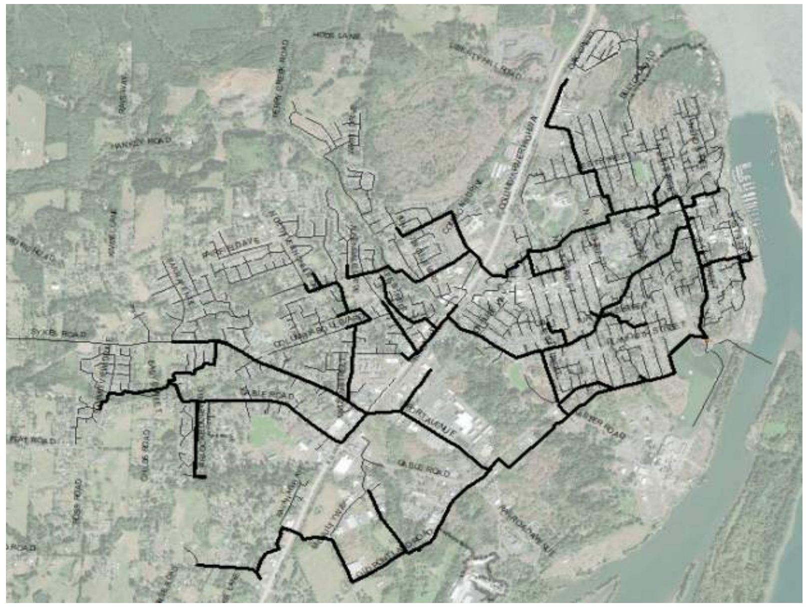
Objective: Update the City of St. Helens Master Plan with new data collected from influent flow meter. Will effect the model and existing/future system evaluation, as well as recommendations and potential future Capital Improvement Projects. Includes Master Planning efforts for treatment.

Design Considerations:

- New areas built-out since previous planning studies

- Combined Wastewater Treatment and Collection System Master Plan Update

SDC Growth Appointment: 100%



Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Planning Update				
Master Plan Update	1	LS	$ 300,000	$ 300,000
			Total Project Cost (rounded)	***$ 300,000***

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Collection System Project: Basin 6 - Pipeline Upsize and Reroute from Old Portland Rd to Kaster Rd.
Project Identifier: 3.1

Objective: Resolve undersized pipelines in Basin 6. Upsize existing and construct new gravity pipeline to be capable of conveying anticipated 20-year peak hour flows.

Design Considerations:
- There is a crossing beneath Milton Creek within the Columbia River Highway. Assume trenchless bore to avoid interference with Milton Creek.

- Anticipate rock excavation for new pipeline from Old Portland Rd to Kaster Rd. Assumed pipes to be upsized will require rock excavation from the new pipe crown to bedding.

- Ensure wastewater service is maintained via bypass pumping when upsizing existing line. Utilize existing trunkline along Umatilla St. to maintain service during construction of new pipeline.

SDC Growth Appointment: 7%

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Port Ave - Gravity Upsize				
27-inch Pipe - Excavation, Backfill	3,030	LF	$ 220	$ 666,600
Roadway Restoration (Half Lane)	2,775	LF	$ 45	$ 124,880
Landscape Restoration	255	LF	$ 20	$ 5,100
Traffic Control w/ Flagging	1	LS	$ 76,000	$ 76,000
60-Inch, Standard Manhole	9	EA	$ 14,000	$ 126,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Railroad Boring	140	LF	$ 900	$ 126,000
Highway Permitting	1	LS	$ 5,000	$ 5,000
Replace Service Laterals	8	EA	$ 1,500	$ 12,000
Bypass Pumping - Pipes 24-inch and smaller	3,030	LF	$ 22	$ 67,240
Rock Excavation	1,546	CY	$ 300	$ 463,680
Existing Utility Protection	3,030	LF	$ 4	$ 12,120
			Subtotal	***$ 1,688,000***
S 18th St, Dubois Lane, Columbia River HWY - Gravity Pipeline Upsize				
15-inch Pipe - Excavation, Backfill	3,829	LF	$ 170	$ 650,930
15-inch Pipe - Excludes Excavation, Backfill	391	LF	$ 27	$ 10,480
Directional Bore - 24" Casing	391	LF	$ 573	$ 224,050
Roadway Restoration (Half Lane)	2,678	LF	$ 45	$ 120,510
Landscape Restoration	760	LF	$ 20	$ 15,200
Highway Permitting	1	LS	$ 5,000	$ 5,000
Traffic Control w/ Flagging	1	LS	$ 106,000	$ 106,000
Railroad Boring	80	LF	$ 900	$ 72,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
ADA Ramp Reconstruction (Compliance)	10	EA	$ 4,600	$ 46,000
Replace Service Laterals	47	EA	$ 1,500	$ 70,500
Bypass Pumping - Pipes 24-inch and smaller	3,829	LF	$ 22	$ 84,970
Rock Excavation	819	CY	$ 300	$ 245,780
Existing Utility Protection	3,829	LF	$ 4	$ 15,320
			Subtotal	***$ 1,798,000***

Old Portland Rd., Kaster Rd. - Gravity Pipeline Reroute to 27" Trunkline				
15-inch Pipe - Excavation, Backfill	425	LF	$ 170	$ 72,250
Roadway Restoration (Half Lane)	425	LF	$ 45	$ 19,130
Traffic Control w/ Flagging	1	LS	$ 7,000	$ 7,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Existing Utility Protection	425	LF	$ 4	$ 1,700
Rock Excavation	10	CY	$ 300	$ 3,070
			Subtotal	***$ 107,000***
			Subtotal (rounded)	***$ 3,593,000***
Mobilization	1	LS	5%	$ 180,000
Contingency	1	LS	30%	$ 1,132,000
			Construction Subtotal (rounded)	***$ 4,905,000***
Engineering and CMS	1	LS	20%	$ 981,000
Permitting (Assume 5% of total)	1	LS	$ 245,300	$ 245,300
Geotechnical (Assume 1% of total)	1	LS	$ 49,050	$ 49,050
Surveying	1	LS	$ 60,000	$ 60,000
Legal and Admin	1	LS	$ 30,000	$ 30,000
			Total Project Cost (rounded)	***$ 6,300,000***

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Collection System Project: Basin 2 - Pipeline Upsize and Reroute from Gable Rd. to Sykes Rd.
Project Identifier: 3.2

Objective: Resolve undersized pipelines in Basin 2. Upsize existing gravity pipeline and construct new pipeines to be capable of conveying anticipated 20-year peak hour flows.

Design Considerations:
- Upsizing by 2 sizes may be larger than existing trench, assumed pipes to be upsized will require rock excavation from the new pipe crown to bedding.

- Anticipate rock excavation when constructing new pipeline from Gable Rd to Sykes Rd.

- Ensure wastewater service is maintained via bypass pumping when upsizing existing line. Utilize existing trunkline along Gable Rd. to maintain service during construction of new pipeline.

SDC Growth Appointment: 12%

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Sykes Road - Gravity Upsize				
12-inch Pipe - Excavation, Backfill	315	LF	$ 160	$ 50,400
15-inch Pipe - Excavation, Backfill	2,645	LF	$ 170	$ 449,650
18-inch Pipe - Excavation, Backfill	522	LF	$ 185	$ 96,570
Roadway Restoration (Half Lane)	3,482	LF	$ 45	$ 156,690
Traffic Control w/ Flagging	1	LS	$ 65,000	$ 65,000
48-Inch, Standard Manhole	15	EA	$ 8,000	$ 120,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	3,482	LF	$ 22	$ 77,270
Rock Excavation	786	CY	$ 300	$ 235,760
ADA Ramp Reconstruction (Compliance)	11	EA	$ 4,600	$ 50,600
Replace Service Laterals	55	EA	$ 1,500	$ 82,500
Existing Utility Protection	2,960	LF	$ 4	$ 11,840
			Subtotal	***$ 1,400,000***
Matzen St. - Gravity Pipeline Upsize				
12-inch Pipe - Excavation, Backfill	1,450	LF	$ 160	$ 232,000
15-inch Pipe - Excavation, Backfill	2,600	LF	$ 170	$ 442,000
Roadway Restoration (Half Lane)	2,980	LF	$ 45	$ 134,100
Landscape Restoration	1,070	LF	$ 20	$ 21,400
Traffic Control w/ Flagging	1	LS	$ 110,000	$ 110,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	4,050	LF	$ 22	$ 89,880
Rock Excavation	792	CY	$ 300	$ 237,540
ADA Ramp Reconstruction (Compliance)	9	EA	$ 4,600	$ 41,400
Replace Service Laterals	42	EA	$ 1,500	$ 63,000
Existing Utility Protection	4,050	LF	$ 4	$ 16,200
			Subtotal	***$ 1,519,000***

Item #4.

Gable Rd. - Gravity Pipeline Upsize and Reroute to Sykes Rd.				
12-inch Pipe - Excavation, Backfill	3,000	LF	$ 160	$ 480,000
Roadway Restoration (Half Lane)	3,000	LF	$ 45	$ 135,000
Traffic Control w/ Flagging	1	LS	$ 87,000	$ 87,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
48-Inch, Standard Manhole	13	EA	$ 8,000	$ 104,000
Existing Utility Protection	3,000	LF	$ 4	$ 12,000
Bypass Pumping - Pipes 24-inch and smaller	3,000	LF	$ 22	$ 66,580
ADA Ramp Reconstruction (Compliance)	3	EA	$ 4,600	$ 13,800
Replace Service Laterals	23	EA	$ 1,500	$ 34,500
Rock Excavation	1,333	CY	$ 300	$ 400,000
			Subtotal	***$ 1,336,000***
Westshire Ln. - Gravity Pipeline Upsize				
10-inch Pipe - Excavation, Backfill	250	LF	$ 150	$ 37,500
12-inch Pipe - Excavation, Backfill	2,300	LF	$ 160	$ 368,000
Roadway Restoration (Half Lane)	2,235	LF	$ 45	$ 100,580
Landscape Restoration	315	LF	$ 20	$ 6,300
Traffic Control w/ Flagging	1	LS	$ 87,000	$ 87,000
48-Inch, Standard Manhole	16	EA	$ 8,000	$ 128,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes 24-inch and smaller	2,550	LF	$ 22	$ 56,590
Rock Excavation	381	CY	$ 300	$ 114,370
ADA Ramp Reconstruction (Compliance)	4	EA	$ 4,600	$ 18,400
Replace Service Laterals	25	EA	$ 1,500	$ 37,500
Existing Utility Protection	2,550	LF	$ 4	$ 10,200
			Subtotal	***$ 968,000***
			Subtotal (rounded)	***$ 5,223,000***
Mobilization	1	LS	5%	$ 262,000
Contingency	1	LS	30%	$ 1,646,000
			Construction Subtotal (rounded)	***$ 7,131,000***
Engineering and CMS	1	LS	20%	$ 1,427,000
Permitting (Assume 8% of total)	1	LS	$ 570,500	$ 570,500
Geotechnical (Assume 1% of total)	1	LS	$ 71,000	$ 71,000
Surveying	1	LS	$ 100,000	$ 100,000
Legal and Admin	1	LS	$ 40,000	$ 40,000
			Total Project Cost (rounded)	***$ 9,400,000***

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Collection System Project: Basin 6 - Southern Trunkline Upsize
Project Identifier: 3.3

Objective: Resolve undersized trunkline in Basin 6. Upsize existing gravity pipeline to be capable of conveying anticipated 20-year peak hour flows.

Design Considerations:
- Upsizing by one to two sizes may be larger than existing trench, assumed pipes to be upsized will require rock excavation from the new pipe crown to bedding.

- Ensure wastewater service is maintained via bypass pumping when upsizing existing line.

SDC Growth Appointment: 26%

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Southern Trunkline - Gravity Upsize				
30-inch Pipe - Excavation, Backfill	420	LF	$ 230	$ 96,600
33-inch Pipe - Excavation, Backfill	1,185	LF	$ 240	$ 284,400
36-inch Pipe - Excavation, Backfill	1,900	LF	$ 245	$ 465,500
Roadway Restoration (Half Lane)	50	LF	$ 45	$ 2,250
Traffic Control w/ Flagging	1	LS	$ 6,000	$ 6,000
72-Inch, Standard Manhole	13	EA	$ 16,500	$ 214,500
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
Bypass Pumping - Pipes larger than 24-inch	3,505	LF	$ 27	$ 96,090
Rock Excavation	3,102	CY	$ 300	$ 930,630
Existing Utility Protection	3,505	LF	$ 4	$ 14,020
			Subtotal	***$ 2,113,000***
			Subtotal (rounded)	***$ 2,113,000***
Mobilization	1	LS	5%	$ 106,000
Contingency	1	LS	30%	$ 666,000
			Construction Subtotal (rounded)	***$ 2,885,000***
Engineering and CMS	1	LS	20%	$ 577,000
Permitting (Assume 8% of total)	1	LS	$ 230,800	$ 230,800
Geotechnical (Assume 1% of total)	1	LS	$ 29,000	$ 29,000
Surveying	1	LS	$ 100,000	$ 100,000
Legal and Admin	1	LS	$ 40,000	$ 40,000
			Total Project Cost (rounded)	***$ 3,900,000***

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Collection System Project: Pump Station 7 Upgrades
Project Identifier: 3.4

Objective: Upgrade Pump Station 7 with new pumps to handle anticipated 20-year flows

Design Considerations:

- Station will continue to use parallel 6" and 8" forcemains to convey wastewater

- Install new pumps in existing pump station

- Revise pump station capacity with anticipated loading during pre-design

- Construction may encounter high groundwater table. Pothole to verify water table depth, provide dewatering measures as necessary. Groundwater level may be influenced by tidal changes.

- Ensure wastewater service is maintained via bypass pumping.

SDC Growth Appointment: 65%

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
New/Significant Upgrades to Pump Station 7				
Pump Station, 1,400 gpm	1	LS	$ 1,200,000	$ 1,200,000
Bypass Pumping	1	LS	$ 30,000	$ 30,000
			Subtotal (rounded)	***$ 1,230,000***
Mobilization	1	LS	5%	$ 62,000
SCADA Integration	1	LS	$ 30,000	$ 30,000
Contingency	1	LS	30%	$ 397,000
			Construction Subtotal (rounded)	***$ 1,719,000***
Permitting	1	LS	$ 20,000	$ 20,000
Geotechnical	1	LS	$ 20,000	$ 20,000
Surveying	1	LS	$ 40,000	$ 40,000
Engineering and CMS	1	LS	20%	$ 344,000
Legal and Admin	1	LS	$ 20,000	$ 20,000
			Total Project Cost (rounded)	***$ 2,200,000***

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Collection System Project: Basin 1 - Pipeline Upsize
Project Identifier: 3.5

Objective: Resolve undersized pipelines in Basin 1. Upsize existing gravity pipeline to be capable of conveying anticipated 20-year peak hour flows.

Design Considerations:

- Restore existing landscaping south of Sunset Pl to pre-disturbed condition or better.

- Assumed pipes to be upsized will require rock excavation from the new pipe crown to bedding.

- Ensure wastewater service is maintained via bypass pumping when upsizing existing line.

SDC Growth Appointment: 9%

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
18-inch Pipe - Excavation, Backfill	230	LF	$ 185	$ 42,550
15-inch Pipe - Excavation, Backfill	2,330	LF	$ 170	$ 396,100
Roadway Restoration (Half Lane)	1,315	LF	$ 45	$ 59,180
Landscape Restoration	1,245	LF	$ 20	$ 24,900
Traffic Control w/ Flagging	1	LS	$ 62,000	$ 62,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
48-inch Manhole	8	EA	$ 8,000	$ 64,000
Bypass Pumping - Pipes 24-inch and smaller	2,560	LF	$ 22	$ 56,810
ADA Ramp Reconstruction (Compliance)	6	EA	$ 4,600	$ 27,600
Rock Excavation	589	CY	$ 300	$ 176,770
Replace Service Laterals	18	EA	$ 1,500	$ 27,000
Existing Utility Protection	2,560	LF	$ 4	$ 10,240
			Subtotal (rounded)	***$ 951,000***
Mobilization	1	LS	5%	$ 48,000
Contingency	1	LS	30%	$ 300,000
			Construction Subtotal (rounded)	***$ 1,299,000***
Engineering and CMS	1	LS	20%	$ 260,000
Permitting (Assume 8% of total)	1	LS	$ 103,900	$ 103,900
Geotechnical (Assume 1% of total)	1	LS	$ 13,000	$ 13,000
Surveying	1	LS	$ 40,000	$ 40,000
Legal and Admin	1	LS	$ 20,000	$ 20,000
			Total Project Cost (rounded)	***$ 1,800,000***

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Collection System Project: Basin 3 - Pipeline Upsize
Project Identifier: 3.6

Objective: Resolve undersized pipelines in Basin 3. Upsize existing gravity pipeline to be capable of conveying anticipated 20-year peak hour flows.

Design Considerations:

- Assumed pipes to be upsized will require rock excavation from the new pipe crown to bedding.

- Ensure wastewater service is maintained via bypass pumping when upsizing existing line.

SDC Growth Appointment: 3%

Item	EST. QTY	UNIT	UNIT PRICE	Cost (2021)
Gravity Pipeline Upszie				
15-inch Pipe - Excavation, Backfill	1,550	LF	$ 170	$ 263,500
Roadway Restoration (Half Lane)	922	LF	$ 45	$ 41,490
Soil Surface Repair	628	LF	$ 5	$ 3,140
Traffic Control w/ Flagging	1	LS	$ 47,000	$ 47,000
48-Inch, Standard Manhole	8	EA	$ 8,000	$ 64,000
Connect to Existing Manhole	2	EA	$ 1,750	$ 3,500
ADA Ramp Reconstruction (Compliance)	4	EA	$ 4,600	$ 18,400
Replace Service Laterals	25	EA	$ 1,500	$ 37,500
Bypass Pumping - Pipes 24-inch and smaller	1,550	LF	$ 22	$ 34,400
Rock Excavation	332	CY	$ 300	$ 99,490
Existing Utility Protection	1,550	LF	$ 4	$ 6,200
			Subtotal (rounded)	***$ 619,000***
Mobilization	1	LS	5%	$ 31,000
Contingency	1	LS	30%	$ 195,000
			Construction Subtotal (rounded)	***$ 845,000***
Engineering and CMS	1	LS	20%	$ 169,000
Permitting (Assume 8% of total)	1	LS	$ 67,600	$ 67,600
Geotechnical (Assume 1% of total)	1	LS	$ 8,000	$ 8,000
Surveying	1	LS	$ 20,000	$ 20,000
Legal and Admin	1	LS	$ 10,000	$ 10,000
			Total Project Cost (rounded)	***$ 1,200,000***

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.

APPENDIX K

Inflow and Infiltration (I/) Priority Pipelines

KELLER ASSOCIATES

Priority	GIS - Field ID	GIS - Object ID	Diameter	Material	Upstream Manhole	Downstream Manhole	Length (ft)
1	243	265	21"	CP STACKED	I5	I4A	470
1	244	266	30"	CP	I4A	I4	76
1	245	267	20"	PE STACKED	I5	I4A	472
1	246	268	30"	CP	I8	I17A	347
1	262	285	30"	CP	I6	I5	246
1	390	427	6"	PVC	IF48B	IF48	64
1	391	428	8"	PVC	IF52	IF50	167
1	395	432	8"	PVC	IF48	IF50	143
1	396	433	8"	PVC	IF54	IF52	181
1	508	548	6"	VCP	NA1	N1	300
1	631	678	8"	CP	IF30	IF29	67
1	906	971	10"	CP	IA7	IA7A	22
1	1066	1138	8"	VCP	IF62	IF28	116
1	1115	1188	30"	CP	I7A	I7	75
1	1116	1189	30"	CP	I7	I6	305
1	1290	1370	8"	PVC	IA11	IA10B	68
1	1291	1371	8"	PVC	IA10B	IA10A	102
1	1292	1375	8"	DI	IA10	IA19	169
1	1305	1391	6"	DI	IA22	IA21	252
1	1306	1392	6"	DI	IA21	IA20	165
1	1307	1393	8"	DI	IA20	IA19	118
1	1308	1394	6"	CP	M11	MF5	230
1	1321	1409	6"	CP	MF5	MF4	129
1	1322	1410	6"	PVC	MF4	MF3	68
1	1323	1411	6"	CP	MF7	MF1	130
1	1324	1412	6"	CP	MF7A	MF7	58
1	1325	1413	6"	CP	MF6	MF7	164
1	1326	1414	6"	CP/PVC	MF9	MF5	138
1	1327	1415	6"	CP	STUB	M8	117
1	1328	1416	6"	CP	MF10	MF4	115
1	1329	1417	6"	CP/PVC	MF1A	M8	288
1	1387	1477	15"	CI	UNKN	IA25	182
1	1473	1565	8"	PVC	IA11A	IA11	68
1	1480	1572	6"	DI	MK6B	MK6A	172
1	1483	1575	6"	DI/CP	MK6A	MK6	147
1	1530	1626	6"	VCP	I10A	I10	244
1	1531	1627	6"	VCP	I10B	I10A	85
1	1542	1638	6	PVC	IE11	IE6	31
1	1551	1649	8"	PVC	IF50	IF51	147
1	1648	1753			IA7B	IA7	19
1	1682	1791	6"		IA28	IA7D	196
1	1683	1792			UNKN	IA28	166
1	1685	1794			IF64B	IF64A	5
1	1689	1799			IF64A	IF64	49
1	1690	1800	6"		IA7D	IA7B	142
1	1708	1825	10"	VCP		IA25	247
1	1709	1826			IA7B1	IA7	22
1	1710	1830			NE7A		120
1	1716	1844			NE7B	NE7A	87
1	1739	1877	6"	DI/CP	MK6A	MK6	26
2	1795	0	6"	PVC			118
2	98	110	12"	CP	NN6	NN5	419
2	102	114	12"	CP	NN4	NN3	100
2	103	115	12"	CP	NN7	NN6	157
2	104	116	12"	CP	NN8	NN7	228
2	105	117	12"	CP	NN8A	NN8	282
2	106	118	12"	CP	NN5	NN4	130
2	126	138	8"	CP	D25	D24	479
2	142	156	10"	CP	N31	N30	396
2	146	160	12"	CP	NN3	NN2	464
2	147	161	15"	CP	DD9B	DD9	856
2	148	162	12"	CP	NN1A	NN1	244

Priority	GIS - Field ID	GIS - Object ID	Diameter	Material	Upstream Manhole	Downstream Manhole	Length (ft)
2	150	164	6"		NO2	NO1	355
2	151	165	18"	CP	N29	N28	197
2	175	191	6"	PVC	DE18A	DE18	174
2	183	200	6"		N32	NO1	311
2	238	260	30"	CP	I3	I2	189
2	242	264	30"	CP	I4	I3	257
2	268	292	8"	DI	IF22	IF21	55
2	378	409	6"		DD10	DD9	175
2	379	410	15"	CP	DD9	DD8	106
2	380	411	18"	CP	N28	N27	232
2	385	421	10"	PVC	DE4A	DE4	75
2	387	423	8"	CP	DG2	DG1B	232
2	413	450	8"	DI	IF23	IF22	76
2	511	551	8"	CP	IF13	IF4	145
2	512	552	8"	CP	IF14	IF13	44
2	604	649	6"		DL1	D5	228
2	708	761	16"	PE	M10	M9	144
2	709	762	16"	PE	M11	M10	300
2	710	763	16"	PE	M12	M11	126
2	711	764	16"	PE	M13	M12	212
2	717	770	16"	PE	M9	M8A	285
2	769	824	8"	CP	NN41	NN6	91
2	806	866	6"	CIPP	ND26	ND7	56
2	807	867	8"	PVC	ND8	ND7	230
2	817	878	6"	CP	DD2B	DD2	150
2	856	919	8"	CP	SB1	S6	342
2	857	920	8"	CP	SB2	SB1	180
2	1044	1115	8"	CP	IF15	IF14	133
2	1088	1160	10"	PVC	ML8	ML7	158
2	1092	1164	6"	CIPP	ML24	ML10	116
2	1127	1201	8"		STUB	IF22	10
2	1331	1419	6"	CP	NN35	NN34	243
2	1332	1420	6"	CP	NN34	NN10	446
2	1338	1426	10"	PVC	D19	D18A	82
2	1341	1431	6"	CP	DG1B	DG1	324
2	1347	1437	8"	PVC	DE13	DE2	69
2	1369	1459	6"	CP	DE28	DE8	195
2	1370	1460	6"	CP	DE31	DE28	108
2	1372	1462	8"	CP	NN9	DE9	176
2	1378	1468	8"	CP	NN30	NN29	135
2	1379	1469	8"	CP	NN29	NN9	165
2	1380	1470	6"	CP	NN9A	NN9	193
2	1386	1476	6"	CP	DD5	DD4	230
2	1388	1478	8"	CP	DD3	DD2	194
2	1389	1479	8"	PVC	DD2	DD1	185
2	1390	1480	8"	CP	DD4	DD3	41
2	1391	1481	6"	CP	DD6	DD5	259
2	1392	1482	6"	CP	DD13	DD4	266
2	1465	1557	8"	PVC	DG8	DG2	108
2	1466	1558	8"	CP	DG3	DG2	132
2	1477	1569	8"	PVC	ML8A	ML8	82
2	1478	1570	8"	PVC	ML9	ML8A	85
2	1513	1609	6"	CP	DG7	DG5	83
2	1525	1621	6"	CP/PVC	MF1	MF1A	10
2	1536	1632	8"	DI	IA15	IA14	84
2	1537	1633	8"	DI	IA15A	IA15	137
2	1538	1634	8"	PVC	IA16	IA15	50
2	1539	1635	8"	PVC	IA16A	IA16	25
2	1540	1636	8"	PVC	IA17	IA16	63
2	1541	1637	6"	PVC	IE6	IE5	39
2	1543	1639	6"	CP	DE17B	DE17	215
2	1547	1643	6"	PVC/CP	DE13A1	DE13A	138

Priority	GIS - Field ID	GIS - Object ID	Diameter	Material	Upstream Manhole	Downstream Manhole	Length (ft)
2	1550	1648	8"	PVC	IA18	IA17	138
2	1584	1686	6"	CP	DE9A	DE9	104
2	1679	1788	6"	CIPP	ME8	ME8A	150
2	1790	1788	6"	CP	ME8A	ME10	68
2	1715	1840	6"	VCP		IG11	58
2	1717	1846				ME9	145
2	1718	1847				ME9	79
2	1722	1853	10"	CP	N31	N30	160
2	1737	1875	8"	PVC	ML9	ML8A	78
2	1738	1876	10"	CP/PVC	ML8	ML7	124
3	1813	0					226
3	1814	0	6"				317
3	4	5	10"	CP	NI2	NI1	438
3	5	6	10"	CP	NI6	NI5	133
3	8	9	10"	CP	NI3	NI2	123
3	9	10	8"	CP	NI15	NI5	362
3	10	11	8"	CP	NI13	NI4	364
3	11	12	8"	CP	NI12	NI4	297
3	12	13	8"	CP	NI14	NI5	209
3	13	14	8"	CP	NI11	NI3	213
3	14	15	8"	CP	NI10	NI3	346
3	15	16	8"	CP	NJ2	NJ1	137
3	16	17	8"	CP	NJ1	N23	178
3	17	18	10"	CP	NI7	NI6	137
3	18	19	8"	CP	NI8	NI7	136
3	19	20	8"	CP	NI9	NI8	67
3	20	21	8"	CP	NI16	NI8	347
3	21	22	6"	CP	STUB	NI12	10
3	58	69	6"	CP	DK3	DK1	143
3	91	103	8"	CP	NN19	NN20	400
3	92	104	8"	CP	NN21	NN20	323
3	93	105	6"	CP	NN22	NN21	82
3	94	106	6"	CP	NN23	NN22	111
3	96	108	8"	CP	STUB	NN22	4
3	97	109	8"	CP	NN19	NN4	434
3	107	119	8"	CP	NR1	N39	264
3	108	120	12"	CP	N39	N38	132
3	153	167	6"	CP	N43A	N43	302
3	174	190	6"	PVC	IE7	IE11	324
3	248	270	30"	CP	I11	I10	53
3	270	294	30"	CP	I12	I11	245
3	277	301	8"	PE	IE3A	IE3	259
3	330	360	18"	STEEL	S2	S1	644
3	331	361	16"	STEEL	S2	S1	644
3	424	461	15"	CP	W37	W36	372
3	425	462	15"	CP	W36	W35	387
3	426	463	10"	CP	WA1	W36	312
3	427	464	10"	CP	WA2	WA1	228
3	1855	464	10"	CP	WA2	WA1	67
3	1856	464	10"	PVC	WA2	WA1	5
3	428	465	10"	CP	WA3	WA2	200
3	429	466	10"	CP	WA4	WA3	329
3	1857	466	10"	CP	WA4	WA3	51
3	430	467	15"	CP	W35	W34	400
3	431	468	15"	CP	W34	W33	400
3	432	469	15"	CP	W33	W32	443
3	433	470	15"	CP	W31	W30	366
3	434	472	15"	CP	W38	W37	354
3	469	507	8"	CP	NN17	NN16	191
3	470	508	8"	CP	NN14	NN13	284
3	471	509	10"	CP	NN13	NN12	314
3	472	510	12"	CP	NN12	NN11	323

Priority	GIS - Field ID	GIS - Object ID	Diameter	Material	Upstream Manhole	Downstream Manhole	Length (ft)
3	473	511	8"	CP	NN16	NN15	120
3	474	512	8"	CP	NN15	NN14	294
3	475	513	8"	CP	NN38	NN15	244
3	476	514	8"	CP	NN39	NN38	324
3	477	515	8"		NN40	NN38	137
3	478	516	8"	CP	NN37	NN16	115
3	479	517	8"	CP	NN36	NN14	116
3	480	518	12"	CP	NN11	NN10	60
3	481	520	6"	CP	NN36B	NN36	50
3	573	618	15"	PE	M21	M20	117
3	619	666	6"		STUB	M18A	10
3	620	667	6"		STUB	M18	10
3	623	670	6"	PVC	STUB	M16	10
3	624	671	6"	PVC	STUB	M16	15
3	625	672	10"	CP	IF1	I11	258
3	626	673	10"	CP	IF2	IF1	199
3	714	767	12"	DI	M16	M15	141
3	835	896	4	CP	UNKN	DE15	32
3	853	916	12"	PE	M17	M16	163
3	864	928	12"	PE	M18	M17	124
3	865	929	12"	PE	M18	M18A	25
3	866	930	12"	PE	M19	M18A	330
3	867	931	15"	PE	M20	M19	117
3	868	932	12"	PE	M21A	M21	163
3	869	933	12"	PE	M22	M21A	118
3	880	945	8"	CP	STUB	MP15	19
3	1275	1353	8"	CO	NN18	NN17	376
3	1280	1359	8"		STUB	WA4	10
3	1281	1360	15"	CP	W32	W31A	307
3	1282	1362	15"		STUB	W32	10
3	1333	1421	12"	CP	NN10	NN9	278
3	1374	1464	6"	CP	NN31	NN31A	49
3	1377	1467	6"	CP	NN30A	NN30	47
3	1417	1507	30"	CP	I10	I9A	112
3	1486	1580	8"	CP	N40	N39	236
3	1487	1581	8"	CP	N41	N40	115
3	1545	1641	10"	PVC	DE5A	DE4A	32
3	1546	1642	6"	CP	DE18B1	DE18B	41
3	1573	1671	6"	CP	N41A	N41	118
3	1752	1892	6"	CP			164
3	1763	1904	6"	CP			156
3	1772	1919					174
3	1773	1922					272
3	1775	1925				NCC49	213

MACKENZIE.

August 12, 2021 ***(Revised September 28, 2021) (Revised October 29, 2021)***

City of St. Helens
Attention: Matt Brown
265 Strand Street
St. Helens, OR 97051

Re: **St. Helens Industrial Business Park**
Infrastructure Design Work Order #1 Proposal
Project Number 2210214.00

Dear Mr. Brown:

Mackenzie appreciates this opportunity, and we are pleased to present to City of St. Helens ("Client") the following Scope of Services and fee proposal for the St. Helens Industrial Business Park.

Mackenzie's integrated team of design professionals will provide Civil Engineering, Land Use Planning, Transportation Engineering, and Landscape Architecture services for the above project. In addition, Mackenzie will retain Surveying, Wetlands, Geotechnical Engineering, and Pump Station Engineering consultants to complete the team.

Our Basis of Design along with our detailed Scope of Services by phase is as follows:

BASIS OF DESIGN

The following describes in detail the elements that define the basis of our proposal.

1. The City plans to prepare the St. Helens Industrial Business Park (SHIBP) to encourage development and economic growth in the region. The goal of this project is to design and install the Phase 1 infrastructure to support initial development and make the overall site more shovel-ready for future opportunities.
2. Infrastructure within the site will be sized based on Client-provided master plans, utility studies, and City standards documents.
3. The Phase 1 development comprises approximately 37 acres along Kaster Road and approximately 9.6 acres in the northeast corner of the SHIBP property (Parcel 9).
4. The City plans to prepare the infrastructure plans for use with future grant funding applications. No timetable has been set for eventual construction.
5. The infrastructure design is expected to generally follow the implementation plan and parcelization plan prepared for the City by 3J Consulting in 2020.
6. Utility sizing and design will be guided by the upcoming Sewer Master Plan and Stormwater Master Plan updates currently underway by the City. These plans will provide utility sizing and demand information for the SHIBP area.
7. The City plans to grade the Phase 2 area of the SHIBP to prepare the site for eventual development. Mackenzie will prepare the grading design based on the preliminary plans produced by Maul Foster & Alongi (MFA) in February 2021. Based on information provided by MFA and City staff, we expect the original design will need to be revised to incorporate wetland buffers which were not addressed in the MFA grading design.

8. Site grading will require removal of rock from the site. City staff has indicated that this activity would be classified as natural mineral resources development (mining) and therefore require a Conditional Use Permit.

SCOPE OF SERVICES

Pre-Design *Time Duration: 8 weeks*

Provide guidance in defining the project vision, goals and design objectives that will drive the subsequent design process.

1. Provide one (1) kickoff meeting via video conference to initiate the Pre-Design Phase. The following disciplines will attend the kickoff meeting: Civil Engineering, Land Use Planning, Wetlands, Survey, Geotechnical, and Pump Station Engineering. Meeting minutes for this meeting will be prepared by Mackenzie.
2. Complete an initial due diligence review for the project, including the following tasks:
   - A. Review updated and/or new provided information provided by the Client consisting of existing building(s), land survey (ALTA/Boundary/Topographic) including legal description, wetlands delineation, geotechnical report, environmental reports, utility master plans, and preliminary engineering studies.
   - B. Prepare and issue an initial site Due Diligence Report including:
     - I. Summary of anticipated land use and zoning criteria applicable to the project.
     - II. Summary of anticipated entitlement and permitting processes, procedures and schedules.
     - III. Preliminary review of infrastructure conditions and potential improvements (i.e. utilities, right-of-way improvements, etc.).
     - IV. Exploration of options for land use entitlement (e.g., combination of partition and subdivision; phased subdivision; etc.) with regards to process, timelines, and vesting, with recommendation on optimal path to achieve Client's goals.
     - V. Preliminary summary of potential "red flag" issues that may impact either the approach or feasibility of any program or design decisions.
     - VI. Initial Due Diligence Report draft for Client's review and comment.
     - VII. Final Due Diligence Report addressing Client's comments.
   - C. Provide up to one (1) meeting at Mackenzie's office to be attended by Mackenzie's Civil Engineer and Land Use Planner to review our final Due Diligence Report.
3. Provide up to one (1) discovery session at Client's office with the key Client stakeholder group to establish a thorough understanding of the project vision, goals and objectives. We will work with the Client to identify opportunities, challenges, and big picture goals for the project. This will serve as our road map going forward. We will also review site and utility components in detail including: street layout, public utility (water, sewer, storm) demands, franchise utility (power, gas, telecommunication) needs, and parcelization map. Issue minutes from this discovery session as the initial program summary for the Phase 1 infrastructure plan.

Deliverables

1. Kickoff meeting minutes.
2. Preliminary Due Diligence Report.
3. Final Due Diligence Report.
4. Stakeholder meeting minutes/Phase 1 program summary.

Pre-Application Conference

1. Coordinate, prepare for, submit request, and attend Pre-Application Conference with City staff to discuss site issues/process and confirm understanding. One (1) Mackenzie land use planner, civil engineer, and transportation engineer will attend the meeting. A submittal will include the following:
    A. Preliminary site plan and/or preliminary plat.
    B. Aerial map.
    C. Letter with project description and list of questions from the applicant team.
    D. Application form.
2. Prepare and distribute written meeting notes from Pre-Application Conference meeting.
3. Following City meeting, participate in a team meeting/conference call to discuss comments received from City staff regarding issues, including but not limited to zoning and access issues, entitlement strategy, and schedule.

Deliverables

1. Pre-Application Conference submittal materials.
2. Pre-Application Conference notes.

Schematic Design (30%) *Time Duration: 8 weeks*

Provide Schematic Design documents based on the mutually agreed-upon program and schedule. The Schematic Design documents shall establish the conceptual design of the project illustrating the scale and relationship of the project components. The following table summarizes the scope of services and deliverables for the Schematic Design phase.

1. Review Client-provided topographic survey, and identify areas with incomplete or obsolete data to be re-surveyed. No topographic surveying is included in this scope; if additional survey is recommended, we can provide an estimate for those services as needed.
2. Evaluate sewer demands.
    A. Prepare a memorandum summarizing sewer demands, pump station and force main sizing, and concept plans.
    B. Sewer demands to be based on the SHIBP Infrastructure Funding Plan and the ongoing Sewer Master Plan, to be provided by the Client.
3. Evaluate water demands.
    A. Prepare a memorandum summarizing water demands, main sizing, and concept plans.
    B. Water demands to be based on the SHIBP Infrastructure Funding Plan and the ongoing Water Master Plan, to be provided by the Client.
4. Conduct preliminary geotechnical engineering study.
    A. Review historical geotechnical or environmental reports for nearby developments, and/or anecdotal information from City personnel regarding on-site soil/rock conditions.
    B. Review Geologic and Soil Maps.
    C. Prepare geotechnical memorandum.
5. Coordinate Portland General Electric (PGE) substation parcel.
    A. Conduct up to two (2) meetings with PGE planners and City staff to review power utility needs, substation parcel standards, and transmission and distribution system alignments. Issue minutes for each meeting.
    B. Prepare preliminary plans and/or preliminary plat for PGE parcel development.
6. Prepare Schematic Design plans, to include:

A. Sewer pump station plans, including Force Main alignment plan, Pump Station civil site plan, Mechanical plan, Electrical site plan, and Electrical one-line diagram.
B. Roadway plans, including Plan and Profile, and Typical sections.
   I. Include/show right-of-way plans for additional needs like gas, communications, broadband, etc.
   II. Improvements specific to 9th/10th Street included in Phase 1.
   III. "Kaster Road Spur" de-construction and relocation of current utilities for desired road location shall be considered for Kaster Road and its extensions.
C. Water plans, including Plan and Profile of main lines, connection points, and service laterals.
D. Sewer plans, including Plan and Profile of main lines and service laterals.
E. Storm drainage plans, including Plan and Profile, and Typical Stormwater Treatment Facility Details.
   I. Provide preliminary stormwater system sizing calculations.
   II. Provide recommendations for floodplain impact mitigation.

7. Prepare preliminary construction cost estimate.
8. Issue 50% Schematic Design documents for Client review.
9. Refine Schematic Design documents based on review of 50% Schematic Design documents.
10. Issue 100% Schematic Design documents for Client review.
11. Obtain written approval from Client to proceed with Design Development.

Deliverables

1. Topographic Survey evaluation summary.
2. Sewer demand summary memorandum and concept pump station plans.
3. Water demand summary memorandum and concept plans.
4. Geotechnical memorandum.
5. Preliminary PGE substation parcel plans.
6. 50% Schematic Design plans.
7. 100% Schematic Design plans.
8. Preliminary Schematic Design plans.
9. Final Schematic Design plans developed to 30% design level, to include:
   A. Overall plan.
   B. Street plan/profile, typical sections.
   C. Utility plan/profile (water, sewer, storm drainage).
   D. Schematic stormwater treatment system design and memorandum.
   E. Pump station plans.
10. Preliminary construction cost estimate.

SHIBP Phase 2 Grading *Time Duration: 10 weeks*

Develop final grading plans based on the preliminary design completed by Maul Foster & Alongi in February 2021.

1. Provide one (1) kickoff meeting via video conference to initiate the Phase 2 grading design. The following disciplines will attend the kickoff meeting: Civil Engineering, Land Use Planning, and Wetlands. Meeting minutes for this meeting will be prepared by Mackenzie. The goal of this meeting is to develop detailed understanding of the objectives for the Phase 2 grading work, review the preliminary design, and identify key steps for permitting the grading work.
2. Conduct a Wetland and Stream Functional Assessment for the Phase 2 site.

A. As part of the wetland permitting process, Oregon Department of State Lands (DSL) and the U.S. Army Corps of Engineers (Corps) require the applicant to demonstrate that the wetland mitigation plan would provide functional replacement for wetland functions proposed to be impacted by the project. Therefore, existing wetland functions of the wetlands proposed to be impacted are required to be evaluated.
B. The Oregon Rapid Wetland Assessment Protocol (ORWAP) would be conducted separately for the different hydrogeomorphic classes of wetlands present in the project impact area (both depressional wetlands and riverine flow-through wetlands are proposed to be impacted).
C. In addition, the Stream Function Assessment Method (SFAM) would be conducted for impacts to Ditches 1 and 2, which are considered streams not wetland by the Corps.

3. Develop 60% grading plans.
   A. Site grading design will be based on the preliminary MFA plans with updates provided by City staff in the Phase 2 Grading kickoff meeting.
   B. Plans are expected to include: site plan, grading plan, overall cross-sections, wetland impact cross-sections, utility plan, erosion control plan, and stormwater facility details.
   C. Issue 60% plans for Client review.
   D. Meet via video conference with Client to review 60% plan comments.
4. Prepare a Wetland Mitigation Plan.
   A. Prepare a stand-alone wetland mitigation plan document meeting the requirements of the DSL administrative rules for wetland mitigation (OAR 141-085-0705) and the Corps mitigation rule requirements (33 CFR 332.4(c)).
   B. The DSL compensatory mitigation eligibility and accounting determination form would be used to confirm the necessary acreage of mitigation required to replace the lost wetland functions based on the functional assessment for the impacted wetlands and the functional assessment for the proposed mitigation site.
   C. Prepare mitigation plan figures to include: site plan, wetland cross-sections, water control structure schematics.
5. Prepare a Joint DSL/Corps Wetland Permit Application.
   A. The permit application is required to include an “Alternatives Analysis” describing how proposed impacts to wetlands and waters have been minimized during project siting and design. This includes a discussion of both alternative sites (other sites that were evaluated) and an evaluation of alternative site development designs to demonstrate minimization of proposed wetland impacts.
   B. The agencies will likely require a discussion of why wetland impacts are needed for Phase 2 and why the existing brownfield areas of the property cannot be developed prior to impacting areas with wetlands. Alternative phasing and/or site development scenario drawings will likely be required to satisfy this regulatory requirement.
   C. Develop a narrative to support the selected project design, including demonstrating that wetland impacts have been minimized to the extent practicable.
   D. Prepare plans to support the Joint Permit Application, including: site development plan, and wetland impact cross-sections.
   E. Based on Client feedback in September 2021, we will use the City’s SHIBP planning documents to present development alternatives and present coordination with future development phases for the overall project. No additional alternative site plans are included with this scope.
   F. Coordinate with DSL and Corps staff, including email and phone correspondence, for up to three (3) one-hour video conference meetings.
6. Sensitive Lands Assessment.

A. Prepare a sensitive lands assessment report to meet the City's review requirements for St. Helens Municipal Code (SHMC) Chapter 17.40 (Protective Measures for Significant Wetlands, Riparian Corridors and Protection Zones) and Chapter 17.44 (Sensitive Lands).
B. If the proposed Phase 2 development will result in impacts to the wetland protection zone (wetland buffers), the sensitive lands assessment will include a discussion of mitigation to be provided for impacts to wetland buffers in accordance with the requirements of the SHMC.
C. Prepare plans to support the Sensitive Lands Assessment, including: wetlands site plan.

7. Conduct Natural Resource Mineral Extraction Assessment.
   A. Review soil survey maps to estimate overburden thickness atop the site bedrock.
   B. Review readily available geologic maps and well logs the cover the project vicinity.
   C. Review readily available documentation regarding the characteristics of similar bedrock in Columbia County.
   D. Evaluate collected information to identify likely methods of rock excavation/mining (e.g. blasting, ripping, hammer, etc.).
   E. This assessment does not include subsurface exploration or laboratory testing for detailed characterization of rock extent and quality. We recommend these services be deferred to the expected Work Order #2 to coincide with expected subsurface explorations and testing conducted for the Phase 1 infrastructure detailed design scope.
   F. Consult with Oregon Department of Geology and Mineral Industries (DOGAMI) regarding requirements for mining permits.
   G. Consult with City and design team regarding phasing of mining and aggregate processing, and preparation of conditional use or mine operating permits.
   H. Prepare a memorandum summarizing our findings regarding bedrock characteristics and likely mining methodologies.
8. Prepare City of St. Helens Conditional Use Permit application.
   A. Coordinate with Client and consultants to identify and prepare Conditional Use Permit and Sensitive Lands Permit application and supporting documents as required by City of St. Helens. The land use application package will be limited to the Phase 2 grading/mining activities.
   B. Prepare burden of proof materials including narrative addressing approval criteria/policies, maps, and other materials necessary to describe the planned grading operation, timing, and phasing for mining operation in accordance with St. Helens Community Development Code.
   C. Compile Conditional Use Permit and Sensitive Lands Permit application materials including civil site plans, wetlands site plan, written burden of proof narrative, and associated exhibits. Submit narrative and supporting materials to the City.
   D. Monitor Conditional Use Permit and Sensitive Lands Permit application through completeness review (no more than 30 days per Oregon law); revise land use narrative and provide additional materials for up to one (1) response. If deemed incomplete, assumes completeness response can be prepared (including any items from Client) within 2 weeks of receipt of incomplete notice.
   E. Communicate with City staff throughout approval process. Review Planning Director's staff report. Attend Planning Commission meeting and present project on behalf of the Client. Monitor approval appeal period.
   F. Review updates required of the grading plans to address conditions of approval.
9. Prepare 100% grading plans.
   A. Prepare final grading plans based on agency permit review comments and Client review comments.
   B. Grading plans are expected to include:
      I. Site plan.
      II. Grading plan.

III. Utility plan.
IV. Stormwater facilities details.
V. Wetland impact cross-sections.
VI. Wetland mitigation plan.
VII. Erosion control plan.
VIII. Planting Plan.
IX. Construction details.

10. Obtain grading permit approvals.
    A. Prepare and submit applications for the following permits:
        I. Oregon Department of Environmental Quality 1200-C permit.
        II. DOGAMI surface mining permit.
        III. City of St. Helens Grade Permit.
        IV. City of St. Helens Engineering Permit.
        V. Columbia County Grade & Fill Permit.
    B. Respond to agency review comments, for up to two (2) rounds.

Deliverables

1. Kickoff meeting minutes.
2. Functional Assessment: ORWAP and SFAM spreadsheets.
3. 60% Grading Plans.
4. Wetland Mitigation Plan.
5. Joint Wetland Permit Application.
6. Sensitive Lands Assessment Report.
7. 100% Grading Plans.
8. Natural Resource Mineral Extraction Assessment memorandum.
9. Conditional Use Permit and Sensitive Lands Permit narrative and application.
10. Permit Applications noted above.

FEE SUMMARY

Our hourly not to exceed fees for the disciplines and related design services described above are as follows:

Pre-Design:	$40,300
Pre-Application Conference:	$5,700
Schematic Design (30% Plans):	$95,500
Phase 2 Grading Design and Permitting:	$119,300
TOTAL:	**$260,800**

Reimbursable expenses (printing, copying deliveries, ride share vehicles, application-based transportation, mileage, etc.) are not included in the fee outlined above and will be invoiced at 1.1 times cost. We estimate reimbursable expenses to be approximately $950 and will not exceed this amount without Client approval.

Services for development of detailed design plans, construction documents, bid support, permitting, and construction administration are expected to be provided under future work orders or contract amendments. Estimates for these services will be provided upon request.

ASSUMPTIONS

Please review and notify Mackenzie if Client believes that any of the Assumptions listed here are either inaccurate or unreasonable prior to project commencement. Please also notify Mackenzie if any additional clarity is needed for the Client to fully understand these Assumptions. In addition to the Scope of Services outlined above, we have assumed the following:

1. Client will provide current electronic files of existing building(s), land survey (ALTA/Boundary/Topographic) including legal description, wetlands delineation, geotechnical report, environmental report, any other reports and/or surveys that are available, and other studies and/or reports as may be necessary for completion of the project.
2. Scope and fee are based on Client not hiring a third party Client Representative to act on their behalf during any phase(s) of the project. If a third-party PM is hired by the Client, Mackenzie reserves the right to estimate scope and fee impacts that will result in additional services.
3. The Client will approve the Documents at the conclusion of each phase prior to proceeding with the next phase. Redesign efforts after prior Client approvals, including but not limited to Client-driven design modifications, value engineering, cost reduction alternatives to the approved design, or other such changes, will be provided as an additional service, with scope, schedule, and fees to be evaluated on a case-by-case basis.
4. Mackenzie Scope of Service and fees are based on project phases running in sequential order without delay, pause or project being put on hold for any reason between phases.
5. Client is responsible for all fees paid to public bodies having jurisdiction over the project.
6. Subject to the applicable Standard of Care, Mackenzie will design the Project in accordance with applicable laws, including current Federal ADA Accessibility Standards and as required by the Authority Having Jurisdiction (AHJ) for Building Permit per the AHJ's current edition of the governing building code, and by reference therein ANSI ICC/A117.1 ("Building Code") for new construction. Notwithstanding the foregoing sentence, the Client acknowledges that various governmental codes and regulations, including without limitation the ADA and FHA, are subject to varying and sometimes contradictory interpretation and that the ADA is not a detailed building code. In the case of such conflicts or differing interpretations, Mackenzie will notify the Client thereof and will endeavor to design to the most stringent interpretation acceptable to the AHJ.
7. All meetings will occur via video conference, other than construction site meetings unless specifically noted otherwise within the Scope of Services outlined above. We will record and distribute minutes following each meeting for all meetings through all phases up to Construction Contract Administration. During Construction Contract Administration, the General Contractor will provide meeting minutes. Mackenzie will review these minutes for accuracy.
8. Both on and off-site land use entitlements processes, such as Design Review, and related services, such as meetings with Authorities Having Jurisdiction (AHJ), neighborhood/community meetings, public hearings, and other related processes, are assumed to have been completed prior, or have been determined to not be required, and therefore are not included within the scope of this proposal.
9. Building/Site Renovation: Mackenzie will work with the Client to align on the Client's program for the Project, including goals and objectives, and will develop the design in accordance with applicable codes and laws, subject to and in accordance with the applicable standard of care. Client acknowledges that Projects involving additions

and remodels of existing sites/buildings (compared to new construction) create more uncertainty and subjectivity as to code and law interpretation and increases the chance that applicable agencies will have differing interpretations that might require redesign services. Such agency interpretations may not be made known until the Construction Documents and/or Plan Check phase of the Project. Accordingly, Client acknowledges and agrees that Mackenzie expressly excludes any services necessary to address these types of differing code and law interpretation issues from Mackenzie's scope of services, and that such services (including any necessary redesign services) will, upon Client's approval, be performed by Mackenzie as an additional service.

10. Conditions not depicted on available existing site and/or building documents, provided by the Client, or readily visible on project walkthroughs are excluded. Such impacts will be evaluated at the time of discovery and addressed via additional services as necessary.
11. Mackenzie will rely on Client-provided existing facilities information for project, including but not limited to type of construction, building area, occupancy classification and other such parameters affecting design, construction documents, and permitting.

EXCLUSIONS

Please review and notify Mackenzie if Client believes that any of the Exclusions listed here are to be included in Mackenzie's Scope of Services prior to project commencement. Please also notify Mackenzie if any clarity is needed for the Client to fully understand these Exclusions. In addition to any Exclusions outlined within the proposal above, we have also excluded the following from our proposed scope of services.

1. Client provided consultant services

- 1.a. Land survey, topographic survey, tree survey, and related specifications.
- 1.b. Hazardous materials mitigation design.
- 1.c. Coordination of Client provided consultants not identified at the date of this proposal.

2. Land Use Process/Permitting

- 2.a. Appeals, variances, public hearings, land use approvals, conditional use reviews, or any required adjustments other than as specifically outlined within our Scope of Services above.
- 2.b. Meetings with public agencies or other meetings other than those specifically identified in Scope of Services above.
- 2.c. Formal Building code interpretation requests and/or appeals.
- 2.d. Permits other than those identified within the proposal identified above (e.g., phased permitting, trade permits, separate demolition permit, any other special permits).

3. Standard Design Items

- 3.a. Square footage calculations beyond those required to confirm compliance with building and zoning code requirements. (Calculation of gross, net, and rentable square footages, such as BOMA calculations, are not included).

4. Unique Design services

- 4.a. Graphics and/or signage design, permitting, and related coordination.

5. Construction process – construction is not planned with this scope.

6. Graphics/BIM

- 6.a. Presentation-level 3D renderings other than conceptual studies to describe design intent or as utilized as part of Mackenzie's design process unless specifically noted within our Scope of Services above.
- 6.b. Marketing materials.
- 6.c. No Navisworks files or Clashing will be provided or performed. Deliverables shall be PDF and/or hardcopy only. (Revit model RVT files and DWG exports will not be provided.) Revit models and sheets will be created to Mackenzie standards.
- 6.d. No formal BIM Execution Plan will be provided.
- 6.e. Use of CAD Drawings or BIM models by any parties other than the Client or design team.

7. Expenses/Billing

- 7.a. Reimbursable expenses.
- 7.b. Special billing requirements required by Client outside of Mackenzie's standard billing procedures.
- 7.c. Building permit fees, design review fees, or any other fees paid to public bodies having jurisdiction over the project.

It is our understanding the project will start in November 2021. If the proposal is agreeable to you, please issue a City contract for review and execution. Please note that this proposal is valid for 60 days.

We look forward to working with City of St. Helens on this new project. If you need additional information or have any questions, please do not hesitate to call.

Sincerely,

Brent Nielsen, PE
Senior Associate

Matt Butts, PE
Principal in Charge

Enclosure(s): Hourly Billing Rate Schedule
Reimbursable Rates Schedule
Attachment A – Fee estimate table

MACKENZIE.

P 503.224.9560 ▪ F 503.228.1285 ▪ W MCKNZE.COM
RiverEast Center, 1515 SE Water Avenue, #100, Portland, OR 97214

Portland, Oregon ▪ Vancouver, Washington ▪ Seattle, Washington

HOURLY BILLING RATE SCHEDULE*

PRINCIPALS	$ 160 – $ 280
ARCHITECTURE/LANDSCAPE	
Design Director	$ 175 – $ 220
Senior Project Architect	$ 160 – $ 250
Project Architect I – III	$ 100 – $ 200
Architectural Designer II-III	$ 80 – $ 165
Architectural Designer I	$ 60 – $ 95
Designer/Drafter	$ 50 – $ 80
Intern	$ 50 – $ 75
ENGINEERING	
Senior Project Engineer	$ 160 – $ 250
Project Engineer I – III	$ 100 – $ 200
Designer I – II	$ 70 – $ 140
Transportation Analyst I – II	$ 65 – $ 115
Designer/Drafter	$ 80 – $ 130
Intern	$ 50 – $ 75
PLANNING	
Senior Project Planner	$ 150 – $ 235
Project Planner I – IV	$ 90 – $ 200
Permit Coordinator	$ 55 – $ 95
Assistant Planner	$ 65 – $ 100
Intern	$ 50 – $ 75
INTERIOR DESIGN	
Senior Project Interior Designer	$ 150 – $ 230
Interior Designer III – V	$ 100 – $ 175
Interior Designer I – II	$ 60 – $ 135
Intern	$ 50 – $ 75
ADMINISTRATION	
Administrator	$ 60 – $ 175
Word Processor	$ 70 – $ 110
Graphic Artist	$ 85 – $ 130

*Subject to change April 2022

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REIMBURSABLE CHARGES

Mackenzie will charge the following standard, cost-based rates for in-house reimbursable items listed below:

IN-HOUSE PRINTING

Scanning – Black & White

Small Format: $0.25/sheet
(8-1/2 x 11 - 11 x 17)

Large Format: $1.00/sheet
(Including Half Size)

Scanning – Color

Small Format: $0.50/sheet
(8-1/2 x 11 - 11 x 17)

Large Format: $3.00/sheet
(Including Half Size)

Printing/Copying – All Sizes

Black & White: $0.21/sq. ft.
Full Color: $4.00/sq. ft.

Fax

Local: $1.00/sheet
Long distance: $1.30/sheet

OTHER IN-HOUSE REIMBURSABLE ITEMS

Digital Photo Documentation

$15.00/download

Check Generation Fee

$25.00

Automobile Mileage

Billed according to IRS guidelines

Delivery Service

Fixed rates: $7.75 to $54.40
(depending on mileage)

Data Supplies

CD documentation: $15.00
DVD documentation: $30.00

Report Binder

Without tabs: $3.00/book
With tabs: $4.00/book

Foamcore: $4.25/sheet

			Mackenzie												
			Civil Principal	Civil Engineer III / Project Manager	Civil Engineer II	Civil Designer I	Transportation Engineer III	Transportation Designer I	Land Use Planner IV	Land Use Planner III	Land Use Planner I	Landscape Architect	Landscape Designer	Project Architect II	Admin
A	**Pre-Design**	**8 weeks**	**16**	**64**	**18**	**0**	**0**	**0**	**3**	**32**	**32**	**0**	**0**	**0**	**15**
	Project Management (ongoing)			*35*											*5*
	Due diligence review and report		*10*	*15*	*10*				*3*	*22*	*28*				*4*
	Stakeholder discovery session and program summary		*4*	*8*	*4*					*4*	*4*				*2*
	Client meetings		*2*	*6*	*4*					*6*					*4*
			$4,080.00	**$11,840.00**	**$2,430.00**	**$0.00**	**$0.00**	**$0.00**	**$585.00**	**$5,440.00**	**$3,360.00**	**$0.00**	**$0.00**	**$0.00**	**$1,350.00**
B	**Pre-Application Conference**	**4 weeks**	**0**	**7**	**0**	**0**	**4**	**2**	**1**	**9**	**10**	**0**	**0**	**0**	**6**
	Prepare pre-application documents			*2*			*2*	*2*	*1*	*3*	*6*				*4*
	Attend pre-application meeting with City			*2*			*2*			*2*					
	Prepare pre-app meeting minutes			*1*						*2*	*2*				*2*
	Follow-up meeting			*2*						*2*	*2*				
			$0.00	**$1,295.00**	**$0.00**	**$0.00**	**$800.00**	**$180.00**	**$195.00**	**$1,530.00**	**$1,050.00**	**$0.00**	**$0.00**	**$0.00**	**$540.00**
C	**Schematic (30%) Design**	**8 weeks**	**30**	**69**	**92**	**114**	**20**	**10**	**0**	**10**	**10**	**10**	**30**	**0**	**4**
	SD Kick-Off Meeting		*2*	*4*	*2*					*2*	*2*				
	Street plan/profile		*4*	*8*	*15*	*30*	*10*	*10*		*4*	*4*	*10*	*30*		
	Utility plan/profiles		*4*	*8*	*15*	*30*									
	Stormwater treatment plans and memo		*4*	*15*	*30*	*15*									
	Pump station plans		*2*	*6*											
	QC		*8*	*8*			*6*								
	Preliminary geotechnical memo			*2*											
	PGE Coordination and Preliminary parcel plans		*2*	*4*	*10*	*15*	*2*								
	Preliminary cost estimate		*2*	*6*	*12*	*20*	*2*								
	Meetings		*2*	*8*	*8*	*4*				*4*	*4*				*4*
			$7,650.00	**$12,765.00**	**$12,420.00**	**$10,260.00**	**$4,000.00**	**$900.00**	**$0.00**	**$1,700.00**	**$1,050.00**	**$1,600.00**	**$3,000.00**	**$0.00**	**$360.00**
D	**Phase 2 Grading and Wetland Permitting**	**10 weeks**	**12**	**65**	**90**	**126**	**0**	**0**	**18**	**71**	**100**	**20**	**45**	**0**	**10**
	Phase 2 Kick-Off Meeting		*2*	*3*	*3*										
	Team meetings		*2*	*4*	*6*	*6*				*2*					
	Wetland functional assessment			*3*	*3*										
	60% Phase 2 grading plans		*4*	*10*	*20*	*45*						*10*	*25*		
	Wetland Mitigation Plan			*5*	*10*	*15*									
	JPA Application			*10*	*15*	*15*									
	Sensitive Lands Asssessment														
	Natural Resource Mineral Extraction Assessment			*2*						*4*					
	Condtional Use Permit								*8*	*50*	*80*				*10*
	Agency Coordination			*3*	*3*										
	100% Phase 2 grading plans		*4*	*15*	*20*	*45*						*10*	*20*		
	Permits: Grade & Fill, Grading, 1200-C, DOGAMI, Engineering			*10*	*10*				*10*	*15*	*20*				
			$3,060.00	**$12,025.00**	**$12,150.00**	**$11,340.00**	**$0.00**	**$0.00**	**$3,510.00**	**$12,070.00**	**$10,500.00**	**$3,200.00**	**$4,500.00**	**$0.00**	**$900.00**
	Total Work Order #1 Hours		58	205	200	240	24	12	22	122	152	30	75	0	35
	Hourly Rate		$255.00	$185.00	$135.00	$90.00	$200.00	$90.00	$195.00	$170.00	$105.00	$160.00	$100.00	$150.00	$90.00
	Fee		*$14,790.00*	*$37,925.00*	*$27,000.00*	*$21,600.00*	*$4,800.00*	*$1,080.00*	*$4,290.00*	*$20,740.00*	*$15,960.00*	*$4,800.00*	*$7,500.00*	*$0.00*	*$3,150.00*
	Total Fee By Discipline		**$101,315.00**				**$5,880.00**		**$40,990.00**			**$4,800.00**	**$7,500.00**	**$0.00**	**$3,150.00**

		Hart Crowser						Wetlands Solutions NW			NW Survey	
		Senior Principal	*Principal*	*Project Engineer*	*Senior Staff*	*Drafter*	*Project Assistant*	*Wetland Biologist*			*Professional Surveyor*	
A Pre-Design	**8 weeks**	**0**	**9**	**9**	**6**	**2**	**4**	**16**	**0**	**0**	**10**	**0**
Project Management (ongoing)			*4*	*4*			*4*					
Due diligence review and report			*2*	*2*	*6*	*2*		*10*			*8*	
Stakeholder discovery session and program summary								*4*				
Client meetings			*3*	*3*				*2*			*2*	
		$0.00	**$2,524.50**	**$1,584.00**	**$924.00**	**$275.00**	**$440.00**	**$1,760.00**	**$0.00**	**$0.00**	**$1,320.00**	**$0.00**
B Pre-Application Conference	**4 weeks**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Prepare pre-application documents												
Attend pre-application meeting with City												
Prepare pre-app meeting minutes												
Follow-up meeting												
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
C Schematic (30%) Design	**8 weeks**	**0**	**5**	**8**	**14**	**4**	**2**	**12**	**0**	**0**	**0**	**0**
SD Kick-Off Meeting												
Street plan/profile								*4*				
Utility plan/profiles												
Stormwater treatment plans and memo								*4*				
Pump station plans												
QC												
Preliminary geotechnical memo			*2*	*5*	*14*	*4*	*2*					
PGE Coordination and Preliminary parcel plans												
Preliminary cost estimate												
Meetings			*3*	*3*				*4*				
		$0.00	**$1,402.50**	**$1,408.00**	**$2,156.00**	**$550.00**	**$220.00**	**$1,320.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
D Phase 2 Grading and Wetland Permitting	**10 weeks**	**5**	**25**	**40**	**25**	**6**	**0**	**232**	**0**	**0**	**0**	**0**
Phase 2 Kick-Off Meeting								*2*				
Team meetings												
Wetland functional assessment								*40*				
60% Phase 2 grading plans												
Wetland Mitigation Plan								*50*				
JPA Application								*50*				
Sensitive Lands Asssessment								*30*				
Natural Resource Mineral Extraction Assessment		*5*	*15*	*20*	*25*	*6*						
Condtional Use Permit												
Agency Coordination								*30*				
100% Phase 2 grading plans								*30*				
Permits: Grade & Fill, Grading, 1200-C, DOGAMI, Engineering			*10*	*20*								
		$1,595.00	**$7,012.50**	**$7,040.00**	**$3,850.00**	**$825.00**	**$0.00**	**$25,520.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Total Work Order #1 Hours		5	39	57	45	12	6	260	0	0	10	0
Hourly Rate		$319.00	$280.50	$176.00	$154.00	$137.50	$110.00	$110.00	$0.00	$0.00	$132.00	$0.00
Fee		*$1,595.00*	*$10,939.50*	*$10,032.00*	*$6,930.00*	*$1,650.00*	*$660.00*	*$28,600.00*	*$0.00*	*$0.00*	*$1,320.00*	*$0.00*
Total Fee By Discipline		**$31,806.50**						**$28,600.00**			**$1,320.00**	

		TetraTech										
		Principal Engineer	*Senior Civil Engineer*	*Civil Engineer*	*Structural Engineer*	*Electrical Engineer*	*Designer / CADD*	*Word Processing*	*Administrative Assistant*	*Direct Billing Reimbursables*	**Hours by Task**	**Fee by Task**
A Pre-Design	**8 weeks**	**0**	**5**	**4**	**0**	**0**	**0**	**0**	**2**	**$125.00**	**247**	
Project Management (ongoing)			*1*						*2*		*55*	***$9,741***
Due diligence review and report											*122*	***$18,568***
Stakeholder discovery session and program summary			*2*	*2*							*34*	***$5,640***
Client meetings			*2*	*2*						*$125.00*	*36*	***$6,421***
		$2,320.00								**$125.00**		**$40,370.00**
B Pre-Application Conference	**4 weeks**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$140.00**	**39**	
Prepare pre-application documents										*$50.00*	*20*	***$2,700***
Attend pre-application meeting with City										*$90.00*	*6*	***$1,209***
Prepare pre-app meeting minutes											*7*	***$915***
Follow-up meeting											*6*	***$920***
		$0.00								**$140.00**		**$5,744.00**
C Schematic (30%) Design	**8 weeks**	**4**	**12**	**64**	**12**	**16**	**88**	**4**	**0**	**$575.00**	**644**	
SD Kick-Off Meeting											*12*	***$2,070***
Street plan/profile										*$115.00*	*129*	***$16,392***
Utility plan/profiles										*$115.00*	*57*	***$7,352***
Stormwater treatment plans and memo											*68*	***$9,635***
Pump station plans			*8*	*56*	*12*	*12*	*88*	*4*		*$220.00*	*188*	***$30,162***
QC		*4*									*26*	***$5,830***
Preliminary geotechnical memo											*29*	***$4,737***
PGE Coordination and Preliminary parcel plans			*1*	*4*		*2*					*40*	***$5,740***
Preliminary cost estimate			*1*	*4*		*2*					*49*	***$6,830***
Meetings			*2*							*$125.00*	*46*	***$6,837***
		$32,190.00								**$575.00**		**$95,584.00**
D Phase 2 Grading and Wetland Permitting	**10 weeks**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$200.00**	**890**	
Phase 2 Kick-Off Meeting											*10*	***$1,690***
Team meetings											*20*	***$2,940***
Wetland functional assessment										*$50.00*	*46*	***$5,415***
60% Phase 2 grading plans											*114*	***$13,720***
Wetland Mitigation Plan										*$50.00*	*80*	***$9,180***
JPA Application										*$50.00*	*90*	***$10,780***
Sensitive Lands Asssessment										*$50.00*	*30*	***$3,355***
Natural Resource Mineral Extraction Assessment											*77*	***$15,048***
Condtional Use Permit											*148*	***$19,360***
Agency Coordination											*36*	***$4,260***
100% Phase 2 grading plans											*144*	***$17,445***
Permits: Grade & Fill, Grading, 1200-C, DOGAMI, Engineering											*95*	***$16,125***
		$0.00								**$200.00**		**$119,317.50**
Total Work Order #1 Hours		4	17	68	12	16	88	4	2	$1,040.00	**1820**	
Hourly Rate										$1.10		
Fee										*$1,144.00*		
Total Fee By Discipline		**$34,510.00**								**$1,144.00**		**$261,016**

CONTRACT PAYMENTS

City Council Meeting
November 17, 2021

Edge Development Project: Campbell Park Sports Court	**$**	**46,508.50**
Otak Project: S. 1st & Strand Streets, Road & Utility Ext (Inv#102100386)	**$**	**76,242.11**

Edge Invest. Develop. Grow.

APPLICATION AND CERTIFICATE FOR PAYMENT

AIA G702

Continuation Sheet, G703, is attached.

TO OWNER: **City of Saint Helens**
Address 264 Strand Street, St. Helens, OR 97051
FROM CONTRACTOR: **Edge Development**
2233 NW 23rd Ave., Suite100, Portland, OR 97210
PROJECT: Campbell Park
Address 150 McMicheal Street

APPLICATION NO.: 2
FOR THE PERIOD ENDING: 10/30/2021
CONTRACT DATE: 6/17/2021

Distribution to:
☐ OWNER
☒ CONTRACTOR

C/O	Brief Description	Date	Amount
1	CO #01: Fencing around Tennis and Pickelball courts	1/0/1900	104,580.00
2	CO #02:	1/0/1900	-
3	CO #03:	1/0/1900	-
4	CO #04:	1/0/1900	-
5	CO #05:	1/0/1900	-
6	CO #06:		
7	CO #07:		
8	CO #08:		
9	CO #09:		
10	CO #10:		
11	CO #11:		
12	CO #12:		
		Total	$104,580.00
		Net	

1. ORIGINAL CONTRACT SUM	$	291,535.00
2. Net change by CHANGE ORDERS	$	$104,580.00
3. Contingency	$	20,121.00
CONTRACT SUM TO DATE (Line 1 + 2)	$	416,236.00
4. TOTAL COMPLETED AND STORE TO DATE	$	221,609.54
5. RETAINAGE	$	10,781.15
6. TOTAL EARNED LESS RETAINAGE (Line 4 less Line 5 Total)	$	210,828.39
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT	$	172,666.04
8. CURRENT PAYMENT DUE	$	48,943.50
8a. CURRENT RETAINAGE	$	2,435.00
8b. CURRENT PAYMENT DUE LESS RETAINAGE	$	**46,508.50**
9. BALANCE TO FINISH, INCLUDING RETAINAGE	$	205,407.62

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

Edge Development

By: Dave Didier Date: 11-01-2021

Dave Didier, Dir. Of Construction

APPROVED FOR PAYMENT

INIT		DATE
MZ	ACCOUNTS PAYABLE FINANCE	11-4-2021
SW	SUPERVISOR	11-3-2021

704-000-53027

CONTINUATION SHEET

AIA G703 | Exhibit D

Project: Campbell Park | APPLICATION NO: 2

Edge Invest. Develop. Grow.

APPLICATION DATE: 11/1/2021
PERIOD TO: 10/30/2021

BUILDING AREA:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK Campbell Park APP# 2	SCHEDULED VALUE REVISED (AUTO CALC)	WORK COMPLETED FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE TO DATE (G x K)
01 General Conditions									
01.100	01 General Conditions	$ 4,751	3,126.00	1,250.00		4,376.00	92%	375.00	218.80
01.120	BOND/LIABILITY INSURANCE	$ 4,884	4,884.00			4,884.00	100%	-	-
	Sub Section TOTAL:	**9,635.00**	**8,010.00**	**1,250.00**	-	**9,260.00**		**375.00**	218.80
01 General Conditions (Services)									
01.711	PROJECT MANAGEMENT	$ 6,375	4,375.00	1,000.00		5,375.00	84%	1,000.00	268.75
01.712	ON-SITE SUPERVISION	$ 9,946	5,750.00	2,000.00		7,750.00	78%	2,196.00	387.50
01.713	OFFICE SUPPORT	$ 1,913	913.00	500.00		1,413.00	74%	500.00	70.65
	Sub Section TOTAL:	**18,234.00**	**11,038.00**	**3,500.00**		**14,538.00**		**3,696.00**	726.90
02 Sitework									
02.100	**02 Sitework**	$ 48,050.00	48,050.00			48,050.00	100%	-	2,402.50
02.200	COURT SURFACE	$ 118,747.00				-	0%	118,747.00	-
02.300	FENCING AND GATES	$ 104,580.00		43,950.00		43,950.00	42%	60,630.00	2,197.50
	SECTION TOTAL:	**271,377.00**	**48,050.00**	**43,950.00**	-	92,000.00		**179,377.00**	4,600.00
03 Concrete									
03.100	**03 Concrete**	104,709.00	104,709.00			104,709.00	100%	-	5,235.45
	SECTION TOTAL:	**104,709.00**	**104,709.00**	-	-	**104,709.00**		-	5,235.45
	SECTION TOTAL:	-		-	-	-		-	-
	CONSTRUCTION SUB-TOTAL:	**403,955.00**	**171,807.00**	**48,700.00**	-	**220,507.00**	55%	**183,448.00**	10,781.15
00.170	GC OVERHEAD:	$ -				-	0%	-	-
990.000	CAT TAX @ .50%	2,019.78	859.04	243.50	-	1,102.54		917.24	
	CONSTRUCTION TOTAL *(CARRY TO G702)*:	**405,974.78**	**172,666.04**	**48,943.50**	-	**221,609.54**	**55%**	**184,365.24**	10,781.15
00.000	CONTINGENCY: *Available to Move to Item Codes Above*	12,281.00	-			-	0%	12,281.00	
	CONSTRUCTION TOTAL	418,255.78	172,666.04	48,943.50	-	221,609.54	53%	196,646.24	

KY

Item #6.

Otak

Progress Report

202-723-52019

APPROVED FOR PAYMENT

INIT DATE

ACCOUNTS PAYABLE

MZ FINANCE 11-01-2021

SUPERVISOR 11-01-2021

October 29, 2021

Sue Nelson, PE
City Engineer
265 Strand Street
St. Helens, OR 97051

RE: ***Otak Project No. 019823.000***
S. 1st and Strand Streets, Road and Utility Extensions
Design, Construction, and Permit Documents
Invoice No. 000102100386

Dear Sue:

P-525

Enclosed is Otak's invoice for the ***S. 1st and Strand Streets, Road and Utility Extensions***, for the period starting September 10, 2021 and ending October 15, 2021. Invoices from Leeway, Grayling, and DKS include work from August. The total fee for work completed during this time period is $76,242.11.

The following is a summary of the activities performed under each phase activities:

Phase 110 Project Management and Administration
- Day-to-day project management and coordination.
- Prepared Invoice and progress reporting.

Phase 120 Project Coordination, Meetings, Schedule
- Coordination of meeting agendas and setup.

Phase 210 Topographic Survey
- None.

Phase 220 Geotechnical
- None.

Phase 230 Environmental Investigation
- Summarized the results of the environmental investigation in a report that included a summary of field activities and observations, laboratory reports, and a discussion of the analytical results within the context of DEQ's regulatory framework.

Phase 310 Planning Code-Zoning Requirements
- None.

Phase 320 Alignment Alternatives
- None.

Phase 330 Concept Development Plan
- None.

Phase 340 Scoring Criteria/Worksession
- None.

Phase 410 30% Roll-Map Plans
- Performed lighting analysis along S. 1st Street and Strand between the street extension limits at public intersections and pedestrian crossings and summarized in a memorandum with results of the findings.
- Developed signing and striping plans.

Phase 420 Stormwater Management
- None.

Phase 430 Lift Station Relocation Analysis
- None.

Phase 440 30% Cost Est/Construct Review
- Developed 30% cost estimate for signing/striping and lighting.
- Developed 30% cost estimate for sewer and water.

Phase 450 30% Plans – Strand/Cowlitz
- Preliminary concept layouts for extension and one-way north.
- Progress through 30% design layout.

Phase 510 90% and Final PS&E
- Progress through and develop 90% plans.
- Work with City on responses to 30% comments to incorporate into 90% plans.
- Develop combined water and gravity sanitary sewer plan and profile drawings, including Tualatin Street waterline connection.
- Develop force main plan and profile drawings.
- Develop streetscape Plans and Details

Phase 520 Stormwater Management

- Evaluate north water quality swale options and conduct hydraulic calculations.
- Review south water quality swale configuration and pipe sizing.

Phase 530 Lift Station Design Documents
- Advance lift station design documents.

Phase 610 Lift Station – DEQ
- None.

Phase 620 1200-C Erosion Control DEQ
- None.

Phase 630 Grading Permit – City
- None.

Phase 640 Building Permit – City
- None.

Issues that may affect the schedule:
- *None at this time.*

If you have any questions, please do not hesitate to call me at 503.415.2337.

Sincerely,

Otak, Inc.

Keith Buisman, PE
Senior Project Manager

INVOICE

Remit Payment to:
Otak Inc
P.O. Box 894448
Los Angeles, CA 90189-4448

Sue Nelson
City of St. Helens
265 Strand Street
St. Helens, OR 97051

October 29, 2021
Project No: 019823.000
Invoice No: 000102100386

Project 019823.000 City of St. Helens - 1st and Strand Streets

For Professional Services Ending October 15, 2021

Phase 110 Project Management and Admin

Task 110 Project Management and Admin CIVIL

Professional Personnel

	Hours	Rate	Amount	
Civil Engineer IX				
Buisman, Keith	8.00	193.00	1,544.00	
Totals	8.00		1,544.00	
Total Labor				**1,544.00**
			Total this Task	**$1,544.00**

Task 114 Project Management and Admin CMI

Professional Personnel

	Hours	Rate	Amount	
CM Documentation Specialist III				
Flett, Amanda	12.50	120.00	1,500.00	
Totals	12.50		1,500.00	
Total Labor				**1,500.00**
			Total this Task	**$1,500.00**
			Total this Phase	**$3,044.00**

Phase 120 Project Coord, Mtgs, Schedule

Task 120 Project Coord, Mtgs, Schedule CIVIL

Professional Personnel

	Hours	Rate	Amount	
Civil Engineer IX				
Buisman, Keith	8.75	193.00	1,688.75	
Totals	8.75		1,688.75	
Total Labor				**1,688.75**
			Total this Task	**$1,688.75**

Task 124 Project Coord, Mtgs, Schedule CMI

Project	019823.000	City of St. Helens - 1st and Strand Sts.	Invoice	000102100386

Professional Personnel

	Hours	Rate	Amount	
Construction Manager VI				
Williams, Michael	1.00	202.00	202.00	
Totals	1.00		202.00	
Total Labor				**202.00**
		Total this Task		**$202.00**
		Total this Phase		**$1,890.75**

Phase	230	Environmental Investigation
Task	236	Environmental Investigation sub GEO

Consultants

Geotechnical Consultants		4,632.50	
Total Consultants	**1.05 times**	**4,632.50**	**4,864.13**
	Total this Task		**$4,864.13**
	Total this Phase		**$4,864.13**

Phase	410	30% Roll-map Plans
Task	415	30% Roll-map Plans sub M/R

Consultants

Direct Cost Subconsultants		1,237.38	
Total Consultants	**1.05 times**	**1,237.38**	**1,299.25**
	Total this Task		**$1,299.25**

Task	417	30% Roll-map Plans sub LWE

Consultants

Direct Cost Subconsultants		5,043.50	
Total Consultants	**1.05 times**	**5,043.50**	**5,295.68**
	Total this Task		**$5,295.68**

Task	418	30% Roll-map Plans sub DKS

Consultants

Traffic Consultants		8,377.50	
Total Consultants	**1.05 times**	**8,377.50**	**8,796.38**
	Total this Task		**$8,796.38**
	Total this Phase		**$15,391.31**

Phase	440	30% Cost Est/Construct Review
Task	448	30% Cost Est/Construct Review sub DKS

Consultants

Traffic Consultants		1,072.50	
Total Consultants	**1.05 times**	**1,072.50**	**1,126.13**
	Total this Task		**$1,126.13**

Task 449 30% Cost Est/Construct Review sub GRE

Consultants

Direct Cost Subconsultants		125.40	
Total Consultants	**1.0 times**	**125.40**	**125.40**
	Total this Task		**$125.40**
	Total this Phase		**$1,251.53**

Phase 450 30% Plans - Strand/Cowlitz

Task 450 30% Plans - Strand/Cowlitz CIVIL

Professional Personnel

	Hours	**Rate**	**Amount**	
Civil Engineer IV				
Hollen, Daniel	58.25	128.00	7,456.00	
Civil Engineer IX				
Ballou, Kristen	1.25	193.00	241.25	
Buisman, Keith	7.00	193.00	1,351.00	
Engineering Technician V				
Haynes, Michael	6.00	120.00	720.00	
Urban Designer V				
Dixon, Stephen	.50	185.00	92.50	
Totals	73.00		9,860.75	
Total Labor				**9,860.75**
		Total this Task		**$9,860.75**

Task 455 30% Plans - Strand/Cowlitz sub M/R

Consultants

Direct Cost Subconsultants		4,465.37	
Total Consultants	**1.05 times**	**4,465.37**	**4,688.64**
	Total this Task		**$4,688.64**
	Total this Phase		**$14,549.39**

Phase 510 90% and Final PS&E

Task 510 90% and Final PS&E CIVIL

Professional Personnel

	Hours	Rate	Amount	
Civil Engineer IV				
Hollen, Daniel	30.75	128.00	3,936.00	
Civil Engineer IX				
Buisman, Keith	21.25	193.00	4,101.25	
Engineering Designer III				
Sanghani, Rasik	26.25	98.00	2,572.50	
Engineering Designer IV				
Sibert, Hailey	32.75	112.00	3,668.00	
Engineering Technician V				
Haynes, Michael	48.75	120.00	5,850.00	
Totals	159.75		20,127.75	
Total Labor				**20,127.75**
			Total this Task	**$20,127.75**

Task 515 90% and Final PS&E sub M/R

Consultants

Direct Cost Subconsultants		3,605.00	
Total Consultants	**1.05 times**	**3,605.00**	**3,785.25**
		Total this Task	**$3,785.25**

Task 519 90% and Final PS&E sub GRE

Consultants

Direct Cost Subconsultants		1,146.90	
Total Consultants	**1.0 times**	**1,146.90**	**1,146.90**
		Total this Task	**$1,146.90**
		Total this Phase	**$25,059.90**

Phase 520 Stormwater Mgmt Design and Report

Task 521 Stormwater Mgmt Design and Report WNR

Professional Personnel

	Hours	Rate	Amount	
Civil Engineer VI				
Horton, Rose	13.25	149.00	1,974.25	
Civil Engineer VIII				
Nordahl, Karina	.50	173.00	86.50	
Engineering Designer III				
Tiffany, Roger	36.00	98.00	3,528.00	
Totals	49.75		5,588.75	
Total Labor				**5,588.75**
			Total this Task	**$5,588.75**

Project	019823.000	City of St. Helens - 1st and Strand Sts.	Invoice	000102100386

Total this Phase **$5,588.75**

Phase 530 Lift Station Design Documents

Task 539 Lift Station Design Documents sub GRE

Consultants

Direct Cost Subconsultants		3,851.60	
Total Consultants	**1.0 times**	**3,851.60**	**3,851.60**

Total this Task **$3,851.60**

Total this Phase **$3,851.60**

Phase 900 Direct Expenses

Task 919 Direct Expenses sub GRE

Consultants

Direct Cost Subconsultants		750.75	
Total Consultants	**1.0 times**	**750.75**	**750.75**

Total this Task **$750.75**

Total this Phase **$750.75**

Total this Invoice **$76,242.11**

Invoice Summary

Description	Contract Amount	Prior Billed	Current Billed	Total Billed	Remaining
Project Management and Admin	55,262.00	17,305.25	3,044.00	20,349.25	34,912.75
Project Coord, Mtgs, Schedule	33,535.00	16,443.25	1,890.75	18,334.00	15,201.00
Topographic Survey	74,787.20	71,427.86	0.00	71,427.86	3,359.34
Geotechnical	22,049.50	21,806.39	0.00	21,806.39	243.11
Environmental Investigation	21,023.10	8,847.58	4,864.13	13,711.71	7,311.39
Planning Code-Zoning Requiremnts	2,652.75	2,527.50	0.00	2,527.50	125.25
Alignment Alternatives	53,333.15	53,703.26	0.00	53,703.26	-370.11
Concept Development Plan	29,942.00	29,060.28	0.00	29,060.28	881.72
Scoring Criteria / Worksession	16,213.75	9,777.00	0.00	9,777.00	6,436.75
30% Roll-map Plans	172,464.00	135,958.71	15,391.31	151,350.02	21,113.98
Stormwater Management	17,370.00	15,097.25	0.00	15,097.25	2,272.75
Lift Station Relocation Analysis	18,732.00	13,241.32	0.00	13,241.32	5,490.68
30% Cost Est/Construct Review	14,283.65	11,616.23	1,251.53	12,867.76	1,415.89
30% Plans - Strand/Cowlitz	52,720.50	0.00	14,549.39	14,549.39	38,171.11
90% and Final PS&E	465,131.60	7,926.88	25,059.90	32,986.78	432,144.82
Stormwater Mgmt Design and Report	30,428.00	1,725.25	5,588.75	7,314.00	23,114.00
Lift Station Design Documents	48,177.25	0.00	3,851.60	3,851.60	44,325.65

Project	019823.000	City of St. Helens - 1st and Strand Sts.	Invoice	000102100386

Lift Station - DEQ	10,450.65	0.00	0.00	0.00	10,450.65
1200-C Erosion Control - DEQ	12,082.70	0.00	0.00	0.00	12,082.70
Grading Permit - City	7,940.00	0.00	0.00	0.00	7,940.00
Building Permit - City	3,500.70	0.00	0.00	0.00	3,500.70
Direct Expenses	110,211.70	43,075.39	750.75	43,826.14	66,385.56
Total	1,272,291.20	459,539.40	76,242.11	535,781.51	736,509.69

INVOICE
720 SW Washington St., Suite 500
Portland, OR 97205
503.243.3500
www.dksassociates.com

Mike Peebles
OTAK, Inc
Attn: Accounts Payable
808 SW 3rd Avenue, Suite 800
Portland, OR 97204

September 15, 2021
Project No: 21058-000
Invoice No: 0078679

Project 21058-000 City of St Helens 1st and Strand Streets Road and Utility Extensions
City of St. Helens: 1st and Strand Streets: **Otak Project 019823.000**, NTP Effective 3-23-21; Prime agreement expiration 12/31/2023.

Professional Services for Period August 1, 2021 Through August 31, 2021

Phase 002 4.1 Development of 40% Roll-map Plans

Task 001 4.1.1 Lighting Analysis & Memo

Professional Personnel

	Hours	Rate	Amount	
Grade 30				
Boice, Steven	1.00	200.00	200.00	
Totals	1.00		200.00	
Total Labor				**200.00**
			Total this Task	**$200.00**

Task 002 4.1.2 Traffic Analysis & Memo

Professional Personnel

	Hours	Rate	Amount	
Grade 18				
Fleskes, Kayla	1.00	140.00	140.00	
Grade 30				
Boice, Steven	1.00	200.00	200.00	
Tech V				
Whitt, Danella	2.00	140.00	280.00	
Totals	4.00		620.00	
Total Labor				**620.00**
			Total this Task	**$620.00**

Task 003 4.1.3 Lighting Design

Professional Personnel

	Hours	Rate	Amount
Grade 11			
Ralis-Zazueta, Maria	5.00	105.00	525.00
Snellings, Rebecca	1.50	105.00	157.50
Grade 15			
Shelton, Jacob	8.50	125.00	1,062.50
Grade 16			
Anganis, George	3.00	130.00	390.00

TERMS: Net 30 Days
Remit To: 720 SW Washington St. #500
Portland, OR 97205

	Hours	Rate	Amount	
Grade 30				
Boice, Steven	1.75	200.00	350.00	
Tech T				
Norwood, Eva	.50	130.00	65.00	
Totals	20.25		2,550.00	
Total Labor				**2,550.00**
		Total this Task		**$2,550.00**

Task 004 4.1.4 Signing & Striping Design

Professional Personnel

	Hours	Rate	Amount	
Grade 6				
Sinkus, Ivan	2.00	80.00	160.00	
Grade 11				
Ralis-Zazueta, Maria	6.00	105.00	630.00	
Grade 15				
Shelton, Jacob	3.50	125.00	437.50	
Grade 16				
Anganis, George	21.00	130.00	2,730.00	
Grade 30				
Boice, Steven	5.25	200.00	1,050.00	
Totals	37.75		5,007.50	
Total Labor				**5,007.50**
		Total this Task		**$5,007.50**
		Total this Phase		**$8,377.50**

Phase 003 4.4 30% Cost Estimate/Constructability Review

Professional Personnel

	Hours	Rate	Amount	
Grade 21				
Vadaei, Sina	6.50	155.00	1,007.50	
Tech T				
Norwood, Eva	.50	130.00	65.00	
Totals	7.00		1,072.50	
Total Labor				**1,072.50**
		Total this Phase		**$1,072.50**

Billing Limits	**Current**	**Prior**	**To-Date**
Total Billings	9,450.00	31,507.50	40,957.50
Limit			91,751.00
Remaining			50,793.50

Total this Invoice **$9,450.00**

Outstanding Invoices

Number	**Date**	**Balance**
0078310	8/12/2021	23,810.00
Total		**23,810.00**

PROGRESS REPORT

City of St Helens 1st and Strand Streets Road and Utility Extensions
Otak Project 019823.000, subconsultant agreement NTP effective 3-23-21
Contract Begin (NTP) 3/23/31; Expires: 3/15/2023

DKS Inv #: 0078679
Period: 8/1/21 through 8/31/21
DKS Project #: 21058-000
DKS PM: Steve Boice

DKS

Task Number / Name	Budget	Invoiced This Period	Previously Billed	Billed to Date	Remaining Budget	Est. % Complete	Percent Billed
3.2 Alignment Alternatives (10%)	$ 4,310.00	$ -	$ 4,280.00	$ 4,280.00	$ 30.00	100%	99%
4.1 Development of 40% Roll-map Plans	$ 42,435.00	$ 8,377.50	$ 26,967.50	$ 35,345.00	$ 7,090.00	100%	83%
4.4 30% Cost Estimate/Constructability Review	$ 1,610.00	$ 1,072.50	$ 260.00	$ 1,332.50	$ 277.50	100%	83%
5.1 90% and Final PS&E	$ 41,650.00	$ -	$ -	$ -	$ 41,650.00	0%	0%
Direct Expenses	$ 1,746.00	$ -	$ -	$ -	$ 1,746.00	0%	0%
		$ -	$ -	$ -	$ -	0%	0%
PROJECT TOTAL:	**$91,751.00**	**$9,450.00**	**$31,507.50**	**$40,957.50**	**$50,793.50**	**40%**	**45%**

Authorized Budget: $ 91,751.00
Authorized Amount Remaining: $ 50,793.50

Amount This Invoice: $ 9,450.00
Amount Previously Invoiced: $ 31,507.50
Total Billed to Date: $ 40,957.50

Activity This Period	
Task 4:	Prepare 40% lighting, signing, and striping plans, perform photometric analysis, prepare draft lighting analysis memorandum, prepare draft traffic analysis memorandum, design team coordination, attend weekly meeting, prepare cost estimates

LEEWAY
engineering solutions
"Providing the freedom to act and change"

INVOICE

Leeway Engineering Solutions LLC
12597 NW Majestic Sequioa Way
Portland, Oregon 97229
Ph: (503) 828-7542

Project:	St Helens 1st/Strand Street (P-525 PSA)
Client Project Number:	019823.000
Leeway Project Number:	134.21
Invoice Number:	404
Project Invoice:	4
Invoice Date:	9/8/2021

Mr Mike Peebles, PE
OTAK, Inc.
808 SW Third Avenue
Portland, OR 97204-2426

Invoice for activity between 7/31/2021 through 8/27/2021
Leeway Project Manager: Robert Lee rob.lee@leewayengineeringsolutions.com

Labor, Subconsultants and Other Expenses Summary (per attached Billing Support Schedule)

Labor	$5,043.50
Subconsultants and Other Expenses	$5,874.65
Invoice Total	**$10,918.15**

Summary of Account

Previous Balance	$42,647.22	Invoiced to Date	$53,565.37
Payments Since Last Invoice	$8,501.03	Payments to Date	$8,501.03
Balance Forward	**$34,146.19**	**Total Balance Due***	**$45,064.34**
		Total Project Budget	$233,214.00
		Remaining Budget	**$179,648.63**

** Note that the total balance due does not reflect payments received after invoice date.*

Please remit to Leeway Engineering Solutions LLC
12597 NW Majestic Sequioa Way Portland, Oregon 97229

LEEWAY
engineering solutions
"Providing the freedom to act and change"

Leeway Engineering Solutions LLC
12597 NW Majestic Sequioa Way
Portland, Oregon 97229
Ph: (503) 828-7542

INVOICE

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Invoice Number:	404
Project Invoice:	4
Invoice Date:	9/8/2021

Billing Support Schedule

Task 4 - Road and Utility Extensions: Preliminary Design (30%)

Subtask 4.1 Development of 30% Roll-Map Plans

Labor

Staff	Role	Rate	Hours	Cost
Lul Kidane	Staff Engineer	$109.00	13.5	$1,471.50
Robert Lee	Principal Engineer	$234.00	14.5	$3,393.00
Yarrow Murphy	Senior Engineer	$179.00	1	$179.00
	Labor Subtotal		**29**	**$5,043.50**
	Subtask 4.1 Subtotal			$5,043.50

Subtask 4.4 30% Cost Estimate/Constructability Review

Subconsultants and Other Expenses

Description	Unit Cost	Quanity	Unit	Cost
Grayling Invoice 352 8/31/21 - 30% Constructability Review	$119.43	1.05	multiplier	$125.40
Subconsultants and Expenses Subtotal				**$125.40**
Subtask 4.4 Subtotal				$125.40
Task 4 Subtotal				**$5,168.90**

LEEWAY
engineering solutions
"Providing the freedom to act and change"

INVOICE

Leeway Engineering Solutions LLC
12597 NW Majestic Sequioa Way
Portland, Oregon 97229
Ph: (503) 828-7542

Project:	St Helens 1st/Strand Street (P-525 PSA)
Client Project Number:	019823.000
Leeway Project Number:	134.21
Invoice Number:	404
Project Invoice:	4
Invoice Date:	9/8/2021

Billing Support Schedule

Task 5 - Road and Utility Extensions: Final Design (90% and Final PS&E)

Subtask 5.1 90% and Final PS&E

Subconsultants and Other Expenses

Description	Unit Cost	Quanity	Unit	Cost
Grayling Invoice 352 8/31/21 - Final PS&E	$1,092.29	1.05	multiplier	$1,146.90
	Subconsultants and Expenses Subtotal			$1,146.90
	Subtask 5.1 Subtotal			$1,146.90

Subtask 5.3 Lift Station Design Documents

Subconsultants and Other Expenses

Description	Unit Cost	Quanity	Unit	Cost
Grayling Invoice 352 8/31/21 - Final PS&E	$750.75	1	multiplier	$750.75
Grayling Invoice 352 8/31/21 - Lift Sta Design Documents	$3,668.19	1.05	multiplier	$3,851.60
	Subconsultants and Expenses Subtotal			$4,602.35
	Subtask 5.3 Subtotal			$4,602.35

Task 5 Subtotal	**$5,749.25**
Invoice Total Labor Hours	29
Invoice Labor Total	$5,043.50
Invoice Expenses Total	$5,874.65
Invoice Total	**$10,918.15**

Grayling Engineers
654 Officers Row
Vancouver, WA 98661 US
360.347.6399
billing@graylingeng.com
www.graylingeng.com

INVOICE

BILL TO
Leeway Engineering Solutions, LLC
12597 NW Majestic Sequoia Way
Portland, OR 97229

INVOICE # 352
DATE 08/31/2021
DUE DATE 09/30/2021
TERMS Net 30

CATEGORY	DESCRIPTION	QTY	RATE	AMOUNT
Service	4.4 30% Cost Estimate / Constructability Review, Design Engineer I	1.14	104.76	119.43
Service	5.1 90% and Final PS&E, Senior Engineer	1	204.76	204.76
Service	5.1 90% and Final PS&E, Design Engineer III	5.10	151.43	772.29
Service	5.1 90% and Final PS&E, Design Engineer I	1.10	104.76	115.24
Service	5.3 Lift Station Design Documents, Senior Engineer	8.50	204.76	1,740.46
Service	5.3 Lift Station Design Documents, Design Engineer III	11.90	151.43	1,802.02
Service	5.3 Lift Station Design Documents, Design Engineer I	1.20	104.76	125.71
Expense	Subconsultant-Electrical	1	750.75	750.75

1st and Strand Streets, Road and Utility Extensions

BALANCE DUE **$5,630.66**

Mayer/Reed 319 SW Washington Street, Suite 820
Portland, Oregon 97204

INVOICE

OTAK
808 SW Third Avenue, Suite 300
Portland, OR 97204

INVOICE NUMBER: 13033
INVOICE DATE: 09/30/2021
PROJECT: SHS-21014 City of St. Helens - 1st and Strand Street

Professional services through 09/25/2021

		HOURS/ UNITS	RATE	BILLED
Task 4 Preliminary Design				
	Principal	8.25	$210.00	$1,732.50
Task 5 Final Design				
	Landscape Designer	2.00	$100.00	$200.00
	Landscape Designer	28.25	$90.00	$2,542.50
	Project Manager	7.50	$115.00	$862.50
	Subtotal:			**$3,605.00**
Task 4 Road & Utility Ext - PD 30%				
	Landscape Architect	16.50	$106.00	$1,749.00
	Principal	2.50	$210.00	$525.00
	Project Manager	14.75	$115.00	$1,696.25
	Subtotal:			**$3,970.25**
	TOTAL THIS INVOICE:			**$9,307.75**

MAXIMUM FEE:	AMOUNT BILLED TO DATE:
$138,415.00	$51,760.75

INVOICE

Federal Tax ID# 91-1780825

GeoDesign, Inc., DBA NV5

Remittance Address Change:
GeoDesign, Inc., DBA NV5
PO Box 74008680
Chicago, IL 60674-8680

Remittance ACH Transfer Change:
ABA Routing Number 063100277
Account Number 898052466590
Email ACH/Wire remittance details to RemittanceNotifications@nv5.com

Remittance Wire Transfers Change:
ABA Routing Number 026009593
Account Number 898052466590
Swift Code INTL. BOFAUS3N

Project Manager: Colby Hunt

Otak, Inc.
808 SW Third Avenue, Suite 800
Portland, OR 97204

October 8, 2021
Project No: 124221-1000017.02
Invoice No: 235822
Due Date: November 7, 2021

Project 124221-1000017.02 StHelens-3-02 S. 1st and Strand Streets

Professional Services through October 2, 2021

Phase 01 Environmental Services

Professional Personnel

	Hours	Rate	Amount	
Engineering/Geological Staff I	8.50	106.00	901.00	
Principal	13.50	224.00	3,024.00	
Project Assistant	.25	90.00	22.50	
Senior Technician	1.50	101.00	151.50	
Senior Technical Editor	5.50	97.00	533.50	
Totals	29.25		4,632.50	
Total Labor				**4,632.50**
			Total this Phase	**$4,632.50**

Billing Limits	**Current**	**Prior**	**To-Date**
Total Billings	4,632.50	29,212.08	33,844.58
Limit			62,222.00
Remaining			28,377.42

Total this Invoice **$4,632.50**

Questions? Call 503.968.8787 or email orwil-projectadministrators@nv5.com

Please Reference Our Invoice Number on your Payment

City of St. Helens

AMENDMENT OF PERSONAL SERVICES AGREEMENT

This Amendment is made on November 5, 2021, between City of St. Helens, an Oregon municipal corporation ("St. Helens"), and **Mayer/Reed, Inc.** ("Contractor").

RECITALS

A. WHEREAS, on or about March 4, 2021, St. Helens and Contractor entered into an agreement ("Agreement") in which Contractor agreed to provide services ("Services") related to 1) prepare full plans, specifications, estimates, permitting, and bid assistance for the Riverwalk Project Phase I and the Columbia View Park Amphitheater, 2) prepare plans, specifications, and estimates for Riverwalk Project Phase II at 30 percent design, and 3) bid assistance and construction management services for Riverwalk Project Phase I and Columbia View Park Amphitheater; and

B. WHEREAS, Section 2 and Section 4 of the Agreement provides that additional Work Orders may be added to complete the Scope of Work; and

C. WHEREAS, St. Helens and Contractor mutually desire to add an **Archaeological Survey** to the Agreement. The Scope of Work for the Archeological Survey is included as **Attachment A** of this amendment. The terms of compensation are included as **Attachment B** of this amendment.

AGREEMENT

NOW, THEREFORE, the parties mutually agree as follows:

1. The Agreement signed on or about March 4, 2021 shall be amended to include the Scope of Work included in **Attachment A,** unless terminated according to the terms of the Agreement.

2. All other terms and conditions of the Agreement shall remain in full force and effect other than as specifically amended herein.

ST. HELENS:	**CONTRACTOR:**
CITY OF ST. HELENS, an Oregon municipal corporation	**MAYER/REED, INC**
By: [signature], City Administrator	By: [signature]
Name: John Walsh	Name: Jeramie Shane
Its:	Its: Vice President

Amendment of 2021.12

ATTACHMENT A

Archaeological Investigations Northwest, Inc.

3510 N.E. 122nd Ave. • Portland, Oregon 97230
Phone (503) 761-6605 • Fax (503) 761-6620

Vancouver Phone (360) 696-7473
E-mail: ainw@ainw.com
Web: www.ainw.com

MEMO

Date: September 7, 2021

To: Shannon Simms, ASLA, PLA, Associate, Mayer Reed, Inc.

From: Jo Reese, M.A., R.P.A., President/Senior Archaeologist

Re: St. Helens Riverwalk, Phase 1, Oregon
Archaeological Survey

The City of St. Helens proposes to create Phase 1 of its Riverwalk project. This part of the project connects with Columbia View Park and extends up the Columbia River for about 300 feet. This is all on City land. None of the project area will be within Ordinary High Water and no permit from the US Army Corps of Engineers will be needed. The city proposes adding an overlook and replacing the bandshell. Some funding will be through the Oregon Department of Environmental Quality (DEQ). As part of its grant program, DEQ reached out to Tribes and one, the Confederated Tribes of Grand Ronde Community of Oregon, responded back requesting subsurface exploration.

The entire project area was formerly river channel, and has been filled with dredged materials to create the land. The project area was formerly a veneer plant that was supported by wood piers over the river; it is now a capped Brownfield. I appreciate getting the opportunity to view some of the historical photographs and maps you have collected as part of your work. These verify that the project area is covered in fill. The geotechnical report also supports this observation.

I propose to conduct a pedestrian survey but not excavate shovel tests; shovel testing will require a permit from the SHPO, and that will add about six weeks or more to the study. Instead, AINW's report will provide a historical overview of the project area using historic photographs and maps as well as Lidar images to show the former setting and alterations that have occurred. One objective will be to determine the former shoreline, prior to the commercial development, and my team will likely be able to do this from the Sanborn Insurance maps, other historical maps, and Lidar. The geotechnical report will also provide useful information. Two of my senior archaeologists, Nicholas Smits, MA, RPA, and Eva Hulse, Ph.D., RPA, would prepare the study. Nicholas has a focus on historical archaeology, and Eva is an expert in geoarchaeology.

AINW can provide this for a cost estimated to not exceed $6,980.00. If the cost is acceptable to you, please sign and return this proposal to note your acceptance. AINW's payment terms are Net 30 days from issuance of an invoice. Please note that if collection for nonpayment of our invoice is necessary, reasonable collection or legal costs will be charged to you. This letter contains the entire agreement between us and there are no other representations, warranties, or commitments. I can provide you with certificates of our worker's compensation insurance, general and auto liability insurance, and professional liability insurance, upon request. I appreciate the opportunity to serve as your archaeological consultant. Please feel free to call me if you have any questions.

Approval for project, as presented in this letter:

Signed: ______________________ Date ______________________

Name/title: ______________________

ATTACHMENT B

Archaeological Investigations Northwest, Inc.

CLIENT: Mayer/Reed, Inc.

Project Name: St. Helens Riverwalk, Phase 1

Date: September 7, 2021

Task	Description	Reese PI/PM/Senior Archaeologist	Smits Senior Archaeo.	Hulse Senior Geoarch.	Seaver Architect. Historian/ Archaeo.	Assist.PM/ Supervising Archaeolog	Supervising Archaeolg.	blank	Staff Archaeolog.	Cowan Graphics-GIS	Inman Research/ Proj. Assist./ Proj. Admin	Field/Lab Archaeo. Assistant	Hours	Labor	Expenses	Total
	Archaeological Survey	1	22	6	20					3	4		56	$6,942.23	$38.42	$6,980.65
													0	$0.00	$0.00	$0.00
													0	$0.00	$0.00	$0.00
													0	$0.00	$0.00	$0.00
	Total Labor Hours	1	22	6	20	0	0	0	0	3	4	0	56			
	Labor Rates	**$196.65**	**$144.90**	**$144.90**	**$96.02**	**$108.36**	**$96.26**	**$0.00**	**$76.80**	**$144.90**	**$83.32**	**$65.56**				
	Total Labor	$196.65	$3,187.80	$869.40	$1,920.40	$0.00	$0.00	$0.00	$0.00	$434.70	$333.28	$0.00	$6,942.23		$38.42	$6,980.65
	DIRECT EXPENSES	Each	Qty	Total								**GRAND TOTAL**		**$6,942.23**	**$38.42**	**$6,980.65**
	Vehicle Mileage 1 RT	$0.565	68	$38.42												
	Field Vehicle @ $58/day	$65.00	0	$0.00												
	Blank	$0.00	0	$0.00												
	Blank	$0.00	0	$0.00												
	TOTAL EXPENSES TASK			$38.42												
	TOTAL EXPENSES			$38.42												
						FN = AINW Cost Est St Helens Riverwalk Ph 1 9-7-21										

City of St. Helens

Library Board

Minutes from Monday, October 11, 2021

St. Helens Public Library via ZOOM

Members Present
Becky Bean
Rob Dunn, Vice Chair
Melisa Gaelrun-Maggi, Past Chair
Amanda Heynemann
Jana Mann

Councilors in Attendance
Stephen Topaz

Staff Present
Margaret Jeffries, Library Director
Dan Dieter, Library Board Secretary

Members Absent
Dan Davis, Chair
Jessica Sturdivant
Diana Wiener

Guests
Rachael Barry, City of St Helens

CALL MEETING TO ORDER: The meeting was called to order at 7:20 pm by Past Chair Gaelrun-Maggi.

INVITATION TO CITIZENS FOR PUBLIC COMMENT: N/A

PREVIOUS MEETING MINUTES: Minutes were reviewed and approved.

UPDATES: TRUNK OR TREAT / DRIVE THROUGH BOO – OCTOBER 31: Past Chair Gaelrun-Maggi stated that she is not going to be able to organize the event this year. The group discussed the risk of being in close proximity during the event and the possibility of other groups pulling out. The group decided to err on the side of caution and not participate in this year's event. Past Chair Gaelrun-Maggi will email Support Services Clerk Malinda Duran to give notice of the Board's withdrawal. NATIONAL NOVEL WRITING MONTH – NOVEMBER: Member Mann gave an update on this year's event. There is no meeting in person, and some participants are meeting online through Google Meet or Facebook. All five members of the Writer's Guild that met last Saturday said that they were participating. Director Jeffries stated that the Library would be able to help get the word out with flyers and handouts at the front desk. Member Mann stated that she would send out links to the event's website.

STRATEGIC PLANNING DISCUSSION: Rachael Barry, the Government Affairs & Project Support Specialist introduced the Strategic Plan process. This included an overview of the past plan's scope and what will be involved in developing a new plan. Rachael described to the Board the roles in plan development, including definitions of key steps in the process such as, environmental scans, mission and core values, goal development, strategy development, action planning, implementation and finally, review and evaluation. The group discussed the different steps in the process. Rachael gave a further breakdown of the environmental scan components, including definitions of internal and external stakeholders. The group was then given an assignment to work on for the next board meeting. Each Board member was requested to ask 5 people that they know to identify themes for a better understanding to the community's perception of what the Library does and what it could do. The group discussed different groups that could be contacted as external stakeholders, such as Community Action Team (CAT), Columbia County Mental Health (CCMH), and the St Helens Senior Center. There was also a suggestion to utilize lists of past program participants, such as those from the recent Summer Reading program. There was some discussion about how to reach local citizens who may not have a residential address. The group discussed the use of an informal survey for anyone visiting the Library. Visitors would be encouraged to put down a few words on a post-it note as an answer to a survey question, and that note would be placed on a large display that would help form part of the environmental scan. The idea is to get a feel for trends. The group discussed questions that might be asked to get a better understanding of not only what motivates patrons to come to the Library, but also what might keep patrons away. Director Jeffries stated that Rachael would be meeting with Library staff on Wednesday to cover the same information. Director Jeffries also stated that anyone who wanted a copy of the book (*Expect More: Demanding Better Libraries for Today's Complex World*) which was distributed to staff and board members prior to the last strategic planning session, to let her know and she would get them a copy.

LIBRARY DIRECTOR'S REPORT: Director Jeffries thanked all the Board members for helping with the Makerspace Policy evaluation as well as assisting with the Makerspace open house. The open house was very successful and many people showed up and asked questions. The job posting for a full time Library Technician (Makerspace Specialist) was posted last Thursday. Director Jeffries stated that she and Reference Librarian Herren-Kenaga are working on the statistical report that is submitted to the State Library every year. The data from this report is collected and then combined into a National report. The data usually takes about six to nine months to be posted. Outdoor activities will likely diminish with the onset of colder weather. The Ukulele Orchestra will try to continue to meet outdoors, but at some point they will try to find an alternate space to accommodate their group. Councilor Topaz asked if the City employees who helped with the setup for the Makerspace were acknowledged. Director Jeffries stated that she wrote a letter to the Public Works Director and named all of the employees who worked on everything from plumbing the new sink to pouring the new sidewalk.

CITY COUNCILOR'S REPORT: Councilor Topaz stated that he thought the Makerspace would offer a space where parents and their children can work together and siblings can help each other. How can we measure the 'happy sounds' that were heard at the open house?

BOARD MEMBER CONCERNS / COMMENTS / QUESTIONS:

SUMMARIZE ACTION ITEMS: Board members were given the task of asking five people that they know a series of questions. For example, 'what two words do you associate with the St Helens Public Library?', or 'how do you use library services?'. The responses will be discussed at the next Board meeting.

NEXT MEETING: The next regularly scheduled meeting will be Monday, November 8, 2021 at 7:15 p.m. via Zoom.

ADJOURNMENT: Past Chair Gaelrun-Maggi adjourned the meeting at 8:40 pm.

Respectfully submitted by:

____

Library Board Secretary, Dan Dieter

2021-2022 Library Board Attendance Record

P=Present E=Excused Absence U=Unexcused Absence

Date	Bean	Davis	Dunn	Gaelrun-Maggi	Heynemann	Mann	Sturdivant	Wiener	VACANT
07-12-2021	P	E	P	P	P	P	P	E	
08-9-2021	P	P	P	P	P	P	P	E	
09-13-2021	E	P	P	P	E	P	P	P	
10-11-2021	P	E	P	P	P	P	E	E	
11-8-2021									
12-13-2021									
01-10-2022									
02-14-2022									
03-14-2022									
04-11-2022									
05-9-2022									
06-13-2022									

PLANNING COMMISSION

Tuesday, October 12, 2021, at 7:00 PM

DRAFT MINUTES

Members Present:	Chair Cary Vice Chair Hubbard Commissioner Webster Commissioner Semling Commissioner Lawrence Commissioner Pugsley
Members Absent:	Commissioner Cavanaugh
Staff Present:	City Planner Graichen Associate Planner Dimsho Community Development Admin Assistant Sullivan Councilor Birkle
Others:	Peter Olsen Keller Associates

1. 7:00 P.M. CALL TO ORDER & FLAG SALUTE

2. CONSENT AGENDA

A. Planning Commission Minutes Dated August 10, 2021

Commissioner Webster requested a correction under "deliberations."

Motion: Upon Commissioner Webster's motion and Commissioner Semling's second, the Planning Commission unanimously approved the Draft Minutes as amended dated August 10, 2021. [AYES: Vice Chair Hubbard, Commissioner Pugsley, Commissioner Lawrence, Commissioner Webster, Commissioner Semling NAYS: None]

B. Planning Commission & City Council Joint Meeting Minutes dated September 22, 2021

Motion: Upon Commissioner Webster's motion and Commissioner Semling's second, the Planning Commission unanimously approved the Draft Minutes dated September 22, 2021. [AYES: Vice Chair Hubbard, Commissioner Pugsley, Commissioner Lawrence, Commissioner Webster, Commissioner Semling NAYS: None]

3. TOPICS FROM THE FLOOR (Not on Public Hearing Agenda): Limited to five minutes per topic

There were no topics from the floor.

4. SANITARY SEWER AND STORM WATER MASTER PLAN PRESENTATION

C. Storm Water Executive Summary

D. Sanitary Sewer Executive Summary

Peter Olsen, with Keller Associates, presented the report. He said they take all the data they collect through the study and establish a storm and planning criteria to develop and evaluate future Storm Water and Sanitary Sewer Master Plans. He said they create a hydrologic and hydraulic computer model to try to mimic the system that is currently in place and then they evaluate where the deficiencies are. Then they add in future development and pipelines to address those deficiencies. The presentation showed the differences between the current and proposed updates. He also reviewed the engineering design standards, Municipal Code, and Comprehensive Plan for our City when creating the Master Plan. They gave several recommendations to update the code. They provided recommendations for staffing for yearly replacements of pipeline, manholes, pump stations and catch basins.

Chair Cary asked about the stormwater treatment requirements for development on new projects. Olsen explained the plan was to recommend improvements and identify deficiencies for the system, but not for the quality of the stormwater.

Chair Hubbard asked about new development and if they would be required to put in a retention system. Olsen agreed that this would be a requirement based on the City design standards.

There was some discussion about some problematic areas in the city for drainage.

5. PUBLIC HEARING AGENDA (times are earliest start time)

E. 7:30 p.m. Variance at 544 & 564 S 12th Street - McGhie

Commissioner Pugsley recused herself from the hearing as she is the co-owner of the real estate company who has been hired to sell the property for the City. She stated that the applicant is also Commissioner Pugsley's client.

Chair Cary's ex-parte contact did not impact his ability to make a fair decision in the matter.

City Planner Jacob Graichen presented the staff report dated October 5, 2021. He mentioned this was a City surplus lot. He said the property was unique as it had several public utilities running through the center of the property requiring a 15-foot easement. He said the applicant was requesting a variance for the front setback in order to maintain a reasonable building footprint. Graichen mentioned there could be a zero-foot front setback. He said the Commission could also recommend a six-foot setback instead of the normal 20-feet. He said with the new Development Code amendments there was a front porch encroachment into the setback that is allowed. It was increased from three-feet to four-feet. He mentioned the applicant was requesting to move the porch all the way to the lot line which would be six-foot.

He discussed the street and sidewalk development. He said this was in an area with an 80-foot right-of-way. He mentioned even if a zero-foot setback was allowed the house would still be very far back from the street since the improved road is skewed to the opposite side of the right-of-way. Graichen showed a map of the houses currently on the street and how there were already houses located at the zero-foot setback.

McGhie, John. Applicant. McGhie said he is excited to build a house in St. Helens. He understood the sewer easements were important, and he is just trying to build a house correctly according to the City Development Code.

In Favor

No one spoke in favor.

Neutral

No one spoke as neutral testimony.

In Opposition

No one spoke in opposition.

End of Oral Testimony

There were no requests to continue the hearing or leave the record open.

Close of Public Hearing & Record

The applicant waived the opportunity to submit final written argument after the close of the record.

Deliberations

There was a small discussion about the setbacks and the porch encroachment.

Motion: Upon Commissioner Webster's motion and Commissioner Semling's second, the Planning Commission unanimously approved the Variance allowing a 0' front yard (setback) as recommended by staff. [Ayes: Vice Chair Hubbard, Commissioner Semling, Commissioner Webster, Commissioner Pugsley, Commissioner Lawrence; Nays: None]

Motion: Upon Commissioner Webster's motion and Commissioner Semling's second, the Planning Commission unanimously approved the Chair to sign the Findings when prepared. [Ayes: Vice Chair Hubbard, Commissioner Semling, Commissioner Webster, Commissioner Lawrence, Commissioner Pugsley; Nays: None]

F. 8:00 p.m. Annexation at 58241 Division Road – McPherson

Associate Planner Jennifer Dimsho presented the staff report dated October 5, 2021. She presented a map to orient the Commission on where the property was located. She said the applicant wants to connect to the sewer so they can develop the back portion of the property. She said they would review the improvements of development later in the process, not at Annexation. She said Columbia County did not have any concerns with this property annexing into the City. She mentioned the current zoning was Columbia County R10 and based on our Comprehensive Plan zoning, it could be zoned into the City as R10 or R7. She said staff recommended R7. Dimsho said that in addition to consistency with adjacent zoning, there is surplus of R10 properties based on the Housing Needs Analysis.

In Favor

No one spoke in favor.

Neutral

No one spoke as neutral testimony.

In Opposition

No one spoke in opposition.

End of Oral Testimony

There were no requests to continue the hearing or leave the record open.

Close of Public Hearing & Record

The applicant waived the opportunity to submit final written argument after the close of the record.

Deliberations

The Commission agreed with staff's recommendation for approval.

Motion: Upon Commissioner Webster's motion and Commissioner Lawrence's second, the Planning Commission unanimously recommended approval of the Annexation to City Council as recommended by staff. [Ayes: Vice Chair Hubbard, Commissioner Semling, Commissioner Webster, Commissioner Pugsley, Commissioner Lawrence; Nays: None]

G. 8:15 p.m. Annexation at 35285 Millard Road – Columbia Soil & Water Conservation District

Associate Planner Jennifer Dimsho presented the staff report dated October 5, 2021. She shared a map of the property to orient the Commission on where it was located. She said the annexation has been on hold since May of 2011. She recommended R7 zoning for this property, due to the surrounding zoning. She said they could not approve this annexation unless the previous annexation for 58241 Division Road was approved, so that the subject property would be abutting property in City limits. She said Columbia County had no concerns with annexation. She mentioned the use, upon annexation, would be a public facility (major), which means it would not create a non-conforming use.

In Favor

No one spoke in favor.

Neutral

No one spoke as neutral testimony.

In Opposition

No one spoke in opposition.

End of Oral Testimony

There were no requests to continue the hearing or leave the record open.

Close of Public Hearing & Record

The applicant waived the opportunity to submit final written argument after the close of the record.

Deliberations

The Commission agreed with staff's recommendation for approval.

Motion: Upon Commissioner Webster's motion and Commissioner Lawrence's second, the Planning Commission unanimously approved the Annexation as recommended by staff. [Ayes: Vice Chair Hubbard, Commissioner Semling, Commissioner Webster, Commissioner Pugsley, Commissioner Lawrence; Nays: None]

6. PLANNING COMMISSION TERM EXPIRATIONS AND VACANCIES

Graichen discussed the upcoming vacancies of Commissioner Pugsley and Vice Chair Hubbard. He asked them if they wished to continue for another term. He said neither had served two full terms so if they wished to continue it would just move forward.

Both Commissioners agreed to continue.

Motion: Upon Commissioner Webster's motion and Commissioner Lawrence's second, the Planning Commission unanimously approved the Commissioner Pugsley and Vice Chair Hubbard to another term. [Ayes: Vice Chair Hubbard, Commissioner Semling, Commissioner Webster, Commissioner Pugsley, Commissioner Lawrence; Nays: None]

Graichen also discussed Commissioner Cavanaugh. She has missed three consecutive meetings without an approved absence. This is presumed to be nonconformance of duty and justification to be removed from the Commission. He mentioned the Council would have to provide a public hearing to provide an opportunity for any rebuttal to formally vacate the position. He mentioned himself and Community Development Administrative Assistant Sullivan reached out several times to make a connection via email or phone with Commissioner Cavanaugh with no response.

Motion: Upon Commissioner Lawrence's motion and Vice Chair Hubbard's second, the Planning Commission unanimously agreed that no excuse was granted for absence of Commissioner Cavanaugh and to vacate the position. [Ayes: Vice Chair Hubbard, Commissioner Semling, Commissioner Webster, Commissioner Pugsley, Commissioner Lawrence; Nays: None]

Graichen discussed the interview committee to bring on another Commissioner. He asked if anyone would like to volunteer. Commissioner Pugsley, Vice Chair Hubbard and Commissioner Webster all volunteered.

7. ACCEPTANCE AGENDA: Planning Administrator Site Design Review

1. Site Design Review (Minor) at 454 Milton Way – Crown Castle
2. Site Design Review (Minor) at 155 N Columbia River Hwy – Victorico's

Motion: Upon Commissioner Webster's motion and Commissioner Semling's second, the Planning Commission unanimously approved the Acceptance Agenda. [Ayes: Vice Chair Hubbard, Commissioner Semling, Commissioner Webster, Commissioner Pugsley, Commissioner Lawrence; Nays: None]

8. PLANNING DIRECTOR DECISIONS (previously e-mailed to the Commission)

1. Sign Permit at 100 St. Helens Street – RY Industries, LLC

9. PLANNING DEPARTMENT ACTIVITY REPORT

H. Planning Department Report – August

Vice Chair Hubbard asked a question about the southwest corner of the Pittsburg and Highway 30 location and was wondering about the continuance of cleanup. Graichen mentioned he had spoken with Code Enforcement and had planned to go out again to check the progress.

I. Planning Department Report – September

10. FOR YOUR INFORMATION ITEMS

Dimsho said that in preparing for the Annual Planning Department report to Council, she discovered that on average, the City has processed one annexation every year for nine years and that this year they were on track to process nine annexations before the end of the year. She said it was a signal of the growth coming to our city.

Councilor Birkle discussed the joint City Council and Planning Commission meeting. He said he thought there was a desire from the Planning Commission to not just be informed but be more actively involved in the recommendations that go before the City Council.

11. ADJOURNMENT

NEXT REGULAR MEETING: November 9, 2021

There being no further business before the Planning Commission, the meeting was adjourned 9:23 p.m.
Respectfully submitted,

Christina Sullivan
Community Development Administrative Assistant

City of St. Helens

Consent Agenda for Approval

CITY COUNCIL MINUTES

Presented for approval on this 17th day of November, 2021 are the following Council minutes:

2021

- Work Session, Executive Session, Public Hearings, and Regular Session Minutes dated November 3, 2021

After Approval of Council Minutes:

- ☐ Scan as PDF Searchable
- ☐ Make one double-sided, hole-punched copy and send to Library Reference
- ☐ Minutes related to hearings and deliberations get copied to working file
- ☐ Save PDF in Minutes folder
- ☐ Update file name & signature block on Word document & copy Word document into Council minutes folder in Shared Drive
- ☐ Upload & publish in MuniCode
- ☐ Email minutes link to distribution list
- ☐ Add minutes to HPRMS
- ☐ Add packet and exhibits to HPRMS
- ☐ File original in Vault
- ☐ Update minutes spreadsheet

COUNCIL WORK SESSION

Wednesday, November 03, 2021

DRAFT MINUTES

MEMBERS PRESENT
Mayor Rick Scholl
Council President Doug Morten
Councilor Patrick Birkle
Councilor Stephen R. Topaz
Councilor Jessica Chilton

STAFF PRESENT
John Walsh, City Administrator
Matt Brown, Deputy City Administrator
Kathy Payne, City Recorder
Lisa Scholl, Deputy City Recorder
Mouhamad Zaher, Public Works Director
Sue Nelson, City Engineer
Jacob Graichen, City Planner
Jenny Dimsho, Associate Planner
Crystal King, Communications Officer
Sharon Darroux, Engineering Project Manager I
Tina Curry, Event Coordinator

OTHERS
Lynne Pettit
Art Leskowich
Stephanie Patterson
Malinda Jones
Peter Olsen
Emily Flock
Steve Donovan

CALL WORK SESSION TO ORDER – 1 p.m.

Mayor Scholl read the Council Mantra.

VISITOR COMMENTS - *Limited to five (5) minutes per speaker*

- Stephanie Patterson, Spirit of Halloweentown Vendor Coordinator. It was an epic season. They were packed every weekend with happy people. They taught people the witch dance and cupid shuffle. The vendors did very well and made a lot of money. They all want to come back next year.

- Tina Curry. Spirit of Halloweentown update:
  - Stayed in the black and have funds leading into next year
  - Everyone seemed happy
  - No major incidents
  - Restaurants and merchants did very well
  - Everyone was busy
  - They only had bad weather issues one weekend
  - The weather the last weekend was perfect
  - Giving back to volunteer organizations, such as CERT, Kiwanis, Lions Club, and Rotary. The CERT team did a great job monitoring the parking lot and keeping things moving.
  - The pirates were so popular they came every weekend
  - People generally followed the rules

DISCUSSION TOPICS - *The Council will take a break around 3:00 p.m.*

1. **Waste Connections (Hudson Garbage) Request for Christmas Promise Contribution for Kids Bike Build Program -** ***Malinda Jones***

Malinda Jones reviewed her request. This is their sixth annual bicycle build. They work with DHS and the Giving Tree. They fundraise and partner with Walmart to purchase the bikes. They build the bikes and then deliver them before Christmas. In 2019, they did 150 bikes. Last year was different because of COVID and they did 124 bikes. The need is big this year. She is requesting the City's assistance with the bikes. Last year, Waste Connections built the bikes at homes because of COVID. They hope to work together this year to build the bikes and invite the community.

Mayor Scholl reported that they have changed their process for grant requests, but he knows they have supported the program in the past. Malinda recently learned about that process and plans to follow that next year.

Councilor Birkle appreciates the cause. Pointing out the new donation request process, he suggested they partner to help promote the program.

Councilor Chilton asked how much was given to them in the past. Malinda said the City donated $500 in the past. Walmart donates as well.

Councilor Topaz said we can't do it this year because of the new program but asked if the City can help promote the program. City Administrator Walsh explained that in the past the Council addressed the requests as they came up. The new process doesn't mean Council can't award funds as they come in. It would just take away from the next round.

Mayor Scholl talked about how they didn’t know about the process. He recommends making the donation and allowing the use of the Recreation Center for the bike build.

Motion: Council President Morten moved, and Councilor Topaz seconded to donate $500 to Waste Connections from Council funds.

Discussion.

Motion tabled until the regular session. Mayor Scholl recommended Malinda work with Parks & Recreation Manager Shanna Duggan to use the Recreation Center.

2. **Review of Sewer & Stormwater Master Plans -** ***Peter Olsen & Emily Flock, Keller Associates***

Peter Olsen and Emily Flock reviewed the plans. A copy is included in the archive packet for this meeting.

Stormwater Master Plan review:

- Need and purpose
- Planning criteria
  - Target a 25-year storm event
- Existing system
- Model development
- Existing capacity evaluation
- Identified potential pipes under structures
  - Recommend moving them during the next repair cycle
- Current design standards do not include clear triggers and requirements for water quality
- Priority areas
- Operations and maintenance recommendations
  - Clean and CCTV every two years
  - Clean catch basins and manholes every two years

- Clean/inspect ditches and inlets annually
    - Sweep roadways twice per year
    - Perform detention facility maintenance annually
    - Continue in-house storm line replacement and repair
    - Complete construction inspection
    - Comply with new Mercury TMDL plan and reporting
- Annual cost estimate for replacement is $900,000
- Recommendations
    - 4.25 - 4.5 FTE to meet operations and maintenance goals
    - Additional Engineering FTE for GIS and CIP projects
    - Implement Stormwater CCTV programs
    - Implement Mercury TMDL plan and annual report

Councilor Topaz said that between 1990-2000, the EPA wanted the City to change all of their combined sewer to sanitary sewer and decided to put in storm sewer. It was not done completely but a lot of work was done with the volumes of water in the basins. Engineering Project Manager I Sharon Darroux clarified that it was not a combined system. They were having overflows, so EPA mandated that they stop the overflows. That's why they started upgrading the sanitary lines and put in a storm sewer at the same time.

Councilor Topaz said one of the original systems from 1914 was a combined system that dumped into the river. They had to stop dumping into the river in the 1960's. They put a pump station in and closed off a number of catch basins because a rainstorm would overwhelm the system. After that, there was a mandate that they had to have separate sanitary and storm systems. They've been changing the road levels, so the water distribution is different. When they were doing the systems, they found out people had installed pipes prior to the 1900's. He talked about Dillard Lake that once was a quarry. There were private neighborhood drains dumping water there. That was redone in 1913. When the pump system came in the 1960's, a lot of the lines were severed. Unfortunately, with the basalt the water flow fills in the basalt ditch. Because of the road changes, there are some places that just flood. In one location, they added four catch basins where there were none. One of the catch basins stays dry because it's higher than the water level. The water goes into the sewer. He doesn't see any effort in the process to highlight those problems areas. There are people with water in their basements on Pittsburg Road below where there used to be a swamp. How is their project…are they going to look at the local…? It can rain all over but ends up in one place with the basalt. Mayor Scholl pointed out that he doesn't see the same problems Councilor Topaz sees. The consultants are here to talk about the current infrastructure and not the system from 1913, 1920, 1960, or 1990. He doesn't appreciate that they are being sent down a rabbit hole. These are professionals here.

Councilor Topaz declared that he is an engineer. He has been watching the water. A lot of the original systems are incorporated in this system. It's not gone. Have they indexed the 1990 study for how much water is in the basins? Mayor Scholl said that is what they are here for. It's up to the developer to take care of issues on private property. Darroux informed Councilor Topaz that they referenced all the previous historical data and the old master plans in this process.

Councilor Chilton talked about the new Public Safety Facility. One of the issues is that it's in the 100-year flood plain. Do they have any comments about the location? Peter responded that he would have to look at the map and get back to her. The flood plain will be considered with the development.

Councilor Topaz asked what the federal government is going to mandate in the next 20 years about dumping into natural streams. Peter said that will likely change over the next 20 years with lawsuits. It will become more stringent.

Councilor Topaz asked about properties on basalt. Peter responded that is part of the process with soils and absorption. They will use flow monitoring equipment to predict and model the system. Councilor Birkle pointed out that basalt is not impermeable. There's a lot of water that soaks in there. Just because it's on basalt, does not mean it will accumulate, run off the surface, and flood. Soil types are taken into consideration. Peter agreed that basalt is very conducive to transmitting water.

Wastewater Master Plan review:

- Need and purpose
- Planning criteria
- Inflow and infiltration (I&I) - definitely a bigger issue in western Oregon; not specific to just St. Helens
- Existing system
- Model development
- Existing capacity evaluation
- Inadequate slopes and identified pipes under structures
- Pump stations - risk of failure analysis
- 20-year growth areas
- Priorities
- Operations and maintenance recommendations
    - Clean the collection system every three years
    - CCTV every six years
    - Coordinate manhole inspections and cleaning with pipeline cleaning and CCTV
    - Prioritize I&I projects and sump pump efforts as part of the annual replacement program
- Recommendations
    - $500,000 annually in 20-year CIP. City should aim to increase to $790,000 over the 20-year period.
    - 3.5 - 4 FTE to meet operations and maintenance and level of service goals
    - Additional engineering FTE for GIS and CIP projects
    - Implement wastewater CCTV program

Councilor Topaz asked where they would move the sewer treatment plan to if they wanted to combine with Scappoose. Peter responded that it would take an entire study on its own. They would need to start with a feasibility study. He suggested inviting Scappoose to partner. Mayor Scholl added that they have spoken with Scappoose, and it was not feasible for them at the time. He agreed with Councilor Topaz that it's a good idea. Councilor Topaz went on to talk about his experience in the past with sewer lines. What would it take to do it if they were forced? Peter said it's typically driven by violations. It would be a big project.

Brown asked how often the plans should be updated? When you rate priorities 1-3, what is the timeline? Emily responded that master plans are typically updated every 5-10 years. Depending on how active they are with I&I, it would benefit the City to update the Wastewater Master Plan sooner rather than later. The Stormwater Master Plan is not as urgent.

Mayor Scholl asked about the FTE's. They would be able to get a lot more projects done in-house rather than hiring out. They need to review the budget and determine what is the most feasible.

In response to the question about the timeline, Emily explained that priority one for sewer is typically looked at within the first six years. All three would be completed within the 20-year planning period. A lot of it depends on how they have addressed I&I.

Councilor Chilton asked what they have been budgeting for stormwater. Brown said they have held off on projects so it would not be accurate. To get to their suggested numbers, it needs to go into the rate model. Mayor Scholl asked if they could bring the numbers down if they do the work in-house. Emily said the cost estimates are for a contractor to do open trench.

Councilor Topaz talked about the history of St. Helens. There's a lot of strange groundwater here.

Brown reviewed the current Public Works budget for staffing.
- Storm 3.45 FTEs
- Sewer 3.25 FTEs
- Water is 5.1 FTEs
- Those numbers do not include all Public Works staff.

3. Review Proposed Equivalent Dwelling Unit (EDU) Code Changes – *Matt Brown & Steve Donovan*

Steve Donovan reviewed his report. A copy is included in the archive packet for this meeting. He is here to talk about how they bill for services. What is the $3 Public Safety Facility (PSF) fee based on? They will barely be able to build the new PSF at $3 fee per EDU. A method needs to be created to bill users who are not a single-family dwelling. An EDU is a measure of demand based on the service you are receiving. 85-90% of users are residential. Brown reported that the biggest users of police are Walmart, an apartment complex, and a hotel/motel on Highway 30. Steve talked about ordinance amendments needing to be made before the fee is added.

Next steps:
- Make modifications to the Incode utility billing system to accept EDU assignments to active utility accounts
- Prepare draft ordinances to modify the Municipal Code Section 13.02.010 to define EDUs for water and sewer
- Prepare draft resolutions to establish and implement the PSF fee on January 1, 2022
- Report back to Council with progress/status at the next Council meeting

The $2 Recreation fee will be removed at the same time the $3 PSF will be added. The fee is only added to in-City customer accounts.

Councilor Topaz asked if other cities do this. Steve said a lot do. Gresham charges $15/month for public safety.

Councilor Chilton pointed out that financial assistance is available for families in need.

4. Strategic Action Plan Updates

No updates.

5. City Administrator Report - *John Walsh*
- Tonight's agenda includes the Infrastructure Design Work Order #1 with Mackenzie for St. Helens Industrial Business Park. Some of it includes stormwater issues, as discussed earlier.
- The November 17th Urban Renewal Plan and Funding Overview meeting has been switched to January 5th to accommodate staff schedules.
- Council will hold a retreat November 17th.
- Christmas decorations will be going up soon.
- Spirit of Halloweentown is over. They will have a debrief.
- The Dock Use Committee is coordinating meeting dates. The kiosk is already here, and the vendor is ready to program it.
- Displayed drawings of the proposed signage for the Recreation Center and Community Center.
    - A former local student designed the logo.
    - The Recreation Center will be a leasable space.
    - The Community Center will be used for staff and programs.

- The last Mainstreet meeting went very well.
- The Community Survey is still taking place.
- The Riverwalk design is progressing. The technical advisory committee will be meeting on November 10th, 10 a.m. – 3 p.m.
- 1st Street and Strand Street project is progressing.
- Central Waterfront project is progressing.
- City Engineer Sue Nelson retiring tomorrow. There is a card in the Copy Room to sign.
- Library Director Margaret Jeffries announced her retirement. They will need to coordinate the process to fill her position.

ADJOURN – 3:02 p.m.

EXECUTIVE SESSION

Respectfully submitted by Lisa Scholl, Deputy City Recorder.

ATTEST:

Kathy Payne, City Recorder	Rick Scholl, Mayor

City of St. Helens
CITY COUNCIL

Executive Session Summary **November 3, 2021**

Members Present: Rick Scholl, Mayor
Doug Morten, Council President
Patrick Birkle, Councilor
Stephen R. Topaz, Councilor
Jessica Chilton, Councilor

Staff Present: John Walsh, City Administrator
Kathy Payne, City Recorder
Matt Brown, Assistant City Administrator
Jacob Graichen, City Planner
Jenny Dimsho, Associate Planner/Community Development Project Manager

Others: Jim Atkins, Atkins and Dame
Lemoine Eiler, Lemoine Eiler Architecture Planning LLC
Patrick Kessi, PHK Development

◆

At 3:10 p.m., Mayor Scholl opened the Executive Session pursuant to the ORS numbers listed below and then gave Council roll call. Representatives of the news media and designated staff shall be allowed to attend the executive session. All other members of the audience are asked to leave the room. Representatives of the news media were specifically directed not to report on or otherwise disclose any of the deliberations or anything said about these subjects during the executive session, except to state the general subject of the session as previously announced. No decision may be made in executive session. Any person in attendance, including the news media, who has a recording device is directed to turn it off.

- **Real Property Transactions,** under **ORS 192.660(2)(e)**
  - Update on City-owned Millard Road property.
  - Update on Masonic Building property.

- **Consult with Counsel/Potential Litigation,** under **ORS 192.660(2)(h)**
  - Nothing was discussed under this item.

The Executive Session was adjourned at 4:22 p.m.

◆

ATTEST:

______________________________ ______________________________
Kathy Payne, City Recorder Rick Scholl, Mayor

COUNCIL PUBLIC HEARING

Wednesday, November 03, 2021

DRAFT MINUTES

MEMBERS PRESENT
Mayor Rick Scholl
Council President Doug Morten
Councilor Patrick Birkle
Councilor Stephen R. Topaz
Councilor Jessica Chilton

STAFF PRESENT
John Walsh, City Administrator
Matt Brown, Deputy City Administrator
Kathy Payne, City Recorder
Jenny Dimsho, Associate Planner/Community Development Project Manager
Tina Curry, Event Coordinator

OTHERS
Paul Vogel
Angela Wayman
Brady Preheim
Stephanie Patterson

OPEN PUBLIC HEARING – 6:45 p.m.

TOPIC

1. **Annexation of 58241 S. Division Road (McPherson)**

Associate Planner/Community Development Project Manager Dimsho covered preliminary matters and presented the staff report, a copy of which is included in the archive packet for this meeting. There were no ex-parte contacts, conflicts of interest, or bias in this matter. There were no objections from the audience for the Council to make a fair decision.

Planning Commission and staff both recommend approval and recommend the property have a Comprehensive Plan designation of Suburban Residential, be zoned Moderate Residential, and designated as "developing."

Council President Morten asked if she looked up the agreement with McNulty Water. He recalls that the agreement requires the user to connect to City water and sewer upon annexation. Dimsho responded that the water service is over 2,500 feet away. There is an exemption in the agreement that allows users to not connect to City water if it's not physically available. City Administrator Walsh agreed with the exemption due to distance. Council President Morten asked if they would be required to connect when City water becomes available. Dimsho will investigate that question.

Councilor Topaz asked if this is a mute discussion if the City buys out McNulty Water. Walsh has experience with that and does not recommend doing it. As urban densities develop in that area that may be a decision McNulty Water needs to make.

TESTIMONY IN FAVOR – None

TESTIMONY IN OPPOSITION – None

CLOSE PUBLIC HEARING – 6:56 p.m.

Respectfully submitted by Lisa Scholl, Deputy City Recorder.

ATTEST:

Kathy Payne, City Recorder	Rick Scholl, Mayor

COUNCIL PUBLIC HEARING

Wednesday, November 03, 2021

DRAFT MINUTES

MEMBERS PRESENT
Mayor Rick Scholl
Council President Doug Morten
Councilor Patrick Birkle
Councilor Stephen R. Topaz
Councilor Jessica Chilton

STAFF PRESENT
John Walsh, City Administrator
Matt Brown, Deputy City Administrator
Kathy Payne, City Recorder
Jenny Dimsho, Associate Planner/Community Development Project Manager
Tina Curry, Event Coordinator

OTHERS
Paul Vogel
Angela Wayman
Brady Preheim
Stephanie Patterson

OPEN PUBLIC HEARING – 6:56 p.m.

TOPIC

1. **Annexation of 35285 Millard Road (Columbia Soil & Water Conservation District)**

Associate Planner/Community Development Project Manager Dimsho covered preliminary matters and presented the staff report, a copy of which is included in the archive packet for this meeting. There were no ex-parte contacts, conflicts of interest, or bias in this matter. There were no objections from the audience for the Council to make a fair decision.

Planning Commission and staff both recommend approval and recommend the property have a Comprehensive Plan designation of Suburban Residential, be zoned Moderate Residential, and designated as "established" with the condition that this annexation shall only be processed if Annexation A.4.21 at 58241 S. Division Road is also approved.

The use of the building is a conditionally allowed use in the R7 and R10 zoning districts, so it would not create a nonconforming use upon annexation.

Council President Morten clarified the history of the building. Prior to Columbia Soil & Water Conservation District it was Warren Grange, prior to that it was the McNulty Grade School for years and years.

TESTIMONY IN FAVOR – None

TESTIMONY IN OPPOSITION – None

CLOSE PUBLIC HEARING – 7:02 p.m.

Respectfully submitted by Lisa Scholl, Deputy City Recorder.

ATTEST:

Kathy Payne, City Recorder	Rick Scholl, Mayor

COUNCIL REGULAR SESSION

Wednesday, November 03, 2021

DRAFT MINUTES

MEMBERS PRESENT
Mayor Rick Scholl
Council President Doug Morten
Councilor Patrick Birkle
Councilor Stephen R. Topaz
Councilor Jessica Chilton

STAFF PRESENT
John Walsh, City Administrator
Matt Brown, Deputy City Administrator
Kathy Payne, City Recorder
Jenny Dimsho, Associate Planner/Community Development Project Manager
Mouhamad Zaher, Public Works Director
Tina Curry, Event Coordinator

OTHERS

Paul Vogel	Stephanie Patterson
Angela Wayman	Bob Brawand
Brady Preheim	

CALL REGULAR SESSION TO ORDER – 7:03 p.m.

PLEDGE OF ALLEGIANCE
Mayor Scholl led the Pledge of Allegiance.

Councilor Topaz read the Council Mantra.

VISITOR COMMENTS – *Limited to five (5) minutes per speaker*

- Angela Wayman. She is organizing the Spirit of Christmas parade for St. Helens and Scappoose. She started it last year due to Covid. The parade travels through neighborhoods and collects donations for Columbia Pacific Food Bank. They collected about 4,000 pounds of food last year. She is requesting the City sponsor the event by including an informational flyer in the next utility bill that is mailed.

Assistant City Administrator Brown reported that the next utility bills go out around November 20. Council adopted a fee for including information in utility bills to cover the costs of printing and mailing. It is $500 for a standard black and white and $1,500 for color two-sided. The service is only available to nonprofits. Angela said they are working on getting sponsors.

Council President Morten asked if it could be included in the City's e-newsletter. City Administrator Walsh agreed that it would be much more affordable.

Councilor Chilton asked if Angela is having them printed. Angela responded that Paulson's Printing is printing 2,000 for them in black and white. Brown clarified that an outside printing company prints and stuffs them. There have been cases where they physically delivered about 4,000 copies for stuffing.

- Tina Curry.
  - The Columbia County Public Information Officer contacted them about attending the AOC meeting, which includes elected officials and County staff from all of Oregon. They want their display table to be exclusively Spirit of Halloweentown. They have asked the City for things to display on the table.
  - Received a call from the Main Street program in Tennessee. They heard how successful Spirit of Halloweentown is and wanted specifics of what they are doing and how they are doing it.
  - The Price is Right held a Halloween episode and one of the prizes was a completely paid for trip to Spirit of Halloweentown.
  - Christmas Ships is December 11
    - Begins around 6:00 p.m. with Santa and his elves handing out candy on the Courthouse steps. It will be a walk-through instead of a drive-through this year.
    - Closing the Plaza and a portion of S. 1st Street to keep everyone safe.
    - Music will be performed.
    - There will be friendly, festive alpacas on site.
    - Last year, they provided to-go dinner boxes for the ship captains and their mates. She is waiting to hear if they want to do that again or try to eat together like in the past.
    - They did not have an official tree lighting with Santa last year. The tree was just lit when it was put up. She suggests doing the same thing.
    - They will be decorating the week before Thanksgiving this year.

Council President Morten heard a rumor of choirs or groups of people wanting to sing. Tina responded that she sent an email to all the churches in Columbia County, and no one responded.

Mayor Scholl agreed with lighting the tree as soon as it is up. Councilor Chilton would prefer to have an official tree lighting when everyone was there. It was decided to turn the lights off on the tree that day and then and have an official tree lighting that evening. Council President Morten suggested bringing Santa in with the taxi.

- Brady Preheim.
  - He hates the Council mantra.
  - He is opposed to giving a tax break to Cascades Tissue. They had record profits, made over $625 million, and they want the City to give them a $225,000 tax credit because they failed to create 21 jobs. Paul Vogel will not be able to tell you how many jobs they did or did not create because he does not have that information and has been asked several times. They need to provide the jobs, or they shouldn't get the tax break.
  - Spirit of Halloweentown was fantastic.
    - It's number three on Martha Stewart's list.
    - It is offered as a prize on a game show.
    - Now the County wants to take credit for what St. Helens is doing. At least they are recognizing that it is an event that affects the entire county.
    - He encouraged the Council to thank the Tourism Director for the fantastic event that she organized.
  - He does not understand why they can't move the pirate ships. The rules need to be enforced.
  - He thanked Councilor Chilton for the comment she made last week in response to Councilor Topaz saying he has a developer coming but won't provide it unless he's not censured. Councilor Chilton said something about that sounding like blackmail, which he agrees with. Why is Councilor Topaz not being held accountable for that?

Councilor Chilton read a letter into the record from Calli Ross who asked to have her letter read into the record.

"Hello, St. Helens City Council. We had a really awful time today at Halloweentown. Which is disappointing because today was supposed to mean a lot. I called last week and spoke with someone who assured me you were both handicap accessible and enforcing the indoor mask mandate.

I spent nearly $200 purchasing 5 tickets for my family online following that reassurance. I drove my 6yo son who has end stage heart and lung disease, dependent on a ventilator and is non mobile following a prolonged heart attack an hour and a half to come to your event.

When we got there...we quickly realized there was no designated handicap parking spaces for the crowd...and it was purely first come first serve. We dragged him through mud and puddles across a field to even begin. We got our punch cards and started with the alien exhibit. After waiting in the rain for 20 mins we got to the front of the line and see the only way up is a steep, narrow staircase. He and his nurse waited outside while the rest of us went in. Neither of the people working at that attraction were wearing masks inside, only half of the families were and the young girl out front wasn't enforcing the mandate- or wearing one herself.

We attempted your haunted house next, but the 3rd curve is too narrow to negotiate his medical stroller (smaller width than a standard wheelchair) and had to turn back.

We went down to the whispering woods and found that the shuttle wasn't equipped to handle a wheelchair. With the help of the shuttle driver we were able to get my son in...where we just held onto him in the aisle. We pulled up to....Stairs. And an impossible gravel and mud path.

At that point we gave up. I returned and asked the person where punch cards were being handed out for a refund for my son and his nurse. I didn't request one for myself, my mother in law or my older son. I was respectful yet firm but treated with disdain. One person sent me to another. One told me "well just leave then and email someone" while trying to ignore me and speak to other guests.

And one finally reached out to someone on the phone who took my information and told me I would receive a refund .... When I started crying at the other's statement.

I reached out about our experience on some of the larger Portland area moms groups and the posts have kind of blown up. I was contacted by a local news reporter that wants to interview us and do a story on our experience Tuesday. I would like to hear The Spirit of Halloweentown's response before I do.

Why is there no designated handicap parking in a paid lot? Why are your props not even accessible to get to via wheelchair? What attractions do you offer for kids that are non mobile? What are you going to do to ensure your volunteers and staff are following the mask mandate? Being an old town is not an excuse to not attempt any inclusion. We visit Aurora on a regular basis and my son is able to be a participant. Small things can be done..The haunted house isles can be widened, the photo props can be placed next to foot paths or have paths built to them for easier access, you could easily add an arts and craft booth or pumpkin carving booth that kids of all abilities can participate. ADA designated handicap parking in the overflow lot, the amount of ADA parking is not proportional to the influx of people during your event (all spots were full when we visited on Sunday). The rudeness from your employee when I requested a refund because my handicapped child was stuck out in the rain instead of able to participate in anything, is just really not okay.

I hope that you all will take my letter as a learning experience, as to some of the changes that need to be made so that ALL children and adults can enjoy Halloweentown.

Thank you,

Calli Ross"

Mayor Scholl apologized that she was confused about the event being handicap/ADA accessible. It clearly states on the website that the attractions she referred to are not ADA accessible or even stroller friendly. Councilor Chilton responded that they need to change that and make it accessible. Mayor Scholl pointed out other activities that are not ADA accessible. He would like to continue this discussion later. He is concerned about Calli. Councilor Chilton said she is also concerned about her and the way she was treated. Mayor Scholl apologized to Calli that she was misled and misinformed.

DELIBERATIONS

1. **Annexation of 58241 S. Division Road (McPherson)**

Motion: Motion made by Council President Morten and seconded by Councilor Topaz to approve the annexation of 58241 S. Division Road. **Vote:** Yea: Mayor Scholl, Council President Morten, Councilor Birkle, Councilor Topaz, Councilor Chilton

2. **Annexation of 35285 Millard Road (Columbia Soil & Water Conservation District)**

Motion: Motion made by Council President Morten and seconded by Councilor Topaz to approve the annexation of 35285 Millard Road as recommended. **Vote:** Yea: Mayor Scholl, Council President Morten, Councilor Birkle, Councilor Topaz, Councilor Chilton

RESOLUTIONS

3. **Resolution No. 1938:** A Resolution of the City of St. Helens Waiving Standard Enterprise Zone Tax Abatement's Employee Requirements Under Section 3, HB 2343 (2021) for Cascades Tissue Group-Oregon Converting, a Division of Cascades Holding U.S. Inc. (Cascades), Located in the South Columbia County Enterprise Zone

Mayor Scholl read Resolution No. 1938 by title.

Paul Vogel, Executive Director of Columbia Economic Team and Enterprise Zone Manager for South Columbia County, was in attendance and explained what the resolution is for. He is here to advocate for their request as a business partner. The temporary employment waiver is time sensitive due to the legislative mandate. There is only a brief window to act. The employment waiver is an acknowledgement of the economic realities and the impact to the economic corruption the pandemic is having on businesses. The legislature did agree that this statutory opportunity will help enterprise zones help companies. Investments still have to be made, higher wages will have to be paid, and Business Oregon reports more than 30 businesses statewide are similarly impacted. The resolution is to provide a good faith acknowledgement of the circumstances and a temporary two-year opportunity for Cascades Tissue to achieve one of three of the required elements in order to retain the tax abatement approved by all six South Columbia County Enterprise Zones sponsors in late 2020, early 2021. Cascades has already made the $14 million investment in equipment and is paying 150% of annual covered wages to employees. They are acting in good faith. They are falling short with the required 10% increase in zone-wide employment level in the first 10 months of this year. HB 2343 statutorily allows for more time to reach that level without the company losing the authorized abatement approved by the zone sponsors. Cascades could have requested a construction in process deferment, but they chose not to do that. The economy and market for their products has not been ambitious or helpful. The two new lines manufacture commercial grade towels, napkins, etc. Their primary customers are office buildings and workplaces where employees have not returned to work. Restaurants have closed, limited reopening, starved for workers, and have adjusted to using sanitizer as much as napkins. Cascades stated, "Covid-19 has significantly impacted Cascades sales as well as its production, due in large part to limited demand for Cascades products in the away from home market. In 2020, Cascades sales for its US away from home business underperformed its projections by $19 million. In addition, Cascades current production levels have been impacted by the diminished demand. Cascades Scappoose facility produced 521,000 cases less than projected figures for the first two quarters of 2021. It represents a 22% reduction in anticipated production. Cascades has made a good faith investment in Columbia County. The total amount of investment today is more than $121 million and more than $60 million in St. Helens. They pay 150% of annual averages wages and employ close to 200 people in local plant operations and management. The company purchased an extra 15 acres at the Scappoose site for a future Phase II. With these previous investments, the Enterprise Zone investors have approved multiple two-year extended abatements that have worked as intended. Over the next three years, approximately more than $1 million will begin rolling back into tax rolls, taxing districts, urban renewals, etc." Paul went on to review the request. Cascades needs more time, which this two-year extension would allow.

Mayor Scholl agreed with Brady's statement. He is disappointed. The 21 jobs were going to benefit St. Helens and they failed to meet that. Councilor Chilton agreed. There are plenty of other businesses in the same boat.

Councilor Topaz talked about the number of "help wanted" signs on businesses. The employment picture on the street is very different than a normal year.

Discussion of exemption. Due to Covid-19, the need for products from this facility has decreased and they have not been able to fill the 21 positions. They will lose the exemption if they don't meet the requirements in 2022.

Motion: Motion made by Councilor Birkle and seconded by Councilor Topaz to adopt Resolution No. 1938. **Vote:** Yea: Mayor Scholl, Councilor Birkle, Councilor Topaz; Nay: Council President Morten, Councilor Chilton

AWARD BID/CONTRACT

4. Little Street, Tualatin Street, & N. 7th Street Waterline Improvements to Clark & Sons Excavating for $295,778

Motion: Motion made by Councilor Birkle and seconded by Councilor Chilton to approve '4' above.

Discussion.

Councilor Birkle pointed out the significant range of bids. Walsh confirmed that they met and reviewed the bid closely. Their biggest number was on mobilization. Associate Planner/Community Development Project Manager Dimsho added that she spoke to Engineering Project Manager I Darroux briefly about this. Darroux has seen this before when a company really wants to get into public bidding so they bid low on mobilization or things they can control. Walsh said there are a lot of contractors who are hungry and trying to fill their schedules.

Vote: Yea: Mayor Scholl, Council President Morten, Councilor Birkle, Councilor Topaz, Councilor Chilton

APPROVE AND/OR AUTHORIZE FOR SIGNATURE

5. Second Amendment to Agreement with Pacific Northern Environmental DBA Advanced Electrical Technologies for Water Filtration Facility SCADA Update
6. Contract Payments
7. Infrastructure Design Work Order #1 with Mackenzie for St. Helens Industrial Business Park

Motion: Motion made by Councilor Birkle and seconded by Councilor Chilton to approve '5' through '7' above.

Discussion.

Councilor Topaz reported that number seven was just added, and he has not had enough time to review it. Walsh explained that it is the third draft, and they are trying to move things forward. It's a work order that will get them to another work order. It generally lays out the water, sewer, understanding the storm conditions on the site, and addressing environmental issues. There is a limited window with the ARPA funds to complete the project.

Councilor Topaz repeated that he wants more time to study it before making a decision. Councilor Birkle would also like more time to review it.

Vote: Yea: Mayor Scholl and Council President Morten; Nay: Councilor Birkle, Councilor Topaz, Councilor Chilton; motion fails

Motion: Motion made by Councilor Birkle and seconded by Councilor Topaz to approve '5' and '6' above. **Vote:** Yea: Mayor Scholl, Council President Morten, Councilor Birkle, Councilor Topaz, Councilor Chilton

Walsh encouraged Council to reach out to him or Dimsho if they have questions when they review the document prior to the next meeting.

CONSENT AGENDA FOR APPROVAL

8. Council Work Session, Executive Session, Hearing, and Regular Session Minutes dated October 20, 2021
9. Accounts Payable Bill Lists

Motion: Motion made by Council President Morten and seconded by Councilor Topaz to approve '8' and '9' above. **Vote:** Yea: Mayor Scholl, Councilor President Morten, Councilor Birkle, Councilor Topaz, Councilor Chilton

WORK SESSION ACTION ITEMS

<u>Waste Connections (Hudson Garbage) Bike Build</u>
Mayor Scholl reported that they reviewed the bike build during the work session. A motion was made, seconded, and tabled until tonight to approve donating $500 to the bike build and the coordination with Recreation Manager Duggan to use the Recreation Center.

Vote: Yea: Mayor Scholl, Council President Morten, Councilor Birkle, Councilor Topaz, Councilor Chilton

<u>Spirit of Christmas Parade</u>
Discussion of Angela Wayman's request. Councilor Birkle had the impression that Angela is seeking sponsors to pay for the cost of flyers to be added to the utility bills.

Mayor Scholl agreed with Councilor President Morten's suggestion to share the information in the City's newsletter and on social media. Walsh pointed out that the City's social media policy says they will support nonprofits. He is not aware that this organization is a nonprofit. Discussion ensued about it being a community event. The parade could partner with a nonprofit.

MAYOR SCHOLL REPORTS

- Spirit of Halloweentown had a lot going on. The last weekend was beautiful.
- He is looking forward to Christmas.
- There is a lot of good things going on in our community.
- They are doing well with master plan updates.

COUNCIL MEMBER REPORTS

Council President Morten reported...

- Dimsho authored the Parks Master Plan update when she first started, which was a huge undertaking. They are beginning to review it for updates again.
- There is no Parks & Trails Commission meeting this month.
- Unfortunately, the Veterans Day ceremony at the McCormick Veterans Plaza has been cancelled.

- Thanked Tina for thanking the service-based groups who helped with Spirit of Halloweentown. His fellow Kiwanis service members embraced the opportunity and made it happen.

Councilor Topaz reported...

- Has received a number of concerns about Spirit of Halloweentown
  - Why is the Houlton area not involved in the action as well?
  - There are not enough garbage cans. People are throwing garbage on private property.
  - There was no transportation for people wanting to go to the Highway for a cheap meal.
- Library Director Jeffries is going to retire earlier than planned. She will leave a big hole. She has built an incredibly good crew.
- He would like to request as many federal dollars as possible for the Sewer and Stormwater Master Plans. The infrastructure has been patchworked since the 1900s. He recommends painting as bad a picture as possible to get money.

Councilor Chilton reported...

- She read a statement into the record. "I just want to take a moment to talk about a goal of mine as our City grows. I would like to see a more inclusive City for all people, including our parks, riverfront, and community events. My hopes are that all people who live here and travel here feel included and able to participate and enjoy the beauty of St. Helens. We have a job. A job to provide this and improve quality of life through access and design that is inclusive to all abilities. It is my hope that we will continue to move in this direction as we look towards the future."

Councilor Birkle reported...

- He had the opportunity to visit Spirit of Halloweentown a couple more times.
  - Participated in the Halloween celebration at the Klondike.
  - It really is fun to talk with people who enjoy visiting our town.
  - For a majority of people, it seems to be a worthwhile experience.
  - With all good work, there are things they can continue to work on and improve. He was not aware of the letter beforehand. It is important to be aware of these concerns as they plan for the future.
- He was excited to attend the Main Street Alliance meeting. There was a lot of positive energy. They are headed in the right direction.

OTHER BUSINESS

ADJOURN – 8:24 p.m.

Respectfully submitted by Lisa Scholl, Deputy City Recorder.

ATTEST:

_____________________________ _____________________________

Kathy Payne, City Recorder Rick Scholl, Mayor

City of St. Helens

Consent Agenda for Approval

ANIMAL FACILITIES

The following facilities have been inspected by City of St. Helens Police Department and are recommended for approval of an Animal Facility License:

Owner Name	Location	Purpose
• Leland Derrick	325 N. 11th Street	Multiple Chickens
• Liana Wichses	455 N. 6th Street	Multiple Chickens

CITY OF
ST. HELENS OREGON
DEPARTMENT OF POLICE

On Tuesday, 10/02/2021 at approximately 1030 hours, I met with Mr. Leland Derrick at his residence at 325 N 11th St, in St. Helens, OR to conduct a prescheduled Animal Facility License Application inspection. This inspection is to ensure the premises is in compliance with Ordinance 6.04.080, OAR 609.415, OAR 609.420, OAR 603-015-0025 through 603-015-0065. Included with her application was her liability insurance information from State Farm Insurance Company ( ) and information regarding where they seek veterinary care for their animals, Midway Veterinary Clinic. Leland stated that they do not take the chickens to the vet, but they do basic routine care at home.

I noticed his home is a single-family home in a residential neighborhood. Leland explained that the facility license is to allow him to have a larger number of chickens/ducks for egg production, not to run a shelter or boarding service. Leland has a total of 18 chickens, all of whom appeared to be in good health.

I saw the residence had a spacious back yard encircled with a sturdy 6' fence. The fence was in good condition. The chickens are kept inside a spacious coop. Inside the coop there is a heat lamp that they use during winter as well as 4 individual nesting spaces. This space has adequate runoff to prevent water pooling. Leland told me that they let the chickens out in the yard when they are outside to let them run around and exercise.

The chickens did not appear to be aggressive. The food was stored in a sealed plastic container to prevent vermin infestation. The food is served inside a container with feeding tubes attached to keep food covered; water is served in bowls. Leland explained that the chickens mainly stay inside of the coop.

The yard is clean and orderly. Leland said they have self decomposing bark dust, when and if needed they will scoop out the poop and put it into the garbage. The backyard did not have any smell of feces or urine While Leland does not have a quarantine area for possible diseased animals, he stressed she does not run a shelter or "rescue facility"

I am not aware of any recent complaints received by SHPD regarding noise, odors, stray animals, or other Ordinance violations regarding Leland or his residence. In my opinion I think that Leland should be granted her Animal Facility License.

Thank you,

Code Enforcement Officer Moreno

Application Fee

City of St. Helens

265 Strand Street • St. Helens, OR 97051 • 503-397-6272

Animal Facility License Application

St. Helens Municipal Code Chapter 6.04

If you own any of the following inside the city limits, you must have an Animal Facility License:

- More than 3 adult dogs; or
- More than 3 adult dogs and one litter of puppies; or
- More than 3 adult hens and/or ducks and 6 chicks or ducklings under 9 weeks; or
- More than 3 adult rabbits and/or 1 litter of bunnies under 9 weeks; or
- An exotic animal

Complete the application and return to the above address with the fee, copies of your dogs' licenses and a copy of your homeowners insurance. You must list each animal separately in the space provided below that you intend to keep at your facility. Your facility, including perimeter fence if required, must be inspected before your application will be forwarded to the City Council for action. The Police Department will contact you within 10 days of application to schedule an inspection. The application fee is $40 for a two year license and must be renewed prior to expiration.

If your application is denied, you have two options to obtain compliance: 1) You meet the requirements for an animal facility license; or 2) you have only allowed animals on your property. Once you can prove that you are in compliance for a license, we can seek approval by the City Council. If you have eliminated the need for an animal facility license, you may request a refund of the application fee.

Address at which animal(s) will be kept:

Applicant Information	Alternate Contact/In Case of Emergency
Name: Leland C. Derrick	Name: Lance L. Derrick
Mailing address: 325 N. 11th	Mailing address: 325 N. 11th
City/State/Zip: ST. Helens OR. 97051	City/State/Zip: ST. Helens, OR. 97051
Cell [redacted]	Cell phone: [redacted]
Hom [redacted]	Home phon [redacted]
Emai [redacted]	e of week that works b [redacted]

List each animal to be kept at the above address (attach additional paper if more than 6 animals)

Species/Breed	Name	Sex	Age	County Dog License Expiration Date
1. muscovy duck	Susan	F	?	
2. muscovy duck	Betty	F	?	
3. Guinea Hen	Shut/Christmas	F	6m	
4. Guinea Hen	UA/Easter	F	6m	
5. Chicken	Ophilia	F	1 1/2	
6. Chicken	Speckles	F	1 1/2	

Veterinarian Information

Name:	Phone:
Address:	City/State/Zip:

Liability Insurance Information

Agent's Name: Joel Avim	Phone: 503-397-4808
Insurance Company: STATE farm	Policy No [redacted]

Attach a copy of the policy indicating applicant is covered while maintaining the described animal(s).

AUTHORIZATION

I, Leland C. Derrick understand that I am applying for an animal facility license to keep the above listed animal(s) at 325 N. 11th, St. Helens, Oregon. I have read Municipal Code Chapter 6.04 Animal Control Code, and fully understand my obligation as an animal owner and facility operator and agree to comply with the Code and applicable county, state and federal laws. I further understand that this license, if approved, is valid for a period of two years and must be renewed prior to expiration.

Leland C Derrick
Applicant Signature

10-7-2021
Date Signed

FOR OFFICE USE ONLY

Date received: 10/13/21	Officer assigned: Marimar Moreno	Date forwarded to City Recorder: 11/5/21
Received by: Lisa	Date/Time of inspection: 10/2/21, 10:30 am	Council meeting date: 11/17/21
Receipt No.: R00107590	Officer recommendation:	☐ Approved ☐ Denied
Dated forwarded to PD: 10/31/21	☒ Approve ☐ Deny	If approved, date license issued:
Forwarded by: Lisa		Expiration date:

Updated 1/6/2020

7. Chicken Smokey F 6m (grey)
8. Chicken Coal F 6m (grey)
9. Chicken Asher F 6m (grey)
10. Chicken Sunny F 6m (orange)
11. Chicken Penny F 6m (orange)
12. Chicken Ginger F 6m (orange)
13. Chicken Bella F 6m (o/b)
14. Chicken Grace F 6m (o/b)
15. Chicken Sophia F 6m (o/b)
16. Chicken Pepper F 6m (black)
17. Chicken Dahlia F 6m (black)
18. Chicken Morticia F 6m (black)

CITY OF
ST. HELENS OREGON
DEPARTMENT OF POLICE

On Tuesday, 10/02/2021 at approximately 1500 hours, I met with Mrs. Liana Wichses at her residence at 455 N 6TH St, St. Helens, OR to conduct a prescheduled Animal Facility License Application inspection. This inspection is to ensure the premises is in compliance with Ordinance 6.04.080, OAR 609.415, OAR 609.420, OAR 603-015-0025 through 603-015-0065. Included with her application was her liability insurance information from Country Mutual Insurance Company ( ) and information regarding where they seek veterinary care for their animals; Midway Veterinary Clinic. Liana stated that they do not take the chickens to the vet, but they do basic routine care at home.

I noticed her home is a single family home in a residential neighborhood. Liana explained that the facility license is to allow her to have a larger number of chickens for egg production, not to run a shelter or boarding service. Liana has a total of 7 chickens, all of whom appeared to be in good health.

I saw the residence had a spacious back yard encircled with a sturdy 6' fence. The fence was in good condition. The chickens are kept inside a spacious coop. Inside the coop there is a heat lamp that they use during winter as well as 4 individual nesting spaces. This space has adequate runoff to prevent water pooling. Liana told me that they let the chickens out in the yard when they are outside to let them run around and exercise.

The chickens did not appear to be aggressive. The food was stored in a sealed plastic container to prevent vermin infestation. The food is served inside a container with feeding tubes attached to keep food covered; water is served in bowls. Liana explained that the chickens mainly stay inside of the coop.

The yard is clean and orderly. Liana said they have self decomposing bark dust, when and if needed they will scoop out the poop and put it into the garbage. The backyard did not have any smell of feces or urine While Liana does not have a quarantine area for possible diseased animals, she stressed she does not run a shelter or "rescue facility"

I am not aware of any recent complaints received by SHPD regarding noise, odors, stray animals, or other Ordinance violations regarding Liana or her residence. In my opinion I think that Liana should be granted her Animal Facility License.

Officer Moreno

Item #11.

City of St. Helens

265 Strand Street • St. Helens, OR 97051 • 503-397-6272

Application Fee: $40.00

Animal Facility License Application

St. Helens Municipal Code Chapter 6.04

If you own any of the following inside the city limits, you must have an Animal Facility License:

- More than 3 adult dogs; or
- More than 3 adult dogs and one litter of puppies; or
- More than 3 adult hens and/or ducks and 6 chicks or ducklings under 9 weeks; or
- More than 3 adult rabbits and/or 1 litter of bunnies under 9 weeks; or
- An exotic animal

Complete the application and return to the above address with the fee, copies of your dogs' licenses and a copy of your homeowners insurance. You must list each animal separately in the space provided below that you intend to keep at your facility. Your facility, including perimeter fence if required, must be inspected before your application will be forwarded to the City Council for action. The Police Department will contact you within 10 days of application to schedule an inspection. The application fee is $40 for a two year license and must be renewed prior to expiration.

If your application is denied, you have two options to obtain compliance: 1) You meet the requirements for an animal facility license; or 2) you have only allowed animals on your property. Once you can prove that you are in compliance for a license, we can seek approval by the City Council. If you have eliminated the need for an animal facility license, you may request a refund of the application fee.

Address at which animal(s) will be kept:

Applicant Information	Alternate Contact/In Case of Emergency
Name: Liana Wicksel	Name: Steve Buchanan
Mailing address: 455 N. 6th Street	Mailing address: 455 N. 6th Street
City/State/Zip: St. Helens, OR 97051	City/State/Zip: St. Helens, OR 97051
Cell p ✱	Cell phone:
Home	Home phone:
Email:	Day/time of week that works best

List each animal to be kept at the above address (attach additional paper if more than 6 animals)

Species/Breed	Name	Sex	Age	County Dog License Expiration Date
1. chicken/sexlink	HT	F	3 mos	
2. chicken/sexlink	Spice	F	3 mos	
3. chicken/Plymouth	Pepper	F	3 mos	
4. chicken/B. Sapphire	Blue	F	3 mos	
5. chicken/silkie	Ozzy	F	3 mos	
6. chicken/silkie	Toto	F	2 mos	

→

Veterinarian Information	
Name: Midway	Phone: 503-397-6470
Address: 34453 McBary, ~~Warren, OR~~	City/State/Zip: Warren, OR 97053

Liability Insurance Information	
Agent's Name: Jesse R. Vassar	Phone: 503-203-1422
Insurance Company: Country Mutual Ins. Co.	Policy No.:

Attach a copy of the policy indicating applicant is covered while maintaining the described animal(s).

AUTHORIZATION

I, Liana Wickser, understand that I am applying for an animal facility license to keep the above listed animal(s) at 455 N. 6th Street, St. Helens, Oregon. I have read Municipal Code Chapter 6.04 Animal Control Code, and fully understand my obligation as an animal owner and facility operator and agree to comply with the Code and applicable county, state and federal laws. I further understand that this license, if approved, is valid for a period of two years and must be renewed prior to expiration.

Liana Wickser
Applicant Signature

7/1/2021
Date Signed

FOR OFFICE USE ONLY

Date received: 7/1/21	Officer assigned: Marimax Moreno	Date forwarded to City Recorder: 11/5/21
Received by: LS	Date/Time of inspection: 10/2/21, 3pm	Council meeting date: 11/17/21
Receipt No.: R00090586	Officer recommendation:	☐ Approved ☐ Denied
Dated forwarded to PD: 7/1/21	☒ Approve ☐ Deny	If approved, date license issued:
Forwarded by: LS		Expiration date:

7. chicken/sicilianButtercup | Buttercup | 2 mos

St. Helens, OR

Expense Approval Register

Packet: APPKT00447 - AP 10.29.2021

Vendor Name	Payable Number	Post Date	Description (Item)	Account Number	Amount
Fund: 100 - GENERAL FUND					
KRISTA BUSBY	10.25.21	10/25/2021	REFUND PUBLIC RECORDS RE...	100-000-37004	20.00
HUDSON GARBAGE SERVICE	11485746	10/26/2021	7539- TRASH CITY HALL 265 ST...	100-715-52023	99.10
HUDSON GARBAGE SERVICE	11485747	10/26/2021	2046-1287547 - POLICE GARB...	100-705-52023	99.10
HUDSON GARBAGE SERVICE	11485749	10/26/2021	7598- TRASH MCCORMICK ARK	100-708-52023	925.38
HUDSON GARBAGE SERVICE	11485750	10/26/2021	7636- TRASH COL VIEW PARK ...	100-708-52023	185.49
COLUMBIA COUNTY COMM. J...	20219CSH	10/26/2021	WORK CREW	100-708-52019	1,450.00
CBM SYSTEMS LLC	221060	10/26/2021	JANITORIAL SERVICES	100-705-52023	1,019.95
CBM SYSTEMS LLC	221060	10/26/2021	JANITORIAL SERVICES	100-706-52023	2,000.00
CBM SYSTEMS LLC	221060	10/26/2021	JANITORIAL SERVICES	100-708-52023	127.85
CBM SYSTEMS LLC	221060	10/26/2021	JANITORIAL SERVICES	100-709-52023	152.76
CBM SYSTEMS LLC	221060	10/26/2021	JANITORIAL SERVICES	100-715-52023	1,269.80
SHRED-IT C/O STERICYCLE INC	8000136314	10/26/2021	POLICE DEPT SHRED SERVICE	100-705-52019	186.28
LAND DEVELOPMENT SERVICES	SEPT 2021	10/26/2021	INSPECTIONS FOR ST. HELENS ...	100-711-52015	375.00
OREGON ASSOCIATION OF WA...	31869	10/28/2021	JOB ANNOUNCEMENT	100-702-52011	133.50
WEX BANK	75158896	10/28/2021	POLICE FUEL PURCHASES	100-705-52022	5,154.89
WEX BANK	75158896	10/28/2021	PLANNING 7782 FUEL PURCHA...	100-710-52022	45.18
WEX BANK	75158896	10/28/2021	BUILDING FUEL PURCHASES 2...	100-711-52022	99.50
WEX BANK	75158896	10/28/2021	CITY HALL FUEL PURCHASES 2...	100-715-52022	11.88
WEX BANK	75158896	10/28/2021	CITY HALL FUEL 0256	100-715-52022	32.50
SHRED-IT C/O STERICYCLE INC	8000094002	10/28/2021	CITY HALL SHRED SERVICE	100-715-52001	186.28
JOBIN CONSRUCTION	10.29.21	10/29/2021	REFUND OVER PAYMENT PER...	100-000-20700	7.62
SAFARILAND LLC	I21-132673	10/29/2021	IMPACT SPONGE / SHOT TRAIN...	100-705-52001	1,246.05
				Fund 100 - GENERAL FUND Total:	**14,828.11**
Fund: 201 - VISITOR TOURISM					
E2C	4447	10/26/2021	MONTHLY MARKETING TINA ...	201-000-52019	10,000.00
COLUMBIA RIVER PUD	10.21.2021	10/28/2021	94111	201-000-52003	476.76
COLUMBIA COUNTY TAX COLL...	2021-2022	10/28/2021	2021 2022 PORPERTY TAX 290...	201-000-52028	6,300.25
E2C	4448	10/28/2021	ENTERTAINMENT	201-000-52028	30,000.00
				Fund 201 - VISITOR TOURISM Total:	**46,777.01**
Fund: 202 - COMMUNITY DEVELOPMENT					
COLUMBIA COUNTY TAX COLL...	2021-2022	10/28/2021	2021 2022 PORPERTY TAX 177...	202-721-52053	93.90
COLUMBIA COUNTY TAX COLL...	2021-2022	10/28/2021	2021 2022 PORPERTY TAX 434...	202-721-52053	18.19
COLUMBIA COUNTY TAX COLL...	2021-2022	10/28/2021	2021 2022 PORPERTY TAX 434...	202-721-52053	18.19
COLUMBIA COUNTY TAX COLL...	2021-2022	10/28/2021	2021 2022 PORPERTY TAX 6TH...	202-721-52053	1,614.85
COLUMBIA COUNTY TAX COLL...	2021-2022	10/28/2021	2021 2022 PORPERTY TAX 437...	202-721-52053	55,034.68
COLUMBIA COUNTY TAX COLL...	2021-2022	10/28/2021	2021 2022 PORPERTY TAX 435...	202-721-52053	32,817.32
				Fund 202 - COMMUNITY DEVELOPMENT Total:	**89,597.13**
Fund: 203 - COMMUNITY ENHANCEMENT					
JOBIN CONSRUCTION	10.29.21	10/29/2021	REFUND OVER PAYMENT PER...	203-711-35020	3.17
				Fund 203 - COMMUNITY ENHANCEMENT Total:	**3.17**
Fund: 205 - STREETS					
BRIDGE TOWER OPCO LLC	745187021	10/28/2021	2021 ASHPHALT PATCHING R ...	205-000-53001	77.44
				Fund 205 - STREETS Total:	**77.44**
Fund: 601 - WATER					
ABOVE AND BEYOND HYDROS...	10.13.21	10/25/2021	HYDRANT MEER RENTAL REFU...	601-000-37004	195.55
JORDAN RAMIS PC ATTORNEYS...	182518	10/28/2021	WPI LITIGATION	601-731-52019	735.00
GRAINGER	9802029158	10/28/2021	GASKET	601-732-52001	55.92
				Fund 601 - WATER Total:	**986.47**
Fund: 603 - SEWER					
HUDSON GARBAGE SERVICE	11485619	10/26/2021	8333- TRASH WWTP 451 PLY...	603-736-52023	167.86
HUDSON GARBAGE SERVICE	11485619	10/26/2021	8333- TRASH WWTP 451 PLY...	603-737-52023	167.86

Vendor Name	Payable Number	Post Date	Description (Item)	Account Number	Amount
ALLSTREAM	17779538	10/26/2021	ALLSTREAM PHONE ACCT 754...	603-736-52010	25.44
ALLSTREAM	17779538	10/26/2021	ALLSTREAM PHONE ACCT 754...	603-737-52010	25.44
CBM SYSTEMS LLC	221060	10/26/2021	JANITORIAL SERVICES	603-736-52023	233.22
				Fund 603 - SEWER Total:	**619.82**
Fund: 605 - STORM					
EAGLE STAR ROCK PRODUCTS ...	40382	10/26/2021	ROCK MELVIN ST STORM	605-000-52001	136.19
				Fund 605 - STORM Total:	**136.19**
Fund: 702 - INFORMATION SYSTEMS					
CENTURY LINK	10.17.2021	10/26/2021	025B	702-000-52010	39.40
CENTURY LINK	10.17.2021	10/26/2021	369B	702-000-52010	39.40
MORE POWER TECHNOLOGY ...	12599	10/26/2021	MICROSOFT 365 BUS STANDA...	702-000-52019	3,128.00
ALLSTREAM	17779538	10/26/2021	ALLSTREAM PHONE ACCT 754...	702-000-52010	50.87
QWEST DBA CENTURYLINK AC...	3263X201S21287	10/26/2021	5163X204S3	702-000-52010	160.66
U.S BANK EQUIPMENT FINANCE	455613695	10/26/2021	CONTRACT PAYMENT EQUIPM...	702-000-52006	150.00
SOLUTIONS YES	INV293296	10/28/2021	CONTRACT C11782-01 CITY HA...	702-000-52006	37.87
				Fund 702 - INFORMATION SYSTEMS Total:	**3,606.20**
Fund: 703 - PW OPERATIONS					
HUDSON GARBAGE SERVICE	11485748	10/26/2021	7555- TRASH PW 984 OR ST	703-734-52023	92.84
COLUMBIA COUNTY COMM. J...	20219CSH	10/26/2021	WORK CREW	703-734-52019	375.00
EMPLOYMENT TAX -STATE OF...	3/21	10/26/2021	GP DAVIS , SM SAMPLE BIN 05...	703-734-51015	1,209.00
WEX BANK	75158896	10/28/2021	PW CHEROKEE 6555	703-734-52022	558.16
				Fund 703 - PW OPERATIONS Total:	**2,235.00**
				Grand Total:	**158,866.54**

Fund Summary

Fund	Expense Amount
100 - GENERAL FUND	14,828.11
201 - VISITOR TOURISM	46,777.01
202 - COMMUNITY DEVELOPMENT	89,597.13
203 - COMMUNITY ENHANCEMENT	3.17
205 - STREETS	77.44
601 - WATER	986.47
603 - SEWER	619.82
605 - STORM	136.19
702 - INFORMATION SYSTEMS	3,606.20
703 - PW OPERATIONS	2,235.00
Grand Total:	**158,866.54**

Account Summary

Account Number	Account Name	Expense Amount
100-000-20700	State Surcharge	7.62
100-000-37004	Miscellaneous	20.00
100-702-52011	Public Information	133.50
100-705-52001	Operating Supplies	1,246.05
100-705-52019	Professional Services	186.28
100-705-52022	Fuel	5,154.89
100-705-52023	Facility Maintenance	1,119.05
100-706-52023	Facility Maintenance	2,000.00
100-708-52019	Professional Services	1,450.00
100-708-52023	Facility Maintenance	1,238.72
100-709-52023	Facility Maintenance	152.76
100-710-52022	Fuel	45.18
100-711-52015	Intergovernmental Servic…	375.00
100-711-52022	Fuel	99.50
100-715-52001	Operating Supplies	186.28
100-715-52022	Fuel	44.38
100-715-52023	Facility Maintenance	1,368.90
201-000-52003	Utilities	476.76
201-000-52019	Professional Services	10,000.00
201-000-52028	Projects & Programs	36,300.25
202-721-52053	Property Taxes	89,597.13
203-711-35020	Building Technology Fee	3.17
205-000-53001	Capital Outlay	77.44
601-000-37004	Miscellaneous	195.55
601-731-52019	Professional Services	735.00
601-732-52001	Operating Supplies	55.92
603-736-52010	Telephone	25.44
603-736-52023	Facility Maintenance	401.08
603-737-52010	Telephone	25.44
603-737-52023	Facility Maintenance	167.86
605-000-52001	Operating Supplies	136.19
702-000-52006	Computer Maintenance	187.87
702-000-52010	Telephone	290.33
702-000-52019	Professional Services	3,128.00
703-734-51015	Other Benefits	1,209.00
703-734-52019	Professional Services	375.00
703-734-52022	Fuel	558.16
703-734-52023	Facility Maintenance	92.84
	Grand Total:	**158,866.54**

Project Account Summary

Project Account Key	Expense Amount
None	158,866.54
Grand Total:	**158,866.54**

Expense Approval Register

St. Helens, OR

Packet: APPKT00451 - AP 11.5.2021

Vendor Name	Payable Number	Post Date	Description (Item)	Account Number	Amount
Fund: 100 - GENERAL FUND					
AT&T MOBILITY	10232021	11/01/2021	287302289330 POLICE PHONES	100-705-52010	1,666.09
RICOH USA INC	105518688	11/01/2021	POLICE EQUIPMENT LEASE 14...	100-705-52023	200.38
COMCAST	10.26.21	11/02/2021	GABLE RD ACCT 8778 10 201 0...	100-709-52003	198.35
ERSKINE LAW PRECTICE LLC	11.1.21	11/02/2021	4/16-4/29	100-704-52019	2,085.65
HUDSON GARBAGE SERVICE	11486806	11/02/2021	6435- TRASH MCBRIDE ELEME...	100-709-52001	96.68
HUDSON GARBAGE SERVICE	11486807	11/02/2021	6437- TRASH ST. HELENS MID...	100-709-52001	171.45
ORKIN	219965651	11/02/2021	265 STRAND PEST SERVICE CIT...	100-715-52023	88.00
COLUMBIA NW HEATING INC	70751300	11/02/2021	SERVICE CALL REC CENTER	100-709-52023	647.00
CINTAS	8405375613	11/02/2021	CITY HALL FIRST AID CABINET ...	100-715-52001	168.29
CINTAS	8405375614	11/02/2021	PARKS FIRST AID CABINET SER...	100-708-52001	140.82
NET ASSETS	95-202110	11/02/2021	ESCROW TITLE SERVICES	100-707-52019	591.00
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	100-706-52023	6.80
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	100-706-52023	8.69
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	100-708-52001	2.40
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	100-709-52023	2.59
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	100-709-52023	4.99
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	100-709-52023	-37.38
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	100-709-52023	10.79
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	100-715-52001	51.20
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	100-715-52001	48.86
OBERDORFER LAW FIRM LLC	10.29.21	11/03/2021	JUDGE PRO TEM OCT 6.25 HRS	100-704-52019	625.00
BEAVER BARK	219584	11/03/2021	FIR	100-708-52001	150.00
NORTHWEST DELI DISTRIBUTI...	438525	11/03/2021	TP PAPER TOWELS G BAGS	100-708-52001	3,295.80
KJ SECURITY SOLUTIONS & LO...	0004315	11/04/2021	REPIN LOCK	100-705-52023	115.00
PITNEY BOWES INC	1019230560	11/04/2021	INK AND TAPE FOR POSTAGE ...	100-715-52001	416.46
STAPLES BUSINESS CREDIT	1638513270	11/04/2021	OFFICE SUPPLES	100-715-52001	463.47
JORDAN RAMIS PC ATTORNEYS...	183314	11/04/2021	PLANNING LEGAL SERVICES	100-710-52019	97.50
JORDAN RAMIS PC ATTORNEYS...	183315	11/04/2021	FINANCE / FRANCHISE	100-701-52019	75.00
JORDAN RAMIS PC ATTORNEYS...	183315	11/04/2021	FINANCE / FRANCHISE	100-707-52019	225.00
CHAVES CONSULTING INC	192596	11/04/2021	MONTHLY USER FEE PER USER...	100-702-52019	185.10
SIERRA SPRINGS	21814586 101621	11/04/2021	WATER BOTTLED COURT / UB ...	100-715-52001	99.45
CBM SYSTEMS LLC	221123	11/04/2021	JANITORIAL SERVICES	100-705-52023	1,019.95
CBM SYSTEMS LLC	221123	11/04/2021	JANITORIAL SERVICES	100-706-52023	2,000.00
CBM SYSTEMS LLC	221123	11/04/2021	JANITORIAL SERVICES	100-708-52023	127.85
CBM SYSTEMS LLC	221123	11/04/2021	JANITORIAL SERVICES	100-709-52023	152.76
CBM SYSTEMS LLC	221123	11/04/2021	JANITORIAL SERVICES	100-715-52023	1,269.80
SECURE PACIFIC CORPORATION	314389	11/04/2021	MONITORING	100-705-52019	271.70
VERIZON	9891094983	11/04/2021	CRYSTAL KING	100-701-52010	40.05
VERIZON	9891094983	11/04/2021	CRYSTAL KING	100-701-52010	46.15
VERIZON	9891094983	11/04/2021	MAYOR SCHOLL IPAD	100-703-52001	40.01
VERIZON	9891094983	11/04/2021	PD JETPACK1	100-705-52010	40.01
VERIZON	9891094983	11/04/2021	PD JETPACK2	100-705-52010	40.01
VERIZON	9891094983	11/04/2021	CAMERON PAGE	100-708-52010	36.15
VERIZON	9891094983	11/04/2021	TORY SHELBY	100-708-52010	36.15
VERIZON	9891094983	11/04/2021	REC PHONE	100-709-52010	37.00
VERIZON	9891094983	11/04/2021	RECREATION CENTER	100-709-52010	49.97
VERIZON	9891094983	11/04/2021	MIKE DEROIA	100-711-52010	73.37
VERIZON	9891094983	11/04/2021	JOHN HICKS	100-711-52010	44.97
VERIZON	9891094983	11/04/2021	BUILDING DEPT IPAD	100-711-52010	40.01
VERIZON	9891094983	11/04/2021	DARIN COX - BUILDING DEPT I...	100-711-52010	59.97
DEPARTMENT OF TRANSPORT...	INV0002128	11/04/2021	DMV SERVICES	100-704-52001	12.90
KJ SECURITY SOLUTIONS & LO...	00004314	11/05/2021	RIM CYLINDER REKEY	100-715-52023	102.00
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	100-708-52001	94.62

Vendor Name	Payable Number	Post Date	Description (Item)	Account Number	Amount
HUDSON GARBAGE SERVICE	11.5.21	11/05/2021	CHRISTMAS BIKE DONATION	100-703-52041	500.00
JORDAN RAMIS PC ATTORNEYS..	183313	11/05/2021	GENERAL LEGAL SERVICES	100-701-52019	370.00
JORDAN RAMIS PC ATTORNEYS..	183313	11/05/2021	GENERAL LEGAL SERVICES	100-703-52019	1,555.00
JORDAN RAMIS PC ATTORNEYS..	183313	11/05/2021	GENERAL LEGAL SERVICES	100-706-52019	325.00
JORDAN RAMIS PC ATTORNEYS..	183313	11/05/2021	GENERAL LEGAL SERVICES	100-710-52019	319.00
WILLEMSE GLASS	35398	11/05/2021	GLASS UNIT INSTALLED	100-706-52023	281.00
MIDWEST TAPE	501146561	11/05/2021	DVD / ABD 2000010011	100-706-52034	26.24
MIDWEST TAPE	501162354	11/05/2021	DVD / ABD 2000010011	100-706-52034	24.99
LIBRARY IDEAS LLC	82515	11/05/2021	FREEGAL MUSIC AND STREAM...	100-706-52032	4,220.00
LIBRARY IDEAS LLC	82516	11/05/2021	INCREASE TO 24 HOUR STREA...	100-706-52032	49.22
CITY OF ST. HELENS	INV0002134	11/05/2021	PERMIT FEE 2625 GABLE RD	100-709-52001	394.62
ENVISIONWARE INC	INV-US-54947	11/05/2021	ANNUAL SYSTEM MAINENANCE	100-706-52006	655.35
DEPARTMENT OF TRANSPORT...	L0028095547	11/05/2021	DMV SERVICES ACCT 67431	100-705-52001	8.00
				Fund 100 - GENERAL FUND Total:	**26,264.25**
Fund: 201 - VISITOR TOURISM					
CITY OF ST. HELENS	10.22.21	11/02/2021	01-00178-001 MASONIC BUILD..	201-000-52003	66.83
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	201-000-52028	29.80
				Fund 201 - VISITOR TOURISM Total:	**96.63**
Fund: 202 - COMMUNITY DEVELOPMENT					
JH KELLY LLC	JS 285241	11/04/2021	COL PAC FOOD BANK RENO	202-721-52096	441,462.72
OREGON DEPT. OF FORESTRY	INV0002135	11/05/2021	RENEWAL OF LOG BRAND	202-724-52001	20.00
				Fund 202 - COMMUNITY DEVELOPMENT Total:	**441,482.72**
Fund: 205 - STREETS					
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	205-000-52001	7.29
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	205-000-52001	27.76
TURNEY EXCAVATING INC	2	11/03/2021	ADA CURB RAMP IMPROVEM...	205-000-53001	3,960.75
TURNEY EXCAVATING INC	1740	11/04/2021	TRENCH PATCHING RETENTION	205-000-52019	219.92
				Fund 205 - STREETS Total:	**4,215.72**
Fund: 302 - WATER SDC					
KELLER ASSOCIATES, INC	212804	11/03/2021	WATER MASTER PLAN W-474 ...	302-000-52019	31,105.25
				Fund 302 - WATER SDC Total:	**31,105.25**
Fund: 303 - SEWER SDC					
KELLER ASSOCIATES, INC	212798	11/03/2021	SANITARY SEWER MASTER PL...	303-000-52019	24,630.02
				Fund 303 - SEWER SDC Total:	**24,630.02**
Fund: 304 - STORM SDC					
KELLER ASSOCIATES, INC	212797	11/03/2021	STORMWATER MASTER PLAN ...	304-000-52019	24,924.92
				Fund 304 - STORM SDC Total:	**24,924.92**
Fund: 601 - WATER					
HACH	12722486	11/02/2021	REAGENT SET CHLORINE FREE ...	601-731-52001	76.07
HACH	12722486	11/02/2021	REAGENT SET CHLORINE FREE ...	601-732-52001	141.28
NORTHSTAR CHEMICAL	209232	11/02/2021	SODIUM HYDROXIDE 25%	601-732-52083	7,140.10
VERIZON	9891094983	11/04/2021	GUY DAVIS- WFF EXTRA	601-732-52010	49.97
VERIZON	9891094983	11/04/2021	JOHN SAVAGE	601-732-52010	46.77
LAWRENCE OIL COMPANY	CFSI-4901	11/05/2021	247752 WATER	601-732-52022	162.65
				Fund 601 - WATER Total:	**7,616.84**
Fund: 603 - SEWER					
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	603-736-52001	23.38
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	603-737-52001	23.38
DONOVAN ENTERPRISES INC	1410	11/03/2021	CONSULTANT	603-735-52019	2,720.00
HASA	785983	11/03/2021	MULTI CHLOR	603-736-52083	5,273.33
CBM SYSTEMS LLC	221123	11/04/2021	JANITORIAL SERVICES	603-736-52023	233.22
VERIZON	9891094983	11/04/2021	STEWART HARTLEY	603-736-52010	241.90
VERIZON	9891094983	11/04/2021	AARON KUNDERS	603-736-52010	12.05
VERIZON	9891094983	11/04/2021	SAM ORTIZ	603-736-52010	16.65
VERIZON	9891094983	11/04/2021	STEWART HARTLEY	603-737-52010	242.10
VERIZON	9891094983	11/04/2021	SAM ORTIZ	603-737-52010	16.67
VERIZON	9891094983	11/04/2021	AARON KUNDERS	603-737-52010	12.04
VERIZON	9891094983	11/04/2021	AARON KUNDERS	603-738-52010	12.06

Vendor Name	Payable Number	Post Date	Description (Item)	Account Number	Amount
VERIZON	9891094983	11/04/2021	STEWART HARTLEY	603-738-52010	242.11
VERIZON	9891094983	11/04/2021	SAM ORTIZ	603-738-52010	16.65
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	603-738-52001	4.56
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	603-738-52001	124.30
COLUMBIA RIVER PUD	11.01.21	11/05/2021	38633 594 S 9 ST POWER	603-737-52003	11,582.22
				Fund 603 - SEWER Total:	**20,796.62**
Fund: 605 - STORM					
TURNEY EXCAVATING INC	INV0002122	11/03/2021	STORM DRAIN ABANDONMEN...	605-000-53001	41,780.00
				Fund 605 - STORM Total:	**41,780.00**
Fund: 702 - INFORMATION SYSTEMS					
COMCAST	10.21.2021	11/02/2021	COMCAST CABLE 8778108990...	702-000-52003	1,439.77
CENTURY LINK	10.25.21	11/02/2021	966B	702-000-52010	338.14
U.S BANK EQUIPMENT FINANCE	455937433	11/02/2021	CONTRACT PAYMENT EQUIPM...	702-000-52006	99.00
				Fund 702 - INFORMATION SYSTEMS Total:	**1,876.91**
Fund: 703 - PW OPERATIONS					
SCAPPOOSE CHIROPRACTIC PC	10.26.2021	11/02/2021	CDL PHYSICALS	703-734-52019	125.00
SCAPPOOSE CHIROPRACTIC PC	10.26.21	11/02/2021	CDL PHYSICALS	703-734-52019	125.00
PEAK ELECTRIC GROUP LLC	23266	11/02/2021	CUT CONDUIT REMOVED WIRE...	703-734-52019	215.00
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	703-734-52001	14.09
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	703-734-52023	58.18
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	703-734-52023	92.14
UNITED RENTALS INC	199286207-001	11/04/2021	TANK ASSY FUEL	703-734-52099	245.00
VERIZON	9891094983	11/04/2021	SHARON DARROUX	703-733-52010	58.59
VERIZON	9891094983	11/04/2021	TIM UNDERWOOD	703-733-52010	49.97
VERIZON	9891094983	11/04/2021	SCOTT WILLIAMS	703-734-52010	49.97
VERIZON	9891094983	11/04/2021	PW SPARE 4	703-734-52010	40.01
VERIZON	9891094983	11/04/2021	SUE NELSON	703-734-52010	49.97
VERIZON	9891094983	11/04/2021	CURT LEMONT	703-734-52010	18.18
VERIZON	9891094983	11/04/2021	DAVE ELDER	703-734-52010	49.97
VERIZON	9891094983	11/04/2021	PW SPARE 3	703-734-52010	40.01
VERIZON	9891094983	11/04/2021	MOUHAMAD ZAHER	703-734-52010	49.97
VERIZON	9891094983	11/04/2021	PW SPARE2	703-734-52010	40.01
VERIZON	9891094983	11/04/2021	PW HOTSPOT1 / EQUIPMENT ...	703-734-52010	40.01
VERIZON	9891094983	11/04/2021	BUCK TUPPER	703-734-52010	49.97
VERIZON	9891094983	11/04/2021	BRETT LONG	703-734-52010	49.97
VERIZON	9891094983	11/04/2021	SCOTT HARRINGTON	703-734-52010	18.18
VERIZON	9891094983	11/04/2021	ETHAN STERLING	703-734-52010	49.97
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	97.46
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	8.99
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	30.89
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	34.38
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	48.39
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	18.49
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	72.37
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	125.23
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	49.39
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	35.66
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	74.68
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	-14.80
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	-49.39
SUNSET AUTO PARTS INC - NA...	10.31.2021	11/05/2021	AUTO PARTS ACCT 6355	703-734-52099	338.70
CARQUEST AUTO PARTS STOR...	10.31.2021	11/05/2021	AUTO PARTS ACCT 315752	703-734-52099	20.99
PAPE MACHINERY	13125852	11/05/2021	FILTER	703-734-52099	315.43
LAWSON PRODUCTS	9308916470	11/05/2021	MATERIALS	703-734-52099	178.50
LAWRENCE OIL COMPANY	CFSI-4901	11/05/2021	247750 PUBLIC WORKS	703-734-52022	159.66
LAWRENCE OIL COMPANY	CFSI-4901	11/05/2021	247748 PUBLIC WORKS	703-734-52022	1,586.24
				Fund 703 - PW OPERATIONS Total:	**4,660.42**
Fund: 704 - FACILITY MAJOR MAINTNANCE					
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	704-000-53017	48.79

Vendor Name	Payable Number	Post Date	Description (Item)	Account Number	Amount
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	704-000-53017	16.49
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	704-000-53017	16.49
DAHLGREN'S DO IT BEST BUIL...	10.25.2021	11/03/2021	BUILDING SUPPLIES ACCT 100...	704-000-53017	22.28
PEAK ELECTRIC GROUP LLC	23267	11/03/2021	SENIOR CENTER FREEZER PLUG	704-000-53025	215.00
KJ SECURITY SOLUTIONS & LO...	0004316	11/05/2021	RE KEY	704-000-53017	1,440.00
				Fund 704 - FACILITY MAJOR MAINTNANCE Total:	**1,759.05**
Fund: 706 - PUBLIC SAFETY					
WEST CONSULTANTS INC	015930	11/04/2021	MILTON CREEK LOMR	706-000-52019	564.00
ISSQUARED INC	W3N4VO	11/05/2021	FORTINEET	706-000-52019	2,606.08
				Fund 706 - PUBLIC SAFETY Total:	**3,170.08**
				Grand Total:	**634,379.43**

Fund Summary

Fund	Expense Amount
100 - GENERAL FUND	26,264.25
201 - VISITOR TOURISM	96.63
202 - COMMUNITY DEVELOPMENT	441,482.72
205 - STREETS	4,215.72
302 - WATER SDC	31,105.25
303 - SEWER SDC	24,630.02
304 - STORM SDC	24,924.92
601 - WATER	7,616.84
603 - SEWER	20,796.62
605 - STORM	41,780.00
702 - INFORMATION SYSTEMS	1,876.91
703 - PW OPERATIONS	4,660.42
704 - FACILITY MAJOR MAINTNANCE	1,759.05
706 - PUBLIC SAFETY	3,170.08
Grand Total:	**634,379.43**

Account Summary

Account Number	Account Name	Expense Amount
100-701-52010	Telephone	86.20
100-701-52019	Professional Services	445.00
100-702-52019	Professional Services	185.10
100-703-52001	Operating Supplies	40.01
100-703-52019	Professional Services	1,555.00
100-703-52041	Community Support Funds	500.00
100-704-52001	Operating Supplies	12.90
100-704-52019	Professional Services	2,710.65
100-705-52001	Operating Supplies	8.00
100-705-52010	Telephone	1,746.11
100-705-52019	Professional Services	271.70
100-705-52023	Facility Maintenance	1,335.33
100-706-52006	Computer Maintenance	655.35
100-706-52019	Professional Services	325.00
100-706-52023	Facility Maintenance	2,296.49
100-706-52032	Digital Resources	4,269.22
100-706-52034	Visual Materials	51.23
100-707-52019	Professional Services	816.00
100-708-52001	Operating Supplies	3,683.64
100-708-52010	Telephone	72.30
100-708-52023	Facility Maintenance	127.85
100-709-52001	Operating Supplies	662.75
100-709-52003	Utilities	198.35
100-709-52010	Telephone	86.97
100-709-52023	Facility Maintenance	780.75
100-710-52019	Professional Services	416.50
100-711-52010	Telephone	218.32
100-715-52001	Operating Supplies	1,247.73
100-715-52023	Facility Maintenance	1,459.80
201-000-52003	Utilities	66.83
201-000-52028	Projects & Programs	29.80
202-721-52096	CDBG Grant Expenses	441,462.72
202-724-52001	Operating Supplies	20.00
205-000-52001	Operating Supplies	35.05
205-000-52019	Professional Services	219.92
205-000-53001	Capital Outlay	3,960.75
302-000-52019	Professional Services	31,105.25
303-000-52019	Professional Services	24,630.02
304-000-52019	Professional Services	24,924.92
601-731-52001	Operating Supplies	76.07
601-732-52001	Operating Supplies	141.28

Account Summary

Account Number	Account Name	Expense Amount
601-732-52010	Telephone	96.74
601-732-52022	Fuel	162.65
601-732-52083	Chemicals	7,140.10
603-735-52019	Professional Services	2,720.00
603-736-52001	Operating Supplies	23.38
603-736-52010	Telephone	270.60
603-736-52023	Facility Maintenance	233.22
603-736-52083	Chemicals	5,273.33
603-737-52001	Operating Supplies	23.38
603-737-52003	Utilities	11,582.22
603-737-52010	Telephone	270.81
603-738-52001	Operating Supplies	128.86
603-738-52010	Telephone	270.82
605-000-53001	Capital Outlay	41,780.00
702-000-52003	Utilities	1,439.77
702-000-52006	Computer Maintenance	99.00
702-000-52010	Telephone	338.14
703-733-52010	Telephone	108.56
703-734-52001	Operating Supplies	14.09
703-734-52010	Telephone	546.19
703-734-52019	Professional Services	465.00
703-734-52022	Fuel	1,745.90
703-734-52023	Facility Maintenance	150.32
703-734-52099	Equipment Operations	1,630.36
704-000-53017	Capital Outlay - Rec Center	1,544.05
704-000-53025	Capital Outlay - Sr Center	215.00
706-000-52019	Professional Services	3,170.08
	Grand Total:	**634,379.43**

Project Account Summary

Project Account Key		Expense Amount
None		634,379.43
	Grand Total:	**634,379.43**