

Jackson East Project
Public Utilities and Services Report

Submitted to:
Dan Rutzick
Senior Planner, City of Hillsboro

Prepared by:
Otak, Inc.
808 SW 3rd Ave, Suite 300
Portland, OR 97204

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TABLE OF CONTENTS

- I. Introduction 1
- II. Existing Conditions 1
 - A. Water 1
 - B. Sanitary Sewer 1
 - C. Stormwater 2
 - D. Other Services 2
- III. Review of Previous Studies 3
 - A. Water 3
 - B. Sanitary Sewer 5
 - C. Stormwater 6
 - D. Other services 10
- IV. Preliminary Public Utilities and Services 11
 - A. Water 11
 - B. Sanitary Sewer 13
 - C. Stormwater 16
 - D. Other services 18
- V. Estimated Public Utilities and Services' Costs 19
 - A. Water 19
 - B. Sanitary Sewer 19
 - C. Stormwater 20
 - D. Other services 21
- VI. Next Steps 21

I. Introduction

The Jackson East project area includes 545-acres brought into the Urban Growth Boundary (UGB) as a result of and adjacent rural-residential land along NE Sewell Avenue brought into the UGB in 2005. The approximately 670-acre project area outside Hillsboro city limits is bordered on the north by U.S. Highway 26; on the south by NW Evergreen Road; on the east generally by NE Sewell Avenue; and on the west by NW Jackson School Road. The North Hillsboro Industrial Renewal Area (IRA) is located to the east of the project area. This background report will focus on project area public utilities and services' existing conditions, a review of previous studies, preliminary public utilities and services, estimated public utilities and services' costs, and next steps.

II. Existing Conditions

A. Water

Developed properties in the Jackson East project area are currently served by well water. The project area will be served by the City of Hillsboro Water Department. The City of Hillsboro receives its potable water from the Joint Water Commission's (JWC) 75 MGD water treatment plant located in Forest Grove. The City is served by a 66-inch water transmission main in NW Evergreen Road. There are two storage reservoirs in the vicinity of the project, the Evergreen Reservoir and the Crandall Reservoir. The Evergreen Reservoir is located near NW Brookwood Parkway and NW Evergreen Road and the Crandall Reservoir is near NW Evergreen Road and NW Glencoe Road.

Within the vicinity of the Jackson East project area, the City of Hillsboro owns an 18-inch water distribution line in NW Evergreen Road. East of NE Sewell Avenue this 18-inch waterline leaves the NW Evergreen Road right-of-way and is located in an easement south of NW Evergreen Road. A pressure reducing valve is located on this 18-inch waterline in the vicinity of NE 25th Avenue, dividing the system into two pressure zones (north and main). The north zone, a higher pressure zone with an approximate hydraulic grade line of 390 feet, will serve the Jackson East project area. This 18-inch waterline south of NW Evergreen Road becomes a 12-inch waterline west of NW 25th Avenue.

B. Sanitary Sewer

There are currently no existing public sanitary sewer facilities within the Jackson East project area. Inhabited properties currently employ septic systems. The area will need to be annexed into the Clean Water Services (CWS) District and the City of Hillsboro before sewer services will be provided. Annexations will likely occur incrementally as development is proposed.

The Jackson East project area is in the vicinity of two existing sanitary sewer trunk lines. The McKay Creek trunk line extends west from a point just south of NW Evergreen Road at the intersection of NE Sewell Avenue. The McKay Creek Trunk conveys flows to the Hillsboro Treatment Plant located along South 1st Avenue in the northern edge of the Jackson Bottom Wetlands Preserve. At the upstream end, the McKay Creek Trunk is an 18-inch sewer line. The Mackay Creek trunk line is near full capacity so flows within the Jackson East project area cannot be allowed into this line.

The Dawson Creek Trunk is a 24-inch sewer line located east of the Jackson East project area that terminates approximately 1,300 feet north of NW Evergreen Road in NE 41st Avenue. The Dawson Creek trunk line conveys flows to the Rock Creek Treatment Plant. At the upstream end, the Dawson Creek Trunk is a 21-inch sewer line.

There is an existing abandoned 10-inch force main in NW Jackson School Road, which connects to the McKay Creek trunk line south of NW Evergreen Road.

C. Stormwater

CWS is identified as the agency that holds the Environmental Protection Agency's Municipal Separate Storm Sewer System (MS4) permit in urban Washington County. Jackson East properties will need to be annexed into the CWS District and the City of Hillsboro before services will be provided. The City of Hillsboro is a co-implementer of the MS4 permit and through IGAs, the City of Hillsboro will manage the conveyance, detention, and water quality treatment of stormwater in the Jackson East project area relying on CWS guidelines.

Beyond the existing creeks and associated agricultural tiling, there is currently no stormwater conveyance system within the Jackson East project area. The western section of NW Evergreen Road, which forms the southern boundary of the project area, is drained by roadside ditches.

The City will require all new development in this area to employ detention techniques limiting runoff to predevelopment flows. Without detention, downstream properties would be negatively impacted by flooding and erosion due to the change in flows. New potential outfall locations will need to be introduced with the development of the area and warrant some amount of data gathering of existing stream conditions as documentation of base conditions for comparison after development has been in place. Data should also include in stream structures such as culverts and dams.

As the City moves forward with the IRA there may be concepts within its stormwater management approach that could be considered for the Jackson East project area. By implementing concepts that can apply to both areas, stormwater management facilities can be designed to protect water quality and ensure that maintenance obligations are met without excessive legal complexity.

D. Other Services

Parks

Currently there are no parks located in the project area. The nearest public park is Glencoe Creek Park, a two-acre neighborhood park located less than a half mile south of the project area on NE 15th Ave. The Gordon Faber Recreation Complex, which includes Hillsboro Stadium, Ron Tonkin Field and the Hondo Dog Park, is located approximately 3 miles east of the project area.

Emergency Services

The nearest fire station is Hillsboro Fire Station No. 5 located 0.5 miles south of the project area on NE 25th Avenue. The nearest police station is the Hillsboro Main Precinct located 3 miles southwest of the project area on SE 10th Avenue.

III. Review of Previous Studies

Several studies have been completed within the last 10 years that planned how to extend public utilities and services to land in the vicinity of the Jackson East project area. The Evergreen Concept Plan completed in 2008 examined the area along NE Sewell Avenue between Waibel Creek and NW Evergreen Road, but especially the adjacent large-lot areas to the east. It should be noted that the Evergreen Concept Plan was high-level planning that did not account for the majority of the Jackson East project area and does not reflect the needed improvements identified for the North Hillsboro Industrial Renewal Plan established in December 2015. The North Hillsboro Industrial Renewal Plan provides guidance for implementation of plans, as well as codes and policies that were adopted to help the City reach its goals for improving the land, transportation infrastructure, utilities and services, natural resource areas, and stimulating growth. The Industrial Renewal Area includes the Evergreen Concept Plan Area, land adjacent to the Jackson East project area between Waibel Creek and U.S. Highway 26, and an area east of NW Brookwood Parkway.

The Washington County-led Regional Industrial Site Readiness Project study completed in 2015 included a site assessment of the Vanrose Farms site, which is the largest parcel within the Jackson East project area.

In addition, the Jackson East project team met with key staff from the City of Hillsboro and CWS to provide early discussions on how public utilities and services would be extended to the Jackson East project area. A summary of these meetings is also included below.

A. Water

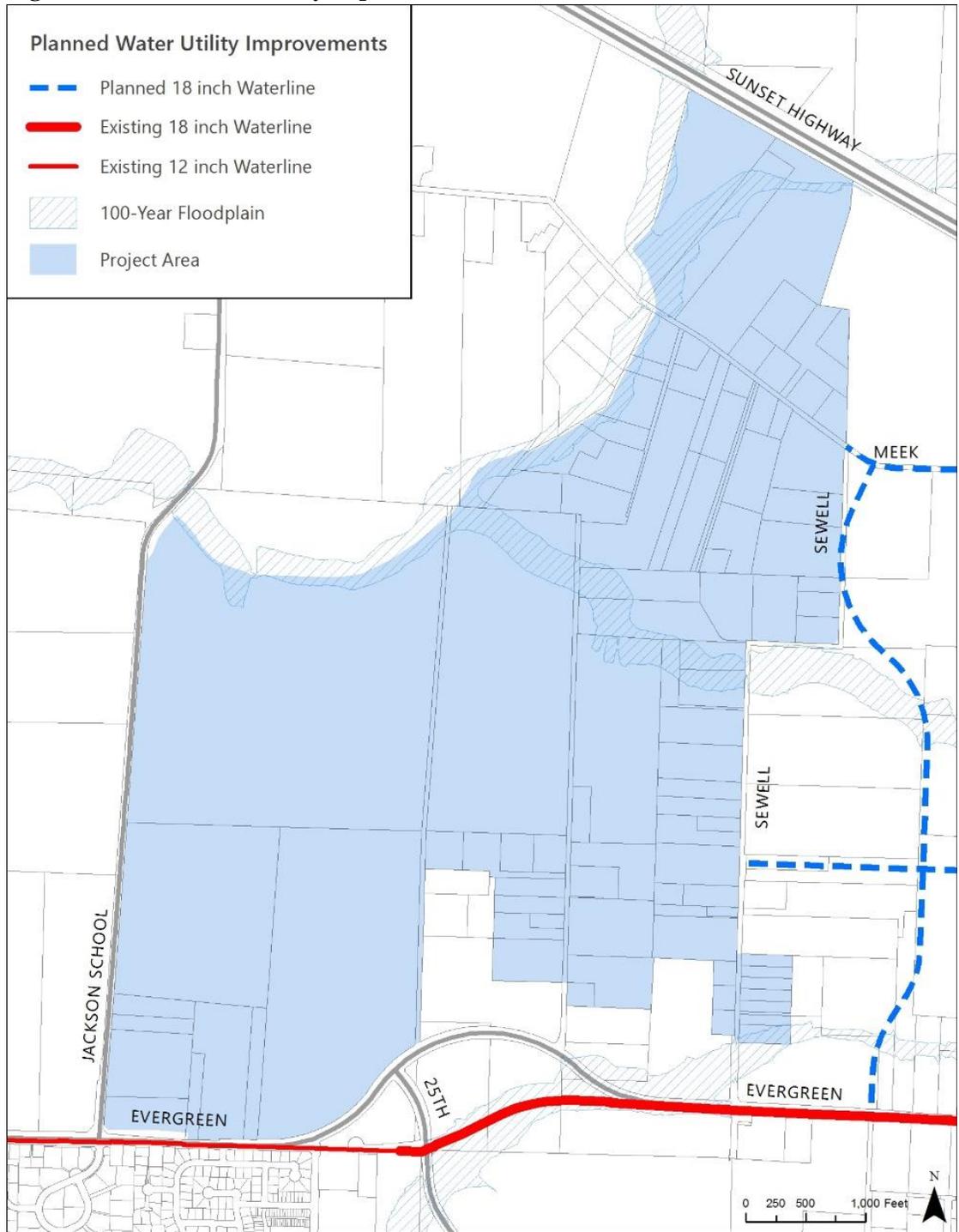
1) Evergreen Concept Plan

The Evergreen Concept Plan's Water System Concept Planning infrastructure report, dated September 2007, anticipates water service to be extended into the Evergreen Concept area from the existing 18-inch water main in NW Evergreen Road with four connections to the existing main. A network of 12-inch and 18-inch waterlines was proposed within the concept area.

2) North Hillsboro Industrial Renewal Plan

Planned water utility improvements for the IRA include the extension of high capacity lines. Planned 18-inch water mains will be constructed within the planned transportation improvements (i.e. NE Huffman Street, NE 41st Avenue, NE 30th Avenue, and NW Meek Road improvements). See Figure 1.

Figure 1. Planned water utility improvements



Source: City of Hillsboro, Metro RLIS, and Washington County GIS data

3) Washington County-led Regional Industrial Site Readiness Project

The Washington County-led Regional Industrial Site Readiness Project study completed in 2015 included a site assessment report for the Vanrose Farms site, which is the largest parcel within the Jackson East project area. This assessment included an analysis of how to extend water service to the Vanrose Farms site. The analysis proposes the extension of water mains from NW Evergreen Road north to the Vanrose Farms site. The analysis proposes to create a looped water system that includes 18-inch and 12-inch waterlines.

4) Meeting with City of Hillsboro Water Department

Additional information was also obtained during a meeting between the Jackson East project team and Tyler Wubbena from the City of Hillsboro Water Department in July 2016.

The Water Department anticipates that there is adequate water supply in the City's system to serve the Jackson East project area. There is a planned improvement to the Joint Water Commission's water treatment plant that will expand supply by 10 MGD, scheduled to be complete in 2019. In addition, the construction of the Willamette Supply Line, estimated to be complete in 2026, will further expand and increase the reliability of water supply for the City of Hillsboro.

According to City of Hillsboro Water Department, the Jackson East project area should be part of the north (higher) pressure zone. This is consistent with the IRA. In 2017 the Hillsboro Water Department intends to begin an update of their water system master plan which will include refined planning for the Jackson East project area.

B. Sanitary Sewer

1) Evergreen Concept Plan

The Evergreen Concept Plan's Sanitary Sewer Trunk Concept Planning infrastructure report, dated August 2007, describes two concepts for providing sanitary sewer service to the Evergreen Industrial Area. The first alternative is to construct a gravity system that would connect to the McKay Creek Trunk. The second alternative is to construct a pump station near NW 273rd Avenue, north of planned NW Huffman Street, and construct a force main in NW Evergreen Road or within the planned transportation improvements to the Dawson Creek trunk line. A combination of these two alternatives is also a possibility.

2) North Hillsboro Industrial Renewal Plan

The IRA Plan's proposed sanitary sewer public utilities described for this area includes the extension of sewer to the IRA within the planned transportation improvements, The IRA Plan also proposes the construction of an interim sanitary sewer pump station near Waibel Creek and NE 41st Avenue, and a permanent sanitary sewer pump station near Waibel Creek and an extended NE 30th Avenue.

3) Washington County-led Regional Industrial Site Readiness Project

The Washington County-led Regional Industrial Site Readiness Project included a project area assessment of how to extend sanitary sewer service to the Vanrose Farm project area. The analysis proposes to send sanitary sewer flows to a proposed pump station near NW Jackson School Road, at the northwest corner of the project area. This pump station would utilize the existing abandoned force main in NW Jackson School Road to convey flows to the McKay Creek Trunk. Per conversations with CWS, this assumption is incorrect.

4) Meeting with City of Hillsboro and Clean Water Services

Additional information was also obtained during a meeting between the Jackson East project team and Jadene Stensland from the CWS in July 2016.

Since the completion of the Evergreen Concept Plan and the Vanrose Project area Assessment, CWS has determined that there is no additional capacity in the McKay Creek Trunk to be able to serve the Jackson East project area, as previously assumed in the Vanrose Project area Assessment report.

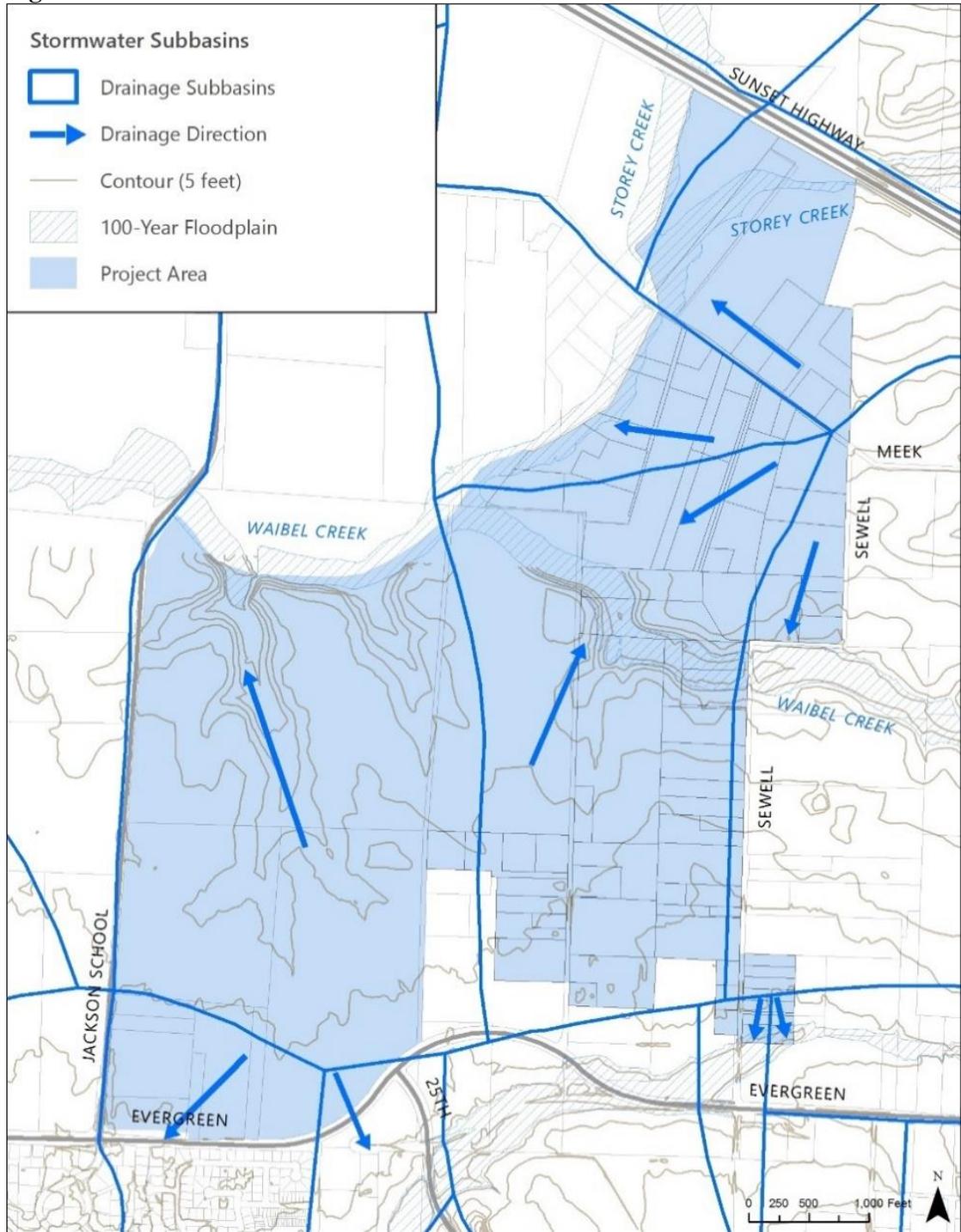
Preliminary discussions with CWS suggested that this project area be served by a pump station in the northwest corner of the project area near NW Jackson School Road and Waibel Creek. Flows would likely be pumped along an extended NW Huffman Street east to the Dawson Creek trunk line.

C. Stormwater

The majority of the project area drains to Storey and Waibel Creeks, with the exception of approximately 50 acres that drain south to the NW Evergreen Road conveyance system toward Glencoe Creek. See Figure 2. Farming practices within the project area have influenced drainage patterns, and also led to some channelizing of these creeks.

Stormwater standards have been established since the development of this area, and were adopted to protect waterways from degradation due to urbanization as well as to meet local and federal permit requirements. With urbanization of this area and the types of impacts imposed, runoff from new development will need to be mitigated by the developer using approved treatment and detention techniques to meet CWS standards and/or federal standards.

Figure 2. Stormwater subbasins



Source: City of Hillsboro, Metro RLIS, and Washington County GIS data

1) Review of CWS Standards

CWS Design and Construction Manual for Sanitary and Surface Water Management (June 2007) sets forth requirements for treating and detaining stormwater runoff associated with new and redevelopment. These requirements were adopted to provide direction for managing stormwater to a level that meets local agency goals as well as permit requirements. Current standards require treatment of runoff generated by 0.36 inches of rainfall during a 4-hour period. Standards also require detention of the 2-year, 10-year, and 25-year storm events such that post development flow rates match pre-development flow rates in instances where a downstream deficiency has been identified. For the purposes of this analysis, it is assumed that all receiving waters contain deficiencies, and therefore development of the Jackson East area will require both detention and treatment of stormwater.

When developing near sensitive areas and streams, CWS requires mitigation for impacts to the vegetated corridor, which is defined in the Design and Construction Standards as well as Metro Title 13. Title 13 states that “Metro-area cities and counties demonstrate their programs adequately protect designated rivers, streams and drainage ways, wetlands, floodplains, riparian areas, and wildlife habitat.” Generally, it directs development away from streams and other habitat areas and requires mitigation for development related impacts. The vegetated corridor is defined for each waterway based on slopes within adjacent developing project areas, contributing basin area, and intermittency of flow. The developable area within Jackson East is divided and bordered by Waibel and Storey Creeks, which will both contain sensitive areas and vegetated corridors.

A new permit was issued to CWS in the spring of 2016, and a subsequent update to the Design and Construction Standards is anticipated to be released and implemented in the near future. Planning and construction within Jackson East will be required to follow standards in place at the time of development.

2) North Hillsboro Industrial Renewal Plan

IRA goals related to stormwater management include development of regional stormwater facilities and related public stormwater conveyance public utilities, and enhancement of natural resources, particularly related to habitat and water quality improvements of Waibel Creek. These goals, in conjunction with the CWS Design and Construction Standards document, should be considered in the development of the Jackson East project area stormwater management plan.

3) Federal Stormwater Requirements

Federal requirements are triggered when an action impacts jurisdictional waters or wetlands. Standards have been developed for mitigating stormwater runoff that are more stringent than CWS standards. Standard Local Operating Procedures for Endangered Species (SLOPES) V is a programmatic biological opinion that was developed by National Marine Fisheries Service (NMFS) and released in 2014 to provide for a more streamlined review process for standard development type projects. The document contains design standards for stormwater management that are more stringent than CWS standards, but meet the criteria for the biological opinion.

If development in this area impacts this wetland or other sensitive areas, the more stringent design standards will need to be met. For the purpose of this analysis, it is assumed that impacts to jurisdictional waters and wetlands can be avoided in the Jackson East development. Future analysis may find that stormwater management design will need to follow SLOPES V standards, which will likely increase facility sizes.

In addition to stormwater requirements, NMFS has recently issued a biological opinion for FEMA following consultation based on impacts related to development within floodways. NMFS recommendations include Reasonable and Prudent Alternatives (RPA) to address protection of endangered species, which include educational and interim measures as well as floodplain management requirements. These requirements may affect developable area within the Jackson East project area, and include wider buffers than those identified in CWS standards.

4) Port of Portland Design Guidance

The Port of Portland developed a stormwater master plan and wildlife hazard mitigation plan for Portland International Airport that address additional mitigation practices to be applied on their property, as well as practices to be considered within a 10,000 foot radius of the airport property. These additional practices are mainly focused on integrating stormwater management requirements with wildlife hazard mitigation. Along with fulfilling stormwater treatment and peak matching requirements set forth by CWS, this plan should follow guidelines set forth by the Port for limiting the duration of ponded water (as applicable to above ground treatment and detention facilities) to 48 hours, and implementing a specific approach to planting facilities with the intent to deter waterfowl.

FAA regulations also prohibit the use of surface stormwater detention facilities of more than ¼ acre in area within 5,000 sq. ft. of an airport runway. This restriction could result in higher stormwater treatment costs for development that introduces a significant amount of impervious surface.

5) Existing Stormwater Public Utilities

A conveyance system exists within the NW Evergreen Road right-of-way, however there is currently no stormwater public utilities within the Jackson East area. New roadways within the project area will be required to include conveyance systems (open or closed) in order to implement regional stormwater management for the area. In addition, improvements will likely need to be made to portions of NW Jackson School Road as the project area develops.

D. Other services

Parks

1) City of Hillsboro 2015 Trails Master Plan

The City of Hillsboro 2015 Trails Master Plan envisions a system of trails, multi-use paths, on-street bike facilities, proposed trails, and parks. The Trails Master Plan includes the concept of a Crescent Park Greenway, a continuous loop around Hillsboro, incorporating both paved and natural surfaces. The City envisions that the Crescent Park Greenway will meet multiple objectives: to provide active transportation and recreation opportunities, to enhance and restore natural areas, manage stormwater, and to be an asset for future development. The exact location of the greenway has yet to be decided, but it will cross the Jackson East Project Area, likely along Waibel Creek.

2) North Hillsboro Industrial Renewal Plan

The IRA Plan, completed in 2015, includes the area east of the Jackson East area. This plan provides guidance for implementation of plans, as well as codes and policies that were adopted to help the City reach its goals for improving the land, public utilities, natural resource areas, and stimulating growth. Goal 5 of the plan encourages the development of trails and open space within the project area. Trail systems would improve connectivity from surrounding areas for the IRA. The Crescent Park Greenway trail would extend through the area. Trailhead improvements would provide access to natural areas and open space.

3) Emergency Services

No studies were reviewed for emergency services.

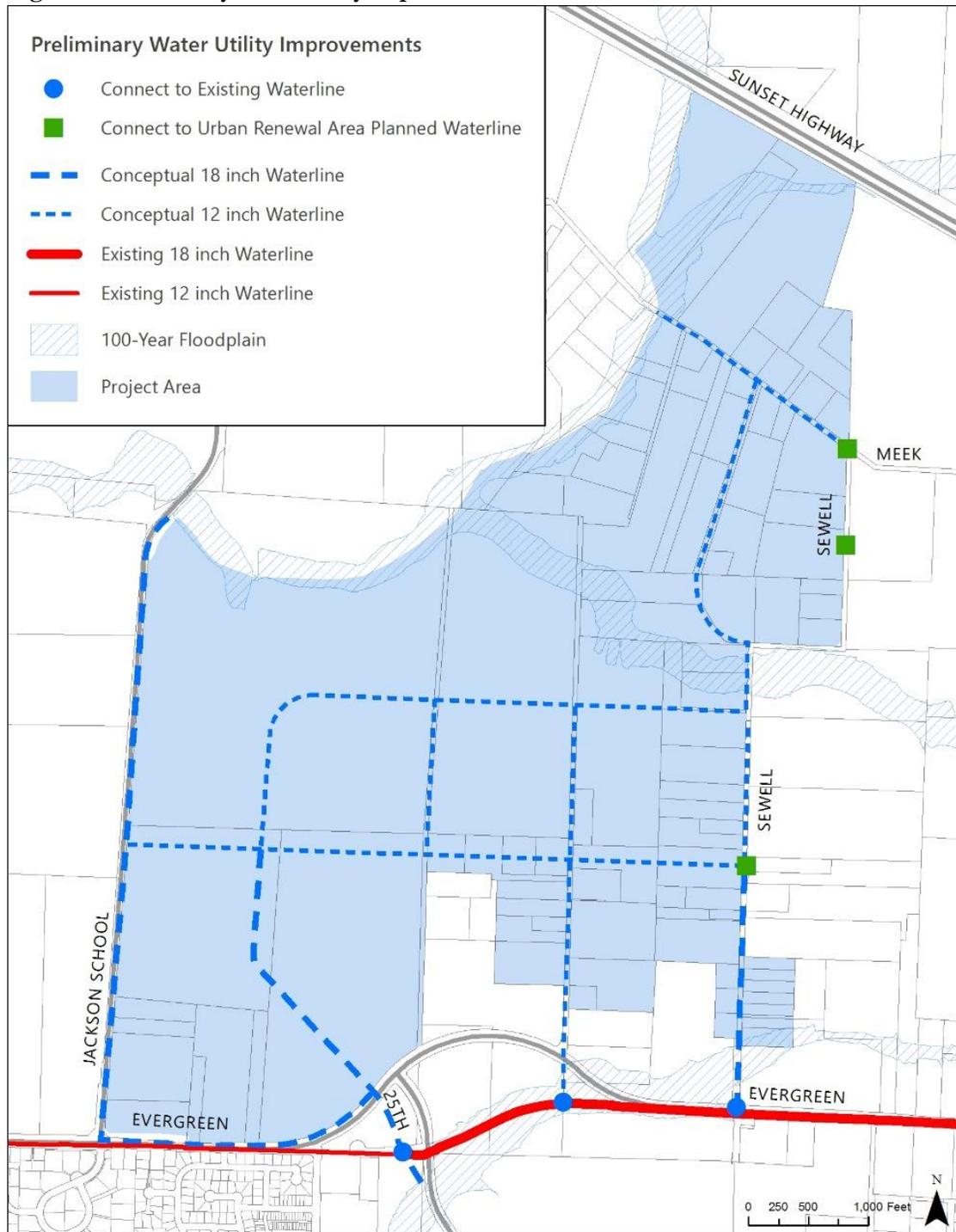
IV. Preliminary Public Utilities and Services

Recommendations for preliminary public utilities and services needed in the planning area are provided below.

A. Water

This section reviews the preliminary water public utility improvements recommended to provide water service to the Jackson East project area.

Figure 3. Preliminary water utility improvements



Source: City of Hillsboro, Metro RLIS, and Washington County GIS data

Figure 3 above shows that water service to the project area will be provided via three connections to the existing 18-inch line in NW Evergreen Road (at NE 25th Avenue, NW 273rd Avenue, and NE Sewell Avenue). A looped water system will be constructed within the project area by extending 18-inch waterlines at the edge of the project area and 12-inch within the existing or preliminary street right of ways shown in Figure 3. In addition, smaller 8-inch local distribution waterlines will be extended along other new local roads within the project area.

NW Jackson School Road and NE Sewell Avenue from NW Evergreen Road to NW Huffman Ave will have 18-inch waterlines. The NE 25th Avenue extension, NW 273rd Avenue, NW Huffman Ave, and the road north of and parallel to Huffman will contain 12-inch waterlines. As NE Sewell Avenue extends north of Waibel Creek, a 12-inch line is proposed to NW Meek Road. A 12-inch line will also be constructed in NW Meek Road for connection to the IRA to the east and potential future extension to the west. Local Roads within any residential areas will be constructed with 8-inch local distribution waterlines. Adjacent to the Jackson East Area, an 18-inch waterline in NE 41st Avenue between NW Evergreen Road and NW Meek Road is proposed within the IRA.

The Jackson East project area will be located within the north (higher) pressure zone. The pressure zone boundary at NW Evergreen Road is located west of NE 25th Avenue. A pressure reducing valve (PRV), located on the 18-inch waterline west of NE 25th Avenue regulates pressures between the higher and lower pressure zones. Connections to the existing system west of the PRV will be served by the higher pressure zone. Connections to the existing system east of the PRV will be served by the lower pressure zone. The Jackson East project area to fall within the higher pressure zone, therefore all connections to the existing line will need to be made east of NE 25th Avenue. In order to extend a waterline north on NW Jackson School Road, a connection to the existing line will need to be made east of NE 25th Avenue, with an extension of a new 18-inch line west in NW Evergreen Road.

In the vicinity of the NW 273rd Avenue and NW Evergreen Road intersection, the existing waterline is located in an easement approximately 300 feet south of NW Evergreen Road. In order to connect to the existing waterline at NW 273rd Ave, an easement through Port of Portland owned property would need to be obtained. Alternately, if an easement cannot be acquired, the waterline could be constructed within the existing NW Evergreen Road right-of-way and a connection could be made approximately 750 feet east of NW 273rd Ave.

During final design of the project area, water system modeling should be completed to confirm preliminary pipe sizing. Pipe sizing should provide for sufficient flows and pressure to each development project area based on specific use. As development occurs, water sizing may depend on the assumed future uses of undeveloped areas within Jackson East. Pipe sizing will also need to provide for adequate fire flow. Pipes should be sized to maintain pipeline velocities of less than 5 feet per second.

Potential Challenges

Some potential challenges in serving the area are the unknown end users of the water system and potentially the order of development.

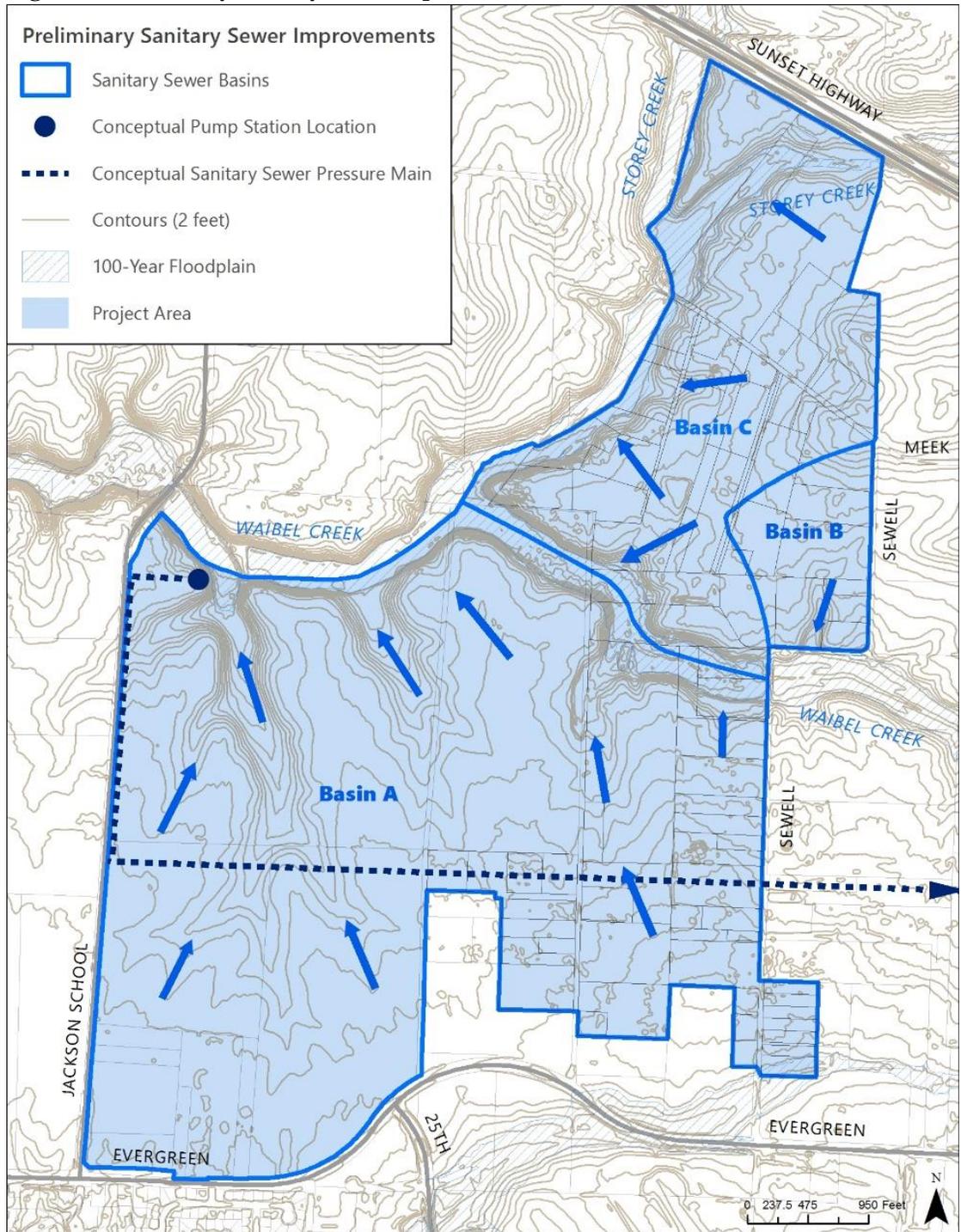
Water demands for industrial water customers can vary depending on the type of industry and the specific use. If water lines are extended into the site prior to knowing all of the end users, conservative estimates would be used in order to provide enough supply and pressure for future development.

Water service will be extended into the Jackson East project area from existing facilities on NW Evergreen Road. If development occurs within the site from south to north, then water public utilities would logically be constructed from the existing facilities into the project area along with development. However, if development first occurred in the north, then up-front costs to extend water public utilities to that area would be higher. Future development in the North Hillsboro Industrial Renewal Area could potentially serve the Jackson East project area north of Waibel Creek by extending water service along NW Meek Road.

B. Sanitary Sewer

Based on GIS contour data of the existing topography, it appears that the Jackson East project area can be divided into three sanitary sewer basins, as shown in Figure 4. Basin A includes the area south of Waibel Creek. Basins B and C include the area north of Waibel Creek. North of Waibel Creek, a ridge line running north and south divides the area into two basins. The southeast corner north of Waibel Creek slopes to the southeast (Basin B). The remaining area slopes to the west, toward Storey Creek (Basin C).

Figure 4. Preliminary sanitary sewer improvements



Source: City of Hillsboro, Metro RLIS, and Washington County GIS data

Sanitary sewer flows from the Jackson East project area would need to gravity flow to a pump station at the lowest point on the site, where a force main would carry the flow via an extended NW Huffman Street or NW Evergreen Road east to the Dawson Creek trunk line. Basin A generally slopes to the northwest corner of the project area near the intersection of NW Jackson School Road and Waibel Creek, with the exception of three fingers of depressed area extending south from the creek. The project area would likely require a pump station at the low point (NW Jackson School Road and Waibel Creek). Assuming that the area immediately south of Waibel Creek is developable (no wetland or

flood plain issues), the depressed fingers would likely require fill, and trigger additional permits (e.g., floodplain permit) depending on the location, in order for a sewer line to pass through this area.

The IRA is also planning for a pump station to serve their site. It was suggested by CWS that the proposed pump stations for the Jackson East area and IRA be combined into a single pump station to serve both areas. This could create issues depending on project timing and order of development.

The force main to carry flows from the pump station to the Dawson Creek trunk line should be located within the future road network and would likely be located in NW Jackson School Road before heading east in NW Huffman Avenue. Alternatively, sanitary sewer could be installed in NW Evergreen Road if sufficient public right-of-way or easements exists. For the purpose of this report, we would assume that the IRA would construct the force main through their project area, with the ultimate connection to the Dawson Creek trunk line, in NE 41st Avenue.

Basin B generally slopes toward the IRA. Sanitary sewer for Basin B could potentially connect to the sewer public utilities for that area in the vicinity of planned NE 30th Avenue extension. However, at this time, it is unclear from the IRA Plan reports how the industrial area north of Waibel Creek is being served for sanitary sewer. A second option would be to route a sewer line along the southern project area boundary westward into Basin C.

The Basin C area generally slopes toward Storey Creek. To serve Basin C, a sanitary sewer line would be needed parallel to Storey Creek in order to convey flows from north to south. Basin C sanitary sewer flows would then need to cross Waibel creek and be conveyed to the pump station located at NW Jackson School Road. The two options for crossing Waibel Creek include boring a sewer line under the creek, or hanging a sewer line from the bridge crossing at NE Sewell Avenue. Utilizing the bridge crossing would likely not be feasible depending on the elevation of the bridge compared to the depth of the sewer lines in Basins B and C.

In addition, because Basin A generally sloping to the north toward Waibel Creek, a sewer line would likely need to be installed parallel to Waibel Creek in order to reach the proposed pump station at NW Jackson School Road.

Environmental concerns including wetland impacts should be considered when constructing sanitary sewer public utilities in the vicinity of either creek.

Potential Challenges

The timing of (re)development in the Jackson East project area is linked to the construction of a pump station near Waibel Creek and NW Jackson School Road and the extension of sanitary sewer lines flowing east on an extended NW Huffman Street or along NW Evergreen Road at a higher cost. Some potential challenges for the sanitary sewer public utilities include coordination with the adjacent IRA development regarding the construction of the proposed pump station and force main, the crossing of Waibel Creek

to provide sewer service north of the Creek, as well as the construction of sanitary sewer lines adjacent to natural resource areas.

As discussed above, the proposed pump station near NW Jackson School Road and Waibel Creek could serve both the Jackson East project area as well as the IRA. Significant up-front investment is needed to construct both the pump station and the force main, from NW Jackson School Road eastward. This would also require coordination between the two planning and design efforts, as well as right-of-ways through both project areas in order to construct the forcemain.

Gravity sewer lines need to be located along to lowest points in the site. There are two drainages that run through the site, Storey Creek and Waibel Creek. Sanitary sewer lines are planned along these two drainage ways, which could potentially create impacts to natural resource areas. In addition, sewer service north of Waibel Creek would need to cross the creek. Boring under the creek could reduce the environmental impacts.

C. Stormwater

Existing project area drainage basins were delineated based on topography and receiving water, assuming overland flow patterns for the entire Jackson East area. These basins were further subdivided in a previous analysis and are shown in Figure 1. Drainage basins associated with the future development should uphold existing drainage patterns and be subdivided according to newly constructed regional and sub-regional stormwater facility outfalls into the receiving creeks.

Storm alignments will likely follow preliminary roadway alignments while also maintaining current drainage patterns to the maximum extent practicable. Drainage sub-basins may be allowed to be redirected to adjacent basins based on the new conveyance system, however plans will need to be reviewed and approved during future design and planning efforts in order to implement this type of change. Collection systems will be determined based on location and available capacity of regional treatment and detention facilities, as well as phasing of development within Jackson East.

The City is also encouraged to consider creating an incentive program for private developments that integrate Low Impact Development Approaches (LIDA) into the project area. Implementation of LIDA can alleviate impacts to downstream systems, and in many cases can help to relieve cost of construction and maintenance for regional downstream management facilities. Stormwater that is retained and/or attenuated within the project area will reduce the sizes of downstream facilities, which will also help to address the Port's concern for creating ponding that could attract wildlife that is undesirable near airport facilities. The following LID strategies have been identified by the Port as preferred stormwater management approaches in the PDX master plan, and may be applied to the Jackson East planning efforts:

- Minimize disturbance of sensitive areas;
- Minimize impact of development;
- Manage runoff from disturbed areas;

- Implement LIDA practices that do not result in standing water beyond the maximum 48-hour drawdown time or vegetation that is attractive to wildlife;
- Manage stormwater through infiltration (where feasible), which offers the following potential benefits:
 - Reduces the potential for flooding during storm events through reduced runoff volume, which can reduce the risk of operational interruptions during a storm event.
 - Reserves the existing capacity of the drainage system downstream, which provides a potential for savings in stormwater public utilities and construction costs.
 - Reduces the size of new designated stormwater conveyance system and downstream water quantity and quality control BMPs, providing a potential savings in stormwater public utilities and construction costs.
 - Facilities that are designed as flow-through facilities in areas where native soils offer little infiltration capacity, as is often the case within the City of Hillsboro, can offer some infiltration, even when most of the stormwater is collected and conveyed into the main storm system.

The proposed approach for managing stormwater, per discussions with the City of Hillsboro and CWS, is to construct regional stormwater treatment and detention facilities that would be owned and maintained by the City. For the purposes of this analysis and cost estimate, the assumption was that treatment and detention could be accomplished using a combined facility that would be able to be drained within 48 hours of inundation, and also shaped in a linear manner and planted in a way that would deter nesting of waterfowl. An assumption was also made that impacts to wetlands and other sensitive areas be avoided as much as possible (roads will cross creeks and wetlands), therefore requiring facilities to meet CWS, and in some cases federal, stormwater management standards.

Other techniques that could be considered for stormwater management include enhancements within the floodplain and natural channels. These approaches could be applied to both the Jackson East project area and IRA by creating opportunities within Waibel Creek that satisfy flow attenuation in a comprehensive manner. Water quality treatment would be provided by regional facilities and/or privately owned and maintained LIDA facilities on a development basis within each project area prior to discharging flows in the enhanced streams. These opportunities should be explored as the area plan develops to determine the types and locations of enhancements within Waibel Creek that would provide the most benefit to the surrounding area.

Encouraging land use development that reduces impervious area will reduce the need for stormwater management Low Impact Development Approaches (e.g., implementing the use of green roofs, pavers, porous surfaces.) This is to be reinforced in the Comprehensive Plan Update's stormwater goals and policies currently under development.

Potential Challenges

One potential stormwater challenge is that LIDA practices are not always appropriate in areas of Hillsboro where soils do not infiltrate at a rate that can be used to manage stormwater. Another potential stormwater challenge will be implementation of regional

stormwater collection and management systems with respect to phasing of development. If a drainage basin is completely developed in a short time frame by one developer, or within a short period of time, the associated stormwater management systems could be constructed along with that development. If a drainage basin is only partially developed, and the remaining area isn't expected to be developed for the foreseeable future, the stormwater management system may need to be phased according to the amount of development within that basin at that time but constructed in a way that allows for modifications to accommodate future expansion and development. This type of phasing can be challenging to implement due to the immediate need of a management system but potential lack of funding sources to construct the necessary facilities. The City will need to consider implementation as a part of the planning process, as well as a funding strategy for construction regional facilities as needed.

D. Other services

Parks

Parks and open space will be incorporated into the project area layout. Waibel Creek and Storey Creek border and cross the Jackson East project area. These natural areas will be a significant amenity for the area. The City of Hillsboro's 2015 Trails Master Plan envisions a system of trails, multi-use paths, on-street bike facilities, proposed trails, and parks. The Trails Master Plan includes the concept of a Crescent Park Greenway, a continuous loop around Hillsboro. The exact location of this Greenway has yet to be decided, but it will cross the Jackson East Project Area, likely along Waibel Creek. Beyond the Crescent Park Greenway offering recreation on a natural-surface trail, enhancing and restoring natural areas, managing stormwater, and being an asset for future development, a paved trail providing active transportation is being considered beside this Greenway. Active transportation is defined as any form of human-powered transportation—walking, bicycling, using strollers, wheelchairs/mobility devices, in-line skating, and skateboarding.

Emergency Services

No emergency service facilities are proposed for the project area and additional emergency services will be evaluated as development occurs.

Potential Challenges

Hillsboro Parks and Recreation has said that the acquisition of land, dedication of rights-of-way, and creation of easements for a continuous greenway can be challenging. Hillsboro Police and Hillsboro Fire have both emphasized the challenge of emergency response on smaller streets and in the absence of sufficient addressing and trail signage. Hillsboro Police has emphasized the challenge of crime prevention in new areas that have not been better designed around safety. Hillsboro Police has also said that industrial areas on the edge of the City with less activity on evenings and weekends may require patrol. Hillsboro Fire has also emphasized the challenge of emergency service provision in areas without a sufficient water supply.

V. Estimated Public Utilities and Services' Costs

This section reviews the estimated construction cost for public utilities required for the development of the Jackson East project area. Costs were primarily developed based on unit cost data from contactor bid tabulations from recent, local public utility improvement projects. It is assumed that most utilities will be located within public right-of-ways. Costs for street right-of-way acquisitions were included in the Jackson East Transportation Infrastructure Report. Costs below do not include costs of easements or right-of-ways that may be needed for public utilities located outside of street right-of-ways. Each of the estimated costs provided below include the following factors as a percentage of overall construction costs:

- 30% Contingency
- 25% Preliminary Engineering
- 5% Permitting
- 20% Construction Administration

A. Water

A conceptual level cost estimate was developed for the water public utilities required to serve the Jackson East project area. The cost estimate includes the preliminary public waterlines described above and shown in Figure 2. The estimate does not include private water systems in development parcels, water meters, check valves, or system development charges.

The total estimated cost for water public utilities is estimated to be \$9.6 million.

B. Sanitary Sewer

A conceptual level cost estimate was developed for the sanitary sewer public utilities required to serve the Jackson East project area. The cost estimate includes a pump station and the sanitary sewer force main lines; however, private on-project area sewer utilities to serve individual development project areas are not included.

CWS has expressed a desire to ultimately have one permanent pump station to serve both the IRA and the Jackson East project area. Due to its lower elevation, the logical location of such a facility would be within Jackson East near Waibel Creek and NW Jackson School Road. If industrial development begins in the IRA well ahead of development in Jackson East, an interim pump station and a permanent pump station may need to be constructed in the IRA. Because the sequence of development in the IRA and Jackson East is unknown, it is unclear whether the cost of the Jackson East pump station should be allocated to only Jackson East or between Jackson East and the IRA. The costs below show a range for sanitary sewer public utility costs. The high end of the range assumes that the full cost of the Jackson East pump station would be allocated to Jackson East. The low end of the range assumes that the cost would be allocated between the Jackson East and IRA, based on the portion of flow each area will contribute to the pump station.

The estimated cost for the sanitary sewer force main is only the portion that is located within the Jackson East project area. It is assumed that the IRA would be responsible for the cost of the force main through the IRA to the Dawson Creek trunk line. If development begins in the Jackson East project area prior to the IRA, then the upfront

costs to extend sanitary sewer service to the existing trunk in Dawson Creek trunk line would be significantly higher.

The total estimated cost for sewer public utilities is estimated to be between \$11.9 million and \$25.2 million.

C. Stormwater

Stormwater Conveyance

Storm water conveyance costs were calculated based on an estimated cost per linear foot of roadway being constructed. Costs include storm drainage pipe, manholes, and inlets. Storm water detention or treatment is not included in the conveyance costs.

The total estimated cost for storm drain conveyance is estimated to be \$7.2 million.

Basis for Detention/Treatment Facility Cost Estimation

The Jackson East Project is exploring the potential of industrial and residential uses in the project area. Clackamas County Water and Environment Services (WES) published a study of impervious surfaces as part of the Damascus area Urban Growth Boundary (UGB) expansion. The WES study analyzed the impervious area percentages of a number of neighborhoods representative of current and future development in the Damascus area. Neighborhoods that were studied include Residential C and Residential B, which are similar in density to a conceptual 4 and 7 unit/acre figure being explored for a portion of Jackson East. These neighborhoods have an estimated impervious area of 42 percent. Industrial zones were estimated to consist of 70 percent impervious area, and Commercial zones were estimated to be 50-75 percent impervious depending on the use. A summary of these findings are presented below in Table 1.

Table 1. Summary of Impervious Area Reference Calculations

Reference Source	Description	Density (units/acre)	Impervious Area (%)
Clackamas County WES	Low Density Residential	4.3	42
	Industrial	N/A	70
	Commercial	N/A	50-75

An example of land uses being explored for the Jackson East project area are listed in Table 2 alongside the impervious percentage assumed for stormwater management calculations in this plan.

Table 2. Impervious Percentage by Land Use

Land Use	Impervious Percentage
Industrial/Commercial ¹	85
Future Street	100
Existing Street	100
Low Density Residential (4.5 Dwelling Units/Acre)	45

In order to develop costs for regional treatment/detention facilities, recent extended dry basin designs were consulted to estimate a relationship between facility footprint area and contributing impervious area. Based on previous designs a ratio of 5 cubic feet per acre of impervious area applied to a 4-foot deep facility was used to estimate the pond volume needed to treat and detain flows to meet CWS standards. If development is determined to impact wetlands or other sensitive areas, SLOPES V standards will apply and facilities will likely increase in size.

For analysis purposes a minimum of one facility per drainage sub-basin was assumed, however in future analysis efforts the facility placement and availability of vertical drop would determine the number of facilities that would be necessary. A breakdown of estimated costs for stormwater treatment/detention facilities for the Jackson East area is included as Attachment A.

D. Other services

Parks

A rough cost estimate for the Crescent Park Greenway's natural-surface trail is \$1.9 million. This amount includes the construction, planning, and mitigation for the soft-surface trail, as well as acquisition of a twenty foot easement for the length of the trail. A rough cost estimate for a medium sized trailhead beside NW Jackson School Road, which includes the purchase of over an acre of land, is \$1.08 million. Costs have not been developed at this time for Jackson East project area parks and open space, nor a paved trail being considered to provide active transportation beside the Crescent Park Greenway. These costs will become available once Crescent Park Greenway Master Plan work is more refined and as the forthcoming Jackson East Subareas Master Plan better defines parks and open space opportunities.

Emergency Services

There are no costs emergency services' facilities associated with future Jackson East project area.

VI. Next Steps

This report will act as a supporting document to the Jackson East Subareas Master Plan. Upon review and decision making with stakeholders, options will be reduced and additional specificity added where appropriate.