North Santiam Sewer Authority

Wastewater Master Plan

September 2021

MID-WILLAMETTE VALLEY COUNCIL OF GOVERNMENTS

NSSA North Santiam Sewer Authority

KELLER ASSOCIATES

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NORTH SANTIAM SEWER AUTHORITY

WASTEWATER MASTER PLAN

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OREGON
NOV. 10, 2009
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EXPIRES: 12-31-2022

9/7/2021

SEPTEMBER 2021

PROJECT NO. 219126

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ACRONYMS, ABBREVIATIONS, AND SELECTED DEFINITIONS

AACE	Association for the Advancement of Cost Engineering
AADF	average annual daily flow
AAGR	average annual growth rate
ADWF	average dry weather flow
AWWF	average wet weather flow
BLM	Bureau of Land Management
BMP	Biosolids Management Plan
BOD	biochemical oxygen demand
BOD_5	5-day biochemical oxygen demand
ºC	degrees Celsius
CFR	Code of Federal Regulations
CMOM	Capacity management, Operation, and Maintenance
CWA	Clean Water Act
DEQ	Oregon Department of Environmental Quality
DMR	discharge monitoring report
DSL	Oregon Department of State Lands
DWADL	dry weather average daily load
DWMML	dry weather maximum month load
e.g.	for example *(exempli gratia)*
EGL	energy grade line
EIS	environmental impact statement
EPA	Environmental Protection Agency
EQC	Environmental Quality Commission
etc.	and the rest *(etcetera)*
FEMA	Federal Emergency Management Agency
FOG	fats, oils, and grease
ft	feet or foot
ft^2	feet squared or foot squared
gal	gallon
GIS	geographic information system
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
HGL	hydraulic grade line
hr(s)	hour(s)
i.e.	that is *(id est)*
I/I	infiltration and inflow
in	inch
Kcals	kilocalories
lb(s)	pound (s)
M	million
MBR	membrane bioreactor
MDL	maximum daily average load
MFA	Maul Foster & Alongi
MG	million gallons
MGD	million gallons per day
mg/L	milligrams per liter
mg/L	million gallon per liter
mL	milliliter
mL/g	milliliter per gallon
MMDWF	maximum monthly dry weather flow
$MMDWF_{10}$	maximum monthly dry weather flow
MMWWF	maximum monthly wet weather flow
$MMWWF_5$	maximum monthly wet weather flow
MMF	maximum month flow
mo	month
MWVCOG	Mid-Willamette Valley Council of Governments
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPV	net present value
NSC	North Santiam Canyon
NSSA	North Santiam Sewer Authority
NTU	Nephelometric turbidity units
OAR	Oregon Administrative Rules
ODEQ	Oregon Department of Environmental Quality
ODOT	Oregon Department of Transportation
O&G	oil & grease
O&M	operation and maintenance
OH&P	overhead and profit
OHA	Oregon Health Authority
ORS	Oregon Revised Statutes
ORVs	outstanding remarkable values
OSU	Oregon State University
PDAF	peak daily average flow
$PDAF_5$	peak daily average flow
pH	Hydrogen ion concentration
PIF	peak instant flow
PIF_5	peak instant flow
PLC	programmable logic controller
POC	pollutant of concern
ppcd	pounds per capita per day

ppd	pounds per day
psi	pounds per square inch
PSU	Portland State University
PVC	polyvinyl chloride
PWkF	peak week flow
RAS	return activated sludge
RIB	rapid infiltration basin
RGF	recirculating gravel-bed filter
ROW	right-of-way
RPA	reasonable potential analysis
RWUP	recycle water use permit
SCADA	supervisory control and data acquisition
SHPO	State Historic Preservation Office
STEG	septic tank effluent gravity
STEP	septic tank effluent pumping
SU	standard unit
TBD	to be determined
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TRC	technical review committee
TSS	total suspended solids
UGB	urban growth boundary
US	United States
USA	United States of America
USACE	Unites States Army Corps of Engineers
USDA	US Department of Agriculture
USDA-RD	US Department of Agriculture, Rural Development
USFS	United States Forest Service
USFWS	US Fish and Wildlife Service
UV	ultraviolet
WAS	waste activated sludge
WLA	waste load allocation
WPCF	water pollution control facility
WWADL	wet weather average daily load
WWMML	wet weather maximum month load
WWMP	wastewater master plan
WWTP	wastewater treatment plant
yr	year

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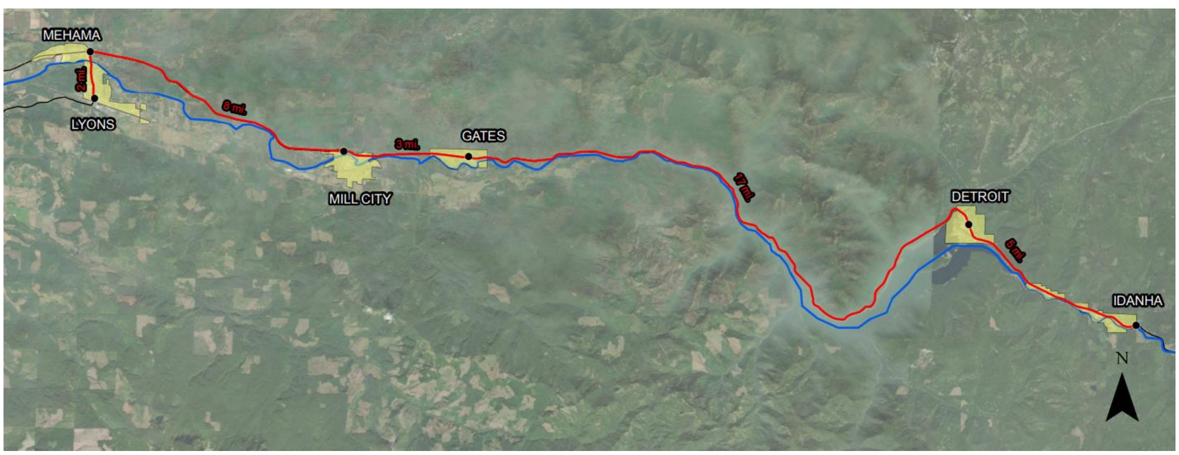
ES. EXECUTIVE SUMMARY

In 2020, Keller Associates was contracted to complete a Wastewater Master Plan for a proposed joint sewer project between Detroit, Gates, Idanha, and Mill City. This Wastewater Master Plan provides evaluation and selection of alternatives, cost estimates and details needed to guide the NSSA in providing community wastewater systems that will meet their long-term needs and be financially sustainable. This document serves as the stand-alone summary of the project engineering recommendations.

ES-1 PURPOSE AND BACKGROUND

The North Santiam Canyon (NSC) is located in Marion and Linn Counties, about one hour east of the Oregon Capitol, City of Salem. The Canyon area includes the cities of Lyons/Mehama, Mill City, Gates, Detroit and Idanha. These communities are located along State Highway 22 and serve as a gateway to the nearby Cascade mountains and North Santiam River recreation areas. Figure ES-1 shows the location of the four communities in the NSSA and the outside communities of Lyons and Mehama. Mill City, Gates, Detroit, and Idanha have a combined population of 2,730 per 2019 Portland State University population data. These NSC communities are surrounded by federal, state, and county lands which limits growth beyond their current UGB's.

FIGURE ES-1: STUDY AREA



Over the last twenty-five years, the NSC has experienced severe economic distress fueled by a sharp decline in economic activity. A reduction of employment in the timber industry has had a profound impact on the ability of local governments in the Canyon to provide essential services to their citizens.

Although the NSC has retained strength in its community roots the economic situation in the Canyon has negatively impacted the ability of families to make a decent wage and remain in the area. A lack of community facilities and ability to maintain public infrastructure among reduced populations prevents businesses from locating in the region and is forcing residents to move toward larger population centers or commute further to work.

Tourism and outdoor recreation have become an important part of the Canyon's economy as activities near Detroit Lake continue to drive and attract users from around the state. However, current wastewater infrastructure remains a limiting factor to reach the region's full economic potential and to protect the water resources of the North Santiam Watershed from widespread septic system failures. The water from this watershed serves more than 225,000 residents daily, many of which are down stream and outside the watershed such as the Oregon Capitol, the City of Salem.


Detroit Lake State Recreation Area

ES.1.1 Economic Studies

The North Santiam Canyon Economic Opportunity Study was completed in 2000 in response to the designation of the Opal Creek Wilderness and Scenic Recreation Area. The purpose of the study was to determine the best use of $15 million that were authorized to support economic development activities for the communities resulting from the transfer of the federal lands and its impact upon the area. Unfortunately, the promised funds never materialized. In 2014, the study was updated and resubmitted to the USDA with the hopes of improving the persistent conditions of economic distress.

Currently, inadequate wastewater infrastructure prevents many businesses from expanding or locating in the region. While each community has its own infrastructure constraints, they share a common constraint that originates from the Oregon Three-Basin Rule (OAR 340-041-0350). This Oregon Administrative Rule prohibits any discharge of treated wastewater to the nearby North Santiam River which would, in general, be a standard practice after appropriate treatment.

ES.1.2 Urgency Post Fires

The Beachie Creek and Lionshead fires in 2020 heavily impacted the communities in the NSC - including, Detroit, Gates, Idanha, and Mill City. The loss of residential homes and buildings has devastated an already economically distressed region.


North Santiam Canyon convenience store destroyed during 2020 fires

The wildfires caused substantial structural destruction and water infrastructure damage in the North Santiam Canyon. At last count, 720 structures were destroyed throughout Marion County and the fire spread into Linn County destroying 193 structures.[1]

The wildfires and the mass destruction created additional pressure to obtain permits for septic repairs or new septic systems for recovering business owners and residents. The permitting challenge and costs to repair or replace septic systems will likely stall the recovery process for many in the region.

[1] *OREGON OFFICE OF EMERGENCY MANAGEMENT 2020 Oregon Wildfire Spotlight*

ES.1.3 Funding

In 2021, Marion County submitted a Capital Funding Request to the Oregon Legislature on behalf of the NSSA for $50 million. The funding was approved under HB5006-A for the North Santiam Canyon Sewer Project. The initial funding request was broken down into two distinct projects; Project A: Gates/ Mill City and Project B: Interim Measures Detroit/Idanha. Additional funds will be necessary to allow for the project to remain geologically sustainable and financially viable for years to come. The recommended proposals now funded in this master plan are anticipated to fully comply with the Three Basin Rule.

It is expected a strategic combination of state and federal grants/appropriations and potentially some revenue bonds will be necessary to fully fund this project. Since the NSSA was formed under ORS 190, the organization may only seek out revenue bonds based on the services provided. Other non-traditional avenues for funding and revenue should also be pursued to narrow the ongoing annual operation and maintenance costs for this economically distressed area.

ES.1.4 Feasibility Study and Formation of the Sewer Authority

In January 2017, Keller Associates completed a Regional Wastewater Analysis for the NSC. The report recommended a comparison of alternative approaches to move forward.

Next steps included further evaluation of collection, treatment, and disposal systems. Additional recommendations advised forming a wastewater facility planning committee to review the merits of each of the governance option and provide city leaders time to consider options, create a unified vision of future wastewater facilities and services while developing a strategic plan that outlines a path forward.

The North Santiam Joint Sewer Task Force met for more than four years to make important decisions regarding the future of NSC wastewater infrastructure. In May 2020, the Parties (Detroit, Gates, Idanha, and Mill City) created the North Santiam Sewer Authority (NSSA), formed by an intergovernmental agreement under the auspices of ORS Chapter 190. The Parties agreed and acknowledged that the NSSA shall exist and operate independently from each city's own governing bodies.

ES-2 HISTORIC EFFORTS AND CURRENT WASTEWATER MANAGEMENT

Previous efforts to provide cities in the NSC with community sewer systems are documented through several historical studies. These studies have sought to determine the project's feasibility, evaluate alternatives, and perform preliminary engineering for wastewater systems designed to meet the individual needs of the communities within the NSC. A list of the key studies referenced for this master plan are listed below.

- Upper North Santiam River Canyon Sewage Treatment Feasibility Study, 1996
- Gates Sanitary Survey, 1999
- Detroit-Idanha WW Facilities Pre-Design Report 2001
- Detroit-Idanha VE Study Conceptual Design Review, 2002
- Sanitary Survey of On-Site Sewage Disposal Systems – Detroit & Idanha, 2003
- Idanha Wastewater Facility Plan Update, 2008/2009
- Mill City Wastewater O&M Manual, 2010
- Detroit Wastewater Feasibility Study, 2015
- North Santiam Canyon Regional Wastewater Analysis, 2017

Amongst the views of tall evergreen trees, surrounding mountains, and glistening bodies of water, it is not uncommon to see port-a-potties dispersed throughout the NSC. This is due, in part, to the communities of Idanha, Detroit, and Gates lacking community sanitary sewer systems. Residents and businesses in those communities rely on individually managed septic systems.

A port-a-potty on Patton St. in Detroit (Thursday, January 3rd, 2019)

In a 2003 sanitary survey, performed by the Oregon Department of Environmental Quality (DEQ), noted many of the individual systems in Detroit consist of cesspools on small lots, which do not meet existing standards or on-site sewage systems. Cities surveyed by DEQ that year in the region has a failure rate of 34-37 percent.

Mill City is the only city in the study area that operates a community sanitary sewer system. The majority of the collection and treatment systems were built in 1992. In 2009, all three collection system pump stations were replaced, as well as some treatment system components. Mill City has some urgent and immediate needs and anticipates significant investments necessary to increase capacity to handle the projected growth.

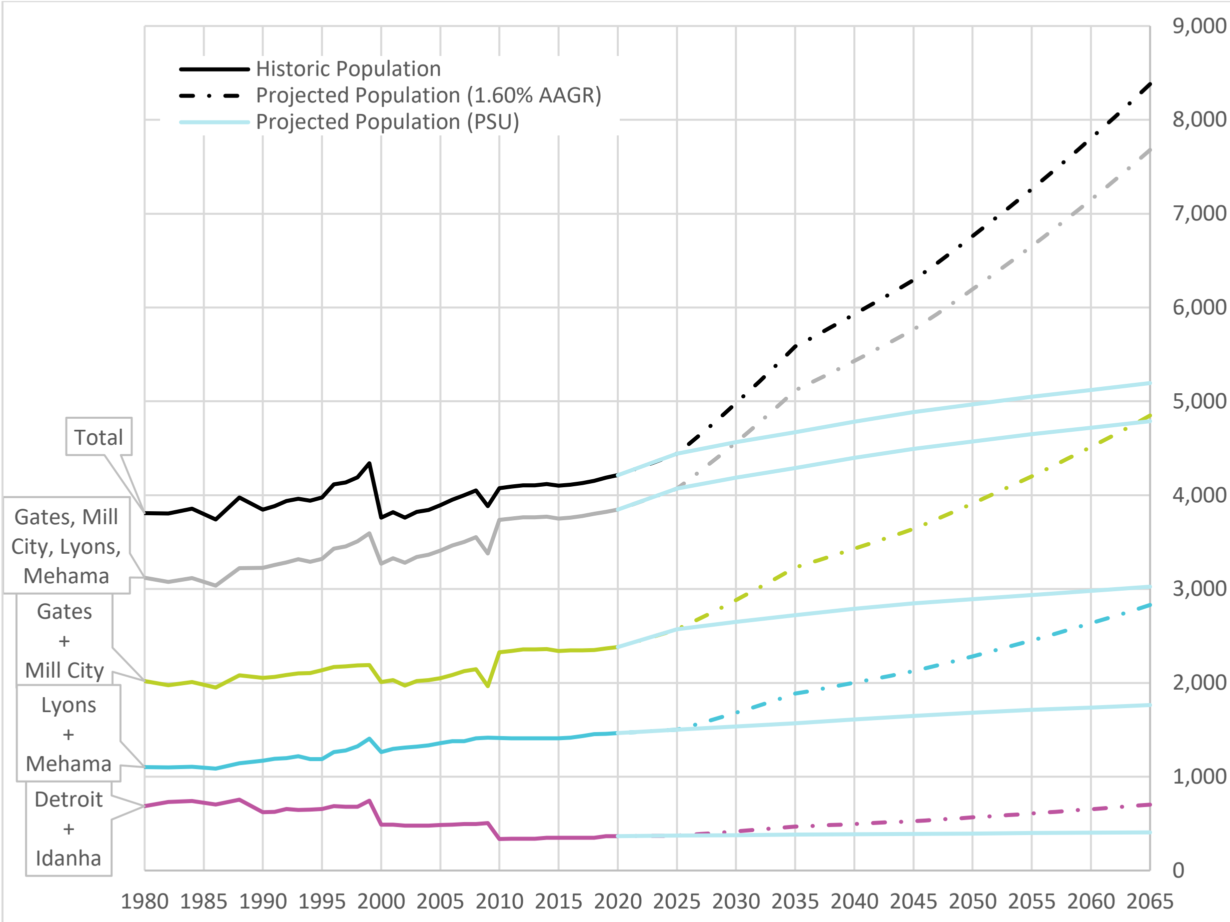
ES-3 POPULATION PROJECTIONS

Planning criteria was established to refine the details for providing community wastewater services to these four communities in the NSC. The goal for the project is to have the system be geologically suitable, environmentally sustainable, financially feasible, and politically viable.

ES.3.1 Population

Historical and projected population was retrieved from Portland State University (PSU) and a case study of the nearby city of Sisters was utilized to evaluate future growth projections and scenarios. Sisters, Oregon shares many similarities with the NSC region. The city attributes much of its rapid population growth to the construction of a community wastewater system in 2002. The Sisters case study was used to develop an annual average growth rate (AAGR) for the communities in the NSC at 1.60% as shown in Chart ES-1

CHART ES-1: PROPOSED AAGR, COMBINED SYSTEMS



ES-4 REGIONALIZATION

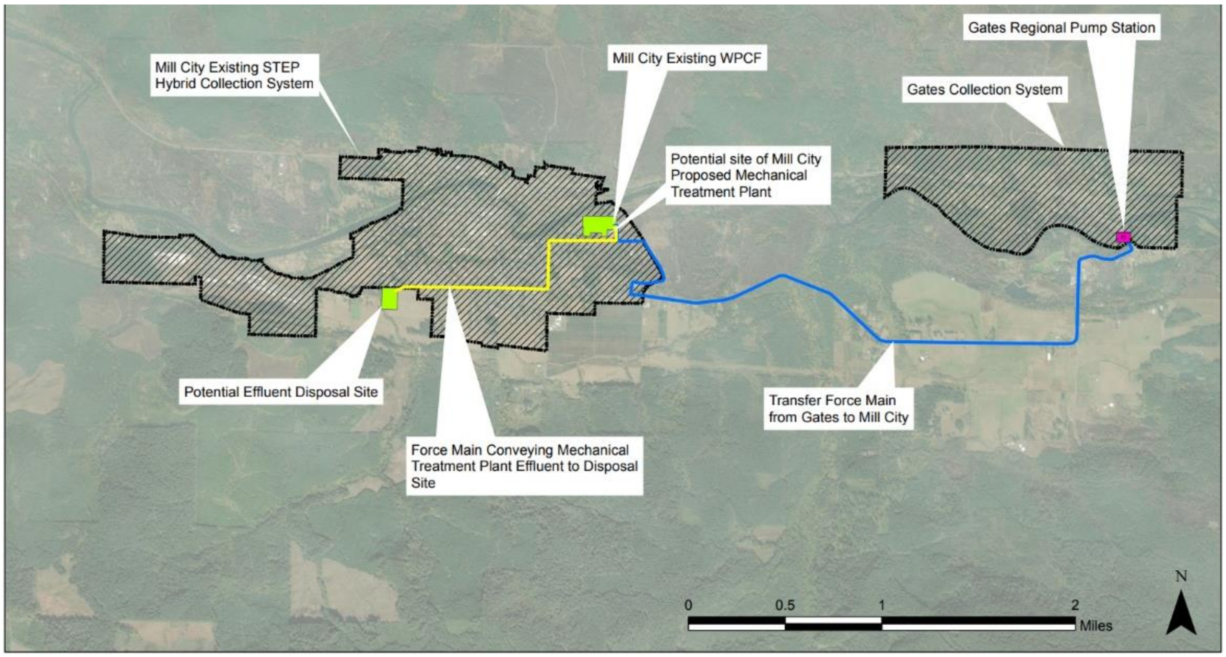
"Economy of scale" is a phrase used to explain why large facilities are usually overall less expensive to build than small facilities. The fixed costs of a project apply regardless of the size of the project. Additionally, the relationship between project size and project cost is typically not a linear one. Neglecting fixed costs, constructing a two-million-gallon water tank would still be expected to cost less per gallon than a one-million-gallon water tank. Administrative costs will also be less per customer as the number of customers increase. Because of this economy of scale, it is recommended that NSSA regionalize their wastewater treatment services. Another financial advantage of a regional wastewater facility is having *more* customers to share the burden of paying the bills.

Keller Associates recommends that the NSSA establish the two sanitary sewer basins described below.

ES.4.1 Mill City and Gates Basin

One of the two proposed basins encompasses Mill City and Gates (Figure ES-2). Wastewater flows would be collected in Gates and conveyed to Mill City via a regional lift station and force main. Wastewater flows from Mill City would combine with the incoming flows from Gates at a new mechanical treatment plant. Treated effluent at the proposed mechanical treatment plant will be disposed of, to a new rapid infiltration basin. The figure below provides an overview of the Mill City and Gates basin.

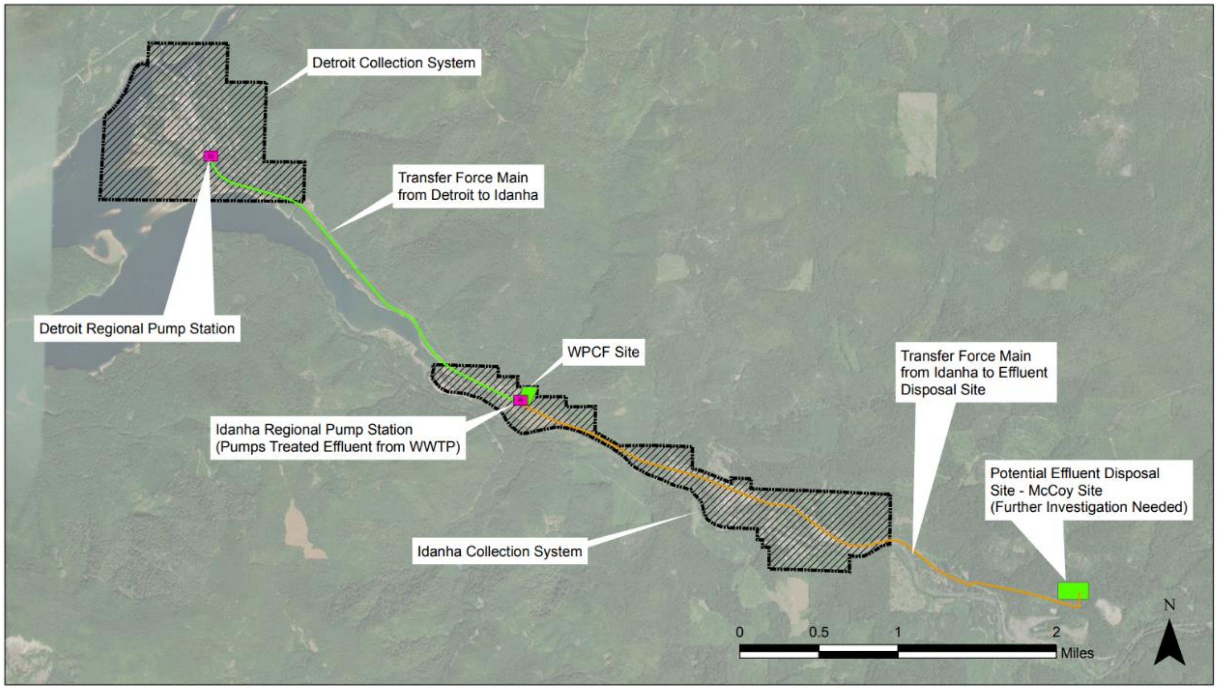
FIGURE ES-2: MILL CITY AND GATES BASIN



ES.4.2 Detroit and Idanha Basin

The other proposed basin will service Detroit and Idanha (Figure ES-3). Wastewater flows would be collected in Detroit and conveyed to Idanha via a regional lift station and force main. Wastewater flows collected from Idanha would combine with the flows from Detroit at an advanced mechanical wastewater treatment plant located near Blowout Road. Treated effluent would be disposed of at one of the three identified properties (McCoy, Ranger Station, or South Shore sites). The figure below provides an overview of the Detroit and Idanha basin.

FIGURE ES-3: DETROIT AND IDANHA BASIN



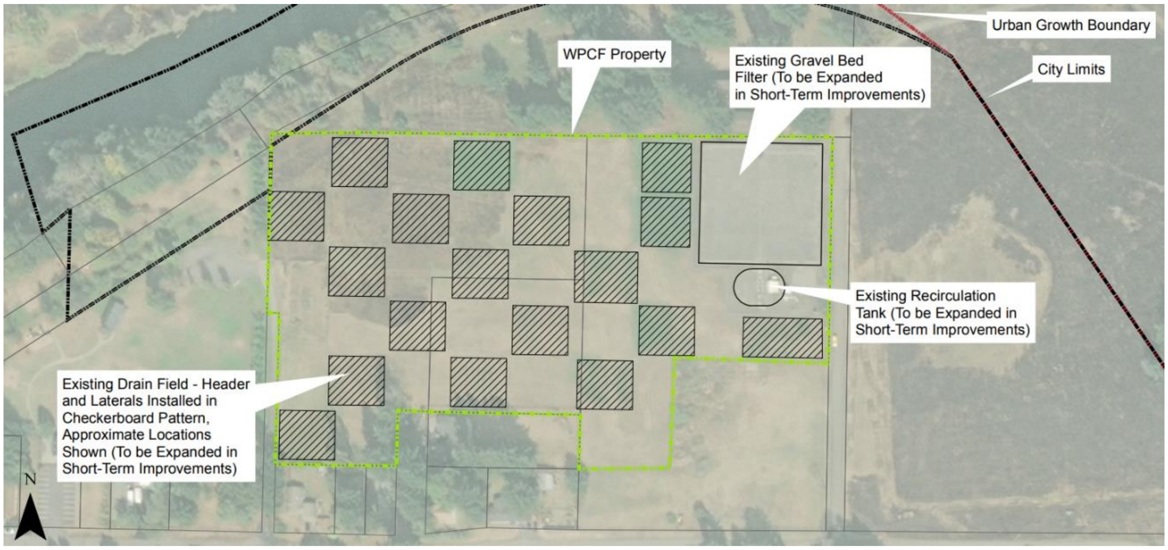
ES-5 COLLECTION SYSTEMS

Keller Associates examined the feasibility of constructing gravity and septic tank effluent pumping (STEP) collection systems in Gates, Detroit, and Idanha. The cost of a complete overhaul of Mill City's existing septic tank effluent gravity (STEG)/STEP system is tentatively estimated to cost over $15 million, making this option cost prohibitive. Instead, it is recommended that Mill City and after acquisition, the NSSA continue to operate the existing STEG/STEP system and perform upgrades and expansions, as necessary. It is recommended that the NSSA proceed with the further planning, design, and construction of gravity collection systems for Gates, Detroit, and Idanha.

ES-6 MILL CITY EXISTING SYSTEM IMPROVEMENTS

Immediate improvements are needed to address the operations and capacity of Mill City's existing water pollution control facility (WPCF). Mill City's current WPCF could expand the recirculating gravel bed filter (RGF) and the existing drain field. Because the long-term recommendation includes a mechanical treatment plant with a higher quality effluent, Keller Associates recommends that Mill City and the NSSA take steps toward developing the mechanical treatment plant in lieu of expanding the capacity of the RGF and drain field. This would prevent the sunk cost associated with the short-term improvements for expanding the RGF. This may delay the short-term expansion in Mill City but will provide a better long-term solution. A site layout of Mill City's existing WPCF is shown in Figure ES-4 below. Note that because of recent wildfires, the site proposed for WPCF expansion is currently occupied by FEMA trailers.

FIGURE ES-4: EXISITING MILL CITY WPCF



ES.6.1 Short-Term Improvements

Much of the existing equipment at Mill City's WPCF is reaching the end of its useful life. Keller Associates recommends that Mill City perform immediate improvements to short-lived assets (pumps, fans, valves, etc.). These improvements are needed to keep the WPCF treating wastewater at its current rated capacity until the new mechanical treatment plant can be operable.

ES.6.2 Capacity Expansion

Immediate improvements are needed to address the capacity of Mill City's existing WPCF. Keller Associates recommends that Mill City begin the process to develop a new mechanical treatment plant that will be consistent with the recommended scenario. Additional coordination and approval from DEQ will be required to allow for use of the existing drain field or expansion of the drain field in an interim status until a new RIB can be sited, tested, and approved by the DEQ. Due to this process and the time required, it does not provide enough of a time savings to go through the process of approving new drain field for the new mechanical treatment plant. The DEQ has indicated that moving directly to a preliminary engineering report (PER) in lieu of a Facilities Planning Study (FPS) could be acceptable given the extenuating circumstances in the canyon. The schedule presented later in this executive summary assumes some overlap but does allow for both the FPS and PER process.

ES.6.3 Interim New Connections

While the PDWWF design conditions are above the existing WPCF's capacity, it is also recommended that Mill City and the NSSA begin communications with DEQ to show that progress is being made toward a solution.

The DEQ may also allow Mill City to add new connections with the understanding and commitment that the long-term solution will be funded and implemented. Early discussions along with better details on what type of connections and how many are being requested will be required for the DEQ to provide meaningful input and make any decision.

ES-7 WASTEWATER TREATMENT

To provide the level of treatment necessary for effluent disposal in the North Santiam Canyon (NSC), Keller Associates examined the type and potential site of a treatment plant facility in each of the proposed basins.

ES.7.1 Treatment in the Mill City and Gates Basin

Keller Associates recommends the NSSA proceed with the planning, design, and construction of a new mechanical wastewater treatment plant on property adjacent to the existing Mill City WPCF. Flows from Gates and Mill City will be combined ahead of the new mechanical treatment plant. The expected performance of a mechanical treatment plant is provided in Table ES-1 below.

TABLE ES-1: EXPECTED EFFLUENT QUALITY FROM MECHANICAL TREATMENT PLANT

Contaminant	Units	Value
BOD	mg/L	<20
TSS	mg/L	<20
Ammonia	mg/L	<5
Nitrates	mg/L	<5
Turbidity	NTU	<1
E. coli	no/100 mL	<2.2

ES.7.2 Treatment in the Detroit and Idanha Basin

Keller Associates recommends flows from the Detroit and Idanha basin be treated by a new advanced mechanical wastewater treatment plant located in Idanha, near Blowout Road. The expected performance of an advanced mechanical treatment plant is provided in Table ES-2 below.

TABLE ES-2: EXPECTED EFFLUENT QUALITY FROM ADVANCED MECHANICAL TREATMENT PLANT

Containment	Units	Value
BOD	mg/L	<20
TSS	mg/L	<20
Ammonia	mg/L	<5
Nitrates	mg/L	<5
Phosphorus	mg/L	<0.3
Turbidity	NTU	<0.2
E. coli	no/100 mL	<2.2

ES-8 EFFLUENT DISPOSAL

The Three Basin Rule provides many challenges regarding effluent disposal in the NSC. Keller Associates examined several effluent disposal options including drainage fields, surface infiltration, land application, injection wells and aquifer recharge, and surface discharge to the North Santiam River with a modification to the Three Basin Rule.

ES.8.1 Disposal in the Mill City and Gates Basin

Keller Associates recommends that treated effluent from the new mechanical treatment plant be pumped through a force main to a site suitable for disposal in a rapid infiltration basin (RIB). One potential site is located outside of city limits to the southwest.

GSI's recommendations are to continue to engage with the DEQ to identify testing and regulatory requirements as well as identifying a specific site where an agreement can be agreed upon with the property owner and begin the site-specific testing and monitoring.

ES.8.2 Disposal in the Detroit and Idanha Basin

Keller Associates recommends that the Detroit and Idanha basin dispose of effluent in an RIB. Three potential sites, McCoy, Ranger Station, and South Shore require further investigation to determine their suitability as an RIB.

GSI recommends that the McCoy site should be further explored and confirmed or ruled out prior to advancing any significant additional efforts related to the other two potential sites.

ES-9 ENVIRONMENTAL PERMITTING

A summary of initial environmental permitting considerations for the proposed NSSA project are listed below. The list includes key permits, authorizations, and necessary coordination (approving agency).

- Clean Water Act 404 permit (U.S. Army Corps of Engineers [USACE])
- Clean Water Act 401 water quality certification (Oregon Department of Environmental Quality [ODEQ])
- Oregon Removal/Fill permit (Oregon Department of State Lands [DSL])
- Endangered Species Act (ESA) Section 7 consultation (U.S Fish and Wildlife Service [USFWS] and National Marine Fisheries Service [NMFS])
- Magnuson-Stevens Essential Fish Habitat Assessment (NMFS)
- Migratory Bird Treaty Act (USFWS)
- Bald and Golden Eagle Protection Act (USFWS)
- National Historic Preservation Act Section 106 consultation (Oregon State Historic Preservation Officer [SHPO]) and Tribal coordination.
- National Environmental Policy Act – there may be multiple NEPA requirements (i.e., different aspects of the project may involve federal decisions requiring NEPA and different agencies will have different needs) (U.S. Forest Service [USFS], U.S. Department of Agriculture [USDA], Oregon Department of Transportation [ODOT])
- Special Use Permit (USFS)
- Right of Way approvals (City, County, ODOT, USFS)

- Fish Passage Assessments and Approval (Oregon Department of Fish and Wildlife [ODFW])
- Air Quality Construction Permit (ODEQ)
- NPDES Stormwater General Permit (ODEQ)
- Local permits/approvals - Specific permit requirements will vary by city and/or county and according to site specific environmental and land use conditions. Examples of common permits include land use permits, zoning variances, general development permits, and floodplain development permits

It is anticipated that the project permitting may be broken up into phases if one could provide rationale that each segment had independent utility (i.e., each segment could stand alone as a single project and would be constructed absent the construction of the other segment – that is, it did not rely on the other segment to be completed). General notes regarding permitting strategy are listed below.

- Though the project may be phased by funding sources, unless segments of the project have independent utility, they will need to be permitted all together (regardless of funding phases).
- There may be opportunities to permit Mill City and Gates together and then Detroit and Idanha together (i.e., it may be possible to show independent utility for these 2 different segments of the project).
- There may also be opportunities to pursue efficiencies by preparing programmatic agreements for the entire project with various agencies. Programmatic agreements can be used for large, long-term, or frequent actions and allow an expedited review process by identifying general effects and standard mitigation measures. These could be developed collaboratively as the project proceeds. An example would be a programmatic agreement to cover NHPA Section 106 consultation for cultural resources.
- Permit applications and NEPA generally need at least a 30% design. Some permits or authorizations (e.g., 404 permit application and ESA consultation) will require more advanced design information.
- Permitting strategies depend on funding sources, timing, and scope of phases that funding enables.

Assumptions made during the formulation of the two lists above are shown below.

- USFS would require an environmental impact study (EIS) for the anticipated Special Use Permit, or land acquisition under the Townsites Act.
- An individual permit authorization under Clean Water Act Section 404 would be required.
- Biological Assessment(s) for USFWS and NMFS would be required for Endangered Species Act compliance.
- The project would be designed to avoid impacts to environmental resources wherever feasible.

- Permitting for any required mitigation is not included.
- Permitting for wastewater treatment facilities would be led by the engineering team.

ES-10 COST SUMMARY

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. As a result, the final project costs will vary from the estimated presented in this document.

The costs are based on cost estimating resources and experience with similar/recent wastewater projects and were developed based on 2021 dollars. 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 construction administrative costs.

Total capital and annual costs for the recommended treatment and disposal scenario, including the recommended collection system option is summarized in Table ES-3.

TABLE ES-3: RECOMMENDED COLLECTION, TREATMENT AND DISPOSAL COSTS

Capital Cost	Annual Cost
$106.2M	$0.44M

Total capital costs for the recommended Scenario are summarized in more detail in Table ES-4.

TABLE ES-4: COST SUMMARY

Item		Cost
MILL CITY EXISTING SYSTEM IMPROVEMENTS		
Short-Term Improvements		$176,000
MILL CITY EXISTING SYSTEM IMPROVEMENTS TOTAL		**$176,000**

MILL CITY AND GATES BASIN		
Demolition of Existing RGF Plant	$	300,000
New WPCF (Mill and Gates, 255,000 gpd)	$	5,272,000
Effluent Pressure Pipe to Infiltration Basins	$	3,750,000
Gates Collection System (Gravity)	$	10,534,000
Gates Pump Stations	$	680,000
Subtotal	**$**	**20,536,000**
General Conditions (10%)	$	2,054,000
Contractor OH&P (15%)	$	3,081,000
Contingency (30%)	$	7,702,000
General and Administrative Costs (30%)	$	10,012,000
Total Construction Cost	**$**	**43,385,000**
Land Purchase		
Easements	$	46,000
Pump Stations	$	450,000
Land for Infiltration Basins	$	1,000,000
Drainage Field for Short-Term Improvements	$	100,000
Total Land Purchase Costs	**$**	**1,596,000**

MILL CITY AND GATES BASIN TOTAL	**$**	**45,157,000**

DETROIT AND IDANHA BASIN		
New WPCF (Detroit and Idanha, 124,000 gpd)	$	5,925,000
Effluent Pressure Pipe to McCoy Site	$	2,376,000
Effluent Pump Stations to McCoy Site	$	200,000
Drain Fields For McCoy Site	$	549,000
Detroit Collection System (Gravity)	$	13,014,000
Detroit Pump Stations	$	680,000
Idahna Collection System (Gravity)	$	5,480,000
Idahna Pump Stations	$	340,000
Subtotal	**$**	**28,564,000**
General Conditions (10%)	$	2,857,000
Contractor OH&P (15%)	$	4,285,000
Contingency (30%)	$	10,712,000
General and Administrative Costs (30%)	$	13,926,000
Total Construction Cost	**$**	**60,344,000**
Land Purchase		
Easements	$	46,000
Pump Stations	$	450,000
Land at Gravel Pit	$	200,000
Total Land Purchase Costs	**$**	**696,000**

DETROIT AND IDANHA TOTAL	**$**	**61,040,000**
TOTAL (Without Mill City Short-Term Improvements)	**$**	**106,021,000**
TOTAL (With Mill City Short-Term Improvements)	**$**	**106,197,000**

ES-11 COST ASSOCIATED WITH DIFFERING

The recommendation for the collection system option and treatment/disposal scenario do not represent the least cost option. For treatment/disposal, the least cost option is not compliant with the Three Basin Rule and therefore was not deemed to be in the interest of the NSSA to pursue. Changing the Three Basin Rule would likely be time and resource intensive and would likely have significant stakeholder and public comments. The delay to the project could not be estimated.

Similarly, the collection system option selected is estimated to have a higher capital cost, yet lower annual operation and maintenance costs. After consulting with the Board to better understand their priorities and with the intention of recommending the option that represents a better long term financially sustainable scenario, the gravity collection system is the option that was selected by the board for further consideration and development. The need to limit annual O&M costs was also more apparent after the Business Case Scenario was completed by FCS Group.

ES-12 BUSINESS CASE SCENARIO

FCS Group prepared a business case scenario. The purpose of the business case scenario was to identify and test the conditions under which a new regional wastewater system in the NSC could be economically viable. It includes an explanation of the key variables that would drive financial feasibility, reasonable assumptions about those variables, and an analysis of the alternative choices available to the decision-makers whose support would be necessary. Based on their findings; the following are the recommended next steps from FCS Group.

- The development of a phasing plan for project costs.
- A year-by-year forecast of potential EDUs by phasing area, including the potential for new growth as well as reconstruction of existing homes and businesses on septic.
- Refinement of the O&M cost estimates.
- A series of policy decisions that will help narrow the range of potential sewer rates.
- Design of either a connection requirement or a package of incentives and requirements that might encourage conversion from septic to sewer, once a sewer line is within range.
- Design of requirements for sewer extensions and connections associated with new development, where there is no existing septic system.
- Continued efforts to obtain funding support from the State and Federal governments.

ES-13 POLICY DECISIONS

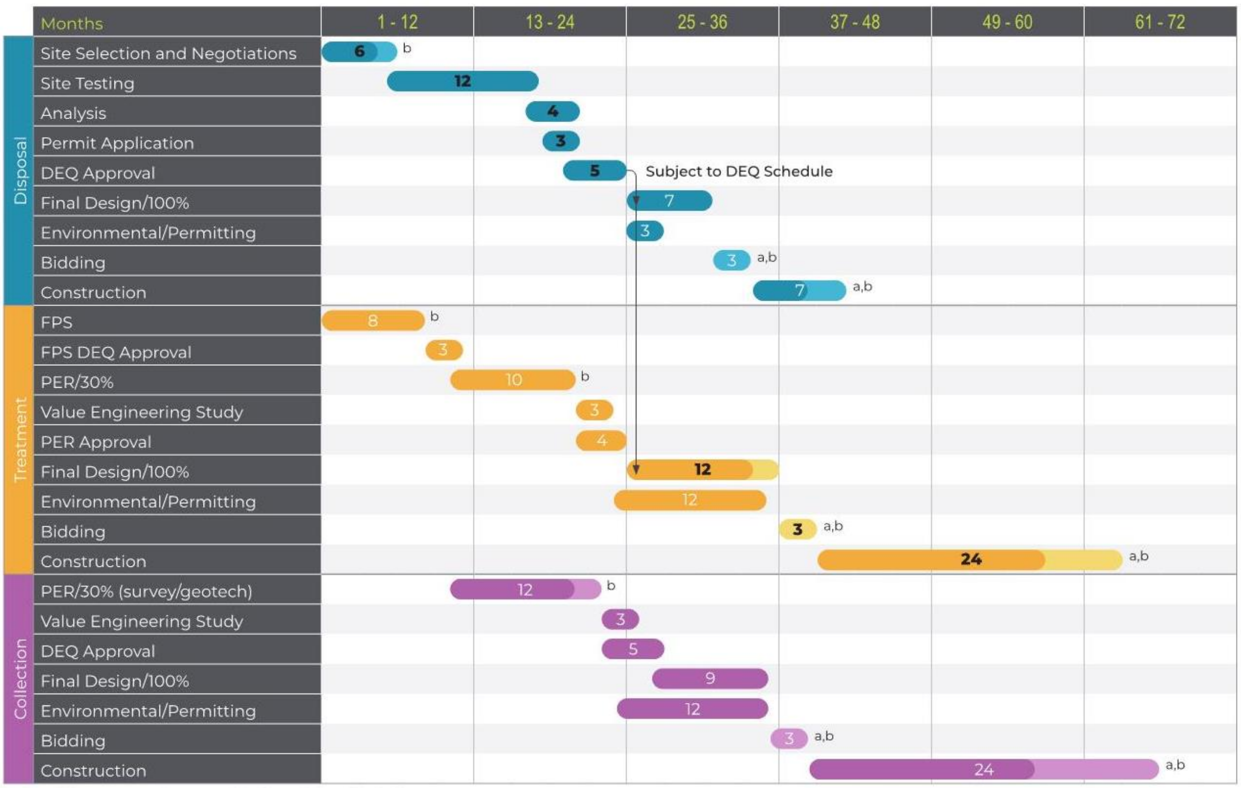
Keller Associates recommends the NSSA Board evaluate and prioritize policy decisions and create a timeline for each one. Certain policy decisions will need to be completed before the financial plan and/or engineering can be completed.

ES-14 PROJECT PHASING / PATH

Charts ES-2 and ES-3 summarize the estimated schedule for the NSSA project by treatment / disposal basin. The schedules indicate potential savings in time be compressing some project components. Many items within the schedule are out of the control of the NSSA or Keller

Associates and are the best estimates based on discussions with regulators and experience with other projects. As the project development gets closer to construction, advancing or delaying construction may be necessary depending on the typical construction season in the NSC. A Gantt chart for each basin is presented on the next two pages.

CHART ES-2: NSSA PROJECT SCHEDULE – MILL CITY / GATES



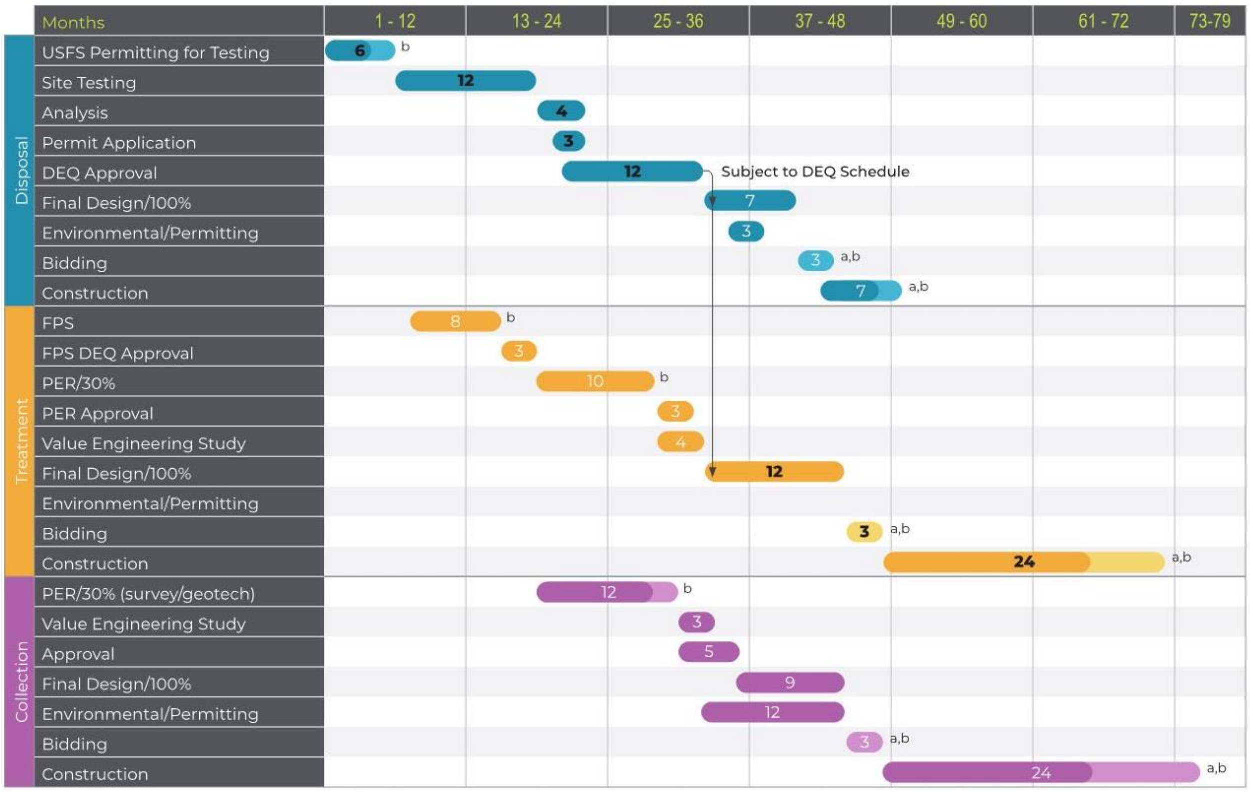
Bold Text - Indicates critical path in schedule

a = Could start earlier, compress, or eliminate this schedule item with CM/GC alternative delivery

b = Potential to compress this schedule item

= Lighter shade represents estimate of potential to compress schedule

CHART ES-3: NSSA PROJECT SCHEDULE – DETROIT / IDANHA



Bold Text - Indicates critical path in schedule

a = Could start earlier, compress, or eliminate this schedule item with CM/GC alternative delivery

b = Potential to compress this schedule item

● ● ● = Lighter shade represents estimate of potential to compress schedule

ES-15 IMMEDIATE ACTION ITEMS

In the near term the following is a list of recommended action items:

- Negotiate scope / fee for Phase 2 engineering services
  - Develop environmental permitting plan (SWCA)
  - Permitting and subsurface investigation (GSI)
  - Site specific testing, monitoring, and analysis
  - WPCF permit application support and negotiations with DEQ
  - Mill City / Gates basin Facilities Planning Study for DEQ approval
  - Mill City WPCF short term improvements
- Engage with owners of potential properties in Mill City area, select site and negotiate.
- Population growth study for PSU concurrence
- Negotiate with DEQ for interim connections to existing Mill City system
- Continue to pursue additional funding
- Business case scenario recommendations
- Evaluate key decisions
  - Requirement to connect
  - Sewer connection recommendations for rebuilding effort
  - Decommissioning of abandoned septic tanks
  - Utility easements, NSSA ownership limits
  - Purchasing of Mill City assets
  - Income / Household survey
  - Liability for sewer backups
  - Pretreatment ordinance (wastewater strength requirements)

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1. PURPOSE AND BACKGROUND

This section introduces the North Santiam Canyon (NSC), provides a brief history of challenges the NSC has experienced, and introduces current wastewater master planning efforts.

1.1 WHY THIS AREA

The NSC is located in Marion and Linn Counties, about one hour east of the capitol City of Salem. The Canyon area is 670 square miles and includes the cities of Lyons/Mehama, Mill City, Gates, Detroit and Idanha. These communities are located along State Highway 22 and serve as a gateway to the nearby Cascade mountains and North Santiam River recreation areas.

Over the last twenty-five years, the NSC has experienced severe economic distress fueled by a sharp decline in economic activity. A reduction of employment in the timber industry has had a profound impact on the ability of local governments in the Canyon to provide essential services to their citizens. Oregon Employment Department data from 1999 shows that logging, mills, and wood products (manufacturing) supported 63.5 percent of all employment in the region. Most of the industry remaining is comprised of multi-generational, family-owned companies. These mills do not have access to resources to expand operations and are unable to support the level of jobs needed to return to employment levels seen during the heights of timber production.

Although the NSC has retained strength in its community roots, dedicated volunteers, and professionals, the economic situation in the Canyon has significantly impacted the ability of families to make a decent wage and remain in the area. A lack of community facilities and ability to maintain public infrastructure among reduced populations prevents businesses from locating in the region and is forcing families to move toward larger population centers or commute further to work.

FIGURE 1-1: DETROIT LAKE STATE RECREATION AREA

Additionally, tourism and recreation use are becoming an important part of the Canyon's economy as recreational activities near Detroit Lake continue to attract users from around the state. However, current infrastructure remains a limiting factor. This project is necessary to protect the North Santiam Watershed from widespread toxic septic system failures. The water from the North Santiam River serves more than 225,000 residents daily. In addition, a sewer system will allow for economic redevelopment of existing properties, as available land is currently limited by private drain fields and accompanying septic systems.

1.2 MID-WILLAMETTE VALLEY COUNCIL OF GOVERNMENTS ECONOMIC OPPORTUNITIES STUDY

The NSC Economic Opportunity Study, found in Appendix A, was originally completed in 2000 in response to the designation of the Opal Creek Wilderness and Scenic Recreation Area. As part of an overall agreement to transfer these lands to the federal government, the legislation designated the State of Oregon with the responsibility of developing an Economic Opportunity Study to determine the best use of the $15 million authorized to support economic development activities for the communities in the area resulting from the transfer of lands and its impact upon the area. The lands were designated and taken off the tax rolls; the plan was completed and submitted to the U.S. Department of Agriculture in 2000 and unfortunately, the funds never materialized.

In 2014, the Marion County Board of Commissioners approved funding for the Mid-Willamette Valley Council of Governments (MWVCOG) to update the North Santiam Canyon Economic Opportunity Study. With the hope of improving persistent conditions of economic distress, communities in the NSC once again took the necessary steps to update and resubmit the updated plan to the U.S. Department of Agriculture. The study area consists of an approximate 670 square mile area lying within Marion and Linn Counties. The objective was to secure the $15 million in funds authorized in the original legislation and ensure the federal government lives up to its promise and to provide the region the opportunity to plan for their economic and employment needs into the future. A legacy of federal involvement and broken promises has contributed significantly to the decline of economic development opportunities in the NSC. In addition, regulatory requirements placed on the North Santiam River (Three Basin Rule) further complicate economic development in the NSC.

Currently, inadequate infrastructure and basic community facilities prevent businesses from expanding or locating in the area and creating a diverse economic base. While businesses within all five communities could benefit substantially from assistance in dealing with basic infrastructure, such as wastewater disposal, they also share the constraints established through the Oregon Three-Basin Rule (OAR 340-041-0350), which prohibits any discharge to the North Santiam River. All the cities have their own water supplies for potable water and fire protection that is limited primarily to the city limits, and all but Mill City use individual septic tanks for wastewater management.

FIGURE 1-2: OVERHEAD PORTAL CRANE BUILT IN 1993, FRERES LUMBER, MILL CITY

The most revealing characteristic of the region's economy is its relative lack of diversification. Historically, employment in the region has largely been dependent on logging, mills, and wood products. Unfortunately for the NSC communities, much of the competitive economic advantage that they historically enjoyed was the proximity to significant and productive federal timberlands in the Willamette National Forest. As access to this raw material base declined with reduced federal harvest levels and as older mills have either been closed or refitted with new labor-saving equipment, local employment has been sharply reduced.

The region's economy continues to diversify, albeit at a slow rate; and logging, wood products, and mills continue to make up a significant portion of the economy. Future economic opportunities include timber based manufacturing and natural resource industries; heritage tourism; recreation and leisure services and businesses; retail opportunities; and campgrounds that provide excellent outdoor recreation opportunities.

Challenges to economic development and growth in the area include the lack of services and facilities to support residents and tourism activity; inadequate community infrastructure to support economic development; nonexistent business diversity; low income levels and lack of employment opportunities; depressed property values and industrial properties that require clean-up (brownfield sites); absence of an updated Salem to Bend Corridor plan; and deficiency in communication between cities in the region.

Solutions that capitalize on the region's competitive advantages and assets are based around four strategic economic objectives: build the capacity of the region to attract and accommodate new job creating development by investing in public infrastructure; seek to diversify the regional economy by supporting small business development in such industries as tourism; take measures to ensure that existing vacant industrial and commercial sites with environmental problem areas are cleaned up and ready for new uses; and improve the quality of life in NSC communities by strengthening schools and other public services and by taking steps to improve the appearance of the communities.

1.3 URGENCY POST FIRES[1]

The Beachie Creek and Lionshead fires in 2020 heavily impacted the communities in the NSC including, Mill City, Gates, Detroit, and Idanha. The loss of residential homes and buildings has devastated an economically troubled community. Urgency to create stable infrastructure is higher than ever. Models compared pre-fire conditions to predicted post-fire conditions to determine relative changes and risk. There has already been significant loss of topsoil due to heavy rains immediately following the fires. The fires removed vegetation that keeps slopes and drainages intact and changed the structure and erosivity of the soil. This greatly affects the watershed and water quality in the area due to ash and burned materials being flushed through waterways. Disturbances will become less evident when vegetation is reestablished, and infiltration will be reduced over the long-term.[1]

FIGURE 1-3: NORTH SANTIAM CANYON CONVENIENCE STORE DESTROYED DURING 2020 FIRES

Oregon's Governor Brown stated that the 2020 Oregon wildfire events could be "the greatest loss of human lives and property due to wildfire in our state"[2]. Transportation through the region was closed or limited for an extended time following the wildfire. The wildfires caused substantial structure destruction and water infrastructure damage in the North Santiam Canyon. An estimated 720 structures were destroyed throughout Marion County and the fire spread into Linn County destroying 193 structures. [2]

Urgency is also called for due to the Three Basin Rule. It is challenging for residents and homeowners to get permitted for new septic tanks if their systems were damaged. This is expected to stall the recovery process for the area. Much of the infrastructure, including roadways, need to be repaired or improved, making this the ideal and most cost-effective time to

[1] *USDA BAER Reports for Beachie and Lionshead Fires: https://inciweb.nwcg.gov/*
[2] *OREGON OFFICE OF EMERGENCY MANAGEMENT 2020 Oregon Wildfire Spotlight*

undertake the large wastewater project. If wastewater challenges are not addressed in a timely fashion, the cities in the NSC will continue to experience significant revenue loss from a decrease in the taxpayer base, in-turn threatening the economic viability of these communities.

1.4 MARION COUNTY FUNDED

Marion County on behalf of the North Santiam Sewer Authority (NSSA), submitted a Capital Funding Request to the Oregon Legislature for $50 million for continued work on the North Santiam Canyon Sewer Project. To phase the proposed work and address different challenges in complexity between each basin, the request was broken down into two projects, Project A and Project B. The proposal fully complies with the Three Basin Rule and accelerates the immediate work on the North Santiam Sewer Project. The Oregon Legislature approved HB 5006 A in the last few days of the long session which provides Marion County $50 million for the North Santiam Sewer Project.

Project A: Cities of Gates and Mill City: $40 million to provide new sewer infrastructure for the cities of Gates and Mill City. The project will provide Mill City with a new wastewater treatment and disposal system, and provide a new collection system for Gates, with treatment and disposal at the Mill City facilities. It is imperative for this project to commence immediately for the rebuilding and recovery of the City of Gates.

Project B: Cities of Detroit and Idanha: $10 million for interim septic measures and further engineering and testing. While additional time will be necessary for groundwater sampling, and testing, engineering design and property challenges, Marion County sought interim funding for homeowners and business septic system grants for Detroit and Idanha. These grants are intended to purchase and install geologically suitable septic systems as they begin to rebuild in their communities. In addition, funding will be used to evaluate and engineer an environmentally sound solution for the future Detroit and Idanha Sewer System.

1.5 ADDITIONAL FUNDING

Further funding opportunities must be pursued to minimize the annual system costs for these economically distressed areas. Funding wastewater projects is especially challenging for small communities, defined as having a population of 10,000 or fewer (Mill City, Gates, Detroit, and Idanha having a combined population of 2,730 per 2019 Portland State University population data). A combination of state and federal grants/appropriations and potentially revenue bonds will be necessary to fund this project. Since the NSSA was formed under ORS 190, the organization may only seek out revenue bonds based on the services provided. Outside of bonds or traditional loans, publicly owned wastewater utilities in Oregon have four primary sources of public funds available to them, described below. The goal for the NSSA sewer system is to acquire sufficient funding to ensure that the annual payment amount from each residential user does not exceed 1.4% of the median household income.

- Oregon Department of Environmental Quality
    - DEQ administers the Clean Water State Revolving Fund, which provides below market rate loans to public agencies for preparing planning and environmental review documents, design and construction of wastewater facilities and other water quality improvement design and construction projects. DEQ offers initial assistance for communities who need technical guidance or are in the early stages of planning a wastewater treatment facility.

- Business Oregon
  - Business Oregon administers the federal Housing and Urban Development Community Development Block Grant program for "non-entitlement areas," meaning cities with fewer than 50,000 people and counties with fewer than 200,000, within Oregon, as well as the Oregon Lottery-funded Water/Wastewater Financing and Special Public Works Fund grant and loan programs. These programs can finance preparation of planning and environmental review documents; however, Business Oregon focuses on post-planning projects that are ready for design and construction. Business Oregon hosts financing meetings called One Stops that connect communities with shovel ready projects to financing agencies.
- United States Department of Agriculture USDA-RD
  - United States Department of Agriculture USDA-RD administers several loan and grant programs focused on constructing and upgrading needed public and private nonprofit utility systems, including wastewater systems in small rural communities of fewer than 10,000 people.
- Rural Community Assistance Corporation
  - Rural Community Assistance Corporation is a private nonprofit organization that provides training and technical assistance with funding through the national Rural Community Assistance Partnership. This agency is designated a Community Development Financial Institution by the U.S. Department of Treasury and can provide low-interest loans for projects. Financing can cover feasibility and pre-development expenses to meet USDA-RD's requirements.

These organizations require the submittal of an appropriate planning document as a condition of funding. Additionally, DEQ's Clean Water State Revolving Fund, USDA-RD, and Rural Community Assistance Corporation require an environmental review to comply with the National Environmental Policy Act or the Clean Water State Revolving Fund's State Environmental Review Process. Non-traditional avenues for funding and revenue should also be pursued to narrow limit the annual costs for this economically distressed area.

1.6 INITIAL WASTEWATER REGIONALIZATION FEASIBILITY STUDY

In January 2017, Keller Associates completed a Regional Wastewater Analysis for the NSC, which can be found in Appendix B. The lack of community wastewater systems in Idanha, Detroit, Gates, Mehama and Lyons and the need for upgrades to Mill City's wastewater system were identified as limiting factors to economic and community development in the area. The distressed nature of the communities along with the challenge of designing a system in compliance with the "Three Basin Rule" have proven cost prohibitive and the report recommends a comparison of alternative approaches to move forward. Additionally, interviews to gather community-specific perspectives were conducted as well as stakeholder meetings and meetings with Marion County officials.

Data was gathered, analyzed and alternatives were presented to stakeholders. The final recommendations of the report concluded the best approach consists of new collection systems for each community except for the existing Mill City collection system, new treatment plants in

Idanha (Idanha/Detroit), Gates (Gates/Mill City), and Lyons (Lyons/Mehama), and disposal systems for each treatment plant at or near the same site for each treatment plant.

Next steps included further evaluation of collection, treatment, and disposal systems. Additional recommendations advised forming a wastewater facility planning committee prior to selecting any preferred option for governance. This committee and the effort to form the committee should be led by Marion County. It recommended that the committee review the merits of each of the governance options.

This committee was recommended to give city leaders in the NSC time to consider options, create a unified vision of future wastewater facilities and services and develop a strategic plan that outlines a path forward. A wastewater facilities planning committee composed of local officials can also demonstrate to state and federal funding agencies that there is agreement on the need for the proposed projects and a desire to obtain funding for wastewater facilities in the NSC.

1.7 NORTH SANTIAM SEWER AUTHORITY GOVERNANCE

The North Santiam Joint Sewer Task Force met for more than four years to make important decisions regarding the future of NSC infrastructure. The Parties (Mill City, Gates, Detroit, and Idanha) created the NSSA, formed by an intergovernmental agreement under the auspices of ORS Chapter 190, specifically ORS 190.00, and declare that it will be known as the North Santiam Sewer Authority (NSSA). The Parties agreed and acknowledged that the NSSA shall exist and operate independently from each Parties' governing bodies.

1.8 CONCEPT OF APPROACH

Wastewater is typically collected through gravity collection systems; however, some cities in Oregon have elected to construct, operate, and maintain alternative collection systems. Given the unique situation experienced in the NSC, a variety of collection system options must be considered. Any wastewater will have to receive a high level of treatment through a water pollution control facility (WPCF). Through extensive conversations with Oregon Department of Environmental Quality (DEQ), it was determined that any change to the Three Basin Rule is extremely unlikely. As such, effluent treated at the WPCF must be disposed of in a method that is compliant with the existing Three Basin Rule.

1.9 WHAT WILL BE IN THIS MASTER PLAN AND WHAT WILL NOT

In 2020, Keller Associates was contracted to complete a Wastewater Master Plan for a proposed joint sewer project between Mill City, Gates, Detroit, and Idanha. This Wastewater Master Plan provides refined costs and details needed to guide the NSSA in evaluating and selecting alternatives to meet the long-term needs of the communities in the NSC.

Planning criteria was established to refine the details of providing community wastewater services to these four communities in the NSC. A case study of the nearby city of Sisters was evaluated to better understand future growth projections and scenarios. Considerations for the Three Basin Rule were thoroughly examined, and council was sought from regulatory agencies. Several Three Basin Rule compliant effluent disposal options were evaluated. This Master Plan also includes conceptual collection system layouts and a discussion of the varying types of collection systems. System scenarios are summarized, costs estimated, and an evaluation of pros/cons, resulting in recommendations for moving forward. This Master Plan also included a communication and public outreach section summarizing the extent of public involvement that went into the plan. The

Summary of Recommendations lays out the logic and process for the choices made and is broken down into collection, treatment, and disposal – all items that can be independent of one another. Cost summaries and project phasing recommendations are included in the report.

This master plan does not include final planning and design data for the aforementioned options. This information will be finalized in subsequent facilities planning studies and preliminary engineering reports.

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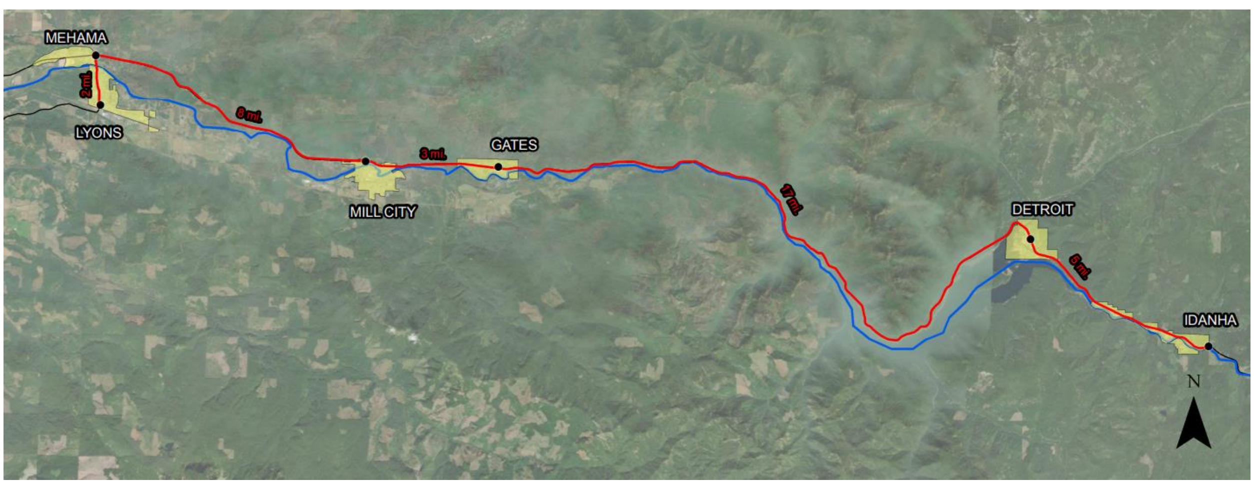
2. INTRODUCTION TO THE STUDY AREA

This chapter provides an overview of the study area, which includes Mill City, Gates, Detroit, Idanha, and pipeline corridors between each of the cities. The City of Lyons and the unincorporated community of Mehama are currently not included in the North Santiam Sewer Authority (NSSA). However, their proximity to Mill City may lead to their future involvement in the NSSA. For this reason, they are included in population projections and occasionally referenced throughout this report.

2.1 LOCATION

From west to east, the study area spans from Mill City to Idanha. Mill City is located approximately 33 miles east of the City of Salem (along State Highway 22). The travel distance from Mill City to Idanha is approximately 25 miles. The communities are all located within the narrow canyon of the North Santiam River. Both sides of the canyon, and portions of the canyon floor, are covered with dense coniferous forests. The canyon is surrounded by federal, state, and county public lands. The topography of the study area generally slopes down to the west following the flow of the river. Figure 2-1 shows the location of the four communities in the NSC including Lyons and Mehama.

FIGURE 2-1: STUDY AREA



Figures 2A through Figure 5E in Appendix C present the zoning, topography and floodplain, soil designation, wetlands, and above ground cultural resources for each community within the study area.

2.2 PORTLAND STATE UNIVERSITY POPULATION DATA

Historical population estimates from 1982 to 2019 were documented by retrieving Population Reports from Portland State University (PSU) published in 2019, 2009, 2000, and 1994. Population forecasts were retrieved from the most recent certified PSU Population Forecast available, which was updated in 2017 for all incorporated communities in the study area. The population forecasts are for 2020 through 2065.

PSU only produces population estimates for incorporated cities. Mehama census data was retrieved from 2010 and 2000. Population estimates for Mehama were produced by assuming the same percent rise and fall as the neighboring City of Lyons. The population data from PSU is shown for each community in graphic form (Chart 2-1) and tabular form (Table 2-1). The total trend line is a summation of all six communities.

CHART 2-1: PSU POPULATION DATA

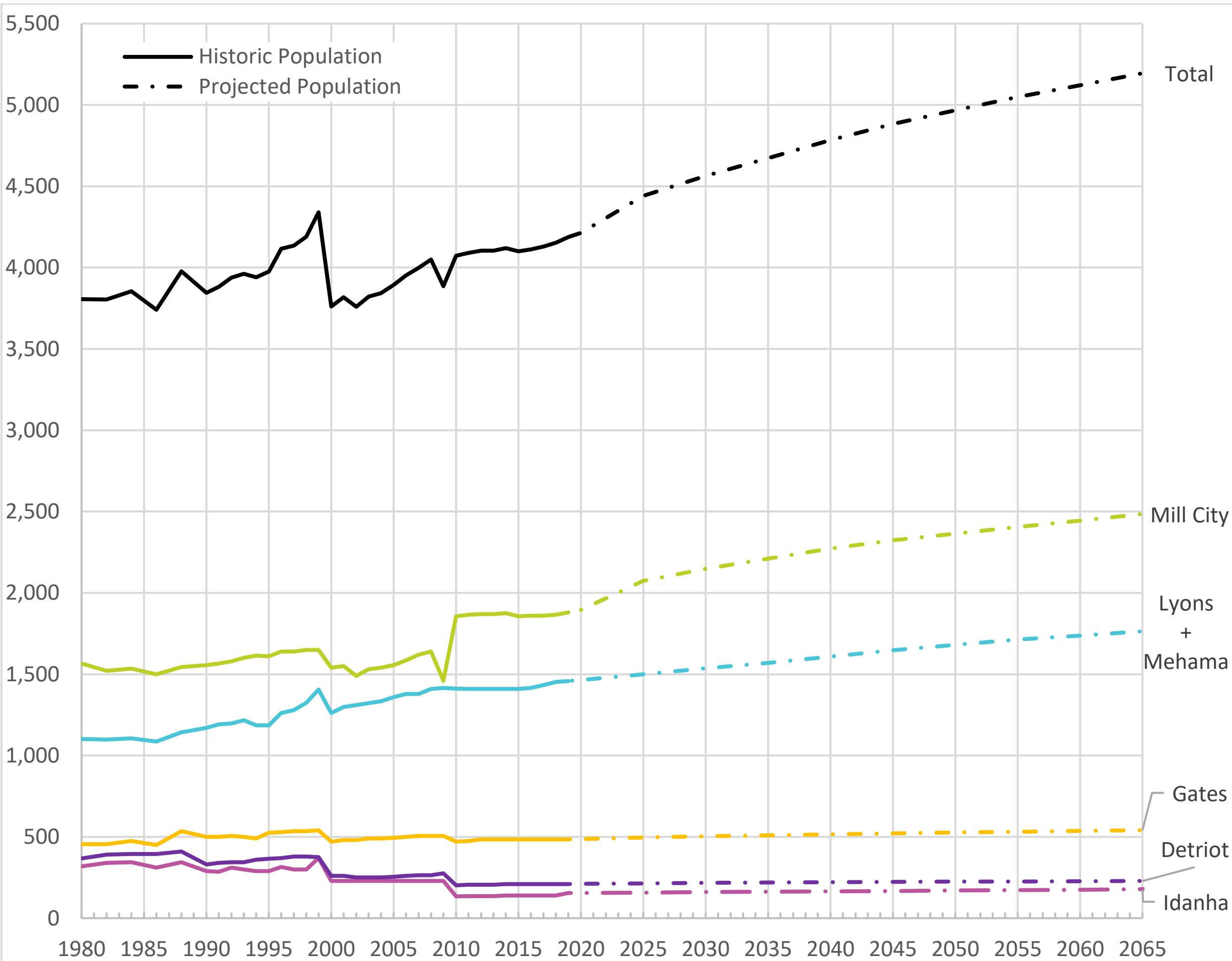


TABLE 2-1: PSU POPULATION DATA

	Detroit	Gates	Idanha	Mill City	Lyons + Mehama	Total Study Area
Year	Pop.	Pop.	Pop.	Pop.	Pop.	Pop.
2065	**228**	**541**	**178**	**2,484**	**1,763**	**5,195**
2060	227	536	175	2,445	1,737	5,121
2055	226	532	173	2,406	1,713	5,049
2050	224	527	170	2,365	1,680	4,967
2045	**223**	**522**	**168**	**2,324**	**1,648**	**4,884**
2040	221	516	165	2,273	1,609	4,783
2035	**219**	**510**	**163**	**2,210**	**1,570**	**4,672**
2030	217	503	160	2,148	1,536	4,564
2025	**214**	**496**	**158**	**2,075**	**1,500**	**4,442**
2020	211	487	155	1,894	1,465	4,212
2019	210	485	155	1,880	1,458	4,188
2018	210	485	140	1,865	1,452	4,152
2017	210	485	140	1,860	1,434	4,129
2016	210	485	140	1,860	1,416	4,111
2015	210	485	140	1,855	1,410	4,100
2010	202	471	134	1,855	1,411	4,073
2005	255	495	230	1,555	1,359	3,894
2000	260	470	230	1,540	1,261	3,761
1995	365	525	290	1,610	1,186	3,976
1990	331	499	289	1,555	1,171	3,845
1982	390	455	340	1,520	1,099	3,804
1980	367	455	319	1,565	1,101	3,807

A regional approach may facilitate the development of greater economies of scale compared to an alternative option of providing each community with an individual system. Given the geographic locations of each community, the most likely combinations based on proximity are as follows: (1) Idanha and Detroit; (2) Gates and Mill City; and (3) Lyons and Mehama. PSU population data for the combinations are illustrated in Chart 2-2 and Table 2-2.

CHART 2-2: PSU POPULATION DATA, COMBINED SYSTEMS

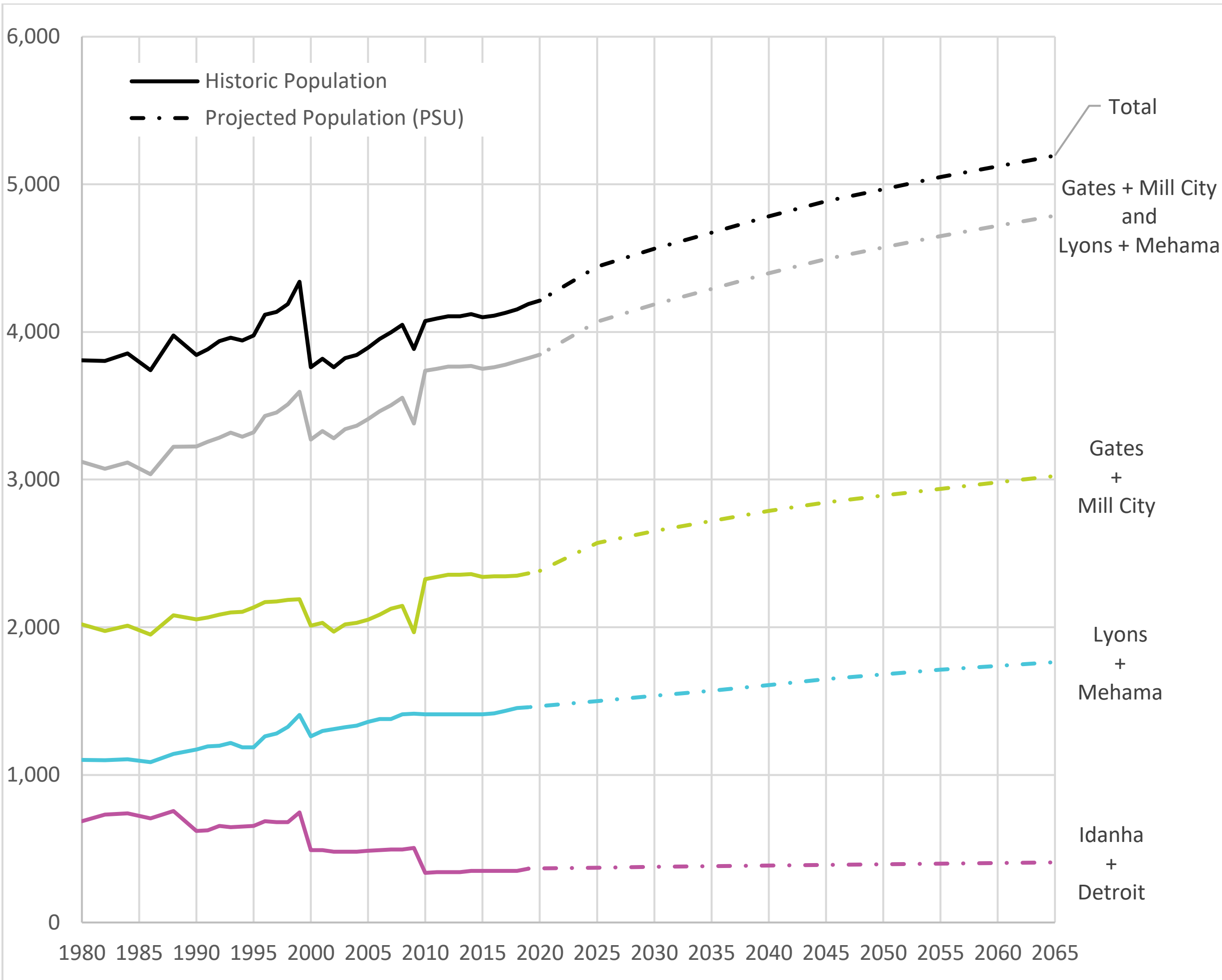


TABLE 2-2: PSU POPULATION DATA, COMBINED SYSTEMS

	Idanha + Detroit	Gates + Mill City	Lyons + Mehama	Lyons + Mehama and Gates + Mill City
Year	Pop.	Pop.	Pop.	Pop.
2065	**406**	**3,025**	**1,763**	**4,788**
2060	402	2,981	1,737	4,719
2055	399	2,937	1,713	4,650
2050	395	2,892	1,680	4,572
2045	**390**	**2,846**	**1,648**	**4,494**
2040	386	2,788	1,609	4,397
2035	**382**	**2,720**	**1,570**	**4,290**
2030	377	2,651	1,536	4,187
2025	**372**	**2,570**	**1,500**	**4,070**
2020	366	2,381	1,465	3,846
2019	365	2,365	1,458	3,823
2018	350	2,350	1,452	3,802
2017	350	2,345	1,434	3,779
2016	350	2,345	1,416	3,761
2015	350	2,340	1,410	3,750
2010	336	2,326	1,411	3,737
2005	485	2,050	1,359	3,409
2000	490	2,010	1,261	3,271
1995	655	2,135	1,186	3,321
1990	620	2,054	1,171	3,225
1982	730	1,975	1,099	3,074
1980	686	2,020	1,101	3,121

In Section 5 – Planning and Design Criteria, populations are projected using a custom average annual growth rate (AAGR) that accounts for an increase in growth due to the construction of a community sewer system. This AAGR is developed by examining the City of Sisters, Oregon, and Deschutes County as a case study.

2.3 ENVIRONMENTAL RESOURCES AND VALUES OF THOSE RESOURCES (VALUE OF WATER DOCUMENT)

An inventory of existing environmental resources was compiled to consider the environmental impacts of this master plan. The factors analyzed in this section include land use/prime farmland, floodplains, wetlands, cultural resources, coastal resources, and socio-economic conditions.

2.3.1 Land Use

Property zoning for each community in the study area is shown in Figures 2A, 3A, 4A, and 5A in Appendix C. Most of the property within the NSC communities is zoned for residential uses. There is some commercial zoning, mainly along North Santiam Highway 22. Most of the communities also have a small amount of farming/agricultural, industrial, and public zoning as well. A summary of the land use in the study area is summarized in Table 2-3 below.

TABLE 2-3: SUMMARY OF NSC LAND USE

	Detroit		Gates		Idanha		Mill City	
Zone Designation	Acres	% of Total	Acres	% of Total	Acres	% of Total	Acres	% of Total
Commercial	29.5	10.4%	30.7	8.9%	151.5	35.5%	78.1	10.1%
Industrial	---	---	21.5	6.3%	68.1	16.0%	207.6	26.8%
Residential	193.3	68.1%	287.3	83.8%	185.0	43.4%	375.2	48.4%
Public	60.9	21.5%	---	---	4.5	1.1%	73.7	9.5%
Planned Development	---	---	---	---	---	---	14.7	1.9%
Urban Transitional	---	---	3.4	1.0%	---	---	7.0	0.9%
Farm/Agricultural	---	---	---	---	---	---	11.9	1.5%
Forest Conservation and Management	---	---	---	---	17.4	1.1%	6.9	0.9%
Total Acreage	283.7	---	342.9	---	426.5	---	775.0	---

2.3.2 Floodplains

The Federal Emergency Management Agency (FEMA) publishes flood insurance studies that classify land into different flood zone designations. As shown in Figures 2B, 3B, 4B, and 5B (Appendix C), some portions of the study area are located inside the 100-year and 500-year floodplains of the North Santiam River and some of its tributary creeks.

2.3.3 Wetlands

The Oregon Department of State Lands (DSL) keeps an inventory of the local wetland inventories created for areas in Oregon. Two communities in the study area were listed on DSL's website. Detroit has a pending local wetland inventory at this time and Mill City had a wetland inventory approved on 12/16/2011. Wetland delineation was not within the scope of this project, so the U.S. Fish and Wildlife National Wetlands Inventory was used to determine the wetland areas that could potentially be impacted. The map of delineated wetlands from the National Wetlands Inventory is shown in Figures 2C, 3C, 4C, and 5C (Appendix C).

2.3.4 Cultural Resources

The State Historic Preservation Office (SHPO) maps above-ground cultural resources on their website. Maps developed from the SHPO website for each community are shown in Figures 2D, 3D, 4D, and 5D (Appendix C). SHPO also keeps track of underground cultural resources. They only provide information from their database to professional archaeologists, with one exception. They will provide information for small project areas if provided the complete legal description of the project location, a United States Geological Survey (USGS) map of the project area, and a description of the project and ground disturbance. SHPO should be consulted as part of the environmental / design process of any proposed recommendation.

2.3.5 Biological Resources

The Bureau of Land Management (BLM) lists the endangered, threatened, and sensitive species for districts in the state. The communities in the NSC lie within the BLM's Northwest Region.

Species listed as federally threatened or federally endangered in this region include Marbled Murrelet, Streaked Horned Lark, Northern Spotted Owl, Coho Salmon, Steelhead, Chinook Salmon, Pacific Eulachon, Bull Trout, Golden Paintbrush, Willamette Daisy, Water Howellia, Bradshaw's Desert Parsley, Kincaid's Lupine, Nelson's Checkermallow, Taylor's Checkerspot, Fender's Blue Butterfly, and the Oregon Silverspot Butterfly. Additionally, the communities of Idanha and Detroit are surrounded by the Willamette National Forest. The Forest Service maintains a Special Species Status List, which includes federally threatened, endangered, and sensitive species. One additional species appears on this list that is not on the federal list, the Oregon Spotted Frog.

2.3.6 Water Resources

The communities within the NSC have an abundance of surface and groundwater resources. The largest surface water resource is the North Santiam River itself, stretching 92 miles from its origin high in the Cascade Mountains to where it joins the South Santiam River just south of Jefferson. The North Santiam River basin drains approximately 766 square miles of land; and serves as a drinking water source, wildlife habitat, and recreation area. The North Santiam River provides the source water for more than 225,000 people per day, with most of those users located downstream of the canyon communities and outside of the North Santiam River watershed. The North Santiam River basin is subject to the Three Basin Rule (OAR 340-041-0350), which currently prohibits new surface wastewater discharge permits. The National Parks Service classifies the North Santiam River as a scenic river and has Outstandingly Remarkable Values (ORVs) for scenery, recreation, and fish.

The Lyons-Mehama Water District and the City of Gates both use the North Santiam River as their primary drinking water source. Mill City historically used the North Santiam River as its sole drinking water source until it switched to two groundwater wells within the city limits in 2005. Both wells are subject to a wellhead protection area that will need to be considered in all future developments. The City of Detroit uses its Mackey Creek Intake #1 as its primary source from October through April/May, and the Breitenbush River for supplemental flows when Mackey Creek's flows decrease during the summer months. Mackey Creek and Breitenbush River are a part of the upper North Santiam River watershed. Both streams are part of the upper North Santiam River watershed. The City of Idanha uses Chittum Creek, Mud Puppy Creek, and Rainbow Creek as its sources, all three of which are part of the upper North Santiam River watershed.

The North Santiam River subbasin is part of the Willamette Basin Total Maximum Daily Load (TMDL) that was approved by the EPA on September 29, 2006 and administered by the Oregon Department of Environmental Quality (DEQ). None of the NSC communities are currently required to manage for the TMDL. Chapters 4 and 8 of the TMDL pertain to the North Santiam subbasin and describe the methodology of developing the temperature TMDL for the rivers within the subbasin. The temperature criteria for the North Santiam River are shown in Table 2-4 below:

TABLE 2-4: WILLAMETTE BASIN TMDL TEMPERATURE CRITERIA

River Mile	Season	Criteria
0 to 10	September 1 - June 30	Spawning: 12.8 °C
10 to 26.5	September 15 - June 30	Spawning: 12.8 °C
0 to 10	Summer	Rearing: 17.8 °C

*All river miles in the table are downstream of the City of Stayton

2.3.7 Coastal Resources

There are no coastal areas within the study area.

2.3.8 Socio-Economic Conditions

The population in Marion County is primarily (81.3%) Caucasian, according to the 2019 ACS 5-Year Estimates Data Profiles. Hispanic or Latino is the second most common, making up 26.6% of the population. The County median household income is $59,625. The population in Linn County is primarily (89.6%) Caucasian, according to the 2019 ACS 5-Year Estimates Data Profiles. Hispanic or Latino is the second most common, making up 9.1% of the population. The County median household income is $55,893. It is anticipated that income in the communities in the NSC falls well below the county-wide median household income.

2.3.9 Miscellaneous Issues

Other environmental resources considered were air quality and soils. The study area is not located in an area designated as an air maintenance or nonattainment area by DEQ. Soils maps are provided in Figure 2E, 3E, 4E, and 5E (Appendix C); soils in the Detroit and Idanha area are generally cryic cold soils. Further west, around Gates, Mill City, Lyons, and Mehama, soils are typically loams but can vary widely.

2.4 GROWTH CONSTRAINTS

Population is generally a considerable constraint on economic growth. In the case of the NSC communities, population is growing slowly or, depending on the community, declining. New residential developments are hindered by minimum lot sizes needed to facilitate the construction of privately owned, on-site septic systems. The aforementioned population growth and minimum lot size also hinders the desire to develop new commercial or industrial facilities in the NSC. The only city in the study area with an existing community sanitary sewer system, Mill City, is experiencing challenges with allowing new construction because the existing water pollution control facility is nearing capacity. While Marion County has experienced population growth, communities in the NSC without a sewer system have experienced a stagnation in population growth.

2.5 DESIRE TO ADD HOUSING, TOURISM

The capacity to develop additional housing in NSC is desired to allow new residents to move in, promote economic growth, and recover from recent wildfires. The study area surrounds one of four major highways that connect the Interstate 5 corridor to central Oregon. As seen in the Sisters population case study (See Section 5.2), central Oregon has experienced rapid population growth and is known for attracting a large number of tourists. Additionally, Detroit Lake, and the North Santiam River, hold high outdoor recreational value and attract tourism. Additional development in the NSC is desired to allow Oregonians to enjoy the high recreational value of the canyon, provide a desirable stop halfway in between Salem and Bend, and attract additional tourism. Many of the surrounding federal, state, and county public lands have restroom facilities available to tourists. These agencies have expressed interest in connecting their facilities, where feasible, to the proposed sewer system. Further discussion and coordination with these governing bodies can be referenced in Chapter 12.

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3. PREVIOUS REPORTS

Efforts to provide cities in the North Santiam County (NSC) with community sewer systems are documented through several historical studies. These studies have sought to determine the project's feasibility, evaluate alternatives, and perform preliminary engineering for wastewater systems designed to meet the individual needs of the communities within the NSC. This chapter provides summaries of the various reports and their outcomes. A flow chart of historical reports that have preceded the development of this master plan can be found in Figure 1 (Appendix C). References to each of these historical studies are included in Appendix D.

3.1 HISTORICAL REPORT SUMMARIES BY LOCATION

Descriptions of each historical study are grouped by location and presented below.

3.1.1 Detroit/Idanha

Upper North Santiam River Canyon Sewage Treatment Feasibility Study, 1996 (Curran-McLeod, Inc., Consulting Engineers with Riverside Engineering Company and David Newton & Associates)

This 1996 study examined the feasibility of a combined sanitary sewer system designed to serve the upper NSC, including the communities of Detroit, Idanha, and some facilities operated by the U.S.D.A. Forest Service, and Oregon Department of Parks and Recreation. The study recommended a single combined treatment system for the communities and facilities that were part of the study. The study proposed the construction of a combined sanitary sewer collection system using gravity and pressure pipes under existing roadways. The study proposed utilizing aerated lagoons for wastewater treatment and disposing of treated effluent to surrounding forest lands via land application. This study also summarized state regulations, which prohibit the discharge of effluent into surface waters in the North Santiam River Basin. Procuring funding through the Forest Service, State Parks department, as well as public funding, user connection and monthly fees were proposed for the project.

Detroit-Idanha WW Facilities Pre-Design Report 2001 (Curran-McLeod, Inc., Consulting Engineers)

This 2001 Pre-Design Report was produced as a succeeding document to the 1996 Feasibility study described above. The purpose of this report was to document design criteria and provide details for preliminary treatment process design and effluent disposal. The proposed treatment system included four lagoons – two lagoons with mechanical aeration, a third lagoon for primary facultative treatment, and a fourth lagoon providing secondary treatment and solids settling. Additional disinfection through sodium hypochlorite injection into the effluent pipeline was also proposed. Effluent disposal was to be achieved by irrigation of 71 acres of Douglas Fir Forest.

The preliminary design included in this study was not constructed as proposed due to complications with funding.

Detroit-Idanha VE Study Conceptual Design Review, 2002 (Tetra Tech/KCM, Inc.)

This 2002 report presented the results of a value engineering (VE) study produced for the Detroit/Idanha combined sewer project. The primary finding of the VE study was that the project could not be constructed as designed with the funds available to the cities. As a result, the VE report examined a number of elements of the proposed project in attempt to provide cost savings.

Sanitary Survey of On-Site Sewage Disposal Systems – Detroit & Idanha, 2003 (Oregon Department of Environmental Quality)

This 2003 Sanitary Survey was performed and produced by the Oregon Department of Environmental Quality (DEQ) in partnership with Detroit and Idanha. As a result of continued funding challenges for a combined wastewater treatment system, DEQ entered a partnership with Detroit and Idanha to assist in the documentation of failing on-site sewage disposal systems.

This survey found many old, and failing on-site sewer systems, including cesspools and other types or configurations of systems not considered under current standards to adequately treat wastewater before disposal into the soil. Recommendations by DEQ included improvements for existing systems to provide higher levels of nutrient removal, consideration for groundwater and surface water contamination, and establishing an active management and operation structure of individual sewage treatment facilities.

3.1.2 Detroit

Detroit Wastewater Feasibility Study, 2015 (HBH Consulting Engineers)

This 2015 feasibility study examined the possibility of developing a community wastewater system for the City of Detroit. New wastewater flow and loading criteria for the community on a 20-year planning period were developed, as well as a preliminary design and cost estimate for the proposed wastewater facilities.

The recommended collection system incorporated septic tank effluent pump (STEP) systems, which were expected to provide nutrient reduction prior to being pumped to a centralized treatment facility. A series of recirculating media filters was recommended as the treatment method due to meeting facility sizing constraints. For disposal, subsurface drip dispersal in surrounding lands was recommended, as the Three Basin Rule would not allow for any surface water discharge. With a total land requirement of 8.75 acres and a capital cost of nearly $7,800,000, it was concluded that construction of this system is feasible, but acquisition of land and capital funds would be a challenge for the City of Detroit.

3.1.3 Idanha

Idanha Wastewater Facility Plan Update, 2008/2009 (Kennedy/Jenks Consultants)

This Facility Plan, and subsequent updates, were produced to provide planning and preliminary engineering for wastewater facilities designed to serve the community of Idanha. After evaluating alternatives, the recommended approach for the city included construction of a STEP collection system, using recirculating gravel media filtration for treatment, with subsurface discharge for effluent disposal.

3.1.4 Gates

Sanitary Survey, 1999 (Edgewater Environmental)

This Sanitary Survey for Gates was conducted by Edgewater Environmental, under contract with the City in February of 1999. 27% of the community did not participate in the study, and conditions at these properties was not able to be surveyed. The study found that 16.7% of the surveyed septic systems were in marginal condition or failing. It was noted that the failing septic systems were not concentrated in specific areas in the city.

3.1.5 Mill City

Wastewater O&M Manual, 2010 (CH2M Hill)

This O&M manual provides documentation on Mill City's wastewater collection, treatment, and Disposal facilities. Operations and Maintenance procedures are included, as well as permit requirements.

3.1.6 Regional - North Santiam Canyon

North Santiam Canyon Regional Wastewater Analysis, 2017 (Keller Associates)

This 2017 Regional Wastewater Analysis was produced to provide a feasible approach and associated cost for wastewater facilities serving communities in the NSC. The recommendation for this study includes new collection systems for each community in the NSC except for Mill City, due to the city having an existing community system. Three new wastewater treatment plants are proposed – One in Idanha (serving Idanha and Detroit), one in Gates (serving Gates and Mill City), and one in Lyons (serving Lyons and Mehama). Effluent disposal for each of the three wastewater facilities was proposed to be located nearby the treatment plants.

The total project cost was projected to be $97,000,000. Acquisition of project funding and appropriate land was identified as the primary challenges for this project. In order to address these challenges, and plan for future wastewater treatment in the NSC, the report proposed to form a wastewater facilities planning committee.

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4. EXISTING CONDITIONS OF WASTEWATER MANAGEMENT IN STUDY AREA

Amongst the views of tall evergreen trees, surrounding mountains, and glistening bodies of water, it is not uncommon to see port-a-potties dispersed throughout the North Santiam County (NSC). This is due, in part, to the communities of Idanha, Detroit, and Gates lacking community sanitary sewer systems. To present some of the challenges that this master plan is looking to overcome, this chapter discusses the existing wastewater management operations and facility conditions in the study area.

FIGURE 4-1: A PORT-A-POTTY ON PATTON ST. IN DETROIT (THURSDAY, JANUARY 3, 2019)

4.1 DETROIT

Residents in the city of Detroit maintain private, individual septic systems. It was reported in a 2003 sanitary survey, performed by the Oregon Department of Environmental Quality (DEQ), that many of the individual systems in Detroit consist of cesspools on small lots, which do not meet existing standards or on-site sewage systems. Of the 93 systems surveyed in Detroit, 32 were either nonconforming, failing or suspected of failing. Prior to the recent wildfires, residents in Detroit reported strong odors, presumably from failing septic systems. Chemical toilets (Port-a-Potties) were frequently used in 2019 and in 2003, when the sanitary survey was performed, to reduce loading to failing on-site sewage systems.

In recent years, increased visitors during peak season, small parcels, and limited land use have resulted in challenges with repair, replacement, and expansion of on-site sanitary sewer systems. These challenges have impeded economic development in Detroit and resulted in overuse of wastewater facilities. These concerns are consistent among the communities in the NSC operating without community sanitary sewer systems.

4.2 GATES

Residents in the City of Gates maintain private, individual septic systems, with the exception of the trailer parks, motels and apartment/multi-family housing that are typically served by shared septic systems. The most recent sanitary survey was performed in 1999, which presented the following information regarding the condition of the on-site sewage systems.

At the time of the study, there were 192 dwelling units within the city. Due to historical permitting processes for Marion County, and Gates, septic permits could not be located, and the sizes of the systems could not be determined. A local septic tank pumping contractor, however, did indicate that there were no chronic repeat customers (more than one pump-out per year) in Gates.

The results of the survey included 105 septic systems, 88 were found to be operational/ satisfactory, 10 marginal, and 7 failing. 87 systems were not able to be surveyed, where the condition remains unknown. The results of water sampling in nearby creeks and ditches were inconclusive in determining if failing septic systems had caused groundwater contamination in the City.

4.3 IDANHA

Similar to Detroit, Idanha does not have an existing community sanitary sewer system, and residents rely on private, individual septic systems. The previously mentioned 2003 sanitary survey for Detroit, performed by DEQ, also included a survey of on-site sanitary sewer systems in Idanha. Of the 51 properties surveyed, 19 systems were either nonconforming, failing, or suspected of failing.

4.4 MILL CITY

Mill City is the only city in the study area that operates a community sanitary sewer system. The majority of the collection and treatment systems were built in 1992. in 2009, all three collection system pump stations were replaced, as well as some treatment system components. A complete evaluation of Mill City's existing system can be found in Section 6.

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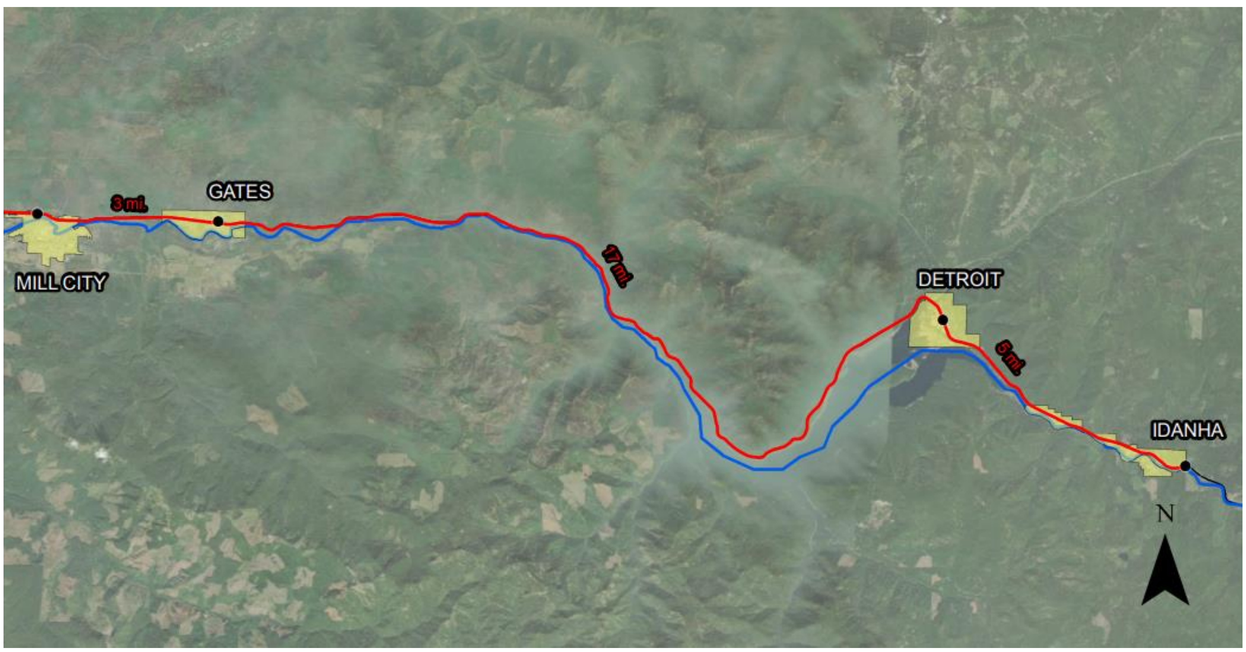
5. PLANNING CRITERIA AND DESIGN

This chapter outlines the planning criteria which will be used to refine details of the plan to provide community wastewater services to these four communities in the North Santiam Canyon (NSC).

5.1 LOCATION

As discussed in Section 2.1, the study area spans from Mill City to Idanha. The City of Lyons and the unincorporated community of Mehama are currently not included in the North Santiam Sewer Authority (NSSA). However, their proximity to Mill City may lead to their future involvement in the NSSA. For this reason, they are included in population projections and occasionally referenced throughout this report. Figure 5-1 depicts the communities that are the main area of focus for this report (Cities that are currently a member of the NSSA).

FIGURE 5-1: STUDY AREA



5.2 POPULATION AND GROWTH PROJECTIONS

Section 2.2 evaluated the population of the NSC using data from Portland State University (PSU). This population discussion evaluates the growth of the City of Sisters as a point of comparison for population in the NSC. Sisters' investment in a wastewater system was integral to enabling economic growth in the community. Data from the Sisters' community wastewater treatment and collection system was used as a case study to develop these population projections for the NSC communities, which serve as the basis for projecting future flow and loading data.

5.2.1 Sisters, Oregon - Population Case Study

In 2002, the City of Sisters, Oregon completed construction on a wastewater collection system and treatment facility. The conveyance system consists of PVC pipes varying between 6- and 24-inch diameter. The collection system also includes four pump stations. The wastewater treatment facility consists of a three-cell aerated lagoon system with a winter holding pond. The treated wastewater is discharged to a dike and forest irrigation reuse system.

Sisters shares many similarities with the NSC region. A series of boom-and-bust economic cycles marked the later part of the 20th century, generally tied to the timber industry. With the loss of timber access because of supply and changing forestry management practices, the Sisters' community turned to tourism and also attracted retirees. This pivot could not have occurred without a community wastewater system (City of Sisters Urban Area Comprehensive Plan, 2005 (Appendix E).

Population Projection

Even though the 1997 Wastewater System Facilities Plan (Appendix F) for Sisters used an average annual growth rate (AAGR) of 3% for 1997 to 2020 (higher than the PSU forecast), the actual growth was substantially greater. The City of Sisters Planning Department believes the publicity regarding the construction of the sewer system released "pent up demand" for residential structures (Deschutes County Coordinated Population Forecast 2000-2025). Chart 5-1 and Table 5-1 presents Sisters' historical population as well as the 1997 Wastewater System Facilities Plan projected population based on the 3% AAGR. From 1996 to 2020, the actual AAGR in Sisters was approximately 6%. During this period, Deschutes County as a whole also experienced exceptional growth.

CHART 5-1: CITY OF SISTERS POPULATION HISTORY

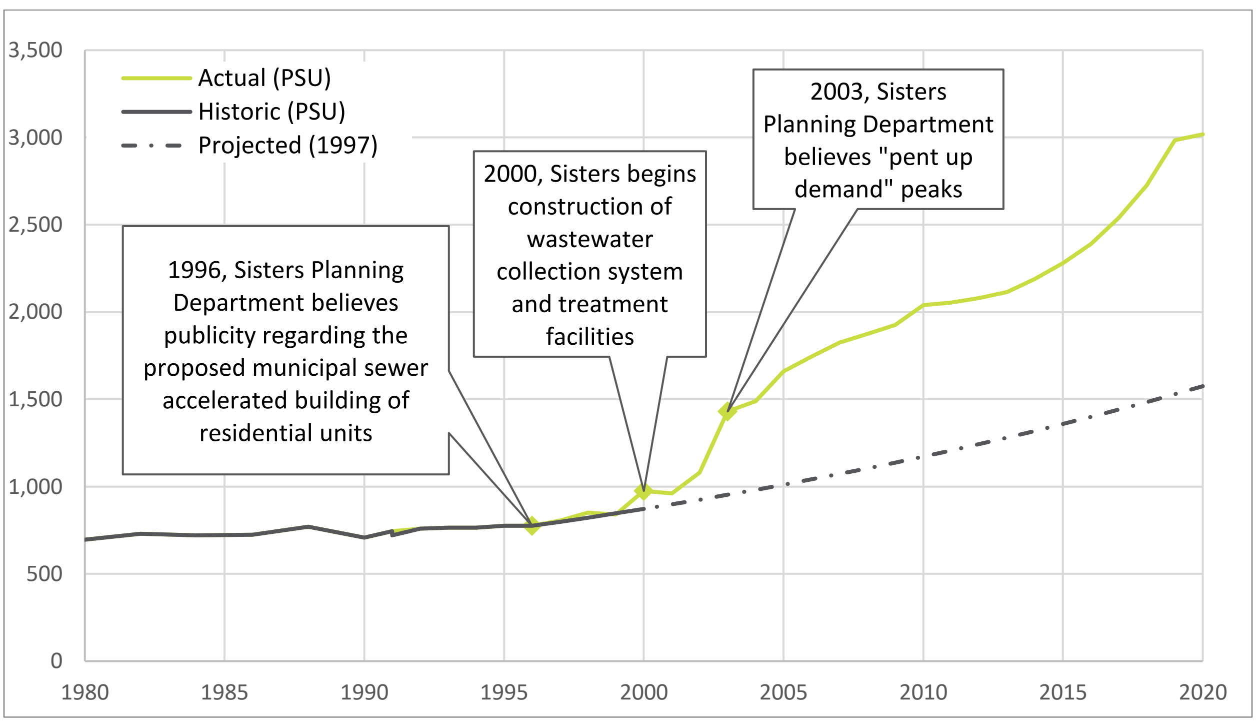


TABLE 5-1: CITY OF SISTERS POPULATION HISTORY

	Actual (PSU)	Projected (1997)	Deschutes County Actual (PSU)
Year	Pop.	Pop.	Pop.
2020	3,018	1,575	199,793
2019	2,985	1,529	193,000
2018	2,725	1,485	188,980
2017	2,540	1,441	182,930
2016	2,390	1,399	176,635
2015	2,280	1,359	170,740
2010	2,040	1,172	157,905
2005	1,660	1,011	143,490
2000	975	872	116,600
1995	775	---	94,100
1990	708	---	74,958
1982	730	---	64,350
1980	696	---	62,142

Applying the Case Study to North Santiam Canyon

In the next 40 years, Marion and Linn County's population growth is expected to slightly outpace the rest of the state of Oregon. However, it is not anticipated to match the rate Deschutes County experienced during the past 30 years (1990 to 2020). To realistically compare Sisters' growth to the potential growth in the NSC requires adjustments to reflect the exceptional growth experienced in the Deschutes County. The list below relates the AAGR seen in Sisters to the AAGR seen in Deschutes County before and after the sewer system was constructed.

- 1992-2002 Sisters experienced an AAGR 1.2 times smaller than Deschutes County
- 2002-2012 Sisters experienced an AAGR 2.6 times larger than Deschutes County
- 2012-2022 Sisters experienced an AAGR 1.6 times larger than Deschutes County
- 2022-2042 Sisters AAGR is projected to be 2.0 times larger than Deschutes County

In Table 5-2, PSU projected AAGRs for Marion and Linn Counties are combined using an average weighted by the population in each county. Assuming a similar population growth when compared to the county as Sisters, we can estimate AAGRs that might be representative for the NSC communities.

TABLE 5-2: 10, 20, AND 40 YEAR PROPOSED AAGR

Period	Marion Co AAGR Projected by PSU	Linn Co AAGR Projected by PSU	Linn and Marion Co Combined AAGR	Factor	NSC AAGR Projection
2025-2035	0.91%	0.84%	0.90%	2.6	2.31%
2035-2045	0.77%	0.73%	0.76%	1.6	1.20%
2045-2065	0.73%	0.68%	0.72%	2.0	1.44%
			Average AAGR		**1.60%**

Applying the NSC AAGR projections for each period to the combined communities is shown in Chart 5-2 and Table 5-3. The projected AAGR through the entire planning period is 1.6%. It was assumed population growth anticipated in each community will not be dependent on the difference in population residing in Linn versus Marion County.

CHART 5-2: COMBINED SYSTEMS PROPOSED AAGR

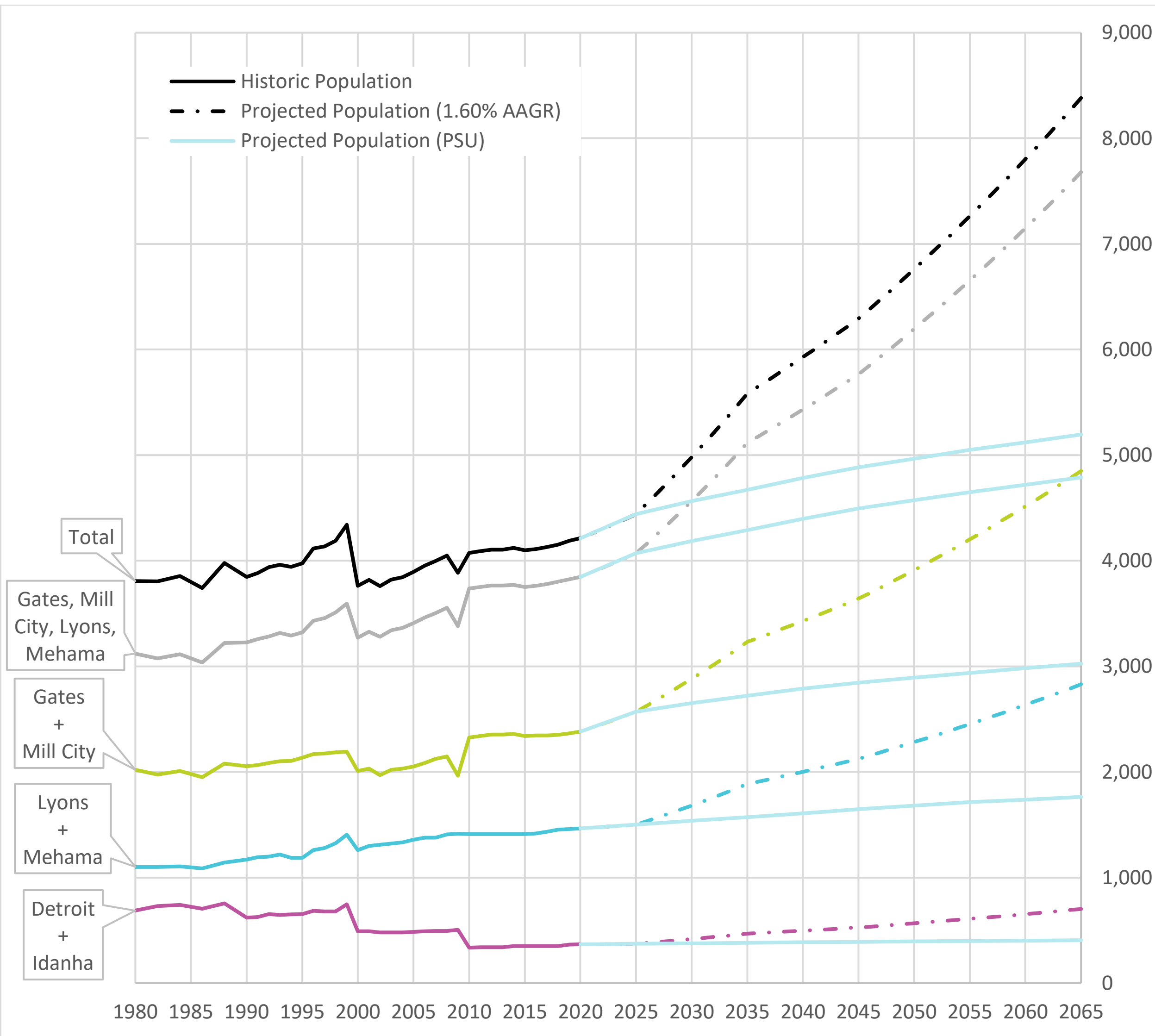


TABLE 5-3: COMBINED SYSTEMS PROPOSED AAGR

	Idanha + Detroit	Gates + Mill City	Lyons + Mehama	Lyons + Mehama and Gates + Mill City	Total Study Area
Year	Pop.	Pop.	Pop.	Pop.	Pop.
2065	**702**	**4,849**	**2,830**	**7,679**	**8,381**
2060	653	4,514	2,634	7,148	7,801
2055	608	4,202	2,452	6,654	7,262
2050	566	3,911	2,283	6,194	6,760
2045	**527**	**3,641**	**2,125**	**5,766**	**6,292**
2040	496	3,430	2,002	5,431	5,927
2035	**467**	**3,231**	**1,885**	**5,116**	**5,583**
2030	417	2,881	1,682	4,563	4,980
2025	**372**	**2,570**	**1,500**	**4,070**	**4,442**
2020	366	2,573	1,465	4,038	4,404
2019	365	2,365	1,458	3,823	4,188
2018	350	2,350	1,452	3,802	4,152
2017	350	2,345	1,434	3,779	4,129
2016	350	2,345	1,416	3,761	4,111
2015	350	2,340	1,410	3,750	4,100
2010	336	2,326	1,411	3,737	4,073
2005	485	2,050	1,359	3,409	3,894
2000	490	2,010	1,261	3,271	3,761
1995	655	2,135	1,186	3,321	3,976
1990	620	2,054	1,171	3,225	3,845
1982	730	1,975	1,099	3,074	3,804
1980	686	2,020	1,101	3,121	3,807

In addition to the population projections provided above, the NSSA should coordinate with PSU to facilitate the development of a population growth study that PSU is willing to accept and implement into their published population projections.

5.3 ENVIRONMENTAL CONSTRAINTS (THREE BASIN RULE)

The Three Basin Rule (See Appendix G), originally adopted in 1978 and modified in 1995, was established to preserve and improve the high quality of water in the Clackamas River, the McKenzie River (above the Hayden Bridge), and the North Santiam River subbasins for municipal water supplies, recreation, and preservation of aquatic life. This rule prohibits new (after January 28, 1994) or increased wastewater discharges requiring a National Pollution Discharge Elimination System (NPDES) permit, Water Pollution Control Facility (WPCF) permit, or 401 Water Quality Certification. An NPDES permit and 401 Water Quality Certification are required for discharge into surface waters, and an WPCF permit is required for discharges onto or beneath the ground surface.

Individual on-site sewage disposal systems (subject to issuance of a construction installation permit), small domestic facilities (less than 5,000 gpd), land-applied biosolids, and reclaimed domestic wastewater are allowed by this rule. Domestic wastewater is understood to mean "municipal" wastewater that may contain domestic, commercial, and industrial wastewater. Also in 1995, on-site rules from Oregon Administrative Rules (OAR) 340-071 were rewritten so that if a septic system were greater than 2,500 gpd (or multiple systems on the same property with a total greater than 2,500 gpd), the property would be subject to a WPCF permit.

5.4 GEOTECHNICAL CONSIDERATIONS

A geotechnical site evaluation was conducted by subconsultant Shannon & Wilson, Inc. The evaluation examined site geology and potential seismic hazards in the study area. The regional geology, faults, seismicity, potential liquefaction hazards, and potential landslide hazards were summarized using previously published information. The full report can be found in Appendix H.

Shannon & Wilson, Inc. developed planning level recommendations based on the findings within the evaluation. To the extent feasible for achieving project goals, it is recommended that the lowest anticipated geological and seismic susceptibility areas be chosen for the proposed work. These areas can be identified by viewing Figure 2 through Figure 6 in the Appendix H report. Consultation with an engineering geologist on a site-specific basis is recommended for areas defined as Moderate or High landslide susceptibility. Area defined as Very High landslide susceptibility should be avoided when possible. A site-specific geotechnical investigation is encouraged once site selection has occurred to determine which hazards are present and provide further recommendations.

5.5 FLOW PROJECTIONS

Planning flows for Mill City were developed using the method recommended by DEQ in the (2018) “Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon.” Mill City’s water consumption data was utilized in conjunction with the calculated wastewater flows to develop a variety of conversion and peaking factors. These factors were used to project wastewater flows for the other communities and their historic water consumption data.

5.5.1 Mill City

The existing sanitary sewer system in Mill City is a septic tank effluent gravity (STEG) system. The STEG system is comprised of small diameter pipes that transport effluent from residential septic tanks to gravity collection mains. These mains have very few manholes, instead utilizing smaller clean outs and inspection ports. As seen in the following analysis of Mill City’s existing STEG system, STEG systems generally have less infiltration and inflow (I/I) influence than a traditional gravity collection system, but more I/I influence than a septic tank effluent pumping (STEP) system. Keller Associates recommends further consideration be given regarding the influence of I/I on the chosen collection system.

The wastewater flow analysis looks at historic wastewater flows to develop flow projections for the planning period. This section summarizes the results of the flow analysis. Flow data came from discharge monitoring reports provided by Mill City. Rainfall data is sourced from four different NOAA Stations. Two of the stations are in Mill City, one of the stations is in Gates, and one of the stations is near the Detroit dam. Four stations were necessary to obtain complete rainfall data for 2016 through 2020.

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. The years with a complete data set (2016-2020) were averaged to obtain the design AADF.

Average Dry-Weather Flow (ADWF)

The average dry-weather flow (ADWF) is the average daily flow for the period of May through October. An ADWF was calculated for each year of data. The years with a complete data set (2015-2020) were averaged to obtain the design ADWF.

Average Wet-Weather Flow (AWWF)

The AWWF was calculated as the average daily flow for the period encompassing January-April, and November-December for each year of data. Four years' worth of data (2016-2020) was averaged to obtain the AWWF.

Max Month 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 year 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 (8.47 inches) was extrapolated from the NOAA Summary of Monthly Normals from 1981 to 2010.

Data from 2016–2020 was used according to the DEQ guidance to produce Chart 5-3. Table 5-4 summarizes the data points illustrated in the chart.

Max Month 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 most likely corresponds to the maximum monthly flow during the wet-weather period for a 5-year event. The January 80% precipitation exceedance value (17.24 inches) was extrapolated from the NOAA Summary of Monthly Normals from 1981 to 2010. The DEQ method and $MMWWF_5$ result are illustrated in Chart 5-3 and summarized in Table 5-4.

CHART 5-3: MONTHLY AVERAGE FLOW VS. RAINFALL ($MMDWF_{10}$ AND $MMWWF_5$)

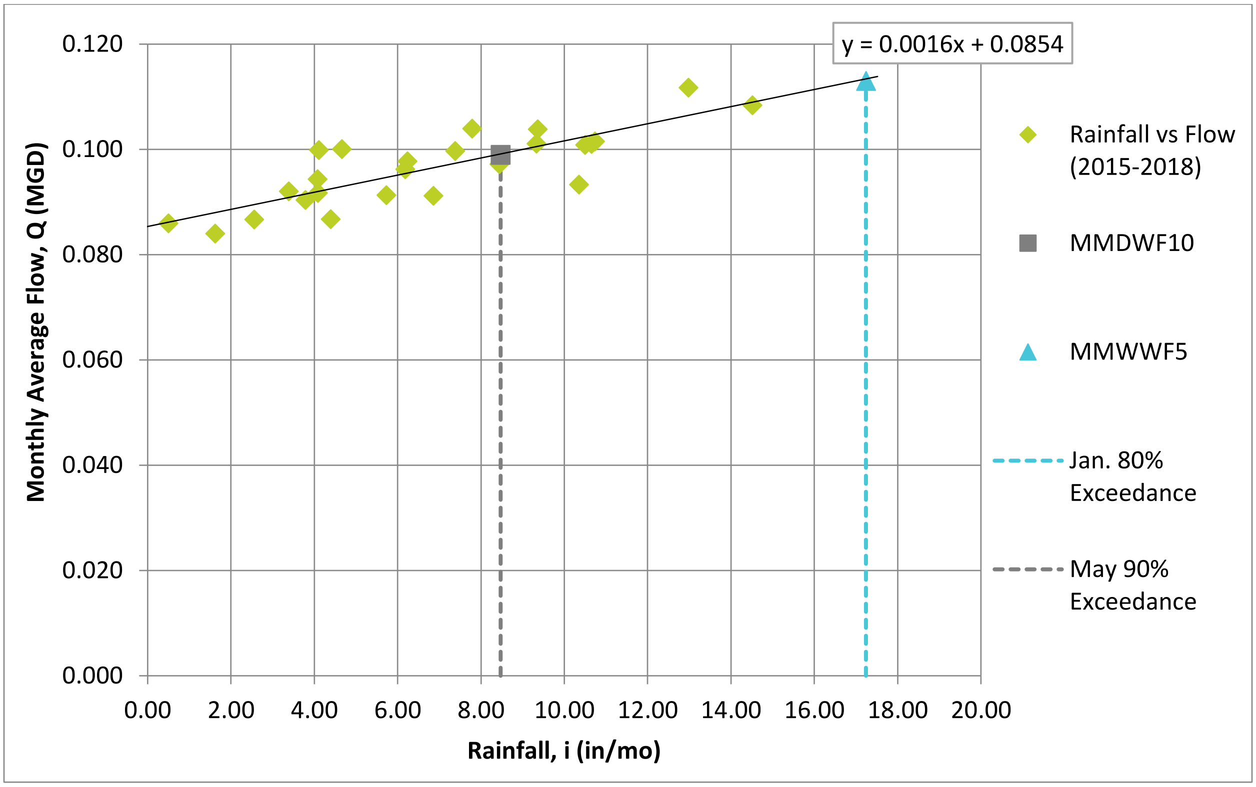


TABLE 5-4: MONTHLY AVERAGE FLOW VS. RAINFALL ($MMDWF_{10}$ AND $MMWWF_5$)

Month	Monthly Average Flow (MGD)					Rainfall (in/mo)				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
January	0.093	0.104	0.104	0.092	0.101	10.4	9.4	7.8	4.1	10.7
February	0.096	0.108	0.100	0.101	0.100	6.2	14.5	4.1	9.3	4.7
March	0.097	0.112	0.098	0.090	0.091	8.4	13.0	6.2	3.8	5.7
April	0.087	0.102	0.100	0.101	0.092	4.4	10.7	7.4	10.5	3.4
May	0.084	0.094	0.086	0.087	0.091	1.6	4.1	0.5	2.6	6.9
$MMDWF_{10}$	0.099 MGD					8.5 in/mo				
$MMWWF_5$	0.114 MGD					17.2 in/mo				

To confirm the validity of the DEQ method, a 30-day rolling average of the available and complete flow data (January 1, 2016, through December 31, 2020) was evaluated. The maximum observed 30-day rolling average flow was 0.114 million gallons per day (MGD). This average flow occurred on 4/3/2017. A $MMWWF_5$ of 0.114 MGD was used because this observed flow is consistent with the DEQ method's estimated flow.

Peak Week Flow (PWkF)

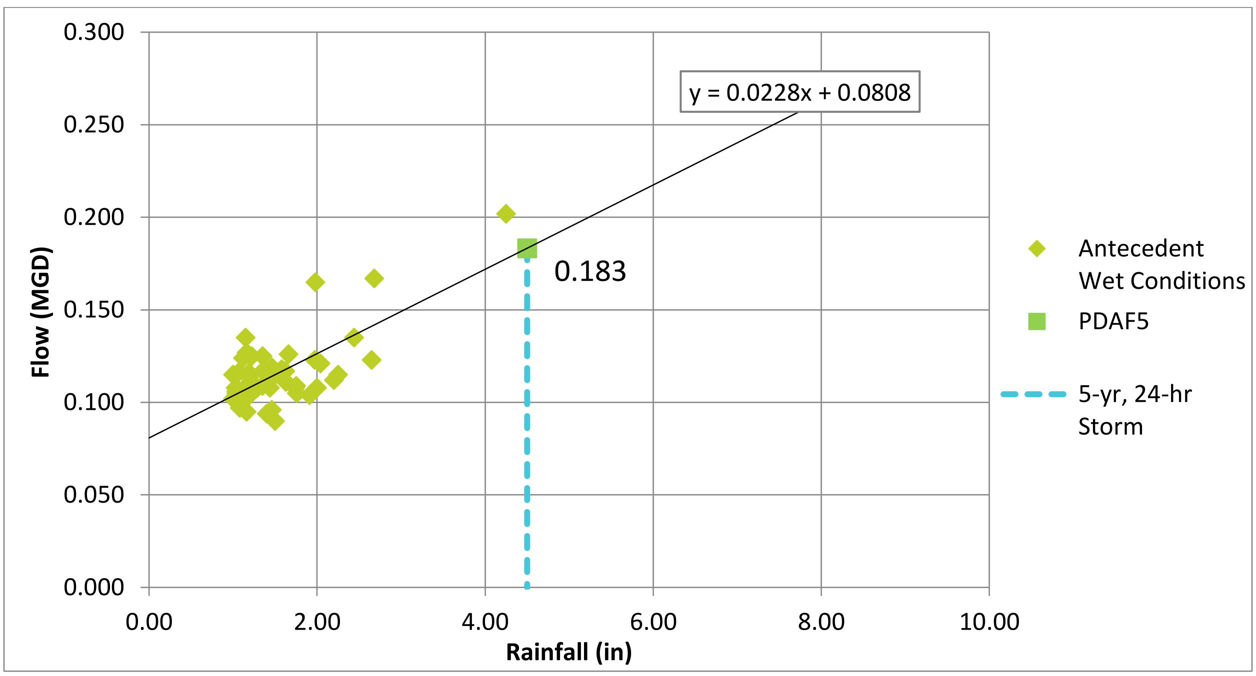
The PWkF was calculated using a 7-day rolling average for each year. The maximum of all the year PWkF values was used as the PWkF.

Peak Daily Average Flow ($PDAF_5$)

As outlined by the DEQ, the peak daily average flow ($PDAF_5$) corresponds to a 5-year storm event. The DEQ's method for determining $PDAF_5$ is plotting daily plant flow against daily precipitation for significant storm events, using data only for wet-weather seasons when groundwater is high. The $PDAF_5$ is the 5-year, 24-hour storm event (4.5 inches per the NOAA isopluvial maps for Oregon (Appendix I) from a trend line fitted to the data. 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. The cutoff for 30-day cumulative rainfall (for purposes of this analysis) was 4.5-inches. Chart 5-4 below shows the results of the DEQ analysis.

An analysis per the DEQ method resulted in a $PDAF_5$ of 0.183 MGD. The peak daily average flow observed in discharge monitoring reports (DMR) data was 0.202 MGD. The observed flow of 0.202 MGD was used for the design $PDAF_5$ flow.

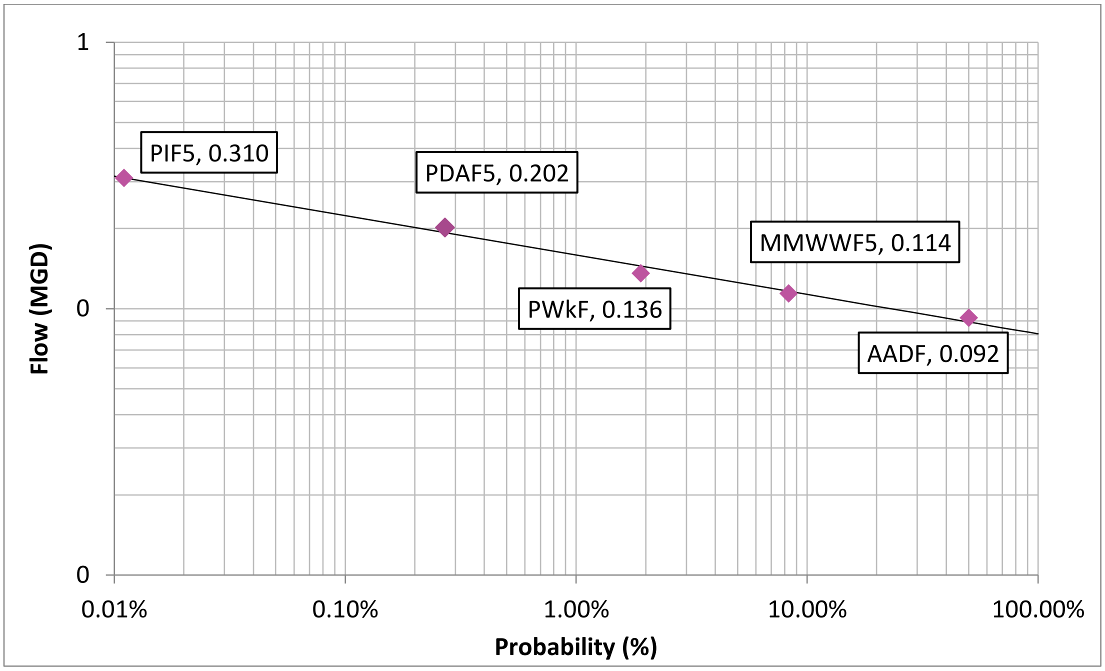
CHART 5-4: FLOW VS. RAINFALL ($PDAF_5$)



Peak Instantaneous Flow (PIF_5)

The peak instantaneous flow (PIF_5) represents the peak flow recorded at the WPCF. The DEQ recommends evaluating hourly or instantaneous flow data for high-flow days if available. Mill City does not record instantaneous flow data. As an alternative, DEQ recommends estimating PIF_5 by extrapolation. A probability graph, where the PIF_5 was extrapolated from a known $PDAF_5$ was produced. Chart 5-4shows the results.

CHART 5-4: FLOW VS. PROBABILITY (PIF_5)



Per the DEQ extrapolation method, the PIF_5 was found to be 0.310 MGD.

Observed Historical Flows and Projected Design Flows

Table 5-5 summarizes the observed flows for each year from 2016-2020. The historical flows were derived as described in the preceding paragraphs.

TABLE 5-5: MILL CITY OBSERVED HISTORICAL FLOWS

	Historical Flows (MGD)					Design Flow (MGD)
Year	2016	2017	2018	2019	2020	2021
Population	1,860	1,860	1,865	1,880	1,894	1,894
ADWF	0.087	0.089	0.086	0.085	0.088	0.087
$MMDWF_{10}$	0.100	0.097	0.089	0.089	0.092	0.100
AADF	0.092	0.097	0.092	0.089	0.092	0.092
AWWF	0.097	0.105	0.098	0.093	0.097	0.098
$MMWWF_5$	0.110	0.114	0.105	0.102	0.104	0.114
PWkF	0.116	0.130	0.110	0.136	0.124	0.136
$PDAF_5$	0.141	0.176	0.125	0.169	0.202	0.202
PIF_5	0.216	0.270	0.191	0.259	0.310	0.310
Total Rainfall (in/yr)	71.5	84.1	47.5	46.6	63.4	
Total Flow (MGY)	33.5	35.3	33.6	32.5	32.4	

To project the planning flows to future populations, a projected flow per capita (reported in gallons per capita per day, gpcd) was developed. The per capita per day flows are shown in Table 5-6.

This method recognizes the existing effects of inflow and infiltration (I/I) on the current system, and the assumed reduced I/I influence on wet weather flows in the future as better construction methods and materials are utilized. Table 5-6 summarizes the projected planning flows using the higher custom AAGR developed for the NSC communities (see Table 5-3). Actual future flows will depend on several factors and could potentially decrease through aggressive I/I reduction efforts. It is generally recommended that flows be reviewed periodically, and future capital projects phased where practical.

To account for an increase in industrial development following the construction of a municipal sewer system, ADWF projections for 2035, 2045, and 2065 were increased by 1,500 gallons per acre per day. It was assumed industrial development will be 3 acres. Peaking factors were used to project the increase in ADWF to other projected design flows.

TABLE 5-6: MILL CITY PROJECTED DESIGN FLOWS

	Design Flow (MGD)	Design Unit Flow (gpcd)	Projected Design Flow (MGD)			
Year	2021	---	2025	2035	2045	2065
Population	1,894	---	2,075	2,608	2,939	3,914
ADWF	0.087	46	0.095	0.124	0.139	0.184
$MMDWF_{10}$	0.100	53	0.109	0.142	0.160	0.211
AADF	0.092	49	0.101	0.132	0.148	0.196
AWWF	0.098	52	0.107	0.140	0.157	0.207
$MMWWF_5$	0.114	60	0.125	0.163	0.183	0.241
PWkF	0.136	72	0.149	0.194	0.218	0.288
$PDAF_5$	0.202	107	0.221	0.289	0.324	0.428
PIF_5	0.310	164	0.339	0.443	0.497	0.657

5.5.2 Idanha, Detroit, and Gates

The cities of Idanha, Detroit, Gates do not have existing community wastewater systems. Therefore, the DEQ method of using historical plant flow data to develop design flows and projections is not possible. Design flows and peaking factors were estimated using a combination of water usage data, previous planning studies, data from planning studies from other communities in the surrounding region, including data from Mill City.

Flows for Detroit are different from the other communities due to influence from tourism and seasonal recreation. This is reflected in the total projected flows by a much higher per capita residential flow, and a higher commercial land demand than other communities. Keller Associates recommends a closer look into the volume of tourism and recreational activities to better gauge its impact on peak and seasonal flows for future planning studies.

<u>Average Dry-Weather Flow (ADWF)</u>

The average dry-weather flow (ADWF) represents the average daily flow for the period of May through October. *Wastewater Engineering Treatment and Resource Recovery* by Metcalf and Eddy suggests, as a rule of thumb, that 10% of potable water demand is consumed and 90% of the potable water demand will return to the wastewater system for treatment. This adjustment factor was reconstructed specific to the NSC region using Mill City's average wet weather potable water consumption and the dry weather wastewater flows. Wet weather potable water consumption was selected to avoid capturing water usage that is unlikely to return to the system (i.e., summertime irrigation). The Mill City wet weather water meter consumption data was compared to the city's dry weather wastewater flows as they are likely to have the least influence from inflow and infiltration. This comparison provides a base line adjustment factor to convert water meter consumption data into dry weather wastewater flows. The Mill City adjustment factor was found to be 0.911, which is in line with the Metcalf and Eddy recommended 0.90.

To confirm that using Mill City's adjustment factor is valid for the three other communities, a 5-year 24-hour stormwater isopluvial map of Oregon was referenced from NOAA Atlas 2, Volume X. The 5-year 24-hour event for all communities in the canyon was found to be comparable. Additionally, a color-coded intensity map of the average annual precipitation in Oregon was retrieved. This color-coded intensity map can be found in Appendix J. The average annual precipitation for Detroit was found to fall within the 80-to-100 inches range. Mill City, Idanha, and Gates average annual precipitation were found to be approximately on the edge of the 80-to-100 inches range and the 65-to-80 inches range.

For Idanha and Gates the ADWF for wastewater was estimated by averaging the community's wet weather water usage (January to March and November to December) and adjusting usage by the Mill City adjustment factor, 0.911.

Water meter consumption data was not available for Detroit. Instead, the water system operator provided the average wet weather monthly metered consumption amount. The operator estimated 1.2 MG/Month. This value was then increased by an additional 150,000 gallons per month to account for the increased usage during the summer months due to tourism. The ADWF values for the three communities serve as a baseline for developing the other design flow criteria.

Developing Peaking Factors

All other flows for Idanha, Detroit, and Gates were developed by calculating peaking factors observed in Mill City flows. Table 5-7 summarizes the peaking factors and their numeric definitions.

TABLE 5-7: MILL CITY WASTEWATER PEAKING FACTORS

Mill City Observed Peaking Factors					
Peaking Factor	AADF/ADWF	AWWF/ADWF	$MMDWF_5$/ADWF	$PDAF_5$/ADWF	PIF_5/ADWF
Value	1.064	1.128	1.312	2.325	3.145

These peaking factors were used to relate ADWF to other flow values for Idanha, Detroit, and Gates. Historical flow estimates and future flow projections for Idanha, Detroit, and Gates are summarized in Tables 5-8 through 5-10. A planning flow (2011) and planning unit flow (2011) were developed using available water consumption data (2008 through 2011). Flows were projected for a design flow and a design unit flow on a per capita basis (reference the 2021 column). Historical flow estimates are a hypothetical situation – the communities do not have a wastewater treatment plant receiving flow. The historical flow years reflect the years that water usage data was available. These flows are then projected to 2020, which is considered the design flow. Further projections for the planning period, 2025 to 2065, are shown in the tables.

Additional increases in projected flow from future industrial development was incorporated into flow projections for Idanha, Detroit, and Gates by the same methodology described above for Mill City.

TABLE 5-8: IDANHA FLOWS

	Idanha Historical Flows (MGD)				Planning Flow (MGD)	Planning Unit Flow (gpcd)	Design Flow (MGD)	Design Unit Flow (gpcd)	Idanha Projected Design Flow (MGD)			
Year	2008	2009	2010	2011	2011	2011	2021	---	2025	2035	2045	2065
Population	230	230	134	135	135	135	140	---	158	198	224	298
ADWF	0.013	0.017	0.008	0.010	0.012	90	0.013	90	0.014	0.022	0.025	0.031
AADF	0.014	0.018	0.008	0.011	0.013	96	0.013	96	0.015	0.024	0.026	0.033
AWWF	0.015	0.020	0.009	0.012	0.014	101	0.014	101	0.016	0.025	0.028	0.035
$MMWWF_5$	0.017	0.023	0.010	0.013	0.023	168	0.024	168	0.027	0.039	0.044	0.056
$PDAF_5$	0.031	0.040	0.018	0.024	0.040	298	0.042	298	0.047	0.070	0.077	0.099
PIF_5	0.047	0.062	0.028	0.036	0.062	458	0.064	458	0.072	0.107	0.118	0.152

TABLE 5-9: GATES FLOWS

	Gates Historical Flows (MGD)			Design Flow (MGD)	Design Unit Flow (gpcd)	Gates Projected Design Flow (MGD)			
Year	2018	2019	2020	2021	---	2025	2035	2045	2065
Population	485	485	481	481	---	496	623	702	935
ADWF	0.028	0.032	0.034	0.032	66	0.033	0.046	0.051	0.066
AADF	0.030	0.035	0.037	0.034	70	0.035	0.049	0.054	0.071
AWWF	0.032	0.037	0.039	0.036	75	0.037	0.052	0.057	0.075
MMWWF5	0.037	0.043	0.045	0.045	94	0.047	0.064	0.072	0.094
PDAF5	0.066	0.075	0.080	0.080	167	0.083	0.114	0.127	0.166
PIF5	0.102	0.116	0.123	0.123	256	0.127	0.175	0.196	0.255

TABLE 5-10: DETROIT FLOWS

	Operator Observed Flow (1.2 MG/Mo, Winter)	Design Flow (MGD)	Design Unit Flow (gpcd)	Detroit Projected Design Flow (MGD)			
Year	---	2021	---	2025	2035	2045	2065
Population	---	218	---	214	269	303	404
ADWF	0.041	0.041	187	0.040	0.055	0.061	0.080
AADF	0.043	0.043	198	0.042	0.058	0.065	0.085
AWWF	0.046	0.046	210	0.045	0.062	0.069	0.090
MMWWF5	0.053	0.053	245	0.052	0.072	0.080	0.105
PDAF5	0.095	0.095	434	0.093	0.127	0.142	0.186
PIF5	0.145	0.145	666	0.143	0.195	0.218	0.285

5.5.3 Residential Versus Non-Residential Flow

Mill City wet weather (November to April) water consumption data was examined to determine anticipated sewer flows for residential versus non-residential development. Water usage was categorized as residential or non-residential by the city. Only properties within the city limits were counted as the UGB contains undeveloped land and flows per acre would be greatly underestimated. The flows associated with a $PDAF_5$ and PIF_5 flow event are shown in Table 5-11 The wet weather water consumption data was related to wastewater flow per the adjustment factor, 0.911.

TABLE 5-11: RESIDENTIAL AND NON-RESIDENTIAL PLANNING FLOW

	Residential Design Flow (MG/Acre)	Non-Residential Design Flow (MG/Acre)
Year	2020	2020
Population	1,894	1,894
$PDAF_5$	713	132
PIF_5	1094	203

5.6 LOADING CONSTRAINTS

This section projects values for several wastewater constituents in the effluent of each community.

5.6.1 Wastewater Constituents

Depending on the discharge location, a different level of treatment may be required. Key contaminants in the wastewater that may need to be monitored and treated include the following.

- Biochemical oxygen demand (BOD): the amount of oxygen required by microorganisms to break down organic material in the wastewater. Higher BOD concentrations in receiving waters will lead to a reduction in dissolved oxygen and will produce more microbes.
- Total suspended solids (TSS): the total solids not dissolved in the wastewater. High TSS concentrations in receiving waters can be detrimental to water quality and aquatic life.
- Nitrogen and Phosphorus: nutrients found in wastewater that can lead to poor water quality, growth of algae (which results in a reduction of dissolved oxygen) and can be toxic to aquatic life. Nitrogen is often found in organic compounds, as well as ammonia and nitrates.
- Turbidity: this is the relative clarity of the water. The more turbid the water, the more likely there is inorganic and organic materials present.
- E. Coli: bacteria commonly used as a marker to identify the number of pathogens in the wastewater.

These contaminants, when not adequately treated, can be detrimental to water quality and aquatic life. Mill City's historical loading data (2016 to 2020) was also analyzed. The wastewater influent loading analysis follows a similar methodology used for the influent flows. The exception is Mill City has a STEP (Septic Tank Effluent Pump) system. This means that the influent has already received partial treatment in septic tanks before it enters Mill City's WPCF and is sampled.

The historical wastewater loading data was used to develop future loading projections for the planning period. An estimate was also made for influent loadings without a STEP system. This section summarizes the results of the 5-day biochemical oxygen demand (BOD5), total suspended solids (TSS), and Total Kjeldahl Nitrogen (TKN) load analysis. Dry weather (May 1 –

October 31) and wet weather (November 1 – April 30) loads were evaluated. The following definitions summarize the terminology of the loading conditions:

Average Daily Load

The average daily load is the average load during a period. The average daily load was calculated for both the 6-months of dry weather (DWADL) and the 6-months of wet weather (WWADL) for each year of data.

Maximum Month Load

The maximum month load is the month with the largest average daily load. The maximum month load was reported for both the 6-months of dry weather (DWMML) and the 6-months of wet weather (WWMML) for each year of data. The maximum month data is from the DMRs and represents the samples taken during the month rather than a 30-day rolling average.

5.6.2 Observed Historical and Projected BOD_5, TSS, G&O, and TKN Loadings

The BOD_5, TSS, and TKN historical loadings (pounds per day (ppd)) observed in Mill City are summarized in Table 5-11.

TABLE 5-11: MILL CITY HISTORICAL LOADS

Parameter	2016	2017	2018	2019	2020	Avg.	Max.
Population	*1,860*	*1,860*	*1,865*	*1,880*	*1,894*	--	--
BOD_5 ppd							
WWADL (BOD_5)	99.8	74.0	88.7	101.5	100.5	92.9	101.5
WWMML (BOD_5)	113.6	82.7	114.9	138.8	171.7	124.3	171.7
DWADL (BOD_5)	97.2	62.2	92.5	82.4	78.3	82.5	97.2
DWMML (BOD_5)	99.6	65.9	107.8	100.7	111.5	97.1	111.5
TSS ppd							
WWADL (TSS)	30.2	25.4	28.7	30.0	22.7	27.4	30.2
WWMML (TSS)	31.4	30.4	34.1	35.6	44.5	35.2	44.5
DWADL (TSS)	36.3	21.5	30.2	29.3	25.0	28.5	36.3
DWMML (TSS)	41.1	25.2	47.0	40.1	36.8	38.1	47.0
TKN ppd							
WWADL (TKN)	36.8	35.8	39.9	41.9	40.9	39.1	41.9
WWMML (TKN)	46.1	39.8	46.0	44.0	51.1	45.4	51.1
DWADL (TKN)	46.1	35.6	40.3	42.0	34.2	39.6	46.1
DWMML (TKN)	46.8	36.4	46.5	53.7	47.3	46.1	53.7

The historical unit loadings (load divided by the population (pound per capita per day (ppcd)) were calculated for each year of data analyzed. For the planning criteria, the maximum unit loading was selected based on the 2016 to 2020 data. Projected BOD_5, TSS, and TKN loads are summarized in Table 5-12. It is assumed the unit loadings will not change during the planning period. This means the new wastewater will have similar characteristics to Mill City's current influent.

TABLE 5-12: MILL CITY PROJECTED LOADS

Parameter	Planning Criteria (ppcd)	Loading Projections (ppd)			
	2020	2025	2035	2045	2065
Population	*1,894*	*2,291*	*2,880*	*3,245*	*4,323*
BOD_5					
WWADL (BOD_5)	**0.054**	122.7	154.3	173.9	231.6
WWMML (BOD_5)	**0.091**	207.7	261.1	294.3	391.9
DWADL (BOD_5)	**0.051**	117.5	147.7	166.5	221.7
DWMML (BOD_5)	**0.059**	134.9	169.5	191.1	254.5
TSS ppd					
WWADL (TSS)	**0.016**	36.5	45.9	51.7	68.9
WWMML (TSS)	**0.024**	53.8	67.7	76.3	101.6
DWADL (TSS)	**0.019**	43.9	55.2	62.2	82.9
DWMML (TSS)	**0.025**	56.9	71.5	80.5	107.3
TKN ppd					
WWADL (TKN)	**0.022**	50.7	63.8	71.9	95.7
WWMML (TKN)	**0.027**	61.8	77.7	87.6	116.6
DWADL (TKN)	**0.024**	55.8	70.1	79.0	105.2
DWMML (TKN)	**0.028**	65.0	81.7	92.1	122.7

The STEP system does remove some of the contaminants prior to the WPCF. According to EPA's Onsite Wastewater Treatment Systems Manual, approximately 40% of the influent BOD_5 and 70% of the TSS are removed from a typical STEP system. Tables 5-13, 5-14, and 5-15 show the projected loads in non-STEP systems for Idanha, Gates, and Detroit, respectively.

TABLE 5-13: IDANHA PROJECTED LOADS

Parameter	Planning Criteria (ppcd) 2020	Loading Projections (ppd) 2025	2035	2045	2065
Population	*140*	*142*	*178*	*201*	*268*
BOD_5					
WWADL (BOD_5)	**0.089**	12.7	15.9	17.9	23.9
WWMML (BOD_5)	**0.151**	21.5	26.9	30.4	40.5
DWADL (BOD_5)	**0.085**	12.1	15.2	17.2	22.9
DWMML (BOD_5)	**0.098**	13.9	17.5	19.7	26.3
TSS ppd					
WWADL (TSS)	**0.053**	7.5	9.5	10.7	14.2
WWMML (TSS)	**0.078**	11.1	13.9	15.7	21.0
DWADL (TSS)	**0.064**	9.1	11.4	12.8	17.1
DWMML (TSS)	**0.083**	11.7	14.7	16.6	22.2
TKN ppd					
WWADL (TKN)	**0.022**	3.1	3.9	4.5	5.9
WWMML (TKN)	**0.027**	3.8	4.8	5.4	7.2
DWADL (TKN)	**0.024**	3.5	4.3	4.9	6.5
DWMML (TKN)	**0.028**	4.0	5.1	5.7	7.6

TABLE 5-14: GATES PROJECTED LOADS

Parameter	Planning Criteria (ppcd) 2020	Loading Projections (ppd) 2025	2035	2045	2065
Population	*481*	*490*	*616*	*694*	*925*
BOD_5					
WWADL (BOD_5)	**0.089**	43.8	55.0	62.0	82.6
WWMML (BOD_5)	**0.151**	74.0	93.1	104.9	139.8
DWADL (BOD_5)	**0.085**	41.9	52.7	59.3	79.1
DWMML (BOD_5)	**0.098**	48.1	60.4	68.1	90.8
TSS ppd					
WWADL (TSS)	**0.053**	26.0	32.7	36.9	49.1
WWMML (TSS)	**0.078**	38.4	48.3	54.4	72.5
DWADL (TSS)	**0.064**	31.3	39.4	44.4	59.1
DWMML (TSS)	**0.083**	40.5	51.0	57.4	76.5
TKN ppd					
WWADL (TKN)	**0.022**	10.8	13.6	15.4	20.5
WWMML (TKN)	**0.027**	13.2	16.6	18.7	25.0
DWADL (TKN)	**0.024**	11.9	15.0	16.9	22.5
DWMML (TKN)	**0.028**	13.9	17.5	19.7	26.2

TABLE 5-15: DETROIT PROJECTED LOADS

Parameter	Planning Criteria (ppcd)	Loading Projections (ppd)			
	2020	2025	2035	2045	2065
Population	*218*	*222*	*279*	*314*	*419*
BOD_5					
WWADL (BOD_5)	**0.089**	19.8	24.9	28.0	37.4
WWMML (BOD_5)	**0.151**	33.5	42.2	47.5	63.3
DWADL (BOD_5)	**0.085**	19.0	23.9	26.8	35.8
DWMML (BOD_5)	**0.098**	21.8	27.4	30.8	41.1
TSS ppd					
WWADL (TSS)	**0.053**	11.8	14.8	16.7	22.3
WWMML (TSS)	**0.078**	17.4	21.9	24.6	32.8
DWADL (TSS)	**0.064**	14.2	17.8	20.1	26.8
DWMML (TSS)	**0.083**	18.4	23.1	26.0	34.7
TKN ppd					
WWADL (TKN)	**0.022**	4.9	6.2	7.0	9.3
WWMML (TKN)	**0.027**	6.0	7.5	8.5	11.3
DWADL (TKN)	**0.024**	5.4	6.8	7.6	10.2
DWMML (TKN)	**0.028**	6.3	7.9	8.9	11.9

5.7 REGULATORY REQUIREMENTS

Keller Associates had several conversations with DEQ regarding the Three Basin Rule. A new surface water discharge (NPDES permit) would not be allowed without a significant waiver from the Environmental Quality Commission (EQC). There is currently no process or mechanism for DEQ staff or the EQC to provide a waiver. An action of this type would need to involve the state legislature. The first step would be for the Sewer Authority to request the EQC to add this item to their agenda for consideration.

The DEQ may issue a WPCF permit for a new domestic sewage treatment facility in accordance with the Three Basin Rule, contingent on the following terms: **1) THERE IS NO WASTE** (waste meaning any discharge that requires an NPDES permit, WPCF permit, or 401 Certification) **DISCHARGE TO SURFACE WATER**; 2) all groundwater protection requirements of OAR 340-040-0030 are met; and 3) the Environmental Quality Commission (EQC) finds that the new domestic sewage treatment facility provides a preferable means of disposal compared to the current means of disposal. A preferable means must meet one of the following three criteria:

There are a significant number of failing individual collection systems (based on the DEQ survey presented in Section 3) that would be replaced by the new domestic treatment facility that cannot be repaired adequately or cost effectively,

The impact of all individual treatment systems to groundwater is greater than the anticipated impact of the new sewage treatment facility, or

If an individual, or several, on-site collection system(s) would not normally be utilized (e.g., the system is frequently hydraulically overloaded due to flows exceeding the design flow of the system), a new sewage treatment facility may be allowed if the social and economic benefits outweigh the possible environmental impacts.

Applications for domestic wastewater WPCF permits must also not include wastes that would incapacitate the treatment system; be operated or supervised by a certified wastewater treatment plant operator per OAR 340-049-0005 (however, may be exempt per OAR 340-049-0075); and provide annual written certification of proper treatment and disposal system operation from a qualified Registered Sanitarian, Professional Engineer, or certified wastewater treatment system operator.

Once the DEQ has reviewed a domestic wastewater WPCF permit application, drafted a permit, and allowed the required time for public comment, the draft permit is placed before the EQC. The EQC serves as the DEQ's policy and rulemaking board, and reviews all WPCF permits related to the Three Basin Rule. It is a five-member committee appointed by the governor, composed of citizens with backgrounds in politics, education, engineering, finance, etc. that serve four-year terms. The EQC will review the draft WPCF permit and may have additional comments or questions that need to be addressed. The EQC must approve the final WPCF permit.

5.7.1 North Santiam River Water Quality

This section discusses some of the potential parameters that could be regulated based on the water quality in the North Santiam River, if a discharge were allowed. The Clean Water Act (CWA) and Oregon antidegradation policies (OAR 340-04-0004)) would be the main rules for compliance. The beneficial uses of the North Santiam River are: public domestic water supply, private domestic water supply, industrial water supply, livestock watering, anadromous fish passage, salmonid fish spawning, resident fish and aquatic life, fishing and hunting, salmonid fish rearing, water contact recreation, irrigation, wildlife, boating, aesthetic quality, and hydropower. Fecal coliform bacteria and turbidity have been concerns with the river's water quality in the past, but those issues are not likely to drive additional regulations for treatment for the North Santiam.

Dissolved Oxygen

The North Santiam River subbasin has stream segments that are listed under the CWA 303(d) list for dissolved oxygen. At this time there is not a TMDL for the subbasin. There is potential for a TMDL to be developed in the future, but the timeline and if a TMDL would impact discharge limits are unknown at this time.

The discharge would have a biochemical oxygen demand (BOD) limit. Usually this is technology-based effluent limits based on the Basin Standards of OAR 340-041, but further evaluation of the water quality may lead to more stringent limits.

Temperature

The temperature requirements are set by the TMDL on the North Santiam River. The requirements are derived from a waste load allocation (WLA).

pH

There are pH requirements for the North Santiam River, which require the pH to be between 6.5 and 8.5 at the edge of the mixing zone in the river.

Ammonia

In August 2015, EPA approved revisions to Oregon's ammonia water quality standards for the protection of aquatic life. This standard indicates that mussels and snails are the most sensitive species to ammonia. DEQ did not adopt criteria for ammonia, based on the absence of snails/mussels, but current information indicates that they are (or historically were) present through most of Oregon. DEQ did not preclude the development of site-specific criteria. A reasonable potential analysis (RPA) could be performed to indicate if a limit would be likely. In other words, could the discharge cause or contribute to harming the water quality of the receiving body of water.

Nutrients and Algae

Nitrogen and phosphorus are the typical concerns for nutrient impaired receiving water bodies. The North Santiam River subbasin is not currently water quality limited for nutrients. However, Detroit Lake has experienced blue-green algae (cyanobacteria) blooms. The algae can produce toxins that are unsafe for domestic consumption.

Other Toxic Pollutants

Any discharges must be evaluated for toxic pollutants of concern (POCs) that might cause an exceedance of the water quality standard in the receiving water body. The current water quality criteria for aquatic toxicity are listed in OAR 340-41 pollutant Tables 20, 33A and 33B, and for human health water quality criteria in OAR 340-41 pollutant Table 40. Mercury is a contaminate of concern throughout the Willamette Basin, of which the North Santiam River is a subbasin.

5.7.2 Effluent Reuse Regulations

Land application or subsurface disposal is governed by recycled water regulations, as outlined in OAR 340-055. OAR 340-055 defines five categories of effluent, identifies allowable uses for each category, and provides requirements for treatment, monitoring, public access, and setback distances. Fewer restrictions are imposed for higher quality effluent, as shown in Table 5-16. For recycled water use, groundwater must be protected in accordance with the requirements of OAR 340-040.

TABLE 5-16: REUSE REQUIREMENTS BY EFFLUENT CATEGORY

	Class A	Class B	Class C	Class D	Non-disinfected
Treatment[1]	O,D,F	O,D	O,D	O,D	O
Total coliform, 7-day median #/100 mL	2.2 [2]	2.2 [2]	23 [3]	- [4]	Per permit
Turbidity, NTU	2	-	-	-	
Public access [5]		Limited	Limited	Controlled	Prevented
Setback to property line [6]		10 feet	70 feet	100 feet	Per permit
Setback to water supply source		50 feet	100 feet	100 feet	150 feet

[1] O = oxidized, D = disinfection, F = filtration, RWUP = Recycle Water Use Permit
[2] Must not exceed 23 total coliform organisms per 100 milliliters (ml) in any single sample
[3] Must not exceed 240 total coliform organisms per 100 ml in any two consecutive samples
[4] Rather than total coliform, Class D Recycled Water is required to sample for E. coli. E. coli is a subgroup of the total coliform organisms, so a total coliform analysis includes the E. coli organisms. For Class D Recycled Water, the 30-day log mean must not exceed 126 E. coli organisms per 100 ml; and must not exceed 406 E. coli organisms per 100 ml in a single sample
[5] Limited public access: no direct contact during irrigation cycle
[6] Sprinkler irrigation assumed

5.7.3 Biosolids

Both federal and state regulations apply to land application of biosolids from wastewater treatment plants. Title 40 of the Code of Federal Regulations, Part 503 (40 CFR §503) discusses standards for the use and disposal of biosolids. Oregon regulations include OAR 340-050, which were most recently revised in July 1995. They reference many of the federal technical biosolids regulations (40 CFR §503), including limits on trace pollutants and pathogens. Under state regulations, a Biosolids Management Plan (BMP) and Land Application Plan are required. Note that land application of biosolids is not anticipated to be a part of this project.

5.8 OVERALL DESIGN CONCEPT

A common and economical solution to wastewater treatment and disposal used by other communities in Oregon is to treat effluent in aerated lagoons, with additional treatment via chemicals. Treated effluent can be land applied to a field of crops in the dry season or discharged to a river in the wet season. Regulatory requirements applying to the North Santiam River will likely require constructing a wastewater treatment system capable of producing an effluent of higher quality than aerated lagoon systems are capable of. Additionally, the Canyon receives approximately 65 – 100 inches of rain annually and is predominately mountainous topography.

FIGURE 5-2: EXAMPLE AERATED LAGOONS

These constraints require a different type of treatment system be constructed in the NSC.

The wastewater treatment system will be permitted as a water pollution control facility (WPCF). For DEQ to issue the WPCF permit, the facility must not discharge to surface water. Treated effluent must be disposed of in a method that is cognizant of the heavy rainfall, feasible to construct in the Canyon's topography, and compliant with the Three Basin Rule by being demonstratable as not connected to the North Santiam River.

5.9 DESIGN CRITERIA

Regulations, existing constraints, and water quality impacts directly affect the requirements for wastewater infrastructure, as discussed below.

5.9.1 Collection System

Pump Station Regulatory Requirements

Pump stations lift wastewater and convey it to a discharge point. Pump stations, regardless of the type of collection system, 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. 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. Ideally, a dedicated gen-set, with automatic transfer switch, is located at each pump station to meet redundancy requirements. However, mobile generators or portable trash pumps may be acceptable for some 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.

<u>Pipeline Regulatory Rules (CMOM Guidance)</u>

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) infiltration and inflow (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 (i.e., requirements for installation and regular maintenance of grease interceptors). All new facilities believed to contribute FOG should be equipped with grease interceptors. This is a policy decision that the NSSA will have to make.

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. The City's discharge permit also includes requirements for an Emergency Response and Public Notification Plan.

<u>Excessive Infiltration and Inflow</u>

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 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.

<u>Pipeline Surcharging</u>

Pipeline surcharging occurs as flow in the pipe exceeds the capacity of a full pipe (deeper than the diameter of the 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

Any illicit cross connections from the City's storm water system should be removed.

5.9.2 Wastewater Treatment Plant

Treatment Reliability and Redundancy

The EPA Technical Bulletin EPA-430-99-74-001: Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability (1973) requires new or expanding wastewater treatment plants that discharge to a receiving stream to meet minimum standards for mechanical, electrical, and component reliability. Redundancy and reliability refer to the level of protection required for the environment and receiving stream. The standards are divided into three increasingly stringent classes of reliability:

Reliability Class I: Works that discharge, or potential discharge, (1) into public water supply, shellfish, or primary contact recreation waters, or (2) as a result of its volume and/or character, could permanently or unacceptably damage or affect the receiving waters or public health if normal operations were interrupted.

- *Example:* discharging near drinking water intakes or into shellfish waters.

Reliability Class II: Works that discharge, or potential discharge, as a result of its volume and/or character, would not permanently or unacceptably damage or affect the receiving waters or public health during periods of short-term operations interruptions, but could be damaging if continued interruption of normal operations were to occur (on the order of several days).

- *Example:* discharging into recreational waters

Reliability Class III: Works not otherwise classified as Class I or Class II.

Class I and Class II requirements are outlined in Table 5-17. In addition to these standards, unit operations must be designed to pass the peak hydraulic flow with one unit out of service. Also, mechanical components in the facility must be designed to enable repair or replacement without violating the effluent limitations or causing control diversion.

TABLE 5-17: EPA REQUIREMENTS FOR RELIABILITY

Component	Reliability Class I	Reliability Class II
Raw sewage pumps, lift stations	Peak flow with largest unit out of service. Peak flow is defined as the maximum wastewater flow expected during the design period.	
Mechanical bar screens	One backup with either manual or mechanical cleaning shall be provided. Facilities with only two screens shall have at least one manually cleaned bar screen.	
Grit removal	Overflow shall be sufficient to pass peak flow with all grit units out of service.	
Primary sedimentation	50% of design flow capacity with the largest unit out of service. Design flow is defined as the flow used as the design basis of the component.	
Active sludge process	A minimum of two equal volume basins shall be provided. No backup basin required.	
Aeration blowers	Supply the design air capacity with the largest unit out of service shall be provided. A minimum of two units.	
Air diffusers	With the largest section of diffusers isolated or out of service, oxygen transfer capacity shall not be measurably impaired	
Secondary sedimentation	The units shall be sufficient in number and size so that, with the largest unit out of service, the remaining units have capacity for at least 65% of the design flow.	The units shall be sufficient in number and size so that, with the largest unit out of service, the remaining units have capacity for at least 50% of the design flow.
Filters/advanced treatment	The units shall be sufficient in number and size so that, with the largest unit out of service, the remaining units have capacity for at least 75% of the design flow.	No backup required.
Disinfection basins	50% of the design flow capacity with the largest unit out of service. Design flow is defined as the flow used as the design basis of the component.	
Effluent pumps	Peak flow with largest unit out of service. Peak flow is defined as the maximum wastewater flow expected during the design period.	
Electrical power	Provisions of two separate and independent sources of electrical power, either from two separate utility substations or from a single substation and a works-based generator shall be provided. Designated backup source shall have sufficient capacity to operate all vital components, critical lighting, and ventilation during peak flow conditions.	
	The provision of backup power capacity for secondary treatment, final clarification, and advanced treatment is required. The provision of capacity for degritting and sludge handling and treatment is optional.	The provisions of backup power capacity for secondary treatment, final clarification, and advanced treatment is optional. The provisions of capacity for degritting and sludge handling and treatment is not required.
Sludge holding tanks	The volume of the holding tanks shall be based on the expected time necessary to perform maintenance and repair of the component in question.	
Anaerobic digestion	At least two digestion tanks shall be provided. Backup sludge mixing equipment shall be provided or the system shall be flexible enough such that with one piece of equipment out of service, total mixing capacity is not lost. Backup equipment may be uninstalled.	
Aerobic digestion	A backup basin is required. At least two blowers or mechanical aerators shall be provided. Isolation of largest section of diffusers without measurable impairing oxygen transfer is allowed.	
Sludge pumping	Pumps sized to pump peak sludge quantity with one pump out of service. Backup pump may be uninstalled.	

Source: EPA Technical Bulletin EPA-430-99-74-001: Design Criteria for Mechanical, Electrical, and Fluids System and Component Reliability (1973)

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6. MILL CITY SEWER SYSTEM EVALUATION

This section presents a description of Mill City's existing sewer system, an evaluation of existing assets and capacity, presents options for improvements, and references the valuation of the existing assets and liabilities.

6.1 BACKGROUND

Mill City has the only wastewater system among the canyon communities. The majority of the collection and treatment system was built in 1992. In 2009 an improvement project replaced all three of the collection system pump stations as well as some treatment system components. No other major improvements have been made to the collection or treatment system. The required operator classification for both the collection and treatment systems is Grade I.

6.2 EXISTING CONDITION - COLLECTION SYSTEM

Mill City's community wastewater collection system includes remote treatment in interceptor and septic tank effluent gravity (STEG) as well as some septic tank effluent pumping (STEP) systems. The effluent flows by gravity or is pumped to a gravity main or directly to a pump station – River Road, Spring Street, or First Street – for conveyance to the wastewater treatment plant from these remote treatment units. The piping network is 2, 4, 6, and 8-inch PVC pipe. However, the majority of the system is 4-inch PVC. There are cleanouts on the conveyance piping but very few manholes.

FIGURE 6-1: SPRING SREET PUMP STATION

A permanent diesel generator with a transfer switch is located at each of the three pump stations in the event of power loss. The City can also bypass each pump station using a backup pump on a trailer. The River Road Pump Station pumps to a gravity main on NW Alder Street and then drains into the First Street Pump Station. Each pump station has two pumps with an additional spare pump not in service. The pump station characteristics are summarized in Table 6-1.

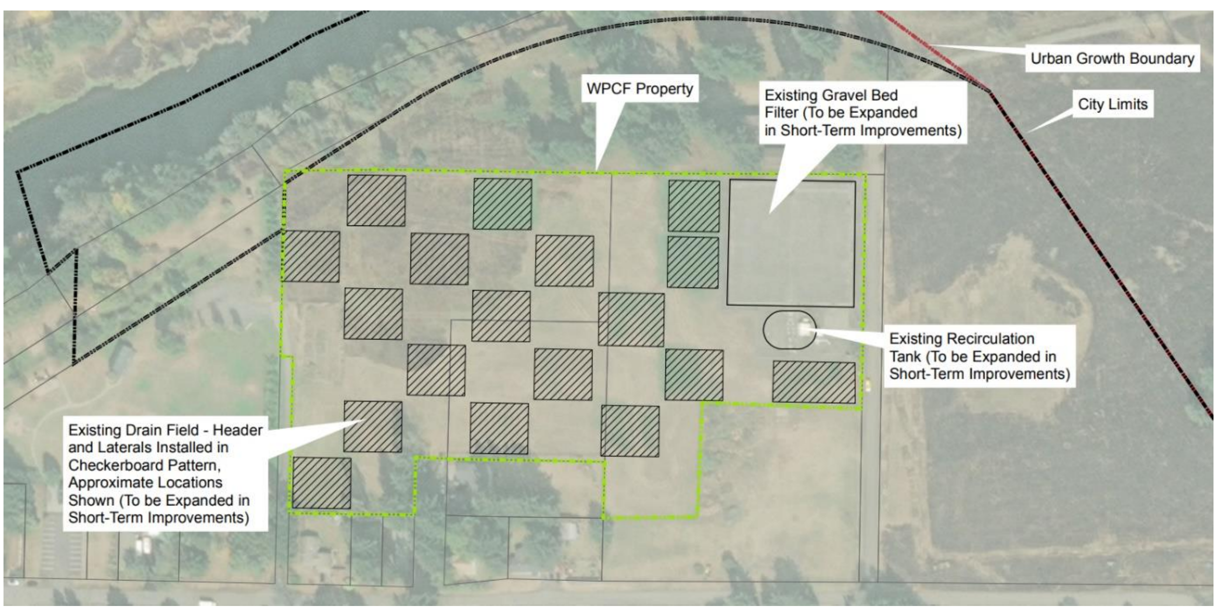
TABLE 6-1: PUMP STATION SUMMARY

Parameter	River Road	Spring Street	First Street
Number of Pumps	2	2	2
Firm Capacity (gpm)	60	350	125
Total Dynamic Head (ft)	58	90	85
Pump Horsepower (Each)	6.5	20	6.5

Several measures taken by the City's operators have improved the collection system performance over the past several years. The collection system has historically seen very little infiltration and inflow (I/I). However, an area near the school and another area in northeast Mill City were identified as problematic during smoke testing. These areas have been repaired, and less flow is observed at the treatment plant during rain events. Another recent software upgrade of the pump station transfer switches has resulted in fewer nuisance alarms from the SCADA system. Finally, more frequent, or consistent solids removal by the City from the STEP tanks has reduced the issues with too many solids making their way to the Water Pollution Control Facility (WPCF).

6.3 EXISTING CONDITION - TREATMENT PLANT AND DISPOSAL

FIGURE 6-2: MILL CITY WPCF



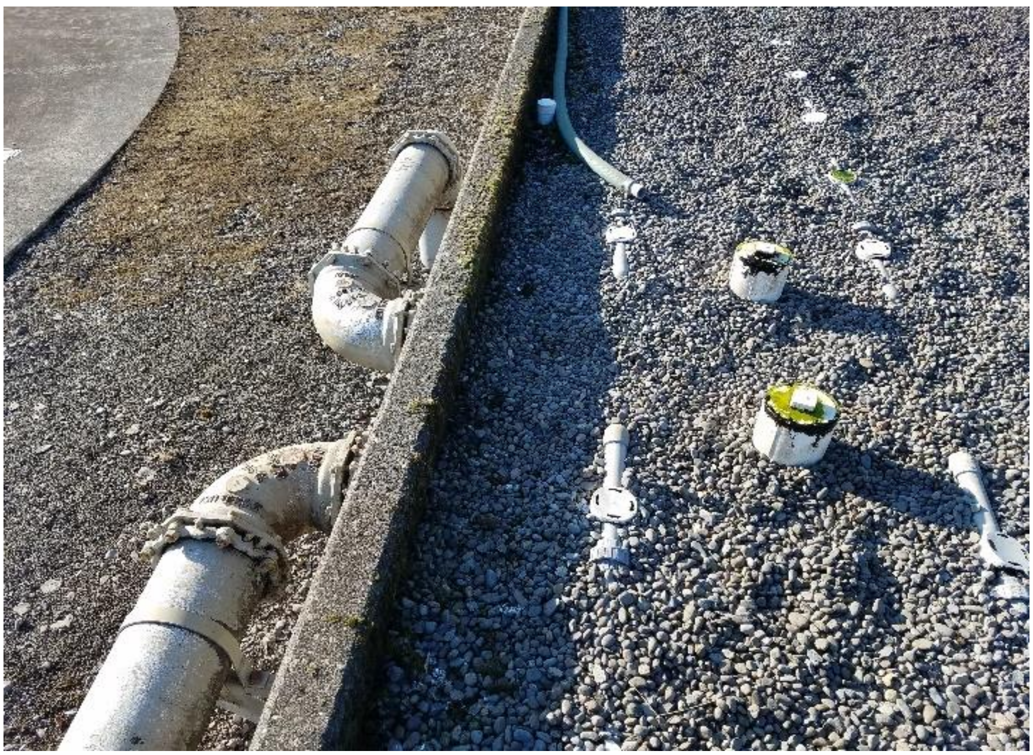
WPCF is located adjacent to Kimmel Park on Remine Road. Mill City's WPCF (Figure 6-1) consists of influent flow monitoring, a recirculation/equalization tank (with two compartments), a recirculating sand filter, and disposal drain fields. The influent flow is measured in the influent Parshall flume. Following the flume, the influent passes through a static screen into the recirculation/equalization tank. The screen is cleaned manually. Filter feed pumps transport the wastewater from the recirculation/equalization tank to the sand filter. A biofilm on the sand filter treats the wastewater. After passing through the filter, approximately 80% of the filtrate water is recirculated in the recirculation/equalization tank back to the sand filter. The remaining 20% is routed to the effluent pumps. Manual slide gates are used to adjust and control the flow to the effluent pumps. The effluent pumps dispose of the treated wastewater in the City's drain fields.

FIGURE 6-3: MILL CITY'S WATER POLLUTION CONTROL FACILITY

Automatic samplers collect the influent and effluent wastewater samples. The influent sample is taken from the influent flow metering manhole. The effluent sample is taken from the effluent pump chamber. The samples are sent to Waterlab Corporation (Salem, OR) for testing. Solids from the WPCF are periodically removed from the recirculation/equalization tank and disposed of by a licensed sewage disposal service. The removal frequency is approximately every five years. Odors are drawn from the influent metering manhole, energy absorption manhole, and recirculation/equalization tank influent chamber and are treated using a biofilter. A permanent diesel generator with an automatic transfer switch is installed at the WPCF for use in the event of power loss. The City's SCADA system monitors the collection system pump stations and WPCF. Backup power at each connection is not necessary as most discharge by gravity with a small group of STEP systems. These STEP systems provide some storage. During a prolonged power outage, this may require limiting wastewater discharge by users or providing backup power to STEP users. During past emergency power outages, the mayor of Mill City has had to travel around town providing backup power to residents on STEP systems.

The pumps, composite samplers, biofilter, and Parshall flume ultrasonic level sensor were replaced in 2009. Most of the current issues at the WPCF are electrical. Several of the electrically actuated valves in the drain field have failed and need to be replaced. The wiring and relays in the control room have burned out. Although the SCADA system information is collected at the WPCF Office, the SCADA system does not provide details on the alarms to the operator, so the operator, when notified, must first go to the WPCF Office to observe the specific alarm. The programmable logic controller (PLC) is old and is no longer supported. The heater in the WPCF Office is also broken. Most recently, the bearings on the odor control blower have failed, as well as a seal of one of the effluent pumps. In general, the equipment is wearing down and requiring more expensive repairs.

FIGURE 6-4: MILL CITY'S FILTER



Deficiencies

- Electric valves in the drain field have failed leading to uneven use of the drain field.
- The wiring and relays in the control room have burned out.
- The SCADA system does not provide specific alarms to the operator.
- The PLC needs to be replaced.
- The office heater is broken.

6.3.1 Treatment Plant Performance

Mill City's current WPCF permit requirements are shown in Table 6-2.

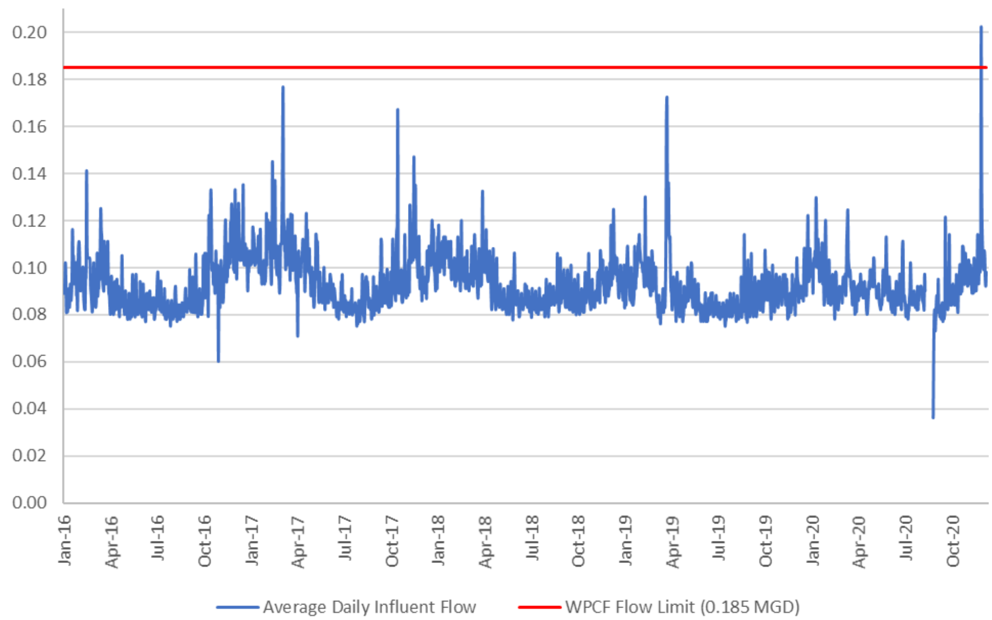
TABLE 6-2: WPCF PERMIT REQUIREMENTS

Parameter	Maximum Daily Limit
Influent Max. BOD_5 (mg/L)	300
Influent Max. O&G (mg/L)	25
Influent Max. TSS (mg/L)	150
Influent Max. TKN (mg/L)	150
Influent Flow (MGD)	0.185
Effluent Flow (MGD)	0.0925 (Approximately 50% of Influent Flow)
Effluent Max. BOD_5 (mg/L)	20
Effluent Max. TSS (mg/L)	20

BOD_5 = five-day biochemical oxygen demand
mg/L = milligrams per liter
MGD = million gallons per day
TSS = total suspended solids
TKN = total Kjeldahl nitrogen
O&G = oil and grease

The City's WPCF data from 2016 through 2020 was analyzed as a part of this planning study. A comparison of the historical influent flow is compared to the WPCF permit conditions in Chart 6-1 below. From 2016 to 2020, with the exception of one day, the WPCF was in compliance with influent flow permit requirements, with many of the average flows well below 80% of the WPCF capacity. On December 21, 2020, Mill City received approximately 4¼ inches of rain and the influent flow was 0.202 MGD (0.017 MGD higher than the permit limit). This correlates to the WPCF being within flow limits for more than 99.9% of the time.

CHART 6-1: WPCF MAXIMUM DAILY FLOW



The influent concentrations were in compliance with permit requirements as shown in Charts 6-2 through 6-4. Since the collection system includes treatment that clarifies the wastewater, the influent TSS and BOD_5 measured at the WPCF are lower than typical domestic influent.

CHART 6-2: WPCF MONTHLY AVERAGE INFLUENT BOD CONCENTRATIONS

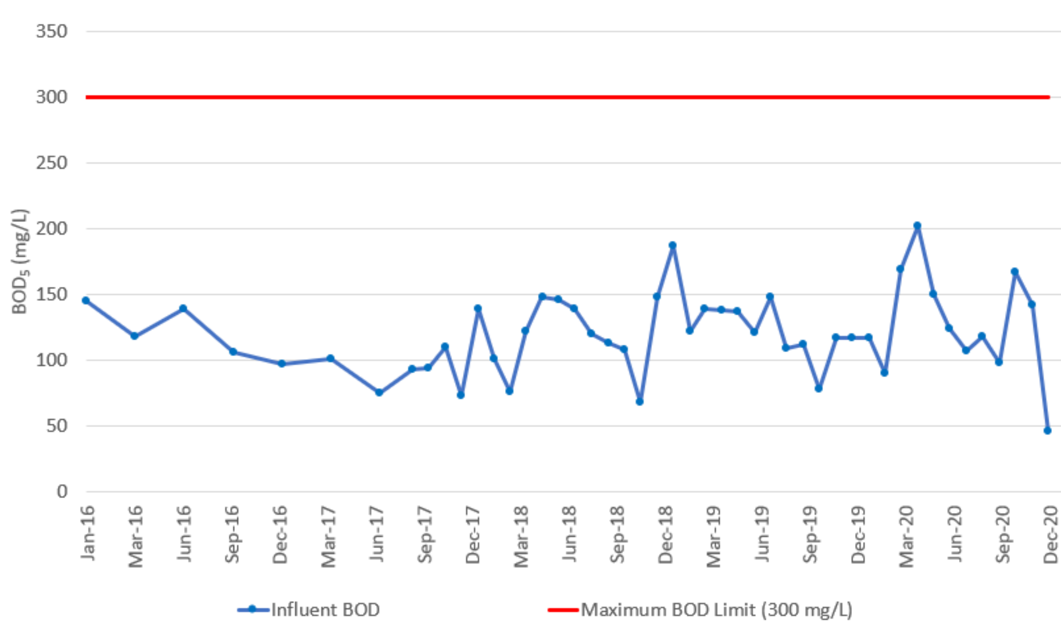


CHART 6-3: WPCF MONTHLY AVERAGE INFLUENT TSS AND TKN CONCENTRATIONS

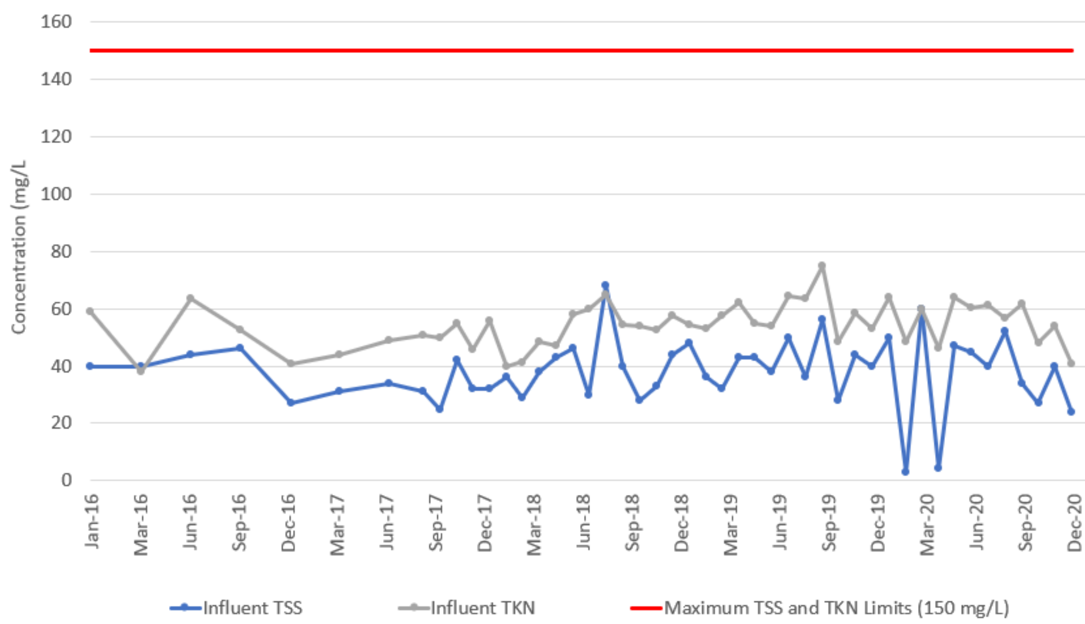
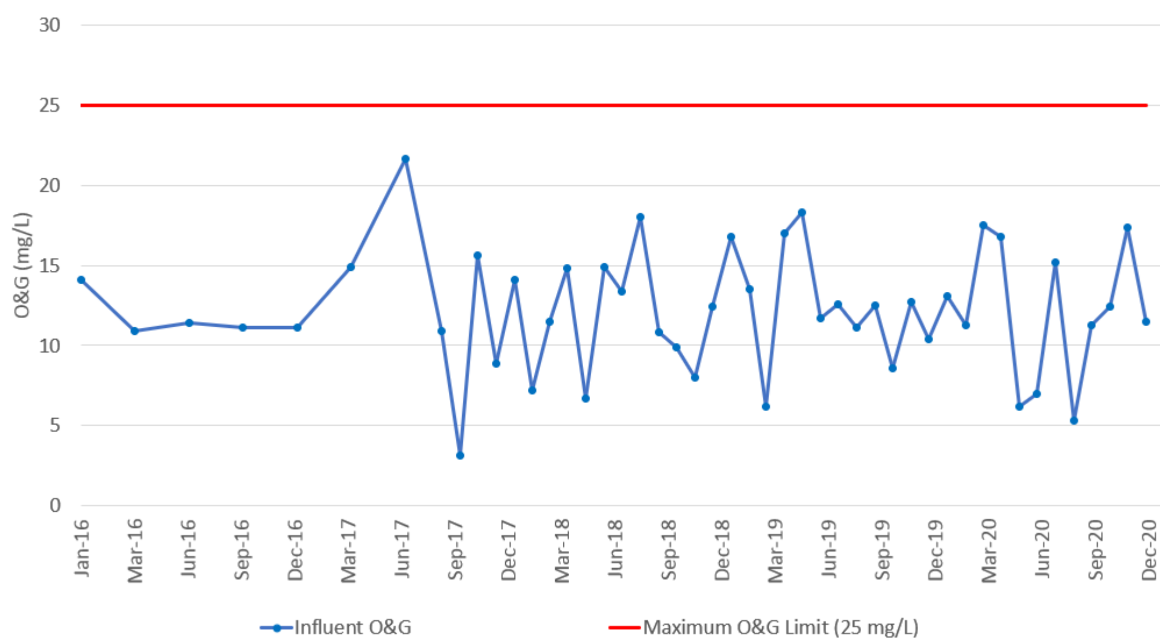
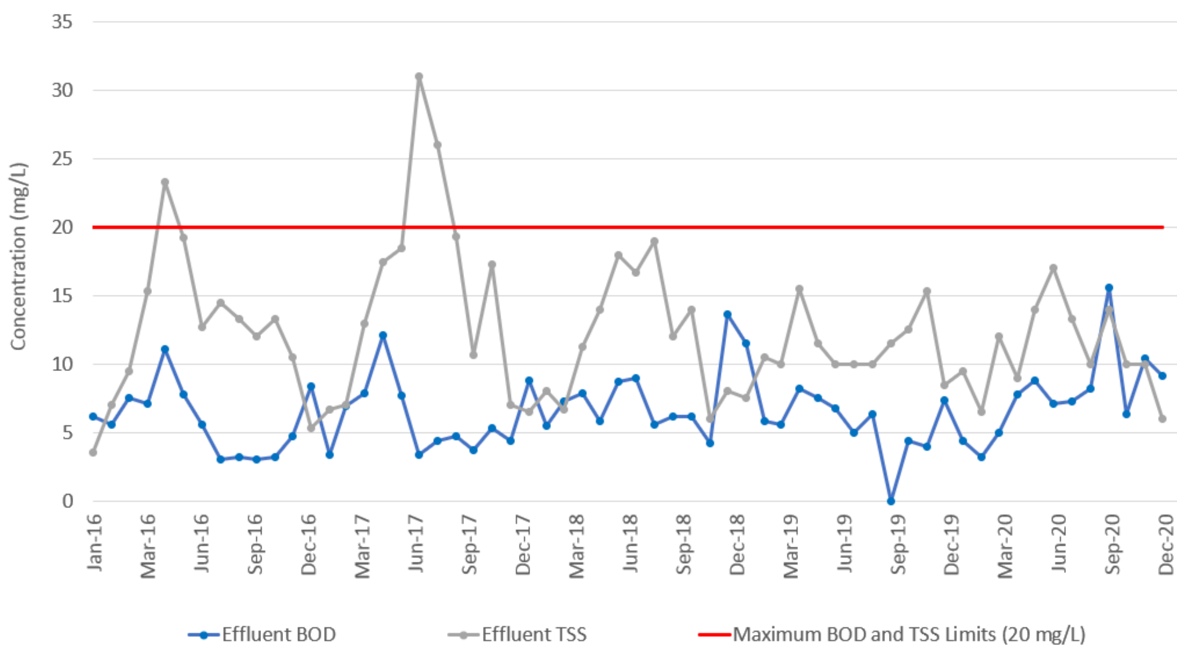


CHART 6-4: WPCF INFLUENT O&G CONCENTRATIONS



The Mill City WPCF effluent data for the years 2016 to 2020 is shown in Chart 6-5.

CHART 6-5: WPCF EFFLUENT CONCENTRATIONS



From 2016-2020, except for a few months where the effluent TSS exceed permit limits, the WPCF was in compliance with the effluent permit requirements. The Mill City WWTP operator believes the high TSS concentrations may have come from cottonwood tree seeds getting into the filter.

6.3.2 Treatment Plant and Disposal Capacity

This section compares the original rated capacity to the current influent flow. Mill City's flows are discussed in Section 5.5. Table 6-3 summarizes the rated capacity and the current influent flows. The rated capacity was established from the 1990 WPCF design documents.

TABLE 6-3: DESIGN CAPACITY VS. CURRENT INFLUENT

	Design Capacity	2021 Planning Flows
Influent		
Average Dry Weather Flow (gpd)	92,500	87,000
Average Wet Weather Flow (gpd)	170,000	98,000
Peak Day Wet Weather Flow (gpd)	185,000	202,000
Influent Biochemical Oxygen Demand (BOD_5, mg/L)	200	105
Influent BOD_5 (lbs/day)	307	155
Recirculation/Equalization Tank		
Volume (gallons)	185,000	--
Hydraulic Retention Time @ Peak Day Wet Weather Flow (hr)	24	25
Sand Filter		
Surface Area (ft^2)	36,864	--
Average Dry Weather Hydraulic Loading ($gal/ft^2/day$)	2.5	2.4
Average Wet Weather Hydraulic Loading ($gal/ft^2/day$)	4.6	2.7
Peak Day Wet Weather Hydraulic Loading ($gal/ft^2/day$)	5.0	5.5
Drainfield		
Area (acres)	10	--
Design Hydraulic Loading (gal/ft)	12.5	5.7 (ADWF) 6.5 (AWWF) 13.3 (PDWWF)
Linear Feet	15,200	--

Based on the planning criteria established in Section 5, and the WPFC design capacity, the design flows are below the rated capacity for both average dry and wet weather flows. However, the design peak wet weather flow is above the rated capacity.

As shown in Table 6-3, the drain field is within capacity limits for average day and average wet weather flow. However, as with the gravel bed filter, the peak day wet weather design condition does exceed the capacity of the drain fields.

6.4 IMPROVEMENTS

As mentioned in Section 6.3.2, the WPCF has had a one-day event in which it exceeded its peak day rated capacity. To address the flow capacity limitations, one solution is to expand the existing WPCF. This is described in Section 6.4.1 below. Another option to address flow capacity limitations, is to construct a new wastewater treatment plant (refer to Chapter 10 of this report for details) with sufficient capacity for the planning period. Either of these options will likely require Facility Planning Studies, studies related to impacts to groundwater quality and similar design and construction schedules. As such, it is anticipated that either option will take several years to study, design and construct a facility with sufficient capacity to meet design flows.

6.4.1 Expansion of Existing WPCF to Address Capacity Limitations

These improvements include expanding the equalization/recirculation tankage, installing larger capacity pumps, and constructing additional gravel bed filters. Additionally, land for drainage fields would need to be acquired, and drainage fields installed. In connection with all of these improvements, applicable permitting and environmental analysis will need to be completed. Table 6-4 shows the possible improvement costs to expand the WPCF and disposal systems rated capacity to approximately 255,000 gallons per day, peak day flow. This would place the treatment plant and drainage fields at 80% capacity, which would provide a buffer to allow for a small amount of growth. These improvements are not intended to be a long-term solution for growth in Mill City, but rather a stop gap until future improvements are implemented. These future improvements are discussed in Chapter 10.

TABLE 6-4: ESTIMATED COST FOR SHORT-TERM CAPACITY INCREASE

WPCF Expansion Improvements	$797,000
General Conditions (10%)	$80,000
Contingency (30%)	$270,000
Contractor OH&P (15%)	$180,000
Total Construction Cost	**$1,327,000**
Drainage Field, Land Acquisition	$100,000
Permitting, General and Administrative Costs (30%)	$400,000
Total Project Cost	**$1,827,000**

The costs shown are planning-level estimates (Class 4 cost opinion by the Association for the Advancement of Cost Engineering) and can vary depending on market conditions. The costs assume the new flows come from the existing STEG/STEP systems. For disposal, a new drain field adjacent to the WPCF was assumed.

6.4.2 Short Term Improvements

As the capacity related improvements identified in Section 6.4.1 may require several years to implement, it is prudent to identify short term improvements that need to occur prior to this work. As mentioned in Section 6.3, there are some pressing needs at the existing WPCF. Additionally, in general the existing equipment is also reaching the end of its useful life, so additional funds are included for repairs on other short-lived assets (e.g., pumps, fans, valves, etc.). The estimated costs for improvements to short-lived assets for the existing equipment is shown in Table 6-5. These improvements provide no additional capacity to the WPCF.

TABLE 6-5: SHORT-TERM REPLACEMENT COSTS

Drain Field Electric Valves	$20,000
New Control Panel with New PLC	$45,000
SCADA System Alarms and Office Heater	$11,000
Miscellaneous Replacements (Existing and New; Pumps, Fans, etc.)	$100,000
Short-Term Replacement Costs	**$176,000**

6.4.3 Recommendations for Improvements

As noted in Section 6.4.2, several components of the existing WPFC have failed or are at the end of their useful life. In order to maintain the current level of service, it is recommended to carry out these short-term improvements.

For capacity related issues, either the expansion of the existing facility (and associated drain fields) or the construction of a new mechanical treatment plant (with an alternative disposal option) will require several years of study, design, and construction. Furthermore, in communications with DEQ, it has been noted that the current drain field loading rate of 12.5 gpd/ft2 is much higher than what is typically permitted and there is potential that any expansions of the drain fields may not be permitted at the current loading of 12.5 gpd/ft^2. Additionally, there is the potential that drain fields installed on land near the existing WPCF may be determined to be directly connected to the Santiam River and may result in a violation of the Three Basin Rule, thus requiring new drain fields to be installed in a different location. This would add cost to this option in a new pipeline and pumping system.

Based on these limitations, it is recommended to address capacity limitations by moving forward with the study, design, and construction of a new mechanical treatment plant with an alternative disposal option as described in Chapter 10. While the PDWWF design conditions are above the existing WPCF's capacity, it is also recommended that Mill City and the North Santiam Sewer Authority (NSSA) begin communications with DEQ to show that progress is being made toward this solution.

The DEQ may also allow Mill City to add new connections with the understanding and commitment that the long-term solution recommended in Section 10 will be funded and implemented. Early discussions along with better details on what type of connections and how many are being requested will be required for the DEQ to provide meaningful input and make any decision.

6.5 IMPENDING COSTS TO MILL CITY CURRENT RESIDENTS FOR NEEDED REPAIRS AND EXPANSIONS

The short-term capacity related improvements described in Table 6-4 are anticipated to result in a change in sewer rates. The calculation of these rate changes is included in the previously mention Business Case Scenario (Appendix K). Table 6-6 summarizes the anticipated monthly rate.

TABLE 6-6: MILL CITY ALTERNATIVE COST

Exhibit 4: Mill City Rates with Short-term Capital Improvements

Mill City Comparison of Alternatives		
If Mill City were not part of a regional partnership:		
Short-term capital investment needed		$ 1,827,000
Source: Keller. Includes soft costs and land acquisition		
Assumed Borrowing Terms:		
Length of Loan	20 years	
Interest Rate	3%	
New Debt Service - annual		$ 120,000
Assumed additional O&M costs		$ 100,000
Total additional annual costs		$ 220,000
Number of EDUs		839
Impact on monthly rate		$ 22.00
Current monthly rate per EDU		$ 44.10
Monthly rate with short-term improvements (rounded)		$ 66.00

6.6 MILL CITY VALUATION AND BUSINESS CASE SCENARIO

Among the four communities in the NSSA, Mill City is the only one with an existing sewer utility. To form an integrated regional sewer utility, NSSA would need to acquire the Mill City system. As part of this acquisition, the regional system would take over the Mill City assets and liabilities in exchange for payment.

As part of master planning efforts, a financial sub-consultant, FCS Group, prepared a valuation of Mill City's existing system. The purpose of the valuation is to determine a recommended Fair Value of the Mill City sewer assets and liabilities. Reference the Business Case Scenario (Appendix K) for the valuation details.

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7. COLLECTION SYSTEM OPTIONS

This section outlines the development of concept level alignments for septic tank effluent gravity, septic tank effluent pumping, and gravity collection systems, and approximate lift station locations. Note that the regional conveyance between cities seen in conceptual collection system layouts require the construction of pressure pipes outside of the urban growth boundaries (UGBs). This requires a land use approval by Marion and Linn Counties.

7.1 WASTEWATER BASINS

The cost of constructing, operating, and maintaining a community wastewater collection and treatment system can be mitigated through economies of scale. Connecting more users to a single system lowers the cost per user and simplifies maintenance. The cities of Idanha-Detroit and Gates-Mill City are relatively close to each other with the distance in between the communities being approximately 4 and 3 miles, respectively. Following the alignment of the North Santiam Highway, the distance between Detroit and Gates is approximately 16.1 miles. Geographically, it is most efficient to consider two wastewater treatment plant (WWTP) basins: Idanha-Detroit and Gates-Mill City. Alternatively, effluent or treated wastewater may be transferred by pipe from the Idanha-Detroit area to the Gates-Mill City area. A pipeline between the Idanha-Detroit basin and the Gates-Mill City basin would be subject to significant geological hazards. Oregon Department of Transportation has reported that landslide mitigation efforts are conducted annually along the highway, as the roadway continually settles. For more discussion on the scenario that uses a pipeline to transfer effluent from Idanha/Detroit to Gates/Mill City, see Section 10.

7.2 SEPTIC TANK EFFLUENT GRAVITY COLLECTION SYSTEM

A Septic Tank Effluent Gravity (STEG) utilizes components from both a Gravity and Septic Tank Effluent Pumping (STEP) system. Gravity collector lines are designed to flow by gravity to low points in town. From the low points, a pump station pumps wastewater through a force main to the treatment facility. Connections are made to the gravity collector line via gravity, where possible, but can also be made through a small pressurized lateral line.

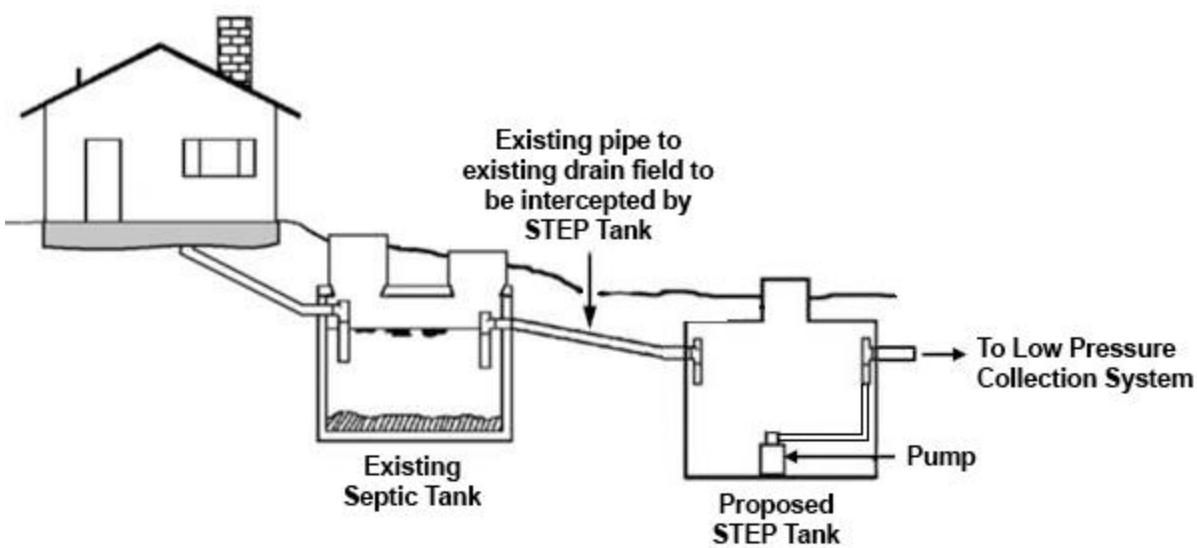
7.3 SEPTIC TANK EFFLUENT PUMPING COLLECTION SYSTEM

This section describes the collection system layout of each community if they were served by a STEP system as opposed to a gravity collection system. A STEP system pumps effluent from each septic tank to the Water Pollution Control Facility (WPCF). Where the gravity system requires a lift station at every low point, STEP systems can pump using a constant pressure from the entire STEP network to carry flow to the WPCF or a regional lift station. Note that septic tanks in a STEP system will require ongoing maintenance. Policy decisions that the sewer authority will have to make regarding potential septic tank maintenance activities are discussed in Section 11. The cost comparisons between gravity and STEP collection systems can be referenced in Section 10.

The gravity collection systems described later in this section have alignments that are required to deviate from the public right-of-way to avoid constructing additional lift stations. The STEP collection systems can remain inside the public right-of-way without this design limitation. The pressure lines carrying effluent from the septic tanks to the WPCF was assumed to be a minimum of 2-inch based on typical industry standards. One regional lift station per community is still required to pump the City's flow to the WPCF.

The communities of Gates, Detroit, and Idanha already have existing septic tanks and these facilities could be utilized, where suitable, to implement the new STEP sewer collection system. Existing STEP systems could be inspected to determine their condition, if they are in satisfactory condition, they could be plumbed into the new collection system, but if they do not pass inspection, it is recommended that they be replaced. In general, existing septic tanks in satisfactory condition will have their drain field line connected to a new STEP pipe and tank to pump into the new collection system as shown in Figure 7-1. The following sub-sections discuss the STEP system and the required facilities in each town.

FIGURE 7-1: STEP SYSTEM WITH EXISTING SEPTIC TANK



7.3.1 Gates (STEP System)

The STEP collection system in Gates would follow the public right-of-way and convey flows to the Sorbin Street Regional lift station where effluent would be pumped to the existing WPCF east of Mill City. One bridge crossing would be required to serve properties south of the Sorbin Street bridge.

<u>Lift Stations and Force Mains</u>

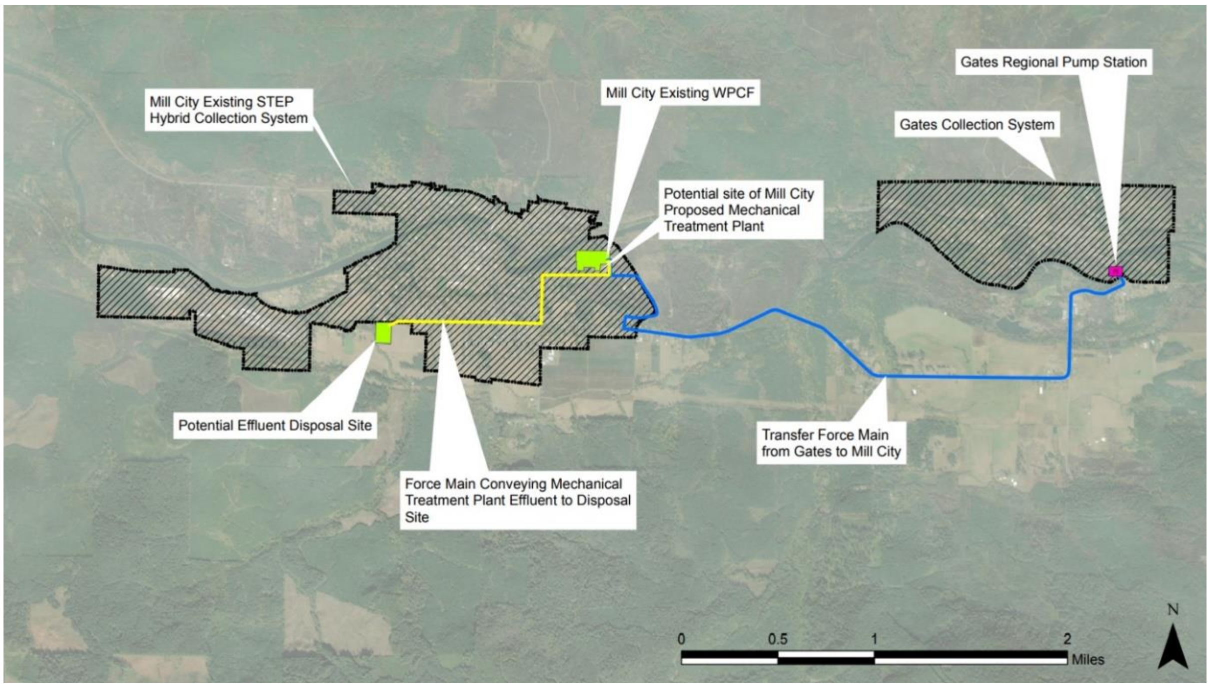
Sorbin Street Regional Lift Station

The Sorbin Street lift station would be the only lift station required in Gates. This lift station would be in the same location, same force main alignment, with the same right-of-way and easement constraints as described in the gravity collection system summary and would convey the same flows.

Regional Conveyance

Consistent with the basins presented earlier in this section, the STEP collection systems would require regional conveyance between Gates and Mill City. This would require the construction of a regional lift station and transfer pipeline. The basin is presented in Figure 7-2.

TABLE 7-2 MILL CITY AND GATES BASIN



7.3.2 Detroit (STEP System)

The STEP collection system in Detroit would follow the public right-of-way and convey flow to the Highway Regional lift station where it would be pumped either to the City of Gates or the new Blowout Regional lift station.

Lift Stations and Force Mains

Highway Regional Lift Station

The Highway Regional lift station would be the only lift station required in Detroit. This lift station would be in the same location, same force main alignment, with the same right-of-way and easement constraints as defined in sub-section gravity collection system summary and would convey the same flows.

7.3.3 Idanha (STEP System)

The STEP collection system in Idanha would follow the public right-of-way and require one bridge crossing over the Santiam River on Church Street. All pressure pipe in Idanha would flow to the Blowout Regional lift station where it would be pumped either to the City of Detroit or to the adjacent WPCF.

Lift Stations and Force Mains

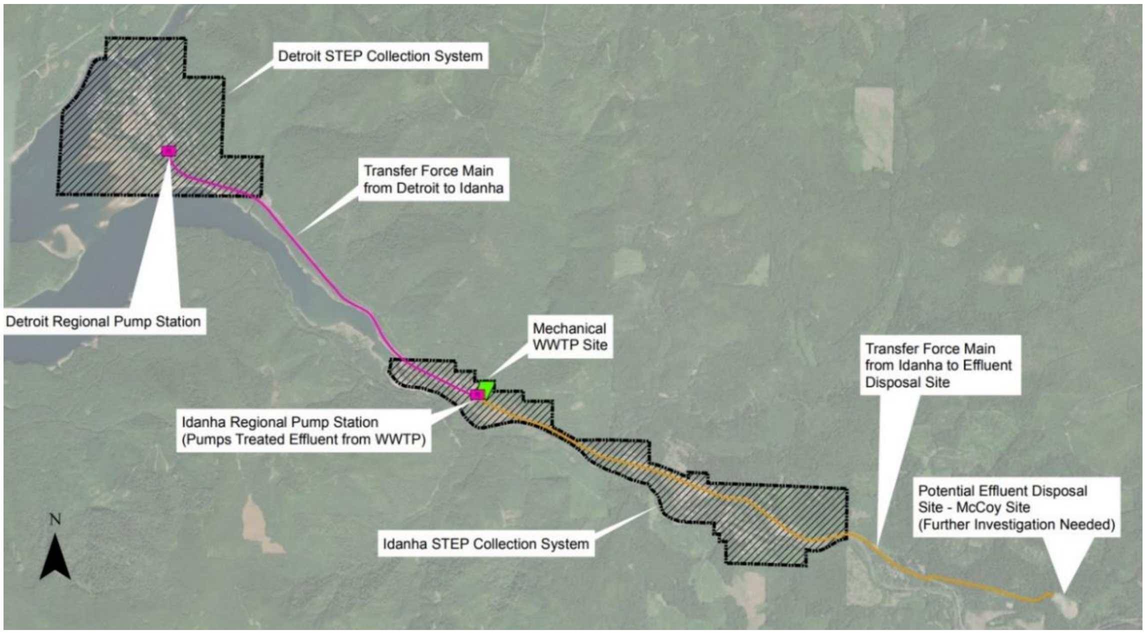
Blowout Regional Lift Station

The Blowout Regional lift station would be the only lift station required in Idanha. This lift station would be located as described in the gravity collection system summary and would convey the same flows.

Regional Conveyance

Consistent with the basins presented earlier in this section, the STEP collection system would require regional conveyance between Detroit and Idanha. This would require the construction of a regional lift station and transfer pipeline. The basin is presented in Figure 7-3.

FIGURE 7-3: IDANHA AND DETROIT BASIN



7.4 GRAVITY

A gravity collection system collects flow from users via laterals, where flow travels by gravity. From the laterals, wastewater flows by gravity to low points throughout town. At the low points, a lift station is to be constructed. The lift stations pump wastewater through force mains to the WPCF site. Because gravity collection systems depend on topography, the North Santiam Sewer Authority (NSSA) Board requested that conceptual gravity collection system alignments and profiles be prepared. The following section identifies the gravity pipes, grinder pumps, lift stations, and pressure pipes necessary to create a functioning gravity collection system for the Cities of Idanha, Detroit and Gates' sewer systems.

Lift Stations

All lift stations assume an underground concrete wet well with submersible pumps, adjacent electrical/controls pedestal, and an outdoor sound attenuated generator. The following sub-sections describe the collection system required to service each community by gravity.

Force Mains

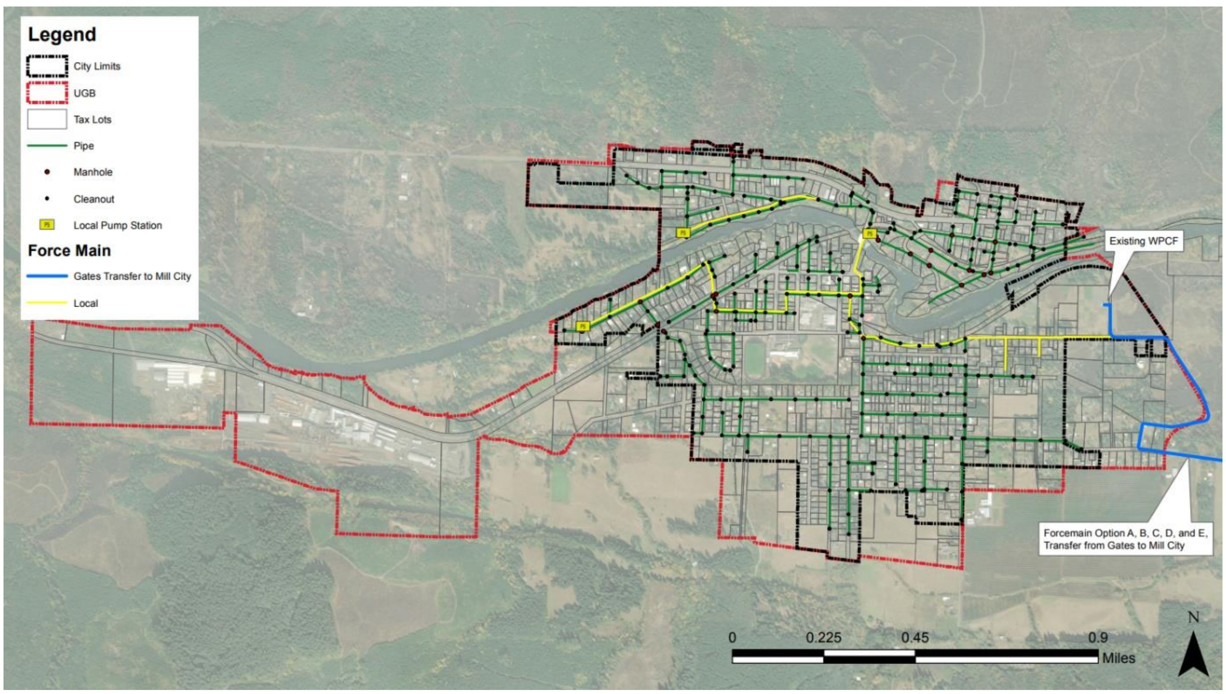
All force mains are assumed to be constructed at a four-foot minimum depth and follow the general topography of the land. For analysis and comparison, an air release valve is assumed to be necessary every 300 feet along the force main.

For final design efforts, the maximum spacing of manholes in the collection system is recommended to be 400 feet. For this master planning level conceptual layout of collection systems, manholes were conservatively placed at a distance no greater than 300 feet.

7.4.1 Mill City

Mill City is the only community in the study area with an existing community wastewater collection system (Figure 7-4). For a discussion and evaluation of Mill City's existing system, see Section 6. The full-size image can be found in Appendix C as Figure 9.

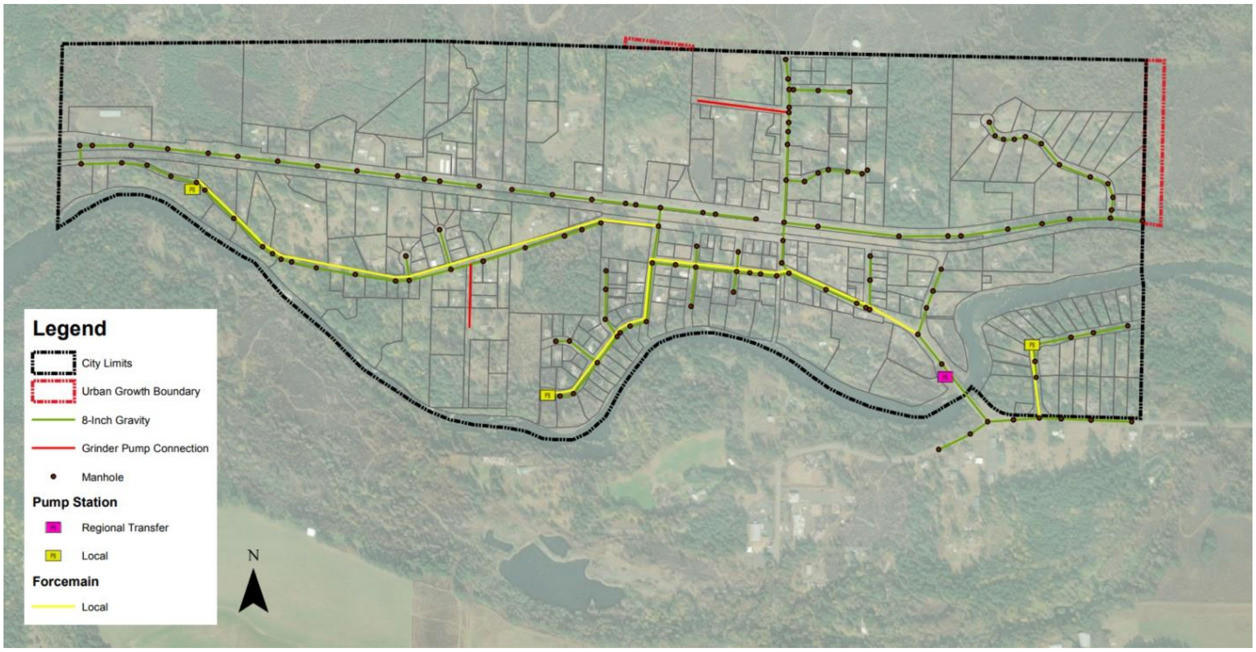
FIGURE 7-4: MILL CITY EXISTING COLLECTION SYSTEM



7.4.2 Gates (Gravity Collection)

The proposed local gravity collection system for Gates is illustrated in Figure 7-5. The full-sized figure can be found in Appendix C as Figure 8.

FIGURE 7-5: GATES GRAVITY COLLECTION SYSTEM



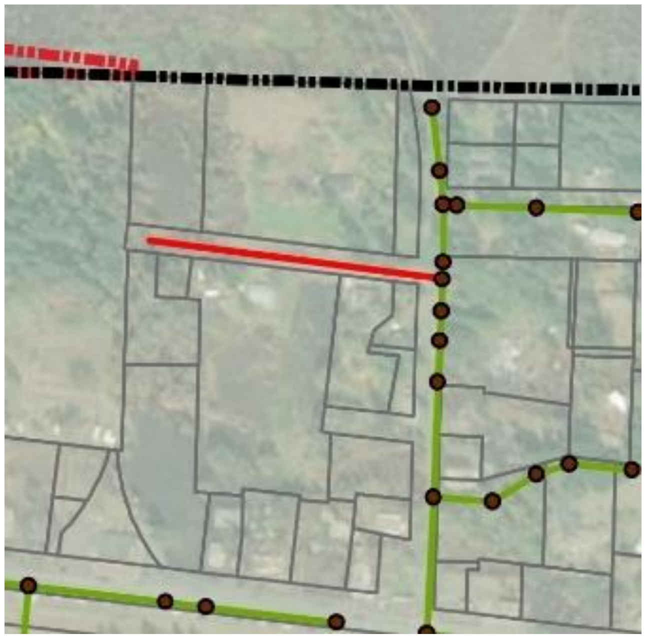
Gravity Pipes

Design of Gates' gravity collection system is driven by the North Santiam River. The surrounding residential areas vary greatly in vertical elevation. Most of the proposed pipes and structures are less than 10 feet deep and generally flow toward the river. Three lift stations would be needed to convey wastewater from low points along the North Santiam River to a single lift station that will pump the effluent south and west along Gates School Road to the existing Mill City WWTP.

Grinder Pumps

Grinder pumps or some other private pumping system will be required for the properties along Clark Street where the tax lots are much lower than the alignment going down Gates Hill Road. Several alignments outside of the public right of way were examined as an alternative to a private pumping system, but the required earthwork and land acquisition is not likely preferable to a small number of grinder pumps (Figure 7-6).

FIGURE 7-6: GATES GRINDER PUMPS



Lift Stations

West Central Street Lift Station (Figure 7-7) - This lift station would receive flow from approximately 85 tax lots on the western side of Gates. Wastewater can flow by gravity from the hillside north of the North Santiam Highway south to the collection system proposed along the highway. Once intercepted, flow would be conveyed to the West Central Lift Station. Flow would also be received from the neighborhoods on the east end of West Central Street near Woodward Place, Roundtree.

FIGURE 7-7: WEST CENTRAL LIFT STATION

Way, and Garden Lane. Effluent flow would be pumped through an approximate 3,760-foot force main to a manhole in the Dogwood Drive lift station's tributary area at the intersection of Louisa Drive and West Central Street. Alternatively, the lift station and force main could be designed to combine with the force main that discharges from Dogwood Drive lift station, thus reducing the number of times the wastewater must be pumped. Construction of this lift station will most likely require easements or land acquisition from two properties due to the lack of available right-of-way and heavily forested area at the low point identified along West Central Street. The lift station is anticipated to be 17 to 22 feet deep. One culvert stream crossing was identified along the force main alignment.

Dogwood Drive Lift Station (Figure 7-8) - This lift station would receive flow from approximately 164 tax lots in central and northeast Gates, and the flow from the West Central Street lift station. Wastewater can flow by gravity from Gates Hill Road and Thistledown Lane along the North Santiam Highway to the Dogwood Drive Lift Station. The wastewater from the most densely developed portion of Gates between the North Santiam Highway and the North Santiam River would also flow to this lift station. Lift station effluent would be pumped in an approximately 3,500-foot force main east along E. Sorbin Street to the Sorbin Street lift station's basin at the intersection of River View Street and E. Sorbin Street.

FIGURE 7-8: DOGWOOD DRIVE LIFT STATION

Construction of this lift station may require an easement or land acquisition depending on the available public ROW and future plans for Dogwood Drive. Dogwood Drive is a dead-end road that terminates at the entrance to three private properties. At the end of Dogwood Drive it appears there is enough right-of-way for a lift station facility. Any future plans to pave, widen, or extend Dogwood Drive to connect to another portion of town could result in easements or land acquisitions being required. The lift station is anticipated to be 12 to 17 feet deep. No stream crossings or environmental concerns were identified along the force main alignment.

Linnwood Drive Lift Station (Figure 7-9) - This lift station would receive flow from approximately 22 tax lots in the southeastern area of Gates. The use of grinder pumps for adjacent properties was investigated, and it was determined that for the number of lots along the Linnwood alignment, a lift station was appropriate. The lift station would pump wastewater in an approximate 560-foot force main south on Linnwood Drive to the proposed trunk line along Gates Bridge East which then flows to the Sorbin Street lift station's basin. No stream crossings or environmental concerns were identified along the force main alignment.

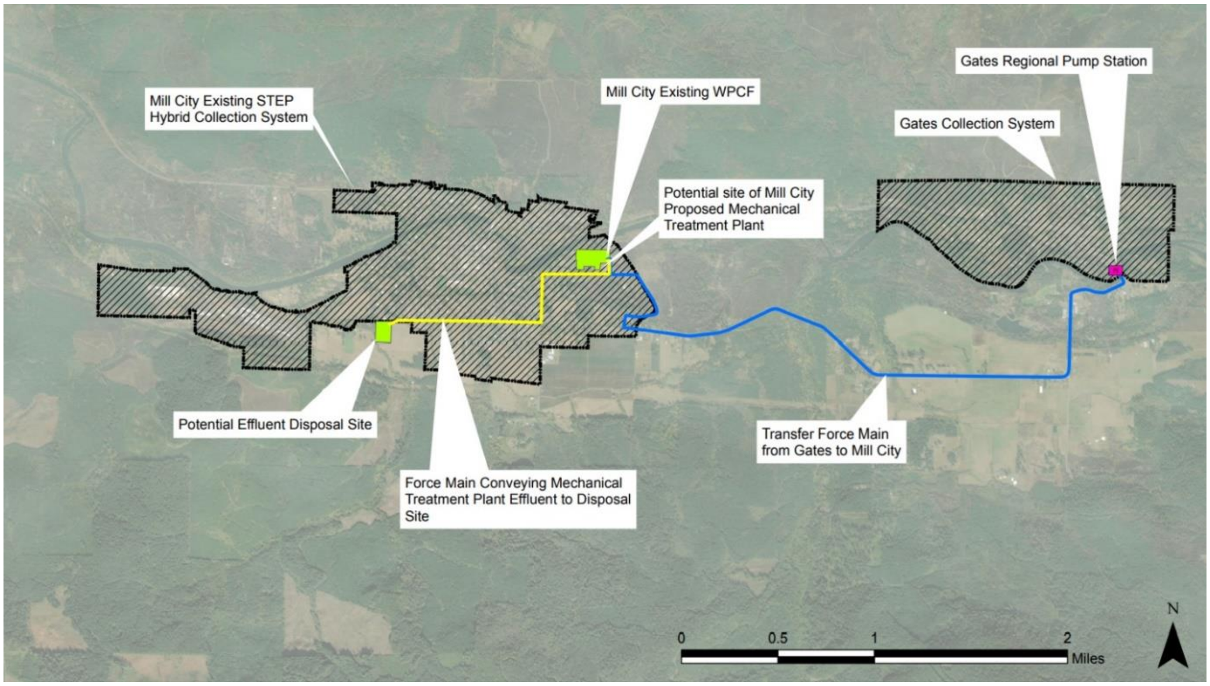
FIGURE 7-9: LINNWOOD DRIVE LIFT STATION

This lift station can be constructed within the public right-of-way so no easements or land acquisitions should be required based on available GIS mapping and imagery. There appears to be about 20 feet of flat land between the northern edge of pavement and the right-of-way line where Linnwood Drive's alignment turns from the north to the east at the proposed lift station's location. The lift station is anticipated to be 12 to 17 feet deep.

Sorbin Street Regional Lift Station (Figure 7-10) - This lift station would receive flow from approximately 37 tax lots in central Gates in the area around the North Santiam River bridge crossing, and the flow from the other three lift stations previously mentioned. In total, this station could serve up to 308 tax lots for just Gates. If flows are transferred from Detroit/Idanha down to Gates this station could serve up to 1,137 tax lots identified in Gates, Detroit, and Idanha in this analysis. Wastewater would be pumped across the North Santiam River bridge crossing and follow Gates School Road south and east toward the existing Mill City WWTP as shown on the Mill City and Gates Basin figure (Figure 7-11) shown on the following page.

FIGURE 7-10: SORBIN STREET REGIONAL LIFT STATION

FIGURE 7-11: MILL CITY AND GATES BASIN



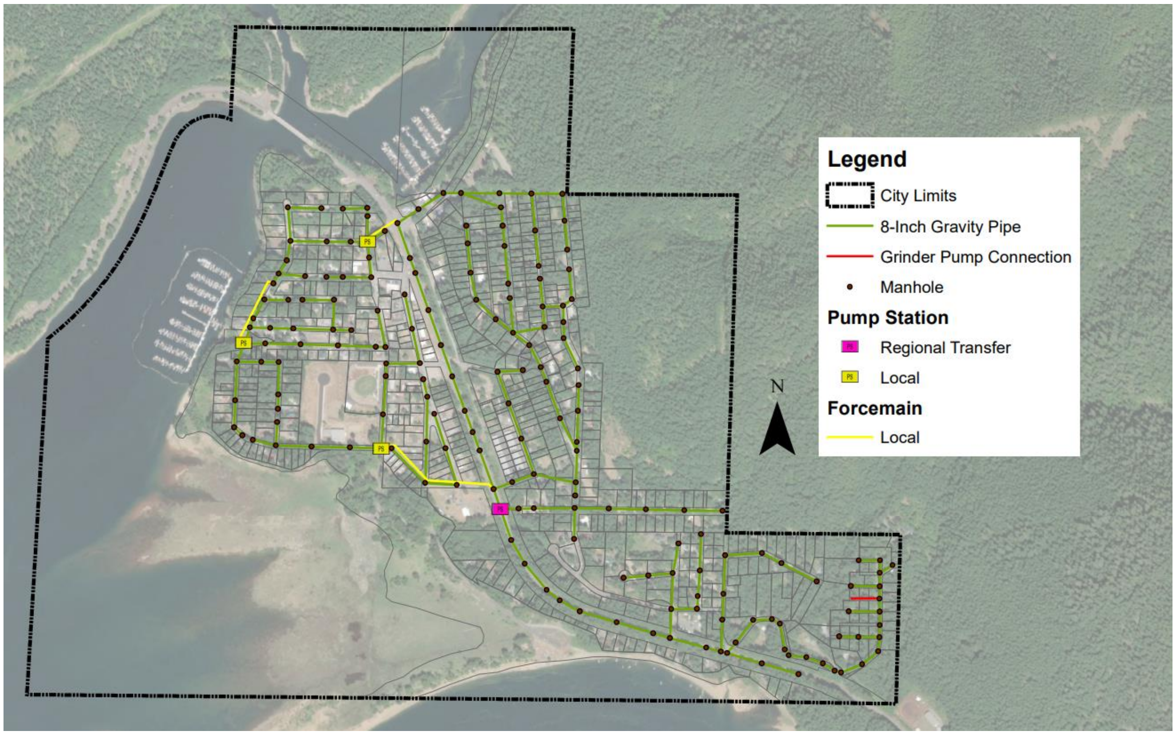
This lift station would be placed on the north side of the bridge crossing previously mentioned. Based on available mapping and imagery, there appears to be a 160-foot-wide public right-of-way around the bridge abutments and only about 45 feet of it is used by the bridge and roadway. The remaining right-of-way appears to provide enough room to install a lift station facility, therefore no easements or land acquisitions are anticipated. Due to its proximity to the riverbank, geotechnical, wetland, and environmental investigations should be completed during design to identify potential impacts. The lift station is anticipated to be 15 to 20 feet deep.

Sorbin Street Regional Force Main (Gates to Mill City) - The Sorbin Street Regional lift station's flow could require a 4-inch to 10-inch force main. The anticipated scenario requires a 4-inch force main, but depending on the scenario selected, the pumps will need to produce either 110 or 136 feet of head (50 or 60 PSI) to transfer the flows to the WPCF. The scenario requiring a 10-inch line creates an excess of 120 feet of head at the WPCF that can be used to generate power or needs to be dissipated through a pressure relief valve. The total length of the force main depends on the final location/layout of the WPCF but for this section's analysis it is assumed that the flow will travel 19,650 feet along Gates School Road and Kingwood Ave to the existing Mill City WPCF. This pipe alignment will require multiple air/vac release valve stations.

7.4.3 Detroit (Gravity Collection)

The proposed local gravity collection system for Detroit is illustrated in Figure 7-12. The full-size figure can be found in Appendix C as Figure 7.

FIGURE 7-12: DETROIT GRAVITY COLLECTION SYSTEM



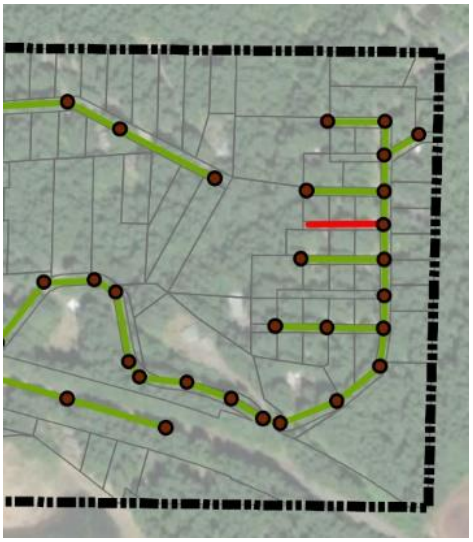
<u>Gravity Pipes</u>

Detroit's gravity pipe collection system would be constrained by the City's challenging topography and shallow bedrock layer. Most of the pipes and structures would be five to ten feet deep, and only exceed ten feet when necessary due to the high cost of installing pipe in bedrock. Most of the pipe alignments follow City streets in the public right-of-way and only deviate when paralleling a property line outside of the right-of-way would alleviate the need to construct an additional lift station or install pipe deeper than ten feet.

Grinder Pumps

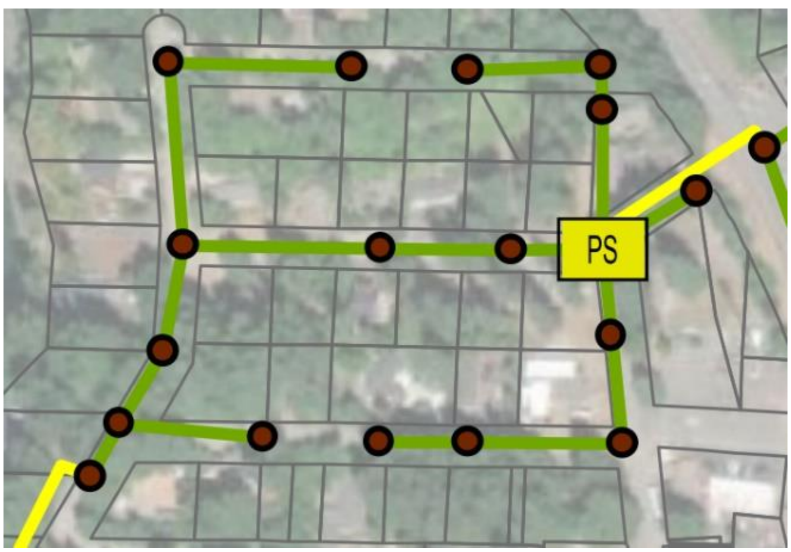
Grinder pumps or some other private pumping system will be required for the properties along Mackey Lane where the tax lots are much lower than and sloping away from the gravity sewer along Guy Moore Road. There are a total of five properties along Mackey Lane that will require grinder pumps, making the installation of a lift station impractical and non-economical for so few properties (Figure 7-13).

FIGURE 7-13: DETROIT GRINDER PUMPS



2nd Street Lift Station (Figure 7-14)

FIGURE 7-14: 2ND STREET LIFT STATION



This lift station collects flow from approximately 43 tax lots on the northwestern portion of town. It also receives flow from the Clester Road lift station. Effluent is pumped in an approximately 270-foot force main to the east and into the main trunkline in the North Santiam Highway where the sewer gravity flows south to the Highway Regional lift station. No stream crossings or environmental concerns were identified along the pipe alignment.

This station is located at the intersection of 2nd Street and Patton Road. After reviewing the available property and right-of-way lines in GIS, the likely location for the wet well and controls building would be on the south side of 2nd Street just west of the intersection. There is a piece of flat land going from the edge of pavement to the southern right-of-way line along 2nd Street from Patton Road to Lakecrest Drive to the west, approximately 22 feet wide by 600 feet long. The lift station is anticipated to be 21 to 26 feet deep.

Clester Road Lift Station (Figure 7-15) - This lift station collects flow from approximately 79 tax lots on the southwestern portion of town. This is the lowest elevation lift station for Detroit and pumps up to the 2nd Street lift station.

FIGURE 7-15: CLESTER ROAD LIFT STATION

Effluent is pumped in an approximately 530-foot force main. The force main alignment starts at the sewer facility near the Marina and heads north across both public and private property requiring an easement until it reaches the furthest southwestern manhole in the 2nd Street lift station sewer basin on Lakecrest Drive.

This lift station will most likely require an easement or land acquisition to be constructed since the preferred location is not located in the public right-of-way. The sewer basin's low point was estimated to be around the entrance to Kane's Marina off Clester Road. The south side of the Marina's tax lot is flat and appears to have open space for the location of a lift station. The surrounding area within 100 feet of the low point is primarily private property with limited space for the required facilities. The best location for the lift station would be on the Marina's property, preferably farther from the lakeshore on the southeast side of the property. Wetland and environmental investigative work should be completed in this area to identify the best location for the structure due to its proximity to the lakeshore. The lift station is anticipated to be 15 to 20 feet deep.

Park Lift Station (Figure 7-16) - This lift station would collect flow from approximately 89 tax lots on the southern portion of town. Flow would be pumped in an approximately 1,000-foot force main to the east and into the main trunkline in the North Santiam Highway where it would gravity flow south to the Highway Regional lift station. No stream crossings or environmental concerns were identified along the force main alignment.

FIGURE 7-16: PARK LIFT STATION

After reviewing the available property and right-of-way lines in GIS, two potential locations were identified. One is in a 20-foot-wide strip of public right-of-way at the southwestern corner of the intersection of Patton Road and Santiam Avenue. If this is not enough space, it may be possible to acquire an easement or purchase a portion of the property from the Detroit Lake Foundation and build the facility on the southeastern corner of this lot. The lift station is anticipated to be 20 to 25 feet deep.

Highway Regional Lift Station (Figure 7-17) - This would be the largest lift station in Detroit, receiving flow from 402 tax lots, in addition to flow from the other three lift stations previously identified. The gravity sewer trunklines would run parallel to the North Santiam Highway until reaching a low point in the roadway alignment roughly 240 feet southeast of the intersection of the North Santiam Highway and Santiam Avenue where this lift station could be located. Effluent from this station would be pumped to the decided upon location for treatment.

FIGURE 7-17: HIGHWAY REGIONAL LIFT STATION

The potential location for this facility would be on the east side of the North Santiam Highway within the public right-of-way. There appears to be 50 feet of Oregon Department of Transportation (ODOT) right-of-way from the edge of pavement to the eastern right-of-way line which will provide enough space for a lift station facility. This location is in the right-of-way ditch line and should be investigated to confirm whether jurisdictional wetlands are present. The lift station is anticipated to be 23 to 28 feet deep. Coordination with ODOT will be necessary for construction along the highway.

Highway Regional Force Main (Detroit to Gates) - This Highway Regional lift station's flow requires approximately 15 miles of 10-inch force main for the evaluated Scenario A (See Section 10). The pipe alignment starts at the lift station and heads north and west along the highway in public right-of-way until it reaches the City of Gates' sewer collection system. Due to the varying topography, the outlet of this force main will have approximately 600 feet of head to dissipate. This can be accomplished through pressure reducing valves before the tie-in to the Gates system. Another method of dissipating the additional head would be to install a power generator that feeds power into the local power network.

Based on available imagery and mapping from Google Maps and straight-line charts from ODOT, 64 culverts, 10 concrete box culverts, and four bridges were located between the Highway Regional lift station and the City of Gates' collection system. The ten box culvert crossings will require boring, and the four bridge crossings will require either boring under the crossing or hanging the pipes from the bridge. This 15-mile-long pipeline will also require multiple air/vac release valve stations along the alignment.

A pipeline between the Idanha-Detroit basin and the Gates-Mill City basin would be subject to significant geological hazards. ODOT has reported that landslide mitigation efforts are conducted annually along the highway, as the roadway continually settles.

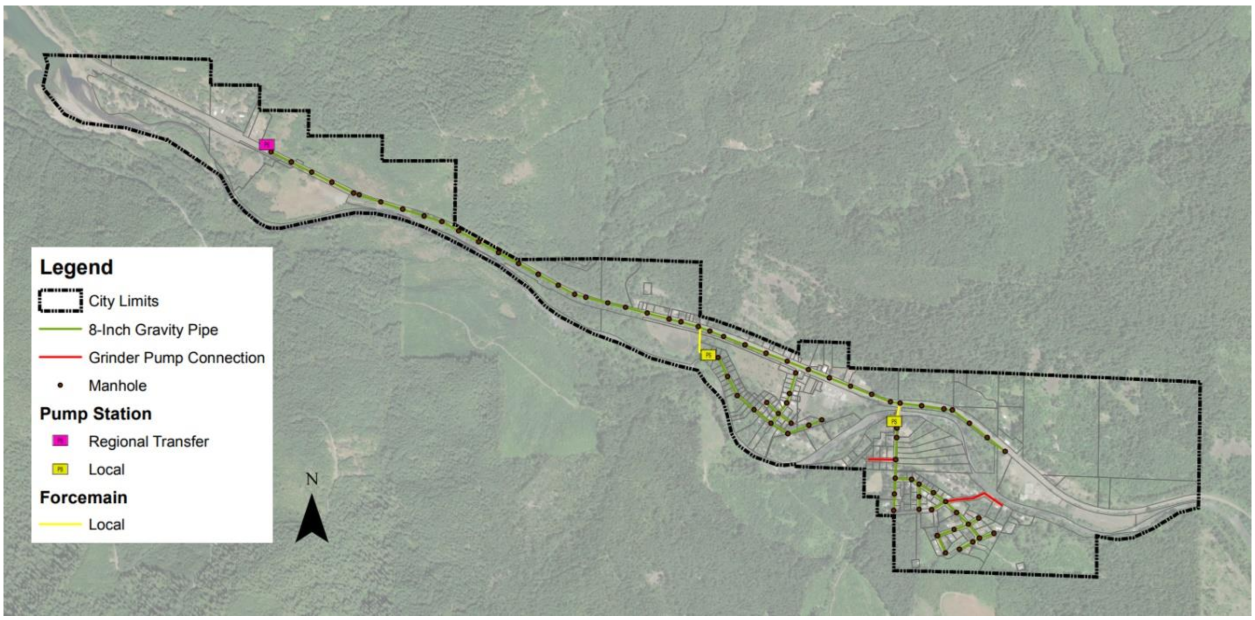
Highway Regional Force Main (Detroit to Idanha) - This Highway Regional lift station's flow requires approximately 13,720 feet of 8-inch force main for one of the evaluated scenarios (See Section 10). The pipe alignment starts at the lift station and heads south and east along public right-of-way until it reaches the Blowout Regional lift station. These pumps will be required to produce approximately 272 feet of head (118 PSI) to pump against the increasing elevation and head losses encountered in the pipe.

Based on available imagery and mapping from Google Maps and straight-line charts from ODOT, four culverts and one concrete box culvert were located between the lift station and Blowout Regional lift station. The one concrete box culvert and potentially the other four culvert crossings will require boring. The pipeline may also require air/vac release valve stations along the alignment.

7.4.4 Idanha (Gravity Collection)

The proposed local gravity collection system for Idanha is illustrated in Figure 7-18. The full-size figure can be found in Appendix C as Figure 6.

FIGURE 7-18: IDANHA GRAVITY COLLECTION SYSTEM



<u>Gravity Pipes</u>

Idanha’ s gravity collection system will typically be less than 10 feet deep and generally flow toward the river. It will need to be pumped north across the North Santiam River for the Linn County portion of the City where a gravity trunkline along the North Santiam Highway will intercept it and flow to the west end of the City. The entirety of the gravity pipeline network is laid out in the public right-of-way and should not require any private easements or land acquisition.

<u>Grinder Pumps</u>

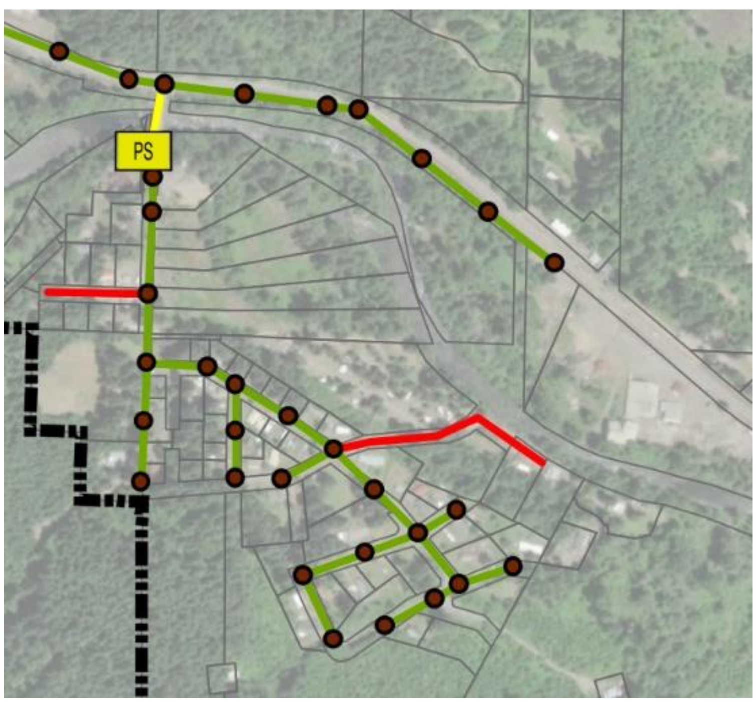
Grinder pumps or some other private pumping system will be required for the properties along Cedar Avenue where the tax lots are much lower than the gravity sewer along Church Street and it is not economical to add a lift station for eleven properties. Pumps will also be needed for the five river front properties off Mountain Avenue in eastern Idanha (Figure 7-19).

FIGURE 7-19: IDANHA GRINDER PUMPS

Lift Stations and Force Mains

Church Street Lift Station (Figure 7-20) - This lift station would collect flow from approximately 82 tax lots on the eastern portion of Idanha, south of the North Santiam River. Flow would be pumped in an approximately 330-foot force main to be hung from the Church Street bridge and intercepted by the gravity trunkline along the North Santiam Highway on the north side of the river.

FIGURE 7-20: CHURCH STREET LIFT STATION



This lift station might require an easement or land acquisition from the property to the east (tax lot 120) to be constructed since there is not much available public right-of-way around the bridge to construct the facility. County geospatial data shows that there may be some existing public right-of-way or easement(s) to the west of the current bridge and river crossing alignment as an older bridge had been demolished and replaced with the current bridge. Further investigation and survey will be required to verify the exact location of the proposed facility. Additional investigations should be completed to assess environmental, or wetland impacts prior to the design and construction of the lift station.

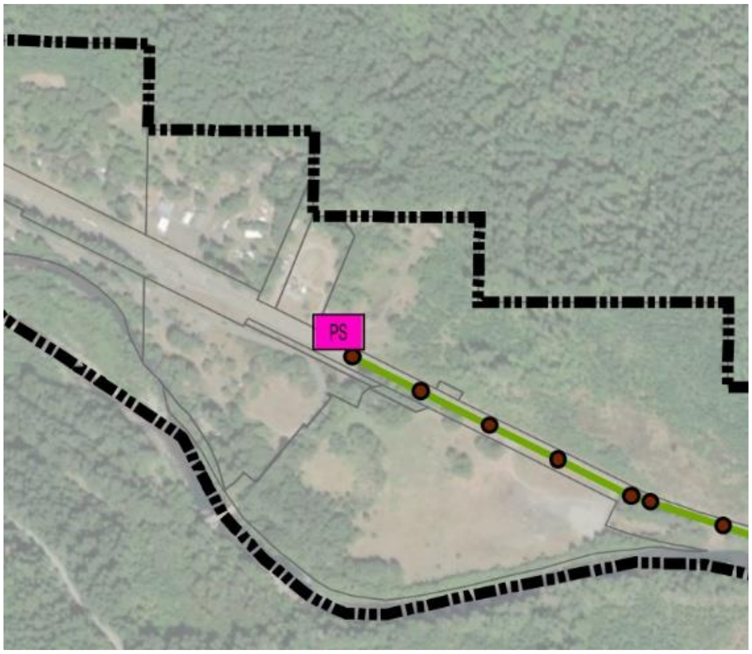
Riverside Drive Lift Station (Figure 7-21) - This lift station would collect flow from approximately 81 tax lots south of the highway, but north of the North Santiam River. Flow would be pumped in an approximately 475-foot force main heading northwest and intercepted by a gravity trunkline along the North Santiam Highway.

FIGURE 7-21: RIVERSIDE DRIVE LIFT STATION

This lift station will most likely require an easement or land acquisition because it is located at the end of Riverside Drive which is currently undeveloped. If it is constructed at the end of the proposed roadway alignment, then the structure will be in the way of future roadway construction and development. It will most likely be built on the northernmost side of the public right-of-way in conjunction with an easement with one of the two properties at the end of the roadway alignment.

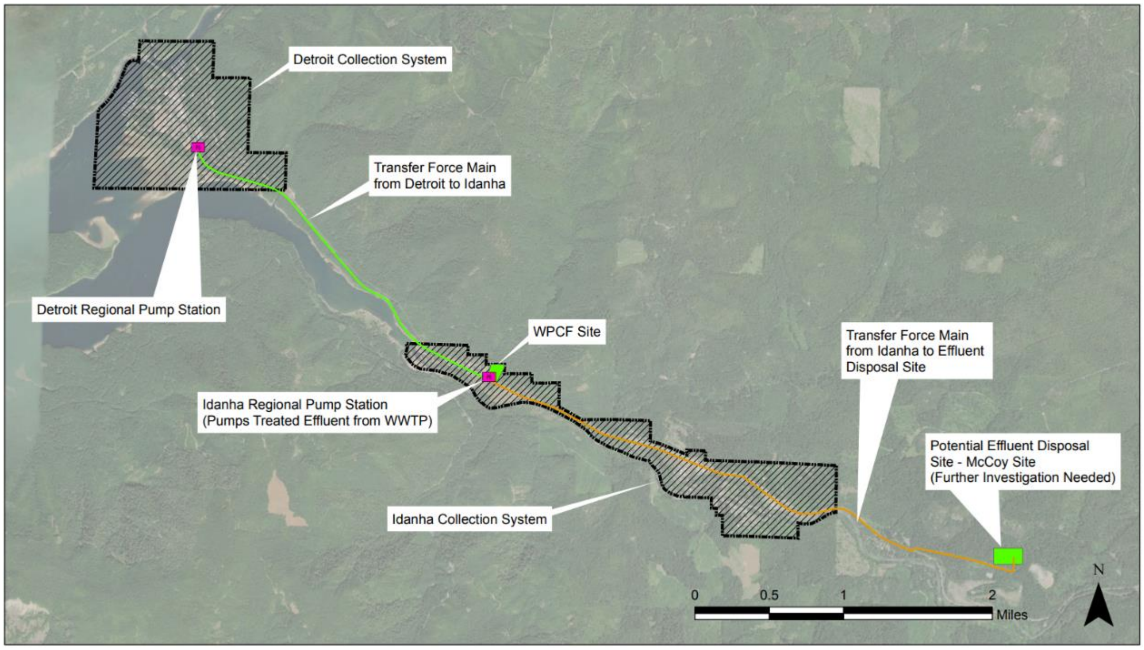
Blowout Regional Lift Station (Figure 7-22) - This would be the largest lift station in Idanha, receiving flow from the entire community. The gravity sewer trunklines would run parallel to the North Santiam Highway until reaching the intersection of the old blowout road (north of the highway) and the North Santiam Highway. Coordination with ODOT will be necessary for construction along the highway. Effluent from this station would be pumped to the decided upon location for treatment. If pumped to Detroit, the pumps will need to produce approximately 148 feet of head (64.1 PSI) to reach the Detroit collection system. The lift station is anticipated to be 23 to 28 feet deep.

FIGURE 7-22: BLOWOUT REGIONAL LIFT STATION



The Detroit and Idanha Basin figure (Figure 7-23) shows the anticipated regional lift station scenario that is presented in greater detail in Section 10.

FIGURE 7-23: IDANHA AND DETROIT BASIN



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8. TREATMENT OPTIONS

This section outlines potential treatment and disposal options that have been considered for the four communities in the North Santiam Sewer Authority (NSSA) boundaries. Each of these treatment and disposal options is compatible with collection systems receiving flows from either raw sewage or from septage tank effluent. The type of treatment system required to serve the NSSA is driven more by regulatory requirements for disposal.

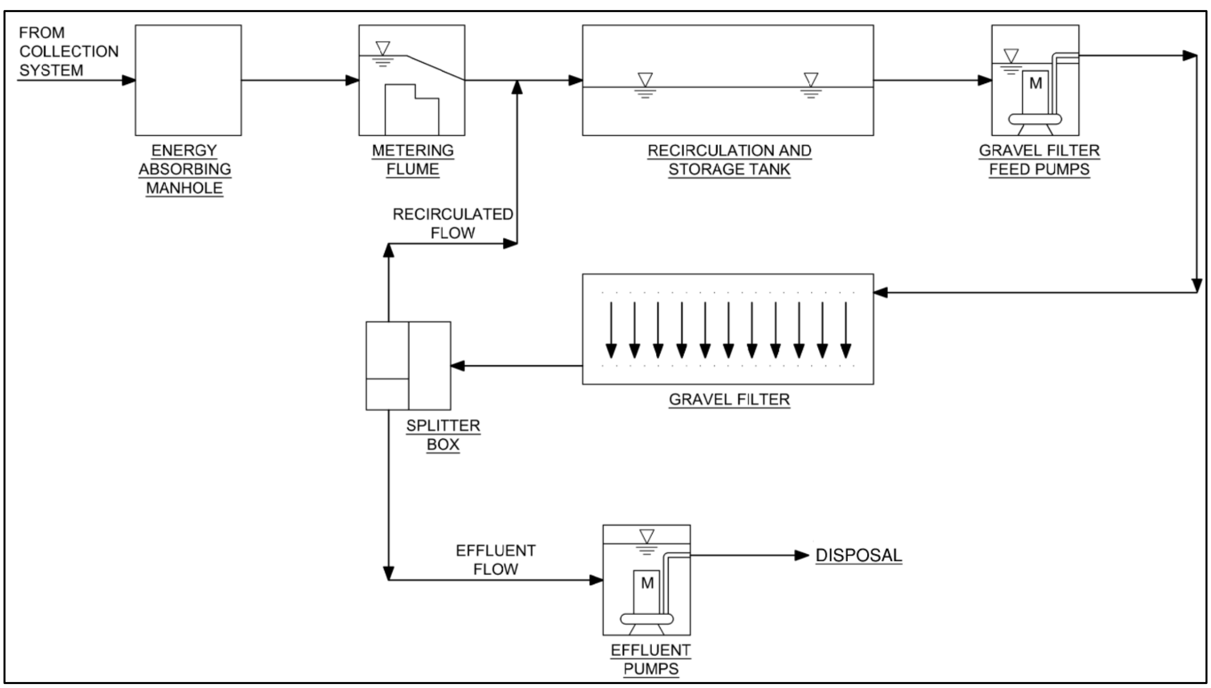
Three types of treatment systems were considered for differing levels of treatment. These options are as follows: Recirculating Gravel Bed Filters, Mechanical Treatment Plant with Nitrogen Removal, and Mechanical Treatment Plant with Advanced Treatment. These options are described in more detail below.

8.1 RECIRCULATING GRAVEL BED FILTER

A recirculating gravel bed filter (RGF) treats wastewater by providing an environment in which attached growth microorganisms are able to grow and consume contaminants in the wastewater. An RGF is capable of reducing BOD and TSS, with typical effluent concentrations of less than 20 mg/L. An RGF is not designed to remove ammonia or nitrates.

A typical RGF includes flow metering, screening, recirculation tanks and pumping, and the media bed filter. The existing WPCF at Mill City operates as an RGF. The following paragraphs describe each process in the RGF. Figure 8-1 shows the process flow diagram of the major components of an RGF system.

FIGURE 8-1: RECIRCULATING GRAVEL BED FILTER PROCESS FLOW DIAGRAM



Flow metering is provided for permitting requirements and can also be used to control the recirculation flow rate. This can often be accomplished using a Parshall flume or an inline magnetic flow meter.

After flow metering, the raw influent is screened. Screening of raw influent protects downstream equipment (such as pumps and valves) and reduces maintenance issues related to clogging of piping or the gravel bed filter. Depending on the size of the WPCF, this may be a manual screen that must be cleaned by plant operators or could be an automatic mechanical screen, which self-cleans without the need for operator involvement.

Raw influent then mixes with drain flows from the gravel bed filters. This combined flow is then pumped from a recirculation/equalization tank to the gravel bed filters, where it is evenly distributed over the surface area of the filters. The flow then trickles down through the media. Microorganisms attached to the gravel consume organic material in the wastewater, reducing the BOD. Oxygen required for microbial growth is provided from the air within the spaces in the gravel. After passing through the filter, the filtrate water drains to the recirculation/equalization tank. A portion of the filtrate is recirculated back to the gravel bed filter. The purpose of the recirculated flow is to retain a portion of the microorganisms that would otherwise be lost with the effluent being discharged. The effluent is typically routed to effluent pumps, from which it can be discharged to the disposal system. Settled solids, including microorganisms that have sluffed off the filter media, accumulate in the recirculation/equalization tank and must be periodically removed and disposed of. The frequency at which this must occur is often less than once a year. The expected performance of a gravel bed filter is given in Table 8-1 below.

TABLE 8-1: EXPECTED EFFLUENT QUALITY FROM RECIRCULATING GRAVEL BED FILTER

Contaminant	Units	Value
BOD	mg/L	< 30
TSS	mg/L	< 30
Ammonia	mg/L	*
Nitrates	mg/L	*
Phosphorus	mg/L	*
Turbidity	NTU	*
E. coli	no/100 mL	*

Note:
**No treatment for this contaminant is expected*

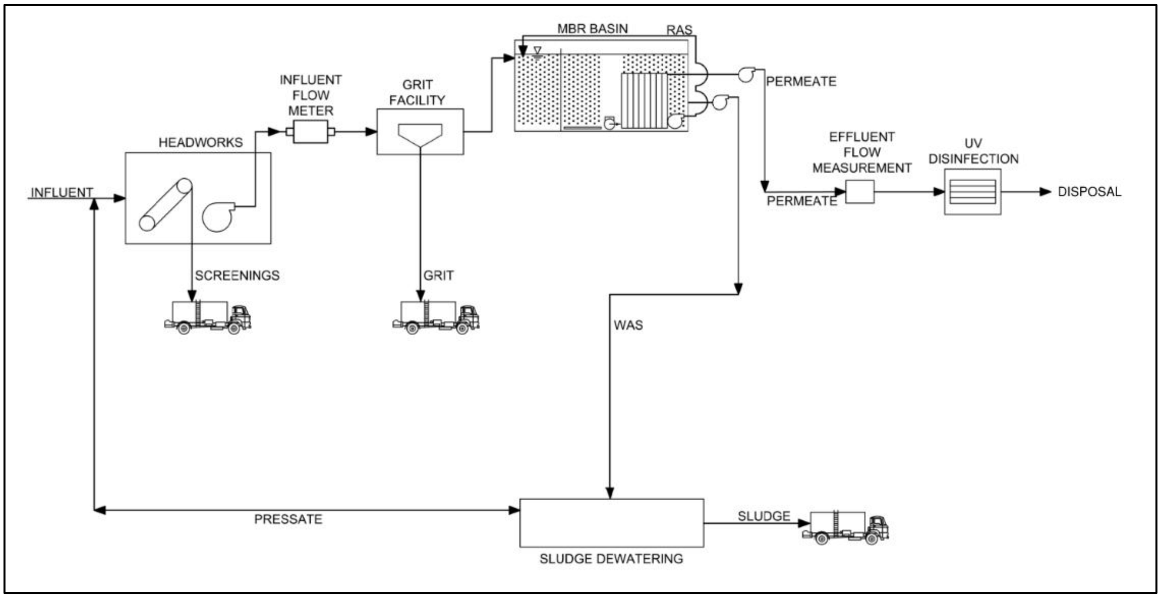
8.2 MECHANICAL TREATMENT PLANT

There are many types of mechanical treatment plants that could be considered. In general, the type of mechanical treatment plant considered for this evaluation functions by providing large quantities of oxygen to microorganisms concentrated in process basins or tanks. These microorganisms remove BOD and nitrify ammonia into nitrates, and based on the design of the process basins, can also denitrify nitrates into nitrogen gas. This plant also includes processes to separate sludge (the combination of suspended solids and microorganisms present in the wastewater during treatment) from clear water. This is often accomplished with clarifiers or membrane filters.

Other treatment can be provided for the separated solids, including stabilization of the solids or further separation of the water by thickening, or dewatering the sludge. This allows for reduced costs in hauling and allows for more alternatives for places where the sludge can be disposed of.

The treatment plant considered for the NSSA consists of the following components: screening, grit removal, biological treatment, membrane filtration and discharge. Solid's treatment consists of dewatering of the sludge prior to disposal offsite. These are discussed in detail in the following paragraphs. Figure 8-2 shows the process flow diagram of the major components of a mechanical treatment plant.

FIGURE 8-2: MECHANICAL TREATMENT PLANT PROCESS FLOW DIAGRAM



Screening serves the same function as described for the RGF, except that the screen is nearly always automatically operated. Grit removal provides a means to separate sand, gravel and rocks commonly found in collection systems from the wastewater stream. Both the screening and grit removal processes protect pumps and other equipment and reduces the frequency of cleaning of the process basins.

Biological treatment is provided by containing wastewater in process tanks where suspended growth microorganisms thrive. This mix of wastewater and microorganisms, called mixed liquor, provides an environment that allows the microorganisms to continue to grow based on the organic material provided in the raw wastewater. The microorganisms remove BOD, ammonia, and nitrates. Oxygen is provided by air blowers, which is introduced into the bottom of the process tanks as small bubbles that diffuses oxygen into the mixed liquor to provide the needed oxygen to the microorganisms. Pumps are provided to recirculate mixed liquor between different zones of the process basins.

Separation of the microorganisms from the wastewater is accomplished using microfiltration, which draws clear water through membrane sheets or tubes while retaining the sludge in the process tanks. Reduction of viruses is accomplished by UV disinfection. UV light interferes with the DNA of the viruses and prevents reproduction. Depending on the dosage of UV light, varying levels of disinfection are possible. This UV disinfection equipment is installed downstream of the membrane filtration system and prior to discharge. The clear water can then be discharged to the effluent site.

The remaining mixed liquor is recirculated back to the process tanks. As the bacterial population ages, a portion must be removed or wasted from the process. A portion of the mixed liquor is pumped out of the basins as waste activated sludge. Additional water is removed from this sludge by means of a mechanical dewatering press prior to disposing of the sludge offsite. This dewatering process reduces both the volume and weight of sludge that must be hauled, thus also reducing the operational costs. The expected performance of a mechanical treatment plant is provided in Table 8-2 below.

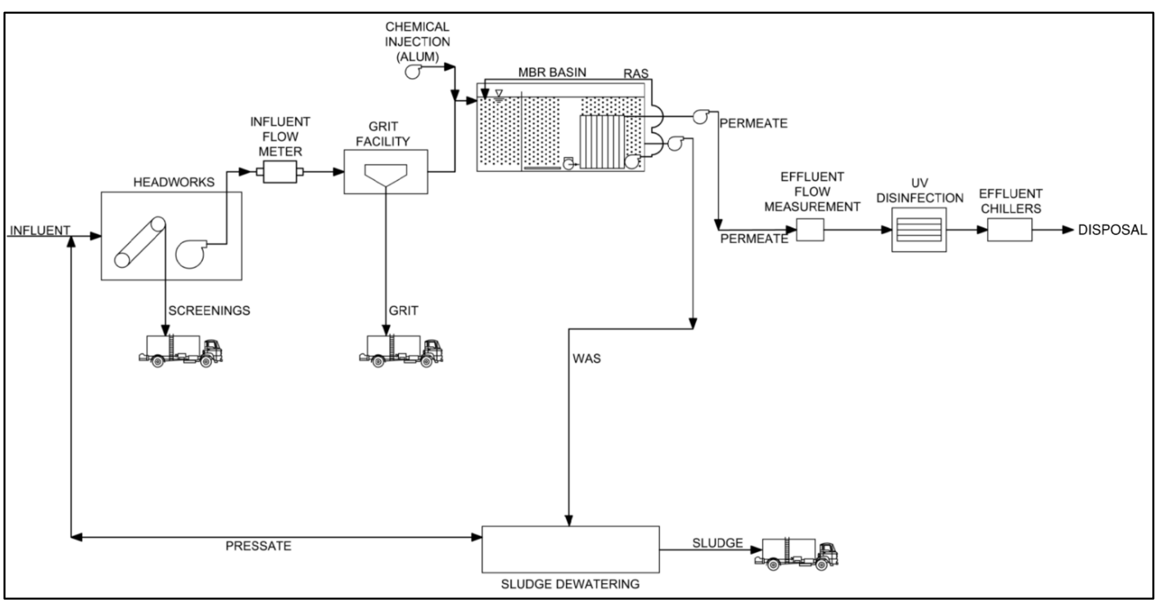
TABLE 8-2: EXPECTED EFFLUENT QUALITY FROM MECHANICAL TREATMENT PLANT

Contaminant	Units	Value
BOD	mg/L	<20
TSS	mg/L	<20
Ammonia	mg/L	<5
Nitrates	mg/L	<5
Turbidity	NTU	<1
E. coli	no/100 mL	<2.2

8.3 ADVANCED MECHANICAL TREATMENT PLANT

An advanced mechanical treatment plant has the same performance capabilities as the treatment plant described above, but also addresses other contaminants, such as temperature and phosphorus. Figure 8-3 shows the process flow diagram for the advanced mechanical treatment plant.

FIGURE 8-3: ADVANCED MECHCANICAL TREATMENT PLANT PROCESS FLOW DIAGRAM



Removal of phosphorus is achieved by expanding the biological process tanks to create a zone that favors the growth of microorganisms that uptake phosphorous in the raw wastewater. These microorganisms are then removed with the sludge. Where very low phosphorous concentrations are required, chemical coagulants can be used to precipitate phosphorus into a suspended solid that is captured by the membrane filters and removed in the sludge. With more stringent e. coli limits, a larger UV disinfection system would be required, compared to the standard mechanical treatment plant. An advanced mechanical treatment plant would also include chillers for reducing effluent water temperatures. The expected performance of an advanced mechanical treatment plant is provided in Table 8-3 below.

TABLE 8-3: EXPECTED EFFLUENT QUALITY FROM ADVANCED MECHANICAL TREATMENT PLANT

Contaminent	Units	Value
BOD	mg/L	<20
TSS	mg/L	<20
Ammonia	mg/L	<5
Nitrates	mg/L	<5
Phosphorus	mg/L	<0.3
Turbidity	NTU	<0.2
E. coli	no/100 mL	<2.2

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9. DISPOSAL OPTIONS

This section examines the options that may be available for each community or combination of communities. The evaluation of these options also considers the level of treatment that will be required, and consequently, the type of treatment facility that will need to be constructed. The disposal options considered are as follows: subsurface disposal through drainage fields, surface infiltration, land application (with winter storage), surface discharge to the North Santiam River, and injection wells.

A memorandum (Appendix L) issued by the Director of ODEQ on April 5th, 2021, outlined regulatory issues regarding water quality and land usage that will need to be addressed in considering disposal options. These issues are summarized as follows:

Water Quality Regulatory Issues

In order to permit a new WPCF, or an expansion to the existing WPCF in Mill City, the following objectives must be met:

1. No discharge to surface water, per the Three Basin Rule;
2. The new facility will protect groundwater quality, and will include a groundwater monitoring plan, effluent concentration limits, and plans to restore groundwater quality if it is adversely affected;
3. A new treatment facility improves protection relative to the existing facility;
4. Land usage for collection, treatment and disposal systems should be located within the Urban Growth Boundaries or have a land use exception approved by Marion County or Linn County.

9.1 DRAINAGE FIELDS

Drainage fields allow for subsurface disposal of treated wastewater. This disposal method relies on the soil to filter and remove contaminants not removed in the treatment plant. Per the Three Basin Rule, disposal through drainage fields must not be hydraulically connected to the North Santiam River. This means that drainage fields must be placed in locations with sufficient separation from the river.

Drain fields consist of a network of buried piping that evenly distributes wastewater over a given surface area. The distribution piping is typically small diameter PVC pipe with perforations along its length to allow the water to discharge. The piping is installed on a bed of gravel or sand on top of native soils.

The surface area required for drainage fields is dependent on the type of soils and what may be allowed for by DEQ. For typical individual drain fields, the loading of wastewater is limited to 1-3 gallons per day per linear foot (gdf) of drain field piping. However, DEQ may allow for higher loading rates where field tests and infiltration studies support this. For example, the current WPCF in Mill City has been permitted with a loading rate of 12.5 gdf. Note that the Oregon Administrative Rules (OAR) require a replacement drain field equal to the same area required for the initial drain field area.

There are no explicit effluent quality limits associated with disposal to drainage fields. However, as the Mill City WPCF has been permitted at a higher loading rate, it also has site specific limitations for effluent quality. It is expected that if new drainage fields were to be permitted at the same loading rate as the Mill City WPCF, they would be subject to the same effluent requirements summarized in Table 9-1.

TABLE 9-1: REQUIRED EFFLUENT QUALITY FOR HIGH LOADING DRAIN FIELDS

Contaminent	Units	Value
BOD	mg/L	<20
TSS	mg/L	<20

9.2 SURFACE INFILTRATION

Surface infiltration is accomplished by conveying treated wastewater to an earthen basin (typically referred to as a rapid infiltration basin or RIB) where the water then percolates directly into the soil. The benefit of an RIB over drainage fields is loading rates are often higher, resulting in less required area. An RIB may also be favored over drainage fields as there is essentially no distribution piping or other equipment that must be installed or maintained. RIBs are typically available year-round for disposal.

The design and permitting of RIBs are not specifically described in the OARs, and as such, close coordination with DEQ would be required to ensure the system will adequately protect groundwater quality. At a minimum, it is anticipated that redundancy in the basins will be required and that the surface area of the basins is adequate for the allowable infiltration rate into the soils. As the loading rate will likely be much higher than that for the drain fields, it is expected that a higher quality of wastewater effluent will be required to protect groundwater. OAR 340-040-0090 identifies the maximum concentrations of various inorganic contaminants, including nitrate, which has a limit of 10 mg/L. As ammonia is the most common form of nitrogen in wastewater, and can easily convert to nitrates in the soil, it is assumed that the total nitrogen concentration in the effluent must be less than 10 mg/L to meet the limit noted in OAR 340-040. The following table gives the assumed water quality limitations. Actual water quality effluent limitations would need to be determined by groundwater modeling and sampling, in coordination with DEQ. This may result in other contaminant limits, such as E. coli or turbidity. The expected effluent limitations are given in Table 9-2.

TABLE 9-2: EXPECTED REQUIRED EFFLUENT QUALITY
FOR RAPID INFILTRATION BASINS

Contaminant	Units	Value
BOD	mg/L	<20*
TSS	mg/L	<20*
Total Nitrogen	mg/L	<10

Note:
**No BOD or TSS limits are explicitly defined in Rule 340-040. The values given assume what is expected to be required.*

9.3 LAND APPLICATION

Land application consists of the disposal of treated wastewater by sprinkler or drip irrigation of vegetation. The wastewater is taken up by the vegetation and released to the atmosphere through evapotranspiration. Land application does require irrigation systems, including pumps, piping and valving. As such, this system requires a certain degree of maintenance that would not be required by drain fields or RIBs.

Land application can be beneficial over drainage fields or RIBs in areas where these other disposal options may not be available or may be restrictive due to soil conditions. Land application also limits disturbance to the environment as no excavation or permanent basins are required. Additionally, vegetation will uptake nutrients such as nitrogen and phosphorus that would be present in the wastewater and thus reduce the amount of these nutrients that would reach and impact groundwater sources. It is expected that land application of wastewater would be subject to OAR 340-055, “Recycled Water Quality Standards and Requirements”. (Appendix M) Based on these rules, it is expected that the water be treated to a Class D standard. Table 9-3 below gives the water quality limitations for Class D recycled water.

TABLE 9-3: REQUIRED EFFLUENT QUALITY FOR LAND APPLICATION (CLASS D REUSE WATER)

Contaminant	Units	Value
BOD	mg/L	<30
TSS	mg/L	<30
E. coli	no./ 100 mL	126

Land application is typically only suitable during growing periods. During non-growing periods, water must either be stored or disposed of by other means. In this option, it would be anticipated that water would be stored. This storage would be accomplished by earthen basins with a natural or plastic liner to prevent seepage. Once the growing season begins again, this water would again be used for land application.

As noted above, permitting of land application of treated wastewater will be regulated by OAR 340-055, which includes other requirements beyond water quality, such as soil types, slopes, flooding hazards, depth to groundwater and so forth. Where land application is to be considered for this project, these other factors should be considered in evaluating suitable sites.

9.4 SURFACE DISCHARGE TO NORTH SANTIAM RIVER

From a disposal standpoint, surface discharge is straightforward. This would consist of piping treated wastewater directly to the North Santiam River and discharging via a diffuser. Currently, by virtue of the Three Basin Rule, no discharge directly connected to the river is allowed. For this option to become a possibility, an alteration to the Three Basin Rule would be required (See Section 5.7). Furthermore, even if the rule was altered to allow certain direct discharges, it is expected that the water quality would need to be exceptionally high quality prior to discharge and would need to be lower than background/naturally occurring values in the North Santiam River. At a minimum, it is expected that the water quality would need to meet Class A reuse limits. Additionally, it is assumed that there will be limits on total nitrogen and phosphorus. While there are no TMDLs for these nutrients, an assumed value is listed. Note also that the North Santiam

River has a TMDL for temperature that it is expected and would need to be met for discharge in this scenario. Table 9-4 below gives the assumed water quality limitations.

TABLE 9-4: EXPECTED EFFLUENT QUALITY FOR SURFACE DISCHARGE

Contaminant	Units	Value
BOD	mg/L	<20
TSS	mg/L	<20
Total Nitrogen	mg/L	<5
E. coli	no./ 100 mL	2.2
Phosphorus	mg/L	<0.03
pH	-	6.5-8.5
Water Temperature	C	<18
Turbidity	NTU	0.2

9.5 INJECTION WELLS/AQUIFER RECHARGE

An injection well is used to dispose of the treated wastewater directly into the groundwater. These injection wells can either be dry wells or pressure injection wells and can be designed to discharge water into shallow or deep aquifers. An injection well offers a benefit over other subsurface disposal options in that no land area is required for drain fields, RIBs, or vegetation for land application.

The State of Oregon has permitted one dry well for discharge of wastewater in downtown Portland at Hassalo on Eighth. This water is treated to Class A reuse standards prior to discharge into the dry well. The design and permitting of injection wells are regulated by OAR 340-044.

It is expected that any injection wells considered for these communities will need to meet the Class A water quality standard. These water quality limitations are given in Table 9-5. Furthermore, where discharge from the injection well into the aquifer may be considered to influence the Santiam River, the Three Basin Rule would likely not allow for this type of discharge and alterations to the rule may need to be considered.

TABLE 9-5: REQUIRED EFFLUENT QUALITY FOR INJECTION WELLS (CLASS A REUSE WATER)

Contaminant	Units	Value
BOD	mg/L	<20
TSS	mg/L	<20
Total Nitrogen	mg/L	<10
E. coli	no./ 100 mL	2.2
Turbidity	NTU	2

9.6 WATER REUSE OPTIONS

The North Santiam Sewer Authority will need to plan for a disposal method that they can have confidence will be ready and available when needed. The reuse disposal options summarized in this sub-section do not account for all the possibilities available for reuse. These options often cannot be relied on for permanent or year-round disposal but can provide economic development opportunities and better sustainability. The potential reuse options range from irrigation to various manufacturing purposes. Each opportunity would need to be evaluated on an individual basis and approved by the ODEQ.

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10. SYSTEM SCENARIOS

This section evaluates several possible wastewater collection, treatment, and disposal scenarios, based on the options introduced in Sections 7, 8, and 9. The evaluation and selection of the wastewater collection system within each community can be determined independent of the treatment and disposal system evaluation and selection.

10.1 COLLECTION SYSTEM ALTERNATIVES

As described in Section 7, sewage from each of the four communities in the Sewer District could be collected either by direct gravity systems with community pump stations (gravity collection system) or could be received following pre-treatment in existing septic tanks and conveyed via lines pressurized from pumps at individual connections (STEP collection system).

This section evaluates the options of STEP versus untreated sewage collection systems, from a capital and annual operational cost perspective. Supplemental information regarding this analysis can be found in the attached memorandum titled Collection System Annual Cost Evaluation (Appendix N). For the Mill City community, existing connections are already provided with a septic tank effluent gravity or pump (STEG or STEP) system. The option of converting this system to an untreated gravity sewage system was not considered as this would require the entire collection system throughout the city to be removed or abandoned in place and replaced with new gravity piping and manholes. The costs of this system overhaul (tentatively estimated at over $15 million) would make this option cost prohibitive.

Both the STEP and untreated gravity systems were considered for all other communities, as they do not currently have any collection system in place. The three options for combinations of STEP and gravity collection systems are as follows:

1. Mill City retains its STEP and STEG systems, STEP systems are installed in the other three communities. Where possible, existing septic tanks would be utilized, and new effluent pumping structures installed. Where existing septic tanks are not serviceable, new septic tanks would be installed with the capacity to install the STEP pumps directly in the septic tank.
2. Mill City retains its STEP and STEG systems, but the other three communities would have gravity collection systems installed. Existing septic tanks would be abandoned or removed and new laterals from each property would be connected to a collection main in the road. In certain cases, grinder pumps would be needed where existing sewer laterals would be lower than the collection main.
3. Mill City retains its STEP and STEG systems. Gates would have a new STEP system installed while Detroit and Idanha would have gravity collection systems.

Pricing for each of these options is provided in Section 10.1.1 through 10.1.3. Note that these costs do not include collection piping and STEP systems (where applicable) for future growth.

10.1.1 Collection System Option 1

Mill City retains its STEP and STEG systems, STEP systems are installed in the other three communities. The cost for this option is shown in Table 10-1.

TABLE 10-1: CAPITAL AND O&M COSTS FOR OPTION 1

Item	Cost
Gates Collection System (STEP)	$9,207,000
Gates Regional Pump Station	$200,000
Detroit Collection System (STEP)	$11,679,000
Detroit Regional Pump Station	$200,000
Idahna Collection System (STEP)	$4,291,000
Idanha Regional Pump Station	$200,000
Subtotal	***$ 25,777,000***
General Conditions (10%)	$2,578,000
Contractor OH&P (15%)	$3,867,000
Contingency (30%)	$9,667,000
General and Administrative Costs (30%)	$12,567,000
Total Construction Cost	**$ 54,456,000**

Easements	$92,000
Pump Stations	$900,000
Total Land Purchase Costs	**$ 992,000**

Total Project Capital Cost	**$ 55,448,000**

Item	Cost
Electricity	$8,100
Chemicals	$48,400
Disposal	$156,100
Parts	$62,400
Personnel	$240,900
Estimated Annual O&M	**$ 515,900**

10.1.2 Collection System Option 2

Mill City retains its STEP and STEG systems, but the other three communities would have gravity collection systems installed. The cost for this option is shown in Table 10-2.

TABLE 10-2: CAPITAL AND O&M COSTS FOR OPTION 2

Item	Cost
Gates Collection System (Gravity)	$10,534,000
Gates Pump Stations	$680,000
Detroit Collection System (Gravity)	$13,014,000
Detroit Pump Stations	$680,000
Idahna Collection System (Gravity)	$5,480,000
Idahna Pump Stations	$340,000
Subtotal	***$ 30,728,000***
General Conditions (10%)	$3,073,000
Contractor OH&P (15%)	$4,610,000
Contingency (30%)	$11,524,000
General and Administrative Costs (30%)	$14,981,000
Total Construction Cost	**$ 64,916,000**
Easements	$92,000
Pump Stations	$900,000
Total Land Purchase Costs	**$ 992,000**
Total Project Capital Cost	**$ 65,908,000**

Item	Cost
Electricity	$10,100
Chemical	$25,400
Disposal	$83,900
Parts	$59,600
Personnel	$15,600
Estimated Annual O&M	**$ 194,600**

10.1.3 Collection System Option 3

Mill City retains its STEP and STEG systems. Gates would have a new STEP system installed while Detroit and Idanha would have gravity collection systems. The cost for this option is shown in Table 10-3.

TABLE 10-3: CAPITAL AND O&M COSTS FOR OPTION 3

Item	Cost
Gates Collection System (STEP)	$9,207,000
Gates Regional Pump Station	$200,000
Detroit Collection System (Gravity)	$13,014,000
Detroit Pump Stations	$680,000
Idahna Collection System (Gravity)	$5,480,000
Idahna Pump Stations	$340,000
Subtotal	***$ 28,921,000***
General Conditions (10%)	$2,893,000
Contractor OH&P (15%)	$4,339,000
Contingency (30%)	$10,846,000
General and Administrative Costs (30%)	$14,100,000
Total Construction Cost	**$ 61,099,000**

Easements	$92,000
Pump Stations	$900,000
Total Land Purchase Costs	**$ 992,000**

Total Project Capital Cost	**$ 62,091,000**

Item	Cost
Electricity	$7,800
Chemical	$34,100
Disposal	$111,700
Parts	$32,300
Personnel	$102,400
Estimated Annual O&M	**$ 288,300**

10.1.4 Collection System Options Net Present Value

In general, STEP systems have less capital cost for installation, because smaller diameter piping can be installed at shallower depths and manholes can be eliminated (replaced by air relief stations). These savings in pipeline costs more than offset the increase in system cost for each individual pump system.

However, the annual O&M costs for the STEP systems are higher than a gravity system, with the largest differentiators in cost being staffing and travel time associates with operation and maintenance of the systems. Supplemental information regarding O&M costs can be found in the attached memorandum titled Collection System Annual Cost Evaluation (Appendix M). As would be expected, this is due to the power costs, maintenance, and replacement of the STEP pumps. There are also chemical usage costs associated with the treatment options. Septic tanks remove a portion of the BOD found in wastewater, which reduces the biological growth of organisms that remove nutrients such as nitrogen and phosphorus from the wastewater. Thus, where influent wastewater is deficient of BOD, additional carbon may need to be added at the treatment plant, commonly in the form of methanol. As the number of STEP systems increase, the chemical costs will also increase. The 20-year net present value of each of these options is summarized in Table 10-4.

TABLE 10-4: NET PRESENT VALUE COSTS FOR COLLECTION SYSTEM OPTIONS

Option	Description	Capital Cost	Annual Cost	20-Year NPV
1	Mill City retains existing system, install STEP system in all three other communities	\$55.5M	\$0.52M	\$65.5M
2	Mill City retains existing system, install gravity system in all three other communities	\$65.9M	\$0.20M	\$69.7M
3	Mill City retains existing system, install STEP system in Gates and gravity system in Detroit and	\$62.1M	\$0.29M	\$67.7M

10.1.5 Collection System Options Evaluation

Table 10-5 below summarizes the advantages and disadvantages of each of these types of collection systems.

TABLE 10-5: COLLECTION SYSTEMS – ADVANTAGES/DISADVANTAGES

STEP	Untreated Gravity
Advantages	
- Provides a degree of pretreatment, which may reduce the amount of treatment required at the treatment plant - Effluent from septic tanks can be pumped in smaller, shallower piping, reducing collection system line costs (including elimination of manholes) - Can utilize existing septic tanks, if in serviceable condition - Mill City public works staff has familiarity with these types of collection systems - May have less Inflow / Infiltration	- Simple collection system, with less mechanical parts that require maintenance - Provides carbon to treatment plant which is helpful if advanced treatment is required - More resilient to power outages and varying homeowner usage habits - Can connect future gravity and pressurized connections to a gravity system - Less staffing required for maintenance, repair/replaces alarm calls - Less disturbance to homeowners and their property in the long term for maintenance
Disadvantages	
- Requires new pumping system at each point of connection, increasing maintenance costs for homeowner / NSSA - Pretreatment in septic tanks removes carbon, which may be needed for advanced treatment at treatment plant, increasing operational costs - Failures in septic tank pumps results in backups at residence - Requires more operator maintenance and travel time between communities	- Gravity flow will require minimum 8-inch diameter piping, installed at depths up to 20 feet. This increases collection system capital costs compared to STEP system - Existing septic tanks would need to be removed or abandoned in place - Short term disturbance to homeowners for decommissioning of existing septic tanks

To assist the NSSA in selecting the type of collection system that best suits the needs of the canyon communities, a collection system evaluation matrix was completed. This matrix was completed after initial consultation with the Board and based on priorities unique to the North Santiam Canyon (NSC). This matrix considers the criteria that are to be considered in making a decision about the type of collection system to be selected. The weighting was developed in coordination with the NSSA board members. Each criterion is weighted (from 0 to 1, totaling up to 1) based on its importance in the decision-making process. Each option is then scored on each criterion (from 0 to 1) and a total score for each option is based on the sum of each criterion multiplied by the weighting factor. The highest scoring option is recommended for selection. Below is a description of each of the criteria.

- Capital Cost: This includes all estimated upfront costs, including construction, permitting, easements, pipeline construction, traffic control measures, and new onsite treatment systems (where applicable). The scoring for each option is based on the ratio of the lowest capital cost relative to the capital cost of the respective option. Capital cost was weighted at 25%.

- Annual O&M Cost: This includes all annual expenses incurred by operating maintaining and servicing the system. This includes power, pump maintenance and replacement costs, operator labor, septic tank pumping, collection main cleaning and maintenance, and any differences in chemical uses expected at the treatment plant. The scoring for each option is based on the ratio of the lowest cost relative to the cost of the respective option. Annual O&M cost was weighted at 35%.

- Reliability: This includes considerations for expected downtimes of the system, as well as impacts from power outages, delays in parts and service, misuse, and intermittent usage (such as in conditions where residences are not regularly occupied). Reliability was weighted at 10%.

- Ease of Operation: This considers the amount of effort required by the system operator to ensure the system works as designed. This includes considerations for how much time an operator spends maintaining the system, as well as what level of experience, skills, and patience are required by the operator to adequately keep the system running. This also includes difficult-to-quantify monetary impacts, such as how much time is required for travel between communities to service the system. Ease of operation was weighted at 20%.

- Expandability: This considers the flexibility of the system to accommodate unexpected changes to the design, such as: 1) customers previously operating with onsite septic systems who want to connect, 2) new commercial and industrial users connecting and 3) growth exceeding that which is predicted in the planning period. Expandability was weighted at 10%. The scenario evaluation matrix is presented in Table 10-6.

TABLE 10-6: COLLECTION SYSTEM EVALUATION MATRIX

Evaluation Criteria	Weight	Option 1: All Communities on STEP	Option 2: Mill City on STEP, Others on Gravity	Option 3: Mill City and Gates on STEP, Others on Gravity
Capital Cost	0.25	1.00	0.84	0.90
Annual O&M Cost	0.35	0.38	1.00	0.67
Reliability	0.10	0.70	0.80	0.75
Ease of Operation	0.20	0.85	1.00	0.92
Expandability	0.10	0.70	0.75	0.72
Total Rating	1.00	0.69	0.92	0.79

Based on the scoring of each option in the evaluation matrix, Option 2 scores the highest and is recommended as the basis for the NSSA to proceed with for planning, design, and construction.

10.2 TREATMENT AND DISPOSAL SYSTEM ALTERNATIVES

The evaluation of treatment and disposal systems can be conducted independent of the evaluation and selection of the collection system. The scenarios considered for treatment and disposal are summarized below. Scenarios B and C are not compliant with the Three Basin Rule.

- Scenario A: One Regional Treatment Plant with Drainage Fields and Surface Infiltration for All Communities
- Scenario B: Two Basin Treatment Plants with River Discharge for All Communities
- Scenario C: Two Basin Treatment Plants with Surface Infiltration for Lower Communities and River Discharge for Upper Communities
- Scenario D: Two Basin Treatment Plants with Surface Infiltration for Lower Communities and Land Application for Upper Communities
- Scenario E: Two Basin Treatment Plants with Surface Infiltration for Lower and Upper Communities

The other disposal option discussed in Section 9.5, “Injection Wells and Aquifer Recharge” was briefly considered but was not deemed feasible due to regulatory concerns and challenges. Note that all scenarios considered above require some level of regional conveyance (between the distinct communities). A discussion of these regional pipelines is presented in the evaluation of each of the scenarios listed below.

The following paragraphs provide a conceptual description of each alternative and identifies potential issues that would need to be addressed, such as permitting, environmental impacts, constructability, and phasing of the work. These issues identified are not intended to be a comprehensive list and where a particular alternative is recommended, additional research and planning will be required to more accurately capture all issues that will need to be addressed.

10.2.1 Scenario A – One Regional Treatment Plant with Drainage Fields and Surface Infiltration for All Communities

This scenario considers having all wastewater conveyed to a single treatment plant site and discharged at one location. The optimal design for this option would be to use the existing Mill City WPCF in connection with the existing drainage fields and build another treatment plant adjacent to it, with flows from this plant disposed of at a rapid infiltration basin. Flows from all four communities would be delivered to an inlet structure, where flows would be evenly split between the existing WPCF and the new WPCF. The elements of this option are described in the following paragraphs.

Regional Transfer Pipeline

Flow collected from Idahna and Detroit would enter a common pump station located on the east side of the bridge. The flow would be conveyed across Detroit Lake near Detroit and follow the North Santiam Highway alignment for 15 miles to Gates.

This combined flow would eventually reach Gates and along with flow from the collection system in Gates, it would enter a pump station located on the north end of the Sorbin Street bridge. This pump station would take flow from all three communities and deliver it to a splitter structure near the existing Mill City WPCF. Note that this pump station at Sorbin Street would need to be installed in all Scenarios and costs were included in the Collection System alternatives evaluation.

Disposal System

The existing treatment plant would continue to discharge effluent to the existing drainage fields. Existing groundwater sampling wells for the existing WPCF would continue to be used to monitor groundwater quality. While the existing drainage fields have been permitted to load at 12.5 gallons per lineal feet, current Oregon Administrative Rules (OAR) only allow for drainage fields to be loaded at 3-4 gallons per lineal feet, depending on the ability of the soil to receive the water. As such, expansion of the existing drain fields to dispose all flows at the 20-year build out conditions (approximately 435,000 gallons per day), would require approximately 40-60 additional acres of land for drain fields. Because it is unlikely to locate, purchase and permit this much land for drainage fields, surface infiltration was considered for the additional flows beyond the capacity of the current system.

A new RIB would be located in the vicinity of Mill City, within a distance of 3 miles (note that land would need to be purchased for this basin). Three sites were preliminary evaluated by GSI to identify infiltration rates. Based on the infiltration rates identified in this study, an area of approximately 6.5 acres would be required. It is anticipated that a minimum of two separate basins will need to be constructed. Where DEQ requires redundant area for infiltration basins, this would be in addition to the acreage identified here. As it is not clear if this will be required, the cost for these redundant basins is not included. Groundwater sampling wells would be placed around the RIBs to monitor groundwater quality in the vicinity of the site.

Treatment System

Because the existing RGF has neither the flow capacity nor treatment capacity for the flows that will be disposed of in the RIBs, a new mechanical treatment plant will be required. The existing splitter structure near the existing WPCF would split the flow between the existing RGF and a new plant. It is noted that the short-term improvements to the RGF discussed in Section 6. would include expansion of the facility to have a capacity of 235,000 gallons per day (based on peak daily average flows). Based on this capacity, approximately 35% of the flow would be sent to the RGF and the remaining 65% would be sent to the new mechanical treatment plant. This new plant would likely be installed adjacent to or near the existing treatment facility and would include the equipment and processes described in Section 8.

Potential Issues

From a regulatory standpoint, a new mechanical WPCF and rapid infiltration basin would need to be permitted for groundwater discharge, through OAR 340-040. The permitting of the RIB would likely require a groundwater impact study to be completed to show that this system would not adversely impact groundwater quality and that there is no indirect connection to the Santiam River. While it is anticipated that the required effluent quality will be similar to what has been identified in Section 9.2, final effluent quality would be determined by ODEQ. Other regulatory issues are related to land use for areas outside of the UGB. This would be applicable to the regional collection systems between communities and would require approval from Marion and Linn Counties for the proposed use. Additionally, the highway between Detroit and Gates, the alignment for one of the regional pump station conveyance pipelines would be constructed under a highway that experiences significant settlement. According to Oregon Department of Transportation, the roadway requires annual repairs to address this settlement.

The phasing of the project would aim to connect existing residences to the new system as quickly as possible. As the permitting process for a new WPCF in Mill City is anticipated to be relatively straightforward, a shorter time frame for completing the collection systems for the lower community of Gates, as well as the completion of the treatment plant and infiltration basin may be reasonable.

The completion of collection systems in Detroit and Idanha, along with the new regional transfer pipeline to Gates could potentially face longer time periods as the regional transfer pipeline would likely require more lengthy environmental impact evaluation and permitting. Additionally, the construction of this new transfer pipeline would likely take several years. Following its completion, new collection mains and STEP systems in each of those communities could be completed and connected.

10.2.2 Scenario B – Two Basin Treatment Plants with River Discharge for All Communities

This scenario considers both the lower and the upper communities having a direct discharge to the river. The benefit of this scenario is that the 15-mile regional transfer pipeline between Detroit and Gates would not need to be constructed, thus saving a significant cost. However, this option would require a change to the Three Basin Rule to allow for direct discharges. This scenario assumes that Gates and Mill City would have a common outfall and that Detroit and Idanha would have a common outfall. The elements of this option are described in the following paragraphs.

Disposal System

Because both the lower and upper communities would be discharging to the river, it is expected that they will be required to meet the effluent quality limits given in Table 9-4. Each basin would have its own outfall and associated NPDES permit. Sampling would be conducted at each outfall to ensure that the effluent meets the compliance requirements.

Treatment Systems

As any change to the Three Basin Rule would likely require very strict effluent quality standards for any direct discharges to the North Santiam River (as identified in Section 9), it is expected that new advanced mechanical treatment plants would be needed for both outfalls. While each treatment plant would be designed to treat different amounts of flow (202,000 AADF gpd for Mill City and Gates and 91,000 AADF gpd for Detroit and Idanha), the treatment plant process would be similar as well as the effluent quality from each treatment plant. These plants would include the processes and equipment as described in Section 8.3.

Potential Issues

The most significant regulatory issue is regarding direct discharge to the North Santiam River. The Three Basin Rule does not allow this discharge and the option to discharge to the river would require modifications to the rule.

The phasing and schedule of this option is also tied into the status of the Three Basin Rule. It is impossible to estimate a reasonable timeline for allowing a change to the rule, but as it is dependent upon legislative changes, it could easily take more than five years to get any modification. Additional TMDL and environmental studies would also be likely, which could further extend this timeframe. The City of Salem has been opposed to any change to the Three Basin Rule. Salem is located outside of the watershed protected by the Three Basin Rule. The city enjoys being politically shielded and reaping the benefits of the Three Basin Rule but does not have to abide by the same requirements. As a benefactor of these rules, Salem is opposed to any change to the Three Basin Rule.

The construction of the new treatment plants, as well as the construction of new STEP systems and collection systems within the communities could occur after the permitting steps mentioned above are completed.

10.2.3 Scenario C – Two Basin Treatment Plants with Surface Infiltration for Lower Basin and River Discharge for Upper Basin

This scenario is a variation of Scenarios A and B; the lower communities (Mill City and Gates) would discharge to the existing drain fields and new rapid infiltration basins, while the upper communities (Detroit and Idanha) would discharge to the North Santiam River. This scenario would allow improvements to continue in the Mill City and Gates communities independent of the outcome of any changes to the Three Basin Rule. Improvements in the Detroit and Idanha areas would still be dependent on any modifications to the rule.

Disposal System

The disposal of treated wastewater in the Lower Basin would be identical to the system proposed in Scenario A, with similar water quality, sampling requirements and disposal location.

The Upper Basin would discharge directly to the North Santiam River as was proposed in Scenario B. Water quality and sampling would be similar.

Treatment System

The treatment system for the Lower Basins would match what was proposed in Scenario A, i.e., a mechanical treatment plant. Because this option would not be subject to the same extended construction schedule as Scenario A, or the extended time needed to address regulatory issues as with Scenario B, this option recommends demolishing or abandoning the existing RGF and constructing a new mechanical treatment plant for Mill City and Gates. This would save the cost of expanding the RGF in the short term to address current capacity limitations. Flow from Detroit and Idanha would be delivered to a new advanced mechanical treatment plant (as described in Section 8.3).

The Upper Basin treatment system would match the same system as described in Scenario B.

Potential Issues

As with Scenario A, the construction of the new treatment plant and RIBs in Mill City could commence as soon as permitting was complete. The new advanced mechanical treatment plant for Detroit and Idanha would be subject to the same phasing and regulatory issues as described in Scenario B.

10.2.4 Scenario D – Two Basin Treatment Plants with Surface Infiltration for Lower Basin and Land Application for Upper Basin

This scenario considers having two collection, treatment, and disposal systems (one for Mill City and Gates, and one for Detroit and Idanha), with no direct discharge to the North Santiam River. This allows the upper communities to avoid potential issues and costs associated with either constructing a 15-mile pipeline to the lower communities, and avoids the challenges associated with modifying the Three Basin Rule. The lower communities would discharge to existing drain fields and RIBs, as described in Scenarios A and C and the upper communities would land apply treated wastewater at a site northeast of Idanha.

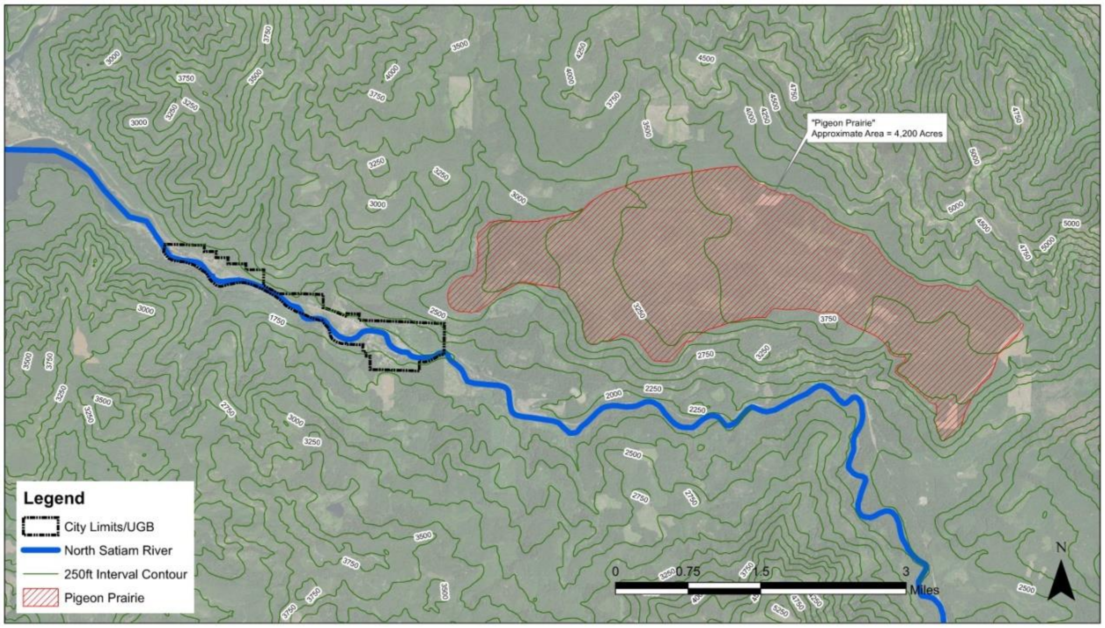
Disposal System

The disposal from the Mill City and Gates treatment system would match what is recommended for Scenario C. Disposal of treated wastewater for the Upper Basin could potentially be land applied by pumping treated effluent to a site approximately 5 miles east of Idanha, with an elevation gain of approximately 1,200 feet. This location is approximately shown in Figure 10-1 (next page). Because of the significant elevation gain, several pump stations would be required. This land application would require the installation of new sprinkler or drip irrigation systems installed over an area of approximately 80 acres. In addition to the infrastructure needed for land applying the water, winter storage would need to be provided. Based on an estimated land application season of 5 months, a total of 116 acre-feet of winter storage would be required. At a depth of 10 feet, this is equivalent to a total area of 12 acres needed for winter storage. It is expected that this winter storage would be located in the same vicinity of the application site. Based on the proposed depth, the site would need to be fenced.

Treatment Systems

The treatment systems would be identical to that described in Scenario C, with the exception that the upper basin would not need an advanced mechanical treatment plant. As is the case with Scenario C, the permitting and construction process for the Lower Basin treatment system would not be dependent on the Upper Basin. Where this timeline could be accelerated, expansion to the existing Mill City WPCF may not be necessary and the new mechanical treatment plant could be constructed to replace the existing system.

FIGURE 10-1: LAND APPLICATION SITE AT PIGEON PRAIRIE



Potential Issues

As with Scenarios A and C, the regulatory issues related to treatment and disposal in the lower communities are related to permitting a new WPCF and new RIBs. It is expected that pending a groundwater study, the permitting of the treatment and disposal should be relatively straightforward.

Potential issues related to the storage and land application of treated wastewater at the Pigeon Prairie site are numerous. These include access to the site for investigations to determine if the site is suitable, permitting with the United State Forest Service (USFS), including NEPA permitting, land purchase or leasing of the required land, and permitting for land application with the DEQ. Furthermore, it is understood that the land under consideration is often used for public access/recreation and any permitting for the use of this land as described would be subject to public comments. There are also technical issues, including installing high pressure pipelines and pumping systems in remote areas, and the concern of providing adequate maintenance for both the pipeline, pump stations, winter storage pond, and irrigation system. The phasing of the work would be contingent upon review of the site for suitability, negotiations with the USFS for purchase or leasing of the land and approval of all applicable permitting. This permitting process and land acquisition is anticipated to take several years. Once this is completed, construction of the Upper Basin treatment plant and effluent discharge piping and pump stations to Pigeon Prairie, as well as the new storage pond and irrigation system could begin. It is anticipated that this construction work could take several years as well. The Lower Basin treatment facility and infiltration basins could likely occur simultaneously, or prior to the construction of the Upper Basin improvements.

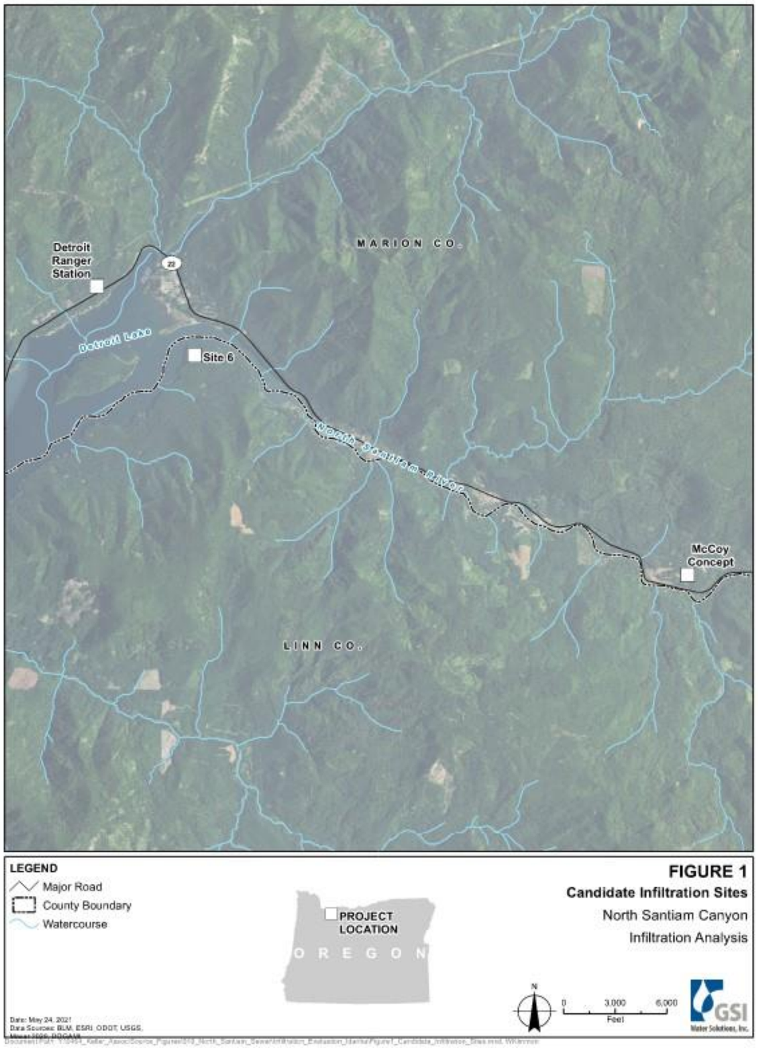
10.2.5 Scenario E – Two Basin Treatment Plants with Surface Infiltration for Lower Basin and Surface Infiltration for Upper Basin

This scenario is identical to Scenario D, with the exception that instead of land applying treated water at Pigeon Prairie for the Upper Basins, this scenario would dispose of treated wastewater in an RIB in the vicinity of the Upper Basin. The treatment and disposal of wastewater for the lower basin would be as described previously in Scenario D.

Disposal System

The disposal from the Mill City and Gates treatment system would match what is recommended for Scenarios C and D. The disposal for the Upper Basin would be accomplished with surface infiltration. Three potential sites were identified by GSI (Appendix O). All three sites would require further investigation to determine suitability. The three locations identified by GSI are 1) McCoy Site, 2) Detroit Ranger Station, and 3) Site 6. These three locations are shown in Figure 10-2 (next page). Each site offers unique geological conditions that may provide a long enough groundwater flow path to consider surface infiltration disposal as not being a direct or indirect discharge into the Santiam River. However, to verify these assumptions, additional investigations into the geologic, hydrogeologic and hydrologic conditions would need to be performed. If at least one of the sites proves to be a viable source for surface infiltration that is not connected to the Santiam River, further steps could be taken in terms of permitting, environmental impacts, and ultimately construction and operation of a rapid infiltration basin. It is estimated that an RIB that disposes of treated wastewater collected from the Detroit and Idanha communities would require an area of approximately 3 acres. Note that an RIB can infiltrate year-round and winter storage of effluent would not be necessary.

FIGURE 10-2: POTENTIAL DISPOSAL SITES FOR UPPER BASIN



Treatment Systems

The treatment systems would be identical to that described in Scenario D, with the exception that the upper basin would need an advanced mechanical treatment plant. As is the case with Scenario C, the permitting and construction process for the Lower Basin treatment system would not be dependent on the Upper Basin. Where this timeline could be accelerated, expansion to the existing Mill City WPCF may not be necessary and the new mechanical treatment plant could be constructed to replace the existing system.

Potential Issues

As with Scenarios A and C, the regulatory issues related to treatment and disposal in the lower communities are related to permitting a new WPCF and new RIBs. It is expected that pending a groundwater study, the permitting of the treatment and disposal should be relatively straightforward.

Similar to Scenario D, this alternative could have significant permitting and Forest Service challenges that would need to be addressed. All three potential sites for infiltration are on Forest Service land and would require NEPA permitting, land purchase/leasing, as well as DEQ permitting for disposal of the treated wastewater. It is estimated that a similar timeline to Scenario D would be expected for this alternative.

10.2.6 Treatment and Disposal Scenario A Costs

Table 10-7 below identifies estimated capital costs associated with this scenario. Table 10-8 shows the annual costs based on the number of estimated users on day 1.

TABLE 10-7: SCENARIO A – CAPITAL COSTS ESTIMATE

Item	Cost
Treatment Plant Short-Term Improvements	$797,000
New Mechanical WPCF with RIBs	$5,272,000
Effluent Pressure Pipe to Infiltration Basins	$3,750,000
Main Pipeline from Detroit/Idahna to Gates	$26,102,000
Main Pipeline Manholes	$2,176,000
Culvert Crossings	$7,030,000
Main Pipeline Pump Stations	$700,000
Subtotal	***$ 45,827,000***
General Conditions (10%)	$4,583,000
Contractor OH&P (15%)	$6,875,000
Contingency (30%)	$17,186,000
General and Administrative Costs (30%)	$22,342,000
Total Construction Cost	**$ 96,813,000**
Drainage Field for Short-Term Improvements	$100,000
Land for Infiltration Basins	$1,000,000
Pump Stations	$100,000
Total Land Purchase Costs	**$ 1,200,000**
Total Project Capital Cost	**$ 98,013,000**

TABLE 10-8: SCENARIO A – OPERATIONS AND MAINTENANCE COSTS ESTIMATE

Item	Cost
Electricity	$67,900
Chemical	$2,700
Disposal	$9,900
Parts	$17,200
Personnel	$93,600
Estimated Annual O&M	**$ 191,300**

10.2.7 Treatment and Disposal Scenario B Costs

Table 10-9 below identifies estimated capital costs associated with this scenario. Table 10-10 shows the annual costs based on the number of estimated users on day 1.

TABLE 10-9: SCENARIO B – CAPITAL COSTS ESTIMATE

Item	Unit Price
Treatment Plant Short-Term Improvements	$797,000
Demolition of Existing RGF Plant	$300,000
New Advanced Mechanical WPCF (Mill City)	$8,497,000
New Advanced Mechanical WPCF (Idanha)	$5,925,000
Subtotal	***$ 15,519,000***
General Conditions (10%)	$1,552,000
Contractor OH&P (15%)	$2,328,000
Contingency (30%)	$5,820,000
General and Administrative Costs (30%)	$7,566,000
Total Construction Cost	**$ 32,785,000**
Drainage Field for Short-Term Improvements	$100,000
Total Land Purchase Costs	**$ 100,000**
Total Project Capital Cost	**$ 32,885,000**

TABLE 10-10: SCENARIO B – OPERATIONS AND MAINTENANCE COSTS ESTIMATE

Item	Cost
Electricity	$43,000
Chemical	$23,300
Disposal	$25,000
Parts	$26,700
Personnel	$124,800
Estimated Annual O&M	**$ 242,800**

10.2.8 Treatment and Disposal Scenario C Costs

Table 10-11 below identifies estimated capital costs associated with this scenario. Table 10-12 shows the annual costs based on the number of estimated users on day 1.

TABLE 10-11: SCENARIO C – CAPITAL COSTS ESTIMATE

Item	Cost
Demolition of Existing RGF Plant	$300,000
New Mechanical WPCF with RIBs	$5,272,000
Effluent Pressure Pipe to Infiltration Basins	$3,750,000
New Advanced Mechanical WPCF (Idanha)	$5,925,000
Subtotal	***$ 15,247,000***
General Conditions (10%)	$1,525,000
Contractor OH&P (15%)	$2,288,000
Contingency (30%)	$5,718,000
General and Administrative Costs (30%)	$7,434,000
Total Construction Cost	**$ 32,212,000**
Land for Infiltration Basins	$1,000,000
Total Land Purchase Costs	**$ 1,000,000**
Total Project Capital Cost	**$ 33,212,000**

TABLE 10-12: SCENARIO C – OPERATIONS AND MAINTENANCE COSTS ESTIMATE

Item	Cost
Electricity	$54,600
Chemical	$9,500
Disposal	$25,000
Parts	$29,800
Personnel	$124,800
Estimated Annual O&M	**$ 243,700**

10.2.9 Treatment and Disposal Scenario D Costs

Table 10-13 below identifies estimated capital costs associated with this scenario. Table 10-14 shows the annual costs based on the number of estimated users on day 1.

TABLE 10-13: SCENARIO D – CAPITAL COSTS ESTIMATE

Item	Unit Price
Demolition of Existing RGF Plant	$300,000
New WPCF (Mill and Gates, 255,000 gpd)	$5,272,000
Effluent Pressure Pipe to Infiltration Basins	$3,750,000
New WPCF (Detroit and Idanha, 124,000 gpd)	$5,925,000
Effluent Pressure Pipe to Pigeon Prairie	$7,392,000
Effluent Pump Stations to Pigeon Prairie	$1,200,000
Land Application Irrigation System	$100,000
Subtotal	***$ 23,939,000***
General Conditions (10%)	$2,394,000
Contractor OH&P (15%)	$3,591,000
Contingency (30%)	$8,978,000
General and Administrative Costs (30%)	$11,671,000
Total Construction Cost	**$ 50,573,000**
Drainage Field for Short-Term Improvements	$100,000
Land at Pigeon Prairie	$1,000,000
Land for Infiltration Basins	$1,000,000
Total Land Purchase Costs	**$ 2,100,000**
Total Project Capital Cost	**$ 52,673,000**

TABLE 10-14: SCENARIO D – OPERATIONS AND MAINTENANCE COSTS ESTIMATE

Item	Cost
Electricity	$94,300
Chemical	$9,500
Disposal	$25,000
Parts	$29,800
Personnel	$124,800
Estimated Annual O&M	**$ 283,400**

10.2.10 Treatment and Disposal Scenario E Costs

Table 10-15 below identifies estimated capital costs associated with this scenario. Table 10-16 shows the annual costs based on the number of estimated users on day 1.

TABLE 10-15: SCENARIO E – CAPITAL COSTS ESTIMATE

Item	Unit Price
Demolition of Existing RGF Plant	$300,000
New WPCF (Mill and Gates, 255,000 gpd)	$5,272,000
Effluent Pressure Pipe to Infiltration Basins	$3,750,000
New WPCF (Detroit and Idanha, 124,000 gpd	$5,925,000
Effluent Pressure Pipe to Gravel Pit	$2,376,000
Effluent Pump Stations to Gravel Pit	$200,000
Drain Fields For Gravel Pit	549,000
Subtotal	***$ 18,372,000***
General Conditions (10%)	$1,838,000
Contractor OH&P (15%)	$2,756,000
Contingency (30%)	$6,890,000
General and Administrative Costs (30%)	$8,957,000
Total Construction Cost	**$ 38,813,000**
Drainage Field for Short-Term Improvements	$100,000
Land at Gravel Pit	$200,000
Land for Infiltration Basins	$1,000,000
Total Land Purchase Costs	**$ 1,300,000**
Total Project Capital Cost	**$ 40,113,000**

TABLE 10-16: SCENARIO E – OPERATIONS AND MAINTENANCE COSTS ESTIMATE

Item	Cost
Electricity	$60,500
Chemical	$9,500
Disposal	$25,000
Parts	$29,800
Personnel	$124,800
Estimated Annual O&M	**$ 249,600**

10.2.11 Net Present Value of Scenarios

Table 10-17 presents the 20-year net present value of each of the treatment and disposal scenarios described above. Scenarios B and C incorporate treatment and disposal options that would be allowed if the Three Basin Rule did not exist. Scenario B is the least cost Scenario. Scenario E is the least cost Scenario that is compliant with the Three Basin Rule. The capital cost difference between the two scenarios is $14 million. The Three Basin Rule has a $14 million impact on being able to develop community based sanitary sewer services for the North Santiam Sewer Authority (NSSA). If the federal land in scenarios D and E is not available for the disposal of treated effluent, a pipeline between the basins would need to be constructed. This pipeline is estimated to create a net cost increase of approximately $44 million to $57 million depending on the scenario it is compared with.

TABLE 10-17: 20-YEAR NET PRESENT VALUE

Scenario	Description	Capital Cost	Annual Cost	20-Year NPV
A	One Regional Treatment Plant with Drainage Fields and Surface Infiltration for All Communities	$98.0M	$0.19M	$101.7M
B	Two Basin Treatment Plants with River Discharge for All Communities	$32.9M	$0.24M	$37.6M
C	Two Basin Treatment Plants with Surface Infiltration for Lower Communities and River Discharge for Upper Communities	$33.2M	$0.24M	$37.9M
D	Two Basin Treatment Plants with Surface Infiltration for Lower Communities and Land Application for Upper Communities	$52.7M	$0.28M	$58.2M
E	Two Basin Treatment Plants with Surface Infiltration for Lower and Upper Communities	$40.1M	$0.25M	$45.0M

10.3 EVALUATION OF ALTERNATIVES

Sections 10.3.1 and 10.3.2 evaluate each of the treatment and disposal scenarios, and the collection system options.

10.3.1 Treatment and Disposal Scenario Evaluation

This section summarizes the five scenarios described above and provides a recommendation. An advantages/disadvantages summary for each scenario is presented below in Table 10-18.

TABLE 10-18: TREATMENT AND DISPOSAL ADVANTAGES/DISADVANTAGES

Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
Advantages				
- Meets Three Basin Rule requirements - Utilizes existing WPFC infrastructure - Relatively simple permitting process - RIB disposal does not require winter storage	- Significant cost savings by eliminating the pipeline from Detroit to Gates - No significant area required for disposal	- Significant cost savings by eliminating the pipeline from Detroit to Gates - Allows for quick implementation for Mill City and Gates as it would not be conditional upon the improvements for Detroit and Idanha - Utilizes existing WPFC infrastructure	- Significant cost savings by eliminating the pipeline from Detroit to Gates - Meets Three Basin Rule requirements - Allows for quick implementation for Mill City and Gates as it would not be conditional upon the improvements for Detroit and Idanha	- Significant cost savings by eliminating the pipeline from Detroit to Gates - Meets Three Basin Rule requirements - Allows for quick implementation for Mill City and Gates as it would not be conditional upon the improvements for Detroit and Idanha - RIB disposal does not require winter storage
Disadvantages				
- Requires costly pipeline connecting Detroit to Gates - Impact studies, permitting and construction of new pipeline from Detroit to Gates could take several years	- Does not meet Three Basin Rule requirements; feasibility of this option is contingent upon changes to the Three Basin Rule - Would require an advanced mechanical treatment plant, which would require skilled operators and close attention to ensure the system meets tight effluent requirements.	- Does not meet Three Basin Rule requirements; feasibility of this option is contingent upon changes to the Three Basin Rule - Would require an advanced mechanical treatment plant, which would require skilled operators and close attention to ensure the system meets tight effluent requirements.	- Requires the use of USFS land for upper basin - Coordination with USFS and final approval may require additional impact studies and evaluations	- Requires the use of USFS land for upper basin - Coordination with USFS and final approval may require additional impact studies and evaluations

10.4 COST ASSOCIATED WITH DIFFERING

This section provided the costs for each collection system option and treatment/disposal scenario. The recommendation for both does not represent the least cost option. For treatment/disposal, the least cost option is not compliant with the Three Basin Rule and therefore was not deemed to be in the interest of the NSSA to pursue. Changing the Three Basin Rule would likely be time and resource intensive and would likely have significant stakeholder and public comments. The delay to the project could not be estimated.

Similarly, the collection system option selected is estimated to have a higher capital cost, yet lower annual operation and maintenance costs. After consulting with the Board to better understand their priorities and with the intention of recommending the option that represents a better long term financially sustainable scenario, the gravity collection system is the option that was selected by the board for further consideration and development. The need to limit annual O&M costs was also more apparent after the Business Case Scenario was completed by FCS Group (Appendix K).

10.5 BUSINESS CASE SCENARIO

FCS Group prepared a business case scenario. The purpose of the business case scenario was to identify and test the conditions under which a new regional wastewater system in the NSC could be economically viable. It includes an explanation of the key variables that would drive financial feasibility, reasonable assumptions about those variables, and an analysis of the alternative choices available to the decision-makers whose support would be necessary. FCS Group's report can be referenced in Appendix K. Based on their findings; the following are the recommended next steps from FCS Group.

- The development of a phasing plan for project costs.
- A year-by-year forecast of potential EDUs by phasing area, including the potential for new growth as well as reconstruction of existing homes and businesses on septic.
- Refinement of the O&M cost estimates.
- A series of policy decisions that will help narrow the range of potential sewer rates.
- Design of either a connection requirement or a package of incentives and requirements that might encourage conversion from septic to sewer, once a sewer line is within range.
    - For instance, a jurisdiction might design its connection policy so that an existing septic property can defer connection as long as the current septic system is functioning and property ownership does not change hands, but connection would be required upon sale or transfer of the property. (This obligation would need to be recorded with the deed.)
    - Similarly, a jurisdiction might put a fixed deadline on the deferral of septic conversions— for example, a maximum of 15 years from sewer availability or 25 years from installation of the septic system.
- Design of requirements for sewer extensions and connections associated with new development, where there is no existing septic system.
- Continued efforts to obtain funding support from the State and Federal governments.

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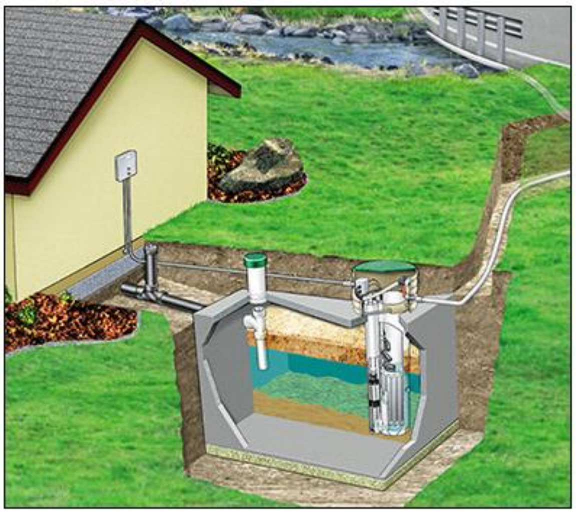
11. KEY POLICY DECISIONS AHEAD

This section discusses choices that the North Santiam Sewer Authority (NSSA) must make regarding the types of feasible systems and accompanying policy decision that must be made.

11.1 SCENARIO AND OPTIONS FOR ENGINEERING PATHWAY

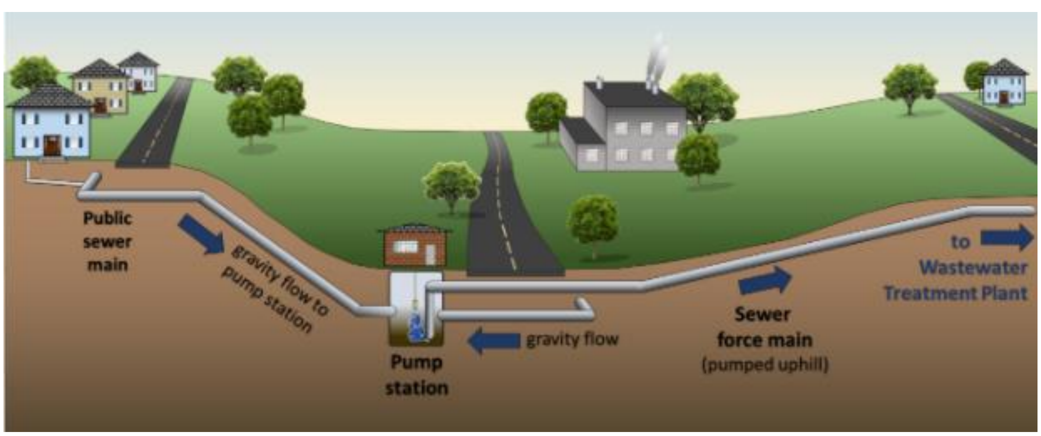
An important choice that the NSSA will have to make is the type of collection system best suited for the needs of the canyon communities. This master plan has discussed providing the canyon communities with a STEP or gravity collection system. A STEP system utilizes tanks and pumps at every connection. Wastewater receives some degree of pretreatment in the tanks and is pumped through small diameter, pressurized pipes to a site for additional treatment.

FIGURE 11-1: STEP COLLECTION SYSTEM AT A RESIDENTIAL DEVELOPMENT



In a gravity collection system, wastewater flows from each connection by gravity. Larger diameter pipes carry flows to topographic low points throughout town, where a pump station is to be built. This pump station pumps wastewater through a force main to the treatment site.

FIGURE 11-2: GRAVITY COLLECTION SYSTEM



Regardless of the collection system selected, treatment of wastewater and disposal of treated effluent are driven by regulatory requirements and options in the canyon are limited. The NSSA must pursue treatment and disposal methods that are compliant with all applicable standards discussed throughout this report.

11.2 POLICY DECISIONS

Key policy decisions identified during the development of this master plan that the NSSA Board will have to consider are discussed below.

11.2.1 Requirement to Connect

The NSSA may elect to require the owners of developed properties within city limits and/or urban growth boundaries to connect to the proposed sewer system. Requiring connection to the system would result in a larger number of users, and consequently, lowering the user rates. If the NSSA Board decides to require connection, they must also provide a date that connections must be made by. If the NSSA elects not to require connection to the system, residents will feel that they have retained more of the autonomy enjoyed in the canyon, but it could result in a higher rate to those that choose to connect.

Another aspect of this policy decision is that if connection is not required, the Board will need to consider the incentive for choosing to connect as well as what the cost to connect will be in the future for those that elect to not connect. Establishing these details early will allow property owners to make a better-informed decision.

The last item to consider in requiring a connection is whether the Board will elect to require that developed properties connect within a specified time frame. This could be coupled with any of the concepts already discussed regarding a requirement to connect.

11.2.2 Issuance of Recommended Sewer Connections for Rebuilding Efforts

If the NSSA elects to pursue STEP collection systems, an issuance may be made recommending septic tanks that are compatible with the STEP system to be installed. This would result in most post-wildfire rebuilding efforts being more likely to be compatible with the proposed sewer project, thereby reducing the possibility of residents incurring sunk costs. Note that recommending STEP compatible tanks does not provide a solution for the permitting of new drain fields for Mill City or the NSSA for any shorter-term solution. Before this can occur, the NSSA would have to decide that a STEP collection system is best suited to meet the long-term needs of the canyon communities and select a STEP system manufacturer/contractor to be used in the canyon. It should be noted in the issuance of a tank recommendation that future conflicts may arise, and at this stage, it is not guaranteed that the type or location of the tank will be compatible with the proposed system.

For a gravity collection system, the Board will need to decide on whether to provide a recommended connection that can be installed at the same time as an interim septic system, allowing for an easier process to switch the plumbing towards the future gravity connection instead of the septic tank.

11.2.3 Decommissioning of Abandoned Septic Tanks

Existing septic tanks that are not compatible with the collection system selected by the Sewer Authority will have to be decommissioned and abandoned or removed. The NSSA must decide whether this task is part of the proposed project or if property owners will be responsible for the decommission of their own septic tanks. If the NSSA elects to require property owners to decommission their own tanks, they may also elect to provide funding assistance. Including this task in the project would allow the NSSA to retain more control over decommissioning and ensure that it is done properly, but increases the overall cost associated with the project. Decommissioning of existing septic tanks was not included in cost estimates.

11.2.4 Contracting STEP Tank Maintenance

If the NSSA elects to pursue a STEP collection system, tank and pump maintenance, including pump outs, may be performed by NSSA operators or contracted out. When deciding this, the NSSA should consider cost, reliability, liability, and local preference to property owners allowing maintenance staff or contractors on their property.

11.2.5 Utility Easements

If the NSSA elects to pursue a gravity collection system, it must be determined where NSSA ownership ends. This may be at the property line and include a cleanout, resulting in property owners being responsible for operating and maintaining their laterals. This is typical for most cities in Oregon. Conversely, the NSSA may elect to maintain ownership beyond the property line up to a specified distance outside the home through a utility easement.

If the NSSA elects to pursue a STEP collection system, consideration must be given to the operation and maintenance of the portion of the STEP system located on each property. The NSSA may elect to place the burden of tank and/or pump maintenance on property owners. This would hinder the NSSA's ability to respond to emergencies and prevent the neglect of system maintenance. Additionally, property owners in the canyon may feel that the system does not provide them any value as they will still have a tank that they pay to maintain in addition to monthly payments to the NSSA. On the other hand, the NSSA may elect to maintain ownership of the STEP system beyond the property line through a utility easement. This would be less of a burden on property owners and allow the NSSA to maintain more control of the system. A hybrid approach could be decided on that allows for certain maintenance activities such as, pump replacement and tank pump outs, a specified schedule. If the maintenance activity is required earlier than scheduled, the property owner could be assessed a proportional fee.

11.2.6 Purchasing of Mill City Assets

A new regional wastewater system that includes Mill City as a member would need to acquire the existing Mill City wastewater system. Items to consider in the acquisition of assets are Mill City's existing debt, acquisition of vehicles and other minor equipment owned by Mill City's sewer utility, Mill City's sewer utility's existing cash reserve accounts, and maintaining a successful relationship between all cities in the NSSA. An in-depth discussion of this acquisition can be found in the Technical Memorandum prepared by FCS Group (Appendix K).

In addition to the existing assets of Mill City's sewer utility, the NSSA must consider Mill City's existing staff. Contracting with the existing staff would allow the NSSA to retain the experience in billing and collection system operations and maintenance that Mill City has cultivated over time.

11.2.7 Income/Household Survey

Examination of the scenarios presented in Section 10 and the business case evaluation in Appendix K should be conducted with consideration given to the annual income of NSSA residents. The cost estimates and net present value tables should be closely reviewed. Electing to pursue a STEP collection system is anticipated to have a lower capital cost and a lower 20-year net present value, as shown in Table 10-4. However, outside funding opportunities for operations and maintenance activities are not typical. If enough capital funding is raised, selecting a gravity treatment system may result in a lower monthly user rate, despite the higher capital cost.

11.2.8 Liability for Sewer Backups

Both collection system types have inherent risks for sewer backups. The NSSA Board will need to assess these potential risk and liability associated with sewer backups. After assessing the potential, the Board should identify mitigating factors along with their cost/benefit to reduce the risk and liability. One of the more commonly seen policies for mitigating risks is covered in the utility easement sub section. For a gravity collection system, a cleanout located on the property line is a clear delineation of who is responsible for a backup due to a lateral blockage.

11.2.9 Wastewater Strength Requirements for Users, Design Standards, and Standard Construction Specifications

It is typical for cities with community sewer systems to place restrictions on the strength of wastewater loading introduced into the system by users. Certain facilities are often required to implement additional pretreatment measures to ensure they are not overloading the system. One example of this is installing grease traps at restaurants. The NSSA Board will have to develop and enforce these standards. Other than standards for the wastewater strength, the NSSA will need to establish design standards, standard details, and standard construction specifications to be used by future developers that will connect to the system after the initial system development.

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12. COMMUNICATION AND PUBLIC OUTREACH

This section summarizes internal and external communication and outreach efforts that were conducted during the development of the North Santiam Canyon Wastewater Master Plan.

12.1 OVERVIEW

Internal communication efforts included Technical Review Committee (TRC) meetings, North Santiam Sewer Authority (NSSA) Board meetings, and a site tour/meeting to discuss Mill City's existing sanitary sewer system. External communication efforts included a meeting with Oregon Department of Environmental Quality (DEQ) representatives, townhall meetings, and a Marion County Commissioners meeting. Table 12-1 shows a schedule of the meetings conducted.

TABLE 12-1: WASTEWATER MASTER PLAN MEETING SCHEDULE

Meeting	Date
Preliminary Siting Meeting (TRC Meeting #1)	9/4/2020
Kickoff / Siting Meeting (TRC Meeting #2)	9/29/2020
NSSA Board Meeting #1	10/1/2020
NSSA Board Meeting #2	11/5/2020
Mill City Existing Facilities Meeting	11/30/2020
NSSA Board Meeting #3	1/7/2021
TRC Meeting #3	1/28/2021
NSSA Board Meeting #4	2/4/2021
DEQ Coordination Meeting	2/8/2021
Townhall Meeting #1	2/24/2021
NSSA Board Meeting #5	3/4/2021
County Commissioners Meeting	3/9/2021
Mill City WPCF Permitting Meeting	3/11/2021
NSSA Board Meeting #6	4/1/2021
TRC Meeting #4	4/6/2021
County Commissioners Meeting	4/20/2021
NSSA Board Meeting #7	5/6/2021
NSSA Board Meeting #8	6/3/2021
TRC Meeting #5	6/10/2021
Townhall Meeting #2	7/14/2021
Financial and Master Plan Review	8/5/2021

12.2 DATA GATHERING

Keller Associates sent requests for information (RFIs) to Mill City, Gates, Detroit, and Idanha. Data requested from each city included existing base mapping, utility as built drawings, historic daily water production, monthly water consumption, previous city planning documents, population growth estimates, areas of anticipated development, and the number of potential connections within the initial service areas. Additional requests were made for data regarding Mill City's existing sanitary sewer system.

12.3 NSSA BOARD MEETINGS

Throughout the duration of this master plan, board meetings were conducted with the NSSA and Keller Associates project managers and senior engineers. The purpose of these meetings was to update the NSSA on task progress and provide a brief look ahead at upcoming work.

12.4 TECHNICAL REVIEW COMMITTEE MEETINGS

To assist in planning efforts, the Mid-Willamette Valley Council of Governments (MWVCOG) facilitated the establishment of a TRC. The TRC committee consisted of 16 members, listed below.

McRae Charmichael – MWVCOG

Danielle Gonzalez – Marion County Economic Development

Shane Ottosen – Marion County Public Works

Chrissy Lucas – OSU Extension, Rural Studies

Karen Homolac – Infrastructure Finance Authority Business Oregon

Ken Woodward – North Santiam Sewer Authority Board Chair

Dale Weise – Gates Resident

Jason Pulley – City of Salem

Dennie Houle, Karen Homolac, Michelle Bilberry – Business Oregon

Cliff Serres – Oregon Department of Transportation

Heath Cokely, Jeff Crowther – Oregon Association of Water Utilities

Invited – US Forest Service/Parks

Ryan Sparks – Oregon State Parks

Invited – Department of State Lands

Gregg Baird – Oregon Health Authority

Mary Camarata – Department of Environmental Quality

The TRC held five meetings during the development of this master plan.

12.4.1 Preliminary Siting Meeting (TRC #1)

The first meeting conducted during the development of this master plan was a preliminary siting meeting. GSI Water Solutions provided figures illustrating areas of permeable soils that may be suitable for the infiltration of treated effluent. From these figures, the project team selected ten properties that may be the site of infiltration facility based on local knowledge – property ownership, pipeline alignments, treatment plant sites, local preference, etc.

12.4.2 Kickoff/Siting Meeting (TRC #2)

This meeting discussed the overall project scope, schedule, and general expectations. Additionally, four preferred sites were selected from the original ten sites identified during the Preliminary Siting Meetings. These four sites were subject to further field investigation and analysis.

12.4.3 TRC Meeting #3

TRC #3 was conducted to review the planning criteria – population, environmental resources, flows, and loadings. Additionally, potential wastewater treatment plant sites and effluent disposal sites were discussed, and conceptual gravity collection system layouts were introduced.

12.4.4 TRC Meeting #4

During TRC #4, refined gravity collection system layouts were reviewed, and STEP collection systems were introduced. Different collection system and treatment alternatives were discussed during this TRC. Additionally, an evaluation of Mill City's existing system was presented by a subconsultant, FCS Group.

12.4.5 TRC Meeting #5

During TRC #5, a summary of the recommended project was presented. The project recommendations included 1) Two sewer basins, Mill City/Gates and Detroit/Idanha with regional conveyance between communities within the same basin 2) Mill City to retain existing collection system, other cities to pursue a gravity collection system due to lower minimize O&M strategy 3) Treatment via mechanical treatment plants in Mill City and Idanha 4) Disposal in the Mill City basin via a rapid infiltration basin and 4) Field investigation and data collection to determine suitability of several sites for disposal in the Detroit/Idanha basin. Further details and logistics of analyzing the McCoy effluent disposal site, east of Idanha, were discussed. A discussion of the opportunity to reduce O&M (while upfront capital costs are higher) occurred. Further policy details regarding the ownership and maintenance of a potential STEP system, community population and income, and project funding were discussed.

12.5 TOWNHALL MEETINGS

Townhall Meetings provide a platform for the NSSA to present project milestones to members of the communities and other stakeholders who are not on the board. Participants were provided the opportunity to have their questions answered and concerns addressed. Two Townhall Meetings were held during the development of this master plan.

12.5.1 Townhall Meeting #1

The first Townhall meeting on February 24, 2021, provided an overview of the project including site background information, previous planning studies, master planning scope, and the data collection process. Established planning criteria, the Three Basin Rule, preliminary collection system layouts, and an evaluation of Mill City's existing system were also discussed.

12.5.2 Town Hall Meeting #2

The second Townhall meeting on July 14, 2021, provided an overview of the work conducted to complete the master plan development. Included in the presentation were recommendations for wastewater collection, treatment, and disposal. A summary of the current opinion of the costs associated with the recommended scenario was provided. Additionally, a discussion of the next steps required to proceed with the project was presented.

12.6 MILL CITY

Russ Foltz, the Public Works Supervisor in Mill City, gave staff from Keller Associates a tour of existing sanitary sewer facilities. Any existing deficiencies, recent problems, and effluent compliance were discussed. Additionally, representatives from Mill City met with Keller Associates staff to discuss concerns about the existing WPCF and the process and timing of transferring assets to the NSSA.

12.7 OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

Keller Associates conducted three meetings with Oregon Department of Environmental Quality (DEQ).

12.7.1 Coordination Meeting

This meeting was held to provide the DEQ with an overview of the proposed project and inform them of the status of the master plan. Effluent disposal and the Three Basin Rule were discussed in detail.

12.7.2 Mill City WPCF Permitting Meeting

This meeting between Keller Associates and DEQ staff discussed a path forward for permitting a capacity expansion to Mill City's existing WPCF.

12.7.3 WPCF Permitting and Phasing Meeting

This meeting between Keller Associates, GSI, and DEQ staff discussed project phasing for both the Mill City/Gates basin as well as the Detroit/Idanha basin. The DEQ process and policy were discussed. Further, the key factors for determining if a WPCF permit is adequate and an NPDES permit will not be required for disposal via a rapid infiltration basin.

12.8 ENERGY TRUST OF OREGON

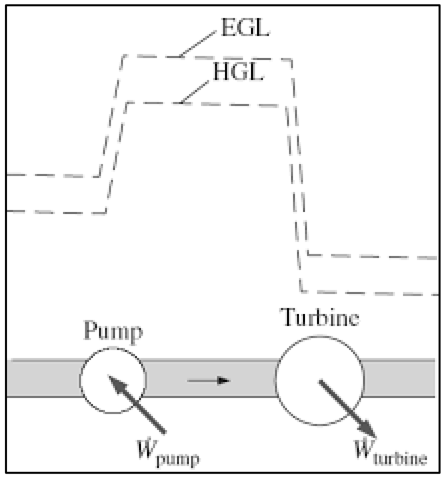
Energy Trust of Oregon is a nonprofit organization that helps utility customers benefit from efficient energy use and generating renewable energy. Keller Associates coordinated with Energy Trust of Oregon to discuss energy saving efforts that could be implemented in this project. Wastewater Treatment Energy Savings Guide by Energy Trust of Oregon can be found in Appendix O. The document includes measures specific to aeration, pumps, fans, and motors, lighting, anaerobic digestion, UV disinfection, and controls.

For new construction, the eligible cost for incentives is the cost difference between a code-minimum baseline and a more efficient alternative. Current incentives (as of 3/24/2021) are $0.30/kWh up to 70% of the eligible project cost and may be subject to change. Energy efficiency measures may be component-specific or high-level design considerations. All design elements that contribute to energy savings are applicable and worth investigating. An example would be a feature that replaces a pump station with gravity feed.

12.8.1 Power Generation

As turbine technology has advanced, some municipalities have begun capturing energy from pipelines that would have previously gone to waste. As flow passes through a turbine, excess head is given up to the turbine to produce electricity, as seen in Figure 12-1.

FIGURE 12-1: EXAMPLE EGL AND HGL THROUGH A PUMP AND TURBINE



Notes
HGL – Hydraulic Grade Line
EGL – Energy Grade Line

It is anticipated that regional conveyance of wastewater between canyon communities will be a part of this project. Pump stations and force mains will be necessary to convey wastewater over the highest point along the pipeline alignment between communities. Once over the high point, gravity may provide excess head to the wastewater that can be recaptured and used to produce power via a turbine.

12.9 MARION COUNTY BOARD COMMISSIONERS

On March 9th, and April 20th, 2021, Keller Associates attended Marion County Board of Commissioners meetings to present updates of the project to the Commissioners. Included in the April 20th summary was a discussion of collection systems, treatment systems, disposal options, and an evaluation of Mill City's existing sanitary sewer system.

12.10 U.S. FOREST SERVICE

During development of this master plan, multiple candidates for a disposal site in the Detroit and Idanha basin were identified – Two of them being Pigeon Prairie and the McCoy Site. Both sites are located on land owned by the U.S. Forest Service (USFS). Through coordination with the Forest Service, Keller Associates, and sub-consultant GSI were permitted access to the sites for a preliminary investigation of field conditions.

Subsequent discussions have been coordinated to better understand the USFS process for gaining access to perform testing and monitoring at the McCoy Site. That communication has been on the local Ranger Station level, while their in-house communication has reached up to the regional level.

12.11 OREGON STATE PARKS

State Park facilities surrounding the study area provide the opportunity to increase the number of users on the sewer system, lowering the cost per user. At this stage in the project, involvement from Oregon State Parks has been limited, but is essential for future considerations. Looking forward, the NSSA may elect to further coordinate with Oregon State Parks to connect some of their existing facilities to the NSSA sewer system. A discussion regarding associated policy decisions can be found in Section 11.

12.12 WILLAMETTE PARTNERSHIP – INFRASTRUCTURE NEXT

Willamette Partnership is a non-profit organization in Oregon seeking to increase investment in green infrastructure – forests, wetlands, watersheds, and other landscapes. One method the group has sought to accomplish this is by helping to minimize the impacts on the environment from the construction and long-term operation of roads, pipes, and transmission lines. During development of this master plan, Willamette Partnership has toured the site and can be a resource to assist in the pursuit of natural infrastructure, if possible.

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13. SUMMARY OF RECOMMENDATIONS

This section summarizes the recommendations for a feasible approach to providing Idanha, Detroit, Gates, and Mill City with community wastewater services. These services include system regionalization, collection systems, wastewater treatment, effluent disposal, and project phasing. Recommendations are also made regarding improvements to Mill City's existing sanitary sewer system.

13.1 POPULATION

In addition to the population projections provided in this report, the North Santiam Sewer Authority (NSSA) should coordinate with Portland State University (PSU) to facilitate the development of a population growth study that PSU is willing to accept and implement into their published population projections. Populations in the canyon communities since the wildfire event have been dynamic and will continue to be a challenging topic as rebuilding increases and this project moves forward.

It is also recommended that the volume of tourism and recreation in Detroit be investigated further to better understand the potential impacts to the NSSA. The potential flows from other various recreational areas near or adjacent to the NSSA communities should also be studied to better understand the potential impacts to the NSSA.

13.2 REGIONALIZATION

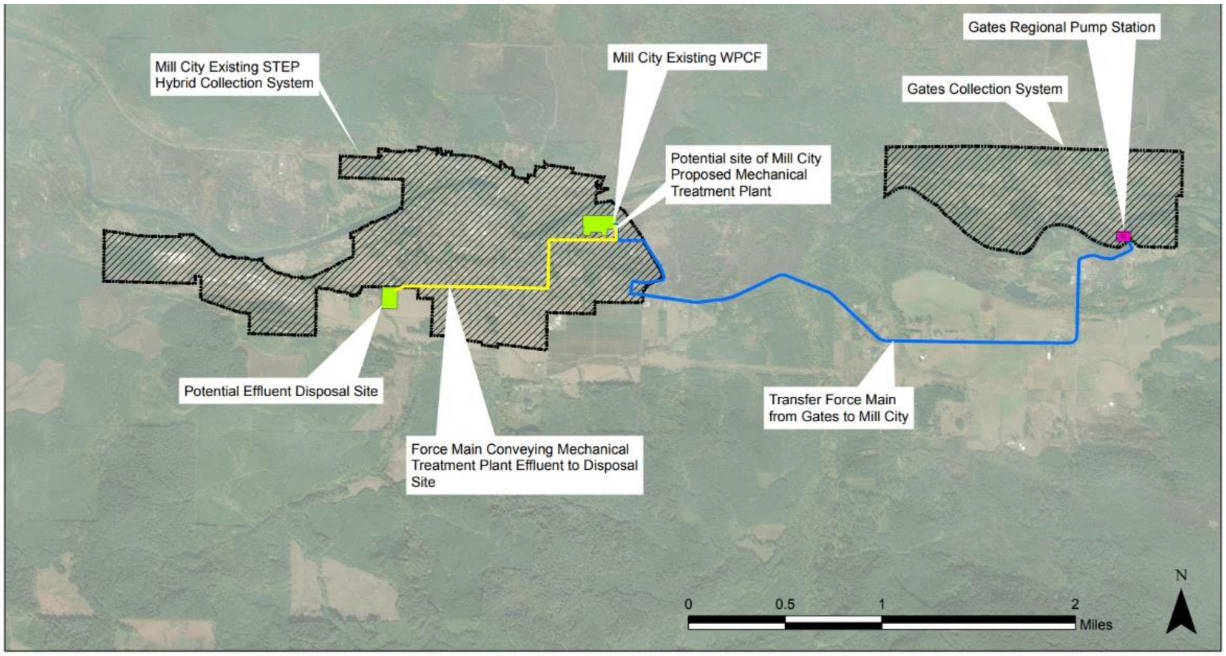
"Economy of scale" is a phrase used to explain why large facilities are usually overall less expensive to build than small facilities. The fixed costs of a project apply regardless of the size of the project. Additionally, the relationship between project size and project cost is typically not a linear one. Neglecting fixed costs, constructing a two-million-gallon water tank would still be expected to cost less per gallon than a one-million-gallon water tank. Administrative costs will also be less per customer as the number of customers increase. Because of this economy of scale, it is recommended that NSSA regionalize their wastewater treatment services. Another financial advantage of a regional wastewater facility is having *more* customers to share the burden of paying the bills.

Keller Associates recommends that the NSSA establish the two sanitary sewer basins described below. Figures 10 and 11 that show the basins, regional lift stations, and transfer force mains can be found in Appendix C.

13.2.1 Mill City and Gates Basin

One of the two proposed basins encompasses Mill City and Gates (Figure 13-1). Wastewater flows would be collected in Gates and conveyed to Mill City via a regional lift station and force main. Wastewater flows from Mill City would combine with the incoming flows from Gates at a new mechanical treatment plant. Treated effluent at the proposed mechanical treatment plant will be disposed of, to a new rapid infiltration basin. The figure below provides an overview of the Mill City and Gates basin.

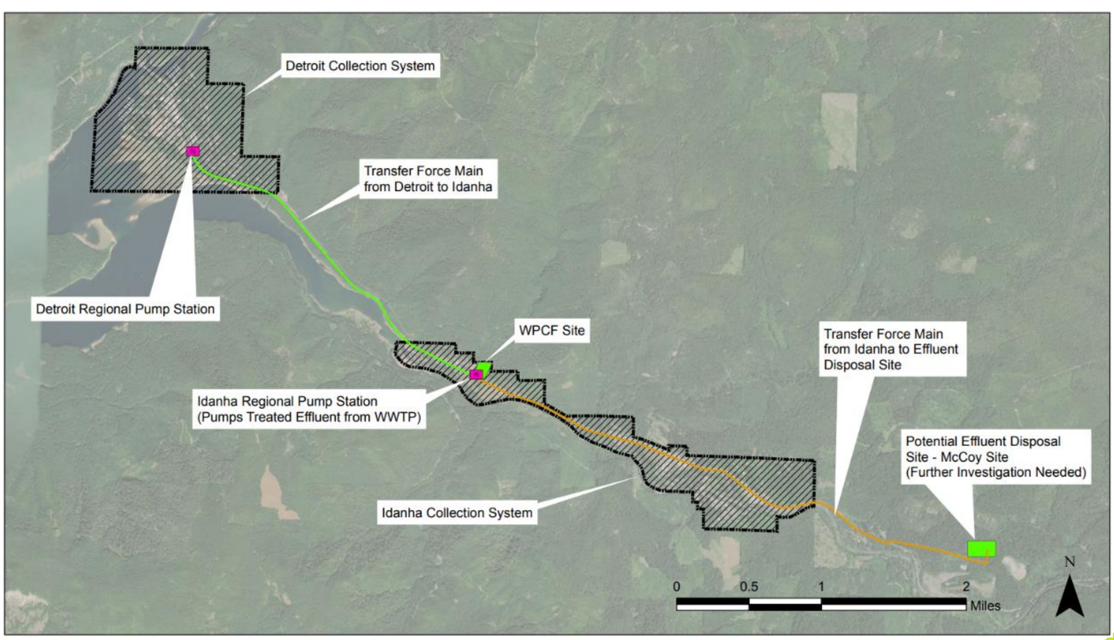
FIGURE 13-1: MILL CITY AND GATES BASIN



13.2.2 Detroit and Idanha Basin

The other proposed basin will service Detroit and Idanha (Figure 13-2). Wastewater flows would be collected in Detroit and conveyed to Idanha via a regional lift station and force main. Wastewater flows collected from Idanha would combine with the flows from Detroit at an advanced mechanical wastewater treatment plant located near Blowout Road. Treated effluent would be disposed of at one of the three properties identified in Section 10 (McCoy, Ranger Station, or South Shore sites). The figure below provides an overview of the Detroit and Idanha basin.

FIGURE 13-2: DETROIT AND IDANHA BASIN



13.3 COLLECTION SYSTEMS

Keller Associates examined the feasibility of constructing gravity and septic tank effluent pumping (STEP) collection systems in Gates, Detroit, and Idanha. The cost of a complete overhaul of Mill City's existing septic tank effluent gravity (STEG)/STEP system is tentatively estimated to cost over $15 million, making this option cost prohibitive. Instead, it is recommended that Mill City and after acquisition, the NSSA continue to operate the existing STEG/STEP system and perform upgrades and expansions, as necessary. It is recommended that the NSSA proceed with the further planning, design, and construction of gravity collection systems for Gates, Detroit, and Idanha.

13.4 MILL CITY EXISTING SYSTEM IMPROVEMENTS

Immediate improvements are needed to address the operations and capacity of Mill City's existing water pollution control facility (WPCF). As discussed in Section 6, Mill City's current WPCF could expand the recirculating gravel bed filter (RGF) and the existing drain field. Because the long-term recommendation includes a mechanical treatment plant with a higher quality effluent, Keller Associates recommends that Mill City and the NSSA take steps toward developing the mechanical treatment plant in lieu of expanding the capacity of the RGF and drain field. This would prevent the sunk cost associated with the short-term improvements for expanding the RGF. This may delay the short-term expansion in Mill City but will provide a better long-term solution. A site layout of Mill City's existing WPCF is shown in Figure 13-3 below. Note that because of recent wildfires, the site proposed for WPCF expansion is currently occupied by FEMA trailers.

FIGURE 13-3: EXISITING MILL CITY WPCF

13.4.1 Short-Term Improvements

Much of the existing equipment at Mill City's WPCF is reaching the end of its useful life. Keller Associates recommends that Mill City perform immediate improvements to short-lived assets (pumps, fans, valves, etc.), as discussed in Section 6. These improvements are needed to keep the WPCF treating wastewater at its current rated capacity until the new mechanical treatment plant can be operable.

13.4.2 Capacity Expansion

Immediate improvements are needed to address the capacity of Mill City's existing WPCF. Keller Associates recommends that Mill City begin the process to develop a new mechanical treatment plant that will be consistent with Scenario E as described in Section 10. Additional coordination and approval from DEQ will be required to allow for use of the existing drain field or expansion of the drain field in an interim status until a new RIB can be sited, tested, and approved by the DEQ. Due to this process and the time required, it does not provide enough of a time savings to go through the process of approving new drain field for the new mechanical treatment plant. The DEQ has indicated that moving directly to a preliminary engineering report (PER) in lieu of a Facilities Planning Study (FPS) could be acceptable given the extenuating circumstances in the canyon. The schedule presented later in this section assumes some overlap but does allow for both the FPS and PER process.

13.4.3 Interim New Connections

While the PDWWF design conditions are above the existing WPCF's capacity, it is also recommended that Mill City and the NSSA begin communications with DEQ to show that progress is being made toward a solution.

The DEQ may also allow Mill City to add new connections with the understanding and commitment that the long-term solution will be funded and implemented. Early discussions along with better details on what type of connections and how many are being requested will be required for the DEQ to provide meaningful input and make any decision.

13.5 WASTEWATER TREATMENT

To provide the level of treatment necessary for effluent disposal in the North Santiam Canyon (NSC), Keller Associates examined the type and potential site of a treatment plant facility in each of the proposed basins.

13.5.1 Treatment in the Mill City and Gates Basin

Keller Associates recommends the NSSA proceed with the planning, design, and construction of a new mechanical wastewater treatment plant on property adjacent to the existing Mill City WPCF. Flows from Gates and Mill City will be combined ahead of the new mechanical treatment plant. The expected performance of a mechanical treatment plant is provided in Table 13-1 below.

TABLE 13-1: EXPECTED EFFLUENT QUALITY FROM MECHANICAL TREATMENT PLANT

Contaminant	Units	Value
BOD	mg/L	<20
TSS	mg/L	<20
Ammonia	mg/L	<5
Nitrates	mg/L	<5
Turbidity	NTU	<1
E. coli	no/100 mL	<2.2

13.5.2 Treatment in the Detroit and Idanha Basin

Keller Associates recommends flows from the Detroit and Idanha basin be treated by a new advanced mechanical wastewater treatment plant located in Idanha, near Blowout Road. The expected performance of an advanced mechanical treatment plant is provided in Table 13-2 below.

TABLE 13-2: EXPECTED EFFLUENT QUALITY FROM ADVANCED MECHANICAL TREATMENT PLANT

Contaminent	Units	Value
BOD	mg/L	<20
TSS	mg/L	<20
Ammonia	mg/L	<5
Nitrates	mg/L	<5
Phosphorus	mg/L	<0.3
Turbidity	NTU	<0.2
E. coli	no/100 mL	<2.2

13.6 EFFLUENT DISPOSAL

The Three Basin Rule provides many challenges regarding effluent disposal in the NSC. Keller Associates examined several effluent disposal options including drainage fields, surface infiltration, land application, injection wells and aquifer recharge, and surface discharge to the North Santiam River with a modification to the Three Basin Rule.

13.6.1 Disposal in the Mill City and Gates Basin

Keller Associates recommends that treated effluent from the new mechanical treatment plant be pumped through a force main to a site suitable for disposal in a rapid infiltration basin (RIB). One potential site is located outside of city limits to the southwest.

For recommended next steps, see GSI's memorandum (Appendix P) in which various sites were evaluated and recommendations provided for the Mill City and Gates Basin. In summary, GSI's recommendations are to continue to engage with the DEQ to identify testing and regulatory requirements as well as identifying a specific site where an agreement can be agreed upon with the property owner and begin the site-specific testing and monitoring.

13.6.2 Disposal in the Detroit and Idanha Basin

Keller Associates recommends that the Detroit and Idanha basin dispose of effluent in an RIB. Three potential sites, McCoy, Ranger Station, and South Shore require further investigation to determine their suitability as an RIB.

For recommended next steps, see GSI's memorandum (Appendix P) in which various sites were evaluated and recommendations provided for the Detroit and Idanha Basin. The McCoy site should be further explored and confirmed or ruled out prior to advancing any significant additional efforts related to the other two potential sites.

13.7 ENVIRONMENTAL PERMITTING

A summary of initial environmental permitting considerations for the proposed NSSA project are listed below. The list includes key permits, authorizations, and necessary coordination (approving agency).

- Clean Water Act 404 permit (U.S. Army Corps of Engineers [USACE])
- Clean Water Act 401 water quality certification (Oregon Department of Environmental Quality [ODEQ])
- Oregon Removal/Fill permit (Oregon Department of State Lands [DSL])
- Endangered Species Act (ESA) Section 7 consultation (U.S Fish and Wildlife Service [USFWS] and National Marine Fisheries Service [NMFS])
- Magnuson-Stevens Essential Fish Habitat Assessment (NMFS)
- Migratory Bird Treaty Act (USFWS)
- Bald and Golden Eagle Protection Act (USFWS)
- National Historic Preservation Act Section 106 consultation (Oregon State Historic Preservation Officer [SHPO]) and Tribal coordination.
- National Environmental Policy Act – there may be multiple NEPA requirements (i.e., different aspects of the project may involve federal decisions requiring NEPA and different agencies will have different needs) (U.S. Forest Service [USFS], U.S. Department of Agriculture [USDA], Oregon Department of Transportation [ODOT])
- Special Use Permit (USFS)
- Right of Way approvals (City, County, ODOT, USFS)
- Fish Passage Assessments and Approval (Oregon Department of Fish and Wildlife [ODFW])
- Air Quality Construction Permit (ODEQ)
- NPDES Stormwater General Permit (ODEQ)
- Local permits/approvals - Specific permit requirements will vary by city and/or county and according to site specific environmental and land use conditions. Examples of common permits include land use permits, zoning variances, general development permits, and floodplain development permits

It is anticipated that the project permitting may be broken up into phases if one could provide rationale that each segment had independent utility (i.e., each segment could stand alone as a single project and would be constructed absent the construction of the other segment – that is, it did not rely on the other segment to be completed). General notes regarding permitting strategy are listed below.

- Though the project may be phased by funding sources, unless segments of the project have independent utility, they will need to be permitted all together (regardless of funding phases).
- There may be opportunities to permit Mill City and Gates together and then Detroit and Idanha together (i.e., it may be possible to show independent utility for these 2 different segments of the project).
- There may also be opportunities to pursue efficiencies by preparing programmatic agreements for the entire project with various agencies. Programmatic agreements can be used for large, long-term, or frequent actions and allow an expedited review process by identifying general effects and standard mitigation measures. These could be developed collaboratively as the project proceeds. An example would be a programmatic agreement to cover NHPA Section 106 consultation for cultural resources.
- Permit applications and NEPA generally need at least a 30% design. Some permits or authorizations (e.g., 404 permit application and ESA consultation) will require more advanced design information.
- Permitting strategies depend on funding sources, timing, and scope of phases that funding enables.

Assumptions made during the formulation of the two lists above are shown below.

- USFS would require an environmental impact study (EIS) for the anticipated Special Use Permit, or land acquisition under the Townsites Act.
- An individual permit authorization under Clean Water Act Section 404 would be required.
- Biological Assessment(s) for USFWS and NMFS would be required for Endangered Species Act compliance.
- The project would be designed to avoid impacts to environmental resources wherever feasible.
- Permitting for any required mitigation is not included.
- Permitting for wastewater treatment facilities would be led by the engineering team.

13.8 COST SUMMARY

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. As a result, the final project costs will vary from the estimated presented in this document.

The costs are based on cost estimating resources and experience with similar/recent wastewater projects and were developed based on 2021 dollars. 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 construction administrative costs.

Total capital and annual costs for the recommended treatment and disposal scenario, including the recommended collection system option is summarized in Table 13-3.

TABLE 13-3: RECOMMENDED COLLECTION, TREATMENT AND DISPOSAL COSTS

Capital Cost	Annual Cost
$106.2M	$0.44M

Total capital costs for the recommended Scenario are summarized in more detail in Table 13-4.

TABLE 13-4: COST SUMMARY

Item		Cost
MILL CITY EXISTING SYSTEM IMPROVEMENTS		
Short-Term Improvements		$176,000
MILL CITY EXISTING SYSTEM IMPROVEMENTS TOTAL		**$176,000**
MILL CITY AND GATES BASIN		
Demolition of Existing RGF Plant	$	300,000
New WPCF (Mill and Gates, 255,000 gpd)	$	5,272,000
Effluent Pressure Pipe to Infiltration Basins	$	3,750,000
Gates Collection System (Gravity)	$	10,534,000
Gates Pump Stations	$	680,000
Subtotal	**$**	**20,536,000**
General Conditions (10%)	$	2,054,000
Contractor OH&P (15%)	$	3,081,000
Contingency (30%)	$	7,702,000
General and Administrative Costs (30%)	$	10,012,000
Total Construction Cost	**$**	**43,385,000**
Land Purchase		
Easements	$	46,000
Pump Stations	$	450,000
Land for Infiltration Basins	$	1,000,000
Drainage Field for Short-Term Improvements	$	100,000
Total Land Purchase Costs	**$**	**1,596,000**
MILL CITY AND GATES BASIN TOTAL	**$**	**45,157,000**

DETROIT AND IDANHA BASIN		
New WPCF (Detroit and Idanha, 124,000 gpd)	$	5,925,000
Effluent Pressure Pipe to McCoy Site	$	2,376,000
Effluent Pump Stations to McCoy Site	$	200,000
Drain Fields For McCoy Site	$	549,000
Detroit Collection System (Gravity)	$	13,014,000
Detroit Pump Stations	$	680,000
Idahna Collection System (Gravity)	$	5,480,000
Idahna Pump Stations	$	340,000
Subtotal	**$**	**28,564,000**
General Conditions (10%)	$	2,857,000
Contractor OH&P (15%)	$	4,285,000
Contingency (30%)	$	10,712,000
General and Administrative Costs (30%)	$	13,926,000
Total Construction Cost	**$**	**60,344,000**
Land Purchase		
Easements	$	46,000
Pump Stations	$	450,000
Land at Gravel Pit	$	200,000
Total Land Purchase Costs	**$**	**696,000**

DETROIT AND IDANHA TOTAL	**$**	**61,040,000**

TOTAL (Without Mill City Short-Term Improvements)	**$**	**106,021,000**

TOTAL (With Mill City Short-Term Improvements)	**$**	**106,197,000**

13.9 BUSINESS CASE SCENARIO

FCS Group prepared a business case scenario. The purpose of the business case scenario was to identify and test the conditions under which a new regional wastewater system in the NSC could be economically viable. It includes an explanation of the key variables that would drive financial feasibility, reasonable assumptions about those variables, and an analysis of the alternative choices available to the decision-makers whose support would be necessary. FCS Group's report can be referenced in Appendix K. Based on their findings; the following are the recommended next steps from FCS Group.

- The development of a phasing plan for project costs.
- A year-by-year forecast of potential EDUs by phasing area, including the potential for new growth as well as reconstruction of existing homes and businesses on septic.
- Refinement of the O&M cost estimates.
- A series of policy decisions that will help narrow the range of potential sewer rates.
- Design of either a connection requirement or a package of incentives and requirements that might encourage conversion from septic to sewer, once a sewer line is within range.
- Design of requirements for sewer extensions and connections associated with new development, where there is no existing septic system.
- Continued efforts to obtain funding support from the State and Federal governments.

13.10 POLICY DECISIONS

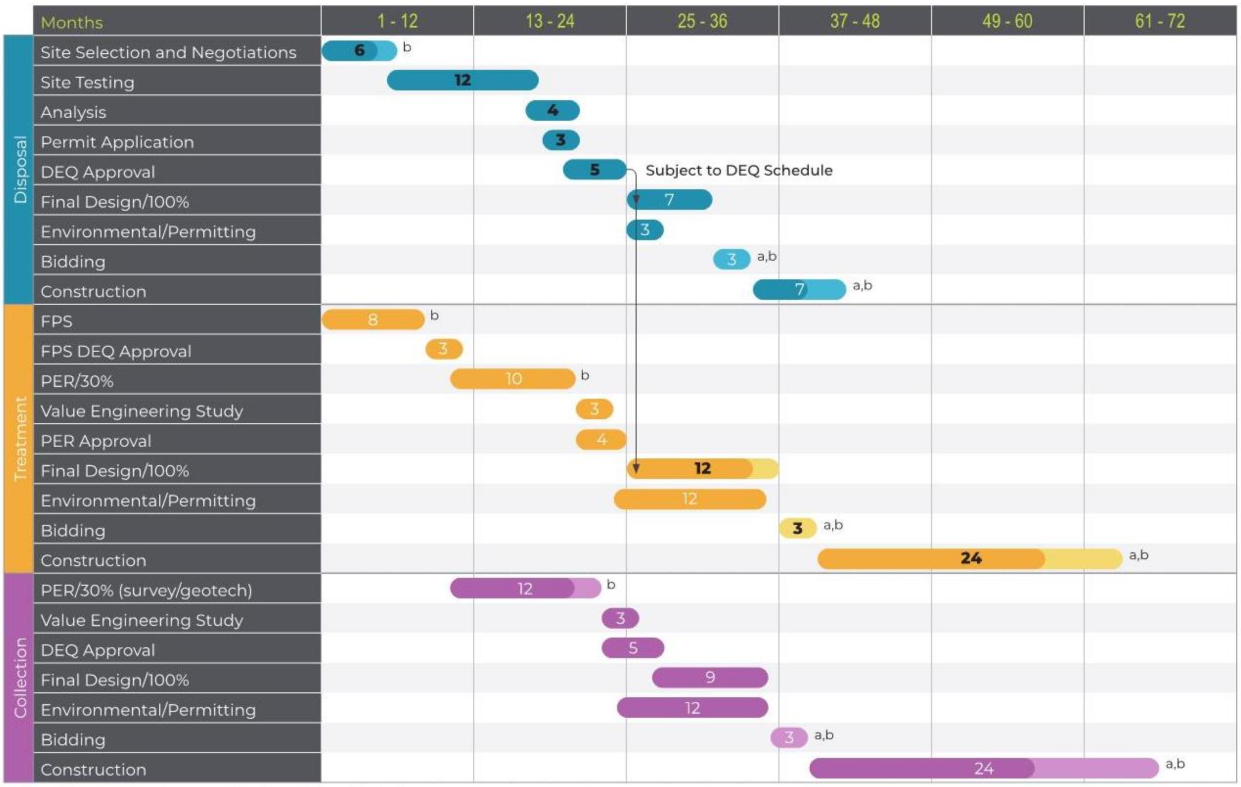
Keller Associates recommends the NSSA Board evaluate the policy decisions discussed in Section 11, prioritize the policy decisions, and create a timeline for each one. Certain policy decisions will need to be completed before the financial plan and/or engineering can be completed.

13.11 PROJECT PHASING / PATH

A flow chart of anticipated major steps to develop the overall project can be found in Figure 12 (Appendix C). Keller Associates recommends on pursuing each path independently and as funding becomes available.

Charts 13-1 and 13-2 summarize the estimated schedule for the NSSA project by treatment / disposal basin. Full page charts for the schedules are provided in Appendix C as Figures 13 and 14. The schedules indicate potential savings in time be compressing some project components. Many items within the schedule are out of the control of the NSSA or Keller Associates and are the best estimates based on discussions with regulators and experience with other projects. As the project development gets closer to construction, advancing or delaying construction may be necessary depending on the typical construction season in the NSC. A Gantt chart for each basin is presented on the next two pages.

CHART 13-1: NSSA PROJECT SCHEDULE – MILL CITY / GATES



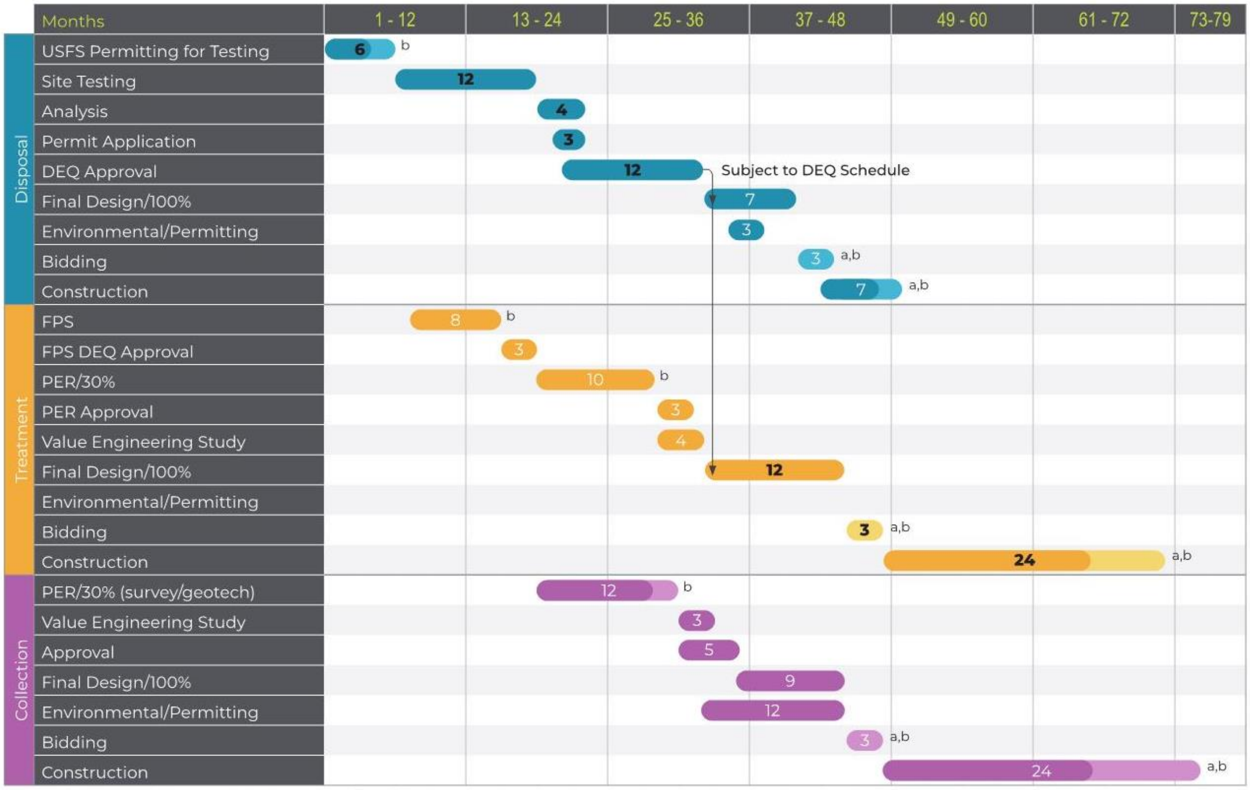
Bold Text - Indicates critical path in schedule

a = Could start earlier, compress, or eliminate this schedule item with CM/GC alternative delivery

b = Potential to compress this schedule item

= Lighter shade represents estimate of potential to compress schedule

CHART 13-2: NSSA PROJECT SCHEDULE – DETROIT / IDANHA



Bold Text - Indicates critical path in schedule

a = Could start earlier, compress, or eliminate this schedule item with CM/GC alternative delivery

b = Potential to compress this schedule item

= Lighter shade represents estimate of potential to compress schedule

13-12 IMMEDIATE ACTION ITEMS

In the near term the following is a list of recommended action items:

- Negotiate scope / fee for Phase 2 engineering services
  - Develop environmental permitting plan (SWCA)
  - Permitting and subsurface investigation (GSI)
  - Site specific testing, monitoring, and analysis
  - WPCF permit application support and negotiations with DEQ
  - Mill City / Gates basin Facilities Planning Study for DEQ approval
  - Mill City WPCF short term improvements
- Engage with owners of potential properties in Mill City area, select site and negotiate.
- Population growth study for PSU concurrence
- Negotiate with DEQ for interim connections to existing Mill City system
- Continue to pursue additional funding
- Business case scenario recommendations
- Evaluate key decisions
  - Requirement to connect
  - Sewer connection recommendations for rebuilding effort
  - Decommissioning of abandoned septic tanks
  - Utility easements, NSSA ownership limits
  - Purchasing of Mill City assets
  - Income / Household survey
  - Liability for sewer backups
  - Pretreatment ordinance (wastewater strength requirements)

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Appendix A: Mid-Willamette Valley Council of Governments, North Santiam Canyon Economic Opportunities Study

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North Santiam Canyon Economic Opportunity Study
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North Santiam Canyon Regional Wastewater Analysis

January 2017

January 2017

North Santiam Canyon
Regional Wastewater Analysis

KELLER associates
Get there!

KELLER associates

Keller Associates
707 13th St. SE. Suite 280
Salem, OR 97301

216051/5/S16-004

REGISTERED PROFESSIONAL ENGINEER
1/12/17
83510PE
OREGON
NOV. 10, 2009
PETER OLSEN
EXPIRES: 12/31/18

Signed by:
Peter Olsen, P.E.
Project Manager

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Appendix C: Figures

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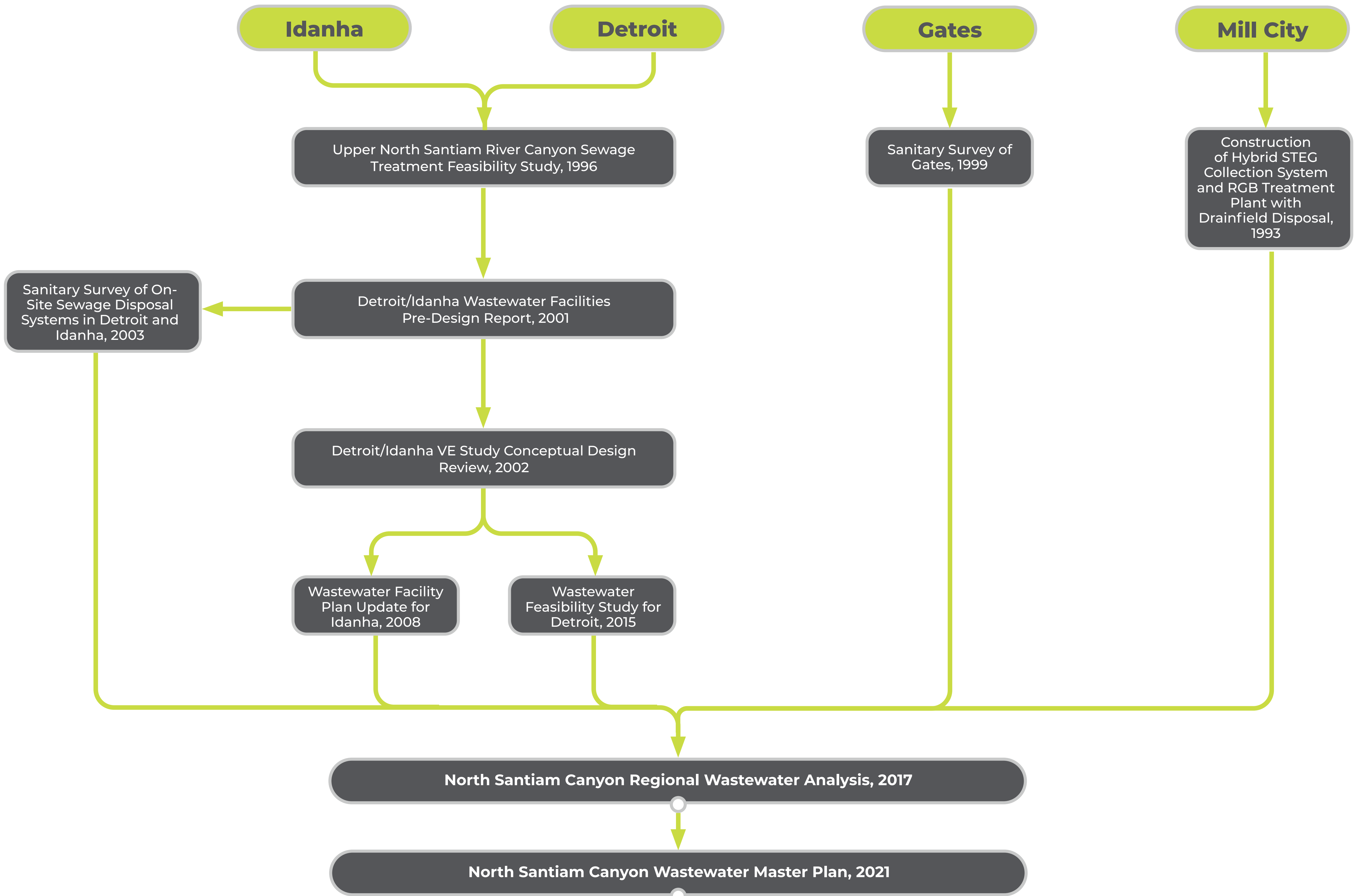
FIGURE I


Idanha
Detroit
Gates
Mill City
Upper North Santiam River Canyon Sewage Treatment Feasibility Study, 1996
Sanitary Survey of Gates, 1999
Construction of Hybrid STEG Collection System and RGB Treatment Plant with Drainfield Disposal, 1993
Sanitary Survey of On-Site Sewage Disposal Systems in Detroit and Idanha, 2003
Detroit/Idanha Wastewater Facilities Pre-Design Report, 2001
Detroit/Idanha VE Study Conceptual Design Review, 2002
Wastewater Facility Plan Update for Idanha, 2008
Wastewater Feasibility Study for Detroit, 2015
North Santiam Canyon Regional Wastewater Analysis, 2017
North Santiam Canyon Wastewater Master Plan, 2021

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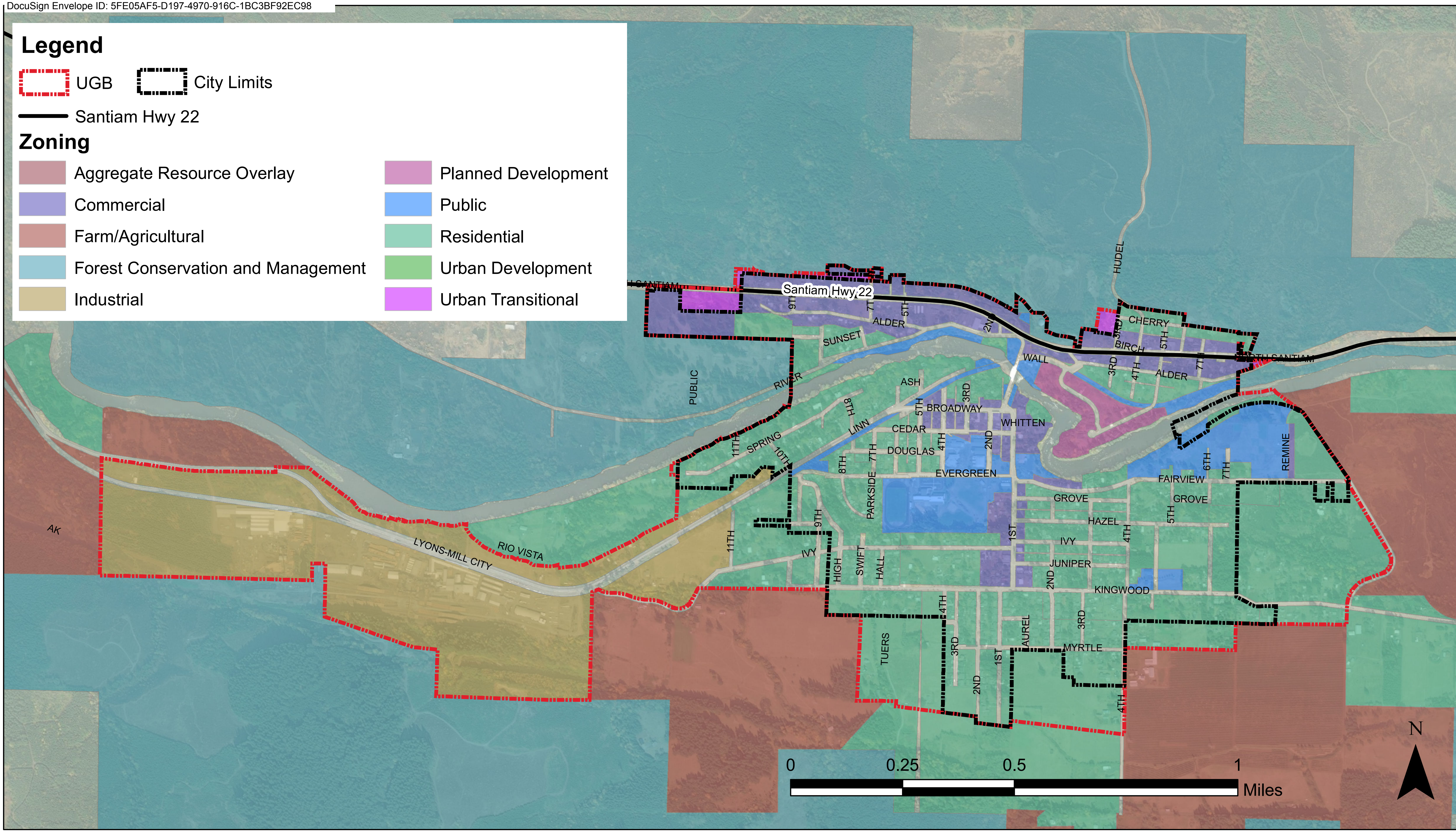

KELLER ASSOCIATES

City of Mill City Zoning

NSC Waste Water Master Plan

Figure 2A

North Santiam Canyon, OR
September 2021

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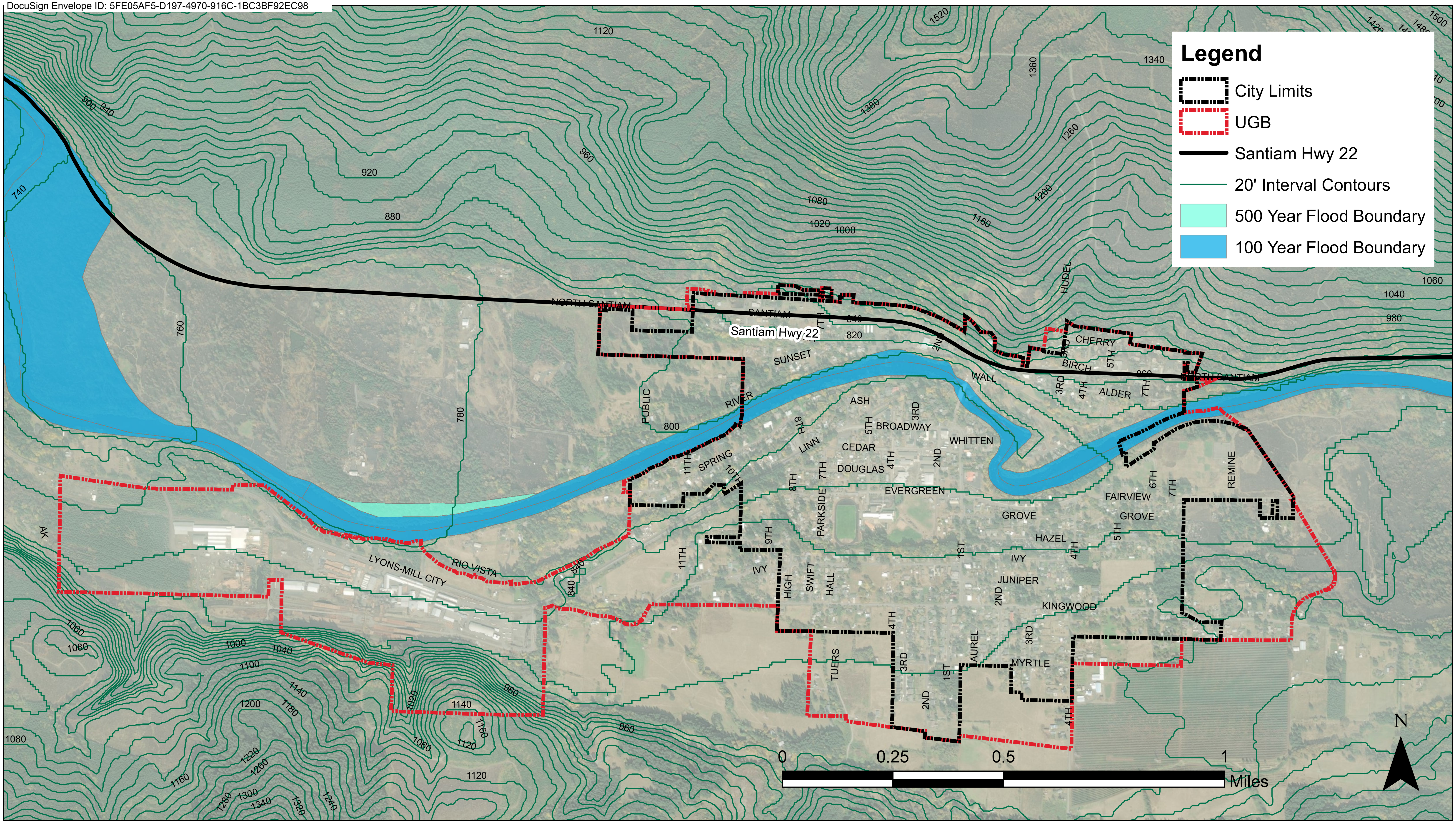

KELLER ASSOCIATES

City of Mill City Topography and Flood Plain

NSC Waste Water Master Plan

Figure 2B

North Santiam Canyon, OR
September 2021

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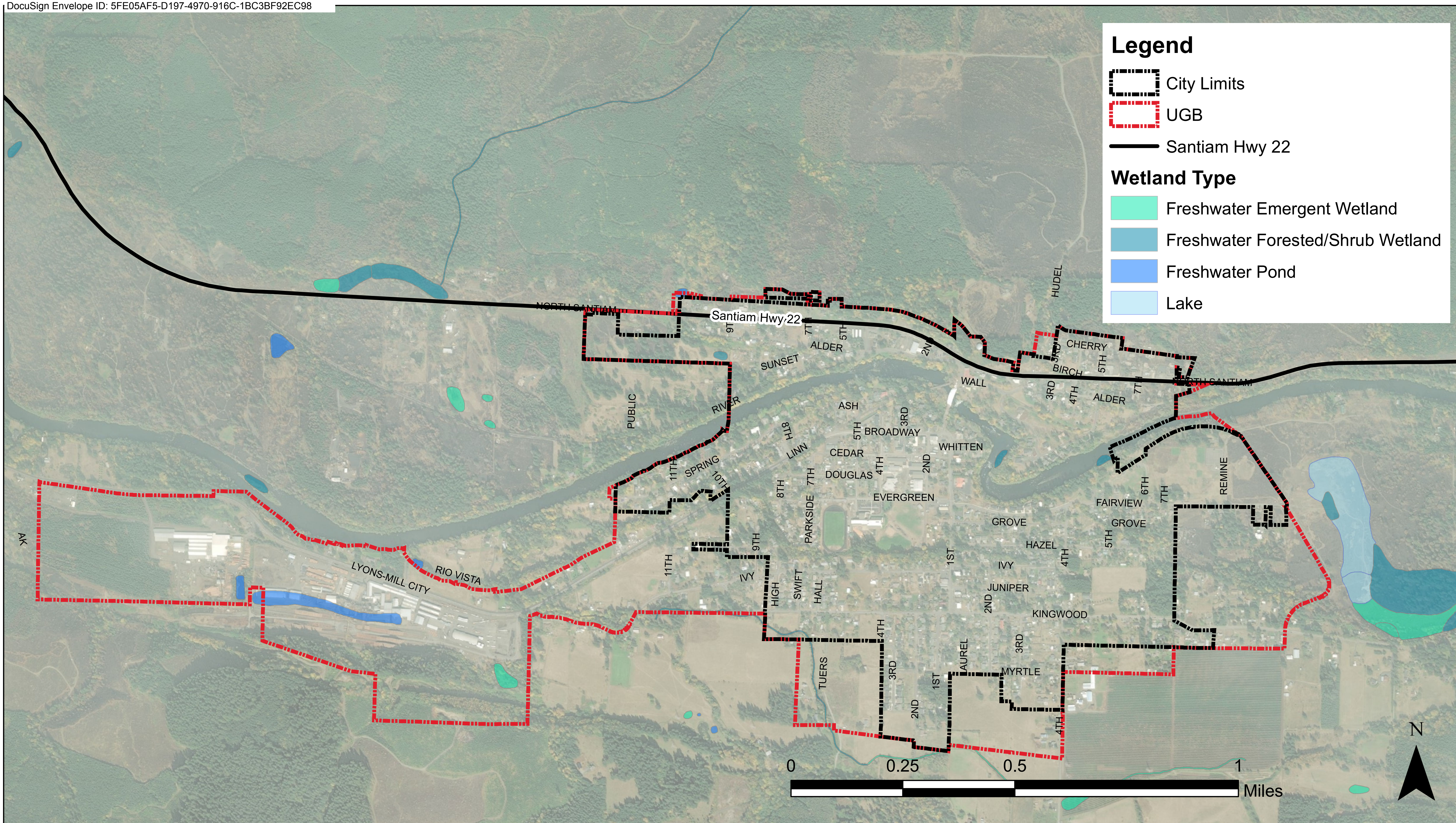

City of Mill City Wetlands

NSC Waste Water Master Plan

Figure 2C

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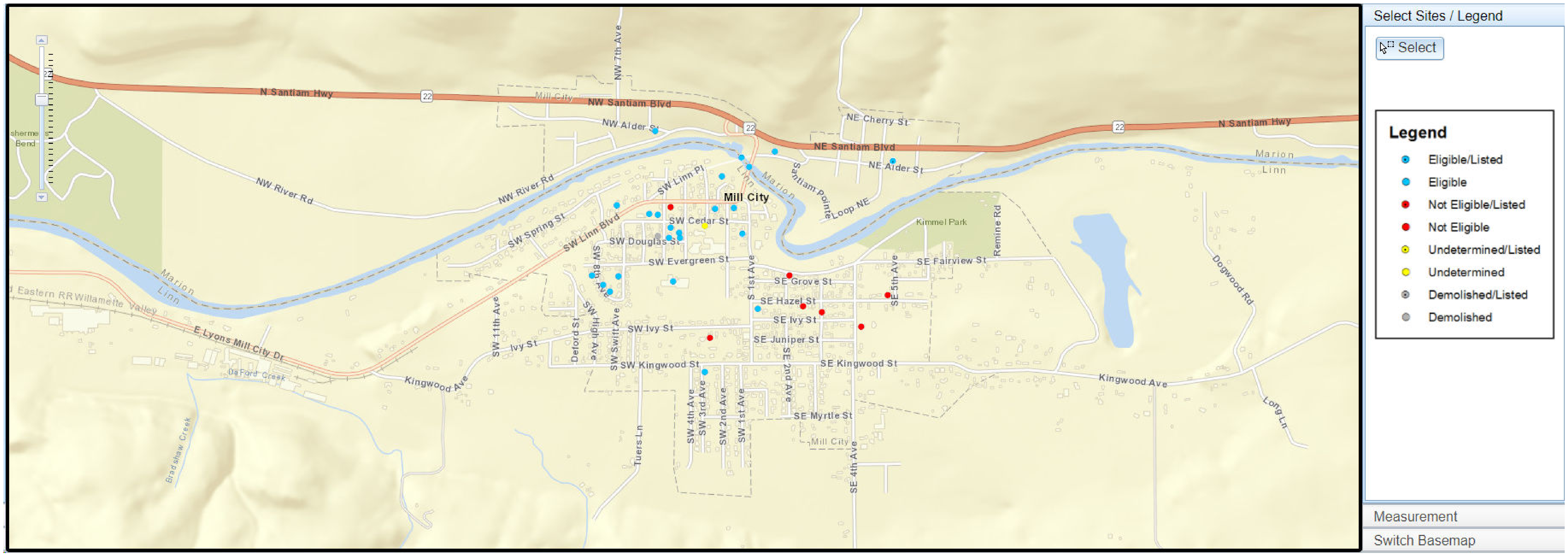

KELLER ASSOCIATES

City of Mill City Above Ground Cultural Resources

NSC Waste Water Master Plan

Figure 2D

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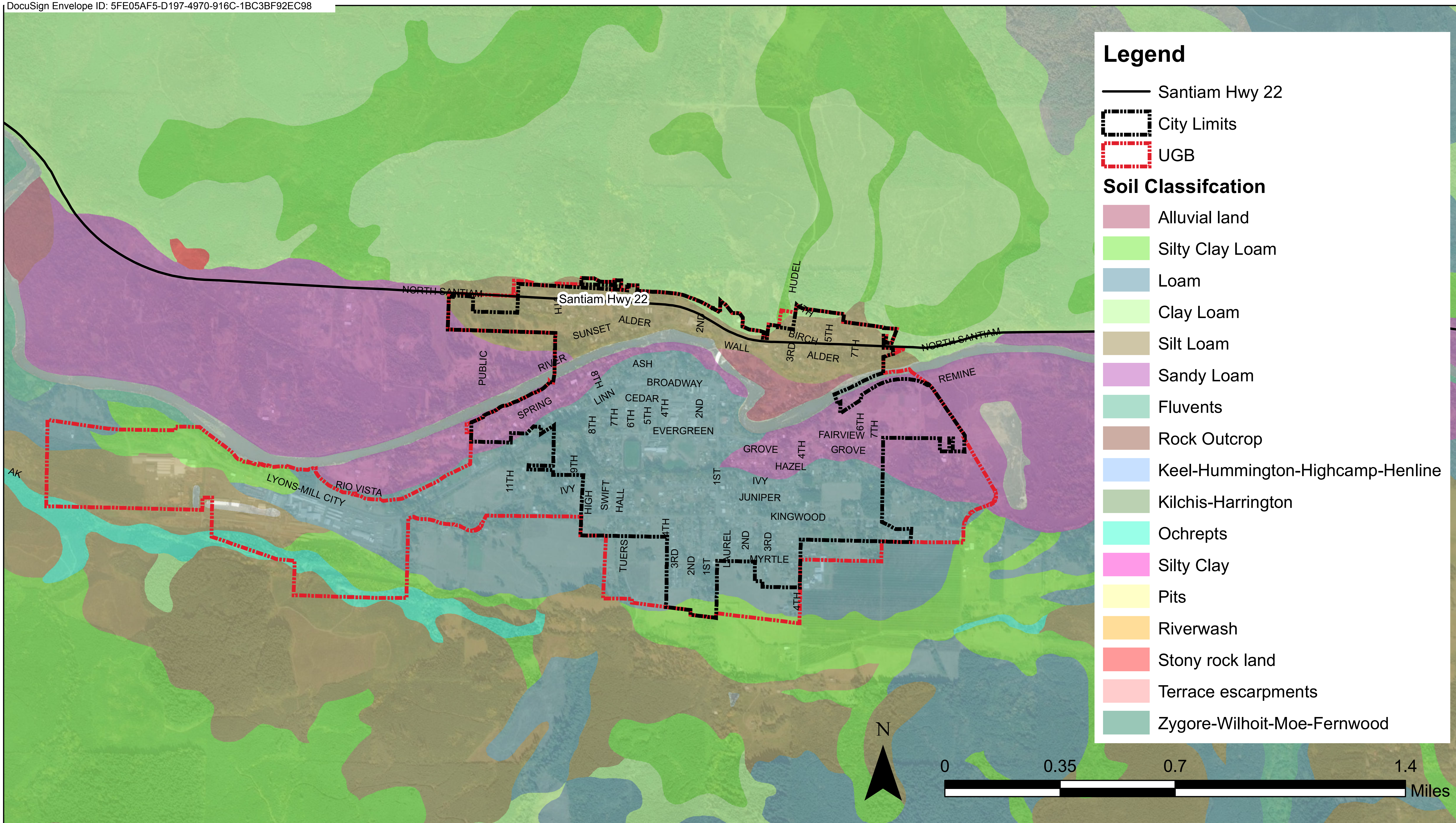

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City of Mill City Soil Designation

NSC Waste Water Master Plan

Figure 2E

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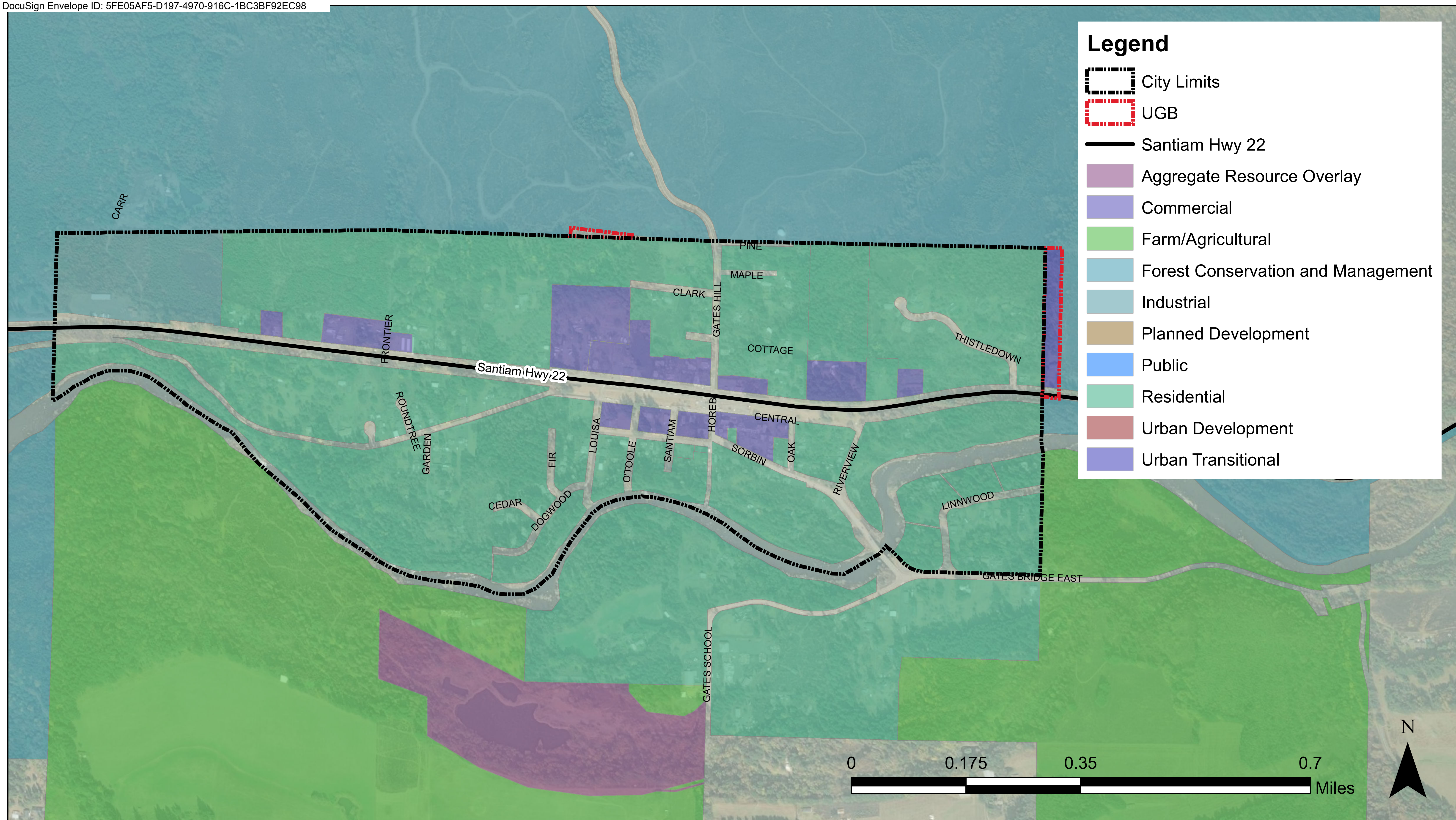

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City of Gates Zoning

NSC Waste Water Master Plan

Figure 3A

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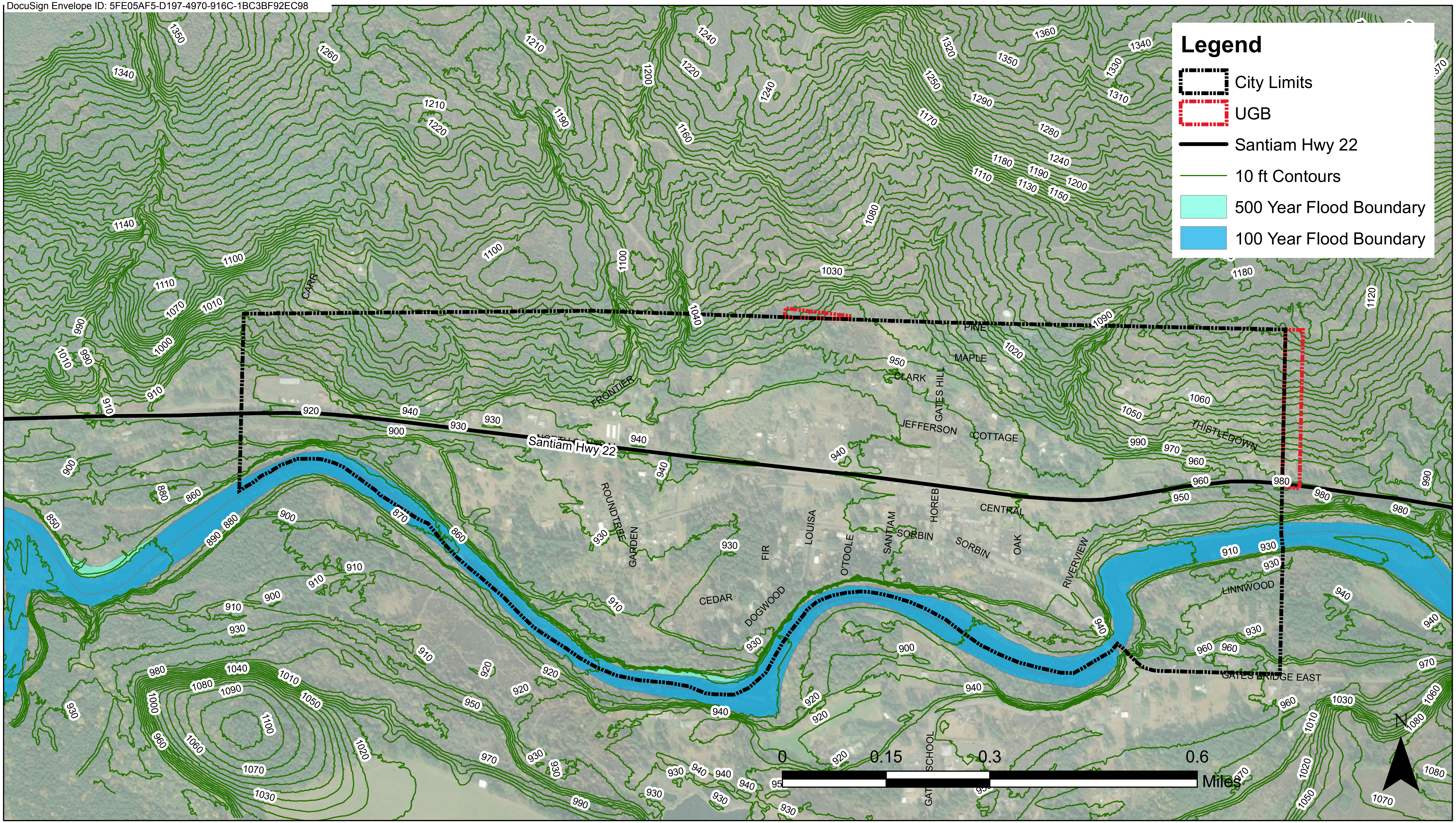

City of Gates Topography and Flood Plain

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Figure 3B

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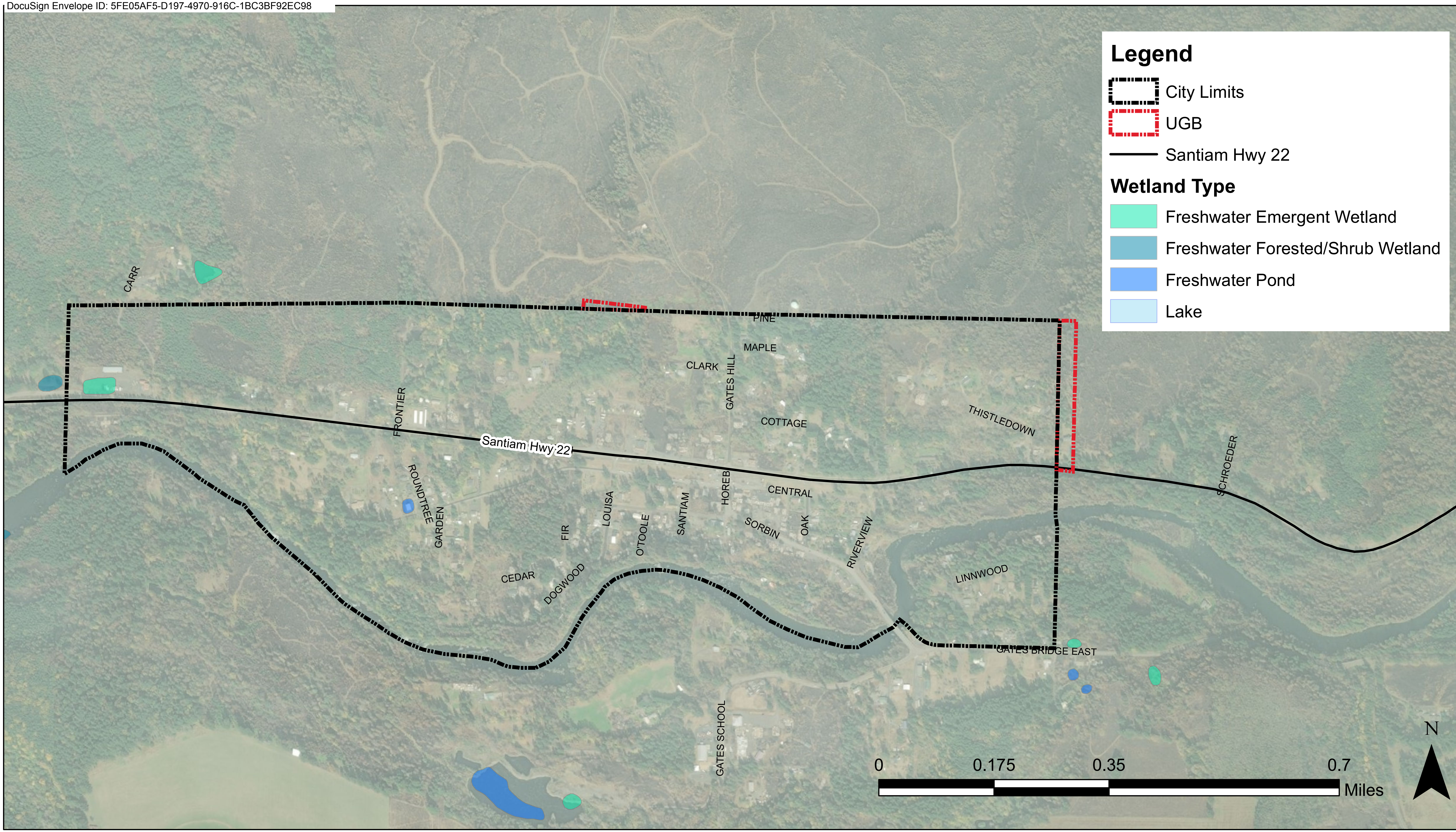

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City of Gates Wetlands

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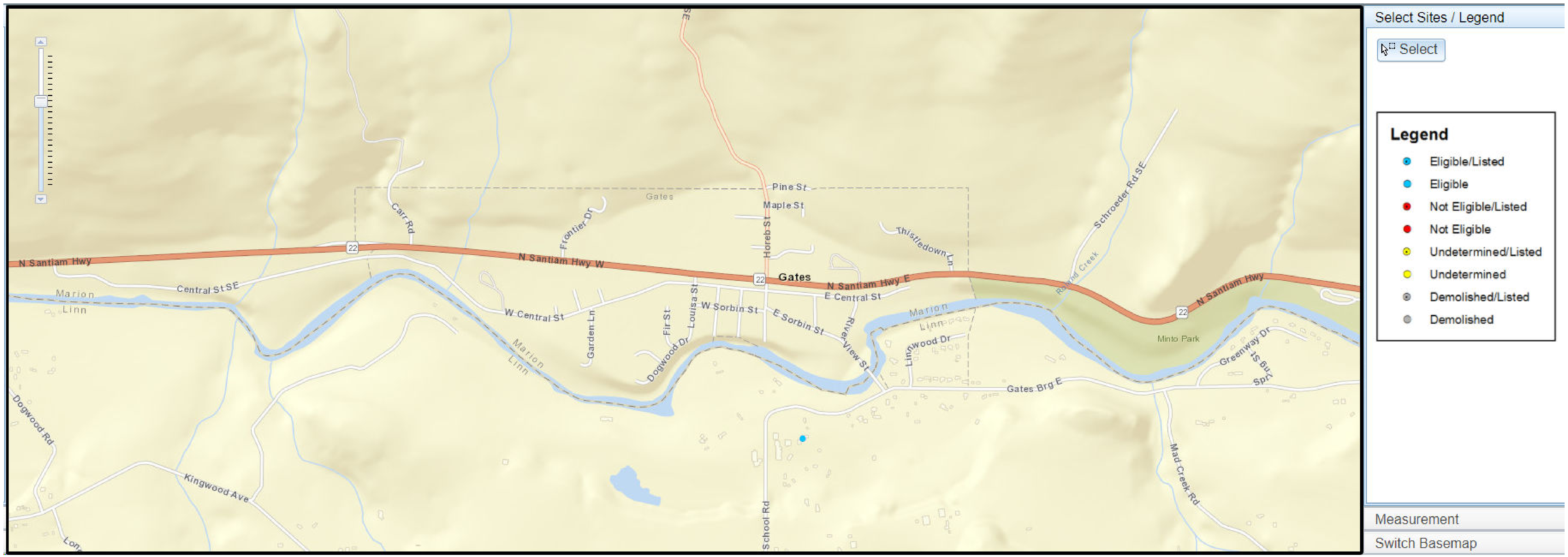

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City of Gates Above Ground Cultural Resources

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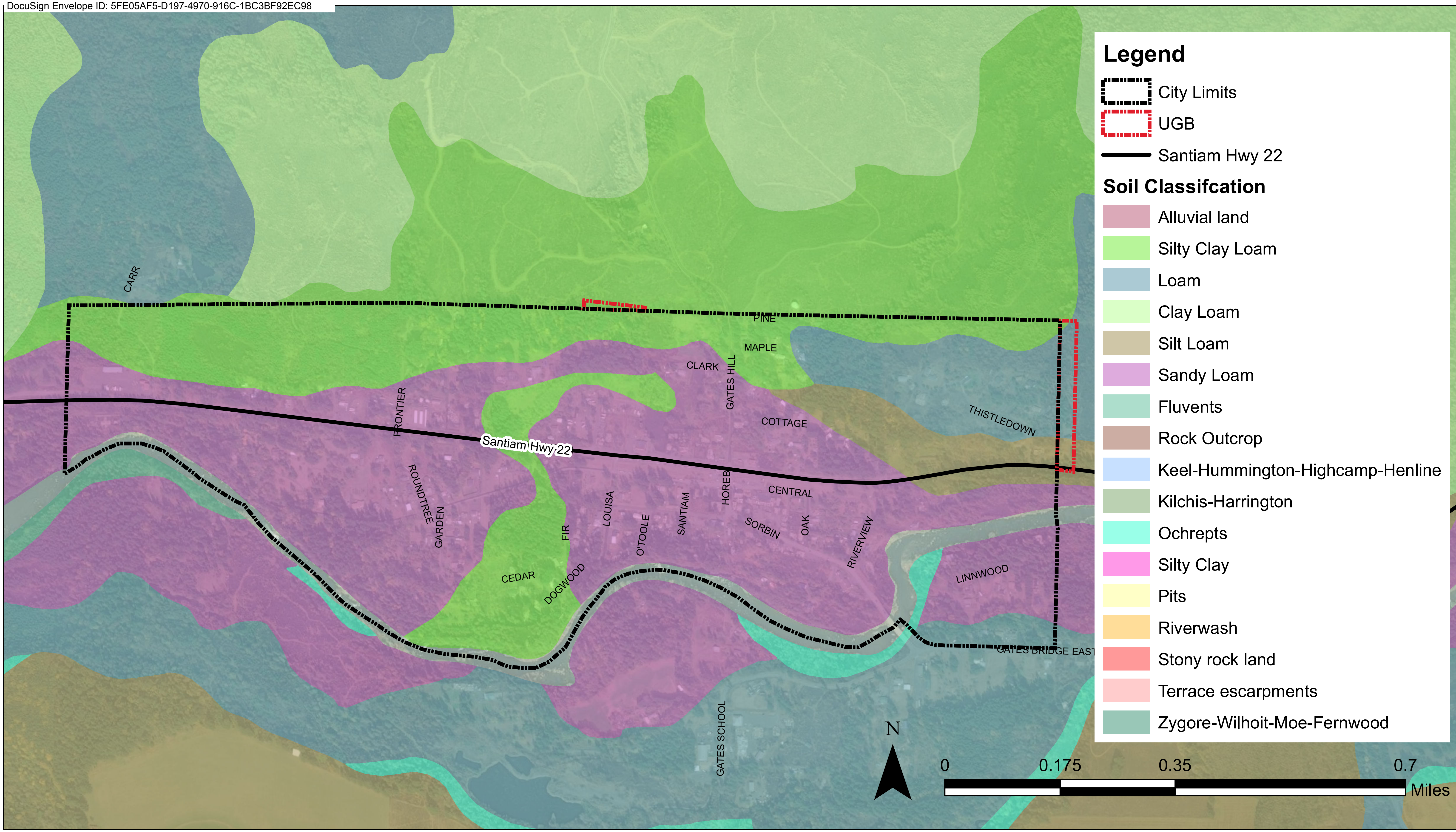

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City of Gates Soil Designation

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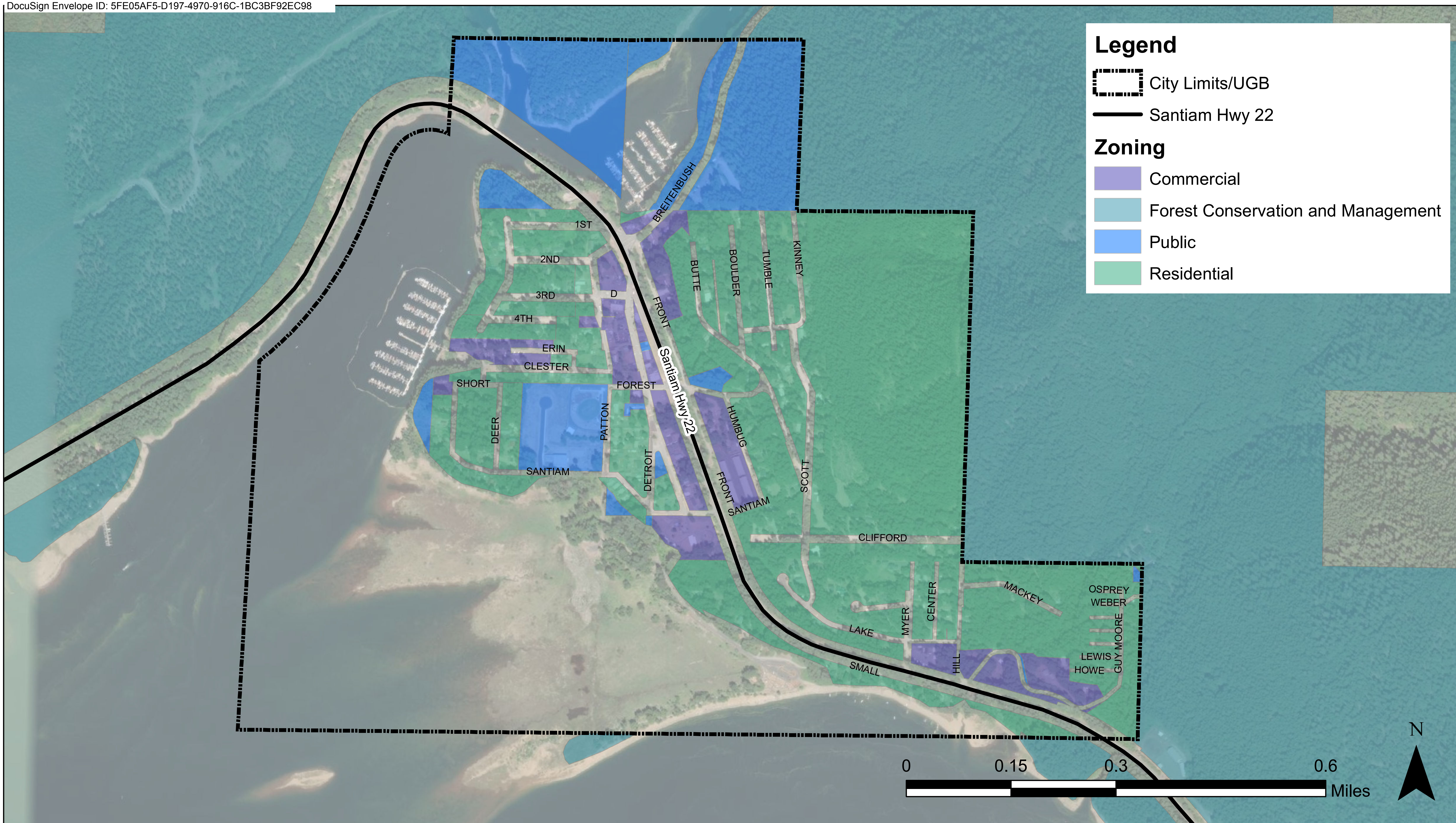

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City of Detroit Zoning

Wastewater Facilities Planning Study

Figure 4A

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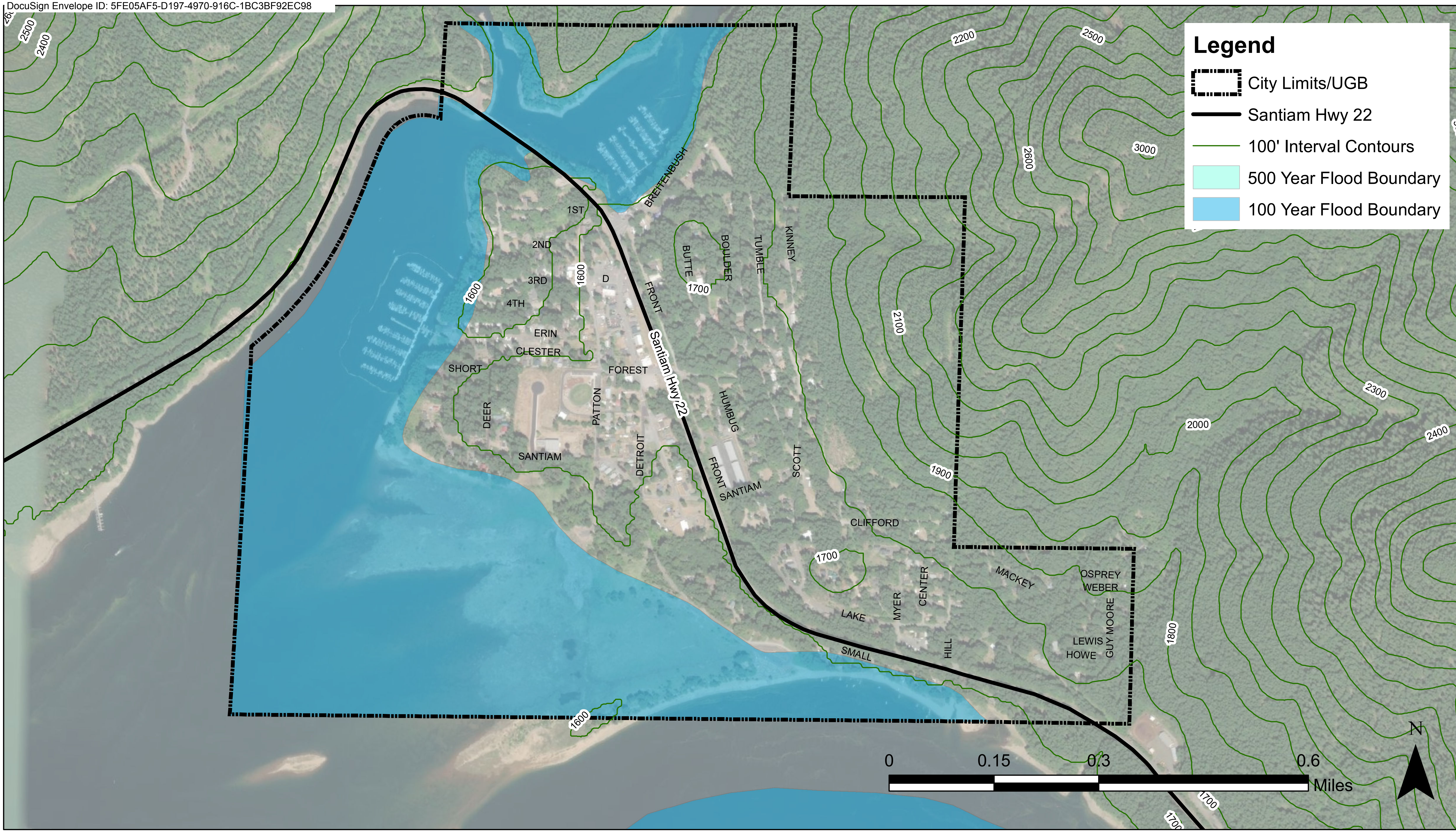

KELLER ASSOCIATES

City of Detroit Topography and Flood Plain

NSC Waste Water Master Plan

Figure 4B

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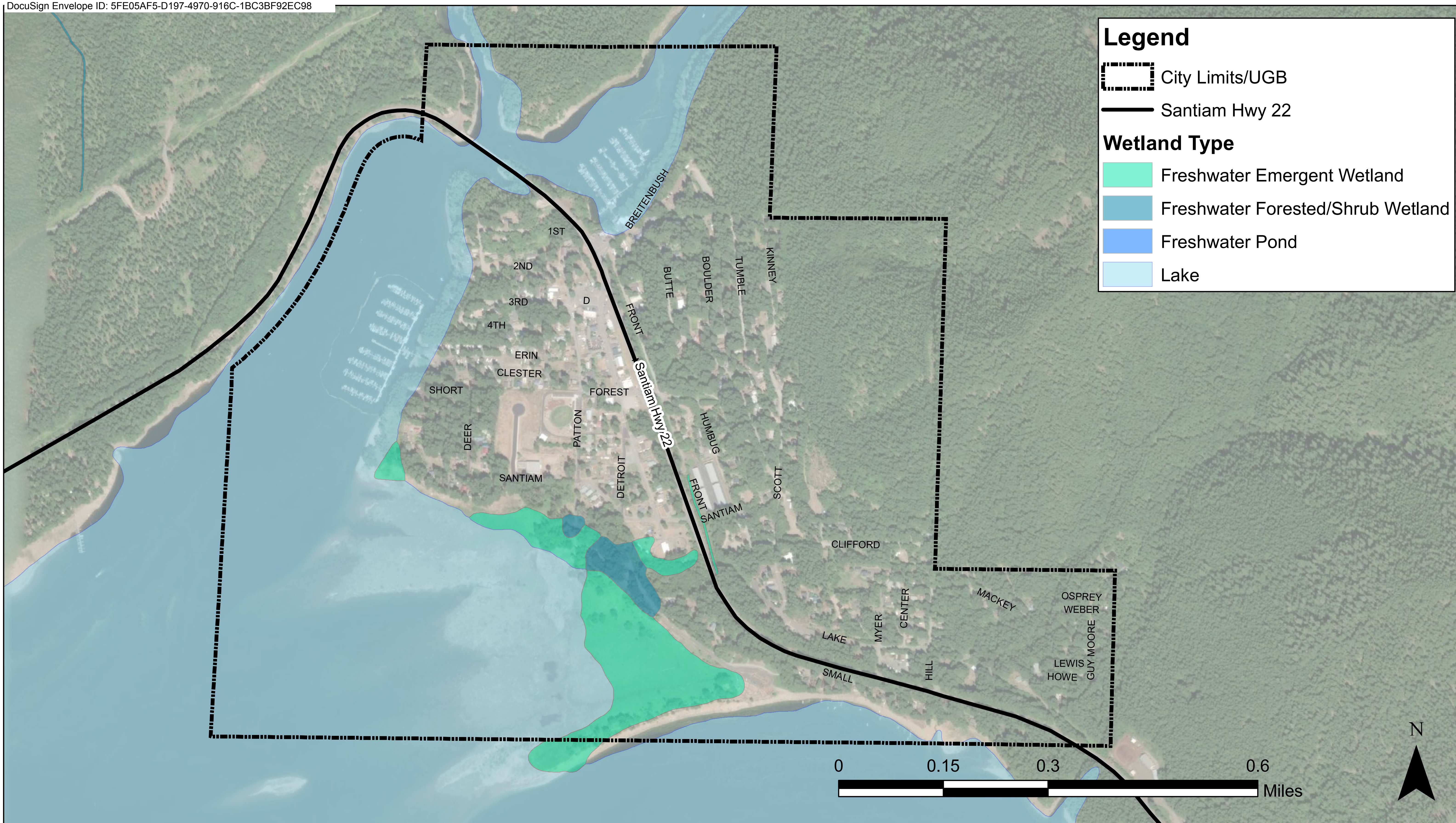

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City of Detroit Wetlands

NSC Waste Water Master Plan

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KELLER ASSOCIATES

City of Detroit Above Ground Cultural Resources

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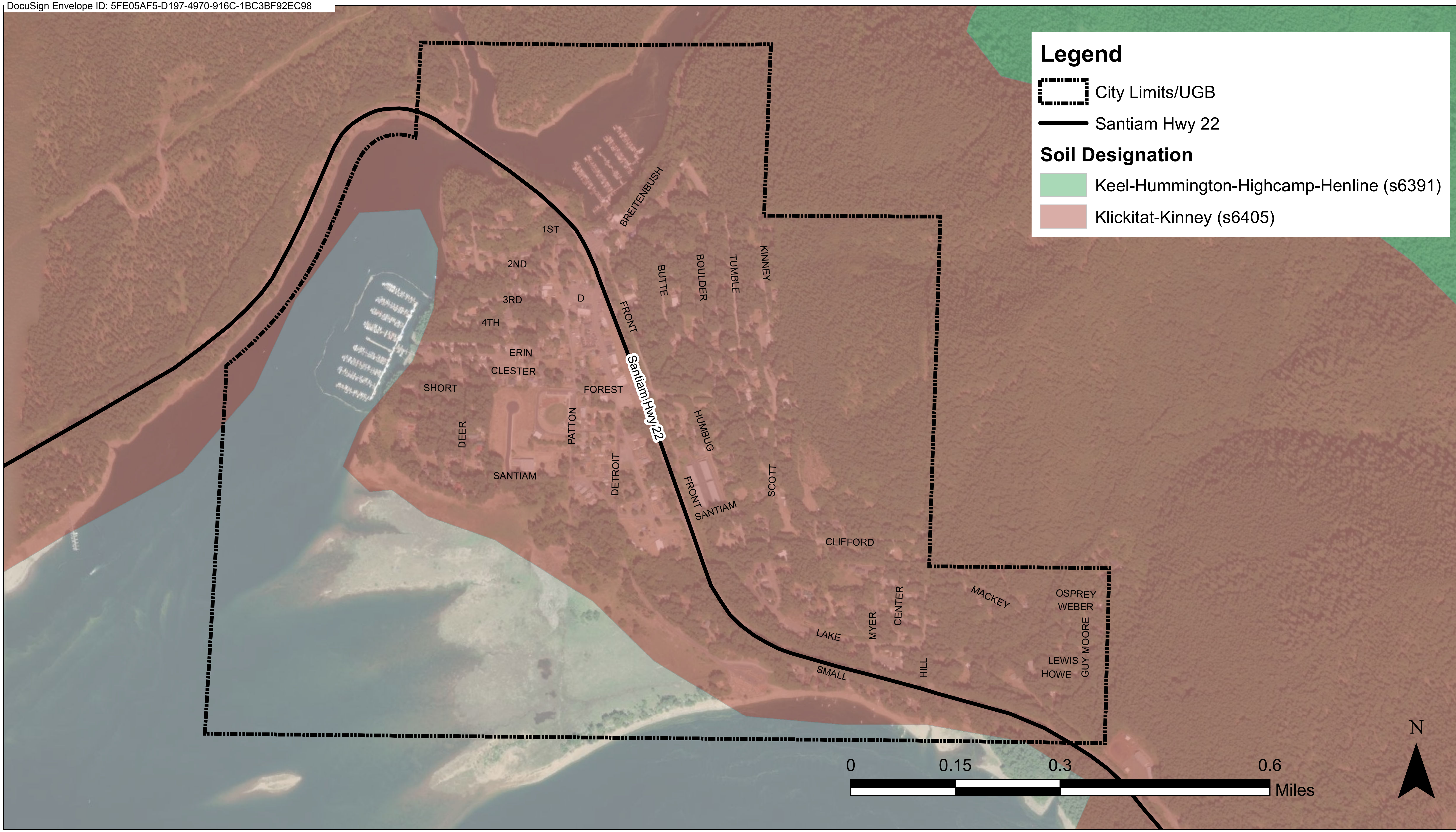

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City of Detroit Soil Designation

Wastewater Facilities Planning Study

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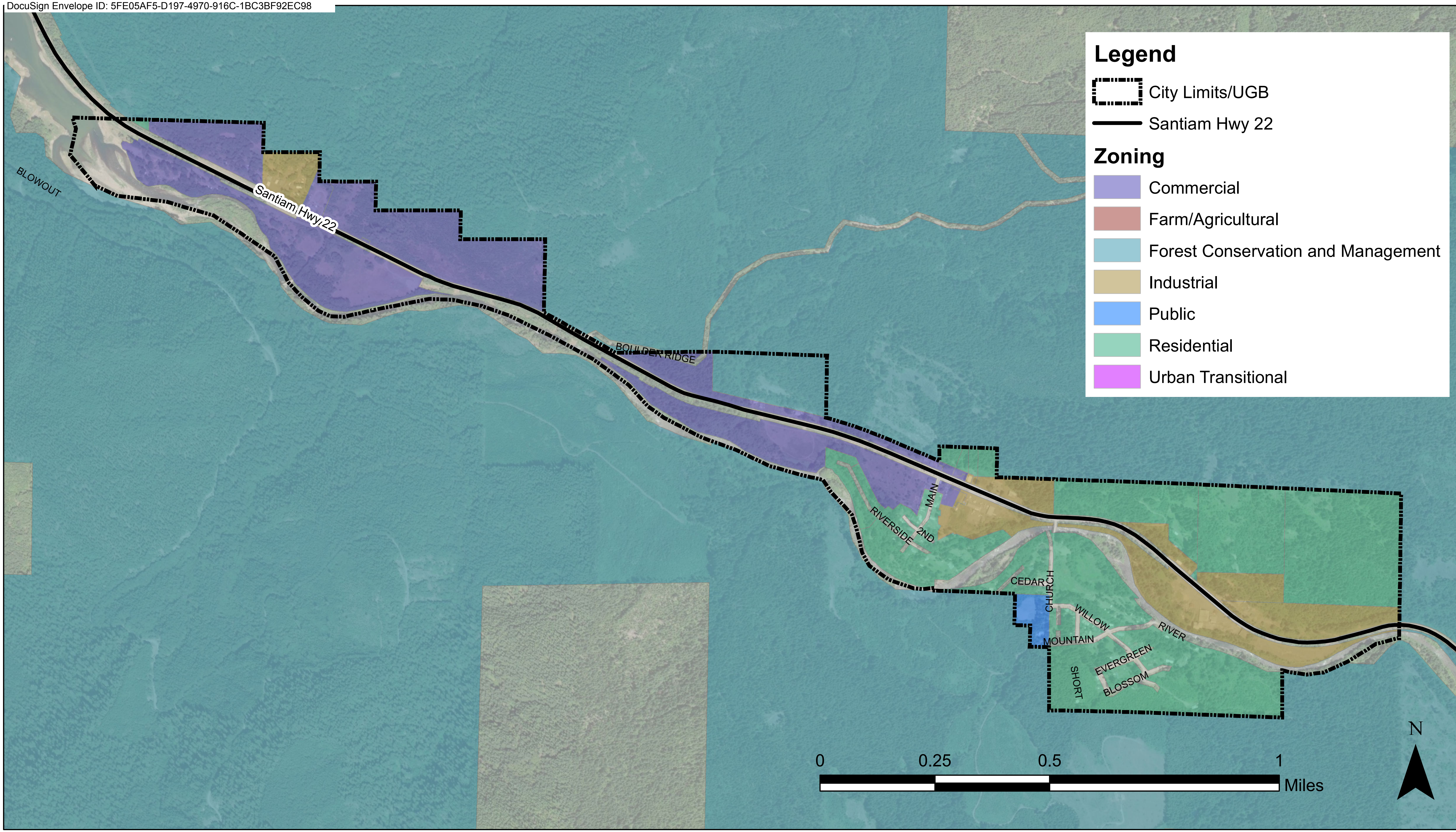

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City of Idanha Zoning

NSC Waste Water Master Plan

Figure 5A

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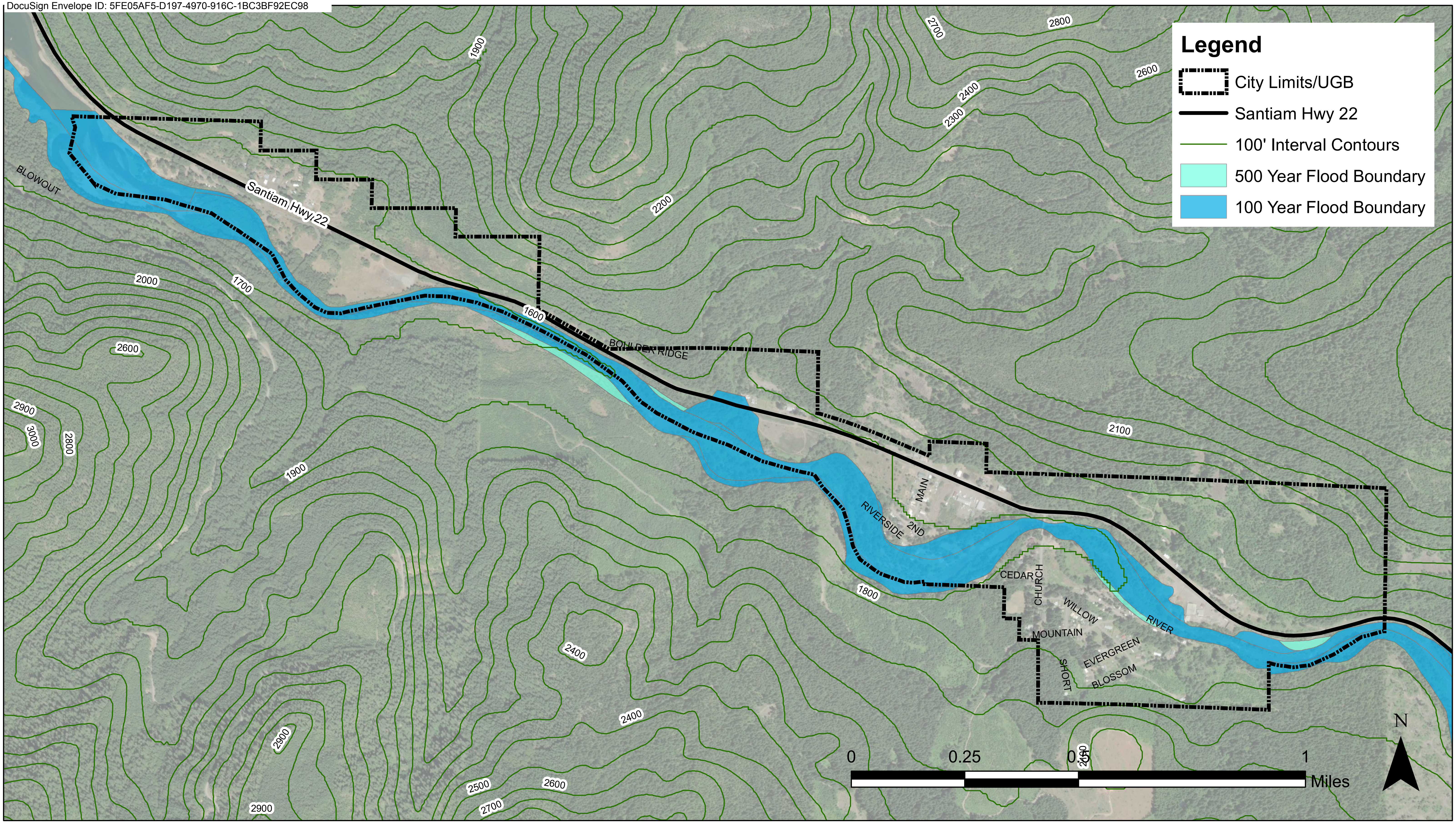

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City of Idanha Topography and Flood Plain

NSC Waste Water Master Plan

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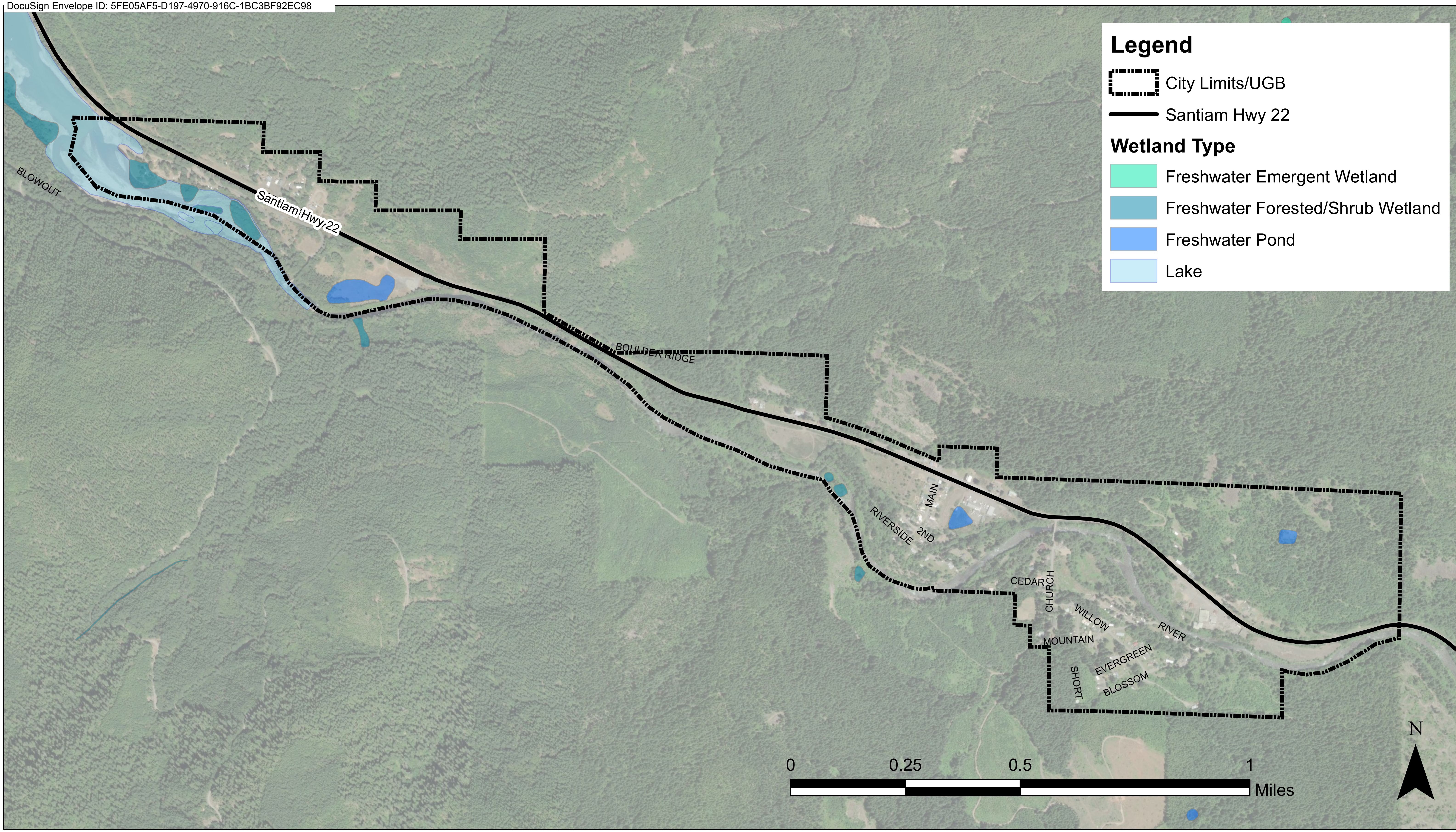

KELLER ASSOCIATES

City of Idanha Wetlands

NSC Waste Water Master Plan

Figure 5C

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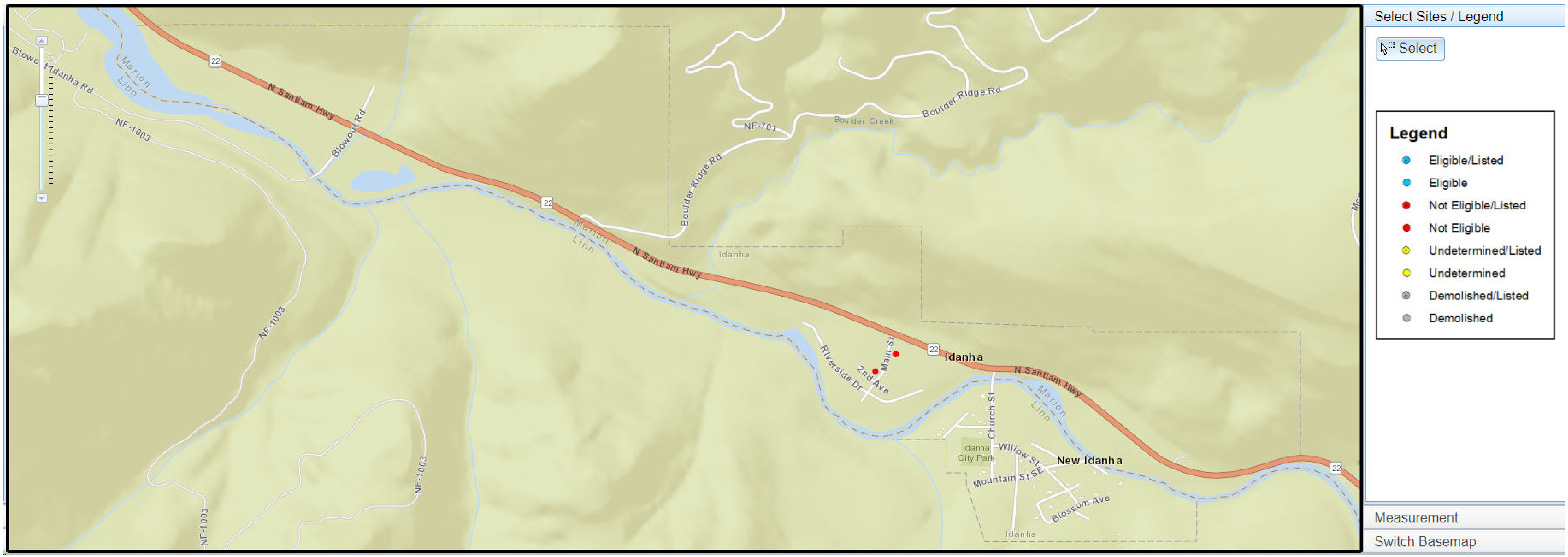

KELLER ASSOCIATES

City of Idanha Above Ground Cultural Resources

NSC Waste Water Master Plan

Figure 5D

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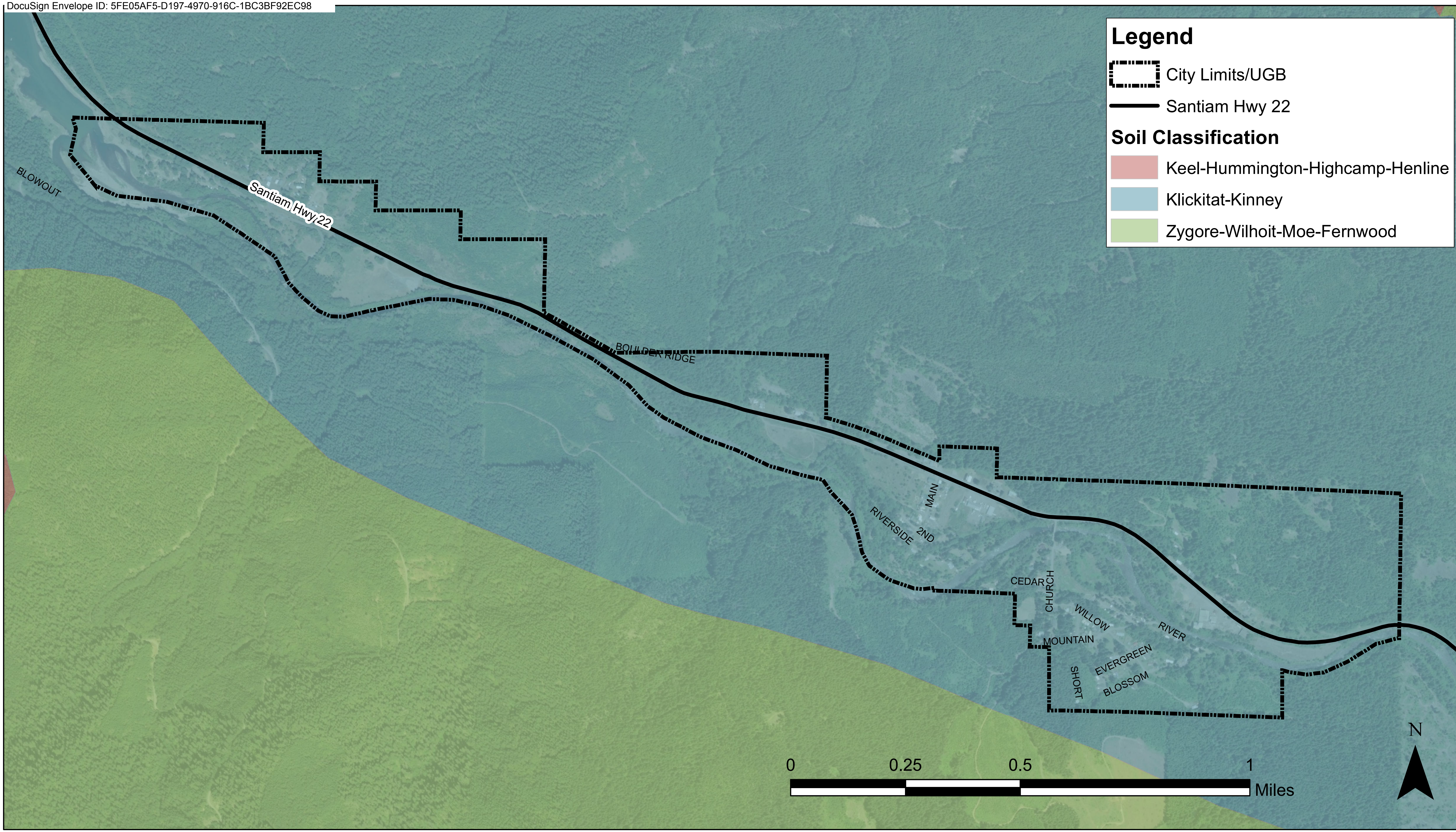

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City of Idanha Soil Designation

NSC Waste Water Master Plan

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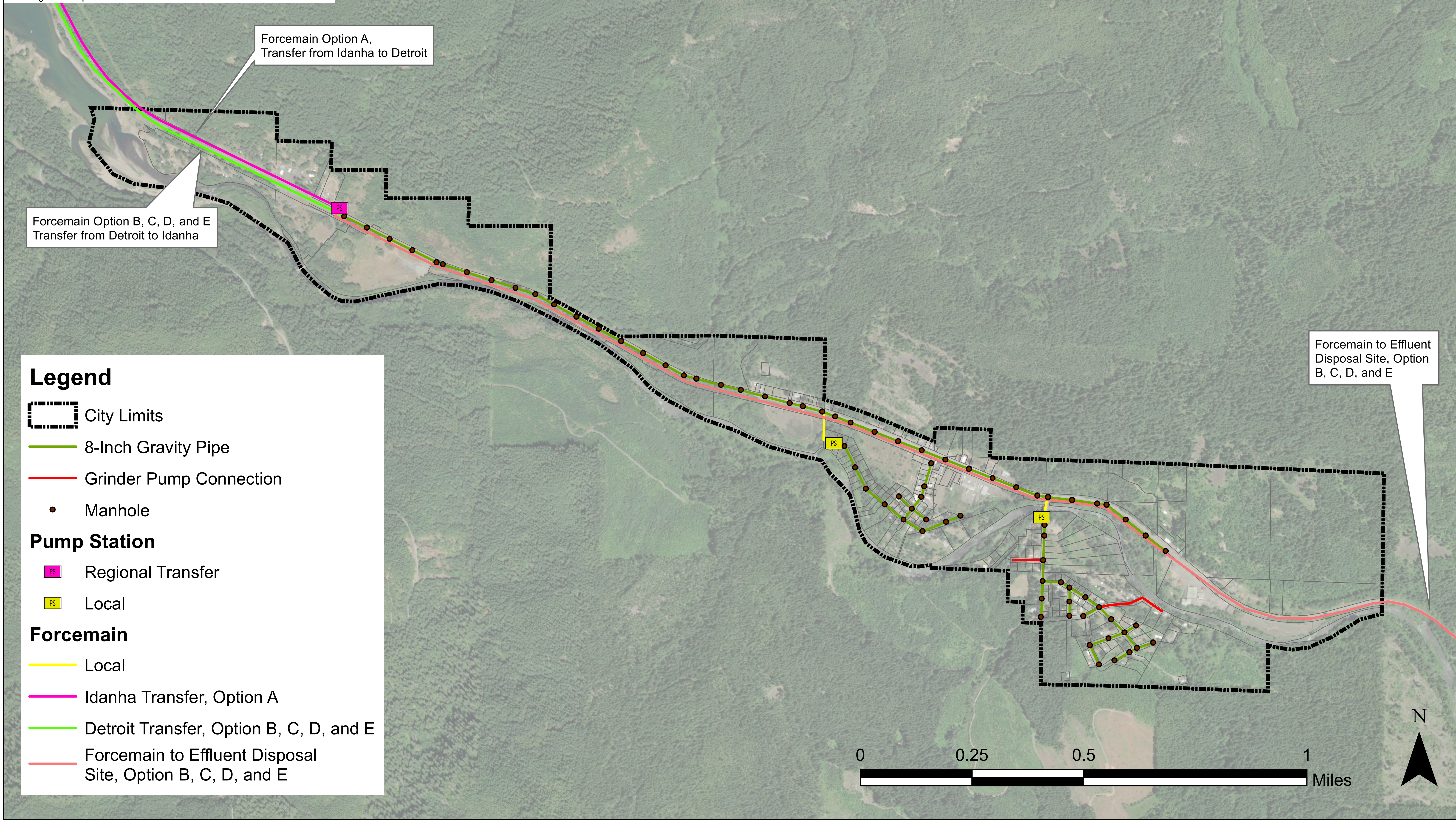

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City of Idanha Conceptual Collection System Layout

NSC Waste Water Master Plan

Figure 6

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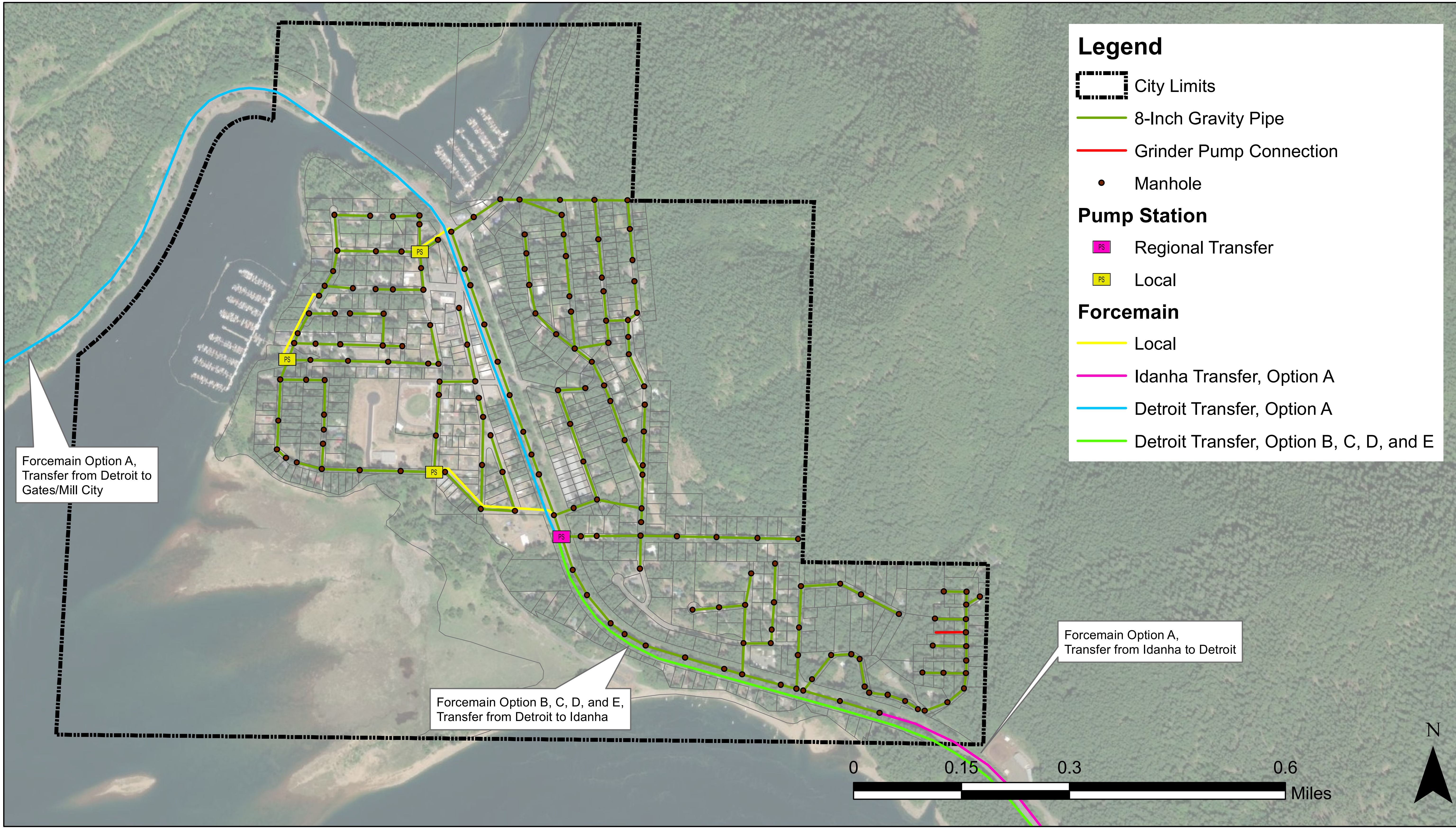

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City of Detroit Conceptual Collection System Layout

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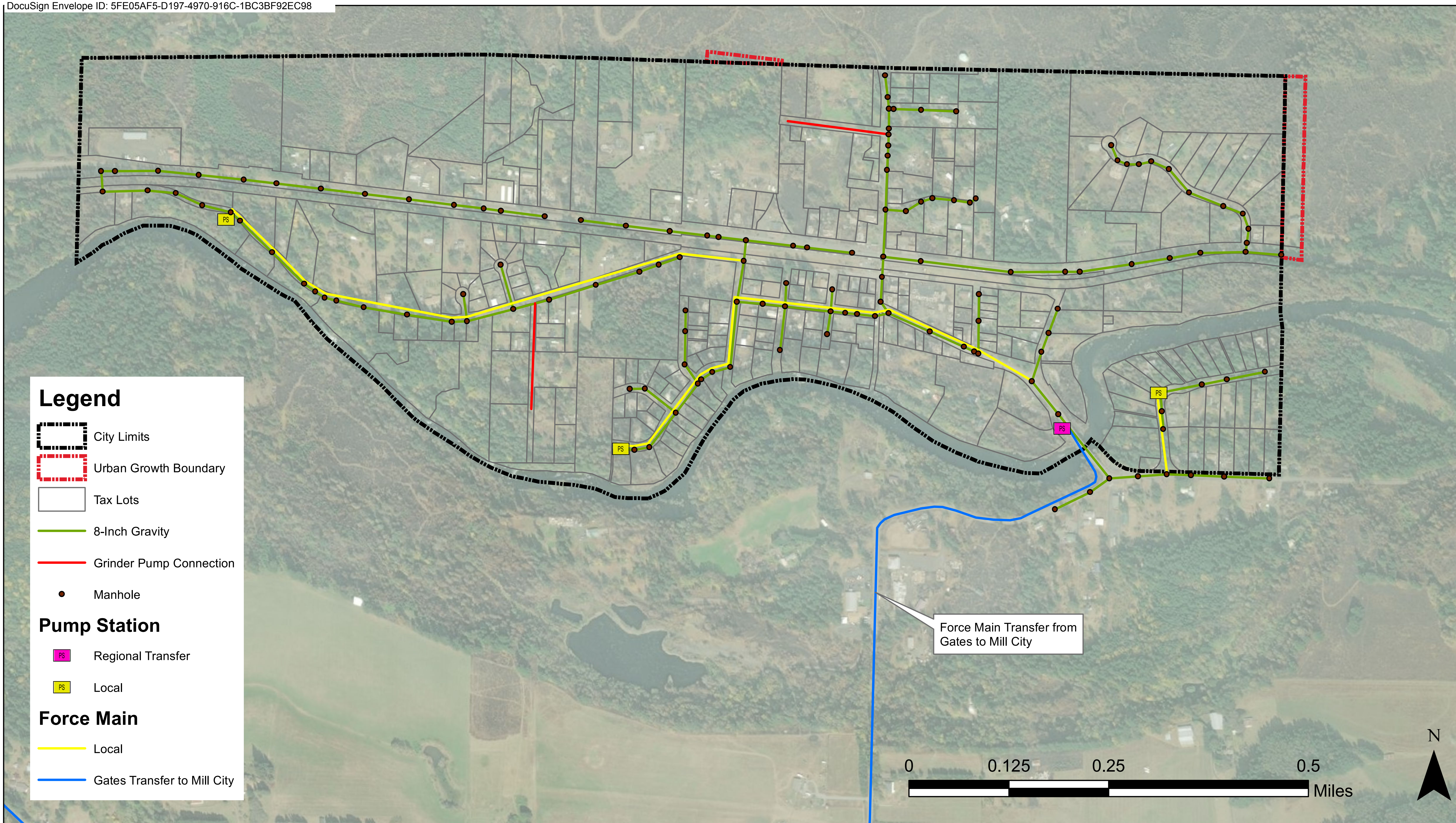

KELLER ASSOCIATES

City of Gates Conceptual Collection System Layout

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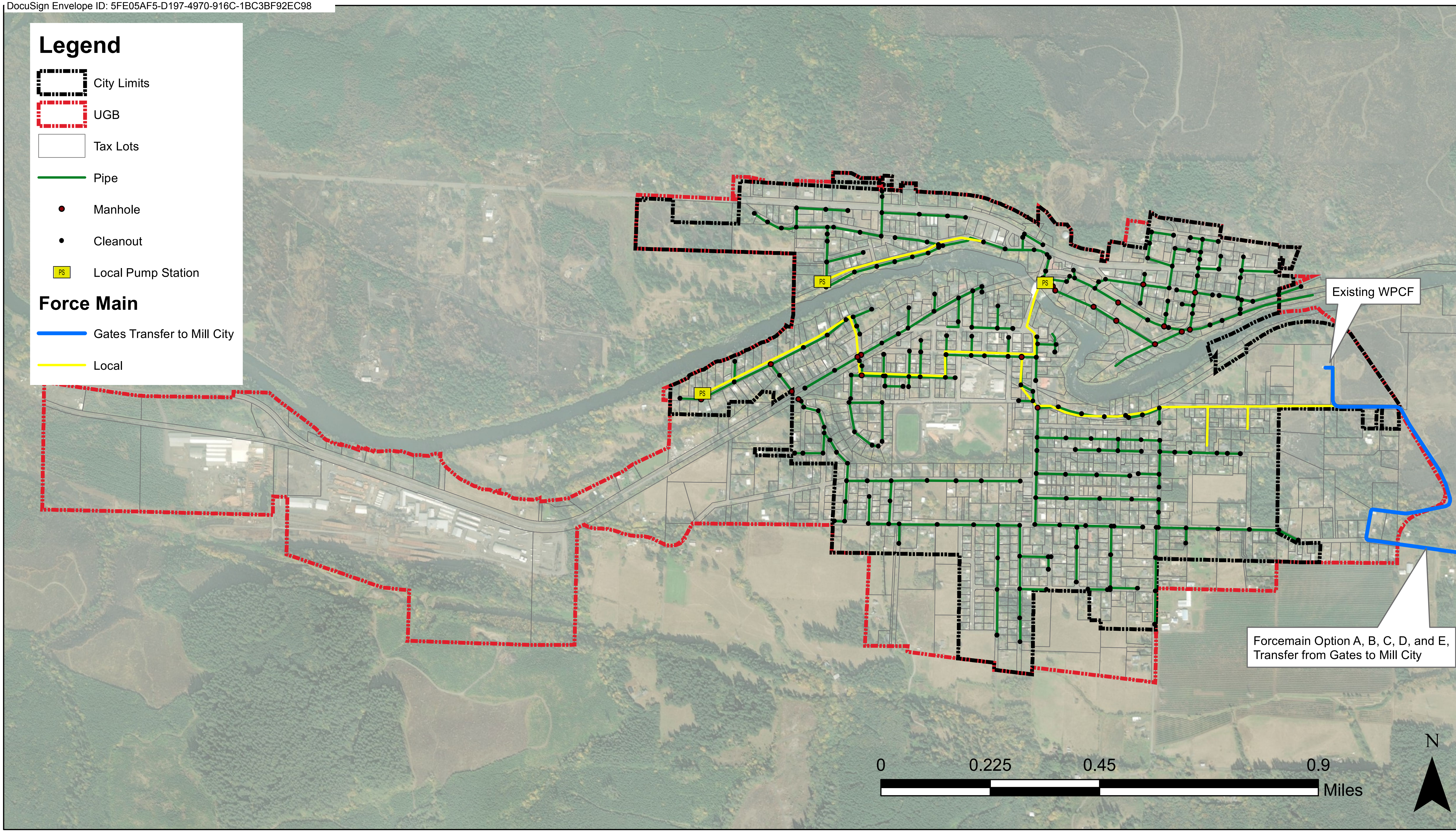

KELLER ASSOCIATES

Mill City Existing Collection System

NSC Waste Water Master Plan

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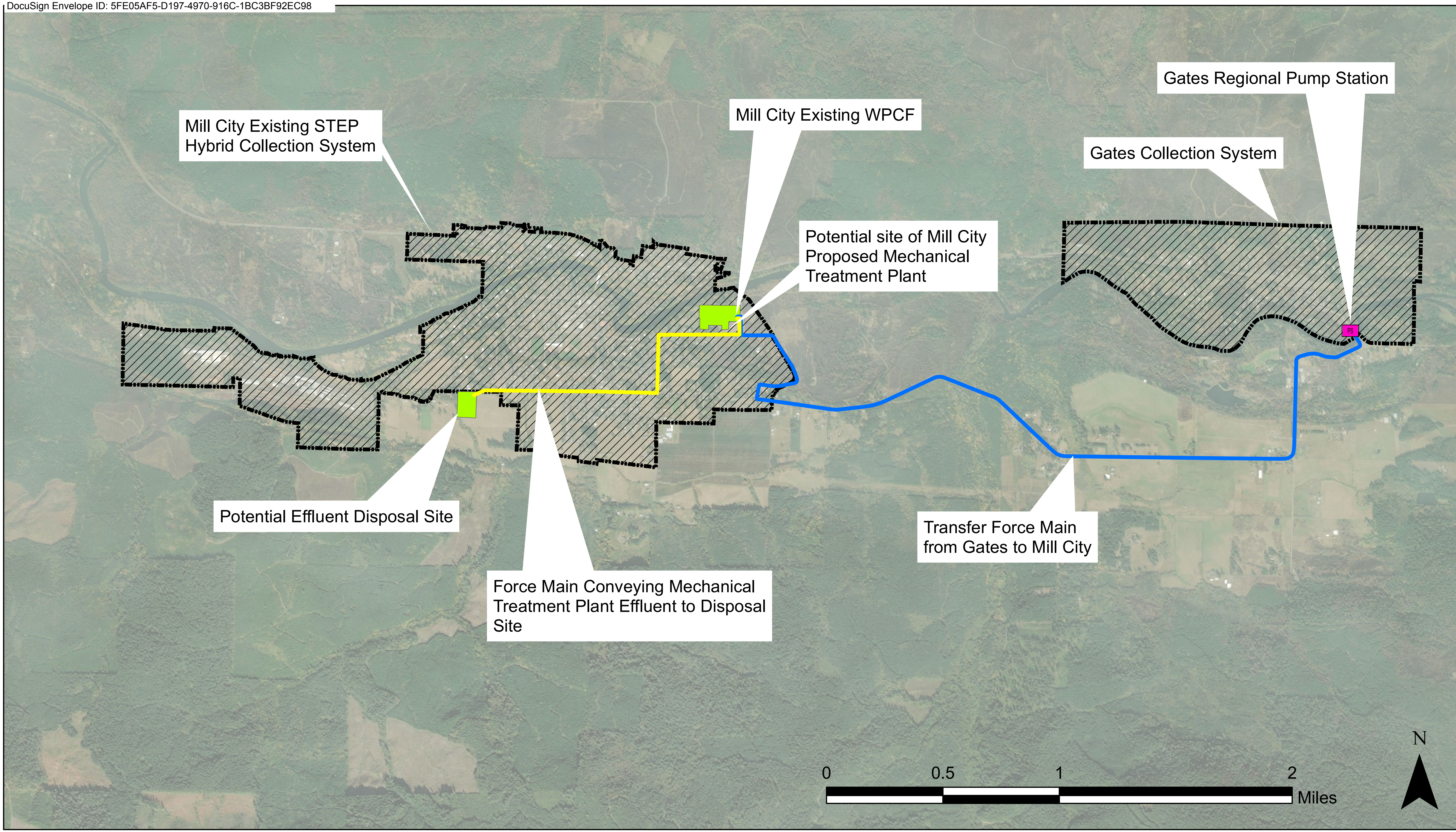

KELLER ASSOCIATES

Gates-Mill City Basin

NSC Waste Water Master Plan

Figure 10

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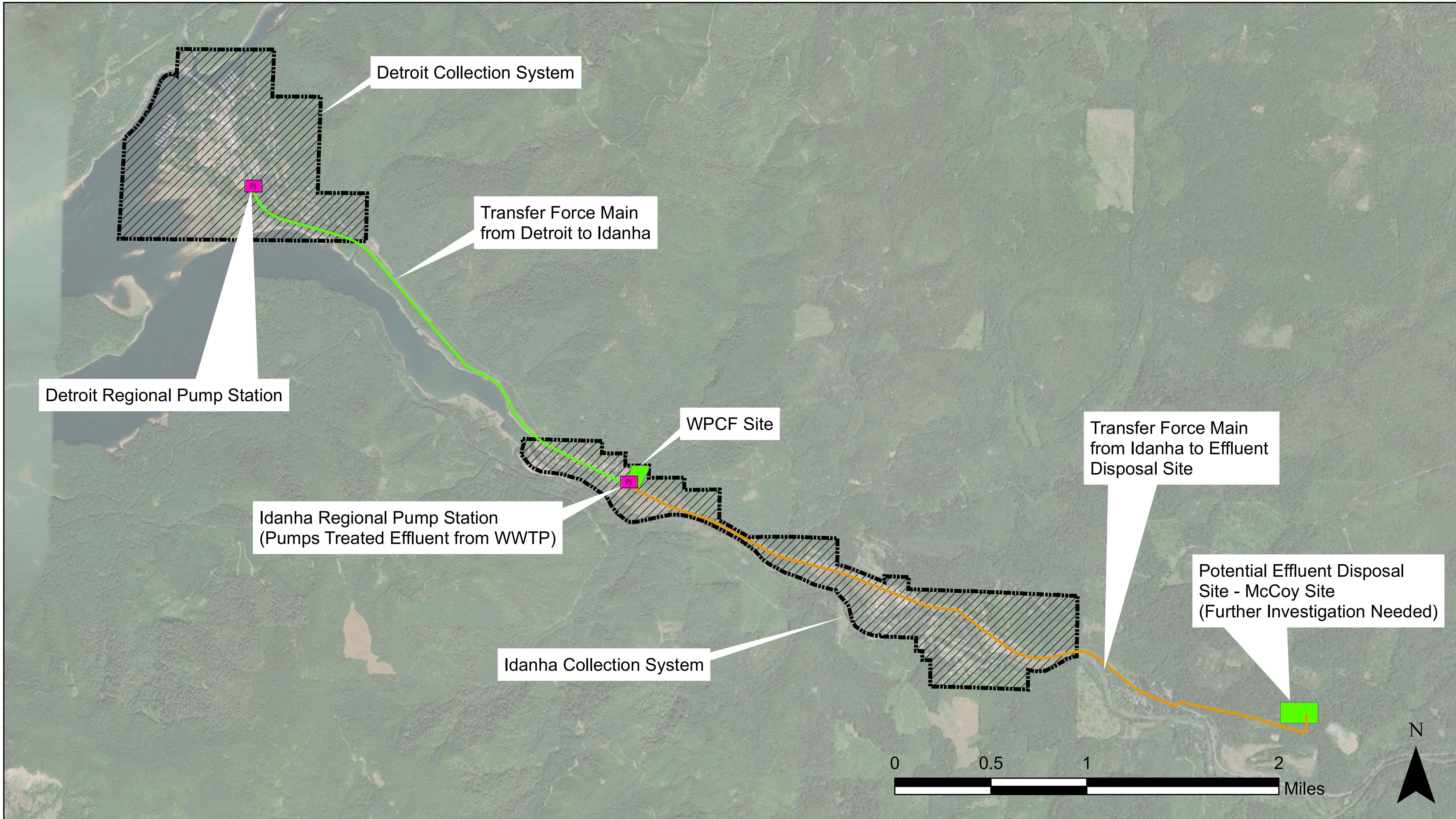

KELLER ASSOCIATES

Idanha-Detroit Basin

NSC Waste Water Master Plan

Figure 11

North Santiam Canyon, OR
September 2021

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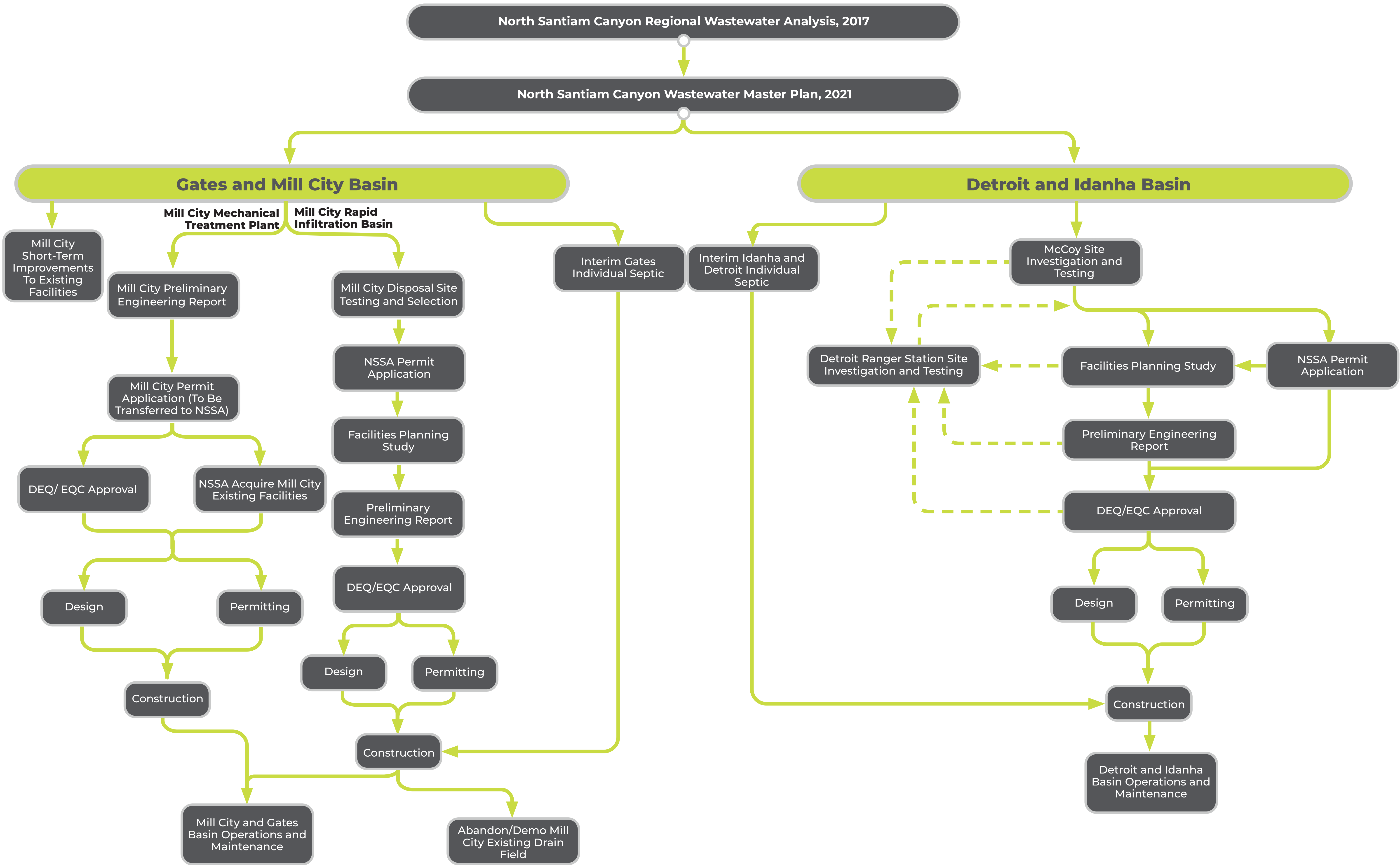
FIGURE : NSSA PROJECT FLOW CHART



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Appendix D:
North Santiam Canyon Historical Sewer Studies

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Upper North Santiam River Canyon Sewage Treatment Feasibility Study

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UPPER NORTH SANTIAM RIVER CANYON

SEWAGE TREATMENT FEASIBILITY STUDY

Funded by the Oregon Community Development Block Grant Program and the Oregon Lottery
through the Water/Wastewater Financing Program

October, 1996

CURRAN-McLEOD, INC.
Consulting Engineers
6655 SW Hampton, Suite 210
Portland, OR 97223

with

Riverside Engineering Company
David Newton & Associates

UPPER NORTH SANTIAM RIVER CANYON

SEWAGE TREATMENT FEASIBILITY STUDY

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COMPREHENSIVE SUMMARY

Sewage Treatment Feasibility Study, October, 1995

In October, 1995, the completed feasibility study for sewage treatment in the Upper North Santiam River Canyon was submitted for regulatory and funding agency review. The report encompasses the alternatives for sewage collection, treatment and disposition within the two canyon cities of Detroit and Idanha, and including facilities of the U.S.D.A. Forest Service and the Oregon Department of Parks and Recreation.

Alternative considered included renovation of on-site absorption, community subsurface absorption, separate municipal sewage collection treatment and storage / irrigation, and area-wide sewage collection, treatment and storage / irrigation.

Major findings are:

1. It is economically and technically feasible to construct an area-wide sewage collection and treatment system to serve the study area.

2. The collection system is a combination of gravity sewers and pumping stations within road rights of way.

3. Treatment is provided by a facultative sewage lagoon augmented in the summer with surface aeration to accommodate seasonal loadings.

4. Treated wastewater is stored during winter low-flow times and irrigated on forest land during the summer growing season. State regulations prohibit the point source discharge of sewage to the North Santiam River and tributaries.

The combined multi-municipal system enjoys overall economic advantages as well as practical benefits. A single area-wide system is more easily managed than multiple systems and operation and maintenance costs are shared by a larger user base.

The environmental impacts of one treatment and storage / irrigation system are less than those associated with more than one system. And, funding opportunities are favorable for a region-wide sewer system due to the appeal of a coordinated solution to a common problem.

Addendum No. 2, May, 1996

A March 14, 1995 letter from the Oregon Economic Development Department prompted final clarifications to the issues of:

1. Groups to be served by the area-wide sewers;
2. Recent documentation of need; and,
3. State Planning Goals compliance.

Addendum No. 2 defines Equivalent Dwelling Units (EDU) in words of one syllable and presents a detailed inventory of EDUs and the relative impacts on final design elements. Costs are distributed based on EDU calculations.

Documentation of Need is presented in graphic terms from 1996 regulatory agency correspondence. Needless to say, all conditions of wastewater failures have been exacerbated by delay, and regulatory support for the project is unstinting. Marion County Public Health officials stand strongly behind the resolution of heath and sanitation problems in the communities. Public need is current and critical.

Finally, Addendum No. 2 presents a schedule for achieving Goal 11/14 Exception through DLCD.

Part I:

Study Report, October 1995

CURRAN-McLEOD, INC., Consulting Engineers

UPPER NORTH SANTIAM RIVER CANYON

SEWAGE TREATMENT FEASIBILITY STUDY

October, 1995

CURRAN-McLEOD, INC. Consulting Engineers
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with

Riverside Engineering Company
David Newton & Associates

UPPER NORTH SANTIAM RIVER CANYON SEWAGE TREATMENT FEASIBILITY STUDY

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UPPER NORTH SANTIAM RIVER CANYON
SEWAGE TREATMENT FEASIBILITY STUDY

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EXECUTIVE SUMMARY

This report summarizes a sewer feasibility study of the upper North Santiam River Canyon area performed by CURRAN-McLEOD, INC. The major findings of the study are listed below.

1. It would be feasible to construct an area-wide sewage collection and treatment system to serve the study area.

2. The sewage collection system would consist of a combination of gravity-flow and pressure sewer pipes (with pump stations to serve low-lying areas) placed within the public roadway right-of-ways where possible.

3. A facultative treatment lagoon (pond) would provide the best method of treating sewage in the study area. The lagoon would be naturally aerated (with oxygen from the atmosphere) during the winter. Mechanical aerators would be placed on the lagoons to provide additional oxygen during the summer. A lagoon treatment system would be well suited to handling the variations in flows and loads expected due to fluctuations in the area's recreational population.

4. The best alternative for managing the treated wastewater would require storing it during the winter and irrigating it on suitable forest land during the summer. The treated effluent could not be discharged into streams or creeks in the study area. State regulations prohibit the discharge of treated sewage into surface waters in the North Santiam River Basin.

The study area could be served by constructing three individual treatment systems (one for Detroit, one for Idanha, and one to serve State Parks and Forest Service); one combined treatment system; or some combination of these two approaches. The best alternative appears to be one combined system. Although its capital cost would be higher than that of the individual systems ($5.6 versus $5.3 million), its total present worth cost would be lower ($6.4 versus $7.1 million) since one system would be less expensive to operate and maintain.

The combined system would have other benefits as well. A single treatment system could be managed more easily than three separate systems and the operation and maintenance costs could be shared by more users. The environmental impacts associated with constructing and operating one sewage treatment plant would be less than those associated with three. The funding opportunities may be greater for the entire study area than for each individual entity. For all of these reasons, we recommend a single treatment system to be constructed on a site above French Creek.

The new facilities could be funded in a number of different ways. The Forest Service and State Parks could each pay for their own collection systems. They could also pay for their share of construction and operation of the combined treatment system. Detroit and Idanha could secure funding through governmental grants/loans, connection fees, monthly user charges, and municipal bonding.

Detroit – Idanha Wastewater Facilities Pre-Design Report

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DETROIT/IDANHA WASTEWATER FACILITIES

PRE-DESIGN REPORT

AUGUST 2001

DRAFT

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Detroit – Idanha Wastewater Treatment Facility and Sewage Collection System Improvements

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CITY OF DETROIT/CITY OF IDANHA

PRE-DESIGN REPORT

Regional Wastewater Treatment Facility and Sewage Collection System Improvements

Marion County

December, 2001

CURRAN-McLEOD, INC., Consulting Engineers
6655 SW Hampton, Suite 210
Portland, Oregon 97223

CITY OF DETROIT
CITY OF IDANHA

PRE-DESIGN REPORT

REGIONAL WASTEWATER TREATMENT FACILITY AND SEWAGE COLLECTION SYSTEM IMPROVEMENTS

MARION COUNTY

REGISTERED PROFESSIONAL ENGINEER
5376
OREGON
JULY 9, 1985
PATRICK D. CURRAN

EXP 12/31/01

DECEMBER, 2001

CURRAN-McLEOD, INC., Consulting Engineers
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Portland, OR 97223

DETROIT/IDANHA REGIONAL WASTEWATER COLLECTION AND TREATMENT FACILITIES PRE-DESIGN REPORT

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In 1996, the *Upper North Santiam River Canyon Sewage Treatment Feasibility Study* evaluated sewage collection and treatment options to serve the Cities of Detroit and Idanha, and recreational areas managed by the United States Forest Service (USFS) and Oregon State Parks and Recreation (OSPR). This study concluded that the construction of an area-wide, multi-municipal sewage collection and treatment system was the most feasible alternative. Surface water discharge restrictions mandated the need for winter effluent storage and effluent irrigation during the summer.

Collection System Improvements

The proposed collection system improvements to serve the City of Detroit include the construction of approximately 35,000 lf of gravity sewer, the Marina Pump Station, and a limited number of individual pump stations for lake front properties. The Marina Pump Station serves the northwest corner of the City, an area of residential and recreational development bounded by N. Patton Street and Clester Road.

The proposed collection system improvements to serve the City of Idanha include the construction of approximately 22,000 lf of gravity sewer, three pump stations, and approximately 12,000 lf of force main. The North and South Side Pump Stations serve areas of residential development south of Highway 22. The Dry Creek Pump Station, located at the western limits of Idanha, reconveys the entire City's wastewater to the City of Detroit collection system.

Wastewater Treatment Facility Improvements

The wastewater treatment facility improvements include the Detroit Central Pump Station, approximately 18,000 lf of force main to the treatment site, 5.5 acres of treatment lagoons, and 37 acres of irrigation application area. The Detroit Central Pump Station is located across from the Detroit Charter School. This facility receives all of the wastewater from the Cities of Detroit and Idanha, as well as the future USFS/OSPR collection facilities.

The proposed wastewater treatment and irrigation sites are located in the French Creek drainage basin north of Detroit. A 14 acre treatment facility site and nearby 68 acre effluent irrigation site provide for wastewater control for the 20-year design period.

Four lagoon cells provide wastewater treatment. The wastewater treatment lagoons include two mechanically aerated cells and two facultative treatment cells within the site constraints. Expansion beyond the 20-year design period will require additional mechanical treatment process and utilization of the treatment lagoons for irrigation equalization storage.

Treatment site slope and soil constraints limit the available storage volume of the treatment cells. Year-round irrigation of treated effluent is necessary to assure compliance with the Three Basin Rule. Treated effluent is disinfected and pumped to the irrigation site for sprinkler system distribution to a forest cover crop. Additional irrigation area will be required beyond the 20-year design to maintain compliance with the Three Basin Rule.

Sprinklers will initially be installed on 37 acres of the irrigation site. Monthly effluent irrigation application rates for projected year 2022 design flows will vary from an average of 4 inches during the winter months to nearly 8.5 inches in August. Concerns with the possible leaching of nitrates to groundwater during winter irrigation periods due to reduced plant nutrient uptake will require a concentration limit variance from DEQ. The elevation of groundwater nitrate levels is expected to be minimal due to the substantial rainfall in the area and large contributing basin area.

Construction Cost

Based on preliminary design, the updated construction cost estimate for the project is nearly $11.6 million including a 10% contingency. The current available construction funding is $6.4 million including contingency. The updated construction cost estimate does not include additional funds necessary for land acquisition or administrative cost overruns. Construction cost increases can be attributed to several items include the following:

1) Treatment Site Constraints - The limited treatment site area and challenging soil conditions add considerable cost to the construction of the lagoon treatment facilities. Steep site topography results in excavation and excess material handling costs not originally anticipated. Rock excavation and dewatering were identified by geotechnical investigations. High groundwater will require the installation of an underdrain system to mitigate the risk of hydrostatic uplift of the lagoon liner.

2) Electrical - The cost to extend electrical service to the treatment site is substantially greater than previously estimated. The installation of multiple surface aerators and high head irrigation pumps combined with the remote location of the site, over 3 miles from the Highway 22 intersection with French Creek Road, requires a substantial investment.

3) Additional Collection System / Force Main Construction - The total length of gravity sewers to serve existing residences, as well as the total length of force main required to pump wastewater to the treatment site and treated effluent to the irrigation site, is greater than previously anticipated.

Detroit – Idanha VE Study Conceptual Design Review

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Final Report
Value Engineering Study
Conceptual Design Review
Detroit/Idanha Regional Sewer Project

August 5, 2002

Prepared for:
Cities of Detroit and Idanha and NSCEDC
833 NW Santiam Blvd.
Mill City, OR 97360

REGISTERED PROFESSIONAL
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OREGON
December 2, 1977
JERRY D. MINOR
EXPIRES: 12/31/02

Prepared by:

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Project #2230053

Funded in part by
the Community Development Block Grant Program administered by
the Oregon Economic and Community Development Department

Contents

EXECUTIVE SUMMARY

Executive Summary

This report presents the results of a value engineering (VE) study of the Detroit/Idanha Regional Sewer Project, which will provide wastewater collection, treatment and disposal facilities to serve the neighboring cities of Detroit and Idanha. The VE study included a workshop held from July 8 through July 11, 2002, at which VE team members developed findings about the project and recommendations for changes to reduce cost or improve operation of the project. A resolution meeting was held July 25 to identify the recommendations developed in the workshop that will be pursued for incorporation into the project.

VE TEAM RECOMMENDATIONS

The VE team developed the following VE ideas into VE recommendations:

Idea No.	Idea Description
CV-1	Cross French Creek downstream with pedestrian bridge.
CV-2	Cross French Creek underground as far downstream as possible.
CW-1	Use pressure collection system with grinder pumps.
CW-4	Use combination of pressure, vacuum, and gravity collection systems.
TW-2	Eliminate secondary lagoon and operate primary lagoon accordingly with variable water elevation to provide minimum winter storage.
TW-3	Reduce mechanical aeration to 25 hp (use five 5-hp mechanical aerators).
TW-16	Place regional wastewater treatment plant and storage in Idanha and pump effluent down Blowout Road to the point (Site 6) for irrigation.
TW-17	Place regional wastewater treatment plant in Idanha and locate infiltration basins adjacent to or near the treatment plant.
TW-21	Place regional plant as well as disposal at point near Cove Creek.
G-8	Develop separate systems for each city; place treatment and irrigation for Detroit on Forest Service site along Highway 22 and for Idanha at point east of Cove Creek CC.
M-1	Use STEP + fabric filter + drainfield. For lots where this approach will not work, provide STEP + fabric filter + community drain field.
M-1A	Apply M-1 to Idanha for existing developed lots. Use community drainfield to supplement new on-site drainfields.
M-1B	Apply M-1 to Detroit for existing developed lots. Use community drainfield to supplement new on-site drainfields.

The above recommendations provide a wide range of options to consider and evaluate. The first six recommendations represent modifications to the system as previously designed to reduce cost or improve operation. This approach would minimize or eliminate any delay in implementing the project. If all compatible ideas from this group were adopted, the estimate of total potential savings is $3.3 million.

The next three recommendations provide options for a new regional system using a different treatment process and improved sites for treatment, storage and irrigation or disposal. The VE team's estimate of total potential savings is between $4.5 and $5.7 million.

One alternative was developed (G-8) that provides separate systems for each city. That alternative is more costly than the three new regional systems but less costly than the system as designed.

The last three recommendations provide two approaches to solving the sewerage problems of developed property at the least possible cost. The VE team estimated that a combination of M-1A and M-1B could be constructed for close to $6 million, the amount of funding that is committed to the project. That estimate does not include contingency allowances, land costs, or non-construction costs.

VE TEAM FINDINGS

The findings of the VE team are as follows:

1. The VE team has concluded that the project under design cannot be constructed for the funds available to the two cities.
2. The VE team has identified some unit costs that appear low and has adjusted the designer's estimate of construction cost accordingly; the adjusted estimate is $12.3 million without a contingency allowance.
3. The VE team suggests that, at the pre-design stage, a contingency allowance of between 20 and 25 percent be used to represent costs that cannot be identified because the design is not complete. The addition of a 20 percent contingency allowance increases the adjusted estimate to $14.8 million.
4. Neither the design cost estimate nor the adjusted cost estimate (above) includes allowance for land costs. The VE team understands that the cost of the land for the treatment and irrigation sites in the French Creek drainage basin is approximately $900,000. Inclusion of this cost will bring the total adjusted cost estimate to $15.7 million.
5. The estimate does not cover the cost of relocating the French Creek Forest Service Road around a failed section of roadway; the VE team assumes that the Forest Service will make the required road repair or modification.
6. The VE team has concluded that there are opportunities to reduce the construction cost of the regional facilities as designed by (1) making some changes to design criteria, (2) reducing the number and size of the treatment lagoons, (3) reducing the length of force main to the treatment site by crossing French Creek near the plant site, and (4) making some modifications to the collection systems in the two cities.
7. The VE team has identified one new potential site for treatment and irrigation facilities south of the City of Detroit across the North Santiam River leg of Detroit

Lake. This site (see Figure ES-1) could be used for either a joint project or a City of Idanha project.

8. The VE team has visited the Forest Service site west of Detroit (identified as Site 1 in the feasibility study report; see Figure ES-1) and has concluded that it should be given further consideration as an alternative site for either a plant or irrigation area for a regional system, or for use by the City of Detroit alone.
9. The VE team considered a new site identified by the designer, located in the Boulder Creek drainage basin. The high head (approximately 700 feet) and associated high pumping energy costs plus shallow soil make this site unattractive (particularly if winter irrigation is required) even though a very large area of new growth trees is available and would benefit from irrigation.
10. The VE team understands that irrigation of reclaimed water that will be produced by a treatment plant will require a waiver from the Environmental Quality Commission from the requirements of the Groundwater Rule because effluent from any plant that is economical to construct and operate will contain some nitrate and existing groundwater has little or no nitrate. The designer is extremely optimistic about the proposed system's ability to nitrify and denitrify. Waivers have been issued in the past.
11. The VE team has identified a potential site at the intersection of Highway 22 and Blowout Road that appears suitable for a site for a regional or City of Idanha wastewater treatment plant.
12. Several suitable alternative wastewater treatment processes would require less land than lagoons and could have lower construction, operation and maintenance costs than the proposed lagoon system at Site 2 (see Figure ES-1) in the French Creek drainage basin.
13. Separation of the treatment and irrigation/disposal sites increases the options for siting and reduces the land area required in any one location.
14. The provision of separate treatment and disposal systems for each city further reduces the land area required by treatment and disposal for each.
15. An alternative regional plant location near the intersection of Highway 22 and Blowout Road, with irrigation at Site 6 (east of Cove Creek Camp Grounds; see Figure ES-1), would reduce pumping costs for untreated sewage by locating the plant between the two cities. Site 6 appears to be a superior irrigation site to the site in the French Creek drainage basin and is at a lower elevation, which would reduce energy costs.
16. The VE Team understands that the French Creek irrigation site was originally selected based on a stipulation of no winter discharge. However, the design requires some irrigation in the winter.
17. If winter discharge is required, Site 6 appears to be superior to the French Creek site.

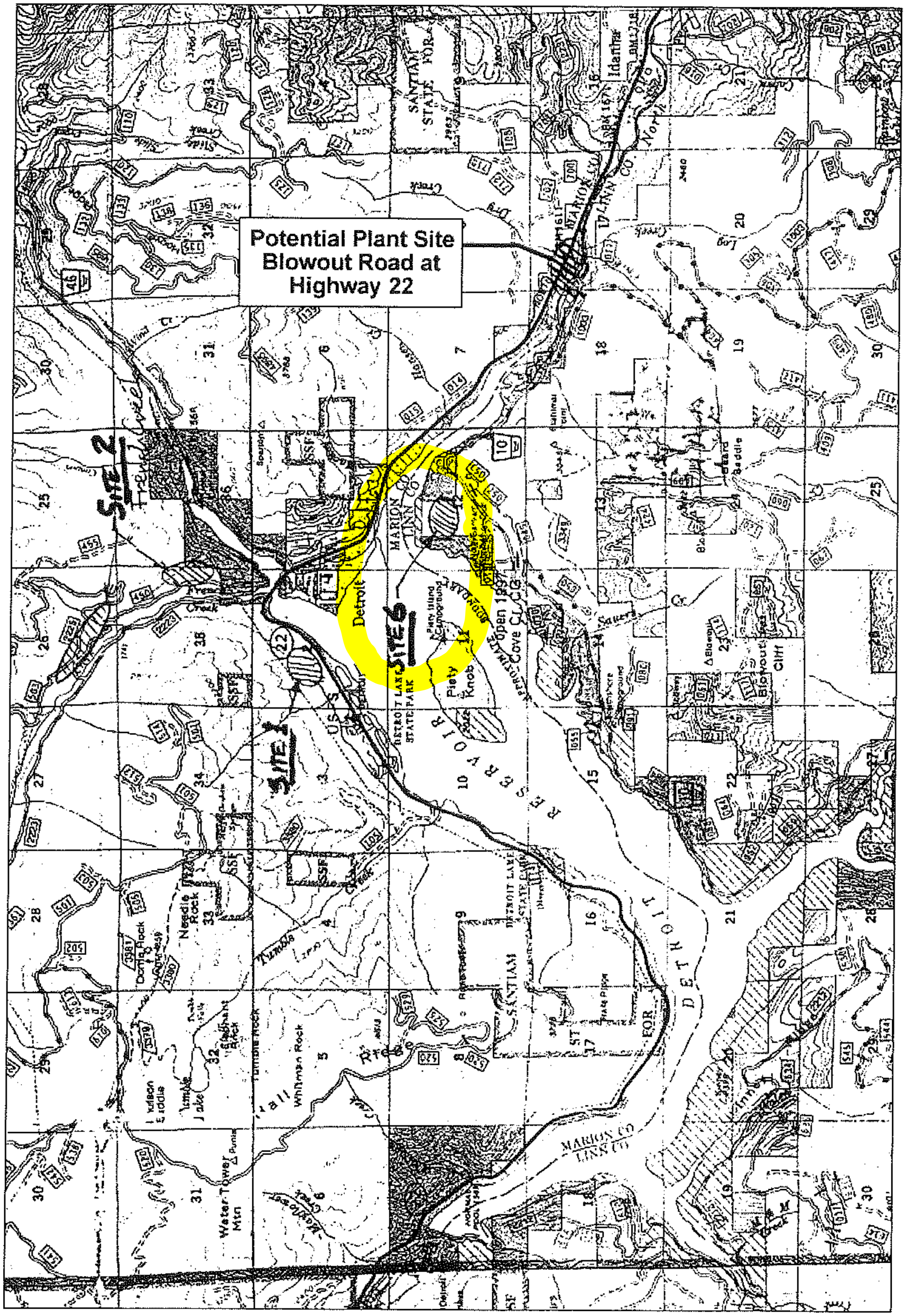

Figure ES-1. Potential Treatment Plant and Irrigation Sites

18. Location of a wastewater treatment plant at Site 6 (either for the City of Idanha or for a regional plant) would allow wastewater service for property along the south side of the North Santiam River as well as future use at camp grounds along the route and at Cove Creek.
19. The pipeline distance to either Site 1 or Site 6 is substantially less than to the French Creek plant site (as designed) and it appears that construction would be less costly because less rock excavation would be required (the cost of rock excavation is not now included in the designer's construction cost estimate).
20. It appears that installation of a force main to the French Creek plant site would require substantial rock excavation that is not reflected in the construction cost estimate.
21. The pumping head (approximately 400 feet) and associated energy cost to the French Creek site will be substantially greater than that required to reach either Site 1 or Site 6.
22. The estimated annual energy cost of pumping to the French Creek treatment plant site (as designed) is approximately $40,000, assuming an average energy cost of $0.08 per kW-hour.
23. The estimated annual cost of operating the 225-hp floating aerators continuously throughout the year for mixing is $118,000, assuming an average energy cost of $0.08 per kW-hour.
24. The VE team has estimated the total annual energy cost for the proposed project as approximately $200,000 and the total annual operation and maintenance cost as approximately $300,000. That estimated cost divided by 585 equivalent dwelling units (EDUs) equals $43/month.
25. In both cities, all or most lots are developed in the mostly densely developed and older parts of the city; at the fringes of the cities, few lots have been developed and the buildings are widely spaced. In some locations, sewers longer than 500 feet are required to serve the most remote buildings.
26. The extent of failure of on-site systems is not documented. However, the lack of capacity is evident by the number of portable toilets observed by the VE team in both cities. The VE team was told that many on-site systems have failed and property owners have been required by the County to make emergency repairs. Many, or most, of the lots have inadequate undeveloped land area to meet present County requirements for a drainfield area plus reserve area.
27. In many areas of both cities, there are a sufficient number of undeveloped lots to allow purchase of the lots by the owners of developed property for additional drainfields. However, during the season of the year when groundwater is high, the additional length of drain filed may not solve septic tank effluent disposal problems.
28. The proposed collection system incorporates a combination of gravity and pressure systems. In the City of Idanha, one developed lot is to be pumped to the gravity system. In the City of Detroit, 26 developed lots are to be pumped to the gravity system. Both collection systems include small pump stations to lift the wastewater collected by gravity systems to higher gravity sewers. Additional pumping is required

to convey the collected wastewater to the proposed regional treatment plant in the French Creek drainage basin (Site 2).

29. Design unit flow allowances provide very little allowance for infiltration and inflow (I/I). Although new systems should be free of I/I, it is extremely difficult for a community to police what private property owners do on their own property, and it is not unusual for property owners or tenants to solve drainage problems by tapping into private laterals.

30. Wastewater from additional lots may be economically collected by pressure systems; the trade-off is the cost of pumping compared to the cost savings in smaller diameter pipe and shallower trench excavation.

31. The addition of community drainfields or percolation basins for treated wastewater or reclaimed water will eliminate the need for storage and winter irrigation.

32. The proposed collection and conveyance system includes approximately 85,000 feet of collection system pipe plus 18,000 feet of conveyance system pipe and 10,000 feet of irrigation system transmission and distribution main, for a total of approximately 110,000 feet of pipeline trench. Assuming an average trench width of 3 feet and trench depth of 6 feet, the pipeline trenches provide an opportunity for 330,000 square feet of percolation area on the trench bottoms and a total of nearly 1,000,000 square feet of trench percolation area if one-half of the trench depth is available for percolation. Use of a gravel sub-base under the pipe, along with an effluent distribution pipe and multiple release points, would allow the sewer pipe trench to be used as a percolation system for effluent from on-site treatment systems or for reclaimed water.

33. The least-cost project that would meet the immediate needs of the two communities and provide for future needs of currently undeveloped lots would be improved on-site treatment followed by effluent pumping to some type of community drainfield or percolation basin. It may be possible to use this approach to solve the existing sewerage problems and keep the construction budget within existing funding constraints.

34. The Sewer Development Team informed the VE Team that the projected $36.50 per month cost to property owners for the new facilities (based on the feasibility study cost estimates) was at the upper limit of what residents can afford. If the project cost exceeds $6 million, both a substantial reduction in annual operation and maintenance costs and an increase in the grant amount would be needed to prevent monthly costs from exceeding $36.50.

RESOLUTION MEETING

A resolution meeting was held July 25 to select the VE recommendations that will be implemented and the one or two design concepts that will be given detailed study and presented August 13, 2002 at a "One Stop Meeting" for consideration by funding and regulatory agencies. At the resolution meeting, the following decisions were made:

- A new concept incorporating VE ideas TW-16 and TW-17 and possible improvements to those two ideas will be presented at the One Stop Meeting. Pat Curran, the design consultant for the two cities, was present and offered to develop the concept for presentation to funding and regulatory agencies. Mia Mohr, of NSCEDC, will present and "sell" the concept to the agencies.

- The team's justification for rejection of VE recommendations M-1, M-1A and M-1B will be presented by Mia Mohr on behalf of the team at the One Stop Meeting.
- Jerry Minor of Tetra Tech/KCM, representing the VE team, will answer any questions on the work of the VE team and the VE recommendations. That presentation will include a corrected copy of a spreadsheet developed by VE team facilitator George Riek and presented at the Resolution Meeting.
- The two city councils will be requested by their representatives to officially endorse the new concept.

Sanitary Survey of On-Site Sewage and Disposal Systems – Detroit and Idanha

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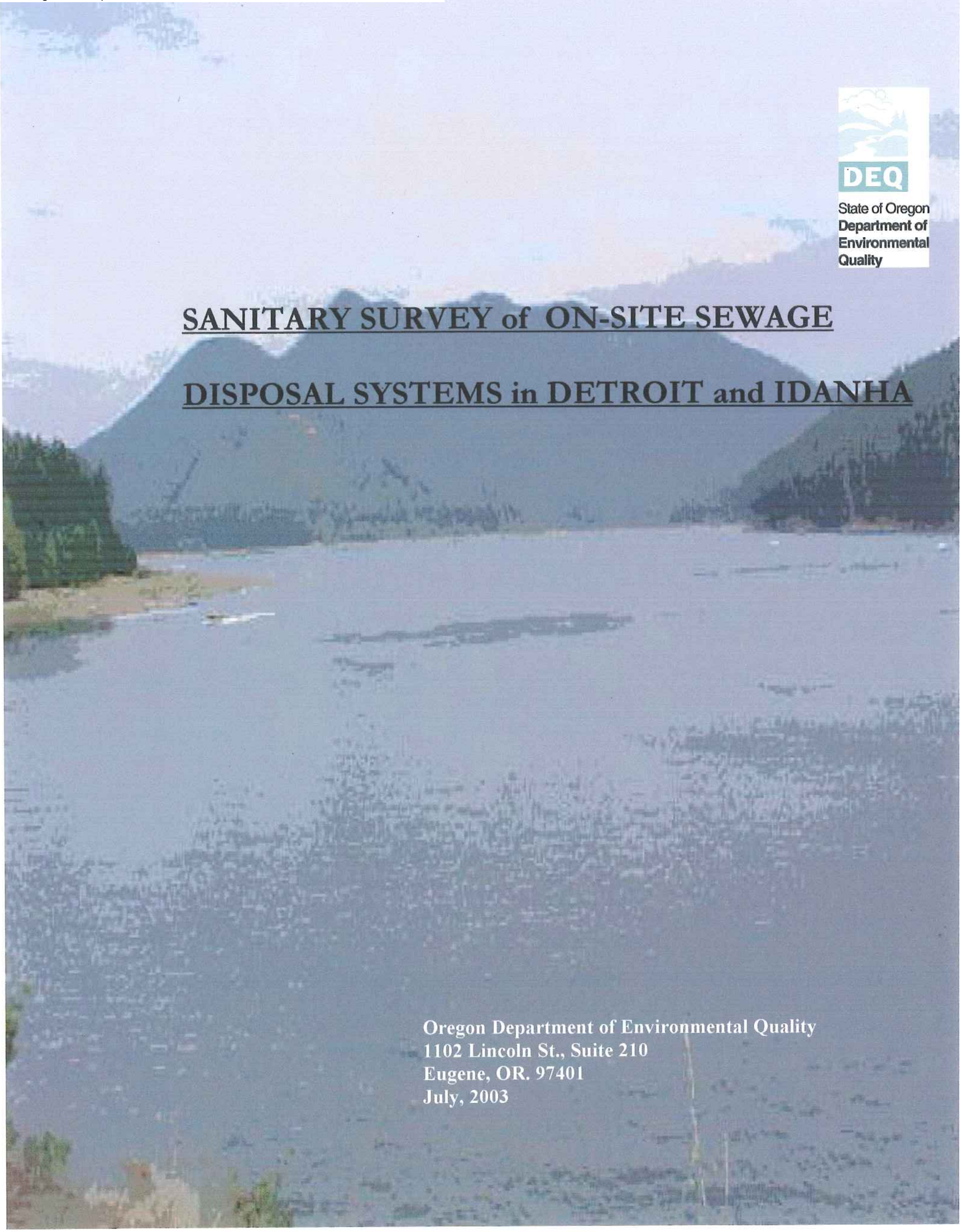

DEQ

State of Oregon
Department of
Environmental
Quality

SANITARY SURVEY of ON-SITE SEWAGE DISPOSAL SYSTEMS in DETROIT and IDANHA

Oregon Department of Environmental Quality
1102 Lincoln St., Suite 210
Eugene, OR. 97401
July, 2003

SANITARY SURVEY of ON-SITE SEWAGE DISPOSAL SYSTEMS in DETROIT and IDANHA

Oregon Department of Environmental Quality
1102 Lincoln St., Suite 210
Eugene, OR. 97401
July, 2003

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5. Vicinity Maps Showing the Communities of Detroit, Idanha and the Properties Evaluated
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Executive Summary

The Communities of Detroit and Idanha are served by existing on-site sewage disposal systems. Many of the existing on-site sewage disposal systems are cesspools and other types or configurations of systems not considered under current standards to adequately treat wastewater before disposal into the soil. Many of the existing undeveloped lots are not large enough to support new development utilizing on-site sewage treatment and disposal systems.

The communities have been exploring wastewater treatment and disposal options that would replace the existing on-site sewage disposal systems including the construction of a joint community sewage treatment plant and collection system. Because of the geographic location of the communities, there are obstacles to the initiation of a joint system that include project cost, the prohibition of new sewer outfalls into surface waters in this area, and the lack of documentation that quantifies failing on-site sewage disposal systems.

The Oregon Department of Environmental Quality entered into a partnership with Detroit and Idanha to assist them in conducting a sanitary survey to document failing on-site sewage disposal systems. During the sanitary survey a large number of old systems that include cesspools located on very small lots were found. High densities of on-site sewage disposal systems that do not utilize advanced treatment technologies have been shown to reduce the quality of both groundwater and surface water.

To avoid future public health hazards and offer increased protection of the water resources existing in and around the communities of Detroit and Idanha, the following recommendations are offered:

- Utilize enhanced treatment alternatives that can increase the removal of nutrients from wastewater and that are capable of treating higher-strength wastewaters to a level that is protective of public health and the environment.
- Utilize treatment technologies that among other considerations, use groundwater and surface water as design boundaries to protect those resources from degradation.
- Establish a maintenance entity capable of managing whatever sewage treatment and disposal system alternatives are selected to ensure that they are operated and maintained in a way that is protective of public health and the environment.
- Inventory and utilize suitable treated wastewater disposal sites in order to decrease wastewater loading in densely developed areas.
- Eliminate existing gray water discharges to the ground surface and waters of the state.

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Detroit Wastewater Feasibility Study

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City of Detroit
Marion County, Oregon

WASTEWATER FEASIBILITY STUDY

REGISTERED PROFESSIONAL ENGINEER
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OREGON
MAY 21, 2014
CINDI LYNN LOMBARD
EXPIRES 12/31/2016

March 2015
Project No. 2006-07-11

The preparation of this document was funded in part with funding from the Water/Wastewater program through Business Oregon- Infrastructure Finance Authority

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City of Detroit
Wastewater Feasibility Study

EXECUTIVE SUMMARY

ES.1 BACKGROUND

Currently, all wastewater generated in the City of Detroit is treated using individual, on-site systems. The lack of a community wastewater infrastructure has contributed to the relatively low rate of development in the area and acted as an impediment to economic growth. Limited available land makes it difficult, if not impossible, to expand or repair existing systems that are not functioning properly. These problems are compounded during the peak tourist season that places excessive strains on wastewater infrastructure (i.e. septic systems) in the area. The lack of a community wastewater system is perhaps the largest obstacle to economic development facing the City of Detroit.

The City lies in the North Santiam Basin, which is governed by Oregon's "Three Basin Rule" (OAR 340-041-0350). This rule prohibits new or increased waste discharges to surface water in the Clackamas, McKenzie (above RM 15) or the North Santiam Rivers. This severely limits the options for wastewater disposal in these area. Additional barriers to developing a community wastewater system include the significant cost of the system as well as physical constraints such as high rainfall and lack of suitable lands.

A community wastewater system is needed in order to sustain the City's commercial and economic vitality. Since developing such a system will require significant investment by the City as well as public support, the City has secured funding from the Oregon Infrastructure Finance Authority to investigate the project's engineering and financial feasibility.

The purpose of this *Feasibility Study* is to assess the viability of developing a community wastewater system for the City of Detroit. This system is needed to address the short and long term economic and environmental challenges that are associated with the lack of a reliable sewerage infrastructure. In order for a new wastewater system to be feasible, it must be able to operate within the regulatory constraints imposed by the Three Basin Rule (OAR 340-041-0350) as well as on-site treatment requirements stipulated by OAR 340 Division 71, without placing too high of a financial burden on the City and its residents. Alternatively, there may be some options that may ultimately be pursued under OAR 340-0045, however, these options are currently undeveloped and would require extensive investigation as well as collaboration with regulatory authorities.

ES.2 STUDY AREA

The City of Detroit is located in Marion County along scenic Highway 22 adjacent to Detroit Lake, approximately 50 miles east of Salem. The City is home to approximately 205 residents as well as a high influx of tourists and part-time residents. Previous estimates have projected that during the peak of tourist season, the City's population increases by nearly 5 times. The city limits, which also represents the Detroit urban growth boundary (UGB), encompasses approximately 600 acres.

The physical characteristics of the area directly impact the development of a community wastewater systems. A summary of key factors is provided below with further details provided in Section 2.

Climate: The climate of this area is temperate, characterized by dry summers and wet winters. The area receives an average of 89 inches of precipitation per year, most of which is in the form of rainfall (82%). Typical average summer temperatures range from 52°F to 76°F and average winter temperatures vary from 34°F to 45°F.

Topography: The study area is located on the western slopes of the Cascade Mountain Range in flooded river valley with steep side slopes ranging in elevation from approximately 1500 to 1800 feet. Most of the slopes in the study area have a gradient of 15% or more.

Geology: The geologic characteristics of the study are have been influenced significantly by volcanic and glacial processes. Detroit's underlying geology is made up of various kinds of andesitic and basaltic flow rock, and volcanic sedimentary rocks.

Water Resources: The most significant water resources in the vicinity of Detroit are Detroit Lake and the North Santiam River. There are also a number of small streams and drainages in the vicinity.

ES.3 REGULATORY ENVIRONMENT

Many different regulations are in effect controlling the way sewage may be managed in the study area. These regulations are directed at protecting surface water, groundwater, public health, land use, and the overall environment. Primary regulations and rules governing a wastewater system in the City include:

Three Basin Rule

The North Santiam River basin is one of three watersheds that are regulated by the Three Basin Rule (3-B Rule) (OAR 340-041-0470). The 3-B Rule prohibits new and increased waste discharges to surface waters including wastewater outfalls (except under very limited conditions). Consequently, under the current rule, the only acceptable forms of wastewater disposal for the City of Detroit are subsurface discharge or effluent reuse. It is unclear obtaining a waiver from OAR 340-041-0470 is a feasible option for the City.

Water Pollution Control Facilities Permit (WPCF)

The Clean Water Act (CWA) as delegated to the State of Oregon and enforced through Oregon Revised Statues (ORS 468B), requires a Water Pollution Control Facilities (WPCF) permit for all discharges of wastes and wastewater onto or beneath the ground surface.

Rules for On-Site Wastewater Systems

Oregon Department of Environmental Quality (DEQ) regulates the construction, alteration, repair, operation, and maintenance of on-site wastewater treatment systems through Oregon

Administrative Rules (OAR) Chapter 340, Divisions 71 and 73 as well as some portions of Divisions 45 and 52.

Further discussion of the regulatory environment affecting the design and operation of a community wastewater system is provided in Section 3.

ES.4 WASTEWATER FLOWS & LOADING

Preliminary estimates of wastewater flows and loading were develop in Section 4 to establish the sizing criteria for the City's wastewater system. The preliminary estimates developed therein should be updated and modified as part of future pre-design or facilities report.

ES.4.1 Equivalent Dwelling Units

A dwelling unit is defined as one typical single-family residence. Non-residential users (commercial, industrial, public facility, etc.) can be described as an equivalent number of dwelling units (EDUs) based on their water consumption compared to the average consumption of a dwelling unit. Capacity of a system can be defined based on its ability to serve a certain number of EDUs. This enables future checks on system capacity to be made at any time regardless of the growth patterns.

EDUs for multi-family and commercial users were calculated based on the average maximum monthly single-family residential use of 165 gpd. The following table provides an inventory of the City's EDUs based on the type of customer usage.

Table 4-1 - Inventory of System EDUs

Type	Accounts	EDUs
Residential		
Single-Family Residential	274	274.0
Multi-Family Residential	35	50.4
Total Residential	**309**	**324.4**
Commercial		
Motel	2	20.5
RV Park	1	3.2
RV Park & Marina	1	21.0
Marina	1	18.4
Gas Station	1	6.8
Market	2	17.9
Restaurants	3	17.5
Offices, Small Stores, Misc.	39	60.4
Total Commercial	**50**	**169.6**
Total System EDUs	**359**	**494.0**

ES.4.2 Wastewater Flows

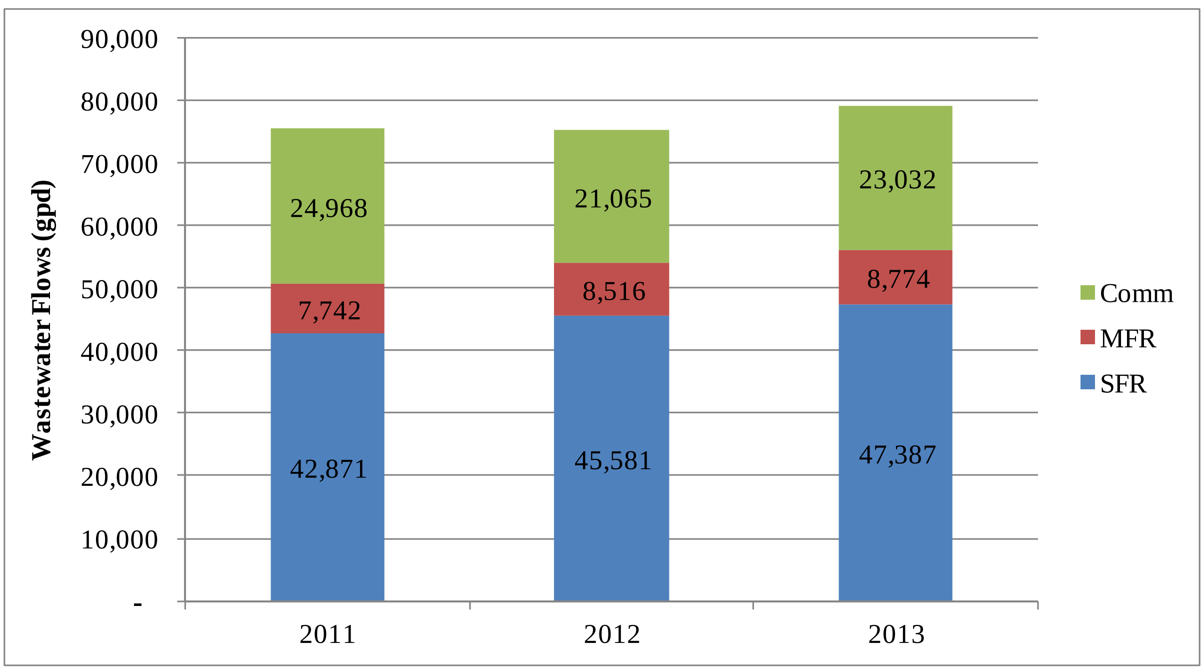
For the purposes of this study, it was assumed that wastewater flows equaled water consumption. Water meter data from January 2011 through December 2013 was used to determine average day flows as well as the daily average during peak month. Wastewater systems' hydraulic capacity are designed based on maximum monthly flows. In the case of Detroit, maximum flows would typically occur in July or August. This corresponds to the peak of the area's tourist season.

Table ES-2- Estimated Wastewater Flow Based on Customer Water Usage

Year	Average Daily Flow (gpd)	Maximum Monthly Flow (gpd)
2011	32,339	82,645
2012	30,523	75,162
2013	33,640	79,193
Average	**32,167**	**79,000**

The primary constituents that would be served by a community wastewater system include single-family residential (SFR), multi-family residential (MFR), and commercial (Comm) accounts. The maximum monthly wastewater generated (i.e. water usage) by each of these sectors is shown in Figure ES-1. SRF accounts currently represent 59% of peak usage while MFR and Comm contribute 11% and 30%, respectively.

Figure ES-1 - Flows per Customer Sector



ES.4.3 Wastewater Loading

For the purposes of this Feasibility Plan, the BOD_5 and TSS are the primary constituents of concern when determining loading of the wastewater system. Since there is no available information on organic loading generated by the existing system, typical loading rates have been used that generally tend towards the high range provide conservative estimates. Note that these loading rates are based on raw sewage and not septic tank effluent.

Table ES-3 - Estimated Wastewater Loading

		BOD (lb/d)		TSS (lb/d)	
		Low	**High**	**Low**	**High**
Loading Rate (lb/c/d)[1]		0.11	0.26	0.13	0.33
2014	1,293	142	336	168	427
2019	1,422	156	370	185	469
2024	1,564	172	407	203	516
2029	1,720	189	447	224	568
2034	1,893	208	492	246	625

ES.5 STUDY FINDINGS & RECOMMENDATIONS

Final recommendations from this Study are presented in Section 6 and includes proposed system design, project phasing, estimated cost and financial impact, land requirements, and schedule. Ultimately, the feasibility of developing a community wastewater system for the City of Detroit will be dependent on its affordability and whether or not sufficient suitable land is available.

ES.5.1 Alternative Analysis & Preliminary System Recommendations

A community wastewater system is composed of three major components: (1) Collection & Conveyance (Sewer) System, (2) Wastewater Treatment System, and (3) Disposal System. There are a number of alternatives for each of these components. These alternative vary in construction cost, operation and maintenance (O&M) needs, performance, land requirements, etc.

A brief analysis of common alternatives was provided in Section 5 of this Study. Based on this analysis, the following preliminary wastewater system design has been recommended. The purpose of this preliminary design is to establish a basis for determining potential cost of a function sewage system that complies with the current regulatory environment. It is important that the City understand that final design will ultimately be determined through a *Wastewater Facility Plan* and may differ from the components presented in this *Feasibility Study*.

[1] Table 3-12, *Wastewater Engineering Treatment and Reuse, 4th Edition,* Metcalf & Eddy, 2003, p. 182

Collection System

This Study considered use of a conventional gravity as well as grinder pump and septic tank effluent pump (STEP) systems for collecting and transporting wastewater. The high construction costs and risk of increasing flows due to I/I make a conventional gravity system inadvisable for the City. Of the remaining alternatives, a grinder pump system was determined to be less favorable due to the higher energy costs and increased TSS loading it is not part of the preliminary design recommendations. A STEP pressure sewer is the recommended for this *Feasibility Study*, however final section for a collection system, based on a thorough and detailed analysis of all options should be developed in a *Wastewater Facilities Plan.*

An STEP system is comprised of on-site and off-site components. On-site components of a new STEP pressure system will include a septic/interceptor tanks, grease tanks (for some commercial applications), pump vault with high-head efficient pump, control panel, and service connection. The off-site equipment will convey the wastewater to the off-site pressure system comprised of small-diameter pipelines (2"-4" diameter).

Treatment System

The STEP system will provide preliminary treatment of wastewater to reduce BOD_5 and TSS by 30-50% and 60-80%, respectively. This treated effluent is pumped through the pressure sewer to a centralized facility for final treatment. This study considered use of activated sludge, membrane bioreactor, lagoon, and packed-bed media filter treatment systems. Due to lower costs and land requirements, a series of recirculating media filters is recommended. In addition to the packaged filter, the system will also require instrumentation and controls for operation as well as system telemetry. The facility will also likely require a small building to house some of the components including electrical control panels, supplies, and controls.

Final section for wastewater treatment will be determined through *Wastewater Facilities Plan*. The Facilities Plan will provide a more in-depth analysis and investigation of all possible treatment options, which is not possible under the limited scope of this Feasibility Study.

Disposal System

Disposal options for treated wastewater effluent are limited due to the prohibition of surface water discharge in the North Santiam River Basin as stipulated by the Three Basin Rule. Consequently, subsurface disposal appears to be the only viable alternative. Although there are a number of subsurface disposal methods, for the purpose of this *Feasibility Study* a drip dispersal system is recommended. The advantages of a drip system include less site disturbance and ability to adapt to irregular shaped lots, however installation costs can be higher compared to other methods and also requires regular O&M. It should also be noted that design (and therefore cost and land requirements) of subsurface disposal is heavily dependent on specific site conditions.

As noted above, final section of wastewater disposal system will be developed as part of an approved *Wastewater Facilities Plan.* This plan will study all possible subsurface disposal and reuse options currently available to the City, but may also consider the feasibility of unconventional systems as well as obtaining a waiver from the current Three Basin Rule.

ES.5.2 Project Phasing

Due to the scope of the project, the City may wish to develop a community wastewater system using a phased approach. Developing a wastewater system in phases will allow the City to first address the most critical areas and expand the system as additional need requires and/or financing is available The suggested service areas for project phasing are provided below:

Service Area A All properties west of Hwy 22 and north of Santiam Ave W as well as the commercially-zoned areas located along Breitenbush Rd and Frontage Rd. This area may be further divided into commercial and residential subsections.

Service Area B The remaining portion of the City not located in service area A.

In order to accommodate a phased approach, preliminary hydraulic and organic loading criteria have been established for each service area. In order to reflect this on-site pretreatment, system loading rates were based on septic tank effluent (STE) and not the raw wastewater strength.

Table ES-4 - Preliminary Design Criteria

	Service Area A		Service Area B	Entire City
	Commercial	Residential		
Connections	47	132	180	359
EDUs	163	147	184	494
Average Day Flow (gpd)	9,200	11,000	11,500	31,700
Maximum Monthly Flow (gpd)	31,000	24,000	27,000	82,000
BOD_5 (lbs/day)**	55	42	47	145
TSS (lbs/day) **	35	26	29	90

** Septic tank effluent

ES.5.3 Project Costs

Preliminary construction and O&M costs were estimated for each of the proposed service areas. These costs are intended as an order-of-magnitude cost for preliminary planning purposes and should be updated as additional information and analysis are obtained.

Estimated construction costs are provided in the table below and include costs for collection, treatment, and disposal systems associated with each phase of the project. Each estimate includes a standard 20% construction contingency as well as an additional 20% for engineering and 5% for administrative/legal costs. Tabulated unit costs are based on recently constructed, publicly bid community projects as well as engineering experience.

Table ES-5 - Estimated Construction costs

	Service Area A		Service Area B	Entire City
	Commercial	*Residential*		
Collection System	$ 758,160	$ 1,527,240	$ 2,333,760	$ 4,619,160
Treatment System	$ 840,000	$ 858,000	$ 696,000	$ 2,394,000
Disposal System	$ 276,000	$ 259,500	$ 247,500	$ 783,000
Total Costs	**$ 1,874,160**	**$ 2,644,740**	**$ 3,277,260**	**$ 7,796,160**
Cost per EDU	*$ 11,498*	*$ 17,991*	*$ 17,811*	*$ 16,194*

The phase 1 cost to provide wastewater service to the commercial sector of Service Area A is projected at $1.87 million. An addition $2.6 million is required to extend service to the residential users in this service area. The final phase of construction cost to provide service to the remaining parts of the City (Service Area B) is estimated at $3.28 million. The overall project cost is nearly $7.8 million. Estimated cost per EDU ranges from approximately $11,500 to $18,000.

Although capital costs for construction represent the largest financial requirement for the system, it is also important to consider the operation and maintenance (O&M) costs of the system. O&M costs include routine maintenance, regular inspections, electricity, and replacement costs. Estimated monthly O&M costs are estimated in Table ES-6. This cost includes periodic pumping of tanks (4-6 years).

Table ES-6 - Estimated Monthly O&M Costs

	Effluent Sewer System ($/EDU/Month)	Advanced Treatment/Disposal ($/EDU/Month)	Total O&M ($/EDU/Month)
Routine O&M	$5.00	$5.00	$10.00
Repair & Replacement	$3.00	$2.00	$5.00
Administration	$2.50	$2.50	$5.00
Total Estimated O&M	**$10.50**	**$9.50**	**$20.00**

One option for funding the new wastewater system would be through user fees to cover project financing as well as O&M costs. The required fee would be dependent on a number of factors, including payment structure, financial terms, and project phasing. The following provides an estimate of the potential financial impact of a community wastewater system. For the purpose of this analysis, the capital costs of the project have been assumed to be 100% financed through loans. The monthly amount required to service this debt is combined with the estimated O&M costs to determine the average monthly user rate required on an EDU basis. Monthly repayment was calculated using a 3% interest rate for a 20-yr loan.

The estimated monthly cost to service debt repayment as well as cover O&M costs for a community wastewater system is provided in Table ES-7. This amount could be reduced if grant funding was obtained as part of the project funding. Information on potential funding sources, including grants, is provided in Section 7.

Table ES-7 - Estimated Monthly Impact of Wastewater System on Rate Payers

	Service Area A		Service Area B	Entire City
	Commercial	*Residential*		
Monthly Loan Repayment	$ 11,233	$ 15,851	$ 19,642	$ 46,726
Monthly O&M	$ 3,260	$ 2,940	$ 3,680	$ 9,880
Total Monthly Cost	$ 14,493	$ 18,791	$ 23,322	$ 56,606
Monthly Cost per EDU	**$ 88.91**	**$ 127.83**	**$ 126.75**	**$ 114.59**

It should be noted that potential cost savings could be accomplished by reusing existing on-site equipment (e.g. septic tanks) that is in good condition. Future planning/design should develop criteria to use in the evaluation of existing equipment and identify tanks in each respective service area that may remain in use. This would allow development to occur without the risk of having to pay twice for a septic tank.

Ultimately, the feasibility of this project will be determined by public support. The City should begin surveying its community to determine if there is sufficient support under a range of financial scenarios, including the scenario that the entire project is funded through loans.

ES.5.4 Land Requirements

Due to the limited available land, the required sizing for the treatment and disposal systems will have a significant impact on determining the feasibility of the project. Sizing criteria for disposal systems are calculated based on the allowable mass loading rate of the soil, which is site specific and must be approved by Oregon Department of Environmental Quality (DEQ). In addition to the primary treatment field, DEQ typically requires sufficient land to be available for a replacement drainfield.

The following table estimates the amount of land required for siting wastewater treatment and disposal systems. For the purposes of this *Feasibility Study*, the design loading rate for the soil has been assumed to be 1 gpd per lineal foot. In addition, it is assumed a typical 42ft x 7ft filter bed can treat a flow of approximately 6,500 gpd. However, both of these assumptions may need to be revised as part of a *Wastewater Facilities Plan.*

Table ES-8 - Treatment & Disposal System Size Requirements

	Service Area A		Service Area B	Entire City
	Commercial	*Residential*		
Treatment System (ft^2)	3,500	4,000	3,000	10,500
Primary Disposal System (ft^2)	50,000	75,000	60,000	185,000
Replacement Field (ft^2)	50,000	75,000	60,000	185,000
Total Land Requirements (ft^2)	103,500	154,000	123,000	380,500
Total Land Requirements (acre)	**2.38**	**3.54**	**2.83**	**8.75**

As previously noted, there are relatively few sites that are suitable for siting a community wastewater system in the City. This is due to a combination of physical site constraints (e.g. steep topography, high groundwater), regulatory restrictions, and lack of undeveloped properties. Several potential sites have been identified:

Properties within City Limits

Tax Lot 105E02AD00100110	The site commonly referred to as the "Old School Property" is located at 110 Patton Road S and contains a total of 2.69 acres. It is situated in the center of Service Area A and is owned by the City. This property has been previously investigated and a site evaluation indicated that soil conditions are favorable for subsurface disposal.
Tax Lot 105E01CB11900	The 3.05-acre property at 430 Santiam Avenue is currently bank owned, however, the City has shown interests in purchasing the lot. A recent site evaluation performed by DEQ indicated that due to high groundwater at this location, the property is not conducive for developing a drainfield.

Properties Outside City Limits

The majority of the properties surrounding the City of Detroit are part to the Willamette National Forest. Some portions of this area have been withdrawn from the Nation Forest and are used by the US Corp of Engineers (COE) while other areas have been officially acquired by COE. The State of Oregon also owns several parcels surrounding the City. While siting of wastewater facilities on National Forests are generally not allowed due to land use considerations, it may be possible for the City to purchase land from the Forest Service through the Townsite Act. The City of Sisters successfully purchased 160 acres in the Deschutes National Forest in 1999 by this process.

Recommendations

Although the property on Santiam Avenue is not suitable for a drainfield, it is the preferred location to site the treatment portion of the wastewater system. This would allow the treatment system to be developed in a multi-phased approach, but ensure the all components of the treatment system (filters, controls, etc.) could be located at the same site. Treated effluent would then have to be pumped offsite to the drainfield(s).

At this time, the "Old School" property is the only available site to develop a community drainfield. This site could be developed in the first phase of the project to serve the commercial sector in Service Area A. Eventually as the City expands its wastewater system, additional land suitable for developing a subsurface disposal system will need to be obtained.

ES.5.5 Future Planning Needs & Consideration

The level of planning represented by this *Feasibility Study* required a number of assumptions to develop preliminary design criteria and system cost. The next phase of planning will require the City to develop a DEQ approved *Wastewater Facilities Plan,* which would provide a much higher level of planning and analysis.

A key component of project feasibility will be dependent on public support. The City should continue to provide the community information on the need for a wastewater system, including the anticipated benefits to the area's economy and environment. Additionally, the City should conduct a survey of its property owners in order to determine who may be interested in connecting to a community wastewater system. Results of this survey may be used to revise the proposed service area boundaries.

Implementation of a wastewater system will also require the City to develop of a number of ordinances and programs to regulate its municipal sewer system including sewer use ordinance, engineering standards, system development charge (SDC) methodology, fats, oils and grease (FOG) control program, and ongoing public education.

ES.5.5 Implementation Schedule

The scope of work required to implement a community wastewater system for the City of Detroit is substantial. For this reason, it is important to outline the required task and provide an estimate of the timeframe required. A summary of the anticipated tasks and respective timeframes is provided in the following table. Based on this preliminary schedule, the earliest the first phase of the wastewater system could be expected to be on line is five to seven years.

Table ES-9 - Preliminary Project Schedule

Required Task	Year Completed
Public Education to Secure Community "Buy In"	On-Going
Secure Financing for Wastewater Facilities Plan (WWFP) & Environmental Report	2016
Complete WWFP and Environmental Review	2019
Develop Ordinances Governing Wastewater System	2019
Obtain WPCF Permit (or NPDES if applicable)	2020
Secure Financing for Phase 1 Design/Construction	2020
Design/Approval/Construct Phase 1	2022
Secure Financing for Design/Construction of Remaining Phases	2024
Design/Approval/Construct Phase of Remaining Phases	2026

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Idanha Wastewater Facility Plan Update

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Kennedy/Jenks Consultants

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Wastewater Facility Plan Update: City of Idanha, Oregon

16 October 2009

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OREGON
JAN. 15, 2002
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EXPIRES: 12/31/2010

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K/J Project No. 0691022.00

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List of Acronyms

ADF	average daily flow
bgs	below ground surface
BOD	biochemical oxygen demand
CAS	conventional activated sludge
CDBG	Community Development Block Grant
cfs	cubic feet per second
CMI	Curran-McLeod, Inc.
CMOM	Capacity Management Operation and Maintenance
City	City of Idanha
DEQ	Oregon Department of Environmental Quality
Detroit	City of Detroit
DHS	Oregon Department of Human Services
EDU	equivalent dwelling unit
EPA	U.S. Environmental Protection Agency
EQC	Environmental Quality Commission
F/M	food-to-microorganism
FOG	fats, oils, and grease
gpcpd	gallons per capita per day
gpd	gallons per day
gpd/EDU	gallons per EDU per day
HUD	U.S. Department of Housing and Urban Development
I&I	infiltration and inflow
Idanha	City of Idanha
kW	kilowatt
kWh	kilowatt-hour
lbs/day	pounds per day
lf	linear feet
MBR	membrane bioreactor
MG	million gallons
mg/l	milligrams per liter
mi^2	square miles
ml	milliliter
MMF	maximum monthly flow
MWVCOG	Mid-Willamette Valley Council of Governments
N	nitrogen
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit
O&M	operation and maintenance
OAR	Oregon Administrative Rule
ODFW	Oregon Department of Fish and Wildlife
OECDD	Oregon Economic and Community Development Department

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PDAF	peak day annual flow
PFRP	processes to further reduce pathogens
PIF	peak instantaneous flow
ppl/mi²	people per square mile
Pre-design Report	City of Detroit/City of Idanha Pre-Design Report Regional Wastewater Treatment Facility and Sewage Collection and Treatment and Sewage Collection System Improvements
PSRP	process to significantly reduce pathogens
PSU	Portland State University
RD	Rural Development
RGF	re-circulating gravel media filter
RMF	re-circulating media filter
RUS	Rural Utilities Services
SPWF	Special Public Works Fund
SSO	sanitary sewer overflow
STEP	septic tank effluent pumping
the Plan	facility plan update
TKN	total Kjeldahl nitrogen
TSS	total suspended solids
UGB	urban growth boundary
USGS	U.S. Geological Survey
VE study	*A Value Engineering Study and Conceptual Design Review Detroit/Idanha Regional Sewer Project* (Tetra Tech/KCM 2002)
VE	value engineering
WPCF	water pollution control facility
WWF	Water/Wastewater Financing
WWTP	wastewater treatment plant

Executive Summary

Purpose

The City of Idanha (the City) has retained Kennedy/Jenks Consultants (Kennedy/Jenks) to prepare this Facility Plan Update to provide a plan for wastewater facilities for the next 20 years. The selected alternatives were determined based on collaborative input from the City, the Department of Environmental Quality (DEQ), and Kennedy/Jenks.

Previous Planning Efforts

The City has previously been involved in the preparation of wastewater facility plans teaming with the City of Detroit to produce the *Upper North Santiam River Canyon Sewage Treatment Feasibility Study* in 1995 (CMI 1995) and a *Pre-design Report* in 2001 (CMI 2001) for a joint wastewater management system. Based on this work, the City concluded that the costs of construction and operational maintenance of wastewater facilities were greater than the available funding. As a result, Idanha began to explore construction of its own wastewater facilities.

Existing Wastewater Facilities and Flow Estimates

Idanha currently has no community collection or treatment system, and wastewater is managed exclusively by onsite systems, including, but not limited to: septic tanks, cesspools, and drain fields. DEQ conducted a sanitary survey in 2003 (DEQ 2003) of the onsite systems in the community, concluding that many of the onsite systems are constrained or were under-designed, and some of the systems were failing. The report suggested that enhanced treatment technologies be investigated to protect beneficial uses of groundwater and surface water.

Projected flows and loading rates for wastewater in Idanha are summarized in Table ES-1.

Table ES-1: Projected 2028 Wastewater Flows and Loads

Design Event	Flow Rate (gpd)	BOD Load (lbs/day)	TSS Load (lbs/day)
ADF	23,100	37	16
MMF	37,800	60	27
PDAF	65,900	104	47

<u>Notes:</u>

ADF = Average daily flow.
BOD = Biochemical oxygen demand.
gpd = Gallons per day.
lbs/day = Pounds per day
MMF = Maximum monthly flow.
PDAF = Peak day annual flow.
TSS = total suspended solids.

Collection System Alternatives

Two methods of wastewater collection from onsite septic tanks were evaluated: a gravity sewer system, and a septic tank effluent pumping (STEP) system. The costs for implementing each system are summarized in Table ES-2.

Table ES-2: Collection System Cost Comparison

Collection System Type	Construction Cost ($)
Gravity	6,300,000
STEP	3,200,000

The STEP system construction costs are lower than those for the gravity system. In addition, the shallower excavation depths avoid some constructability issues related to the gravity system. Finally, the STEP system is subject to negligible infiltration and inflow (I&I) because piping is under pressure. For these reasons, the STEP system is the recommended option.

Wastewater Treatment Alternatives

Treatment options considered include re-circulating gravel filter (Gravel Media re-circulating media filter [RMF]), re-circulating synthetic media filter (Synthetic Media RMF), conventional activated sludge (CAS), and membrane bioreactor (MBR). Each of these treatment systems, coupled with a properly certified operator and upholding all reporting requirements, will address the findings that must be made by the EQC in order to apply for and receive a WPCF permit.

The estimated costs for the treatment systems are shown in Table ES-3.

Table ES-3: Wastewater Treatment System Costs

Treatment Process	Capital Cost Installed Equipment	Total Annual O&M Cost	20-Year Present Worth of Annual Payments	Total Cost Over 20 Years
Synthetic Media RMF	$1,600,000	$59,000	$626,000	$2,226,000
Gravel Media RMF	$1,490,000	$55,000	$562,000	$2,052,000
Conventional Activated Sludge	$1,640,000	$120,000	$1,272,000	$2,912,000
Membrane Bioreactor	$2,260,000	$108,000	$1,145,000	$3,405,000

The Gravel Media RMF is the recommended alternative for the following reasons:

- It is the least-cost option
- Minimal maintenance and operator expertise is required
- Power consumption is low
- It functions well in conjunction with the recommended collection system.

A preliminary site for the wastewater treatment plant (WWTP) has been selected near Blowout Road.

The Gravel Media RMF treatment plant would be comprised of the following major treatment equipment onsite:

- Surge / anaerobic tank
- Re-circulation tank
- Gravel media filtration bed
- Effluent discharge pump station.

Effluent Discharge

Three methods of effluent discharge were evaluated: surface water discharge, subsurface discharge in a drain field, and a combination of subsurface discharge and land application. Surface water discharge was eliminated due to the constraints of the "Three Basin Rule," (Oregon Administrative Rule [OAR] 340-041-0350) which prohibits new surface water discharges within the North Santiam River basin. Land application or subsurface discharge may be allowed under a Water Pollution Control Facility (WPCF) discharge permit, which requires review and approval by the Environmental Quality Commission (EQC). Land application was eliminated due to the logistics of storage and irrigation of wastewater, especially during the cold-weather months. Subsurface discharge was the chosen alternative and has been evaluated for implementation.

Subsurface discharge will be accomplished with two 400-foot-long sections of perforated drain field piping, while reducing the risk of treated effluent reaching surface water sources in the area. A preliminary site for the drain field has been selected south of Highway 22 and east of Blowout Road. The cost for construction of the subsurface discharge system is $200,000 and is included in the "Capital Cost Installed Equipment" column in Table ES-3.

User Costs

Monthly user costs include monthly operation and maintenance costs (not including capital expenses) as well as debt service and related costs. Idanha currently has secured a funding package that includes $1,425,000 in grants and $269,100 in loans, and it is possible that an additional $750,000 in grants and $750,000 in loans may be available. If such a funding package is used, the monthly user costs will exceed $100 per equivalent dwelling unit (EDU). The City may attempt to secure more grant monies to reduce the monthly user cost per EDU to $50, which is the likely "similar systems" cost. It is unlikely that monthly user costs will be reduced to less than $50 per EDU.

Recommended Alternative

The recommended alternative for a community wastewater collection, treatment, and discharge system includes:

- Watertight septic tanks at each connection
- STEP collection system
- Gravel Re-circulating Media Filter Treatment Process with Nitrogen Removal
- No disinfection (contingent upon validation testing)
- Drain field subsurface discharge
- 10-kilowatt (kW) onsite generator.

In this alternative, wastewater produced by the City will be collected, treated, and disposed of in a way that fosters public health and safety and allows for growth in the community. A high level of operator knowledge will not be required due to the simplistic nature of an RMF when compared to the other options evaluated.

New septic tanks at each connection may not be required. During either the design or construction phase of this project, a comprehensive leak testing program should be instituted to evaluate the integrity of existing septic tanks. Should a tank be found in good condition, then its continued use will be acceptable. Should repair of a tank be deemed appropriate and cost-effective, then that option would be more beneficial than a new tank. As such, the final decision regarding the continued use of existing tanks would rest entirely with the City.

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Gates Sanitary Survey

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Sanitary Survey

of the city of

Gates

Prepared by

Edgewater Environmental
610 SE John Nye Rd
Newport, OR 97365
541-265-8389

Executive Summary

A sanitary survey was conducted for the city of Gates. The survey was conducted during February of 1999. Of 192 dwelling units, 105 were surveyed, 51 property owners (27%), chose not to participate. 16.2% of the septic systems surveyed were either failing or marginal. There was no area of concentration for failing and marginal systems. Testing of surface water ditches confirmed very low levels of bacteriological contamination.

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Mill City Sewage Collection System

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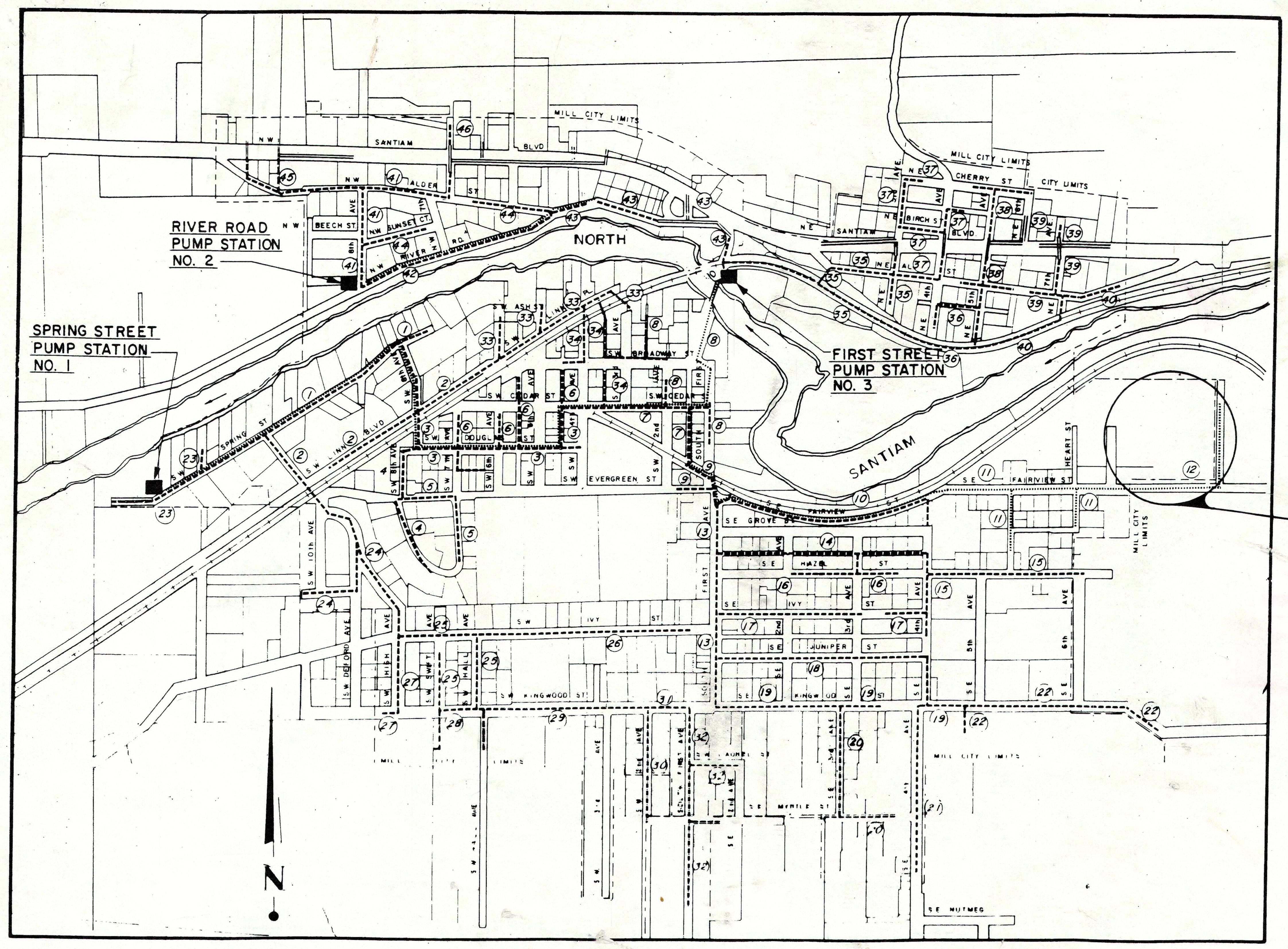


TREATMENT
PLANT LOCATION

MILL CITY SEWERAGE FACILITY PROJECT

SEWERAGE COLLECTION SYSTEM

BID SCHEDULES: A AND B

LINN AND MARION COUNTIES
MILL CITY, OREGON

PROJECT NO. 3685
OCTOBER 1990

CITY COUNCIL

MARY SMITH, MAYOR
BARBARA ALEXA
LLOYD LEWIN
GRANT MERRILL
STAN OGDEN
STEVE WINN

CITY PROJECT COORDINATOR

KEVIN G. LONG

CITY RECORDER

ROEL LUNDQUIST

DIRECTOR OF PUBLIC WORKS

JOHN DICKINSON

WASTEWATER TREATMENT PLANT DESIGN DATA

DESIGN YEAR 1989
POPULATION 1534

DESIGN FLOWS

A.D.W.F. = 92,500 G.P.D.
A.W.W.F. = 170,000 G.P.D.
P.W.W.F. = 185,000 G.P.D.

DESIGN LOADINGS

B.O.D. = 200 MG/L X 8.34#/MG
X 0.585 MGD 307#

DRAINFIELD DESIGN

LAND AREA = 10 ACRES
LOADING = 12.5 GAL./L.F.
185,000 G.P.D. = 15,200 L.F.

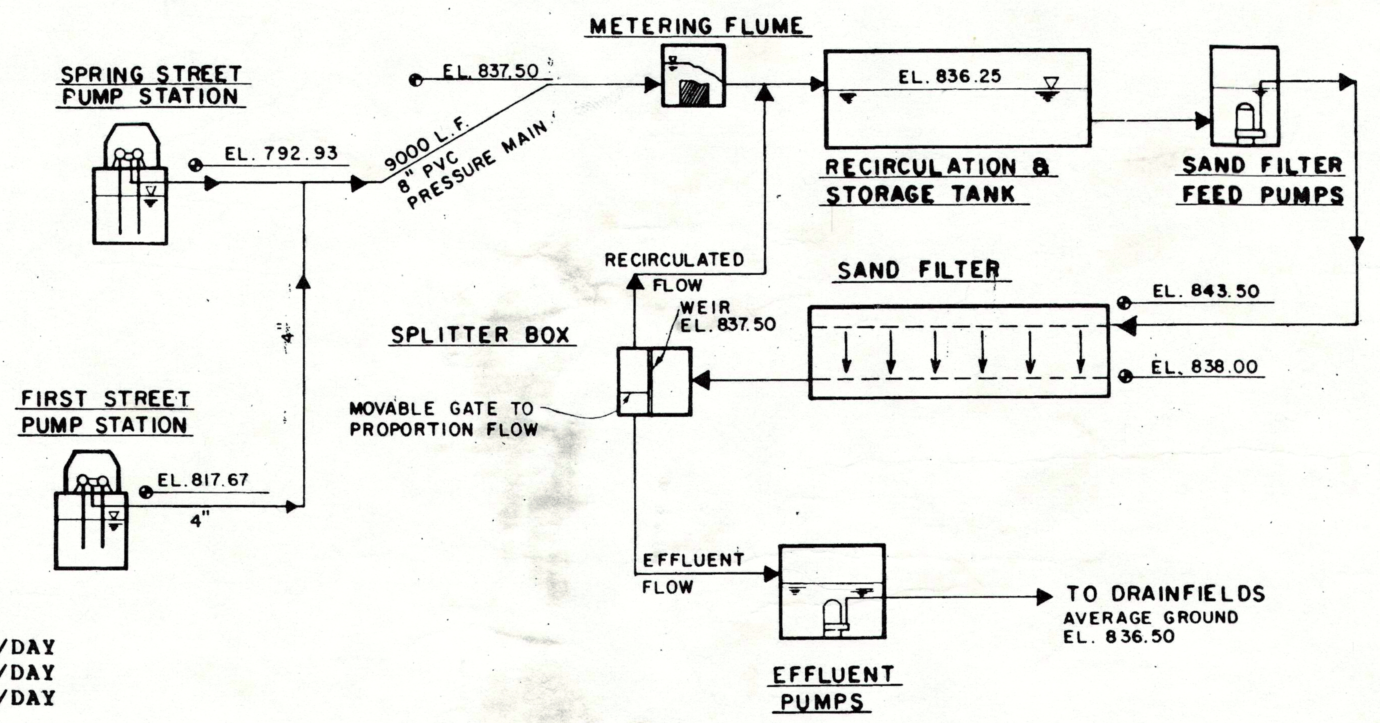
SAND FILTER

A.D.W.F. = 92,500 GPD @ 2.50 GAL./FT²/DAY
A.W.W.F. = 170,000 GPD @ 4.60 GAL./FT²/DAY
P.W.W.F. = 185,000 GPD @ 5.00 GAL./FT²/DAY

RECIRCULATION TANK & PUMPS

ONE DAY STORAGE = 185,000 GALLONS
RECIRCULATION PUMPS = 1,200 GPM
EFFLUENT PUMPS = 900 GPM

SCHEMATIC FLOW DIAGRAM



THIS PROJECT IS BEING FINANCED BY A CITY OF MILL CITY GENERAL OBLIGATION BOND, A GRANT AND LOAN FROM THE FARMERS HOME ADMINISTRATION, A GRANT FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, AND A GRANT FROM THE UNITED STATES DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT THROUGH THE OREGON COMMUNITY DEVELOPMENT PROGRAM ADMINISTERED BY THE INTERGOVERNMENTAL RELATIONS DIVISION OF THE STATE OF OREGON.

LEGEND

======	ASPHALT CONCRETE	○	SINGLE INTERCEPTOR TANK
========	GRAVEL	Ⓣ	SINGLE TRAFFIC INTERCEPTOR TANK
	VEGETATION	Ⓟ	SINGLE INTERCEPTOR TANK WITH S.T.E.P. SYSTEM
—X—X—	FENCE	PⓉ	SINGLE TRAFFIC INTERCEPTOR TANK WITH S.T.E.P. SYSTEM
———	PROPERTY LINE	Ⓓ	DOUBLE INTERCEPTOR TANK
	BUILDING	DBL Ⓣ	DOUBLE TRAFFIC INTRERCEPTOR TANK
⊙	CLEAN OUT	DBL Ⓟ	DOUBLE INTERCEPTOR TANK WITH S.T.E.P. SYSTEM
—⊖—	POWER POLE		
●	MANHOLE		
◁	DIRECTION OF FLOW	TR	TRIPLE INTERCEPTOR TANK
▲	NEW PUMP STATION	TR Ⓣ	TRIPLE TRAFFIC INTERCEPTOR TANK
◐	NEW INSPECTION PORT	TR Ⓓ	TRIPLE INTERCEPTOR TANK WITH S.T.E.P. SYSTEM
═══	EXISTING 4" SANITARY	□	3000 GAL. INTERCEPTOR TANK
—G—	EXISTING GAS LINE	T	3000 GAL. TRAFFIC INTERCEPTOR TANK
—W—	EXISTING WATERLINE	P	3000 GAL. INTERCEPTOR TANK WITH S.T.E.P. SYSTEM
■■■■■■	NEW SANITARY SEWER	T P	3000 GAL. TRAFFIC INTERCEPTOR TANK WITH S.T.E.P. SYSTEM
■■■■■■■■■■	PRESSURE MAIN	G	GREASE INTERCEPTOR TANK
— — —	NEW STORM DRAIN	G T	TRAFFIC GREASE INTERCEPTOR TANK
—SL—	NEW SERVICE LATERAL	P	RESIDENTIAL LIFT STATION
—PL—	PRESSURE SERVICE LINE	■	PRESSURE SERVICE VALVE & BOX
		•	SERVICE LATERAL CLEANOUT
		☒	EXISTING SEPTIC TANK

SHEET INDEX

HGE INC.
ENGINEERS & PLANNERS
19 N.W. FIFTH AVE./PORTLAND, OR 97209
375 PARK AVE./COOS BAY, OR 97420

SHEET TITLE: COVER SHEET

PROJECT: MILL CITY, OREGON WASTEWATER COLLECTION AND TREATMENT FACILITY

REV. DATE

SCALE: AS SHOWN

PROJECT #: 3685

DATE: OCT 1990

SHEET NO.: I OF II

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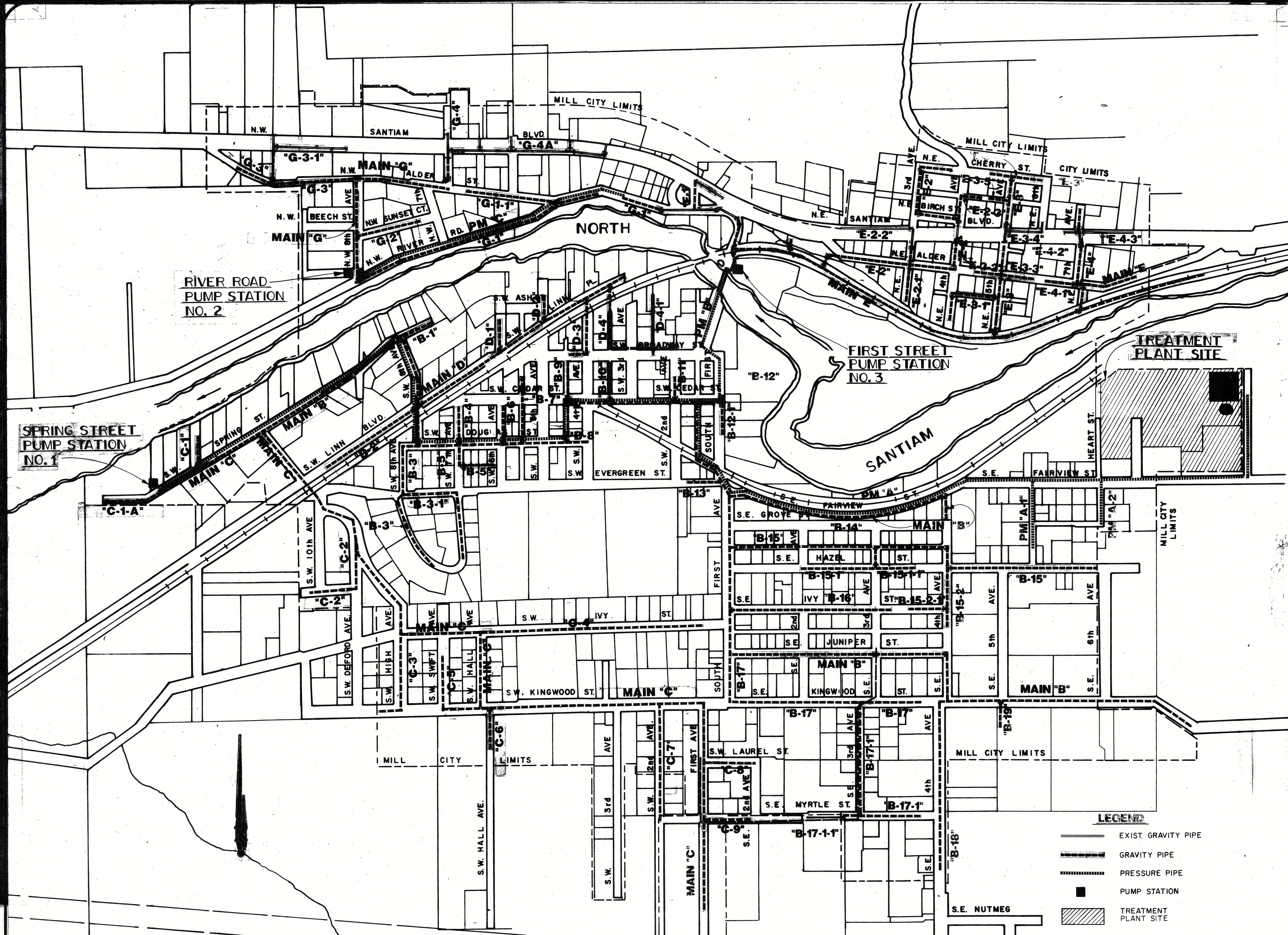

OVERALL SYSTEM MAP

SCALE: 1" = 300'

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REGISTERED PROFESSIONAL ENGINEER
OREGON
RICHARD D. NORED

HGE INC./ENGINEERS & PLANNERS
Coos Bay, Oregon / 375 Park Ave. 97420 / (503) 269-1166
Portland, Oregon / 19 N. W. 5th Ave. 97209 / (503) 222-1687

SHEET TITLE

PROJECT
MILL CITY SEWERAGE FACILITY PROJECT
SEWERAGE COLLECTION SYSTEM

PROJECT #

DATE

SHEET NO.
11 OF 11

C2F, PORTLAND, ORE. — CLEARPRINT

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Mill City Wastewater Treatment Plant

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RECEIVED JAN 27 1993

MILL CITY SEWERAGE FACILITY PROJECT

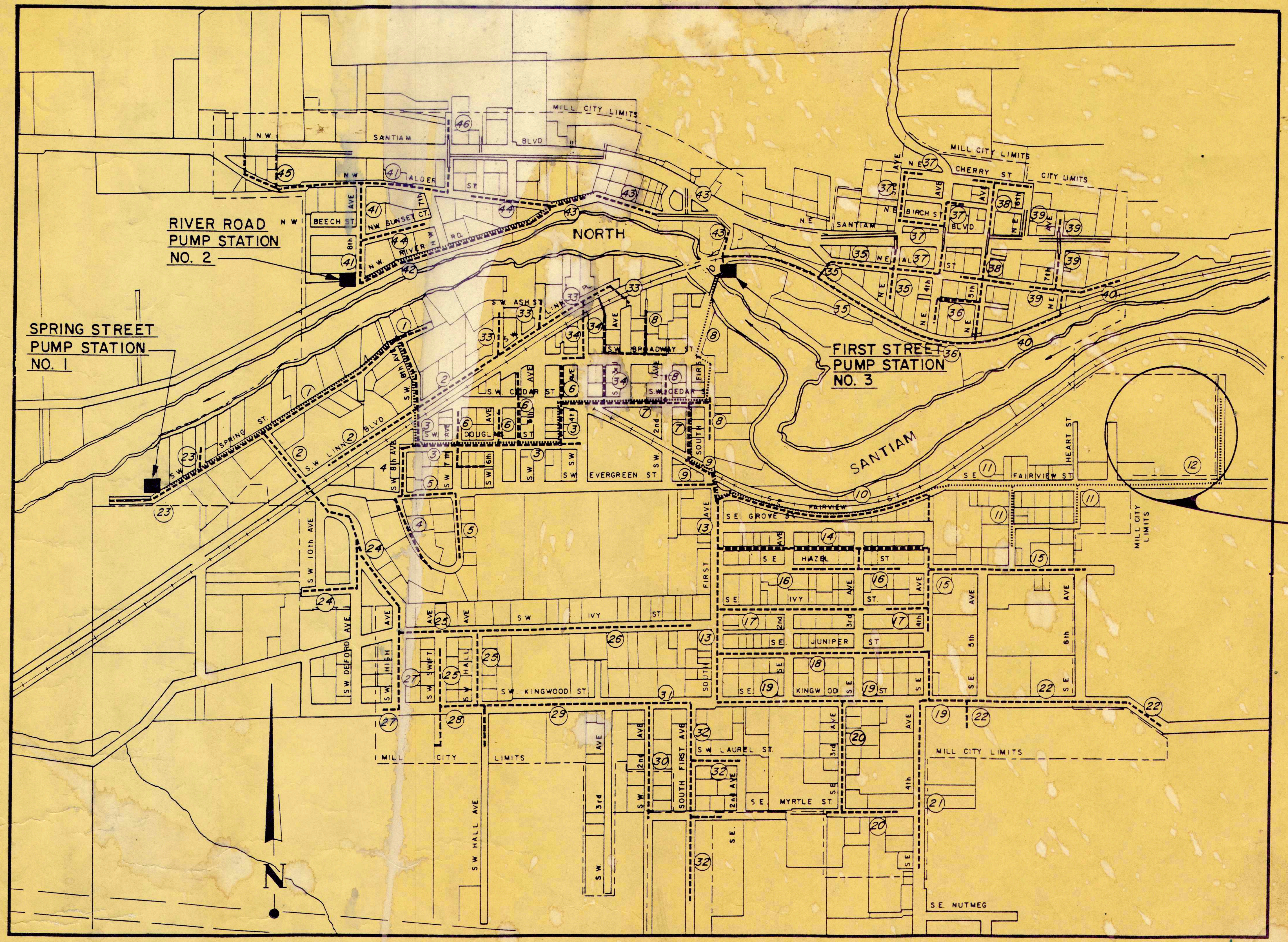
WASTEWATER TREATMENT PLANT

BID SCHEDULE: A

LINN AND MARION COUNTIES
MILL CITY, OREGON

PROJECT NO. 3685

OCTOBER 1990



TREATMENT PLANT LOCATION

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STAN OGDEN
STEVE WINN

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KEVIN G. LONG

CITY RECORDER

ROEL LUNDQUIST

DIRECTOR OF PUBLIC WORKS

JOHN DICKINSON

WASTEWATER TREATMENT PLANT DESIGN DATA

DESIGN YEAR	1989
POPULATION	1534

DESIGN FLOWS

A.D.W.F. = 92,500 G.P.D.
A.W.W.F. = 170,000 G.P.D.
P.W.W.F. = 185,000 G.P.D.

DESIGN LOADINGS

B.O.D. = 200 MG/L X 8.34#/MG
X 0.585 MGD 307#

DRAINFIELD DESIGN

LAND AREA = 10 ACRES
LOADING = 12.5 GAL./L.F.
185,000 G.P.D. = 15,200 L.F.

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A.D.W.F. = 92,500 GPD @ 2.50 GAL./FT^2/DAY
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RECIRCULATION TANK & PUMPS

ONE DAY STORAGE = 185,000 GALLONS
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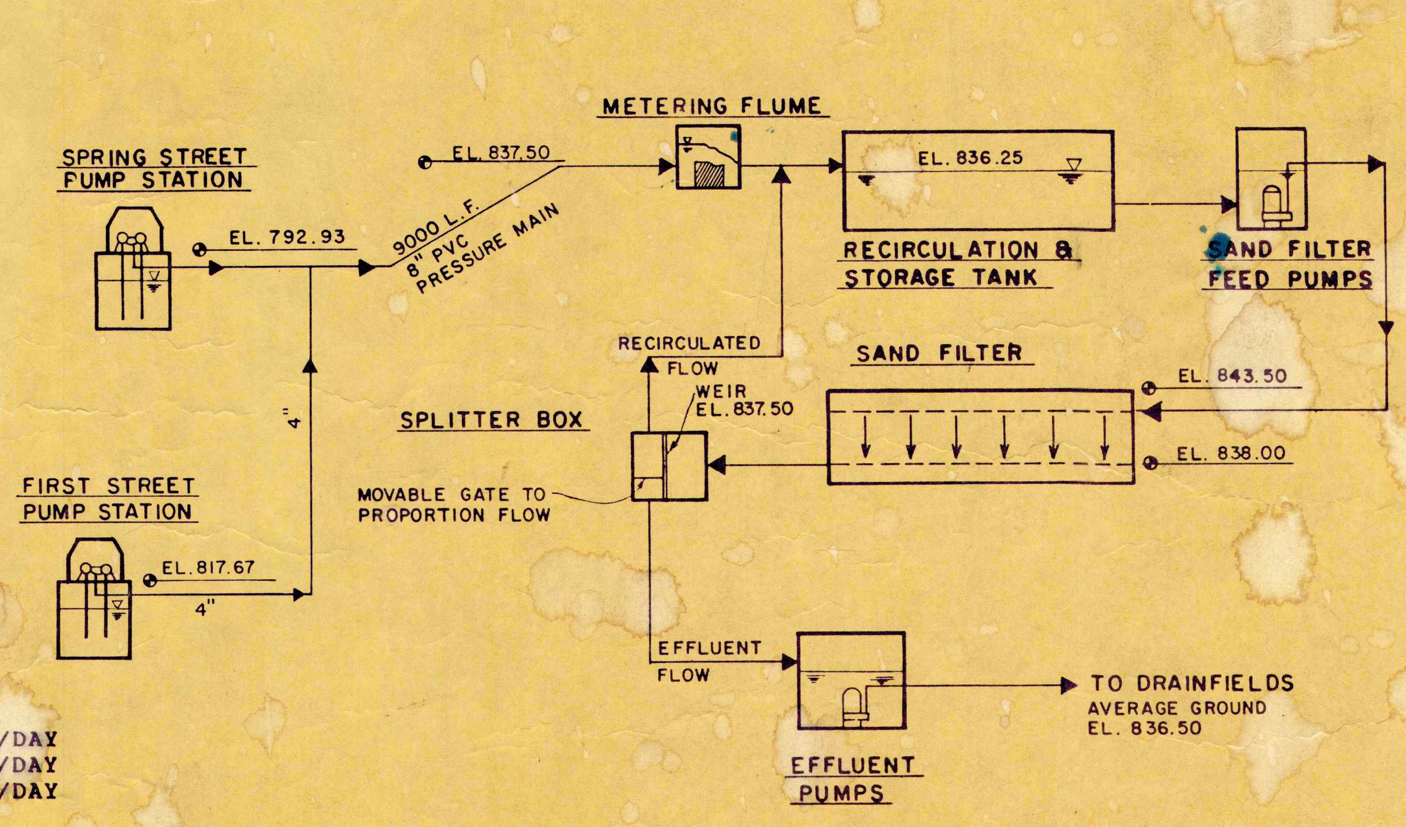
SCHEMATIC FLOW DIAGRAM



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LEGEND

ASPHALT CONCRETE
GRAVEL
VEGETATION
X — X FENCE
PROPERTY LINE
BUILDING
CLEAN OUT
POWER POLE
MANHOLE
DIRECTION OF FLOW
NEW PUMP STATION
NEW INSPECTION PORT
EXISTING 4" SANITARY
G EXISTING GAS LINE
W EXISTING WATERLINE
NEW SANITARY SEWER
PRESSURE MAIN
NEW STORM DRAIN
SL NEW SERVICE LATERAL
PL PRESSURE SERVICE LINE

SHEET INDEX

Richard P Bec[illegible]

MILL CITY OREGON

AS-BUILT DRAWING 12/92 JML

SHEET NO.

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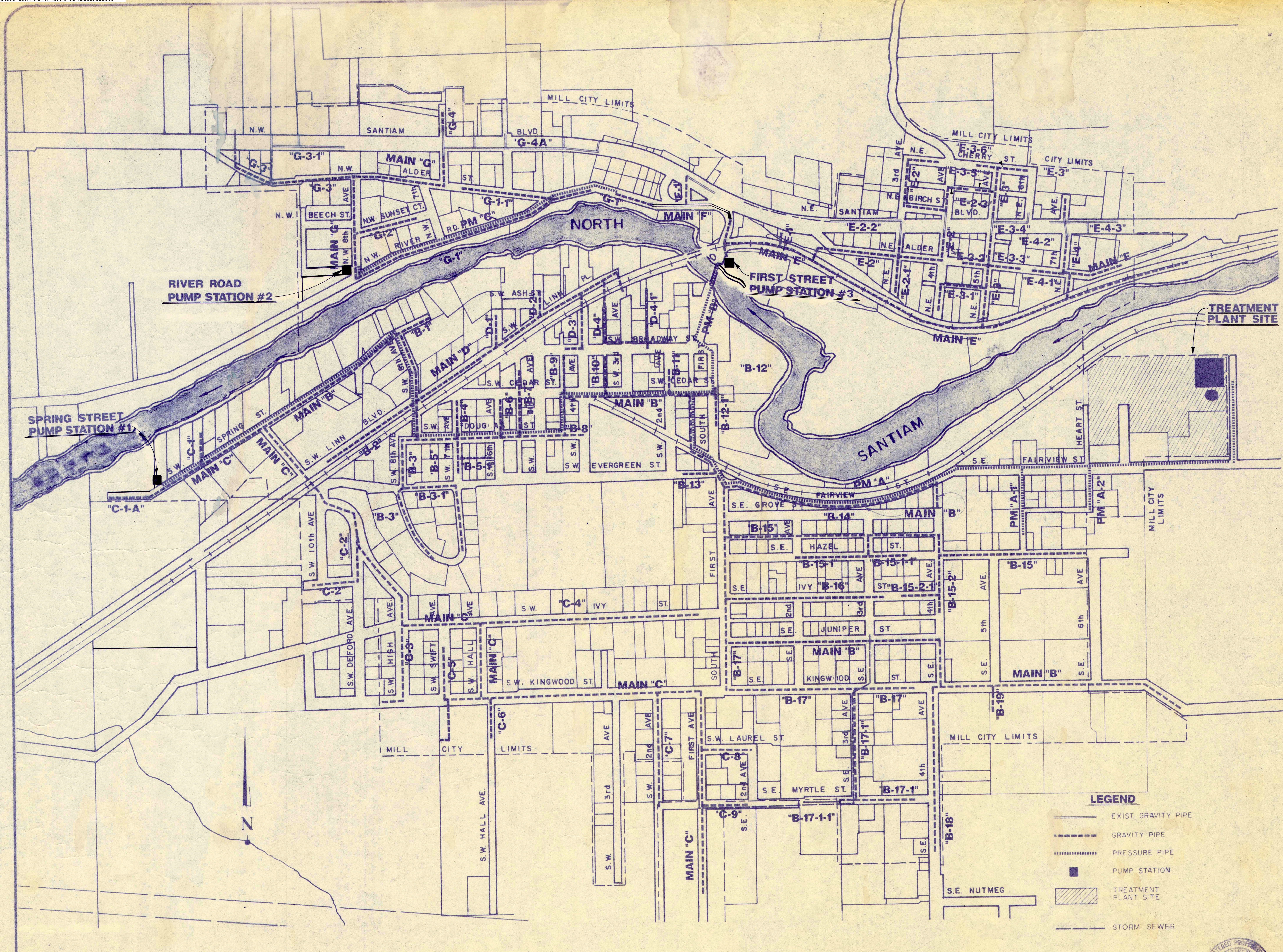

OVERALL SYSTEM MAP

SCALE: 1" = 300'

SHEET INDEX
COLLECTION FACILITIES

AS-BUILT DRAWING 12/92 JML

SHEET INDEX
TREATMENT FACILITY

SEE SHEET NO. 3

HGE INC. ENGINEERS & PLANNERS
Coos Bay, Oregon / 375 Park Avenue 97420 / (503) 269-1166
Portland, Oregon / 19 N.W. Fifth Avenue 97209 / (503) 222-1687

SHEET TITLE: OVERALL SYSTEM MAP

PROJECT: MILL CITY, OREGON WASTEWATER COLLECTION AND TREATMENT FACILITIES

PROJECT # 3685

DATE: DEC 89

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O&M Manual Collection

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Manual

Operation and Maintenance Manual for Wastewater Collection, Treatment, and Disposal Facilities

Prepared for

City of Mill City, Oregon

August 2010

CH2MHILL

Contents

Appendix E:
City of Sisters Urban Area Comprehensive Plan

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City of Sisters Urban Area Comprehensive Plan

Sisters, Oregon
Deschutes County

Adopted July 28, 2005: Ordinance 355
Latest Amendment Adopted - June 27, 2018: Ordinance 485

Foreword

The Sisters Urban Area Comprehensive Plan (Plan) consists of seven parts which are designed for easy reference, clarity and convenience to the general public. The seven parts are:

Part I	Introduction
Part II	Citizen Involvement
Part III	General Goals and Objectives
Part IV	Background
Part V	Comprehensive Plan Goals Findings and Policies
Part VI	Implementation Programs and Policies
Part VII	Appendices

Parts I and II of the Plan includes a statement of public purpose, planning background information and citizen involvement program.

Part III includes a statement of general goals and objectives as they apply to the Sisters Urban Area consistent with past goal setting efforts, the most current goals for the City, and statewide Planning Goals.

Part IV includes an inventory of the historical, environmental, and urban assets and setting of Sisters.

Part V includes the goals, background, findings, policies, and tasks of the Plan.

Part VI describes implementation programs and policies for carrying out and enforcing the Plan.

Part VII includes appendices.

Contents

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Appendix F:
Sisters Wastewater System Facilities Plan

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Barbara - Office Copy

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ENGINEERS
SURVEYORS
PLANNERS

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COOS BAY,
OREGON
97420

541.269.1166
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hgel@presys.com

HGE Project #9661

WASTEWATER SYSTEM FACILITIES PLAN

CITY OF SISTERS
DESCHUTES COUNTY, OREGON

SEPTEMBER 1997

Grant funding for the project was provided through a Forest Service Rural Community Assistance grant. A combined local match was provided by Deschutes County and the city of Sisters.

WASTEWATER SYSTEM FACILITIES PLAN

HGE Project No. 9661

Prepared for:

CITY OF SISTERS

150 North Fir
Sisters, Oregon 97759

REGISTERED PROFESSIONAL ENGINEER
#18309PE
OREGON
JANUARY 16, 1996
WILLIAM M. PAVLICH
EXPIRES: 12/31/98

September 1997

Prepared by:

HGE Inc., Architects, Engineers, Surveyors & Planners

375 Park Avenue
Coos Bay, Oregon 97420
(541) 269-1166 Fax: (541) 269-1833

This Wastewater Engineering Study is being financed in part with a grant from the U.S. Forest Service.

ACKNOWLEDGEMENTS

HGE Inc., Architects, Engineers, Surveyors & Planners would like to acknowledge and thank the following persons for their assistance in the completion of this wastewater engineering study:

City of Sisters

Steve Wilson	Mayor
Gordon Petrie	City Council
Tim Clausen	City Council
Sheryl Whent	City Council
Kathleen Pittman	City Council

Sisters City Staff

Barbara J. Warren	City Administrator
Gary Frazee	Director of Public Works

HGE Inc., Architects, Engineers, Surveyors & Planners

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William Pavlich, P.E.	Project Manager
Clay Baumgartner, P.E.	Project Engineer
Rick Stanley	Graphics
Aimee Finnigan	Technical Editor

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Appendix G:
Three Basin Rule

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Department of Environmental Quality

Chapter 340

Division 41
WATER QUALITY STANDARDS: BENEFICIAL USES, POLICIES, AND CRITERIA FOR OREGON

340-041-0350
The Three Basin Rule: Clackamas, McKenzie (above RM 15) & the North Santiam

(1) In order to preserve or improve the existing high quality water for municipal water supplies, recreation, and preservation of aquatic life, new or increased waste discharges must be prohibited, except as provided by this rule, to the waters of:

(a) The Clackamas River Subbasin;

(b) The McKenzie River Subbasin above the Hayden Bridge (river mile 15);

(c) The North Santiam River Subbasin.

(2) Except as otherwise provided for in this rule, this rule becomes effective and applies to all permits pending or applied for after the date of filing with the Secretary of State.

(3) Special Definitions. The following special definitions apply to this rule:

(a) "Waste Discharges" are defined to mean any discharge that requires and NPDES permit, WPCF permit, or 401 Certification. Individual on-site sewage disposal systems subject to issuance of a construction-installation permit; domestic sewage facilities that discharge less than 5,000 gallons per day under WPCF permit; biosolids land applied within agronomic loading rates pursuant to OAR 340-050; and reclaimed domestic waste water land applied at agronomic rates pursuant to OAR 340-055 are excluded from this definition.

(b) "Existing Discharges" are defined as those discharges from point sources which existed prior to January 28, 1994;

(c) "Existing Facilities" are defined as those for which construction started prior to January 28, 1994. Where existing facilities are exempted from requirements placed on new facilities, the exemption applies only to the specific permit(s) addressed in the subsection which allows the exemption;

(d) "New" NPDES and WPCF permits are defined to include permits for potential or existing discharges which did not previously have a permit, and existing discharges which have a permit, but request an increased load limitation;

(e) "Agronomic Loading Rate" means the application of biosolids or reclaimed effluent to the land at a rate which is designed to:

(A) Provide the quantity of plant nutrients, usually nitrogen, needed by a food crop, feed crop, fiber crop, cover crop or other vegetation grown on the land; and

(B) Minimize the quantity of nitrogen or other nutrients from land applied materials that pass below the root zone of the crop or vegetation grown on the land to groundwater.

(f) "Biosolids" means solids derived from primary, secondary, or advanced treatment of domestic wastewater which have been treated through one or more controlled processes that significantly reduce pathogens and reduce volatile solids or chemical stabilize solids to the extent that they do not attract vectors. This term refers to domestic wastewater treatment facility solids that have undergone adequate treatment to permit their land application;

(g) "Reclaimed Wastewater" means treated effluent from a domestic wastewater treatment system which, as a result of treatment, is suitable for a direct beneficial purpose or a controlled use that could not otherwise occur.

(4) To respond to emergencies or to otherwise avoid imminent serious danger to public health or welfare, the Director or designee may allow lower water quality on a short-term basis.

(5) The Director or a designee may renew or transfer NPDES and WPCF permits for existing facilities. Existing facilities with NPDES permits may not be granted increases in their permitted mass load limitations. The following restrictions and exceptions apply:

(a) The Department may conduct an inspection prior to permit renewal. Existing sources with general permits that are found not to qualify for a general permit, and who wish to continue discharging, must apply for an individual permit;

(b) Fish hatcheries (General Permit 300) and log ponds (General Permit 400) are required to apply for an individual permit at the time of permit renewal;

(c) Additional industrial, confined animal feeding operations, or domestic waste loads that are irrigated on land at agronomic rates or that otherwise meet the conditions of section (7) of this rule is not be considered to be an increase in the permitted wasteload.

(6) The Director or a designee may issue the following General Permits or Certifications subject to the conditions of the Permit or Certification:

(a) Stormwater construction activities (General Permits 1200C and 1200CA);

(b) Underground storage tank cleanups using best available treatment technology (General Permit 1500);

(c) Non-contact cooling water (General Permit 100);

(d) Filter backwash (General Permit 200);

(e) Boiler blowdown water (General Permit 500);

(f) Suction dredging (General Permit 700) only in portions of the basins that are not designated as Scenic Waterways under ORS 390.805 to 390.925;

(g) Federal Clean Water Act Section 401 water quality certifications.

(7) Long-term general and individual stormwater permits may be allowed as required by State and/or Federal law. The following requirements apply:

(a) New stormwater discharge permit holders must maintain a monitoring and water quality evaluation program that is effective in evaluation of the in-stream water quality impacts of the discharge; and

(b) When sufficient data is available to do so, the Department will assess the water quality impacts of stormwater discharges. Within a subbasin, if the proportion of total degradation that is contributed by the stormwater is determined to be significant compared to that of other permitted sources, or if the Department determines that reducing degradation due to stormwater is cost- effective when compared to other available pollution control options, the Department may institute regulatory mechanisms or modify permit conditions to require control technologies and/or practices that result in protection that is greater than that required Statewide.

(8) Industrial waste discharge sources, confined animal feeding operations, and domestic sewage treatment facilities must meet the following conditions:

(a) No NPDES permits for new industrial or new confined animal feeding operation waste discharges, or new domestic sewage treatment facilities may be issued, except as allowed under sections (3), (4), (5), and (6) of this rule;

(b) The Department may issue WPCF permits for new industrial or confined animal feeding operation waste discharges provided:

(A) There is no waste discharge to surface water; and

(B) All groundwater quality protection requirements of OAR 340-040-0030 are met. Neither the Department nor the Commission may grant a concentration limit variance as provided in OAR 340-040-0030, unless the Commission finds that all appropriate groundwater quality protection requirements and compliance monitoring are met and there will be no measurable change in the water quality of the surface water that would be potentially affected by the proposed facility. For any variance request, a public hearing must be held prior to Commission action on the request.

(c) The Department may issue WPCF permits for new domestic sewage treatment facilities provided there is no waste discharge to surface water and provided:

(A) All groundwater quality protection requirements of OAR 340-040-0030 are met. Neither the Department nor the Commission may grant a concentration limit variance as provided in OAR 340-040-0030, unless the Commission finds that all appropriate groundwater quality protection requirements and compliance monitoring are met and there will be no measurable change in the water quality of the surface water that would be potentially affected by the proposed facility. For any variance request, a public hearing must be held and the permit application will be evaluated according to paragraphs (B) and (C) of this subsection;

(B) The Commission finds that the proposed new domestic sewage treatment facility provides a preferable means of sewage collection, treatment and disposal as compared to individual on-site sewage disposal systems. To be preferable, the Commission must find that one of the following criteria applies:

(i) The new sewage treatment facility will eliminate a significant number of failing individual on-site sewage disposal systems that cannot be otherwise reliably and cost-effectively repaired; or

(ii) The new sewage treatment facility will treat domestic sewage that would otherwise be treated by individual on-site sewage disposal systems, from which the cumulative impact to groundwater is projected to be greater than that from the new facility; or

(iii) If an individual on-site sewage disposal system, or several such systems, would not normally be utilized, a new sewage treatment facility may be allowed if the Commission finds that the social and economic benefits of the discharge outweigh the possible environmental impacts.

(C) Applicants for domestic wastewater WPCF permits must meet the following requirements:

(i) Application must be for an individual permit; and

(ii) The proposed discharge must not include wastes that incapacitate the treatment system; and

(iii) The facility must be operated or supervised by a certified wastewater treatment plant operator as required in OAR 340-049-0015, except as exempted by ORS 448.430; and

(iv) An annual written certification of proper treatment and disposal system operation must be obtained from a qualified Registered Sanitarian, Professional Engineer, or certified wastewater treatment system operator.

(9) The Environmental Quality Commission may investigate, together with any other affected State agencies, the means of maintaining at least existing minimum flow during the summer low flow period.

Statutory/Other Authority: ORS 468.020, 468B.030, 468B.035 & 468B.048
Statutes/Other Implemented: ORS 468B.030, 468B.035 & 468B.048
History:
DEQ 2-2007, f. & cert. ef. 3-15-07
DEQ 17-2003, f. & cert. ef. 12-9-03

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Appendix :
Geotechnical Site Evaluation

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SHANNON & WILSON
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

June 16, 2021

Peter Olsen
Keller Associates, Inc.
245 Commercial St SE #210
Salem, Oregon 97301

RE: GEOTECHNICAL SITE EVALUATION
COMMUNITIES OF DETROIT, GATES, IDANHA, AND MILL CITY, OREGON

Dear Mr. Olsen:

Shannon & Wilson, Inc. (Shannon & Wilson), is pleased to submit this letter report documenting our geotechnical site evaluation for the proposed wastewater treatment facility and sewer trunk project for the North Santiam Sewer Authority (NSSA). Keller Associates, Inc. (Keller) is under contract to support the NSSA on initial planning and siting of the proposed improvements. Shannon & Wilson, as a subconsultant to Keller, is providing a geotechnical review of readily available geotechnical information in the project area.

SCOPE OF SERVICES

Shannon & Wilson's services were conducted in accordance with our contract with Keller dated August 4, 2020. We understand that this letter report will be used in evaluating the site geology and seismic hazards at several wastewater treatment plant and sewer pipe trunk locations. Our scope of services for this project consisted of the following:

- Review mapped site geology;
- Review mapped landslides included in Oregon Department of Geology and Mineral Industries' (DOGAMI's) landslide inventory (if any) along the proposed pipeline alignments or at the proposed treatment plant sites;
- Review 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;
- Review mapped relative earthquake liquefaction hazards based on DOGAMI maps (High, Medium, Low, or no susceptibility);
- Review mapped relative landslide risk based on DOGAMI maps (Very High, High, Moderate, or Low susceptibility);

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■ www.shannonwilson.com ■

- Prepare this 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 for mitigation of seismic hazards.

PROJECT UNDERSTANDING

Since 2017, the four Oregon communities of Detroit, Gates, Idanha, and Mill City have been in regular discussions regarding the governance and feasibility of a joint sewer system to serve their communities' wastewater needs. Three of the communities, Detroit, Gates and Idanha, rely on individual septic systems. Mill City maintains a Septic Tank Effluent Pumping (STEP) sewer system that is more than 25 years old, which may require costly repairs or upgrades in the coming years. In some cases where lot sizes are small, shallow water tables, high precipitation or unfavorable soil compositions exist, residents, businesses, and organizations are unable to secure proper permitting by regulation for the necessary replacement of septic system components and drain fields; this is currently the situation with properties in Detroit, Gates and Idanha. With the advancing age of the known components of the existing underground systems, future large-scale failures of individual septic systems would likely threaten the health of the watershed that serves more than 225,000 downstream daily water users in and around the City of Salem, Oregon.

Keller was selected to develop a wastewater master plan for a new wastewater collection, treatment, and disposal systems to serve the four communities. The goal of this study is to identify high level planning issues that could affect design and construction cost estimating, including areas where rock is mapped as the surface unit (resulting in potential rock excavation expenses), and sites where liquefaction of lateral spread hazard is mapped which could require mitigation measures such as avoiding a particular area, or using deep foundations or ground improvement for a seismically resilient system. Geotechnical evaluations performed for this phase of work are to be based on existing geotechnical maps and readily available information; therefore, the current project does not include development of detailed, localized, site-specific subsurface characterizations and design recommendations.

The current plan developed by Keller consists of constructing a Water Pollution Control Facility in Mill City on Remine Road adjacent to Kimmel Park for treatment of waste and a Disposal Site for discharge located downstream of the treatment plant near the western end of SW Kingwood Street in Mill City. The Water Pollution Control Facility in Mill City will treat wastewater from the communities of Gates and Mill City.

As part of this study, Keller evaluated piping all wastewater from Gates, Detroit, and Idanha, to the Mill City Water Pollution Control Facility. However, it was determined that it would be more economical to build a separate Water Pollution Control Facility and Disposal Site near Idanha. Locations of the proposed water pollution control facilities and disposal sites are show on Figures 2 through 6. Our mapping includes the area between Detroit and Gates, as it was evaluated as part of the sewer master plan.

REGIONAL GEOLOGY

The project area is situated along the western edge of the Cascade Range physiographic province, a province made up of two subprovinces composed of the older, broader, and more heavily eroded Western Cascades and the overlying, younger, more easterly volcanoes of the High Cascades. Geologic units in the vicinity of the project site have been mapped by Pungrassami (1969), Beaulieu and others (1974), Hammond and others (1982), Priest and others (1987), and Walker and Duncan (1989) as consisting of Quaternary Surficial Deposits consisting primarily of fluvial, terrace, and landslide deposits, Quaternary Basaltic Andesite of the Cascade Volcanics, and Miocene and Oligocene volcanic and volcaniclastic rocks of the Little Butte Volcanics.

Walker and Duncan describe the Quaternary Surficial Deposits as consisting of unconsolidated deposits of clay, silt, sand, and gravel associated with present day river and stream channels. The Cascade Volcanics consist of lava flows, cinder cones, and stratovolcanoes on the axis of the Cascade Range. The older Little Butte Volcanics are some of the oldest rocks in the Cascade Range and make up a history of ancestral Cascade volcanism and sediment deposition lasting from about 35 to 17 million years ago (Sherrod, 1991). The Little Butte Volcanics are described as consisting of a varied sequence of andesitic to rhyodacitic air-fall and ash-flow tuffs, tuffaceous sandstone and siltstone, debris-flow deposits, basaltic and andesitic lava flows and domes, and small localized shallow igneous intrusions. Along its western edge, the Little Butte Volcanics interfinger with the marine sandstones of the Eugene Formation, while the eastern portion is buried beneath the younger rocks of the Cascade Range.

We reviewed the regional geologic setting of each of the four communities addressed in this report, using a compiled geology map dataset prepared by DOGAMI (Oregon Geologic Data Compilation, Release 6 [OGDC-6]). The location of each community with respect to mapped geology is presented on Figure 2, Geologic Map (Sheets 1 through 4).

The geologic maps indicate the Gates and Mill City Water Pollution Control Facility, Disposal Site and approximately 5 miles of force main system are mapped within Quaternary Surficial Deposits, which include the Leffler Terrace Gravels, Quaternary Terrace Deposits, Quaternary Glacial Deposits, Colluvium, and Mixed Grain Alluvial Deposits. These generally are composed of sand, gravel, and silt forming flood plains and filling channels of present streams. The 6.4-mile sewer line section between Detroit and Idanha includes areas along Detroit Lake and other smaller sections totaling approximately 2 miles in length which are mapped as bedrock rock consisting of Little Butte Volcanics. Depending on the thickness of overburden and the depth of the sewer pipe, rock excavation may be required to construct the sewer line through these areas. The remainder of the pipeline system is generally mapped as Quaternary Surficial Deposits or Landslide Deposits. Both the Mill City and Idanha Water Pollution Control Facilities are in areas mapped as Quaternary Surficial Deposits. The Mill City Disposal Site is located in an area mapped as Quaternary Surficial Deposits and the proposed Idanha Disposal Site is located on the contact between the Little Butte Volcanics and Quaternary Surficial Deposits.

Regional Faults

We reviewed the United States Geological Survey (USGS) Quaternary Fault and Fold Database to determine if Class A or Class B faults are mapped within 5 miles of the project area (USGS, 2020). Faults are designated as Class A where geologic evidence demonstrates the existence of a Quaternary fault of tectonic origin, whether the fault is exposed for mapping or inferred from liquefaction or other deformational features. Class B faults are mapped where geologic evidence demonstrates the existence of a fault or suggests Quaternary deformation, but either (1) the fault might not extend deeply enough to be a potential source of significant earthquakes, or (2) the currently available geologic evidence is not strong enough to assign it to Class A.

Based on our review of the USGS fault database, there are no Class A or Class B faults within 5 miles of the proposed Water Pollution Control Facilities, Disposal Sites and sewer force mains.

SEISMICITY

Anticipated peak ground accelerations in the project area resulting from a Cascadia Subduction Zone Event with a moment magnitude (Mw) of 9.0 have been evaluated and mapped by DOGAMI and published in Open-File Report O-13-06 (Madin and Burns, 2013). The anticipated peak ground acceleration values are presented as ranges and are a function of earthquake magnitude, distance from the event source, and site geology. Typically, areas mapped as landslide deposits or alluvial soil are expected to experience higher peak ground accelerations than areas mapped as rock. Estimated peak ground accelerations for the project area are presented on Figure 3, Peak Ground Acceleration Cascadia Magnitude 9.0 Earthquake.

LIQUEFACTION HAZARD

Liquefaction is a phenomenon in saturated soils in which pore water pressure in loose to medium dense, non-plastic to low plasticity silts and granular soils increases to nearly the effective overburden pressure during seismic ground shaking. The increase in pore pressure results in a reduction of soil shear strength. Primary factors in determining the susceptibility of a soil to liquefaction include relative density, fines content (percent of soil by weight smaller than 0.075 millimeter, passing the No. 200 sieve), and the plasticity characteristics of the fines. Relative density can be estimated based on methods including Standard Penetration Test (SPT) N-values, CPT tip resistances, and shear wave velocity.

We have reviewed liquefaction-susceptibility mapping of the project area performed by DOGAMI and published in Open-File Report O-13-06 (Madin and Burns, 2013). Liquefaction susceptibilities provided in the report are based on application of mapped surface geology to the Youd and Perkins (1978) liquefaction susceptibility methodology.

As shown on Figure 4, Liquefaction Susceptibility, most developed lands within the four subject communities are considered to have low to moderate susceptibility to liquefaction resulting from seismic shaking from a Cascadia Subduction Zone Event. Generally, hillside terrain in the project area (excluding mapped landslide areas) is anticipated to be underlain by relatively shallow rock, and DOGAMI has mapped these areas as non-susceptible to liquefaction.

Based on the existing and proposed alignments and facilities provided by Keller, most facilities are located in areas of low to moderate liquefaction susceptibility. The liquefaction hazard at the Mill City Water Pollution Control Facility is mapped straddling the boundary of low to moderate liquefaction hazard and the Disposal Site is mapped as a low liquefaction hazard. A description of the Quaternary deposits from the Oregon State Geologic Map (Smith and Roe, 2015) at the Mill City Water Pollution Control Facility indicates the site is underlain by Leffler Terrace Gravels which are considered low liquefaction hazard, and younger Quaternary Terrace Deposits which are considered a moderate liquefaction hazard. The Disposal Site is also underlain by Leffler Terrace Gravels which are considered low liquefaction hazard.

At the Idanha Water Pollution Control Facility the liquefaction susceptibility is mostly located in an area mapped as having a moderate liquefaction risk, but the facility is on the boundary with an area of low liquefaction. The Quaternary Surficial Deposits at this location are mostly mapped as Mixed Grain Alluvial Deposits with the Quaternary Surficial Deposits at the northern boundary of the site consisting of Glacial Deposits. The Detroit to Idanha Disposal site is mapped near the contact of Little Butte Volcanics (no susceptibility), and in Quaternary Surficial Deposits consisting of Quaternary Glacial Deposits considered low liquefaction susceptibility, and Colluvium considered moderate liquefaction susceptibility. For a map of liquefaction susceptibility across the entire project site, see Figure 4.

LANDSLIDE HAZARD

We reviewed the DOGAMI Statewide Landslide Information Database for Oregon (SLIDO) to determine the extents and locations of mapped historical and ancient landslides in the project area. The SLIDO database combines geologic mapping data from numerous sources and includes nearly 14,000 historical landslide points and nearly 50,000 landslide polygons. Based on our review of the database, numerous landslides have been mapped in the hills to the south, east, and northwest of the community of Idanha, and a large slide complex has been mapped north of the community of Gates, approximately 1,500 feet north of Santiam Highway. Large landslide complexes have also been mapped as close as approximately 1 mile south of Santiam Highway near the communities of Gates and Mill City, where development appears to be relatively sparse. There does not appear to be any mapped historical or ancient landslides near the community of Detroit. East of Idanha, between Idanha and the Detroit to Idanha Disposal Site the proposed force main alignment crosses numerous areas of mapped Landslide Deposits. The mapped extents of historical slides relative to the four subject communities are presented on Figure 5, Landslide Deposits.

We reviewed the statewide landslide susceptibility map prepared by DOGAMI and presented in Open-File Report O-16-02 (Burns and others, 2016). The statewide landslide susceptibility map classifies slopes on a scale of Low, Moderate, High, or Very High landslide susceptibility based on the presence and abundance of historical landslides near a given site (i.e. landslide density) and the proneness to sliding based on a statistical analysis of slope geometry. Mapped zones with Low susceptibility have low landslide density and low proneness to landsliding. Zones mapped with Moderate susceptibility are in areas with moderate landslide density and/or moderate proneness to landsliding. High-susceptibility zones are in areas with high landslide density and/or high proneness to landsliding. Very High-susceptibility zones are zones where mapped historical or ancient landslides are present.

Based on our review of the statewide landslide susceptibility map, most of the developed areas of Mill City, Gates, and Detroit are located within Low-susceptibility landslide zones. Limited areas of Moderate and High-susceptibility zones are present near these communities along river and stream channels and throughout the foothills bordering the valley. The developed center of Idanha is typically mapped with Low to Moderate landslide susceptibility, but the much of the surrounding area has been mapped with landslide susceptibility of High to Very High. Mapped landslide hazard zones in the project area are presented on Figure 6, Landslide Susceptibility.

Both of the Water Pollution Control Facilities and the Disposal Sites are located in areas of low landslide susceptibility. However, an approximately 1.2-mile section of pipeline is within a mapped landslide between the Idanha Water Pollution Control Facility and the McCoy Disposal Facility.

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 and detailed site-specific analyses. During design, geotechnical explorations and site-specific analysis should be used to further assess the risk.

CONCLUSIONS AND RECOMMENDATIONS

Based on our review of available geotechnical data discussed above, we have prepared planning level recommendations for siting of the proposed wastewater treatment facility and sewer force mains. From a geotechnical perspective and to the extent feasible for achieving project goals, we recommend that the proposed improvements be in areas with the lowest anticipated susceptibility to mapped geologic and seismic hazards. Once initial site selection has been performed, we recommend that a site-specific geotechnical investigation be performed to determine which mapped hazards are present at the site and provide recommendations for site development.

Structures located at liquefaction-susceptible sites may experience adverse total and differential seismic settlement, permanent horizontal displacement and foundation distress resulting from lateral spreading, and surface manifestations including sand boils. Mitigation methods for these hazards may include ground improvement, stiffened shallow foundation systems, or use of deep foundations for structural design. Pipelines located in liquefiable soils may require use of flexible joints capable of tolerating temporary and permanent lateral and horizontal displacements.

Proposed facilities located in areas mapped with Moderate or High landslide susceptibility should be evaluated by an engineering geologist on a site-specific basis. Site-specific investigation may be required to determine if slope stability is a hazard and to develop appropriate mitigation methods for addressing the hazard. Such mitigation methods can include structure setbacks, ground improvement, mitigative site grading, slope stabilization with use of soil nails or rock bolts, and other methods. Design and construction of proposed improvements in areas mapped with Very High landslide susceptibility (i.e. areas with mapped historic or ancient landslides) should be avoided wherever possible.

Rock excavation may be necessary where buried improvements are planned in areas mapped as Little Butte Volcanics or Cascade Volcanics as shown on Figures 3 through 6. A site-specific investigation to determine what types of construction equipment are suitable for rock removal at a given site, or to determine if blasting or mechanical rock excavation may be required.

LIMITATIONS

This letter report was prepared for the exclusive use of the Keller and NSSA and their representatives for the purpose of geotechnical site evaluation for wastewater facilities. The conclusions and recommendations contained in this letter are based on the information and data provided to us, and information that is publicly available. This letter report presents factual data only and 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 borings that will be required for design. We assume that this information is representative of the actual conditions in the project area. Our conclusions and recommendations are based on:

- The limitations of our approved scope, schedule, and budget; and
- Our understanding of the project and information provided by NSSA.

For any site located on or near a slope, there are slope instability risks that 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 recommendations 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.

Sincerely,

SHANNON & WILSON

REGISTERED PROFESSIONAL ENGINEER
77330PE
OREGON
Jan. 10, 2006
ELLIOTT CARL MECHAM
EXPIRES: 12/31/2022

CERTIFIED
OREGON
KEKOA SORENSEN
E 2307
ENGINEERING GEOLOGIST
EXPIRES: 06/01/2022

Elliott Mecham, PE
Senior Associate

Cody Sorensen, CEG
Associate

DSJ/ECM:CKS/mmb

Enc. Figure 1 – Vicinity Map
Figure 2 – Geologic Map
Figure 3 – Peak Ground Acceleration Cascadia Magnitude 9 Earthquake
Figure 4 – Liquefaction Susceptibility
Figure 5 – Landslide Deposits
Figure 6 – Landslide Susceptibility
Attachment A – Important Information About Your Geotechnical Report

References

Beaulieu, J.D., Hughes, P.W., and Mathiot, R.K., 1974, Environmental geology of western Linn County, Oregon: Portland, Oreg., Oregon Dept. of Geology and Mineral Industries Bulletin 84, scale 1:62,500

Burns, W.J., Mickelson, K.A., and Madin, I.P., 2016, Landslide susceptibility overview map of Oregon: Oregon Department of Geology and Mineral Industries, Open-File Report O-16-02.

Franczyk, J.J., Burns, W.J., and Calhoun, N.C., Statewide Landslide Information Database for Oregon, release 4 (SLIDO-4.0), Oregon Department of Geology and Mineral Industries Digital Data Series SLIDO-4.0

Hammond, P.E., Geyer, K.M., and Anderson, J.L., 1982, Preliminary geologic map and cross sections of the Upper Clackamas and North Santiam Rivers area, northern Oregon Cascade Range: Portland, Oreg., Portland State University, scale 1:62,500

Madin, I.P., and Burns, W.J., 2013, Ground Motion, Ground Deformation, Tsunami Inundation, Coseismic Subsidence, and Damage Potential Maps for the 2012 Oregon Resilience Plan for Cascadia Subduction Zone Earthquakes: Oregon Department of Geology and Mineral Industries, Open-File Report O-13-06.

Priest, G.R., Woller, N.M., and Ferns, M.L., 1987, Geologic map of the Breitenbush River area, Linn and Marion Counties, Oregon: Portland, Oreg., Oregon Dept. of Geology and Mineral Industries Geological Map Series GMS-46, scale 1:62,500

Pungrassami, T., 1969, Geologic map and section of the Western Detroit Reservoir Area, Quartzville and Detroit Quadrangles, Linn and Marion Counties, Oregon: Corvallis, Oreg., Oregon State University, thesis, scale 1:24,000

Sherrod, D.R., 1991, Geologic Map of a Part of the Cascade Range Between Latitudes 43°-44°, Central Oregon: U.S. Geological Survey Miscellaneous Investigation Series Map I-1891, scale 1:125,000.

Smith, R.L., and Roe, W.P., 2015, Oregon Geologic Data Compilation, Release 6: Oregon Department of Geology and Mineral Industries, OGDC-6.

United States Geological Survey, Quaternary Fault and Fold Database of the United States, Accessed August 27, 2020. https://earthquake.usgs.gov/cfusion/qfault/query_main_AB.cfm?CFID=1822549&CFTOKEN=e0dfa0c2a59a1f4-BB399363-F835-BD76-309A5D42F655A5F7.

Walker, G.W., and Duncan, R.A., 1989, Geologic map of the Salem 1 by 2 degree quadrangle, Western Oregon: Reston, Va., U.S. Geological Survey Miscellaneous Investigations Map I-1893, scale 1:250,000.

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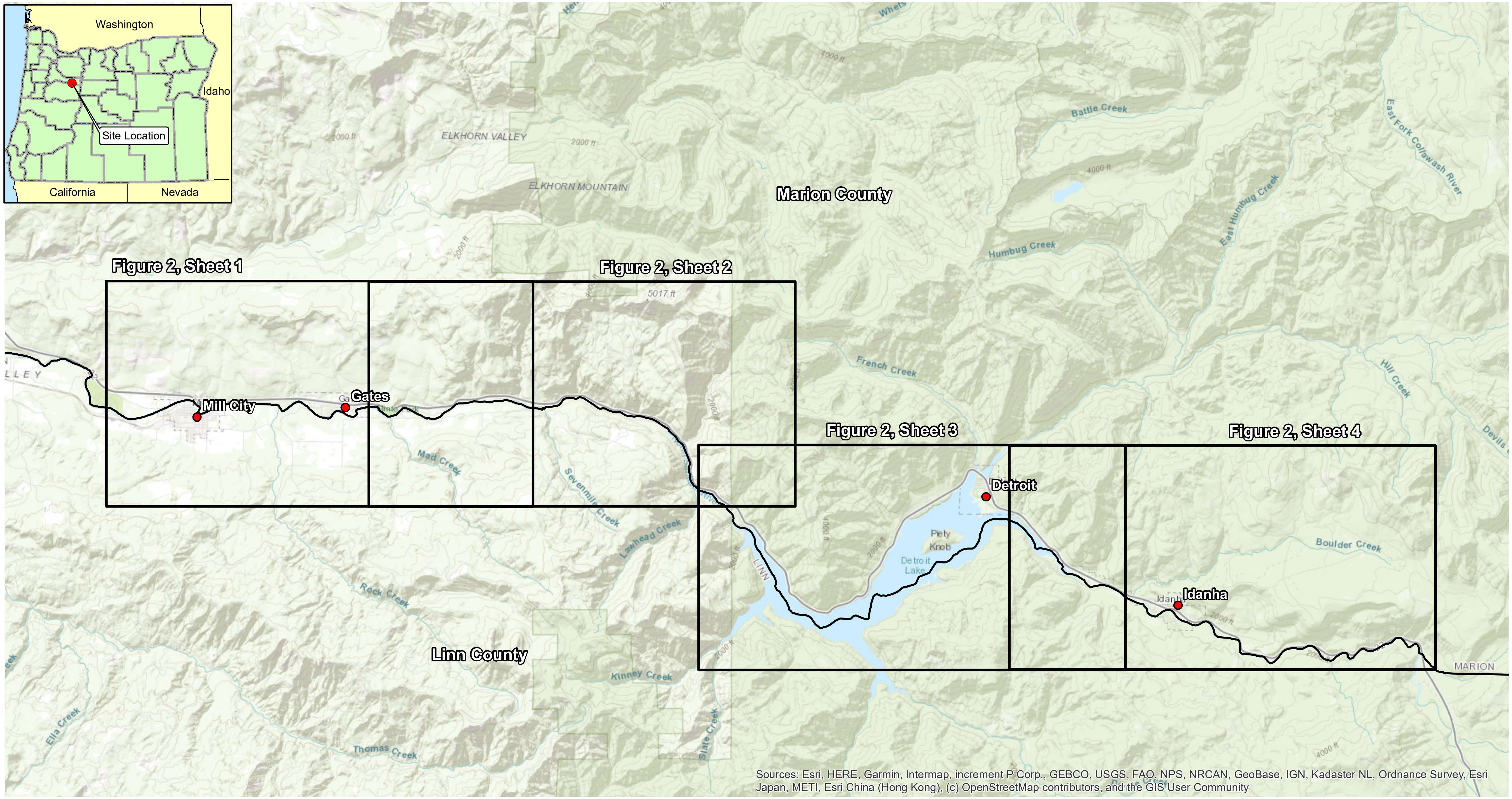

LEGEND

County Boundary

0 1 2 4

Miles

North Santiam Sewer
Marion and Linn Counties, Oregon

VICINITY MAP

June 2021 104120

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1

Filename: T:\Projects\PDX\104000s\104120 North Santiam Sewer\Avmxd\Figure 1 - Vicinity Map2.mxd Date: 9/22/2020 Login: DSJ

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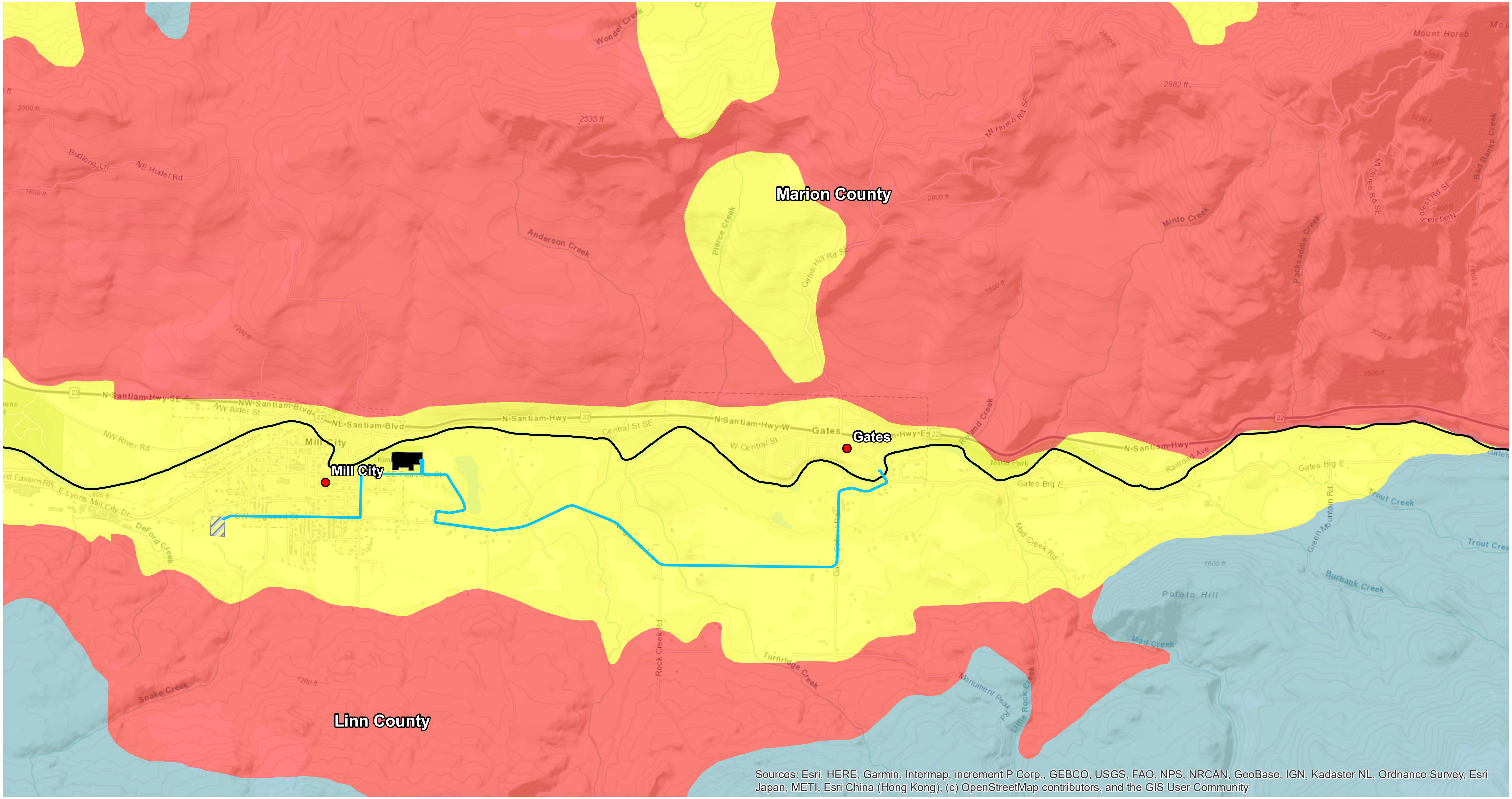

LEGEND

Geologic Map Units

- Quaternary surficial deposits
- Landslide Deposits
- Cascade Volcanics
- Little Butte Volcanics

- Communities
- County Boundary
- Force Mains
- Water Pollution Control Facility
- Disposal Site

0 1,500 3,000 6,000

Scale in Feet

NOTES

1. Geologic Map from DOGAMI publication OGDC Version 6.

North Santiam Sewer
Marion and Linn Counties, Oregon

GEOLOGIC MAP

June 2021 104120

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 1 of 4

Filename: T:\Projects\PDX\104000s\104120 North Santiam Sewer\Avmxd\Figure 2 - Geologic Map (NEW).mxd Date: 6/4/2021 Login: DSJ

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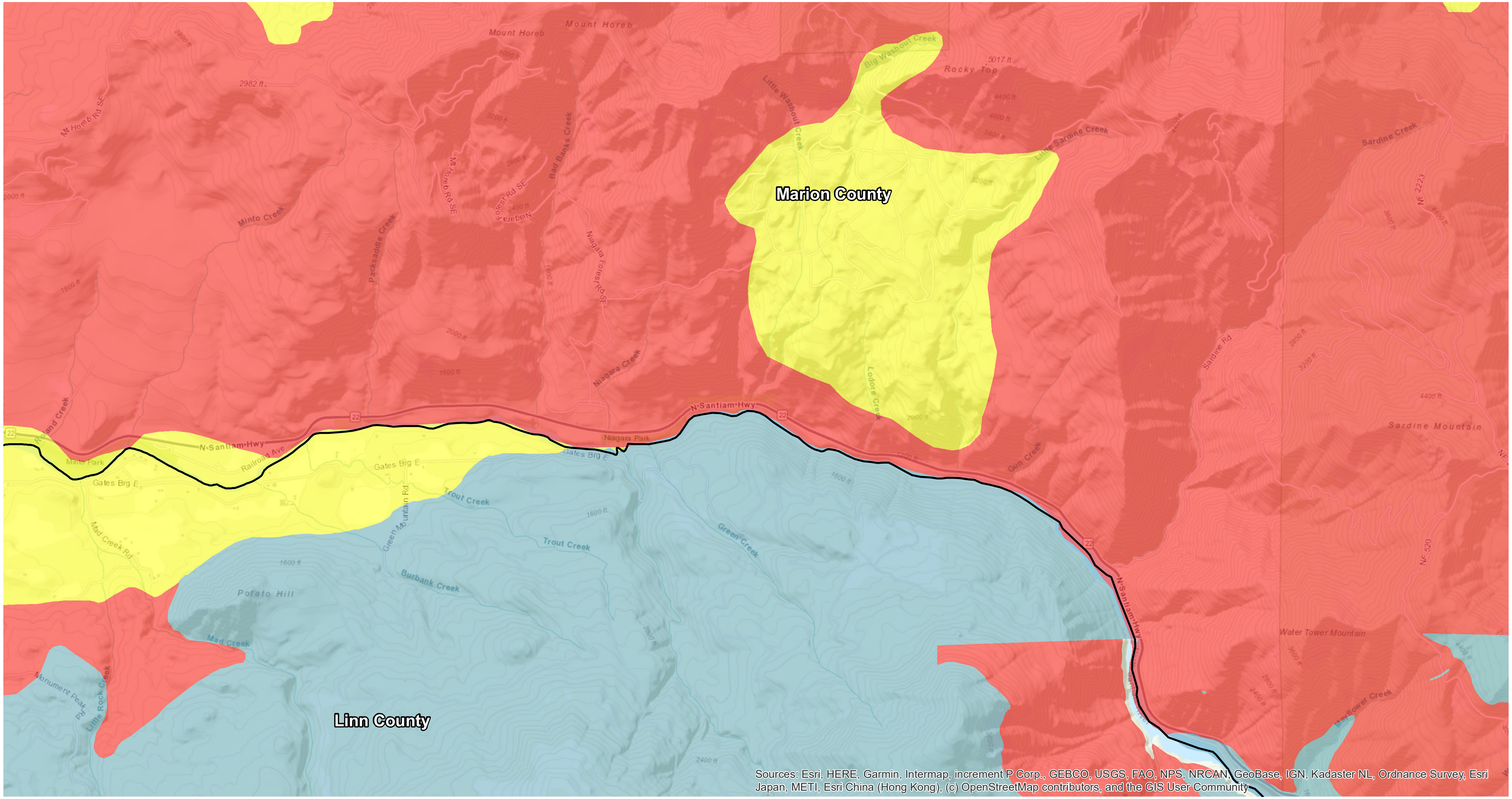

LEGEND

Geologic Map Units

- Quaternary surficial deposits
- Landslide Deposits
- Cascade Volcanics
- Little Butte Volcanics

- Communities
- County Boundary

0 1,500 3,000 6,000

Scale in Feet

NOTES

1. Geologic Map from DOGAMI publication OGDC Version 6.

North Santiam Sewer
Marion and Linn Counties, Oregon

GEOLOGIC MAP

June 2021 104120

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 2 of 4

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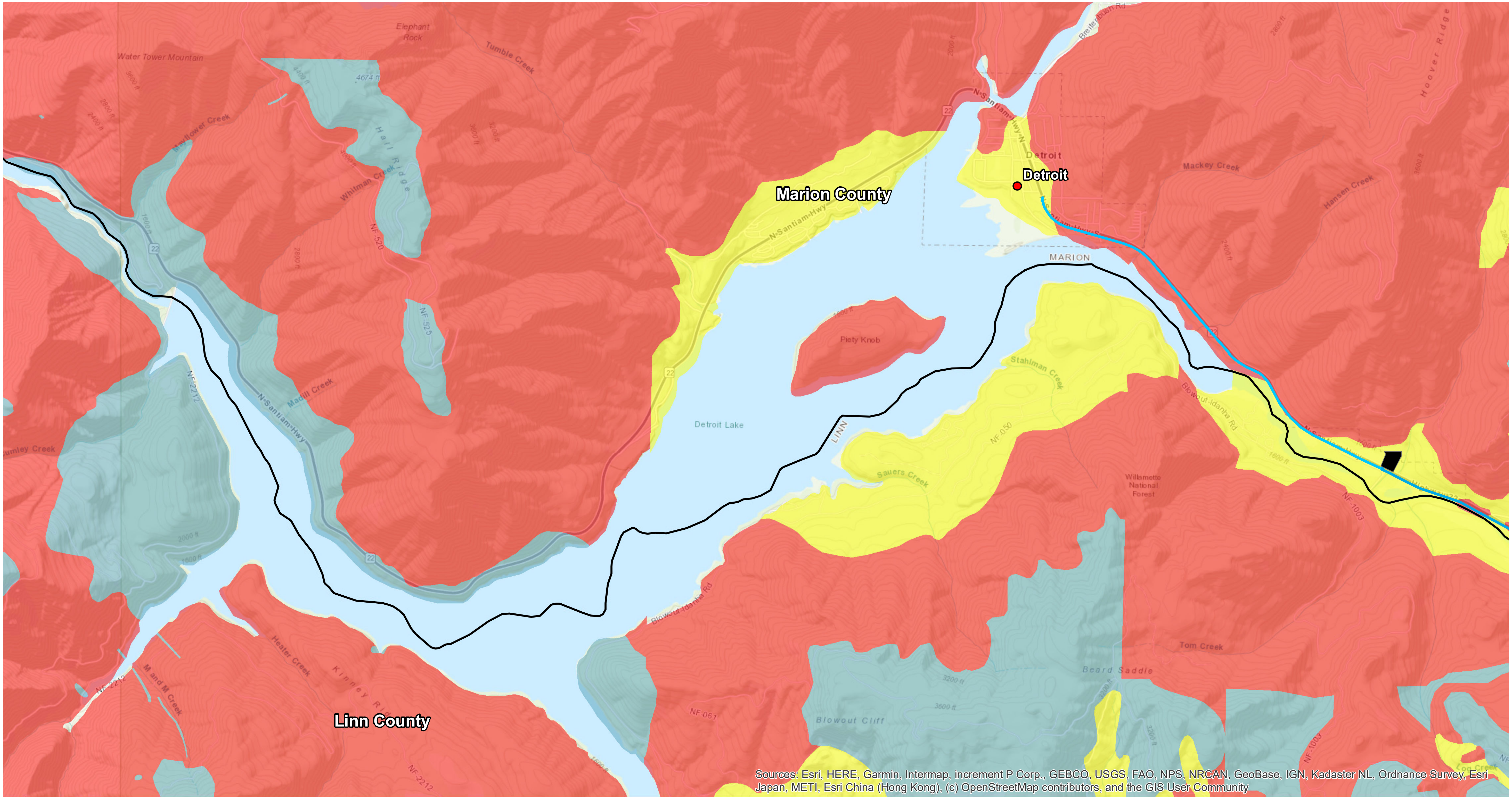

LEGEND

Geologic Map Units

- Quaternary surficial deposits
- Landslide Deposits
- Cascade Volcanics
- Little Butte Volcanics

- Communities
- County Boundary
- Force Mains
- Water Pollution Control Facility

0 1,500 3,000 6,000

Scale in Feet

NOTES

1. Geologic Map from DOGAMI publication OGDC Version 6.

North Santiam Sewer
Marion and Linn Counties, Oregon

GEOLOGIC MAP

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FIG. 2
Sheet 3 of 4

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LEGEND

Geologic Map Units

- Quaternary surficial deposits
- Landslide Deposits
- Cascade Volcanics
- Little Butte Volcanics

- Communities
- County Boundary
- Force Mains
- Water Pollution Control Facility
- Disposal Site

0 1,500 3,000 6,000

Scale in Feet

NOTES

1. Geologic Map from DOGAMI publication OGDC Version 6.

North Santiam Sewer
Marion and Linn Counties, Oregon

GEOLOGIC MAP

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FIG. 2
Sheet 4 of 4

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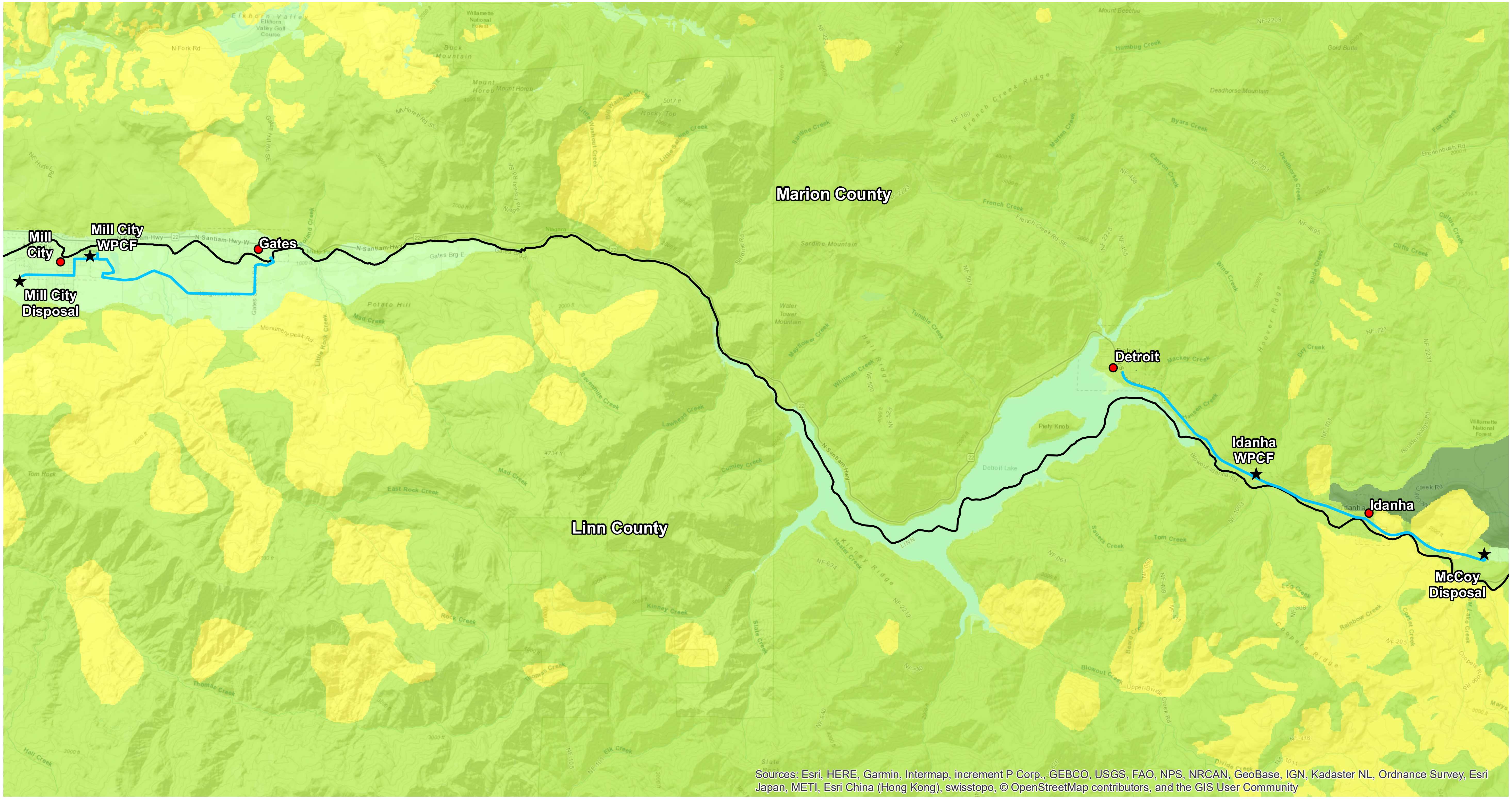

LEGEND

Site Peak Ground Acceleration (g)

- 0 - 0.045
- 0.045 - 0.090
- 0.090 - 0.14
- 0.14 - 0.18
- 0.18 - 0.23

- County Boundary
- ★ Points of Interest
- Force Mains

0 0.75 1.5 3
Miles

NOTES

1. Site peak ground acceleration from DOGAMI Open-File Report O-13-06

North Santiam Sewer
Marion and Linn Counties, Oregon

PEAK GROUND ACCELERATION CASCADIA MAGNITUDE 9 EARTHQUAKE

June 2021 104120

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FIG. 3

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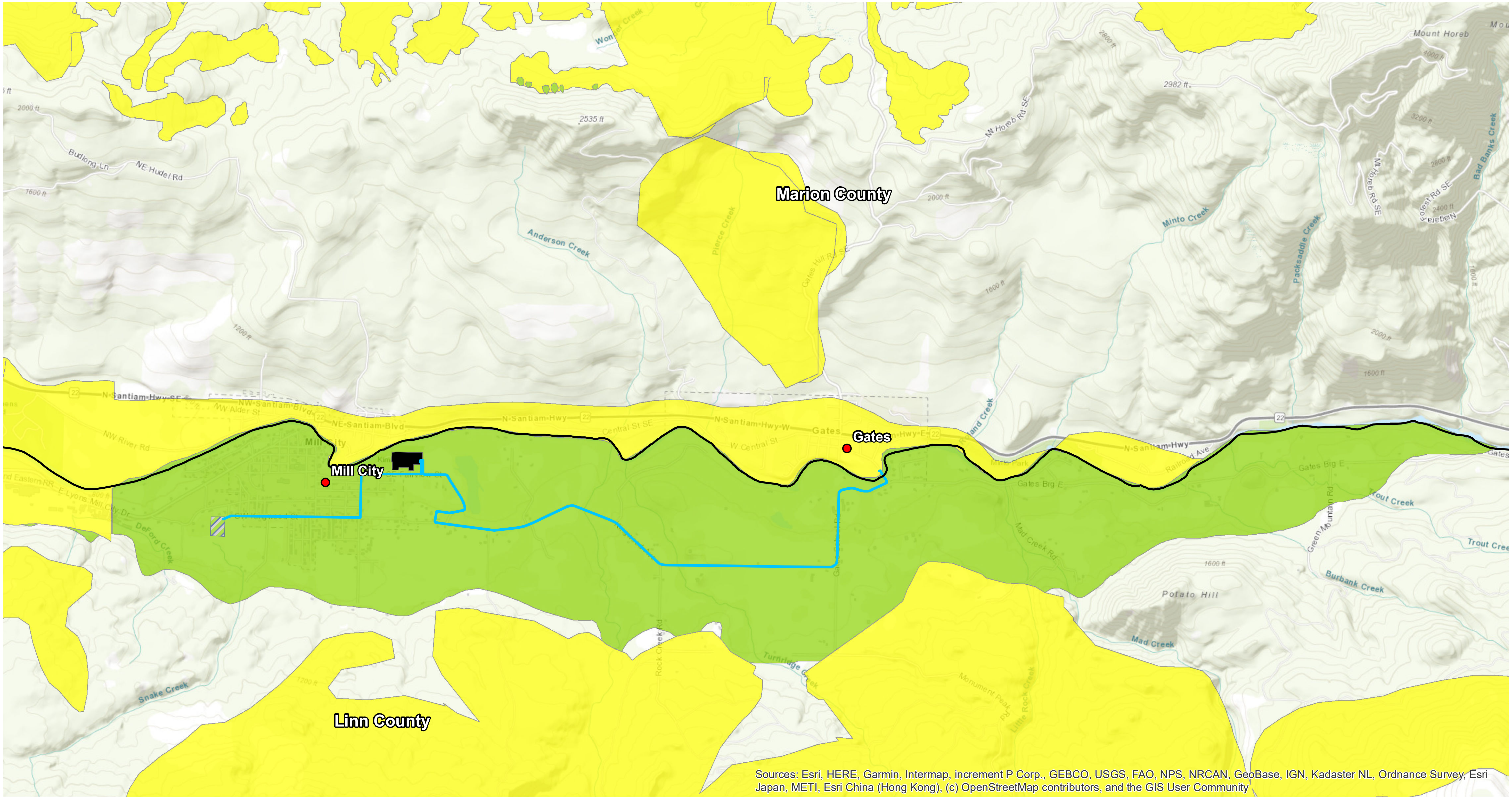

LEGEND

Liquefaction Susceptibility

- Low
- Moderate
- Communities
- County Boundary
- Force Mains
- Water Pollution Control Facility
- Disposal Site

0 1,500 3,000 6,000

Scale in Feet

NOTES

1. Liquefaction susceptibility from DOGAMI Open-File Report O-13-06

North Santiam Sewer
Marion and Linn Counties, Oregon

LIQUEFACTION SUSCEPTIBILITY

June 2021 104120

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FIG. 4
Sheet 1 of 4

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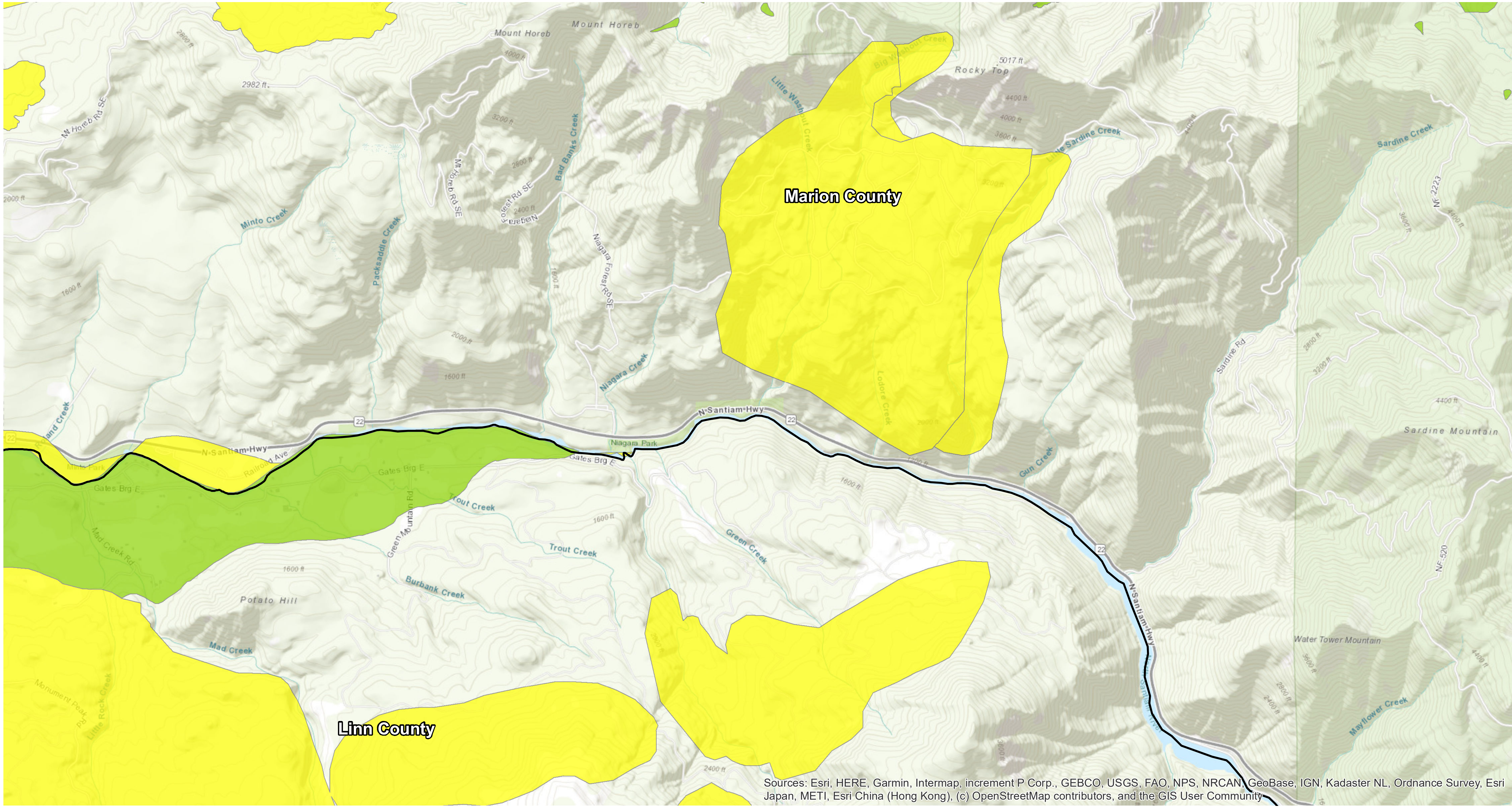

LEGEND

Liquefaction Susceptibility

- Low
- Moderate

- Communities
- County Boundary

0 1,500 3,000 6,000

Scale in Feet

NOTES

1. Liquefaction susceptibility from DOGAMI Open-File Report O-13-06

North Santiam Sewer
Marion and Linn Counties, Oregon

LIQUEFACTION SUSCEPTIBILITY

June 2021 104120

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 4
Sheet 2 of 4

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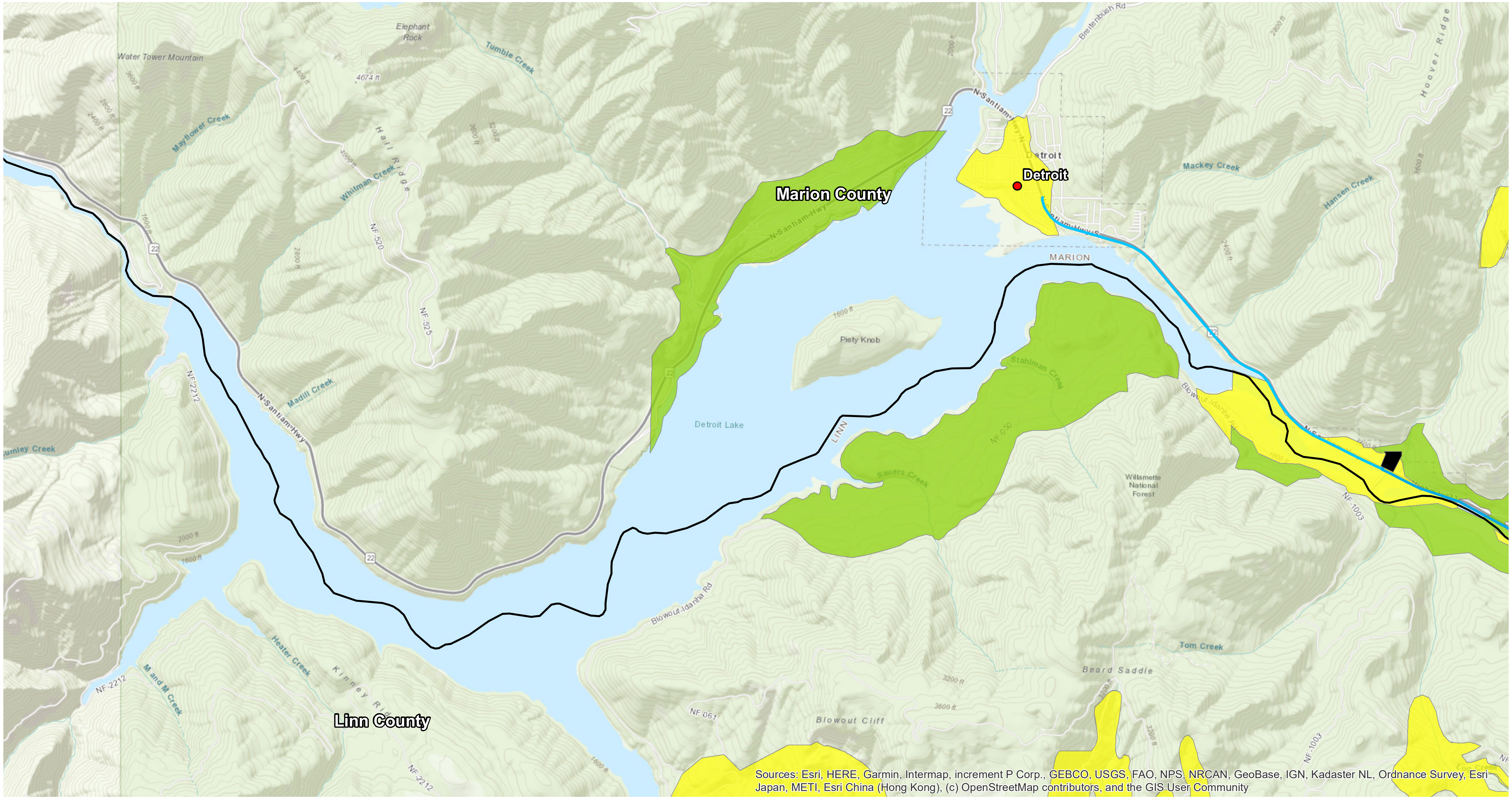

LEGEND

Liquefaction Susceptibility

- Low
- Moderate

- Communities
- County Boundary
- Force Mains
- Water Pollution Control Facility

0 1,500 3,000 6,000

Scale in Feet

NOTES

1. Liquefaction susceptibility from DOGAMI Open-File Report O-13-06

North Santiam Sewer
Marion and Linn Counties, Oregon

LIQUEFACTION SUSCEPTIBILITY

June 2021 104120

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 4
Sheet 3 of 4

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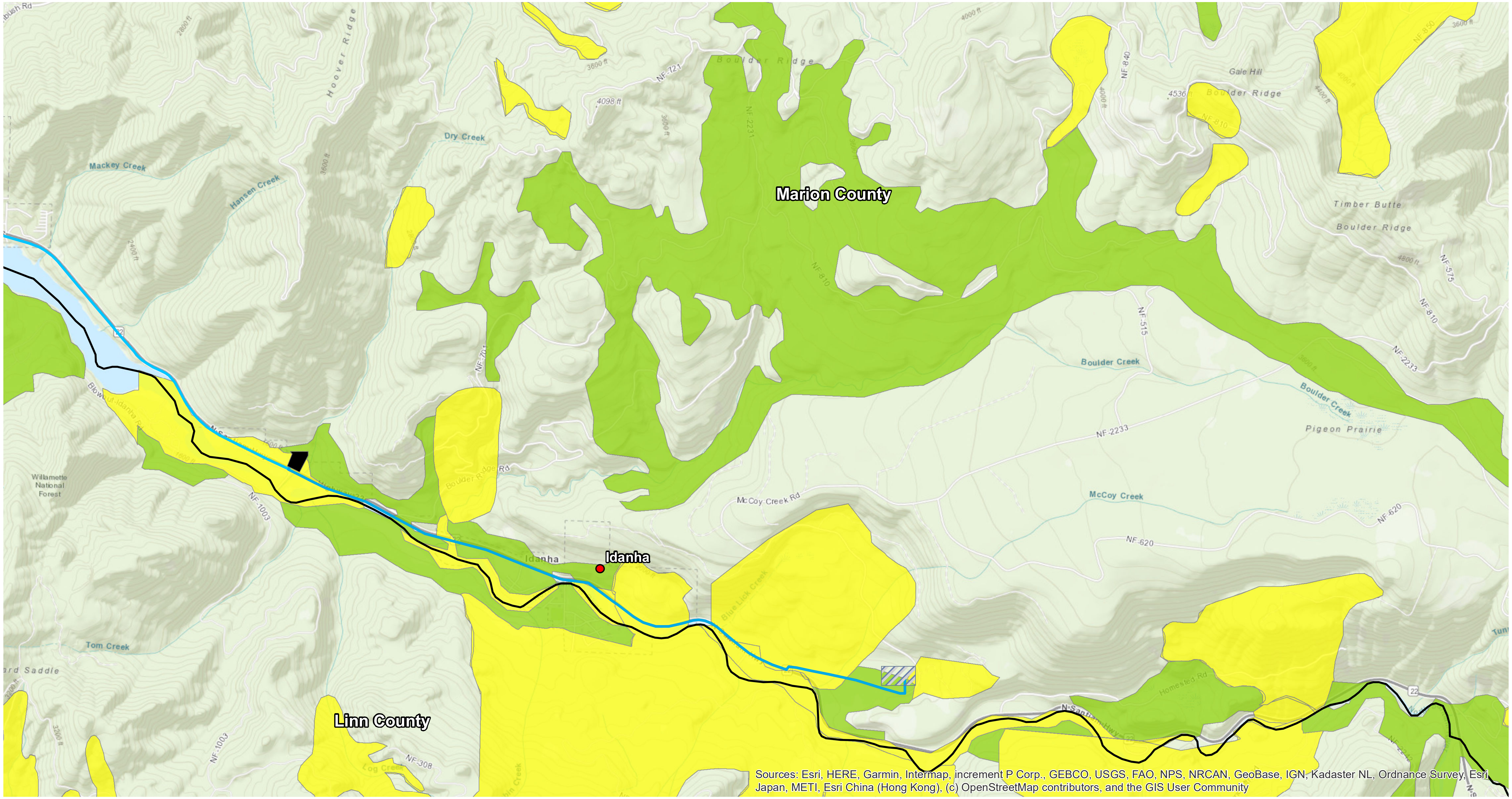

LEGEND

Liquefaction Susceptibility

- Low
- Moderate

- Communities
- County Boundary
- Force Mains
- Water Pollution Control Facility
- Disposal Site

0 1,500 3,000 6,000

Scale in Feet

NOTES

1. Liquefaction susceptibility from DOGAMI Open-File Report O-13-06

North Santiam Sewer
Marion and Linn Counties, Oregon

LIQUEFACTION SUSCEPTIBILITY

June 2021 104120

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 4
Sheet 4 of 4

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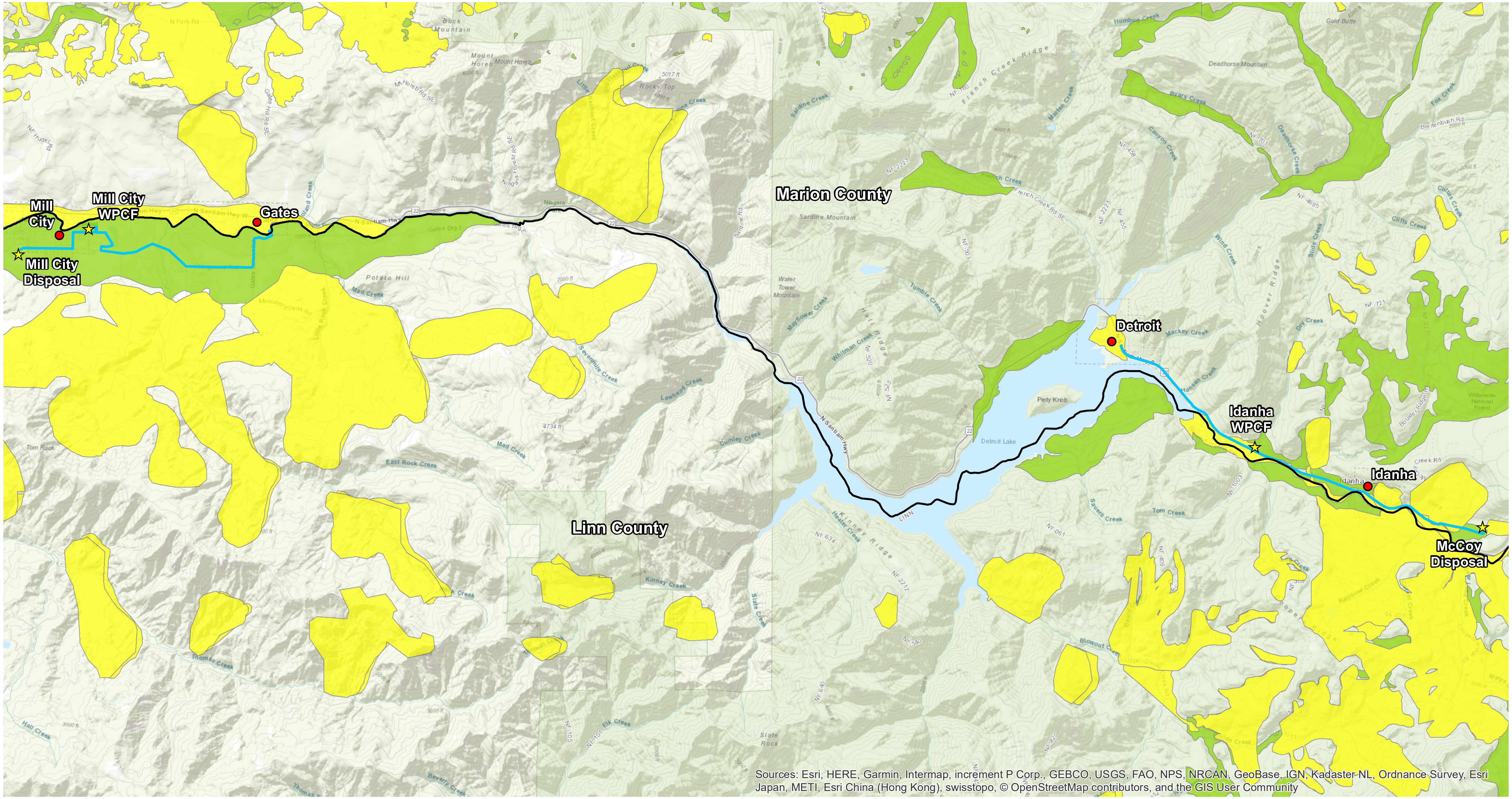

LEGEND

Liquefaction Susceptibility

- Low
- Moderate

- Points of Interest
- Force Mains
- County Boundary

0 0.75 1.5 3
Miles

NOTES

1. Liquefaction susceptibility from DOGAMI Open-File Report O-13-06

North Santiam Sewer
Marion and Linn Counties, Oregon

LIQUEFACTION SUSCEPTIBILITY

June 2021 104120

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 4

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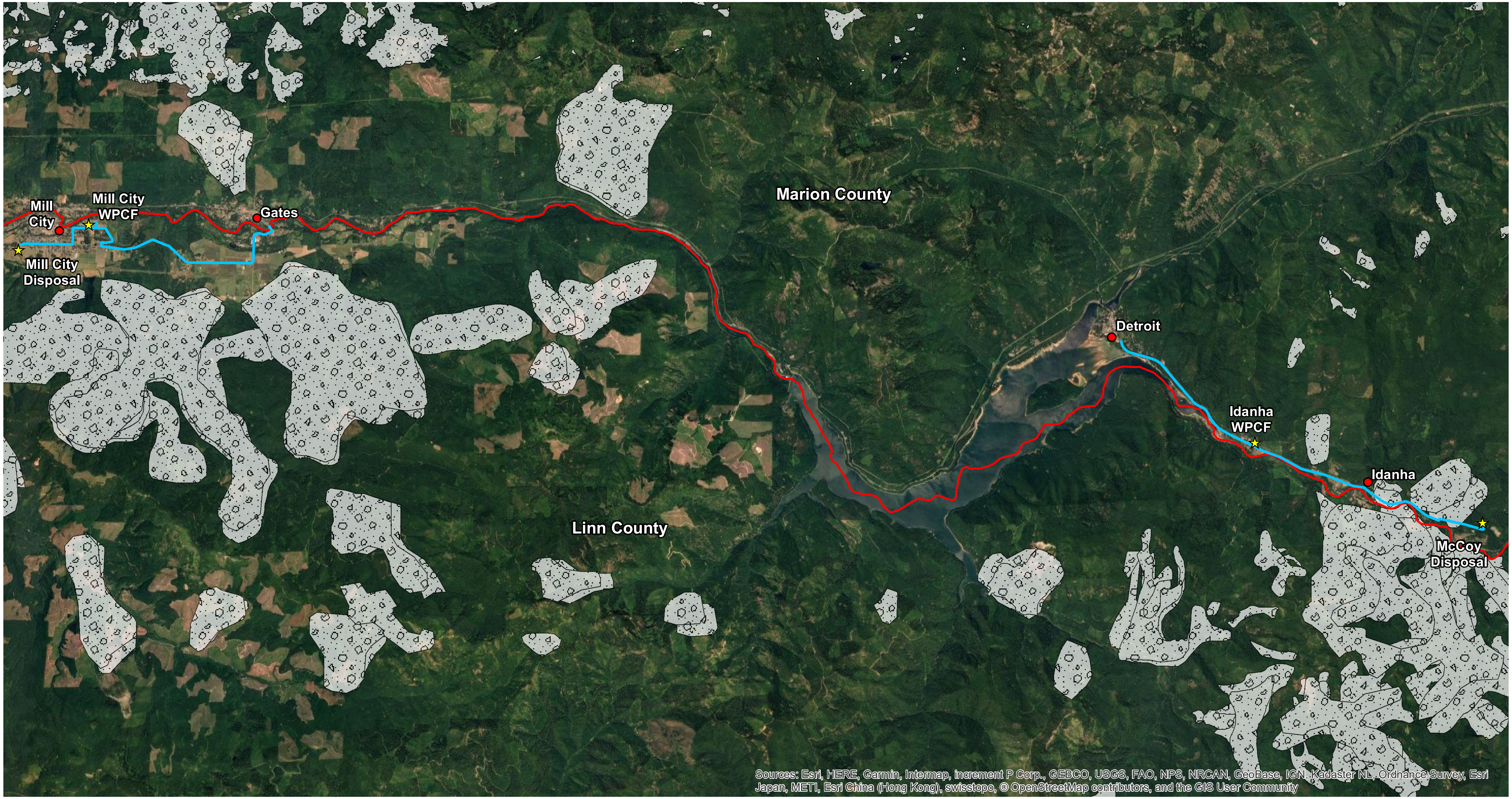

LEGEND

- Landslide Deposits
- Points of Interest
- Communities
- County Boundary
- Force Mains

0 0.75 1.5 3
Miles

NOTES

1. Landslide deposits from DOGAMI SLIDO-4.0.
2. Satellite imagery from Google Maps.

North Santiam Sewer
Marion and Linn Counties, Oregon

LANDSLIDE DEPOSITS

June 2021 104120

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FIG. 5

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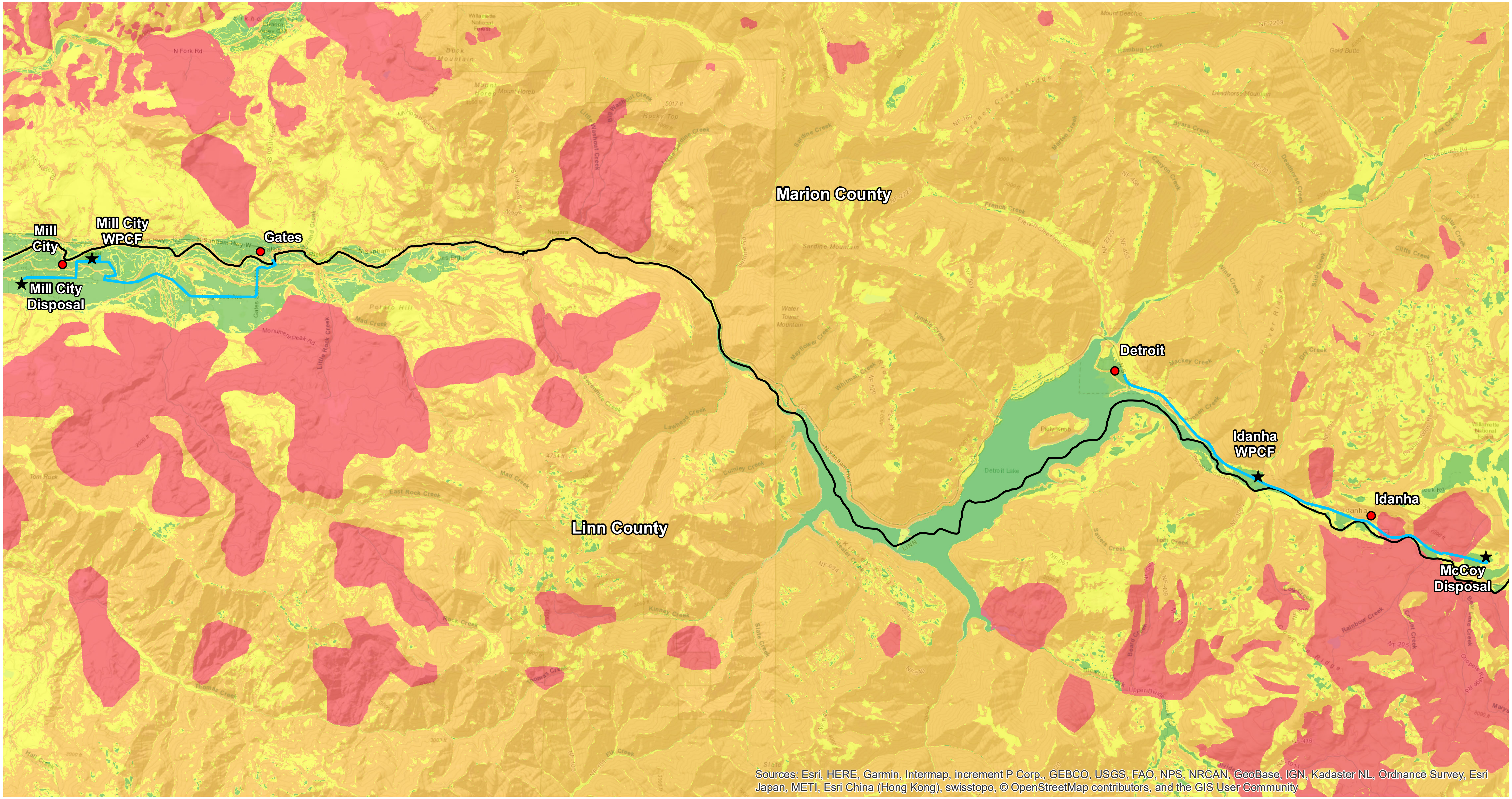

LEGEND

Landslide Susceptibility
- Low
- Moderate
- High
- Very High

★ Points of Interest

Force Mains

County Boundary

0 0.75 1.5 3

Miles

NOTES

1. Landslide susceptibility from DOGAMI Open-File Report O-16-02

North Santiam Sewer
Marion and Linn Counties, Oregon

LANDSLIDE SUSCEPTIBILITY

June 2021 104120

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FIG. 6

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ATTACHMENT A

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

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SHANNON & WILSON
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Attachment to and part of Report: 104120
Date: June 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 ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

Appendix I:
NOAA Atlas 2, Volume X

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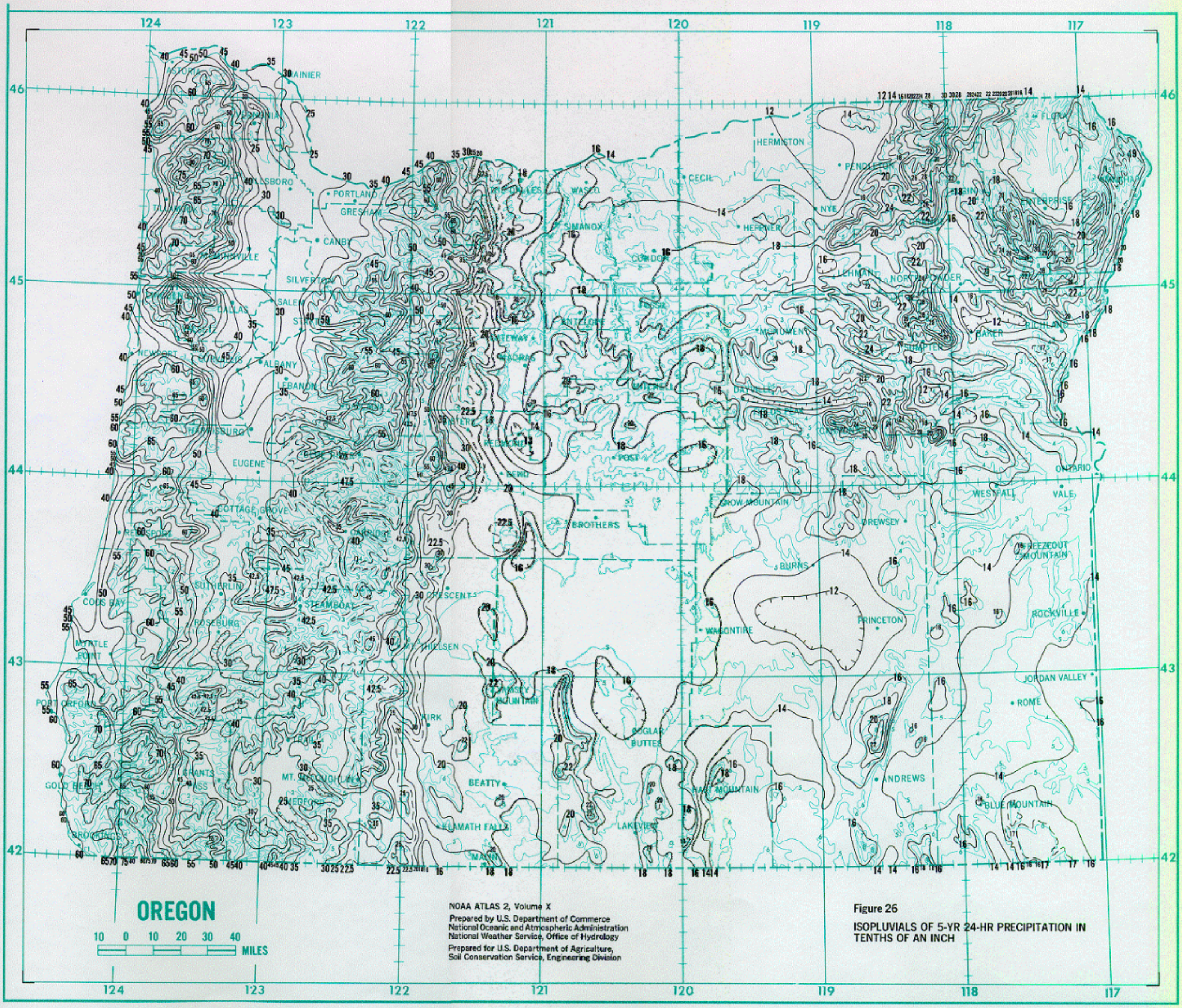

Figure 26

ISOPLUVIALS OF 5-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

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Appendix J: Average Annual Precipitation Map

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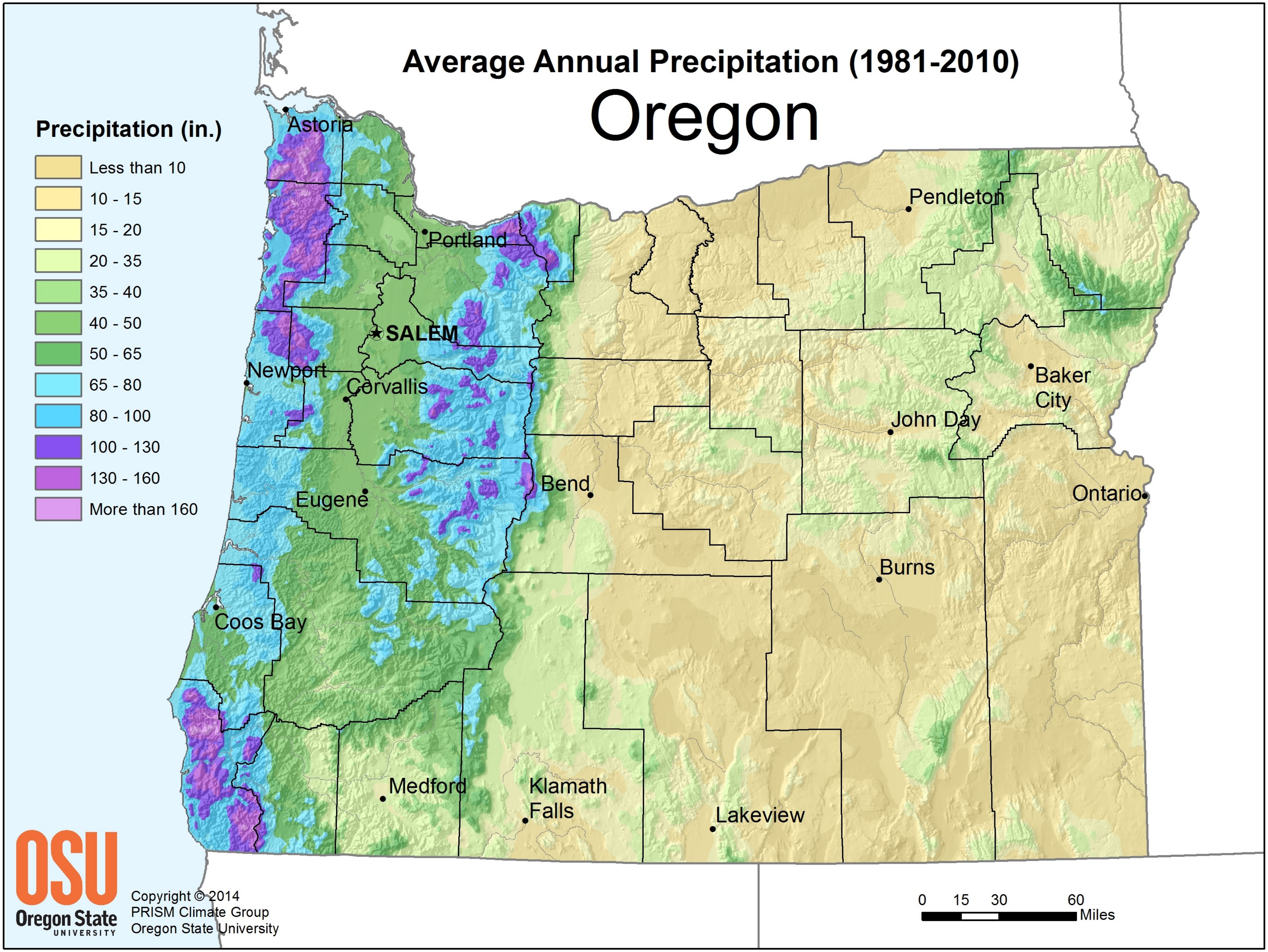
Average Annual Precipitation (1981-2010)
Oregon
Precipitation (in.)
Less than 10
10 - 15
15 - 20
20 - 35
35 - 40
40 - 50
50 - 65
65 - 80
80 - 100
100 - 130
130 - 160
More than 160
Astoria
Portland
SALEM
Newport
Corvallis
Eugene
Coos Bay
Medford
Klamath Falls
Lakeview
Bend
Burns
Pendleton
Baker City
John Day
Ontario
OSU
Oregon State University
Copyright © 2014
PRISM Climate Group
Oregon State University
0 15 30 60
Miles

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Appendix K:
Business Case Analysis

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FCS GROUP
Solutions-Oriented Consulting

| Technical Memorandum

To: Peter Olsen, Keller Associates **Date:** August 27, 2021

From: Gordon Wilson, FCS GROUP Gordon Wilson

Subject: Business Case Analysis – North Santiam Canyon Sewer Project

INTRODUCTION

The purpose of this memo is to document the business case analysis for a new regional sewer system in the North Santiam Canyon (NSC). We will also document the valuation of the existing Mill City sewer utility, which is a subset of the overall business case analysis.

This memo will first describe the purpose and background for the overall business case analysis. We will discuss the key variables that drive economic feasibility for a new NSC sewer utility, along with the assumptions we made regarding those variables. We will share our tentative findings about the economic feasibility of an NSC sewer utility, after which we will compare alternatives to a regional sewer system. Finally, we will make summary observations about the decisions faced by the parties to a regional system.

Appendix A will describe the valuation of the Mill City sewer utility.

Purpose of Business Case Analysis

The purpose of the business case analysis is to identify and test the conditions under which a new regional wastewater system in the North Santiam Canyon could be economically feasible. It includes an explanation of the key variables that would drive financial feasibility, reasonable assumptions about those variables, and an analysis of the alternative choices available to the decision-makers whose support would be necessary.

Background

The regional system under consideration would be a partnership between four cities: Detroit, Gates, Idanha, and Mill City. Mill City has an existing wastewater system; the other three cities have water systems but not a sanitary sewer system. Instead, their properties rely on individual septic systems. The cities have formed a legal partnership, the North Santiam Sewer Authority (NSSA), to pursue the construction and operation of a public sanitary sewer system for the four communities.

Our primary sources of data are the technical evaluation and cost estimates developed by Keller Associates for the NSC Wastewater Master Plan. At this stage, the analysis ignores phasing and the connection ramp-up period. It simply looks at an assumed number of paying customers and compares it with ongoing costs that would need to be covered by those customers.

ECONOMIC FEASIBILITY

Key Variables

The economic feasibility of a new utility depends on the relationship between costs and revenues. If the amount of revenue is sufficient to pay the ongoing costs of the utility, then the utility is *economically feasible*—that is, it is able to be a financially self-supporting organization. Even though a sewer utility provides a service that is critical to environmental and human health, the general expectation in this country is that sewer utilities will not depend on taxpayer funding on an ongoing basis. New sewer utilities often receive "launch aid" from tax resources for their initial capitalization, but they are expected to recover their ongoing costs from rate revenue paid by connected customers.

Terminology: In this analysis, we will use the term "grants" as shorthand for any cash support from an outside governmental source that does not need to be paid back. It may be called a "legislative direct appropriation" or "earmark" or "grant" or "contribution," and it may come from the federal, State, or a county government.

Utility costs are divided between *up-front costs* and *ongoing costs*. In general, up-front costs come from capital investment. Because wastewater systems are very capital-intensive, a new sewer utility will often receive grants for a large share of its initial capital costs. After subtracting the amount of grants from the initial capital investment, a new sewer utility will typically borrow money for the remainder. The resulting debt leads to a type of ongoing cost—debt service. When added to ongoing operating and administrative costs, debt service contributes to the rate *revenue requirement*.

The revenue requirement divided by the number of customers divided by twelve months determines the monthly *rates*. The number of customers is typically measured in *equivalent dwelling units* (EDUs). An EDU represents the equivalent level of demand on the system that would come from an average single-family home. For single family residential customers, each connection is equal to one EDU. However, for multi-family, commercial, or industrial customers, one connected property may represent many EDUs. In this analysis, the *average cost per EDU* is a simplified way of talking about the overall level of rates.

Once grants are subtracted from the up-front capital costs and the remainder is converted into debt service, there are three key variables in determining the ongoing viability of the North Santiam Canyon sewer utility: the ongoing costs, the number of EDUs, and the level of monthly rates. In the rate calculation, costs are the numerator—a higher cost leads to *higher* rates. The number of EDUs is the denominator—a greater number of EDUs leads to *lower* rates. If rates are too high, property owners will not be willing to connect, and the system will not generate enough revenue. If rates are too low, the system will not generate enough revenue to pay its ongoing costs, even if all potential EDUs are connected. The utility needs an adequate number of people paying adequate monthly rates for the system to be economically viable.

Funding Up-front Capital Costs

In funding up-front capital costs, there is an important difference between *financing* and the ultimate *cost responsibility*. *Financing* consists of the borrowing mechanism through which a large up-front cost is spread over time. *Cost responsibility* is the question of who is ultimately responsible to pay off the debt.

In addressing a funding need, the financing is the easy part. The hard part of infrastructure funding is the ultimate cost responsibility. For example, if someone talks about "State or federal *loans*" as a funding source, they are really talking about financing—nice, but revenue is still required to pay back the loan. However, if someone talks about "State or federal *grants*," that is an actual shift in cost responsibility—a much more significant factor in the feasibility of a project.

For most sewer utilities, there are three main sources of cost responsibility for capital investment: *property owners* (including developers), *ratepayers*, and *outside parties* with a policy interest, such as the State or federal government. In this case, because the willingness of property owners to connect is such a crucial and sensitive variable, our analysis assumes that during the initial construction and connection period, property owners will not be charged an up-front assessment or system development charge (SDC). This is a policy judgment for the NSSA Board, but we assume here that the system should make it as easy as possible for property owners to connect, since connection is when they start paying the monthly sewer bills. Minimizing the up-front cost to property owners also makes it more politically realistic to require connection within two years of when sewer is available to a property.

Even costs that are often assigned to the property owner in other utilities—such as the cost of laterals in the right-of-way, or tanks for a Septic Tank Effluent Pumping (STEP) system—are built into the initial project cost estimates for this new system.

Terminology: For simplicity in this memo, we will use the term "STEP system" whether the tank on the property is discharged by pumping or gravity.

The implication of this assumption is that for this particular project, the cost responsibility for up-front capital investment would fall to one of two parties—the ratepayers (who would be responsible to pay off any loans) and outside governments (through grant funding).

This means that the economic feasibility of a new North Santiam Canyon sewer utility rests largely on a two-way balance, between the willingness of property owners to become ratepayers, and the willingness of the State or federal or county governments to provide grants.

KEY ASSUMPTIONS

The following assumptions were used for the initial test of the economic feasibility of the North Santiam Canyon project. While a business case analysis is not a detailed year-by-year financial plan—it is more like a proof of concept—we tried to be realistic in our assumptions.

Up-front Costs:

- Initial project cost:
  - » We assumed the system scenario identified by the NSSA Board as the preferred option (Scenario E2). It is estimated by Keller Associates with a project cost of approximately $106.02 million (rounded) in 2021 dollars.
    - This scenario assumes that the new collection system would consist of gravity lines, while Mill City continues with its STEP systems. It also assumes the construction of two mechanical wastewater treatment plants—a new plant serving Detroit and Idanha and a replacement plant serving Mill City and Gates. These plants would comply with the State's Three-Basin Rule (ORS 340-041-0350).
    - The scenario adopted by the NSSA Board as the preferred option (Scenario E2) has higher up-front capital costs but lower O&M costs than another option using STEP systems for the newly sewered areas (Scenario E1). The Board made its choice of the preferred option based on the long-term cost advantages of gravity lines and the greater difficulty of managing STEP systems over a large area, given the fact that the maintenance of STEP systems is more labor-intensive than gravity systems. Viewed over a 50-year life cycle and assuming a 0.3% discount rate, the preferred option has the lowest life-cycle cost of the scenarios that comply with the Three-Basin Rule.

- » The analysis assumes four years of inflation at 3%/year (midpoint of construction in 2025). Inflation adds about $13.31 million, so the inflation-adjusted initial project cost is estimated at about $119.33 million. If the project were to be delayed, the cost would be even higher.
- » Where STEPs and laterals are needed, they are included in the cost of the initial project.
  - However, the capital cost estimates do not include the cost of STEPs and laterals associated with future development. This is a policy decision for the NSSA Board, but the assumption here is that for future development, property owners or developers will pay for STEPs, laterals, and line extensions if needed. This was the approach taken by Mill City—in 1992, the initial construction of the sewer system included the STEPs and laterals, but subsequent new development has been required to fund any needed line extensions, STEPs, and laterals.

- Acquisition of Mill City Wastewater Utility:
  - » A new regional utility that includes Mill City as a member agency would need to acquire the Mill City wastewater utility.
  - » Assumed value of major fixed assets in the Mill City system: $3,600,000. This valuation is described in **Appendix A**.
  - » Outstanding Mill City sewer debt as of June 30, 2021 (rounded): $2,150,000. The loan payoff would come out of the sale proceeds.
  - » Assumed cost of vehicles and other minor equipment owned by the Mill City sewer utility, net of depreciation: $20,000. This is a placeholder estimate. At the time of an actual transfer of assets and responsibilities, a detailed accounting should be made of the vehicles and other equipment to be transferred to the regional system, and the net book value should be added to the acquisition cost.
  - » Assumed Mill City wastewater utility cash reserves: $310,000. This estimate is a rounded three-year average of the ending fund balances of the Mill City Sewer Operating Fund and Sewer Reserve Fund. At the time of an actual transfer of assets and responsibilities to a new regional system, the then-current cash reserves should be included in the acquisition cost.
  - » Total cost of acquiring the Mill City sewer utility: $3.93 million. Of this, Mill City would receive about $1.78 million, and the State would receive about $2.15 million from the payoff of the outstanding loan.

> *Terminology:* For our purposes in this memo, we use the terms "sewer" and "wastewater" interchangeably. Similarly, we use "system" and "utility" interchangeably. Technically, a wastewater "system" is a collection of fixed assets, while a wastewater "utility" is an organization that owns the system and also has employees, policies, customer accounts, a defined service area, and cash reserves. NSSA would be purchasing the entire wastewater utility from Mill City, not just the fixed assets.

- Assumed additional up-front minor capital: $50,000. This is a placeholder assumption about what the new regional system would need for vehicles and equipment beyond what would be acquired from Mill City.
- The total assumed up-front cost (adding together the inflated initial project cost, acquisition of the Mill City utility, and miscellaneous minor capital) is $123.31 million.

Grant Funding:

- According to Marion County staff, there is a direct legislative appropriation of $40 million that is planned for inclusion in the upcoming State budget. The remaining up-front cost after this appropriation is $83.31 million. Our initial assumption for grant support is 75% of this remaining up-front cost, or about $62.48 million. This variable is tested later in the analysis.

  » The most favorable State loan programs currently require at least 25% local match. That is the basis for the 75% grant assumption for the remaining up-front costs.

- Including the direct appropriation, this initial grant assumption equates to a total of $102.48 million in State/federal funding, or approximately 83% of total up-front costs. This means the local share of the total up-front cost would be $20.83 million.

Debt Service:

- We assumed that the local share of the up-front cost could be financed through State or federal loan programs at a 1% interest rate over a 30-year period.
  - » Existing State loan programs vary in their terms—some have interest rates higher than 1% and some are lower. A 30-year term is the longest we would expect to be offered.
  - » If these loan terms are applied to a $20.83 million up-front local cost, debt service would be about $810,000 per year.

Operating & Maintenance (O&M) Costs:

For regional partnerships, there are two main ways to organize. The regional sewer utility could be an *independent organization*, with a separate headquarters building and a separate General Manager reporting to the NSSA Board. Examples are Clean Water Services, Rogue Valley Sewer, or LOTT Clean Water Alliance.

The regional sewer utility could also be an *embedded organization*, with one of the partners designated as the managing agency. Examples are the Hillsboro Water Commission, North Clackamas Water Commission, or Discovery Clean Water Alliance. With an embedded organization, the Mill City Public Works Director would report to both the City Council and the NSSA Board.

The independent option has the advantage of clearer accountability for managers; however, the embedded option is generally less expensive. For instance, an embedded organization is more likely to take advantage of fractional FTEs to achieve cost economies for both the regional utility and the cities. In addition to sharing operational and management positions with Mill City, it could also contract with the one of the upper canyon cities (Detroit or Idanha) to share public works personnel.

This feasibility test assumes that the regional sewer utility is an embedded organization at first. The initial project cost does not include a headquarters building, and the O&M costs do not assume a separate General Manager.

- For the system maintenance costs, we used the Keller O&M estimate for Option E2, which is about $440,000 per year for the new regional system after it is fully built-out.
- The Keller estimates did not address utility administration costs, which consist of management and customer billing costs. For these costs, our assumption is $310,000 per year. This is twice the Mill City budget for sewer administration, since the new regional system would have about twice as many customers as the existing Mill City system. Of the assumed potential EDUs, about 49% are existing Mill City customers.
- The total assumed O&M costs are therefore about $750,000 per year, and total annual costs--including debt service—are about $1.56 million.

Potential Initial EDUs:

- Our assumption for the potential initial customer base (excluding new development) is 1,696 EDUs, as shown in **Exhibit 1**.
- For Mill City, the EDU figure represents actual EDUs from current City billing records. For the other three cities, this assumption is based on the number of water EDUs before the Beachie Creek fire of September 2020.

Exhibit 1: Assumed Potential Initial EDUs

North Santiam Canyon Sewer Project Business Case Analysis Potential Initial Sewer EDUs by City		Pct of Total
Detroit	494	29%
Gates	278	16%
Idanha	85	5%
Mill City (Existing EDUs)	839	49%
Total Potential Initial Sewer EDUs	1,696	100%

Source: Keller Associates. Except for Mill City, potential sewer EDUs are based on water EDUs for each city.

Calculation of Mill City Existing EDUs	Nov 2020 Number of Accounts	2020 Monthly Charge	EDU Multiple	# Sewer EDUs
Residential:				
Residential - W&S	663	$44.10	1.00	663.0
Residential - Not in Program	9	$27.04	0.61	5.5
Multi-family Units	68	$44.10	1.00	68.0
Total Residential	740			736.5
Non-Residential:				
Commercial - 1 EDU each	32	$44.10	1.00	32.0
Churches & Lodges w/o Food	4	$44.10	1.00	4.0
City Buildings	3	$44.10	1.00	3.0
Public Uses	2	$44.10	1.00	2.0
Non-profits	4	$44.10	1.00	4.0
Schools (Not Auditoriums)	6	$44.10	1.00	6.0
Subtotal Non-Res - 1 EDU each	51			51.0
Restaurants	5	$107.63	2.44	12.2
Churches & Lodges with Food	2	$55.39	1.26	2.5
School Auditoriums	3	$540.23	12.25	36.8
Total Non-Residential	61			102.5
Total City Sewer System	801			**839.0**

Source: Mill City staff

- The number of EDUs is a critical variable for the eventual monthly rates, and this assumption could be either be too high or too low.
  - » On the one hand, there is no guarantee that everyone who lived in these communities before the fire would be able to re-build and willing to connect to public sewer once it is available.
  - » On the other hand, the fact that we are excluding new development provides a buffer in the estimates. It is even possible that new growth will be attracted by the prospect of sewer service. Realistically, the re-building in the aftermath of a catastrophic fire will probably include a mixture of previous and new residents.
  - » Mill City EDUs are a firm estimate, since it is based on customers already connected.

RESULTS OF FEASIBILITY ANALYSIS

Exhibit 2 shows the results of the initial feasibility test, assuming grant funding (including the legislative appropriation) are 83% of the total up-front cost. This table shows how the key variables interact to yield an average monthly cost per EDU—the approximate level of monthly rates.

Exhibit 2: Initial Feasibility Test for North Santiam Canyon Sewer Project

North Santiam Canyon Sewer Project - Business Case Analysis Illustration of Key Financial Variables			
Working Forward - From Capital Cost to Rates		**Preferred Option Scenario E2**	
Ignores phasing and ramp-up in connections.		*3-Basin Rule Compliance*	
Up-front Cost:			
Project Capital Cost (2021 dollars)		$	106,020,000
Inflation - 2020 to 2023	3%/year		13,310,000
Total Project Capital Cost (2025 dollars)		$	119,330,000
Mill City System Acquisition:			
Value of Fixed Assets		$	3,600,000
Assumed Mill City Vehicles/Equipment			20,000
Assumed Mill City Cash Reserves			310,000
Total Cost of Mill City Utility		$	3,930,000
Additional Up-front Minor Capital			50,000
Total Up-Front Cost		$	123,310,000
Assumed Outside Funding (State/Federal/Local Grants):			
State Direct Appropriation FY 2022		$	40,000,000
Remaining Up-front Cost		$	83,310,000
Assumed Grant % of Remaining Up-Front Cost			75%
Grant Funding of Remaining Up-front Cost		$	62,480,000
Total Grant Funding		$	102,480,000
Implied Grant % of Total Up-Front Cost			83%
Local Share of Up-front Cost		$	20,830,000
Debt Service:			
Assumed Length of Loan	30 years		
Assumed Interest Rate	1%		
Total Annual Debt Service		$	810,000
O&M Costs:			
Maintenance *(based on Keller estimate)*		$	440,000
Admin Cost *(2 x Mill City Sewer Admin budget)*		$	310,000
Total O&M Costs		$	750,000
Total Annual Cost		$	1,560,000
Potential Initial EDUs			1,696 EDUs
Actual EDUs for Mill City; for other cities, based on pre-fire number of water EDUs.			
Average Monthly Cost per EDU		$	77
Monthly Cost per EDU by Cost Component			
Debt Service		*$*	*40*
O&M		*$*	*37*
Total		*$*	*77*

With these assumptions, a new regional utility would have an average monthly cost of $77 per EDU with the preferred option.

Sensitivity Analysis for Construction Scenarios

We noted above that Scenario E1, which entails construction of STEP systems instead of gravity lines for the newly served areas, has lower capital costs and higher O&M costs. Although the preferred option has a lower 50-year life cycle cost, Scenario E1 has a lower 20-year life cycle cost, and it would have a rate advantage over the preferred option because of reduced debt service. For any given dollar amount of grant funding, the rates projected for Scenario E1 would be about $7/month less than rates under the preferred option. For the above analysis, this means that Scenario E1 with the same amount of grant dollars would result in rates of $70 per month. The rationale for the preferred option was based on long-term financial considerations and the fact that STEP systems are more labor-intensive and difficult to manage than a gravity system, particularly over a large service area. The implication of the Board's preferred option is that the long-term advantages of a gravity system justify a $7/month rate premium at the outset.

Sensitivity Analysis for Grant Funding

A key variable to test is the overall grant percentage. **Exhibit 3** shows what happens if we undertake the same rate calculation, but we work backwards. Instead of starting with the costs and ending up with the rates, we start with various levels of "maximum tolerable rates" and then see what level of grants are implied by each level of rates.

Exhibit 3: Grant Percentages Implied by Various Levels of Monthly Rates

North Santiam Canyon Sewer Project - Business Case Analysis Illustration of Key Financial Variables					
Working Backward - From Rates to Capital Cost		**1.25% Median HH Income**	**1.4% Median HH Income**	**1.55% Median HH Income**	**2.07% Median HH Income**
Assumed Maximum Tolerable Sewer Rate		$ 60.00	$ 67.50	$ 75.00	$ 100.00
Potential Initial EDUs		1,696 EDUs	1,696 EDUs	1,696 EDUs	1,696 EDUs
Maximum Annual Cost (rounded)		$ 1,221,000	$ 1,374,000	$ 1,526,000	$ 2,035,000
Scenario E2 - 3-Basin Rule Compliance					
Assumed O&M Cost - Preferred Option Scenario E2		$ 750,000	$ 750,000	$ 750,000	$ 750,000
Maximum New Debt Service		$ 471,000	$ 624,000	$ 776,000	$ 1,285,000
Assumed Length of Loan	30 years				
Assumed Interest Rate	1%				
Maximum Local Share of Up-front Cost		$ 12,200,000	$ 16,100,000	$ 20,000,000	$ 33,200,000
Total Up-front Cost		$ 123,310,000	$ 123,310,000	$ 123,310,000	$ 123,310,000
Implied Grant Funding		$ 111,110,000	$ 107,210,000	$ 103,310,000	$ 90,110,000
Implied Grant % of Total Up-front Cost		90%	87%	84%	73%

Assumed Median Household Income (MHI) is $58,000, which is the average 2019 countywide MHI for Linn and Marion counties.

This table explores a maximum tolerable level of rates at $60/month, $67.50/month, $75/month, and $100/month, assuming the preferred option for capital construction costs.

- At $60 rates, the grant percentage would need to be 90% of total up-front costs. That level of grant support might be difficult to achieve.

- At the other end of the spectrum, if the overall grant percentage were 73%, it would require $100 rates. That level of grant support might be achievable, but the NSSA Board has been clear in stating that $100/month rates would be a non-starter in terms of getting residents to connect.
- The two middle scenarios appear to be closer to a balance of the interests of grantors and ratepayers. Assuming 1,696 EDUs paying monthly rates, the regional NSC sewer utility would be financially feasible with either an overall 84% grant percentage and $75 monthly rates, or an overall 87% grant percentage and $67.50 monthly rates.
- Our best estimate at this time for the median household income (MHI) comes from the Census Bureau's 2019 American Community Survey data. The average MHI of Marion and Linn counties is about $58,000 per year. At that level of income, $67.50 monthly rates represent about 1.4% of MHI, which is a key affordability threshold for some grant programs. The $75 monthly rates are equivalent to 1.55% of MHI.
- Based on this analysis, we conclude that if our assumptions are reasonable, there is a pathway for this project to be economically feasible.

ALTERNATE CHOICES

The issue of community acceptability should be framed in the context of other choices that property owners would have. First, we will look at alternative choices faced by Mill City sewer customers. Following will be a discussion of alternative choices faced by property owners on septic systems.

Mill City Choices

For Mill City, the alternative choice is to continue as a separate sewer utility rather than being part of a larger regional system. What might that cost be for Mill City ratepayers?

Impact of Short-term Improvements

According to Keller Associates, the short-term capital improvements needed at the Mill City treatment plant would total about $1.725 million, including direct and indirect costs and the estimated cost of land acquisition. In testing this scenario, we did not assume favorable loan terms from the State. In fact, the State would likely have an interest in discouraging Mill City from exiting the regional partnership, since a regional system minus Mill City would be unable to achieve enough scale to be economically viable. We therefore assumed private revenue bond financing, with a 3% interest rate over 20 years. Because of the small size of the Mill City sewer utility, it might be a challenge to sell revenue bonds on the private market, but here we assumed that it would be possible. We also assumed that an additional $100,000 of annual O&M costs would be required in the relatively short-term to meet treatment standards for an expanded plant.

The results of these assumptions are shown in **Exhibit 4.** The short-term capital and assumed O&M improvements would add about $22/month to the current $44.10 sewer rate. The new total of $66/month would represent a short-term 50% increase in customer rates.

Exhibit 4: Mill City Rates with Short-term Capital Improvements

Mill City Comparison of Alternatives		
If Mill City were not part of a regional partnership:		
Short-term capital investment needed		$ 1,827,000
Source: Keller. Includes soft costs and land acquisition		
Assumed Borrowing Terms:		
Length of Loan	20 years	
Interest Rate	3%	
New Debt Service - annual		$ 120,000
Assumed additional O&M costs		$ 100,000
Total additional annual costs		$ 220,000
Number of EDUs		839
Impact on monthly rate		$ 22.00
Current monthly rate per EDU		$ 44.10
Monthly rate with short-term improvements (rounded)		$ 66.00

These are just the short-term improvements needed. Longer-term treatment plant costs will be driven by regulatory requirements. At the above loan terms, the debt service from every $1 million in capital improvements adds about $7 to the monthly rates, and every $100,000 in required O&M costs add about $10 to the monthly rates.

In the short term, a $66 monthly rate for Mill City as a separate system is $9/month less than the regional rate if a regional utility could be established with an $75 monthly rate, and within $2 of a $67.50 regional rate. However, in order to best compare the choices faced by Mill City and its ratepayers, we need to take into account the impact of the regional system acquiring the City's existing sewer utility.

Impact of Regional Acquisition of Existing Mill City System

A new regional utility would need to acquire the existing Mill City system. **Appendix A** contains a discussion of our recommended acquisition price of $3.6 million for the fixed assets. After deducting the outstanding debt and adding the assumed value of cash reserves and minor equipment, the City would receive about $1.78 million from the regional system. If that amount were to be spread over the remaining life of the Mill City debt at the same interest rate, it is equivalent to approximately $128,500 per year for 15 years. If the City were to distribute that payment to its sewer ratepayers as a bill credit, the amount of the bill credit would be about $12.76 per EDU per month. **Exhibit 5** summarizes the options for how the compensation could be structured.

Exhibit 5: Possible Forms of Compensation for Value of Mill City Wastewater System

Mill City Wastewater Utility Summary of Asset Value Estimate as of June 30, 2021	Alternate Methods: Original Cost Less Depreciation	Replacement Cost New Less Depreciation	Recommended Hybrid Method
Estimated Value of Fixed Assets (rounded)	$ 2,730,000	$ 6,210,000	$ 3,600,000
Option 1: One-time Payment to Mill City			
Outstanding Debt June 30, 2021	(2,148,978)	(2,148,978)	(2,148,978)
Assumed Vehicles & Other Equipment	20,000	20,000	20,000
Assumed Cash Reserves June 30, 2021	310,000	310,000	310,000
Total Asset Value Net of Debt	$ 911,022	$ 4,391,022	$ 1,781,022
Option 2: Annual Payment to Mill City			
Remaining Loan Term-2021 to 2036	15 years	15 years	15 years
Interest Rate on Debt	1%	1%	1%
Annual Payment to Mill City	$ 65,706	$ 316,697	$ 128,454
Current Annual Debt Service	154,993	154,993	154,993
Total Annual Benefit to City (for 15 years)	$ 220,699	$ 471,690	$ 283,447
Includes taking over debt service			
Option 3: Rate Credit on Customer Bills			
Total EDUs (2020 Customer Data)	839	839	839
Monthly Rate Credit for 15 years	$ 6.53 per EDU	$ 31.46 per EDU	$ 12.76 per EDU
Current Debt Service per month	$ 15.39 per EDU	$ 15.39 per EDU	$ 15.39 per EDU
Total Monthly Benefit to Mill City Customers	$ 21.92 per EDU	$ 46.85 per EDU	$ 28.15 per EDU

In other words, if the regional utility rates were to be $75 per month, the amount charged to Mill City customers in this scenario would be $75 minus $12.76, or just over $62 per month for the first fifteen years. This level of rates is less than the $66 monthly rates that might result in the short-term if Mill City were to exit the regional system. If the regional rates were $67.50, then a bill credit would reduce rates to about $55 per month for customers inside Mill City.

There is no guarantee that the City of Mill City would opt to create a sewer bill credit with the payment from the regional sewer utility—it is a policy decision for the City Council. For example, a City representative to the NSSA Board wondered in a Board meeting whether the $1.78 million could be used to repair water pipes. Our only advice on that subject would be that if the City is interested in using the payment for something other than to benefit sewer ratepayers, it should consult with its attorneys about the legality of its planned use. At the very least, establishing a bill credit over 15 years for the Mill City customers of the regional utility would be one reasonable and appropriate way to use the proceeds from the sale of the sewer system, and it could make their monthly sewer bills about the same or less than what they might have had to pay anyway.

After the first fifteen years, the sewer bill credit would go away. But by then, the City's cost of improving and operating an independent wastewater system might well be much higher than $66 per month per EDU anyway.

Summary of Mill City Choices

In summary, the City's choice to continue in the regional partnership largely rests on a comparison of alternatives. The City is growth-constrained, and treatment improvements are needed in the near term. A regional system also offers greater long-term rate stability. In the first 15 years, compensation for the existing system can be used to offset regional rates.

Choices for Property Owners with Septic Systems

Tradeoff – Ongoing Cost with Certainty vs. Capital Cost with Uncertainty

For property owners in Detroit, Idanha, and Gates, the alternative choice is to continue relying on septic systems. For a property owner on septic, converting to public sewer means accepting a monthly cost in exchange for reduced risk of a septic system failure. Septic system failure means at least a large unplanned future capital cost. Depending on lot size and then-current public health requirements, it is even possible that replacement of a failed septic system (or replacement of a septic system damaged in the Beachie Creek fire in September 2020) may not be allowable on an existing lot. If that is the case, a property could be effectively uninhabitable. Connecting to public sewer eliminates that risk.

Exhibit 6 shows the approximate costs related to replacing and operating a septic system. The sources of these estimates are Keller Associates and Hopson Service, which provides pumping and related services for septic systems in the North Santiam Canyon.

Exhibit 6: Approximate Costs Related to Septic Systems

Approximate Costs Related to Septic Systems	
Assumed Up-front Cost of a new Septic System:	
Basic design	$10-15,000
Advanced treatment septic system	$35-40,000
Replacement cost for existing septic system:	
Depends on whether soils have failed, tank has failed, or drain lines have failed.	
Failed soils (most likely cause of failure)	$35-40,000
Failed tank (less common)	$10-15,000
Failed drain lines (less common)	$5-10,000
Source of estimates: Keller Associates	
Pumping cost	
Source: Phone call with Hopson Service	
Current cost is about $550 for 1,000 gallon tank. (Assume $600 to round off monthly cost.) Assume pumping required every 5 years.	
Average monthly cost	$10.00

According to Keller Associates, the cost of replacing a septic system depends on whether the failure comes from the soils, the tank, or the drain lines. The less common scenarios are that either the tank or the drain lines fail. In that case, the replacement cost might be $10-15,000 (tank) or $5-10,000 (drain lines). The more likely scenario is that the soils fail. In that case, a property owner can first try the replacement drain field option at the $5-10,000 price. However, if the replacement drain field area does not solve the problem and there is enough land for a compliant septic system, then an advanced treatment technology (ATT) septic system would be required, costing $35-40,000.

In addition to the potential for sudden capital costs, septic systems must be pumped out periodically. According to Hopson Service, the current cost of pumping a standard 1,000-gallon tank is about $550, and a typical home needs that service about once every five years, meaning an average cost of roughly $10/month. For ATT systems, the State requires an annual service contract, which might be more costly. But if a public sewer were to cost $75 per month, even ATT septic systems would probably have a cost advantage—once they are installed.

Therefore, for any given property owner, the big tradeoff is between certain ongoing costs and potential *capital* costs. The property owner would need to assess the risk—how old is the existing septic system, and how much longer might it last? Septic systems can operate for about 25 years until failure becomes a short-term, "any year now" prospect. If public sewer were to cost $75 per month, that is roughly equivalent to $900 per year. If a property owner judges that the septic system might have to be replaced in about fifteen years, that implies that spending $13,500 on fifteen years of sewer bills would substitute for the risk of having to spend $35-40,000 on an ATT septic system fifteen years from now. In that case, connecting to sewer would look like a good bet. However, if the septic system is relatively new and the property owner judges that it will last 25 or 30 years, then the economic tradeoff is not so clear. Even if a property owner does not run a net present value calculation, there is an intuitive time value of money. For property owners to prefer the public sewer option, the short-term cost with certainty might have to be quite a bit less than the long-term cost with uncertainty. (In assessing how this tradeoff might be perceived by a property owner, we ignore inflation, since both sewer rates and the cost of installing a septic system would be subject to inflation.)

Sewer Rates - What Looks Normal?

The question of community acceptability depends not only on the risk assessment and cost comparison of individual property owners, it also depends on whether the proposed sewer rates seem "normal" and manageable to the people paying the bill. However, the definition of "normal" sewer rates depends on whether we are looking at our neighbors or looking at similarly situated sewer utilities. Utilities that are similarly situated as the North Santiam Canyon regional system would be either new systems with few customers or utilities with a new wastewater treatment plant.

Exhibit 7 shows the 2020 rates for two groups of sewer utilities, where the customer is assumed to use an average of seven hundred cubic feet (ccf) per month. One group is drawn from cities relatively close to the North Santiam Canyon. This is the group that property owners will probably be thinking of when they consider what a "normal" monthly sewer bill is. For long-standing sewer utilities in the Salem area, "normal" would be about $40-$60 per month.

The second group of comparisons consists of sewer utilities with either a new treatment plant or a new system with relatively few customers. For this group of utilities, a sewer rates of over $100 per month are typical.

Exhibit 7: Comparison of Sewer Rates

Sewer Rates - What Looks Normal?		
2020 Monthly Residential Sewer Rates assuming 7 ccf/month		
Salem	$	41.43
Stayton	$	60.05
Mill City	$	44.10
Silverton	$	76.03
Independence	$	51.96
Monmouth	$	37.81
Rates With Either New WWTP or New Systems with Few Customers		
Blaine - new Wastewater Treatment Plant	$	109.60
Cashmere - new Wastewater Treatment Plant	$	108.19
Oak Harbor - new Wastewater Treatment Plant	$	110.08
Carnation - new system, new Wastewater Treatment Plant	$	112.72
Belfair - new WWTP, new system (subsidized rate)	$	96.00
North Bay/Case Inlet - New WWTP, new system (unsubsidized)	$	115.00

In the second group of utilities, the first three examples (Blaine, Cashmere, and Oak Harbor) consist of existing sewer utilities that had to re-build a treatment plant, which led to rates of over $100/month. In those cases, property owners had no option but to pay the higher rates—they did not have septic systems, and they did not have a choice about whether to connect or not. For new utilities such as NSSA, it is more difficult to achieve connections at scale if the rates are $100 or more.

A local government sponsoring a new sewer system may have the authority to require connection within a certain time period after sewer is available. Even if the NSSA Board elects not to create a firm deadline for connection, NSSA or the cities can design a mixture of requirements and incentives that encourage sewer connection. A firm deadline might be more acceptable to the community if the sewer rate is manageable and there are few or no up-front costs applied to property owners.

Summary of Alternatives Analysis

To assess community acceptability to property owners with septic systems, we have looked at two considerations: the economic tradeoff faced by an individual property owner, and the degree to which the level of sewer rates might be perceived as "normal." We have also assessed the impact on current Mill City customers of being part of a regional system vs. continuing as an independent utility.

Our review confirms the NSSA Board's advice that $100/month rates would probably not be acceptable to the community. Rates at that level would likely result in too few property owners converting from septic systems to sewer connections, and $100 rates would also make it difficult for Mill City officials to persuade current ratepayers that being part of a regional system makes sense.

On the other hand, sewer rates closer to $67-75 per month would be challenging but not necessarily out of the range of acceptability. If rates were closer to $67-75/month instead of $100/month, the economic consideration for property owners on septic—the tradeoff between a short-term known cost and the prospect of a much larger future cost—would shift more in favor of connecting to public sewer in order to mitigate their risks. For Mill City customers, a regional rate at the $67-75 level would clearly be a stretch—even if a bill credit is offered, it would be a large increase over their current rates. But City officials can make the case that a large short-term rate increase would be necessary in either case, and a regional system offers the best prospects for long-term rate stability.

SUMMARY OBSERVATIONS

This is a business case analysis, not a year-by-year financial plan. It does not consider the timing of connections and the possible phasing of project expenditures. This analysis is merely to serve as a preliminary "proof of concept" test regarding the economic feasibility of a new North Santiam Canyon sewer utility. At this stage, the NSSA partners and State officials who have been involved in the process mainly need to know whether it is worth it to take the next steps. Based on that level of analysis, we believe it is worth it to take the next steps, and we can make some observations.

- The economic viability of this project rests on the balance between the willingness of property owners to connect and begin paying monthly rates when sewers become available, and the willingness of the State, federal, or county governments to provide grant funding.
- Given the assumptions described in this memo, there is a realistic pathway for this project to be economically feasible. It would require a high degree of effort from both community members and the State, federal or county governments.
  - Outside grant funding will be needed for a high percentage of project costs.
  - The community would need to be willing to connect to the sewer system, even if the level of monthly rates is perceived to be high.
  - For example, given the assumptions described in this memo, a new NSC sewer utility would be economically feasible if grantors are willing to fund 83% of the total up-front cost *and* if property owners representing 1,696 EDUs are willing to connect when sewer service is available and begin paying monthly rates of $67.50, or 1.4% of the average estimated median income for the two counties. Alternatively, the utility could be financially viable if grants cover 84% of the up-front cost and monthly rates averaging $75 are paid by 1,696 EDUs.
- Acceptability to the community and grantors might be influenced by the lack of other alternatives that both preserve the environment and allow future development or redevelopment.
- Community acceptability may depend on a long-term view.
  - For Mill City customers, if the regional rate is close to $75 per month, the short-term impact of joining a regional utility can be largely if the City passes through to ratepayers the compensation from the sale of the existing utility.
  - For property owners in the other communities, connection to a public sewer system would be less costly than having to install an ATT septic system. In the very long term, a public sewer system is more efficient. However, for a given property, as long as the septic system is functioning, its ongoing cost is much less than the ongoing cost of sewer service. The attractiveness of sewer service will therefore depend on a property owner's judgment about how many years before the existing septic system might fail. The more years of expected future life for a septic system, the more resistance we can expect to sewer connection.
  - Local jurisdictions may be able to require connection and septic decommissioning within 1-2 years of sewer availability, where the nearest point of the property line is within some distance (200 feet is typical) of a sewer line. Imposing a firm connection deadline can be politically difficult, particularly if property owners would be required to pay large up-front connection costs in addition to monthly rates. Even if local leaders decide not to impose a firm connection deadline on properties with sewer availability, a combination of incentives and requirements can influence the decisions of property owners and encourage connection.

Next Steps

Based on the above findings, we believe that it is worth taking at least the following next steps:

- The development of a phasing plan for project costs.
- A year-by-year forecast of potential EDUs by phasing area, including the potential for new growth as well as reconstruction of existing homes and businesses on septic.
- Refinement of the O&M cost estimates.
- A series of policy decisions that will help narrow the range of potential sewer rates.
- Design of either a firm connection requirement or a package of incentives and requirements that might encourage conversion from septic to sewer, once a sewer line is within range.
  - » For instance, a jurisdiction might design its connection policy so that an existing septic property can defer connection as long as the current septic system is functioning and property ownership does not change hands, but connection would be required upon sale or transfer of the property. (This obligation would need to be recorded with the deed.)
  - » Similarly, a jurisdiction might put a fixed deadline on the deferral of septic conversions—something like a maximum of 15 years from sewer availability or 25 years from installation of the septic system.
- Design of requirements for sewer extensions and connections associated with new development, where there is no existing septic system.
- Continued efforts to obtain funding support from the State, federal, or county governments.

APPENDIX A

VALUATION OF MILL CITY SYSTEM

CONTEXT FOR THE VALUATION

Among the four partner cities in the North Santiam Sewer Authority (NSSA), Mill City is the only one with an existing sewer utility. In order to form an integrated regional sewer utility, NSSA would need to acquire the Mill City system. As part of this acquisition, the regional system would take over the Mill City assets and liabilities in exchange for payment.

Purpose and Uses of Valuation

The purpose of this valuation is to determine a recommended Fair Value of the Mill City sewer assets and liabilities. This Fair Value would be used as the amount of compensation from NSSA to the City of Mill City as part of the formation of an integrated regional sewer utility.

The primary use of the recommended Fair Value is to create financial equivalence between Mill City customers and other customers within the regional NSSA service area. Mill City is one of the partner cities in NSSA, and the parties are expected to have a continuing relationship. The NSSA Board has expressed interest in being able to have customer rates that are geographically neutral—that is, the same whether a customer lives in Mill City or Detroit or Idanha or Gates. To achieve that goal, the payment from NSSA to Mill City needs to fully account for the value of the prior investment made by Mill City customers.

The assumed valuation date is July 1, 2021.

Definition of Fair Value

In business valuation, a "Fair Value" is a judgment about a price that would be acceptable to both parties in an arms-length transaction, assuming a willing buyer and willing seller where both parties have all relevant information and neither is subject to compulsion to buy or sell. We use the term "Fair Value" here rather than "Fair Market Value," because there is no meaningful market for sewer utilities, but the basic concepts are the same.

Valuation Methods

The valuation process typically consists of calculating "value indicators" using more than one analytical method, and then making a judgment about which method or combination of methods best fits the facts and purpose of this particular situation.

Traditionally, there are three broad approaches for valuing utilities—Cost, Market, and Income. Each approach may have more than one variation. Two of the broad valuation approaches are not recommended here because they do not address the main purpose of this particular valuation.

- The Market approach consists of looking for comparable sales of similar entities and applying a unit cost metric such as cost-per-acre or cost-per-customer. While useful in valuing residential real estate, this is usually the weakest method in utility valuation because of the lack of comparable sales and lack of good metrics.
- The Income approach consists of projecting the net cash flow (or some other measure of income) and then discounting that to an up-front value at a point in time. This method is often useful in utility valuations—particularly for transactions involving investor-owned utilities—because it tracks closely with the buyer's interests in a buyer-seller transaction. However, the income method is very sensitive to the choice of a discount rate, and it does not apply well to the facts of this particular situation. In this case, the buyer (NSSA) is not trying to generate a profit or a positive cash flow; instead, it is focused on seeking equity between customers in different areas.
- The Cost approach consists of the sum of the measured cost of the component assets comprising the system. A focus on the cost of the assets is directly applicable to the purposes and potential uses of this valuation. There are two common ways to measure the cost of the individual assets:
  - Original Cost Less Depreciation (OCLD)
  - Replacement Cost New Less Depreciation (RCNLD)

Both of these Cost methods are relevant to this situation, but in different ways.

Original Cost Less Depreciation (OCLD)

The OCLD method is based on the net book value—that is, the original cost of the assets less accumulated depreciation. While depreciation is a theoretical construct, the original cost is not theoretical—it is a measurement how much was *actually* invested by the seller at the time the assets were acquired. This method ensures compensation for the seller's prior investment.

The OCLD value is net of grant funding. It is also net of accumulated straight-line depreciation since the date the assets were placed in service, using an assumed useful life by asset class.

The OCLD method relies on historical asset records, which may not be readily available. Because Mill City's accounting is on a cash basis, the City does not maintain a fixed asset accounting database. However, other data sources can be used to estimate the original cost.

Replacement Cost New Less Depreciation (RCNLD)

The RCNLD method focuses on the buyer by measuring *avoided* costs—costs that the buyer would have to incur were it not acquiring these assets. For each type of asset, an engineer's estimate is made of the unit cost if it were to be acquired today. For the Mill City system, those estimates were provided by Keller Associates. Those unit costs are then multiplied by the current inventory for each asset class. For example, if the estimated unit cost of 6" PVC pipe is $213/lineal foot, and the system contains 2,790 lineal feet of that type of pipe, then the total 2021 replacement cost of 6" PVC pipe is assumed to be $594,270.

The percentage of grant funding that was received historically is then applied to the replacement cost and deducted from the total asset cost. Accumulated depreciation is subtracted for the number of years each group of assets has been in service, again making a useful life assumption for each asset class. Because accumulated depreciation differs based on when the asset was acquired, the inventory needs to differentiate assets based on the year they were placed in service.

The RCNLD method is more theoretical than OCLD. The idea of replacement cost is based on a hypothetical—how much would we have to spend if we were to acquire this asset now? The RCNLD method is also a step removed from reality in that it applies depreciation to asset costs that were not actually incurred.

Calculation of Mill City OCLD and RCNLD Estimates

Asset Inventory

We relied on the City of Mill City and Keller Associates for the current inventory of assets. The Mill City wastewater system is relatively simple. Its major individual assets consist of a treatment plant and three lift stations. Its collection system includes pipe ranging from 4” to 8” in diameter, STEP systems (including laterals, tanks and some pumps), cleanouts, and manholes.

The original construction of the system was in 1992. This original construction included the collection system, pump stations and the original treatment plant. It was 66.2% funded by State grants. Our primary data source for the 1992 construction and funding package was the analysis attached to the City’s System Development Charge (SDC) resolution adopted in 2008.

Significant reinvestment took place in 2008 (three replacement pump stations) and 2009 (improvements to the treatment plant). The grant percentages for that project were 25.5% for the 2008 portion and 39.5% for the 2009 portion. Our primary data source for the 2008-09 improvements is the narrative from the FY 2009-10 City budget document.

According to Keller Associates, approximately 60 connections and 2,640 lineal feet of pipe were added to the system between 1992 and 2021. For the sake of simplicity, we assumed that those additions to the system occurred evenly throughout those years, that the pipe was 4” PVC pipe, and that the STEPs were gravity systems.

General Approach to Cost Estimates

- Replacement Costs
  - » For all assets, we used unit cost estimates provided by Keller Associates, multiplied by the number of units.
- Original Costs
  - » For 1992 assets, we used actual costs for the total original project, allocated to the various asset classes by their percentage share of replacement costs.
  - » For pipe and STEP systems built since 1992, our assumed straight-line growth pattern results in an average “in service” year of 2007. We adjusted the replacement unit costs using an inflation index, the Engineering News-Record Construction Cost Index (ENR-CCI).
  - » For 2008 and 2009 projects, we had actual historical cost data divided between the treatment plant and pump stations.

Results

Exhibit 8 shows the OCLD and RCNLD calculations for each asset class. The OCLD estimate is about $2.7 million, and the RCNLD estimate is about $6.2 million. Detailed calculations for individual asset classes are shown in the tables at the end of **Appendix A**.

Exhibit 8: Asset Costs for Mill City Wastewater System

Mill City Wastewater Utility
Asset Valuation

Assets	Age and Assumed Service Life					Construction Cost Index		Grants	Comments
Asset Description	**Year Placed in Service (Average)**	**Age as of 2021 (Years)**	**Assumed Service Life (Years)**	**Remaining Life (Years)**	**Accum Depreciation Percentage**	**CCI (Year Placed in Service)**	**Assumed 2021 CCI**	**Grant Percentage**	**Comments on Source and Method**
Sewer Mains (excluding Laterals)									
4-Inch PVC (Gravity) - 1992	1992	29	75	46	39%	4,985	11,770	66.2%	*Replacement Costs:*
6-Inch PVC (Gravity) - 1992	1992	29	75	46	39%	4,985	11,770	66.2%	For all assets, used engineer's estimate of
8-Inch PVC (Gravity) - 1992	1992	29	75	46	39%	4,985	11,770	66.2%	current unit costs, multiplied by number of units.
4-Inch PVC (Pressure) - 1992	1992	29	60	31	48%	4,985	11,770	66.2%	*Original Costs:*
6-Inch PVC (Pressure) - 1992	1992	29	60	31	48%	4,985	11,770	66.2%	For 1992 assets, allocated the actual cost of
8-Inch PVC (Pressure) - 1992	1992	29	60	31	48%	4,985	11,770	66.2%	total system to each component by its
4-Inch PVC (Gravity) - Post-1992	2007	14	60	46	23%	7,967	11,770	0%	percentage share of replacement costs.
Total Sewer Mains									
Other Collection System Assets									For pipe and STEP systems built since 1992,
Cleanouts and Manholes	1992	29	75	46	39%	4,985	11,770	66.2%	calculated average installation year assuming
STEP Systems (including Laterals)									a straight-line growth pattern, then used inflation
Pumped STEP - 1992	1992	29	30	1	97%	4,985	11,770	66.2%	index (ENR-CCI) to adjust replacement cost.
Gravity STEP - 1992	1992	29	50	21	58%	4,985	11,770	66.2%	For 2008 and 2009 assets, used actual historical
Gravity STEP - Post-1992	2007	14	50	36	28%	7,967	11,770	0%	cost of capital project (WWTP and pump stations).
Total Other Collection System Assets									
Treatment & Transmission Assets									
1992 WWTP Improvements	1992	29	50	21	58%		11,770	66.2%	Grant percentages are based on actual funding
2009 WWTP Improvements	2009	12	50	38	24%	8,570	11,770	39.5%	packages in 1992 and 2008-2009.
Total Wastewater Treatment Plant									
Three Pump Stations	2008	13	30	17	43%	8,310	11,770	25.5%	
Total Treatment/Transmission Assets									
All Mill City Wastewater Assets									

Exhibit 8, continued: Asset Costs for Mill City Wastewater System

Mill City Wastewater Utility
Asset Valuation

Assets	Original Cost Less Depreciation (OCLD)					Replacement Cost New Less Depreciation (RCNLD)				
Asset Description	Estimated Original Cost	Grants	Original Cost less Grants	Accum Deprec-Original Cost	Original Cost Less Depreciation	Estimated Replacement Cost	Grants	Replacement Cost Less Grants	Accum Deprec-Replacement Cost	RCN Less Depreciation
Sewer Mains (excluding Laterals)										
4-Inch PVC (Gravity) - 1992	$ 2,674,221	$ 1,770,873	$ 903,348	$ 349,295	$ 554,053	$ 10,251,590	$ 6,788,617	$ 3,462,973	$ 1,339,016	$ 2,123,957
6-Inch PVC (Gravity) - 1992	155,021	102,655	52,366	20,248	32,118	594,270	393,526	200,744	77,621	123,123
8-Inch PVC (Gravity) - 1992	324,374	214,801	109,573	42,368	67,205	1,243,482	823,435	420,047	162,418	257,629
4-Inch PVC (Pressure) - 1992	35,251	23,344	11,908	5,755	6,152	135,136	89,487	45,649	22,064	23,585
6-Inch PVC (Pressure) - 1992	164,633	109,020	55,613	26,880	28,733	631,119	417,928	213,191	103,042	110,149
8-Inch PVC (Pressure) - 1992	499,871	331,015	168,856	81,614	87,242	1,916,250	1,268,943	647,307	312,865	334,442
4-Inch PVC (Gravity) - Post-1992	368,105	-	368,105	85,891	282,214	-	-	-	-	-
Total Sewer Mains	**$ 4,221,476**	**$ 2,551,707**	**$ 1,669,768**	**$ 612,051**	**$ 1,057,718**	**$ 14,771,847**	**$ 9,781,937**	**$ 4,989,910**	**$ 2,017,026**	**$ 2,972,884**
Other Collection System Assets										
Cleanouts and Manholes	$ 102,784	$ 68,064	$ 34,720	$ 13,425	$ 21,295	$ 394,020	$ 260,921	$ 133,099	$ 51,465	$ 81,634
STEP Systems (including Laterals)										
Pumped STEP - 1992	68,867	45,604	23,263	22,488	775	264,000	174,821	89,179	86,206	2,973
Gravity STEP - 1992	1,274,036	843,668	430,368	249,613	180,754	4,884,000	3,234,192	1,649,808	956,889	692,920
Gravity STEP - Post-1992	268,038	-	268,038	75,051	192,987	396,000	-	396,000	110,880	285,120
Total Other Collection System Assets	**$ 1,713,724**	**$ 957,336**	**$ 756,388**	**$ 360,577**	**$ 395,812**	**$ 5,938,020**	**$ 3,669,933**	**$ 2,268,087**	**$ 1,205,440**	**$ 1,062,646**
Treatment & Transmission Assets										
1992 WWTP Improvements	$ 1,080,482	$ 715,497	$ 364,985	$ 211,692	$ 153,294	$ 4,142,015	$ 2,742,848	$ 1,399,167	$ 811,517	$ 587,650
2009 WWTP Improvements	1,371,407	541,906	829,501	199,080	630,421	1,883,521	744,266	1,139,255	273,421	865,834
Total Wastewater Treatment Plant	$ 2,451,889	$ 1,257,403	$ 1,194,486	$ 410,772	$ 783,715	$ 6,025,536	$ 3,487,114	$ 2,538,422	$ 1,084,938	$ 1,453,484
Three Pump Stations	1,170,031	298,094	871,937	377,839	494,098	1,700,000	433,117	1,266,883	548,983	717,901
Total Treatment/Transmission Assets	**$ 3,621,920**	**$ 1,555,497**	**$ 2,066,423**	**$ 788,611**	**$ 1,277,812**	**$ 7,725,536**	**$ 3,920,230**	**$ 3,805,306**	**$ 1,633,921**	**$ 2,171,385**
All Mill City Wastewater Assets	**$ 9,557,120**	**$ 5,064,540**	**$ 4,492,580**	**$ 1,761,238**	**$ 2,731,342**	**$ 28,435,403**	**$ 17,372,101**	**$ 11,063,302**	**$ 4,856,387**	**$ 6,206,915**

Hybrid Method

Inflation pushes costs upward over time, so the fact that RCNLD is based on 2021 dollars instead of actual expenditures at the time of acquisition means that it will yield a higher estimate than the OCLD method. That does not mean that either method is more "right" than the other; it simply means that they measure different things. The OCLD value is a measure of what Mill City customers actually invested in the system. The RCNLD value is a measure of how much more the NSSA regional system would have to spend in order to replicate the system already built in Mill City.

Because both the OCLD method and the RCNLD method are relevant in this case, we recommend a hybrid method that blends the values of the two methods. The starting point in blending the values should be the original cost. Since the purpose of the valuation is to compensate for prior investment, the Fair Value should not stray too far from the actual prior investment. The data sources are also stronger for OCLD, since it is based on actual experience, not hypothetical unit cost estimates.

However, there is real value to NSSA from there being a used sewer system available for purchase—it reduces the up-front project cost of constructing a new regional system. The RCNLD method is based on a hypothetical, but it does recognize the value of avoided costs to the regional system.

After considering the purposes of this valuation, we recommend blending the two values so that OCLD is weighted 75% and RCNLD is weighted 25%. The resulting hybrid value should be closer to the OCLD value, one-quarter of the way from the OCLD value toward the RCNLD value. In other words, the recommended Fair Value is anchored primarily in the actual investment made by Mill City customers, but it is pushed up by the avoided cost consideration. Having the opportunity to purchase a used sewer system gives NSSA a valuable head start toward the development of a regional system, and that justifies a price premium above the original Mill City investment.

Exhibit 9 summarizes the valuations using the three methods: OCLD, RCNLD, and the recommended method (Hybrid with OCLD weighted 75%). Our recommended Fair Value for the Mill City sewer system is $3.6 million. This represents a 32% premium over the original investment.

Exhibit 9: Valuation Summary – Mill City Sewer System Fixed Assets

Mill City Wastewater Utility Summary of Asset Value Estimate as of June 30, 2021	Alternate Methods Original Cost Less Depreciation	 Replacement Cost New Less Depreciation	 Recommended Hybrid Method
	Focus on Actual Investment	Focus on Avoided Cost	75% Weighted on Original Cost
Sewer Mains	$ 4,221,476	$ 14,771,847	$ 6,859,069
Other Collection System Assets	1,713,724	5,938,020	2,769,798
Wastewater Treatment Plant	2,451,889	6,025,536	3,345,301
Pump Stations	1,170,031	1,700,000	1,302,523
Total Cost - All Wastewater Assets	$ 9,557,120	$ 28,435,403	$ 14,276,691
Grant Funding	(5,064,540)	(17,372,101)	(8,141,430)
Net Investment	$ 4,492,580	$ 11,063,302	$ 6,135,261
Accumulated Depreciation	(1,761,238)	(4,856,387)	(2,535,026)
Net Investment Less Depreciation	$ 2,731,342	$ 6,206,915	$ 3,600,235
Estimated Value of Fixed Assets (rounded)	$ 2,730,000	$ 6,210,000	$ 3,600,000
% Premium over Original Cost			*32%*

Other Financial Considerations

In the acquisition of the Mill City wastewater system, there are other considerations than just the fixed assets. Following are some additional things to take into account.

- Mill City Debt
  - As of July 1, 2021, Mill City had about $2.15 million in outstanding sewer debt owed to the State. The debt service on this debt is about $155,000 per year, as shown in **Exhibit 10**.

Exhibit 10: Summary of Mill City Sewer Debt

Mill City Sewer Debt: 2006 OECDD Loan, 1%, Original Amount $4 million, 30-year term, through 2036			
2020 Outstanding Sewer Debt	$ 2,281,159		
Principal due in 2021	$ 132,181		
2021 Outstanding Sewer Debt	**$ 2,148,978**		
Est. June 2021 Cash Reserves	$ 310,000		
Net Debt Outstanding June 2021	$ 1,838,978		
Scheduled Debt Service	Principal	Interest	Total
2020	$ 130,872	$ 24,120	$ 154,992
2021	132,181	22,812	154,993
2022	133,503	21,490	154,993
2023	134,838	20,155	154,993
2024	136,186	18,806	154,992
Avg 2025-2029 (5 yrs)	140,327	14,666	154,992
Avg 2030-2034 (5 yrs)	147,485	7,308	154,792
Avg 2035-2036 (2 yrs)	152,698	2,294	154,992

Source: 2019 City Financial Statement

  - There are 15 years remaining on the debt, and it carries a 1% interest rate.
  - In taking over the City sewer utility, NSSA would be assuming responsibility for this liability. NSSA could pay it off, or it could assume responsibility for the annual debt service payments. In our business case analysis, we assumed that the debt is paid off.
- Minor Equipment
  - As part of acquiring the City's sewer utility, NSSA would need to acquire the sewer share of City vehicles and other equipment. In our discussion below, we assumed a $20,000 value for this equipment. However, this is just a placeholder assumption. In reality, an estimate of the net book value would need to be made closer to the time of an actual transfer of assets, after the form of the new organization is determined and decisions are made about which pieces of equipment are to be assigned to the new entity.
- Cash Reserves
  - Acquisition of the City sewer utility would also need to include acquisition of sewer-related cash reserves, including fund balances from the Sewer Operating and Sewer Reserve funds. In our discussion below, this is assumed to be approximately $310,000, which represents the three-year average beginning fund balance for those two funds. However, that amount will need to be updated as the date of an actual transfer of assets and liabilities approaches.

How to Use the Compensation?

Exhibit 11 shows three options that the City could consider for using the compensation. (This is not an exclusive list; there may be other options as well.)

Exhibit 11: Options for Use of Compensation

Mill City Wastewater Utility Summary of Asset Value Estimate as of June 30, 2021	Alternate Methods Original Cost Less Depreciation	Replacement Cost New Less Depreciation	Recommended Hybrid Method
Estimated Value of Fixed Assets (rounded)	$ 2,730,000	$ 6,210,000	$ 3,600,000
Option 1: One-time Payment to Mill City			
Outstanding Debt June 30, 2021	(2,148,978)	(2,148,978)	(2,148,978)
Assumed Vehicles & Other Equipment	20,000	20,000	20,000
Assumed Cash Reserves June 30, 2021	310,000	310,000	310,000
Total Asset Value Net of Debt	$ 911,022	$ 4,391,022	$ 1,781,022
Option 2: Annual Payment to Mill City			
Remaining Loan Term-2021 to 2036	15 years	15 years	15 years
Interest Rate on Debt	1%	1%	1%
Annual Payment to Mill City	$ 65,706	$ 316,697	$ 128,454
Current Annual Debt Service	154,993	154,993	154,993
Total Annual Benefit to City (for 15 years)	$ 220,699	$ 471,690	$ 283,447
Includes taking over debt service			
Option 3: Rate Credit on Customer Bills			
Total EDUs (2020 Customer Data)	839	839	839
Monthly Rate Credit for 15 years	$ 6.53 per EDU	$ 31.46 per EDU	$ 12.76 per EDU
Current Debt Service per month	$ 15.39 per EDU	$ 15.39 per EDU	$ 15.39 per EDU
Total Monthly Benefit to Mill City Customers	$ 21.92 per EDU	$ 46.85 per EDU	$ 28.15 per EDU

One-time Payment

One option could be a one-time payment from NSSA to Mill City. If the transaction were to include $20,000 of equipment and $310,000 in cash reserves, then the City could receive a net payment of approximately $1.78 million after the debt is paid off. The total paid by NSSA would be about $3.93 million, including $1.78 to the City and about $2.15 million to the State to retire the debt.

The City would need to determine what to do with its one-time payment. If the City wants to consider using the payment for non-sewer purposes (such as water system repairs), it should first ask its attorney whether there are legal constraints.

Annual Payment

A second option could be for the City and NSSA to convert a one-time value to an ongoing stream of payments. If we assume a net payment of $1.78 million, spread over 15 years at 1% interest (the same as the City's current loan terms), that is equivalent to about $128,000 per year.

Rate Credit on Customer Bills

A third option could be a rate credit on the bills of NSSA customers whose property is located within Mill City. Assuming a fifteen-year time period for a rate credit, this could be equivalent to about $13/month/EDU subtracted from the bills of NSSA customers who live in Mill City.

Summary Observations

With the hybrid method, both parties would be getting an outcome more favorable than might otherwise be justifiable. This is a useful outcome for the partnership. A “willing buyer, willing seller” transaction often depends on what feels fair to both parties. A “fair” price can be understood as an outcome in which everyone feels that to some extent, they are getting a good deal. Balancing interests is especially important in this type of transaction, where Mill City is one of the partners in NSSA. Even more in this case than in most, the optimal outcome is one that builds rather than erodes trust.

Calculation Tables

Following are the detailed calculation tables for different types of assets. This is the backup detail that supports the summary of asset costs shown previously on **Exhibit 8**.

Pipe

Assumed Growth in Pipe Over Time

Year Est.	Conn. Added	LF Added
1992	60	2,640

Assume new pipe and STEPs were evenly spread across the years.

Year	Mill City Connections	Pipe Added (LF)	Pipe Age	New STEPs Added	STEP Age
2020	832	94	0	2	0
2019	830	94	1	2	1
2018	828	94	2	2	2
2017	826	94	3	2	3
2016	823	94	4	2	4
2015	821	94	5	2	5
2014	819	94	6	2	6
2013	817	94	7	2	7
2012	815	94	8	2	8
2011	813	94	9	2	9
2010	811	94	10	2	10
2009	808	94	11	2	11
2008	806	94	12	2	12
2007	804	94	13	2	13
2006	802	94	14	2	14
2005	800	94	15	2	15
2004	798	94	16	2	16
2003	796	94	17	2	17
2002	793	94	18	2	18
2001	791	94	19	2	19
2000	789	94	20	2	20
1999	787	94	21	2	21
1998	785	94	22	2	22
1997	783	94	23	2	23
1996	781	94	24	2	24
1995	778	94	25	2	25
1994	776	94	26	2	26
1993	774	94	27	2	27
1992	772	70,602	28	765	28
Total since 1992		2,640		60	
Total Incl. 1992		73,242		825	
Avg since 1992			**13.5**		**13.5**
Avg Incl. 1992			**27.5**		**26.9**
Avg Yr in Service - Since 1992			2007		2007
Avg Yr in Service - Including 1992			1993		1993

Assumptions about Soft Costs

Soft Cost Assumptions	
Mobilization	5%
Traffic Control	4%
OH/profit	10%
Gen Conditions	10%
Erosion/Sediment Control	3%
Compound Total	32%

Source: Peter Olsen, Keller Associates

Pipe, continued

Current Pipe Inventory

Replacement Cost - 2020 Dollars - Current Pipe Inventory (including Laterals)					
Pipe Size and Type	L.F.	$/L.F.	Soft Costs	Loaded $/LF	Total $
4-Inch PVC (Gravity)	52,405	$ 156	$ 50	$ 206	$ 10,795,430
6-Inch PVC (Gravity)	2,790	161	52	213	594,270
8-Inch PVC (Gravity)	5,678	166	53	219	1,243,482
4-Inch PVC (Pressure)	656	156	50	206	135,136
6-Inch PVC (Pressure)	2,963	161	52	213	631,119
8-Inch PVC (Pressure)	8,750	166	53	219	1,916,250
Total	**73,242**	**--**			**$ 15,315,687**

Summary of Pipe Replacement Cost

Pipe Inventory - Main Lines (excluding Laterals) in 2020 Dollars	Installed in 1992		Installed Post-1992		Total	
	Lineal Feet	Replacement Cost	Lineal Feet	Replacement Cost	Lineal Feet	Replacement Cost
4-Inch PVC (Gravity)	49,765	$ 10,251,590	2,640	$ 543,840	52,405	$ 10,795,430
6-Inch PVC (Gravity)	2,790	$ 594,270	0	$ -	2,790	$ 594,270
8-Inch PVC (Gravity)	5,678	1,243,482	0	-	5,678	1,243,482
4-Inch PVC (Pressure)	656	135,136	0	-	656	135,136
6-Inch PVC (Pressure)	2,963	631,119	0	-	2,963	631,119
8-Inch PVC (Pressure)	8,750	1,916,250	0	-	8,750	1,916,250
Total	70,602	$ 14,771,847	2,640	$ 543,840	73,242	$ 15,315,687

Pipe Installed Post-1992	
Estimated Replacement Cost	$ 543,840
Average Year Placed in Service	2007
ENR Adjustment	0.68
Estimated Original Cost	$ 368,105

STEP Systems and Other Collection System Assets

Other Collection System Assets	Direct Replacement Unit Cost	Loaded Replacement Unit Cost	Number	Est. Total Replacement Cost	Grant Percentage	Grant Funding	System Net Investment
Cleanouts and Manholes							
Cleanouts	$ 750	$ 990	278	$ 275,220	66.2%	$ 182,251	$ 92,969
Manholes	6,000	7,920	15	118,800	66.2%	78,670	40,130
Total Cleanouts and Manholes				$ 394,020		$ 260,921	$ 133,099
STEP Systems (Including Laterals)							
Pumped - 1992 Project	$ 8,000	$ 10,560	25	$ 264,000	66.2%	$ 174,821	$ 89,179
Gravity - 1992 Project	5,000	6,600	740	4,884,000	66.2%	3,234,192	1,649,808
Gravity - Property Owner Funded	5,000	6,600	60	396,000	0.0%	-	396,000
Total STEP Systems			825	$ 5,544,000		$ 3,409,013	$ 2,134,987
Total Other Collection System Assets				$ 5,938,020		$ 3,669,933	$ 2,268,087

Source: Peter Olsen e-mail 3/15/2021 for costs; Russ Foltz 3/12/2021 for number of STEP systems. Total connected property owners is about 850, but about 25 have shared connections, where two tanks are served by one lateral. According to Russ Foltz, STEP systems were funded as part of the 1992 project but subsequent new STEP systems were paid for by property owners and deeded to the City. For simplicity in calculation, we assumed that post-1992 STEP systems were gravity systems. Per Peter Olsen e-mail 2/26/2021, about 60 new connections (and therefore about 60 new STEP systems) have been installed since 1992. STEP cost estimates include laterals.

STEP Systems Installed Post-1992	
Estimated Replacement Cost	$ 396,000
Average Year Placed in Service	2007
ENR Adjustment	0.68
Estimated Original Cost	$ 268,038

Pump Stations

Three Pump Stations		
Original Cost 2008	$	1,170,031
Funded by CDBG Grant		298,094
Net System Investment in 2008	$	871,937
Grant Percentage		25.5%
Estimated Replacement Cost	$	1,700,000
Assumed Grant Share		433,117
Replacement Cost Net of Grants	$	1,266,883
Sources:		
FY 2009-10 City Budget for original costs.		
Keller Associates for replacement cost estimate.		
Estimate includes soft costs.		

For Comparison of Replacement Cost:		
ENR 2020/ENR 2008		1.42
Original Cost adjusted for ENR	$	1,657,247
Replacement Cost Est. for Insurance Purposes		
Wall Street Pump Station	$	401,700
River Road Pump Station		384,800
Spring Street Pump Station		446,200
Total	$	1,232,700

Three Current Cost Estimates for Pump Stations		
Insurance	$	1,232,700
Original + ENR	$	1,657,247
Keller Associates	**$**	**1,700,000**

Estimates include soft costs.

Treatment Plant

Replacement Cost of WWTP in 2021 Dollars			
Total Replacement Cost (Engineer's Estimate)			6,025,536
2009 Improvements to WWTP			
Original Cost (2009)		$	1,371,407
ENR Adjustment	1.37		
Replacement Cost (2021 dollars)		$	1,883,521
Grant Percentage	39.5%		
Less Grant Funding			744,266
Net Investment		$	1,139,255
1992 Original WWTP Project			
Implied 1992 WWTP in 2021 dollars		$	4,142,015
Grant Percentage	66.2%		
Grant Funding			2,742,848
Net Investment - Original WWTP (2021 dollars)		$	1,399,167
Total WWTP			
Total WWTP Improvements (2021 dollars)		$	6,025,536
Less Grant Funding			3,487,114
Total WWTP Net Investment (2021 dollars)		$	2,538,422

Summary of WWTP Replacement Cost	1992 Improvements	2009 Improvements	Total Improvements
Replacement Cost	$ 4,142,015	$ 1,883,521	$ 6,025,536
Less Grant Funding	2,742,848	744,266	$ 3,487,114
Net Investment	$ 1,399,167	$ 1,139,255	$ 2,538,422

Three Current Cost Estimates for WWTP		
Insurance	Replacement	$ 4,564,800
Original + ENR	Reproduction	6,025,536
Keller Associates	Replacement	6,025,536

WWTP Replacement Cost Estimates For Insurance Purposes	
WWTP Lab Building	$ 223,800
WWTP Bio Contact Tank	1,164,000
WWTP Wet Well	2,483,000
WWTP Bio Odor Control Tank	112,000
WWTP Process Piping	582,000
Total	$ 4,564,800

Source: AssetWorks Appraisal (Nov 2019)

Original Costs

Original Cost - 2008 and 2009 Improvements

2009-10 Budget Narrative for Sewer Project Fund (Fund 33)
The narrative describes a major capital project funded by grants and loans. Initial work in FY 2008-09 was construction of three pump stations and some design of WWTP improvements. FY 2009-10 work was remaining WWTP design plus all of the WWTP construction. The following summary assumes that $20,000 spent in FY 2008-09 was for engineering design on the WWTP; all other FY 2008-09 money was assumed to be for the pump stations. An additional $92,085 was budgeted for WWTP design in 2009-10.

Original Cost of Capital Project by Funding Source 2008 and 2009 Improvements	Pump Stations 2008	WWTP 2009	Total
CDBG Grant	$ 298,094	$ 541,906	$ 840,000
State loan	779,223	821,777	$ 1,601,000
Local Match	92,714	7,724	$ 100,438
Total	$ 1,170,031	$ 1,371,407	$ 2,541,438
Net System Investment	$ 871,937	$ 829,501	$ 1,701,438
Percentage Grant Funding	25.5%	39.5%	33.1%

Source: 2009-10 Budget Narrative for Sewer Project Fund (Fund 33)

Original Cost - 1992 Improvements

Original Cost of WWTP in 1992 Dollars	
Funding Package:	
Total 1992 project - WWTP plus collection lines, pump stations, and STEPs	$ 6,823,000
Grant funding	4,518,200
Net Investment	$ 2,304,800
Grant %	66.2%
Project Costs:	
Total Project - 1992 dollars	$ 6,823,000
Less: Other Collection System Assets	
STEPs (installed in 1992)	1,342,903
Collector Pipe (installed in 1992)	3,853,371
Less Cleanouts & Manholes	102,784
Less Spring Street Pump Station	443,460
Retired asset - both pumps replaced in 2008	
Total Other Collection System Assets	5,742,518
Estimated Original Cost of WWTP	$ 1,080,482
Less Grants	715,497
Net Investment in WWTP from 1992 Project	$ 364,985
Original Cost of 2009 WWTP Improvements	$ 1,371,407
Grant % for 2009 Project	39.5%
Grants Applied to WWTP Cost	541,906
Net Investment in WWTP from 2009 Project	$ 829,501
Combined Original Cost	
1992 Improvements	$ 1,080,482
2009 Improvements	$ 1,371,407
Total Original Cost of WWTP	$ 2,451,889
Total Net Investment in WWTP - Original Cost	**$ 1,194,486**

Source: 2008 SDC Resolution

Original Costs, continued

1992 Project - Assumed Original Costs

Original Cost of Assets Included in 1992 Project	Unit Cost 2021	Units/LF in 1992	Replacement Cost of 1992 Assets	Preliminary Original (ENR Adjust)	% of Total	Adjusted Original Cost 1992	Grant Funding	Original Net Investment
STEP Systems including Laterals								
ENR Factor: 0.42								
Gravity STEP (loaded)	$ 6,600	740	$ 4,884,000	$ 2,068,401	18.7%	$ 1,274,036	$ 843,668	$ 430,368
Pumped STEP (loaded)	10,560	25	264,000	111,805	1.0%	68,867	45,604	23,263
Total STEP Systems		765	$ 5,148,000	$ 2,180,207	19.7%	$ 1,342,903	$ 889,272	$ 453,631
Collector Pipe excluding Laterals								
4-Inch PVC (Gravity)	$ 206	49,765	$ 10,251,590	$ 4,341,606	39.2%	$ 2,674,221	$ 1,770,873	$ 903,348
6-Inch PVC (Gravity)	213	2,790	594,270	251,677	2.3%	155,021	102,655	52,366
8-Inch PVC (Gravity)	219	5,678	1,243,482	526,622	4.8%	324,374	214,801	109,573
4-Inch PVC (Pressure)	206	656	135,136	57,231	0.5%	35,251	23,344	11,908
6-Inch PVC (Pressure)	213	2,963	631,119	267,282	2.4%	164,633	109,020	55,613
8-Inch PVC (Pressure)	219	8,750	1,916,250	811,543	7.3%	499,871	331,015	168,856
Total Collector Pipe		70,602	$ 14,771,847	$ 6,255,960	56.5%	$ 3,853,371	$ 2,551,707	$ 1,301,663
Cleanouts & Manholes								
Cleanouts & Manholes	$ 394,020		$ 394,020	$ 166,870	1.5%	$ 102,784	$ 68,064	$ 34,720
Pump Stations								
Three pump stations	$ 1,700,000		$ 1,700,000	$ 719,960	6.5%	$ 443,460	$ 293,660	$ 149,800
1992 Assets Other Than WWTP			$ 22,013,867	$ 9,322,996	84.2%	$ 5,742,518	$ 3,802,703	$ 1,939,815
Wastewater Treatment Plant	$ 4,142,015		$ 4,142,015	$ 1,754,166	15.8%	$ 1,080,482	$ 715,497	$ 364,985
Total 1992 Project			$ 26,155,882	$ 11,077,163	100.0%	$ 6,823,000	$ 4,518,200	$ 2,304,800

Note that the pump stations built in 1992 were retired when replaced in 2008, so that value is not part of the Original Cost estimate. But it is used here to calculate the WWTP original cost.

Appendix L:
ODEQ Memorandum

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Oregon
Kate Brown, Governor

Department of Environmental Quality
Agency Headquarters
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Portland, OR 97232
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April 5, 2021

TO: Leah Horner, Director, Regional Solutions
Jason Miner, Director, Natural Resources Office
Matt Garrett, Director of Wildfire Recovery

FM: Richard Whitman, DEQ Director

RE: Santiam Canyon Infrastructure

The Labor Day fires in Oregon resulted in unprecedented loss of homes, businesses and public and private infrastructure in several communities, including in the Santiam Canyon communities of Idanha, Detroit, Gates and Mill City. There is a strong, shared, desire to build back better, but doing so is going to require timely financial and technical support for these communities.

DEQ has been asked to provide a high-level overview of the likely processes for rebuilding sanitary wastewater systems in these communities, ideally in a way that provides sustainable long-term solutions that respond to the multiple interests with significant stakes in the future of the Santiam and its resources. Those interests include (but are not limited to) the four directly-affected communities ,along with down-river communities that rely on the river as a primary source of drinking water, and multiple public and private recreational uses of the river.

Our understanding is that the current concepts for wastewater treatment for these communities involves two projects: (1) Project A - $40 million for constructing new and increase capacity sewer infrastructure for the City of Gates, linking to an improved existing system in Mill City; and (2) Project B – funding for advanced on-site (septic) systems in Detroit and Idanha, suitable for protecting the water quality of Detroit Lake and the Santiam. These projects would be coordinated by Marion County and the North Santiam Sewer Authority (NSSA), utilizing funding requested from the Oregon legislature.

1. Project A – Gates and Mill City

Background

The primary elements of this proposal are to sewer Gates and then connect that collection system via a main lateral line to the sanitary sewer system and wastewater treatment system of Mill City. Mill City's treatment system was built in 1990, and disposes to a 10-acre drain field (the system also uses septic tanks at individual homes and businesses that are periodically cleaned of solids). Solids from the treatment plant are collected and disposed of by a separate service contract. The city's system operates under a Water Pollution Control Facility (WPCF) permit issued by DEQ. The system does not discharge to surface water, including the Santiam River. The system is currently operating on average at about 75% of its permitted flow with wet weather flows exceeding 94%.

Regulatory Issues: Water Quality

Approximately 225,000 people depend on the Santiam River as a primary drinking water source. To protect water quality in the Santiam (and Clackamas and McKenzie Rivers), Oregon adopted a requirement known as the Three Basin Rule in 1978 (modified in 1995) that places limits on pollution discharges in the basin. Those limitations are summarized as follows:

· No new or increased wastewater discharges are allowed that require an NPDES permit (federal requirement for direct or indirect discharges to surface water).

· There are exceptions for small on-site (septic) systems, confined animal feeding operations that do not discharge directly or indirectly to surface water, the land application of biosolid and reclaimed wastewater, and construction stormwater runoff and other insignificant discharges to surface water.

· To approve a WPCF permit for a new or expanded facility (as is contemplated for Mill City), DEQ (and the Environmental Quality Commission (EQC)) must find that: (1) there is no discharge to surface water; (2) the new treatment system/facility will protect groundwater quality (including: (a) a groundwater monitoring plan; (b) effluent concentration limits ; and (c) plans to restore conditions if groundwater quality is adversely affected) ; and (3) that the new treatment system/facility improves protection relative to the current system(s). This last requirement can be met by showing any of the following three conditions: (a) that there are a significant number of failing individual systems that cannot be repaired cost-effectively; (b) that the impact of individual treatment systems to groundwater is greater than the anticipated impact of a new facility; or (c) that the social and economic benefits of the new treatment system outweigh possible environmental impacts and individual treatment systems would not normally be used.

Regulatory Issues: Land Use

In general, urban public facilities including sanitary sewer collection and treatment systems are typically required to be located within urban growth boundaries. For Project A, the main lateral collector between Gates and Mill City would cross lands outside of the approved urban growth boundaries of the two cities – requiring approval by Marion County of a land use exception or other land use action complying with state-wide land use planning goals 11 and 14. Similarly, if the existing 10-acre drain field requires expansion (which DEQ believes is likely), appropriate land for that part of the system will need to be found within the city's urban growth boundary.

Approval Processes

To demonstrate that the regulatory requirements summarized above will be met by Project A, the project proponents should prepare a public facilities plan (recent planning documents completed for Marion County and the communities may meet some of the facilities plan requirements (see OAR 340-052)). That plan will be used by funding agencies to assure that the proposed project will meet applicable requirements, and is generally a prerequisite to DEQ issuing a new or modified WPCF permit for Project A. It is highly recommended to consult with both funding agencies and DEQ before completing a public facilities plan.

The public facilities plan also should be coordinated with required land use approvals by Marion County (Goal exceptions) and the two cities (public facilities elements of their comprehensive plans).

The final step in approvals will be review and a decision on a new or modified WPCF permit for the combined Mill City/Gates Project A. This permit application is governed by OAR 340-045, and generally involves development of a draft permit with an opportunity for the applicant(s) to comment, followed by public notice and a hearing and consideration of comments prior to a final decision.

2. Project B – Detroit and Idanha

Background

The primary elements of Project B are to repair and replace residential and commercial septic systems in Detroit and Idanha, utilizing advanced on-site treatment to the maximum extent possible. Due to the small size of some residential properties destroyed by fire, it may be desirable or necessary to include systems serving more than one residence or business. There is a history of higher frequency of septic system failure in the downtown area of Detroit. Further, soil conditions in these two communities are challenging for on-site systems, which may increase costs of solutions.

Regulatory Issues: Water Quality

As for Project A, the Three Basin Rule introduces some additional regulatory requirements for on-site systems beyond the normal requirements. As noted above, small domestic on-site (septic) systems (less than 5,000 gallons per day) are exempt from these additional requirements. Nevertheless, because of soil conditions and the proximity to the river and Detroit Lake, DEQ is likely to want systems to incorporate advanced treatment to avoid cumulative impacts to ground and surface water. These systems will be more expensive, and require a higher level of ongoing maintenance, but they are being widely used in other areas of the state with a history of groundwater impacts (such as South Deschutes County).

Regulatory Issues: Land Use

DEQ is not aware of land use issues associated with repair and replacement of on-site wastewater treatment systems in Idanha and Detroit. These systems are typically considered a rural level of public (or private) facility, and can be approved both inside and outside of urban growth boundaries.

Approval Processes

As with Project A, DEQ recommends that Detroit and Idanha prepare comprehensive public facilities plans for how to rebuild on-site systems so that if systems need to be combined (community systems) due to lot size and soil conditions, opportunities to do that are preserved. Those plans would be used both by funding agencies and by DEQ in assuring that public investments are effective in allowing all parts of the communities to rebuild.

The final step in approvals will be review and decisions on a new or modified on-site permits for individual and/or group systems. Generally, review of permits for small residential systems is carried out by Marion County, while DEQ is responsible for larger systems and those that require a WPCF permit. DEQ and the county will need to coordinate carefully in order for this work to be done efficiently and in a way that creates affordable and effective treatment for the communities.

Appendix M:
Recycled Water Use
(OAR 340-055)

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Department of Environmental Quality

Chapter 340

Division 55
RECYCLED WATER USE

340-055-0005
Purpose

These rules (OAR 340-055-0005 to 340-055-0030) prescribe requirements for the use of recycled water for beneficial purposes. The purpose of this division is to protect the environment and public health in the State of Oregon.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.015 & 468B.020
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0007
Policy

It is the policy of the Environmental Quality Commission to encourage the use of recycled water for domestic, agricultural, industrial, recreational, and other beneficial purposes in a manner which protects public health and the environment of the state. The use of recycled water for beneficial purposes will improve water quality by reducing discharge of treated effluent to surface waters, reduce the demand on drinking water sources for uses not requiring potable water, and may conserve stream flows by reducing withdrawal for out-of-stream use.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.015
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0010
Definitions

The following definitions apply to this division of rules:

(1) “Artificial Groundwater Recharge” means the intentional addition of water diverted from another source to a groundwater reservoir.

(2) "Beneficial Purpose" means a purpose where recycled water is utilized for a resource value, such as nutrient content or moisture, to increase productivity or to conserve other sources of water.

(3) “Department” means the Oregon Department of Environmental Quality.

(4) "Disinfected Wastewater" means wastewater that has been treated by a chemical, physical or biological process and meets the criteria if applicable to its classification for use as recycled water.

(5) “Filtered Wastewater” means an oxidized wastewater that meets the criteria defined in OAR 340-055-0012(7)(c).

(6) “Human Consumption” means water used for drinking, personal or oral hygiene, bathing, showering, cooking, or dishwashing.

(7) "Landscape Impoundment" means a body of water used for aesthetic purposes or other function that does not include public contact through activities such as boating, fishing, or body-contact recreation. Landscape impoundments include, but are not limited to, golf course water ponds or non-residential landscape ponds.

(8) "Nonrestricted Recreational Impoundment" means a constructed body of water for which there are no limitations on body-contact water recreation activities. Nonrestricted recreational impoundments include, but are not limited to, recreational lakes, water features accessible to the public, and public fishing ponds.

(9) "NPDES Permit" means a National Pollutant Discharge Elimination System permit as defined in OAR chapter 340, division 45.

(10) "Oxidized Wastewater" means a treated wastewater in which the organic matter is stabilized and nonputrescible, and which contains dissolved oxygen.

(11) "Person" means the United States and agencies thereof, any state, any individual, public or private corporation, political subdivision, governmental agency, municipality, copartnership, association, firm, trust estate, or any other legal entity.

(12) “Processed Food Crops” means those crops that undergo thermoprocessing sufficient to kill spores of Clostridium botulinum.

(13) “Recycled Water” means treated effluent from a wastewater treatment system which as a result of treatment is suitable for a direct beneficial purpose. Recycled water includes reclaimed water as defined in ORS 537.131.

(14) "Restricted Recreational Impoundment" means a constructed body of water that is limited to fishing, boating, and other non-body contact water recreation activities.

(15) “Sprinkler Irrigation” means the act of applying water by means of perforated pipes or nozzles operated under pressure so as to form a spray pattern.

(16) “Wastewater” or "Sewage" means the water-carried human or animal waste from residences, buildings, industrial establishments or other places, together with such groundwater infiltration and surface water as may be present. The admixture with sewage of wastes or industrial wastes shall also be considered “wastewater” within the meaning of this division.

(17) “Wastewater Treatment System” or "Sewage Treatment System" means an approved facility or equipment used to alter the quality of wastewater by physical, chemical or biological means or a combination thereof that reduces the tendency of the wastewater to degrade water quality or other environmental conditions.

(18) “Waters of the State” means lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon, and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters which do not combine or effect a junction with natural surface or underground waters) that are located wholly or partially within or bordering the state or within its jurisdiction.

(19) "WPCF Permit" means a Water Pollution Control Facilities permit as defined in OAR chapter 340, division 45.

(20) “Wetlands” means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.005, 468B.030 & 468B.050
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0012
Recycled Water Quality Standards and Requirements

(1) Any person having control over the treatment or distribution or both of recycled water may distribute recycled water only for the beneficial purposes described in this rule, and must take all reasonable steps to ensure that the recycled water is used only in accordance with the standards and requirements of the rules of this division.

(2) Any person who uses recycled water may use recycled water only for the beneficial purposes described in this rule, and must comply with the standards and requirements of this rule and the rules of this division.

(3) The following requirements apply to nondisinfected recycled water.

(a) Beneficial Purposes. Nondisinfected recycled water may be used only for the following beneficial purposes and only if the rules of this division are met:

(A) Irrigation for growing fodder, fiber, seed crops not intended for human ingestion, or commercial timber; and

(B) Any beneficial purpose authorized in writing by the department pursuant to OAR 340-055-0016(6).

(b) Treatment. Nondisinfected recycled water must be an oxidized wastewater.

(c) Criteria. There are no disinfection criteria for nondisinfected recycled water.

(d) Monitoring. Monitoring must be in accordance with the wastewater treatment system owner's NPDES or WPCF permit.

(e) Setback Distances. There must be a minimum of 150 feet from the edge of the irrigation site to a water supply source used for human consumption. Other site specific setback distances for irrigation necessary to protect public health and the environment must be established in the recycled water use plan and must be met when irrigating.

(f) Access and Exposure. Public access to the irrigation site must be prevented.

(g) Site Management.

(A) Irrigation with recycled water is prohibited for 30 days before harvesting.

(B) Sprinkler irrigation is prohibited unless authorized in advance and in writing by the department based on demonstration that public health and the environment will be adequately protected from aerosols.

(4) The following requirements apply to Class D recycled water.

(a) Beneficial Purposes. Class D recycled water may be used only for the following beneficial purposes and only if the rules of this division are met:

(A) Any beneficial purpose defined in subsection (3)(a) of this rule;

(B) Irrigation of firewood, ornamental nursery stock, Christmas trees, sod, or pasture for animals; and

(C) Any beneficial purpose authorized in writing by the department pursuant to OAR 340-055-0016(6).

(b) Treatment. Class D recycled water must be an oxidized and disinfected wastewater that meets the numeric criteria in subsection (c) of this section.

(c) Criteria. Class D recycled water must not exceed a 30-day log mean of 126 E. coli organisms per 100 milliliters and 406 E. coli organisms per 100 milliliters in any single sample.

(d) Monitoring. Monitoring for E. coli organisms must occur once per week at a minimum.

(e) Setback Distances.

(A) Where an irrigation method is used to apply recycled water directly to the soil, there must be a minimum of 10 feet from the edge of the site used for irrigation and the site property line.

(B) Where sprinkler irrigation is used, there must be a minimum of 100 feet from the edge of the site used for irrigation and the site property line.

(C) There must be a minimum of 100 feet from the edge of an irrigation site to a water supply source used for human consumption.

(D) Where sprinkler irrigation is used, recycled water must not be sprayed within 70 feet of an area where food is prepared or served, or where a drinking fountain is located.

(f) Access and Exposure.

(A) Animals used for production of milk must be restricted from direct contact with the recycled water.

(B) When using recycled water for irrigation of sod, ornamental nursery stock, or Christmas trees, the personnel at the use area must be notified that the water used is recycled water and is not safe for drinking. The recycled water use plan must specify how notification will be provided.

(g) Site Management.

(A) When irrigating, signs must be posted around the perimeter of the irrigation site stating recycled water is used and is not safe for drinking.

(B) Irrigation of fodder, fiber, seed crops not intended for human ingestion, sod, commercial timber, firewood, ornamental nursery stock, or Christmas trees is prohibited for three days before harvesting.

(5) The following requirements apply to Class C recycled water.

(a) Beneficial Purposes. Class C recycled water may be used only for the following beneficial purposes and only if the rules of this division are met:

(A) Any beneficial purpose defined in subsection (4)(a) of this rule;

(B) Irrigation of processed food crops;

(C) Irrigation of orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil;

(D) Landscape irrigation of golf courses, cemeteries, highway medians, or industrial or business campuses;

(E) Industrial, commercial, or construction uses limited to: industrial cooling, rock crushing, aggregate washing, mixing concrete, dust control, nonstructural fire fighting using aircraft, street sweeping, or sanitary sewer flushing;

(F) Water supply source for landscape impoundments; and

(G) Any beneficial purpose authorized in writing by the department pursuant to OAR 340-055-0016(6).

(b) Treatment. Class C recycled water must be an oxidized and disinfected wastewater that meets the numeric criteria in subsection (c) of this section.

(c) Criteria. Class C recycled water must not exceed a median of 23 total coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 240 total coliform organisms per 100 milliliters in any two consecutive samples.

(d) Monitoring. Monitoring for total coliform organisms must occur once per week at a minimum.

(e) Setback Distances.

(A) Where an irrigation method is used to apply recycled water directly to the soil, there must be a minimum of 10 feet from the edge of the site used for irrigation and the site property line.

(B) Where sprinkler irrigation is used, there must be a minimum of 70 feet from the edge of the site used for irrigation and the site property line.

(C) There must be a minimum of 100 feet from the edge of an irrigation site to a water supply source used for human consumption.

(D) Where sprinkler irrigation is used, recycled water must not be sprayed within 70 feet of an area where food is being prepared or served, or where a drinking fountain is located.

(f) Access and Exposure.

(A) When irrigating for a beneficial purpose defined in subsection (4)(a) of this rule, the access and exposure requirements defined in subsection (4)(f) of this rule must be met.

(B) During irrigation of a golf course, a cemetery, a highway median, or an industrial or business campus, the public must be restricted from direct contact with the recycled water.

(C) If aerosols are generated when using recycled water for an industrial, commercial, or construction purpose, the aerosols must not create a public health hazard.

(D) When using recycled water for an agricultural or horticultural purpose where sprinkler irrigation is used, or an industrial, commercial, or construction purpose, the public and personnel at the use area must be notified that the water used is recycled water and is not safe for drinking. The recycled water use plan must specify how notification will be provided.

(g) Site Management.

(A) When irrigating for a beneficial purpose defined in subsection (4)(a) of this rule, the site management requirements defined in subsection (4)(g) of this rule must be met.

(B) When using recycled water for a landscape impoundment or for irrigating a golf course, cemetery, highway median, or industrial or business campus, signs must be posted at the use area and be visible to the public. The signs must state that recycled water is used and is not safe for drinking.

(C) Irrigation of processed food crops is prohibited for three days before harvesting.

(D) When irrigating an orchard or vineyard, the edible portion of the crop must not contact the ground, and fruit or nuts may not be harvested off the ground.

(E) When using recycled water for a landscape impoundment, aerators or decorative fixtures that may generate aerosols are allowed only if authorized in writing by the department.

(6) The following requirements apply to Class B recycled water.

(a) Beneficial Purposes. Class B recycled water may be used only for the following beneficial purposes and only if the rules of this division are met:

(A) Any beneficial purpose defined in subsection (5)(a) of this rule;

(B) Stand-alone fire suppression systems in commercial and residential buildings, non-residential toilet or urinal flushing, or floor drain trap priming;

(C) Water supply source for restricted recreational impoundments; and

(D) Any beneficial purpose authorized in writing by the department pursuant to OAR 340-055-0016(6).

(b) Treatment. Class B recycled water must be an oxidized and disinfected wastewater that meets the numeric criteria in subsection (c) of this section.

(c) Criteria. Class B recycled water must not exceed a median of 2.2 total coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 milliliters in any single sample.

(d) Monitoring. Monitoring for total coliform organisms must occur three times per week at a minimum.

(e) Setback Distances.

(A) Where an irrigation method is used to apply recycled water directly to the soil, there are no setback requirements.

(B) Where sprinkler irrigation is used, there must be a minimum of 10 feet from the edge of the site used for irrigation and the site property line.

(C) There must be a minimum of 50 feet from the edge of the irrigation site to a water supply source used for human consumption.

(D) Where sprinkler irrigation is used, recycled water must not be sprayed within 10 feet of an area where food is being prepared or served, or where a drinking fountain is located.

(f) Access and Exposure.

(A) During irrigation of a golf course, the public must be restricted from direct contact with the recycled water.

(B) If aerosols are generated when using recycled water for an industrial, commercial, or construction purpose, the aerosols must not create a public health hazard.

(C) When using recycled water for an agricultural or horticultural purpose where sprinkler irrigation is used, or an industrial, commercial, or construction purpose, the public and personnel at the use area must be notified that the water used is recycled water and is not safe for drinking. The recycled water use plan must specify how notification will be provided.

(g) Site Management.

(A) When irrigating for a beneficial purpose defined in subsection (4)(a) of this rule, the site management requirements defined in subsection (4)(g) of this rule must be met.

(B) When using recycled water for a landscape impoundment or for irrigating a golf course, cemetery, highway median, or industrial or business campus, signs must be posted at the use area and be visible to the public. The signs must state recycled water is used and is not safe for drinking.

(C) Irrigation of processed food crops is prohibited for three days before harvesting.

(D) When irrigating an orchard or vineyard, the edible portion of the crop must not contact the ground, and fruit or nuts may not be harvested off the ground.

(7) The following requirements apply to Class A recycled water.

(a) Beneficial Purposes. Class A recycled water may be used only for the following beneficial purposes and only if the rules of this division are met:

(A) Any beneficial purpose defined in subsection (6)(a) of this rule;

(B) Irrigation for any agricultural or horticultural use;

(C) Landscape irrigation of parks, playgrounds, school yards, residential landscapes, or other landscapes accessible to the public;

(D) Commercial car washing or fountains when the water is not intended for human consumption;

(E) Water supply source for nonrestricted recreational impoundments;

(F) Artificial groundwater recharge by surface infiltration methods or by subsurface injection in accordance with OAR chapter 340, division 44. Direct injection into an underground source of drinking water is prohibited unless allowed by OAR chapter 340, division 44; and

(G) Any beneficial purpose authorized in writing by the department pursuant to OAR 340-055-0016(6).

(b) Treatment. Class A recycled water must be an oxidized, filtered and disinfected wastewater that meets the numeric criteria in subsection (c) of this section are met.

(c) Criteria. Class A recycled water must not exceed the following criteria:

(A) Before disinfection, unless otherwise approved in writing by the department, the wastewater must be treated with a filtration process, and the turbidity must not exceed an average of 2 nephelometric turbidity units (NTU) within a 24-hour period, 5 NTU more than five percent of the time within a 24-hour period, and 10 NTU at any time, and

(B) After disinfection, Class A recycled water must not exceed a median of 2.2 total coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 milliliters in any single sample.

(d) Monitoring.

(A) Monitoring for total coliform organisms must occur once per day at a minimum.

(B) Monitoring for turbidity must occur on an hourly basis at a minimum.

(e) Setback Distances. Where sprinkler irrigation is used, recycled water must not be sprayed onto an area where food is being prepared or served, or onto a drinking fountain.

(f) Access and Exposure. When using recycled water for an agricultural or horticultural purpose where spray irrigation is used, or an industrial, commercial, or construction purpose, the public and personnel at the use area must be notified that the water used is recycled water and is not safe for drinking. The recycled water use plan must specify how notification will be provided.

(g) Site Management. When using recycled water for a landscape impoundment, restricted recreational impoundment, nonrestricted recreational impoundment, or for irrigating a golf course, cemetery, highway median, industrial or business campus, park, playground, school yard, residential landscape, or other landscapes accessible to the public, signs must be posted at the use area or notification must be made to the public at the use area indicating recycled water is used and is not safe for drinking. The recycled water use plan must specify how notification will be provided.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
Renumbered from 340-055-0015, DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0013
Exempted Use of Recycled Water

Recycled water used by a wastewater treatment system owner for landscape irrigation or for in plant processes at a wastewater treatment system is exempt from the rules of this division if:

(1) The recycled water is an oxidized and disinfected wastewater;

(2) The recycled water is used at the wastewater treatment system site where it is generated or at an auxiliary wastewater or sludge treatment facility that is subject to the same NPDES or WPCF permit as the wastewater treatment system. Contiguous property to the parcel of land upon which the treatment system is located is considered the wastewater treatment system site if under the same ownership;

(3) Spray or drift or both from the use does not occur off the site; and

(4) Public access to the site is restricted.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.050
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0016

General Requirements for Permitting the Use of Recycled Water

(1) NPDES or WPCF permit. A wastewater treatment system owner may not provide any recycled water for use unless authorized by a NPDES or WPCF permit issued by the department pursuant to OAR chapter 340, division 045.

(2) Recycled water use plan.

(a) Except for use of recycled water authorized by a NPDES or WPCF permit, a wastewater treatment system owner may not provide any recycled water for distribution or use or both until a recycled water use plan meeting the requirements of OAR 340-055-0025 has been approved in writing by the department. Upon approval of the plan, the permittee must comply with the conditions of the plan.

(b) Before approving or modifying any plan for the use of Class C, Class D, or nondisinfected recycled water, the department will submit the proposed plan to the Oregon Department of Human Services for comment.

(c) For use of recycled water previously authorized under a NPDES or WPCF permit but without a department approved recycled water use plan, the wastewater treatment system owner must submit a recycled water use plan to the department within one year of the effective date of these rules.

(3) Land application on land zoned exclusive farm use. A recycled water use plan will not be approved for the land application of recycled water on land zoned exclusive farm use until the requirements of ORS 215.213(1)(bb) and 215.283(1)(y) for recycled water are met.

(4) Compliance with this division. When the rules of this division require a limitation or a condition or both that conflicts with a limitation or a condition or both in an existing permit, the existing permit controls until the permit is modified or renewed by the department. When the existing permit is modified or renewed, the permittee will be given a reasonable compliance schedule to achieve new requirements if necessary.

(5) Additional permit limitations and conditions. The department may include additional permit limitations or conditions or both if it determines or has reason to believe additional requirements for the use of recycled water are necessary to protect public health or the environment or both.

(6) Authorization of other recycled water uses. The department may authorize through a NPDES or WPCF permit a use of recycled water for a beneficial purpose not specified in this division. When the department considers the authorization, it may request information and include permit limitations or conditions or both necessary to assure protection of public health and the environment. The department will confer with the Oregon Department of Human Services before authorizing other uses of Class C, Class D, or nondisinfected recycled water under this section.

(7) Setback distances. The department may consider and approve, on a case-by-case basis, a setback distance other than what is required in this division. For a reduced setback distance, it must be demonstrated to the department that public health and the environment will be adequately protected. The recycled water use plan must include any approved alternative setback distance.

(8) Public outreach and sign posting. When the rules of this division require the posting of signs at a use area, the department may, on a case-by-case basis, approve an alternative method for public outreach where it considers the method will assure an equivalent degree of public protection.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
Renumbered from 340-055-0015, DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0017

Treatment and Use of Recycled Water

(1) Alternative treatment process. The department may approve in writing an alternative wastewater treatment process not specified in the rules of this division if it is demonstrated that the treatment is equivalent to and can achieve the recycled water criteria required for a specific beneficial purpose.

(2) Additional treatment. A person using recycled water from a wastewater treatment system may provide additional treatment for a different class of recycled water that is identified in this division. The wastewater treatment system owner providing the additional treatment is subject to the rules of this division and must have a NPDES or WPCF permit issued by the department.

(3) Blending recycled water. The department may approve on a case-by-case basis blending recycled water with other water if proposed by a wastewater treatment system owner. Before blending recycled water, the owner must obtain written authorization from the department. In obtaining authorization, the wastewater treatment system owner must submit to the department, at a minimum the following:

(a) An operations plan,

(b) A description of any additional treatment process,

(c) A description of blending volumes, and

(d) A range of final recycled water quality at the compliance point identified in the NPDES or WPCF permit.

(4) Water right. The rules of this division do not create a water right under ORS chapters 536, 537, 539 or 540. A person must contact the Oregon Water Resources Department to determine water right requirements for the use of recycled water.

(5) Prohibited use for human consumption. The use of recycled water for direct human consumption, regardless of the treatment class, is prohibited unless approved in writing by the Oregon Department of Human Services, and after public hearing, and it is so authorized by the Environmental Quality Commission.

(6) Prohibited use for a public pool. The use of recycled water as a source of supply for a public pool, spa, or bathhouse is prohibited unless authorized in writing by the department and with written approval from the Oregon Department of Human Services. Public pools are subject to the requirements of ORS 448 and the Oregon Department of Human Services administrative rules.

(7) Transporting recycled water. A vehicle used to transport or distribute recycled water must not be used to transport water for human consumption, unless authorized in writing by the department. The vehicle must be clearly identified with the words “nonpotable water” written in letters at least six inches high and displayed on each side and rear of the vehicle unless otherwise authorized by the department.

(8) Impoundments. Constructed landscape, and restricted and nonrestricted recreational impoundments approved for use under the rules of this division are not considered waters of the state for water quality purposes. Impoundments used for wastewater treatment are subject to ORS 215.213 and 215.283.

(9) Wetlands.

(a) The term “waters of the state” as provided in OAR 340-055-0012(18) includes, but is not limited to, the following wetlands and discharge to any of these wetlands requires a NPDES permit issued by the Department pursuant to OAR chapter 340, division 45:

(A) Enhanced or restored wetlands;

(B) Existing natural wetlands; and

(C) Wetlands created as mitigation for loss of wetlands under the Clean Water Act, Section 404.

(b) Wetlands constructed on non-wetland sites and managed for wastewater treatment are exempt from the rules of this division and are not considered waters of the state for water quality purposes.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
Renumbered from 340-055-0015, DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0020
Groundwater Quality Protection

Recycled water will not be authorized for use unless all groundwater quality protection requirements in OAR chapter 340, division 40 are met. The requirements in OAR chapter 340, division 40 are considered to be met if the wastewater treatment system owner demonstrates recycled water will be used or land applied in a manner and at a rate that minimizes the movement of contaminants to groundwater and does not adversely impact groundwater quality. If the use of recycled water occurs within a designated groundwater management area, the department may require additional conditions to be met.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.150 - 468B.190
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0022
Monitoring and Reporting

(1) The department will include in a NPDES or WPCF permit authorizing the use of recycled water, at a minimum, the monitoring requirements in OAR 340-055-0012.

(2) When chlorine or a chlorine compound is used as a disinfecting agent, the department may specify in the NPDES or WPCF permit a minimum chlorine residual concentration. When other disinfecting agents are used, the department may require additional monitoring requirements to assure adequate disinfection.

(3) The department will include in a NPDES or WPCF permit authorizing the use of recycled water, a requirement that the wastewater treatment system owner submit an annual report to the department describing the effectiveness of the system to comply with the approved recycled water use plan, the rules of this division, and the permit limits and conditions for recycled water.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
Renumbered from 340-055-0015, DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0025
Recycled Water Use Plan

(1) A recycled water use plan must describe how the wastewater treatment system owner will comply with the rules of this division and must include, but is not limited to, the following:

(a) A description of the wastewater treatment system, including treatment efficiency capability;

(b) A detailed description of the treatment methods that will be used to achieve a specific class of recycled water and for what beneficial purpose;

(c) The estimated quantity of recycled water to be provided by the wastewater treatment system owner to the user, and at what frequency and for what beneficial purpose;

(d) A description of contingency procedures that ensure the requirements of this division are met when recycled water is provided for use;

(e) Monitoring and sampling procedures;

(f) A maintenance plan that describes how the wastewater treatment system equipment and facility processes will be maintained and serviced;

(g) If notification is required by the rules of this division, a description of how the public and personnel at the use area will be notified; and

(h) A description of any measuring and reporting requirements identified by the Oregon Water Resources Department after consultation with that agency.

(2) If Class B, C, or D, or nondisinfected recycled water is to be used for irrigation, a recycled water use plan must also include, but is not limited to, the following:

(a) A description and identification of the land application site, including the zoned land use of the irrigation site and surrounding area, a site map with setbacks, and distances of nearest developed property from all boundaries of the irrigation site;

(b) A description of the irrigation system, including storage, distribution methods, application methods and rates, and shut off procedures;

(c) A description of the soils and crops or vegetation grown at the land application site;

(d) A description of site management practices including, but not limited to, the timing of application, methods used to mitigate potential aerosol drift, and if required by this division, posting of signs or public outreach; and

(e) If public access control or notification is required by this division, descriptions of public access control and how the public and personnel will be notified.

(3) If Class A recycled water is to be used for the beneficial purpose of artificial groundwater recharge, a recycled water use plan must also include, but is not limited to, the following:

(a) A groundwater monitoring plan in accordance with OAR 340-040-0030(2);

(b) A determination if the recharge will be to a drinking water protection area;

(c) A description of the soils and characteristics;

(d) The distance from the recharge area to the nearest point of withdrawal and the retention time in the aquifer until the time of withdrawal; and

(e) Verification from Oregon Water Resources Department that a request for authorization for this use has been initiated.

(4) Conditions contained in a department approved recycled water use plan are NPDES or WPCF permit requirements.

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

340-055-0030
Operational Requirements for the Treatment and Distribution of Recycled Water

(1) Bypassing. The intentional diversion of wastewater from any unit process in the wastewater treatment system for a beneficial purpose is not allowed, unless with the unit process out of service the recycled water meets the criteria of this division for a specific class and beneficial purpose described in the recycled water use plan.

(2) Alarm devices. Alarm devices are required to provide warning of power loss and failure of process equipment essential to the proper operation of the wastewater treatment system and compliance with this division.

(3) Standby power. Unless otherwise approved in writing by the department, a wastewater treatment system providing recycled water for use must have sufficient standby power to fully operate all essential treatment processes. The department may grant an exception to this section only if the wastewater treatment system owner demonstrates that power failure will not result in inadequately treated water being provided for use and will not result in any violation of an NPDES or WPCF permit limit or condition or Oregon Administrative Rule.

(4) Redundancy. A wastewater treatment system that provides recycled water for use must have a sufficient level of redundant treatment facilities and monitoring equipment to prevent inadequately treated recycled water from being used or discharged to public waters.

(5) Distribution system requirements. Unless otherwise approved in writing by the department, all piping, valves, and other portions of the recycled water use system that is outside a building must be constructed and marked in a manner to prevent cross-connection with a potable water system. Unless otherwise approved in writing by the department or as required by the rules of this division, construction and marking must be consistent with sections (2), (3), (4), and (5) of the 1992 "Guidelines for the Distribution of Nonpotable Water" of the California-Nevada Section of the American Water Works Association.

(6) Cross-connection control. Connection between a potable water supply system and a recycled water distribution system is not authorized unless the connection is through an air gap separation approved by the department. A reduced pressure principle backflow prevention device may be used only when approved in writing by the department and the potable water system owner.

[Publications: Publications referenced are available from the agency.]

Statutory/Other Authority: ORS 468.020, 468.705 & 468.710
Statutes/Other Implemented: ORS 468B.030 & 468B.050
History:
DEQ 6-2008, f. & cert. ef. 5-5-08
DEQ 32-1990, f. & cert. ef. 8-15-90

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Appendix N:

Collection System Annual Cost Evaluation

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KELLER ASSOCIATES

Technical Memorandum

TO: North Santiam Sewer Authority Board of Directors

FROM: Dallin Stephens, PE; Peter Olsen, PE

CC: Danielle Gonzalez, McRae Carmichael

DATE: July 29, 2021

SUBJECT: Collection System Annual Cost Evaluation

1.0 BACKGROUND

The North Santiam Sewer Authority (NSSA) has requested that Keller Associates conduct an evaluation of the annual costs developed for the maintenance and service of the gravity and pressure collection systems considered in the Master Plan. This evaluation will compare the annual budgets for other communities using pressurized collection systems. This evaluation also summarizes discussions with local collection system maintenance companies regarding typical annual costs and frequencies of maintenance.

Keller Associates attempted to reach out to seven communities in Oregon, Washington and Idaho that utilize pressurized collection systems for a portion or the entirety of their system. These communities are listed below. Keller also obtained the financial records of Mill City to evaluate their current cost of maintenance on their system.

- City of Coburg, OR
- City of Donald, OR
- City of Falls City, OR
- City of Harrison, ID
- City of La Pine, OR
- City of Lacey, WA
- City of Tangent, OR

The City of Stayton, which operates a traditional gravity collection system, was also contacted. Two private collection system maintenance companies, Pacific Int-R-Tek, and Blackwater LLC, were contacted to identify typical contracted rates for video recording, cleaning and repairs of collection systems and septic systems. The following paragraphs summarize information received from the various entities contacted.

2.0 DISCUSSION OF FINANCIAL INFORMATION RECEIVED

A number of the cities listed above were contacted to better understand actual costs associated with maintaining and servicing pressure sewer collection systems. It should be made clear that information received may have some inherent inaccuracies in representing total costs. This is due to the fact that some budgetary costs were provided through public works director's best estimates over a phone call. In other cases where financial records were available, it was difficult to identify which line item (or how much of a given line item) costs should be applied to collection system maintenance vs. other city services, such as treatment plants.

While each city had different ways of tracking expenses for maintenance of their collection system, three key expenses were identified in the evaluation: labor, repairs/replacements/miscellaneous, and septic tank pumping. Note that the cost of power was not included as a key expense as each individual residence was responsible for this cost.

Labor: This includes wages, benefits and payroll taxes for operation and maintenance staff. Where staff split their time between maintaining the collection system and other duties (such as treatment plant or other city services), the total expense was multiplied by the proportional time spent on the collection system.

Repairs/Replacements: This includes parts and materials required to maintain the pumps, floats, valves, control panels or other components of the collection system. This also includes vehicle expenses, training and other minor miscellaneous expenses associated with maintaining the collection system.

Septic Tank Pumping: This includes only the cost for pumping of the septic tanks.

2.1 CITY OF COBURG, OREGON

The City of Coburg consists of approximately 1,700 people with 700 sewer connections, all of which are on a Septic Tank Effluent Pumping (STEP) system, manufactured by Orenco. The system was installed in 2014. Effluent is pumped to an MBR treatment plant which is owned and operated by the city.

According to communications with Brian Harmon, the public works director, the city employs 6 public works operators to maintain the collection system and treatment plant. Approximately 60-70% of the operators' time is spent maintaining the collection system, primarily consisting of replacing pumps, floats, and miscellaneous components in each pump station. While they would like to be able to perform preventative maintenance for the system, they are busy enough that they are only able to provide reactive maintenance responding to individual system alarms. In addition to normal service, the city responds to approximately 3-4 after hour alarms per week. The staff has not observed any plugging issues in the pressure mains.

Approximate annual budgets for maintaining the system were provided by Brian Harmon and are as follows:

- Septic tank maintenance and pumping: $54,000
- Materials and supplies: $12,500
- Tools and equipment: $8,000
- Repairs: $16,500
- Training/licensing: $3,500

The following table summarizes the totals of key expenses and the cost per connection. Note that the labor cost was calculated based on six full time employees spending 65% of their time on the collection system at a loaded labor cost of $60/hour. Note that the $60/hour is representative of the expected loaded labor cost in the NSSA Wastewater Master Plan.

Key Expense	Total Cost	Cost per Connection
Labor	$486,720	$695
Septic Tank Pumping	$54,000	$77
Repairs, Parts and Miscellaneous	$40,500	$58
Total	**$581,220**	**$830**

2.2 CITY OF DONALD, OREGON

The City of Donald consists of approximately 401 sewer connections, including both residential and commercial. It is understood that all connections use a STEP system. The system was originally installed with Orenco equipment in 1982, but as pumps have needed replacing, the city staff has opted to use other manufacturers, such as Hydromatic or Champion. Effluent is pumped to treatment lagoons, which also receive flows from a neighboring community.

Keller Associates was able to speak with the City Manager (Heidi Bell) as well as the Public Works Director (Alonso Limones), who provided information regarding the city operations. The city employs three full time operators to maintain the collection system and treatment plant and provide other city maintenance services. The public works director estimates that of the time spent on the collection and treatment system, 80% of the staff's time is spent on the collection system, 20% at the treatment plant. He estimates that they receive 30-40 calls per year to replace parts in the STEP systems. They schedule septic tanks to be pumped every five years at a rate of $375 per tank. The City staff also provided the approved 2021 budget for our review. The following expenses in the sewer fund were identified:

- Wages, benefits, and payroll taxes for staff related to the sewer fund (excluding administrative): $111,000
- Vehicle operation: $2,000
- Outside services: $16,200
- Septic tank pumping: $30,000
- Repair and maintenance: $17,500

The following table summarizes the totals of key expenses and the cost per connection. Note that the labor cost was based on the operators spending 80% of their time allocated to the sewer fund toward the collection system.

Key Expense	Total Cost	Cost per Connection
Labor	$88,800	$221
Septic Tank Pumping	$30,000	$75
Repairs, Parts and Miscellaneous	$35,700	$89
Total	**$154,500**	**$385**

2.3 CITY OF FALLS CITY, OREGON

The City of Falls City consists of approximately 400 connections to their water system. However, only 80-100 of these connections are connected to the sewer system. The remainder of the connections use private septic systems. Keller contacted the city manager, who has only recently been employed by the city. As such, he had a limited amount of historical information. Attempts to contact the public works director were unsuccessful.

2.4 CITY OF HARRISON, IDAHO

The City of Harrison, Idaho is located near Coeur d'Alene. The community consists of approximately 217 people, with residences connected to a STEP system. The collection system ultimately discharges to treatment lagoons prior to discharge to surface waters. Financial records related to the operation and maintenance of the collection system were requested but were not received prior to this memo being completed.

2.5 CITY OF LA PINE, OREGON

The City of La Pine, Oregon consists of approximately 800 sewer connections, of which about 90% are connected as Septic Tank Effluent Gravity (STEG) systems and 10% are connected as STEP systems. The effluent discharges to facultative lagoons. The city pumps STEP tanks every 2 years (due to clogging in the pump screens) and every 5-7 years in the STEG tanks. However, more specific budget and financial information was not available through discussions with the city representative.

2.6 CITY OF LACEY, WASHINGTON

Keller attempted to contact the city engineer on multiple occasions but was unsuccessful. Additional follow up calls will be made, and any information received can be presented to the Authority when available.

2.7 CITY OF TANGENT, OREGON

The City of Tangent consists of approximately 1,200 people, with 500-600 connections to the sewer system. It is understood that the entire city operates on STEP systems and was originally installed in 1985. The collection system discharges to facultative lagoons. The city contracts with the City of Adair Village to provide maintenance services. These services include the maintenance of the STEP systems and treatment plant but does not include septic tank pumping or replacement parts. According to conversations with Matt Lydon of Adair Village, approximately 50-75% of their staff time servicing Tangent City is spent at the treatment plant. The City of Tangent budgets the following amounts outside of the contract with Adair Village:

- Septic tank pumping: $35,000
- Parts and replacement pumps: $35,000

The following table summarizes the totals of key expenses and the cost per connection. Note that the labor cost was based on the contracted operators spending 37.5% of their contracted time maintaining the collection system. Also note that the number of connections is assumed to be 550.

Key Expense	Total Cost	Cost per Connection
Labor	$75,000	$136
Septic Tank Pumping	$35,000	$64
Repairs, Parts and Miscellaneous	$35,700	$65
Total	**$145,700**	**$265**

2.8 CITY OF MILL CITY, OREGON

Mill City has approximately 839 connections. Keller Associates was able to speak with Russ Foltz, the public works supervisor. From this communication, there are an estimated 30-50 STEP systems, while the remainder are STEG systems. The system was originally installed in 1994. Russ estimates that most of his staff's time is spent on the collection system, with only 10-15% of their time spent at the treatment plant. The City of Mill City also provided their financial records for our review. The following expenses were identified in the 2021-2022 proposed budget:

- Labor: $196,000, of which approximately 55% is administrative
- Maintenance and Repair of Sewer System: $10,000
- Sludge Management (septic tank pumping): $25,000
- Vehicle Maintenance: $2,000
- Training: $1,500
- Sewer System Supplies: $2,500

The following table summarizes the totals of key expenses and the cost per connection. Note that the labor cost was based on the contracted operators spending 87.5% of their time allocated toward the sewer fund maintaining the collection system.

Key Expense	Total Cost	Cost per Connection
Labor	$77,175	$92
Septic Tank Pumping	$25,000	$30
Repairs, Parts and Miscellaneous	$16,000	$19
Total	**$118,175**	**$141**

2.9 BLACKWATER, LLC

Blackwater LLC is a contracted collection system and treatment plant operator who primarily serves very small communities (less than 100 connections) near Boise, Idaho. They only maintain one collection system using STEP pumps and did not readily have records available of annual costs for maintaining these systems. They did note that they typically pump out septic pumps for a fee of $300 every five years.

2.10 SUMMARY OF DATA RECEIVED FOR PRESSURE SYSTEMS

The following table summarizes the cost per connection for key expenses given in the previous sections. This figure also shows the cost per connection used in the May draft NSSA Wastewater Master Plan (Option 1).

City	Labor	Septic Tank Pumping	Repairs, Parts and Miscellaneous	Total Cost per Connection
Coburg	$695	$77	$58	$830
Donald	$221	$75	$89	$385
Tangent	$136	$64	$65	$265
Mill City	$92	$30	$19	$141
Master Plan (Option 1)	**$72**	**$100**	**$75**	**$247**

Based on the information received, it is prudent to provide some adjustments to the costs in the Master Plan. These adjustments would include the following:

- Increase the labor cost to $154 per connection to be more in line with what was reported from other cities. This increase also attempts to capture costs associated with travel between the communities.
- Decrease the repairs, parts, and miscellaneous cost to $40 per connection. This accounts for the fact that nearly half of the systems are STEG, without any pumps, floats or valves that need replacing.
- Keep septic tank pumping as is. While Mill City has a low cost here, they pump their tanks infrequently at low cost. This cost and frequency may not be a conservative estimate for the Sewer District.
- The total cost per connection becomes $294.

3.0 GRAVITY COLLECTION SYSTEM MAINTENANCE

Keller contacted the City of Stayton, Oregon as well as Pacific Int-R-Tek, a private company who provides gravity collection system cleaning and CCTVing services.

The City of Stayton has approximately 200,000 linear feet of gravity sewer piping that they attempt to service on a five year cycle. The system was originally installed in 1962. Their system includes some section of older piping (concrete or clay) and some new piping. They currently have a contract for outside services to provide CCTVing at a cost of $60,000 to $70,000 annually. They estimate the total budget needed for CCTVing, cleaning and repair of their system to be $175,000 to $200,000 annually. This equates to an annual cost of $0.87 - $1.00 per linear foot of piping.

In conversations with Pacific Int-R-Tek, they have recommended a budgetary cost of $1.00 per linear foot for CCTVing, done on a 5-8 year cycle, and a cost of $1.00 per linear foot for cleaning, done on a 4 year cycle. This is equivalent to $0.38 to $0.45 per linear foot per year for both services. Pacific Int-R-Tek did not provide estimates for repairs as this can widely vary from system to system.

The following table summarizes the costs for servicing and repairing a gravity collection system. This table also includes the costs used in the May draft of the Master Plan (Option 2).

Entity	CCTV	Cleaning	Repairs	Cost per Linear Foot
City of Stayton	x	x	x	$1.00
Pacific Int-R-Tek	x	x		$0.45
Master Plan (Option 2)	x	x	x	$0.12

Based on the information received, it is prudent to adjust the costs presented in the May draft of the Master Plan. Based on the fact that this collection system would consist of new piping, and repair costs should be lower than the City of Stayton (due to the age of the system), a value of $0.60 per linear foot is proposed.

For the gravity collection system identified in the Master Plan Option 2, there is approximately 78,000 linear feet of gravity collection piping. With the proposed maintenance cost noted above, this would be equivalent to $47,000 of annual costs. In addition to the maintenance of the collection system, there is expected costs for maintaining the lift stations, which is estimated at $9,000 annually. With $56,000 of annual costs, this is equivalent to $36 per connection per year for the maintenance of a gravity collection system.

Appendix O:
Oregon Energy Trust

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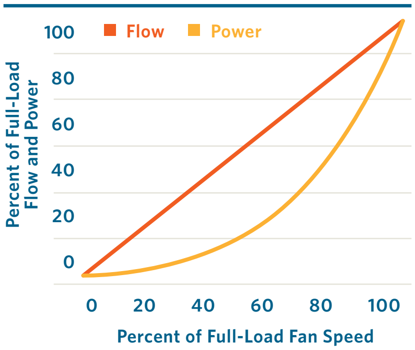
Wastewater Treatment Energy Savings Guide

Oregon wastewater treatment plants face challenges of growing hydraulic demand, rising operating costs, increased regulatory requirements and outdated equipment and facilities. Throughout the state, treatment plants continuously look for ways to control costs, while improving effluent quality and meeting temperature standards. Because treatment plants require a significant energy input, energy efficiency offers an expanding opportunity to trim operating costs.

Energy Trust of Oregon is dedicated to helping you identify options for improving your facility's energy efficiency over time. The chart below shows how energy is used in a typical wastewater treatment plant and can help you understand where to focus your efforts. We've also compiled a list of "next steps" for you to review. Talk with your Program Delivery Contractor, PDC, about which of these steps could have the biggest impact on energy savings at your plant.

EnergyTrust of Oregon

FAN AFFINITY LAWS



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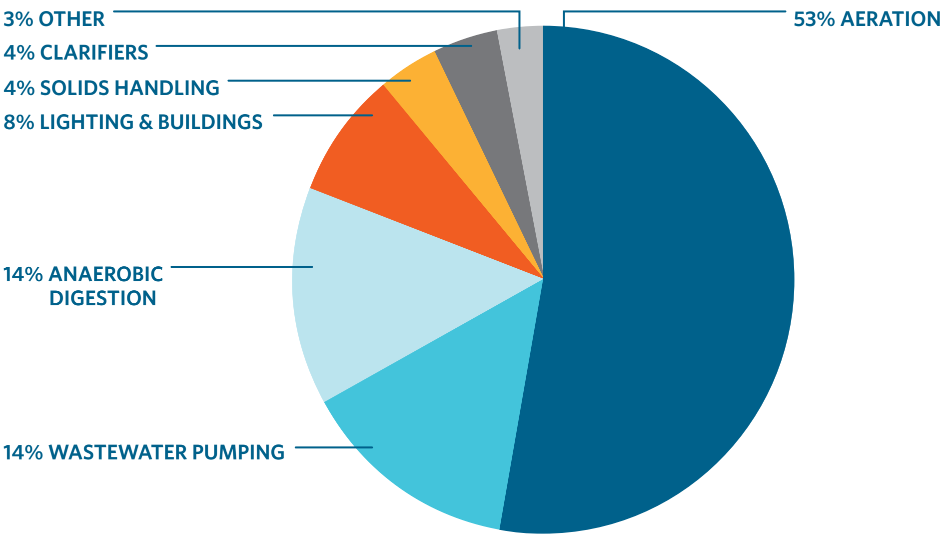

AERATION SYSTEM

Could operations and maintenance improvements reduce energy use in aeration basins? Making simple Operations & Maintenance, O&M, adjustments to existing aeration equipment can pay back quickly in reduced energy costs.

- ❑ Optimize the dissolved oxygen, DO, set point to reduce the amount of blower energy. It's not uncommon for systems to operate with DO levels that exceed what is required.
- ❑ Adjust the position of DO sensors to provide a more accurate assessment of DO levels.
- ❑ Adjust control systems to optimize mechanical mixing and bubble diffusion.
- ❑ Implement the Most Open Valve strategy in which the aeration zone with the highest oxygen demand is opened fully to reduce pressure at the blowers. DO levels in remaining aeration zones are controlled by valves that maintain the proper DO set point for each zone.
- ❑ Adjust the placement of mechanical mixers for more efficient oxygen transfer.

Consider upgrading your existing aeration basin technology. Aeration uses between 40 and 60 percent of the energy consumed in a typical wastewater treatment plant. Improving oxygen transfer efficiency can significantly impact total energy consumption in your facility.

- ❑ Upgrade from coarse bubble diffusion to fine bubble diffusion to increase the efficiency of oxygen transfer and reduce blower load while maintaining proper DO control.
- ❑ Install automated DO controls to reduce aeration energy by up to 40 percent compared to control systems that use manual sampling. Systems that rely on manual DO sampling often operate at levels that are much higher than necessary. Installing a DO sensor with integrated aeration control allows levels to be maintained within a narrower band, thereby reducing blower load.
- ❑ Add DO probes to different zones of the aeration basin to provide more accurate DO readings and optimize aeration for each zone.
- ❑ Upgrade systems that use mechanical mixing by installing controls that cycle on and off in response to process control parameters.
- ❑ Retrofit mechanical mixers with variable frequency drives, VFDs, which adjust the speed of the mixer motors to match the process needs in real-time. Typical simple payback of two to seven years.

Are there opportunities to improve the efficiency of blower systems by implementing O & M measures? Making adjustments to blower system controls can yield substantial energy savings at little cost.

- ❑ Adjust controls to optimize blower staging.
- ❑ Optimize DO set points to allow for blower system flow reduction.
- ❑ Find and reduce obstructions to blower airflow to decrease the pressure in the blower system, with accompanying energy savings.

Could capital improvements to your blower system lead to substantial energy savings? Up to 75 percent of the lifecycle cost of a blower system is attributable to energy use. When replacing an existing blower system, select a blower appropriate for the application. Your Program Delivery Contractor, PDC, can work with you to determine the blower technology that best fits your needs now and in the future.

- ❑ Install controls that allow staging of systems that have multiple blowers. Control systems optimize blower staging based on system requirements.
- ❑ Upgrade to a high-efficiency turbo blower system, which uses very high-speed motors and air-bearing technology to efficiently produce airflow. Turbo blower systems are typically VFD-equipped, and are capable of providing a range of airflow based on DO sensor feedback. Typical simple payback of 2-1/2 to seven years.
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PUMPING

Could O&M improvements improve pumping system efficiency? Low-cost adjustments to existing pumping systems could boost energy efficiency, often delivering a simple payback of less than one year.

- ❑ Determine pump system efficiency over the range of pumping requirements and stage pumps for optimum energy use.
- ❑ Adjust basin fluid levels to decrease pump head and reduce pump load. Wet-well levels can be raised in pumping stations to reduce pump head.
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Can energy be saved through capital improvements to pumping systems Pumping accounts for about 14 percent of the energy used to maintain a typical municipal wastewater treatment facility. Improvements in pumping technology have the opportunity to substantially reduce facility energy us.

- ❑ Install VFDs on pumps that move varying volumes of fluid to adjust speed to match pumping demand in real-time. When less pump flow or pressure is required, pump speed and accompanying energy use will be reduced.
- ❑ Replace worn or inefficient pumps with new, high-efficiency pumps that use less energy and operate with less maintenance and downtime.
- ❑ Oversized pumps that operate at constant flow are good candidates for impeller trims. Trimming the impeller is frequently a lower-cost alternative to making larger capital investments in pumps, motors or control technology.
- ❑ Install different sized pumps in new plants or during plant expansion. As seasonal flows change, controls can bring different pump combinations online to match pumping need.
- ❑ Improve piping and valves to decrease friction losses.

LIGHTING

Could plant lighting be improved for better function and energy efficiency? Modern lighting technologies offer better performance and efficiency compared to older technologies. An upgrade to lighting systems is likely to have a quick payback, while increasing the comfort of those working in the space.

- ❑ Use occupancy sensors to turn off lamps in unoccupied spaces and trim lighting energy substantially. Equip occupancy sensors with a time delay to turn off lamps after a set period after workers leave seldom-occupied pumping stations or other isolated areas.
- ❑ Upgrade existing High Intensity Discharge lighting systems to newer, more energy efficient technologies. The switch from Metal Halide or Sodium Vapor to T5 or T8 lighting could reduce lighting energy use by up to 50 percent.
- ❑ Replace less efficient fluorescent lamps with high-efficiency linear fluorescent technology. Fluorescent lamp options include energy efficient T8 task lighting and T5 high-bay lighting.
- ❑ Install induction lighting in places where long lamp life and low maintenance is necessary. Induction lighting is a good fit for areas that are difficult to access for maintenance.
- ❑ Consider installing LED lighting as an energy-efficient replacement for other less-efficient technologies. LEDs combine ultra-high efficiency with excellent performance and long life in an increasingly affordable package.
- ❑ Add photo sensors on indoor and outdoor lighting systems to dim or switch off lamps when natural light levels are sufficient.

ANAEROBIC DIGESTION

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- ❏ Adjust existing digester mixing systems to use the minimum number of mixers possible for adequate mixing of influent and a high volume of gas.
- ❏ Optimize mixer speed in systems with VFD-controlled motors to reduce energy use while maintaining a high output of digester gas.
- ❏ Replace mixing systems that are not functioning correctly or operating inefficiently with higher efficiency systems.
- ❏ Upgrade existing systems such as gas lance or draft tube systems to a linear motion mixing system.

MOTORS

Are motors in your wastewater treatment process operating as efficiently as possible? Several energy-saving strategies may be applicable to electric motors that are using more energy than necessary.

- ❏ Adjust existing motor control systems to minimize the amount of energy used for normal operation. Small adjustments to control systems could lead to significant energy savings.
- ❏ Add VFD control to motors to adjust the speed to process needs in real-time. During periods of reduced demand, the rpm of the motor could be reduced to lower energy use.
- ❏ Retrofit motors that run constantly with control systems that rely on sensor feedback to turn off the motor when the system does not require motor operation.
- ❏ Replace oversized motors with high-efficiency motors more appropriately sized for the load.
- ❏ When they need replacing, upgrade standard-efficiency motors with premium-efficiency motors.
- ❏ Rebuild worn motors to an efficiency similar to the original specifications for that motor. Green rewinds are a cost effective way to boost energy efficiency.

UV DISINFECTION

Does your plant's ultraviolet, UV, disinfection system need adjustment? UV disinfection systems can use more energy than necessary to ensure proper disinfection. UV dose control systems ensure that energy is not being wasted.

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Energy Trust of Oregon 421 SW Oak St., Suite 300, Portland, OR 97204 1.866.368.7878 503.546.6862 *fax* **energytrust.org**

Energy Trust of Oregon is an independent nonprofit organization dedicated to helping utility customers benefit from saving energy and tapping renewable resources. Our services, cash incentives and energy solutions have helped participating customers of Portland General Electric, Pacific Power, NW Natural and Cascade Natural Gas save on energy costs. Our work helps keep energy costs as low as possible, creates jobs and builds a sustainable energy future. **Printed with vegetable-based inks on paper that contains 100% post-consumer waste. 3/14**

Appendix P :

Oregon Energy Trust

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Wastewater Treatment Energy Savings Guide

Oregon wastewater treatment plants face challenges of growing hydraulic demand, rising operating costs, increased regulatory requirements and outdated equipment and facilities. Throughout the state, treatment plants continuously look for ways to control costs, while improving effluent quality and meeting temperature standards. Because treatment plants require a significant energy input, energy efficiency offers an expanding opportunity to trim operating costs.

Energy Trust of Oregon is dedicated to helping you identify options for improving your facility's energy efficiency over time. The chart below shows how energy is used in a typical wastewater treatment plant and can help you understand where to focus your efforts. We've also compiled a list of "next steps" for you to review. Talk with your Program Delivery Contractor, PDC, about which of these steps could have the biggest impact on energy savings at your plant.

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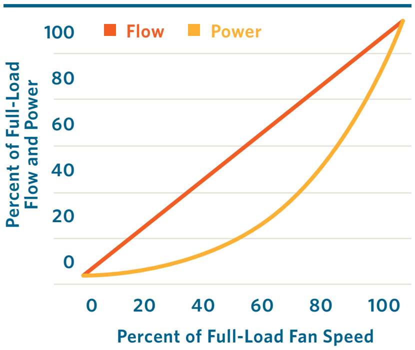

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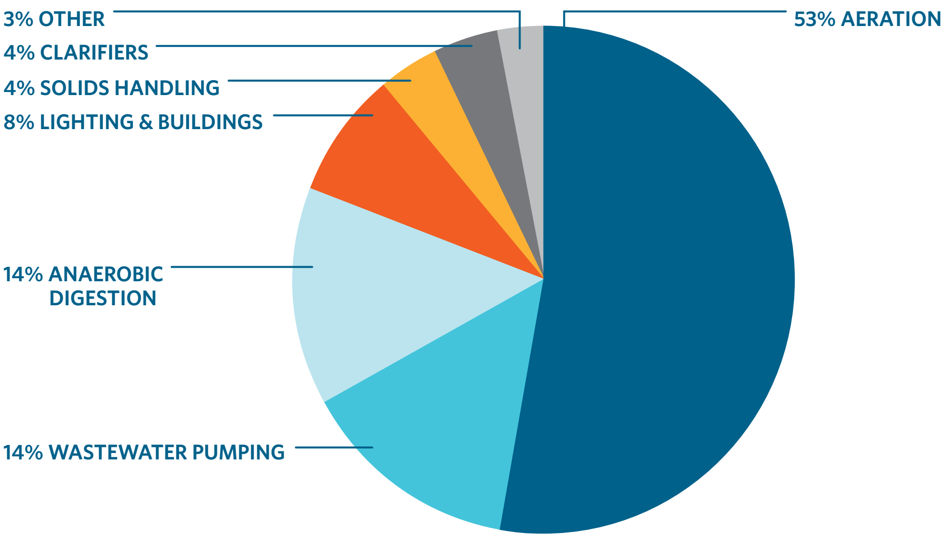

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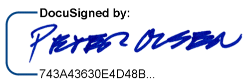
Peter Olsen polsen@kellerassociates.com Keller Associates Security Level: Email, Account Authentication (None)	 Signature Adoption: Uploaded Signature Image Using IP Address: 50.209.49.221	Sent: 9/7/2021 4:38:02 PM Viewed: 9/7/2021 4:39:48 PM Signed: 9/7/2021 4:44:37 PM

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