APPENDIX A:

National Pollutant Discharge Elimination System
Permit 101384

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

Department of Environmental Quality
Western Region – Salem Office
750 Front Street NE, Suite 120, Salem, OR 97301-1039
Telephone: (503) 378-8240

Issued pursuant to ORS 468B.050 and The Federal Clean Water Act

ISSUED TO:
City of Lowell
PO Box 490
Lowell, Oregon 97452

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Treated Wastewater	001	R.M. 15.7
Emergency Overflow	002	Alder Street Pump Station

FACILITY TYPE AND LOCATION:
Activated Sludge
Lowell Wastewater Treatment Plant
240 S Moss Street
Lowell
Treatment System Class: Level III
Collection System Class: Level II

RECEIVING STREAM INFORMATION:
Basin: Willamette
Sub-Basin: Middle Fork Willamette
Receiving Stream: Middle Fork Willamette River
LLID: 1230144440225 15.7 D
County: Lane

EPA REFERENCE NO: OR002004-4

Issued in response to Application No.972846 received June 26, 2008.

This permit is issued based on the land use findings in the permit record.

John J. Ruscigno, Water Quality Manager
Western Region North

February 23, 2010
Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system and discharge to public waters adequately treated wastewaters only from the authorized discharge point or points established in Schedule A and only in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

Unless specifically authorized by this permit, by another NPDES or WPCF permit, or by Oregon Administrative Rule (OAR), any other direct or indirect discharge to waters of the state is prohibited, including discharge to an underground injection control system.

SCHEDULE A: Waste Discharge Limits
(not to be exceeded after permit issuance)

1. Outfall 001 Treated Effluent:

a. May 1 - October 31:

Parameter	Average Effluent Concentrations Monthly	Weekly	Monthly Average lb/day	Weekly Average lb/day	Daily Maximum lbs
BOD_5	10 mg/L	15 mg/L	13	19	26
TSS	10 mg/L	15 mg/L	13	19	26

b. November 1 - April 30:

Parameter	Average Effluent Concentrations Monthly	Weekly	Monthly Average lb/day	Weekly Average lb/day	Daily Maximum lbs
BOD_5	30 mg/L	45 mg/L	58	87	120
TSS	30 mg/L	45 mg/L	58	87	120

Summer mass load limits are based on average dry weather design flow of 0.15 MGD; winter mass load limits are based upon average wet weather design flow of 0.23 MGD. The daily mass load limit is suspended on any day in which the flow to the treatment facility exceeds 0.3 MGD (twice the design average dry weather flow).

c. Year round:

Other parameters	Limits
E. coli bacteria	Must not exceed 126 organisms per 100 mL monthly geometric mean; no single sample can exceed 406 organisms per 100 mL **(See Note A1)**
BOD_5 and TSS, removal efficiency	Must not be less than a monthly average of 85%
pH	Must be within the range of 6.0 - 9.0
Chlorine , total residual	Must not exceed a monthly average of 0.5 mg/L

d. Except as provided for in OAR 340-45-080, no wastes shall be discharged and no activities shall be conducted which violate Water Quality Standards as adopted in OAR 340-41-0445 except in the following defined mixing zone:

The mixing zone is defined as five percent of the stream flow from Dexter Reservoir through Dexter Dam. The zone of initial dilution is defined as one percent of the stream flow from Dexter Reservoir through Dexter Dam.

2. Outfall 002 Emergency Overflow (Alder Street Pump Station):

No wastes shall be discharged from this outfall.

3. Notes:

A1. If a single sample exceeds 406 organisms per 100 mL, then five consecutive re-samples may be taken at four-hour intervals beginning within 48 hours after the original sample was taken. If the geometric mean of the five re-samples is less than or equal to 126 organisms per 100 mL, a violation shall not be triggered.

SCHEDULE B: Minimum Monitoring and Reporting Requirements

1. Monitoring procedures:

The permittee shall monitor the parameters as specified below at the locations indicated. The laboratory used by the permittee to analyze samples shall have a quality assurance/quality control (QA/QC) program to verify the accuracy of sample analysis. If QA/QC requirements are not met for any analysis, the results shall be included in the report, but not used in calculations required by this permit. When possible, the permittee shall re-sample in a timely manner for parameters failing the QA/QC requirements, analyze the samples, and report the results.

a. Influent

Influent grab samples, measurements, and composite samples must be taken just after the helisieve headworks.

Parameter	Minimum Frequency	Sample Type
BOD_5, concentration	Weekly	Composite
TSS, concentration	Weekly	Composite
pH	2/Week	Grab

b. Outfall 001 Treated Effluent

Effluent grab samples, measurements, and composite samples must be taken from the dechlorination/re-aeration tank.

Parameter	Minimum Frequency	Sample Type
Flow, total (MGD)	Daily	Measurement
Flow Meter Calibration	Annual	Verification
BOD_5, concentration	Weekly	Composite
BOD_5, pounds discharged	Weekly	Calculation
BOD_5, average removal efficiency	Monthly	Calculation
TSS, concentration	Weekly	Composite
TSS, pounds discharged	Weekly	Calculation
TSS, average removal efficiency	Monthly	Calculation
pH	3/Week	Grab
E. coli	Weekly	Grab
Temperature	3/Week	Grab
Chlorine, quantity used	Daily	Measurement
Chlorine, total residual	Daily	Grab

c. Biosolids Management (Class B biosolids)

Parameter		Minimum Frequency	Sample Type
Total solids,	% dry wt.	Annual	Composite (see Note B1)
Volatile solids,	% dry wt.	Annual	Composite (see Note B1)
NH_3-N,	% dry wt.	Annual	Composite (see Note B1)
NO_3-N,	% dry wt.	Annual	Composite (see Note B1)
TKN,	% dry wt.	Annual	Composite (see Note B1)
P,	% dry wt.	Annual	Composite (see Note B1)
K,	% dry wt.	Annual	Composite (see Note B1)
pH,	S.U.	Annual	Composite (see Note B1)
Total As	mg/kg	Annual	Composite (see Note B1)
Total Cd	mg/kg	Annual	Composite (see Note B1)
Total Cu	mg/kg	Annual	Composite (see Note B1)
Total Hg	mg/kg	Annual	Composite (see Note B1)
Total Mo	mg/kg	Annual	Composite (see Note B1)
Total Ni	mg/kg	Annual	Composite (see Note B1)
Total Pb	mg/kg	Annual	Composite (see Note B1)
Total Se	mg/kg	Annual	Composite (see Note B1)
Total Zn	mg/kg	Annual	Composite (see Note B1)
Fecal coliform or equivalent per 40CFR503.32	per unit total dry wt. solids	Annual	Composite of at least 7 individual samples; representative of product to be land applied
Locations where applied		Each occurrence	Date, volume, location
Percent total solids achieved by air dry before addition of inert material; note if solids included unstabilized solids from primary wastewater treatment process		Each batch	Composite (see Note B1)

2. Discharge Monitoring Reports:

a. The reporting period is the calendar month.

b. State discharge monitoring reports must:

- be submitted to the appropriate Department office by the 15th day of the month following.the reporting period,
- be reported on approved forms,
- identify the name, certificate classification, and grade level of each principal operator designated by the permittee as responsible for supervising the wastewater collection and treatment systems during the reporting period,
- identify each system classification as found on page one of this permit,
- record the quantity and method of use of all sludge and biosolids removed from the treatment facility,
- record all applicable equipment breakdowns and bypasses

3. Other Reports:

a. The permittee shall have in place a program to identify and reduce inflow and infiltration into the sewage collection system. An annual report detailing sewer collection maintenance activities that reduce inflow and infiltration shall be submitted to the Department by February 1 each year. The report shall state those activities that have been done in the previous year and those activities planned for the following year.

b. For any year in which sludge is landfilled, a report shall be submitted to the Department by February 19 of the following year that describes solids handling activities for the previous year and includes, but is not limited to, the required information outlined in OAR 340-50-035(6)(a)-(e).

c. The permittee must submit a land application biosolids report for each year by February 19 of the following year.

4. Notes:

B1. Composite samples shall be taken from reference areas in the sludge drying bed pursuant to **Test Methods for Evaluating Solid Waste, Volume 2: Field Manual, Physical/Chemical Methods**, third edition, chapter 9 (November 1986).

Inorganic pollutant monitoring must be conducted according to **Test Methods for Evaluating Solid Waste, Physical/Chemical Methods**, second edition (1982) with Updates I and II and third edition (1986) with Revision I.

SCHEDULE D: Special Conditions

1. The permittee must dispose of its sludge as solid waste in a Department approved landfill in accordance with the General Provisions of the Department's Solid Waste Rules (OAR Chapter 340, Division 093). Proper waste monitoring would be prescribed by the landfill in accordance with those rules.
2. The permittee must report transport of sludge on its monthly Discharge Monitoring Reports as well as on its annual sludge report.
3. Any biosolids applied must comply with the federal biosolids regulations (40 CFR Part 503) and biosolids monitoring must be done in accordance with Schedule B of this permit.
4. The permittee must comply with OAR Chapter 340, Division 49, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and accordingly:

    a. The permittee shall have its wastewater system supervised by one or more operators who are certified in a classification and grade level (equal to or greater) that corresponds with the classification (collection and/or treatment) of the system to be supervised as specified on page one of this permit.

Note: ***A "supervisor" is defined as the person exercising authority for establishing and executing the specific practice and procedures of operating the system in accordance with the policies of the permittee and requirements of the waste discharge permit. "Supervise" means responsible for the technical operation of a system, which may affect its performance or the quality of the effluent produced. Supervisors are not required to be on-site at all times.***

    b. The permittee's wastewater system may not be without supervision (as required by Special Condition 4.a. above) for more than thirty (30) days. During this period, and at any time that the supervisor is not available to respond on-site (i.e. vacation, sick leave or off-call), the permittee must make available another person who is certified at no less than one grade lower than the system classification.

    c. If the wastewater system has more than one daily shift, the permittee shall have the shift supervisor, if any, certified at no less than one grade lower than the system classification.

    d. The permittee is responsible for ensuring the wastewater system has a properly certified supervisor available at all times to respond on-site at the request of the permittee and to any other operator.

    e. The permittee shall notify the Department of Environmental Quality in writing within thirty (30) days of replacement or redesignation of certified operators responsible for supervising wastewater system operation. The notice shall be filed with the Water Quality Division, Operator Certification Program, 811 SW 6th Ave, Portland, OR 97204. This requirement is in addition to the reporting requirements contained under Schedule B of this permit.

    f. Upon written request, the Department may grant the permittee reasonable time, not to exceed 120 days, to obtain the services of a qualified person to supervise the wastewater

system. The written request must include justification for the time needed, a schedule for recruiting and hiring, the date the system supervisor availability ceased, and the name of the alternate system supervisor(s) as required by 4.b. above.

5. The permittee shall not be required to perform a hydrogeologic characterization or groundwater monitoring during the term of this permit provided:

   a. The facilities are operated in accordance with the permit conditions, and;

   b. There are no adverse groundwater quality impacts (complaints or other indirect evidence) resulting from the facility's operation.

6. If warranted, the Department may evaluate the need for a full assessment of the facilities impact on groundwater quality at permit renewal.

7. The permittee shall notify the appropriate DEQ Western Region Office in accordance with the response times noted in the General Conditions of this permit, of any malfunction so that corrective action can be coordinated between the permittee and the Department.

SCHEDULE F

NPDES GENERAL CONDITIONS – DOMESTIC FACILITIES

SECTION A. STANDARD CONDITIONS

1. Duty to Comply with Permit

The permittee must comply with all conditions of this permit. Failure to comply with any permit condition is a violation of Oregon Revised Statutes (ORS) 468B.025 and the federal Clean Water Act and is grounds for an enforcement action. Failure to comply is also grounds for the Department to terminate, modify and reissue, revoke, or deny renewal of a permit.

2. Penalties for Water Pollution and Permit Condition Violations

The permit is enforceable by DEQ or EPA, and in some circumstances also by third-parties under the citizen suit provisions 33 USC §1365. DEQ enforcement is generally based on provisions of state statutes and EQC rules, and EPA enforcement is generally based on provisions of federal statutes and EPA regulations.

ORS 468.140 allows the Department to impose civil penalties up to $10,000 per day for violation of a term,
condition, or requirement of a permit. The federal Clean Water Act provides for civil penalties not to exceed $32,500 and administrative penalties not to exceed $11,000 per day for each violation of any condition or limitation of this permit.

Under ORS 468.943, unlawful water pollution, if committed by a person with criminal negligence, is punishable by a fine of up to $25,000, imprisonment for not more than one year, or both. Each day on which a violation occurs or continues is a separately punishable offense. The federal Clean Water Act provides for criminal penalties of not more than $50,000 per day of violation, or imprisonment of not more than 2 years, or both for second or subsequent negligent violations of this permit.

Under ORS 468.946, a person who knowingly discharges, places, or causes to be placed any waste into the waters of the state or in a location where the waste is likely to escape into the waters of the state is subject to a Class B felony punishable by a fine not to exceed $200,000 and up to 10 years in prison. The federal Clean Water Act provides for criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment of not more than 3 years, or both for knowing violations of the permit. In the case of a second or subsequent conviction for knowing violation, a person shall be subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than 6 years, or both.

3. Duty to Mitigate

The permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment. In addition, upon request of the Department, the permittee must correct any adverse impact on the environment or human health resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and have the permit renewed. The application must be submitted at least 180 days before the expiration date of this permit.

The Department may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

5. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any term, condition, or requirement of this permit, a rule, or a statute
b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts
c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge
d. The permittee is identified as a Designated Management Agency or allocated a wasteload under a Total Maximum Daily Load (TMDL)
e. New information or regulations
f. Modification of compliance schedules
g. Requirements of permit reopener conditions
h. Correction of technical mistakes made in determining permit conditions
i. Determination that the permitted activity endangers human health or the environment
j. Other causes as specified in 40 CFR 122.62, 122.64, and 124.5
k. For communities with combined sewer overflows (CSOs):
   (1) To comply with any state or federal law regulation that addresses CSOs that is adopted or promulgated subsequent to the effective date of this permit
   (2) If new information, not available at the time of permit issuance, indicates that CSO controls imposed under this permit have failed to ensure attainment of water quality standards, including protection of designated uses
   (3) Resulting from implementation of the Permittee's Long-Term Control Plan and/or permit conditions related to CSOs.

The filing of a request by the permittee for a permit modification, revocation or reissuance, termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Toxic Pollutants

The permittee must comply with any applicable effluent standards or prohibitions established under Oregon Administrative Rules (OAR) 340-041-0033 and 307(a) of the federal Clean Water Act for toxic pollutants, and with standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

7. Property Rights and Other Legal Requirements

The issuance of this permit does not convey any property rights of any sort, or any exclusive privilege, or authorize any injury to persons or property or invasion of any other private rights, or any infringement of federal, tribal, state, or local laws or regulations.

8. Permit References

Except for effluent standards or prohibitions established under Section 307(a) of the federal Clean Water Act and OAR 340-041-0033 for toxic pollutants, and standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, all rules and statutes referred to in this permit are those in effect on the date this permit is issued.

9. Permit Fees

The permittee must pay the fees required by Oregon Administrative Rules.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems that are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Need to Halt or Reduce Activity Not a Defense

For industrial or commercial facilities, upon reduction, loss, or failure of the treatment facility, the permittee must, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It is not a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities

a. Definitions

(1) "Bypass" means intentional diversion of waste streams from any portion of the treatment facility. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, provided the diversion is to allow essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs b. and c. of this section.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Prohibition of bypass.

(1) Bypass is prohibited and the Department may take enforcement action against a permittee for bypass unless:

i. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

ii. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventative maintenance; and

iii. The permittee submitted notices and requests as required under General Condition B.3.c.

(2) The Department may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, when the Department determines that it will meet the three conditions listed above in General Condition B.3.b.(1).

c. Notice and request for bypass.

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, a written notice must be submitted to the Department at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee must submit notice of an unanticipated bypass as required in General Condition D.5.

4. Upset

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operation error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of General Condition B.4.c are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the causes(s) of the upset;
(2) The permitted facility was at the time being properly operated;
(3) The permittee submitted notice of the upset as required in General Condition D.5, hereof (24-hour notice); and,
(4) The permittee complied with any remedial measures required under General Condition A.3 hereof.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Treatment of Single Operational Upset

For purposes of this permit, A Single Operational Upset that leads to simultaneous violations of more than one pollutant parameter will be treated as a single violation. A single operational upset is an exceptional incident that causes simultaneous, unintentional, unknowing (not the result of a knowing act or omission), temporary noncompliance with more than one Clean Water Act effluent discharge pollutant parameter. A single operational upset does not include Clean Water Act violations involving discharge without a NPDES permit or noncompliance to the extent caused by improperly designed or inadequate treatment facilities. Each day of a single operational upset is a violation.

6. Overflows from Wastewater Conveyance Systems and Associated Pump Stations

a. Definitions

(1) "Overflow" means any spill, release or diversion of sewage including:

i. An overflow that results in a discharge to waters of the United States; and
ii. An overflow of wastewater, including a wastewater backup into a building (other than a backup caused solely by a blockage or other malfunction in a privately owned sewer or building lateral), even if that overflow does not reach waters of the United States.

b. Prohibition of overflows. Overflows are prohibited. The Department may exercise enforcement discretion regarding overflow events. In exercising its enforcement discretion, the Department may consider various factors, including the adequacy of the conveyance system's capacity and the magnitude, duration and return frequency of storm events.

c. Reporting required. All overflows must be reported orally to the Department within 24 hours from the time the permittee becomes aware of the overflow. Reporting procedures are described in more detail in General Condition D.5.

7. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs that threatens public health, the permittee must take such steps as are necessary to alert the public, health agencies and other

affected entities (e.g., public water systems) about the extent and nature of the discharge in accordance with the notification procedures developed under General Condition B.8. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

8. Emergency Response and Public Notification Plan

The permittee must develop and implement an emergency response and public notification plan that identifies measures to protect public health from overflows, bypasses or upsets that may endanger public health. At a minimum the plan must include mechanisms to:

a. Ensure that the permittee is aware (to the greatest extent possible) of such events;
b. Ensure notification of appropriate personnel and ensure that they are immediately dispatched for investigation and response;
c. Ensure immediate notification to the public, health agencies, and other affected public entities (including public water systems). The overflow response plan must identify the public health and other officials who will receive immediate notification;
d. Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained;
e. Provide emergency operations; and
f. Ensure that DEQ is notified of the public notification steps taken.

9. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must be disposed of in such a manner as to prevent any pollutant from such materials from entering waters of the state, causing nuisance conditions, or creating a public health hazard.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Sampling and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples must be taken at the monitoring points specified in this permit, and shall be taken, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance. Monitoring points may not be changed without notification to and the approval of the Department.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices must be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices must be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device. Devices selected must be capable of measuring flows with a maximum deviation of less than ± 10 percent from true discharge rates throughout the range of expected discharge volumes.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 CFR part 136, or in the case of sludge use and disposal, under 40 CFR part 503, unless other test procedures have been specified in this permit.

4. Penalties of Tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit may, upon conviction, be punished by a fine of not more than $10,000 per violation, imprisonment for not more than two years, or both. If a conviction of a person is for a violation committed after a first conviction of such

person, punishment is a fine not more than $20,000 per day of violation, or by imprisonment of not more than four years, or both.

5. Reporting of Monitoring Results
Monitoring results must be summarized each month on a Discharge Monitoring Report form approved by the Department. The reports must be submitted monthly and are to be mailed, delivered or otherwise transmitted by the 15th day of the following month unless specifically approved otherwise in Schedule B of this permit.

6. Additional Monitoring by the Permittee
If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR part 136, or in the case of sludge use and disposal, under 40 CFR part 503, or as specified in this permit, the results of this monitoring must be included in the calculation and reporting of the data submitted in the Discharge Monitoring Report. Such increased frequency must also be indicated. For a pollutant parameter that may be sampled more than once per day (e.g., Total Chlorine Residual), only the average daily value must be recorded unless otherwise specified in this permit.

7. Averaging of Measurements
Calculations for all limitations that require averaging of measurements must utilize an arithmetic mean, except for bacteria which shall be averaged as specified in this permit.

8. Retention of Records
Records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities shall be retained for a period of at least five years (or longer as required by 40 CFR part 503). Records of all monitoring information including all calibration and maintenance records, all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit and records of all data used to complete the application for this permit shall be retained for a period of at least 3 years from the date of the sample, measurement, report, or application. This period may be extended by request of the Department at any time.

9. Records Contents
Records of monitoring information must include:

a. The date, exact place, time, and methods of sampling or measurements;
b. The individual(s) who performed the sampling or measurements;
c. The date(s) analyses were performed;
d. The individual(s) who performed the analyses;
e. The analytical techniques or methods used; and
f. The results of such analyses.

10. Inspection and Entry
The permittee must allow the Department or EPA upon the presentation of credentials to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and
d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

11. Confidentiality of Information
Any information relating to this permit that is submitted to or obtained by DEQ is available to the public unless classified as confidential by the Director of DEQ under ORS 468.095. The Permittee may request that information be classified as confidential if it is a trade secret as defined by that statute. The name and address of the permittee, permit applications, permits, effluent data, and information required by NPDES application forms under 40 CFR 122.21 will not be classified as confidential: 40 CFR 122.7(b).

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes
The permittee must comply with OAR chapter 340, division 52, "Review of Plans and Specifications" and 40 CFR Section 122.41(l) (1). Except where exempted under OAR chapter 340, division 52, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers may be commenced until the plans and specifications are submitted to and approved by the Department. The permittee must give notice to the Department as soon as possible of any planned physical alternations or additions to the permitted facility.

2. Anticipated Noncompliance
The permittee must give advance notice to the Department of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

3. Transfers
This permit may be transferred to a new permittee provided the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of the permit and the rules of the Commission. No permit may be transferred to a third party without prior written approval from the Department. The Department may require modification, revocation, and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under 40 CFR Section 122.61. The permittee must notify the Department when a transfer of property interest takes place.

4. Compliance Schedule
Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this permit must be submitted no later than 14 days following each schedule date. Any reports of noncompliance must include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

5. Twenty-Four Hour Reporting
The permittee must report any noncompliance that may endanger health or the environment. Any information must be provided orally (by telephone) to DEQ or to the Oregon Emergency Response System (1-800-452-0311) as specified below within 24 hours from the time the permittee becomes aware of the circumstances.

a. Overflows.

(1) Oral Reporting within 24 hours.

i. For overflows other than basement backups, the following information must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311. For basement backups, this information should be reported directly to DEQ.

a) The location of the overflow;
b) The receiving water (if there is one);
c) An estimate of the volume of the overflow;

d) A description of the sewer system component from which the release occurred (e.g., manhole, constructed overflow pipe, crack in pipe); and

e) The estimated date and time when the overflow began and stopped or will be stopped.

ii. The following information must be reported to the Department's Regional office within 24 hours, or during normal business hours, whichever is first:

a) The OERS incident number (if applicable) along with a brief description of the event.

(2) Written reporting within 5 days.

i. The following information must be provided in writing to the Department's Regional office within 5 days of the time the permittee becomes aware of the overflow:

a) The OERS incident number (if applicable);

b) The cause or suspected cause of the overflow;

c) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps;

d) Steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps; and

e) (for storm-related overflows) The rainfall intensity (inches/hour) and duration of the storm associated with the overflow.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

b. Other instances of noncompliance.

(1) The following instances of noncompliance must be reported:

i. Any unanticipated bypass that exceeds any effluent limitation in this permit;

ii. Any upset that exceeds any effluent limitation in this permit;

iii. Violation of maximum daily discharge limitation for any of the pollutants listed by the Department in this permit; and

iv. Any noncompliance that may endanger human health or the environment.

(2) During normal business hours, the Department's Regional office must be called. Outside of normal business hours, the Department must be contacted at 1-800-452-0311 (Oregon Emergency Response System).

(3) A written submission must be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission must contain:

i. A description of the noncompliance and its cause;

ii. The period of noncompliance, including exact dates and times;

iii. The estimated time noncompliance is expected to continue if it has not been corrected;

iv. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and

v. Public notification steps taken, pursuant to General Condition B.7

(4) The Department may waive the written report on a case-by-case basis if the oral report has been received

within 24 hours.

6. Other Noncompliance

The permittee must report all instances of noncompliance not reported under General Condition D.4 or D.5, at the time monitoring reports are submitted. The reports must contain:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. The estimated time noncompliance is expected to continue if it has not been corrected; and

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

7. Duty to Provide Information
The permittee must furnish to the Department within a reasonable time any information that the Department may request to determine compliance with the permit or to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit. The permittee must also furnish to the Department, upon request, copies of records required to be kept by this permit.

Other Information: When the permittee becomes aware that it has failed to submit any relevant facts or has submitted incorrect information in a permit application or any report to the Department, it must promptly submit such facts or information.

8. Signatory Requirements
All applications, reports or information submitted to the Department must be signed and certified in accordance with 40 CFR Section 122.22.

9. Falsification of Information
Under ORS 468.953, any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, is subject to a Class C felony punishable by a fine not to exceed $100,000 per violation and up to 5 years in prison. Additionally, according to 40 CFR 122.41(k)(2), any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a federal civil penalty not to exceed $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

10. Changes to Indirect Dischargers
The permittee must provide adequate notice to the Department of the following:
a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the Clean Water Act if it were directly discharging those pollutants and;
b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.
c. For the purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

SECTION E. DEFINITIONS

1. *BOD* means five-day biochemical oxygen demand.
2. *CBOD* means five day carbonaceous biochemical oxygen demand
3. *TSS* means total suspended solids.
4. "*Bacteria*" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
5. *FC* means fecal coliform bacteria.
6. *Total residual chlorine* means combined chlorine forms plus free residual chlorine
7. *Technology based permit effluent limitations* means technology-based treatment requirements as defined in 40 CFR Section 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR Chapter 340, Division 41.
8. *mg/l* means milligrams per liter.
9. *kg* means kilograms.
10. m^3/d means cubic meters per day.

11. *MGD* means million gallons per day.
12. 24-hour *Composite sample* means a sample formed by collecting and mixing discrete samples taken periodically and based on time or flow. The sample must be collected and stored in accordance with 40 CFR part 136.
13. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
14. *Quarter* means January through March, April through June, July through September, or October through December.
15. *Month* means calendar month.
16. *Week* means a calendar week of Sunday through Saturday.
17. *POTW* means a publicly owned treatment works

National Pollutant Discharge Elimination System (NPDES) Permit Evaluation Report

State of Oregon
Department of Environmental Quality

Water Quality
Western Region
750 Front St. #120
Salem, OR 97301-1039
(503) 378-8240
(800) 349-7677
(503) 373-7944 (Fax)

www.oregon.gov/deq

City of Lowell Wastewater Treatment Plant

Source location	240 S. Moss St. Lowell
Permittee	City of Lowell P.O. Box 490 Lowell, OR 97452 *contact:* William Hartwig (541) 937-2157
Proposed action	Renew NPDES permit Application no. 972846 Received date: 6/26/2008
Source category	NPDES Minor Dom
Permit writer	Mary Pfauth
File number	51447
Permit number	101805
Expires	06/30/2014

Introduction

The Federal Water Pollution Control Act of 1972, also known as the Clean Water Act, and Oregon Revised Statutes (ORS 468B.050) require a discharger to obtain a National Pollutant Discharge Elimination System (NPDES) permit to discharge wastewater to surface waters. The permit is designed to allow a discharge as long as it protects the designated beneficial uses of the receiving surface waters.

The State of Oregon has developed human health and aquatic life water quality criteria to protect these beneficial uses. The criteria fall into broad two categories, toxic and non-toxic. Toxic criteria deal with chemicals that have poisonous effects. Chlorine, for example, is commonly used to disinfect treated sewage. Chlorine is a powerful oxidizer that kills bacteria but is also harmful to other organisms at high enough levels. Non-toxic criteria deal with conditions or substances that can have harmful effects but are not poisonous. Dissolved oxygen, for example, must be sufficient to maintain aquatic life in a water body. Low enough levels can cause fish kills.

During permit development, DEQ evaluates whether water quality criteria are being or can be met by a discharge. DEQ gathers data on the discharge and on the receiving waters. It uses these data to model the discharge and the receiving water as well as to determine if there is a reasonable potential for the discharge to exceed water quality criteria. If there is a reasonable potential, then the permit sets limits on the discharge.

There are two categories of effluent limits for NPDES permits: 1) technology based effluent limits, and 2) water quality based effluent limits. Technology based effluent limits require a minimum level of treatment for industrial or municipal sources using available technology. Technology based effluent limits are developed by applying EPA guidelines for specific industrial categories. Water quality based effluent limits are independent of the available treatment technology.

Federal regulations and Oregon Administrative Rules allow DEQ to suspend all or part of the water quality standards in small, designated areas within receiving waters around a discharge. These small areas allow treated wastes and receiving waters to thoroughly mix and dilute the treated wastes. These are known as “allocated impact zones” or “mixing zones.” Two mixing zones can be developed for each discharge: 1) The acute mixing zone, also known as the “zone of initial dilution” (ZID), and 2) the chronic mixing zone, usually referred to as “the mixing zone.” The ZID must be designed to prevent lethality to organisms drifting through it and the mixing zone must be designed to protect the integrity of the entire water body.

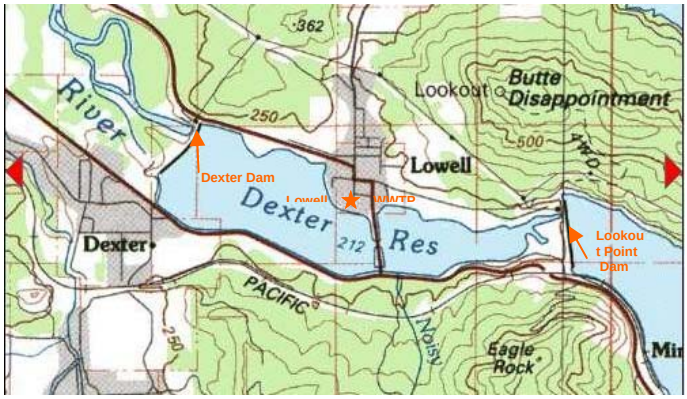
In addition to limiting what is discharged into the receiving water, DEQ requires a discharger to monitor the discharge and report the monitoring results. DEQ may require additional studies and set special conditions unique to the discharge. There is also a set of standard requirements included in every NPDES permit that address reporting, the duty to reapply, operation, etc.

Both the permit applicant and the public can review and comment on the draft version of the NPDES permit. DEQ reads these comments, responds to them, and may or may not change the draft. The permit goes into effect (is “issued”) upon signature by DEQ’s authorized representative. A NPDES permit typically expires five years from the date it was issued.

Facility

Facility: Background

The City of Lowell (City) owns and operates a sewage collection and wastewater treatment system located on the north side of Dexter Reservoir at 240 S. Moss Street (see map left) The system treats the City's wastewater and discharges it into the penstock of the U.S. Army Corps of Engineers (USACOE) Dexter Dam on the Middle Fork Willamette River. The City operates its wastewater treatment plant (WWTP) under National Pollutant Discharge Elimination System (NPDES) Permit number 101384. The permit was last renewed on May 5, 2004 and expired on December 31, 2008. The DEQ of Environmental Quality (DEQ) received a timely renewal application on June 26, 2008 and proposes to renew the permit. This permit evaluation report describes the basis and methodology used to develop the permit and proposes effluent limitations and special conditions necessary to carry out state and federal law. The permit is divided into the following sections, each of which is discussed in this evaluation report:



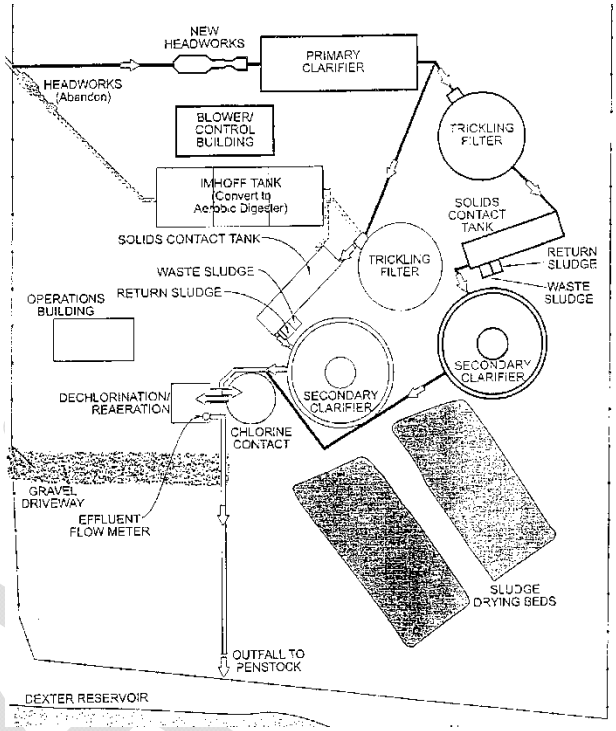
Schedule A – Waste discharge limitations
Schedule B – Minimum monitoring and report requirements
Schedule D – Special conditions
Schedule F – General conditions

Facility: Description

The U. S. Army Corp of Engineers built the City's wastewater treatment plant in the 1950's to serve the people who built Dexter Dam. The City moved the outfall in 1990 from near the treatment plant, where it discharged directly into the reservoir, to approximately 20 feet upstream of the Dam's penstock intake. The outfall's new location allowed for more adequate mixing and dilution of the treatment plant effluent. Subsequent upgrades have been made to both the collection system (replacing lines, disconnecting storm drains from the sanitary sewer, upgrading the Alder Street lift station) and the treatment plant (new headworks, new clarifier, new filter media, conversion of Imhoff tank to aerobic digester, lining of sludge drying beds).

The plant receives municipal sewage and, at this time, there are no industrial discharges to the system. However, the City has developed an industrial park and future industrial discharges are possible. All sewage arrives at the treatment plant by gravity flow with the exception of flows entering a pump station located on Alder Street. There was one overflow from this pump station on December 31, 2005 during a period of high rainfall and saturated ground. On December 14, 2006, sewage bypassed the pump station during a power outage caused by a downed tree on the power lines.

The following description of the treatment plant's process is diagrammed in the figure below, right. Influent wastewater to the facility passes through a helisieve (the headworks), then goes into a primary clarifier equipped with skimmers that move sludge to a bottom hopper and to the digester. The clarifier has two separate, redundant chambers. Wastewater then flows through a corrugated screen type of trickling filter and into a solids contact aeration basin/oxidation ditch. Flow then goes to a secondary clarifier and from there to the chlorine contact chamber. The wastewater is chlorinated with chlorine gas after which it is dechlorinated with sulfur dioxide and sent through a re-aeration basin. Effluent flow is measured at a point after the re-aeration basin using a Stevens Recorder (float meter with stilling well) and subsequently discharged through Outfall 001. The outfall line is over one mile long and discharges into the Dexter Reservoir to a point 20 feet upstream of the penstock intake of Dexter Dam.



Sludge from the primary clarifiers and waste activated sludge from the secondary clarifier are transferred to an aerobic sludge digester. Following digestion, sludge goes to the sludge beds for water removal and drying after which it is transported to the Lane County Landfill. Decanted wastewater from the drying beds is returned to the plant headworks. The City wants the option, during this permit cycle, to treat the sludge to meet Class B criteria for biosolids with subsequent beneficial land application.

Facility: Treatment Plant Flows

The upgraded treatment system has a design average dry weather flow (ADWF) of 0.22 million gallons per day (mgd). DEQ analysis of the May, 2004 through July, 2008 discharge monitoring reports (DMRs) shows an actual average dry weather (May through October) flow of 0.06 mgd with a minimum flow of 0.04 mgd occurring every summer, and an actual average wet weather (November through April) flow of 0.16 mgd with a peak flow of 0.36 mgd in January, 2006. According to the data, the facility is operating at 27% of its hydraulic capacity.

Facility: Sludge and Biosolids Management

Sludge from the primary clarifiers and waste activated sludge from the secondary clarifier are transferred to the aerobic sludge digester. Following digestion, sludge goes to the sludge beds for water removal and drying prior to transport to the Lane County Landfill. Decanted wastewater from the drying beds is returned to the headworks of the plant. Required analytical results for sludge sampling are overseen by the landfill under their solid waste disposal permit issued by the DEQ. This permit renewal proposes monthly and annual reporting of the transportation of sludge to this or any other facility.

The permittee intends to maintain an option to make beneficial use of biosolids by land application at agronomic rates. The permittee has submitted and DEQ has approved a Biosolids Management Plan for Class B Biosolids. Any biosolids applied must comply with the federal

biosolids regulations (40 CFR Part 503) and biosolids monitoring must be done. The permittee must submit a biosolids report for each year by February 19 of the following year.

Facility: Inflow and Infiltration

The permittee has conducted smoke and dye tests of the collection system to locate inflow points, has located and capped open laterals, and has replaced over 3000 feet of collection lines in the City. In addition, new manholes and new manhole catch basins were installed in numerous locations.

DEQ recommends a long-term program that will completely replace the collection system based on life expectancy (usually 60 to 80 years). The replacement program should be directed at the oldest areas or those areas that are in the worst condition. The permit requires an annual report describing the Inflow and Infiltration (I &I) detection and removal activities that have been completed during the year and those planned for the upcoming year. The City has an Inflow and Infiltration Reduction Plan and has been timely in submitting the required annual reports.

Facility: Pretreatment

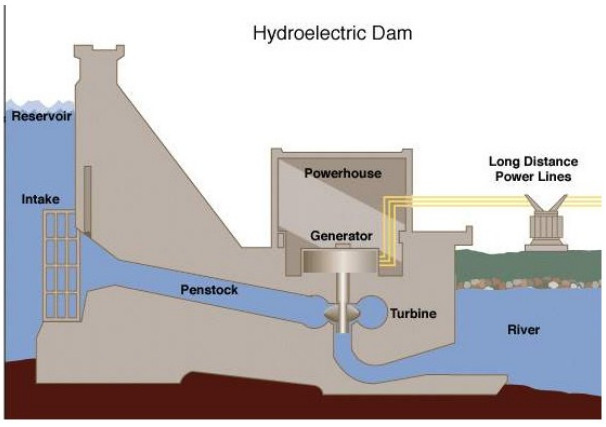
The permittee does not have a formal pretreatment program and none is required for this source.

Facility: Pollutants Discharged

The proposed renewal permit will regulate the same parameters as the current permit. These parameters are: Five-day Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS), Total Residual Chlorine (TRC), *E. coli* bacteria, pH, BOD removal efficiency, and TSS removal efficiency.

Facility: Outfalls

The City's wastewater treatment plant discharges treated wastewater into the Middle Fork Willamette River at River Mile 15.7. The 16 -inch diameter outfall line from the treatment plant to the discharge point is over a mile long and terminates in a single, 16-inch diameter port. The port is approximately 12 inches above the reservoir bottom and approximately 20 feet upstream of the penstock intakes of Dexter Dam.



The penstock is a pipe by which water from the reservoir is conveyed to the turbine inside the dam. The water turns the turbine and the generator attached to the turbine converts mechanical energy into electricity (see figure left). Flow continues past the turbine and exits the dam on the downstream side.

Outfall 002 is the Alder Street pump station overflow point. Discharge from this outfall is prohibited

Facility: Mixing Zone and Zone of Initial Dilution

The Middle Fork Willamette is a highly regulated stream having several dams that provide electricity, flood control, irrigation water, etc. Two dams upstream of the City, Lookout Point and Hills Creek, regulate flow in the river reach where the City discharges treated wastewater. Dexter Dam lies just below the City's treated wastewater outfall and regulates downstream flows. DEQ used the minimum low flow through Dexter Dam (1200 cfs per USACOE) rather than US Geological Survey gaging data for calculating dilutions.

DEQ proposes to redefine the Regulatory Mixing Zone for this facility to one based on percentage of receiving stream flow rather than on a defined distance downstream of the discharge for the following reasons. This discharge is difficult to model with conventional models or with dye testing due to its proximity to the penstock intake of Dexter Dam. The receiving stream hydraulics close to the penstock outlet is also complex. The size of the discharge (0.22 mgd = 0.34 cfs) relative to the size of minimum receiving stream flow through the penstock (1200 cfs) is very small – a ratio of 3 to 10,000.Therefore, DEQ has calculated dilutions using conservative stream flow percentages at the edge of the Zone of Initial Dilution (ZID) and mixing zone. DEQ's Regulatory Mixing Zone Internal Management Directive recommends limiting the percentage of stream flow available for dilution at the edge of the mixing zone to 25%. In this case, DEQ has chosen to be more conservative than that and to apply percentages that seem reasonable considering the size of the discharge relative to the stream flow. Toxicity is not expected to be an issue with this effluent.

DEQ proposes a mixing zone that allows for mixing with 5% of the stream flow and a ZID that allows for mixing with 1% of the stream flow. DEQ calculated dilutions of 177 and 35 at the edge of the mixing zone and ZID respectively, using the minimum flow through the penstock of 1200 cfs and the treatment plant average dry weather design flow of 0.22 mgd.

DEQ has determined that the discharge poses little risk to the environment based on the amount of dilution available and the low potential for effluent toxicity. In addition, DEQ believes that the beneficial uses of the receiving stream will not be affected by the discharge into this mixing zone and that the defined mixing zone meets the criteria in OAR 340-041-0053(2)(b)(A)

> The mixing zone is defined as five percent of the stream flow from Dexter Reservoir through Dexter Dam. The zone of initial dilution is defined as one percent of the stream flow from Dexter Reservoir through Dexter Dam.

Facility: Groundwater

The treatment plant is constructed entirely of impervious structures and, thus, has a low potential for adversely impacting groundwater quality. Schedule A of the proposed permit includes a condition prohibiting adverse impacts to groundwater. Schedule D of the proposed permit includes a condition stating that no groundwater evaluations will be required during this permit cycle and that DEQ may evaluate the need for a full assessment of the facilities impact on groundwater quality at permit renewal.

Facility: Stormwater

This renewal does not address stormwater because general NPDES permits for stormwater are not required for facilities with a design flow of less than 1 MGD, as is the case for the City's wastewater treatment plant.

Facility: Compliance History

DEQ and the City entered into a Mutual Agreement and Order (MAO) on November 8, 2001. The MAO set interim limits for the facility during the time that the City got funding for and completed a major facility upgrade. The upgrade was completed in March 2004 and, since the facility was operating in compliance with its permitted limits, the MAO was terminated in June 2004.

The facility's Discharge Monitoring Reports (DMRs) submitted since the last permit renewal, the permit compliance conditions, and all inspection reports for the same period were reviewed.

DEQ issued one Notice of Non-compliance to the permittee on November 21, 2007 for exceeding BOD and pH permit limits.

Receiving Stream

Receiving Stream: Description

The Middle Fork Willamette Watershed comprises roughly 865,000 acres. The communities of Oakridge, Westfir, Lowell, Dexter, Fall Creek, Jasper, and portions of south Springfield and Pleasant Hill all lie within the watershed, as does the North Fork of the Middle Fork Willamette River and Waldo Lake.

Receiving Stream: Anti-Degradation Review

DEQ completed an Anti-degradation Review Worksheet (see OAR 340-041-0004) and recommends renewing the permit. A copy of the review worksheet is attached (See Appendix 1) and the findings are discussed below.

Receiving Stream: 303(d) List

The Oregon List of Water Quality Limited Water Bodies (the 303(d) List), contained in the 2004/2006 Integrated Report, does not list the section of the Middle Fork Willamette River just upstream or downstream of the outfall location (from river mile 0 to 15.6) as water quality limited. The Total Maximum Daily Load for the Willamette Basin, completed in 2006, did not assign a Waste Load Allocation to this source.

Receiving Stream: Beneficial Uses

The water quality standards for the Willamette Basin were developed to protect the beneficial uses for the basin. Applicable water quality standards and beneficial uses for the Middle Fork Willamette River are found in Oregon Administrative Rule (OAR) 0340-041-0340. The beneficial uses for the Willamette Basin listed in the Rules are:

- Public domestic water supply
- Private domestic water supply
- Industrial water supply
- Irrigation
- Livestock watering
- Fish and aquatic life
- Wildlife and hunting
- Fishing
- Boating
- Water contact recreation
- Aesthetic quality
- Hydroelectric power

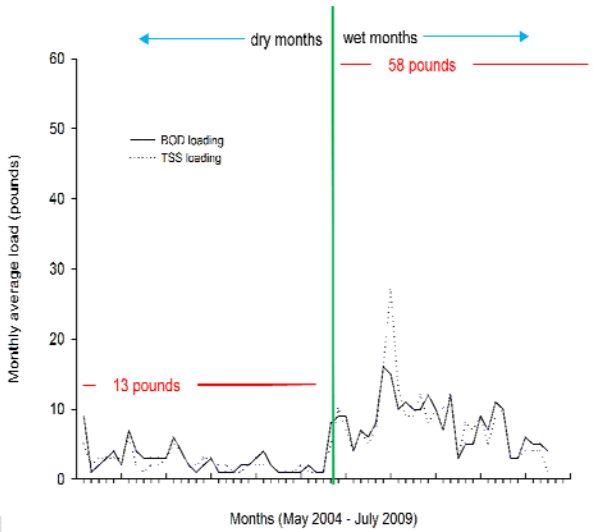
Receiving Stream: BOD_5 and TSS

Five Day Biochemical Oxygen Demand (BOD_5) is a measure of the quantity of oxygen used by microorganisms when they break down organic matter. If too much organic matter is in the water, then microorganisms use up all the available oxygen in the water. The result is water having no dissolved oxygen which fish and other organisms require for survival.

Total Suspended Solids (TSS) is a measure of organic and inorganic solid materials that are suspended in the water. High concentrations of suspended solids can lower water quality by absorbing light. Waters then become warmer and, because warmer water holds less oxygen than cooler water, aquatic life can suffer. If aquatic plants live in the water body, the suspended solids allow less light to reach their leaves and they will photosynthesize less. This also reduces the amount of oxygen in the water body because photosynthesis produces oxygen. Suspended solids affect aquatic life in other ways. They can clog fish gills, reduce growth rates, decrease resistance to disease, and prevent egg and larval development. Particles that settle out can smother fish eggs and those of aquatic insects, as well as suffocate newly hatched larvae. The

material that settles also fills the spaces between rocks and makes these microhabitats unsuitable for various aquatic insects.

The Willamette Basin minimum design criteria require wastewater treatment that results in a monthly average effluent concentration of 10 mg/L for BOD_5 and TSS from May 1 - October 31, and 30 mg/L for BOD_5 and TSS from November 1 through April 30.



DEQ proposes concentration limits at least as stringent as these. The proposed summer period monthly average BOD_5 and TSS concentration limits are 10 mg/L with a weekly average limit of 15 mg/L. The proposed winter period monthly average BOD_5 and TSS concentration limits are 30 mg/L with a weekly average limit of 45 mg/L. These limits are identical to those in the current permit.

Because the permittee did not request a mass load limit increase, the proposed mass load limits are based on the design flows to the pre-upgraded facility as follows. The summer mass load limits are based on the design average dry weather flow of 0.15 MGD and BOD_5 and TSS concentrations of 10 mg/l. The winter mass load limits are based upon the average wet weather design flow of 0.23 MGD and BOD_5 and TSS concentrations of 30 mg/L. The calculations are shown below with all mass load limits rounded to two significant figures.

Calculations:

May 1 – October 31

(1) BOD_5 and TSS

(a) 0.15 MGD x 8.34 lbs/gal x 10 mg/L monthly avg. = 13 lbs/day

(b) 13 lbs/day monthly avg. x 1.5 = 19 lbs/day weekly avg. and daily average

(c) 13 lbs/day monthly avg. x 2 = 26 lbs/day weekly avg. and daily average

November 1 – April 30

(1) BOD_5 and TSS

(a) 0.23 MGD x 8.34 lbs/gal x 30 mg/L monthly avg. = 58 lbs/day

(b) 58 lbs/day monthly avg. x 1.5 = 87 lbs/day weekly avg.

(c) 58 lbs/day monthly avg. x 2 = 116 (120) lbs/day daily average

The City's actual monthly average BOD_5 and TSS loads from May 2004 through July 2009 were below permitted limits of 13 and 58 pounds (see figure right).

The current permit suspends the daily mass load limit when the flow to the treatment facility exceeds 0.3 MGD (twice the design average dry weather flow) per OAR 340-041-0061(10a).

Receiving stream: Bacteria

The proposed permit limits are based on the *E. coli* standard contained in OAR 340-041-0009(5). The proposed limits are a monthly geometric mean of 126 *E. coli* per 100 mL, with no single sample exceeding 406 *E. coli* per 100 mL. If a single sample exceeds 406 *E. coli* per 100 mL, then the permittee may take five consecutive re-samples. If the log mean of the five re-samples is less than or equal to 126, a violation is not triggered. The re-sampling must be taken at four hour intervals beginning within 28 hours after the original sample was taken.

The proposed limits are taken directly from the Oregon bacteria rule which is found in OAR 340-041-0009. This rule establishes numeric in-stream water quality standards (OAR 340-041-0009(1)), establishes a prohibition against discharging raw sewage with some exceptions (OAR 340-041-0009(2)(6) & (7)) and establishes effluent limitations and the methodology for establishing a violation (OAR 340-041-0009(5)). Regarding the general condition 6 found in Section B of Schedule F in this permit which prohibits overflows from wastewater conveyance systems, the Environmental Quality Commission (EQC) recognizes that it is impossible to design and construct a conveyance system that will prevent overflows under all storm conditions. The applicant is not seeking permit coverage for overflows and the permit does not authorize such discharges. The State of Oregon has determined that all wastewater conveyance systems should be designed to transport storm events up to a specific size to the treatment facility. Therefore, in exercising its enforcement discretion regarding Sanitary Sewer Overflows, the Department will consider the following:

(1) Whether the permittee has conveyance and treatment facilities adequate to prevent overflows except during a storm event greater than the one-in-five-year, 24-hour duration storm from November 1 through May 21 and except during a storm event greater than the one-in-ten-year, 24-hour duration storm from May 22 through October 31. In addition, DEQ will also consider using enforcement discretion for overflows that occur during a storm event less than the one-in-five-year, 24-hour duration storm from November 1 through May 21 if the permittee had separate sanitary and storm sewers on January 10, 1996, had experienced sanitary sewer overflows due to inflow and infiltration problems, and has submitted an acceptable plan to the Department to address these sanitary sewer overflows by January 1, 2010;

(2) Whether the permittee has provided the highest and best practicable treatment and/or control of wastes, activities, and flows and has properly operated the conveyance and treatment facilities;

(3) Whether the permittee has minimized the potential environmental and public health impacts from the overflow; and

(4) Whether the permittee has properly maintained the capacity of the conveyance system.

DEQ will review the permittee's determination of the one-in-five-year, 24-hour duration winter storm and the one-in-ten year, 24-hour duration summer storm as described above in the permit holder's facilities plan. In the event that a permit holder reports an overflow event associated with a storm event and DEQ does not have information from the permit holder sufficient to determine whether or not the storm event exceeds storm events as specified in OAR 340-041-0009(6) & (7), DEQ will perform the determination using the information contained in Figure 26 of the 1973 NOAA Atlas 2 entitled "Precipitation-Frequency Atlas of the Western United States, Volume X – Oregon". This figure is entitled "Isopluvials of 5-yr 24-hr precipitation in tenths of an inch". The Atlas can be obtained on line at http://hdsc.nws.noaa.gov/hdsc/pfds/other/or_pfds.html, however the file is very large. A scanned version of Figure 26 is available at: http://www.wrcc.dri.edu/pcpnfreq/or5y24.gif. DEQ will compare the information in this figure with rainfall data available from the National Weather Service, or other source as necessary.

Receiving stream: Temperature

Water temperatures affect the life cycles of aquatic species and are a critical factor in maintaining and restoring healthy salmonid populations. The purpose of the temperature criteria in OAR 340-041-0028 is to protect designated, temperature sensitive, beneficial uses (including salmonid life cycle stages) from adverse warming caused by human activities.

According to the Middle Fork Willamette Fish Use Designation maps (Figures 340A and 340B) in OAR 340-041, the designated uses of the Middle Fork Willamette River immediately downstream from Dexter Dam are year around rearing and migration for which the temperature criterion is 18°C. The maps do not identify spawning and core cold-water habitat as designated uses immediately upstream or downstream of the Dexter Dam.

The Willamette Basin is water quality limited for temperature from April through October and DEQ must evaluate whether discharges to main stem Willamette River tributaries have reasonable potential to contribute to temperature exceedances. If there is reasonable potential, then DEQ must include thermal limits in the permit.

The Lowell WWTP effluent temperature (23°C) is lower than the temperature which causes thermal shock in fish (25°C). Twenty-five degrees Celsius is the temperature on which the thermal plume 5% criterion is based. Therefore, a 5% thermal plume Reasonable Potential Analysis (RPA) was not done for this discharge. A 25% RPA, however, was done for the Lowell discharge (See Appendix 2). The analysis showed no reasonable potential to violate the 25% thermal plume criterion.

The mixing zone temperature RPA of the Lowell discharge showed no reasonable potential to violate the temperature standard at the edge of the mixing zone (See Appendix 3). Therefore, DEQ does not propose an excess thermal load limit in this permit renewal.

DEQ may reopen the permit and include maximum allowable thermal loads when more accurate effluent temperature data become available.

Receiving stream: pH

The pH is a measure of how acidic or basic a solution is. A solution is considered neutral at a pH of 7.0 standard units (s.u). The general purpose of an in-stream water quality pH standard is to protect aquatic life because most aquatic organisms can tolerate only a fairly narrow range - around 7.0 s.u.

The Willamette Basin Water Quality Standard for pH, found in OAR 340-041-0345(1)(a), allows a pH range from 6.5 to 8.5 s.u. The proposed permit limits pH to the range 6.0 to 9.0 s.u. This limit is based on Federal secondary treatment standards for wastewater treatment facilities (40 CFR Part 133.102), and is applied to the majority of domestic NPDES permittees in the state. The water quality standard for pH does not have to be met within the permittee's mixing zone. Mixing with ambient water within the mixing zone will ensure that the pH at the edge of the mixing zone meets the ambient criteria. DEQ analyzed the effects of the City's effluent on pH at the edge of the mixing zone and concluded that the pH would remain within the Willamette Basin Water Quality Standard of 6.5 to 8.5 s.u. as long as the effluent remained within the range of 6.0 to 9.0 s.u. (See Appendix 4). Therefore, DEQ considers the proposed permit limits to be protective of the water quality standard.

Receiving stream: Chlorine

Chlorine is a strong chemical oxidizer and is toxic to many aquatic organisms. Its oxidizing properties also make it an effective disinfectant. The City disinfects its treated effluent with chlorine gas and has consistently achieved *E. coli* bacterial counts below the current permit limits. The City installed dechlorination facilities in the early 1990's and a file review of recent effluent monitoring data shows that the total chlorine residual concentration has been consistently under the permitted limit of 0.5 mg/l.

A reasonable potential analysis for chlorine was conducted using background water quality data collected by DEQ, dilution available within the mixing zone as described above, and assumed worst case effluent concentrations of chlorine (See Appendix 5). The conservative analysis

indicates that there is no reasonable potential to violate either the chronic or acute toxicity standard. DEQ proposes to retain the current total residual chlorine limit in the renewal permit.

Receiving stream: Ammonia

Ammonia is toxic to fish and aquatic organisms, even in very low concentrations. The higher the pH and the warmer the temperature, the more toxic the ammonia. A reasonable potential analysis for ammonia was conducted using background water quality data collected by DEQ, dilution available within the mixing zone as described above, and assumed worst case effluent concentrations of ammonia (See Appendix 5). The conservative analysis indicates that there is no reasonable potential to violate either the chronic or acute toxicity standard. DEQ does not propose ammonia limits in the renewal permit.

Permit

Permit: Facility Classification

The plant operation and collection system classifications were re-evaluated to determine the appropriateness of the current operator certification requirements (See Appendix 6). The plant is currently classified as Level III and the collection system as Level II. The re-evaluation does not result in any change to these classification levels. The plant must be supervised by one or more operators who hold valid certification at or above Level III (plant) and Level II (collection).

Permit: Waste Discharge Limits (Schedule A)

BOD and TSS limits

Parameter	Average effluent concentration		Average effluent loading		
	Monthly	Weekly	Monthly	Weekly	Daily
May 1 - October 31					
BOD_5	10 mg/L	15 mg/L	13 lb/day	19 lb/day	26 lb/day
TSS	10 mg/L	15 mg/L	13 lb/day	19 lb/day	26 lb/day
November 1 - April 30					
BOD_5	30 mg/L	45 mg/L	58 lb/day	87 lb/day	120 lb/day
TSS	30 mg/L	45 mg/L	58 lb/day	87 lb/day	120 lb/day

BOD and TSS removal efficiency limits

The Code of Federal Regulations (CFR) secondary treatment standards require municipal dischargers to remove a minimum of 85 percent of BOD_5 and TSS (40 CFR, Part 133). DEQ proposes an 85 percent removal efficiency limit to comply with these federal requirements.

pH limits

DEQ proposes pH effluent limits of 6.0 to 9.0 s.u., which are in accordance with Federal wastewater treatment guidelines for sewage treatment facilities (40 CFR 133.102(c)) and are applied to the majority of NPDES permittees in the state. DEQ considers the proposed limits to be protective of the water quality standard as discussed above. The limits are the same as those in the current permit and the City has been meeting these limits.

Bacteria limits

The proposed limits are based on an E. *coli* standard approved in January 1996. The proposed limits are a monthly geometric mean of 126 per 100 mL, with no single sample to exceed 406 per 100 mL.

Chlorine residual limit

DEQ proposes a maximum monthly average limit of 0.5 mg/L on total residual chlorine as discussed in the section on Receiving Stream Impacts. This is the same as the limit in the current permit.

Groundwater limits

The permittee may not conduct activities that could cause an adverse impact on existing or potential beneficial uses of groundwater. The permittee must manage and dispose of all wastewater and process related residuals in a manner that will prevent a violation of the Groundwater Quality Protection Rules (OAR 340-040).

Permit: Minimum Monitoring and Reporting Requirements (Schedule B)

The permittee is required to have a laboratory Quality Assurance/Quality Control program. DEQ recognizes that some tests do not accurately reflect the performance of a treatment facility due to quality assurance/quality control problems. These tests should not be considered when evaluating the compliance of the facility with the permit limitations.

In 1988, DEQ developed a monitoring matrix for commonly monitored parameters. Proposed monitoring frequencies for all parameters are based on this matrix and, in some cases, may have changed from the current permit. The proposed monitoring frequencies for all parameters correspond to those of facilities of similar size and complexity in the state. Refer to the table below for proposed monitoring and reporting requirements.

Parameter		Minimum Frequency	Sample Type
Influent			
BOD_5	concentration	weekly	composite
TSS	concentration	weekly	composite
pH		2/week	grab
Effluent			
Flow	total	daily	measurement
Flow	meter calibration	annual	verification
BOD_5,	concentration	weekly	composite
BOD_5,	pounds discharged	weekly	calculation
BOD_5,	average removal efficiency	monthly	calculation
TSS	concentration	weekly	composite
TSS	pounds discharged	weekly	calculation
TSS	average removal efficiency	monthly	calculation
pH		3/week	grab
Bacteria	*E. coli*	weekly	grab
Temperature		2/week	grab
Chlorine	quantity used	daily	measurement
Chlorine	total residual	daily	grab
Biosolids			
Quantity & Location	where applied	each occurrence	record
Solids, total	% dry weight	annual	composite
Solids, volatile	% dry weight	annual	composite
Bacteria	per unit dry weight	annual	composite
Nutrients*:	% dry weight	annual	composite
Metals**	% dry weight	annual	composite

* NH_4-N, NO_3-N, TKN, Total P, Total K

** As, Cd, Cu, Pb, Hg, Mo, Ni ,Se, Zn

The renewal requires that the date, quantity, location, and method of sludge disposal and handling be reported. It also requires annual sampling of biosolids for metals and nutrients as well as volatile solids reduction on a monthly basis. If the permittee land applies biosolids, then it must submit an annual report no later than February 19.

Monthly Discharge Monitoring Reports (DMRs) must be submitted to DEQ by the 15th day of the month following the reporting period. The DMRs must be on DEQ approved forms and, in addition to the required monitoring data, must identify the principal operators designated by the

Permittee to supervise the treatment and collection systems, records concerning biosolids application, and all applicable equipment breakdowns and bypasses.

Schedule B also includes requirements for submitting annual reports. The conditions are standard language requirements concerning an Infiltration and Inflow (I/I) reduction program and annual report, as well as an annual biosolids report.

Permit: Compliance Conditions (Schedule C)

N/A

Permit: Special Conditions (Schedule D)

The proposed renewal includes special conditions requiring the permittee to manage biosolids in accordance with a DEQ approved Biosolids Management Plan and to retain DEQ certified staff to supervise the treatment and collection systems. In addition, it contains a condition that addresses hydrogeology and groundwater monitoring at the facility.

Permit: General Conditions (Schedule F)

All NPDES permits issued in the State of Oregon contain General Conditions that remain the same regardless of the type of discharge and the activity causing the discharge. They can be changed or modified only on a statewide basis.

Section A contains standard conditions which include compliance with the permit, assessment of penalties, mitigation of non-compliance, permit renewal application, enforcement actions, toxic discharges, property rights and referenced rules and statutes. Section B contains requirements for operation and maintenance of the pollution control facilities. This section includes conditions for proper operation and maintenance, duty to halt or reduce activity in order to maintain compliance, bypass of treatment facilities, upset conditions, treatment of single operational events, overflows from wastewater conveyance systems and associated pump stations, public notification of effluent violation or overflow, and disposal of removed substances. Section C contains requirements for monitoring and reporting. This section includes conditions for representative sampling, flow measurement, monitoring procedures, penalties of tampering, reporting of monitoring results, additional monitoring by the permittee, averaging of measurements, records retention, records contents, and inspection and entry. Section D contains reporting requirements and includes conditions for reporting planned changes, anticipated non-compliance, permit transfers, progress on compliance schedules, non-compliance which may endanger public health or the environment, other non-compliances, and other information. Section D also contains signatory requirements and the consequences of falsifying reports. Section E contains the definitions used throughout the permit.

The General Conditions were revised in 2008. A summary of the changes is as follows:

- There are additional citations to the federal Clean Water Act and CFR, including references to standards for sewage sludge use or disposal.
- There is additional language regarding federal penalties.
- Bypass language has been made consistent with the Code of Federal Regulations.
- Overflow language has been modified. Formerly the language stated that overflows in response to the five or ten year event would not violate the permit. Now it states that overflows are prohibited. DEQ will continue to exercise enforcement discretion with respect to overflows consistent with the provisions of the Bacteria Rule (OAR 340-041-0009).
- Reporting requirements regarding overflows have been made more explicit.

- Requirements regarding emergency response and public notification plans have been made more explicit.
- Language pertaining to duty to provide information has been made more explicit.
- Confidentiality of information is addressed.

Permit: Processing/Public Comment/Appeal Process

The beginning and end date of the public comment period to receive written comments regarding this permit, and the contact name and telephone number are Included in the public notice. The permittee is the only party having standing to file a permit appeal. If the permittee is dissatisfied with the conditions of the permit when issued, they may request a hearing before the EQC or its designated hearing officer, within 20 days of the final permit being mailed. The request for hearing must be sent to the Director of DEQ. Any hearing held shall be conducted pursuant to regulations of DEQ.

Appendix 1
ANTI-DEGRADATION REVIEW SHEET
FOR A PROPOSED INDIVIDUAL NPDES DISCHARGE

1. What is the name of Surface Water that receives the discharge? *Middle Fork Willamette River*

   Briefly describe the proposed activity: ***The City of Lowell discharges treated effluent from its municipal wastewater treatment plant.***

   Is this review for a renewal OR new (circle one) permit application?
   Go to Step 2.

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2. Is this surface water an **Outstanding Resource Water** or **upstream** from an **Outstanding Resource Water**?

   Yes. Go to Step 5.
   No. Go to Step 3.

3. Is this surface water a **High Quality Water**?

   Yes. Go to Step 8.
   No. Go to Step 4.

4. Is this surface water a **Water Quality Limited Water**?

   Yes. Go to Step 14.
   No. Go to Step 2. Note: The surface water must fall into one of three (3) categories: Outstanding Resource Water (Step 2), High Quality Water (Step 3), or Water Quality Limited Water (Step 4).

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5. Will the proposed activity result in a permanent new or expanded source of pollutants directly to or affecting the **Outstanding Resource Water**? [see OAR 340-041-0004(3)-(5) for a description in rule of discharges that do not result in lowering of water quality or do not constitute a new and/or increased discharge or are otherwise exempt from anti-degradation review; otherwise see "Is an Activity Likely to Lower Water Quality?" in *Anti-degradation Policy Implementation Internal Management Directive for NPDES Permits and Section 401 Water Quality Certifications*.]

   Yes. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 21.
   No. Please provide basis for conclusion. Go to Step 6.

6. Will the proposed activity result in a lowering of water quality in the **Outstanding Resource Water**? [see OAR 340-041-0004(3)-(5) for a description in rule of discharges that do not result in lowering of water quality or do not constitute a new and/or increased discharge or are otherwise exempt from anti-degradation review; otherwise see "Is an Activity Likely to Lower Water Quality?" in *Anti-degradation Policy Implementation*

Internal Management Directive for NPDES Permits and Section 401 Water Quality Certifications.]

Yes. Please provide basis for conclusion. Go to Step 7.
No. Please provide basis for conclusion. Go to Step 18.

7. If the proposed activity results in a non-permanent new or expanded source of pollutants directly to or affecting an **Outstanding Resource Water**, will the lowering of water quality in the **Outstanding Resource Water** be on a short-term basis in response to an emergency or to protect human health and welfare?
   Yes. Proceed with Application Process to Interagency Coordination and Public Comment. Go to Step 21.
   No. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 18.

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8. Will the proposed activity result in a Lowering of Water Quality in the **High Quality Water**[see OAR 340-041-0004(3)-(5) for a description in rule of discharges that do not result in lowering of water quality or do not constitute a new and/or increased discharge or are otherwise exempt from anti-degradation review; otherwise see "Is an Activity Likely to Lower Water Quality?" in *Anti-degradation Policy Implementation Internal Management Directive for NPDES Permits and Section 401 Water Quality Certifications*.]
   Yes. Go to Step 9.
   (No.) Proceed with Permit Application. *The permittee does not propose to change its waste load from the current permitted status.*

   Go to Step 21.

9. OAR 340-041-0004(6)(c) of the *High Quality Waters Policy* requires that the Department evaluate the application to determine all water quality standards will be met and beneficial uses protected after allowing discharge to **High Quality Waters**. Will all water quality standards be met and beneficial uses protected?
   Yes. Please provide basis for conclusion. Proceed with Application Process to Interagency Coordination and Public Comment. Go to Step 10.
   No. Please provide basis for conclusion. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 21.

10. OAR 340-041-0004(6)(a) of the *High Quality Waters Policy* requires that the Department evaluate the application to determine if no other reasonable alternatives exist except to discharge to **High Quality Waters**. Were any of the alternatives (at a minimum, the following list must be considered) feasible?
    - Improved operation and maintenance of existing treatment system
    - Recycling or reuse with no discharge
    - Discharge to on-site system
    - Seasonal or controlled discharges to avoid critical water quality periods
    - Discharge to sanitary sewer Land application

Yes. Please provide basis for conclusion (see below for information requirements). Recommend Preliminary Decision that applicant use alternative. Go to Step 8.

No. Please provide basis for conclusion (see below for information requirements). Go to Step 11.

In a separate statement to this application, please explain the *technical feasibility* of the alternative, explain the *economic feasibility* of the alternative, and provide an *estimated cost* of NPDES permit alternative for a five-year period from start-up.

11. OAR 340-041-0004(6)(b) of the *High Quality Waters Policy* requires that the Department evaluate the application to determine if there are social and economic benefits that outweigh the environmental costs of allowing discharge to High Quality Waters. Do the social and economic benefits outweigh the environmental costs of lowering the water quality?

Yes. Please provide basis for conclusion (see below for information requirements). Go to Step 12.

No. Please provide basis for conclusion (see below for information requirements). Go to Step 21.

The basis for conclusion should include a discussion of whether the lowering of water quality is necessary and important. "Necessary" means that the same social and economic benefits cannot be achieved with some other approach. "Important" means that the value of the social and economic benefits due to lowering water quality is greater than the environmental costs of lowering water quality. Benefits can be created from measures such as:

- Creating or expanding employment (provide current/expected number of employees, type & relative amount of each type
- Increasing median family income
- Increasing community tax base (provide current/expected annual sales, tax info)
- Providing necessary social services
- Enhancing environmental attributes

and Environmental Costs can include:

- Losing assimilative capacity otherwise used for other industries/development
- Impacting fishing, recreation, and tourism industries negatively
- Impacting health protection negatively
- Impacting societal value for environmental quality negatively

12. OAR 340-041-0004(6)(d) of the *High Quality Waters Policy* requires that the Department to prevent federal threatened and endangered aquatic species from being adversely affected. Will the lowering the water quality likely result in adverse effects on federal threatened and endangered aquatic species?

Yes. Please provide basis for conclusion (see below for information requirements). Go to Step 21.

No. Please provide basis for conclusion (see below for information requirements). Go to Step 13.

13. Will the lowering of water quality in the **High Quality Water** be on a short-term basis in response to an emergency or to protect human health and welfare?
    Yes. Go to Step 18.
    No. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 21.

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14. Will the proposed activity result in a Lowering of Water Quality in the **Water Quality Limited Water**? [see OAR 340-041-0004(3)-(5) for a description in rule of discharges that do not result in lowering of water quality or do not constitute a new and/or increased discharge or are otherwise exempt from anti-degradation review; otherwise see "Is an Activity Likely to Lower Water Quality?" in *Anti-degradation Policy Implementation Internal Management Directive for NPDES Permits and Section 401 Water Quality Certifications*.]
    Yes. Go to Step 15.
    No. Proceed with Permit Application. Applicant should provide basis for conclusion. Go to Step 21.

15. OAR 340-041-0004(9)(a)(A) of the *Water Quality Limited Waters Policy* requires that the Department evaluate the application to determine that all water quality standards will be met. Will all water quality standards be met?
    Yes. Please provide basis for conclusion. Go to Step 16.
    No. Please provide basis for conclusion. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 21.

16. OAR 340-041-0004(9)(a)(C) of the *Water Quality Limited Waters Policy* requires that the Department evaluate the application to determine that all recognized beneficial uses will be met and that threatened or endangered species will not be adversely affected. Will all beneficial uses be met and will threatened or endangered species be protected from adverse effects?
    Yes. Please provide basis for conclusion. Go to Step 17.
    No. Please provide basis for conclusion. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 21.

17. OAR 340-041-0004(9)(a)(D)(i-iv) of the *Water Quality Limited Waters Policy* requires that the Department evaluate the application for one of the following: Will the discharge be associated (directly or indirectly) with the pollution parameter(s) causing the waterbody to be designated a Water Quality Limited Water?
    Yes. Please provide basis for conclusion. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 21.
    No. Please provide basis for conclusion. Go to Step 18.

Have TMDLs, WLAs, LAs, and reserve capacity been established, compliance plans been established, and is there sufficient reserve capacity to assimilate the increased load under the established TMDL?

Yes. Please provide basis for conclusion. Go to Step 18.

No. Please provide basis for conclusion. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 21.

Will the proposed activity meet the requirements, as specified under OAR 340-041-0004(9)(a)(D)(iii) of the *Water Quality Limited Waters Policy*, for dissolved oxygen?

Yes. Please provide basis for conclusion. Go to Step 18.

No. Please provide basis for conclusion. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 21.

Will the activity solve an existing, immediate, and critical environmental problem?

Yes. Please provide basis for conclusion. Go to Step 18.

No. Please provide basis for conclusion. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 21.

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18. Is the proposed activity consistent with local land use plans?

Yes. Go to Step 19.

No. Please provide basis for conclusion. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 21.

19. OAR 340-041-0004(9)(c)(A) requires the Department to consider alternatives to lowering water quality. Were any of the alternatives (at a minimum, the following list must be considered) feasible?

- Improved operation and maintenance of existing treatment system
- Recycling or reuse with no discharge
- Discharge to on-site system
- Seasonal or controlled discharges to avoid critical water quality periods
- Discharge to sanitary sewer
- Land application

Yes. Please provide basis for conclusion (see below for information requirements). Recommend Preliminary Decision that applicant use alternative. Go to Step 14.

No. Please provide basis for conclusion (see below for information requirements). Go to Step 20.

In a separate statement to this application, please explain the *technical feasibility* of the alternative, explain the *economic feasibility* of the alternative, and provide an *estimated cost* of NPDES permit alternative for a five-year period from start-up.

20. OAR 340-041-0004(9)(c)(B) of the *Water Quality Limited Waters Policy* requires the Department to consider the economic effects of the proposed activity, which in this context consists of determining if the social and economic benefits of the activity outweigh the

environmental costs of allowing a lowering of water quality. Do the social and economic benefits outweigh the environmental costs of lowering the water quality?

Yes. Please provide basis for conclusion. Proceed with Application Process to Interagency Coordination and Public Comment. Go to Step 21.

No. Please provide basis for conclusion. Recommend Preliminary Decision to deny proposed activity (subject to Interagency Coordination and Public Comment). Go to Step 21.

The basis for conclusion should include a discussion of whether the lowering of water quality is necessary and important. "Necessary" means that the same social and economic benefits cannot be achieved with some other approach. "Important" means that the value of the social and economic benefits due to lowering water quality is greater than the environmental costs of lowering water quality. Benefits can be created from measures such as:

- Creating or expanding employment (provide current/expected number of employees, type & relative amount of each type
- Increasing median family income
- Increasing community tax base (provide current/expected annual sales, tax info)
- Providing necessary social services
- Enhancing environmental attributes

and Environmental Costs can include:

- Losing assimilative capacity otherwise used for other industries/development
- Impacting fishing, recreation, and tourism industries negatively
- Impacting health protection negatively
- Impacting societal value for environmental quality negatively

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21. On the basis of the Anti-degradation Review, the following is recommended:

__X__ Proceed with Application to Interagency Coordination and Public Comment Phase.
____ Deny Application; return to applicant and provide public notice.

Action Approved

Section: Western Region, Salem Office
Review Prepared By: Mary Pfauth
Phone: (503) 378-4978
Date Prepared: 9-11-2008

Please provide the following information and submit with the completed application form to:

Department of Environmental Quality
Water Quality Division—Surface Water Management
811 SW Sixth Avenue
Portland, Oregon 97204-1390

Name: _____
Name of Company: _____
Address: _____
_____
_____
_____
Phone: _____
Fax: _____

Appendix 2
25% Thermal Plume Reasonable Potential Analysis
Lowell WWTP
2009

Enter data into white cells below:

7Q10 =	1200	cfs
Ambient Temperature or Criterion	18	ºC
Effluent Flow =	0.22	mgd
Effluent Temperature	23	ºC
Allowable increase =	0.3	ºC

25% of 7Q10 =	300.0	cfs
25% dilution =	882	dilution = (Qe+Qr)/Qe

ΔT at edge of MZ =	**0.01**	**ºC**	**No Reasonable Potential**

Thermal Load Limit =	**N/A**	**Million Kcals**

Equation used to calculate ΔT at edge of MZ

$$\Delta T_{mz} = \frac{T_e + (S-1)T_a}{S} - T_a$$

Equation used to calculate thermal load limit

$$TLL = 3.7854 Q_e S \Delta T_{all} C_p \rho$$

Where:

Qe =	Effluent Flow in mgd
S =	Dilution
ΔT_{all} =	Allowable temperature increase at edge of MZ (°C)
Cp =	Specific Heat of Water (1 cal/g °C)
ρ =	Density of Water (1 g/cm^3)
3785.41 =	Flow conversion from mgd to m^3/day

Appendix 3
Mixing Zone Temperature RPA
Lowell WWTP
2009

Enter data into white cells below:

Dilution =	177	
Ambient Temperature or Criterion	18	°C
Effluent Temperature	23	°C
Allowable increase =	0.3	°C
Effluent Flow Rate =	0.22	mgd

ΔT at edge of MZ=	**0.03**	**°C**	**No Reasonable Potential**

Thermal Load Limit =	**N/A**	**Million Kcals**

Equation used to calculate ΔT at edge of MZ

$$\Delta T_{mz} = \frac{T_e + (S-1)T_a}{S} - T_a$$

Equation used to calculate thermal load limit

$$TLL = 3.785411 Q_e S \Delta T_{all} C_p \rho$$

Where:

Qe = Effluent Flow in mgd
S = Dilution
ΔT_{all} = Allowable temperature increase at edge of MZ (°C)
Cp = Specific Heat of Water (1 cal/g °C)
ρ = Density of Water (1 g/cm^3)
3785.41 = Flow conversion from mgd to m^3/day

Appendix 4
pH Reasonable Potential Analysis
Lowell WWTP
2009

	RPA for pH	
INPUT	Lower pH Criteria	Upper pH Criteria
1. DILUTION FACTOR AT MZ BOUNDARY - (Qe+Qr)/Qe	177	177
2. UPSTREAM/BACKGROUND CHARACTERISTICS		
Temperature (deg C):	15.4	15.4
pH:	7.5	7.6
Alkalinity (mg CaCO3/L):	20.0	20.0
3. EFFLUENT CHARACTERISTICS		
Temperature (deg C):	21.0	21.0
pH:	6.0	9.0
Alkalinity (mg CaCO3/L):	75.0	75.0
4. APPLICABLE PH CRITERIA	6.5	8.5
OUTPUT		
1. IONIZATION CONSTANTS		
Upstream/Background pKa:	6.42	6.42
Effluent pKa:	6.38	6.38
2. IONIZATION FRACTIONS		
Upstream/Background Ionization Fraction:	0.92	0.94
Effluent Ionization Fraction:	0.30	1.00
3. TOTAL INORGANIC CARBON		
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	21.65	21.31
Effluent Total Inorganic Carbon (mg CaCO3/L):	252.90	75.18
4. CONDITIONS AT MIXING ZONE BOUNDARY		
Temperature (deg C):	15.43	15.43
Alkalinity (mg CaCO3/L):	20.31	20.31
Total Inorganic Carbon (mg CaCO3/L):	22.96	21.62
pKa:	6.42	6.42
pH at Mixing Zone Boundary:	**7.3**	**7.6**
Is there Reasonable Potential?	**No**	**No**

Appendix 5
Chlorine and Ammonia Reasonable Potential Analysis
Lowell WWTP
2009

Dilution Values? (Y/N)	y	calculated
Low Flow Dilution @ ZID (1Q10)	36	*
Low Flow Dilution @ MZ (7Q10)	177	*
Low Flow Dilution @ MZ (30Q5)	177	*
High Flow Dilution @ ZID (1Q10)	*	*
High Flow Dilution @ MZ (7Q10)	*	*
High Flow Dilution @ MZ (30Q5)	*	*

Summer data	Effluent	Stream	Mixed		
			ZID	MZ	
pH * =	7.3	7.5	7.5	7.5	(6.5-9)
Temp * =	23	20	20.1	20.0	° C
Alkalinity =	75	26			
Salmonids Present? (Y/N)	n/a	Y			
Salmonid Spawning? (Y/N)	n/a	N			
Fresh Water ? (Y/N)	n/a	Y			
Salinity (ppt)	*	*	*	*	

PARAMETER	# of Samples	Highest Conc. mg/l	Coef. of Variance	Calculated Maximum Conc. mg/l	Background Conc. mg/l	Maximum Conc. at ZID mg/l	Maximum Conc. at MZ mg/l	WQ CRITERIA Acute (CMC) mg/l	WQ CRITERIA Chronic (CCC) mg/l	REASONABLE POTENTIAL ? ACUTE	REASONABLE POTENTIAL ? CHRONIC	ZID	MZ
Low Flow Season													
CHLORINE	365	0.480	1.00	0.480	0.00	0.013	0.003	0.019	0.011	NO	NO	ZID	MZ
AMMONIA - Freshwater	12	5.0	0.60	9.50	0.02	0.28	0.07	12.2	1.24	NO	NO		MZ

Appendix 6
Wastewater System Classification Worksheet

General Requirements (OAR 340-049-0015) - Each owner of a regulated wastewater system must have its system supervised by one or more operators who hold a valid certificate for the type of system, wastewater treatment or collection, at a grade equal to or greater than the wastewater system classification as defined in OAR-340-049-0020 and 0025. **Because classification establishes the operator certificate type and grade required for compliance, it must be determined prior to start-up of a new or upgraded facility.**

Wastewater treatment system classifications are derived from the total points assigned based on criteria shown in OAR 340-049-0025 (see Step 1 of the worksheet). Pursuant to OAR 340-049-0020(4), if the complexity of a treatment system is not reflected in -0025, DEQ may classify a system higher as long as the designation is consistent with the intent of the classification system (see Step 2 of the worksheet).

Collection system classifications are based on a service area design population to be handled by the wastewater treatment facility (see footnote on page 1 of worksheet). Like treatment, if deemed appropriate, DEQ may classify the system higher than by population alone (OAR 340-049-0020(5)). For example, the design service area population for "X" Sanitary District is 1350 (Class I), but there are 280 city-maintained STEP or STEG units and a chemical feed system for control of hydrogen sulfide. A Class II designation may be appropriate to meet the intent of the classification system to establish minimum operator requirements for experience and knowledge.

Upon written notice to the wastewater system owner, DEQ may change the classification of a wastewater system and give the owner reasonable time to comply with requirements of the new classification (OAR 340-049-0020(6)). If you have any questions, please contact the Operator Certification Program office in The Dalles at (541) 298-7255 x35.

Classification of Wastewater Systems (OAR 340-049-0020) All wastewater systems regulated under OAR 340-049 will be classified by DEQ as wastewater treatment systems and/or wastewater collection systems, as appropriate, in accordance with the following classification system:

Wastewater Treatment Systems	Wastewater Collection Systems
Class I - 30 total points or less	**Class I - 1,500 or less design population**
Class II - 31-55 total points	**Class II - 1,501 to 15,000 design population**
Class III - 56-75 total points	**Class III - 15,001 to 50,000 design population**
Class IV - 76 or more points	**Class IV - 50,001 or more design population**

Definitions used in these regulations unless otherwise required by context (see OAR 340-049-0010):

"Average Dry Weather Flow" (ADWF) means the design average dry weather flow capacity of the wastewater treatment system in gallons per day or Million Gallons per Day (MGD), as approved by the Department.

"Industrial Waste" means liquid wastes from an industrial or commercial process discharged into a wastewater system for conveyance and treatment.

"NPDES Permit" means a waste discharge permit issued in accordance with requirements and procedures of the National Pollutant Discharge Elimination System authorized by Section 402 of the Federal Clean Water Act and OAR 340, Division 45.

"Population" means the design population of the wastewater system represented as the number of people or the population equivalent the system is designed to serve. Equivalent population ordinarily is determined based on 70 gallons per person per day average dry weather flow (ADWF) or 0.17 lbs. BOD5 per person per day, whichever is greater.

"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 of domestic and industrial waste or other by-products, such as sludge, is also considered wastewater or sewage.

"Wastewater Treatment System" or "Sewage Treatment System" means any structure, equipment or process for treating and disposing of, or recycling or reusing wastewater and sludge (including industrial waste) that is discharged to the wastewater system.

"Wastewater Collection System" or "Sewage Collection System" means the trunks, arterials, pumps, pump/lift stations, piping and other appurtenances necessary to collect and carry away wastewater or other liquid waste treatable in a community or private wastewater treatment facility.

Wastewater System Classification Worksheet

"Wastewater System" means "Sewage Treatment Works" defined in ORS 448.405 as any structure, equipment or process required to collect, carry away and treat domestic waste and dispose of sewage as defined in ORS 454.010. Typically, components of a wastewater system include a wastewater collection system and a wastewater treatment system.

"WPCF Permit" means a Water Pollution Control Facilities permit to construct and operate a collection, treatment and/or disposal system with no discharge to navigable waters.

WW System Common Name: Lowell STP

Facility ID: 51447 **Location:** Lowell, OR

Total Points (from page 3): 69 **WWT Class (check):** ☐ I ☐ II ☒ III ☐ IV

Design Population[1]: 3142 **WWC Class (check):** ☐ I ☒ II ☐ III ☐ IV

Design ADWF load (Influent MGD) 0.22 **Design BOD load (Influent lbs./day)** _____

Classified by: Mary Pfauth **Date:** _____

Date this classification filed with the Operator Certification Office: _____

System start-up date for this classification (new, upgrade or expansion): N/A

Is this a change from a prior classification? (check): ☐ **Yes** ☒ **No**

STEP 1 - Criteria for Classifying Wastewater Treatment Systems (OAR 340-049-0025)

(1) Design Population or Population Equivalent Points (10 Points Maximum)

☐ Less than 750	0.5 points
☐ 751 to 2000	1 point
☒ 2001 to 5000	1.5 points
☐ 5001 to 10,000	2 points
☐ Greater than 10,000	3 points+1 pt. for ea. add. 10k
Part 1 Subtotal	1.5 points

(2) Average Dry Weather Flow (Design Capacity) Points (10 points Maximum)

☐ Less than 0.075 MGD	0.5 point
☐ Greater than 0.075 to 0.1 MGD	1 point
☒ Greater than 0.1 to 0.5 MGD	1.5 points
☐ Greater than 0.5 to 1.0 MGD	2 points
☐ Greater than 1.0 MGD	3 points+1 pt. for ea. add. MGD
Part 2 Subtotal	1.5 points

(3) Unit Process Points (Check all that apply)

Preliminary Treatment and Plant Hydraulics: See also STEP 2

☐ Comminution (cutter, shredder, grinder, barminutor, etc.)	1 point
☒ Grit Removal, gravity	1 point
☐ Grit Removal, mechanical	2 points
☒ Screen(s), in-situ or mechanical (coarse solids only)	1 point
☒ Pump/Lift Station(s) (pumping of main flow)	2 points
☐ Flow Equalization (any type)	1 point
Subtotal	4 points

Primary Treatment: _____

☐ Community Septic Tank(s) (STEP, STEG, etc)	2 points
☒ Clarifier(s)	5 points

[1] **See "Population" definition. Use the design average daily equivalent load per person for Influent Flow or Influent BOD5, whichever is greater. This value is used to determine the Collection System Classification.**

Wastewater System Classification Worksheet

☐ Flotation Clarifier(s)	7 points
☐ Chemical Addition System	2 points
☐ Imhoff Tanks, (large septic tank or similar sedimentation & digestion)	3 points
Subtotal	5 points
Page 1 Subtotal	12 points

Unit Process Points – Continued (Check all that apply) _____

Secondary, Advanced, and Tertiary Treatment **See also STEP 2:**

☐ Low Rate Trickling Filter(s) (no recirculation)	7 points
☐ High Rate Trickling Filter(s) (recirculation)	10 points
☒ Trickling Filter - Solids Contact System	12 points
☒ Activated Sludge (includes SBR & basic MBR process)	15 points
☐ Pure Oxygen Activated Sludge	20 points
☐ Activated Bio Filter Tower less than 0.1 MGD	6 points
☐ Activated Bio Filter Tower greater than 0.1 MGD	12 points
☐ Rotating Biological Contactors 1 to 4 shafts	7 points
☐ Rotating Biological Contactors, 5 or more shafts	12 points
☐ Stabilization Lagoons, 1 to 3 cells without aeration	5 points
☐ Stabilization Lagoons, 1 or more cells with primary aeration	7 points
☐ Stabilization Lagoons, 2 or more cells with full aeration	9 points
☐ Recirculating Gravel Filter	7 points
☐ Chemical Precipitation Unit(s)	3 points
☐ Gravity Filtration Unit(s)	2 points
☐ Pressure Filtration Unit(s)	4 points
☐ Nitrogen Removal, Biological (BNR) or Chemical/Biological System	4 points
☐ Nitrogen Removal, Designed Extended Aeration Only (Nitrification)	2 points
☐ Phosphorus Removal Unit(s)	4 points
☐ Effluent Microscreen(s)	2 points
☐ Chemical Flocculation Unit(s)	3 points
☐ Chemical Addition System @ 2 points (describe): _____	_____ points
Subtotal	27 points

Solids Handling (Excludes long-term storage in lagoons above) **See also STEP 2:**

☐ Anaerobic Primary Sludge Digester(s) w/o Mixing and Heating	5 points
☐ Anaerobic Primary Sludge Digester(s) with Mixing and Heating	7 points
☐ Anaerobic Primary and Secondary Sludge Digesters	10 points
☐ Sludge Digester Gas reuse	3 points
☒ Aerobic Sludge Digester(s)	8 points
☐ Sludge Storage Lagoon(s) (List Basin(s) or Tank(s) under STEP 2)	2 points
☐ Sludge Lagoon(s) with aeration	3 points
☒ Sludge Drying Bed(s)	1 point
☐ Sludge Air or Gravity Thickening	3 points
☐ Sludge Composting, In Vessel	12 points
☐ Sludge Belt(s) or Vacuum Press/Dewatering	5 points
☐ Sludge Centrifuge(s)	5 points
☐ Sludge Incineration	12 points
☐ Sludge Chemical Addition Unit(s) (alum, polymer, alkaline stab. etc.)	2 points
☒ Non-Beneficial Sludge Disposal (landfill or burial)	1 point
☒ Beneficial Sludge Utilization (see also STEP 2)	3 points
Subtotal	13 points

Disinfection:

☐ Liquid Chlorine Disinfection	2 points

☒ Gas Chlorine Disinfection	5 points
☒ Dechlorination System	4 points
☐ Other disinfection systems including ultraviolet and ozonation	5 points
Subtotal	9 points
Page 2 Subtotal	49 points

(4) Effluent Permit Requirement Points (Check as applicable) **See also STEP 2**:

☐ Minimum of secondary effluent limitations for BOD and/or TSS	2 points
☐ Minimum of 20 mg/L BOD and/or Total Suspended Solids	3 points
☒ Minimum of 10 mg/L BOD and/or Total Suspended Solids	4 points
☐ Minimum of 5 mg/L BOD and/or Total Suspended Solids	5 points
☐ Effluent limitations for effluent oxygen (For other limits see Step 2)	1 point
Part 4 Subtotal	4 points

(5) Variation in Raw Waste Points. Points in this category will be awarded only when conditions are extreme to the extent that operation and handling procedure changes are needed to adequately treat waste due to variation of raw waste (strength or flow)

☐ Recurring deviations or excessive variations 100% to 200%	2 points
☐ Recurring deviations or excessive variations of more than 200%, **or** conveyance and treatment of industrial wastes by pretreatment program	4 points
☐ Septage or truck-hauled waste	2 points
Part 5 Subtotal	0 points

(6) Sampling and Laboratory Testing Points (check as applicable)

☒ Sample for BOD, Total Suspended Solids performed by outside lab or	2 points
☐ BOD or Total Suspended Solids analysis performed at treatment plant	4 points
☒ Bacteriological analysis performed by outside lab or	1 point
☐ Bacteriological analysis performed at WWT plant lab	2 points
☒ Nutrient, Heavy Metals or Organics analysis performed by outside lab or	3 points (≤1/mo. 1 pt)
☐ Nutrient, Heavy Metals or Organics analysis performed at WWT plant	5 points
Part 6 Subtotal	4 points
Parts 4-6 Total	8 points*

OAR 340-049-0025 Accumulated Points, pg1 12, **pg2** 49 **& pg3*** 8 = 69 **Go to Step 2▼**

STEP 2 - Complexity Not Reflected Above (OAR 340-049 0020(4))

Note: This step may justify a higher classification. Points shown are given as guidance.

☐ Fine Screen Preliminary Treatment (includes washing & compaction)	2 points
☐ SCADA or similar instrumentation providing data w/ process op. (2-4 pts)	_____ points
☐ Post aeration, includes mechanical and diffused aeration (not cascade)	1 point
☐ Class A recycled water (storage, distribution & monitoring)	6 points
☐ Class B, C, D and non-disinfected recycle (surface & subsurface)	3 points
☐ Sludge dewatering using bag or tube system	1 point
☐ Composting, ASP or windrow	6 points
☐ Land application of biosolids by system operator (add to BSU pts. Pg. 2)	5 points
☐ Odor or corrosion control (separate or combined)	2 points
☐ Chemical/Physical advanced waste treatment (10 -15 points)	_____ points
☐ Reverse Osmosis or Electro-dialysis	15 points
☐ Other Effluent Requirements @ 1 pt (describe): _____	_____ point(s)
☐ Other (describe): _____	_____ point(s)
OAR 340-049-0020(4) points	0 points

Wastewater System Classification Worksheet

Accumulated Point Total - Steps 1 and 2 (enter here and on page 1) **69 points**

A COPY OF THIS COMPLETED WORKSHEET TO BE FILED WITH THE OPERATOR CERTIFICATION PROGRAM OFFICE, WQ DIVISION, PRIOR TO SYSTEM START-UP

APPENDIX B:

Flood Insurance Rate Map FEMA

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM209	703.277	A brass cap stamped Elevation 703.277, located approximately 100 feet south of Pengra Road, in northwest abutment, at the north end of Dexter Dam. Set by U.S. Army Corps of Engineers (BM).

122°48'45" 43°56'15"

122°45'00" 43°56'15"

JOINS PANEL 1685

ZONE X

ELIJAH BRISTOW STATE PARK

PENGRA ROAD

ZONE X

AP

LIMIT OF DETAILED STUDY

MIDDLE FORK WILLAMETTE RIVER

ZONE AE

RM209

ROAD

Spillway

DEXTER DAM

ZONE X

ZONE AE (EL 639)

FLOODING EFFECTS FROM MIDDLE FORK WILLAMETTE RIVER

ZONE X

LANE COUNTY
CITY OF LOWELL

CITY OF LOWELL
410125

JASPER-LOWELL ROAD

LN.

LORIUS AVE

EVERLY STREET

ALDER ST

MAIN ST

UPLAND STREET

PIONEER ST

PARKER LN

LAKEVIEW ST

SUMMIT ST

ZONE A

DEXTER

ZONE X

LANE COUNTY
UNINCORPORATED AREAS
415591

LOOKOUT POINT LAKE

LOOKOUT POINT DAM

ZONE A

CORPORATE LIMITS

LAKE

ZONE A

PARK RD

DEXTER ROAD

58

ROGERS LANE

LOST CREEK ROAD

WILLAMETTE HIGHWAY

LOWELL COVERED BRIDGE

SOUTHERN PACIFIC

ZONE X

JOINS PANEL 1690

LOST CREEK ROAD

RATTLESNAKE ROAD

Noisy Creek

Mosquito Creek

ZONE X

ZONE AE

Lost Creek

ZONE X

LOST CREEK ROAD

770

772

775

K

43°52'30" 122°48'45"

JOINS PANEL 2135

43°52'30" 122°45'00"

JOINS PANEL 1725

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 19 SOUTH, RANGE 1 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined.
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction ; no base flood elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year floodplain.
- **ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.
- D — D — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.
- RM7 — Elevation Reference Mark
- M2 — River Mile
- 97°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for more detailed data on BFE's, and for any information on floodway delineations, prior to use of this map for property purchase or construction purposes.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, A99, V, VE and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 120 inch.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

This map may incorporate approximate boundaries of Coastal Barrier Resource System Units and /or Otherwise Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-591).

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels and base map source see separately printed Map Index.

MAP REPOSITORY
Refer to Repository Listing on Map Index

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:
JUNE 2, 1999

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE DATE shown on this map to determine when actuarial rates apply to structures in zones where elevations or depths have been established.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

LANE COUNTY,
OREGON AND
INCORPORATED AREAS

PANEL 1695 OF 2975
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
LOWELL, CITY OF	410125	1695	F
LANE COUNTY, UNINCORPORATED AREAS	415591	1695	F

MAP NUMBER
41039C1695 F

EFFECTIVE DATE:
JUNE 2, 1999

Federal Emergency Management Agency

APPENDIX C:

Natural Resource Conservation Service Soil Report

United States Department of Agriculture

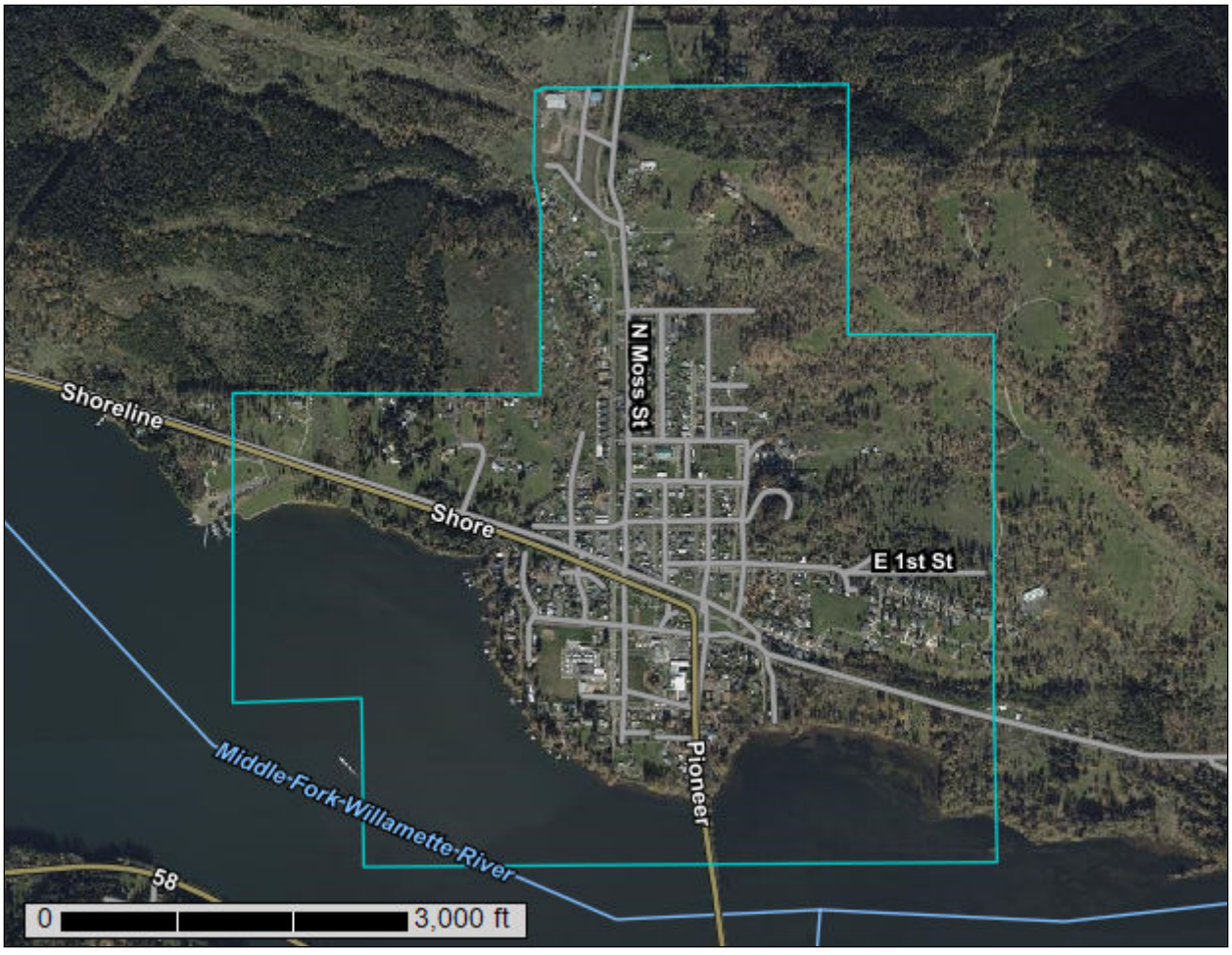
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Lane County Area, Oregon

UGB



September 28, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

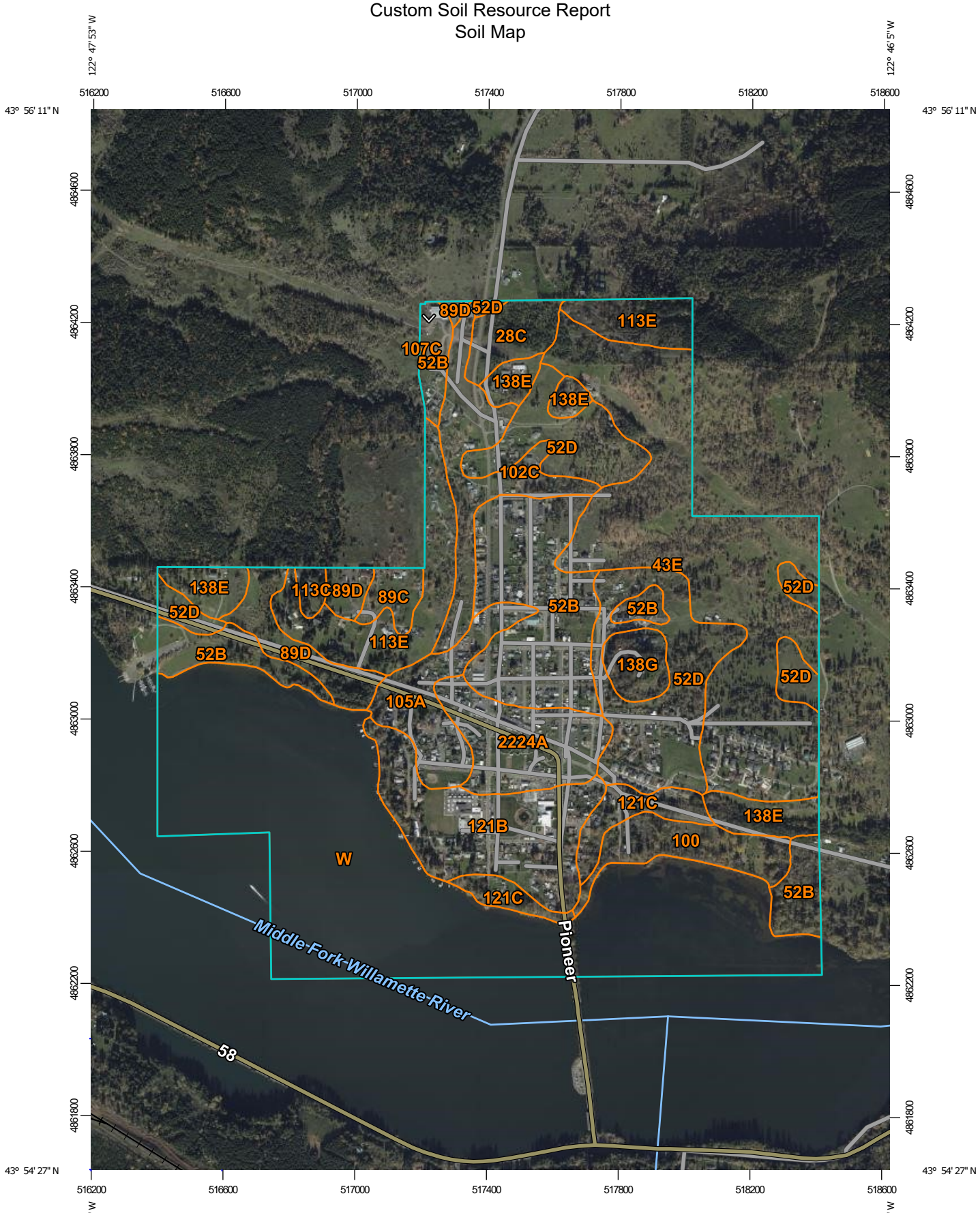
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lane County Area, Oregon
Survey Area Data: Version 21, Mar 13, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 30, 2019—Nov 1, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
28C	Chehulpum silt loam, 3 to 12 percent slopes	11.7	1.5%
43E	Dixonville-Philomath-Hazelair complex, 12 to 35 percent slopes	119.5	15.7%
52B	Hazelair silty clay loam, 2 to 7 percent slopes	82.0	10.8%
52D	Hazelair silty clay loam, 7 to 20 percent slopes	76.9	10.1%
89C	Nekia silty clay loam, 2 to 12 percent slopes	6.6	0.9%
89D	Nekia silty clay loam, 12 to 20 percent slopes	19.7	2.6%
100	Oxley gravelly silt loam	18.5	2.4%
102C	Panther silty clay loam, 2 to 12 percent slopes	29.5	3.9%
105A	Pengra silt loam, 1 to 4 percent slopes	22.9	3.0%
107C	Philomath silty clay, 3 to 12 percent slopes	0.2	0.0%
113C	Ritner cobbly silty clay loam, 2 to 12 percent slopes	2.9	0.4%
113E	Ritner cobbly silty clay loam, 12 to 30 percent slopes	41.1	5.4%
121B	Salkum silty clay loam, 2 to 8 percent slopes	46.6	6.1%
121C	Salkum silty clay loam, 8 to 16 percent slopes	15.9	2.1%
138E	Witzel very cobbly loam, 3 to 30 percent slopes	24.0	3.2%
138G	Witzel very cobbly loam, 30 to 75 percent slopes	9.1	1.2%
2224A	Courtney gravelly silty clay loam, 0 to 3 percent slopes	28.8	3.8%
W	Water	204.2	26.9%
Totals for Area of Interest		**760.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps.

The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Lane County Area, Oregon

28C—Chehulpum silt loam, 3 to 12 percent slopes

Map Unit Setting

National map unit symbol: 2363
Elevation: 400 to 1,200 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Chehulpum and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chehulpum

Setting

Landform: Low hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, nose slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from sedimentary rock

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 13 inches: clay loam
H3 - 13 to 23 inches: weathered bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R002XC009OR - Bald Group
Forage suitability group: Well drained < 15% Slopes (G002XY002OR)
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

43E—Dixonville-Philomath-Hazelair complex, 12 to 35 percent slopes

Map Unit Setting

National map unit symbol: 236y
Elevation: 400 to 1,800 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Dixonville and similar soils: 35 percent
Philomath and similar soils: 30 percent
Hazelair and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dixonville

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, toeslope
Landform position (three-dimensional): Base slope, nose slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium and residuum derived from basalt

Typical profile

H1 - 0 to 14 inches: silty clay loam
H2 - 14 to 26 inches: silty clay
H3 - 26 to 36 inches: weathered bedrock

Properties and qualities

Slope: 12 to 35 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R002XC011OR - Low Hill Group
Forage suitability group: Well Drained > 15% Slopes (G002XY001OR)
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)
Hydric soil rating: No

Description of Philomath

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, toeslope
Landform position (three-dimensional): Base slope, nose slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium and residuum derived from basic igneous rock

Typical profile

H1 - 0 to 6 inches: cobbly silty clay
H2 - 6 to 14 inches: cobbly silty clay
H3 - 14 to 24 inches: weathered bedrock

Properties and qualities

Slope: 12 to 35 percent
Depth to restrictive feature: 12 to 20 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: R002XC009OR - Bald Group
Hydric soil rating: No

Description of Hazelair

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, toeslope
Landform position (three-dimensional): Base slope, nose slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from sedimentary rock

Typical profile

H1 - 0 to 11 inches: silty clay loam
H2 - 11 to 15 inches: silty clay
H3 - 15 to 36 inches: clay
H4 - 36 to 46 inches: weathered bedrock

Properties and qualities

Slope: 12 to 35 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None

Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R002XC010OR - Claypan Low Hill Group
Hydric soil rating: No

52B—Hazelair silty clay loam, 2 to 7 percent slopes

Map Unit Setting
National map unit symbol: 237b
Elevation: 200 to 2,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 160 to 235 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Hazelair and similar soils: 85 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hazelair

Setting
Landform: Mountains, mountains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountainbase
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Colluvium derived from sedimentary rock

Typical profile
H1 - 0 to 11 inches: silty clay loam
H2 - 11 to 15 inches: silty clay
H3 - 15 to 36 inches: clay
H4 - 36 to 46 inches: weathered bedrock

Properties and qualities
Slope: 2 to 7 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: R002XC010OR - Claypan Low Hill Group
Forage suitability group: Moderately Well Drained < 15% Slopes (G002XY004OR)
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Panther

Percent of map unit: 4 percent
Landform: Swales
Hydric soil rating: Yes

52D—Hazelair silty clay loam, 7 to 20 percent slopes

Map Unit Setting

National map unit symbol: 237c
Elevation: 200 to 2,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 160 to 235 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hazelair and similar soils: 85 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hazelair

Setting

Landform: Mountains, mountains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from sedimentary rock

Typical profile

H1 - 0 to 11 inches: silty clay loam
H2 - 11 to 15 inches: silty clay
H3 - 15 to 36 inches: clay
H4 - 36 to 46 inches: weathered bedrock

Properties and qualities

Slope: 7 to 20 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R002XC010OR - Claypan Low Hill Group
Forage suitability group: Moderately Well Drained < 15% Slopes (G002XY004OR)
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Panther

Percent of map unit: 3 percent
Landform: Swales
Hydric soil rating: Yes

89C—Nekia silty clay loam, 2 to 12 percent slopes

Map Unit Setting

National map unit symbol: 239g
Elevation: 350 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Nekia and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nekia

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, nose slope
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Colluvium and residuum derived from basalt and tuff

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 11 inches: silty clay loam
H2 - 11 to 36 inches: clay
H3 - 36 to 40 inches: unweathered bedrock

Properties and qualities

Slope: 2 to 12 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R002XC012OR - Red Hill Group
Forage suitability group: Well drained < 15% Slopes (G002XY002OR)
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

89D—Nekia silty clay loam, 12 to 20 percent slopes

Map Unit Setting

National map unit symbol: 239h
Elevation: 350 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Nekia and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nekia

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, nose slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium and residuum derived from basalt and tuff

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 11 inches: silty clay loam
H2 - 11 to 36 inches: clay
H3 - 36 to 40 inches: unweathered bedrock

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R002XC012OR - Red Hill Group
Forage suitability group: Well Drained > 15% Slopes (G002XY001OR)
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)
Hydric soil rating: No

100—Oxley gravelly silt loam

Map Unit Setting

National map unit symbol: 2338
Elevation: 170 to 800 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Oxley and similar soils: 85 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oxley

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Mixed gravelly alluvium

Typical profile

H1 - 0 to 17 inches: gravelly silt loam

H2 - 17 to 23 inches: gravelly clay loam
H3 - 23 to 41 inches: very gravelly clay loam
H4 - 41 to 60 inches: extremely gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: R002XC005OR - High Flood Plain Group
Forage suitability group: Somewhat Poorly Drained (G002XY005OR)
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

Minor Components

Courtney

Percent of map unit: 4 percent
Landform: Depressions
Hydric soil rating: Yes

102C—Panther silty clay loam, 2 to 12 percent slopes

Map Unit Setting

National map unit symbol: 233b
Elevation: 90 to 1,200 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 160 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

Panther and similar soils: 80 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Panther

Setting

Landform: Swales on hills, benches on hills
Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: Colluvium and residuum derived from basic igneous and sedimentary rock

Typical profile

H1 - 0 to 10 inches: silty clay loam
H2 - 10 to 42 inches: clay
H3 - 42 to 52 inches: weathered bedrock

Properties and qualities

Slope: 2 to 12 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R002XC010OR - Claypan Low Hill Group
Forage suitability group: Poorly Drained (G002XY006OR)
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Bashaw

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: Yes

105A—Pengra silt loam, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: 233g
Elevation: 170 to 2,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 160 to 235 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Pengra and similar soils: 85 percent
Minor components: 9 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pengra

Setting

Landform: Fans, hills
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified alluvium

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 21 inches: silty clay loam
H3 - 21 to 60 inches: clay

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: R002XC010OR - Claypan Low Hill Group
Forage suitability group: Poorly Drained (G002XY006OR)
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Panther

Percent of map unit: 3 percent
Landform: Swales
Hydric soil rating: Yes

Natroy

Percent of map unit: 3 percent
Landform: Terraces
Hydric soil rating: Yes

Courtney

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

107C—Philomath silty clay, 3 to 12 percent slopes

Map Unit Setting

National map unit symbol: 233j
Elevation: 350 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Philomath and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Philomath

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, nose slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium and residuum derived from basic igneous rock

Typical profile

H1 - 0 to 6 inches: silty clay
H2 - 6 to 14 inches: cobbly silty clay
H3 - 14 to 24 inches: weathered bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 12 to 20 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R002XC009OR - Bald Group
Forage suitability group: Well drained < 15% Slopes (G002XY002OR)
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

113C—Ritner cobbly silty clay loam, 2 to 12 percent slopes

Map Unit Setting

National map unit symbol: 233s
Elevation: 400 to 1,800 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ritner and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ritner

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Nose slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Cobbly colluvium derived from basic igneous rock

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 8 inches: cobbly silty clay loam
H2 - 8 to 33 inches: very cobbly silty clay loam
H3 - 33 to 37 inches: unweathered bedrock

Properties and qualities

Slope: 2 to 12 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: C
Ecological site: F002XC013OR - Foothill Group
Forage suitability group: Well drained < 15% Slopes (G002XY002OR)
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

113E—Ritner cobbly silty clay loam, 12 to 30 percent slopes

Map Unit Setting

National map unit symbol: 233t
Elevation: 400 to 1,800 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Ritner and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ritner

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Nose slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Cobbly colluvium derived from basic igneous rock

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 8 inches: cobbly silty clay loam
H2 - 8 to 33 inches: very cobbly silty clay loam
H3 - 33 to 37 inches: unweathered bedrock

Properties and qualities

Slope: 12 to 30 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F002XC013OR - Foothill Group
Forage suitability group: Well Drained > 15% Slopes (G002XY001OR)
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)
Hydric soil rating: No

121B—Salkum silty clay loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2347
Elevation: 500 to 1,000 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Salkum and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Salkum

Setting

Landform: Terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium derived from glacial outwash material

Typical profile

H1 - 0 to 13 inches: silty clay loam
H2 - 13 to 49 inches: clay
H3 - 49 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: R002XC011OR - Low Hill Group
Forage suitability group: Well drained < 15% Slopes (G002XY002OR)
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

121C—Salkum silty clay loam, 8 to 16 percent slopes

Map Unit Setting

National map unit symbol: 2348
Elevation: 500 to 1,000 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Salkum and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Salkum

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium derived from glacial outwash material

Typical profile

H1 - 0 to 13 inches: silty clay loam
H2 - 13 to 49 inches: clay
H3 - 49 to 60 inches: silty clay loam

Properties and qualities

Slope: 8 to 16 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R002XC011OR - Low Hill Group
Forage suitability group: Well drained < 15% Slopes (G002XY002OR)
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

138E—Witzel very cobbly loam, 3 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2354
Elevation: 300 to 1,500 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Witzel and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Witzel

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Nose slope, interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium and residuum derived from basic igneous rock

Typical profile

H1 - 0 to 4 inches: very cobbly loam
H2 - 4 to 17 inches: very cobbly clay loam
H3 - 17 to 21 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 30 percent
Depth to restrictive feature: 12 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: R002XC009OR - Bald Group
Forage suitability group: Well Drained > 15% Slopes (G002XY001OR)
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)
Hydric soil rating: No

138G—Witzel very cobbly loam, 30 to 75 percent slopes

Map Unit Setting

National map unit symbol: 2355
Elevation: 300 to 1,500 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Witzel and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Witzel

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Colluvium derived from basic igneous rock

Typical profile

H1 - 0 to 4 inches: very cobbly loam
H2 - 4 to 17 inches: very cobbly clay loam
H3 - 17 to 21 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 75 percent
Depth to restrictive feature: 12 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: R002XC009OR - Bald Group
Hydric soil rating: No

2224A—Courtney gravelly silty clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xpsh
Elevation: 160 to 800 feet
Mean annual precipitation: 39 to 59 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Courtney and similar soils: 85 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Courtney

Setting

Landform: Drainageways on stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave
Parent material: Alluvium

Typical profile

A1 - 0 to 8 inches: gravelly silty clay loam
A2 - 8 to 17 inches: gravelly silty clay loam
2Btg1 - 17 to 24 inches: gravelly clay
2Btg2 - 24 to 33 inches: gravelly clay
3Cg - 33 to 48 inches: very gravelly clay loam
4C - 48 to 60 inches: extremely gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 10 to 19 inches to abrupt textural change
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Ecological site: R002XC005OR - High Flood Plain Group
Forage suitability group: Poorly Drained (G002XY006OR)
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Awbrig

Percent of map unit: 6 percent
Landform: Drainageways on stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Bashaw

Percent of map unit: 4 percent
Landform: Depressions on stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Conser

Percent of map unit: 2 percent
Landform: Depressions on stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

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APPENDIX D:

Inflow and Infiltration Analyses

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▪ TECHNICAL MEMORANDUM ▪

TO	Max Baker Public Works Director City of Lowell	**DATE**	09/11/2023	**JOB #**	2101-015
		RE	City of Lowell Wastewater Facilities Plan Inflow and Infiltration Study		

SUMMARY

The City of Lowell's sanitary sewer collection system was evaluated for sources of inflow and infiltration (I/I) via smoke testing and flow mapping. Twenty-six locations were identified as likely sources of stormwater inflow and eight sections of the collection system were identified as likely sources of groundwater infiltration. This effort resulted in multiple recommendations to rehabilitate the collection system and suggests further study of specific areas.

It is recommended that the City prioritize addressing two instances of the storm drainage system being directly connected to the collection system. Specifically, a curb inlet on the corner of Moss Street and Lakeview Street, and a culvert on 2nd street between Moss Street and Cannon Avenue. Other recommendations include the rehabilitation of nine manholes, varying from grout patching to replacement, and CCTV surveillance of approximately 6,300 linear feet of pipe in the collection system. The City should also notify fourteen property owners to replace/repair cleanout caps on their properties and repair three potentially broken service laterals.

INTRODUCTION

The City of Lowell, based on local precipitation data and wastewater treatment plant discharge monitoring reports, has a unit sewage flow of approximately 500 gallons per capita per day (gpcd) during periods of significant rainfall. When compared to the City's average dry weather flow of approximately 70 gpcd and the US Environmental Protection Agency (EPA) benchmark of 275 gpcd for typical wet-weather flowrates, it is apparent that the City's sanitary sewer collection system experiences significant levels of inflow and infiltration (I/I). The EPA defines I/I as followed:

Inflow- "Water other than sanitary wastewater that enters a sewer system from sources such as roof leaders, cellar/foundation drains, yard drains, area drains, drains from springs and swampy areas, manhole covers, cross connections between storm sewers and sanitary sewers, and catch basins."

Infiltration- "Water other than sanitary wastewater that enters a sewer system from the ground through defective pipes, pipe joints, connections, or manholes."

Source: U.S. Environmental Protection Agency, Guide for Estimating Infiltration and Inflow, June 2014

Minimizing the sources and volume of I/I is critical to ensuring that the sanitary sewage collection system has sufficient capacity to convey waste to the treatment plant, that the treatment plant can maintain adequate treatment during high flow events, and that costs for waste treatment are minimized. In addition to identifying sources of I/I, this study recommends repairs that can be made to decrease water contributions from those sources and locations where further investigation is needed prior to undertaking repair work.

METHODS

Flow Mapping

Flow mapping involves flow rate measurements throughout the collection system to identify sections of pipe where infiltration may be occurring. Flow mapping is accomplished using a flow meter (commonly called a “Flow Poke”) that can be quickly and easily inserted through a manhole into a pipeline as shown in Figure 1. The meter allows for an instantaneous flow measurement in gallons per minute through a sewer pipe. Another flow reading can then be made at an upstream manhole that allows for a comparison between the two manholes. If it is found that there is more flow in the downstream manhole than the upstream manhole, then an infiltration problem may exist between the two manholes.

Figure 1: Flow mapping using a flow meter.

Flow mapping is performed during the midnight hours when domestic flows are significantly reduced and most of the flow in the collection system is infiltration. Additionally, flow mapping occurs after a sustained period of rainfall has saturated the subsurface. The goal is to measure consistent flows generated from underground leaks while avoiding measurement of flows from residential uses.

The flow information is plotted on a map of the system to show the location and amounts of flows in the system at the time the measurements were made. This allows the engineer to review the entire system and determine where additional investigation is warranted.

A two-person team conducted the assessment. The team used the following general procedure:

1. The team would remove the lid from a strategically selected manhole. A visual inspection of the manhole was made, noting any deficiencies.
2. At manholes where flow was visible, an appropriately sized metering insert was selected for the ISCO™ Flow Poke flow measuring device. Due to relatively low flow rates, a v-notch weir plate was attached to the metering insert.
3. The assembled flow meter was inserted into the manhole and the manometer was zeroed.
4. The flow meter was inserted into the inflow pipe to the manhole and the rubber collar was inflated to create a seal.
5. The flow was allowed to stabilize prior to taking a measurement.
6. This process was repeated for each inflow line in a manhole prior to removing the flow meter and replacing the manhole lid.

After completing measurements at a given manhole, the process was repeated at manholes upstream and downstream of the first manhole. Dramatic differences in flow measurements are indicative of the presence of an infiltration source.

Smoke Testing

Smoke testing is used to locate, identify, and classify potential inflow sources to the sanitary sewer system. Smoke testing involves pumping large volumes of white smoke into the collection system through an open manhole. This is accomplished using a blower that sits directly over an open manhole. The blower consists of a custom mounting plate, large fan blades, and is powered by a small internal combustion engine. Smoke is generated using smoke candles. The smoke travels inside the piping under the positive pressure created by the blower. The smoke-filled air then seeks locations to escape. This may include escape points that are normal and acceptable, such as roof vent pipes (plumbing stacks) and manhole lid holes.

Figure 2: Smoke testing the sanitary sewer system to identify inflow sources.

Other points where smoke escapes may be indicative of deficiencies in the system. These may include:

- Leaks in the piping and fissures leading to the ground surface
- Open cleanouts
- Cross-connections to the storm drainage system
- Downspouts on buildings

Smoke testing aims to locate the escape points or “smoke return” locations. Smoke return locations often indicate where inflow from rainfall can enter the system and occasionally reveal infiltration sources.

Flyers were hung on the doors of homes and businesses to notify residents in advance of the test. These flyers informed residents that the smoke would pose no danger to them and provided a phone number for reporting concerns or problems. A four-person team completed the survey. Each team member was outfitted with a camera and clipboard with blank smoke testing result forms. The team utilized the following general pattern during smoke testing.

1. The team removed the manhole lid and placed the smoke blower on a specific and strategically selected manhole. The smoke candle was lit, and the blower was started.
2. Each member of the survey team began walking away from the manhole in a pre-determined direction following the piping runs shown on the sewer system map.
3. Each surveyor watched for smoke escaping from anticipated locations such as roof vents and other manholes.
4. Each surveyor also watched for smoke escaping from anywhere that would not be expected for the sanitary sewer. If there was unexpected smoke found, the surveyor would take a photograph of the smoke return, prepare a smoke testing result form, and continue recording any other problems until the smoke candle burned out.
5. If a surveyor was unsure of a smoke return or found other concerns, an additional smoke candle might be lit to spend more time evaluating the location.
6. The team would confer together and mark notes on field maps including deficiencies identified and other manholes where smoke should be injected.

Upon completion of the field work, the team members prepared a digital smoke testing report of each identified deficiency. The reports are based upon data from the smoke testing results form and photos of the incident.

RESULTS

Potential Infiltration Sources

A summary of flow measurements and pipes that had noticeable increases of flows is presented in Figure 3. Eight sections of the sewer collection system were observed to have increases in flow likely due to infiltration. While flow testing can indicate where in the collection system infiltration is occurring, it may not be cost effective to replace or line an entire stretch of pipe without knowing the root cause. Further evaluation via CCTV surveillance should be performed on the pipes highlighted yellow in Figure 3. Based on total flow volume due to infiltration, the pipe segments to CCTV should be prioritized in the following order:

1. Alder Street, South of the Lift Station to Main Street
2. 1st Street, West of Cannon Avenue to N Hyland Drive
3. East of Moss Street, from 3rd Street to North of 4th Street to first manhole on D Street.
4. Between 3rd and 4th Streets, West of Pioneer Street to N Hyland Drive
5. South of Main Street, from Moss Street to the first manhole by the School
6. 6th Street to second manhole on 7th Street.
7. North end of Alder Street to 2nd Street, and 2nd Street to Damon Street
8. North end of Cannon Street to Pioneer Street (pipe south of North Shore Drive)

It would also be reasonable to prioritize the pipes within the sewershed of the Alder Street lift station (numbers 1 and 7 as listed above) since that station is historically prone to storm-related overflows. Based on the results of CCTV surveillance, a plan can then be made to replace/line segments of the collection system.

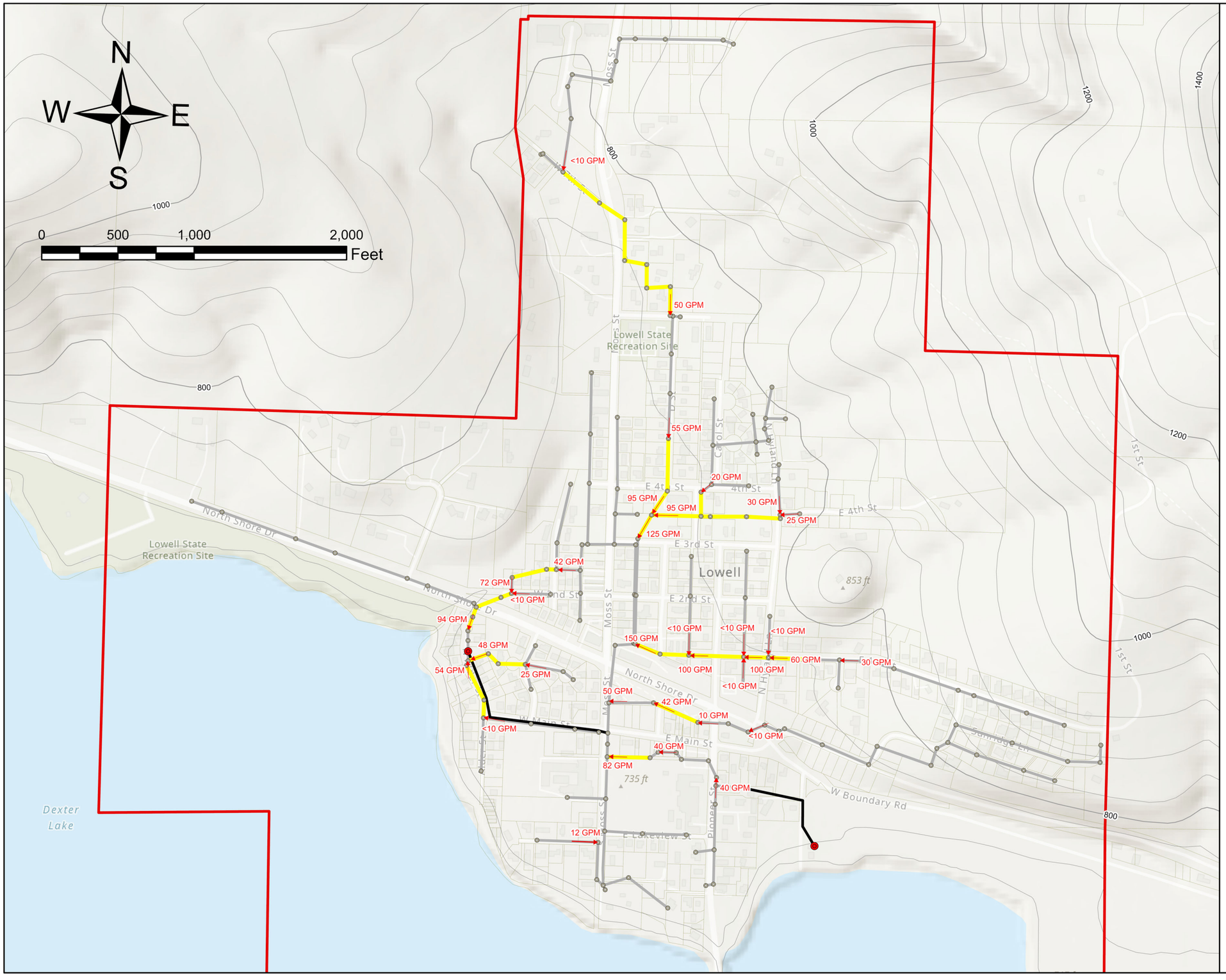
During flow testing, multiple manholes were observed to have issues with infiltration. These issues ranged from leaks in grout between manhole rings, cracks in the rings, and full leakage at the manhole base. The locations of these manholes are provided in Figure 4 and associated photos are provided in the section titled “Manhole Rehabilitation Exhibits.” Cost estimates to repair these issues are provided in the next section.

Potential Inflow Sources

A summary of likely inflow sources identified via smoke testing are presented in Table 1. Smoke was observed in twenty-six locations indicative of an entry point for stormwater into the sewer collection system. Thirteen of these were identified as broken or missing cleanout caps. Property owners should be notified to repair these cleanouts; the addresses associated with these are italicized in Table 1.

Two of the most significant inflow-related issues were apparent cross-connections between the stormwater drainage system and the sanitary sewer collection system. Smoke was observed emanating from a drainage culvert on 2nd street between Moss Street and Cannon Avenue, on the north side of 2nd street across from East Valley Church as seen in Figure 5. Another case was smoke visible from a curb inlet on the corner of Moss Street and Lakeview Street (Figure 6). The stormwater drain lines in this area should be inspected to identify where the cross connection is and a plan to fix should be developed once more information is available.

There also is an area drain in the Lane County owned parking lot at 570 N Moss Street that is directly connected to the sewer collection system. However, this seems to be a drain for wash and vehicle maintenance for the county. Generally, car wash drains are appropriate to connect to the wastewater system as the wash water contains pollutants. It could be reasonable to require a valve or equivalent on this connection, so that it can be isolated when not in use. This would help prevent all of the area’s drainage from entering the wastewater system during the wet season.



Lowell WWFP I/I Study

Flow Test Results

- Manholes
- Pump Station
- Urban Growth Boundary
- Parcels

Pressure Sewer

Gravity Sewer

Recommend CCTV

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Civil West Engineering Services, Inc.

Figure 3: Flow Test Results and CCTV Recommendations

Lowell WWFP
I/I Study

Manhole Rehabilitation

N
W
E
S

0 500 1,000 2,000 Feet

SIGNIFICANT DETERIORATION IN GROUT. SIGNIFICANT LEAKS AND CRACKING THROUGHOUT.

LEAK IN GROUT ABOVE INLET.

2ND GROUT RING FROM THE BOTTOM IS LEAKING AROUND THE CIRCUMFERENCE OF THE MH. THE 1ST GROUT RING HAS A LEAK ABOVE THE NORTH INLET.

ONE LARGE LEAK NEXT TO NORTH INLET. ONE SMALL LEAK EACH NEXT TO EAST AND SOUTH INLETS.

LEAK IN GROUT ON 2ND RING

APPROXIMATELY 90% OF FLOW ENTERING FROM GROUT ABOVE THE OUTLET

TWO LARGE VERTICAL CRACKS WERE NOTED ABOVE THE NORTH INLET AND SOUTH OUTLET.

LARGE CRACK IN THE BASE OF THE MANHOLE.

LARGE LEAK IN GROUT ABOVE 14" INLET. SMALL LEAK IN GROUT NEAR THE TOP OF THE MANHOLE BELOW THE RIM ON THE EAST SIDE.

79 80 136 126 57 68 12 17 7

- Pump Station
- Manholes
- Leaking Manholes
- Urban Growth Boundary
- Pressure Sewer
- Gravity Sewer
- Parcels

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Civil West Engineering Services, Inc.

Figure 4: Manhole Rehabilitation Recommendations

Figure 5: Likely Stormwater System Cross Connection; Across from East Valley Church

Figure 6: Curb Inlet Cross Connected to Sewer System; Corner of Moss and Lakeview

Table 1: Smoke Testing Result Summary Table.

Cross connection related issues in bold, private cleanout related issues in italics

Number	Location	Description	Potential Cause
1	*201 S Moss Street*	*Smoke visible from apparent cleanout about 8' above deck.*	*Broken or missing cleanout cap.*
2	*101 E Summit Street*	*Smoke visible from cleanout in front yard.*	*Broken or missing cleanout cap.*
3	*4 Lakeview Street*	*Smoke visible from cleanout in side yard.*	*Broken or missing cleanout cap.*
4	**103 S Moss Street**	**Smoke visible from curb inlet.**	**Possible cross connection.**
5	*13 S Moss Street*	*Smoke visible from cleanout near debris pile.*	*Broken or missing cleanout cap.*
6	*208 E Main Street*	*Visible smoke from sewer main cleanout.*	*Broken or missing cleanout cap.*
7	Rolling Rock Park	Smoke observed rising from cracks in ground.	Cracked or otherwise damaged pipe.
8	*205 W Main Street A*	*Smoke coming from uncapped cleanout on the back side of the structure.*	*Broken or missing cleanout cap.*
9	205 W Main Street B	Smoke coming out of the ground.	Based on location - Old lateral open to the atmosphere.
10	10 Wetleau Drive	Smoke visible in front yard between street and private cleanout.	Possible cracked lateral.
11	*49 Wetleau Drive*	*Smoke visible from cleanout in front yard.*	*Broken or missing cleanout cap.*
12	*70 N Pioneer Street*	*Smoke visible from cleanout between structures.*	*Broken or missing cleanout cap.*
13	72 E 2nd Street	Smoke visible from roof of church.	Source unknown, possible related to bathroom vent installation/location.
14	**75 E 2nd Street**	**Smoke visible from culvert on north side of street.**	**Possible cross connection.**
15	62 E 3rd Street	Smoke discharging from ground.	Break at lateral connection to stub out.
16	107 E 3rd Street	Smoke visible from manhole rim and surrounding sidewalk joints.	Broken rim and/or leaking joints.
17	212 4th Street	Smoke visible in empty lot east of 212 4th St.	Unknown. No noted manhole at location of smoke.
18	23 4th Street	Smoke visible from backyard behind fence.	Cause unknown due to inability to see source.
19	37 W 4th Street	Smoke visible from manhole.	Broken ring or exposed and leaking joints.
20	501 N Moss Street	Visible smoke rising from joint between sidewalk and structure.	Possible cracked or otherwise damaged pipe.
21	*540 Carol Street*	*Smoke visible from cleanout.*	*Broken or missing cleanout cap.*
22	**570 N Moss Street**	**Visible smoke rising from area drain.**	**Possible cross connection.**
23	*41 E 6th Street*	*Smoke visible from cleanout.*	*Broken or missing cleanout cap.*
24	*101 7th Street*	*Smoke visible from cleanout.*	*Broken or missing cleanout cap.*
25	*1181 Industrial Way*	*Smoke visible from elevated cleanout near small structure and at ground level on north side of driveway.*	*Missing or broken cleanout cap.* *Possible damaged cleanout or service line (north of road).*
26	*1160 Industrial Way*	*Smoke visible from cleanout.*	*Broken or missing cleanout cap.*

RECOMMENDATIONS AND COST ESTIMATES

This section provides some cost estimates for the City's planning purposes to budget and prioritize I/I reduction projects.

Manhole Rehabilitation Recommendations and Estimates

The following table presents the manholes in need of rehabilitation by order of priority. This priority is based on severity, primarily a judgement call based on the field observations. Generally, full replacement of the manhole is recommended where significant leaks were observed at the base of the manhole or around the connected pipes. In these instances, patching or adding a layer of grout is unlikely to fix the issue long-term. In other cases, patching or regrouting to rehabilitate small leaks is the recommended fix.

Table 2: Manhole Rehabilitation Cost Estimates

Manhole Number	Type of Repair	Cost Estimate
68	Full Replacement	$15,000
79	Full Replacement	$15,000
17	Full Replacement	$15,000
7	Regrout Ring	$1,500
136	Patch Holes/Regrout Ring	$2,000
126	Regrout Ring	$1,500
57	Patch Holes/Regrout Ring	$2,000
12	Patch Cracks	$1,000
80	Regrout Ring	$1,500
	Total Cost Estimate	**$54,500**

CCTV Survey Recommendations and Estimates

Before developing a plan to rehabilitate the identified cross connections, it will be necessary to investigate the exact nature of each issue. The most straightforward way to do this is via CCTV surveillance, as that will allow the City to identify the location where the cross connection occurs. It will be more cost effective to CCTV the storm drains than the sewer lines in this case. An estimate of the length of storm drain to CCTV and the associated cost is provided in the table below.

For the segments of the collection system that were identified by flow mapping to have infiltration issues, CCTV cost estimates are provided in Table 4. In these cases, CCTV surveillance is necessary to determine if the infiltration is caused by root intrusion, improperly installed laterals, pipe breaks, or other causes. This will help develop the most cost-effective rehabilitation strategy.

Table 3: Cross Connection Investigation Cost Estimate

Location of Cross Connection	Length to CCTV	Cost Estimate
2nd St between Moss St and Cannon Ave	200 feet	$400
Corner of Moss St and Lakeview Ave	500 feet	$1,000
	Total Cost Estimate	**$1,400**

Table 4: CCTV of Sewer Lines Cost Estimates

Location to CCTV	Length (ft)	Cost Estimate
Alder Street, South of the Lift Station to Main Street	790	$1,580
1st Street, West of Cannon Avenue to N Hyland Drive	1165	$2,330
East of Moss Street, from 3rd Street to North of 4th Street to first manhole on D Street.	720	$1,440
Between 3rd and 4th Streets, West of Pioneer Street to N Hyland Drive	1010	$2,020
South of Main Street, from Moss Street to the first manhole by the School	280	$560
6th Street to second manhole on 7th Street.	1290	$2,580
North end of Alder Street to 2nd Street, and 2nd Street to Damon Street	710	$1,420
North end of Cannon Street to Pioneer Street (pipe south of North Shore Drive)	320	$640
	Total Cost Estimate	**$12,570**

MANHOLE REHABILITATION EXHIBITS

The following pictures were taken by technicians in the field during flow mapping. Only seven of the nine manholes identified to have infiltration issues had images that clearly show the issue in need of rehabilitation.

Manhole #12: Cracks above north and south pipes

Manhole #17: Crack in base of manhole

Manhole #57: Leak in grout between 1st and 2nd rings from bottom

Manhole #68: Leak around circumference of outlet pipe

Manhole #79: Significant leaks in grout throughout entire manhole

Manhole #80: Leak above inlet

Manhole #136: Leaks above each inlet

SMOKE TEST REPORTS

The following pages provide the field observations of the crew that performed the smoke testing study. Each report includes a map showing the location of the issue, an associated photo, and field notes.

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/15/21 **Time:** 11:21 ☑ a.m. ☐ p.m.

Street Address/Location: 201 S MOSS ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** S MOSS ST & E SUMMIT ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM APPARENT CLEANOUT ABOUT 8' ABOVE DECK.

Probable Cause:

BROKEN OR MISSING CLEANOUT CAP.

Recommendations:

NOTIFY HOMEOWNER TO REPAIR OR REPLACE CLEANOUT CAP.

Inflow and Infiltration Study - Smoke Testing Report Form

Note:

Note:

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Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/15/21 **Time:** 11:26 ☑ a.m. ☐ p.m.

Street Address/Location: 101 E SUMMIT ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** E SUMMIT ST & S MOSS ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM CLEANOUT IN FRONT YARD.

Probable Cause:

MISSING OR BROKEN CLEANOUT CAP.

Recommendations:

NOTIFY HOMEOWNER TO REPAIR OR REPLACE CAP.

Inflow and Infiltration Study - Smoke Testing Report Form

Note:

Note:

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/15/21 **Time:** 10:41 ☑ a.m. ☐ p.m.

Street Address/Location: 4 LAKEVIEW ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** LAKEVIEW ST & S MOSS ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM CLEANOUT IN SIDEYARD.

Probable Cause:

BROKEN OR MISSING CLEANOUT CAP.

Recommendations:

NOTIFY OWNER TO INSPECT AND REPLACE CLEANOUT CAP.

Inflow and Infiltration Study - Smoke Testing Report Form

Note:

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/15/21 **Time:** 11:01 ☑ a.m. ☐ p.m.

Street Address/Location: 103 S MOSS ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** S MOSS ST & LAKEVIEW ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM CURB INLET.

Probable Cause:

POSSIBLE CROSS CONNECTION

Recommendations:

CCTV INSPECTION TO CONFIRM CROSS CONNECTION AND IDENTIFY NEXT STEPS.

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/15/21 **Time:** 12:16 ☐ a.m. ☑ p.m.

Street Address/Location: 13 S MOSS ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** W MAIN ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM CLEANOUT NEAR DEBRIS PILE.

Probable Cause:

BROKEN OR MISSING CLEANOUT CAP.

Recommendations:

NOTIFY OWNER TO INSPECT AND REPLACE CLEANOUT CAP.

Inflow and Infiltration Study - Smoke Testing Report Form

Note:

Note:

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/15/21 **Time:** 09:53 ☑ a.m. ☐ p.m.

Street Address/Location: 208 E MAIN ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** IN FRONT OF 26 S PIONEER ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

VISIBLE SMOKE FROM SEWER MAIN CLEANOUT.

Probable Cause:

BROKEN/DAMAGED CAP OR LOOSE SEAL INSIDE CLEANOUT.

Recommendations:

INSPECT THE CLEANOUT TO IDENTIFY POSSIBLE DAMAGE AND REPAIR/REPLACE AS INSPECTION INDICATES.

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: City of Lowell, Oregon **Date:** 9/16/21 **Time:** 09:13 ☑ a.m. ☐ p.m.

Street Address/Location: ROLLING ROCK PARK **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** ROLLING ROCK PARK NEAR BATHROOM

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

Observed Smoke Indicator:

SMOKE OBSERVED RISING FROM CRACKS IN GROUND.

Probable Cause:

CRACKED OR OTHERWISE DAMAGED PIPE.

Recommendations:

RECOMMEND CCTV IN LINE TO OBSERVE PIPE ISSUES AND IDENTIFY APPROPRIATE REPAIR METHOD.

X

Inflow and Infiltration Study - Smoke Testing Report Form

Note:

Note:

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: City of Lowell, Oregon **Date:** 9/16/21 **Time:** 09:15 ☑ a.m. ☐ p.m.

Street Address/Location: 205 W MAIN ST **Smoke from Manhole No.**

Observer: MOLTEN **Location of Manhole:** ON EAST SIDE OFPROPERTY

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE COMING OUT OF THE GROUND

Probable Cause:

BASED ON LOCATION, OLD LATERAL THAT IS OPEN TO THE ATMOSPHERE

Recommendations:

EXCAVATE, CAP AND/OR REPAIR LATERAL

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

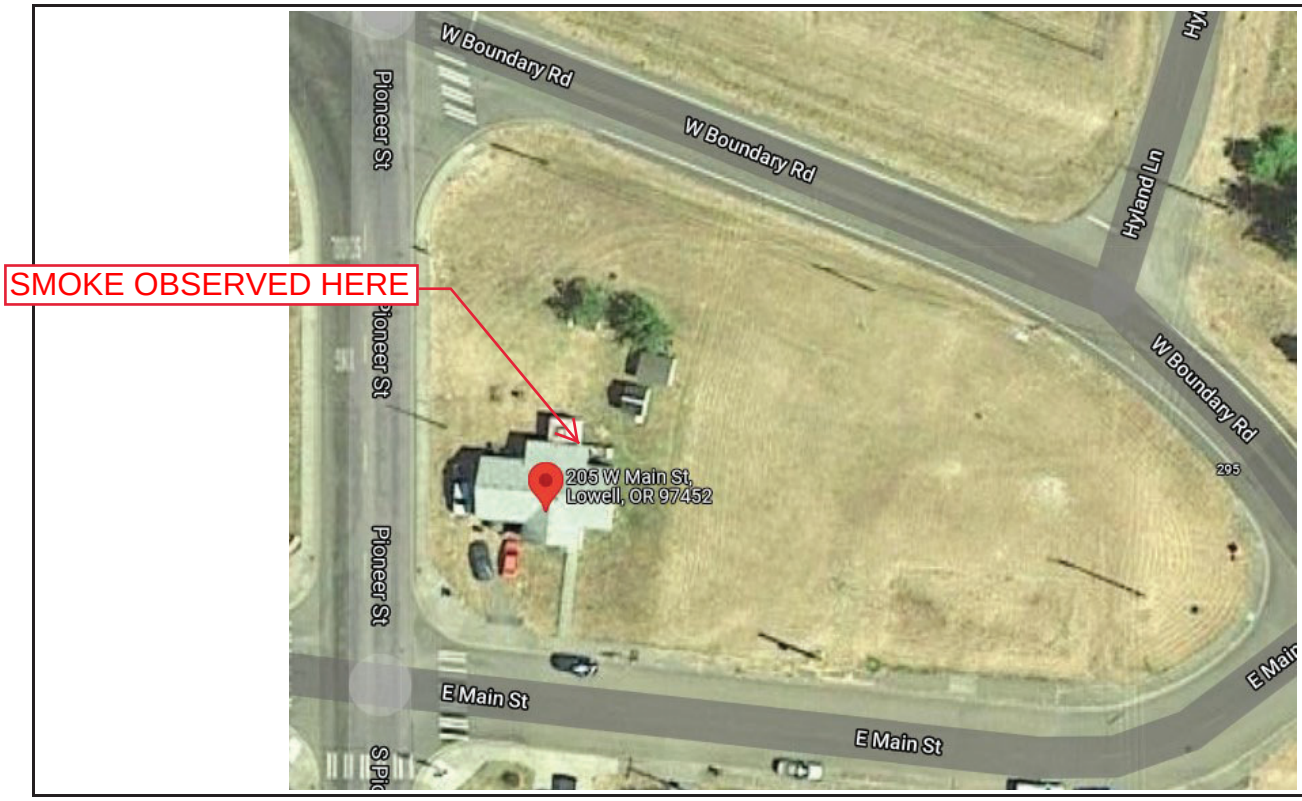
Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 09:15 ☑ a.m. ☑ p.m.

Street Address/Location: 205 W Main St **Smoke from Manhole No.**

Observer: MOLTEN **Location of Manhole:** MANHOLE ON PROPERTY

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)



X

Observed Smoke Indicator:

SMOKE COMING FROM UNCAPPED CLEANOUT ON THE BACK SIDE OF THE STRUCTURE

Probable Cause:

UNCAPPED OR BROKEN CLEANOUT

Recommendations:

REPAIR CLEANOUT OR REPLACE CAP DEPENDING ON NEED

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 08:54 ☑ a.m. ☐ p.m.

Street Address/Location: 10 WETLEAU DR **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** WETLEAU DR

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

Observed Smoke Indicator:

SMOKE VISIBLE FROM FRONT YARD BETWEEN STREET AND PRIVATE CLEANOUT.

Probable Cause:

POSSIBLE CRACKED PIPE.

Recommendations:

NOTIFY HOMEOWNER. RECOMMEND CONDUCTING AN INSPECTION TO IDENTIFY POTENTIAL CRACKS AND REPAIR ISSUE.

X

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 08:57 ☑ a.m. ☐ p.m.

Street Address/Location: 49 WETLEAU DR **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** WETLEAU DR

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM CLEANOUT IN FRONT YARD.

Probable Cause:

MISSING CLEANOUT CAP.

Recommendations:

NOTIFY HOMEOWNER TO INSTALL CLEANOUT CAP.

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 02:58 ☐ a.m. ☑ p.m.

Street Address/Location: 70 N PIONEER ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** E 1ST NEAR PUBLIC LIBRARY

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM CLEANOUT BETWEEN STRUCTURES.

Probable Cause:

BROKEN OR MISSING CLEANOUT CAP.

Recommendations:

CONFIRM CLEANOUT CAP IS MISSING AND REPLACE

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 09:36 ☑ a.m. ☐ p.m.

Street Address/Location: 72 E 2ND ST **Smoke from Manhole No.**

Observer: Sierra Tabaczynski **Location of Manhole:**

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

Observed Smoke Indicator:

SMOKE VISIBLE FROM ROOF OF CHURCH, DIRECTLY ABOVE BATHROOM.

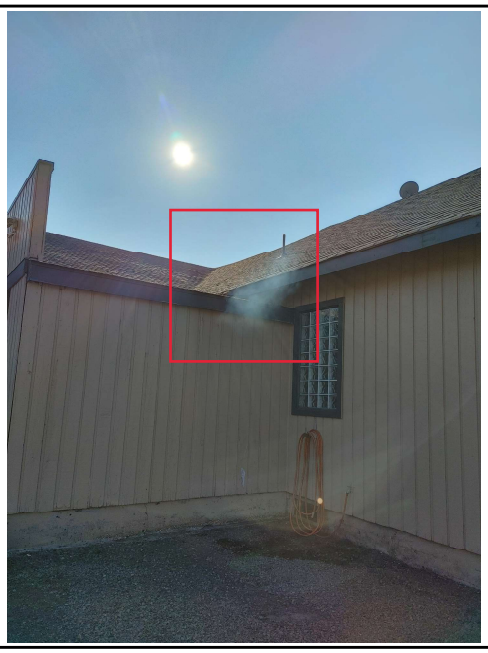
Probable Cause:

SOURCE UNKNOWN. POSSIBLY RELATED BATHROOM VENT INSTALLATION/LOCATION.

Recommendations:

NOTIFY OWNER. RECOMMEND CHECKING BATHROOM PLUMBING VENTILATION AND REPAIRING AS FINDINGS INDICATE.

X



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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 11:39 ☑ a.m. ☐ p.m.

Street Address/Location: 75 E 2ND ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** E 2ND ST NEAR LOWELL GRANGE

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM CULVERT ALONG STREET.

Probable Cause:

POSSIBLE CROSS CONNECTION.

Recommendations:

CCTV THE SEWER MAIN TO IDENTIFY THE POTENTIAL PRESENCE OF A CROSS CONNECTION.

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 11:45 ☑ a.m. ☐ p.m.

Street Address/Location: 62 E 3rd St **Smoke from Manhole No.**

Observer: MOLTEN **Location of Manhole:** SECOND ST GRANGE

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE COMING OUT OF GROUND

Probable Cause:

BREAK AT LATERAL CONNECTION TO STUB OUT

Recommendations:

NOTIFY HOMEOWNER TO HAVE LATERAL INSPECTED AND REPAIRED

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 09:35 ☑ a.m. ☐ p.m.

Street Address/Location: 107 E 3RD ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** E 2ND ST NEAR LOWELL GRANGE

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM MANHOLE RIM AND SURROUNDING SIDEWALK JOINTS.

Probable Cause:

BROKEN RIM AND/ OR LEAKING JOINTS.

Recommendations:

CONDUCT FOLLOWUP INSPECTION TO IDENTIFY APPROPRIATE METHOD FOR REHABILITATING MANHOLE VIA RING REPLACEMENT OR GROUTING.

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 12:56 ☐ a.m. ☑ p.m.

Street Address/Location: 212 4th Street **Smoke from Manhole No.**

Observer: Sierra Tabaczynski **Location of Manhole:**

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

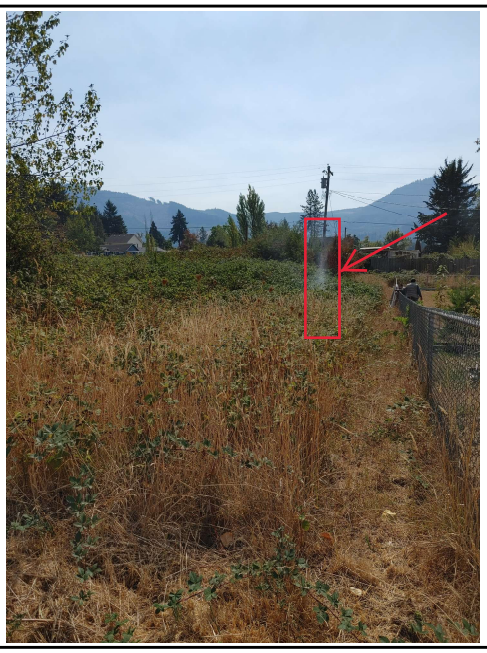
SMOKE VISIBLE IN EMPTY LOT EAST OF 212 4TH STREET.

Probable Cause:

UNKNOWN, NO NOTED MANHOLE AT LOCATION OF SMOKE.

Recommendations:

CLEAR BLACKBERRY BUSH COVERING SITE TO IDENTIFY SOURCE.



Inflow and Infiltration Study - Smoke Testing Report Form

Note:

EXACT SOURCE OF SMOKE UNKNOWN, SITE OBSTRUCTED BY BLACKBERRY BUSH

Note:

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 01:56 ☐ a.m. ☑ p.m.

Street Address/Location: 23 4TH ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** 4TH ST & N MOSS ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

Observed Smoke Indicator:

SMOKE VISIBLE FROM BACKYARD BEHIND FENCE.

Probable Cause:

CAUSE UNKNOWN DUE TO LACK OF SOURCE CONFIRMATION.

Recommendations:

NOTIFY HOMEOWNER. IF CLEANOUT IS PRESENT, RECOMMEND INSPECT FOR DAMAGE AND REPAIR/REPLACE AS NEEDED. OTHERWISE, INSPECT SERVICE LATERAL FOR DAMAGE.

X

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 01:30 ☐ a.m. ☑ p.m.

Street Address/Location: 37 W 4TH ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** W 4TH ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM MANHOLE.

Probable Cause:

BROKEN RING OR EXPOSED AND LEAKING JOINTS.

Recommendations:

CONDUCT FOLLOWUP INSPECTION TO IDENTIFY APPROPRIATE METHOD FOR REHABILITATING MANHOLE VIA RING REPLACEMENT OR GROUTING.

609 SW Hurbert St. • Newport, OR 97365 • 541/264-7040 • Fax 541/264-7041
486 E Street • Coos Bay, OR 97420 • 541/266-8601 • Fax 541/266-8681
10558 Hwy 62 Suite B-1 • Eagle Point, OR 97524 • 541/326-4828
200 SW Ferry St • Albany, OR 97322 • 541/266-8601

Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 01:33 ☐ a.m. ☑ p.m.

Street Address/Location: 501 N MOSS ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** W 4TH ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

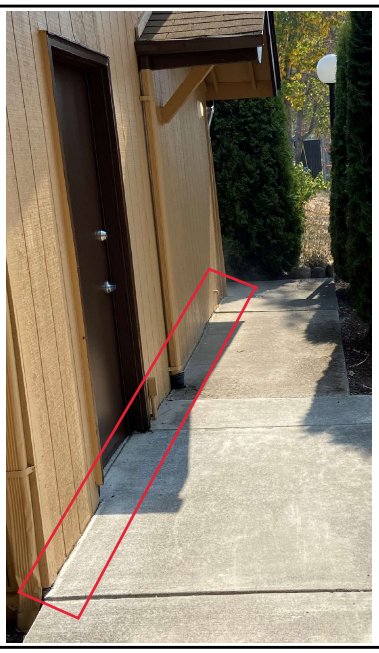
VISIBLE SMOKE RISING FROM JOINT BETWEEN SIDEWALK AND STRUCTURE.

Probable Cause:

POSSIBLE CRACKED OR OTHERWISE DAMAGED PIPE.

Recommendations:

NOTIFY OWNER. INSPECT SEWER LATERAL FOR CRACKS OR DAMAGE AND REPAIR AS INDICATED.



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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

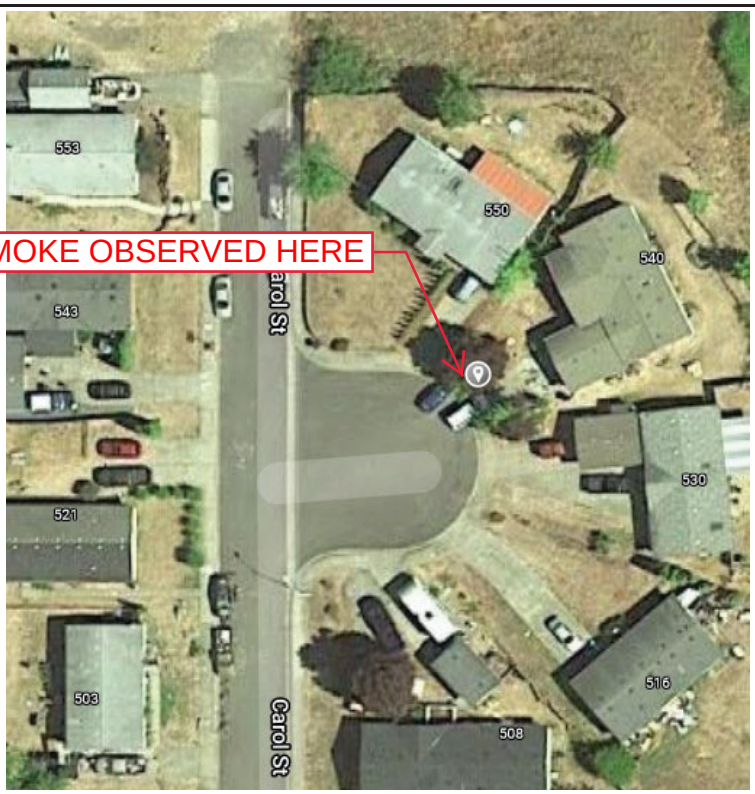
Client: CITY OF LOWELL, OREGON **Date:** **Time:** 01:15 ☐ a.m. ☑ p.m.

Street Address/Location: 540 CAROL ST **Smoke from Manhole No.**

Observer: MOLTEN **Location of Manhole:** CAROL ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)



X

Observed Smoke Indicator:

SMOKE COMING OUT OF FAULTY CLEANOUT

Probable Cause:

FAULTY CLEANOUT OR NO CLEANOUT CAP

Recommendations:

NOTIFY PROPERTY OWNER TO REPAIR CLEANOUT/REPLACE CLEANOUT CAP

Inflow and Infiltration Study - Smoke Testing Report Form

Note:

Note:

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 02:39 ☐ a.m. ☑ p.m.

Street Address/Location: 570 N MOSS ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** E 6TH ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

VISIBLE SMOKE RISING FROM AREA DRAIN.

Probable Cause:

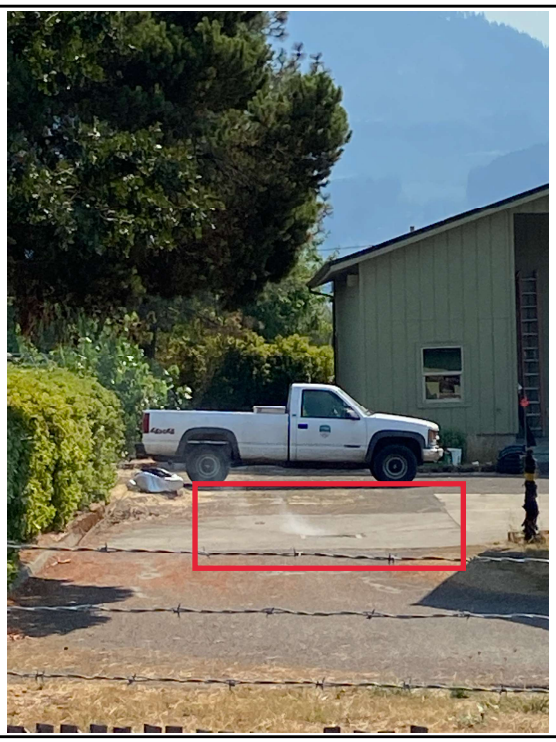
POSSIBLE CROSS CONNECTION.

Recommendations:

NOTIFY OWNER. RECOMMEND CCTV STUDY TO CONFIRM CROSS CONNECTION AND FIX ACCORDINGLY.

Inflow and Infiltration Study - Smoke Testing Report Form

Note:



Note:

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 02:27 ☐ a.m. ☑ p.m.

Street Address/Location: 41 E 6TH ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** E 6TH ST & D ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM CLEANOUT.

Probable Cause:

CRACKED AND BROKEN CLEANOUT.

Recommendations:

NOTIFY HOMEOWNER TO REPLACE BROKEN AND MISSING CLEANOUT CAP.

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/16/21 **Time:** 10:53 ☑ a.m. ☐ p.m.

Street Address/Location: 101 7TH ST **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** 7TH ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM CLEANOUT.

Probable Cause:

BROKEN OR MISSING CLEANOUT CAP.

Recommendations:

NOTIFY HOMEOWNER TO REPAIR OR REPLACE CLEANOUT CAP.

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200 SW Ferry St • Albany, OR 97322 • 541/266-8601

Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: City of Lowell, Oregon **Date:** 9/16/21 **Time:** 10:38 ☑ a.m. ☐ p.m.

Street Address/Location: 1181 INDUSTRIAL WAY **Smoke from Manhole No.**

Observer: BRAD JONES **Location of Manhole:** N MOSS ST & SENECA ST

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM ELEVATED (~3') CLEANOUT NEAR SMALL STRUCTURE AND AT GROUND LEVEL ON NORTH SIDE OF DRIVEWAY.

Probable Cause:

MISSING OR BROKEN CLEANOUT CAP (SMOKE NEAR STRUCTURE).

POSSIBLE DAMAGED CLEANOUT OR SERVICE LINE (NORTH OF ROAD).

Recommendations:

NOTIFY OWNER TO REPAIR OR REPLACE CLEANOUT CAP.

RECOMMEND AN INSPECTION TO IDENTIFY POTENTIAL CRACKS AND REPAIR ISSUE.

Inflow and Infiltration Study - Smoke Testing Report Form

Note:

Note:

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937 Geary St. No. 3 Albany • OR 97322 • 541/266-8601

Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: City of Lowell, Oregon **Date:** 9/16/21 **Time:** 10:30 ☑ a.m. ☐ p.m.

Street Address/Location: 1160 Industrial Way, Lowell, OR 97452 **Smoke from Manhole No.**

Observer: Molten **Location of Manhole:** INDUSTRIAL X SENECA

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE VISIBLE FROM BROKEN CLEANOUT

Probable Cause:

BROKEN CLEANOUT

Recommendations:

NOTIFY PROPERTY OWNER TO FIX CLEANOUT, REINSTALL BELOW GRADE TO PREVENT MOWER DAMAGE

Inflow and Infiltration Study - Smoke Testing Report Form

Note:

Note:

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Civil West Engineering Services, Inc.

Inflow and Infiltration Study - Smoke Testing Report

Client: CITY OF LOWELL, OREGON **Date:** 9/15/21 **Time:** 12:45 ☐ a.m. ☑ p.m.

Street Address/Location: CITY ALDER ST LIFT STATION **Smoke from Manhole No.**

Observer: MOLTEN **Location of Manhole:** ALDER AVE

Sketch of Area

(Location of MH, Street, any structures, areas smoke was observed, etc.)

X

Observed Smoke Indicator:

SMOKE EXITING GRATING FOR ENGINEERED OVERFLOW FOR LIFT STATION

Probable Cause:

LIFT STATION OVERFLOW IS WITHIN FLOWLINE FOR DITCH

Recommendations:

CONFIRM STORM DRAIN DOES NOT DRAIN INTO LIFT STATION OVERFLOW.

Civil West Engineering Services, Inc.

South Coast Office
486 E Street
Coos Bay, OR 97420

Willamette Valley Office
200 Ferry Street SW
Albany, OR 97321

Rogue Valley Office
830 O'Hare Parkway, Suite 102
Medford, OR 97504

North Coast Office
609 SW Hurbert Street
Newport, OR 97365

Tel (541) 266-8601 • Fax (541) 266-8681

▪ TECHNICAL MEMORANDUM ▪

TO	Max Baker Public Works Director City of Lowell	**DATE**	12/20/2023	**JOB #**	2101-015
		RE	City of Lowell Wastewater Facilities Plan CCTV Results		

The City of Lowell contracted with C-More Pipe Services in December 2023 to survey segments of the City's storm and sanitary sewer systems via closed-circuit television (CCTV). These pipe segments were identified in earlier inflow and infiltration (I/I) investigation efforts to be potential sources of I/I. This memo summarizes the significant results of this survey and provides budgetary cost estimates to repair identified issues for the City's Wastewater Facilities Plan. The full survey report from C-More is provided as an appendix to this memo.

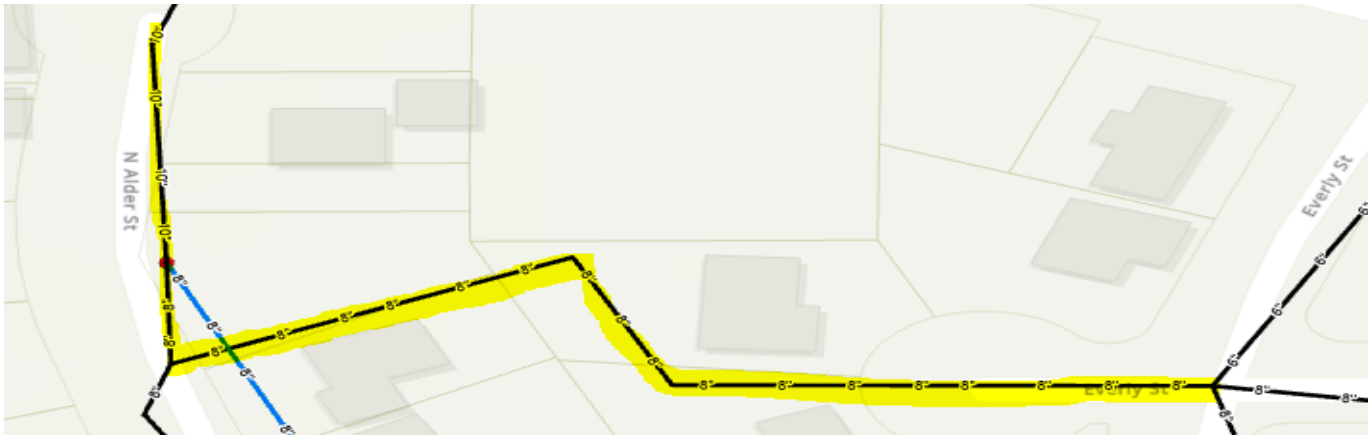


Figure 1: Lift Station Sanitary Sewer Line CCTV Surveyed

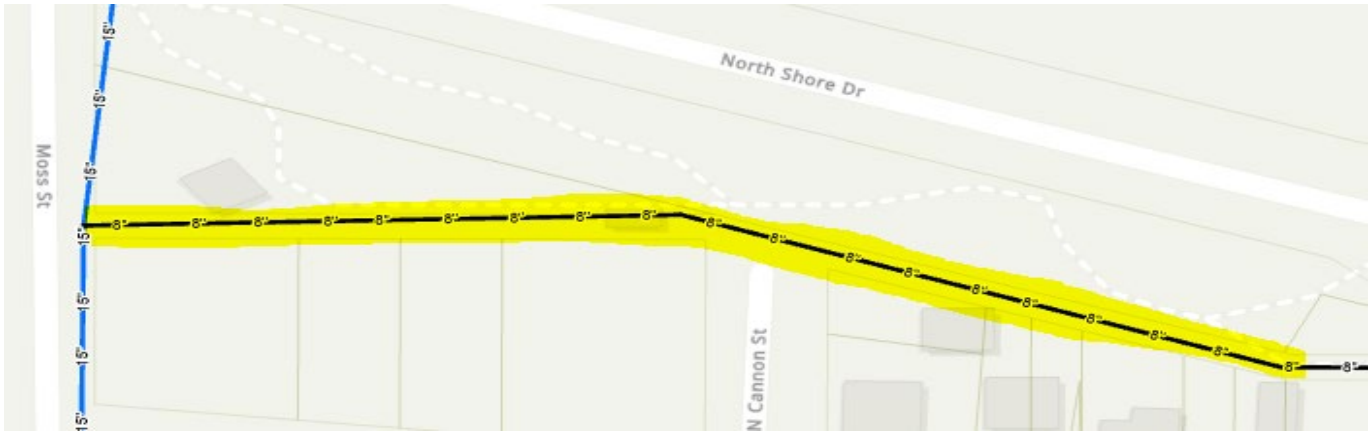


Figure 2: Gravity System Sewer Line CCTV Surveyed

Figure 3: Storm Line (Approximate Location) CCTV Surveyed

RESULTS

Lift Station Sewershed

The storm line and sanitary sewer line that drain west from the Everly Street cul-de-sac to Alder Street are in close proximity. The storm line has multiple voids, and both longitudinal and latitudinal cracks throughout the entirety of the surveyed pipe segment. The sanitary sewer line is in mostly fair condition, however a significant gushing void in the joint connecting the southern sewer line and the lift station wet well was observed (Figure 4). The sewer line from the north end of Alder Street going into the wet well was also observed to have a broken joint at the wet well outlet (Figure 5).

Figure 4: Broken Joint at Wet Well, From South

Figure 5: Broken Joint at Wet Well, From North

The City had the local fire department dump water from a tanker truck into the storm catch basin at the end of the Everly Street cul-de-sac, and a noticeable amount of water was observed flowing into the lift station wet well. It is probable that the storm line, being in very poor condition, infiltrates a significant portion of stormwater from the drainage basin of Everly Street and Loftus Avenue. A portion of this infiltrated stormwater could potentially enter the sanitary sewer system via the broken joints at the lift station wet well.

Gravity Sewershed

The sanitary sewer pipe running under Rolling Rock park, south of North Shore Drive seemed to be in mostly good condition. At the transition from concrete to PVC, about 2.3 feet from the manhole invert on Moss Street, there was a break at the joint connection (Figure 6). No other significant issues were observed. This segment of pipe was observed via flow testing to have potential infiltration issues; since the main pipe doesn't seem to have enough cracks or voids to explain the flow increases observed, the City should prioritize fixing the cross-connection issues from private connections to this main that were listed in the previous I/I memo.

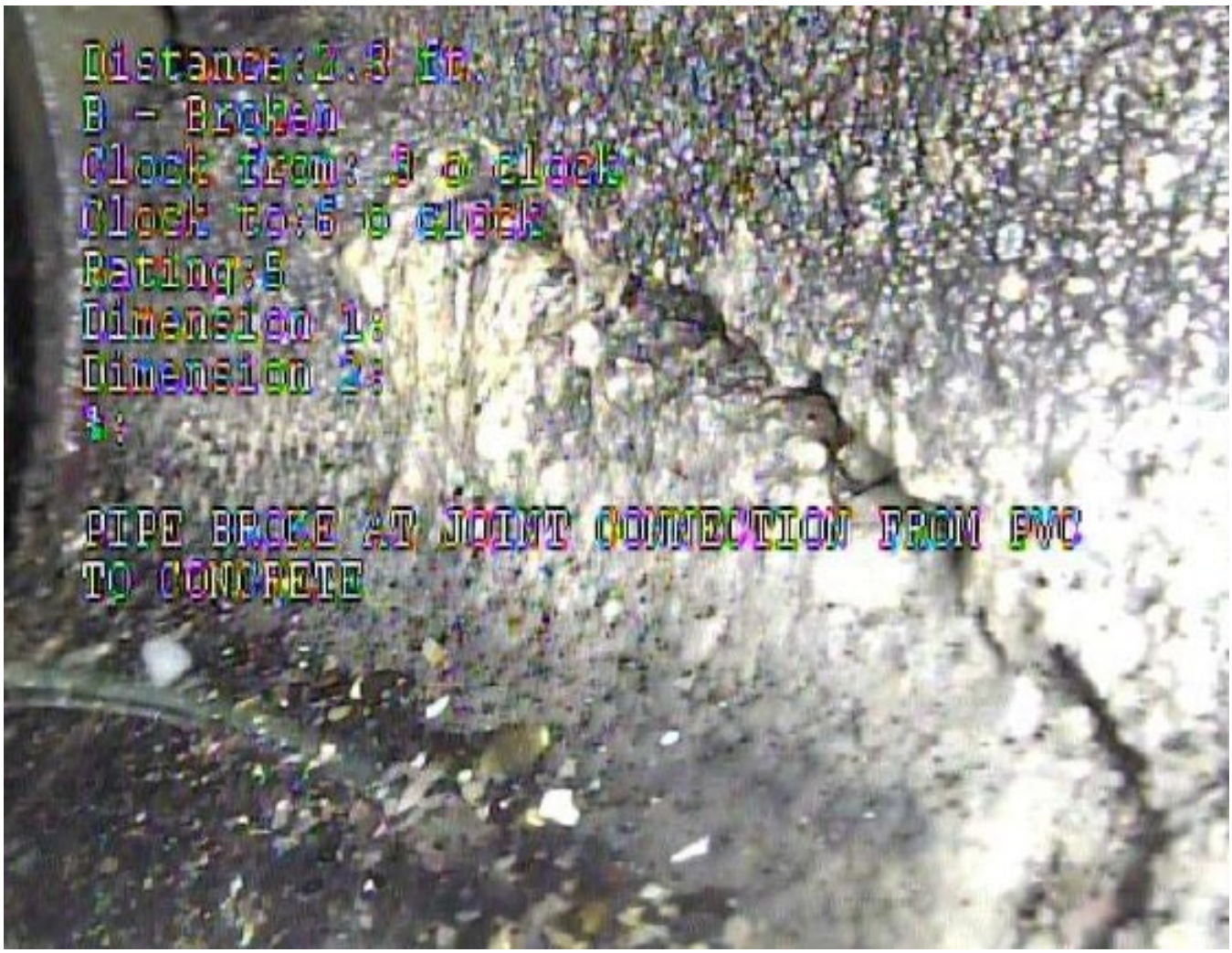


Figure 6: Broken Joint in Gravity Sewer under Rolling Rock Park

RESULTS AND ESTIMATES

As a result of this effort, it is recommended that the City budget for spot repairs of the two sanitary sewer pipes at the inlet into the Alder Street Lift Station. During the wet season, these broken joints are significant sources of infiltration, and also potential inflow sources given the close proximity of the poor-condition storm drainpipe. While full replacement of this storm pipe should be considered, this planning effort is focused on repairs that could potentially be funded via the City's sewer fund. Repairing these joints is likely the most cost-effective strategy to reduce I/I in the Alder Street Lift Station sewershed. The City should also budget to spot repair the crack in the sewer pipe under Rolling Rock park.

Alder Street Lift Station – Spot Repair Budgetary Estimates Capital Cost					
No.	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Spot Repair of Sewer Pipe Voids	3	EA	$5,000	$15,000
				Labor and Materials Subtotal	$15,000
				Mobilization, Insurance, Overhead, Bonds (10%)	$1,500
				Administration and Legal (5%)	$750
				Contingency (25%)	$3,750
				Engineering (20%)	$3,000
				Estimated Construction Costs (2023$)	**$24,000**

CUES, Inc.
3600 Rio Vista Avenue
Orlando, FL 32805
Phone: 407-849-0190
Fax: 407-425-1569

Main Inspections Large Photos

Mainline ID:	City:	Street:	Project name:
CB#1-MH#1	**LOWELL, OREGON**	**LOFTUS CT.**	**CITY OF LOWELL**
Start date/time:	Total length:	Weather:	Surveyed by:
11/22/2023 10:45 AM	**108.4 ft.**	**1**	**MIchael NASSCO6**
Upstream MH No:	Depth US:	Downstream MH No:	Depth DS:
CB#1		**MH#1**	
Shape:	Material:	Height:	Width:
C	**CP**	**10 in.**	

Additional info:
CCTV LOOKING FOR DEFECTS

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
0.0 ft.	**D**		**/**	**ACB**			**CB#1, START INSPECTION AT CB HEADING DOWN STREAM WITH FLOW**
0.0 ft.	**D**		**/**	**MWL**			**0**

Observations

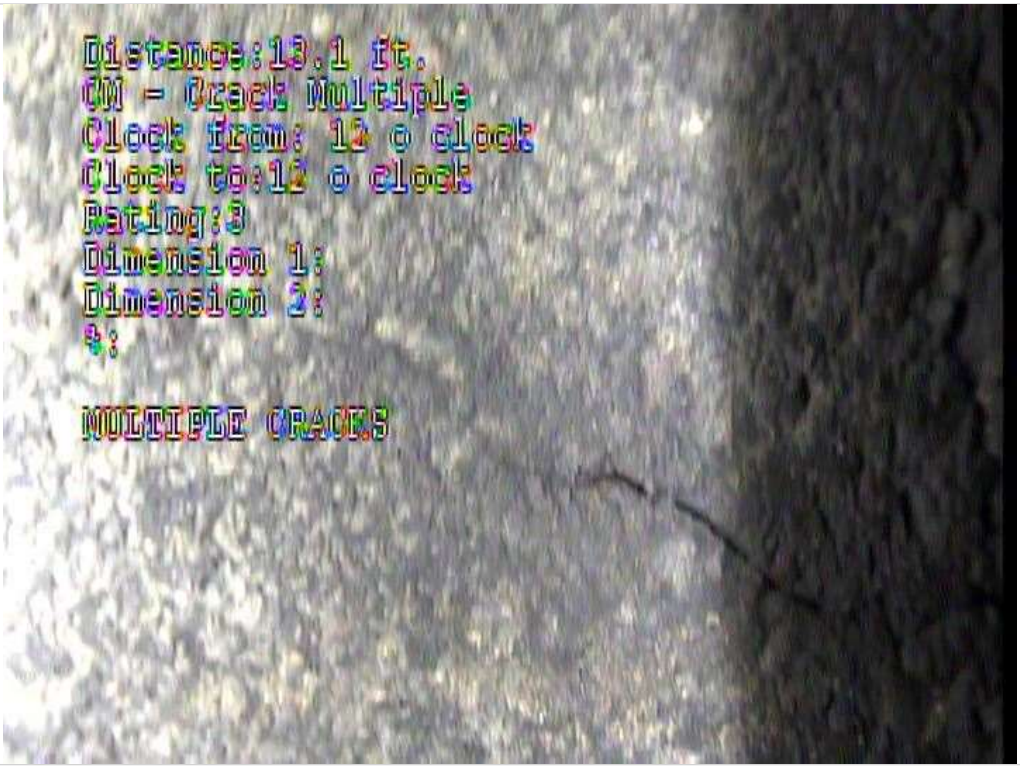
Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
5.7 ft.	**D**		**10 /**	**BSV**		**5**	**PIPED BROKE AT JOINT SOIL AND ROCK VISIBLE.**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
5.7 ft.	**D**		**12 /**	**CL**		**2**	**CRACK AT TOP CROWN OF PIPE**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
13.1 ft.	**D**		**12 / 12**	**CM**		**3**	**MULTIPLE CRACKS**



Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
16.9 ft.	**D**		**12 / 12**	**CM**		**3**	**CRACKS MULTIPLE**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
20.0 ft.	**D**		**12 / 12**	**CM**		**3**	**CRACKS MULTIPLE**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
28.1 ft.	**D**		**12 / 1**	**CM**		**3**	

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
30.5 ft.	**D**		**12 / 12**	**CM**		**3**	

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
36.2 ft.	**D**		**6 /**	**CL**		**2**	

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
108.4 ft.	**D**		**/**	**AMH**			**END INSPECTION IN MIDDLE ON SEWER MH #1**

Main Inspections Large Photos

Mainline ID:	City:	Street:	Project name:
SSMH1 TO SSMH2	**LOWELL, OREGON**	**EVERLY ST.**	**CITY OF LOWELL**
Start date/time:	Total length:	Weather:	Surveyed by:
11/22/2023 11:20 AM	**210.7 ft.**	**1**	**MIchael NASSCO6**
Upstream MH No:	Depth US:	Downstream MH No:	Depth DS:
SSMH#1		**SSMH#2**	
Shape:	Material:	Height:	Width:
C	**CP**	**8 in.**	

Additional info:

CCTV 8" SEWER FOR DEFECTS

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
0.0 ft.	**D**		**/**	**AMH**			**SSMH#1, START INSPECTION HEADING DOWN STREAM TO SSMH#2 IN BACK YARD OF 69 LOFTUS CT.**
0.0 ft.	**D**		**/**	**MWL**			**5**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
61.6 ft.	**D**		**3 /**	**TFA**			**SERVICVE RIGHT,ACTIVE CONCRETE**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
68.4 ft.	**D**		**9 /**	**TFA**			**SERVICE LEFT, ACTIVE CONCRETE**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
201.6 ft.	**D**		**9 /**	**TFA**			**SERVICE LEFT, ACTIVE CONCRETE**

Observations

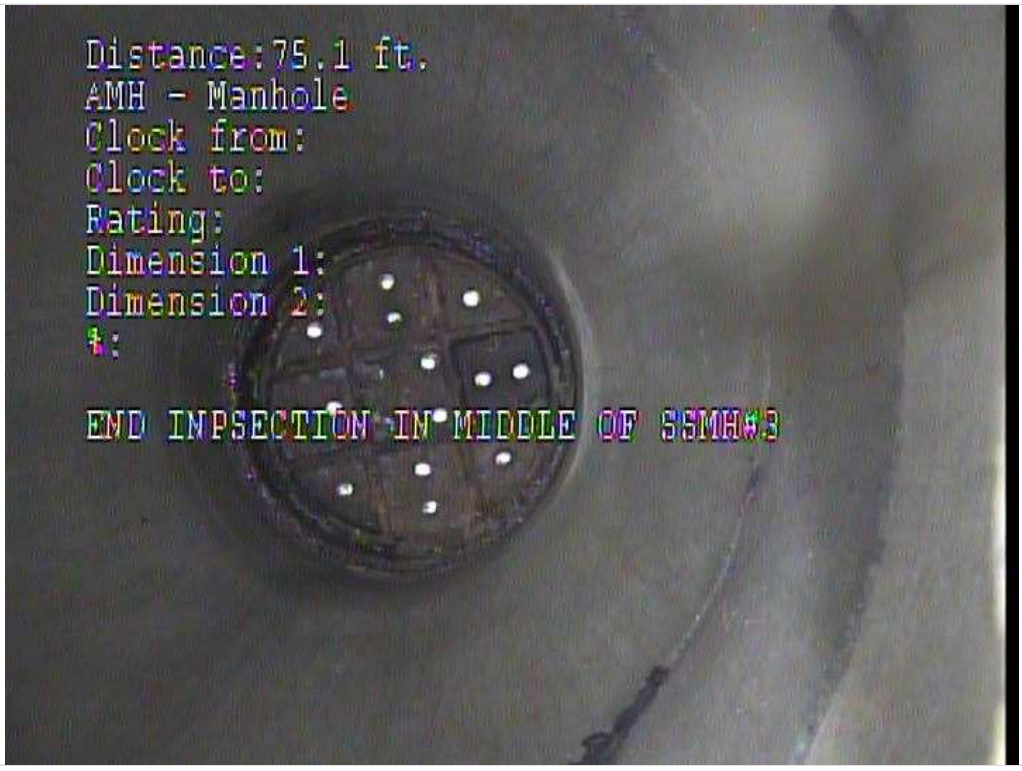
Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
210.6 ft.	**D**		**/**	**AMH**			**END INPSECTION IN MIDDLE OF SSMH #2**

Main Inspections Large Photos

Mainline ID:	City:	Street:	Project name:
SSMH2 TO SSMH3	**LOWELL, OREGON**	**EVERLY ST.**	**CITY OF LOWELL**
Start date/time:	Total length:	Weather:	Surveyed by:
11/22/2023 11:33 AM	**75.1 ft.**	**1**	**MIchael NASSCO6**
Upstream MH No:	Depth US:	Downstream MH No:	Depth DS:
SSMH#2		**SSMH#3**	
Shape:	Material:	Height:	Width:
C	**CP**	**8 in.**	
Additional info:			

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
0.0 ft.	**D**		**/**	**AMH**			**SSMH#2, START INSPECTION HEADING DOWN STREAM.**
0.0 ft.	**D**		**/**	**MWL**			**5**
75.1 ft.	**D**		**/**	**AMH**			**END INPSECTION IN MIDDLE OF SSMH#3**



Main Inspections Large Photos

Mainline ID:	City:	Street:	Project name:
SSMH3-SSMH4	**LOWELL, OREGON**	**N. ALDER ST**	**CITY OF LOWELL**
Start date/time:	Total length:	Weather:	Surveyed by:
11/22/2023 11:57 AM	**155.1 ft.**	**1**	**MIchael NASSCO6**
Upstream MH No:	Depth US:	Downstream MH No:	Depth DS:
SSMH#3		**SSMH#4**	
Shape:	Material:	Height:	Width:
C	**CP**	**8 in.**	

Additional info:
CCTV 8" FOR DEFECTS

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
0.0 ft.	**U**		**/**	**MWL**			
0.0 ft.	**U**		**/**	**AMH**			**SSMH#4 HEADING UPSTREAM TO SSMH#3 NOTE THAT DIRECTION IS LABLED WRONG AND CCTV IS GOING UP STREAM**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
19.6 ft.	**U**		**/**	**MWLS**		**2**	

Observations

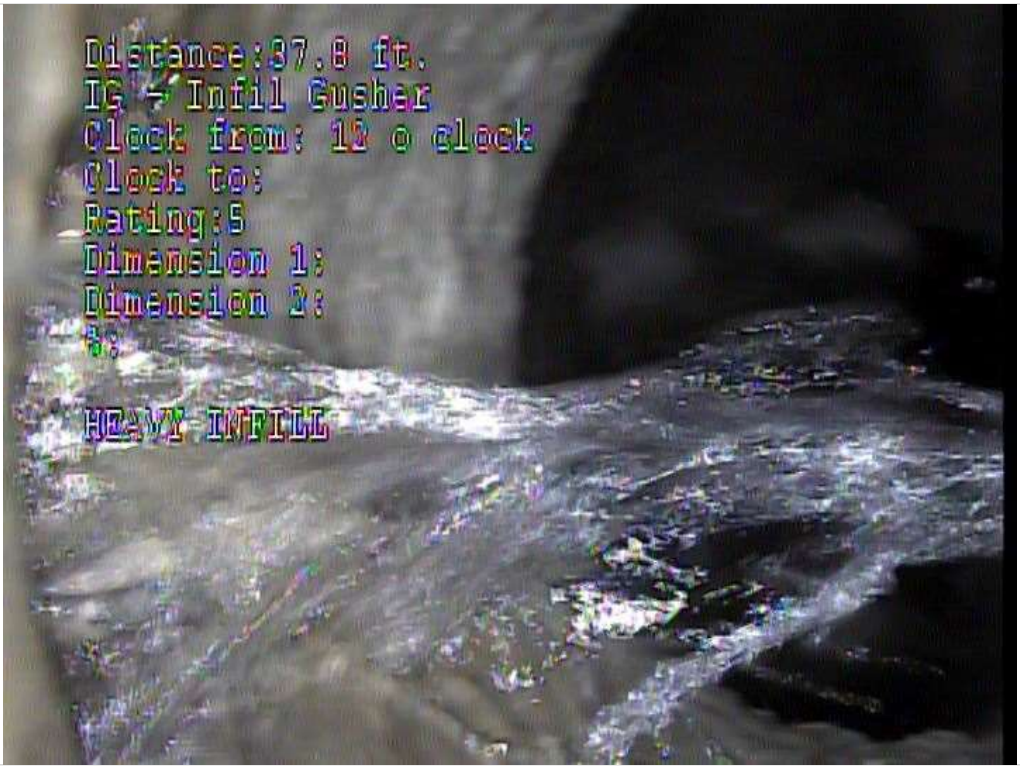
Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
149.1 ft.	**U**		**/**	**AMH**			**END INPSECTION IN CENTER OF SSMH#3**

Main Inspections Large Photos

Mainline ID:	City:	Street:	Project name:
SSMH4 TO PS146	**LOWELL, OREGON**	**N. ALDER ST**	**CITY OF LOWELL**
Start date/time:	Total length:	Weather:	Surveyed by:
11/22/2023 12:10 PM	**38.5 ft.**	**1**	**MIchael NASSCO6**
Upstream MH No:	Depth US:	Downstream MH No:	Depth DS:
SSMH#4		**PS 146**	
Shape:	Material:	Height:	Width:
C	**CP**	**8 in.**	
Additional info:			
CCTV FOR DEFECTS			

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
0.0 ft.	**D**		**/**	**MWL**			
0.0 ft.	**D**		**/**	**AMH**			**SSMH#4, START INSPECTION AT MH HEADING DOWN STREAM TO PS146**
37.8 ft.	**D**		**12 /**	**IG**		**5**	**HEAVY INFILL**



Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
38.5 ft.	**D**		**/**	**AMH**			**END INSPECTION AT PUMP STATION 146**

Main Inspections Large Photos

Mainline ID:	City:	Street:	Project name:
SSMH6-SSMH5	**LOWELL, OREGON**	**N. ALDER ST**	**CITY OF LOWELL**
Start date/time:	Total length:	Weather:	Surveyed by:
11/22/2023 12:23 PM	**85.7 ft.**	**1**	**MIchael NASSCO6**
Upstream MH No:	Depth US:	Downstream MH No:	Depth DS:
SSMH#6		**SSMH#5**	
Shape:	Material:	Height:	Width:
C	**PVC**	**8 in.**	

Additional info:
CCTV 8" FOR DEFECTS

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
0.0 ft.	**D**		**/**	**AMH**			**SSMH#6, START INSPECTION HEADING DOWN STREAM**
0.0 ft.	**D**		**/**	**MWL**			**5**
85.7 ft.	**D**		**/**	**AMH**			**END INSPECITON IN CENTER OF SSMH#5**

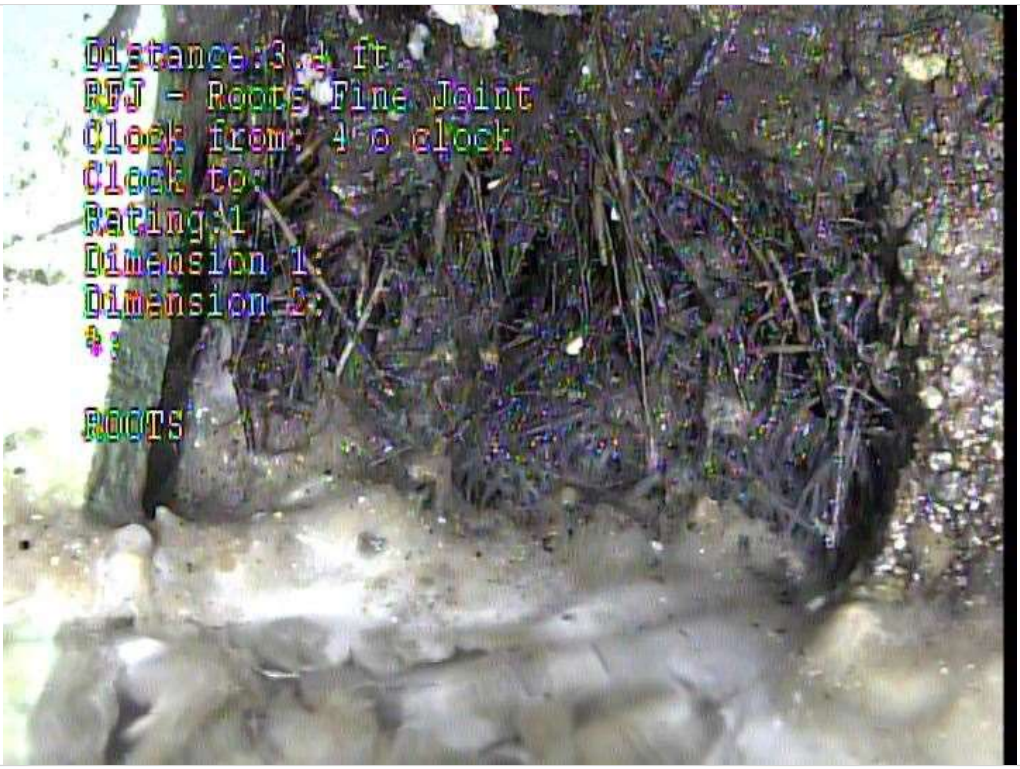
Main Inspections Large Photos

Mainline ID:	City:	Street:	Project name:
SSMH5 TO PS146	**LOWELL, OREGON**	**N. ALDER ST**	**CITY OF LOWELL**
Start date/time:	Total length:	Weather:	Surveyed by:
11/22/2023 12:37 PM	**78.0 ft.**	**1**	**MIchael NASSCO6**
Upstream MH No:	Depth US:	Downstream MH No:	Depth DS:
SSMH#5		**PS 146**	
Shape:	Material:	Height:	Width:
C	**PVC**	**8 in.**	

Additional info:
CCTV 8" FOR DEFECTS

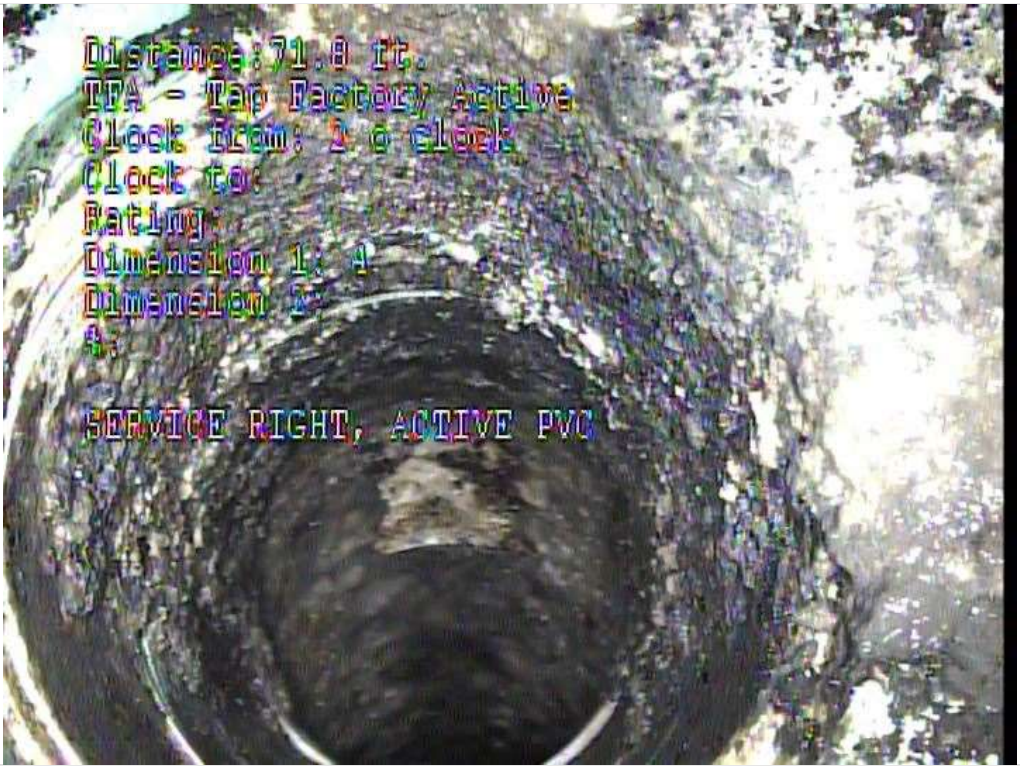
Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
0.0 ft.	**D**		**/**	**AMH**			**SSMH#5, START INSPECTION HEADING DOWN STREAM TO PUMP STATION 146**
0.0 ft.	**D**		**/**	**MWL**			**5**
3.4 ft.	**D**		**4 /**	**RFJ**		**1**	**ROOTS**



Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
71.8 ft.	**D**		**2 /**	**TFA**			**SERVICE RIGHT, ACTIVE PVC**



Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
76.7 ft.	**D**		**4 /**	**IG**		**5**	**INFILTRATION**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
78.0 ft.	**D**		**/**	**AMH**			**END INPSECTION AT PUMP STATION 146**

Main Inspections Large Photos

Mainline ID:	City:	Street:	Project name:
RR-1 TO RR-2	**LOWELL, OREGON**	**N. ALDER ST**	**CITY OF LOWELL**
Start date/time:	Total length:	Weather:	Surveyed by:
11/22/2023 1:29 PM	**306.1 ft.**	**1**	**MIchael NASSCO6**
Upstream MH No:	Depth US:	Downstream MH No:	Depth DS:
SSMH-RR-1	**6.0 ft.**	**SSMH-RR-2**	**4.0 ft.**
Shape:	Material:	Height:	Width:
C	**PVC**	**8 in.**	

Additional info:

CCTV 8" FOR DEFECTS

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
0.0 ft.	**U**		**/**	**AMH**			**SSMH-RR-2, START INPSECTION HEADING UPSTREA TO MH RR-1 AGAINST FLOW**
0.0 ft.	**U**		**/**	**MWL**			**5**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
2.3 ft.	**U**		**3 / 6**	**B**		**5**	**PIPE BROKE AT JOINT CONNECTION FROM PVC TO CONCRETE**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
86.8 ft.	**U**		**2 /**	**TFA**			**SERVICE RIGHT, ACTIVE PCE TEE**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
198.1 ft.	**U**		**2 /**	**TFA**			**SERVICE RIGHT, ACTIVE PVC TEE**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
224.3 ft.	**U**		**2 /**	**TFA**			**SERVICE RIGHT, ACTIVE PVC TEE**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
306.1 ft.	**U**		**/**	**AMH**			**END INSPECTION CENTER OF SSMH-RR-1**

Main Inspections Large Photos

Mainline ID:	City:	Street:	Project name:
RR-2 TO RR-3	**LOWELL, OREGON**	**N. ALDER ST**	**CITY OF LOWELL**
Start date/time:	Total length:	Weather:	Surveyed by:
11/22/2023 2:00 PM	**301.2 ft.**	**1**	**MIchael NASSCO6**
Upstream MH No:	Depth US:	Downstream MH No:	Depth DS:
SSMH-RR-2	**4.0 ft.**	**SSMH-RR-3**	
Shape:	Material:	Height:	Width:
C	**PVC**	**8 in.**	
Additional info:			

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
0.0 ft.	**D**		**/**	**AMH**			**SSMH-RR-2, START INSPECTION HEADING DOWN STREAM WITH FLOW**
0.0 ft.	**D**		**/**	**MWL**			**5**
20.8 ft.	**D**		**9 /**	**TFA**			**SERVICE LEFT, ACTIVE PVC**

Observations

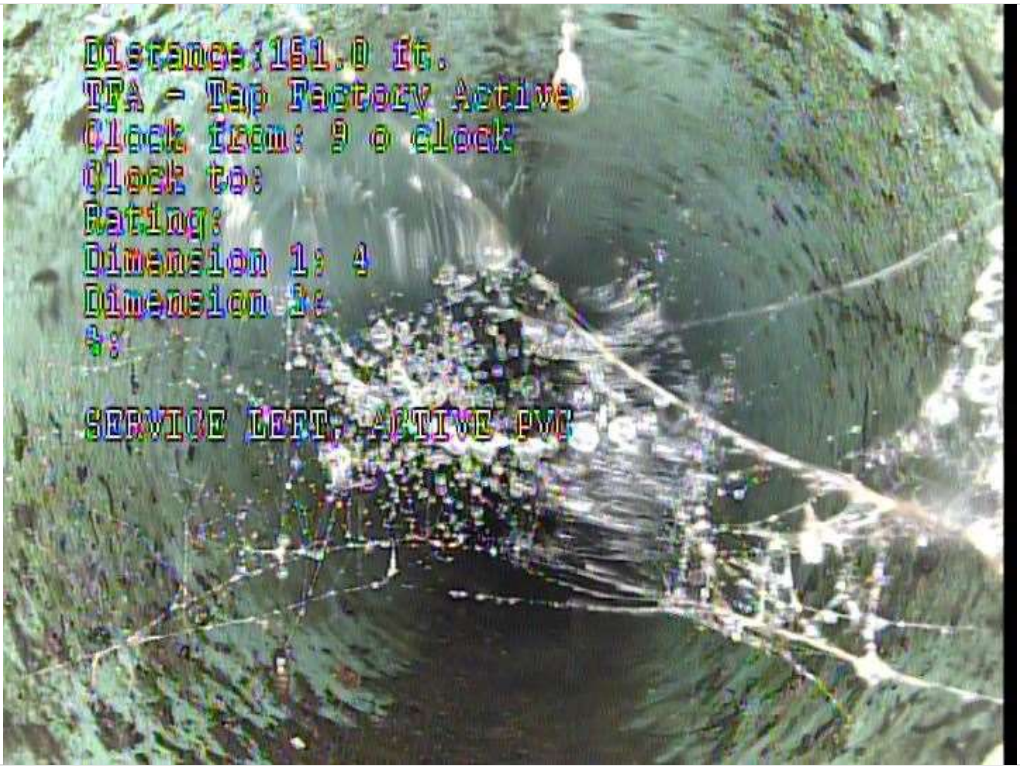
Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
52.1 ft.	**D**		**2 /**	**TFA**			**SERVICE RIGHT, PVC**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
126.4 ft.	**D**		**9 /**	**TFA**			**SERVICE LEFT, ACTIVE PVC**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
151.0 ft.	**D**		**9 /**	**TFA**			**SERVICE LEFT, ACTIVE PVC**



Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
268.7 ft.	**D**		**10 /**	**TFA**			**SERVICE LEFT, ACTIVE PVC**

Observations

Distance	Dir.	Length	From/To	Code	Modifier	Rating	Remarks
301.2 ft.	**D**		**/**	**AMH**			**END INSPECTION AT SSMH-RR-3**

APPENDIX E:

Discharge Monitoring Report Summaries and Data used in Flow Analyses

City of Lowell Wastewater Facility Plan - Future Flow Projections										
Year	**Population***	**Growth Rate****	**Population Increase**	**Sewerage Increase**	**ADWF**	**AWWF PF = 1.4**	**MMDWF PF = 1.4**	**MMWWF PF = 1.4**	**PDAF PF = 2.0**	**PHF PF = 5**
2022	1,235	1.20%	- -	- -	- -	- -	- -	- -	- -	- -
2023	1,250	1.20%	15	- -	0.082	0.198	0.288	0.400	1.40	2.70
2024	1,264	1.20%	15	0.001	0.083	0.199	0.289	0.401	1.40	2.70
2025	1,279	1.20%	15	0.001	0.084	0.201	0.290	0.403	1.40	2.71
2026	1,294	1.20%	15	0.001	0.085	0.202	0.292	0.404	1.41	2.71
2027	1,310	1.20%	15	0.001	0.086	0.203	0.293	0.405	1.41	2.72
2028	1,325	1.20%	15	0.001	0.087	0.205	0.294	0.407	1.41	2.72
2029	1,341	1.20%	16	0.001	0.088	0.206	0.296	0.408	1.41	2.73
2030	1,357	1.20%	16	0.001	0.089	0.207	0.297	0.409	1.41	2.73
2031	1,373	1.20%	16	0.001	0.090	0.209	0.299	0.411	1.42	2.74
2032	1,389	1.20%	16	0.001	0.091	0.210	0.300	0.412	1.42	2.74
2033	1,405	1.20%	16	0.001	0.092	0.212	0.301	0.414	1.42	2.75
2034	1,422	1.20%	17	0.001	0.093	0.213	0.303	0.415	1.42	2.75
2035	1,439	1.20%	17	0.001	0.094	0.215	0.304	0.417	1.42	2.76
2036	1,456	1.20%	17	0.001	0.095	0.216	0.306	0.418	1.43	2.76
2037	1,473	1.20%	17	0.001	0.096	0.218	0.307	0.420	1.43	2.77
2038	1,490	1.20%	17	0.001	0.097	0.219	0.309	0.421	1.43	2.77
2039	1,508	1.20%	18	0.001	0.098	0.221	0.310	0.423	1.43	2.78
2040	1,526	1.20%	18	0.001	0.099	0.222	0.312	0.424	1.43	2.79
2041	1,544	1.20%	18	0.001	0.100	0.224	0.314	0.426	1.44	2.79
2042	1,562	1.20%	18	0.001	0.101	0.225	0.315	0.427	1.44	2.80
2043	1,580	1.20%	18	0.001	0.102	0.227	0.317	0.429	1.44	2.80
2044	1,599	1.20%	19	0.001	0.104	0.229	0.318	0.431	1.44	2.81
2045	**1,618**	1.20%	**19**	**0.001**	**0.105**	**0.230**	**0.320**	**0.432**	**1.45**	**2.81**

PF = Peaking Factor applied to Sewerage Increase

*Lowell's 2022 population obtained from PSU's Certified 2022 Population Estimate (PSU Table 4. Populations for Oregon and Its Counties and Incorporated Cities and Towns, April 2023).

**Growth Rate obtained from "Portland State University Coordinated Population Forecast 2021 through 2071, Lane County Urban Growth Boundaries & Area Outside UGBs," June 30, 2021. Obtained from Table 2, AAGR (2020 – 2045).

Average Influent BOD Concentration (mg/L):							
	2018	2019	2020	2021	2022	2023	Average
January	588	336	230	287	379	452	379
February	480	202	549	467	524	418	440
March	283	270	388	508	493	327	378
April	335	208	754	900	311	269	463
May	927	720	501	497	382	810	640
June	500	810	522	1030	547	690	683
July	670	870	816	780	660		759
August	810	730	830	770	960		820
September	840	505	800	813	690		730
October	980	950	770	630	710		808
November	570	670	519	400	510		534
December	379	600	362	301	426		414
Annual:	614	573	587	615	549	494	587

Average Influent BOD Loading (ppd):							
	2018	2019	2020	2021	2022	2023	Average
January	325	71	152	160	133	148	165
February	155	139	187	211	112	125	155
March	103	102	89	125	245	89	125
April	83	84	137	125	123	111	110
May	118	91	77	74	100	79	90
June	50	107	56	120	104	72	85
July	58	78	71	89	108		81
August	63	80	125	96	85		90
September	119	96	112	78	85		98
October	96	99	128	101	77		100
November	107	107	173	203	117		141
December	158	161	122	112	102		131
Annual:	120	101	119	124	116	104	114
Max	325	161	187	211	245	148	213
Peaking Factor	2.72	1.59	1.57	1.70	2.12	1.42	1.85

Average Influent TSS Concentration (mg/L):							
	2018	2019	2020	2021	2022	2023	Average
January	115	72	59	70	112	129	93
February	110	59	107	147	113	106	107
March	85	70	89	76	113	81	86
April	81	82	169	215	94	83	121
May	156	170	115	307	112	226	181
June	108	233	127	198	136	228	171
July	163	214	198	188	175		187
August	146	310	243	240	206		229
September	330	165	174	124	209		200
October	174	296	233	173	175		210
November	146	135	112	93	143		126
December	118	160	105	75	108		113
Annual:	144	164	144	159	141	142	152

Average Influent TSS Loading (ppd):							
	2018	2019	2020	2021	2022	2023	Average
January	288	78	198	163	200	170	183
February	154	163	147	277	100	134	163
March	117	104	82	96	292	108	133
April	89	135	155	121	151	143	132
May	99	111	72	176	116	107	114
June	42	130	60	117	135	99	97
July	55	95	89	85	116		88
August	57	132	145	121	87		108
September	162	147	132	63	104		122
October	93	153	155	109	76		117
November	100	87	146	210	133		135
December	207	183	161	139	105		159
Annual:	122	127	129	140	135	127	129
Max	288	183	198	277	292	170	235
Peaking Factor	2.36	1.45	1.54	1.98	2.17	1.34	1.81

Average BOD5 Effluent Concentration (mg/L):							
	2018	2019	2020	2021	2022	2023	Average
January	3.2	3.0	4.4	6.1	3.4	4.9	4
February	3.0	2.0	2.8	8.1	5.5	4.9	4
March	2.0	2.3	4.1	4.4	3.7	2.9	3
April	2.8	2.3	6.6	11.2	6.3	2.4	5
May	4.8	3.2	4.3	20.0	4.5	8.6	8
June	3.8	3.8	2.6	15.6	3.7	8.8	6
July	7.5	8.2	8.5	14.1	3.2		8
August	10.4	10.3	6.8	4.3	5.3		7
September	11.3	7.0	10.4	6.5	5.6		8
October	13.8	8.8	7.8	2.6	7.0		8
November	11.8	12.9	11.6	4.9	5.3		9
December	3.8	6.9	2.9	3.2	2.7		4
Annual:	6	6	6	8	5	5	6

Average BOD5 Effluent Loading (ppd):							
	2018	2019	2020	2021	2022	2023	Average
January	7.4	3.4	13.0	15.8	7.1	6.1	9
February	3.8	5.8	3.7	16.1	4.6	5.7	7
March	2.8	4.0	3.7	5.6	10.8	4.3	5
April	2.8	4.5	8.2	6.2	9.8	4.4	6
May	3.0	2.2	2.8	14.9	4.7	4.0	5
June	1.5	2.3	1.3	9.3	3.5	3.9	4
July	2.3	3.8	3.7	6.4	2.1		4
August	4.2	4.5	4.1	2.1	2.2		3
September	5.3	6.0	7.1	2.9	2.7		5
October	7.4	4.5	5.0	1.7	3.2		4
November	9.5	7.5	17.4	12.5	6.3		11
December	7.0	7.5	5.5	5.7	3.5		6
Annual:	5	5	6	8	5	5	6
Max	10	7	17	16	11	6	11
Peaking Factor	2.01	1.61	2.76	1.95	2.14	1.28	1.96

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Average TSS Effluent Concentration (mg/L):							
	2018	2019	2020	2021	2022	2023	Average
January	1.6	2.8	6.2	4.9	2.0	2.0	3
February	2.8	3.3	6.6	5.3	2.0	2.6	4
March	1.0	2.5	3.8	2.0	2.0	2.0	2
April	1.0	2.5	3.6	4.8	2.5	2.0	3
May	3.4	3.6	2.6	3.5	2.0	2.5	3
June	4.8	3.5	4.0	3.9	2.0	2.0	3
July	4.3	4.0	3.9	2.5	2.0		3
August	2.4	6.3	4.6	2.6	2.0		4
September	2.0	8.3	2.7	3.1	2.0		4
October	2.8	4.6	2.5	2.7	2.9		3
November	2.5	3.2	4.6	2.0	2.0		3
December	4.5	4.6	3.8	2.0	2.0		3
Annual:	3	4	4	3	2	2	3

Average TSS Effluent Loading (ppd):							
	2018	2019	2020	2021	2022	2023	Average
January	4.2	3.2	21.1	15.1	4.9	2.7	9
February	2.8	8.3	8.8	10.5	1.8	2.8	6
March	1.3	4.3	3.4	2.5	5.1	3.1	3
April	1.5	5.5	4.5	2.8	4.4	3.8	4
May	2.2	2.2	1.8	2.8	2.5	1.3	2
June	2.0	2.3	2.5	2.3	2.1	0.8	2
July	1.5	1.8	1.7	1.1	1.3		1
August	1.2	3.3	2.7	1.3	0.9		2
September	1.3	9.3	1.8	1.6	0.9		3
October	1.6	2.4	1.7	1.8	1.4		2
November	2.8	1.9	8.8	5.1	2.8		4
December	8.3	4.0	6.8	4.4	2.7		5
Annual:	3	4	5	4	3	2	4
Max	8	9	21	15	5	4	10
Peaking Factor	3.25	2.30	3.86	3.53	1.98	1.56	2.75

Average Influent Temperature (C°):							
	2018	2019	2020	2021	2022	2023	Average
January	14.5	14.7	13.4	12.7	11.9	12.0	13
February	14.5	12.7	12.9	11.7	11.9	11.5	13
March	14.4	13.1	13.8	12.6	12.5	10.9	13
April	16.2	15.0	15.9	14.7	13.2	11.7	14
May	17.5	16.8	16.6	16.5	14.3	15.5	16
June	18.7	18.3	18.6	19.0	16.4	18.0	18
July	20.8	19.8	20.7	21.0	19.1		20
August	21.3	21.2	21.6	21.7	21.2		21
September	20.3	20.3	21.4	20.6	20.6		21
October	19.2	17.1	19.7	18.0	19.0		19
November	17.4	15.6	16.1	16.1	15.6		16
December	14.8	14.8	13.8	13.9	12.6		14
Annual:	17	17	17	17	16	13	17

Average Effluent Temperature (C°):							
	2018	2019	2020	2021	2022	2023	Average
January	14.7	14.0	13.9	13.1	12.1	11.2	13
February	14.7	12.5	12.9	11.9	11.5	10.8	12
March	14.8	13.2	14.1	12.8	12.7	10.7	13
April	16.3	15.2	16.5	15.0	13.0	11.7	15
May	18.0	17.0	17.5	16.6	14.6	15.8	17
June	19.0	19.1	20.0	19.9	16.9	18.4	19
July	21.1	20.4	21.6	21.7	20.2		21
August	21.3	21.7	21.3	22.0	21.7		22
September	19.2	19.7	20.8	19.9	19.8		20
October	17.8	16.2	18.9	16.9	17.5		17
November	16.1	14.4	16.0	15.4	13.6		15
December	13.6	14.1	14.0	13.9	11.6		13
Annual:	17	16	17	17	15	13	16

Average Effluent E. coli (# per 100 mL):							
	2018	**2019**	**2020**	**2021**	**2022**	**2023**	**Average**
January	3.4	1.0	1.2	1.3	97.5	1.0	18
February	1.0	1.0	1.0	7.9	1.0	1.5	2
March	1.0	1.0	1.0	1.0	1.0	4.2	2
April	1.3	1.3	1.2	1.0	1.0	2.8	1
May	1.0	1.6	1.8	2.8	2.3	3.4	2
June	1.0	2.0	1.0	16.3	1.0	1.3	4
July	3.3	2.4	1.4	15.8	1.0		5
August	1.2	2.3	1.0	1.0	1.2		1
September	1.0	1.0	22.4	3.4	1.5		6
October	3.8	12.0	1.3	3.5	1.0		4
November	1.0	12.3	4.0	1.0	1.0		4
December	2.3	47.3	1.0	3.8	1.5		11
Annual:	2	7	3	5	9	2	5

Flow Data for DEQ Graph #1

		Month:	Precipitation (inches/month)	Monthly Average Flow (MGD)
Most Recent Wet-Season (January - May)	2023	January	2.73	0.144
		February	2.34	0.121
		March	4.36	0.201
		April	4.88	0.253
		May	0.56	0.060
		MMDWF	6.08	0.288
		MMWWF	8.69	0.399
5-Year Monthly Precipitation High	2020	January	9.24	0.350

Flow Data for DEQ Graph #2

Date	Precipitation (in/day)	Flow (MGD)
1/19/2019	1.06	0.68
1/20/2019	0.97	0.72
1/21/2019	0.39	0.35
1/23/2019	0.12	0.19
2/4/2019	0.57	0.31
2/5/2019	0.22	0.26
2/25/2019	2.53	0.42
2/26/2019	1.35	0.39
2/27/2019	0.32	0.39
1/4/2020	0.66	0.37
1/6/2020	0.1	0.19
1/8/2020	0.49	0.47
1/9/2020	0.56	0.30
1/11/2020	0.73	0.49
1/12/2020	0.55	0.44
1/13/2020	0.34	0.53
1/14/2020	0.71	0.40
1/16/2020	0.8	0.52
1/18/2020	0.11	0.27
1/24/2020	0.65	0.35
1/26/2020	0.53	0.41
1/27/2020	0.21	0.39
1/28/2020	0.67	0.45
1/30/2020	0.63	0.34
2/2/2020	0.4	0.26
2/16/2020	1.18	0.50
3/31/2020	1.14	0.37
1/3/2021	0.69	0.45
1/5/2021	0.62	0.32
1/6/2021	0.19	0.47
1/7/2021	0.38	0.36
1/8/2021	0.27	0.40
1/9/2021	0.25	0.27
1/12/2021	0.64	0.76
1/13/2021	0.8	0.49
1/28/2021	0.28	0.27
1/29/2021	0.12	0.19
2/3/2021	0.5	0.40
2/13/2021	0.75	0.41
2/14/2021	0.22	0.31
2/15/2021	0.16	0.36
2/16/2021	0.3	0.31
2/17/2021	0.12	0.23
2/19/2021	0.56	0.45
2/20/2021	0.52	0.40
2/23/2021	0.24	0.25
1/4/2022	1.42	0.63
1/5/2022	0.66	0.77
1/6/2022	0.41	0.43
1/7/2022	0.13	0.45
1/8/2022	0.27	0.29
3/2/2022	1.05	0.95
3/3/2022	1.1	0.50
3/14/2023	0.98	0.29
3/28/2023	0.29	0.29

EPA Infiltration Analysis Summary

Date	Flow (MGD)	Precipitation (Inch)	Date	Flow (MGD)	Precipitation (Inch)
2/9/23	0.113	0	2/1/22	0.098	0.09
2/10/23	0.079	0	2/2/22	0.099	0.04
2/11/23	0.081	0	2/3/22	0.094	0
2/12/23	0.072	0	2/4/22	0.087	0
2/13/23	0.146	0.11	2/5/22	0.082	0.03
2/14/23	0.183	0.46	2/6/22	0.095	0
2/15/23	0.139	0	2/7/22	0.089	0
2/16/23	0.114	0	2/8/22	0.077	0
2/17/23	0.084	0	2/9/22	0.076	0
2/18/23	0.072	0	2/10/22	0.097	0
2/19/23	0.073	0	2/11/22	0.082	0
2/20/23	0.077	0	2/12/22	0.079	0
1/23/22	0.114	0	2/13/22	0.081	0
1/24/22	0.099	0	2/14/22	0.114	0
1/25/22	0.084	0	3/17/20	0.100	0
1/26/22	0.107	0	3/18/20	0.113	0
1/27/22	0.092	0	3/19/20	0.090	0
1/28/22	0.089	0	3/20/20	0.075	0
1/29/22	0.081	0	3/21/20	0.073	0
1/30/22	0.115	0	3/22/20	0.076	0
1/31/22	0.101	0.18	3/23/20	0.093	0
			Average (MGD):	**0.101**	
			Gal/Day/Capita:	**80**	< Less than 120 gpcd

EPA Inflow Analysis Summary

Date	Flow (MGD)	Precipitation (Inches)
2/25/19	0.422	2.53
4/8/19	1.354	2.31
1/4/22	0.631	1.42
2/26/19	0.386	1.35
4/7/19	1.175	1.35
2/16/20	0.499	1.18
3/31/20	0.374	1.14
3/3/22	0.500	1.1
1/19/19	0.684	1.06
3/2/22	0.949	1.05
5/1/21	0.214	1.04
5/18/20	0.329	1.03
Average (MGD):	**0.626**	
Gal/Day/Capita:	**501**	> Exceeds 275 gpcd

APPENDIX F:

National Oceanic and Atmospheric Administration
Climatography of the United States

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data,
and Information Service

Climatography of the United States No. 20 1971-2000

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801
www.ncdc.noaa.gov

Station: LOOKOUT POINT DAM, OR **COOP ID: 355050**

Climate Division: OR 2 **NWS Call Sign:** **Elevation: 712 Feet** **Lat: 43°55N** **Lon: 122°46W**

Precipitation (inches)

Precipitation Totals

Month	Means/ Medians(1) Mean	Means/ Medians(1) Median	Extremes Highest Daily(2)	Year	Day	Highest Monthly(1)	Year	Lowest Monthly(1)	Year
Jan	6.03	6.63	3.56	1966	4	11.23	2000	.74	1985
Feb	5.21	4.71	4.05	1961	10	9.96	1986	1.52	1988
Mar	5.05	4.81	1.55	1997	2	10.25	1989	1.59	1992
Apr	4.23	4.08	2.54	1992	10	7.82	1993	1.66	1987
May	3.47	3.17	1.59	1991	8	7.32	1998	.67	1982
Jun	2.12	1.77	1.34	1969	26	4.94	1993	.58	1977
Jul	.79	.49	1.49	1987	19	3.52	1987	.01	1972
Aug	1.10	.73	2.07	1989	23	4.07	1989	.00+	2000
Sep	1.76	1.62	2.32	1981	27	4.54	1986	.09	1991
Oct	3.28	2.97	2.00	1955	10	7.11	1996	.12	1987
Nov	7.11	6.10	5.50	1996	19	16.92	1973	2.09	1993
Dec	6.57	5.36	4.62	1981	6	15.43	1981	1.23	1976
Ann	46.72	46.22	5.50	Nov 1996	19	16.92	Nov 1973	.00+	Aug 2000

Mean Number of Days (3)

Daily Precipitation

Month	>= 0.01	>= 0.10	>= 0.50	>= 1.00
Jan	19.2	12.6	4.0	1.1
Feb	18.1	12.0	3.2	.6
Mar	19.9	13.0	3.1	.5
Apr	18.4	11.8	2.4	.2
May	14.6	9.2	2.1	.3
Jun	9.3	5.9	1.3	.1
Jul	4.9	2.2	.4	.1
Aug	5.4	2.6	.8	.1
Sep	7.4	4.8	1.0	.1
Oct	12.2	7.6	2.2	.3
Nov	20.1	14.1	4.8	1.5
Dec	20.1	13.6	4.3	1.1
Ann	169.6	109.4	29.6	6.0

Precipitation Probabilities (1)

Probability that the monthly/annual precipitation will be equal to or less than the indicated amount

Monthly/Annual Precipitation vs Probability Levels
These values were determined from the incomplete gamma distribution

Month	.05	.10	.20	.30	.40	.50	.60	.70	.80	.90	.95
Jan	1.52	2.09	2.97	3.75	4.51	5.32	6.22	7.29	8.69	10.90	12.97
Feb	1.97	2.45	3.15	3.73	4.28	4.84	5.45	6.16	7.06	8.44	9.71
Mar	2.28	2.73	3.35	3.85	4.32	4.79	5.29	5.87	6.60	7.70	8.70
Apr	1.80	2.18	2.72	3.16	3.57	3.99	4.43	4.95	5.60	6.59	7.49
May	1.00	1.33	1.83	2.26	2.68	3.12	3.60	4.18	4.92	6.08	7.16
Jun	.69	.89	1.19	1.44	1.68	1.94	2.21	2.54	2.95	3.60	4.20
Jul	.02	.06	.14	.24	.36	.51	.69	.94	1.29	1.91	2.53
Aug	.00	.00	.05	.21	.41	.65	.95	1.34	1.89	2.83	3.80
Sep	.10	.20	.42	.65	.92	1.24	1.63	2.12	2.81	3.99	5.17
Oct	.57	.85	1.33	1.78	2.24	2.74	3.31	4.00	4.92	6.40	7.83
Nov	2.25	2.93	3.93	4.78	5.61	6.46	7.40	8.50	9.91	12.12	14.16
Dec	1.73	2.35	3.30	4.14	4.96	5.83	6.79	7.94	9.42	11.77	13.96
Ann	34.04	36.52	39.68	42.08	44.19	46.24	48.35	50.67	53.48	57.55	61.06

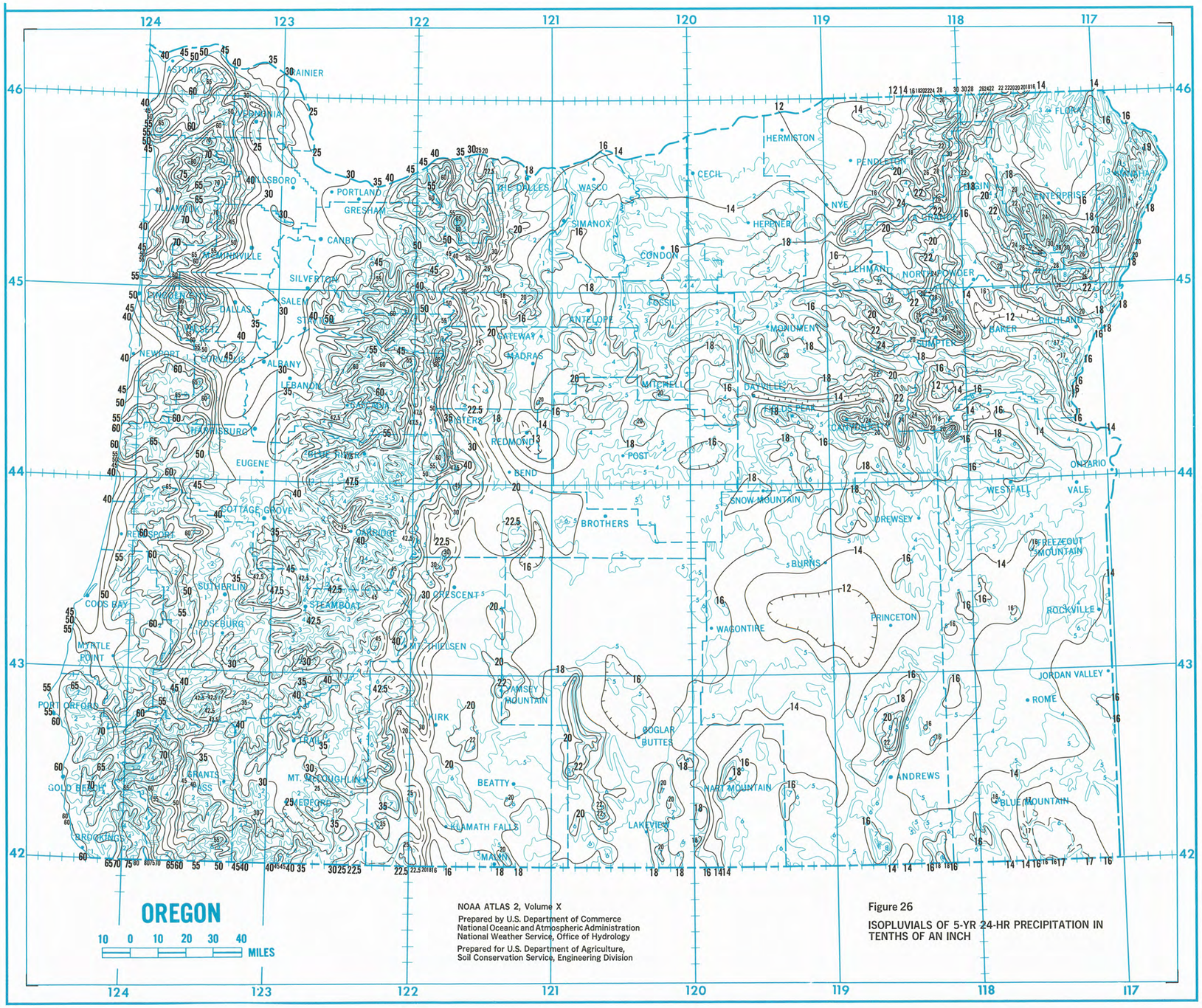
\+ Also occurred on an earlier date(s)
\# Denotes amounts of a trace
@ Denotes mean number of days greater than 0 but less than .05
** Statistics not computed because less than six years out of thirty had measurable precipitation

(1) From the 1971-2000 Monthly Normals
(2) Derived from station's available digital record: 1955-2001
(3) Derived from 1971-2000 serially complete daily data

Complete documentation available from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

APPENDIX G:

National Oceanic and Atmospheric Administration
Isopluvial Map



NOAA ATLAS 2, Volume X

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

Figure 26

ISOPLUVIALS OF 5-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

APPENDIX H:

Biological Model Output Reports

LOWELL PROCESS DESIGN SUMMARY
CONVENTIONAL ACTIVATED SLUDGE
NO PRIMARIES, NON-NITRIFYING

16-Nov-23

	CURRENT YEAR 2023					DESIGN YEAR 2045				
	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH WW	MAX DAY	MAX HOUR	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH	MAX DAY	MAX HOUR
RAW WASTEWATER LOADINGS										
Flow, mgd:	0.080	0.20	0.40	1.42	2.40	0.10	0.23	0.43	1.47	2.51
BOD, mg/L:	171	68	64	36		177	77	77	45	
BOD, lbs/day:	114	114	213	423		148	148	276	548	
TSS, mg/L:	193	77	70	42		200	87	85	53	
TSS, lbs/day:	129	129	235	502		167	167	304	650	
NH_3-N, mg/L:	21	8	7	2		22	9	9	3	
NH_3-N, lb/day:	14	14	25	25		18	18	33	33	
TKN, mg/l:	29	12	10	3		30	13	13	4	
TKN, lb/day:	20	20	35	35		25	25	46	46	
RECYCLE STREAM FROM DIGESTERS TO AERATION BASIN										
Flow, gpd:	1,822	2,247	4,163	4,163	4,163	3,082	2,942	5,474	5,474	5,474
BOD, lbs/day:	4.6	4.14	7.70	7.70	-	5.70	5.44	10.16	10.16	-
TSS, lbs/day:	2.7	6.90	12.84	12.84	-	9.49	9.06	16.93	16.93	-
TOTAL LOADINGS TO AERATION BASIN										
Flow, mgd:	0.082	0.20	0.40	1.42	2.40	0.10	0.23	0.44	1.48	2.52
BOD, lbs/day:	118.6	118.1	220.7	430.7	-	153.7	153.4	286.2	558.2	-
BOD, mg/l:	174	70	65	36		179	79	79	45	
TSS, lbs/day:	132	136	248	515	-	176	176	321	667	-
TSS, mg/l:	193	81	74	43		205	91	88	54	
AERATION BASINS - (See detailed calcs. below)										
Basin volume, each of two; gallons:	41,300									
Number basins on line	1	1	1	1	2	1	1	1	1	2
Aeration Volume, gal :	41,300	41,300	41,300	41,300	82,600	41,300	41,300	41,300	41,300	82,600
Detention, hrs:	12.1	4.9	2.5	0.7	0.8	9.6	4.3	2.3	0.7	0.8
SRT, days	3.5	3.5	3.0	1.5		3.5	3.5	3.0	1.5	
Loading, lb BOD/1000 cf/day:	21.5	21.4	40.0	78.0	-	27.8	27.8	51.8	101.1	-
F/M; lb BOD/lb MLVSS:	0.38	0.38	0.45	0.85	-	0.38	0.38	0.45	0.86	-
MLSS, mg/L	1,280	1,290	2,048	2,100	-	1,689	1,669	2,647	2,713	-
Oxygen demand, lb/hr:	4.5	4.4	7.7	10.8	-	5.9	5.7	9.9	13.8	-
Oxygen uptake, mg/L-hr:	13.2	12.8	22.3	31.2	-	17.0	16.6	28.8	40.2	-
Min mixing air (25 scfm/kcf)	138	138	138	138	276	138	138	138	138	276
Air for O_2, scfm:	70	68	119	149	-	90	88	153	192	-
SECONDARY CLARIFIERS										
Number:	1+1									
SC #1 Diameter, ft:	40		SC #1, Surface area, sq. ft:			1,257				
SC #2 Diameter, ft:	28		SC #2, Surface area, sq ft:			616				
Sidewater depth, ft.:	14									
#1 in Service:	0	0	0	1	1	0	0	0	1	1
#2 in Service:	1	1	1	1	1	1	1	1	1	1
Total surfacea area, sq ft:	616	616	616	1,872	1,872	616	616	616	1,872	1,872
Overflow rate, gpd/sf:	133	328	656	761	1,284	167	378	707	788	1,343
Solids load, lb/day/sq ft*:	2.1	5.3	16.8	17.3	-	3.5	7.9	23.4	23.2	-

*Assuming 50% sludge recycle; 30% at max day

	CURRENT YEAR 2023					DESIGN YEAR 2045				
	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH WW	MAX DAY	MAX HOUR	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH	MAX DAY	MAX HOUR
PERFORMANCE										
Effluent Quality (Estimated)										
BOD, mg/L:	10	10	10	10	-	10	10	10	10	-
BOD, lb/day:	7	17	33	118	-	8	19	36	123	-
TSS, mg/L:	10	10	10	10	-	10	10	10	10	-
TSS, lb/day:	7	17	33	118	-	8	19	36	123	-
Waste activated sludge										
Assumed TS. %	0.8%	0.8%	0.8%	0.8%		0.8%	0.8%	0.8%	0.8%	
Q, gpd:	1,836	1,776	3,272	6,339		2,427	2,316	4,283	8,415	
TSS, lb/day:	123	119	218	423		162	155	286	561	
VSS, lb/day:	86	83	153	295		113	108	200	391	
SLUDGE PROCESSING										
AEROBIC DIGESTER										
Description: Two basins - 87,000 gals each; one in service										
Volume in Service, gallons:	87,000	87,000	87,000	87,000		87,000	87,000	87,000	87,000	
Estimated VS destruction:	45%	45%	42%	38%		43%	43%	40%	35%	
Assumed TS content with decant:	2.0%	2.0%	2.0%	2.0%		2.0%	2.0%	2.0%	2.0%	
Total Feed (WAS + Drying Bed Drain)										
Flow, gpd	2,335	2,260	4,189	7,256		3,101	2,960	5,509	9,640	
TSS, lb/day	125	121	223	428		165	158	292	568	
VSS, lb/day:	88	85	157	299		116	110	205	396	
Outlet TSS, lb/day:	85	83	157	314		116	110	210	429	
Outlet VSS, lb/day	48	47	91	185		66	63	123	258	
% Volatile	57%	56%	58%	59%		57%	57%	59%	60%	
Outlet Flow, gpd:	512	497	943	1,883		693	662	1,259	2,572	
SRT, days	170	175	92	46		126	131	69	34	
Recycle (Decant to AB))										
Flow, gpd:	1,822	1,763	3,246	3,246	-	2,408	2,298	4,249	4,249	-
TSS, mg/L (assumed)	300	300	300	300	-	300	300	300	300	-
TSS, lb/day:	4.6	4.4	8.1	8.1	-	6.0	5.8	10.6	10.6	-
BOD, lb/day:	2.7	2.6	4.9	4.9	-	3.6	3.5	6.4	6.4	-
TKN, mg/L (assumed)	100	100	100	100	-	100	100	100	100	-
TKN, lb/day	1.5	1.5	2.7	2.7	-	2.0	1.9	3.5	3.5	-
DRYING BEDS										
Volume: 126,000 gallons										
Assumed recovery	97%									
Inlet flow, gpd:	512	497	943	-	-	693	662	1,259	-	-
TS feed, lb/day	85	82.9	157.2	-	-	115.6	110.4	210.1	-	-
Dried cake solids (assumed)	40%	40%	40%	-	-	40%	40%	40%	-	-
Cake, dry lb/day	83	80.5	152.5	-	-	112.1	107.1	203.8	-	-
Cake, wet lb/day	201	195	370	-	-	272	260	494	-	-
Recycle (drain)										
Flow, gpd:	499	484	917	917	-	674	644	1,225	1,225	-
TSS, lb/day:	2.6	2.5	4.7	4.7	-	3.5	3.3	6.3	6.3	-
BOD, lb/day:	1.5	1.5	2.8	2.8	-	2.1	2.0	3.8	3.8	-
TOTAL RECYCLE STREAM										
Flow, gpd:	2,321	2,247	4,163	4,163	4,163	3,082	2,942	5,474	5,474	5,474
TSS, lb/day:	7.1	6.9	12.8	12.8		9.5	9.1	16.9	16.9	
BOD, lb/day:	4.3	4.1	7.7	7.7		5.7	5.4	10.2	10.2	

	CURRENT YEAR 2023					DESIGN YEAR 2045				
	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH WW	MAX DAY	MAX HOUR	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH	MAX DAY	MAX HOUR
McKINNEY ACTIVATED SLUDGE MODEL - NON-NITRIFYING										
Nitrifying Yes =1; no =0	0									
Flow, mgd	0.08	0.20	0.40	1.42	2.40	0.10	0.23	0.44	1.48	2.52
Influent BOD, mg/L	174	70	65	36		179	79	79	45	
Influent TSS, mg/L	193	81	74	43		205	91	88	54	
Influent TKN, mg/L	29.4	11.8	10.5	3.0		30.2	13.1	12.9	3.8	
Secondary eff. TSS, mg/L	5	5	5	5		5	5	5	5	
Temperature, deg C	15	15	15	15		15	15	15	15	
Aeration time, hours	12.1	4.9	2.5	0.7	0.8	9.6	4.3	2.3	0.7	0.8
Aeration volume, gallons	41,300	41,300	41,300	41,300	82,600	41,300	41,300	41,300	41,300	82,600
Treatability coefficients										
K_m (20 C)	7.2	7.2	7.2	7.2		7.2	7.2	7.2	7.2	
K_s (20 C)	5.04	5.04	5.04	5.04		5.04	5.04	5.04	5.04	
K_e (20 C)	0.020	0.020	0.020	0.020		0.020	0.020	0.020	0.020	
K_m (@ design temp)	5.09	5.09	5.09	5.09		5.09	5.09	5.09	5.09	
K_s (@ design temp)	3.56	3.56	3.56	3.56		3.56	3.56	3.56	3.56	
K_e (@ design temp)	0.014	0.014	0.014	0.014		0.014	0.014	0.014	0.014	
Mi inf, mg/L	61.8	25.8	23.5	13.9		65.7	29.0	28.3	17.3	
Mii inf, mg/L	48.3	20.1	18.4	10.8		51.3	22.7	22.1	13.5	
Aeration effluent BOD, mg/L	2.8	2.7	4.9	8.0		3.6	3.5	6.3	10.3	
SRT, hrs	84	84	72	36		84	84	72	36	
Ma (active mass), mg/L	379	369	618	679		490	477	796	873	
Me (endogenous mass), mg/L	90	88	126	69		116	113	162	89	
Mi (inorganic mass), mg/L	428	442	691	717		574	572	894	929	
Mii (inert inorg. mass), mg/L	382	391	614	635		509	506	795	822	
MLVSS, mg/L	898	899	1,434	1,465		1,180	1,163	1,853	1,891	
MLSS, mg/L	1,280	1,290	2,048	2,100		1,689	1,669	2,647	2,713	
% Volatile	70.2%	69.7%	70.0%	69.8%		69.9%	69.7%	70.0%	69.7%	
Oxygen uptake, mg/L-hr	13.2	12.8	22.3	31.2		17.0	16.6	28.8	40.2	
Oxygen demand, lb/hr	4.5	4.4	7.7	10.8		5.9	5.7	9.9	13.8	
Lb O_2/Lb BOD_r	0.9	0.9	0.9	0.8		0.9	0.9	0.9	0.8	
Effluent TSS, lb/day	3	8	17	59		4	10	18	62	
Waste sludge, lb/day	123	119	218	423		162	155	286	561	
Waste VSS, lb/day	86	83	153	295		113	108	200	391	
Lb VSS prod/lb BOD rem	0.75	0.75	0.75	0.78		0.76	0.75	0.74	0.78	

LOWELL PROCESS DESIGN SUMMARY
NITRIFYING ACTIVATED SLUDGE
NO PRIMARIES

16-Nov-23

	CURRENT YEAR 2023					DESIGN YEAR 2045				
	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH WW	MAX DAY	MAX HOUR	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH	MAX DAY	MAX HOUR
RAW WASTEWATER LOADINGS										
Flow, mgd:	0.080	0.20	0.40	1.42	2.40	0.10	0.23	0.43	1.47	2.51
BOD, mg/L:	171	68	64	36		177	77	77	45	
BOD, lbs/day:	114	114	213	423		148	148	276	548	
TSS, mg/L:	193	77	70	42		200	87	85	53	
TSS, lbs/day:	129	129	235	502		167	167	304	650	
NH_3-N, mg/L:	21	8	7	2		22	9	9	3	
NH_3-N, lb/day:	14	14	25	25		18	18	33	33	
TKN, mg/l:	29	12	10	3		30	13	13	4	
TKN, lb/day:	20	20	35	35		25	25	46	46	
RECYCLE STREAM FROM DIGESTERS TO AERATION BASIN										
Flow, gpd:	1,516	1,947	3,609	3,609	3,609	2,582	2,555	4,950	4,950	4,950
BOD, lbs/day:	3.8	3.60	6.70	6.70	-	4.79	4.73	9.20	9.20	-
TSS, lbs/day:	2.3	6.00	11.16	11.16	-	7.98	7.89	15.34	15.34	-
TOTAL LOADINGS TO AERATION BASIN										
Flow, mgd:	0.082	0.20	0.40	1.42	2.40	0.10	0.23	0.43	1.47	2.51
BOD, lbs/day:	117.8	117.6	219.7	429.7	-	152.8	152.7	285.2	557.2	-
BOD, mg/l:	173	70	65	36		179	79	79	45	
TSS, lbs/day:	131	135	246	513	-	175	175	319	665	-
TSS, mg/l:	193	80	73	43		205	90	88	54	
AERATION BASINS - (See detailed calcs. below)										
Basin volume, each of two; gallons:	41,300									
Number basins on line	2	2	2	2	2	2	2	2	2	2
Aeration Volume, gal :	82,600	82,600	82,600	82,600	82,600	82,600	82,600	82,600	82,600	82,600
Detention, hrs:	24.3	9.8	4.9	1.4	0.8	19.3	8.5	4.6	1.3	0.8
Aerobic SRT, days	14.0	14.0	12.0	5.5		14.0	14.0	9.0	4.0	
Loading, lb BOD/1000 cf/day:	10.7	10.6	19.9	38.9	-	13.8	13.8	25.8	50.5	-
F/M; lb BOD/lb MLVSS:	0.12	0.11	0.13	0.26	-	0.12	0.11	0.17	0.34	-
MLSS, mg/L	2,141	2,251	3,578	3,536	-	2,830	2,914	3,604	3,458	-
Aer. zone O_2 demand, lb/hr:	9.5	9.1	16.2	21.0	-	12.3	11.8	20.7	26.0	-
Aer. zone uptake rate, mg/l-hr	13.7	13.2	23.6	30.4	-	17.8	17.1	30.0	37.8	-
Min mixing air (25 scfm/kcf)	276	276	276	276	276	276	276	276	276	276
Air for O_2, scfm:	146	141	251	291	-	189	182	319	361	-
SECONDARY CLARIFIERS										
Number:	1+1									
SC #1 Diameter, ft:	40		SC #1, Surface area, sq. ft:			1,257				
SC #2 Diameter, ft:	28		SC #2, Surface area, sq ft:			616				
Sidewater depth, ft.:	14									
#1 in Service:	0	0	1	1	1	0	0	1	1	1
#2 in Service:	1	1	0	1	1	1	1	0	1	1
Total surfacea area, sq ft:	616	616	1,257	1,872	1,872	616	616	1,257	1,872	1,872
Overflow rate, gpd/sf:	132	328	321	760	1,284	167	378	346	788	1,343
Solids load, lb/day/sq ft*:	3.5	9.2	14.4	29.1	-	5.9	13.8	15.6	29.5	-

*Assuming 50% sludge recycle; 30% at max day

	CURRENT YEAR 2023					DESIGN YEAR 2045				
	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH WW	MAX DAY	MAX HOUR	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH	MAX DAY	MAX HOUR
PERFORMANCE										
Effluent Quality (Estimated)										
BOD, mg/L:	10	10	10	10	-	10	10	10	10	-
BOD, lb/day:	7	17	33	118	-	8	19	36	123	-
TSS, mg/L:	10	10	10	10	-	10	10	10	10	-
TSS, lb/day:	7	17	33	118	-	8	19	36	123	-
Ammonia, mg/L:	1	1	1	5		1	1	1	5	
Waste activated sludge										
Assumed TS. %	0.8%	0.8%	0.8%	0.8%		0.8%	0.8%	0.8%	0.8%	
Q, gpd:	1,528	1,534	2,826	5,748		2,023	2,004	3,863	8,004	
TSS, lb/day:	102	102	189	383		135	134	258	534	
VSS, lb/day:	68	68	127	261		89	89	175	367	
SLUDGE PROCESSING										
AEROBIC DIGESTER										
Description: Two basins - 87,000 gals each; one in service										
Volume in Service, gallons:	87,000	87,000	87,000	87,000		87,000	87,000	87,000	87,000	
Estimated VS destruction:	45%	45%	42%	38%		43%	43%	40%	35%	
Assumed TS content with decant:	2.0%	2.0%	2.0%	2.0%		2.0%	2.0%	2.0%	2.0%	
Total Feed (WAS + Drying Bed Drain)										
Flow, gpd	1,954	1,959	3,632	6,553		2,598	2,571	4,981	9,122	
TSS, lb/day	104	105	193	388		138	137	263	540	
VSS, lb/day:	69	70	130	264		91	92	180	372	
Outlet TSS, lb/day:	73	73	138	287		99	97	192	410	
Outlet VSS, lb/day	38	39	75	164		52	52	108	242	
% Volatile	52%	53%	55%	57%		53%	54%	56%	59%	
Outlet Flow, gpd:	437	438	828	1,723		591	583	1,149	2,456	
SRT, days	199	199	105	51		147	149	76	35	
Recycle (Decant to AB))										
Flow, gpd:	1,516	1,522	2,804	2,804	-	2,007	1,988	3,832	3,832	-
TSS, mg/L (assumed)	300	300	300	300	-	300	300	300	300	-
TSS, lb/day:	3.8	3.8	7.0	7.0	-	5.0	5.0	9.6	9.6	-
BOD, lb/day:	2.3	2.3	4.2	4.2	-	3.0	3.0	5.8	5.8	-
TKN, mg/L (assumed)	100	100	100	100	-	100	100	100	100	-
TKN, lb/day	1.3	1.3	2.3	2.3	-	1.7	1.7	3.2	3.2	-
DRYING BEDS										
Volume: 126,000 gallons										
Assumed recovery	97%									
Inlet flow, gpd:	437	438	828	-	-	591	583	1,149	-	-
TS feed, lb/day	73	73.0	138.1	-	-	98.6	97.2	191.6	-	-
Dried cake solids (assumed)	40%	40%	40%	-	-	40%	40%	40%	-	-
Cake, dry lb/day	71	70.8	134.0	-	-	95.6	94.3	185.8	-	-
Cake, wet lb/day	172	172	325	-	-	232	229	451	-	-
Recycle (drain)										
Flow, gpd:	426	426	806	806	-	575	567	1,118	1,118	-
TSS, lb/day:	2.2	2.2	4.1	4.1	-	3.0	2.9	5.7	5.7	-
BOD, lb/day:	1.3	1.3	2.5	2.5	-	1.8	1.8	3.4	3.4	-
TOTAL RECYCLE STREAM										
Flow, gpd:	1,942	1,947	3,609	3,609	3,609	2,582	2,555	4,950	4,950	4,950
TSS, lb/day:	6.0	6.0	11.2	11.2		8.0	7.9	15.3	15.3	
BOD, lb/day:	3.6	3.6	6.7	6.7		4.8	4.7	9.2	9.2	

	CURRENT YEAR 2023					DESIGN YEAR 2045				
	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH WW	MAX DAY	MAX HOUR	AVERAGE DRY WEATHER	AVERAGE WET WEATHER	MAX MONTH	MAX DAY	MAX HOUR
McKINNEY ACTIVATED SLUDGE MODEL - NITRIFYING										
Nitrifying Yes =1; no =0	1									
Flow, mgd	0.08	0.20	0.40	1.42	2.40	0.10	0.23	0.43	1.47	2.51
Influent BOD, mg/L	173	70	65	36		179	79	79	45	
Influent TSS, mg/L	193	80	73	43		205	90	88	54	
Influent TKN, mg/L	29.4	11.8	10.5	3.0		30.2	13.1	12.9	3.8	
Secondary eff. TSS, mg/L	5	5	5	5		5	5	5	5	
Temperature, deg C	15	10	10	10		15	10	10	10	
Aeration time, hours	24.3	9.8	4.9	1.4	0.8	19.3	8.5	4.6	1.3	0.8
Aeration volume, gallons	82,600	82,600	82,600	82,600	82,600	82,600	82,600	82,600	82,600	82,600
Anoxic zone, gallons	-	-	-	-	-	-	-	-	-	-
Aerobic zone, gallons	82,600	82,600	82,600	82,600	82,600	82,600	82,600	82,600	82,600	82,600
Treatability coefficients										
K_m (20 C)	7.2	7.2	7.2	7.2		7.2	7.2	7.2	7.2	
K_s (20 C)	5.04	5.04	5.04	5.04		5.04	5.04	5.04	5.04	
K_e (20 C)	0.020	0.020	0.020	0.020		0.020	0.020	0.020	0.020	
K_m (@ design temp)	5.09	3.59	3.59	3.59		5.09	3.59	3.59	3.59	
K_s (@ design temp)	3.56	2.51	2.51	2.51		3.56	2.51	2.51	2.51	
K_e (@ design temp)	0.014	0.010	0.010	0.010		0.014	0.010	0.010	0.010	
Mi inf, mg/L	61.8	25.6	23.4	13.8		65.4	28.9	28.2	17.3	
Mii inf, mg/L	48.3	20.0	18.3	10.8		51.1	22.5	22.0	13.5	
Aeration effluent BOD, mg/L	1.4	1.9	3.5	6.0		1.8	2.5	4.5	7.8	
Aerobic SRT, hrs	336	336	288	132		336	336	216	96	
Total SRT, hrs	336	336	288	132		336	336	216	96	
Ma (active mass), mg/L	289	374	654	864		374	483	779	958	
Me (endogenous mass), mg/L	275	251	376	228		355	324	336	184	
Mi (inorganic mass), mg/L	854	878	1,372	1,311		1,138	1,137	1,335	1,236	
Mii (inert inorg. mass), mg/L	723	748	1175	1133		962	969	1154	1080	
MLVSS, mg/L	1,418	1,502	2,403	2,402		1,868	1,945	2,450	2,378	
MLSS, mg/L	2,141	2,251	3,578	3,536		2,830	2,914	3,604	3,458	
% Volatile	66.2%	66.8%	67.2%	67.9%		66.0%	66.7%	68.0%	68.8%	
Aer zone O_2 total demand, mg/L-hr	13.7	13.2	23.6	30.4		17.8	17.1	30.0	37.8	
Assumed reduction by denit	0%	0%	0%	0%		0%	0%	0%	0%	
Net aer. zone OUR, mg/L-hr	13.7	13.2	23.6	30.4		17.8	17.1	30.0	37.8	
Oxygen demand, lb/hr	9.5	9.1	16.2	21.0		12.3	11.8	20.7	26.0	
Lb O_2/Lb BOD_r	1.9	1.9	1.9	1.4		1.9	1.9	1.8	1.4	
Effluent TSS, lb/day	3	8	17	59		4	10	18	62	
Waste sludge, lb/day	102	102	189	383		135	134	258	534	
Waste VSS, lb/day	68	68	127	261		89	89	175	367	
Lb VSS prod/lb BOD rem	0.59	0.63	0.63	0.70		0.60	0.63	0.66	0.74	

APPENDIX I:

Cost Summaries

Headworks Alternatives:

"No Construction"					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	"Do Nothing"	1	LS	$0	$0
				Labor and Materials Subtotal	$0
				Mobilization, Insurance, Overhead, Bonds (10%)	$0
				Administration and Legal (5%)	$0
				Contingency (25%)	$0
				Engineering (20%)	$0
				Estimated Construction Costs (2024$)	**$0**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor - Existing Fine Screen	65	h	$40	$2,600
2	Operator Labor - Bar Rack Maintenance	20	h	$40	$800
3	Replacement Parts	1	LS	$500	$500
4	Electricity Usage	6000	kWh	$0.08	$506
				Estimated Annual O&M (2024$)	**$4,406**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	"Do Nothing"	$0	0	20	$0
				Estimated Salvage Value (2044$)	**$0**
Net Present Value					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$0
				O&M Unified Series Net Worth (2024$) **[OM]**	$72,041
				Salvage Value Present Worth (2024$) **[S]**	$0
				Net Present Value (2024$) [C+OM-S]	**$72,041**

Headworks Alternatives (Continued):

Add Redundant Fine Screen

Capital Cost

#	Item Description	Quantity	Units	Unit Cost ($)	Item Cost ($)
1	Demo and Site Prep	1	LS	$30,000	$30,000
2	Excavation	30	CY	$90	$2,700
3	Concrete	15	CY	$2,000	$30,000
4	Site Work / Grading / Site Restoration	1	LS	$7,000	$7,000
5	Tie- In to Existing System	1	LS	$5,000	$5,000
6	Mechanical Screen	1	EA	$148,000	$148,000
7	Equipment Installation	1	LS	$44,400	$44,400
8	Electrical and Controls	1	LS	$25,000	$25,000
				Labor and Materials Subtotal	$292,100
				Mobilization, Insurance, Overhead, Bonds (10%)	$29,210
				Administration and Legal (5%)	$14,605
				Contingency (25%)	$73,025
				Engineering (20%)	$58,420
				Estimated Construction Costs (2024$)	**$467,360**

Operations & Maintenance

#	Item Description	Quantity	Units	Unit Cost ($)	Item Cost ($)
1	Operator Labor - Fine Screen	65	h	$40	$2,600
2	Operator Labor - Bar Rack Maintenance	5	h	$40	$200
3	Replacement Parts	1	LS	$750	$750
4	Electricity Usage	6000	kWh	$0.08	$506
				Estimated Annual O&M (2024$)	**$4,056**

Salvage Value

#	Item Description	Construction Cost	Useful Life	Planning Period	Salvage Value ($)
1	Concrete	$30,000	50	20	$18,000
2	Mechanical Screen	$148,000	20	20	$0
3	Electrical and Controls	$25,000	20	20	$0
				Estimated Salvage Value (2044$)	**$18,000**

Net Present Value

Discount Rate (2023, OMB Circular No. A-94)	2.0%
Capital Costs (2024$) **[C]**	$467,360
O&M Unified Series Net Worth (2024$) **[OM]**	$66,318
Salvage Value Present Worth (2024$) **[S]**	$12,113
Net Present Value (2024$) [C+OM-S]	**$521,565**

Secondary Treatment Alternatives:

"No Construction"					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	"Do Nothing"	1	LS	$0	$0
				Labor and Materials Subtotal	$0
				Mobilization, Insurance, Overhead, Bonds (10%)	$0
				Administration and Legal (5%)	$0
				Contingency (25%)	$0
				Engineering (20%)	$0
				Estimated Construction Costs (2024$)	**$0**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	1296	h	$40	$51,840
2	Replacement Parts	1	LS	$2,000	$2,000
3	Electricity Usage	51100	kWh	$0.08	$4,308
				Estimated Annual O&M (2024$)	**$58,148**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	"Do Nothing"	$0	0	20	$0
				Estimated Salvage Value (2044$)	**$0**
Net Present Value					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$0
				O&M Unified Series Net Worth (2024$) **[OM]**	$950,799
				Salvage Value Present Worth (2024$) **[S]**	$0
				Net Present Value (2024$) [C+OM-S]	**$950,799**

Secondary Treatment Alternatives (Continued):

Redundant Secondary Clarifier					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Demo and Site Prep	1	LS	$20,000	$20,000
2	Excavation	85	CY	$90	$7,650
3	Site Work / Grading / Site Restoration	1	LS	$300,000	$300,000
4	Flow Diversion/Splitter	1	EA	$25,000	$25,000
5	Clarifier Structure	1	EA	$150,000	$150,000
6	Clarifier Mechanism and Accessories	1	EA	$200,000	$200,000
7	Clarifier Equipment Install	1	LS	$50,000	$50,000
8	RAS/WAS Pumping Systems	1	LS	$89,000	$89,000
9	Electrical and Controls	1	LS	$100,000	$100,000
				Labor and Materials Subtotal	$941,650
				Mobilization, Insurance, Overhead, Bonds (10%)	$94,165
				Administration and Legal (5%)	$47,083
				Contingency (25%)	$235,413
				Engineering (20%)	$188,330
				Estimated Construction Costs (2024$)	**$1,506,640**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	80	h	$40	$3,200
2	Electricity Usage	10000	kWh	$0.08	$843
				Estimated Annual O&M (2024$)	**$4,043**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Flow Diversion/Splitter	$25,000	50	20	$15,000
2	Clarifier Structure	$150,000	50	20	$90,000
3	Clarifier Mechanism and Accessories	$200,000	20	20	$0
4	RAS/WAS Pumping Systems	$89,000	20	20	$0
5	Electrical and Controls	$100,000	20	20	$0
				Estimated Salvage Value (2044$)	**$105,000**
Net Present Value					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$1,506,640
				O&M Unified Series Net Worth (2024$) **[OM]**	$66,109
				Salvage Value Present Worth (2024$) **[S]**	$70,662
				Net Present Value (2024$) [C+OM-S]	**$1,502,087**

Secondary Treatment Alternatives (Continued):

Supplemental Alkalinity Addition					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Demo and Site Prep	1	LS	$10,000	$10,000
2	Excavation	10	CY	$90	$900
3	Site Work / Grading / Site Restoration	1	LS	$3,000	$3,000
4	Site Piping	20	LF	$50	$1,000
5	Supplemental Alkalinity Dosing System	1	LS	$70,000	$70,000
6	Equipment Installation	1	LS	$10,000	$10,000
7	Electrical and Controls	1	LS	$15,000	$15,000
				Labor and Materials Subtotal	$109,900
				Mobilization, Insurance, Overhead, Bonds (10%)	$10,990
				Administration and Legal (5%)	$5,495
				Contingency (25%)	$27,475
				Engineering (20%)	$21,980
				Estimated Construction Costs (2024$)	**$175,840**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	32	h	$40	$1,280
2	Electricity Usage	2500	kWh	$0.08	$211
3	MgOH Costs	1000	gal	$3.00	$3,000
				Estimated Annual O&M (2024$)	**$4,491**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Site Piping	$1,000	50	20	$600
2	Supplemental Alkalinity Dosing System	$70,000	20	20	$0
3	Electrical and Controls	$15,000	20	20	$0
				Estimated Salvage Value (2044$)	**$600**
Net Present Value					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$175,840
				O&M Unified Series Net Worth (2024$) **[OM]**	$73,430
				Salvage Value Present Worth (2024$) **[S]**	$404
				Net Present Value (2024$) [C+OM-S]	**$248,866**

Secondary Treatment Alternatives (Continued):

Trickling Filter - Activated Sludge Rehabilitation					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Demo and Site Prep	1	LS	$25,000	$25,000
2	Excavation	30	CY	$90	$2,700
3	Site Work / Grading / Site Restoration	1	LS	$300,000	$300,000
4	Flow Splitter	1	LS	$50,000	$50,000
5	Aeration Basin - Base	30	CY	$750	$22,500
6	Aeration Basin - Walls	40	CY	$1,000	$40,000
7	Aeration Basin Diffusers and Blowers	1	LS	$250,000	$250,000
8	Aeration Basin Equipment Install	1	LS	$100,000	$100,000
9	Blower Building	1	LS	$300,000	$300,000
10	WAS/RAS Piping	1	LS	$30,000	$30,000
11	Electrical and Controls	1	LS	$60,000	$60,000
				Labor and Materials Subtotal	$1,180,200
				Mobilization, Insurance, Overhead, Bonds (10%)	$118,020
				Administration and Legal (5%)	$59,010
				Contingency (25%)	$295,050
				Engineering (20%)	$236,040
				Estimated Construction Costs (2024$)	**$1,888,320**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	1296	h	$40	$51,840
2	Electricity Usage	146000	kWh	$0.08	$12,308
				Estimated Annual O&M (2024$)	**$64,148**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Flow Splitter	$50,000	50	20	$30,000
2	Aeration Basin - Base	$22,500	50	20	$13,500
3	Aeration Basin - Walls	$40,000	50	20	$24,000
4	Aeration Basin Diffusers and Blowers	$250,000	20	20	$0
5	Blower Building	$300,000	50	20	$180,000
6	WAS/RAS Piping	$30,000	50	20	$18,000
7	Electrical and Controls	$60,000	20	20	$0
				Estimated Salvage Value (2044$)	**$235,500**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$1,888,320
				O&M Unified Series Net Worth (2024$) **[OM]**	$1,048,908
				Salvage Value Present Worth (2024$) **[S]**	$158,485
				Net Present Value (2024$) [C+OM-S]	**$2,778,744**

Secondary Treatment Alternatives (Continued):

Sequencing Batch Reactors					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Demo and Site Prep(5%)	1	LS	$180,000	$180,000
2	Excavation	3000	CY	$90	$270,000
3	Site Work / Grading / Site Restoration	1	LS	$600,000	$600,000
4	Site Piping	1	LS	$50,000	$50,000
5	SBR Basin Structures	1	LS	$750,000	$750,000
6	SBR Basin Equipment	1	LS	$315,000	$315,000
7	SBR Basin Equipment Install	1	LS	$130,000	$130,000
8	Blower Building	1	LS	$300,000	$300,000
9	Electrical and Controls	1	LS	$80,000	$80,000
				Labor and Materials Subtotal	$2,675,000
				Mobilization, Insurance, Overhead, Bonds (10%)	$267,500
				Administration and Legal (5%)	$133,750
				Contingency (25%)	$668,750
				Engineering (20%)	$535,000
				Estimated Construction Costs (2024$)	**$4,280,000**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	1192	h	$40	$47,680
2	Electricity Usage	220000	kWh	$0.08	$18,546
				Estimated Annual O&M (2024$)	**$66,226**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Site Piping	$50,000	50	20	$30,000
2	SBR Basin Structures	$750,000	50	20	$450,000
3	SBR Basin Equipment	$315,000	20	20	$0
4	Blower Building	$300,000	50	20	$180,000
5	Electrical and Controls	$80,000	20	20	$0
				Estimated Salvage Value (2044$)	**$660,000**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$4,280,000
				O&M Unified Series Net Worth (2024$) **[OM]**	$1,082,890
				Salvage Value Present Worth (2024$) **[S]**	$444,161
				Net Present Value (2024$) [C+OM-S]	**$4,918,729**

Secondary Treatment Alternatives (Continued):

Conventional Activated Sludge					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Demo and Site Prep	1	LS	$15,000	$15,000
2	Baffle Wall Concrete	20	CY	$1,000	$20,000
3	Flow Splitter	1	LS	$50,000	$50,000
4	Aeration Basin Diffusers and Blowers	1	LS	$250,000	$250,000
5	Aeration Basin Equipment Install	1	LS	$100,000	$100,000
6	WAS/RAS Piping	1	LS	$50,000	$50,000
7	Blower Building	1	LS	$300,000	$300,000
8	Bypass Treatment	1	LS	$150,000	$150,000
9	Electrical and Controls	1	LS	$75,000	$75,000
				Labor and Materials Subtotal	$1,010,000
				Mobilization, Insurance, Overhead, Bonds (10%)	$101,000
				Administration and Legal (5%)	$50,500
				Contingency (25%)	$252,500
				Engineering (20%)	$202,000
				Estimated Construction Costs (2024$)	**$1,616,000**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	958	h	$40	$38,320
2	Electricity Usage	220000	kWh	$0.08	$18,546
				Estimated Annual O&M (2024$)	**$56,866**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Baffle Wall Concrete	$20,000	50	20	$12,000
2	Flow Splitter	$50,000	50	20	$30,000
3	Aeration Basin Diffusers and Blowers	$250,000	20	20	$0
4	WAS/RAS Piping	$50,000	50	20	$30,000
5	Blower Building	$300,000	50	20	$180,000
6	Electrical and Controls	$75,000	20	20	$0
				Estimated Salvage Value (2044$)	**$252,000**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$1,616,000
				O&M Unified Series Net Worth (2024$) **[OM]**	$929,841
				Salvage Value Present Worth (2024$) **[S]**	$169,589
				Net Present Value (2024$) [C+OM-S]	**$2,376,252**

Secondary Treatment Alternatives (Continued):

Extended Aeration System					
Capital Cost					
No.	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Demo and Site Prep	1	LS	$125,000	$125,000
2	Excavation	1600	CY	$90	$144,000
3	Site Work / Grading / Site Restoration	1	LS	$650,000	$650,000
4	Package System	2	EA	$300,000	$600,000
5	Equipment Installation	1	LS	$300,000	$300,000
6	Bypass Treatment	1	LS	$250,000	$250,000
7	Blower Building	1	LS	$300,000	$300,000
8	Electrical and Controls	1	LS	$75,000	$75,000
				Labor and Materials Subtotal	$2,444,000
				Mobilization, Insurance, Overhead, Bonds (10%)	$244,400
				Administration and Legal (5%)	$122,200
				Contingency (25%)	$611,000
				Engineering (20%)	$488,800
				Estimated Construction Costs (2024$)	**$3,910,400**
Operations & Maintenance					
No.	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	1038	h	$40	$41,520
2	Electricity Usage	220000	kWh	$0.08	$18,546
				Estimated Annual O&M (2024$)	**$60,066**
Salvage Value					
No.	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Package System	$600,000	50	20	$360,000
2	Equipment Installation	$300,000	50	20	$180,000
3	Blower Building	$300,000	50	20	$180,000
4	Electrical and Controls	$75,000	20	20	$0
				Estimated Salvage Value (2044$)	**$720,000**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$3,910,400
				O&M Unified Series Net Worth (2024$) **[OM]**	$982,165
				Salvage Value Present Worth (2024$) **[S]**	$484,539
				Net Present Value (2024$) [C+OM-S]	**$4,408,026**

Disinfection Alternatives:

"No Construction"					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	"Do Nothing"	1	LS	$0	$0
				Labor and Materials Subtotal	$0
				Mobilization, Insurance, Overhead, Bonds (10%)	$0
				Administration and Legal (5%)	$0
				Contingency (25%)	$0
				Engineering (20%)	$0
				Estimated Construction Costs (2024$)	**$0**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	511	h	$40	$20,440
2	Replacement Parts	1	LS	$1,000	$1,000
3	Hypochlorite	2000	gal	$4.00	$8,000
4	Thiosulfate	750	gal	$4.00	$3,000
5	Electricity Usage	5000	kWh	$0.08	$422
				Estimated Annual O&M (2024$)	**$32,862**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	"Do Nothing"	$0	0	20	$0
				Estimated Salvage Value (2044$)	**$0**
Net Present Value					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$0
				O&M Unified Series Net Worth (2024$) **[OM]**	$537,333
				Salvage Value Present Worth (2024$) **[S]**	$0
				Net Present Value (2024$) [C+OM-S]	**$537,333**

Disinfection Alternatives (Continued):

Chlorine Disinfection - New Chlorine Contact Basin					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Demo and Site Prep	1	LS	$30,000	$30,000
2	Excavation	250	CY	$90	$22,500
3	Site Work / Grading / Site Restoration	1	LS	$100,000	$100,000
4	Chlorine Basin, Base	20	CY	$750	$15,000
5	Chlorine Basin, Walls	50	CY	$1,000	$50,000
6	Equipment Installation	1	LS	$100,000	$100,000
7	Electrical and Controls	1	LS	$25,000	$25,000
				Labor and Materials Subtotal	$342,500
				Mobilization, Insurance, Overhead, Bonds (10%)	$34,250
				Administration and Legal (5%)	$17,125
				Contingency (25%)	$85,625
				Engineering (20%)	$68,500
				Estimated Construction Costs (2024$)	**$548,000**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	460	h	$40	$18,400
2	Replacement Parts	1	LS	$1,000	$1,000
3	Hypochlorite	1500	gal	$4.00	$6,000
4	Thiosulfate	500	gal	$4.00	$2,000
5	Electricity Usage	3000	kWh	$0.08	$253
				Estimated Annual O&M (2024$)	**$27,653**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Chlorine Basin, Base	$15,000	50	20	$9,000
2	Chlorine Basin, Walls	$50,000	50	20	$30,000
3	Electrical and Controls	$25,000	50	20	$15,000
				Estimated Salvage Value (2044$)	**$54,000**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$548,000
				O&M Unified Series Net Worth (2024$) **[OM]**	$452,165
				Salvage Value Present Worth (2024$) **[S]**	$36,340
				Net Present Value (2024$) [C+OM-S]	**$963,824**

Disinfection Alternatives (Continued):

Construct UV Disinfection System					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Demo and Site Prep	1	LS	$10,000	$10,000
2	Excavation	25	CY	$90	$2,250
3	Site Work / Grading / Site Restoration	1	LS	$12,000	$12,000
4	UV Channel Structure, Base	5	CY	$750	$3,750
5	UV Channel Structure, Walls	10	CY	$1,000	$10,000
6	UV Channel Structure, Cover	1	LS	$25,000	$25,000
7	UV Modules	1	LS	$300,000	$300,000
8	UV Equipment Installation	1	LS	$75,000	$75,000
9	Electrical and Controls	1	LS	$85,000	$85,000
				Labor and Materials Subtotal	$523,000
				Mobilization, Insurance, Overhead, Bonds (10%)	$52,300
				Administration and Legal (5%)	$26,150
				Contingency (25%)	$130,750
				Engineering (20%)	$104,600
				Estimated Construction Costs (2024$)	**$836,800**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	300	h	$40	$12,000
2	Replacement Parts	1	LS	$1,000	$1,000
3	Electricity Usage	15000	kWh	$0.08	$1,265
				Estimated Annual O&M (2024$)	**$14,265**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	UV Channel Structure, Base	$3,750	50	20	$2,250
2	UV Channel Structure, Walls	$10,000	50	20	$6,000
3	UV Channel Structure, Cover	$25,000	50	20	$15,000
4	UV Modules	$300,000	20	20	$0
5	Electrical and Controls	$85,000	20	20	$0
				Estimated Salvage Value (2044$)	**$15,000**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$836,800
				O&M Unified Series Net Worth (2024$) **[OM]**	$233,245
				Salvage Value Present Worth (2024$) **[S]**	$10,095
				Net Present Value (2024$) [C+OM-S]	**$1,059,950**

Solids Treatment Alternatives:

"No Construction"					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	No Construction	1	LS	$0	$0
				Labor and Materials Subtotal	$0
				Mobilization, Insurance, Overhead, Bonds (10%)	$0
				Administration and Legal (5%)	$0
				Contingency (25%)	$0
				Engineering (20%)	$0
				Estimated Construction Costs (2024$)	**$0**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	52	h	$40	$2,080
2	Electricity Usage	180000	kWh	$0.08	$15,174
3	Replacement Parts	1	LS	$1,500	$1,500
				Estimated Annual O&M (2024$)	**$18,754**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	No Construction	$0	0	20	$0
				Estimated Salvage Value (2044$)	**$0**
Net Present Value					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$0
				O&M Unified Series Net Worth (2024$) **[OM]**	$306,655
				Salvage Value Present Worth (2024$) **[S]**	$0
				Net Present Value (2024$) [C+OM-S]	**$306,655**

Solids Treatment Alternatives (Continued):

Rehabilitate Drying Bed Underdrains					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Site Prep	1	LS	$10,000	$10,000
2	Excavation	50	CY	$50	$2,500
3	Drain Pipe	320	LF	$35	$11,200
4	Gravel	25	CY	$85	$2,125
5	Sand	25	CY	$50	$1,250
6	Landscape Fabric	1	LS	$2,000	$2,000
				Labor and Materials Subtotal	$29,075
				Mobilization, Insurance, Overhead, Bonds (10%)	$2,908
				Administration and Legal (5%)	$1,454
				Contingency (25%)	$7,269
				Engineering (20%)	$5,815
				Estimated Construction Costs (2024$)	**$46,520**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	52	h	$40	$2,080
2	Replacement Parts	1	LS	$750	$750
3	Solids Hauling	1	LS	$2,500	$2,500
				Estimated Annual O&M (2024$)	**$5,330**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Drain Pipe	$11,200	50	20	$6,720
2	Gravel	$2,125	50	20	$1,275
3	Sand	$1,250	50	20	$750
4	Landscape Fabric	$2,000	20	20	$0
				Estimated Salvage Value (2044$)	**$8,745**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$46,520
				O&M Unified Series Net Worth (2024$) **[OM]**	$87,153
				Salvage Value Present Worth (2024$) **[S]**	$5,885
				Net Present Value (2024$) [C+OM-S]	**$127,788**

Solids Treatment Alternatives (Continued):

Reconstruction of Drying Beds with Guide Walls					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Site Prep	1	LS	$15,000	$15,000
2	Excavation	50	CY	$50	$2,500
3	Drain Pipe	320	LF	$35	$11,200
4	Gravel	25	CY	$85	$2,125
5	Sand	25	CY	$50	$1,250
6	Landscape Fabric	1	LS	$2,000	$2,000
7	Concrete for Guide Walls	100	CY	$1,500	$150,000
8	New Sludge Distribution System	1	LS	$30,000	$30,000
				Labor and Materials Subtotal	$214,075
				Mobilization, Insurance, Overhead, Bonds (10%)	$21,408
				Administration and Legal (5%)	$10,704
				Contingency (25%)	$53,519
				Engineering (20%)	$42,815
				Estimated Construction Costs (2024$)	**$342,520**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	26	h	$40	$1,040
2	Replacement Parts	1	LS	$200	$200
3	Solids Hauling	1	LS	$2,500	$2,500
				Estimated Annual O&M (2024$)	**$3,740**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Drain Pipe	$11,200	50	20	$6,720
2	Gravel	$2,125	50	20	$1,275
3	Sand	$1,250	50	20	$750
4	Landscape Fabric	$2,000	50	20	$1,200
5	Concrete for Guide Walls	$150,000	50	20	$90,000
6	New Sludge Distribution System	$30,000	50	20	$18,000
				Estimated Salvage Value (2044$)	**$117,945**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$342,520
				O&M Unified Series Net Worth (2024$) **[OM]**	$61,154
				Salvage Value Present Worth (2024$) **[S]**	$79,374
				Net Present Value (2024$) [C+OM-S]	**$324,301**

Solids Treatment Alternatives (Continued):

Aerobic Digester Aeration System Improvements					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Site Prep	1	LS	$5,000	$5,000
2	Blowers	2	EA	$60,000	$120,000
3	Aeration Pipe Upgrades	1	LS	$25,000	$25,000
4	Valves and Appurtenances	1	LS	$10,000	$10,000
5	Installation	1	LS	$25,000	$25,000
				Labor and Materials Subtotal	$185,000
				Mobilization, Insurance, Overhead, Bonds (10%)	$18,500
				Administration and Legal (5%)	$9,250
				Contingency (25%)	$46,250
				Engineering (20%)	$37,000
				Estimated Construction Costs (2024$)	**$296,000**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	52	h	$40	$2,080
2	Electricity Usage	115000	kWh	$0.08	$9,695
3	Replacement Parts	1	LS	$500	$500
				Estimated Annual O&M (2024$)	**$12,275**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Blowers	$120,000	20	20	$0
2	Aeration Pipe Upgrades	$25,000	50	20	$15,000
3	Valves and Appurtenances	$10,000	50	20	$6,000
				Estimated Salvage Value (2044$)	**$21,000**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$296,000
				O&M Unified Series Net Worth (2024$) **[OM]**	$200,706
				Salvage Value Present Worth (2024$) **[S]**	$14,132
				Net Present Value (2024$) [C+OM-S]	**$482,573**

Collection System Alternatives:

Collection System - I/I Reduction					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Manhole Rehabilitation	1	LS	$54,500	$54,500
2	CCTV Surveillance	1	LS	$13,970	$13,970
3	Cross-Connection Repair	1	LS	$105,000	$105,000
4	Spot Repair of Sewer Pipe Voids	3	EA	$5,000	$15,000
				Labor and Materials Subtotal	$188,470
				Mobilization, Insurance, Overhead, Bonds (10%)	$18,847
				Administration and Legal (5%)	$9,424
				Contingency (25%)	$47,118
				Engineering (20%)	$37,694
				Estimated Construction Costs (2024$)	**$301,552**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	10	h	$40	$400
2	Replacement Parts	1	LS	$1,000	$1,000
				Estimated Annual O&M (2024$)	**$1,400**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Manhole Rehabilitation	$54,500	50	20	$32,700
2	Cross-Connection Repair	$105,000	50	20	$63,000
				Estimated Salvage Value (2044$)	**$32,700**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$301,552
				O&M Unified Series Net Worth (2024$) **[OM]**	$22,892
				Salvage Value Present Worth (2024$) **[S]**	$22,006
				Net Present Value (2024$) [C+OM-S]	**$302,438**

Collection System Alternatives (Continued):

Alder Street Lift Station Upgrade					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Site Preparation	1	LS	$25,000	$25,000
2	Pump Upgrades	1	LS	$125,000	$125,000
3	Electrical and Controls	1	LS	$85,000	$85,000
				Labor and Materials Subtotal	$235,000
				Mobilization, Insurance, Overhead, Bonds (10%)	$23,500
				Administration and Legal (5%)	$11,750
				Contingency (25%)	$58,750
				Engineering (20%)	$47,000
				Estimated Construction Costs (2024$)	**$376,000**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	20	h	$40	$800
2	Replacement Parts	1	LS	$1,000	$1,000
				Estimated Annual O&M (2024$)	**$1,800**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	Pump Upgrades	$125,000	25	20	$25,000
				Estimated Salvage Value (2044$)	**$25,000**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$376,000
				O&M Unified Series Net Worth (2024$) **[OM]**	$29,433
				Salvage Value Present Worth (2024$) **[S]**	$16,824
				Net Present Value (2024$) [C+OM-S]	**$388,608**

Collection System Alternatives (Continued):

Capacity Upgrades - Cannon Avenue Alternative					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Site Preparation	1	LS	$20,000	$20,000
2	12" PVC Gravity Sewer	1200	LF	$150	$180,000
3	15" PVC Gravity Sewer	300	LF	$200	$60,000
4	Manhole Assemblies	5	EA	$6,500	$32,500
5	ACP Decomissioning	1	LS	$3,000	$3,000
				Labor and Materials Subtotal	$295,500
				Mobilization, Insurance, Overhead, Bonds (10%)	$29,550
				Administration and Legal (5%)	$14,775
				Contingency (25%)	$73,875
				Engineering (20%)	$59,100
				Estimated Construction Costs (2024$)	**$472,800**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	1	h	$40	$40
2	Replacement Parts	1	LS	$500	$500
				Estimated Annual O&M (2024$)	**$540**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	12" PVC Gravity Sewer	$180,000	50	20	$108,000
2	15" PVC Gravity Sewer	$60,000	50	20	$36,000
3	Manhole Assemblies	$32,500	50	20	$19,500
				Estimated Salvage Value (2044$)	**$163,500**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$472,800
				O&M Unified Series Net Worth (2024$) **[OM]**	$8,830
				Salvage Value Present Worth (2024$) **[S]**	$110,031
				Net Present Value (2024$) [C+OM-S]	**$371,599**

Collection System Alternatives (Continued):

Capacity Upgrades - Moss Street Alternative					
Capital Cost					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Site Preparation	1	LS	$20,000	$20,000
2	10" PVC Gravity Sewer	50	LF	$125	$6,250
3	12" PVC Gravity Sewer	500	LF	$150	$75,000
4	15" PVC Gravity Sewer	750	LF	$200	$150,000
5	Manhole Assemblies	6	EA	$6,500	$39,000
6	ACP Decomissioning	1	LS	$3,000	$3,000
				Labor and Materials Subtotal	$293,250
				Mobilization, Insurance, Overhead, Bonds (10%)	$29,325
				Administration and Legal (5%)	$14,663
				Contingency (25%)	$73,313
				Engineering (20%)	$58,650
				Estimated Construction Costs (2024$)	**$469,200**
Operations & Maintenance					
#	**Item Description**	**Quantity**	**Units**	**Unit Cost ($)**	**Item Cost ($)**
1	Operator Labor	1	h	$40	$40
2	Replacement Parts	1	LS	$500	$500
				Estimated Annual O&M (2024$)	**$540**
Salvage Value					
#	**Item Description**	**Construction Cost**	**Useful Life**	**Planning Period**	**Salvage Value ($)**
1	10" PVC Gravity Sewer	$6,250	50	20	$3,750
2	12" PVC Gravity Sewer	$75,000	50	20	$45,000
3	15" PVC Gravity Sewer	$150,000	50	20	$90,000
4	Manhole Assemblies	$39,000	50	20	$23,400
				Estimated Salvage Value (2044$)	**$162,150**
Net Present Value Analysis					
				Discount Rate (2023, OMB Circular No. A-94)	2.0%
				Capital Costs (2024$) **[C]**	$469,200
				O&M Unified Series Net Worth (2024$) **[OM]**	$8,830
				Salvage Value Present Worth (2024$) **[S]**	$109,122
				Net Present Value (2024$) [C+OM-S]	**$368,907**