EXECUTIVE SUMMARY

Recognizing the interrelationship between wastewater conveyance and treatment, the City of McMinnville carefully planned for and embarked upon the development of the *Sanitary Sewer Master Plan Updates.* This closely coordinated planning effort strikes a balance between conveyance and treatment to reach a cost-effective comprehensive plan for wastewater management through buildout conditions. A key element of the plan is an inherent flexibility which will allow the City to adapt to changing conditions.

CONVEYANCE SYSTEM

The *Conveyance System Master Plan* is an update to efforts that began with the infiltration and inflow (I/I) reduction analysis performed in 1991. The plan continues to be refined as analyses and system improvements are performed. The current plan includes updates to collection system configuration, recent flow monitoring data, and a structural condition element and a review of system management practices relative to EPA's Capacity Management Operations and Maintenance (CMOM) guidelines.

Regulatory Setting

As a part of the State of Oregon's Triennial Review of Oregon's Water Quality Standards, new bacterial standards were developed for waters of the State. This bacterial standard is now in effect. It states that raw sewage discharges to waters of the State are prohibited from November 1 through May 21, except during a storm event greater than the one-in-five year, 24-hour duration storm. The bacterial water quality standard states that an acceptable plan must be implemented to eliminate overflows from sanitary sewers by no later than January 1, 2010.

Description of Existing Collection System

The City's collection system is divided into seven sub-basins forming the current and future service areas. These basins are named according to prominent geographic or cultural landmarks. Mainline pipe lengths and basin areas are summarized in Table ES-1. There are nearly 701,250 linear feet of sewer pipe in service, ranging in size from 4 to 54 inches in diameter. With the exception of a small area in the Downtown Basin, the system consists of a network of separate sanitary and storm sewers.

Because of the largely favorable topographic relief of the area, most of the City is served by gravity sewer lines. However, in those areas that have adverse topographic relief, pumping is required to transport wastewater to the gravity portion of the collection system. The flow from the gravity system is pumped to the Water Reclamation Facility (WRF) by the Raw Sewage Pump Station (RSPS). There are currently thirteen pump stations operating in the collection system.

Table ES-1. Collection System Pipe Length and Sub-Basin Gross Area within the UGB

Basin Name	Total Length of Gravity and Pressure Pipe, feet	Basin Area, acres
Airport	38,803	1,780
Cozine	195,326	1,901
Downtown	90,544	711
Fairgrounds	141,842	1,899
High School	110,317	674
Michelbook	102,864	1,135
Yamhill	21,554	199
Totals	701,250	8,299
Total Miles	133 (31.2 miles modeled)	—

Modeled System Elements

In general, the modeled system includes all pipes 12 inches in diameter and greater. There are sections of the system that are 8 and 10 inches in diameter that have been included in the model to address key areas of system operation. The following seven existing pump stations were also incorporated into the model:

- 3 Mile Lane #1
- 3-Mile Lane #3
- Cozine
- Cozine Woods
- Northeast
- Kathleen Manor
- Raw Sewage Pump Station

The only locations that the model allows flow to exit the system are the following diversions/ bypasses:

- Lafayette Bypass
- Diversion Structure at Raw Sewage Pump Station
- Cozine Pump Station

Figure ES-1 shows the drainage basin areas, collection system pipelines, modeled pipelines, pump stations and flow monitoring locations.

Planning Area

The planning area for the current and future service area is 8,299 acres, or approximately 13 square miles, and is consistent with the City's Comprehensive Plan. The planning area is the same as the City's newly proposed urban growth boundary (UGB) (8,299 acres), which is 1,255 acres greater than the existing UGB (7,044 acres). The enlarged UGB has been proposed in order to account for future population and economic expansion identified in the 2003 *Growth Management and Urbanization Plan*. A request to expand the UGB was acknowledged by the Oregon Department of Land Conservation and Development (DLCD) and approved by the Land Conservation and Development Commission (LCDC) in September, 2006. Subsequently, LCDC's approval of the City's plan was appealed to the Oregon Court of Appeals in December of 2006. As of this date, the appeal still awaits decision by the Courts. For purposes of this master planning study, the planning area shall include the existing and proposed UGB, as shown in Figure ES-2.

The *Growth Management and Urbanization Plan* utilizes a population growth rate of 2.2 percent per year and estimates that buildout conditions will be reached by the year 2023. At this time, the City's population is estimated to reach 44,000. When considering the combined effects of planned residential, commercial, and industrial growth, the number of equivalent dwelling units (EDUs) is expected to increase by over 9,900 compared to current conditions.

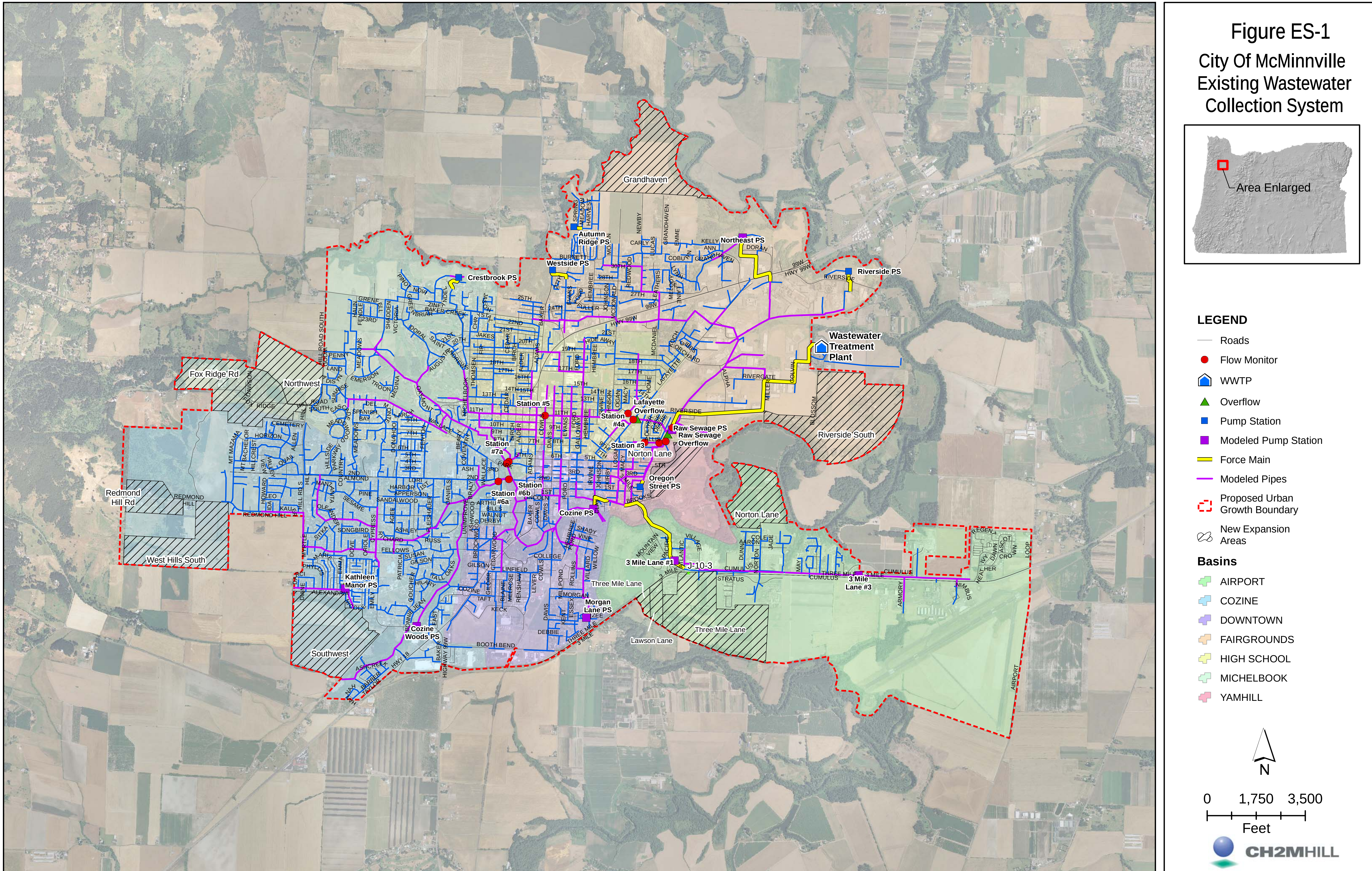
Flow Monitoring

Temporary flow and rainfall monitoring was conducted through a private flow monitoring contractor for a period of 3 months (February – April 2006). Monitoring was conducted during wet weather conditions when soils are saturated, thus resulting in peak I/I conditions.

The temporary flow monitoring and rainfall data, coupled with data from pump stations within the system, provided the data set from which to calibrate the sanitary sewer model and to evaluate the effects that I/I has on the collection system.

Flow Development and Calibration

A hydraulic model of the wastewater collection system was developed using the EPA Storm Water Management Model (SWMM) Version 5 to simulate the flow conditions within the service area. The modeling task assists in the identification of areas in the collection/conveyance system where hydraulic capacity deficiencies may exist. The model was refined and calibrated to simulate the existing collection system and to reflect recent sewer rehabilitation efforts, flow monitoring, and historic pump station and treatment facility flow data. This calibrated model was used to estimate the 5-year peak day and 5-year peak hour wet weather regulatory design flow rates for the existing condition.



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Estimates of rainfall dependent infiltration and inflow (RDII) are based on an observed relationship between rainfall and flow. RDII is flow resulting from rainfall that has entered the collection system over the past hours, days and weeks. An equation was developed which described the relationship between measured flow at monitoring locations and the rainfall that occurred prior to that flow measurement.

Calibration of the collection system model involves adjusting regression equation coefficients as well as flows and hydraulic parameters in the model such that model-predicted flows, depths and velocities more closely matched observed data.

The ability to closely predict measured flows during large storm events indicates that the model has achieved an appropriate level of calibration and can be used to predict flows for the design rainfall event. Attributes including peak flow rate, hydrograph shape and volume were used to confirm the ability to predict performance in the system.

Application of Calibrated Model

Results from two rainfall conditions were evaluated, both of which meet the DEQ written regulatory criteria for a 5-year, 24-hour wet weather event. The first condition includes 48-hours of rainfall prior to the start of the 24-hour regulatory event. The amount of rainfall during this period is consistent with a 5-year frequency from 0 to 72 hours, including the 24-hour regulatory design event. The second condition assumes no prior (antecedent) rainfall to the 24-hour regulatory event. Table ES-2 presents the peak wet weather flows anticipated in the collection system during current and build-out conditions for the two rainfall conditions assuming that no collection system rehabilitation is performed, and that there are no capacity restrictions in the system, either in the pipelines or at pump stations.

System Capacity Performance

The collection system generally has capacity to convey flow to the RSPS with several relatively isolated areas of inadequate conveyance capacity in the Michelbook and High School Basins. The deficient areas are similar for all land use and storm durations analyzed. The most significant deficient elements of the system are the 21-inch line downstream of the Lafayette bypass and at the Cozine Pump Station. The system generally has capacity (with limited conveyance improvements) to deliver peak flows much greater than the RSPS and existing treatment capacity. Therefore, improvement alternatives include storage and I/I reduction improvements to reduce flows as well as increasing capacity at the RSPS and WRF.

For both storm durations, the existing collection system deficiencies were identified in the following areas:

- Michelbook Basin: between 9th Street and 10th Street, West of Michelbook Lane, at 13th Street, East of Michelbook Lane, Michelbook Lane near 17th Street.
- High School Basin: along the parallel 21-inch lines on Allis Drive between Lafayette Ave. and the RSPS, 19th Street near Baker Street

Table ES-2. Model Results of the Peak Wet Weather Flows

Flow Condition	Existing, mgd	Build-out, mgd
72-Hour Duration (48 hours of antecedent rainfall prior to the 24-hour regulatory event)	—	—
Peak Hour Dry Weather Sanitary Flow and Base Infiltration	5.4	6.8
Peak Hour RDI/I	46.6	55.2
Maximum Day Wet Weather Flow	47.6	54.5
Peak Hour Flow	52	62
24-Hour Duration (no antecedent rainfall)	—	—
Peak Hour Dry Weather Sanitary Flow and Base Infiltration	5.4	6.8
Peak Hour RDI/I	37.9	42.1
Maximum Day Wet Weather Flow	35.1	45.5
Peak Hour Flow	43.3	48.9

Similar to the existing land use results, additional collection system deficiencies that were identified for build-out conditions consisted of:

- Michelbook Basin: in the vicinity of 10th Street and east of Michelbook Lane and continuing upstream
- High School Basin: along 19th Street at Baker Street, the parallel 21-inch lines along Allis Drive between Lafayette Ave and the RSPS and the 42-inch pipe just upstream from the RSPS.

Structural Condition Data Evaluation

A brief assessment of the structural condition of and data availability for the City of McMinnville collection system was performed. Recommendations were made for maintaining a level of service for the collection system where proactive maintenance is of greater benefit than reactive maintenance.

The goals of this assessment were to: a) summarize known condition deficiencies and develop priorities and strategies to remedy the deficiencies, and b) recommend future activities consistent with the results of the CMOM Gap Analysis, including review of existing condition scoring and data management practices.

In summary, it is recommended that the City:

> Investigate potential problem areas identified in this report for capital improvement funding.
>
> Enhance current best practices and plan for normal system deterioration over time through regular inspection and rating, risk assessment, and funding for condition-related improvements.

Alternatives Evaluation

Alternative solutions to the deficiencies identified for the two design storm durations (24 and 72-hour) were evaluated. The peak flows in the collection systems and potentially conveyed for treatment at the Water Reclamation Facility (WRF) vary for the two storm durations. Therefore, a least cost combination of conveyance and treatment improvements were identified for each design storm. A series of cost curves were developed to show the relationship between alternative solutions including RDII reduction, conveyance improvements, treatment capacity increases, and storage of peak flows. The cost impacts of peak flow associated with the alternatives assumes flow blending at the WRF.

The least cost combination of solutions occurred for the 24-hour duration storm. This is a direct result of the lower peak flows and volumes associated with this shorter duration event.

The total cost of improvements for the existing land use condition is $13.0M and includes pipeline rehabilitation and associated RDII reduction to reduce flows to the RSPS and WRF. When flows exceed 32 mgd at the RSPS, the treatment costs exceed the corresponding costs to reduce the peak flow.

Similar to the existing land use condition, the least cost combination for future land use ($21.7M) occurs for the 24-hour storm duration and includes rehabilitation to limit flows to 32 mgd at the RSPS and WRF. The only difference in the cost of improvements between the two land use conditions is due to increased rehabilitation from 13 to 28% in the targeted basins.

Collection System Recommended Plan

The relative risk of overflow from the 5-year, 24- and 72-hour design storms was evaluated. The decision regarding the design storm event was based on a risk management evaluation that included, but was not limited to, the information provided in this Master Plan Update. There is a low likelihood of occurrence for the 72-hour design storm evaluated given the combination of plant flow and timing and intensity of rainfall associated with it. This combination has not occurred during the last 12 years. Therefore, a decision to use the 24-hour duration storm was made with confidence because the 72-hour event and the resulting flows are unlikely and the associated risk can be managed. Other factors not directly addressed include the financial impact to the City given other infrastructure and publicly funded needs.

The major features of the recommended plan consist of targeted I/I reduction to limit flows at the RSPS to 32 mgd and capacity improvements in the Michelbook Basin. A complete description of the recommended plan is as follows:

- *Pipeline Capacity Improvements.* Construction of the 10th Street pipeline and Michelbook trunk line pipeline improvements.
- *Treatment Capacity Improvements.* Limited upgrades to the WRF to provide peak flow treatment capacity of 32 mgd.
- *RDII Reduction.* Near term RDII reduction of 31 percent, and ultimate reduction of 45 percent from 2006 levels in targeted basins with high levels of I/I.

A phased and flexible approach to wet weather flow management is recommended. The improvements associated with the 24-hour storm event are programmed into the implementation plan with consideration for expanding on that solution if observed system performance results in unacceptable overflows, or reducing the amount of system rehabilitation if effectiveness estimates are exceeded. Improvements focus on collection system rehabilitation as opposed to conveyance and treatment improvements, given that rehabilitation provides multiple benefits including asset replacement, I/I reduction, and contributes to the least cost combination of improvements. Table ES-3 summarizes the recommended pipeline improvements and their cost. These improvements along with the basins targeted for rehabilitation are shown in Figure ES-3.

<u>Future Development</u>

In addition to recommended conveyance capacity improvements, areas that will develop in the future will require service extensions to connect them to the existing collection system. Based on the areas where future development is anticipated, preliminary locations of pump stations and pipelines needed to serve these areas were developed.

<u>Plan Summary</u>

Table ES-6 at the end of this chapter summarizes the phasing and estimated annual cost of collection system improvement projects through buildout conditions in fiscal year 2020-21. Improvement implementation should also include the means to define system performance for multiple rainfall events and to assess I/I reduction levels resulting from rehabilitation efforts. To achieve this end, permanent flow monitors should be placed in the system and the resulting data combined with monitored flows at the RSPS and Cozine PS. This will provide value in determining SSO control compliance, assessing accuracy of hydraulic model predictions, and assisting with subsequent model refinements.

The City should reevaluate this approach in 2012-13 and then, in conjunction with discharge permit renewals, determine if any refinements are warranted. This re-evaluation should include:

- Update the model based on collection system flow monitoring data
- Assess the effectiveness of rehabilitation efforts based on the monitoring and the updated model.

- Update the cost-effectiveness determination (rehabilitation/conveyance/treatment) based on the latest available information
- Review compliance history and actual consequences of overflows.
- Adjust design storm selection and peak flow management approach as appropriate.

Table ES-3. Recommended Collection System Improvements for Existing and Future Conditions, 5-year, 24-hour Storm Event with Recommended Rehabilitation

Pipe ID	Existing Diameter, inches	Required Diameter, inches	Length, feet	Cost, dollars
C_H-6-7	10	12	301	109,000
C_H-6-8	10	12	128	46,000
C_H-7-4	10	12	131	47,000
C_H-7-5	10	12	291	105,000
C_H-7-6	10	12	393	142,000
C_H-7-7	10	12	237	86,000
C_H-7-8	10	12	17	6,000
C_H-7-9	10	12	253	92,000
C_H-7-10d1	—	10	43	20,000[a]
C_H-7-10d2	—	10	123	55,000[a]
			Total	708,000

(a) Values from City's current CIP

WATER RECLAMATION FACILITY

Developed concurrently with the Conveyance System Master Plan, the Water Reclamation Facility Plan addresses the treatment aspects of long-term wastewater management. Accommodating growth and establishing a direction for complying with a wide range of potential regulatory scenarios are key aspects of the plan.

Existing Wastewater Treatment Facilities

Construction of the Water Reclamation Facility (WRF) was completed in 1996. During its twelve years of operation, the WRF has consistently complied with some of the most stringent treatment requirements in the state. Major treatment processes at the WRF include offsite influent pumping, screening, grit removal, secondary treatment in advanced oxidation ditches (Orbals), secondary clarification, tertiary clarification, filtration, ultraviolet (UV) disinfection, and post aeration prior to discharge to the South Yamhill River. The solids treatment processes include thickening and autothermal thermophilic aerobic digestion (ATAD). Biosolids are stored, in liquid form, on site during the wet weather months and land applied during dry weather months. A site plan of the existing facility is provided in Figure ES-4.

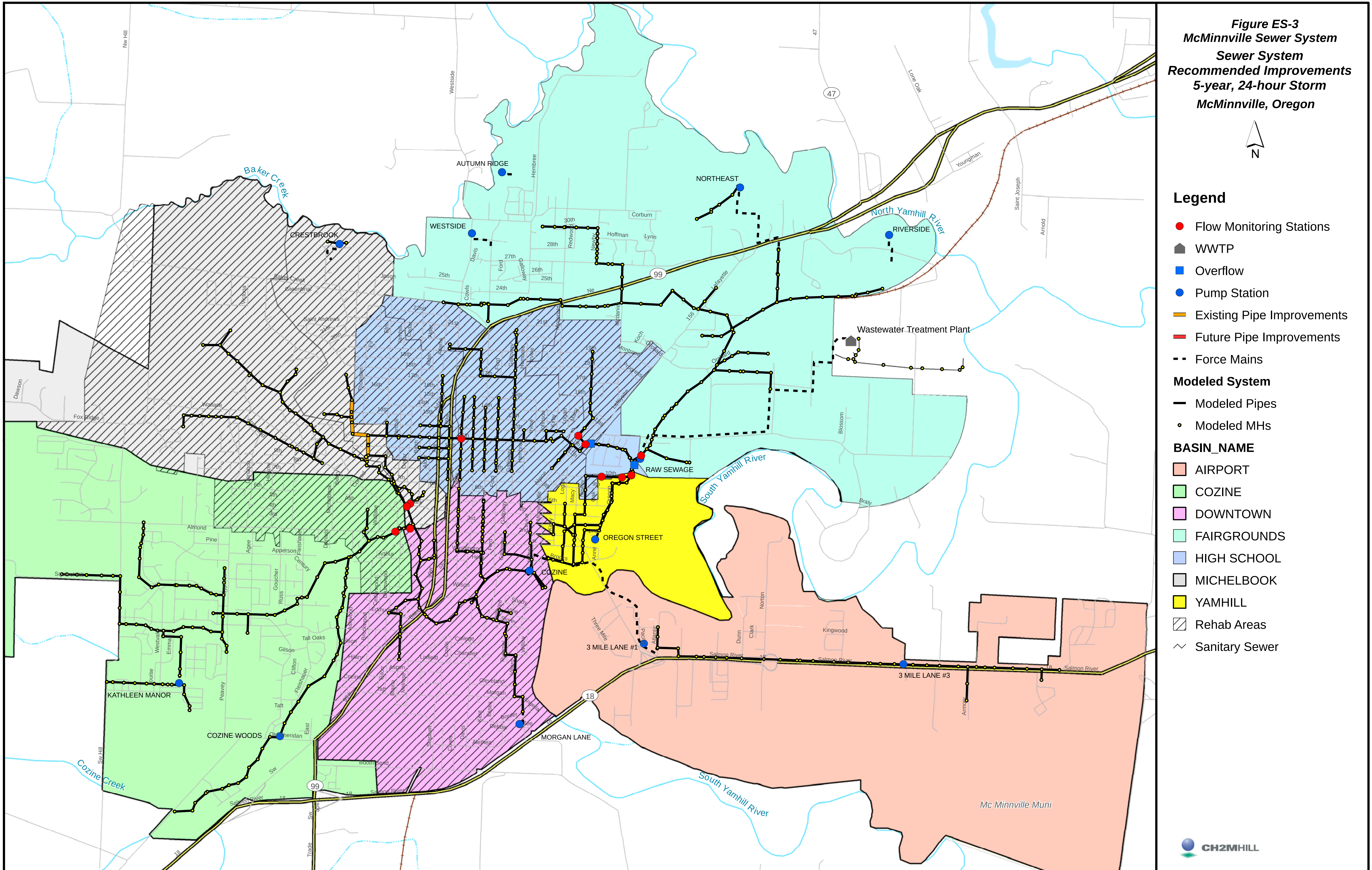


Figure ES-3
McMinnville Sewer System
Sewer System Recommended Improvements 5-year, 24-hour Storm
McMinnville, Oregon

Wastewater Flows and Loads

The key wastewater characteristics affecting the WRF are flows, solids loads, organic loads, and nutrients. Increases in flows and loads over time are expected to be driven by population growth and significant commercial and industrial development. Current and projected buildout flows and loads are summarized in Table ES-4. The wet weather flows are based on significant reduction of infiltration and inflow through collection system rehabilitation, consistent with the *Conveyance System Master Plan*.

Regulatory Requirements

The regulatory environment surrounding water quality protection in Oregon is relatively complex, requiring interaction and cooperation between a number of federal, state, and local agencies. It is the responsibility of the Oregon Department of Environmental Quality (DEQ) to establish and enforce water quality and waste treatment standards. The DEQ's general policy is one of antidegradation of surface water quality. The Environmental Protection Agency (EPA) oversees state regulatory agencies, and can intervene if the state agencies do not successfully protect water quality.

Clean Water Act Section 303(d) List

DEQ issued the latest Section 303(d) list of water quality limited water bodies in January 2003. If a parameter is listed in the 303(d) list, then a Total Maximum Daily Load (TMDL) is required to be developed for that waterbody. The following parameters are included on the current 303(d) list for river miles 1 to 18.1 of the South Yamhill River and apply to the WRF:

- Iron – Year Around
- Temperature – Summer
- Fecal Coliform – Winter/Spring/Fall

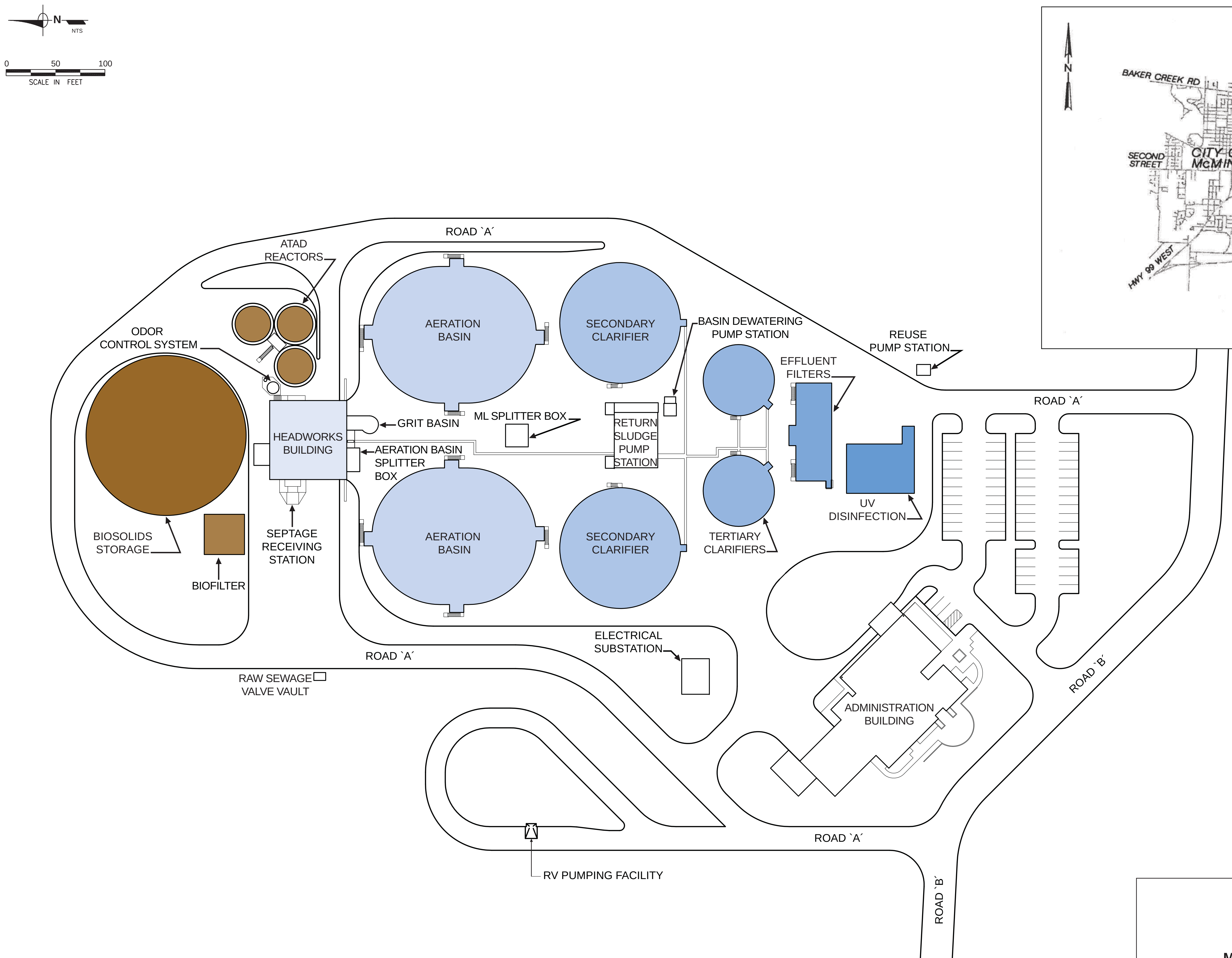
The 2004/2006 Integrated Report water quality assessment list has been submitted to the federal Environmental Protection Agency (EPA) for approval. It is expected that dissolved oxygen requirements for January 1 through May 15 will be included on the updated 303 (d) list.

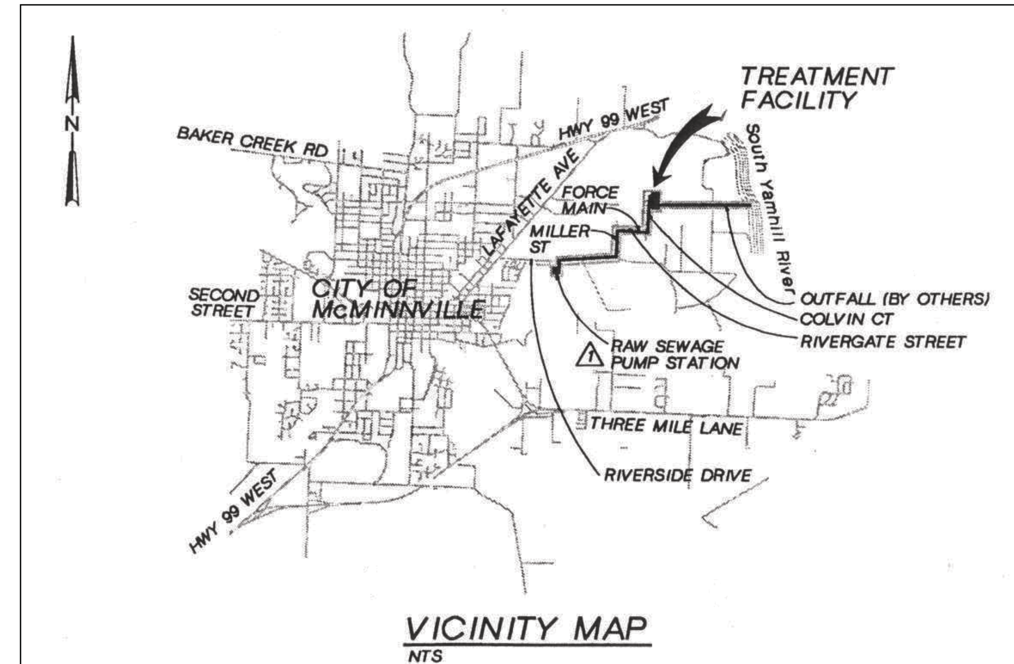
Total Maximum Daily Loads

A phosphorus TMDL analysis was completed for the Yamhill River in the early 1990s. This analysis led to the phosphorus effluent limits currently listed in the City's NPDES permit. The upcoming Yamhill Sub-Basin TMDL analysis, which includes the North, South, and mainstream Yamhill rivers, is scheduled to be completed in 2010. Pollutants that are currently scheduled to be addressed include dissolved oxygen, temperature, bacteria, pesticides, iron, manganese, and chlorophyll-a. The pesticide concern currently is limited to West Fork Palmer Creek, and thus is not an issue for the City. The iron and manganese concentrations are thought to be a result of natural conditions and should also not be a substantial issue for the City. Manganese and bacteria are not listed for the South Yamhill River. Thus, the upcoming dissolved oxygen and temperature TMDLs appear to be most relevant to the City at this time.

Table ES-4. Summary of WRF Design Flows and Loads after Collection System Rehabilitation

Description	Existing	Buildout
Wastewater Flows:		
Average Dry Weather Flow (ADWF), mgd	3.3	6.1
Average Wet Weather Flow (AWWF), mgd	7.2	12
Maximum Month Dry Weather Flow (MMDWF), mgd	6.1	11
Maximum Month Wet Weather Flow (MMWWF), mgd	12	20
Peak Hour Flow (PHF), mgd	32	32
Wastewater Loads:		
BOD Loads		
Average annual, ppd	6,100	11,500
Maximum month, ppd	8,200	15,500
Peak Day, ppd	16,800	31,700
TSS Loads		
Average annual, ppd	7,600	14,400
Maximum month, ppd	11,300	21,300
Peak Day, ppd	33,600	63,500
Ammonia Loads		
Average annual, ppd	490	930
Maximum month, ppd	760	1,440
Peak Day, ppd	1,190	2,250
Total Phosphorus Loads		
Average annual, ppd	180	340
Maximum month, ppd	270	510
Peak Day, ppd	450	850





NOTES:

1. HEADWORKS BUILDING CONTAINS:
   - CHEMICAL FEED / STORAGE SYSTEM
   - INFLUENT SCREENS
   - ATAD TRANSFER PUMPS
   - GRIT HANDLING
   - SEPTAGE RECEIVING
   - TS TRANSFER PUMPS
   - GBT(S)
   - BIOSOLIDS PUMPS
   - PLANT DRAIN PUMP STATION
   - AERATION BASIN SPLITTER BOX

Figure ES-4

McMinnville Water Reclamation Facility

EXISTING SITE PLAN AND PLANT LAYOUT

WEST YOST ASSOCIATES
Consulting Engineers

Toxics

The DEQ has developed an Internal Management Directive "Reasonable Potential Analysis for Toxic Pollutants" (September 2005). This Directive outlines the procedures to be used by permit writers to establish if there is a reasonable potential for a discharge to cause or contribute to an exceedance of water quality criteria in the receiving stream, and if so, how to establish effluent limitations for that pollutant.

The Reasonable Potential Analysis (RPA) for aquatic life criteria has been completed for the WRF effluent for metals and cyanide, and the analysis indicates that there is not a reasonable potential for any metal or cyanide to cause an exceedance of aquatic life criteria in the receiving water. A similar result is obtained for human health criteria, except for arsenic. This is not an unexpected result, due to the very low arsenic human health criteria. The analysis is based on data from June 2004 through June 2008. Following a procedure provided by the RPA Directive, it was concluded that the WRF effluent is not a significant contributor of arsenic, and therefore an effluent limitation is not required for arsenic based on human health criteria.

The human health RPA was not conducted for any toxic organic compounds. The city has analyzed three samples for toxic organics, using EPA methods 608, 624, and 625. Results for all compounds in all three samples were non-detect.

Treatment Requirements

Future treatment requirements are expected to mirror the limits set forth in the WRF's current NPDES permit, with the following exceptions:

- Phosphorus. Effluent phosphorus limits may change based on the results of the upcoming TMDL. There may be an opportunity for the City to negotiate a modification to the NPDES permit such that effluent limits are based on ortho-phosphorus rather than total phosphorus.
- Temperature. The upcoming TMDL will likely result in a modification of the WRF's thermal discharge allocation.

Liquid Stream Treatment Alternatives

A key consideration in establishing liquid stream treatment alternatives is recognizing that the future holds many uncertainties. Coping with unknown conditions can be challenging; however, a flexible plan will allow the City to respond to uncertainty. Accordingly, the approach to developing liquid stream treatment alternatives included the following steps:

1. Identify requirements and criteria that could apply to the future design, operation, and maintenance of the WRF.
2. Develop wastewater management strategies that would accommodate the range of criteria identified.
3. Select management strategies that would be consistent with the following objectives:

- meet the requirements of the most likely criteria
- preferably have the lowest initial costs
- result in little or no stranded expense should requirements change in the future
- be adaptable to meet other potential requirements if and when they apply.

4. Develop and evaluate alternatives for upgrading specific treatment processes, consistent with the selected wastewater management strategies.

Wastewater Management Strategy Evaluation Criteria

Over 20 criteria were developed for use in evaluating wastewater management strategies:

- Regulatory
    - Thermal limits
    - Nutrient limits
    - Mass discharge limits
    - Mixing zone
    - Toxics
    - Metals
    - Silver
    - Turbidity
    - Mercury
    - Persistent bioaccumulative and toxic pollutants (PBTs)
- Wet weather
    - Sanitary sewer overflows
    - Blending policy
    - Bacteria standard compliance
- O&M considerations
    - Increased loading
    - Performance
    - Operational flexibility
    - Reliability
    - Maintainability
    - Odors

    - Environmental

- Implementation

Wastewater Management Strategies

Wastewater management strategies were developed and evaluated through application of the above criteria.

Dry Weather Strategies. Strategies intended to address dry weather issues consisted of the following:

DW1. Expand Existing Facilities

DW2. Membrane Treatment

DW3. Dry Weather Reuse

DW4. Zero Discharge

DW5. Subsurface Discharge

DW6. Effluent Cooling

DW7. River Temperature Mitigation

DW8. Constructed Wetlands

Wet Weather Strategies. Management strategies which would address wet weather concerns included:

WW1. Expand WRF

WW2. Collection System Improvements

WW3. Peak Flow Attenuation through Storage

WW4. Satellite Treatment Facilities

WW5. Peak Flow Treatment Facilities at WRF

Recommended Management Strategies.

Through the application of the evaluation criteria and subsequent assessment, the following management strategies were selected:

- DW1. Expand Existing Facilities. The capacity of the existing treatment facilities would be expanded through construction of similar facilities (Figure ES-5).
- WW2. Collection System Improvements. Collection system rehabilitation would remove infiltration and inflow such that the peak hour flow would be reduced to 32 mgd, which is the current nominal hydraulic capacity of the WRF (Figure ES-6).

Figure ES-5. Dry Weather Alternative Management Strategy: Expansion of Existing Facilities

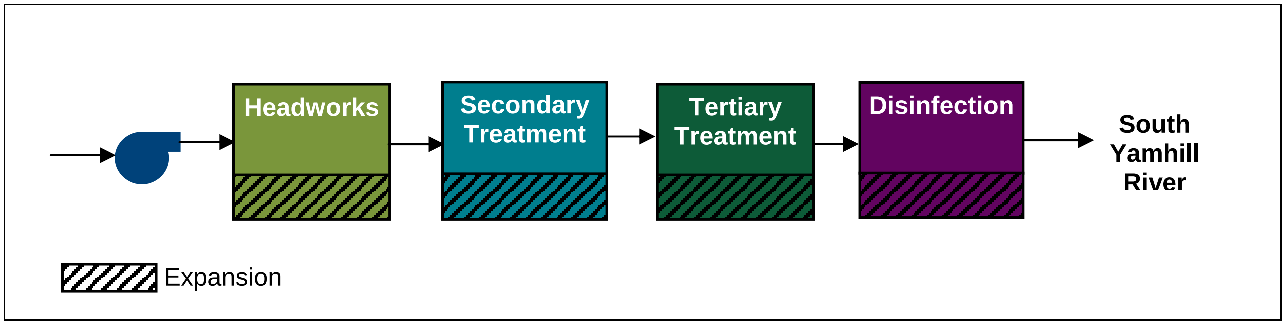
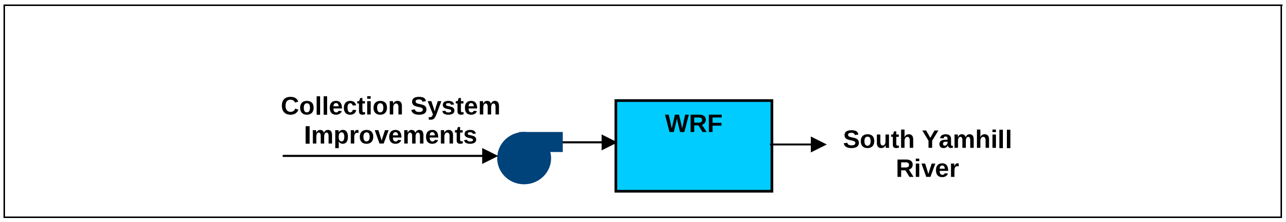


Figure ES-6. Wet Weather Alternative Management Strategy: Collection System Improvements



Collectively, the selected wastewater management strategies conform to the stated objectives as follows:

- *Meet the requirements of the most likely criteria*. The most likely future requirements are those that are in existence today. The selected management strategies meet current needs, and minimize investment in facilities to accommodate potential future requirements.
- *Have the lowest initial costs*. These strategies best utilize the existing capacities of the conveyance system and WRF, minimizing the need for construction of new facilities. A cost effectiveness analysis performed as part of the *Conveyance System Master Plan* concluded that collection system rehabilitation to reduce peak flows would be less costly than conveying and treating high peak flows.
- *Result in little or no unnecessary expense should requirements change in the future*. The selected management strategies represent "basic" programs that, in terms of treatment performance, generally meet only current requirements. Additional performance can be attained by adding facilities to these basic programs.
- *Be adaptable to meet other potential requirements if and when they apply*. Flexibility is a key element of the overall plan. Should requirements change in the future, the management strategies should be reviewed and reconsidered as necessary to set a new course for the wastewater program.

Liquid Stream Alternatives

With the selection of overall wastewater management strategies, alternatives for upgrading each specific treatment process were developed and evaluated.

Preliminary Treatment Alternatives. Preliminary treatment facilities consist of the following:

- Prescreening. The existing mechanically raked bar screen upstream of the raw sewage pump station has adequate capacity to screen the projected buildout peak hour flow of 32 mgd. Therefore, no upgrades are required.
- Raw Sewage Pump Station. The capacity of the Raw Sewage Pump Station exceeds the anticipated peak hour flow, so no capacity enhancements are required.
- Influent screens. While the influent screens have adequate capacity to accommodate the buildout peak hour flow, there is no bypass channel available for use in the event a screen fails.
- Grit removal. The existing vortex chamber is rated for a peak flow capacity of 20 mgd, well under the 32-mgd peak hour flow. Additional grit removal capacity is required.

The following alternatives were evaluated:

- Alternative 1. Construct a third screen channel.
- Alternative 2. Construct a bypass channel.
- Alternative 3. Install an automatic screen lifting system.

A second vortex chamber to increase grit removal capacity would be included in each of these alternatives. An economic analysis revealed that Alternative 3 would have the lowest capital and present worth costs.

Secondary Treatment Alternatives. Major secondary treatment facilities consist of the Orbal aeration basins, secondary clarifiers, and return activated sludge (RAS) pumping system. A secondary treatment process capacity analysis concluded that the existing facilities have inadequate capacity for projected buildout conditions. Consequently, the following alternatives for increasing the capacity of the secondary treatment process were developed and evaluated:

- Alternative 1. Construct third secondary treatment train
- Alternative 2. Construct third Orbal and wet weather upgrades to the existing Orbals

Because Alternative 2 avoids construction of a third secondary clarifier, its cost is lower. However, a third secondary clarifier may be needed to meet performance requirements, and would be necessary if regulatory changes eliminate the ability to perform blended treatment.

Tertiary Treatment Alternatives. Tertiary treatment facilities include the tertiary clarifiers, filters, and chemical sludge pumping system. An evaluation of tertiary treatment process capacity revealed that additional filtration capacity is required. Therefore, three alternatives to enhancing the tertiary treatment process were considered:

- Alternative 1. Expand existing tertiary facilities
- Alternative 2. Construct parallel membrane filtration system
- Alternative 3. Replace existing facilities with membrane filtration system

The high capital and operating costs of membrane filtration systems resulted in Alternative 1 being the lowest cost option.

Disinfection Alternatives. The existing UV disinfection system has adequate capacity to treat the projected buildout peak hour flow. Therefore, no expansion is required. Disinfection equipment should be replaced over time as its useful life is reached.

Solids Management Alternatives

Solids that are produced as part of the wastewater treatment process must be treated and reused or disposed of in an environmentally and economically acceptable manner. The WRF's solids management program historically has been very effective. Therefore, solids management strategies are based on providing a level of treatment to continue to produce Class A biosolids.

<u>Solids Management Strategy Evaluation Criteria.</u>

The following criteria were developed for use in evaluating solids management strategies:

- Regulatory
- Agricultural Practices
- Public Acceptance
- Odor
- Energy and Fuel Cost
- Ease of Operation and Maintenance
- Volatile Solids Reduction/Stabilization
- Increased Sustainability Requirements
- Flexibility in End Use
- Implementation

<u>Solids Management Strategies.</u>

Solids management strategies were developed and evaluated on the basis of the above criteria. Five strategies were evaluated and were classified into two general approaches:

- SM1. Continue with ATAD treatment of all sludge
- SM2. Continue ATAD treatment of sludge to the capacity of the existing process. Construct a parallel process for treatment of sludge quantities that exceed the capacity of the ATAD process.

Recommended Solids Management Strategy.

Through the application of the evaluation criteria and present worth evaluation and assessment, the management strategy SM2: ATAD Treatment and Dewatering and Stabilization was selected. This strategy consists of continued use of the ATAD process up to the capacity of the existing process and constructing a parallel process that includes dewatering, sludge stabilization and storage for treatment of additional sludge volume (Figure ES-7).

Collectively, the selected solids management strategy conforms to the stated objectives as follows:

- *Continues to provide Class A biosolids.* The selected management strategy retains the existing ATAD process and adds a parallel treatment train with a stabilization process that also will produce Class A biosolids. A Class A product maximizes the City's beneficial reuse opportunities.
- *Has the lowest cost.* The selected strategy best utilizes the existing capacity of the solids processing facilities at the WRF. A present worth cost evaluation concluded that the cost of a second treatment technology operating parallel to the ATAD process has lower initial costs and equivalent or lower present worth costs than expanding the ATAD process.
- *Be adaptable to meet changing beneficial end uses.* The selected strategy provides flexibility for adapting to changes in available options for the end use of the biosolids by providing the ability to produce a dewatered product in addition to or instead of liquid.

Solids Treatment Alternatives.

With the selection of overall wastewater management strategies, alternatives for upgrading each specific treatment process were developed and evaluated.

Sludge Thickening. The existing gravity thickeners and associated pumping and storage facilities have sufficient capacity to handle projected solids quantities. Therefore, no expansion of the thickening process is required.

ATAD Digestion. The ATAD digestion process will be used to its available capacity. Improved aeration equipment will be installed to enhance performance and increase capacity.

Sludge Dewatering. The parallel solids processing process would include dewatering prior to sludge stabilization. Flexibility should be built into the process so that digested and stored liquid biosolids could also be dewatered. An evaluation of dewatering technology including pilot testing should be considered.

Dewatered Sludge Stabilization. Sludge stabilization processes that provide a Class A product were evaluated. These processes included thermal drying, lime stabilization and composting. Each of the processes offer advantages in capital cost, operational cost, or characteristics of the final product. A more detailed process evaluation should be performed in a predesign phase.

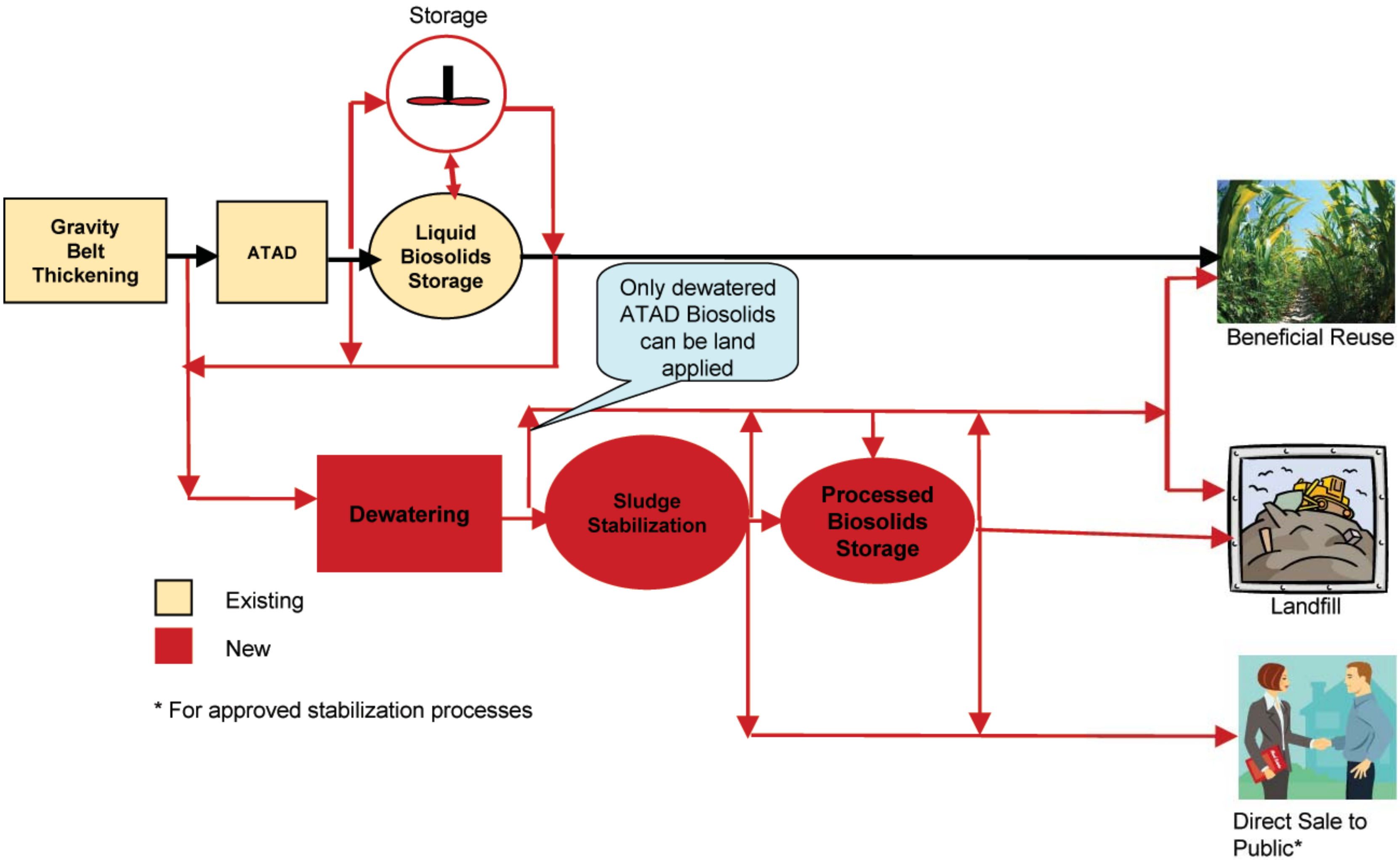


Figure ES-7

McMinnville Water Reclamation Facility

RECOMMENDED SOLIDS MANAGEMENT STRATEGY

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Liquid Biosolids and Dewatered/Stabilized Biosolids Storage. Currently, liquid biosolids storage is only adequate with significant decanting back to the secondary process. A new 1 million gallon biosolids storage tank will extend liquid storage capacity. Mixing will be provided in the new tank to provide a homogenous product for reuse. The balance of the required storage capacity will be provided for dewatered/stabilized biosolids. The capacity and configuration of the storage area will depend on the selected biosolids process.

Odor Control. The biofilter should be expanded to provide odor control for new biosolids processing areas.

Water Reclamation

The City has developed several short-term and long-term reuse goals to address wastewater treatment and community needs. The short-term goals are to:

- Promote public acceptance of reuse through public awareness programs.
- Establish proof of community benefits of reuse through demonstration projects.
- Reduce level of treatment of some wastewater as appropriate for the type of use.

The long-term goals are to:

- Apply reuse technologies to accommodate community growth without increasing the level of WRF treatment to meet permit load limits.
- Incorporate reuse programs to reduce potable water demand.
- Develop and implement reuse systems to address new TMDL standards.

The following circumstances could trigger additional consideration of reuse options:

- Reuse could reduce the cost of WRF upgrades by reducing the required level of effluent treatment.
- More stringent thermal load limitations.
- Iron, mercury, or other limitations are added to the WRF's permit.

<u>Potential Reuse Opportunities</u>

Reuse opportunities investigated as part of the facilities planning process are summarized below.

Land Application. Land application is a potentially viable reuse option for the WRF because a significant amount of agricultural land is nearby. In addition, the prevalent soil types are productive for irrigated agriculture. Many nearby water rights holders use river water for irrigation. The river water could be replaced or supplemented with reclaimed water, providing the double benefit of preserving river flow and reusing effluent. Without storage, approximately 1,000 acres of grass land would be needed to accommodate the current dry season flow of 3.3 mgd. By comparison, the buildout ADWF of 6.1 mgd would require approximately 1,900 acres of grass land without storage.

Treatment Wetlands. Wetlands provide a combination of reuse and treatment. They naturally affect many aspects of water quality. Because they are considered treatment processes, they are regulated. During the dry season, wetlands can consume as much as 36 inches/acre of effluent, more than double that of conventional crops. Wetlands can cool effluent, and remove some metals and ammonia. Based on wetlands temperature modeling done for treatment wetlands in the Willamette Valley, it is estimated that a wetlands designed for effluent cooling of 3.3 mgd would have a footprint of about 18 acres.

Hyporheic Discharge. Hyporheic discharge (indirect discharge to surface water) in combination with high-rate land application or permeable wetlands can significantly reduce the number of acres needed for the reuse site. Hyporheic discharge systems also perform well as diffusers, with effluent distributed over a large segment of the river. Evaporation from the surface where the water is applied, such as in a permeable wetland or a high-rate irrigation system, can also provide cooling. The City appears to be in a good position to implement this approach because: (1) it owns nearby property that could be used for this purpose, and (2) the property does not contain drinking water wells that could be potentially impacted by hyporheic discharge. Lastly, the local soils appear to be well suited to hyporheic discharge.

Industrial Reuse. The cost of potable water produced by McMinnville Water & Light is relatively low, and consequently does not provide a large financial incentive for industrial user to switch to reclaimed water. Industrial reuse has been previously investigated and potential customers identified. Discussions with these potential customers could be undertaken to further assess interest.

Water Reclamation Facility Recommended Plan

The recommended facilities are sized to accommodate the City's wastewater needs through buildout conditions. Recommended improvements for dry weather are based on expanding capacity through construction of facilities similar to existing. Collection system rehabilitation will reduce peak flows and, correspondingly, the cost of new wet weather treatment facilities. A site plan showing the recommended facilities is provided as Figure ES-8.

Liquid Stream Facilities

Major recommended liquid stream facilities include the following:

- Screen lifting system which allows the screens to be removed from the influent channel in the event of mechanical failure
- New vortex grit chamber to increase grit removal capacity
- New Orbal oxidation ditch
- Upgrades to the existing Orbal oxidation ditches to allow operation in contact/stabilization mode
- New secondary clarifier and return activated sludge pump station
- Expansion of filtration system

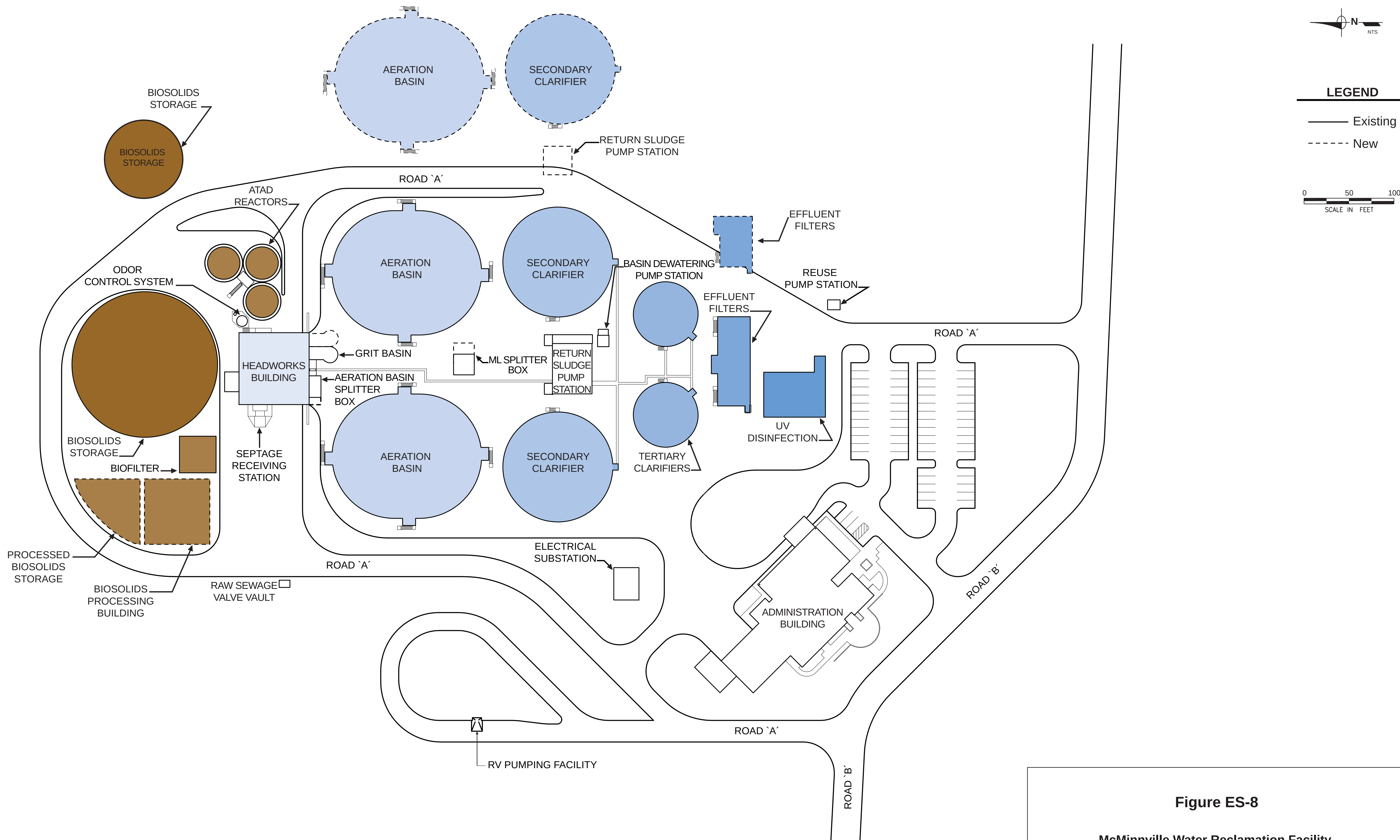

Figure ES-8

McMinnville Water Reclamation Facility

SITE PLAN AND PLANT LAYOUT

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Consulting Engineers

Solids Management Facilities

Major recommended solids management facilities include the following:

- New liquid biosolids storage tank
- New dewatering process
- New stabilization process
- Expand odor control facilities

Other Facilities

The most significant recommended support facility change is the expansion and improvements to the administration building. The existing administration building has reached its design occupant capacity.

Estimated Capital Costs

The estimated capital costs for buildout facilities are listed in Table ES-5.

Table ES-5. Capital Costs for the WRF Recommended Plan

Item	Capital Cost, 2008$ ($1,000)
Liquid Stream	
Screen modifications	150
Grit system expansion	2,000
Orbal No. 3	7,000
Orbal Nos. 1 and 2 Contact Stabilization modifications	366
Clarifier No. 3 and RAS pumping expansion	6,600
Filtration system expansion	2,200
Solids Management	
1 MG storage tank and mixer	4,300
Dewatering (based on centrifuge dewatering, 1 unit)	5,700
Stabilization (based on thermal drying, 1 unit)	9,400
Stabilized Biosolids Storage	700
Odor Control	250
Total	38,700

IMPLEMENTATION PLAN

The implementation plan provided as Table ES-6 includes both conveyance and treatment system improvements. The timing of improvements is typically based on one or more of the following generalized factors:

- Need for additional capacity
- Need for performance improvements
- Available financial resources

For some projects, the City has significant flexibility in implementation timing. Conversely, other projects have relatively well defined drivers:

- *Third orbal.* Construction of the third Orbal will be driven by increased loading from residential, commercial, and industrial growth.
- *Third secondary clarifier.* Higher sustained flow rates will increase the demands on the existing clarifiers. In addition, if regulatory changes eliminate blending as a treatment option, the third secondary clarifier will have to be constructed earlier than planned.
- Filtration system expansion. As dry weather flows increase in response to growth, the existing filtration system will approach its capacity.
- *Biosolids processing.* The ATADs are at their rated capacity based on detention time design criteria. New aerators have improved the performance of the process allowing their capacity to be extended. However, increased solids production as a result of increasing loads will continue to stress the process.
- *Biosolids storage.* The existing storage capacity is adequate only with decanting back to the secondary process. If high plant flows or process capacity limit the volume of decanting during the wet weather season, additional storage will be needed to meet current biosolids storage needs.

A number of uncertainties exist which could substantially affect the City's approach to long-term wastewater and solids management. Therefore, as important regulatory, loading, and flow uncertainties become resolved, the City should revisit the potential management strategies presented in Chapters 7 and 8 to see if significant plan modifications are warranted.

Table ES-6. Implementation Plan

Item	Fiscal Year															Totals
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	19-20	20-21	21-22	22-23	
	ADWF Flow, mgd															
	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.7	4.9	5.1	5.3	5.5	5.7	5.9	6.1	
	Annual Average BOD Load, ppd															
	6,100	6,486	6,871	7,257	7,643	8,029	8,414	8,800	9,186	9,571	9,957	10,343	10,729	11,114	11,500	
Collection System																
Michelbook Basin Pipelines		$634,000														$634,000
10th Street Pipeline	$75,000															$75,000
Existing Rehabilitation	$1,000,000	$2,000,000	$2,500,000	$2,500,000												$8,000,000
Buildout Rehabilitation					$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$8,690,000
WRF - Liquids																
Headworks - Screen modifications							$30,000	$60,000	$60,000							$150,000
Headworks - Grit system expansion							$400,000	$800,000	$800,000							$2,000,000
Secondary Treatment - Orbal No. 3				$1,400,000	$2,800,000	$2,800,000										$7,000,000
Secondary Treatment - Orbal Nos. 1 and 2 CS Mods							$366,000									$366,000
Secondary Treatment - Clarifier No. 3 + RAS pumping expansion												$1,320,000	$2,640,000	$2,640,000		$6,600,000
Tertiary Treatment - Filtration system expansion			$400,000	$900,000	$900,000											$2,200,000
Administration Building										$1,250,000	$1,250,000					$2,500,000
WRF - Solids																
New 1 MG Storage Tank and Mixer		$900,000	$1,700,000	$1,700,000												$4,300,000
Dewatering Process (Equipment and Building)						$1,100,000	$2,300,000	$2,300,000								$5,700,000
Dryer													$1,800,000	$3,800,000	$3,800,000	$9,400,000
Dry Biosolids Storage						$100,000	$300,000	$300,000								$700,000
Odor Contol						$50,000	$100,000	$100,000								$250,000
Investigation and Consultant Services																
Flow monitoring																$0
Model updates																$0
Totals	$1,075,000	$3,534,000	$4,600,000	$6,500,000	$4,490,000	$4,840,000	$4,286,000	$4,350,000	$1,650,000	$2,040,000	$2,040,000	$2,110,000	$5,230,000	$7,230,000	$4,590,000	$58,565,000