COMMUNITY DEVELOPMENT

APPEAL APPLICATION – BOARD OF COUNTY COMMISSIONERS

FEE: $5,482.60

EVERY NOTICE OF APPEAL SHALL INCLUDE:

1. A statement describing the specific reasons for the appeal.
2. If the Board of County Commissioners is the Hearings Body, a request for review by the Board stating the reasons the Board should review the lower decision.
3. If the Board of County Commissioners is the Hearings Body and *de novo* review is desired, a request for *de novo* review by the Board, stating the reasons the Board should provide the *de novo* review as provided in Section 22.32.027 of Title 22.
4. If color exhibits are submitted, black and white copies with captions or shading delineating the color areas shall also be provided.

It is the responsibility of the appellant to complete a Notice of Appeal as set forth in Chapter 22.32 of the County Code. The Notice of Appeal on the reverse side of this form must include the items listed above. Failure to complete all of the above may render an appeal invalid. Any additional comments should be included on the Notice of Appeal.

Staff cannot advise a potential appellant as to whether the appellant is eligible to file an appeal (DCC Section 22.32.010) or whether an appeal is valid. Appellants should seek their own legal advice concerning those issues.

Appellant's Name (print): Steven Liday on behalf of Doug and Braedi Kolberg Phone: (503) 205-2362

Mailing Address: 111 SW 5th Avenue, Suite 3400 City/State/Zip: Portland, OR 97204

Email Address: steven.liday@millernash.com

Land Use Application Being Appealed: 23-152-AD

Property Description: Township 14S Range 13E Section 30 Tax Lot 101; others listed in appeal statement

Appellant's Signature: [signature] Date: August 18, 2023

By signing this application and paying the appeal deposit, the appellant understands and agrees that Deschutes County is collecting a deposit for hearing services, including "whether to hear" proceedings. The appellant will be responsible for the actual costs of these services. The amount of any refund or additional payment will depend upon the actual costs incurred by the county in reviewing the appeal.

Except as provided in section 22.32.024, appellant shall provide a complete transcript of any hearing appealed, from recordings provided by the Planning Division upon request (there is a $5.00 fee for each recording copy). Appellant shall submit the transcript to the planning division no later than the close of

the day five (5) days prior to the date set for the *de novo* hearing or, for on-the-record appeals, the date set for receipt of written records.

NOTICE OF APPEAL

See Appeal Statement below.

Pursuant to DCC 22.32.024(D), appellants request that the County waive the requirement that they provide a transcript for the June 20, 2023, hearing on the application.

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Request for Review by Board of County Commissioners

Appeal of hearings officer's approval of
Application for Major Administrative Determination,
File No. 23-152-AD
5801 NW Way, Redmond, Oregon 97756
Tax Lots: 1413300000101, 1413000002604, 1413290000201

I. Overview of Application and Decision

The City of Redmond (the "City") has decided to close its wastewater treatment facilities within its city limits and pump the raw sewage produced by its citizens to a new complex located outside its urban growth boundary (UGB) on exclusive farm use (EFU) land, which will also require the expansion of a conveyance pipe between the city and EFU property. The City proposes to relocate all of its wastewater division operations to this EFU site, including administrative offices, vehicle/equipment parking, and maintenance shops, which it claims are utility facilities that can be sited on EFU land. The City has also repeatedly stated that it will open this site as a public park.

On February 28, 2023, the City submitted applications for a conditional use permit, site review, lot of record verification, and major administrative determination. Remarkably, the new $60-million-plus wastewater treatment and operations complex was only addressed in the request for an administrative decision.

On August 8, 2023, all applications were approved in a decision by the Deschutes County Hearings Officer (the "Decision"). This appeal concerns only the approval of the application for an administrative determination for the new wastewater treatment and operations facility at 5801 NW Way, Redmond, Oregon 97756 ("Application").

II. Reasons the Board of County Commissioners Should Review the Decision

There are several reasons for the Board of County Commissioners (the "Board") to review the Decision:

- **Size and impact of development.** The Application proposes a new wastewater treatment system covering more than 1,000 acres, as well as the relocation of all operations of the City's wastewater division to EFU land outside the City's UGB. This development will have a significant impact on the surrounding rural community.

- **Important policy concerns.** The appeal raises several important policy questions that should be answered by the County's governing body, including:

    - ***Preemption of local code:*** The Decision states that the County's site plan review code is preempted by ORS 215.283, even though that statute concerns only the *uses* allowed on EFU land, not the *design* of the development. This conclusion turns ORS 215.283 on its head: instead of a list of limited exceptions to the strict protection of farm use land, the statute is converted into a preference for development on EFU land. The County's governing body should decide if its code is preempted in this manner.

    - ***Preferential treatment for projects by municipal bodies:*** Throughout the Decision, the hearings officer expressly defers to representations by the City, repeatedly stating that it is not the job of a hearings officer to "second guess" the statements of City staff. There is no discussion of the burden of proof that applies to all other applicants. The Board should decide if this preferential treatment for a municipal body is consistent with the County's code.

    - ***The applicable standards for protection of county farmland:*** The Decision adopts a low standard for siting utility facilities on EFU land, finding that the requirement of infeasibility is satisfied by showing that it is more convenient or efficient to site the facility on EFU land. This application of the standard will encourage additional proposals for utility facilities on farm use land.

- **The Decision will almost certainly be reversed by the Oregon Land Use Board of Appeals (LUBA).** As a result of the inappropriate deference to the City representations, the Decision contains multiple errors that are independent grounds for reversal by LUBA on appeal, including:

    - Most of the components of the proposed wastewater treatment and operations complex cannot be sited on the City's property under state-law restrictions because their construction on EFU land is not necessary for provision of the services. This fact is unequivocally set out in the City's own project feasibility report and 2020 wastewater facility plan amendment.

    - The proposed "future disposal wetlands" are not only unnecessary—as clearly stated in the City's 2020 reports, and thus ineligible for construction on EFU land—but also not a legitimate part of the application at issue.

    - The County's site plan review code is not preempted by state law, and the proposed utility facilities can be allowed without site plan approval.

- The planned recreational facilities that are clearly shown in the Application site plans should not have been approved without approval of a conditional use permit.

Foregoing local review—thus, sending the appeal directly to LUBA—will harm all parties involved. Not only will the City, County, and appellants be forced to expend significant financial resources on legal fees, but review of the Decision by LUBA will take significantly longer than a decision by the Board. The City has stated that expansion of its wastewater treatment facilities is time sensitive. Correcting the Decision to approve only the necessary lagoons and treatment wetlands would avoid a delay in the City's expansion of its wastewater treatment capacity.

For all the reasons above, appellants respectfully request that the Board elect to review the Decision.

4870-3576-5625.2

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Appeal Statement

Appeal by Doug and Braedi Kolberg
of
Approval of Application for Major Administrative Determination,
File No. 23-152-AD
5801 NW Way, Redmond, Oregon 97756
Tax Lots: 1413300000101, 1413000002604, 1413290000201

I. Introduction

The City of Redmond (the "City") has decided to close its wastewater treatment facilities within its city limits and pump the raw sewage produced by its citizens to a new complex located outside its urban growth boundary (UGB) on exclusive farm use (EFU) land. The City also proposes to relocate all of its wastewater division operations to this EFU site, including administrative offices, vehicle/equipment parking, and maintenance shops, which it claims are utility facilities that can be sited on EFU land. The City has also repeatedly stated that it will open this site as a public park, and even obtained a $750,000 grant from the state to do so.

Despite the obvious impacts of this expansive development on nearby residents—including appellants—the City proposed no design features, mitigation measures, or even advance planning to ameliorate the harm to the surrounding community. Moreover, the City claims that Deschutes County (the "County") has no authority to review the design of this wastewater treatment, operations, and public park complex, even though the County code states that these facilities are subject to site plan review and conditional use approval. The City argues that site plan review is preempted by state law and that it can build the park facilities without conditional use review so long as it seeks that permit before opening the site to the public.

The City is wrong, both in its lack of consideration of surrounding residents and in its arguments concerning the applicable code and state law. As set out below:

- Most of the components of the proposed wastewater treatment and operations complex cannot be sited on the City's property under state-law restrictions because their construction on EFU land is not necessary for provision of the sewer services. This fact is unequivocally set out in the City's own project feasibility report and 2020 wastewater facility plan amendment.
- The proposed "future disposal wetlands" are not only unnecessary—as clearly stated in the City's 2020 reports, and thus ineligible for construction on EFU land—but also not a legitimate part of the application at issue.

- The County's site plan review code is not preempted by state law and the proposed utility facilities can be allowed without site plan approval.
- The planned recreational facilities—clearly shown in the site plans—should not have been approved without approval of a conditional use permit.

The August 8, 2023, decision approving the proposed wastewater treatment and operations complex (the "Decision") did not critically examine any of the above issues, but instead repeatedly deferred to the City as though it is the decision-maker for this land use application—finding criteria met because the City had provided some form of explanation, which it found to be not patently unreasonable.

That, however, is not the applicable standard. As set out below, the City does not come close to proving compliance with applicable code criteria and state-law standards. Accordingly, the Decision should be reversed and the City's application denied.

II. Overview of Project and Application

The City seeks to shut down its wastewater treatment facilities within city limits and relocate all of its wastewater division operations—including treatment facilities, offices/administrative buildings, maintenance buildings, etc.—to the City's property at 5801 Northwest Way (the "Property"). The City intends to replace its existing mechanical treatment plant with lagoons and wastewater treatment wetlands, and thus refers to the major development as the "Redmond Wetlands Project."[1]

The Property is outside the City's UGB and is zoned EFU, Terrebonne (EFUTE). Contrary to the repeated claims by the City, the site is not currently used for treatment of wastewater, but for the storage, application, and disposal of already-treated wastewater and biosolids.[2] The site primarily consists of hay fields used for repurposing of treated water, an irrigation pond, and a few structures for biosolid drying and disposal. Nearby, on land owned by the Bureau of Land Management (BLM), is an infiltration gallery that the City uses to dispose of treated wastewater.

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[1] Burden of Proof Statement ("Statement"), submitted with the City's applications on February 28, 2023, at 2.

[2] City's website states that the property is currently "used to repurpose and discharge all of Redmond's treated wastewater effluent, and biosolids." https://www.redmondoregon.gov/government/departments/public-works/wastewater-division. This matches the description in the City's wastewater facility plan.

Satellite Image from Deschutes County Property Information (DIAL)

The City outlines the long list of improvements for the Property in its application materials as: "New primary treatment facilities with headworks screening; New aerated lagoon system for secondary treatment; New lined treatment wetlands for effluent polishing; New and expanded unlined wetlands for effluent disposal (on adjacent BLM property; Tax Lot 2600, 14-13-00 and Tax Lot 200, 14-12-00); Maintain existing infiltration gallery; Sloped concrete slab vector dump station; Headworks structure (three-sided structure covering equipment); New operational buildings: Electrical Building, Disinfection Building, Maintenance Building, Division Building."[3]

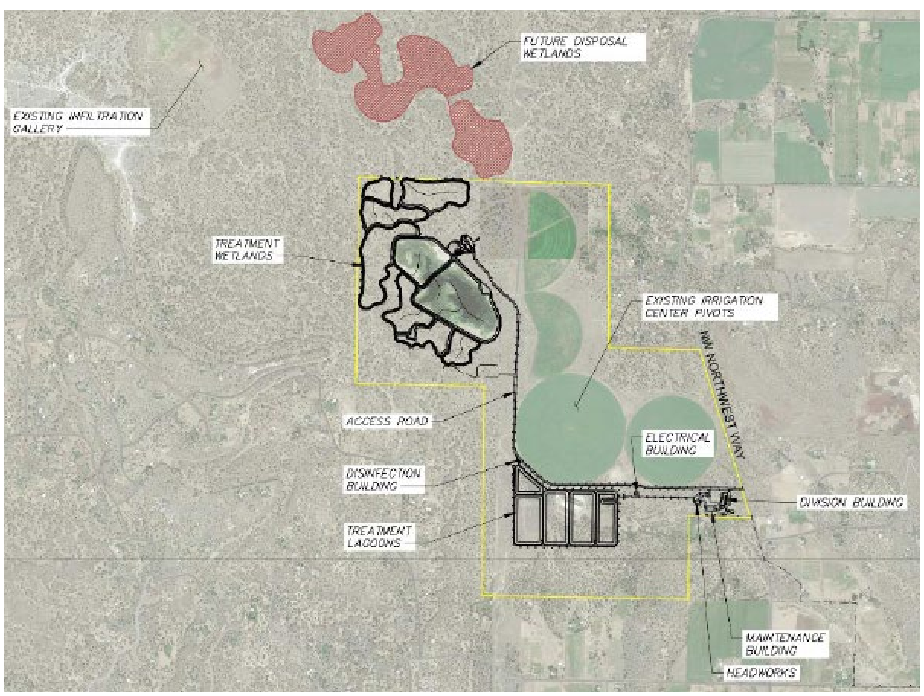

Image from Preliminary Overall Site Plan (Sheet G-G07)

[3] Statement at 16.

Because the sewer system requires the City to pump raw sewage instead of treated wastewater to the Property, the City also proposes to replace a 24-inch-diameter conveyance pipe between the existing facilities and the Property with a pipe twice that size.[4]

From the very outset, the City has also stated that the complex is designed and will be used as a public park with walking paths, trails, bird-viewing areas, and other recreational facilities. These facilities are prominently featured on the official Project website, including photo renderings and maps and of the paths and recreation areas.[5] In fact, the City obtained a $750,000 grant from the Oregon Parks and Recreation Department (OPRD) to help pay for the construction of these recreational facilities.[6]

On February 28, 2023, the City submitted applications for the new treatment and operations complex and the conveyance pipe replacement. Remarkably, the City submitted applications for a conditional use permit, site review, and lot of record verification for the replacement pipe, but only a request for administrative determination for the new $60-million-plus wastewater treatment and operations complex.[7] Despite clear requirements under the County's zoning code, the City did not submit site plan review or conditional use applications for the complex because it claims that the site plan review code is preempted by state law and that it can obtain approval of the park use after the recreational facilities are built.

This appeal challenges only the approval of the wastewater treatment and operations complex on the Property (the "Project"), including approval of the City's application for a Major Administrative Determination (File No. 23-152-AD) (the "Application").[8]

III. Grounds for Reversal of Decision

A. The proposed disposal wetlands, administrative buildings, and treatment headworks cannot be sited on EFU land under state law and local code standards.

Oregon has an "overriding policy of preventing agricultural land from being diverted to nonagricultural use." *Warburton v. Harney Cty.*, 174 Or App 322, 328-29, 25 P3d 978 (2001). Accordingly, utility facilities are only allowed in EFU zones if they are "necessary for public

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[4] Statement at 15.

[5] https://redmondwetlandscomplex.com/expansion-site-design/.

[6] Attachment 3.

[7] Statement at 15-16.

[8] It does not challenge the approval of the three applications for the conveyance pipe (File Nos. 247-23-000149-CU, 23-150-SP, and 23-151-LR).

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service." ORS 215.283(1)(c). This means that a utility facility addresses an "identified need"[9] and the facility "must be sited in an exclusive farm use zone in order to provide the service." ORS 215.275(1).[10]

Under Deschutes County Code (DCC) 22.24.050, the City has the burden to prove that all improvements in the Project satisfy these standards. Except for the lagoons and treatment wetlands, the City did not and cannot do so. The City's own feasibility study and official wastewater facility plan amendment state that the administrative buildings, headworks, and disposal wetlands do not need to be included as part of the Project. As set out below, the City's post hoc, contradictory justifications for siting these facilities on EFU land are patently untenable.

The hearings officer adopted these justifications, however, stating that it was not the job of a hearings officer to "second guess" the explanations provided by City staff.[11] With all due respect, that is exactly the job of the hearings officer,[12] and had he critically evaluated the City's attempts to undermine its own feasibility report and official wastewater treatment plan, he would have found them lacking. Further, the Decision fails to analyze and make findings on the feasibility of siting the various improvements on non-EFU land, i.e., their current location. Instead, the Decision states "I also will defer to the Cities' elected officials on this matter and their determination that other sites were infeasible."[13] As set out below, the City's justifications are untenable and the hearings officer erred by adopting them without critical examination.

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[9] "[O]nce the decision is made to construct a particular kind of utility facility to respond to an identified need, that facility may only be located on EFU-zoned lands if there are no feasible sites for the proposed facility that are not zoned EFU." *Dayton Prairie Water Ass'n v. Yamhill Cty.*, 38 Or LUBA 14, 20 (2000).

[10] Proposed sewer systems in rural land are subject to further state-law restrictions. "Components of a sewer system that serve lands inside an urban growth boundary (UGB) [are allowed to be built outside that boundary if] [s]uch placement is *necessary* to serve [those] lands inside the UGB." OAR 660-011-0060(3) (emphasis added). Further exceptions are provided for components that are necessary to serve unincorporated communities or Goal 14 exception areas, as well as for components that more efficiently transport wastewater or connect other components. The state-law standards for siting utility facilities and sewer systems within EFU land are set out in sections 18.16.025(E) and 18.16.038 of the Deschutes County Code.

[11] Decision at 9, 10, and 34.

[12] *Oregon Shores Conservation Coal. v. City of North Bend*, 2020 WL 4814312, at *15 (general comments by geotechnical engineers were not substantial evidence sufficient to demonstrate compliance with approval standards); *Palmer v. Lane Cty.*, 1995 WL 1773127, at *5 (same); *Phillips v. Lane Cty.*, 62 Or LUBA 92, 114, 2010 WL 3925421, at *14 (comments by county sanitarian were not sufficient to rebut detailed concerns raised by opponents); *Lenox v. Jackson Cty.*, 54 Or LUBA 272, 280, 2007 WL 1661237, at *5 (letter from expert that did not support conclusions was insufficient to demonstrate compliance with standards).

[13] Decision at 9.

1. Each of the components of the proposed wastewater treatment and operations complex must be evaluated independently for siting on EFU land.

Throughout its application materials, the City treats the entire wastewater treatment and operations complex as an inseparable utility facility, which it argues can be approved for siting on EFU land as a whole.[14] This characterization of the Project and related legal argument are contradicted by the City's own materials and clear state law.

In determining whether utility-related facilities satisfy the above standards for siting utility facilities on EFU land, the local government must evaluate the individual component separately. As LUBA stated in *City of Albany v. Linn Cty.*, 40 Or LUBA 38, 47-48 (2001):

> It is worth noting that the 'utility facility' permitted under ORS 215.213(1)(d) and 215.283(1)(d) may have multiple components that require separate analysis and justification. In *Dayton Prairie* [*Water Ass'n v. Yamhill Cty.*, 38 Or LUBA 14, *aff'd*, 170 Or App 6, 11 P3d 671 (2000)], * * * [w]e held that the county had justified the necessity, i.e., lack of feasible alternatives on non-EFU land, for locating the wells on EFU land, but that the county had not justified the necessity of locating the treatment facility and reservoir on EFU land. * * * In other words, justification for siting one component of a utility facility in an EFU zone does not necessarily justify siting other components in that zone.

The City's own materials unequivocally show that the proposed wastewater treatment and operations complex is composed of distinct and separable improvements. The Project was initiated in 2020 when the City engaged Anderson Perry & Associates, Inc. (APAI), to evaluate options for expanding the City's wastewater treatment capacity. APAI provided its analysis in the 2020 Lagoon and Wetland Treatment and Disposal Feasibility Evaluation (the "Feasibility Report").[15] In this report, APAI studied three feasible options:

- Expanding the existing mechanical treatment plant;
- Constructing new lagoons and treatment wetlands at the Property while continuing to use the headworks and other supporting facilities at the existing site; and

[14] E.g., Statement at 31 ("The proposal is for major structures that are * * * for the transmission and processing of wastewater. All facilities proposed are interconnected components that are designed to serve this end and only this end. All buildings are devoted exclusively to enable the transmission and processing of wastewater. Accordingly, the proposed Redmond Wetlands Complex is a "utility facility" both within the meaning of the statutory term as interpreted by Cox and the County code's definition of the same.")

[15] Lagoon and Wetland Treatment and Disposal Feasibility Evaluation (July 8, 2020); originally attached to Letter from Steven Liday to Haleigh King (June 12, 2023) as Attachment 2. Enclosed with this letter as Attachment 1.

- Constructing new lagoons, treatment wetlands, headworks, offices, and all other facilities at the Property.[16]

APAI expounded on its analysis of these options in the 2020 Wastewater Facility Plan Amendment (the "2020 WFP Amendment")[17] that it prepared for the City later that year. Based on this "extensive alternatives analysis,"[18] APAI founds that constructing only the lagoons and wetlands at the Property, while continuing to use the existing headworks, offices, and other support facilities at the current plant, was the least expensive option, both in initial capital costs and total costs over a 20-year life cycle.[19] Moreover, the estimated capital costs for the proposed Project, i.e., relocating all of the wastewater division's operations to the Property, has nearly doubled from $41.6 million in 2020 to $69.7 million in 2023.[20]

Thus, not only is it feasible to separate the headworks and other improvements from the lagoons and wetlands, but it is much less expensive to do so.

2. Office space is not a utility facility that can be sited on EFU land—and even if it was, the City has not shown that its administrative buildings must be sited on EFU land.

Despite the clear analysis in the Feasibility Report and 2020 WFP Amendment, the City claims that it must site its administrative building near the treatment wetlands for three reasons: (i) efficiency, (ii) need for monitoring of the treatment facilities, and (iii) wastewater testing logistics. Each fail to rebut the unequivocal findings in the Feasibility Report and wastewater treatment plan.

a. Efficiency.

During the June 20, 2023, hearing and in a letter submitted the same day, City staff argued that the office and administrative buildings proposed in the Project must be sited on EFU land for efficiency purposes. This purported efficiency, however, is irrelevant. Rather, the City must demonstrate that it is "infeasible" to site the proposed facilities in non-EFU land. *Harshman v. Jackson Cty.*, 41 Or LUBA 330, 335 (2002) (holding that "an applicant who wishes to site a utility facility on EFU-zoned land must show that it is infeasible to locate the facility on land that

[16] Feasibility Report at 8.

[17] 2020 Wastewater Facility Plan Amendment for City of Redmond, Oregon (Dec. 17, 2020); originally attached to Letter from Steven Liday to Haleigh King (June 12, 2023) as Attachment 3. Enclosed with this letter as Attachment 2.

[18] 2020 WFP Amendment at 4.

[19] Feasibility Report at 8.

[20] City Budget for fiscal year 2022-2023 at 50; available at: https://www.redmondoregon.gov/home/showpublisheddocument/23849/637986674979200000.

is not zoned EFU[,] * * * [and] it is quite clear that a finding that the proposed site is the best of the available sites is inadequate.").

As described, the City's comprehensive expert analysis concluded that it is not only feasible to provide the wastewater treatment services at issue with only the lagoon and treatment wetlands located at the Property, but that such an arrangement would be less expensive.

b. Facility Monitoring.

The City also claims that it must site its administrative buildings at the Property to monitor the wastewater treatment facilities.[21] The wastewater division manager argued that "without staff on site to monitor the supervisory control systems and respond with corrective action in real time, operations of the facility would suffer." *Id*. The City also raised concerns with emergency response times.

There are multiple flaws with these claims. First, these justifications presuppose that the headworks and other primary treatment facilities will be located on the Property, which the Feasibility Report and 2020 WFP Amendment state is not necessary. The City does not claim that passive lagoons and treatment wetlands present a need for "real time" maintenance and responses.

Second, the City only provides generic, high-level representations without detailed explanations or specific examples—which, at a minimum, is necessary to refute two comprehensive, official reports prepared by the City's own experts.[22]

Finally, the general references to emergency responses are unpersuasive, considering that outside normal working hours no one is required to be at the treatment facilities anyway. As explained in APAI's post-hearing memo, the City's emergency response plan involves "a variety of alarms *telemetered*, 24-hours/day, to the wastewater treatment plant personnel via *a priority call sequence*.[23] Further, the City fails to even identify the types of emergencies at issue or the consequences that would occur if a division manager needed to drive 2.5 miles (approximately a four-minute drive[24]) from the existing facilities to the Property.

[21] Letter from Ryan Kirchner to Haleigh King (June 20, 2023) at 1.

[22] *Oregon Shores Conservation Coal. v. City of North Bend*, 2020 WL 4814312, at *15 (general comments by geotechnical engineers were not substantial evidence sufficient to demonstrate compliance with approval standards); *Palmer v. Lane Cty.*, 1995 WL 1773127, at *5 (same).

[23] Memo from APAI to Ryan Kirchner (June 26, 2023) at 2 (emphasis added).

[24] According to Google Maps.

Most importantly, the City never claims that it is not feasible to monitor the new facilities on the Property from the existing administrative offices—only that it would be better to have them together. That is not the applicable standard.

c. Time-Sensitive Wastewater Testing.

The City also claims that it is not possible to maintain its current division offices at the existing site because of the need for "time-sensitive analyses for wastewater testing[,]" specifically, "items like pH and Chlorine testing."[25] The wastewater division manager claimed that this challenge is "insurmountable due to wastewater testing protocols – lab testing must be conducted within 15 minutes of taking the sample in the wastewater facilities..."[26]

The City fails to explain, however, how it is has managed to overcome this insurmountable challenge of time-sensitive water testing for the last several decades. Under the City's existing Water Pollution Control Facilities Permit from DEQ, the City is already required to conduct 15-minute testing of pH, chlorine, and coliform for the infiltration basin and irrigation water disposed of at the Property.[27]

Moreover, this justification asks the County to believe that it is impossible, in 2023, to conduct pH and chlorine testing of water without a laboratory on the same site. That is not the case, as demonstrated by the Environmental Protection Agency (EPA) guide, "Water Sensors Toolbox," which outlines in detail how remote sensors can be used for "[m]easuring the use and effectiveness of wastewater and drinking water treatment," including testing for pH and chlorine, among many other pollutants.[28]

Finally, even if a testing laboratory needed to be located on the Property, that does not explain why all the wastewater division buildings also need to located on the site.

3. The City did not and cannot show that it is necessary to relocate the primary wastewater treatment facilities to the Property.

As stated above, APAI concluded, in both the Feasibility Report and 2020 WFP Amendment, that it was not only feasible to continue to use the existing headworks and primary treatment facilities at the existing location, but that it would be less expensive than moving them to the

[25] Letter from Ryan Kirchner to Haleigh King (June 20, 2023) at 1-2.

[26] Letter from Ryan Kirchner to Haleigh King (July 5, 2023) at 2.

[27] 2007 Water Pollution Control Facilities Permit at 4-5, attached to APAI June 27, 2023, memo.

[28] Available at https://www.epa.gov/water-research/water-sensors-toolbox; Although not submitted into the record, government reports and publications are subject to judicial notice. *See, e.g.*, *Oregon Dep't of Fish and Wildlife v. Lake Cty.*, 2020 WL 2306258, at *3 (LUBA Nos 2019-084/085/093 (Apr. 29, 2020) (taking notice of an Oregon Department of Fish and Wildlife publication on big-game habitat); *Shaff v. City of Medford*, 79 Or LUBA 317, 321 (2019) (taking official notice of a United States Centers for Disease Control publication regarding bicyclist deaths).

Property. In fact, in the City's 2018 Wastewater Facility Plan update, the engineering firm Stantec found that the headworks are in "good condition" and "expected to meet the hydraulic capacity of the plant through 2045 for both average annual and peak hour flows."[29]

Nevertheless, the City claims that it needs to move the headworks facilities to the Property because otherwise dried waste will still need to be trucked off site and the headworks facility will "need to be rebuilt before 20 years."[30] It is unclear how the need to rebuild within 20 years justifies rebuilding right now on EFU land. Regardless, neither the continuation of trucking biosolids or the need to rebuild the headworks in 20 years addresses the feasibility standard that applies.

The only other justification the City could provide is a general claim that it is "industry practice" to site all treatment facilities together. Again, industry practice is not the standard—only feasibility matters. As detailed in the City's Feasibility Report, it is entirely feasible to pump treated wastewater to wetlands at another site for further polishing. In fact, the Roseburg Urban Sanitary Authority (RUSA) operates its facilities in this manner. The City of Roseburg's wastewater is first treated at RUSA's main facility—located within Roseburg city limits—and then pumped to wetlands located on nearby EFU land.[31]

4. The City's own analysis concludes that the disposal wetlands are unnecessary.

Finally, the City cannot justify the construction of disposal wetlands at or near the Property because they are not needed at all. As background, the Project proposes the construction of treatment wetlands (wetlands where wastewater is actively polished and not allowed to seep into the ground) and the "future" construction of disposal wetlands (wetlands that allow treated wastewater to slowly filter into the ground).

The City's 2020 WFP Amendment states, however, that the existing infiltration galleries are already sufficient to handle disposal of the expected increase in wastewater volume through at least 2045:

> The existing seepage area has four cells with only one or two cells operated at a time. Based on current operation, the seepage area appears to have sufficient capacity to serve the City in the future. The capacity of the existing seepage area

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[29] Update of 2018 Wastewater Facility Plan at 2.20; letter from Ryan Kirchner to Haleigh King (July 5, 2023), Ex. B.

[30] Letter from Ryan Kirchner to Haleigh King (July 5, 2023) at 2-3.

[31] *See* RUSA summary of natural treatment facilities; letter from Steven Liday to hearings officer Alan Rappleyea (June 27, 2023), Ex. 1.

> is currently adequate to dispose of the design rate of 4.34 MGD, so improvements to the infiltration gallery are not proposed[.][32]

The only justification for construction of the disposal wetlands provided in the WFP Amendment is to create a "natural wildlife and park area," stating:

> Based on current operation, the seepage area appears to have sufficient capacity to serve the City in the future. For this reason, the disposal wetlands are not necessarily needed, but there is an opportunity to beneficially use the effluent in a wetland environment that could be accessible to the public. This would provide a natural wildlife and park area. It is suggested to set aside approximately $4,000,000 for construction of publicly accessible wetland and wildlife park features as disposal wetlands between the treatment wetlands and the existing seepage area.[33]

Building unnecessary disposal wetlands in order to create a larger "natural wildlife and park area" cannot, however, justify the construction of a utility facility on EFU land. *Sprint PCS v. Washington Cty.*, 186 Or App 470, 481, 63 P3d 1261 (2003) (holding that proposed improvement must "advance[] the statutory goal of providing the utility service.").

Appellants raised this issue on June 12, 2023, and the City has been unable to provide a substantive rebuttal since that time.

B. The disposal wetlands cannot be approved through the Application.

The lack of need for new disposal wetlands explains why they are not actually a part of the Application. The City does not provide construction plans, design details, grading plans, geometric data, utility plans, pipe and access road details, or other basic information about the disposal wetlands. Rather, it seeks generic approval of "future disposal wetlands" that the City will construct at some unspecified time in the future.

This is not a valid method for obtaining land use approval of development. At a minimum, the applicant must show what it proposes to build and state the intent to build the improvements within the permit validity period. Moreover, the "future disposal wetlands" are not even proposed to be located on the Property at issue, but instead on BLM land to the north, which the City has no current right to use.

Thus, even if the disposal wetlands were necessary, their unspecified future construction cannot be approved through the Application.

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[32] 2020 WFP Amendment at 12; update of 2018 Wastewater Facility Plan at 2.21 (stating "it is very likely that all four infiltration basins can meet the average annual flow rates through 2045").

[33] 2020 WFP Amendment at 8.

C. The Project cannot be approved without site plan review.

The County's development code states that utility facilities cannot be established, enlarged, or changed until a final site plan is approved. DCC 18.124.030(B)(5). The criteria for the site plan review are set out in DCC 18.124.060. The City did not address these criteria or submit final site plans but instead argued that the County's site plan review code is preempted by ORS 215.283 for proposals to construct utility facilities on EFU land. The City is mistaken.

Oregon courts "begin with a presumption against preemption of local regulation." *Ashland Drilling, Inc. v. Jackson Cty.*, 168 Or App 624, 635, 4 P3d 748 (2000). Only where the legislature "unambiguously expresses an intention" of preemption can that presumption be overcome. *Rogue Valley Sewer Servs. v. City of Phoenix*, 357 Or 437, 454, 353 P3d 581 (2015). Accordingly, Oregon courts "will not determine a local ordinance to be preempted by implication—the legislative preemptive intent must be apparent—that is, "clear and unequivocal"—or the concurrent operation of the local and state law must be impossible." *Rogue Valley Sewer Servs. v. City of Phoenix*, 262 Or App 183, 192, 329 P3d 1 (2014), *aff'd*, 357 Or 437, 353 P3d 581 (2015).

And even where there is a clear intent by the legislature to preempt local law, Oregon courts will construe the scope of that preemption narrowly based on the exact terms used in the law. *Rogue Valley*, 262 Or App at 194 (describing the decision in US West, 336 Or at 187-88, 81 P3d 702 as "reading statutory limits on city's taxing and fee-setting authority narrowly as constrained to the precise words used.").

ORS 215.283(1) states that utility facilities necessary for public service "may be established in any area zoned for exclusive farm use[.]" The statute is silent on the design of such utility facilities. There is nothing to suggest that the Oregon legislature intended to excuse utility facilities on EFU land from site plan review—let alone an "unambiguous intention" to do so.

Such a conclusion is patently untenable in light of Oregon's "overriding policy of preventing agricultural land from being diverted to nonagricultural use." *Warburton v. Harney Cty.*, 174 Or App 322, 328-29, 25 P3d 978 (2001). Reading such preemption into ORS 215.283 turns the statute on its head: instead of a list of limited exceptions to this general policy and Statewide Planning Goal 3, that statute is converted into a preference for development on EFU land. That is certainly not the point of the statute.

The City's sole reliance on *Brentmar v. Jackson Cty.*, 321 Or 481, 496, 900 P2d 1030 (1995) is misplaced. The case concerned a county's treatment of a use expressly allowed in ORS 215.283(1) as a conditional use under county code. This local code was found to be preempted because it *directly* contradicted state law. There is no similar contradiction with site plan review, which only concerns the design of physical development. *Living Strong, LLC v. City of Eugene*, LUBA Nos. 2021-005/006, 2021 WL 1861208, at *4 (Or LUBA Apr. 30, 2021), *aff'd*, 313 Or App 739, 491 P3d 810 (2021) (holding that site review standards have no impact on the nature of the use of the site); *McPhillips Farm v. Yamhill Cty.*, 66 Or LUBA 355, 2012 WL 10816576 (Or LUBA Oct. 30, 2012) (holding that landfill's failure to obtain site design review had no impact on the status of the landfill as an allowed use).

Nevertheless, the Decision adopted the City's analysis because it found that the site plan review process could be used to deny a utility facility use on EFU land.[34] The Decision does not explain how the code could operate in this manner, and a facial review of the code shows that it cannot. DCC 18.124.010 states that the site plan review process "provides for administrative review of the *design* of certain developments and improvements in order to promote functional, safe, innovative and attractive site development compatible with the natural and man-made environment." (Emphasis added.) Thus, the code allows for the denial of a *site plan*, not a development or use in general. DCC 18.124.050-.060.

Accordingly, the County's site plan review code is not preempted and the City is required to obtain site plan review for the proposed wastewater treatment and operations complex in accordance with DCC 18.124.030(B)(5).

D. The Project cannot be approved without conditional use approval.

From its first public announcement of the Project, the City has highlighted the public recreation amenities that would be part of the treatment wetlands site. Staff has repeatedly promoted these extensive walking paths, public trails, and other recreation facilities in press interviews,[35] "open house" and neighborhood association meetings, workshop discussions with nature/wildlife organizations, direct mailers, the city newsletter, and other communications. These facilities are prominently featured on the official Project website, including photo renderings and maps and of the paths and recreation areas. [36]

In fact, in March 2022, the City applied to OPRD for a recreational facilities development grant. In its application, the City set out in detail the specific recreational amenities it would construct as part of the Project:

> Incorporated in the new wastewater treatment system, the Redmond Wetlands Complex (RWC), will be a new trail system, the Redmond Wetlands Complex

[34] Decision at 23.

[35] Nicole Bales, *Redmond to relocate and expand its wastewater treatment facility*, The Bulletin, Jul. 21, 2021 ("[the city's wastewater manager] said the plan will reduce costs and increase public green space because the complex will be accessible to the public for hiking trails and other recreational activities. The city envisions connected trails into a citywide trails system. Kirchner said that once the project is complete, it will be like having an oasis in the desert." *https://www.bendbulletin.com/localstate/redmond/redmond-to-relocate-and-expand-its-wastewater-treatment-facility/article_7ee8f448-e7fe-11eb-b6f2-5b744ad7683b.html*.

[36] https://redmondwetlandscomplex.com/expansion-site-design/.

> Trail System (RWC Trail System), offering over 6 miles of new Americans with Disability Act (ADA) asphalt paved trail loops and compacted gravel trail loops[,] [a] series of educational trail signage[,] * * * informational kiosks and covered seating areas for wildlife viewing[;] * * * The [primary] trailhead will include paved parking, restroom facilities, a large shade structure, a picnic area, a demonstration garden, way finding signage, and an overlook. * * * The secondary trailhead will include a gravel parking area, sized to accommodate horse trailers, and will provide amenities including a vault toilet and staging area for equestrian and mountain bike users.[37]

The City also explained in the grant application how the construction of the RWC Trail System would be part of the construction of the treatment wetlands:

> The trail system, trailheads, and all amenities will be procured in the same construction contract as the RWC lagoons and ponds scheduled to begin construction February 2023. As an important part of the lagoon grading plans, the series of trails will be constructed simultaneously to the RWC ponds. *Id*.

The OPRD application was approved on November 27, 2022, and the City was awarded $750,000 toward the construction of the recreational facilities included in the constructed wetlands complex.[38]

Obviously, hiking paths, covered picnic areas, gardens, and the other public recreational facilities listed above are not components of a sewer system or utility facility. Thus, as the County stated in the March 2022, land use compatibility statement for the OPRD grant application,[39] the trail system constitutes a public park[40] that requires site plan review and a conditional use permit to be sited on EFU land.

In a transparent attempt to avoid this review process, the City claimed in its application materials that constructing the trails and recreational facilities was not part of the Project. The only reference to the trail system and other recreational facilities in the Application appears on page 18 of the Statement, where the City writes:

> Compared to conventional treatment plants, constructed wetlands are cost-effective and easily operated and maintained while supporting wetland habitat for birds and other wildlife and offering recreational and educational opportunities,

[37] Page 6; Attachment 2 to letter from Steven Liday to Haleigh King (April 26, 2023).

[38] Attachment 3 to letter from Steven Liday to Haleigh King (April 26, 2023).

[39] Attachment 4 to letter from Steven Liday to Haleigh King (April 26, 2023).

[40] "'Public park' means an area of natural or ornamental quality for outdoor recreation that provides the resource base for the following activities: picnicking, boating, fishing, swimming, camping and hiking or nature oriented recreation such as viewing and studying nature and wildlife habitat, and may include play areas and accessory facilities that support the activities listed above." DCC 18.04.030.

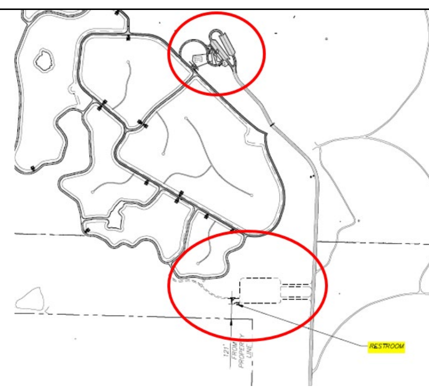
should the City choose to pursue that in the future. (Statement at 18) (emphasis added).

With a $750,000 OPRD grant in hand, this statement was misleading. In its OPRD grant application, the City explained that the trail system, trailheads, and all amenities would be part of the construction contract for the lagoons and ponds and that the trails will be constructed as part of the lagoon grading.[41] It also represented to OPRD that it would obtain the necessary site review and conditional use permits "in tangent to the permitting process to construct [the] engineered wetlands."[42] The City stated that the applications for these permits were "in-progress and will be included in the wetland's construction submission." *Id*.

After appellants raised the contradicting statements in a public comment letter, the City backtracked and stated that it did have plans to construct recreational facilities and open the site as a park, but that it would move forward with that aspect of the Project at a later time.[43] It argued that that the City was not required to obtain approval of a public park, even though the proposed improvements would be used for that purpose. Staff claimed that the design and scope of the proposed improvements would be the same, regardless of the planned recreational uses.

This claim is belied, however, by the site plans submitted by the City. These plans show multiple facilities that relate only to public use of the site, such as parking lots, public restrooms, etc. Simply removing some of the labels from the plans does not change the nature of the facilities.

Sheet G-G07, Overall Site Plan

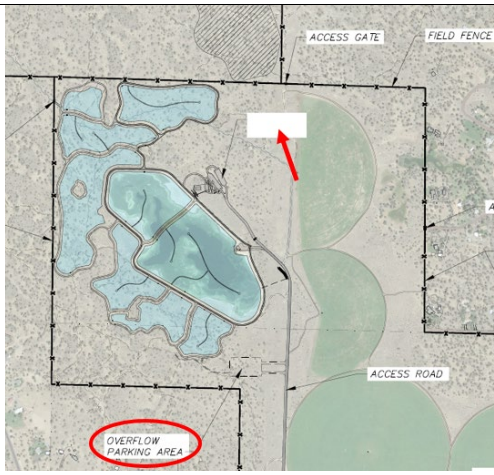


Sheet G-G08, Building Setback

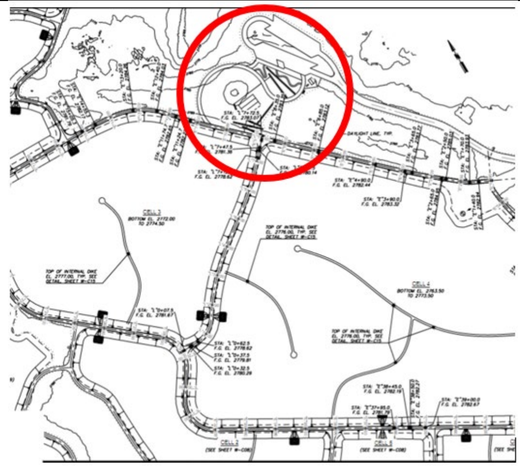
[41] Attachment 2 to letter from Steven Liday to Haleigh King (April 26, 2023) at 6. Due to their inseparable nature, the City included $626,430 for the "Main Entry Roadway" and $771,810 for "Earthwork and Underground Utilities" as part of the cost schedule for the recreational facilities that it submitted to OPRD. Attachment 3 to letter from Steven Liday to Haleigh King (April 26, 2023) at 3.

[42] Attachment 2 to letter from Steven Liday to Haleigh King (April 26, 2023) at 16.

[43] Waffling on the issue, however, City staff submitted a subsequent letter that again characterized the construction of the recreational facilities as only a possibility. "If the City chooses to open the site for public park purposes, the City will submit the required land use applications to jointly use the property for public park purposes." Letter from Ryan Kirchner to Haleigh King (July 5, 2023) at 5.



Sheet S-C06, Fencing Plan 1



Sheet W-C07, Area 1 Grading Plans

Nevertheless, the hearings officer agreed that the City was not proposing any recreational facilities in the Application.[44] The Decision does not address those facilities clearly shown in the plans above. This finding is a clear error and the this development should not have been approved without requiring the City to obtain conditional use approval. Accordingly, the Decision should be reversed.

IV. Conclusion

It is unclear why the City has taken such a hardline approach to the County's review of the Project—refusing to submit for site plan review, flatly opposing the application of any mitigation requirements, and attempting to elude review of the park facilities until after the development is finished. Any potential "gains" by the City in avoiding some application review procedures or mitigation requirements is more than offset by the costs it has and will continue to incur in adversarial local proceedings and a potential future appeal to LUBA.

Regardless of the wisdom of the City's strategy, the Application and supporting materials do not come close to demonstrating compliance with the statutory restrictions and local code requirements. Accordingly, the Decision should be reversed and the Application denied.

[44] Decision at 4.

LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION

FOR

CITY OF REDMOND, OREGON

Prepared for the
City of Redmond, Oregon

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LAGOON AND WETLAND TREATMENT AND DISPOSAL

FEASIBILITY EVALUATION

FOR

CITY OF REDMOND, OREGON

2020

REGISTERED PROFESSIONAL ENGINEER
59632PE
OREGON
SEPT. 2, 1998
BRETT MOORE
7-8-2020
RENEWS 12-31-20

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La Grande, Redmond, and Hermiston, Oregon
Walla Walla, Washington

Job No. 59-00

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Background

The City of Redmond, Oregon, recently completed a Wastewater Facilities Plan (WWFP) and a WWFP Update in November 2019. These planning documents recommended improvements totaling $44.6 million in 2018 dollars ($47.7 million in 2020 dollars) but did not consider improvement alternatives other than mechanical treatment. The WWFP and WWFP Update did not include other locations for the proposed improvements. The City believes it may be prudent to consider other improvement alternatives that could reduce the total life cycle costs to City residents and relocate the existing facilities out of the residential area. As an example of other possible improvements to consider, the City of Prineville, Oregon, has successfully implemented the use of lagoon technology with constructed wetland treatment and disposal, while substantially reducing the overall total cost to the City and providing public access to wetland/wildlife areas. The purpose of this feasibility evaluation is to evaluate the potential of using a lagoon treatment system with a constructed wetland treatment and disposal system as an alternative to meet the City's wastewater treatment and disposal needs.

Design Criteria

The design criteria used for this evaluation are taken from the WWFP Update. The design year 2045 was used with the following wastewater influent parameters:

- Population - 53,800
- Average Annual Flow - 3.49 million gallons per day (MGD)
- Maximum Month Flow - 3.76 MGD
- Average Annual Five-day Biochemical Oxygen Demand (BOD_5) - 14,500 pounds per day (ppd)
- Maximum Month BOD_5 - 19,000 ppd
- Average Annual Total Suspended Solids (TSS) - 9,600 ppd
- Maximum Month TSS - 14,400 ppd
- Average Annual Total Kjeldahl Nitrogen (TKN) - 1,900 ppd
- Maximum Month TKN - 2,400 ppd
- Total Dissolved Solids (TDS) - Approximately 320 milligrams per liter (mg/L)

The City's current Water Pollution Control Facilities (WPCF) Permit has wastewater effluent limits established for discharge into existing infiltration basins. These are as follows:

- BOD_5 and TSS - 20 mg/L
- Nitrate + Nitrite as Nitrogen - 6 mg/L
- Total Nitrogen - 9 mg/L
- pH - 6.0 to 9.0
- *E. coli* - 126 most probable number

The following monthly average groundwater limits apply to the down-gradient groundwater monitoring wells:

- Nitrate - 9 mg/L
- TDS - 500 mg/L

Although these design criteria considered only flows from the City of Redmond, they could be modified to include the community of Terrebonne. The following sizes and costs would be anticipated to be modified only slightly to include the expanded service area.

Lagoon Treatment

Lagoon treatment can be provided with a facultative lagoon, partially aerated lagoon, or aerated lagoon. Cost consideration is also given to an option that utilizes the existing capital investment in the treatment plant's Orbal oxidation ditches to reduce BOD_5 and, thus, lagoon size and aeration requirements. The purpose of the lagoon treatment is to provide for reduction in BOD_5 to the permit limits. Some total nitrogen reduction would also be realized for systems with front-loaded oxygen additions and facultative or anoxic zones at the end of the processes.

Facultative

A facultative lagoon provides oxygen for waste decomposition from an air/water interface area and algae photosynthesis. This system would be a minimum two-stage system operating between 3 and 7 feet in depth, with a minimum detention time of approximately 100 days. For this evaluation, an operating depth between 4 and 5 feet was assumed, and the detention time would be well in excess of 100 days due to the area needed for oxygen transfer. The first stage would need to be 290 acres and the second stage would be 190 acres, for a total lagoon size of 480 acres. For construction purposes, it is suggested to divide these lagoon cells into maximum 40-acre units. There would then be approximately 12 40-acre lagoons.

Solids handling would not be required for this option. Lagoon solids would be anticipated to be removed approximately once every 40 years, once the lagoons reach their design BOD_5 loading. A multi-cell lagoon system would allow a lagoon cell to be taken offline and solids to dry in the bottom of the lagoon for easy and cost-effective removal.

This lagoon type can reduce total nitrogen 40 to 95 percent. A removal efficiency of approximately 85 percent is needed to meet existing WPCF Permit limits. For this reason, adding a treatment wetland for effluent polishing would be recommended.

The estimated capital and 20-year lifecycle costs for this option are $43.4 million and $46.4 million, respectively (see Table 1).

Partially Aerated

A partially aerated lagoon would provide some of the oxygen requirements through an aeration system. For purposes of this evaluation, we would assume that the oxygen for the first stage of the facultative lagoon system would be provided through mechanical aeration. Approximately 2 pounds of oxygen per pound of BOD_5 removed is used in this evaluation to include both BOD_5 and nitrogen reduction, and approximately 2 pounds of oxygen per horsepower (Hp) per hour can be assumed for an aeration system. The first-stage aeration system would mainly be used to increase the dissolved oxygen in the wastewater so it is available for microbial use and provide oxygen that would be consumed during the time water is in this cell. The detention time in this lagoon would be approximately three days. This first stage of the lagoon would then be approximately 10 feet deep to provide for aeration. Approximately 360 Hp of aeration would be needed. This would require a first-stage lagoon of approximately 3.5 acres. The second stage would then be approximately 190 acres and constructed mainly as a facultative system to provide both aerobic and anoxic microbial colonies, but this area would not provide enough oxygen for the BOD_5 loading, so approximately 240 Hp of additional aeration would still be needed in the second stage.

As with the facultative lagoons, solids handling would not be proposed for this system. Solids reduction would occur naturally in the second-stage lagoons, but solids removal from the lagoons may still be needed approximately every 30 years.

This lagoon type can reduce total nitrogen 40 to 95 percent. A removal efficiency of approximately 85 percent is needed to meet the existing WPCF Permit limits. For this reason, a treatment wetland would be recommended to be added for effluent polishing.

The estimated capital and 20-year lifecycle costs for this option are $23.9 million and $31.9 million, respectively (see Table 2).

Aerated

An aerated lagoon would provide sufficient oxygen through aeration systems. A partially mixed, aerated lagoon would consist of five cells with a total detention time of 20 days. The 20-day detention time is on the longer end of what would normally be anticipated, but it provides a factor of safety and capacity to realize increased reduction in total nitrogen. A total requirement of approximately 800 Hp is needed to provide the required oxygen. The depth of the lagoon cells would be approximately 10 feet. The total wet area needed would be approximately 23 acres.

Solids handling would not be anticipated for this option, as solids reduction occurs in the lagoon cells. It is still anticipated that solids removal would be needed approximately once every 20 years, once the flows and loadings reach design levels.

This lagoon type can reduce total nitrogen 60 to 95 percent. A removal efficiency of approximately 85 percent is needed to meet the existing WPCF Permit limits. For this reason, a treatment wetland would be recommended to be added for effluent polishing.

The estimated capital and 20-year lifecycle costs for this option are $10.6 million and $19.5 million, respectively (see Table 3).

Aerated Lagoon with Orbal Pre-Aeration

This alternative utilizes the existing capital investment in the Orbal aeration system to provide pre-aeration and reduce the total capital and operation and maintenance (O&M) requirements at the new lagoon site. The Orbal aeration system capacity provides enough oxygen to reduce the anticipated BOD_5 loads on the proposed lagoon treatment system to approximately 9,000 ppd. This alternative would abandon the existing treatment plant facilities except for the headworks, two Orbal units, and one clarifier and associated sludge pump. The clarifier would harvest biosolids (microorganisms) from the ditch effluent and send them back to the ditch. The effluent from the ditches and clarifier would then be combined with any raw wastewater not sent to the ditch. The combined flows would then be sent to the aerated lagoons. This would reduce the total required at the aerated lagoon to approximately 375 Hp, the required detention time to 15 days, and the lagoon size from 23 acres to 17 acres.

Solids handling and nitrogen reduction would be similar to the aerated lagoon option.

The estimated capital and 20-year lifecycle costs for this option are $6.3 million and $14.7 million, respectively (see Table 4).

Treatment Wetlands

After biologic stabilization of the waste is provided in the lagoon system, the lagoon effluent should be further “polished” in treatment wetlands to provide a more natural environment to further reduce pathogens and nutrients. The wetlands would provide a shallow surface flow system for increased exposure to light and encourage vegetation growth. The vegetation in the wetlands provides a substrate for attached growth microbial colonies that would provide for nitrification of any remaining ammonia. Denitrification would then be provided in the bottom anoxic layers of the wetlands and in deeper sections built into the environment. The treatment wetlands would be sized for a six-day detention time at an average depth of 12 inches. The treatment wetland would have a liner installed under 12 inches of native material in which vegetation would grow. The wetland would be seeded and planted. This would require a wetland complex with approximately 70 wet acres. Additional nitrogen reduction is provided in the wetlands, but nitrogen reduction is improved when multiple wetland cells constructed in series are provided. The estimated capital and 20-year lifecycle costs for this option are $9.8 million and $10.4 million, respectively (see Table 5).

Disposal Wetlands

The existing disposal system utilized by the City is through irrigation and seepage. The area proposed for facility construction contains a concrete sealed irrigation storage pond that holds water and a seepage area that leaks at a high rate. The size of disposal wetlands would depend on the seepage rate of the wetlands. Due to the function of the seepage area, it is assumed that the natural ground would provide very high infiltration rates. The existing seepage area has multiple cells with only one cell operated at a time. Based on current operation, the seepage area appears to have sufficient capacity to serve the City in the future.

The City could construct new disposal wetlands for wildlife and public use using the water reclaimed from the wetland treatment process. These would need to have more controlled seepage by removing the topsoil, treating the fractured rock with bentonite, and replacing the topsoil. The disposal wetlands would be of varying depths and configurations that would more closely follow the natural terrain and provide wildlife habitat and an aesthetically pleasing area that the public may enjoy. For reasons of realizing a beneficial use for the reclaimed water, a capital cost of $4 million is added for disposal wetlands and trails.

Other Beneficial Uses

The City could also utilize the treated effluent for additional beneficial uses such as irrigating turf grass for new sports fields in the area. Some added effluent polishing may be needed, depending on the proposed beneficial use.

Permit Limits

The effluent permit limits that merit further discussion in this evaluation are the BOD_5 and TSS limit of 20 mg/L, total nitrogen limit of 9 mg/L entering the infiltration basins, and TDS limit of 500 mg/L in the monitoring wells. The limits entering the infiltration basins appear to have been established as technology-based effluent limits based on the activated sludge process employed in the existing treatment plant.

Biochemical Oxygen Demand and Total Suspended Solids

The treatment wetland would be susceptible to extensive algae growth that may limit the ability to consistently meet the 20 mg/L limit. This limit may be attainable with the aerated lagoon option prior to entering the treatment wetland. A discussion with the Oregon Department of Environmental Quality would need to occur to determine if the permit limit and/or monitoring location can be changed.

Nitrogen

The total nitrogen limit is achievable through a lagoon and wetland system, as the City of Prineville averaged a total nitrogen concentration of 7.0 mg/L from the lagoons throughout the 2019 season with nitrates in the monitoring wells being approximately 1 mg/L. The design of wetlands for nitrogen reduction has a large range of constants that could be used to achieve reduction efficiencies over a large range (i.e., 45 to 95 percent). This is due to the variability in plant and microbial colonies that can occur in different climatic regions and the type of waste entering the system. For this installation, data from the Cities of Prineville and La Grande, Oregon, lagoon and wetland treatment systems could be used to verify the design parameters. Some of the data that could be useful to verify the facility sizing are not currently being collected by the Cities. If this option is pursued further, additional testing from the Prineville facility would prove beneficial to confirm design parameters to reduce the risk associated with potential unknown design “constants.”

Total Dissolved Solids

TDS data were collected for the existing treatment plant effluent. This TDS is also anticipated to be in the range of what would be expected for lagoon effluent. A mass balance was completed to estimate the TDS seeping into the groundwater by reducing the total seepage volume and increasing the total TDS due to evaporation. The amount of evaporation in the system would directly affect the difference in TDS between the influent and effluent, but this amount is small. TDS is expected to increase by less than 10 percent through the lagoon and wetland system.

Project Consideration

The City could consider three different alternatives to meet their future needs. These include expanding the existing mechanical treatment plant; using lagoons and wetlands to provide the treatment capacity needed for the future and continue using the headworks and office space at the existing facility; or moving the entire treatment system, offices, and shops to a new location. The decision-making process should consider Capital Cost, Life Cycle Cost, Land and Future Expandability, and Community Benefits.

Expand Existing Mechanical Treatment Plant at Existing Site

Capital Cost - This alternative was evaluated in the 2019 WWFP Update of the 2018 WWFP. The total capital cost for this alternative is $44.6 million (2018 dollars), which has been updated to $47.7 million (2020 dollars at 3.5 percent inflation).

Life Cycle Cost - This alternative has an estimated 20-year life cycle cost of approximately $62.0 million.

Land and Future Expandability - This alternative utilizes the existing site located in an area surrounded by residential housing. The options for future expandability are limited. Also, there is concern over having this industrial wastewater facility in the middle of a residential area with a public pathway through the area.

Community Benefits - This alternative will provide wastewater treatment for the City. The water is used for irrigating crops in the summertime but is disposed of in the wintertime through ground percolation. There may be opportunities for further reuse of the reclaimed water.

New Lagoons and Wetlands with Existing Facilities

This project alternative is shown on Figure 1. This alternative includes utilizing the existing headworks facility to provide screening of the influent. Raw wastewater would then flow down the existing pipelines to the proposed lagoon site at and/or adjacent to the existing irrigation area. Wastewater would then be treated in a five-cell, aerated lagoon system with chlorine disinfection. The disinfected lagoon effluent would then flow to the existing irrigation storage pond or into a 70-acre treatment wetland complex before entering a disposal wetland and infiltration basin area for evaporation and seepage into the groundwater. The total project cost for this system is summarized on the following table. The disinfection system evaluation was not part of this evaluation, but a cost estimate is included, assuming a chlorination system is used (see Table 6).

Capital Cost - The total estimated capital and associated life cycle cost is shown on the following table.

NEW LAGOON AND WETLANDS WITH EXISTING FACILITIES

Item	Estimated Capital Cost	Estimated 20-year Life Cycle Cost
Aerated Lagoon	$10.6 million	$19.5 million
Disinfection System	$1.7 million	$2.4 million
Treatment Wetlands	$9.8 million	$10.4 million
Disposal Wetlands	$4.0 million	$4.1 million
Support Facilities	$12.4 million	$16.4 million
Total	**$38.5 million**	**$52.8 million**

Note: Capital costs for Support Facilities taken from 2019 WWFP Update.

Life Cycle Cost - The 20-year life cycle cost shown above needs to be augmented to include the existing facilities that will be used as part of this alternative, and also includes the headworks and lift station. The revised total estimated life cycle cost assumes these facilities are new and is estimated at $37.0 million. Also, this alternative will split the treatment plant staff between two sites. This can provide O&M challenges.

Land and Future Expandability - The existing facilities would still be located in an area surrounded by residential homes with a walking path near the treatment plant. The lagoons and wetland areas are surrounded by undeveloped lands where future expansion could easily occur.

Community Benefits - Maintaining part of the existing treatment facilities will still have odor producing systems in the middle of the residential and pathway area. This alternative would provide a minimum of 70 acres of wetland environment that could provide plant and wildlife habitat. The City of Prineville uses its wetland area as part of their parks and trails and the City of Redmond could implement a similar community enhancement.

New Lagoon and Wetland Treatment Plant with Support Facilities at New Site

The development of new treatment facilities will provide the opportunity to move all of the treatment facilities to a new less populated area north of the City. Figures 2 and 3 show an initial potential layout for moving all of the treatment works. The additional facilities needed would include a main division building, maintenance building, generator building, operations building, vacuum truck dump, headworks screening, lift station, sludge drying beds, and associated roads and parking areas. The inclusion of sludge drying beds will allow lagoon sludge removal to be done by City staff using the drying beds and floating dredge. The drying beds can be completed as a second phase of the project, as lagoon sludge will not need to be removed for many years. The estimated cost for the headworks and support facilities, including the drying beds, is shown on Table 7.

Capital Cost and Life Cycle Cost - The total estimated capital and life cycle cost for moving the treatment plant is summarized on the following table.

NEW LAGOON AND WETLAND TREATMENT PLANT WITH SUPPORT FACILITIES AT NEW SITE

Item	Estimated Capital Cost	Estimated 20-year Life Cycle Cost
Aerated Lagoon	$10.6 million	$19.5 million
Disinfection System	$1.7 million	$2.4 million
Treatment Wetlands	$9.8 million	$10.4 million
Disposal Wetlands	$4.0 million	$4.1 million
Headworks and Support Facilities	$15.5 million	$17.5 million
Total	**$41.6 million**	**$53.9 million**

Land and Future Expandability - This alternative locates all the wastewater treatment facilities in an undeveloped area where future expandability would be easier.

Community Benefits - This alternative would provide a wetland environment that could be made accessible to the public for bird watching, hiking, and cycling. It could also be tied into a City-wide trails system as an extension to Dry Canyon. The reuse of the reclaimed water in this manner provides an ancillary benefit to the City that is otherwise not realized.

Summary

The following table summarizes the project alternatives:

Summary of Project Alternatives

Alternative	Advantages	Disadvantages	Capital Cost	20-Year Life Cycle Cost	Life Expectancy
Expand Mechanical Treatment Plant at Existing Site	Use existing headworks and treatment systems.	Odors, limited expandability, older systems, treatment plant in residential area, higher costs.	$47.7 million	$62.0 million	Reused mechanical components will have shorter life. New mechanical components will need replaced approximately every 10 years.
New Lagoons and Wetlands with Existing Facilities	Use existing headworks.	Odors, older systems, two sites, treatment plant in residential area.	$38.5 million	$52.8 million	Unknown life for existing lift station and headworks but will most likely need to be rebuilt before 20 years.
New Lagoon and Wetland Treatment Plant with Support Facilities at New Site	Move out of residential and Dry Canyon Park area. Expandable. All new systems. Added wildlife habitat. Added trails system. Reduced biosolids handling. Increased tourism possibilities.		$41.6 million	$53.9 million	Lagoons and wetlands have a life expectancy in excess of 50 years.

TABLES

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
FACULTATIVE LAGOON
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (3% of Construction Cost)	LS	$ 1,020,000	All Req'd	$ 1,020,000
2	Earthwork	CY	5	350,000	1,750,000
3	Rock Removal	CY	60	161,333	9,680,000
4	Liner	SF	1	21,000,000	21,000,000
5	Control Structures	EA	15,000	12	180,000
6	Piping	LF	60	5,600	336,000
7	Gravel	CY	20	8,100	162,000
8	Fencing	LF	6	21,000	126,000
9	Site Work	LS	50,000	All Req'd	50,000
	Sum of Estimated Construction Cost				**$ 34,304,000**
	Construction Contingency (15%)				5,146,000
	Subtotal Estimated Construction Cost				**$ 39,450,000**
	Administration, Legal, and Engineering (10%)				3,945,000
	TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)				**$ 43,395,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 41,000
2	Supplies, Parts, Maintenance, and Repairs	1,000
3	Replacement	1,000
4	Lagoon Solids Removal	200,000
	Total OM&R	**$ 243,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	3,029,000
	Total Present Worth (2020 Dollars)	**$ 46,424,000**

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
PARTIALLY AERATED LAGOON
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (4% of Construction Cost)	LS	$ 800,000	All Req'd	$ 800,000
2	Earthwork	CY	5	172,000	860,000
3	Rock Removal	CY	60	64,600	3,876,000
4	Liner	SF	1	8,712,000	8,712,000
5	Control Structures	EA	15,000	5	75,000
6	Piping	LF	60	3,600	216,000
7	Gravel	CY	20	3,800	76,000
8	Diffusers	LS	1,200,000	All Req'd	1,200,000
9	Blowers	LS	650,000	All Req'd	650,000
10	Blower Building	SF	200	1,200	240,000
11	Electrical and Controls	LS	500,000	All Req'd	500,000
12	Fencing	LF	6	10,000	60,000
13	Site Work	LS	50,000	All Req'd	50,000
				Sum of Estimated Construction Cost	**$ 17,315,000**
				Construction Contingency (15%)	2,597,000
				Subtotal Estimated Construction Cost	**$ 19,912,000**
				Administration, Legal, and Engineering (20%)	3,982,000
				TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)	**$ 23,894,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 82,000
2	Supplies, Parts, Maintenance, and Repairs	2,000
3	Power (600 horsepower, $0.08 per kilowatt hour)	314,000
4	Replacement	62,000
5	Lagoon Solids Removal	180,000
	Total OM&R	**$ 640,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	7,976,000
	Total Present Worth (2020 Dollars)	**$ 31,870,000**

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CITY OF
REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
PARTIALLY AERATED LAGOON
PRELIMINARY COST ESTIMATE

TABLE 2

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
AERATED LAGOON
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (5% of Construction Cost)	LS	$ 430,000	All Req'd	$ 430,000
2	Earthwork	CY	6	113,000	678,000
3	Rock Removal	CY	60	32,000	1,920,000
4	Liner	SF	1	1,089,000	1,089,000
5	Control Structures	EA	15,000	4	60,000
6	Piping	LF	60	2,000	120,000
7	Gravel	CY	20	1,400	28,000
8	Diffusers	LS	1,500,000	All Req'd	1,500,000
9	Blowers	LS	800,000	All Req'd	800,000
10	Blower Building	SF	200	1,800	360,000
11	Electrical and Controls	LS	600,000	All Req'd	600,000
12	Fencing	LF	6	5,000	30,000
13	Site Work	LS	50,000	All Req'd	50,000
				Sum of Estimated Construction Cost	**$ 7,665,000**
				Construction Contingency (15%)	1,150,000
				Subtotal Estimated Construction Cost	**$ 8,815,000**
				Administration, Legal, and Engineering (20%)	1,763,000
				TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)	**$ 10,578,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 164,000
2	Supplies, Parts, Maintenance, and Repairs	10,000
3	Power (800 horsepower, $0.08 per kilowatt hour)	418,000
4	Replacement	82,000
5	Lagoon Solids Removal	42,000
	Total OM&R	**$ 716,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	8,923,000
	Total Present Worth (2020 Dollars)	**$ 19,501,000**

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CITY OF
REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
AERATED LAGOON
PRELIMINARY COST ESTIMATE

TABLE 3

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
ORBAL PLUS AERATED LAGOON
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (5% of Construction Cost)	LS	$ 250,000	All Req'd	$ 250,000
2	Earthwork	CY	6	94,000	564,000
3	Rock Removal	CY	60	8,100	486,000
4	Liner	SF	1	828,000	828,000
5	Control Structures	EA	15,000	4	60,000
6	Piping	LF	60	2,000	120,000
7	Gravel	CY	20	1,100	22,000
8	Diffusers	LS	900,000	All Req'd	900,000
9	Blowers	LS	480,000	All Req'd	480,000
10	Blower Building	SF	200	1,200	240,000
11	Electrical and Controls	LS	500,000	All Req'd	500,000
12	Fencing	LF	6	5,000	30,000
13	Site Work	LS	50,000	All Req'd	50,000
				Sum of Estimated Construction Cost	**$ 4,530,000**
				Construction Contingency (15%)	680,000
				Subtotal Estimated Construction Cost	**$ 5,210,000**
				Administration, Legal, and Engineering (20%)	1,042,000
				TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)	**$ 6,252,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 165,000
2	Supplies, Parts, Maintenance, and Repairs	10,000
3	Power (800 horsepower, $0.08 per kilowatt hour)	418,000
4	Replacement	44,000
5	Lagoon Solids Removal	42,000
	Total OM&R	**$ 679,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	8,462,000
	Total Present Worth (2020 Dollars)	**$ 14,714,000**

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CITY OF
REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
ORBAL PLUS AERATED LAGOON
PRELIMINARY COST ESTIMATE

TABLE
4

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
TREATMENT WETLANDS
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (5% of Construction Cost)	LS	$ 400,000	All Req'd	$ 400,000
2	Earthwork	CY	6	67,000	402,000
3	Rock Removal	CY	60	32,400	1,944,000
4	Liner	SF	1	3,050,000	3,050,000
5	Control Structures	EA	15,000	6	90,000
6	Piping	LF	60	4,000	240,000
7	Gravel	CY	20	2,100	42,000
8	Top Soil Removal and Replacement	CY	8	113,000	904,000
9	Seeding and Planting	LS	20,000	All Req'd	20,000
10	Fencing	LF	6	7,000	42,000
				Sum of Estimated Construction Cost	**$ 7,134,000**
				Construction Contingency (15%)	1,070,000
				Subtotal Estimated Construction Cost	**$ 8,204,000**
				Administration, Legal, and Engineering (20%)	1,640,000
				TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)	**$ 9,844,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 41,000
2	Supplies, Parts, Maintenance, and Repairs	1,000
3	Replacement	1,000
4	Vegetation Removal	2,000
	Total OM&R	**$ 45,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	561,000
	Total Present Worth (2020 Dollars)	**$ 10,405,000**

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CITY OF
REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
TREATMENT WETLANDS
PRELIMINARY COST ESTIMATE

TABLE 5

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
DISINFECTION SYSTEM
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (5% of Construction Cost)	LS	$ 66,000	All Req'd	$ 66,000
2	Building	SF	200	1,000	200,000
3	Chlorination Equipment	LS	40,000	All Req'd	40,000
4	Chlorine Contact Basin	LS	280,000	All Req'd	280,000
5	Electrical and Controls	LS	100,000	All Req'd	100,000
6	Piping	LF	60	200	12,000
7	Rock Removal	CY	60	1,000	60,000
8	Gravel	CY	20	100	2,000
9	Steel Building Over Basin	LS	500,000	All Req'd	500,000
	Sum of Estimated Construction Cost				**$ 1,260,000**
	Construction Contingency (15%)				189,000
	Subtotal Estimated Construction Cost				**$ 1,449,000**
	Administration, Legal, and Engineering (20%)				290,000
	TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)				**$ 1,739,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 20,000
2	Supplies, Parts, Maintenance, and Repairs	30,000
3	Replacement	2,000
	Total OM&R	**$ 52,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	649,000
	Total Present Worth (2020 Dollars)	**$ 2,388,000**

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
SUPPORT FACILITIES
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (5% of Construction Cost)	LS	$ 600,500	All Req'd	$ 600,500
2	Main Division Building	SF	250	8,750	2,187,500
3	Maintenance Building	SF	175	12,000	2,100,000
4	Generator Building	SF	200	320	64,000
5	Roads and Parking	SY	22	16,000	352,000
6	Operations Building (Motor Control Center, Control Room, Lab)	SF	250	3,000	750,000
7	Lift Station	LS	400,000	All Req'd	400,000
8	Vacuum Truck/Septage Dump	LS	90,000	All Req'd	90,000
9	Sludge Drying Beds	Acre	750,000	3	2,250,000
10	Domestic Water	LF	40	10,000	400,000
11	Fencing/Site Work	LS	100,000	All Req'd	100,000
12	Headworks	LS	400,000	All Req'd	400,000
13	Rock Removal	CY	60	200	12,000
14	Electrical and Controls	LS	700,000	All Req'd	700,000
15	Site Piping	LF	60	4,000	240,000
16	Grit Chamber	LS	300,000	All Req'd	300,000
17	Rock Processing	LS	250,000	All Req'd	250,000
	Sum of Estimated Improvements Construction Cost				**$ 11,196,000**
	Construction Contingency (15%)				1,679,000
	Subtotal Estimated Improvements Construction Cost				**$ 12,875,000**
	Administration, Legal, and Engineering (20%)				2,575,000
	TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)				**$ 15,450,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor (Headworks and Lift Station Only)	$ 126,000
2	Supplies, Parts, Maintenance, and Repairs	10,000
3	Replacement	30,000
	Total OM&R	**$ 166,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	2,069,000
	Total Present Worth (2020 Dollars)	**$ 17,519,000**

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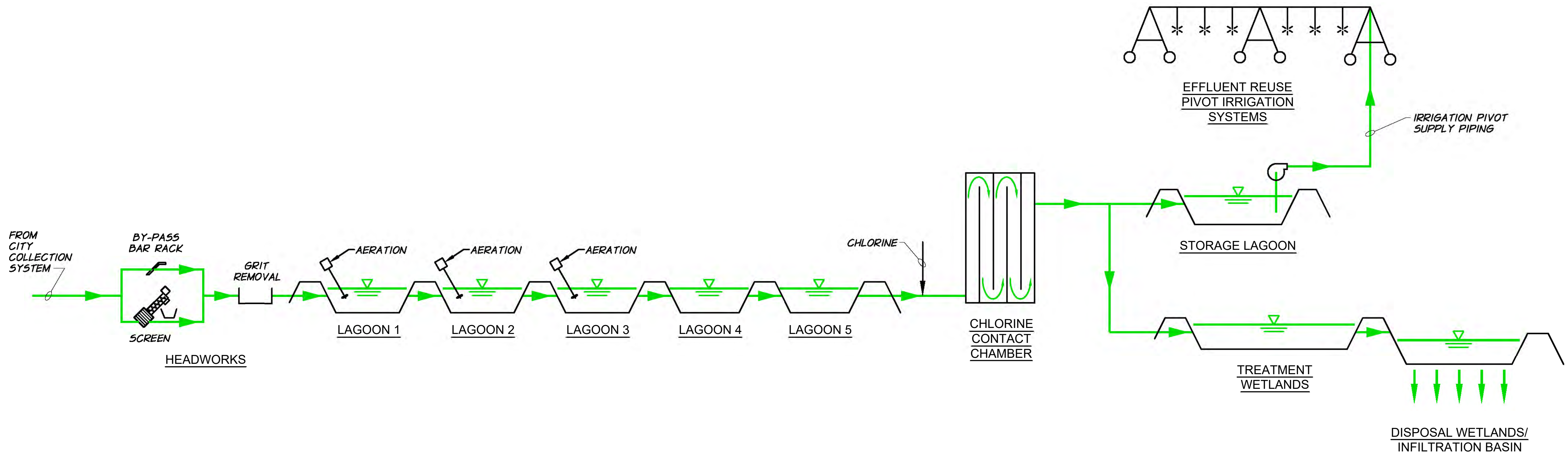
CITY OF
REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
SUPPORT FACILITIES
PRELIMINARY COST ESTIMATE

TABLE 7

FIGURES



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CITY OF
REDMOND, OREGON
RECLAIMED WATER WETLAND REUSE FEASIBILITY EVALUATION

TREATMENT PROCESS FLOW SCHEMATIC

FIGURE 1

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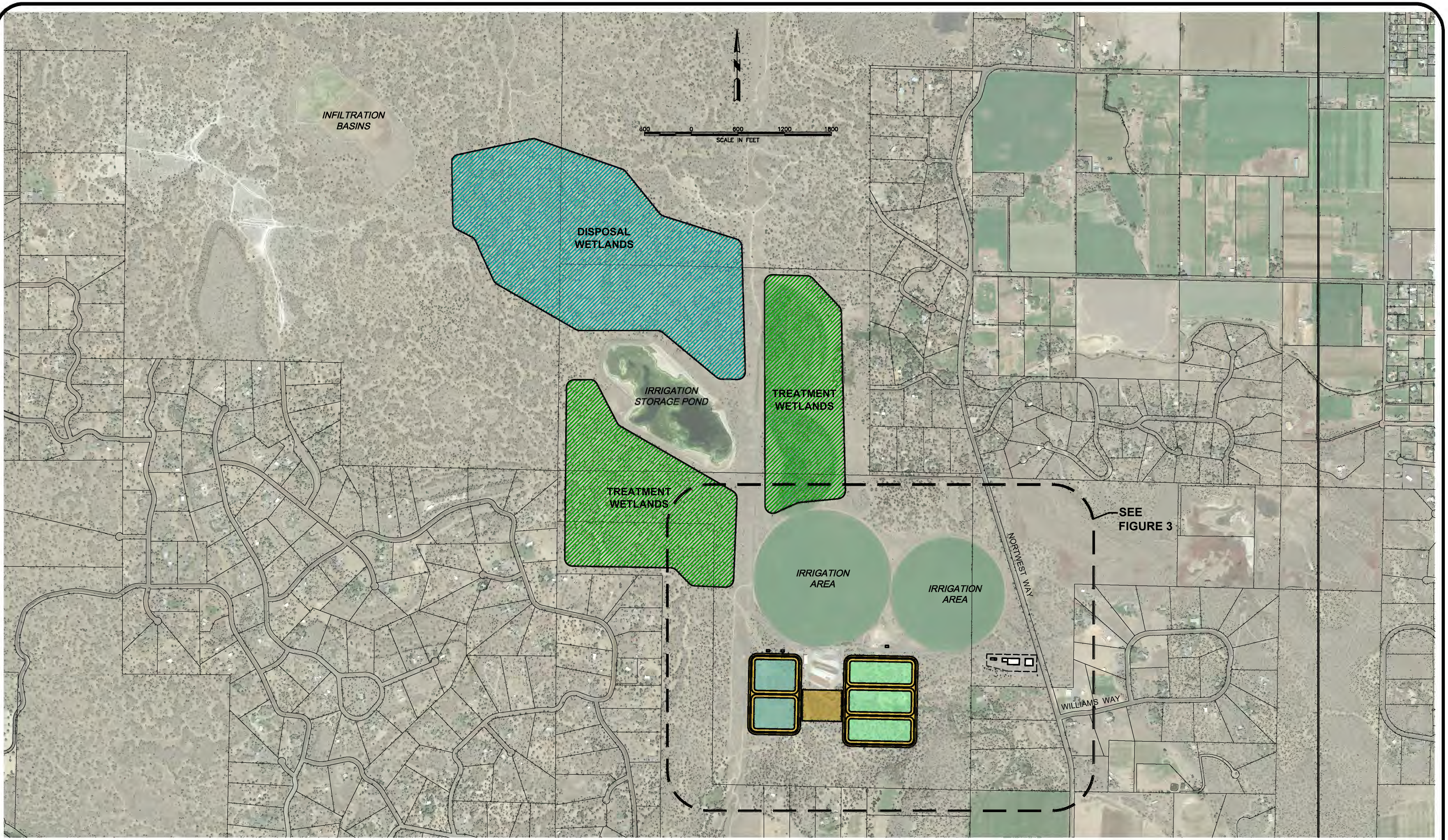

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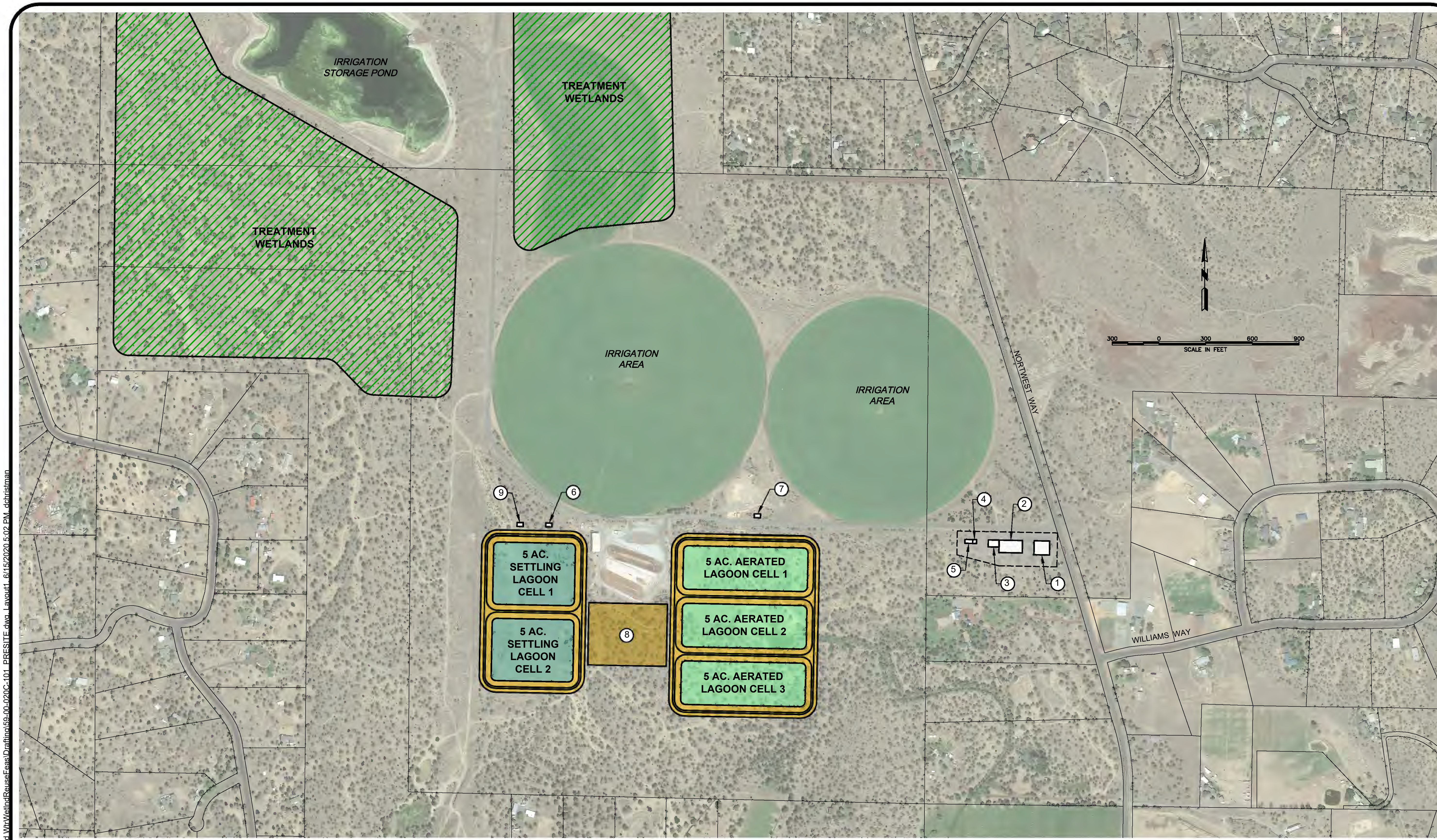
CITY OF
REDMOND, OREGON
RECLAIMED WATER WETLAND REUSE FEASIBILITY EVALUATION

IMPROVEMENTS PLAN

FIGURE 2



IMPROVEMENTS SCHEDULE

1. MAIN DIVISION BUILDING (8,750 SQ. FT.)
2. MAINTENANCE BUILDING (12,000 SQ. FT.)
3. OPERATIONS BUILDING (3,000 SQ. FT.)
4. VAC-TRUCK/SEPTAGE DUMP
5. HEADWORKS (SCREENS AND LIFT STATION)
6. DISINFECTION BUILDING
7. BLOWER BUILDING
8. FUTURE SLUDGE DRYING BEDS
9. CHLORINE CONTACT BASIN

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CITY OF
REDMOND, OREGON
RECLAIMED WATER WETLAND REUSE FEASIBILITY EVALUATION

IMPROVEMENTS DETAIL PLAN

FIGURE
3

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WASTEWATER FACILITY PLAN AMENDMENT - 2020

Prepared for the
City of Redmond, Oregon

anderson perry

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214 E. Birch Street, Walla Walla, Washington
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WASTEWATER FACILITY PLAN AMENDMENT

FOR

CITY OF REDMOND, OREGON

2020

REGISTERED PROFESSIONAL
ENGINEER
59632PE
OREGON
SEPT. 2, 1998
BRETT MOORE
RENEWS 12-31-20

12-17-20

ANDERSON PERRY & ASSOCIATES, INC.

La Grande, Redmond, and Hermiston, Oregon
Walla Walla, Washington

 Job No. 59-00

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Preface

The City of Redmond, Oregon, contracted Anderson Perry & Associates, Inc., to conduct a Lagoon and Wetland Treatment and Disposal Feasibility Evaluation (Evaluation), completed in July 2020 for wastewater treatment alternatives and, subsequently, this Wastewater Facility Plan Amendment (Amendment) to their 2019 Update of the Wastewater Facility Plan (WWFP). This Amendment summarizes the results of the Evaluation and is intended to supplement and not replace the WWFP. Therefore, this Amendment will closely follow the outline of the WWFP to best synchronize the contents of each document. Detailed background on the City of Redmond's physical environment, planning and service area, and existing infrastructure can be found in the WWFP.

Sections that are not addressed in this Amendment can be referred to in the original WWFP.

A1.0 Basis of Planning

A1.1 Introduction and Need for the Project

The City recently completed a WWFP Update in November 2019. The WWFP established a basis of planning, existing facilities evaluation, regulatory requirements, alternatives analysis, and recommended improvements. Several alternatives were evaluated as seen in Section 4.0 of the WWFP; however, all considered alternatives included expanding the existing mechanical treatment plant at its current location. The City wished to also consider abandoning the constrained site of the existing mechanical treatment plant and evaluate the option of lagoon and wetland treatment and disposal. The purpose of this Amendment is to update the design criteria to the year 2045 and add an alternative for a lagoon treatment system with a constructed wetland treatment and disposal system to meet the City's needs.

A1.5 Existing and Future Population, Flows, and Loads

Remaining consistent with the WWFP, this Amendment uses the Portland State University: Oregon Population Forecast Program to estimate future population data. The data suggest the population in Redmond may increase to approximately 54,000 by the end of 2045.

Historic flow data used for this Amendment differ from that used in the WWFP due to a correction in data collected by the City. In October 2019, the City discovered the influent flowmeter was not reading correctly. This provided flows that were less than actual; therefore, the design criteria used in the WWFP were not accurate. The flowmeter has been recalibrated, and the following corrections have been made, along with clarifications:

- **Population - 53,800**. As used in the WWFP.
- **Average Annual Flow - 4.34 million gallons per day (MGD)**. A review of the influent flows between January 2015 and October 2019 showed the average per capita flow to be 65.2 gallons per capita per day (gpcd). This flow is a little lower than what would normally be expected. After the flowmeter was reset, the flows between November 2019 and June 2020 were 80.8 gpcd, which provided an increase of 15.6 gpcd. This is in the range normally seen for communities in this region. This increase was added to the flow records before October 2019 to obtain a more accurate indication of historic influent flows. The per

capita flow was then used with the design population to determine the average annual design flows.

- **Maximum Month Flow - 4.51 MGD**. The adjusted per capita flows noted above were used for the highest flow month of each year. These were then averaged and multiplied by the design population.
- **Average Annual Five-day Biochemical Oxygen Demand (BOD_5) - 501 milligrams per liter (mg/L), 18,134 pounds per day (ppd)**. The average annual concentration was used with the design flows to determine loadings.
- **Maximum Month BOD_5** - A review of the historic data show the maximum flow months produce less BOD_5 loading than the average. For this reason, the average annual loading of 18,134 ppd should be used.
- **Average Annual Total Suspended Solids (TSS) - 353 mg/L, 12,777 ppd**. The historic average concentration was used with the design flow.
- **Maximum Month TSS - 357 mg/L, 13,428 ppd**. The historic average concentrations from each of the annual maximum months were used with the design maximum month flow to obtain the loading.
- **Average Annual Total Kjeldahl Nitrogen (TKN) - 65 mg/L, 2,353 ppd**. The design concentration from the WWFP Update was used with the flow above.
- **Maximum Month TKN - 75 mg/L, 2,821 ppd**. The design concentration from the WWFP Update was used with the flow above.
- **Peak Hour Flow - 11.63 MGD**. The WWFP Update indicated the peak hour flow can be calculated using a peaking factor of 2.68 with the average annual flow.

A1.6 Summary

The updated projected flows and loads used in this Amendment compared to those used in the WWFP can be seen on Tables 1-1 and 1-2. The projections presented on Table 1-2 are used in the following sections.

TABLE 1-1
PROJECT FLOWS AND LOADS FROM THE WASTEWATER FACILITY PLAN

Year	Population	Average Annual Flow, MGD	Maximum Month BOD_5 Load, ppd	Maximum Month TSS Load, ppd	Maximum Month TKN Load, ppd
2017	28,800	1.90	9,800	7,000	1,200
2020	30,700	2.00	10,800	8,200	1,400
2025	34,400	2.20	12,100	9,200	1,500
2030	38,600	2.50	13,600	10,300	1,700
2035	43,200	2.80	15,200	11,600	2,000
2040	48,400	3.10	17,100	13,000	2,200
2045	53,800	3.50	19,000	14,400	2,400

TABLE 1-2
UPDATED PROJECT FLOWS AND LOADS

Year	Population	Average Annual Flow, MGD	Maximum Month BOD_5 Load, ppd	Maximum Month TSS Load, ppd	Maximum Month TKN Load, ppd
2017	28,800	2.33	10,088	7,188	1,510
2020	30,700	2.48	10,753	7,662	1,610
2025	34,400	2.78	12,049	8,586	1,804
2030	38,600	3.12	13,520	9,634	2,024
2035	43,200	3.49	15,131	10,782	2,265
2040	48,400	3.91	16,953	12,080	2,538
2045	53,800	4.34	18,134	13,428	2,821

A3.0 Regulatory Requirements

Section 3 of the WWFP outlines the current water quality standards under the Water Pollution Control Facilities (WPCF) Permit that the City must comply with, as well as potential future regulatory considerations. As this Amendment is focused on evaluating the alternative of lagoon and wetland treatment and disposal, regulatory considerations surrounding this alternative will be outlined.

The City's current WPCF Permit for the existing mechanical treatment plant would be modified or renewed with the construction of an entirely new treatment system. The existing mechanical treatment plant provides secondary treatment through the use of an activated sludge process with discharge to groundwater via an infiltration gallery. The system proposed in this Amendment would utilize aerated lagoons for secondary treatment, lined constructed wetlands for tertiary treatment, and unlined disposal wetlands with the existing infiltration basins for effluent disposal. The added wetland treatment and disposal areas will enhance water quality using more natural processes but will be completely different than the existing facilities. The new treatment system will require that a modified or renewed WPCF Permit be obtained. For this reason, an initial meeting was held with Oregon Department of Environmental Quality (DEQ) staff to discuss this treatment and disposal alternative with respect to a new permit. Generally, the DEQ is supportive of this option and feels that it can be permitted.

Since a new permit will be required but not yet obtained, the existing groundwater protection (Oregon Administrative Rules [OAR] 340-040) and effluent reuse rules (OAR 340-055) will be used for guidance in the evaluation of the lagoon and wetland alternative. The contaminate of specific note for groundwater protection from the proposed facility is a Nitrate - N limit of 10 mg/L. No other contaminates shown on OAR 340-040 Tables 1, 2, and 3 are anticipated to be at levels of concern in the treated effluent.

Effluent reuse is governed by OAR 340-055 and an approved Reclaimed Water Use Plan. Currently, the City irrigates crops not for human consumption using Class C effluent. This type of reuse only requires Class D or non-disinfected effluent based on the OARs. The existing WPCF Permit requires Class D effluent for discharge to the infiltration beds. The proposed treatment system would disinfect secondary effluent prior to discharging to treatment wetlands, then disposal wetlands, and ultimately an infiltration gallery. It is proposed that the wetland area be accessible to the public for non-contact use of adjacent walking paths for wildlife viewing and exercise. The area will be posted to prevent human contact with wetland water. A 10-foot setback is required by OAR 340-055. For this use, disinfecting the effluent to a Class D level prior to discharging to the treatment wetland is proposed. The natural wetland system and wildlife use would make disinfection limits after the treatment wetland unpredictable.

A4.0 Alternatives Analysis

The City conducted an extensive alternatives analysis as seen in Section 4.0 of the WWFP. Along with the preferred mechanical treatment plant expansion alternative, the City can consider two additional alternatives: using lagoons and wetlands to provide the treatment capacity needed for the future and continue using the headworks and office space at the existing facility, or moving the entire treatment system, offices, and shops to a new location. These three options will be compared considering capital cost, life cycle cost, land and future expandability, and community benefits.

A4.1 Lagoon Treatment

Lagoon treatment can be provided with a facultative lagoon, partially aerated lagoon, or aerated lagoon.

A4.1.1 Facultative

A facultative lagoon provides oxygen for waste decomposition from an air/water interface area and algae photosynthesis. This system would be a minimum two-stage system operating between 3 and 7 feet in depth, with a minimum detention time of approximately 100 days. For this evaluation, an operating depth between 4 and 5 feet was assumed, and the detention time would be well in excess of 100 days due to the area needed for oxygen transfer. The first stage would need to be 360 acres and the second stage would need to be 160 acres, for a total lagoon size of 520 acres. For construction purposes, it is suggested to divide these lagoon cells into maximum 40-acre units. Then, there would be approximately 13 40-acre lagoons. See Appendix A for preliminary calculations.

Solids handling would not be required for this option. Lagoon solids would be anticipated to be removed approximately once every 40 years, once the lagoons reach their design BOD_5 loading. A multi-cell lagoon system would allow a lagoon cell to be taken offline and solids to dry in the bottom of the lagoon for easy and cost-effective removal.

This lagoon type can reduce total nitrogen 40 to 95 percent (see Metcalf & Eddy, Wastewater Engineering, Third Edition). A removal efficiency of approximately 85 percent is needed to meet existing WPCF Permit limits. For this reason, adding a treatment wetland for effluent polishing would be recommended.

A4.1.2 Partially Aerated

A partially aerated lagoon would provide some of the oxygen requirements through an aeration system. For purposes of this evaluation, it was assumed that the oxygen for the first stage of the facultative lagoon system would be provided through mechanical aeration. Approximately 2 pounds of oxygen per pound of BOD_5 removed is used in this evaluation to include both BOD_5 and nitrogen reduction, and approximately 2 pounds of oxygen per horsepower (Hp) per hour can be assumed for an aeration system. The first-stage aeration system would mainly be used to increase the dissolved oxygen in the wastewater so it is available for microbial use and provide oxygen that would be consumed during the time water is in this cell. The detention time in this lagoon would be approximately three days. This first stage of the lagoon would then be approximately 10 feet deep to provide for aeration. Approximately 360 Hp of aeration would be needed. This would require a first-stage lagoon of approximately 4 acres. The second stage would then be approximately 160 acres and constructed mainly as a facultative system to provide both aerobic and anoxic microbial colonies, but this area would not provide enough oxygen for the BOD_5 loading, so approximately 106 Hp of additional aeration would still be needed in the second stage.

As with the facultative lagoons, solids handling would not be proposed for this system. Solids reduction would occur naturally in the second-stage lagoons, but solids removal from the lagoons may still be needed approximately every 30 years.

This lagoon type can reduce total nitrogen 40 to 95 percent. A removal efficiency of approximately 85 percent is needed to meet existing WPCF Permit limits. For this reason, it is recommended a treatment wetland be added for effluent polishing.

A4.1.3 Aerated

An aerated lagoon would provide sufficient oxygen through aeration systems. A partially mixed, aerated lagoon would consist of five cells with a total detention time of 20 days. The 20-day detention time is on the longer end of what would normally be anticipated, but it provides a factor of safety and capacity to realize increased reduction in total nitrogen. A total requirement of approximately 755 Hp is needed to provide the required oxygen. The depth of the lagoon cells would be approximately 11 feet. The total wet area needed would be approximately 25 acres.

Solids handling would not be anticipated for this option, as solids reduction would occur in the lagoon cells. Solids removal is still anticipated to be needed approximately once every 20 years, once the flows and loadings reach design levels.

This lagoon type can reduce total nitrogen 60 to 95 percent. A removal efficiency of approximately 85 percent is needed to meet existing WPCF Permit limits. For this reason, a treatment wetland would be recommended to be added for effluent polishing.

A4.1.4 Aerated Lagoon with Orbal Aeration

This alternative utilizes the existing capital investment in the Orbal aeration system to provide pre-aeration and reduce the total capital and operation and maintenance (O&M) requirements at the new lagoon site. The Orbal aeration system capacity would provide enough oxygen to reduce the anticipated BOD_5 loads on the proposed lagoon treatment system to approximately 9,000 ppd. This alternative would abandon the existing mechanical treatment plant facilities except for the headworks, two Orbal units, and one clarifier and associated sludge pump. The clarifier would harvest biosolids (microorganisms) from the ditch effluent and send it back to the ditch. The effluent from the ditches and clarifier would then be combined with any raw wastewater not sent to the ditch. The combined flows would then be sent to the aerated lagoons. This would reduce the total required at the aerated lagoon to approximately 375 Hp, the required detention time to 10 days, and the lagoon size from 25 to 13 acres.

Solids handling and nitrogen reduction would be similar to the aerated lagoon option.

Table 4-1 shows a summary of costs for these treatment alternatives.

TABLE 4-1
SUMMARY OF LAGOON ALTERNATIVES

	Facultative Lagoon	Partially Aerated Lagoon	Aerated Lagoon	Orbal Plus Aerated Lagoon
Mobilization/Demobilization (5% of Construction Cost)	$1,020,000	$800,000	$430,000	$250,000
Earthwork	1,750,000	860,000	678,000	564,000
Rock Removal	9,680,000	3,876,000	1,920,000	486,000
Liner	21,000,000	8,712,000	1,089,000	828,000
Control Structures	180,000	75,000	60,000	60,000
Piping	336,000	216,000	120,000	120,000
Gravel	162,000	76,000	28,000	22,000
Diffusers	0	1,200,000	1,500,000	900,000
Blowers	0	650,000	800,000	480,000
Blower Building	0	240,000	360,000	240,000
Electrical and Controls	0	500,000	600,000	500,000
Fencing	126,000	60,000	30,000	30,000
Site Work	50,000	50,000	50,000	50,000
Sum of Estimated Construction Cost	$34,304,000	$17,315,000	$7,665,000	$4,530,000
Construction Contingency (15%)	5,146,000	2,597,000	1,150,000	680,000
Subtotal Estimated Construction Cost	39,450,000	19,912,000	8,815,000	5,210,000
Administration, Legal, and Engineering (10% to 20%)	3,945,000	3,982,000	1,763,000	1,042,000
Total Capital Costs	43,395,000	23,894,000	10,578,000	6,252,000
20-year Estimated O&M Cost	3,029,000	7,976,000	8,923,000	8,462,000
Total Estimated 20-year Life Cycle Cost (2020 Dollars)	**$46,424,000**	**$31,870,000**	**$19,501,000**	**$14,714,000**

As seen on Table 4-1, the option of using a facultative or partially aerated lagoon is cost prohibitive due to the overall size and amount of liner required. Further examination of the aerated lagoon and using the City's existing Orbal system plus an aerated lagoon is analyzed considering operational impacts, long-term maintenance, location, odor concerns, future flexibility, energy efficiency, and community benefits. This analysis indicates the aerated lagoon alternative should be pursued by the City. Results of the comparison are included in Section A4.5.

A4.2 Wetlands

Wetlands are a natural treatment system that provide an environment for the healthy growth of microbial colonies that decompose organic materials and return them to their basic molecular structures. For example, complex hydrocarbons found in organic materials are consumed by microbes for their stored energy and turned into carbon dioxide, water, nitrogen gas, and phosphorus. In general, wetlands provide food and shelter for a wide variety of microbes, macroinvertebrates, insects, amphibians, waterfowl, upland birds, mammals, and all forms of life in a complex ecosystem.

A4.2.1 Treatment Wetlands

After biologic stabilization of the waste is provided in the lagoon system, the lagoon effluent should be further "polished" in treatment wetlands to provide a more natural environment to further reduce pathogens and nutrients. The wetlands would provide a shallow surface flow system for increased exposure to light and encourage vegetation growth. The vegetation in the wetlands would provide a substrate for attached growth microbial colonies that would provide for nitrification of any remaining ammonia. Denitrification would then be provided in the bottom anoxic layers of the wetlands and in deeper sections built into the environment. The treatment wetlands would be sized for a six-day detention time at an average depth of 12 inches. The treatment wetland would have a liner installed under 12 inches of native material in which vegetation would grow. The wetland would be seeded and planted. This would require a wetland complex with approximately 70 wet acres. Additional nitrogen reduction would be provided in the wetlands, but nitrogen reduction would be improved when multiple wetland cells constructed in series are provided. See Table 4-2 for a preliminary estimated project cost for these improvements.

TABLE 4-2
TREATMENT WETLAND COST ESTIMATE

Mobilization/Demobilization (5% of Construction Cost)	$400,000
Earthwork	402,000
Rock Removal	1,944,000
Liner	3,050,000
Control Structures	90,000
Piping	240,000
Gravel	42,000
Topsoil Removal and Replacement	904,000
Seeding and Planting	20,000
Fencing	42,000
Sum of Estimated Construction Cost	$7,134,000
Construction Contingency (15%)	1,070,000
Subtotal Estimated Construction Cost	8,204,000
Administration, Legal, and Engineering (20%)	1,640,000
TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)	**$9,844,000**

A4.2.2 Disposal Wetlands

The existing disposal system utilized by the City is through irrigation and seepage. The area proposed for facility construction contains a concrete sealed irrigation storage pond that holds water and a seepage area that leaks at a high rate. The size of disposal wetlands would depend on their seepage rate. Due to the function of the seepage area and the standing water from the irrigation ditch return water, it is assumed that the natural ground could provide very high infiltration rates or low infiltration rates. The existing seepage area has multiple cells with only one cell operating at a time. Based on current operation, the seepage area appears to have sufficient capacity to serve the City in the future. For this reason, the disposal wetlands are not necessarily needed, but there is an opportunity to beneficially use the effluent in a wetland environment that could be accessible to the public. This would provide a natural wildlife and park area. It is suggested to set aside approximately $4,000,000 for construction of publicly accessible wetland and wildlife park features as disposal wetlands between the treatment wetlands and the existing seepage area.

A4.3 Disinfection

After the wastewater is treated in the lagoon system, it would be disinfected. The alternatives for wastewater disinfection that would normally be considered include chlorine, ultraviolet (UV), and ozone. Using lagoon treatment prior to disinfection would make UV and ozone somewhat unreliable due to uncontrolled interferences with disinfection efficiency that come from the lagoon treatment system. For this reason, chlorine disinfection is recommended.

The disinfected lagoon effluent would then flow to the existing irrigation storage pond or into a 70-acre treatment wetland complex before entering a disposal wetland and infiltration basin area for evaporation and seepage into groundwater. The total project cost for this system is summarized on Table 4-3.

TABLE 4-3
DISINFECTION SYSTEM ESTIMATED PROJECT COST

Mobilization/Demobilization (5% of Construction Cost)	$66,000
Building	200,000
Chlorination Equipment	40,000
Chlorine Contact Basin	280,000
Electrical and Controls	100,000
Piping	12,000
Rock Removal	60,000
Gravel	2,000
Steel Building over Basin	500,000
Sum of Estimated Construction Cost	$1,260,000
Construction Contingency (15%)	189,000
Subtotal Estimated Construction Cost	1,449,000
Administration, Legal, and Engineering (20%)	290,000
TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)	**$1,739,000**

A4.4 Support Facilities

Support facilities are necessary for all three alternatives. As shown in the WWFP, recommended support facilities upgrades that apply to all alternatives total $7,100,000, as similar facilities are needed for both the Orbal and lagoon systems. However, the alternatives that abandon the Orbal system will require additional support facilities that include a new headworks, grit chamber, septage dump, etc. These are shown on Table 4-4, with the support facilities identified in the WWFP.

Table 4-4 also shows costs for constructing sludge drying beds to provide operator flexibility in being able to continually manage biosolids accumulation by wet dredging some biosolids as an alternative to taking a lagoon cell off line. The beds could also be used to dry grit. These drying beds could be constructed as part of the initial project or could be constructed as an additional phase after a few years of biosolids accumulation.

TABLE 4-4
SUPPORT FACILITIES COST ESTIMATE

Mobilization/Demobilization (5% of Construction Cost)	$600,500
Main Division Building	2,187,500
Maintenance Building	2,100,000
Generator Building	64,000
Roads and Parking	352,000
Operations Building (Motor Control Centers, Control Room, Lab)	750,000
Lift Station	400,000
Vacuum Truck/Septage Dump	90,000*
Sludge Drying Beds	2,250,000
Domestic Water	400,000
Fencing/Site Work	100,000
Headworks	400,000*
Rock Removal	12,000
Electrical and Controls	700,000
Site Piping	240,000
Grit Chamber	300,000*
Rock Processing	250,000
Sum of Estimated Construction Cost	$11,196,000
Construction Contingency (15%)	1,679,000
Subtotal Estimated Construction Cost	12,875,000
Administration, Legal, and Engineering (20%)	2,575,000
TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)	**$15,450,000**

**Not included in the Orbal plus Aerated Lagoon option.*

A4.5 Ranking

The aerated lagoon, existing Orbal aeration system plus aerated lagoon, and recommended expansion of the existing mechanical treatment plant from the WWFP are considered the viable alternatives to be ranked for comparison purposes. The selection of a preferred alternative from a variety of viable alternatives should consider several factors. The factors could include capital cost, total life cycle cost, ease of operation, maintenance, construction risk, odor concerns, future flexibility, energy efficiency, community benefits, and location. Each of these factors does not bear the same level of importance, so a weight factor is also added to assign more value to the more important factors. The factors, their ranks, and the weighted rankings are shown on Table 4-5 below.

TABLE 4-5
ALTERNATIVE RANKINGS

	Ranking (Weighted Ranking)		
Criterion (Weight)	**Aerated Lagoon**	**Orbal Plus Aerated Lagoon**	**Expand Existing Mechanical Treatment Plant**
Capital Cost (2)	$41.6 million 2 (4)	$38.5 million 3 (6)	$47.7 million 1 (2)
Life Cycle Cost (3)	$53.9 million 2 (6)	$52.8 million 2 (6)	$62.0 million 1 (3)
Ease of Operation (1)	3 (3)	1 (1)	2 (2)
Maintenance (2)	3 (6)	2 (4)	1 (2)
Construction Risk (2)	1 (2)	1 (2)	2 (4)
Odors (2)	3 (6)	2 (4)	1 (2)
Future Flexibility (1)	2 (2)	2 (2)	1 (1)
Expandability (3)	3 (9)	3 (9)	1 (3)
Energy Efficiency (1)	3 (3)	2 (2)	1 (1)
Community Benefit (2)	3 (6)	2 (4)	1 (2)
Regulatory Flexibility (3)	3 (9)	2 (6)	1 (3)
Location (2)	3 (6)	2 (4)	1 (2)
Total (Weighted Total)	**31 (62)**	**24 (50)**	**14 (27)**

Notes:

1. Highest Ranking = 3, Intermediate Ranking = 2, Lowest Ranking = 1. Weighted ranking is obtained by multiplying the ranking by the weight.

2. Costs for expand mechanical treatment plant are taken from the WWFP and inflated 2 years at 3.5 percent

3. Capital and life cycle costs are taken from the Lagoon and Wetland Treatment and Disposal Feasibility Evaluation (see Appendix B).

A5.0 Recommended Improvements

Based on the alternative rankings on Table 4-5, the alternative to move the entire treatment system, offices, and shops to a new location is proposed. The improvements would include an aerated lagoon system for secondary treatment with a lined treatment wetland for effluent polishing. Disposal would be through irrigation reuse and reuse in an unlined wetland and the existing infiltration gallery. Primary treatment would be provided with screening and grit removal. Figure 1 shows the proposed treatment process flow schematic and the following details describe each process. Figures 2 and 3 show a conceptual layout on the proposed site. These figures show some of the improvements on property not owned by the City, yet the layout could be modified to utilize City-owned property for everything but the disposal wetlands and infiltration gallery (seepage beds).

The existing WPCF Permit is established for a 2.99 MGD activated sludge mechanical treatment plant and has process limits identified for water entering the constructed disposal area wetlands (seepage beds) that are defined as moderate rate infiltration basins (Outfall 001). These limits were set for the effluent from a 2.99 MGD activated sludge mechanical treatment plant directly entering Outfall 001. In addition, the Permit has limits on downgradient groundwater monitoring wells. The Permit will need to be modified for the new treatment process and treatment plant capacity of 4.34 MGD. The new, larger capacity lagoon and wetland treatment system will protect the groundwater resources, but the change in the system will require a change in permit limits prior to water entering the groundwater. The use of the wetland system for effluent polishing will improve water quality, but the wetlands will also be susceptible to algae blooms (as the existing seepage beds are). This will make it difficult to consistently meet the current TSS limit of 20 mg/L entering the seepage beds. The 20 mg/L TSS limit was appropriately established for the activated sludge mechanical treatment plant. It is proposed to modify the Permit to increase the monthly average daily flow to 4.34 MGD and maintain the current groundwater limits of 9 mg/L nitrate and 500 mg/L total dissolved solids. In addition, it is proposed to eliminate limits for Outfall 001 but impose appropriate limits for treatment equivalent to secondary (as defined in 40 Code of Federal Regulations 133) on the aerated lagoon effluent prior to entering the polishing wetlands.

A5.1 Headworks (Primary Treatment)

The headworks consists of a screening system to remove rags and debris in wastewater. The headworks would have two rotary drum screens sized for the peak hour flow. Moving the existing screens to the new location is proposed.

After screening, wastewater will flow through a grit chamber where grit would be settled and pumped to a grit classifier for dewatering and disposal in a landfill. An aerated grit chamber could be used since air should be available from the lagoon blowers. The aerated grit chamber would provide approximately three minutes of detention time at peak flow and be dual chambered with approximately 1,620 cubic feet in volume in each chamber. The basins would each be approximately 6 feet deep, 10 feet wide, and 30 feet long. Approximately 300 cubic feet per minute of air would be needed to run the chambers. A vortex pump would remove the settled grit from a sump in the bottom of the chamber and pump it to a dewatering system.

A lift station would be added to pump the screened and de-gritted wastewater to the aerated lagoons. This lift station would meet Level 2 reliability with approximately four submersible pumps each rated at 2,020 gallons per minute.

A5.2 Aerated Lagoon (Secondary Treatment)

A partially mixed, aerated lagoon would consist of five cells with a total detention time of 20 days. A total requirement of approximately 750 Hp would be needed to provide the required oxygen. The operating depth of the lagoon cells would be approximately 11 feet. The total wet area needed would be approximately 25 acres.

The five-cell aerated lagoon system would include a final settling cell area that is a minimum of 2 acres in size to provide adequate solids settling. To avoid needing to clean all ponds at one time, the City could install a small drying bed area with dredge piping from the lagoon cells to the drying beds. City crews could then operate a dredge to pump solids from the bottom of the lagoons to the drying beds on a regular maintenance interval. Even with these improvements, it is anticipated it will take several years before there is enough accumulated biosolids in the bottom of the lagoons to be removed with a dredge.

A treatment wetland for effluent polishing would be recommended. To provide added operator flexibility, improvements could be completed that would allow for a future low head recycle pump to be easily added to recycle nitrified effluent to the first aerated lagoon for denitrification and added total nitrogen reduction.

A5.3 Treatment Wetlands

After biologic stabilization of the waste is provided in the lagoon system, the lagoon effluent should be further "polished" in lined treatment wetlands to provide a more natural environment to further reduce pathogens and nutrients. The wetland would be seeded and planted. This would require a wetland complex with approximately 70 wet acres.

A5.4 Disposal Wetlands and Infiltration Gallery

The existing disposal system utilized by the City is through irrigation and seepage. The area proposed for facility construction contains a concrete sealed irrigation storage pond that holds water and an infiltration gallery that leaks at a high rate. The proposed construction site also contains two irrigation tailwater ponds that hold water. The size of disposal wetlands would depend on the seepage rate of the wetlands. Due to the function of the seepage area, it is assumed that the natural ground could provide high infiltration rates, but the tailwater ponds indicate there are areas that could hold water. The existing seepage area has four cells with only one or two cells operated at a time. Based on current operation, the seepage area appears to have sufficient capacity to serve the City in the future. The capacity of the existing seepage area is currently adequate to dispose of the design rate of 4.34 MGD, so improvements to the infiltration gallery are not proposed, and the existing irrigation system is proposed to be maintained.

A5.5 Capital Cost and Life Cycle Cost

The total estimated capital and life cycle cost for moving the treatment plant is summarized on Table 5-1.

TABLE 5-1
NEW LAGOON AND WETLAND TREATMENT PLANT
WITH SUPPORT FACILITIES AT NEW SITE

Item	Estimated Capital Cost	Estimated 20-year Life Cycle Cost
Aerated Lagoon	$10.6 million	$19.5 million
Disinfection System	1.7 million	2.4 million
Treatment Wetlands	9.8 million	10.4 million
Disposal Wetlands	4.0 million	4.1 million
Headworks and Support Facilities	15.5 million	17.5 million
Total	**$41.6 million**	**$53.9 million**

A5.6 Other Beneficial Uses

Although these recommended improvements focus on constructing new wastewater treatment and disposal facilities, considerations could be given to developing other beneficial uses with reclaimed water from the wastewater treatment plant.

The City could construct public trails, viewing areas, and parking for public access to the wetland areas that will be home to a variety of birds and other wildlife. This trail system through the wetland areas could also be tied to a City-wide trails system as an extension to Dry Canyon. The reuse of the reclaimed water in this manner provides an ancillary benefit to the City that is otherwise not realized.

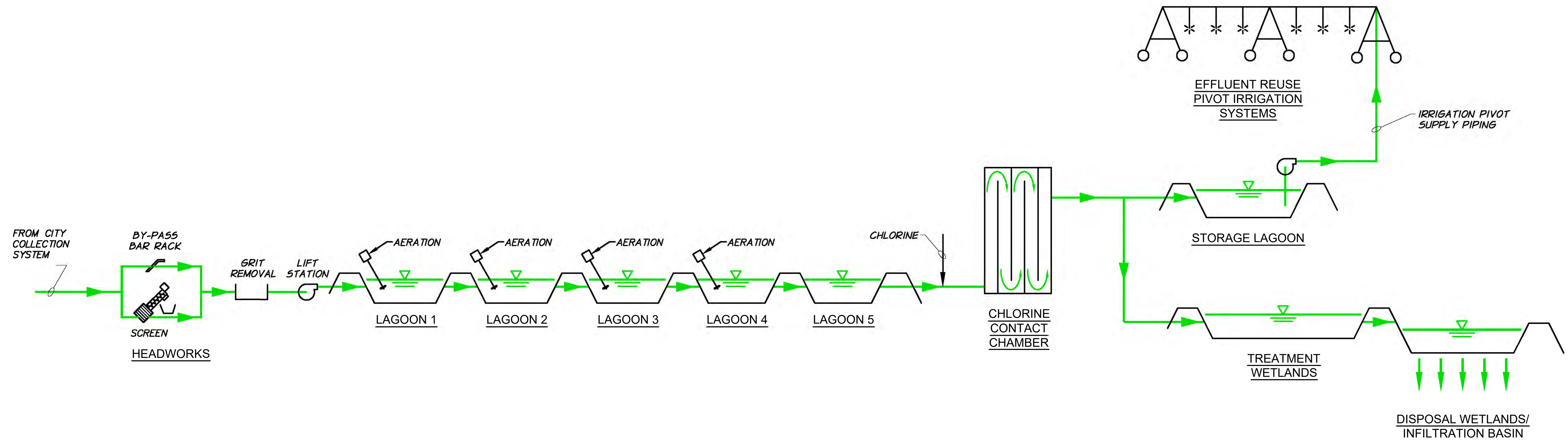
The City could also utilize treated effluent for additional beneficial uses such as irrigating turf grass for new sports fields in the area. Some added effluent polishing may be needed, depending on the proposed beneficial use. At this time, the City is not planning on changing the current irrigation practices.

As improvements are pursued for implementation, these other beneficial uses could be considered.

A6.0 Project Funding

The project will be paid for by user rates and system development charges (SDCs). The project is anticipated be financed (up to 100 percent) primarily through a DEQ loan. Up to $7.5 million of Wastewater Fund cash ($1.8 million operating/$5.7 million SDCs) will either be utilized to pay off higher interest existing debt ($850,000 of annual debt service) or support expansion project costs. The expansion debt will be paid primarily through SDCs, which equated to $2.3 million in fiscal year 2019-20. The Wastewater Fund is positioned to provide support to the expansion debt service as well. Over the past four years, the Wastewater Fund has seen surpluses, averaging approximately $400,000 per year. This surplus is expected to accelerate with the operating efficiencies (reduction in operating costs) gained from the expansion project. Current plant operating costs are approximately $2.5 million annually, which could conservatively see a 25 percent reduction, based on the new treatment concept planned in the expansion project. A five-year forecast is completed annually to evaluate operating needs and any rate increase that may be needed to support ongoing operations and debt service. Over the past five years, operating rates have, on average, increased 1.8 percent annually as part of the City's budget process. Those rate increases have received unanimous support by the Redmond City Council and remain very competitive relative to other public entities in the region.

FIGURES



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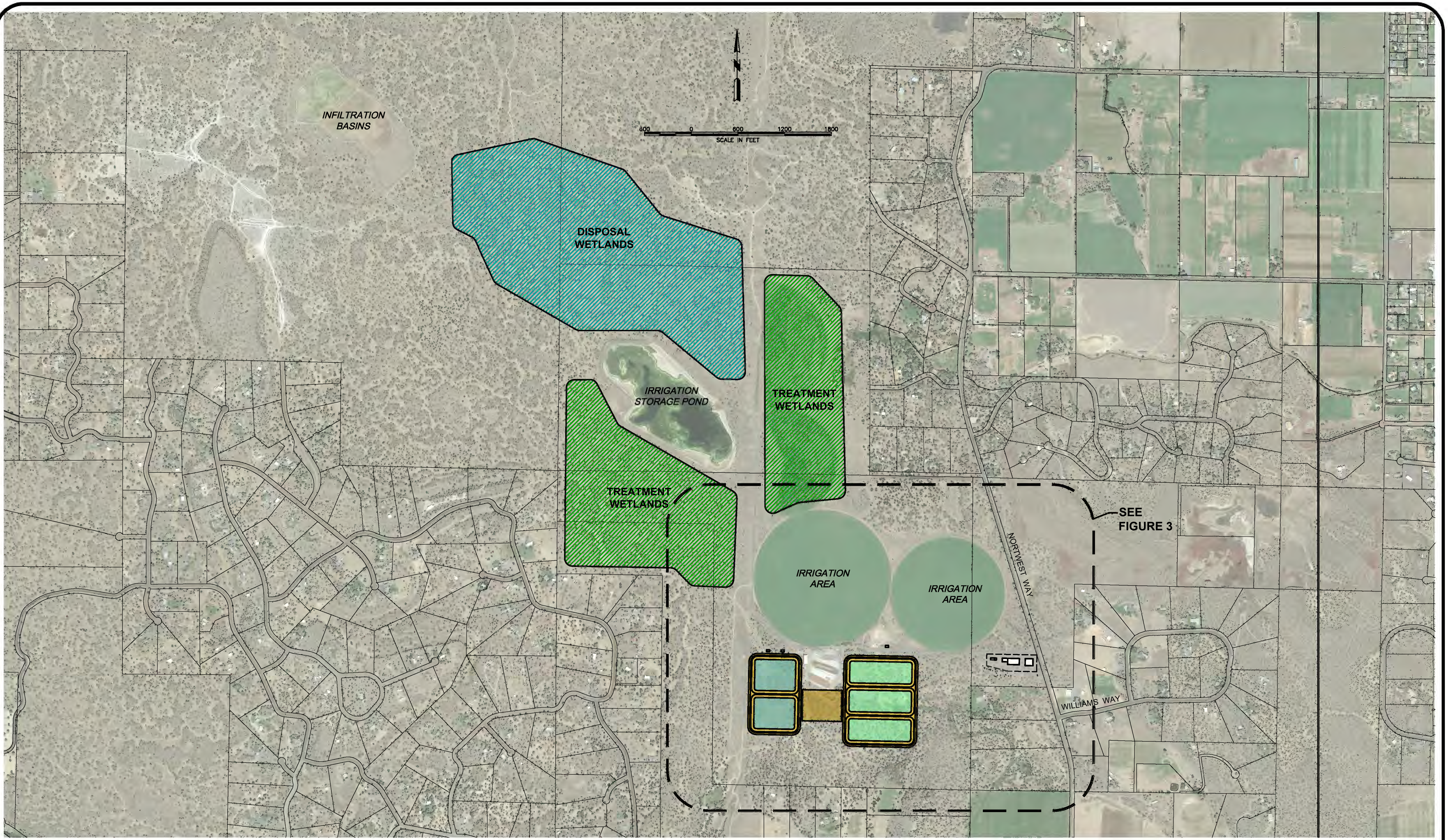
anderson perry & associates, inc.

CITY OF
REDMOND, OREGON
WASTEWATER FACILITY PLAN AMENDMENT

TREATMENT PROCESS FLOW SCHEMATIC

FIGURE
1



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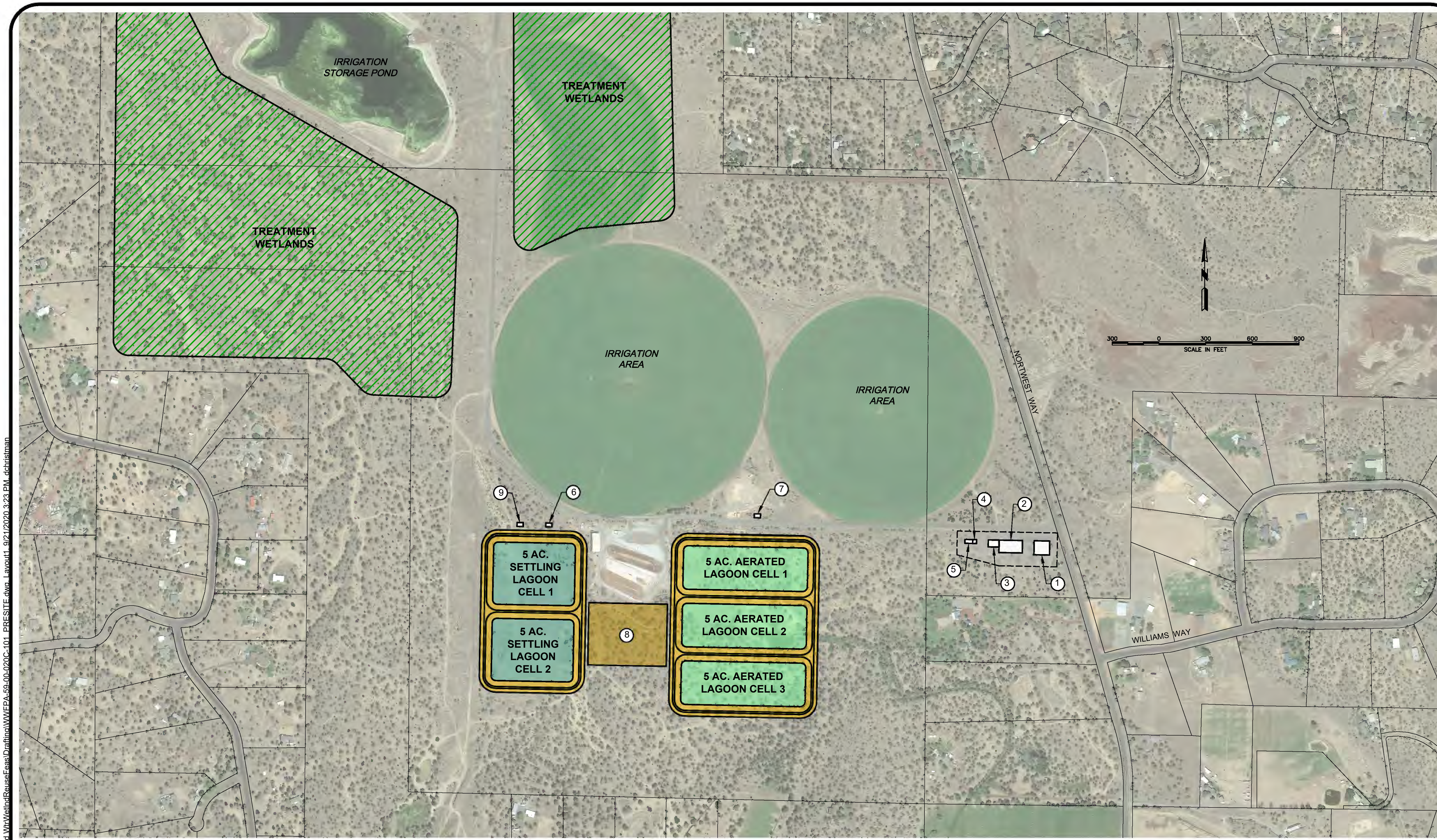
CITY OF
REDMOND, OREGON
WASTEWATER FACILITY PLAN AMENDMENT

IMPROVEMENTS PLAN

FIGURE 2



IMPROVEMENTS SCHEDULE

1. MAIN DIVISION BUILDING (8,750 SQ. FT.)
2. MAINTENANCE BUILDING (12,000 SQ. FT.)
3. OPERATIONS BUILDING (3,000 SQ. FT.)
4. VAC-TRUCK/SEPTAGE DUMP
5. HEADWORKS (SCREENS AND LIFT STATION)
6. DISINFECTION BUILDING
7. BLOWER BUILDING
8. FUTURE SLUDGE DRYING BEDS
9. CHLORINE CONTACT BASIN

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WASTEWATER FACILITY PLAN AMENDMENT

IMPROVEMENTS DETAIL PLAN

FIGURE
3

APPENDIX A
Preliminary Calculations

anderson perry & associates, inc.

Client: Redmond Job No.:
Project: Lagoon Sizing - Prelim.
Designed By: BM Ck. By: Date: 12/20 Page 1 of 2

Facultative

BOD = 18,134 ppd   Q = 4.34 MGD

t_{min} = 100 days   primary pond loading = 50 ppd/ac.
total pond loading = 35 ppd/ac.

$\frac{18,134 \text{ ppd}}{50 \text{ ppd/ac}} = 360 \text{ acres}$ $\frac{18,134 \text{ ppd}}{35 \text{ ppd/ac}} = 520 \text{ acres}$

Partially Aerated

2 #O_2 / #BOD.   2 #O_2/Hp-hr   t = 3 days - Pre-air Cell
depth = 10 feet

Facultative First Stage = 360 acres @ 30 ppd/ac = 10,800 ppd for Pre-air

$\frac{10,800 \text{ ppd}}{24 \text{ hrs}} = 360 \text{ Hp}$ Vol = 4.34 MGD x 3 days = 13.02 MG
= 40.0 ac-ft.

area = 40 ÷ 10 = 4 acres

Second Stage = 520 - 360 = 160 acres.
160 acres x 30 ppd/ac = 4,800 ppd

Total 18,134 ppd - Pre-air 10,800 ppd - Facultative 4,800 = 2,534 ppd second stage air

$\frac{2,534 \text{ ppd}}{24 \text{ hrs}} = 106 \text{ Hp}.$

PRELIMINARY

Partially Mixed aerated

$t = 20$ days $C_o = 501$ mg/l BOD $C_n = ?$ mg/l BOD $n = 5$ stages

$k = 0.14$ @ 1°C $K = 0.276$ @ 20°C

$$\frac{C_n}{C_o} = \frac{1}{\left(1+\left(\frac{kt}{n}\right)\right)^n} \Rightarrow \frac{1}{\left(1+\left(\frac{.276 \times 20}{5}\right)\right)^5} \times 501 = C_n = 12 \text{ mg/l}$$

@ $C_n = 30$ mg/l $k = 0.189\ d^{-1}$ OK

$$\frac{18{,}134 \text{ ppd BOD}}{24 \text{ hr}} = 755 \text{ Hp}$$

4.51 MGD x 20 days = 90.2 MG
= 277 ac. ft

277 ac. ft / 11 Feet deep = 25 acres.

aerated w/ Orbal

BOD for Lagoons = 9,000 ppd.

$$\frac{9000 \text{ ppd}}{24 \text{ hrs}} = 375 \text{ Hp}$$

4.51 MGD

$$\frac{9{,}000 \text{ ppd}}{8.34 \times 4.51 \text{ MGD}} = 239 \text{ mg/l BOD}$$

@ $C_n = 30$ mg/l

$$\frac{C_n}{C_o} = \frac{1}{\left(1+\left(\frac{kt}{n}\right)\right)^n} \quad \left(\left(\frac{C_o}{C_n}\right)^{1/n} - 1\right)\frac{n}{K} = t = \left(\left(\frac{239}{30}\right)^{1/5} - 1\right)\left(\frac{5}{.276}\right) = 9.3 \Rightarrow 10 \text{ days}$$

PRELIMINARY

APPENDIX B
Lagoon and Wetland Treatment and Disposal Feasibility Evaluation

LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION

FOR

CITY OF REDMOND, OREGON

Prepared for the
City of Redmond, Oregon

anderson perry

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LAGOON AND WETLAND TREATMENT AND DISPOSAL

FEASIBILITY EVALUATION

FOR

CITY OF REDMOND, OREGON

2020

ANDERSON PERRY & ASSOCIATES, INC.

La Grande, Redmond, and Hermiston, Oregon
Walla Walla, Washington

 Job No. 59-00

Table of Contents

Background

The City of Redmond, Oregon, recently completed a Wastewater Facilities Plan (WWFP) and a WWFP Update in November 2019. These planning documents recommended improvements totaling $44.6 million in 2018 dollars ($47.7 million in 2020 dollars) but did not consider improvement alternatives other than mechanical treatment. The WWFP and WWFP Update did not include other locations for the proposed improvements. The City believes it may be prudent to consider other improvement alternatives that could reduce the total life cycle costs to City residents and relocate the existing facilities out of the residential area. As an example of other possible improvements to consider, the City of Prineville, Oregon, has successfully implemented the use of lagoon technology with constructed wetland treatment and disposal, while substantially reducing the overall total cost to the City and providing public access to wetland/wildlife areas. The purpose of this feasibility evaluation is to evaluate the potential of using a lagoon treatment system with a constructed wetland treatment and disposal system as an alternative to meet the City's wastewater treatment and disposal needs.

Design Criteria

The design criteria used for this evaluation are taken from the WWFP Update. The design year 2045 was used with the following wastewater influent parameters:

- Population - 53,800
- Average Annual Flow - 3.49 million gallons per day (MGD)
- Maximum Month Flow - 3.76 MGD
- Average Annual Five-day Biochemical Oxygen Demand (BOD_5) - 14,500 pounds per day (ppd)
- Maximum Month BOD_5 - 19,000 ppd
- Average Annual Total Suspended Solids (TSS) - 9,600 ppd
- Maximum Month TSS - 14,400 ppd
- Average Annual Total Kjeldahl Nitrogen (TKN) - 1,900 ppd
- Maximum Month TKN - 2,400 ppd
- Total Dissolved Solids (TDS) - Approximately 320 milligrams per liter (mg/L)

The City's current Water Pollution Control Facilities (WPCF) Permit has wastewater effluent limits established for discharge into existing infiltration basins. These are as follows:

- BOD_5 and TSS - 20 mg/L
- Nitrate + Nitrite as Nitrogen - 6 mg/L
- Total Nitrogen - 9 mg/L
- pH - 6.0 to 9.0
- *E. coli* - 126 most probable number

The following monthly average groundwater limits apply to the down-gradient groundwater monitoring wells:

- Nitrate - 9 mg/L
- TDS - 500 mg/L

Although these design criteria considered only flows from the City of Redmond, they could be modified to include the community of Terrebonne. The following sizes and costs would be anticipated to be modified only slightly to include the expanded service area.

Lagoon Treatment

Lagoon treatment can be provided with a facultative lagoon, partially aerated lagoon, or aerated lagoon. Cost consideration is also given to an option that utilizes the existing capital investment in the treatment plant's Orbal oxidation ditches to reduce BOD_5 and, thus, lagoon size and aeration requirements. The purpose of the lagoon treatment is to provide for reduction in BOD_5 to the permit limits. Some total nitrogen reduction would also be realized for systems with front-loaded oxygen additions and facultative or anoxic zones at the end of the processes.

Facultative

A facultative lagoon provides oxygen for waste decomposition from an air/water interface area and algae photosynthesis. This system would be a minimum two-stage system operating between 3 and 7 feet in depth, with a minimum detention time of approximately 100 days. For this evaluation, an operating depth between 4 and 5 feet was assumed, and the detention time would be well in excess of 100 days due to the area needed for oxygen transfer. The first stage would need to be 290 acres and the second stage would be 190 acres, for a total lagoon size of 480 acres. For construction purposes, it is suggested to divide these lagoon cells into maximum 40-acre units. There would then be approximately 12 40-acre lagoons.

Solids handling would not be required for this option. Lagoon solids would be anticipated to be removed approximately once every 40 years, once the lagoons reach their design BOD_5 loading. A multi-cell lagoon system would allow a lagoon cell to be taken offline and solids to dry in the bottom of the lagoon for easy and cost-effective removal.

This lagoon type can reduce total nitrogen 40 to 95 percent. A removal efficiency of approximately 85 percent is needed to meet existing WPCF Permit limits. For this reason, adding a treatment wetland for effluent polishing would be recommended.

The estimated capital and 20-year lifecycle costs for this option are $43.4 million and $46.4 million, respectively (see Table 1).

Partially Aerated

A partially aerated lagoon would provide some of the oxygen requirements through an aeration system. For purposes of this evaluation, we would assume that the oxygen for the first stage of the facultative lagoon system would be provided through mechanical aeration. Approximately 2 pounds of oxygen per pound of BOD_5 removed is used in this evaluation to include both BOD_5 and nitrogen reduction, and approximately 2 pounds of oxygen per horsepower (Hp) per hour can be assumed for an aeration system. The first-stage aeration system would mainly be used to increase the dissolved oxygen in the wastewater so it is available for microbial use and provide oxygen that would be consumed during the time water is in this cell. The detention time in this lagoon would be approximately three days. This first stage of the lagoon would then be approximately 10 feet deep to provide for aeration. Approximately 360 Hp of aeration would be needed. This would require a first-stage lagoon of approximately 3.5 acres. The second stage would then be approximately 190 acres and constructed mainly as a facultative system to provide both aerobic and anoxic microbial colonies, but this area would not provide enough oxygen for the BOD_5 loading, so approximately 240 Hp of additional aeration would still be needed in the second stage.

As with the facultative lagoons, solids handling would not be proposed for this system. Solids reduction would occur naturally in the second-stage lagoons, but solids removal from the lagoons may still be needed approximately every 30 years.

This lagoon type can reduce total nitrogen 40 to 95 percent. A removal efficiency of approximately 85 percent is needed to meet the existing WPCF Permit limits. For this reason, a treatment wetland would be recommended to be added for effluent polishing.

The estimated capital and 20-year lifecycle costs for this option are $23.9 million and $31.9 million, respectively (see Table 2).

Aerated

An aerated lagoon would provide sufficient oxygen through aeration systems. A partially mixed, aerated lagoon would consist of five cells with a total detention time of 20 days. The 20-day detention time is on the longer end of what would normally be anticipated, but it provides a factor of safety and capacity to realize increased reduction in total nitrogen. A total requirement of approximately 800 Hp is needed to provide the required oxygen. The depth of the lagoon cells would be approximately 10 feet. The total wet area needed would be approximately 23 acres.

Solids handling would not be anticipated for this option, as solids reduction occurs in the lagoon cells. It is still anticipated that solids removal would be needed approximately once every 20 years, once the flows and loadings reach design levels.

This lagoon type can reduce total nitrogen 60 to 95 percent. A removal efficiency of approximately 85 percent is needed to meet the existing WPCF Permit limits. For this reason, a treatment wetland would be recommended to be added for effluent polishing.

The estimated capital and 20-year lifecycle costs for this option are $10.6 million and $19.5 million, respectively (see Table 3).

Aerated Lagoon with Orbal Pre-Aeration

This alternative utilizes the existing capital investment in the Orbal aeration system to provide pre-aeration and reduce the total capital and operation and maintenance (O&M) requirements at the new lagoon site. The Orbal aeration system capacity provides enough oxygen to reduce the anticipated BOD_5 loads on the proposed lagoon treatment system to approximately 9,000 ppd. This alternative would abandon the existing treatment plant facilities except for the headworks, two Orbal units, and one clarifier and associated sludge pump. The clarifier would harvest biosolids (microorganisms) from the ditch effluent and send them back to the ditch. The effluent from the ditches and clarifier would then be combined with any raw wastewater not sent to the ditch. The combined flows would then be sent to the aerated lagoons. This would reduce the total required at the aerated lagoon to approximately 375 Hp, the required detention time to 15 days, and the lagoon size from 23 acres to 17 acres.

Solids handling and nitrogen reduction would be similar to the aerated lagoon option.

The estimated capital and 20-year lifecycle costs for this option are $6.3 million and $14.7 million, respectively (see Table 4).

Treatment Wetlands

After biologic stabilization of the waste is provided in the lagoon system, the lagoon effluent should be further "polished" in treatment wetlands to provide a more natural environment to further reduce pathogens and nutrients. The wetlands would provide a shallow surface flow system for increased exposure to light and encourage vegetation growth. The vegetation in the wetlands provides a substrate for attached growth microbial colonies that would provide for nitrification of any remaining ammonia. Denitrification would then be provided in the bottom anoxic layers of the wetlands and in deeper sections built into the environment. The treatment wetlands would be sized for a six-day detention time at an average depth of 12 inches. The treatment wetland would have a liner installed under 12 inches of native material in which vegetation would grow. The wetland would be seeded and planted. This would require a wetland complex with approximately 70 wet acres. Additional nitrogen reduction is provided in the wetlands, but nitrogen reduction is improved when multiple wetland cells constructed in series are provided. The estimated capital and 20-year lifecycle costs for this option are $9.8 million and $10.4 million, respectively (see Table 5).

Disposal Wetlands

The existing disposal system utilized by the City is through irrigation and seepage. The area proposed for facility construction contains a concrete sealed irrigation storage pond that holds water and a seepage area that leaks at a high rate. The size of disposal wetlands would depend on the seepage rate of the wetlands. Due to the function of the seepage area, it is assumed that the natural ground would provide very high infiltration rates. The existing seepage area has multiple cells with only one cell operated at a time. Based on current operation, the seepage area appears to have sufficient capacity to serve the City in the future.

The City could construct new disposal wetlands for wildlife and public use using the water reclaimed from the wetland treatment process. These would need to have more controlled seepage by removing the topsoil, treating the fractured rock with bentonite, and replacing the topsoil. The disposal wetlands would be of varying depths and configurations that would more closely follow the natural terrain and provide wildlife habitat and an aesthetically pleasing area that the public may enjoy. For reasons of realizing a beneficial use for the reclaimed water, a capital cost of $4 million is added for disposal wetlands and trails.

Other Beneficial Uses

The City could also utilize the treated effluent for additional beneficial uses such as irrigating turf grass for new sports fields in the area. Some added effluent polishing may be needed, depending on the proposed beneficial use.

Permit Limits

The effluent permit limits that merit further discussion in this evaluation are the BOD_5 and TSS limit of 20 mg/L, total nitrogen limit of 9 mg/L entering the infiltration basins, and TDS limit of 500 mg/L in the monitoring wells. The limits entering the infiltration basins appear to have been established as technology-based effluent limits based on the activated sludge process employed in the existing treatment plant.

Biochemical Oxygen Demand and Total Suspended Solids

The treatment wetland would be susceptible to extensive algae growth that may limit the ability to consistently meet the 20 mg/L limit. This limit may be attainable with the aerated lagoon option prior to entering the treatment wetland. A discussion with the Oregon Department of Environmental Quality would need to occur to determine if the permit limit and/or monitoring location can be changed.

Nitrogen

The total nitrogen limit is achievable through a lagoon and wetland system, as the City of Prineville averaged a total nitrogen concentration of 7.0 mg/L from the lagoons throughout the 2019 season with nitrates in the monitoring wells being approximately 1 mg/L. The design of wetlands for nitrogen reduction has a large range of constants that could be used to achieve reduction efficiencies over a large range (i.e., 45 to 95 percent). This is due to the variability in plant and microbial colonies that can occur in different climatic regions and the type of waste entering the system. For this installation, data from the Cities of Prineville and La Grande, Oregon, lagoon and wetland treatment systems could be used to verify the design parameters. Some of the data that could be useful to verify the facility sizing are not currently being collected by the Cities. If this option is pursued further, additional testing from the Prineville facility would prove beneficial to confirm design parameters to reduce the risk associated with potential unknown design "constants."

Total Dissolved Solids

TDS data were collected for the existing treatment plant effluent. This TDS is also anticipated to be in the range of what would be expected for lagoon effluent. A mass balance was completed to estimate the TDS seeping into the groundwater by reducing the total seepage volume and increasing the total TDS due to evaporation. The amount of evaporation in the system would directly affect the difference in TDS between the influent and effluent, but this amount is small. TDS is expected to increase by less than 10 percent through the lagoon and wetland system.

Project Consideration

The City could consider three different alternatives to meet their future needs. These include expanding the existing mechanical treatment plant; using lagoons and wetlands to provide the treatment capacity needed for the future and continue using the headworks and office space at the existing facility; or moving the entire treatment system, offices, and shops to a new location. The decision-making process should consider Capital Cost, Life Cycle Cost, Land and Future Expandability, and Community Benefits.

Expand Existing Mechanical Treatment Plant at Existing Site

Capital Cost - This alternative was evaluated in the 2019 WWFP Update of the 2018 WWFP. The total capital cost for this alternative is $44.6 million (2018 dollars), which has been updated to $47.7 million (2020 dollars at 3.5 percent inflation).

Life Cycle Cost - This alternative has an estimated 20-year life cycle cost of approximately $62.0 million.

Land and Future Expandability - This alternative utilizes the existing site located in an area surrounded by residential housing. The options for future expandability are limited. Also, there is concern over having this industrial wastewater facility in the middle of a residential area with a public pathway through the area.

Community Benefits - This alternative will provide wastewater treatment for the City. The water is used for irrigating crops in the summertime but is disposed of in the wintertime through ground percolation. There may be opportunities for further reuse of the reclaimed water.

New Lagoons and Wetlands with Existing Facilities

This project alternative is shown on Figure 1. This alternative includes utilizing the existing headworks facility to provide screening of the influent. Raw wastewater would then flow down the existing pipelines to the proposed lagoon site at and/or adjacent to the existing irrigation area. Wastewater would then be treated in a five-cell, aerated lagoon system with chlorine disinfection. The disinfected lagoon effluent would then flow to the existing irrigation storage pond or into a 70-acre treatment wetland complex before entering a disposal wetland and infiltration basin area for evaporation and seepage into the groundwater. The total project cost for this system is summarized on the following table. The disinfection system evaluation was not part of this evaluation, but a cost estimate is included, assuming a chlorination system is used (see Table 6).

Capital Cost - The total estimated capital and associated life cycle cost is shown on the following table.

NEW LAGOON AND WETLANDS WITH EXISTING FACILITIES

Item	Estimated Capital Cost	Estimated 20-year Life Cycle Cost
Aerated Lagoon	$10.6 million	$19.5 million
Disinfection System	$1.7 million	$2.4 million
Treatment Wetlands	$9.8 million	$10.4 million
Disposal Wetlands	$4.0 million	$4.1 million
Support Facilities	$12.4 million	$16.4 million
Total	**$38.5 million**	**$52.8 million**

Note: Capital costs for Support Facilities taken from 2019 WWFP Update.

Life Cycle Cost - The 20-year life cycle cost shown above needs to be augmented to include the existing facilities that will be used as part of this alternative, and also includes the headworks and lift station. The revised total estimated life cycle cost assumes these facilities are new and is estimated at $37.0 million. Also, this alternative will split the treatment plant staff between two sites. This can provide O&M challenges.

Land and Future Expandability - The existing facilities would still be located in an area surrounded by residential homes with a walking path near the treatment plant. The lagoons and wetland areas are surrounded by undeveloped lands where future expansion could easily occur.

Community Benefits - Maintaining part of the existing treatment facilities will still have odor producing systems in the middle of the residential and pathway area. This alternative would provide a minimum of 70 acres of wetland environment that could provide plant and wildlife habitat. The City of Prineville uses its wetland area as part of their parks and trails and the City of Redmond could implement a similar community enhancement.

New Lagoon and Wetland Treatment Plant with Support Facilities at New Site

The development of new treatment facilities will provide the opportunity to move all of the treatment facilities to a new less populated area north of the City. Figures 2 and 3 show an initial potential layout for moving all of the treatment works. The additional facilities needed would include a main division building, maintenance building, generator building, operations building, vacuum truck dump, headworks screening, lift station, sludge drying beds, and associated roads and parking areas. The inclusion of sludge drying beds will allow lagoon sludge removal to be done by City staff using the drying beds and floating dredge. The drying beds can be completed as a second phase of the project, as lagoon sludge will not need to be removed for many years. The estimated cost for the headworks and support facilities, including the drying beds, is shown on Table 7.

Capital Cost and Life Cycle Cost - The total estimated capital and life cycle cost for moving the treatment plant is summarized on the following table.

NEW LAGOON AND WETLAND TREATMENT PLANT WITH SUPPORT FACILITIES AT NEW SITE

Item	Estimated Capital Cost	Estimated 20-year Life Cycle Cost
Aerated Lagoon	$10.6 million	$19.5 million
Disinfection System	$1.7 million	$2.4 million
Treatment Wetlands	$9.8 million	$10.4 million
Disposal Wetlands	$4.0 million	$4.1 million
Headworks and Support Facilities	$15.5 million	$17.5 million
Total	**$41.6 million**	**$53.9 million**

Land and Future Expandability - This alternative locates all the wastewater treatment facilities in an undeveloped area where future expandability would be easier.

Community Benefits - This alternative would provide a wetland environment that could be made accessible to the public for bird watching, hiking, and cycling. It could also be tied into a City-wide trails system as an extension to Dry Canyon. The reuse of the reclaimed water in this manner provides an ancillary benefit to the City that is otherwise not realized.

Summary

The following table summarizes the project alternatives:

Summary of Project Alternatives

Alternative	Advantages	Disadvantages	Capital Cost	20-Year Life Cycle Cost	Life Expectancy
Expand Mechanical Treatment Plant at Existing Site	Use existing headworks and treatment systems.	Odors, limited expandability, older systems, treatment plant in residential area, higher costs.	$47.7 million	$62.0 million	Reused mechanical components will have shorter life. New mechanical components will need replaced approximately every 10 years.
New Lagoons and Wetlands with Existing Facilities	Use existing headworks.	Odors, older systems, two sites, treatment plant in residential area.	$38.5 million	$52.8 million	Unknown life for existing lift station and headworks but will most likely need to be rebuilt before 20 years.
New Lagoon and Wetland Treatment Plant with Support Facilities at New Site	Move out of residential and Dry Canyon Park area. Expandable. All new systems. Added wildlife habitat. Added trails system. Reduced biosolids handling. Increased tourism possibilities.		$41.6 million	$53.9 million	Lagoons and wetlands have a life expectancy in excess of 50 years.

TABLES

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
FACULTATIVE LAGOON
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (3% of Construction Cost)	LS	$ 1,020,000	All Req'd	$ 1,020,000
2	Earthwork	CY	5	350,000	1,750,000
3	Rock Removal	CY	60	161,333	9,680,000
4	Liner	SF	1	21,000,000	21,000,000
5	Control Structures	EA	15,000	12	180,000
6	Piping	LF	60	5,600	336,000
7	Gravel	CY	20	8,100	162,000
8	Fencing	LF	6	21,000	126,000
9	Site Work	LS	50,000	All Req'd	50,000
	Sum of Estimated Construction Cost				**$ 34,304,000**
	Construction Contingency (15%)				5,146,000
	Subtotal Estimated Construction Cost				**$ 39,450,000**
	Administration, Legal, and Engineering (10%)				3,945,000
	TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)				**$ 43,395,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 41,000
2	Supplies, Parts, Maintenance, and Repairs	1,000
3	Replacement	1,000
4	Lagoon Solids Removal	200,000
	Total OM&R	**$ 243,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	3,029,000
	Total Present Worth (2020 Dollars)	**$ 46,424,000**

anderson perry & associates, inc.

CITY OF
REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
FACULTATIVE LAGOON
PRELIMINARY COST ESTIMATE

TABLE 1

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
PARTIALLY AERATED LAGOON
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (4% of Construction Cost)	LS	$ 800,000	All Req'd	$ 800,000
2	Earthwork	CY	5	172,000	860,000
3	Rock Removal	CY	60	64,600	3,876,000
4	Liner	SF	1	8,712,000	8,712,000
5	Control Structures	EA	15,000	5	75,000
6	Piping	LF	60	3,600	216,000
7	Gravel	CY	20	3,800	76,000
8	Diffusers	LS	1,200,000	All Req'd	1,200,000
9	Blowers	LS	650,000	All Req'd	650,000
10	Blower Building	SF	200	1,200	240,000
11	Electrical and Controls	LS	500,000	All Req'd	500,000
12	Fencing	LF	6	10,000	60,000
13	Site Work	LS	50,000	All Req'd	50,000
				Sum of Estimated Construction Cost	**$ 17,315,000**
				Construction Contingency (15%)	2,597,000
				Subtotal Estimated Construction Cost	**$ 19,912,000**
				Administration, Legal, and Engineering (20%)	3,982,000
				TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)	**$ 23,894,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 82,000
2	Supplies, Parts, Maintenance, and Repairs	2,000
3	Power (600 horsepower, $0.08 per kilowatt hour)	314,000
4	Replacement	62,000
5	Lagoon Solids Removal	180,000
	Total OM&R	**$ 640,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	7,976,000
	Total Present Worth (2020 Dollars)	**$ 31,870,000**

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
AERATED LAGOON
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (5% of Construction Cost)	LS	$ 430,000	All Req'd	$ 430,000
2	Earthwork	CY	6	113,000	678,000
3	Rock Removal	CY	60	32,000	1,920,000
4	Liner	SF	1	1,089,000	1,089,000
5	Control Structures	EA	15,000	4	60,000
6	Piping	LF	60	2,000	120,000
7	Gravel	CY	20	1,400	28,000
8	Diffusers	LS	1,500,000	All Req'd	1,500,000
9	Blowers	LS	800,000	All Req'd	800,000
10	Blower Building	SF	200	1,800	360,000
11	Electrical and Controls	LS	600,000	All Req'd	600,000
12	Fencing	LF	6	5,000	30,000
13	Site Work	LS	50,000	All Req'd	50,000
				Sum of Estimated Construction Cost	**$ 7,665,000**
				Construction Contingency (15%)	1,150,000
				Subtotal Estimated Construction Cost	**$ 8,815,000**
				Administration, Legal, and Engineering (20%)	1,763,000
				TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)	**$ 10,578,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 164,000
2	Supplies, Parts, Maintenance, and Repairs	10,000
3	Power (800 horsepower, $0.08 per kilowatt hour)	418,000
4	Replacement	82,000
5	Lagoon Solids Removal	42,000
	Total OM&R	**$ 716,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	8,923,000
	Total Present Worth (2020 Dollars)	**$ 19,501,000**

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CITY OF
REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL
FEASIBILITY EVALUATION
AERATED LAGOON
PRELIMINARY COST ESTIMATE

TABLE
3

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
ORBAL PLUS AERATED LAGOON
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (5% of Construction Cost)	LS	$ 250,000	All Req'd	$ 250,000
2	Earthwork	CY	6	94,000	564,000
3	Rock Removal	CY	60	8,100	486,000
4	Liner	SF	1	828,000	828,000
5	Control Structures	EA	15,000	4	60,000
6	Piping	LF	60	2,000	120,000
7	Gravel	CY	20	1,100	22,000
8	Diffusers	LS	900,000	All Req'd	900,000
9	Blowers	LS	480,000	All Req'd	480,000
10	Blower Building	SF	200	1,200	240,000
11	Electrical and Controls	LS	500,000	All Req'd	500,000
12	Fencing	LF	6	5,000	30,000
13	Site Work	LS	50,000	All Req'd	50,000
				Sum of Estimated Construction Cost	**$ 4,530,000**
				Construction Contingency (15%)	680,000
				Subtotal Estimated Construction Cost	**$ 5,210,000**
				Administration, Legal, and Engineering (20%)	1,042,000
				TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)	**$ 6,252,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 165,000
2	Supplies, Parts, Maintenance, and Repairs	10,000
3	Power (800 horsepower, $0.08 per kilowatt hour)	418,000
4	Replacement	44,000
5	Lagoon Solids Removal	42,000
	Total OM&R	**$ 679,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	8,462,000
	Total Present Worth (2020 Dollars)	**$ 14,714,000**

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
TREATMENT WETLANDS
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (5% of Construction Cost)	LS	$ 400,000	All Req'd	$ 400,000
2	Earthwork	CY	6	67,000	402,000
3	Rock Removal	CY	60	32,400	1,944,000
4	Liner	SF	1	3,050,000	3,050,000
5	Control Structures	EA	15,000	6	90,000
6	Piping	LF	60	4,000	240,000
7	Gravel	CY	20	2,100	42,000
8	Top Soil Removal and Replacement	CY	8	113,000	904,000
9	Seeding and Planting	LS	20,000	All Req'd	20,000
10	Fencing	LF	6	7,000	42,000
				Sum of Estimated Construction Cost	**$ 7,134,000**
				Construction Contingency (15%)	1,070,000
				Subtotal Estimated Construction Cost	**$ 8,204,000**
				Administration, Legal, and Engineering (20%)	1,640,000
				TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)	**$ 9,844,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 41,000
2	Supplies, Parts, Maintenance, and Repairs	1,000
3	Replacement	1,000
4	Vegetation Removal	2,000
	Total OM&R	**$ 45,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	561,000
	Total Present Worth (2020 Dollars)	**$ 10,405,000**

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
DISINFECTION SYSTEM
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (5% of Construction Cost)	LS	$ 66,000	All Req'd	$ 66,000
2	Building	SF	200	1,000	200,000
3	Chlorination Equipment	LS	40,000	All Req'd	40,000
4	Chlorine Contact Basin	LS	280,000	All Req'd	280,000
5	Electrical and Controls	LS	100,000	All Req'd	100,000
6	Piping	LF	60	200	12,000
7	Rock Removal	CY	60	1,000	60,000
8	Gravel	CY	20	100	2,000
9	Steel Building Over Basin	LS	500,000	All Req'd	500,000
	Sum of Estimated Construction Cost				**$ 1,260,000**
	Construction Contingency (15%)				189,000
	Subtotal Estimated Construction Cost				**$ 1,449,000**
	Administration, Legal, and Engineering (20%)				290,000
	TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)				**$ 1,739,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor	$ 20,000
2	Supplies, Parts, Maintenance, and Repairs	30,000
3	Replacement	2,000
	Total OM&R	**$ 52,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	649,000
	Total Present Worth (2020 Dollars)	**$ 2,388,000**

CITY OF REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
SUPPORT FACILITIES
PRELIMINARY COST ESTIMATE
(YEAR 2020 COSTS)

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	PRICE
1	Mobilization/Demobilization (5% of Construction Cost)	LS	$ 600,500	All Req'd	$ 600,500
2	Main Division Building	SF	250	8,750	2,187,500
3	Maintenance Building	SF	175	12,000	2,100,000
4	Generator Building	SF	200	320	64,000
5	Roads and Parking	SY	22	16,000	352,000
6	Operations Building (Motor Control Center, Control Room, Lab)	SF	250	3,000	750,000
7	Lift Station	LS	400,000	All Req'd	400,000
8	Vacuum Truck/Septage Dump	LS	90,000	All Req'd	90,000
9	Sludge Drying Beds	Acre	750,000	3	2,250,000
10	Domestic Water	LF	40	10,000	400,000
11	Fencing/Site Work	LS	100,000	All Req'd	100,000
12	Headworks	LS	400,000	All Req'd	400,000
13	Rock Removal	CY	60	200	12,000
14	Electrical and Controls	LS	700,000	All Req'd	700,000
15	Site Piping	LF	60	4,000	240,000
16	Grit Chamber	LS	300,000	All Req'd	300,000
17	Rock Processing	LS	250,000	All Req'd	250,000
	Sum of Estimated Improvements Construction Cost				**$ 11,196,000**
	Construction Contingency (15%)				1,679,000
	Subtotal Estimated Improvements Construction Cost				**$ 12,875,000**
	Administration, Legal, and Engineering (20%)				2,575,000
	TOTAL ESTIMATED PROJECT COST (2020 DOLLARS)				**$ 15,450,000**

PRESENT WORTH ANALYSIS (2020 DOLLARS)

Item	Description	Annual Cost
	ADDITIONAL ANNUAL OPERATION, MAINTENANCE, AND REPLACEMENT (OM&R)	
1	Labor (Headworks and Lift Station Only)	$ 126,000
2	Supplies, Parts, Maintenance, and Repairs	10,000
3	Replacement	30,000
	Total OM&R	**$ 166,000**
	Present Worth Operation and Maintenance Cost (5%, 20 years)	2,069,000
	Total Present Worth (2020 Dollars)	**$ 17,519,000**

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CITY OF
REDMOND, OREGON
LAGOON AND WETLAND TREATMENT AND DISPOSAL FEASIBILITY EVALUATION
SUPPORT FACILITIES
PRELIMINARY COST ESTIMATE

TABLE
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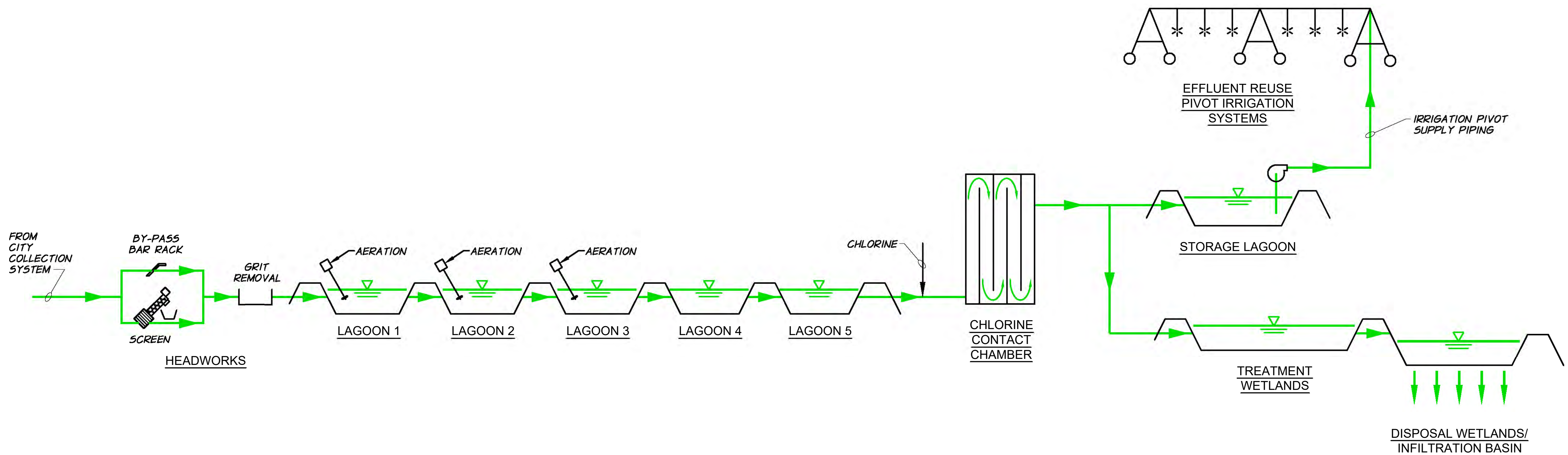
FIGURES



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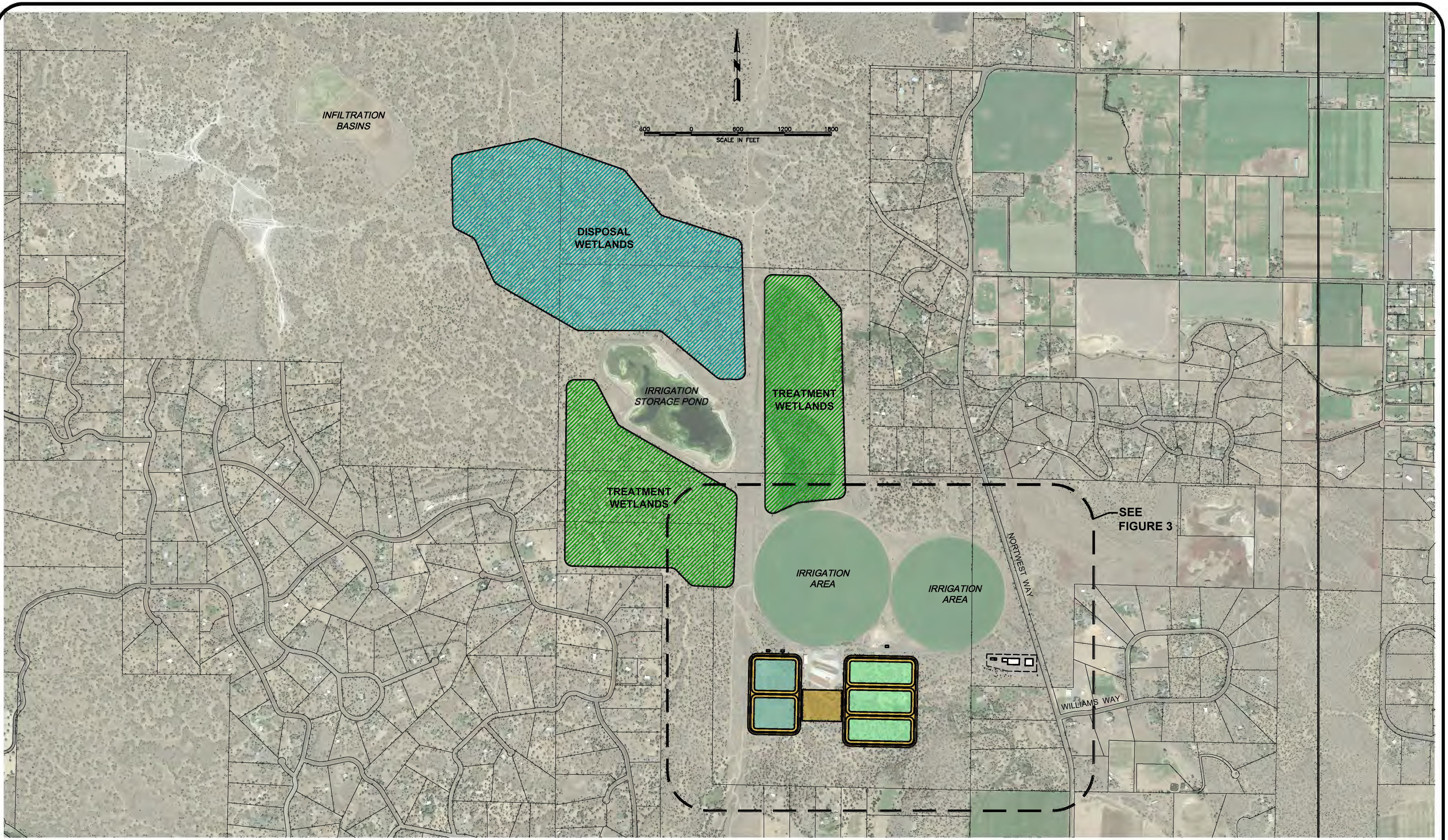
CITY OF
REDMOND, OREGON
RECLAIMED WATER WETLAND REUSE FEASIBILITY EVALUATION

TREATMENT PROCESS FLOW SCHEMATIC

FIGURE 1



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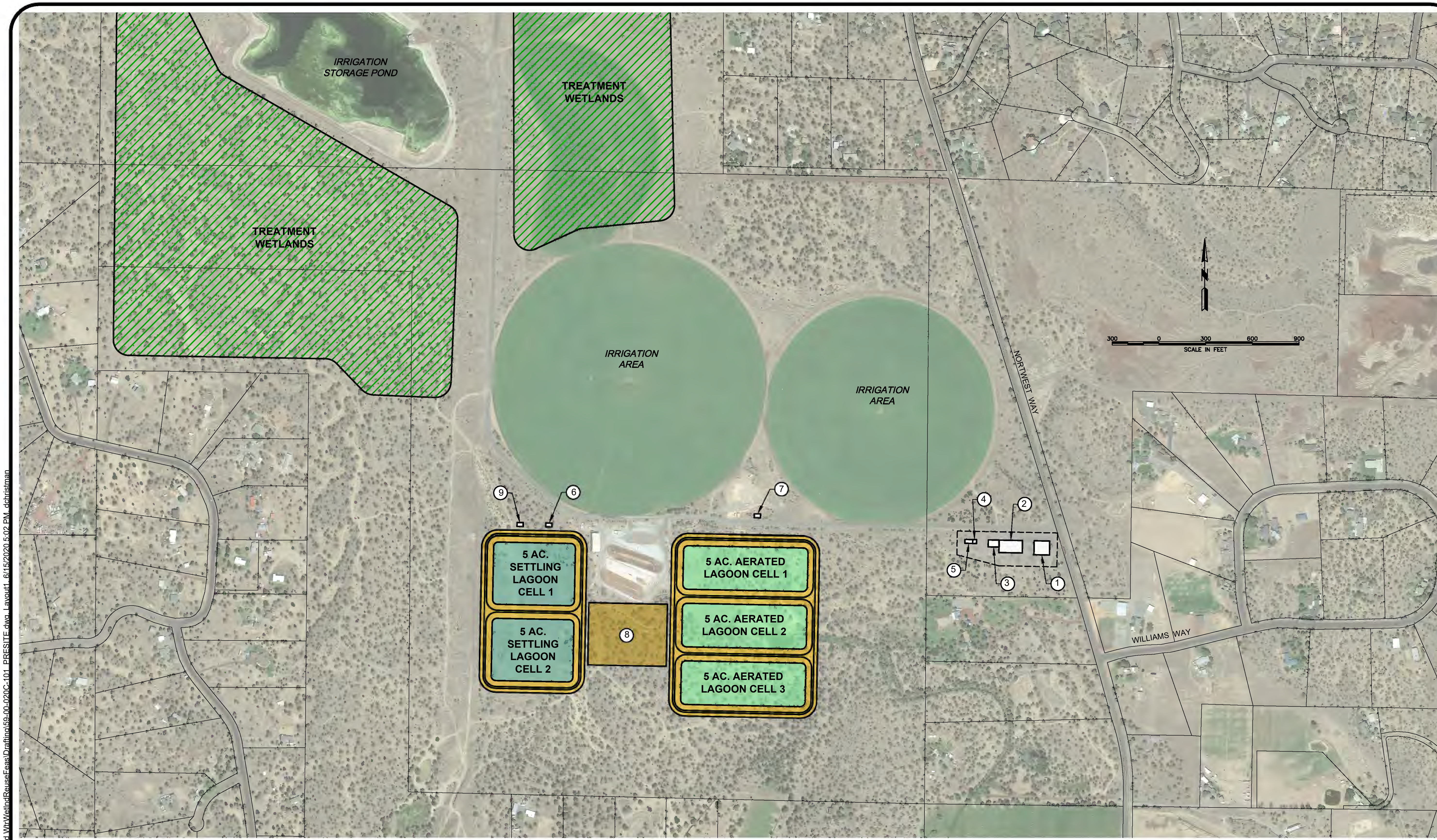
CITY OF
REDMOND, OREGON
RECLAIMED WATER WETLAND REUSE FEASIBILITY EVALUATION

IMPROVEMENTS PLAN

FIGURE
2



IMPROVEMENTS SCHEDULE

1. MAIN DIVISION BUILDING (8,750 SQ. FT.)
2. MAINTENANCE BUILDING (12,000 SQ. FT.)
3. OPERATIONS BUILDING (3,000 SQ. FT.)
4. VAC-TRUCK/SEPTAGE DUMP
5. HEADWORKS (SCREENS AND LIFT STATION)
6. DISINFECTION BUILDING
7. BLOWER BUILDING
8. FUTURE SLUDGE DRYING BEDS
9. CHLORINE CONTACT BASIN

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CITY OF
REDMOND, OREGON
RECLAIMED WATER WETLAND REUSE FEASIBILITY EVALUATION

IMPROVEMENTS DETAIL PLAN

FIGURE
3

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