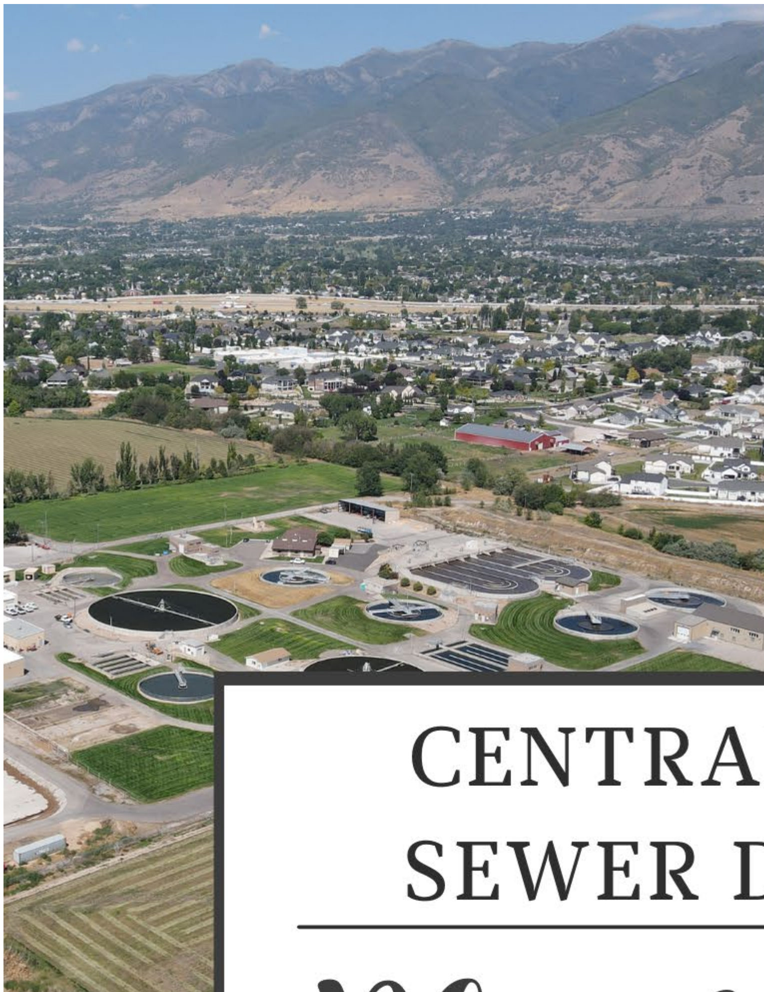

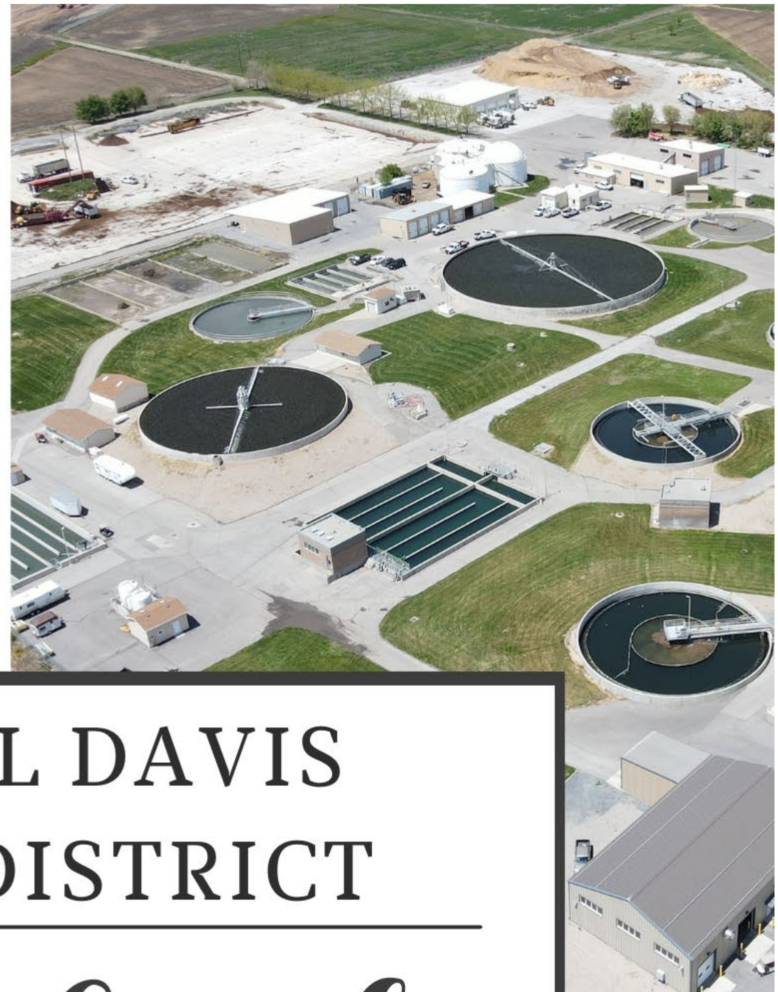

CENTRAL DAVIS SEWER DISTRICT

Plant Guide

Wastewater Treatment Plant General Information

First Constructed	1961
Original Capacity	2.0 MGD
Current Capacity – Peak Flow	22.0 MGD
Maximum Monthly Capacity	12.0 MGD
Design Capacity	9.9 MGD
Organic Treatment Capacity	23,100 lbs.
Tons of Compost Produced Annually	1,750
Tons of Biosolids Land Applied	230
Acres of Hay Farmed	130
Collection System Miles	275
Historical Average MGD	5.60
Service Area	Farmington Fruit Heights Kaysville

Central Davis Sewer District

Block Flow Diagram

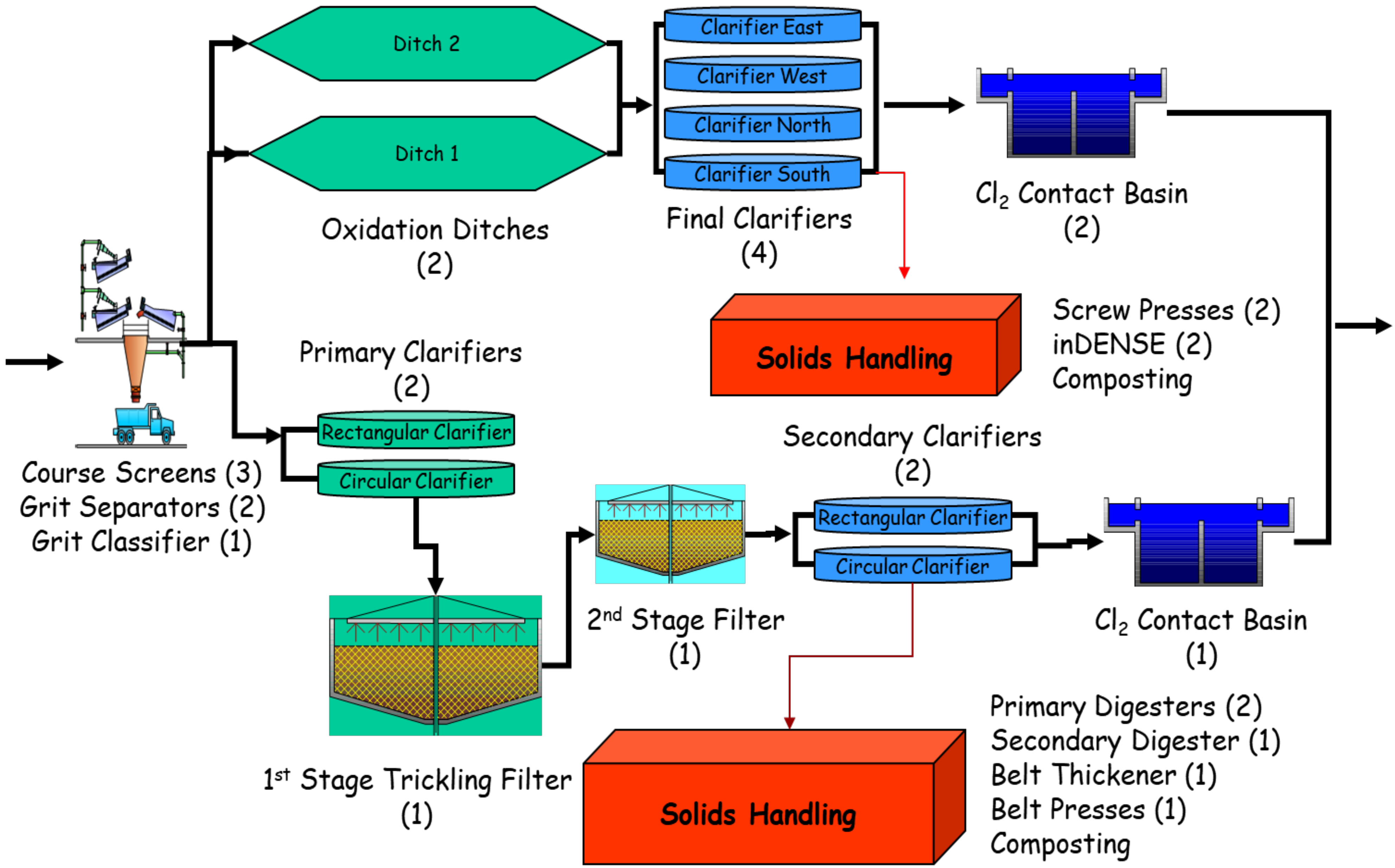

Figure 1: CDSD Treatment Plant

HEADWORKS

Central Davis Sewer District serves the cities of Farmington, Fruit Heights, and Kaysville. The influent flows in from 3 major trunklines on the District's property into the Headworks.

Figures 2: Headworks Arial Photos

Figure 3: Headworks Screens/Compaction and Classifiers

Figure 4: Grit Pumps

Figure 5: Headworks Electrical Panels

The Headworks Building is the primary treatment of the wastewater stream. The plant's headworks plays a crucial role in the pretreatment of the influent for any wastewater treatment facility. It protects the operation of downstream equipment and enhances the efficiency of the overall wastewater treatment process. Because all wastewater debris starts at the headworks, proper screening and debris removal is imperative to the entire wastewater system. Pretreatment devices are designed to remove or reduce large solids like wood, cloth, paper, and plastics, while also dealing with grit and excessive amounts of oil and grease.

CDSD's Headworks contain a total of 3 Screens, two step screens and one band screen. The headwork also contains a grit system with a grit classifier and chambers.

After the Headworks the Flow is then split approximately one third to the Trickling Filter side of the treatment plant and two thirds to the Oxidation Ditch side of the treatment plant. The two processes remain completely separate for the duration of the treatment process until discharge.

Oxidation Ditch Treatment Train

Figure 6: Oxidation Ditch Treatment Arial

After the Headworks, two-thirds of the flow is directed towards the Screw Pumps. The Screw pumps convey the flow into the oxidation ditches.

Figure 7: Screw Pump Station and Generators

Figure 8: Oxidation Ditches

An oxidation ditch is a modified activated sludge biological treatment process that utilizes long solids retention times (SRTs) to remove biodegradable organics. Oxidation ditches are typically complete mix systems. Horizontally or vertically mounted aerators provide circulation, oxygen transfer, and aeration in the ditch. Flow to the oxidation ditch is aerated and mixed with return sludge from a secondary clarifier. The mixing process entrains oxygen into the mixed liquor(the water in the oxidation ditch) to foster microbial growth and the motive velocity ensures contact of microorganisms with the incoming wastewater. Solids are maintained in suspension as the mixed liquor circulates around the ditch. When optimal conditions are maintained the oxidation ditch can provide nitrification and denitrification. Oxidation ditch effluent is usually settled in the secondary or final clarifier.

The Oxidation Ditches were constructed from the late 1980s to the early 1990s. The west ditch being constructed first, along with the north and south final clarifiers. The oxidation ditches can hold a combined volume of 3 MGD (million gallons per day). Each clarifier has a volume of 0.5 MGD.

After the oxidation ditches, the flow is sent to the final clarifiers to separate the solids and the liquid. Alum dosing occurs off the weirs of the oxidation ditch prior to the flow going into the clarifiers.

Figure 9: Oxidation Ditch Alum Building and System

Figure 10: Oxidation Ditch Final Clarifiers

Clarifiers are required wherever the suspended solids in wastewater are higher in concentration. Almost all treatment plant Clarifiers are of circular or rectangular design. Clarifiers work on the principle of gravity settling. The heavier suspended solids settle in the clarifier due to the dormant conditions provided in the Clarification zone. The settled solids are swept to the center well provided for collection of sludge with help of moving scraper blades. Most of the waste waters contain some scum material which does not settle down & needs to be collected on the surface of the clarifier. Hence a scum removal system is typical.

The solids from the clarifiers are directed into the buildings known as RAS1-WAS1 and RAS2-WAS2. Returned Activated Sludge (RAS) is the biosolids that is returned to the system off the bottom of the clarifiers. The RAS is returned back to the oxidation ditch to prevent the loss of microorganisms and to maintain an adequate population in the mixed liquor. The RAS1 building is for the North and South clarifiers for west oxidation ditch. RAS2 is for the east and west clarifiers off the east oxidation ditch. The Waste Activated Sludge (WAS) is the biosolids that is wasted or removed from the bottom of the clarifiers. The WAS is sent to the dewatering building where it is thickened and sent to the landfill or composted.

The WAS is thickened in the dewatering building. The dewatering building contains two screw presses, that were installed in 2019. The dewatering building also houses inDENSE, a hydro-cyclone system that wastes filamentous (lighter particle biosolids that bridges) material and recycles the larger denser flocs.

Figure 11: RAS 1 Building

Figure 12: RAS and WAS Pumps for North and South Clarifiers

Figure 13: RAS 2 Building

Figure 14: RAS and WAS Pumps for East and West Clarifiers

Figure 15: Solids Handling for Oxidation Ditch Treatment Train

Figure 16: Inside Solids Handling for Oxidation Ditch Treatment Train

From the clarifiers the liquid treatment is disinfected through chlorination. Sodium Hypochlorite(liquid bleach) is dripped into the chlorination basin and detained for contact time before discharge.

The final step in the treatment process is disinfection using chlorine. The Chlorine Contact Basins are long, snake-like channels where chlorine is added to the flowing treated wastewater for disinfection. Disinfection is the process where disease-causing organisms (mostly bacteria) are killed by the chlorine. It's the same process used in swimming pools (with the same chlorine smell), but the chemicals used are much stronger. The long channels slow down the flow, allowing the chlorine enough time, at least two hours, to kill all the disease-causing organisms.

Figure 17: Chlorination Basin for Oxidation Treatment Train

Trickling Filter System

Figure 18: Trickling Filter System

After the Headworks, one-thirds of the flow is directed towards the primary clarifiers on the Trickling Filter side.

From the Headworks the flow is split into the two primary clarifiers: the rectangular and circular. The primary clarifiers typically remove 50-70% of the total suspended solids and 25-40 % of the biological oxygen demand (BOD). TSS and BOD are both indicators of the quantity of organic strength of the wastewater.

Figure 19: Primary Clarifiers

After the primary clarifiers the water is combined and pumped into the First Stage Trickling Filter.

The sludge from the bottom of the primary clarifiers is pumped into the primary digestors.

Figure 20: Trickling Filter Primary Pump Station Building

Figure 21: TF Sewage Pumps


Figure 22: Sludge Pumps and Grinder

Trickling filters (TFs) are used to remove organic matter from wastewater. The TF is an aerobic treatment system that utilizes microorganisms attached to a medium to remove organic matter from wastewater. These systems are known as attached-growth processes. Trickling Filters enable organic material in the wastewater to be adsorbed by a population of microorganisms (aerobic, anaerobic, and facultative bacteria; fungi; algae; and protozoa) attached to the medium as a biological film or slime layer (approximately 0.1 to 0.2 mm thick). As the wastewater flows over the medium, microorganisms already in the water gradually attach themselves to the rock, slag, or plastic surface and form a film. The organic material is then degraded by the aerobic microorganisms in the outer part of the slime layer. As the layer thickens through microbial growth, oxygen cannot penetrate the medium face, and anaerobic organisms develop.

From the First Stage Trickling Filter the water is then pumped into the second stage Trickling Filter.

Figure 23: Secondary Pumps

Figure 24: 2nd Stage Trickling Filter

After the Second Stage Trickling Filter the water goes into the secondary clarifiers.

The sludge from the bottom of the secondary clarifiers is pumped into the primary anaerobic digestors.

Figure 25: Second Stage Trickling Filter Pump Station

Anaerobic digestion is a process through which bacteria break down organic matter—such as wastewater biosolids, and food wastes—in the absence of oxygen. Anaerobic digestion for biogas production takes place in a sealed vessel called a reactor. These reactors contain complex microbial communities that break down (or digest) the waste and produce resultant biogas and digestate. The digestate can be sold as a class b product as long as the regulatory requirements are met.

Figure 26: Digestors

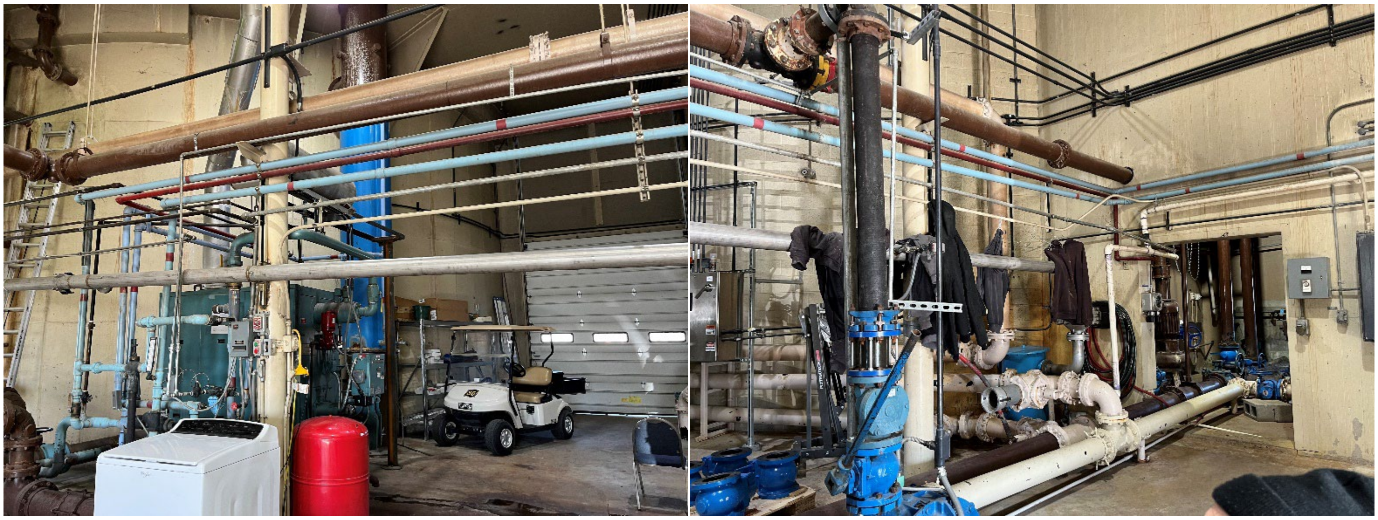

Figure 27: Inside the Digestors

After the Second Stage Trickling Filter the water goes into the secondary clarifiers.

The secondary clarifiers are the final step before disinfection to remove biomass from the treated water. Solids settle to the bottom of the clarifier and are pumped into the digestors.

Figure 28: Secondary Clarifiers

The two primary digestors are heated at mesophilic temperatures (85°F-100F°) and then pumped into the secondary digestor. The secondary digestor has a duo sphere membrane lid for gas/methane capture. Although the District at this time is not capturing the gas. The gas is currently being flared. After digestion the solids are sent to the gravity thickener or the gravity belt to thicken the solids for land application or compost.

Figure 29: Trickling Filter Solids Handling Building

Figure 29: Trickling Filter Solids Handling Building

Figure 30: Gravity Thickener

Figure 31: Belt Press and Polymer System

Figure 32: Loading Building

After the secondary clarifiers the water is disinfected like the oxidation treatment train through sodium hypochlorite. The two treatment trains combine after disinfection. The effluent is then sent to Farmington Bay of Great Salt Lake.

Figure 33: Sodium Hypochlorite Holding Tanks for Disinfection

Figure 34: Central Davis Sewer District Outfall