TOWN OF PALISADE

SEWER TRANSFER STUDY

BY

J-U-B ENGINEERS, INC.

REVISED JUNE 2020

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1 Executive Summary

Background

In 2009 the Colorado Department of Public Health and Environment (CDPHE) issued revised effluent limits to the Town of Palisade (Town) that were scheduled to go into effect in 2013. The Town at that time investigated methods of increasing the quality of treatment utilizing their aerated lagoon wastewater treatment facility. In 2009, the Town also investigated the possibility of transporting its wastewater southwest to Clifton Sanitation District (CSD). This alternative would eliminate the requirement for the Town to construct and operate its own upgraded mechanical wastewater treatment facility needed to meet the requirements of the revised effluent standards issued by the CDPHE. A report was performed by SGM Inc. as part of this investigation, in which they prepared a preliminary route evaluation and ultimately recommended transporting the Town's wastewater using a lift station and force main along HWY 6. The estimated cost of construction in 2010 for this lift station and force main was $4.2M, with an annual O&M cost of approximately $402,000. The Town pursued a funding opportunity through USDA that was not successful. The Town ultimately decided not to construct this lift station and force main.

In 2012 a project was completed to meet more strict effluent limits for ammonia concentration. The Town constructed an effluent diffuser in the main stem of the Colorado River. This allowed the Town to meet the ammonia effluent limit set by the CDPHE. There are other design limits which the CDPHE considers regarding treatment of the Towns wastewater. Influent limits are also established based on the ability of the treatment process to successfully treat the waste to meet required effluent limits. Based on influent data provided by the Town, it is apparent that since approximately 2013 the Town wastewater has exceeded its influent organic load capacity allowed per the current CDPHE permit. The Town is at a point where a decision has to be made regarding treatment of the Towns wastewater. The Town is currently and has for some time been out of compliance with the current discharge permit. A plan needs to be established that will enable the Town to meet current and anticipated more stringent permit requirements. The Town asked J-U-B Engineers to develop several alternatives for treatment that will meet CDPHE requirements for wastewater treatment. Several options were explored.

1. Construction of a mechanical treatment plant.
2. Alternatives for conveyance of wastewater from the Town to the Clifton Sanitation District (CSD) mechanical plant located at 3217 D Road for treatment.
3. Evaluation of feasibility to provide sewer service for future expansion of the Town's sewer service area to the east boundary line of the Cooperative Planning Area (roughly 36 1/10 Road which is the west boundary of the Town's anticipated future sewer service area). This evaluation is based on the Town's existing future land use plan.

Wastewater Treatment Options

The Town may have the option to install a new mechanical plant to directly treat their wastewater. This would allow the Town to meet current and anticipated future effluent limits established by the CDPHE. Some issues must be resolved before a plant could be constructed:

1. As a part of the site application to CDPHE, applicants are required to demonstrate they do not have the ability to regionalize their facility and combine with others. Regionalization helps to

prevent degradation of neighboring rivers. Since CSD is prepared to accept wastewater from the Town and a connection to their wastewater system is only a few miles to the southwest, their mechanical plant would satisfy these requirements. To successfully permit a new mechanical plant with the State, the Town would need to demonstrate that connection to the CSD treatment facility, and therefore regionalization, would not be possible.

2. We anticipate that Clifton Water District, which has a treated water supply intake two miles downstream of the Palisade WWTF site, may argue with CDPHE that regional treatment is the preferred alternative based on proximity of their Colorado River intake.

3. The construction cost of a new wastewater treatment facility would be approximately $18,300,000, including a yearly personnel and maintenance cost of $534,330. The present value for the construction of a new wastewater treatment facility is $37,336,158.

Wastewater Transfer Options

Three transport options were evaluated as part of this report:

1. A gravity only sewer line. This option is estimated to cost approximately $5,457,742 to construct, with a present value estimate of $8,628,625.

2. A lift station with long force main along HWY 6 (previously proposed 2009 conveyance option). This option is estimated to cost approximately $5,205,370 to construct, with a present value estimate of $8,337,445 for the Town. CSD has not agreed to maintain the transfer line for this option.

3. A combination gravity line section and short force main discharging to a second gravity line. This option is estimated to cost approximately $6,856,660 to construct, with a present value estimate of $6,957,998 for the Town. CSD has agreed to maintain the transfer line from the lift station downstream to where it discharges into their system. The present value estimate for CSD's maintenance is $1,857,126. The total present value for this option will be $8,815,125.

Recommended Option

The combination conveyance line option is a happy median between being able to maintenance costs and providing for scouring velocities within the pipeline and is the recommended option. While this option will necessitate a short amount of force main, the maintenance costs will be significantly lower for this method compared to a complete force main.

The gravity only option pipe slope will be much less than what is required for the pipeline to achieve scouring velocity. It's important to maintain a scouring velocity in order to prevent sediment buildup and H_2S formation, and this velocity cannot be achieved using only gravity only for this pipeline. This is not a viable option.

The long force main option will allow for intermittent scouring velocities within the entirety of the line, however due to the length of the force main but there is extensive additional maintenance required to

maintain the various pumps and electrical components, as well as pigging stations that may be necessary to reduce buildup on the interior of the pipeline. Service to air relief valves and hydrogen sulfide mitigation will be expected with this long of a force main.

A new mechanical wastewater treatment plant built and operated by the Town will be very expensive and is unnecessary if a wastewater conveyance opportunity is possible to a regional facility outside the Town of Palisade for a lower cost.

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2 Introduction

Since approximately 2013, the Town's wastewater has exceeded its influent organic load capacity allowed per their current CDPHE permit. This discharge permit expired on September 30, 2018 and is currently on administrative extension until CDPHE revisits the permit, after which, it is anticipated more stringent effluent limits will be established which could only be attained using a mechanical treatment plant. Over the past decade, CDPHE has been updating their sewer discharge limits in an attempt to reduce their effect on Colorado waterways. One of these updates has been to set a limit to the Total Maximum Daily Loads (TMDL) for wastewater discharge. These updated TMDL limits cannot be waived using diffusers and must be met through the treatment process. Once this TMDL limit is met, a diffuser may be used to better diffuse the sewer discharge into the Colorado River water, however the application process for acquiring a permit for a diffuser is a very long and complicated process that takes years of testing.

The Town has the option to either construct a new mechanical treatment plant or transport its wastewater to another nearby treatment facility. The Town has asked that J-U-B Engineers look at options which would meet current and anticipated future CDPHE effluent requirements to bring the Town into compliance with the CDPHE regulations, J-U-B has agreed to develop a report summarizing:

1. Preliminary costs for the installation of a new mechanical treatment plant.
2. Options for conveyance of wastewater from the Town to the Clifton Sanitation District (CSD) mechanical plant located at 3217 D Road for treatment. This includes providing a recommendation for a single conveyance method after discussing options with the Town and identifying a 'preferred' option.
3. Evaluation of methods to provide sewer service for future expansion of the Town's sewer service area to the east boundary line of the Cooperative Planning Area (roughly 36 1/10 Road). This evaluation is based on the Town's existing future land use plan.

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3 Glossary

CDPHE: Colorado Department of Public Health and Environment. This is the governmental organization responsible for monitoring and permitting wastewater treatment systems for municipalities.

Dry Pit: The side of a lift station that contains the pumps and mechanical equipment necessary to run the Lift Station.

Force Main: This is a pressurized sewer line. Most sewer systems transport wastewater using gravity, however force mains are pressurized like a waterline and can transport to a higher elevation.

Grinder: These work to prevent clogs in a system by grinding solids in wastewater, reducing their size.

H_2S: Also called hydrogen sulfide, is a foul-smelling gas that is often responsible for odor complaints near sewer works and can also be converted to sulfuric acid which is corrosive to infrastructure. H_2S is a nuisance and irritant at low concentrations, a health risk at medium concentrations, and lethal at high concentrations.

HDPE: High Density Polyethylene. This is a plastic material that is very resistant to the type of damage common in sanitary sewer systems such as hydrogen sulfide.

Lift Station: These are used to pump water (wastewater in this case) to a higher elevation. These have both a wet well side and dry pit side.

Present Value: The value of an expected income stream determined as of the date of valuation. This considers future investments and standardizes these investments to what they would their present cost would be based on anticipated interest valuation and inflation.

SCADA: Supervisory Control And Data Acquisition. These systems are used to monitor controls and sensors remotely.

Scouring: This is process of removing sediment or preventing sediment from forming in a pipe. Higher velocities tend to move more sediment than lower velocities.

Static Lift: The height the wastewater will rise before arriving at the pump.

Wet Well: The side of a lift station that contains the wastewater.

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4 Wastewater Treatment – Mechanical Treatment Plant Alternative

4.1 Installation of Mechanical Plant

The installation of a new mechanical plant would allow the Town to come into compliance with CDPHE regulations, however there are a number of issues that must be overcome before a plant would be able to be installed.

As a part of the site application to CDPHE, applicants are required to demonstrate they do not have the ability to regionalize their facility and combine with others. Regionalization helps to prevent degradation of neighboring rivers. Since CSD is prepared to accept wastewater from the Town and a connection to their wastewater system is only a few miles to the southwest, their mechanical plant would satisfy these requirements. To successfully permit a new mechanical plant with the State, the Town would need to demonstrate that connection to this CSD treatment facility, and therefore regionalization, would not be possible.

Construction, operation, and maintenance of a new mechanical plant is expensive compared to other treatment alternatives. We have evaluated the cost of this alternative including present value over a 50-year design life.

The most likely location for the installation of a new mechanical plant is on the west end of Riverbend Park which would allow the plant to be constructed on Town property. The Clifton Water District has a Colorado River intake for their water treatment plant that is located approximately five miles downstream of Riverbend Park, and the proposed WWTF discharge point. If a new plant is proposed, we anticipate that Clifton Water may argue the need for regionalization with the CDPHE.

To provide a complete comparison of options for the Town, J-U-B has developed a cost analysis for engineering and construction of a new WWTF based on the following design parameters:

- Upcoming and existing Colorado River regulations (Regulation 37 segment COLCLC02b, Regulation 85, and Regulation 93).
- Design Flow of 0.5 MGD (The approximate limit of the Town's existing discharge permit).
- Design Load of:
    - BOD - 380 mg/L (2013 to 2019)
    - TSS - 340 mg/L (2013 to 2019)
    - NH3-N – 38 mg/L (2013 to 2017)

The design criteria require the use of a membrane treatment system for discharge based on anticipated nutrient, biological, and inorganic limits. Regulations 37, 85 and 93 give guidance for the discharging segment of the Colorado River, specifically Regulation 37 and 93 determinations are based on these criteria. Figure 1 and Figure 2 are excerpts from the respective regulations.

2b. Mainstem of the Colorado River from a point immediately above the confluence with Rapid Creek to immediately above the confluence of the Gunnison River.

COLCLC02B	Classifications
Designation	Agriculture
Reviewable	Aq Life Warm 1
	Recreation E
	Water Supply

Qualifiers:

Other:

Temporary Modification(s):
Arsenic(chronic) = hybrid
Expiration Date of 12/31/2021

*Uranium(acute) = See 37.5(3) for details.
*Uranium(chronic) = See 37.5(3) for details.

Physical and Biological	DM	MWAT
Temperature °C	WS-II	WS-II
	acute	chronic
D.O. (mg/L)	---	5.0
pH	6.5 - 9.0	---
chlorophyll a (mg/m^2)	---	---
E. Coli (per 100 mL)	---	126
Inorganic (mg/L)		
	acute	chronic
Ammonia	TVS	TVS
Boron	---	0.75
Chloride	---	250
Chlorine	0.019	0.011
Cyanide	0.005	---
Nitrate	10	---
Nitrite	0.05	---
Phosphorus	---	---
Sulfate	---	WS
Sulfide	---	0.002

Metals (ug/L)	acute	chronic
Arsenic	340	---
Arsenic(T)	---	0.02
Cadmium	TVS	TVS
Cadmium(T)	5.0	---
Chromium III	---	TVS
Chromium III(T)	50	---
Chromium VI	TVS	TVS
Copper	TVS	TVS
Iron	---	WS
Iron(T)	---	1000
Lead	TVS	TVS
Lead(T)	50	---
Manganese	TVS	TVS/WS
Mercury(T)	---	0.01
Molybdenum(T)	---	150
Nickel	TVS	TVS
Nickel(T)	---	100
Selenium	TVS	TVS
Silver	TVS	TVS
Uranium	varies*	varies*
Zinc	TVS	TVS

Figure 1 Regulation 37, Stream Classification and Water Quality Standards Colorado River Segment COLCL02b

COLCLC02b	2b. Mainstem of the Colorado River from a point immediately above the confluence with Rapid Creek to immediately above the confluence of the Gunnison River.			
Listed portion:	**COLCLC02b_A** Mainstem of the Colorado River from Rapid Creek to Gunnison River except for the Humphrey Backwater area			
	Affected Use	Analyte	Category / List	Priority
	Aquatic Life Use	Sediment	3b. - M&E list	NA
Listed portion:	**COLCLC02b_B** Humphrey Backwater area			
	Affected Use	Analyte	Category / List	Priority
	Aquatic Life Use	Sediment	3b. - M&E list	NA
	Water Supply Use	Manganese (Dissolved)	3b. - M&E list	NA
	Water Supply Use	Nitrite	3b. - M&E list	NA
	Water Supply Use	Sulfate	3b. - M&E list	NA
	Water Supply Use	Arsenic (Total)	5. - 303(d)	L
	Aquatic Life Use	Selenium (Dissolved)	5. - 303(d)	H

Figure 2 Regulation 93, Colorado River Segment COLCL02b

Regulation 37 details the basic standards for temperature, uranium, and nutrients for segment COLCLC02b. The regulation requires the discharge to maintain a normal temperature pattern of diurnal and seasonal fluctuations with no abrupt changes and no increase in temperature, magnitude, rate, or duration deemed deleterious to the resident aquatic life. Uranium is required to be maintained at the lowest practicable level with a general range of 16.8 to 30 µg/L. Nutrients will include Chlorophyll A (after 2022) and Total Phosphorus (Total P) (after 2027). This is based on total health of the river. Regulation 85 details additional nutrient limits to be implemented May 31, 2022. New systems are not considered for increased timelines or variance of the rule without justification for an economically depressed area.

Expected limits are a Total P of 0.7 mg/L average and 1.75 mg/L Max. Inorganic Nitrogen (as N) is expected to be limited at 7 mg/L averaged, and 14 mg/L Max with monthly monitoring. Regulation 93 determines what additional items the segment will be measured and evaluated (M&E) and what will be added to the permitted limits. Segment COLCL02b is listed to remove selenium from the M&E list due to attainment of current water quality standards. The selenium levels were added to the 303(d) list as a high priority. No new data has been collected for sediment. Existing water quality as of 2000 was less restrictive than the Table Value Standards (TVS), therefore the water quality representative of 2000 was used as the standard to add Manganese and Sulfate to the M&E for the segment. Segment COLCL02b added Arsenic for potential non-attainment issues to the 303(d) list. Additionally, the segment added Nitrate to the M&E list for exceedances.

Maintaining river water quality is the most important task of a wastewater treatment facility. This protects the surrounding ecology and downstream populations. There are two options when upgrading/updating a wastewater treatment system. The first is to build in and around the existing system while maintaining treatment. The second is to build at a different location and decommission the old facility after the new facility is commissioned. Portions of the existing system could be reused if the project is phased, however maintaining but keeping the existing facility components going operational while making these upgrades increases the overall risks and cost. It's more cost efficient to relocate the treatment facility if space is readily available.

4.2 Costs

Assuming the WWTF will be relocated, J-U-B has identified the following required processes and estimated capital costs based on a separate study recently performed in Idaho which averaged costs for four different manufacturers (Global Water, Dupont, ADI, MemCore), then checked against industry averages:

Treatment Facility Headworks: $300,000

> Includes: Headworks building (1,000 SF), solids and inert screening, grit removal system, equalization basin, odor control system, electrical and controls, site piping, and site civil.
>
> Required so a limited amount of inert material does not make it into the biological system and equalization of the flow in an attempt to lessen pressure and the required size of treatment equipment/basins.

Primary Biological Treatment: $2,500,000

> Includes: Flow distribution box, biological treatment concrete basins (2), anoxic mixing system, basin cover, aeration system, membrane feed pump system, electrical and controls, site piping, and site civil.
>
> Required to digest the organic compounds.

Membrane Filtration and Treatment Building: $8,300,000

> Includes: Treatment building (20,000 SF), membrane treatment concrete basins (2), air scour system, permeate pump system, return activated sludge pump system, electrical and controls, process piping, and HVAC.
>
> Required to remove remaining inorganic and organic compounds.

UV Disinfection: $300,000

Includes: UV system, electrical and controls, and process piping.

Required for inactivation of the viruses and destruction of harmful bacteria.

Waste Sludge Handling: $2,700,000

Includes: Waste activated sludge pumping system, sludge thickening process, aerobic digester, belt filter press, disposal area, electrical and controls, site piping, and site civil.

Required for handling of removed solid waste.

Capital Costs Total: $14,100,000 (±30%: $9,900,000 to $18,300,000)

Engineering Design Costs: $1,500,000

In addition to the plant construction costs, a gravity sewer line will be required to transfer the wastewater to the proposed plant. This will require about 8,000LF of 12" sewer line, and cost approximately $876,000.

Construction dewatering could also be a significant unanticipated risk and cost associated with this project.

Table 1 Mechanical Plant Present Value Estimate

Item	Assumption
Total Annual Costs	$ 534,330
Interest	5%
Lifespan (yrs)	50
Replacement Costs	10 year life:
	Pumps
	Valves
	Membranes
	Screens
	Basin Covers
	20 year life:
	Equipment
	50 year life:
	Tanks
	Building
Construction Cost	$ 18,300,000
Inflation	3%
Present Value	**$ 37,336,158**

5 Wastewater Transfer Design Methodology

An alternative to construction of a new WWTF is to convey the Town's wastewater to CSD. There were three options evaluated for conveyance of this wastewater.

1. A gravity only sewer line.
2. A lift station with long force main along HWY 6 (previously proposed 2009 conveyance option).
3. A combination gravity line section lift station and short force main discharging to a second gravity line.

For all calculations performed, development of plans, and evaluations of various options in this report, J-U-B has made certain design assumptions.

5.1 Flow Estimations

In preparing cost options between conveyance options and preparing lift station estimates, an estimate of future flow must be assumed. The Town is in the process of updating its comprehensive plan, and final results are not available for this report. As a result, we looked at a reasonable population growth rate of 1.20% per year over 50 years. Assuming a current flow rate of 179,124 MGD, the future wastewater flow rate was estimated to be 650,496 MGD. This will be used as the flow rate from the Town in all design assumptions.

5.2 Pipe Sizing

Flow within the proposed pipe should be limited to a maximum of 60% capacity for pipes 12-inch diameter and less, and 70% for pipes greater than 12-inch. Additionally, wherever possible the minimum peak hour velocity of pipe flows should be 2.5 fps for pipes 12-inch diameter and less, and 3 fps for pipes greater than 12-inch to maintain scouring ability.

5.3 Pipe Alignment

The goal when reviewing routes and alignment options for the proposed pipelines:

1. Where possible, the alignment should stay within the existing ROW or utility easements to limit the effect of the construction to local property owners.
2. The maximum depth of the sewer should be limited to approximately 14 to 15 feet.

Much of the proposed alignments for each of these options will be located within Grand Valley Irrigation Company (GVIC) property or easement. After discussions with GVIC, they have indicated they would prefer locating the transmission line within the northern maintenance road instead of the southern maintenance road. This is partly due to the high utility congestion within the southern part of the canal easement already, but a secondary benefit to GVIC is that as the land between Palisade and Clifton becomes developed in the future and connections are made to this wastewater line, canal crossings won't be necessary. Canal crossings cause additional maintenance issues and preventing these will provide a long-term secondary benefit to GVIC.

Where possible, the proposed routes for every option have attempted to accommodate placement within the northern portion of the canal. The placement on either the northern or southern portion of the canal does not impact the cost of the either the two alternates involving pipeline alignments along the canal west of River Bend Park.

5.4 Easement Acquisition

The sewer line cannot be realistically constructed without acquiring easements at various locations along the alignment. A list of each parcel requiring an easement, as well as an estimation of the area from each parcel that will be required, are provided for each sewer line option. The width of the easement required will be an estimated 20 ft, and Figure 3 below is a simplified exhibit containing the recommended alignment for easements along the GVIC canal.

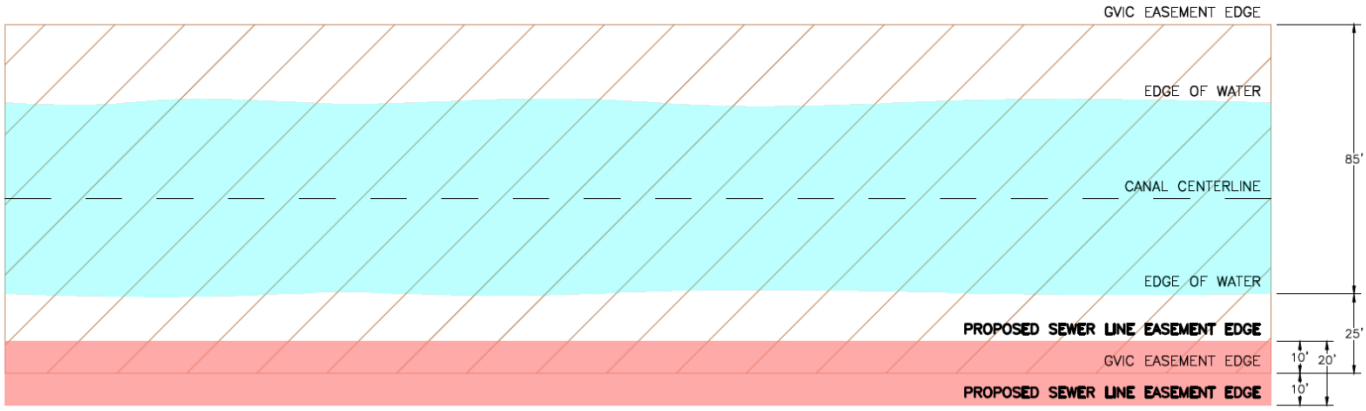

Figure 3 GVIC Easement Alignment

Between the Town and the west end of River Bend Park, the majority of the sewer line may be placed within existing Town property, and minimal easement acquisitions will be necessary.

West of River Bend Park, it may be possible to negotiate with GVIC to allow for the sewer line to be placed fully within the canal company's 25 ft easement from the edge of the water, on either side of the canal. This would save money and time by avoiding negotiations with multiple property owners. The easement estimations and discussions later in this report however are based on the assumption that easements will be required from multiple property owners.

The combination sewer transport option will involve the installation of a sewer lift station at 35 Rd. There is not currently a place to install this lift station, so acquisition of an easement will be required here.

5.5 Lift Stations

The design basis for the lift station is a wet pit/dry pit arrangement that is customized for the Town's specific needs. The wet pit/dry pit arrangement represents the industry standard of care for lift stations designed to pump larger flows (typically >1 MGD). It is envisioned 2 pumps would be installed at startup, and an empty 3rd slot including piping will be included to allow for easy installation of an additional pump if required in the future. The dry pit arrangement allows for improved pump efficiency and ease of operations when maintaining the equipment, along with providing a degree of flexibility to meet future flow increases compared to other systems such as submersible pump or vacuum primed pump lift stations.

The pumps are anticipated to be centrifugal, flooded suction, solids handling type in a vertical dry pit installation. It is proposed the pumps operate on variable frequency drives, VFD's, to allow a wider range of operation. To reduce the risk of pump clogging, it is proposed to install a grinder at the pipe invert into the wet well. The wet well will be constructed adjacent to the dry pit and will utilize common wall construction. The wet well will line up with the dry pit suction pipes and will be sized appropriately to accommodate the design flow rates.

A CMU building will enclose the dry pit and house pump controls and ancillary equipment at grade. The dry pit will be accessible using OSHA-approved stairs, and a monorail crane will be installed to facilitate removal of the pumps for maintenance. The footprint for this building has been preliminarily estimated at about 30'x30'. A permanent diesel generator will be located adjacent to the building to provide backup power in the event of a power outage. Table 2 and Table 3 summarize the proposed concept design.

Table 2 General Lift Station Design Criteria

Design Element	Design Criteria
Lift Station Type	Wet Well / Dry Pit
Number of pumps	2 initially installed with space for future 3rd pump
Peak Hour Flow in 2040	754 gpm
Peak Hour Flow in 2070	893 gpm
Force Main Size	10-inch HDPE DR17
Approximate LS Footprint (Building + Wet Well)	30 ft x 45 ft
Approximate Footprint of Parcel	70 ft x 60 ft
Odor Control	Provisions for future installation
Permanent Backup Generator	Yes
Grinder	Installed at wet well invert
Building	CMU Construction
Subgrade Structure	Cast-in-place concrete wet pit/dry pit
Dry Pit Access	Stairs

Table 3 Site Specific Lift Station Design Criteria

Design Element	Force Main Along HWY 6	Combination Gravity and Force Main
Depth to Gravity Invert	8.2 ft	16.1 ft
Depth to Bottom of Wet Well	13.5 ft	21.5 ft
Length of Force Main	19,000 ft	3,000 ft
Static Lift	34 ft	25 ft
Design Flow	754 gpm	754 gpm
Total Dynamic Head	134 ft	48 ft
Approximate Pump Horsepower (EA)	50 HP	20 HP
Pipe Velocity at Design Flow	3.5 ft/sec	3.5 ft/sec
Availability of 3-Phase Power	3,000 ft away	At existing site

Example photos of J-U-B designed wet well / dry pit lift stations

Figure 4 CMU Lift Station Exterior

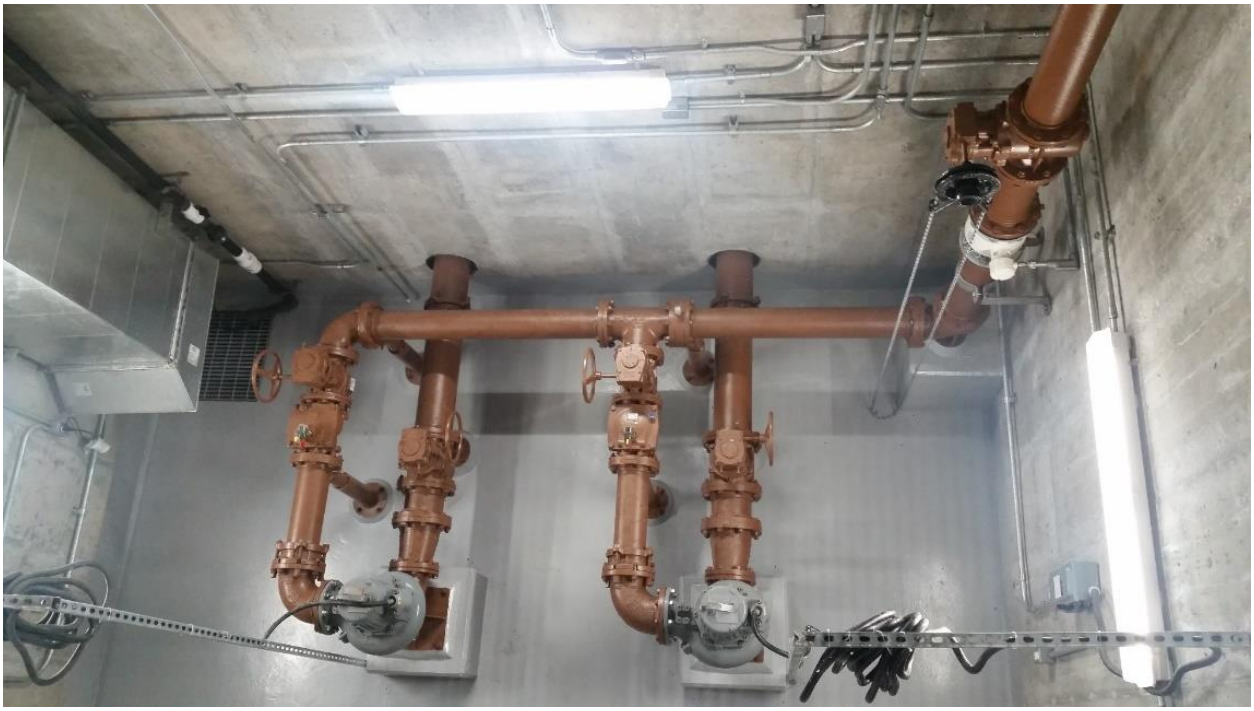

Figure 5 Pumps Inside Dry Pit

Figure 6 Electrical Located at Grade Inside Building

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6 Methods of Wastewater Transfer

6.1 Gravity Only Option

This option involves the use of only gravity lines to convey the wastewater from the Town to CSD. The CSD is at a lower elevation from the Town, and it is possible to construct an interceptor line to transport wastewater using only gravity. The canal flows downhill from the Town and the proposed wastewater gravity line could follow the canal path downstream to the CSD connection point. The elevation drop between the Town and the CSD is relatively small however, and the slope of the transmission line will be very low, which would result in a low velocity of the wastewater. Low velocities equate to long conveyance times and the development of anaerobic conditions which causes hydrogen sulfide creation, sediment buildup, and long-term maintenance issues with the line.

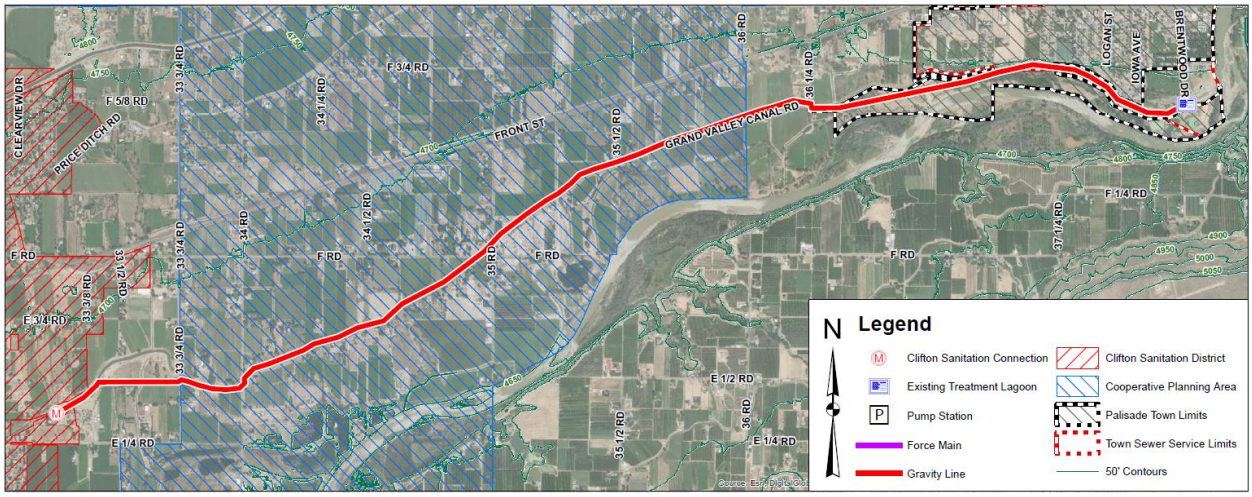

Figure 7 Gravity Only Line Overall Exhibit

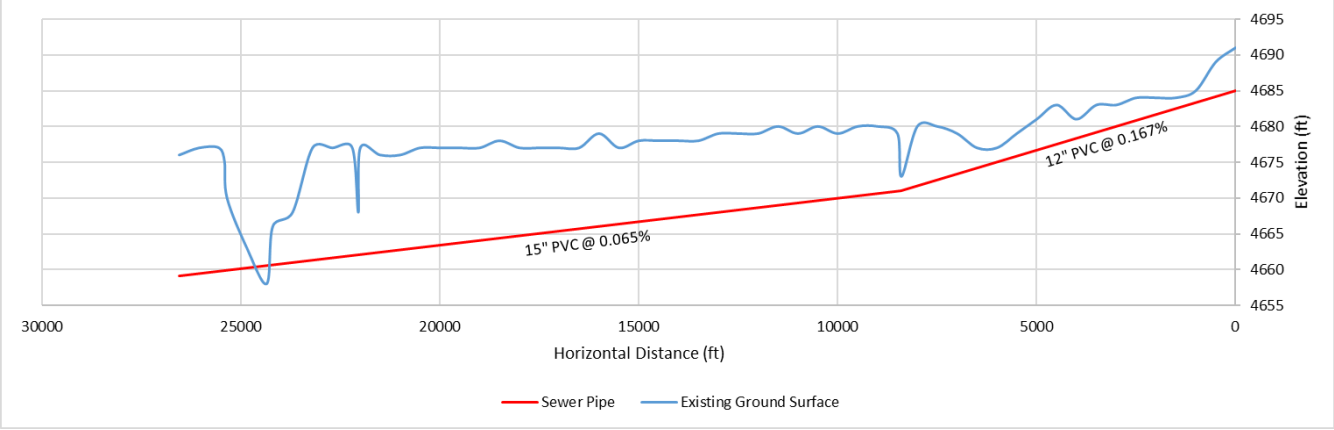

Figure 8 Gravity Only Line Profile

1. Alignment Discussion

   The most efficient gravity line alignment will be located mostly within existing GVIC canal easements on the north side of the canal; however, the beginning and end of the alignment will be located on the south side of the canal. The wastewater line would then connect downstream to the CSD system at an existing manhole along 33 3/8 Rd. This alignment will be approximately

26,550 LF in length with an available fall in elevation of about 26 FT. This will give the pipe an average slope of 0.167% for the first 8,300 LF and 0.065% for the remainder. This slope is much less than what is required for the pipeline to achieve scouring velocity. Based on the pipe assumptions from Section 5.2, a 12" and 15" pipe would require a slope of approximately 0.19%.

2. Property Review

The proposed gravity alignment starts at the existing Town treatment lagoons, and travels west along the south side of the canal until it reaches 34 ¼ Rd. The alignment transfers to the north side of the canal and travels west along the canal. Table 4 contains a summary of the properties expected to be affected by the gravity line alignment, based on the easement acquisition assumptions in Section 5.4.

Table 4 Gravity Only Line Properties

Property Owner	Parcel Number	Approximate Total Easement Area to be Acquired (SF)
Grand Valley Irrigation Co.	294103100183	61,900
Chronos Property LLC	294103200073	6,660
Chronos Property LLC	294103200157	4,220
Peterman John Robert	294104202013	1,890
Donovan Rory	294104202014	4,540
Reiersgaard James L Trust	294104200070	4,640
Bruckner Eyer R	294104200168	5,960
JMA Family Trust	294104200169	6,440
JMA Family Trust	294104200068	1,860
Krabbe Wayne A	294105100079	3,140
First Church of the Nazarene of Palisade	294105100134	4,340
Atchison Emery T	294105100029	3,700
Steele Kevin L	294105100030	4,140
Walker Nathan Judson	294105100031	3,580
Hamilton Scott W	294105100103	7,000
Lombardi David R	294105100061	3,465
Crag Crest LLC	294105100115	2,510
Larsen Robert Martin	294105100114	750
Tolin Ronald J	294105100034	1,980
Taylor Patrick C	294105100035	3,100
Palmer James Hest	294105400086	3,050
Vanlandingham John Perry	294105300055	460
McClain John F	294105300124	28,800
Crawford Harvey L	294105300049	33,200
Hering Frank M	29410700009	24,120
Somerville James T	294107100008	15,180

Property Owner	Parcel Number	Approximate Total Easement Area to be Acquired (SF)
Fitzgerald Diane S	294107100063	7,680
Fitzsimmons Family Trust	294107100155	70
Loucheur Leon Senior	294107100079	3,920
Carter Louis P	294107100139	3,840
Fitzgerald Diane S	294107200065	5,280
Whittington Michael	294107200005	4,900
Sankey Lela May	294107200004	4,500
Houck Treva K	294107200119	14,240
Reeves Brian B	294107200086	6,440
Ridenour Lewis G	294107200085	3,440
Struble Alexis A	294107200024	2,140
Strong Walter H	294107200043	18,600
Clifton Water District	294312400216	9,980
Clifton Water District	294312400217	8,460
Diffendaffer Living Trust	294312400038	8,320
Hallaaron R III	294312100196	4,330
Blankenship Jim R	294312409003	4,720
Rawhide & Lace LLC	294312100197	12,530
Dunham Paul W	294312409004	3,200
Mosby Denise	294312413003	5,180
Reeves Brandon W	294312300192	19,820
Beasley Robert W	294312300046	7,500
Amico David J	294312300047	660

3. Alignment Conflicts

Table 5 Gravity Only Line Alignment Conflicts

Type of Conflict	Conflict Owner	Size of Conflict	Approximate Location
Headgate	GVIC	Unk	160 LF North West of Lagoons
Telephone	CenturyLink	Unk	400 LF West of Logan St
Pipe	Unk	Unk	Bridge at Logan and Pendleton
Pipe	Unk	Unk	Bridge at Logan and Pendleton
Possibly Gas	Unk	Unk	850 LF East of Shiraz Dr
Storm	Unk	Unk	850 LF East of Shiraz Dr
Storm	Unk	Unk	1,400 LF West of Shiraz Dr
Headgate	GVIC	Unk	500 LF of 36 ¼ Rd
Culvert	Unk	Unk	500 LF East of 36 ¼ Rd
Headgate	GVIC	Unk	300 LF of 36 ¼ Rd

Type of Conflict	Conflict Owner	Size of Conflict	Approximate Location
Tele	Charter	Unk	500 LF East of 36 ¼ Rd
Gas	Unk	Unk	Bridge at 36 ¼ Rd and Grand Valley Canal Rd
Gas	Xcel	Unk	140 LF West of 36 ¼ Rd
Gas	Unk	Unk	1,000 LF West of 36 ¼ Rd
Gas	Unk	Unk	36 ½ Rd
Culvert	Unk	Unk	1,400 LF East of 35 Rd
Culvert	Unk	Unk	1,400 LF East of 35 Rd
Pipe	Unk	Unk	Bridge at 35 Rd
Pipe	Unk	Unk	Bridge at 35 Rd
Pipe	Unk	Unk	Bridge at 35 Rd
Pipe	Unk	Unk	Bridge at 35 Rd
Pipe	Unk	Unk	Bridge at 35 Rd
Waterline	Ute Water	8”	Along F Rd West of 35 Rd
Waterline	Ute Water	8”	West of 35 Rd
Gas	Xcel	Unk	F Rd 175 LF West of 35 Rd
Pipe	Unk	Unk	360 LF at 35 Rd
Pipe	Unk	Unk	1,300 LF East of 34 Rd
Headgate	GVIC	Unk	34 Rd
Waterline	Clifton Water	8”	34 Rd
Waterline	Clifton Water	16”	34 Rd
Pipe	Unk	Unk	34 Rd
Waterline	Clifton Water	24”	34 Rd
Headgate	GVIC	Unk	500 LF West of 34 Rd
Headgate	GVIC	Unk	460 LF East of 33 ¾ Rd
Headgate	GVIC	Unk	150 LF East of 33 ¾ Rd
Gas	Xcel	Unk	33 ¾ Rd
Waterline	Clifton Water	3”	33 ¾ Rd
Pipe	Unk	Unk	Ditch 800 LF West of 33 ¾ Rd
Gas	Xcel	Unk	1,650 LF West of 33 ¾ Rd
Headgate	GVIC	Unk	450 LF North East of CSD Connection

In addition to the conflicts listed above, gas lines are known to exist parallel to the proposed alignment along both sides of the canal at various locations. The exact position of these utilities has not been identified and may cause additional conflicts with the proposed sewer line than what are currently listed.

4. Pipe Size Estimation

Table 6 Gravity Only Line Pipe Sizes

Type of Sewer Line	Size	Start of Section	End of Section	Total Length
Gravity	12 in	Existing Lagoons	36 ¼ Rd	8,450 LF
Gravity	15 in	36 ¼ Rd	Connection to CSD MH	18,100 LF

5. Risks and Constructability

While a gravity only line might allow the Town to forego the ongoing maintenance costs that a lift station similar to the ones the other two wastewater transfer options might provide, the low slope will cause low wastewater velocities. These low velocities equate to long conveyance times and the development of anaerobic conditions which causes hydrogen sulfide (H_2S) creation, sediment buildup, and long-term maintenance issues with the line.

There are many options for mitigation of this H_2S, but dilution of the H_2S gas in the headspace with outside air is often the easiest and most cost-effective way to eliminate any potential problems. H_2S in liquid exists in a dissolved form and gas form, and in very slow gravity flows such as would be present with this gravity line, H_2S has more time to be formed. H_2S formation within this gravity line wouldn't be limited to a single location and may be created as long as the right conditions exist in the sewer main. Venting the sewer prevents H_2S accumulation to malodorous or lethal concentrations and conversion to corrosive sulfuric acid. The suitability of using venting to mitigate H_2S in gravity systems is dependent on a number of variables, including the airtightness of the system, air flow possible, and locations of especially high H_2S production.

H_2S mitigation pilot testing would be recommended prior to implementation of any mitigation method, but if venting is believed to be acceptable for this mitigation, a permanent vent setup would most likely include a corrosion resistant vent fan, vent stack, protective fence, permanent power feed, and housing for the fan. In areas located within the flood plain, a vent system would have to be designed to meet flood plain requirements. The additional cost of this venting is provided in the opinion of probable construction cost.

6. Opinion of Probable Construction Cost

Table 7 Gravity Line Opinion of Probable Construction Cost

Item No.	Description	Quantity	Unit	Unit Price	Extended Price
Gravity Only Line - Complete Cost Estimate					
1	12" Gravity Sewer Pipe (SDR-35 PVC) (Includes cost of connection to the existing sewer pipe and/or manhole)	8,450	Lin. Ft.	$ 70.00	$ 591,500.00
2	15" Gravity Sewer Pipe (SDR-35 PVC) (Includes cost of connection to the existing sewer pipe and/or manhole)	18,100	Lin. Ft.	$ 76.50	$ 1,384,650.00
3	HDPE Sanitary Sewer Basic Manhole (48" I.D.) (Includes connection of adjacent sewer line, forming inverts and adjusting to final grade) (No steps required in sewer manholes)	58	Each	$ 4,150.00	$ 240,700.00
4	Manhole Barrel Section (D>5') (48" I.D.)	307	Lin. Ft.	$ 200.00	$ 61,400.00
5	Granular Stabilization Material (Type B) (Crushed Rock) (24" Thick Min.) (Includes haul and disposal of unsuitable excavated material) (Assumed Unit Weight = 138 lbs/ft3)	16,592	Ton	$ 27.00	$ 447,984.00
6	Removal of Asphalt Mat (Full-Depth)	278	Sq. Yd.	$ 5.30	$ 1,473.40
7	Concrete Washout Facility	1	Lump Sum	$ 3,562.50	$ 3,562.50
8	Ground Cover Material (Match Existing)	1334	Sq. Ft.	$ 11.35	$ 15,140.90
9	Aggregate Base Course (Class 3) (Varying Thickness) (24" Minimum) (Pit Run)	35,445	Ton	$ 19.00	$ 673,455.00
10	Aggregate Base Course (Class 6) (6" Thick)	22,278	Sq. Yd.	$ 14.00	$ 311,892.00
11	Aggregate Base Course (Class 6) (12" Thick)	278	Sq. Yd.	$ 14.00	$ 3,892.00
12	Hot Bituminous Pavement (3" Thick) (Grading SX, PG 64-22) (One 3" Lift)	278	Sq. Yd.	$ 36.00	$ 10,008.00
13	Portable Sanitary Facility	1	Each	$ 1,000.00	$ 1,000.00
14	Construction Surveying (Includes As-Built Drawings)	1	Lump Sum	$ 23,000.00	$ 23,000.00
15	Mobilization (7%)	1	Lump Sum	$275,506.55	$ 275,506.55
16	Traffic Control Plan	1	Lump Sum	$ 1,500.00	$ 1,500.00
17	Traffic Control (Complete in Place)	1	Lump Sum	$ 34,000.00	$ 34,000.00
18	Flagging	700	Hour	$ 29.50	$ 20,650.00
19	Quality Control Testing	1	Lump Sum	$ 10,000.00	$ 10,000.00
20	H_2S Mitigation	1	Lump Sum	$292,000.00	$ 292,000.00
22	Minor Contract Revisions	1	Lump Sum	$100,000.00	$ 100,000.00
	Sub-Total				**$ 4,523,754.35**
	Contingency (20%)				**$ 904,750.87**
	Total				**$ 5,428,505.22**

Table 8 Gravity Only Line Permanent Easement Cost

Description	Total Area	Total Cost
Permanent Easement Acquisition	393 Acres	$ 29,236.47

7. Present Value Analysis

Table 9 Gravity Only Line Present Value

Item	Assumption
Total Annual Costs	$ 95,979
Interest	5%
Lifespan (yrs)	50
Replacement Costs	5 year life:
	Biofilter Media
	10 year life:
	Blower Fans
Construction Cost	$ 5,457,742
Inflation	3%
Present Value	**$ 8,628,625**

6.2 Force Main Along HWY 6

The Town originally investigated transporting its wastewater south to CSD in 2009. At that time, SGM Inc. performed a preliminary route evaluation and prepared a report which ultimately recommended transporting the Town's wastewater using a force main along HWY 6. J-U-B performed a brief review of the route information provided in the report and updated the cost and maintenance information.

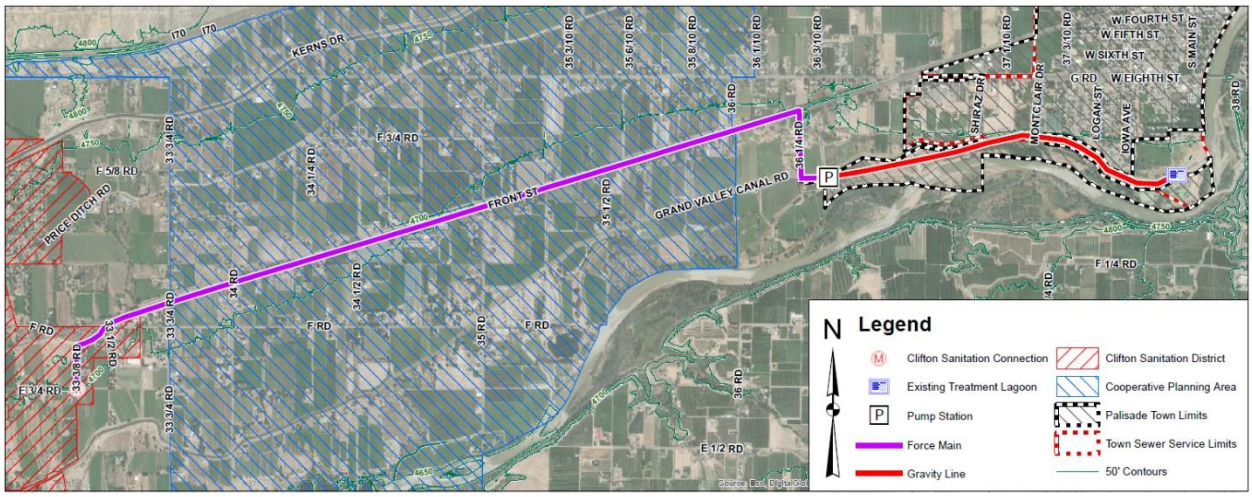

Figure 9 Force Main Overall Exhibit

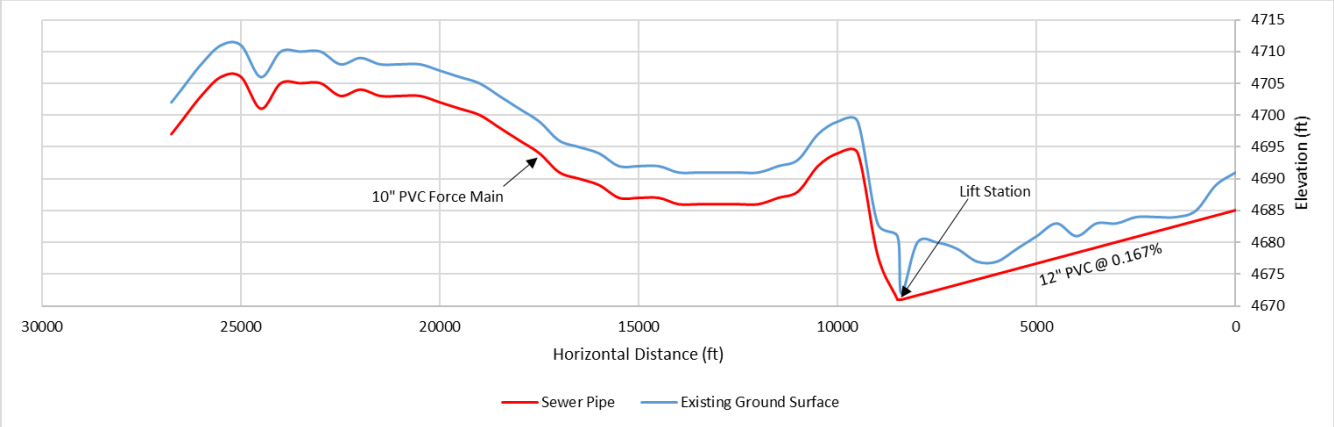

Figure 10 Force Main Profile

1. Alignment Discussion

   A gravity sewer line should be installed from the existing wastewater lagoons to a proposed lift station to the west, near 36 ¼ Rd. Then, wastewater would be transported using a force main from this lift station along the south bank of the canal to 36 ¼ Rd, crossing the canal at 36 ¼ Rd, traveling north to the Highway 6 corridor, following Highway 6 west, and ending at the intersection of 33 3/8 Rd and E ¾ Rd where it would discharge to the existing CSD sewer system.

2. Property Review

   Table 10 contains a summary of the properties expected to be affected by the force main alignment based on the easement acquisition assumptions in Section 5.4.

Table 10 Force Main Properties

Property Owner	Parcel Number	Approximate Total Easement Area to be Acquired (SF)
Grand Valley Irrigation Co.	294103100183	61,900
Chronos Property LLC	294103200073	6,660
Chronos Property LLC	294103200157	4,220

3. Alignment Conflicts

Table 11 Force Main Alignment Conflicts

Type of Conflict	Conflict Owner	Size of Conflict	Approximate Location
Headgate	GVIC	Unk	160 LF North West of Lagoons
Telephone	CenturyLink	Unk	400 LF West of Logan St
Unk	Unk	Unk	Pipe at Bridge at Logan and Pendleton
Unk	Unk	Unk	Pipe at Bridge at Logan and Pendleton
Possibly Gas	Unk	Unk	850 LF East of Shiraz Dr
Storm	Unk	Unk	850 LF East of Shiraz Dr
Storm	Unk	Unk	1,400 LF West of Shiraz Dr
Headgate	GVIC	Unk	500 LF East of 36 ¼ Rd
Culvert	Unk	Unk	500 LF East of 36 ¼ Rd
Headgate	GVIC	Unk	300 LF East of 36 ¼ Rd
Tele	Charter	Unk	500 LF East of 36 ¼ Rd
Gas	Unk	Unk	Bridge at 36 ¼ Rd and Grand Valley Canal Rd
Waterline	Ute	2”	Bridge at 36 ¼ Rd to Hwy 6
Waterline	Ute	3”	36 ¼ Rd and Hwy 6
Tele	Charter	Unk	36 ¼ Rd and Hwy 6
Tele	Charter	Unk	36 ¼ Rd to 33 ¾ Rd
Gas	Xcel	Unk	36 ¼ Rd and Hwy 6
Gas	Xcel	Unk	3569 Front St (Hwy 6)
Waterline	Ute	Unk	Palisade Cemetery
Gas	Xcel	Unk	800 LF East of 35 Rd
Gas	Xcel	Unk	35 Rd
Waterline	Ute	8”	35 Rd to 3463 Front St
Waterline	CWD	4”	34 ½ Rd to 34 Rd
Gas	Xcel	Unk	34 Rd
Gas	Xcel	Unk	33 ¾ Rd
Waterline	CWD	2”	33 ¾ Rd to 33 ½ Rd
Waterline	CWD	4”	33 ½ Rd to E ¾ Rd
Gas	Xcel	Unk	East side of 33 3/8 Rd
Waterline	CWD	4”	E ¾ Rd
Waterline	CWD	6”	E ¾ Rd

In addition to the conflicts listed above, gas lines are known to exist parallel to the proposed alignment along both sides of the canal at various locations. The exact position of these utilities has not been identified and may cause additional conflicts with the proposed sewer line than what is currently listed.

There are also Ute and Clifton Water District waterlines running parallel to the proposed sewer line along 36 ¼ Rd, HWY 6, 33 3/8 Rd, and various water services that will be crossed.

4. Pipe Size Estimation

Table 12 Force Main Pipe Sizes

Type of Sewer Line	Size	Start of Section	End of Section	Total Length
Gravity	12 in	Existing Lagoons	36 ¼ Rd	8,000 LF
Force Main	10 in	36 ¼ Rd	Connection to CSD MH	19,000 LF

5. Risks and Constructability

Force mains require pumps to increase the head within the sewer and raise the wastewater to a higher elevation. These pumps require a source for 3-phase 480 VAC power. Xcel was contacted to confirm power availability near the location specified for the pump installation.

The only nearby available power is single phase, and while VFDs may be used to convert single phase power to 3-phase power, these are not recommended as a long-term solution. The nearest 3-phase power is approximately 3,000 ft to the north along the ROW and would need to be connected to the proposed pump site. The costs for running this power has been included in this cost estimate.

Long force mains have been known to be conducive to the formation of H_2S. Any H_2S created in the force main stays in solution until the wastewater is discharged at the downstream manhole. At this point, when wastewater is released from the force main, the gas form of hydrogen sulfide escapes the liquid to the sewer atmosphere. Venting the sewer near the hydrogen sulfide release point removes that portion of gas, thereby preventing accumulation and associated corrosion downstream of the discharge manhole. Similar assumptions were made for this option as were for the gravity option that venting of the transfer line would successfully mitigate H_2S formation in the line. This assumption should be confirmed with a H_2S pilot study after construction, however initial costs for this venting system have been included in the opinion of probable construction costs.

6. Opinion of Probable Construction Cost

It is noted that these cost opinions have been developed with limited information regarding actual site conditions, geotechnical information, design layouts of any kind or architectural and landscape requirements. A contingency of 20% has been included with the lift station costs to account for these uncertainties.

CSD has agreed to accept responsibility for maintenance of the transfer line, for everything from the lift station to the downstream CSD connection. For the present value analysis, the Town and CSD maintenance costs are separated and shown in Table 15 and Table 16.

Table 13 Force Main Opinion of Probable Construction Cost

Item No.	Description	Quantity	Unit	Unit Price	Extended Price
Force Main Along HWY 6 - Lift Station Only					
1	Mobilization/Demobilization	1	LS	$ 110,000	$ 110,000.00
2	Excavation	1,007	CY	$ 15	$ 15,000.00
3	Dewatering	1	LS	$ 70,000	$ 70,000.00
4	Imported Backfill Material	1,510	Tons	$ 25	$ 38,000.00
5	Asphalt and Roadbase	600	SY	$ 35	$ 21,000.00
6	Double Swing Gate	1	LS	$ 10,000	$ 10,000.00
7	Security Fencing	1	LS	$ 10,000	$ 10,000.00
8	Bypass Pumping	1	LS	$ 20,000	$ 20,000.00
9	Wet Well Coating	1	LS	$ 25,000	$ 25,000.00
10	Wet Well and Dry Pit Below Grade Structure - Cast-in-Place Concrete	1	LS	$ 300,000	$ 300,000.00
11	Stairs into Dry Pit and Grating over Wet Well	1	LS	$ 40,000	$ 40,000.00
12	CMU building and Roofing	900	SF	$ 175	$ 158,000.00
13	Overhead Monorail Crane and Additional Steel for Support	1	LS	$ 30,000	$ 30,000.00
14	Pumps, Valves, and Piping	1	LS	$ 160,000	$ 160,000.00
15	Electrical and Instrumentation	1	LS	$ 180,000	$ 180,000.00
16	Ventilation/HVAC	1	LS	$ 25,000	$ 25,000.00
17	Emergency Backup Generator	1	LS	$ 60,000	$ 60,000.00
18	Pigging Stations	2	EA	$ 20,000	$ 40,000.00
19	Grinder at Wet Well Invert	1	LS	$ 35,000	$ 35,000.00
20	New Manhole and Connect to Existing Sewer, New Gravity Line to Wet Well	1	LS	$ 15,000	$ 15,000.00
21	3-Phase Power to Site	10	Poles	$ 10,000	$ 100,000.00
	Sub-Total				**$ 1,462,000.00**
	Contingency (20%)				**$ 292,000.00**
	Total				**$ 1,754,000.00**

Item No.	Description	Quantity	Unit	Unit Price	Extended Price
Force Main Along HWY 6 - Complete Cost Estimate					
1	10" PVC Force Main (Includes cost of connection to the existing sewer pipe and/or manhole)	19,000	Lin. Ft.	$ 65.00	$ 1,235,000.00
2	12" Gravity Sewer Pipe (SDR-35 PVC) (Includes cost of connection to the existing sewer pipe and/or manhole)	8,000	Lin. Ft.	$ 70.00	$ 560,000.00
3	HDPE Sanitary Sewer Basic Manhole (48" I.D.) (Includes connection of adjacent sewer line, forming inverts and adjusting to final grade) (No steps required in sewer manholes)	15	Each	$ 4,150.00	$ 62,250.00
4	Lift Station	1	LS	$ 1,754,000.00	$ 1,754,000.00
5	Concrete Washout Facility	1	Lump Sum	$ 3,562.50	$ 3,562.50
6	Ground Cover Material (Match Existing)	1,334	Sq. Ft.	$ 11.35	$ 15,140.90
7	Aggregate Base Course (Class 6) (6" Thick)	10,667	Sq. Yd.	$ 14.00	$ 149,338.00
8	Portable Sanitary Facility	1	Each	$ 1,000.00	$ 1,000.00
9	Construction Surveying (Includes As-Built Drawings)	1	Lump Sum	$ 23,000.00	$ 23,000.00
10	Mobilization (7%)	1	Lump Sum	$ 277,860.90	$ 277,860.90
11	Traffic Control Plan	1	Lump Sum	$ 1,500.00	$ 1,500.00
12	Traffic Control (Complete in Place)	1	Lump Sum	$ 34,000.00	$ 34,000.00
13	Flagging	700	Hour	$ 29.50	$ 20,650.00
14	Quality Control Testing	1	Lump Sum	$ 10,000.00	$ 10,000.00
15	H_2S Mitigation	1	Lump Sum	$ 73,000.00	$ 73,000.00
16	Minor Contract Revisions	1	Lump Sum	$ 100,000.00	$ 100,000.00
	Sub-Total				**$ 4,325,412.30**
	Contingency (20%)				**$ 865,082.46**
	Total				**$ 5,190,494.76**

Table 14 Force Main Permanent Easement Cost

Description	Total Area	Total Cost
Permanent Easement Acquisition	41 Acres	$ 14,875.55

7. Present Value Analysis

Table 15 Force Main Present Value (Town Responsibility)

Town of Palisade Maintenance	
Item	**Assumption**
Total Annual Costs	$ 4,009
Interest	5%
Lifespan (yrs)	50
Construction Cost	$ 5,205,370
Inflation	3%
Present Value	**$ 5,230,040**

Table 16 Force Main Present Value (CSD Responsibility)

Clifton Sanitation District Maintenance	
Item	**Assumption**
Total Annual Costs	$ 78,842
Interest	5%
Lifespan (yrs)	50
Replacement Costs	5 year life:
	H2S Biofilter Media (1 H2S Mitigation Fan System)
	10 year life:
	Lift Station Pumps
	Lift Station Grinder
	Lift Station Generator and Electrical Panels
	Lift Station Instrument Repairs/SCADA
	H2S Blower Fans (1 H2S Mitigation Fan System)
Construction Cost	$ -
Inflation	3%
Present Value	**$ 3,107,405**

6.3 Combination Force Main and Gravity Sewer

The final option reviewed by J-U-B involved the use of a combination of primarily gravity sewer and a lift station with a short force main to convey the wastewater. A gravity sewer won't be possible due to limited slopes available for a gravity line, though a lift station and short force main can be utilized to overcome the limited elevation difference available between the Town and CSD.

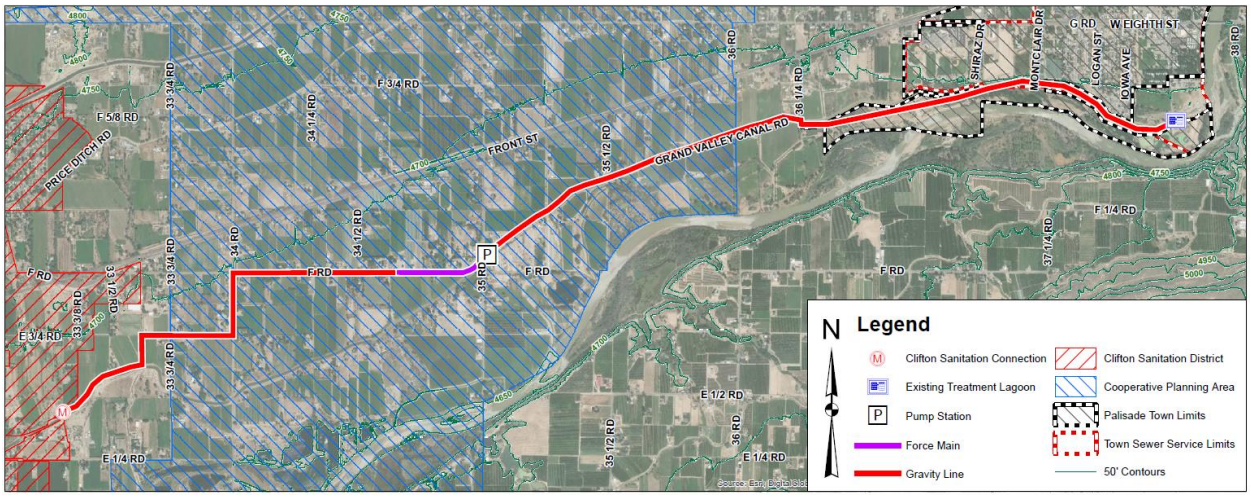

Figure 11 Combination Line Overall Exhibit

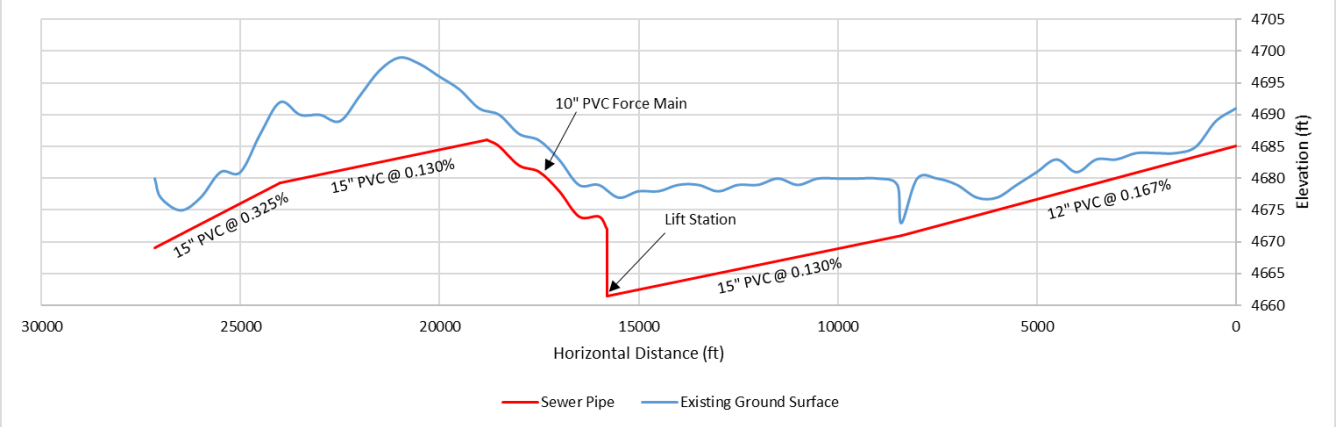

Figure 12 Combination Line Profile

1. Alignment Discussion

   The alignment should follow the same alignment as the gravity sewer option along the north side of the GVIC canal, then will transfer to the existing road rights of way near the intersection of 35 Rd and F Rd. A lift station and short force main should be added along the route to make up the elevation difference necessary to maintain adequate slope on the gravity sections of interceptor sewer line.

2. Property Review

   Table 17 contains a summary of the properties expected to be affected by the combination line alignment based on the easement acquisition assumptions in Section 5.4.

Table 17 Combination Line Properties

Property Owner	Parcel Number	Approximate Total Easement Area to be Acquired (SF)
Grand Valley Irrigation Co.	294103100183	61,900
Chronos Property LLC	294103200073	6,660
Chronos Property LLC	294103200157	4,220
Peterman John Robert	294104202013	1,890
Donovan Rory	294104202014	4,540
Reiersgaard James L Trust	294104200070	4,640
Bruckner Eyer R	294104200168	5,960
JMA Family Trust	294104200169	6,440
JMA Family Trust	294104200068	1,860
Krabbe Wayne A	294105100079	3,140
First Church of the Nazarene of Palisade	294105100134	4,340
Atchison Emery T	294105100029	3,700
Steele Kevin L	294105100030	4,140
Walker Nathan Judson	294105100031	3,580
Hamilton Scott W	294105100103	7,000
Lombardi David R	294105100061	3,465
Crag Crest LLC	294105100115	2,510
Larsen Robert Martin	294105100114	750
Tolin Ronald J	294105100034	1,980
Taylor Patrick C	294105100035	3,100
Palmer James Hest	294105400086	3,050
Vanlandingham John Perry	294105300055	460
McClain John F	294105300124	28,800
Crawford Harvey L	294105300049	33,200
Sauvage Kaibab Snow	294106400065	6,600
Walden Gavin E	294312108004	5,040
Moore Alan D	294312100175	6,030
Confidential Owner	294312108005	7,420
Moore Alan D	294312100136	6,240
Browning Michael I	294312100126	5,490
McElley Edward D	294312100181	5,490
Bency Nicholas J	294312100203	320
Gabossi Joseph J	294312100127	27,000
Gabossi Joseph J	294312200187	18,720
Wilcox Norma J	294312211004	7,720

3. Alignment Conflicts

Table 18 Combination Line Alignment Conflicts

Type of Conflict	Conflict Owner	Size of Conflict	Approximate Location
Headgate	GVIC	Unk	160 LF North West of Lagoons
Telephone	CenturyLink	Unk	400 LF West of Logan St
Unk	Unk	Unk	Pipe at Bridge at Logan and Pendleton
Unk	Unk	Unk	Pipe at Bridge at Logan and Pendleton
Possibly Gas	Unk	Unk	850 LF East of Shiraz Dr
Storm	Unk	Unk	850 LF East of Shiraz Dr
Storm	Unk	Unk	1,400 LF West of Shiraz Dr
Headgate	GVIC	Unk	500 LF of 36 ¼ Rd
Culvert	Unk	Unk	500 LF East of 36 ¼ Rd
Headgate	GVIC	Unk	300 LF of 36 ¼ Rd
Tele	Charter	Unk	500 LF East of 36 ¼ Rd
Gas	Unk	Unk	Bridge at 36 ¼ Rd and Grand Valley Canal Rd
Gas	Xcel	Unk	140 LF West of 36 ¼ Rd
Gas	Unk	Unk	1,000 LF West of 36 ¼ Rd
Gas	Unk	Unk	36 ½ Rd
Culvert	Unk	Unk	1,400 LF East of 35 Rd
Culvert	Unk	Unk	1,400 LF East of 35 Rd
Pipe	Unk	Unk	Bridge at 35 Rd
Pipe	Unk	Unk	Bridge at 35 Rd
Pipe	Unk	Unk	Bridge at 35 Rd
Pipe	Unk	Unk	Bridge at 35 Rd
Pipe	Unk	Unk	Bridge at 35 Rd
Waterline	Ute Water	8”	Along F Rd West of 35 Rd
Waterline	Ute Water	8”	West of 35 Rd
Gas	Xcel	Unk	F Rd 175 LF West of 35 Rd
Pipe	Unk	Unk	360 LF at 35 Rd

In addition to the conflicts listed above, gas lines are known to exist parallel to the proposed alignment along both sides of the canal at various locations. The exact position of these utilities has not been identified and may cause additional conflicts with the proposed sewer line than what is currently listed.

There are also Ute and Clifton Water District waterlines running parallel to the proposed sewer line along F Rd and 34 Rd, and various water services that will be crossed.

Mitigation of these potential utility conflicts would be addressed during formal design of a selected alternative.

4. Pipe Size Estimation

Table 19 Combination Line Pipe Sizes

Type of Sewer Line	Size	Start of Section	End of Section	Total Length
Gravity	12 in	Existing Lagoons	36 ¼ Rd	8,450 LF
Gravity	15 in	36 ¼ Rd	35 Rd	7,400 LF
Force Main	10 in	35 Rd	34 ½ Rd	3,000 LF
Gravity	15 in	34 ½ Rd	Connection to CSD MH	8,350 LF

5. Risks and Constructability

The combination line option will necessitate a lift station to increase the head within the sewer and raise the wastewater to a higher elevation. These pumps require a source for 3-phase 480 VAC power. Xcel was contacted to confirm power availability near the location specified for the pump installation. According to Xcel, 3-phase power is located on the west side of 35 Rd and is available at the recommended site.

6. Opinion of Probable Construction Cost

It is noted that these cost opinions have been developed with limited information regarding actual site conditions, geotechnical information, design layouts of any kind or architectural and landscape requirements. A contingency of 20% has been included with the lift station costs to account for these uncertainties.

CSD has agreed to accept responsibility for maintenance of the transfer line, for everything from the lift station to the downstream CSD connection. For the present value analysis, the Town and CSD maintenance costs are separated and shown in Table 22 and Table 23.

Table 20 Combination Line Opinion of Probable Construction Cost

Item No.	Description	Quantity	Unit	Unit Price	Extended Price
Combination Force Main and Gravity Sewer - Lift Station Only					
1	Mobilization/Demobilization	1	LS	$ 110,000	$ 110,000.00
2	Excavation	2,315	CY	$ 15	$ 35,000.00
3	Dewatering	1	LS	$ 110,000	$ 110,000.00
4	Imported Backfill Material	3,470	Tons	$ 25	$ 87,000.00
5	Asphalt and Roadbase	600	SY	$ 35	$ 21,000.00
6	Double Swing Gate	1	LS	$ 10,000	$ 10,000.00
7	Security Fencing	1	LS	$ 10,000	$ 10,000.00
8	Bypass Pumping	1	LS	$ 20,000	$ 20,000.00
9	Wet Well Coating	1	LS	$ 30,000	$ 30,000.00
10	Wet Well and Dry Pit Below Grade Structure - Cast-in-Place Concrete	1	LS	$ 350,000	$ 350,000.00
11	Stairs into Dry Pit and Grating over Wet Well	1	LS	$ 50,000	$ 50,000.00

Item No.	Description	Quantity	Unit	Unit Price	Extended Price
12	CMU building and Roofing	900	SF	$ 175	$ 158,000.00
13	Overhead Monorail Crane and Additional Steel for Support	1	LS	$ 30,000	$ 30,000.00
14	Pumps, Valves, and Piping	1	LS	$ 120,000	$ 120,000.00
15	Electrical and Instrumentation	1	LS	$ 170,000	$ 170,000.00
16	Ventilation/HVAC	1	LS	$ 25,000	$ 25,000.00
17	Emergency Backup Generator	1	LS	$ 35,000	$ 35,000.00
18	Grinder at Wet Well Invert	1	LS	$ 40,000	$ 40,000.00
19	New Manhole and Connect to Existing Sewer, New Gravity Line to Wet Well	1	LS	$ 15,000	$ 15,000.00
	Sub-Total				**$ 1,426,000.00**
	Contingency (20%)				**$ 285,000.00**
	Total				**$ 1,711,000.00**

Item No.	Description	Quantity	Unit	Unit Price	Extended Price
Combination Force Main and Gravity Sewer - Complete Cost Estimate					
1	10" PVC Force Main (Includes cost of connection to the existing sewer pipe and/or manhole)	3,000	Lin. Ft.	$ 65.00	$ 195,000.00
2	12" Gravity Sewer Pipe (SDR-35 PVC) (Includes cost of connection to the existing sewer pipe and/or manhole)	8,450	Lin. Ft.	$ 70.00	$ 591,500.00
3	15" Gravity Sewer Pipe (SDR-35 PVC) (Includes cost of connection to the existing sewer pipe and/or manhole)	15,750	Lin. Ft.	$ 76.50	$ 1,204,875.00
4	HDPE Sanitary Sewer Basic Manhole (48" I.D.) (Includes connection of adjacent sewer line, forming inverts and adjusting to final grade) (No steps required in sewer manholes)	40	Each	$ 4,150.00	$ 166,000.00
5	Manhole Barrel Section (D>5') (48" I.D.)	176	Lin. Ft.	$ 200.00	$ 35,200.00
6	Lift Station	1	LS	$ 1,711,000.00	$ 1,711,000.00
7	Granular Stabilization Material (Type B) (Crushed Rock) (24" Thick Min.) (Includes haul and disposal of unsuitable excavated material) (Assumed Unit Weight = 138 lbs/ft3)	15,029	Ton	$ 27.00	$ 405,783.00

Item No.	Description	Quantity	Unit	Unit Price	Extended Price
8	Removal of Asphalt Mat (Full-Depth)	223	Sq. Yd.	$ 5.30	$ 1,181.90
9	Concrete Washout Facility	1	Lump Sum	$ 3,562.50	$ 3,562.50
10	Ground Cover Material (Match Existing)	1,334	Sq. Ft.	$ 11.35	$ 15,140.90
11	Aggregate Base Course (Class 3) (Varying Thickness) (24" Minimum) (Pit Run)	26,854	Ton	$ 19.00	$ 510,226.00
12	Aggregate Base Course (Class 6) (6" Thick)	19,756	Sq. Yd.	$ 14.00	$ 276,584.00
13	Aggregate Base Course (Class 6) (12" Thick)	223	Sq. Yd.	$ 14.00	$ 3,122.00
14	Hot Bituminous Pavement (3" Thick) (Grading SX, PG 64-22) (One 3" Lift)	223	Sq. Yd.	$ 36.00	$ 8,028.00
15	Portable Sanitary Facility	1	Each	$ 1,000.00	$ 1,000.00
16	Construction Surveying (Includes As-Built Drawings)	1	Lump Sum	$ 23,000.00	$ 23,000.00
17	Mobilization (7%)	1	Lump Sum	$ 372,214.73	$ 372,214.73
18	Traffic Control Plan	1	Lump Sum	$ 1,500.00	$ 1,500.00
19	Traffic Control (Complete in Place)	1	Lump Sum	$ 34,000.00	$ 34,000.00
20	Flagging	700	Hour	$ 29.50	$ 20,650.00
21	Quality Control Testing	1	Lump Sum	$ 10,000.00	$ 10,000.00
22	Minor Contract Revisions	1	Lump Sum	$ 100,000.00	$ 100,000.00
	Sub-Total				**$ 5,689,568.03**
	Contingency (20%)				**$ 1,137,913.61**
	Total				**$ 6,827,481.64**

Table 21 Combination Line Permanent Easement Cost

Description	Total Area	Total Cost
Permanent Easement Acquisition	265 Acres	$ 29,178.32

7. Present Value Analysis

Table 22 Combination Line Present Value (Town Responsibility)

Town of Palisade Maintenance	
Item	**Assumption**
Total Annual Costs	$ 7,510
Interest	5%
Lifespan (yrs)	50
Construction Cost	$ 6,856,660
Inflation	3%
Present Value	**$ 6,957,998**

Table 23 Combination Line Present Value (CSD Responsibility)

Clifton Sanitation District Maintenance	
Item	**Assumption**
Total Annual Costs	$ 46,200
Interest	5%
Lifespan (yrs)	50
Replacement Costs	10 year life:
	Lift Station Pumps
	Lift Station Grinder
	Lift Station Generator and Electrical Panels
	Lift Station Instrument Repairs/SCADA
Construction Cost	$ -
Inflation	3%
Present Value	**$ 1,857,126**

7 Additional Considerations

7.1 Wetlands

Small areas of wetland designated areas exist along the various alignments. While these areas may necessitate minor changes in construction methods, these areas are relatively minor and are not expected to affect the sewer installation significantly.

7.2 Flood Zones

Unlike the wetland designated areas where the various alignments cross only small sections of wetlands, large portions of each of the alignments are located within FEMA designated AE (100-year) flood zones. Special considerations for construction and manholes designs must be taken within these areas.

7.3 Buffer Zone

There is a portion of unincorporated Mesa County just west of the Town limits and east of the Cooperative planning area that is not currently served by public wastewater treatment systems (See Figure 13).

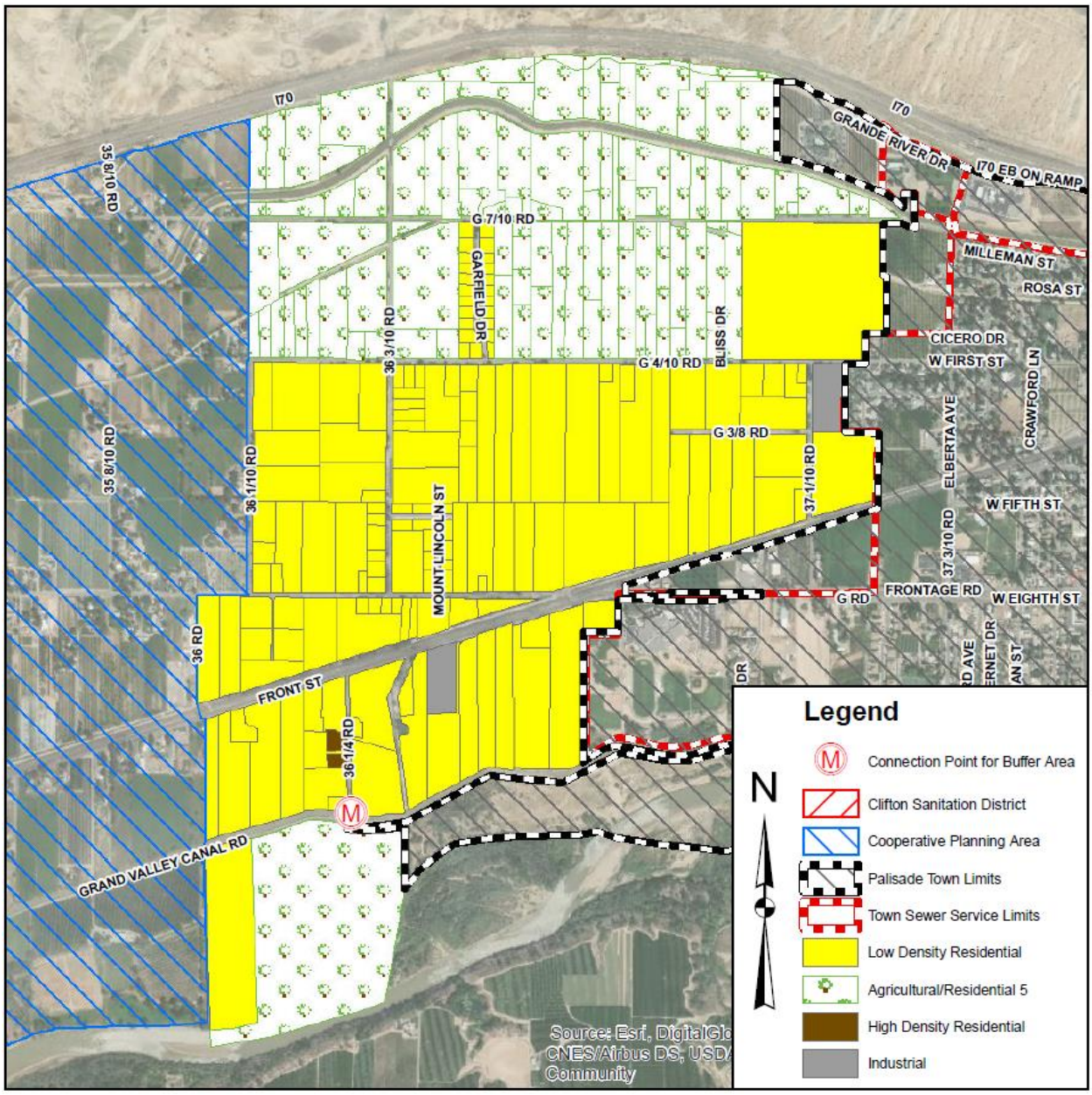

Figure 13 Buffer Zone

Allowing this area to be connected to this sewer conveyance line in the future will allow for development of these properties and will reduce these property's reliance on on-site wastewater treatment systems. As part of this evaluation, J-U-B reviewed methods of providing service to property owners within this area and sized the distribution system required for the area.

To determine the wastewater line size required to serve this area, the Future Land Use Plan from the 2007 Palisade Comprehensive Plan was consulted to identify the land use classification for every property within this buffer zone. Based on the property classification and the number of residential units per land use classification specified within the Comprehensive Plan, a total number of residential units was calculated, which was then used to estimate the wastewater flow. Additional calculations were made to

estimate the amount of infiltration the system might experience. A total flow of 1.01 CFS was calculated for the wastewater line. Table 24 below summarizes the assumptions used for these calculations.

Table 24 Buffer Zone Flow Assumptions

Variable	Assumption	
Residential Flow		
Residential Units	1,747	
People per Res Unit	2.66	
Total People	4,647	
Ave Flow	66	gal/person/day
Gallons	306,703	gal/day
Peaking Factor	2	
Infiltration		
Acres	781.4	
Ave Infilt	50	gal/acre/day
Gallons	39,072	gal/day
Total Flow		
Peak Flow	1.01	CFS

While service lines will not be installed at the time of the conveyance line, an interconnect for future connection to this area should be installed. After review of this area, a 12" wastewater line was found to be required to provide service to this area and should be installed on the proposed conveyance line near 36 ¼ Rd. All three conveyance options should be connected to the future area connection here.

7.4 Lagoon Abandonment

Regardless of the wastewater treatment method the Town proceeds with, the existing lagoons will need to be abandoned. The process for the lagoon abandonment will follow the following approximate steps:

1. Remove the existing wastewater in the lagoons by pumping from pond to pond, east to west, eventually pumping to the proposed sewer transfer line.
2. The remaining sludge at the lagoons should dried, a process which may take as long as a year.
3. The dried sludge may be removed and disposed of to a landfill.
4. The lagoon site can then be graded and contoured to allow for the property to be repurposed.

The approximate cost for abandonment of the existing lagoons is shown in Table 25.

Table 25 Lagoon Abandonment

Item	Assumption
Volume of Fill (ton)	128,000
Total Cost to Recontour Property	$ 2,816,000
Volume of Sludge (ton)	18,000
Cost of Sludge Disposal	$ 428,000
Total Lagoon Abandonment Cost	$ 3,244,000

7.5 Clifton Water District

The Clifton Water District has a Colorado River intake for their water treatment plant that is located approximately five miles downstream of Riverbend Park, and the proposed WWTF discharge point. If a new plant is proposed, we anticipate that Clifton Water may argue the need for regionalization with the CDPHE.

8 Recommended Option; Option 3 – Combination Force Main and Gravity Option

After reviewing all the various options for meeting CDPHE permitting requirements, J-U-B met with the Town on 5/13/2020 to discuss these options. During this meeting, the Town made the decision that the wastewater should be conveyed to CSD using a combination force main and gravity sewer option. The gravity only option doesn't have sufficient slope available to it to allow for scouring velocities within the line which increases maintenance costs to the City. The force main option will allow for scouring velocities within the entirety of the line, but there is extensive maintenance required to maintain the various pumps and electrical components, as well as pigging stations necessary to reduce buildup on the interior of the pipeline. A new mechanical plant built and operated by the Town will be extremely expensive and is unnecessary if wastewater conveyance is possible to outside the Town for a lower cost.

The combination conveyance line does have a lift station and will necessitate a short amount of force main, but maintenance costs will be significantly lower for this method compared to a complete force main. This method is a happy median between reducing maintenance costs and providing for scouring velocities within the pipeline.

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9 Next Steps

1. Prepare a workshop with Town trustees and CSD.
2. Letter of request from Palisade to CSD board.
3. Prepare an agreement with CSD to treat the wastewater.
4. Negotiations with GVIC for use of their easements along the canal.
5. Preparation of an initial design, develop easement needs, and public involvement.
6. Explore funding opportunities. Certain grants are possibly available to assist with funding the design and construction of this sewer line. The USDA Water & Waste Disposal Loan & Grant Program is currently accepting applications, and this project appears to meet the requirements of the program. These grant applications are long processes and should be prepared well in advance of beginning the project.
7. Coordinate with other utility owners with utilities along the proposed alignment. Table 26 contains a list of the most current points of contact for these utilities:

Table 26 Utility Owner Coordination

Owner	Contact	Email	Phone
Charter	Jeff Valdez	jeff.valdez@charter.com	
Xcel	Michael Castro	Michael.A.Castro@xcelenergy.com	970-244-2781
Ute Water	Dave Priske		970-242-7491
	Jeremy Lyon		970-589-4716
	Robert Martin	rmartin@utewater.org	970-256-2873
GVP	Perry Rupp	prupp@gvp.org	970-623-8571
Centurylink	Chris Johnson	chris.johnson5@centurylink.com	970-216-3152

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Appendix A

Town of Palisade
Sewer Transfer Study

Sheet 1 of 10

N
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0 100 200 400
Feet

1 inch = 250 feet

Legend

- Pump Station
- Force Main
- Gravity Line

Utilities

- OH Transmission Line
- Waterline
- Gas
- Tele
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- Headgates
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- Town Sewer Service Limits

- 10' Contours
- 2' Contours
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Flood Zone

- No Base Flood Elev Known
- Zone AE
- Regulatory Floodway
- Levee Flood Risk
- 500-yr Flood Plain
- Clifton Sanitation District

Wetlands

- Emergent Wetland
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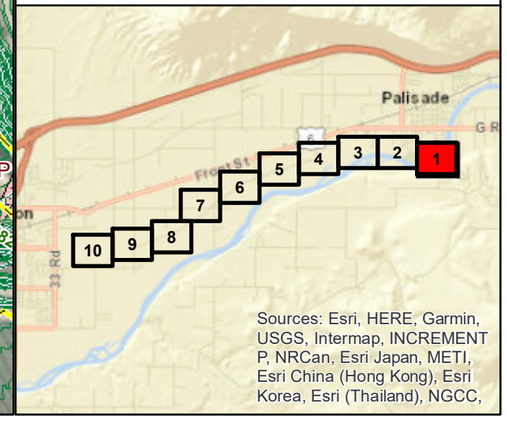
- Freshwater Pond
- Riverine



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Town of Palisade
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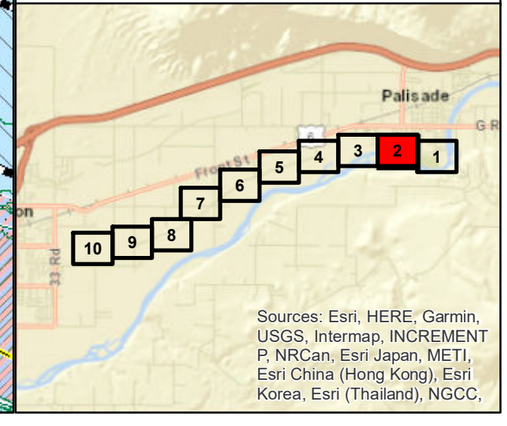

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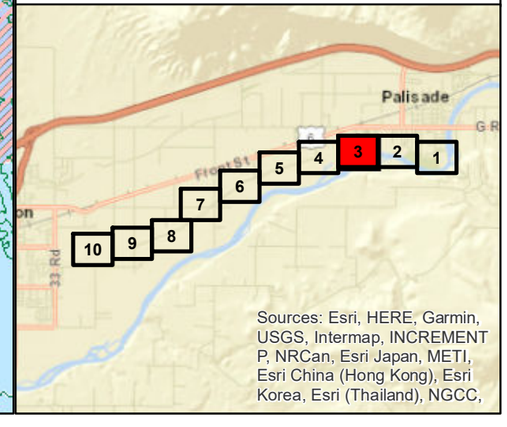

BENSON KAREN L
294104104001

OIEN EMILY E
294104109002

KAUFMAN BRIAN J
294104109001

CHRONOS PROPERTY LLC
294103212002

TOFSRUD BRANDON
294104109004

JOANIS LESLIE J
294104110001

HAAS CARLA C
294104109007

SELLARS JON R
294104110002

KUNTZ DEREK
294104109008

MESA COUNTY VALLEY SCHOOL DISTRICT NO 51
294104100170

CHRONOS PROPERTY LLC
294103200157

BOLLINGER MARK
294104109010

MCCALL DAVID C
294104110005

STONER SCOTT
294104100019

MACPAC VENTURES LLC
294104104002

LICATA LOUIS GEORGE REVOC TRUST
294104105003

MOFFETT BRIAN R
294104109012

HAWKINS GREGG M
294104110007

SHIRAZ DR

RODEO RD

TOWN OF PALISADE
294103200180

TOWN OF PALISADE
294104100172

TOWN OF PALISADE
294104100171

DEPARTMENT OF NATURAL RESOURCES
294103300176

WEST COUNTRY LLC
294104300100

NOLAND MAX L
294104400075

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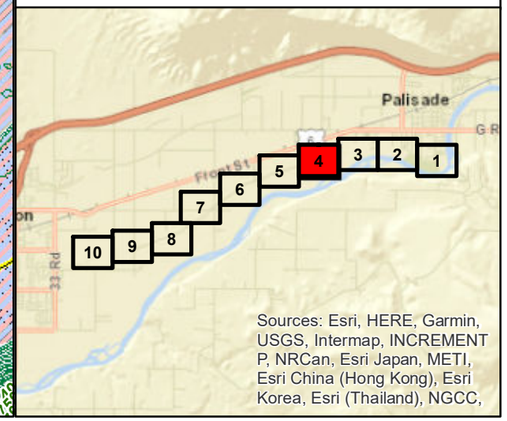

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Town of Palisade
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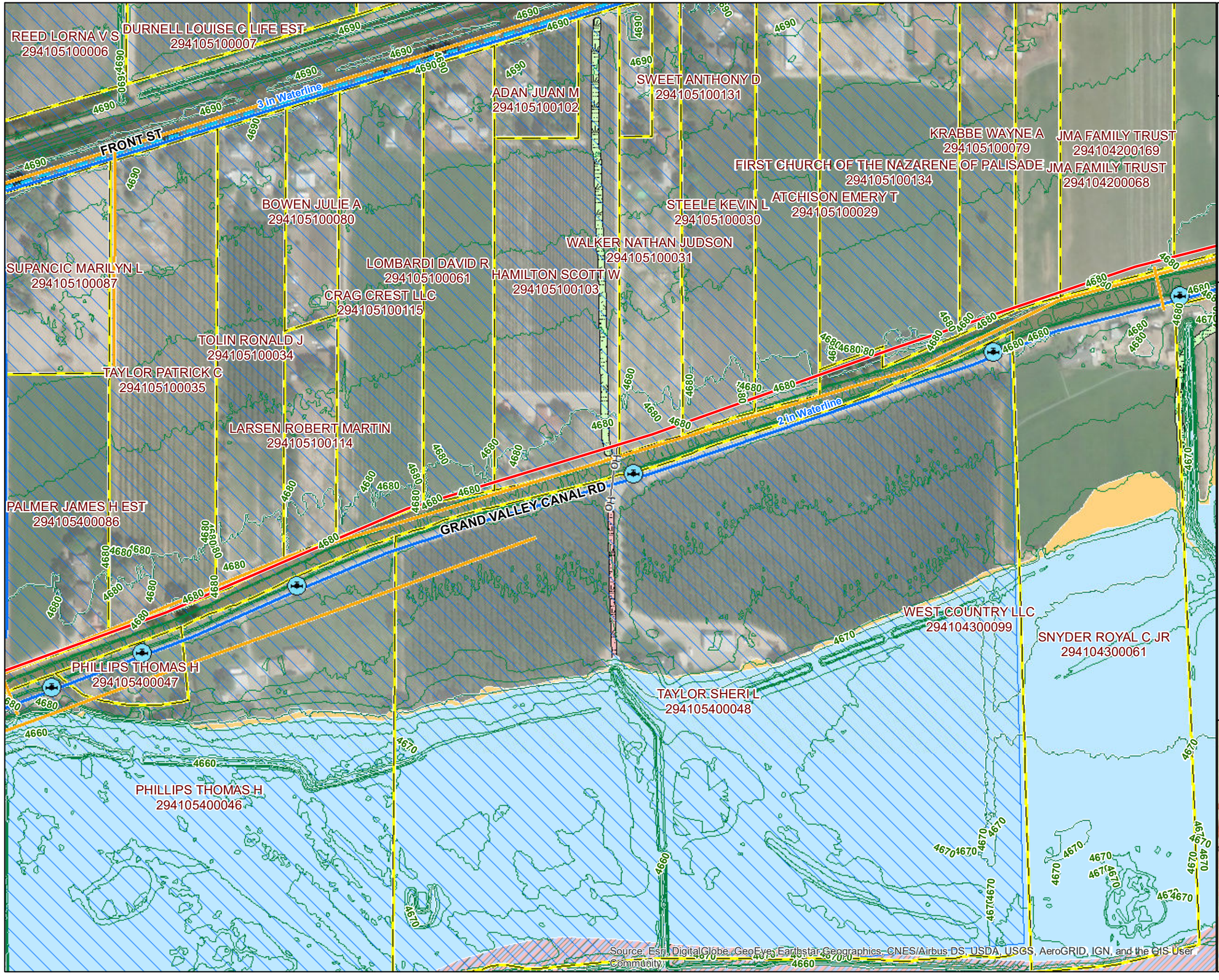

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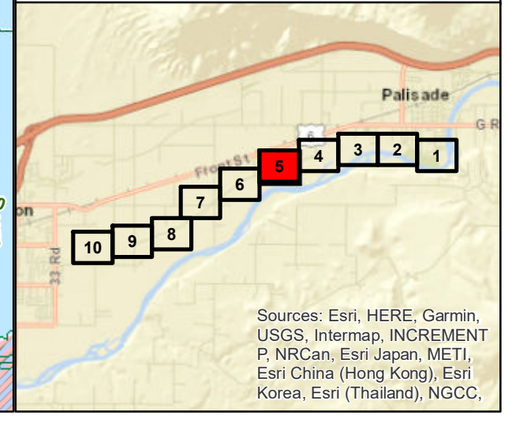

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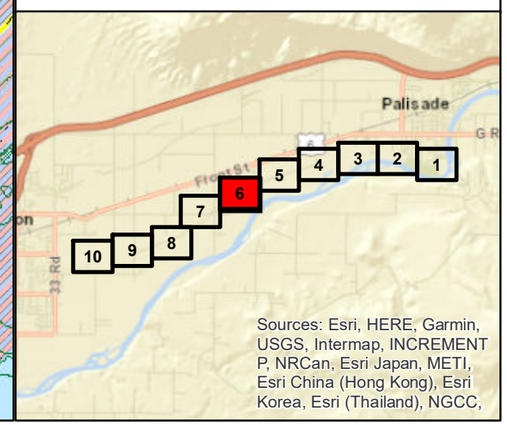

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Town of Palisade
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GROVENOR ESTATE PROPERTIES LLC
294106400052
MESA COUNTY VALLEY SCHOOL DISTRICT
294106400222
DAVIDSON FRANKLIN J
294106404002
WARMING SOLVEIG
294105301002
SASSON MARK
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FORNEY KEITH R
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BROE MATTHEW J
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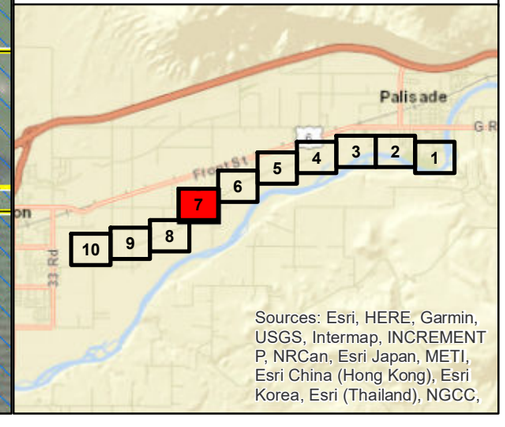
NELSON LEIF OLAF
294108200178
EGGHART JOHANNES K
294107100113
TOFSRUD ROBERT D
294107100097

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC,

Town of Palisade
Sewer Transfer Study

Sheet 8 of 10

N
W E
S

0 100 200 400
Feet

1 inch = 250 feet

Legend

- Pump Station
- Force Main
- Gravity Line

Utilities

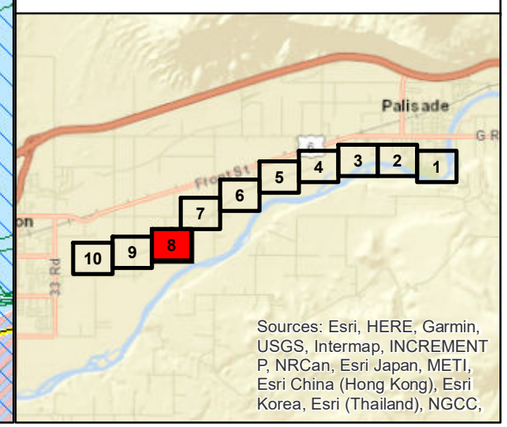
- OH Transmission Line
- Waterline
- Gas
- Tele
- Unknown Pipe
- Headgates
- CSD Manholes
- CSD Sewer Line
- Palisade Town Limits
- Parcel Limits
- Town Sewer Service Limits
- 10' Contours
- 2' Contours
- Cooperative Planning Area

Flood Zone

- No Base Flood Elev Known
- Zone AE
- Regulatory Floodway
- Levee Flood Risk
- 500-yr Flood Plain
- Clifton Sanitation District

Wetlands

- Emergent Wetland
- Forested/Shrub Wetland
- Freshwater Pond
- Riverine



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC,

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

KOCH DALE L
294107200002

BELSHER DENNIS O
294107200158

WENS KARL DAVID
294107200118

FITZGERALD DIANE S
294107200065

SANKEY LELA MAY WHITTINGTON MICHAEL
294107200004
294107200005

FITZGERALD DIANE S
294107100063

HERING FRANK M
294107100009

SOMERVILLE JAMES T
294107100008

CRAIG JOHN D
294107100093

EGGHART JOHANNES K
294107100113

HOUCK TREVA K
294107200119

REEVES BRIAN B
294107200086

CARTER LOUIS P
294107100139

YOUNG PAUL M
294107100052

JOHNSON HAROLD G
294107100112

FITZGERALD DIANE S
294107100145

FITZSIMMONS FAMILY TRUST
294107100155

MEINERS MARK A
294107200151

BRODIE HEATHER D
294107201003

GRAND VALLEY CANAL RD

NICHOLS JOE MORGAN
294107200025

VOSTATEK CARL
294107200130

POPE JAMES G
294107200150

LOUCHEUR LEON SENIOR
294107100079

FITZGERALD DIANE S
294107100137

TALLMAN SISTERS PROPERTIES LLC
294107100156

WELCH GREG R
294107100140

LAVETA V KAY REVOCABLE TRUST
294107300134

BRUNET DARRELL L
294107301004

ADAMS CLAUDE
294107200152

RIGG SONYA K
294107300117

HULBURT FARMS LPA
294107100062

KM FAMILY TRUST
294107300058

MCGUIRE MICHAEL K
294107300126

2-in Waterline

Town of Palisade
Sewer Transfer Study

Sheet 9 of 10

N
W E
S

0 100 200 400
Feet

1 inch = 250 feet

Legend

- Pump Station
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Utilities

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- Waterline
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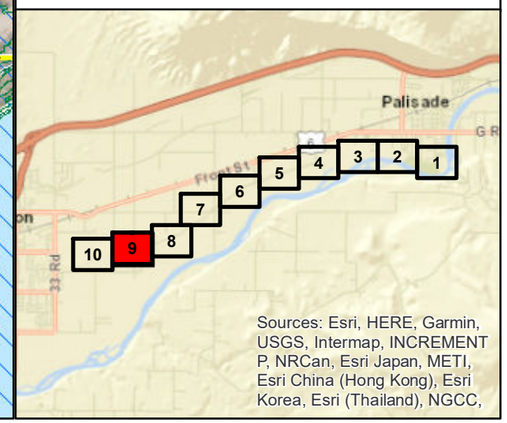
- 500-yr Flood Plain
- Clifton Sanitation District

Wetlands

- Emergent Wetland
- Forested/Shrub Wetland
- Freshwater Pond
- Riverine



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC,

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Town of Palisade
Sewer Transfer Study

Sheet 10 of 10

N
W E
S

0 100 200 400
Feet

1 inch = 250 feet

Legend

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- Force Main
- Gravity Line

Utilities

- OH Transmission Line
- Waterline
- Gas
- Tele
- Unknown Pipe
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- 500-yr Flood Plain
- Clifton Sanitation District

Wetlands

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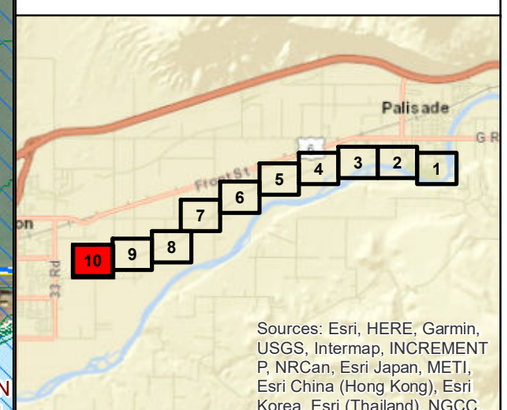
- Forested/Shrub Wetland
- Freshwater Pond
- Riverine



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC,

BRUMBACK KENT G
294312200144

BAKER CONNIE
294312200027

GORTON DARREL
294312211003
MH Depth: 14.1 ft

HOOGEVEEN DOUGLAS F
294312200186

MOORE ALAN D
294312100136

MCELLEY EDWARD D
294312100181

GABOSSI JOSEPH J
294312100127

BRUMBACK KENT G
294312200211

BAKER CARRI L
294312200214

GABOSSI JOSEPH J
294312200187
MH Depth: 11.9 ft

MCELLEY EDWARD D
294312100182

BRUMBACK KENT
294312200212

RAWHIDE & LACE LLC
294312100197

HALL AARON III
294312100191

MH Depth: 15.1 ft

WILCOX NORMA J
294312211004

DIFFENDAFFER LIVING TRUST
294312400038

DUNHAM PAUL W
294312409004

BLANKENSHIP JIM R
294312409003

RINDERLE RENTALS LLC
294312300206
MH Depth: 19.4 ft
MH Depth: 19.6 ft

MOSBY DENISE
294312413003

REEVES BRANDON W
294312300192

MH Depth: 16.6 ft

BERTRAM RUSSELL
294312300191

MH Depth: 10.2 ft

GOFF BYRON
294312400041

Confidential Owner
294312400178

BEASLEY ROBERT W
294312300046

MICHAEL STEPHANIE A LAYFIELD JOHN R
294312413001
294312413002

AMICO DAVID J
294312300047

BERTRAM JAMES J
294312412001

BLACKMAN LILLIAN A
294312409001

MOSBY DENISE
294312413004

MH Depth: Unk
MH Depth: 18.1 ft

E 1/4 RD

WIRTZ DARWIN E
294312300141

BOWLES LARRY LEE
294312400162

FRAME WILLIAM L JR
294312300130

FRAME STEVE A
294312300057

FRAME TIMOTHY L
294312300183

FRAME TIMOTHY L
294312300184

DUFFEY SHIRLEY E
294312400199

DUFFEY SHIRLEY E
294312400198

33 3/4 RD

33 1/2 RD

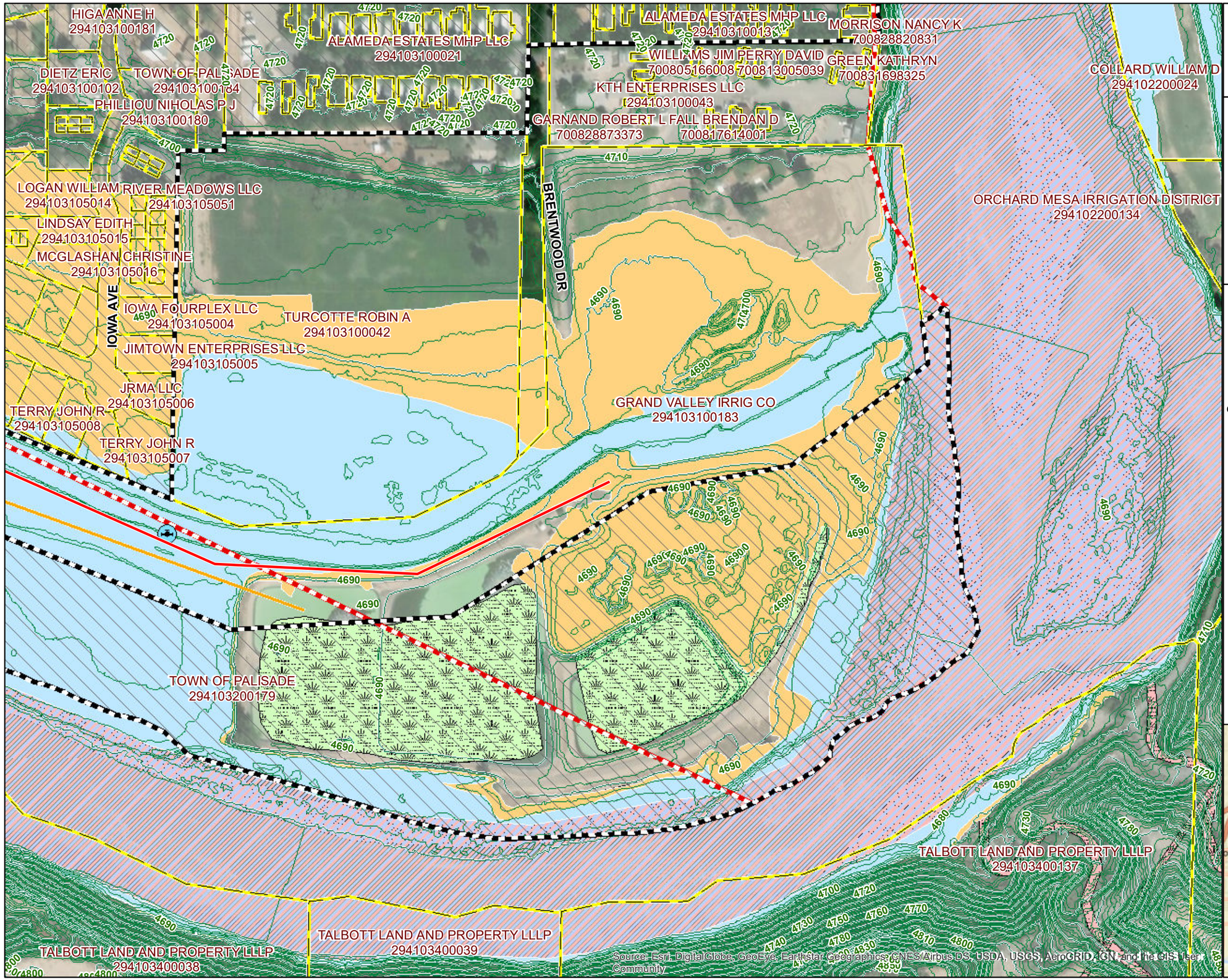
18 in PVC
21 in PVC
10 in PVC

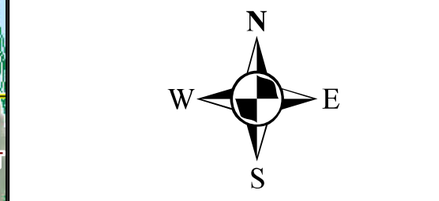
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Appendix B

Town of Palisade Sewer Transfer Study

Sheet 1 of 10





Legend

- Pump Station
- Force Main
- Gravity Line
- 10' Contours
- 2' Contours
- Cooperative Planning Area

Utilities

- OH Transmission Line
- Waterline
- Gas
- Tele
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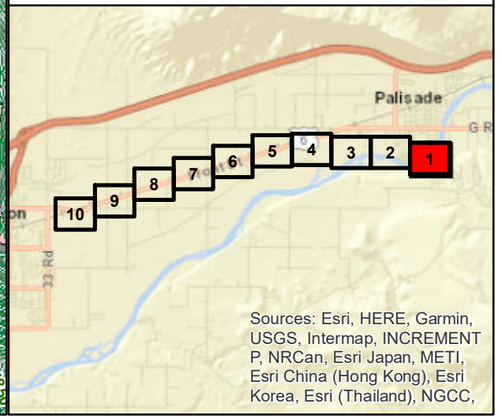
- Levee Flood Risk
- 500-yr Flood Plain
- Clifton Sanitation District

Wetlands

- Emergent Wetland
- Forested/Shrub Wetland
- Freshwater Pond
- Riverine



Town of Palisade Sewer Transfer Study

Sheet 2 of 10

N
W E
S

0 100 200 400 Feet

1 inch = 200 feet

Legend

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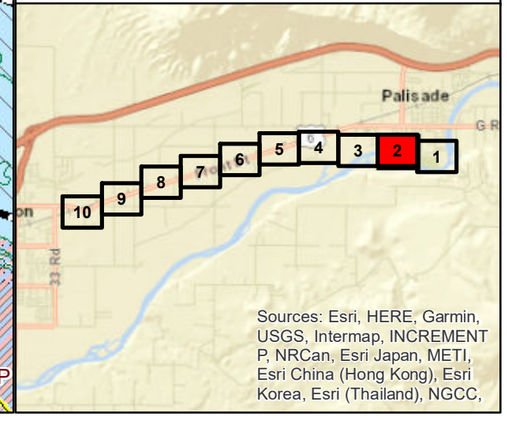

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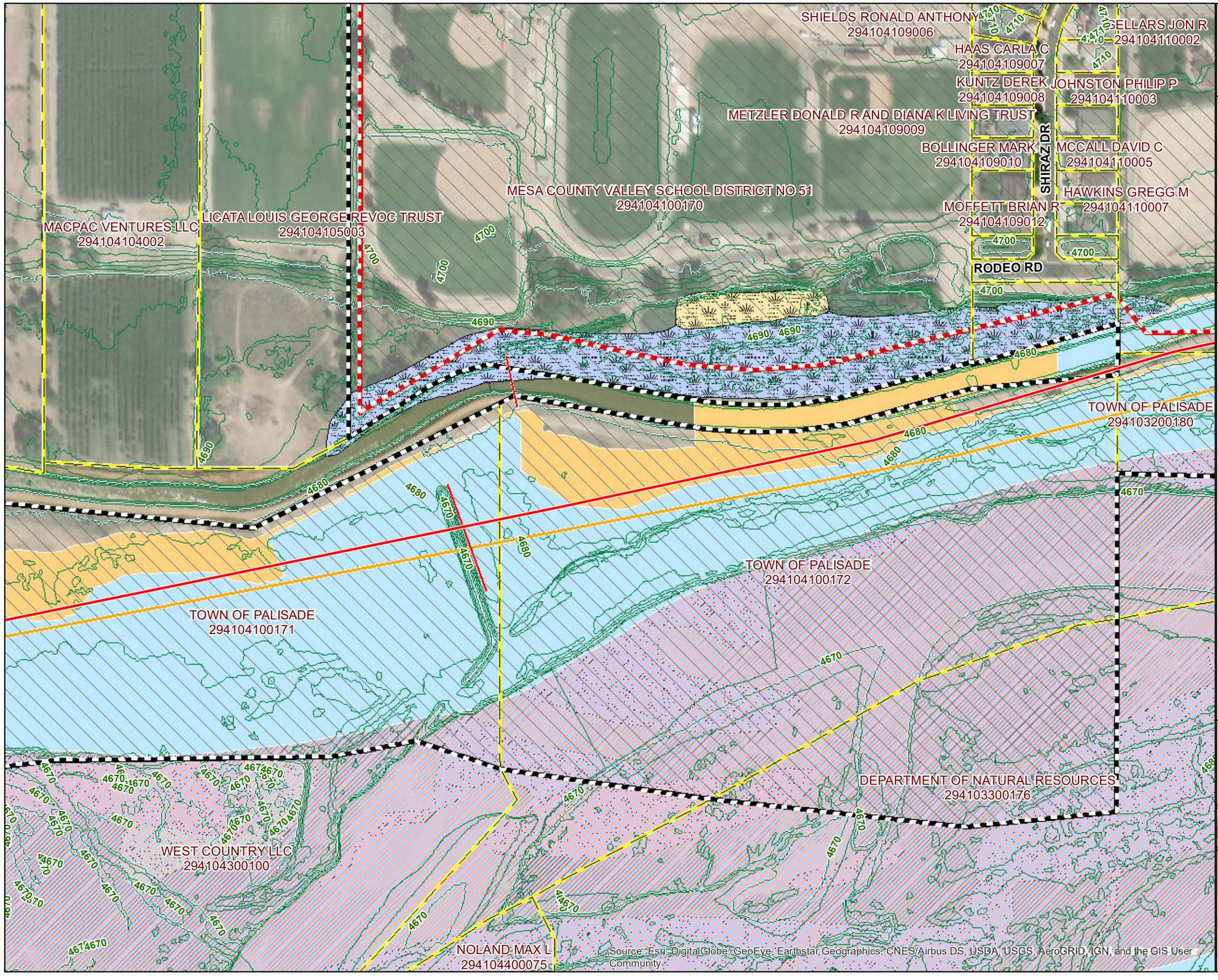
Town of Palisade Sewer Transfer Study

Sheet 3 of 10



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N

W E

S

0 100 200 400

Feet

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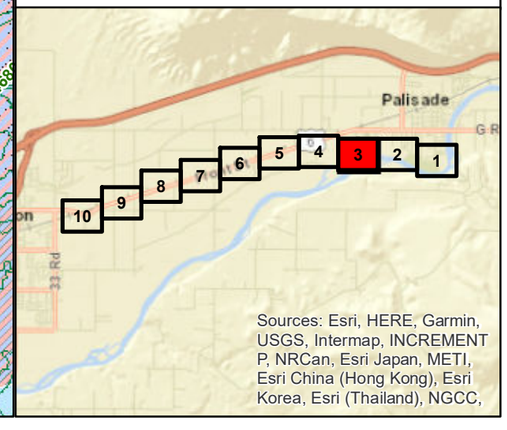

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Town of Palisade
Sewer Transfer Study

Sheet 4 of 10

N
W E
S

0 100 200 400
Feet

1 inch = 200 feet

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Utilities

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Wetlands

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- Riverine

JOHNSON TRACI DALE
294104203003

THEUNISSEN ROGER H JR
294104203004

DUPRE FAITH ALICE
294104200004

CHAPOOSE MAX
294104200063

PINNT DAVID T
294104200101

SMITH DONALD L
294104203006

3 in Waterline

FRONT ST

SIERRA RANCH COMPANY
294104200023

WEINMASTER FLAME E C
294104200024

BROWN CHRIS W
294104206001

SMITH THOM D
294104200084

MCKEE STEPHEN L
294104200058

MULNIX RONALD R
294104100020

EARLY MORNING ORCHARD LLC
294104207001

CLARK JACOB O
294104206002

ARNOLD ELINOR L
294104200054

JOSEPH SALLY JO
294104202006

TAYLOR LAND COMPANY LLC
294104200051

EMMONS MELVA J
294104207002

SJOGREN BRIAN W
294104202011

REIERSGAARD JAMES L TRUST
294104200070

2in Waterline

BRUCKNER EYER R
294104200168

JOSEPH SALLY JO
294104202010

EARLEY WILLIAM CLYDE
294104200098

JMA FAMILY TRUST
294104200169

DONOVAN RORY
294104202014

361/4 RD

PETERMAN JOHN ROBERT
294104202013

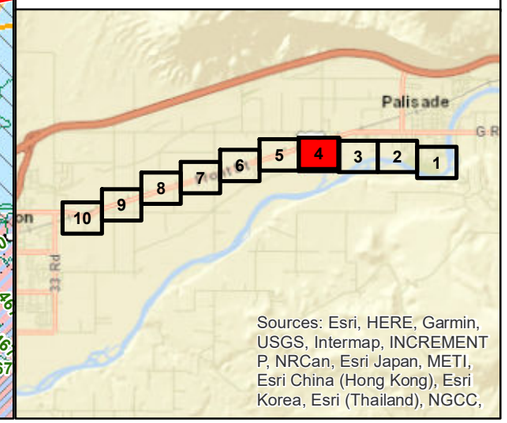
GRAND VALLEY CANAL RD

WEST COUNTRY LLC
294104300099

TOWN OF PALISADE
294104100171

WEST COUNTRY LLC
294104300100

P



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Town of Palisade
Sewer Transfer Study

Sheet 5 of 10

N
W E
S

0 100 200 400 Feet

1 inch = 200 feet

Legend

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- Levee Flood Risk
- 500-yr Flood Plain
- Clifton Sanitation District

Wetlands

- Emergent Wetland
- Forested/Shrub Wetland
- Freshwater Pond
- Riverine

REED LORNA V S
294105100006

NIELSEN BRADLEY
294105100062

DAVIS BETHEL I
294105100063

OLESEN BRIAN E
294105100116

BARBIER JOHN
294105100133

THINNES ROBERT E
294105100132

ZACHER JESSE
294105100011

LATE AFTERNOON ORCHARDS LLC
294105100113

SSH INVESTMENTS LLC
294105100013

KORVER ELAINE L
294104200001

36 RD

FRONT ST

JOHNSON BRIAN E
294105100067

3 in Waterline

ADAN JUAN M
294105100102

SWEET ANTHONY D
294105100131

JMA FAMILY TRUST
294104200068

KRABBE WAYNE A
294105100079

FIRST CHURCH OF THE NAZARENE OF PALISADE
294105100134

ATCHISON EMERY T
294105100029

STEELE KEVIN L
294105100030

WALKER NATHAN JUDSON
294105100031

BOWEN JULIE A
294105100080

LOMBARDI DAVID R
294105100061

HAMILTON SCOTT W
294105100103

CRAG CREST LLC
294105100115

TOLIN RONALD J
294105100034

TAYLOR PATRICK C
294105100035

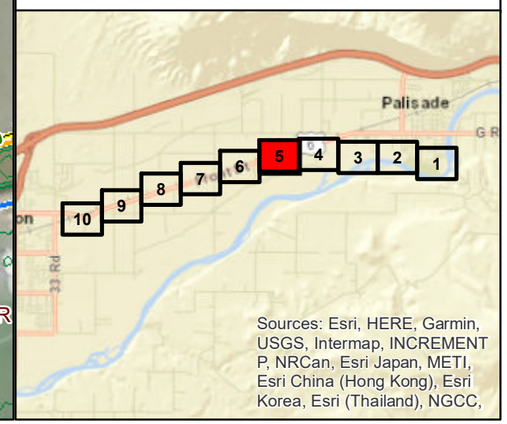
LARSEN ROBERT MARTIN
294105100114

2 in Waterline

GRAND VALLEY CANAL RD

SNYDER ROYAL C JR
294104300061

TAYLOR SHERRI L
294105400048



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Town of Palisade
Sewer Transfer Study

Sheet 6 of 10

N
W E
S

0 100 200 400 Feet

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- Force Main
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Utilities

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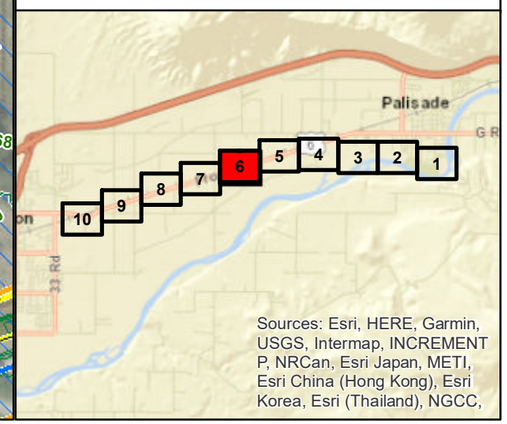

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Town of Palisade
Sewer Transfer Study

Sheet 7 of 10

N
W E
S

0 100 200 400
Feet

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Legend

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BENNETT LYLE E
294106100177

NORRIS STEPHANIE KAY
294106100201

HILL RUBY HILL
294106100025

SCHROEDER ROBERT V
294106100217

PFISTER ROBERT T
294105200069

JENKINS MARIE E
294106100178

MCALLISTER WALTER PATRICK III
294106100202

SCHROEDER ROBERT V
294106100218

COATE CLAYTON P
294106100191

DENNISON RICHARD R
294106400171

PETERSEN RICK L
294106400172

NELSON LEIF OLAF
294106401005

NELSON LEIF OLAF
294106401004

RICHARDS DARYL E
294105301001

PADILLA FELIPE
294106400170

CARTER JOHN W
294106401003

MESA COUNTY SCHOOL DISTRICT #51
294106401007

JANECEK JAMES V
294106401002

EDMISTON ROBERT E
294106401001

MESA COUNTY VALLEY SCHOOL DISTRICT
294106400222

GROVENOR ESTATE PROPERTIES LLC
294106400052

DAVIDSON FRANKLIN J
294106404001

DAVIDSON FRANKLIN J
294106404002

WARMING SOLVEIG
294105301002

SASSON MARK
294106400063

FORNEY KEITH R
294106400213

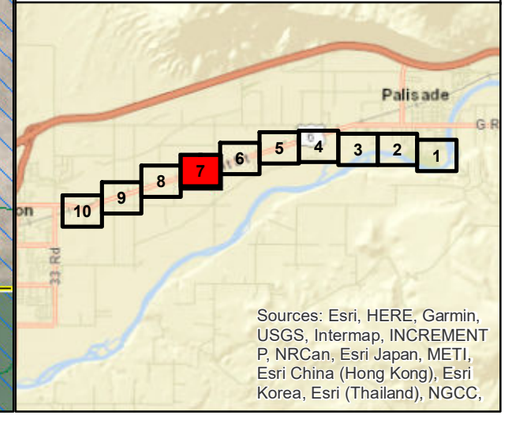
SAUVAGE KAIBAB SNOW
294106400065

BROE MATTHEW J
294106400220

LANCASTER LONNY D
294106403003

CRAWFORD HARVEY L
294105300049

2 in Waterline
4 in Waterline
8 in Waterline
8 in Waterline
35 RD
FRONT ST
MH Depth: Unk
MH Depth: Unk



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Town of Palisade
Sewer Transfer Study

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- 2' Contours
- Cooperative Planning Area

Flood Zone

- No Base Flood Elev Known
- Zone AE
- Regulatory Floodway
- Levee Flood Risk
- 500-yr Flood Plain
- Clifton Sanitation District

Wetlands

- Emergent Wetland
- Forested/Shrub Wetland
- Freshwater Pond
- Riverine

COOPER RONALD D
294106300197

HAYS DEVELOPMENT LLC
294106300194

BROWN DONNA D
294106300039

HARLAN ZELLA JOEY ANN
294106300040

DENNISON RICHARD R
294106400171

PADILLA FELIPE
294106400170

WHITE KARL E
294106306001

BASH DENA R
294106306002

GROVENOR ESTATE PROPERTIES LLC
294106400052

DRISCOLL GERVASE
294106300097

FRONT ST

MARTINEZ JOHN EMANUEL
294106300055

EVANS ROBERT
294106300204

JONES BRUCE R
294106300203

SASSON MARK
294106400063

34 1/2 RD

MILLER MICHAEL EMERY
294106300164

ELDER N EUGENE
294106300165

TAYLOR TERESA M
294106300111

WENS DAVE
294106300113

DIFFENDAFFER BLAINE E
294106300210

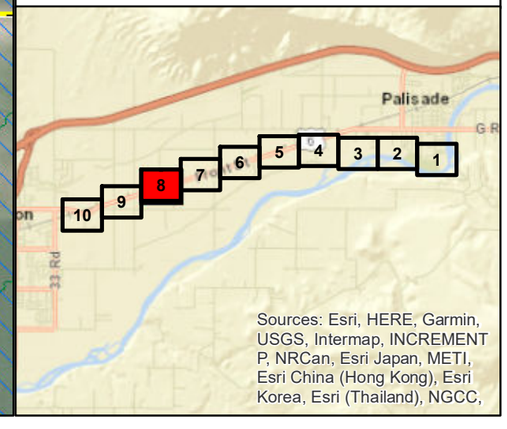
3411 FRONT STREET LLC
294106300057

WHITESIDE PETER D
294106300058

KAUFMAN LINDA P
294106300114

JENSEN CHARLES H JR
294106400099

BAKER BART K
294106300115



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC,

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Town of Palisade
Sewer Transfer Study

Sheet 9 of 10

N
W E
S

0 100 200 400
Feet

1 inch = 200 feet

Legend

- Pump Station
- Force Main
- Gravity Line

Utilities

- OH Transmission Line
- Waterline
- Gas
- Tele
- Unknown Pipe
- Headgates
- CSD Manholes
- CSD Sewer Line
- Palisade Town Limits
- Parcel Limits
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- 2' Contours
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Wetlands

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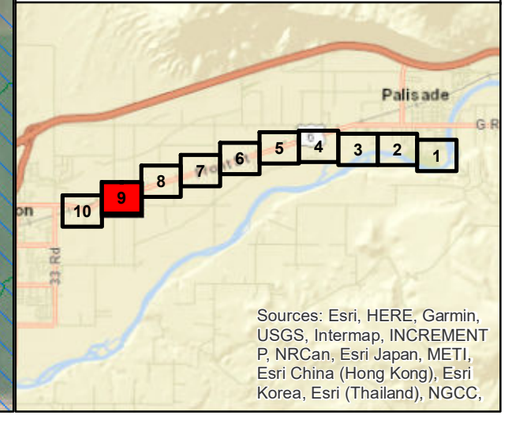

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Town of Palisade
Sewer Transfer Study

Sheet 10 of 10

N
W E
S

0 100 200 400
Feet

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Legend

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Utilities

- OH Transmission Line
- Waterline
- Gas
- Tele
- Unknown Pipe
- Headgates
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- CSD Sewer Line
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- No Base Flood Elev Known
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- Regulatory Floodway
- Levee Flood Risk
- 500-yr Flood Plain
- Clifton Sanitation District

Wetlands

- Emergent Wetland
- Forested/Shrub Wetland
- Freshwater Pond
- Riverine

POWELL DONALD R
294301300070

CLAYPOOLE STEVEN LYNN
294301300071

RODEN OPAL A TRUSTEE
294301300198

FRITZLER COLIN R
294301300197

MAURER BARBARA TRUSTEE
294301300060

RANKIN JOHN H
294301300068

O'BANION DAVID E
294301400061

GRAYSTONE HOUSE LLC
294301400154

DIAZ PROPERTIES LLC
294301400155

F RD

MH Depth: 6.5 ft
8 in VCP
MH Depth: Unk

VEZIE DAVID A
294312200151

FRONT ST

MH Depth: 6.6 ft
8 in VCP

SMITH H SPENCER
700805423603

DE PONCE MARIA
700825898259

PONCE MARIA
700821394149

MH Depth: 6.8 ft

BINETTI BARBARA TAYLOR
294312100115

REYES DE MAYS GRACIELA
700805410100

BESS DAMON OWEN
700828902982

OLSON DAVID
700805354073

FONTANARI RUDOLPH TRUSTEE JR
294312200193

MH Depth: 4.6 ft

33 3/8 RD

33 1/2 RD

FONTANARI RUDOLPH JR AND FONTANARI ETHEL CAROL REVOC LIV TRUST
294312200177

MH Depth: 7.9 ft
8 in VCP

MH Depth: 10.6 ft
8 in VCP

MCKAY CHARLES B
294312100116

WILLIAMS RAYMOND R AND CONDA J LIVING TRUST
294312200123

BECKER CHARLES J
294312100018

FONTANARI RUDOLPH JR AND FONTANARI ETHEL CAROL REVOC LIV TRUST
294312200093

FONTANARI RUDOLPH JR AND FONTANARI ETHEL CAROL REVOC LIV TRUST
294312200194

ORMAN MARY MARGARET
294312200018

PITTSENBARGER JAMES F
294312200132

SISSOM MARY V
294312200012

BUSSELL TERESA L
294312100202

MH Depth: 9.6 ft
8 in PVC

FONTANARI RUDOLPH JR AND FONTANARI ETHEL CAROL REVOC LIV TRUST
294312200013

BENCY NICHOLAS J
294312100203

MH Depth: 15.4 ft
MH Depth: Unk
MH Depth: 12.4 ft
MH Depth: 9.2 ft
MH Depth: 15 ft
MH Depth: 7.6 ft
MH Depth: 8.2 ft
MH Depth: 14.8 ft
MH Depth: 3.3 ft
MH Depth: 14.4 ft
MH Depth: 17.4 ft
8 in VCP
8 in PVC
18 in PVC
21 in PVC
E 3/4 RD

BRUMBACK KENT
294312200212

BRUMBACK KENT G BAKER CONNIE
294312200211
294312200027

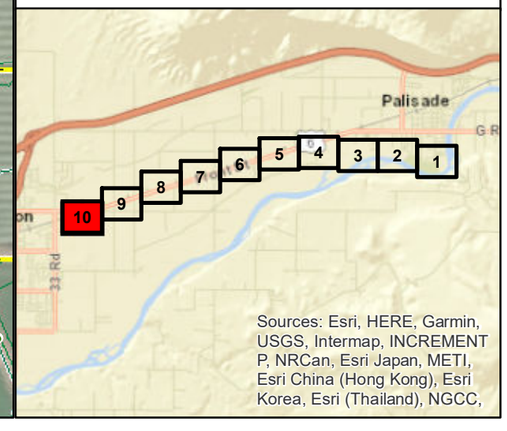
GORTON DARREL
294312211003

HOOGEVEEN DOUGLAS F
294312200186

GABOSSI JOSEPH J
294312200187

GABOSSI JOSEPH J
294312100127

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, GN, and the GIS User Community

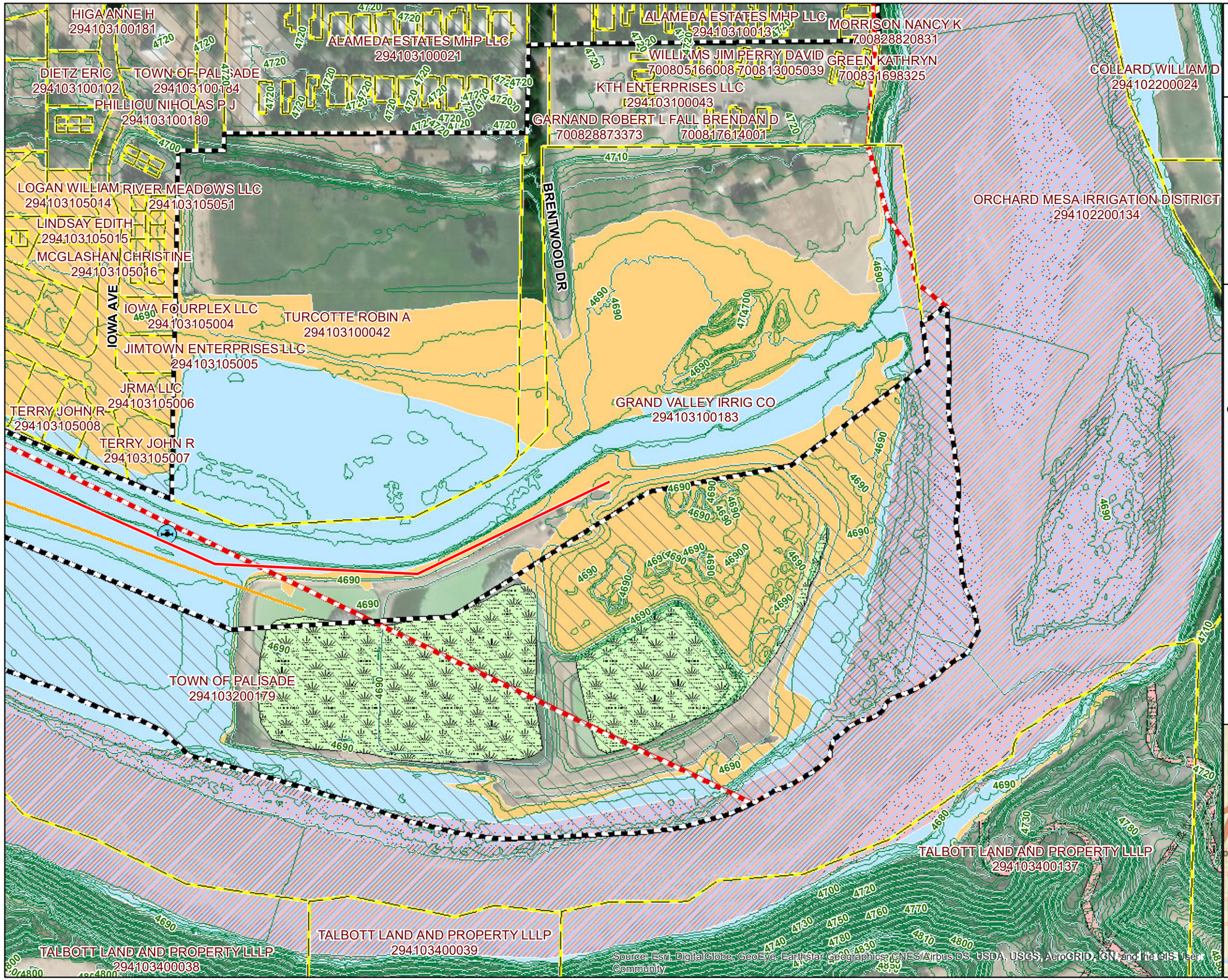


Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC,

Appendix C

Town of Palisade Sewer Transfer Study

Sheet 1 of 11



N

W E

S

0 100 200 400

Feet

1 inch = 200 feet

Legend

- Pump Station
- Force Main
- Gravity Line
- 10' Contours
- 2' Contours
- Cooperative Planning Area

Utilities

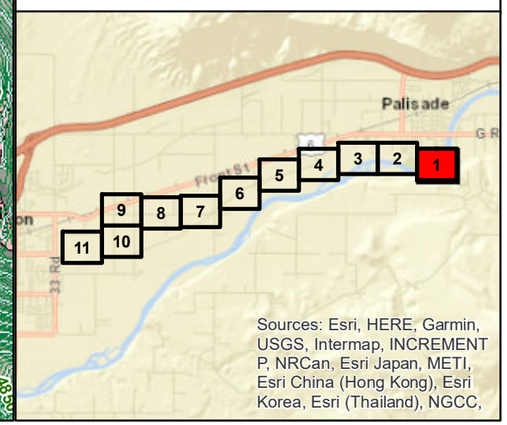
- OH Transmission Line
- Waterline
- Gas
- Tele
- Unknown Pipe
- Headgates
- CSD Manholes
- CSD Sewer Line
- Palisade Town Limits
- Parcel Limits
- Town Sewer Service Limits

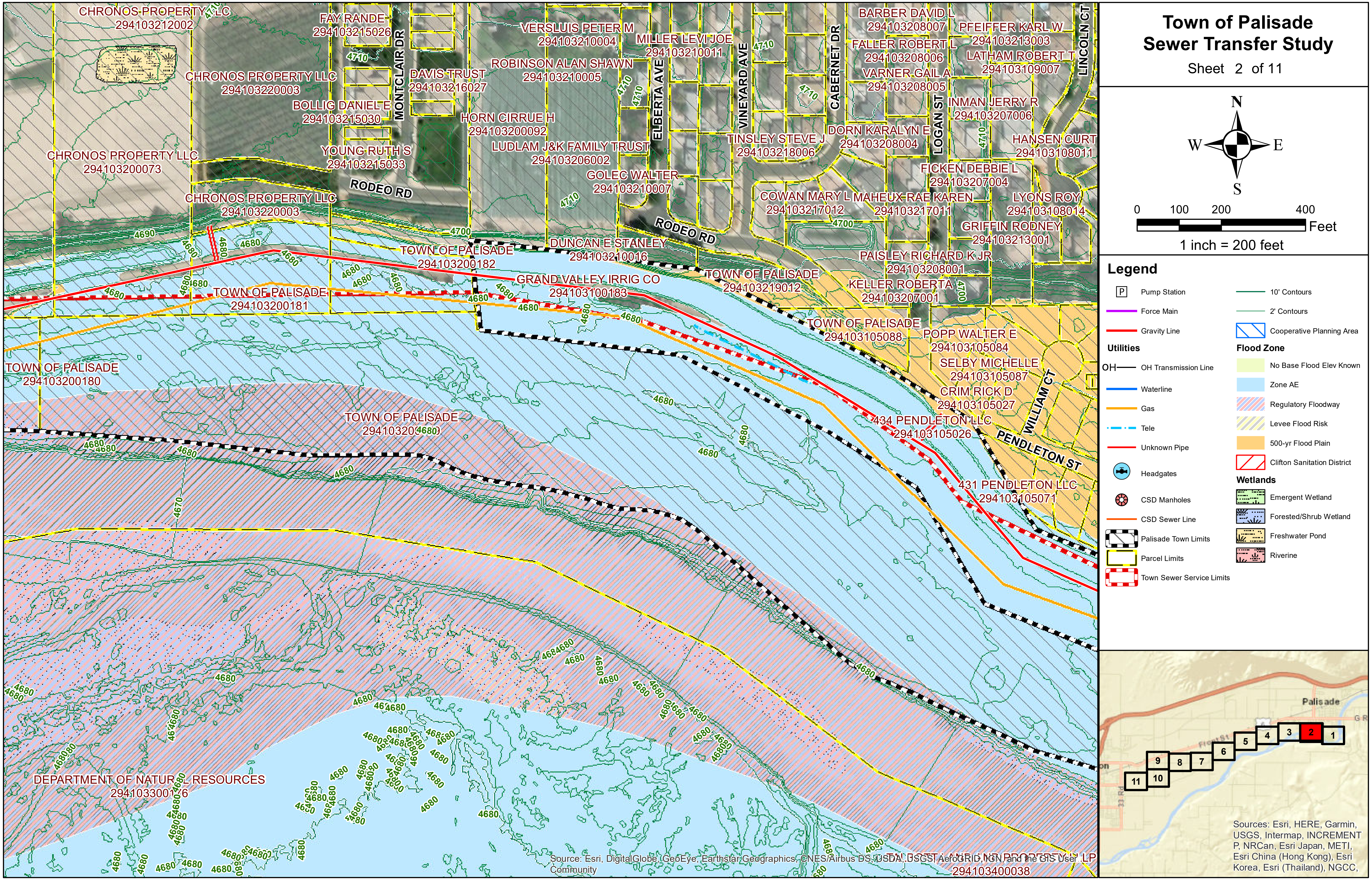
Flood Zone

- No Base Flood Elev Known
- Zone AE
- Regulatory Floodway
- Levee Flood Risk
- 500-yr Flood Plain
- Clifton Sanitation District

Wetlands

- Emergent Wetland
- Forested/Shrub Wetland
- Freshwater Pond
- Riverine

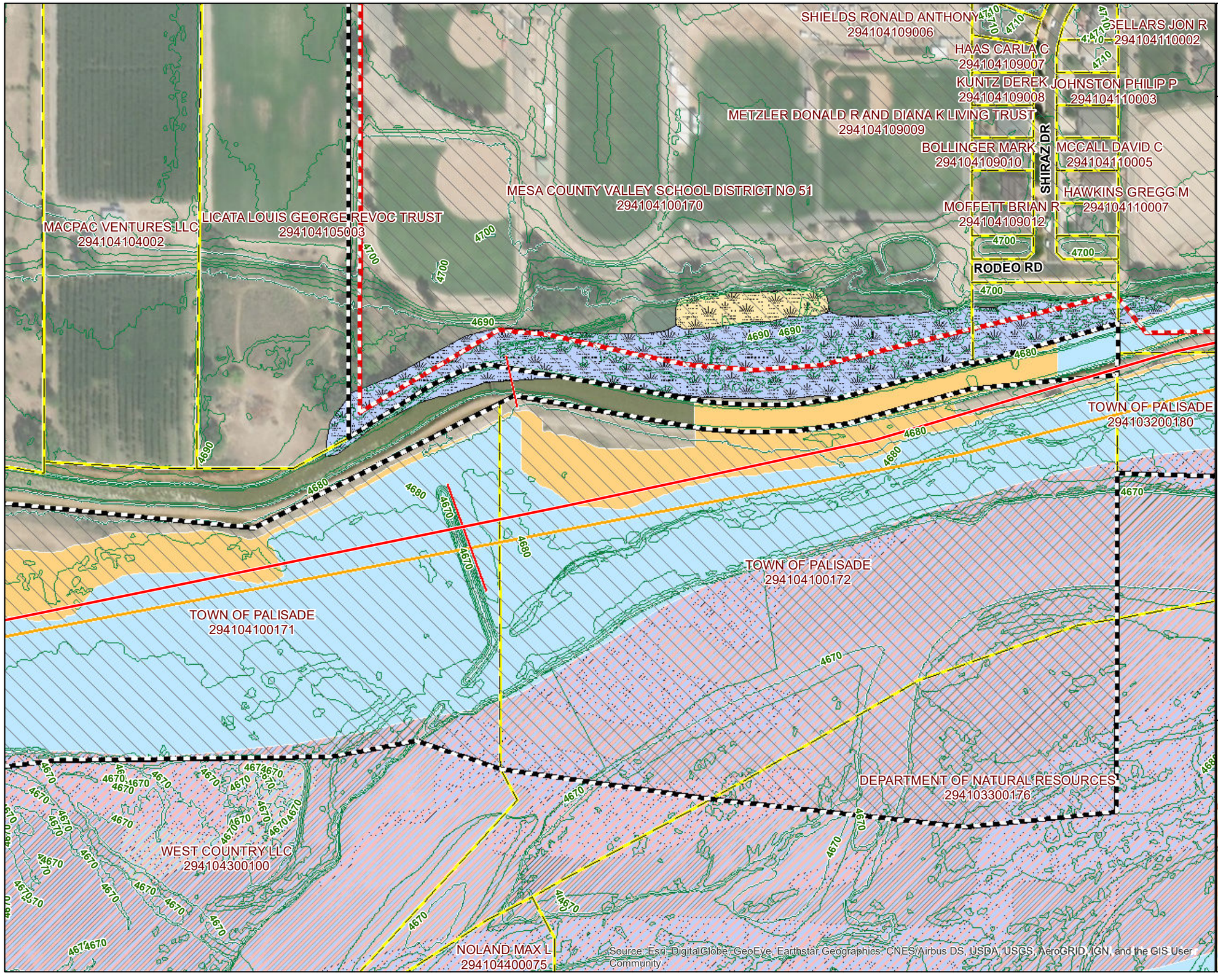




Town of Palisade
Sewer Transfer Study
Sheet 2 of 11
N
W
E
S
0 100 200 400
Feet
1 inch = 200 feet
Legend
Pump Station
Force Main
Gravity Line
Utilities
OH Transmission Line
Waterline
Gas
Tele
Unknown Pipe
Headgates
CSD Manholes
CSD Sewer Line
Palisade Town Limits
Parcel Limits
Town Sewer Service Limits
10' Contours
2' Contours
Cooperative Planning Area
Flood Zone
No Base Flood Elev Known
Zone AE
Regulatory Floodway
Levee Flood Risk
500-yr Flood Plain
Clifton Sanitation District
Wetlands
Emergent Wetland
Forested/Shrub Wetland
Freshwater Pond
Riverine
CHRONOS PROPERTY LLC
294103212002
FAY RANDE
294103215026
VERSLUIS PETER M
294103210004
MILLER LEVI JOE
294103210011
BARBER DAVID L
294103208007
PFEIFFER KARL W
294103213003
FALLER ROBERT L
294103208006
LATHAM ROBERT T
294103109007
CHRONOS PROPERTY LLC
294103220003
DAVIS TRUST
294103216027
ROBINSON ALAN SHAWN
294103210005
VARNER GAIL A
294103208005
BOLLIG DANIEL E
294103215030
HORN CIRRUE H
294103200092
INMAN JERRY R
294103207006
CHRONOS PROPERTY LLC
294103200073
YOUNG RUTH S
294103215033
LUDLAM J&K FAMILY TRUST
294103206002
TINSLEY STEVE J
294103218006
DORN KARALYN E
294103208004
HANSEN CURT
294103108011
GOLEC WALTER
294103210007
FICKEN DEBBIE L
294103207004
CHRONOS PROPERTY LLC
294103220003
COWAN MARY L
294103217012
MAHEUX-RAE KAREN
294103217011
LYONS ROY
294103108014
GRIFFIN RODNEY
294103213001
DUNCAN E STANLEY
294103210016
TOWN OF PALISADE
294103200182
PAISLEY RICHARD K JR
294103208001
GRAND VALLEY IRRIG CO
294103100183
TOWN OF PALISADE
294103219012
KELLER ROBERTA
294103207001
TOWN OF PALISADE
294103200181
TOWN OF PALISADE
294103105088
POPP WALTER E
294103105084
TOWN OF PALISADE
294103200180
SELBY MICHELLE
294103105087
CRIM RICK D
294103105027
TOWN OF PALISADE
294103204680
434 PENDLETON LLC
294103105026
431 PENDLETON LLC
294103105071
DEPARTMENT OF NATURAL RESOURCES
294103300016
294103400038
MONTCLAIR DR
ELBERTA AVE
VINEYARD AVE
CABERNET DR
LOGAN ST
LINCOLN CT
WILLIAM CT
PENDLETON ST
RODEO RD
RODEO RD
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Palisade
1 2 3 4 5 6 7 8 9 10 11
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC,

Town of Palisade
Sewer Transfer Study

Sheet 3 of 11



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N
W E
S

0 100 200 400 Feet

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Legend

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Utilities

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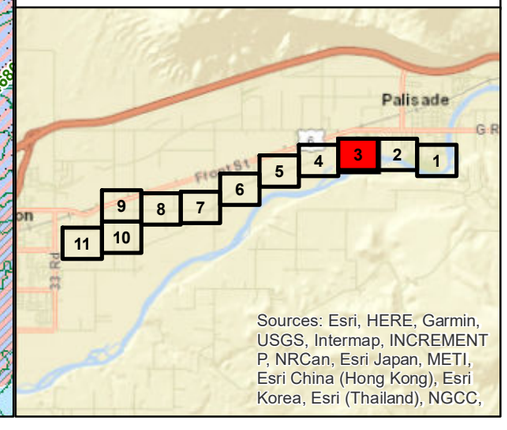
- Parcel Limits
- Town Sewer Service Limits
- 10' Contours
- 2' Contours
- Cooperative Planning Area

Flood Zone

- No Base Flood Elev Known
- Zone AE
- Regulatory Floodway
- Levee Flood Risk
- 500-yr Flood Plain
- Clifton Sanitation District

Wetlands

- Emergent Wetland
- Forested/Shrub Wetland
- Freshwater Pond
- Riverine



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Town of Palisade
Sewer Transfer Study

Sheet 4 of 11

N
W E
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0 100 200 400
Feet

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Legend

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Utilities

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- Levee Flood Risk
- 500-yr Flood Plain
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Wetlands

- Emergent Wetland
- Forested/Shrub Wetland
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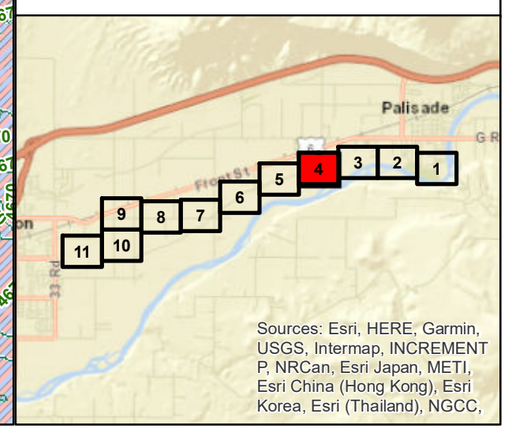
- Riverine



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Town of Palisade
Sewer Transfer Study

Sheet 5 of 11

N
W E
S

0 100 200 400
Feet

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- 2' Contours
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Utilities

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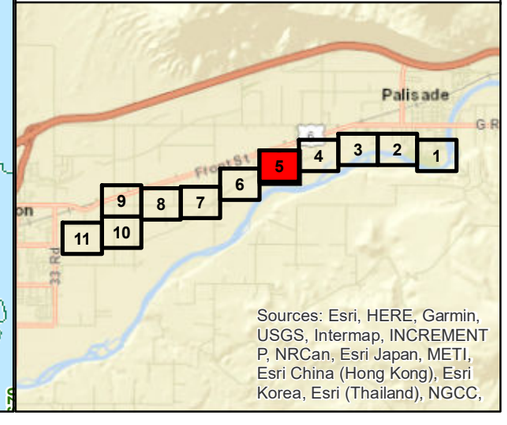

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Town of Palisade
Sewer Transfer Study

Sheet 6 of 11

N
W E
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1 inch = 200 feet

Legend

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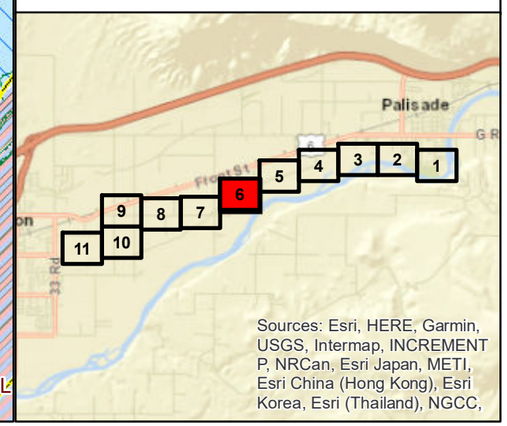

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

RICHARDS DARYL E
294105301001

KRAMER JULIE
294105300095

STARKS WALTER DAVID
294105300041

WARMING SOLVEIG
294105301002

SHAY PATRICK L
294105300042

STEVENS CARL
294105300111

WARR LESLIANN
294105300100

VANLANDINGHAM JOHN PERRY
294105300055

PALMER JAMES H EST
294105400086

PHILLIPS THOMAS H
294105400047

PHILLIPS THOMAS H
294105400046

MCCLAIN JOHN F
294105300124

MILLER DANNY L
294105300126

CRAWFORD HARVEY L
294105300049

THIBODEAU JOSHUA M
294105300090

MOSBY MICHAEL
294105300091

HOYT DARREL
294105300108

GRAND VALLEY CANAL RD

35 1/2 RD

2in Waterline

OH

Town of Palisade
Sewer Transfer Study

Sheet 7 of 11

N
W E
S

0 100 200 400
Feet

1 inch = 200 feet

Legend

- Pump Station
- Force Main
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Utilities

- OH Transmission Line
- Waterline
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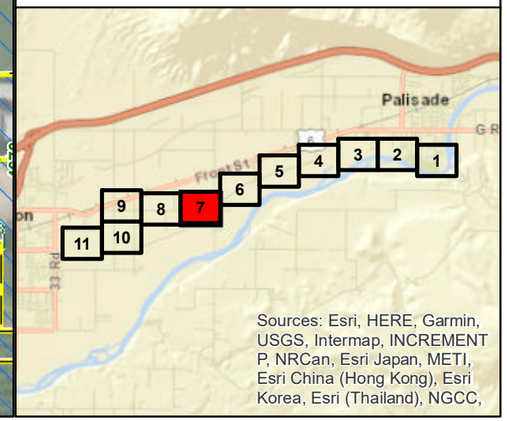

SASSON MARK
294106400063

MUSICH KYLE E
294106403004

WORSHAM JOHN C
294106400168

BROE MATTHEW J
294106400220

CRAWFORD HARVEY L
294105300049

JENSEN CHARLES H JR
294106400099

BLEDSOE BRADY J
294106400214

FORNEY KEITH R
294106400213

SAUVAGE KAIBAB SNOW
294106400065

BRANNON TODD J
294106400130

RASMUSSEN CASEY
294106400151

BRUCKNER PAUL
294106400159

ROSENBROCK KENNETH C
294106400184

MORAN DANNY
294106400153

GOAD RAYMOND L
294106400129

MILES GALE H
294106400221

HAMILTON ALLISON
294106400183

35 RD

WALLACE STEVE L
294106400141

POWELL JODI LYNN
294106400185

BUMGARDNER MICHAEL C
294106400116

KOLPIN DIANE M
294105300053

SCHELL JERRY
294106400160

8 in Waterline

F RD

3 in Waterline

2 in Waterline

REINERS MERLIN
294107100064

LOCKE BUCK
294108200001

RUNDLE LARRY F
294107100075

LANGE EDNA R
294108200002

HERING FRANK M
294107100009

LANCASTER PAUL A
294107100066

SOMERVILLE JAMES T
294107100008

SNAVELY RICHARD L
294108200175

SIDNI L NORWOOD IRREVOCABLE TRUST U/T/A
294107100092

BARLEY KELCY D JR
294107100074

DYKEMAN JAMES
294108200008

MOORE LEWIS H JR TRUSTEE
294107100076

FITZGERALD DIANE S
294107100063

HAMER JESLYN
294107100091

PLACE DAVID C
294107100012

Confidential Owner
294108200117

RUNNELLS HARVEY
294108200116

NELSON LEIF OLAF
294108200179

GRAND VALLEY CANAL RD

CRAIG JOHN D
294107100093

HOLLAND BECKY
294107100089

TOESRUD ROBERT D
294107100098

NELSON LEIF OLAF
294108200178

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Town of Palisade
Sewer Transfer Study

Sheet 8 of 11

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W E
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0 100 200 400
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- Forested/Shrub Wetland
- Freshwater Pond
- Riverine

SASSON MARK
294106400063

ELDER N EUGENE MILLER MICHAEL EMERY
294106300165 294106300164

OWENS KEITH R AND OWENS CELESTE REVOC FAMILY TRUST
294106300145

JENSEN CHARLES H JR
294106400099

DIFFENDAFFER BLAINE E
294106300210

3411 FRONT STREET LLC
294106300057

WHITESIDE PETER D
294106300058

KAUFMAN LINDA P JONES BRUCE R
294106300114 294106300203

WENS DAVE
294106300113

TAYLOR TERESA M
294106300111

34 1/2 RD

BAKER BART K
294106300115

BOYDSTUN WILLIAM C
294106300144

ORIBELLO RONNIE
294106400181

ORIBELLO RONNIE
294106400182

GASKILL JASON
294106300209

F RD

3 in Waterline

KING KERRY C
294107200096

BELSHER DENNIS O
294107200157

COLE LIVING TRUST
294107200001

LANCASTER PAUL A
294107100066

KOCH DALE L
294107200002

WENS KARL DAVID
294107200118

SANKEY LELA MAY
294107200004

FITZGERALD DIANE S
294107200065

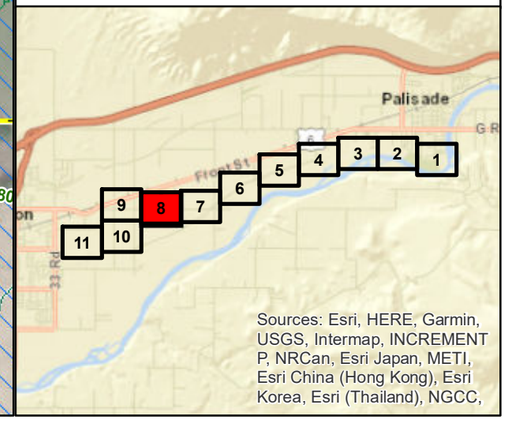
WHITTINGTON MICHAEL
294107200005

BELSHER DENNIS O
294107200158

FITZGERALD DIANE S
294107100063

BARKER BRIAN W
294107200014

HOUCK TREVA K
294107200119



Town of Palisade
Sewer Transfer Study

Sheet 9 of 11

N
W E
S

0 100 200 400
Feet

1 inch = 200 feet

Legend

- Pump Station
- Force Main
- Gravity Line

Utilities

- OH Transmission Line
- Waterline
- Gas
- Tele
- Unknown Pipe
- Headgates
- CSD Manholes
- CSD Sewer Line
- Palisade Town Limits
- Parcel Limits
- Town Sewer Service Limits

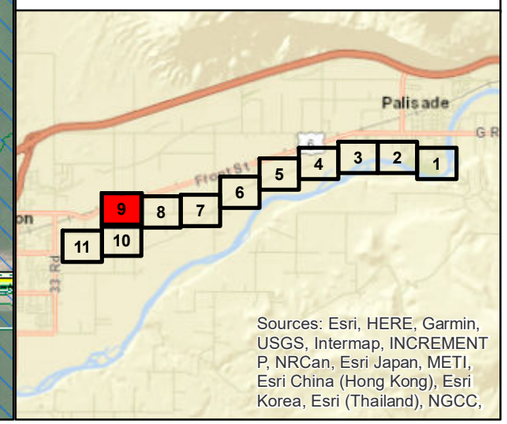
- 10' Contours
- 2' Contours
- Cooperative Planning Area

Flood Zone

- No Base Flood Elev Known
- Zone AE
- Regulatory Floodway
- Levee Flood Risk
- 500-yr Flood Plain
- Clifton Sanitation District

Wetlands

- Emergent Wetland
- Forested/Shrub Wetland
- Freshwater Pond
- Riverine



STORY BRIAN
294301400158

KRUKOW TROY R
294301400195

MYERS LYDIA
294301400196

KENT A B
294301400106

MARTINEZ JOHN EMANUEL
294106300055

O'BANION DAVID E
294301400061

EKX-LINN ANN M
294301400159

BORDEWYK DALE
294106300127

OWENS KEITH R AND OWENS CELESTE REVOC FAMILY TRUST
294106300145

HAYS HERBERT H
294301400108

GOFORTH KEVIN
294301400065

O'BANION DAVID E
294301400213

BOUNDS AUDIT L
294301400064

BOYDSTUN WILLIAM C
294106300144

DIAZ PROPERTIES LLC
294301400155

QUILLIN SALMANCA
294301400218

MURPHY DARLENE M
294301400201

STEIN ALLEN
294301400217

FROST RICHARD
294301400211

DAVIS WESLEY
294312100119

MORRISON ROBERT W TRUST SR
294312100006

MCELLEY EDWARD M
294312100201

FULLER SHERRI L
294312100064

SPENCE REILLY
294312100200

COLE LIVING TRUST
294107200001

MARTIN ALISA J
294312100117

KUCHYT TRENT J
294312100120

MORRISON ROBERT W TRUST SR
294312100004

MCKA BURDETTE W
294312100121

BIBEAU MELISSA J
294312100094

MARTIN ALISA J
294312100118

BROWNING MICHAEL I
294312100122

BROWNING MICHAEL I
294312100126

COOK JEFFREY W
294312100135

FROEDGE HEATHER
294312108006

THOMAS TERRY R
294312108001

BARKER BRIAN W
294307200014

FRONT ST

F RD

33 3/4 RD

34 RD

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC,

Town of Palisade
Sewer Transfer Study

Sheet 10 of 11

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Legend

- Pump Station
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- OH Transmission Line
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- Clifton Sanitation District

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- Riverine

BUSSELL TERESA L
294312100202

BROWNING MICHAEL I
294312100126

BENCY NICHOLAS J
294312100203

FROEDGE HEATHER
294312108006

Confidential Owner
294312108005

BOERNER CLINT W
294312108002

JENKINS SHANNON
294312108003

WALDEN GAVIN E
294312108004

BARKER BRIAN W
294107200014

MYERS PAULINE L
294107200015

CRUSE LLOYD H
294107200016

BELL JOHN E
294107200017

MOORE ALAN D
294312100136

MOORE ALAN D
294312100175

MCELLEY EDWARD D
294312100181

MCELLEY EDWARD D
294312100182

GABOSSI JOSEPH J
294312100127

RAWHIDE & LACE LLC
294312100197

HALL AARON R III
294312100196

LJNHAM PAUL W
294312409004

BLANKENSHIP JIM R
294312409003

DIFFENDAFFER LIVING TRUST
294312400038

CLIFTON WATER DISTRICT
294312400217

CLIFTON WATER DISTRICT
294312400216

GNOJEK TIMOTHY R
294312400139

STRONG WALTER H
294107200043

VALVODA DAVID J
294107200042

WARNER KENT C
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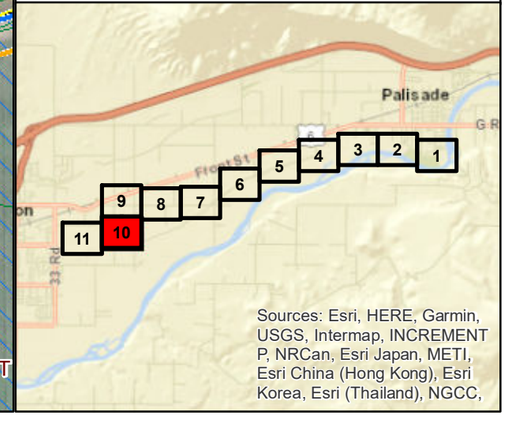
LAVETA V KAY REVOCABLE TRUST
294107300134

33 3/4 RD

34 RD

GRAND VALLEY CANAL RD



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Town of Palisade
Sewer Transfer Study

Sheet 11 of 11

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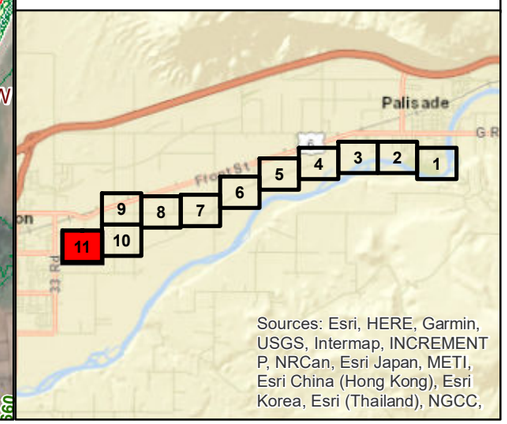

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC,

Appendix D

Photo #1: Northeast corner of Riverbend Park along GVIC canal, looking northeast. Two lines crossing canal, one of them being sewer.

Photo #2: Under bridge entering Riverbend Park, looking southwest. Two lines crossing canal, both unknown.

Photo #3: Riverbend Park along GVIC canal. Two lines crossing canal, sewer (west) and gas (east).

Photo #4: Riverbend Park along GVIC canal. Telephone manhole.

Photo #5: Riverbend Park along GVIC canal, looking northwest. Unknown pipe submerged in canal.

Photo #6: Riverbend Park, looking south. Xcel gas lines in area.

Photo #7: West boundary of Riverbend Park, looking west. Culvert crossing alignment.

Photo #8: West boundary of Riverbend Park, looking south. Electrical boxes.

Photo #9: GVIC canal and 36 ¼ Rd, looking northwest. Gas line crossing bridge.

Photo #10: Along GVIC canal, looking northwest. Gas line crossing canal.

Photo #11: GVIC canal and 35 ½ Rd, looking northwest. Gas line crossing bridge as indicated by signage.

Photo #12: Along GVIC canal, looking west. Unknown pipe crossing canal.

Photo #13: Along GVIC canal, looking west. Two culverts beneath canal.

Photo #14: GVIC canal and 35 Rd, looking north. Various lines and headgates.

Photo #15: GVIC canal and 35 Rd, looking north. Various lines crossing bridge.

Photo #16: Along GVIC canal, looking west. Unknown pipe crossing canal.

Photo #17: Along GVIC canal, looking northwest. Various structures, a headgate, and a pipe crossing canal.

Photo #18: GVIC canal and 34 Rd, looking northwest. Unknown pipe crossing bridge.

Photo #19: GVIC canal and 34 ¾ Rd, looking north. Unknown pipe crossing bridge.

Photo #20: GVIC canal and 34 ¾ Rd, looking north. Unknown gas line crossing bridge.

Photo #21: Along GVIC canal, looking west. View along possible alignment.

Appendix E

Town of Palisade

Project: 2020 Sewer Feasibility Study - Gravity Sewer Line
Subject: Annual costs of operation

Town of Palisade Maintenance				
Item	**Quantity**	**Units**	**Unit Price**	**Annual Cost**
Maintenance cost - Cleaning	26,550	LF	$ 0.95	$ 12,611
H_2S Mitigation Maintenance	260	hr	$ 50	$ 52,000
H_2S Mitigation Power (4 H_2S Mitigation Fan Systems)	----	----	----	$ 31,368
Total Annual Cost				$ 95,979

Short-Lived Assets - Estimated Repair, Rehab, and Replacement Expenses by Item		
Description	**Estimated Life/ Repair (years)**	**Replacement/ Repair Price ($)**
H_2S Biofilter Media (4 H_2S Mitigation Fan Systems)	5	$ 10,000
H_2S Blower Fans (4 H_2S Mitigation Fan Systems)	10	$ 8,000

Interest	5%
Lifespan (yrs)	50
Present Value (maintenance) without inflation factored in	**$ 1,752,187**
Present Value with inflation factored in (from next sheet)	**$ 8,628,625**

Town of Palisade Maintenance	
Item	**Assumption**
Total Annual Costs	$ 95,979
Interest	5%
Lifespan (yrs)	50
Replacement Costs	5 year life:
	H2S Biofilter Media (4 H2S Mitigation Fan Systems)
	10 year life:
	H2S Blower Fans (4 H2S Mitigation Fan Systems)
Construction Cost	$ 5,457,742
Inflation	3%
Present Value	$ 8,628,625

Town of Palisade

Project: 2020 Sewer Feasibility Study - Gravity Sewer Line

Subject: Present Value Analysis

Construction Cost	$ 5,457,742	Interest	5%

Year Inflation Rate	Annual Maintenance 3%	Construction / Equipment Updates 3%	Present Value	Cumulative PV
1	$ 95,979	$ 5,621,474	$ 5,445,193	$ 5,445,193
2	$ 98,858		$ 89,668	$ 5,534,861
3	$ 101,824		$ 87,960	$ 5,622,820
4	$ 104,879		$ 86,284	$ 5,709,105
5	$ 108,025	$ 46,371	$ 120,973	$ 5,830,078
6	$ 111,266		$ 83,028	$ 5,913,106
7	$ 114,604		$ 81,447	$ 5,994,553
8	$ 118,042		$ 79,896	$ 6,074,449
9	$ 121,583		$ 78,374	$ 6,152,823
10	$ 125,231	$ 96,762	$ 136,284	$ 6,289,107
11	$ 128,988		$ 75,417	$ 6,364,524
12	$ 132,857		$ 73,980	$ 6,438,504
13	$ 136,843		$ 72,571	$ 6,511,074
14	$ 140,948		$ 71,189	$ 6,582,263
15	$ 145,177	$ 62,319	$ 99,809	$ 6,682,072
16	$ 149,532		$ 68,502	$ 6,750,574
17	$ 154,018		$ 67,198	$ 6,817,772
18	$ 158,639		$ 65,918	$ 6,883,690
19	$ 163,398		$ 64,662	$ 6,948,352
20	$ 168,300	$ 130,040	$ 112,441	$ 7,060,793
21	$ 173,349		$ 62,222	$ 7,123,015
22	$ 178,549		$ 61,037	$ 7,184,052
23	$ 183,906		$ 59,874	$ 7,243,927
24	$ 189,423		$ 58,734	$ 7,302,661
25	$ 195,106	$ 83,751	$ 82,347	$ 7,385,008
26	$ 200,959		$ 56,518	$ 7,441,526
27	$ 206,988		$ 55,441	$ 7,496,967
28	$ 213,197		$ 54,385	$ 7,551,352
29	$ 219,593		$ 53,349	$ 7,604,702
30	$ 226,181	$ 174,763	$ 92,769	$ 7,697,471
31	$ 232,966		$ 51,336	$ 7,748,807
32	$ 239,955		$ 50,359	$ 7,799,166
33	$ 247,154		$ 49,399	$ 7,848,565
34	$ 254,569		$ 48,458	$ 7,897,023
35	$ 262,206	$ 112,554	$ 67,940	$ 7,964,964
36	$ 270,072		$ 46,630	$ 8,011,594
37	$ 278,174		$ 45,742	$ 8,057,336
38	$ 286,519		$ 44,870	$ 8,102,206
39	$ 295,115		$ 44,016	$ 8,146,222
40	$ 303,968	$ 234,867	$ 76,539	$ 8,222,761
41	$ 313,087		$ 42,355	$ 8,265,116
42	$ 322,480		$ 41,548	$ 8,306,664
43	$ 332,154		$ 40,757	$ 8,347,421
44	$ 342,119		$ 39,980	$ 8,387,401
45	$ 352,383	$ 151,264	$ 56,054	$ 8,443,455
46	$ 362,954		$ 38,472	$ 8,481,927
47	$ 373,843		$ 37,739	$ 8,519,666
48	$ 385,058		$ 37,020	$ 8,556,687
49	$ 396,610		$ 36,315	$ 8,593,002
50	$ 408,508		$ 35,623	$ 8,628,625
Total Present Value			**$ 8,628,625**	

Town of Palisade

Project: 2020 Sewer Feasibility Study - Combination Sewer Line
Subject: Annual costs of operation

J-U-B ENGINEERS, INC.
THE LANGDON GROUP | GATEWAY MAPPING INC.
OTHER J-U-B COMPANIES

Town of Palisade Maintenance				
Item	**Quantity**	**Units**	**Unit Price**	**Annual Cost**
Maintenance cost - Cleaning	15,810	LF	$ 0.95	$ 7,510
Total Annual Cost				$ 7,510
Interest				5%
Lifespan (yrs)				50
Present Value (maintenance) without inflation factored in				**$ 137,097**
Present Value with inflation factored in (from next sheet)				**$ 6,957,998**

Town of Palisade Maintenance	
Item	**Assumption**
Total Annual Costs	$ 7,510
Interest	5%
Lifespan (yrs)	50
Construction Cost	$ 6,856,660
Inflation	3%
Present Value	$ 6,957,998

CSD Maintenance				
Item	**Quantity**	**Units**	**Unit Price**	**Annual Cost**
Lift Station Operator	10	hr/week	$ 50	$ 26,000
Lift Station Power				$ 14,200
Lift Station Pumping (20 HP pumps, 12 hrs/d)	65,437	KWH	$ 0.12	
Grinder Power Draw (5 HP, 24 hrs/d)	32,719	KWH	$ 0.12	
Building HVAC and Lighting	20,449	KWH	$ 0.12	
Lift Station Professional Services	1	LS	$ 3,000	$ 3,000
Lift Station Building Maintenance	1	LS	$ 3,000	$ 3,000
Total Annual Cost				$ 46,200

Short-Lived Assets - Estimated Repair, Rehab, and Replacement Expenses by Item		
Description	**Estimated Life/ Repair (years)**	**Replacement/ Repair Price ($)**
Lift Station Pumps	10	$ 60,000
Lift Station Grinder	10	$ 30,000
Lift Station Generator and Electrical Panels	10	$ 60,000
Lift Station Instrument Repairs/SCADA	10	$ 20,000

Interest	5%
Lifespan (yrs)	50
Present Value (maintenance) without inflation factored in	**$ 843,424**
Present Value with inflation factored in (from next sheet)	**$ 1,857,126**

Clifton Sanitation District Maintenance	
Item	**Assumption**
Total Annual Costs	$ 46,200
Interest	5%
Lifespan (yrs)	50
Replacement Costs	10 year life:
	Lift Station Pumps
	Lift Station Grinder
	Lift Station Generator and Electrical Panels
	Lift Station Instrument Repairs/SCADA
Construction Cost	$ -
Inflation	3%
Present Value	$ 1,857,126

Town of Palisade

Project: 2020 Sewer Feasibility Study - Combination Sewer Line (Town Responsibility)
Subject: Present Value Analysis

Construction Cost $ 6,856,660

Interest 5%

Year Inflation Rate	Annual Maintenance 3%	Construction / Equipment Updates 3%	Present Value	Cumulative PV
1	$ 7,510	$ 7,062,360	$ 6,733,209	$ 6,733,209
2	$ 7,735		$ 7,016	$ 6,740,225
3	$ 7,967		$ 6,882	$ 6,747,107
4	$ 8,206		$ 6,751	$ 6,753,858
5	$ 8,452		$ 6,623	$ 6,760,481
6	$ 8,706		$ 6,496	$ 6,766,977
7	$ 8,967		$ 6,373	$ 6,773,350
8	$ 9,236		$ 6,251	$ 6,779,601
9	$ 9,513		$ 6,132	$ 6,785,734
10	$ 9,799		$ 6,015	$ 6,791,749
11	$ 10,092		$ 5,901	$ 6,797,650
12	$ 10,395		$ 5,788	$ 6,803,438
13	$ 10,707		$ 5,678	$ 6,809,117
14	$ 11,028		$ 5,570	$ 6,814,687
15	$ 11,359		$ 5,464	$ 6,820,151
16	$ 11,700		$ 5,360	$ 6,825,511
17	$ 12,051		$ 5,258	$ 6,830,768
18	$ 12,412		$ 5,158	$ 6,835,926
19	$ 12,785		$ 5,059	$ 6,840,985
20	$ 13,168		$ 4,963	$ 6,845,948
21	$ 13,563		$ 4,868	$ 6,850,817
22	$ 13,970		$ 4,776	$ 6,855,593
23	$ 14,389		$ 4,685	$ 6,860,277
24	$ 14,821		$ 4,596	$ 6,864,873
25	$ 15,266		$ 4,508	$ 6,869,381
26	$ 15,724		$ 4,422	$ 6,873,803
27	$ 16,195		$ 4,338	$ 6,878,141
28	$ 16,681		$ 4,255	$ 6,882,396
29	$ 17,182		$ 4,174	$ 6,886,571
30	$ 17,697		$ 4,095	$ 6,890,665
31	$ 18,228		$ 4,017	$ 6,894,682
32	$ 18,775		$ 3,940	$ 6,898,622
33	$ 19,338		$ 3,865	$ 6,902,488
34	$ 19,918		$ 3,792	$ 6,906,279
35	$ 20,516		$ 3,719	$ 6,909,998
36	$ 21,131		$ 3,648	$ 6,913,647
37	$ 21,765		$ 3,579	$ 6,917,226
38	$ 22,418		$ 3,511	$ 6,920,737
39	$ 23,091		$ 3,444	$ 6,924,181
40	$ 23,784		$ 3,378	$ 6,927,559
41	$ 24,497		$ 3,314	$ 6,930,873
42	$ 25,232		$ 3,251	$ 6,934,124
43	$ 25,989		$ 3,189	$ 6,937,313
44	$ 26,769		$ 3,128	$ 6,940,441
45	$ 27,572		$ 3,069	$ 6,943,510
46	$ 28,399		$ 3,010	$ 6,946,520
47	$ 29,251		$ 2,953	$ 6,949,473
48	$ 30,128		$ 2,897	$ 6,952,369
49	$ 31,032		$ 2,841	$ 6,955,211
50	$ 31,963		$ 2,787	$ 6,957,998
Total Present Value			**$ 6,957,998**	

Town of Palisade

Project: 2020 Sewer Feasibility Study - Combination Sewer Line (CSD Responsibility)
Subject: Present Value Analysis

Construction Cost $ -

Interest 5%

Year Inflation Rate	Annual Maintenance 3%	Construction / Equipment Updates 3%	Present Value	Cumulative PV
1	$ 46,200	$ -	$ 44,000	$ 44,000
2	$ 47,586		$ 43,162	$ 87,162
3	$ 49,014		$ 42,340	$ 129,502
4	$ 50,484		$ 41,533	$ 171,035
5	$ 51,999		$ 40,742	$ 211,777
6	$ 53,558		$ 39,966	$ 251,743
7	$ 55,165		$ 39,205	$ 290,948
8	$ 56,820		$ 38,458	$ 329,406
9	$ 58,525		$ 37,726	$ 367,132
10	$ 60,281	$ 228,466	$ 177,265	$ 544,397
11	$ 62,089		$ 36,302	$ 580,699
12	$ 63,952		$ 35,611	$ 616,310
13	$ 65,870		$ 34,932	$ 651,242
14	$ 67,846		$ 34,267	$ 685,509
15	$ 69,882		$ 33,614	$ 719,123
16	$ 71,978		$ 32,974	$ 752,097
17	$ 74,137		$ 32,346	$ 784,443
18	$ 76,362		$ 31,730	$ 816,173
19	$ 78,652		$ 31,125	$ 847,299
20	$ 81,012	$ 307,039	$ 146,252	$ 993,551
21	$ 83,442		$ 29,951	$ 1,023,502
22	$ 85,946		$ 29,380	$ 1,052,882
23	$ 88,524		$ 28,821	$ 1,081,703
24	$ 91,180		$ 28,272	$ 1,109,975
25	$ 93,915		$ 27,733	$ 1,137,709
26	$ 96,733		$ 27,205	$ 1,164,914
27	$ 99,635		$ 26,687	$ 1,191,601
28	$ 102,624		$ 26,179	$ 1,217,779
29	$ 105,702		$ 25,680	$ 1,243,459
30	$ 108,873	$ 412,635	$ 120,665	$ 1,364,124
31	$ 112,140		$ 24,711	$ 1,388,835
32	$ 115,504		$ 24,240	$ 1,413,076
33	$ 118,969		$ 23,779	$ 1,436,854
34	$ 122,538		$ 23,326	$ 1,460,180
35	$ 126,214		$ 22,881	$ 1,483,061
36	$ 130,000		$ 22,446	$ 1,505,507
37	$ 133,900		$ 22,018	$ 1,527,525
38	$ 137,917		$ 21,599	$ 1,549,124
39	$ 142,055		$ 21,187	$ 1,570,311
40	$ 146,317	$ 554,546	$ 99,555	$ 1,669,865
41	$ 150,706		$ 20,388	$ 1,690,253
42	$ 155,227		$ 19,999	$ 1,710,253
43	$ 159,884		$ 19,618	$ 1,729,871
44	$ 164,681		$ 19,245	$ 1,749,116
45	$ 169,621		$ 18,878	$ 1,767,994
46	$ 174,710		$ 18,519	$ 1,786,513
47	$ 179,951		$ 18,166	$ 1,804,679
48	$ 185,350		$ 17,820	$ 1,822,499
49	$ 190,910		$ 17,480	$ 1,839,979
50	$ 196,637		$ 17,148	$ 1,857,126
Total Present Value			**$ 1,857,126**	

Town of Palisade

Project: 2020 Sewer Feasibility Study - Force Main Sewer Line
Subject: Annual costs of operation

Town of Palisade Maintenance				
Item	**Quantity**	**Units**	**Unit Price**	**Annual Cost**
Maintenance cost - Cleaning Gravity Sewer	8,440	LF	$ 0.95	$ 4,009
Lift Station Operator	10	hr/week	$ 50	$ 26,000
Lift Station Power				$ 26,000
Lift Station Pumping (20 HP pumps, 12 hrs/d)	163,593	KWH	$ 0.12	
Grinder Power Draw (5 HP, 24 hrs/d)	32,719	KWH	$ 0.12	
Building HVAC and Lighting	20,449	KWH	$ 0.12	
H_2S Mitigation Power (1 H_2S Mitigation Fan System)	65,350	KWH	$ 0.12	$ 7,842
H_2S Mitigation Maintenance (1 H2S Mitigation Fan System)	260	hr	$ 50	$ 13,000
Lift Station Professional Services	1	LS	$ 3,000	$ 3,000
Lift Station Building Maintenance	1	LS	$ 3,000	$ 3,000
Total Annual Cost				$ 82,851

Short-Lived Assets - Estimated Repair, Rehab, and Replacement Expenses by Item		
Description	**Estimated Life/ Repair (years)**	**Replacement/ Repair Price ($)**
Lift Station Pumps	10	$ 90,000
Lift Station Grinder	10	$ 30,000
Lift Station Generator and Electrical Panels	10	$ 90,000
Lift Station Instrument Repairs/SCADA	10	$ 25,000
H_2S Biofilter Media (1 H2S Mitigation Fan System)	5	$ 10,000
H_2S Blower Fans (1 H2S Mitigation Fan System)	10	$ 8,000

Interest	5%
Lifespan (yrs)	50
Present Value (maintenance) without inflation factored in	**$ 1,512,521**
Present Value with inflation factored in (from next sheet)	**$ 8,337,445**

Town of Palisade Maintenance	
Item	**Assumption**
Total Annual Costs	$ 82,851
Interest	5%
Lifespan (yrs)	50
Replacement Costs	5 year life:
	H2S Biofilter Media (1 H2S Mitigation Fan System)
	10 year life:
	Lift Station Pumps
	Lift Station Grinder
	Lift Station Generator and Electrical Panels
	Lift Station Instrument Repairs/SCADA
	H2S Blower Fans (1 H2S Mitigation Fan System)
Construction Cost	$ 5,205,370
Inflation	3%
Present Value	$ 8,337,445

Town of Palisade

Project: 2020 Sewer Feasibility Study - Force Main Sewer Line
Subject: Present Value Analysis

Construction Cost $ 5,205,370

Interest 5%

Year Inflation Rate	Annual Maintenance 3%	Construction / Equipment Updates 3%	Present Value	Cumulative PV
1	$ 82,851	$ 5,361,531	$ 5,185,126	$ 5,185,126
2	$ 85,336		$ 77,403	$ 5,262,529
3	$ 87,897		$ 75,928	$ 5,338,457
4	$ 90,533		$ 74,482	$ 5,412,939
5	$ 93,249	$ 11,593	$ 82,147	$ 5,495,086
6	$ 96,047		$ 71,672	$ 5,566,758
7	$ 98,928		$ 70,307	$ 5,637,064
8	$ 101,896		$ 68,967	$ 5,706,032
9	$ 104,953		$ 67,654	$ 5,773,685
10	$ 108,102	$ 340,011	$ 275,102	$ 6,048,787
11	$ 111,345		$ 65,101	$ 6,113,888
12	$ 114,685		$ 63,861	$ 6,177,749
13	$ 118,126		$ 62,645	$ 6,240,394
14	$ 121,669		$ 61,451	$ 6,301,845
15	$ 125,319	$ 15,580	$ 67,775	$ 6,369,620
16	$ 129,079		$ 59,133	$ 6,428,753
17	$ 132,951		$ 58,006	$ 6,486,759
18	$ 136,940		$ 56,901	$ 6,543,660
19	$ 141,048		$ 55,818	$ 6,599,478
20	$ 145,280	$ 456,946	$ 226,973	$ 6,826,451
21	$ 149,638		$ 53,711	$ 6,880,162
22	$ 154,127		$ 52,688	$ 6,932,850
23	$ 158,751		$ 51,685	$ 6,984,535
24	$ 163,514		$ 50,700	$ 7,035,235
25	$ 168,419	$ 20,938	$ 55,918	$ 7,091,153
26	$ 173,471		$ 48,787	$ 7,139,940
27	$ 178,676		$ 47,858	$ 7,187,798
28	$ 184,036		$ 46,946	$ 7,234,745
29	$ 189,557		$ 46,052	$ 7,280,797
30	$ 195,244	$ 614,097	$ 187,263	$ 7,468,060
31	$ 201,101		$ 44,315	$ 7,512,375
32	$ 207,134		$ 43,470	$ 7,555,845
33	$ 213,348		$ 42,642	$ 7,598,487
34	$ 219,748		$ 41,830	$ 7,640,318
35	$ 226,341	$ 28,139	$ 46,135	$ 7,686,452
36	$ 233,131		$ 40,252	$ 7,726,704
37	$ 240,125		$ 39,485	$ 7,766,189
38	$ 247,329		$ 38,733	$ 7,804,922
39	$ 254,749		$ 37,995	$ 7,842,917
40	$ 262,391	$ 825,296	$ 154,501	$ 7,997,419
41	$ 270,263		$ 36,562	$ 8,033,980
42	$ 278,371		$ 35,865	$ 8,069,845
43	$ 286,722		$ 35,182	$ 8,105,028
44	$ 295,324		$ 34,512	$ 8,139,539
45	$ 304,183	$ 37,816	$ 38,063	$ 8,177,603
46	$ 313,309		$ 33,210	$ 8,210,812
47	$ 322,708		$ 32,577	$ 8,243,390
48	$ 332,389		$ 31,957	$ 8,275,346
49	$ 342,361		$ 31,348	$ 8,306,694
50	$ 352,632		$ 30,751	$ 8,337,445
Total Present Value			**$8,337,445**	

Town of Palisade

Project: 2020 Sewer Feasibility Study - Mechanical Sewer Treatment Plant
Subject: Annual costs of operation

J-U-B ENGINEERS, INC.
THE LANGDON GROUP
GATEWAY MAPPING INC.
OTHER J-U-B COMPANIES

Town of Palisade Maintenance				
Item	**Quantity**	**Units**	**Unit Price**	**Annual Cost**
Maintenance cost - Cleaning of Gravity Line	7,440	LF	$ 0.95	$ 3,534
Building Space Operation (Including Electrical Cost)	----		----	$ 44,100
Labor per year average	4745	hr	$ 50	$ 237,250
Chemical Costs	----		----	$ 23,151
Tipping Fees and Disposal of Sludge	----		----	$ 176,295
Laboratory Testing Costs	----		----	$ 50,000
Total Annual Cost				$ 534,330

Short-Lived Assets - Estimated Repair, Rehab, and Replacement Expenses by Item		
Description	**Estimated Life/ Repair (years)**	**Replacement/ Repair Price ($)**
Pumps	10	Described Assets are Generalized and Lumps Many Types of Equipment Together
Valves	10	
Membranes	10	
Screens	10	
Basin Covers	10	
Other Equipment	20	

Interest	5%
Lifespan (yrs)	50
Present Value (maintenance) without inflation factored in	**$ 9,754,689**
Present Value with inflation factored in (from next sheet)	**$ 37,336,158**

Item	Assumption
Total Annual Costs	$ 534,330
Interest	5%
Lifespan (yrs)	50
Replacement Costs	10 year life:
	Pumps
	Valves
	Membranes
	Screens
	Basin Covers
	20 year life:
	Other Equipment
Construction Cost	$ 18,300,000
Inflation	3%
Present Value	$ 37,336,158

Town of Palisade

Project: 2020 Sewer Feasibility Study - Mechanical Sewer Treatment Plant

Subject: Present Value Analysis

Construction Cost	$ 18,300,000	Interest	5%

Year Inflation Rate	Annual Maintenance 3%	Construction / Equipment Updates 3%	Present Value	Cumulative PV
1	$ 534,330	$ 18,849,000	$ 18,460,314	$ 18,460,314
2	$ 550,360		$ 499,193	$ 18,959,507
3	$ 566,871		$ 489,684	$ 19,449,191
4	$ 583,877		$ 480,357	$ 19,929,548
5	$ 601,393		$ 471,207	$ 20,400,755
6	$ 619,435		$ 462,232	$ 20,862,987
7	$ 638,018		$ 453,427	$ 21,316,415
8	$ 657,159		$ 444,791	$ 21,761,205
9	$ 676,873		$ 436,319	$ 22,197,524
10	$ 697,179	$ 1,102,011	$ 1,104,547	$ 23,302,071
11	$ 718,095		$ 419,855	$ 23,721,926
12	$ 739,638		$ 411,858	$ 24,133,784
13	$ 761,827		$ 404,013	$ 24,537,797
14	$ 784,682		$ 396,318	$ 24,934,115
15	$ 808,222		$ 388,769	$ 25,322,883
16	$ 832,469		$ 381,364	$ 25,704,247
17	$ 857,443		$ 374,099	$ 26,078,346
18	$ 883,166		$ 366,974	$ 26,445,320
19	$ 909,661		$ 359,984	$ 26,805,304
20	$ 936,951	$ 2,754,320	$ 1,391,201	$ 28,196,505
21	$ 965,059		$ 346,401	$ 28,542,906
22	$ 994,011		$ 339,803	$ 28,882,708
23	$ 1,023,832		$ 333,330	$ 29,216,038
24	$ 1,054,546		$ 326,981	$ 29,543,019
25	$ 1,086,183		$ 320,753	$ 29,863,772
26	$ 1,118,768		$ 314,643	$ 30,178,415
27	$ 1,152,331		$ 308,650	$ 30,487,065
28	$ 1,186,901		$ 302,771	$ 30,789,836
29	$ 1,222,508		$ 297,004	$ 31,086,840
30	$ 1,259,184	$ 1,990,355	$ 751,870	$ 31,838,710
31	$ 1,296,959		$ 285,797	$ 32,124,508
32	$ 1,335,868		$ 280,353	$ 32,404,861
33	$ 1,375,944		$ 275,013	$ 32,679,875
34	$ 1,417,222		$ 269,775	$ 32,949,650
35	$ 1,459,739		$ 264,636	$ 33,214,286
36	$ 1,503,531		$ 259,596	$ 33,473,882
37	$ 1,548,637		$ 254,651	$ 33,728,533
38	$ 1,595,096		$ 249,801	$ 33,978,334
39	$ 1,642,949		$ 245,043	$ 34,223,376
40	$ 1,692,238	$ 4,974,608	$ 946,997	$ 35,170,373
41	$ 1,743,005		$ 235,796	$ 35,406,169
42	$ 1,795,295		$ 231,305	$ 35,637,474
43	$ 1,849,154		$ 226,899	$ 35,864,374
44	$ 1,904,628		$ 222,577	$ 36,086,951
45	$ 1,961,767		$ 218,338	$ 36,305,289
46	$ 2,020,620		$ 214,179	$ 36,519,468
47	$ 2,081,239		$ 210,099	$ 36,729,567
48	$ 2,143,676		$ 206,098	$ 36,935,665
49	$ 2,207,986		$ 202,172	$ 37,137,837
50	$ 2,274,226		$ 198,321	$ 37,336,158
Total Present Value			**$ 37,336,158**	