

DRAFT Technical Memorandum



Santa Clara Valley Water District

Indirect Potable Reuse Preliminary Program Assessment

Subject: Conveyance Pipeline Facilities Preliminary Assessment Methodology

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Attachments

Attachment A – Alignment Maps

Attachment B – Sunnyvale Alignment Map

Attachment C – Alternatives Comparison Matrix and Sunnyvale Alignments Table

Attachment D – Conveyance Pipeline Facilities - Preliminary Geotechnical Review

Attachment E – October 13 and 15, 2015 Field Drive Notes

Attachment F – PG&E High Pressure Transmission Main in Lafayette Street – Atlas Maps

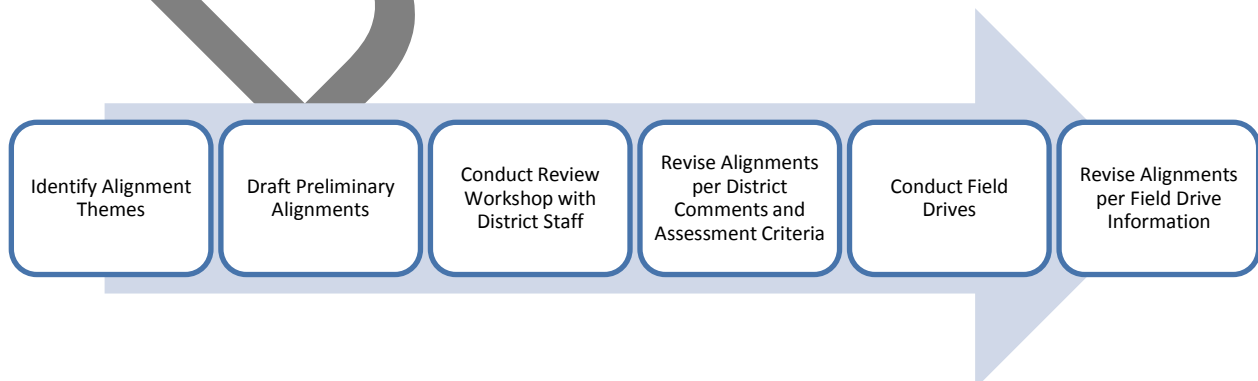
1 Project Overview and Objectives

The Santa Clara Valley Water District (District) is conducting an Indirect Potable Reuse Preliminary Program Assessment (IPR Assessment). The IPR Assessment components include assessing advanced treatment and purified water conveyance systems and associated groundwater replenishment mechanisms to support up to 45,000 acre-feet per year of indirect potable reuse. The IPR Assessment objectives include leveraging the District's existing groundwater replenishment facilities and expanding replenishment capacity to optimize groundwater management and to coincide with regional import water operations. The IPR Assessment includes the following program components:

- residuals management
- advanced treatment components
- conveyance components
- purified water receptors.

This technical memorandum (TM) focuses on the purified water conveyance components including the development and refinement of alternative alignments (see Figure 1-1 for development process), development of an alternative assessment methodology and a preliminary ranking of alternative alignments. The assumed source locations for the conveyance pipeline are the Silicon Valley Advanced Water Purification Center (SVAWPC) and the Sunnyvale Water Pollution Control Plant (Sunnyvale WPCP). The assumed receptor point for the main conveyance pipeline is the Los Gatos Recharge Ponds including McGlincey, Budd, Sunnyoaks, and Page. Additional branches to the planned Injection Well fields were also considered in this assessment.

Figure 1-1: Alignment Development Process



As of November 2, 2015, the precise injection well sites have not been identified. As such, the intersection of Williams Road and Del Cambre Drive was selected as the end point for the western Injection Well field and the intersection of Westfield Avenue and Central Avenue was

selected as the end point for the eastern Injection Well field. The alignment to injection well fields will be revised once locations are identified. Finally, conveyance from the Sunnyvale WPCP was considered for either serving the Injection Well field or to tie in to the purified water pipeline.

The project scope of services does not include hydraulic analysis or calculating the required size of the proposed purified water pipeline. For the purposes of this study, the District provided a pipe diameter of 48-inches for the main pipeline. It is assumed that the Injection Well branch will be a smaller diameter (up to 24 inches). The Sunnyvale branches are assumed to be up to 20 inches in diameter.

The project scope of services also excludes costs estimating and the effort does not include making a final pipeline alignment recommendation. These elements will be completed under the next phase of program work.

On September 23, 2015, the RMC team met with District staff to review preliminary alignments and to identify assessment criteria for the preliminary alignment assessment. The following sections further describe the next generation of the alignments and assessment criteria used in their development.

2 Preliminary Alignment Themes

In order to identify initial preliminary alignments, general alignment themes were developed as guiding selection principles. Using the assessment criteria as outlined in Section 3 below, one alignment was then identified within each theme for additional analysis and consideration. This section describes the five alignment themes and provides a graphic of the alignment identified within each theme.

2.1 Creek

The creek theme was identified during the South Bay Water Recycling (SBWR) strategic and master planning phase as a “fast-track” option to construct above-grade pipes within District right-of-way. The option to construct above-grade pipelines was not the most favorable option when discussed at the September 23rd meeting; however, the District noted that above-grade sections could be considered, if necessary. The main benefit of the creek theme is the reduced easement acquisition required due to construction occurring primarily within District property. The creek alignment as identified within this theme is illustrated in Attachment A-1.

2.2 Zanker Road

This alignment theme was carried forward from the SBWR strategic and master planning phase and includes main corridors throughout San Jose. The alignment follows Zanker Road for a significant distance, which may be difficult to design and construct due to four large diameter San Jose sewer interceptors located in Zanker Road. The alignment also traverses to the east of the Airport as it heads south toward the groundwater recharge area. The Zanker Road alignment is illustrated in Attachment A-2.

2.3 Master Plan

This theme was identified in the SBWR strategic and master planning phase and was initially identified as part of the District Potable Reuse Study. The alignment includes a combination of creek corridors and major roadways. The alignment also traverses to the east of the Airport as it heads south toward the groundwater recharge area. The Master Plan alignment as identified within this theme is illustrated in Attachment A-3.

2.4 Major Streets to West of Airport

The major streets theme uses major arterial streets for construction. Typically, major arterial roads are multi-lane in each direction and may have parking lanes, bike lanes, and/or turn lanes. The extra road width is beneficial for identifying an available pipeline corridor beneath the roadway. One challenge with this theme is that there are very few major streets that run from the Alviso area (north) to the Los Gatos Recharge Ponds (south). As such, it is suspected that other pipeline engineers have previously identified these corridors for their pipes and the corridors may be congested. Utility congestion should be confirmed during the preliminary design phase. One option for an alignment within this theme is identified in Attachment A-4.

This alignment presents an alternative section towards the north that was inserted to demonstrate an alternative to navigating the Highway 237 crossing without using Great America Parkway. All other north-south corridors in this location do not appear to be viable due to the location of the creeks, environmentally sensitive areas, and potential trenchless pit locations for the Highway 237 crossing. See Section 3 below.

2.5 Major and Minor Streets to West of Airport

The major and minor streets theme, as the name implies, uses both major and minor streets for construction. By diverting the alignment off of major roads in the areas that are anticipated to have more traffic congestion, the traffic control associated with the alignment may become more manageable and the roads may be less congested with traffic as well as utilities. As this theme uses minor streets in order to avoid heavily trafficked roadways, several alternatives within this theme were explored, one of which is provided in Attachment A-5. The alignment shown appears to be a reasonable combination of minimizing pipe length and minimizing traffic congestion.

3 Assessment Criteria

The following section describes the assessment criteria. These criteria were used to develop the initial alignments within each of the themes identified in Section 2 (where not already identified through previous studies) as well as screen the five alignments down to the three apparent most feasible alignment alternatives.

3.1 Property Acquisition: SCVWD Right of Way (Creeks)

The main pipeline under consideration will convey purified water from the SVAWPC to the Los Gatos Recharge Ponds. Property acquisition was one of the first considerations in sketching potential alignments that could be completed in an expedited time frame while minimizing traffic and community impact. The District owns and maintains the creek networks in the Santa Clara Valley. As such, the potential to use creek maintenance roads and adjacent land as pipeline corridors became an attractive option. Three creeks (Calabazas, San Tomas Aquino, and Coyote) and one river (Guadalupe) at least partially follow the north-south alignment that is required to traverse from the SVAWPC to the Los Gatos Recharge Ponds. Each of these were investigated for suitability as a pipeline corridor.

Calabazas Creek & San Tomas Aquino Creek:

Calabazas Creek is located between Lawrence Expressway and Great America Parkway. San Tomas Aquino Creek is located between Great America Parkway and Lafayette Street. These creek corridors were not suitable due to narrow levees and maintenance roads. Large diameter pipe (48-inch) would be difficult to install, particularly at street crossings where the available space narrows, often flanked by a retaining wall, to accommodate street bridges.

Coyote Creek:

Coyote Creek is located between Zanker Road and McCarthy Boulevard and has a general northwest-to-southeast alignment. This creek corridor appears to be a potentially suitable alignment between the drying beds at the San Jose/Santa Clara Regional Wastewater Facility (SJ/SC RWF) and Montague Expressway. At that point, the creek corridor narrows, which requires the pipeline to change directions and head west towards the Los Gatos Recharge Ponds. In addition, due to the northwest-to-southeast nature of the creek, the further south into San Jose the creek path is followed, the further east it is forced, forcing it further from the targeted end point at the Los Gatos Recharge Ponds.

Los Gatos Creek:

The Los Gatos Creek flows towards the San Francisco Bay passing directly by the Los Gatos Recharge Ponds. Its confluence with the Guadalupe River is at approximately West Santa Clara Street and Delmas Avenue. This segment of the Los Gatos Creek trail appears to be wide enough to accommodate construction of a large diameter pipeline. However, there is at least one other large diameter pipe that currently exists in this corridor. Further utility investigation will be required during the preliminary design phase to verify the feasibility of this alignment.

Guadalupe River:

The Guadalupe River is located between Wilcox Avenue and North 1st Street. This river corridor was not a suitable alignment due to the narrow levees and maintenance roads. Large diameter pipe would prove difficult to install, particularly at street crossings where the available space narrows, often flanked by a retaining wall, to accommodate street bridges. One section of the Guadalupe River has been improved to include a wider flood plain and recreational trails. This section, between Interstate 880 and West Santa Clara Street, appears to be wide enough to accommodate construction of a large diameter pipe.

It should be noted that construction within levees is not always permissible. This section focuses strictly on the constructability along the creek and river alignments. See Section 3.9 for additional discussion of environmental and permitting constraints.

3.2 Caltrans Right of Way

One of the goals of the preliminary alignment identification process was to minimize the number of Caltrans crossings and to have no longitudinal encroachments in Caltrans right-of-way. Several main Caltrans corridors run throughout the Santa Clara Valley including Interstates 280 and 880 and Highways 17, 82, 87, 101 and 237. The assessment matrix, provided in Attachment C, includes the number of Caltrans crossings for each of the identified preliminary alignments. It is assumed that only perpendicular or nearly-perpendicular trenchless crossings will be allowed at all Caltrans right-of-way crossings. As such, alignments with fewer (4 or less) Caltrans right-of-way crossings were deemed more favorable than those with more than 4 crossings.

3.3 Santa Clara County Right of Way

The County of Santa Clara Roads and Airports Department owns and operates Santa Clara County's expressways, including Central Expressway, Montague Expressway, Lawrence Expressway, San Tomas Expressway, Almaden Expressway, and Capitol Expressway.

Obtaining permits for longitudinal construction within County expressways can be a lengthy process plus any construction on expressway would have significant traffic impacts during construction and future maintenance. Therefore, one goal of the alignment study was to minimize, if not eliminate, alignments that encroach longitudinally along County expressways.

The identified alignments minimize expressway crossings and attempt to avoid expressway on-and-off ramps.

3.4 PG&E High Pressure Gas Mains

Pacific Gas & Electric Company (PG&E) owns and operates high-pressure gas mains throughout California. One alignment study criterion was avoidance of construction parallel and adjacent to PG&E high-pressure gas mains and the minimization of crossings.

The alignment study effort included using PG&E's online Gas Transmission Pipelines map (<http://www.pge.com/en/safety/systemworks/gas/transmissionpipelines/index.page>).

The PG&E gas transmission pipelines were overlaid into Google Earth to determine corridors to avoid. Although this criterion required avoiding alignments parallel to high-pressure gas mains, wider corridors that provide for adequate separation may be feasible options for consideration. One example of these wider corridors is Lafayette Street.

RMC requested drawings from PG&E for the Lafayette Street high-pressure gas mains to determine if they were east of the railroad tracks, leaving the street right-of-way available for the proposed purified water pipeline. PG&E provided plat maps (Attachment F) which show two high-pressure gas mains within the Lafayette Street right-of-way in several locations within the street. As such, the option to use Lafayette Street as a pipeline corridor was eliminated due to conflicts with the gas main.

3.5 Jet Fuel Pipelines

One of the alignment study goals and assessment criterion was to avoid construction (parallel or crossing) in the vicinity of jet fuel pipelines. Jet fuel pipelines can be difficult to relocate and require advanced coordination to complete any relocations. As such, the more conservative approach was used to avoid installation of the new purified water pipeline in the vicinity of any existing jet fuel pipelines.

RMC contacted Kinder Morgan Energy Partners to request information regarding their infrastructure in Santa Clara County. Kinder Morgan provided the requested information, which included an atlas map and record drawings of their pipeline in the northeast corner of Santa Clara County. Kinder Morgan's pipeline did not preclude or impact any pipeline themes or alternatives.

RMC contacted Shell Pipeline Company LP to request information regarding their infrastructure in Santa Clara County. Shell Pipeline Company provided pipeline information indicating that they owned one pipeline in Santa Clara County. The alignment of the fuel pipeline is in the northeast corner of Santa Clara County and does not preclude or impact any pipeline themes or alternative.

3.6 Railroad and Light-Rail Tracks

Several entities own and/or operate railroad or light-rail tracks in Santa Clara County including Union Pacific Railroad, Altamont Corridor Express, Caltrain, Amtrak, and the Santa Clara Valley Transportation Authority (VTA). One of the criterion for alignment selection included avoiding longitudinal encroachment into railroad/light-rail right-of-way and to minimize crossings. Although crossings are somewhat common and can be designed to minimize risk, they require trenchless construction which can drive up construction costs.

3.7 Traffic Control and Public Disruption

Traffic control and temporary construction impacts to commute routes were considered for each of the alignments. Additional consideration was placed separately on residential and commercial disruption.

During alignment corridor field drives on October 13 and 15, 2015, congested traffic areas or areas that appeared to have recently completed construction projects were noted. Following the alignment corridor drives, the alignments were revised to route options that would lessen apparent traffic and commute impacts as well as reduce potential to prolong construction activity in areas that were recently subject to other construction project impacts.

Specific areas of traffic congestion were particularly noted on Winchester Boulevard, approximately between Williams Road and Forest Avenue. This area is a major retail center in San Jose and includes Westfield Valley Fair mall, Santana Row, and the historic Winchester Mystery House. As such, traffic is anticipated to be significantly impacted if the alignment were to be located on Winchester Boulevard, so an alternative route for Alignment 4 was identified to the west.

Another area identified as having recently endured a construction project was Hacienda Avenue in Campbell. On the October 13, 2015 field drive, it was noted that a large project was recently completed and construction crews were working on surface and landscape restoration. As the residents in this area recently experienced construction, it may be impractical to start a new construction project on the same street. As such, an alternative alignment was identified along Westmont Avenue and West Sunnyside Avenue.

Winchester Boulevard and Hacienda Avenue are just two examples of where the preliminary alignments were refined based on the assessment criteria. All alignments were analyzed and refined accordingly.

3.8 Geotechnical Considerations

CDM Smith prepared a Technical Memorandum, entitled "Conveyance Pipeline Facilities - Preliminary Geotechnical Review", provided in Attachment D (Geotechnical TM). The TM presents findings from a desktop geotechnical study of the project area. Several figures in the Geotechnical TM provide visual depictions of the pipeline alignments compare to faults and soil types, and potential areas susceptible liquefaction and high groundwater.

In reviewing the geotechnical maps relative to the preliminary alignments, several items were specifically noted. First, high groundwater will likely be a concern in the area north of Hwy 237. High groundwater can lead to increased construction duration and costs associated with dewatering and possible groundwater treatment requirements. North of Hwy 237, the historical groundwater table depth is <10 feet. Additionally, San Francisco Bay Mud and alluvial fan-estuarine complex deposits are also anticipated north of Hwy 237. As such, the project team reviewed alignment options to decrease construction in the shallow groundwater area and outside of Bay Mud. However, due to the limited options to cross Hwy 237, the most feasible pipeline alignment will likely include construction along Los Esteros Road, Grand Boulevard, and Gold Street until the pipeline can cross Hwy 237 at Great America Parkway.

In addition to consideration of groundwater and soil types, the Geotechnical TM discusses liquefaction potential. Liquefaction susceptibility is considered very high along the creek and river corridors. Aside from the creek alignment, the proximity of the alignments to a very high liquefaction zone was assessed for each alignment.

Finally, proximity to seismic faults was taken into consideration. There are three major faults in the vicinity of the project area: the San Andres, Hayward, and Calaveras faults. However, none

of these faults run through the project area. There are a few inferred faults that run within the project area in a general northwest-to-southeast direction. These faults are estimated to be over 1.6 million years old and appear to be inactive. Each of the alignments crosses the inferred faults at one or more locations.

3.9 Environmental and Permitting Requirements

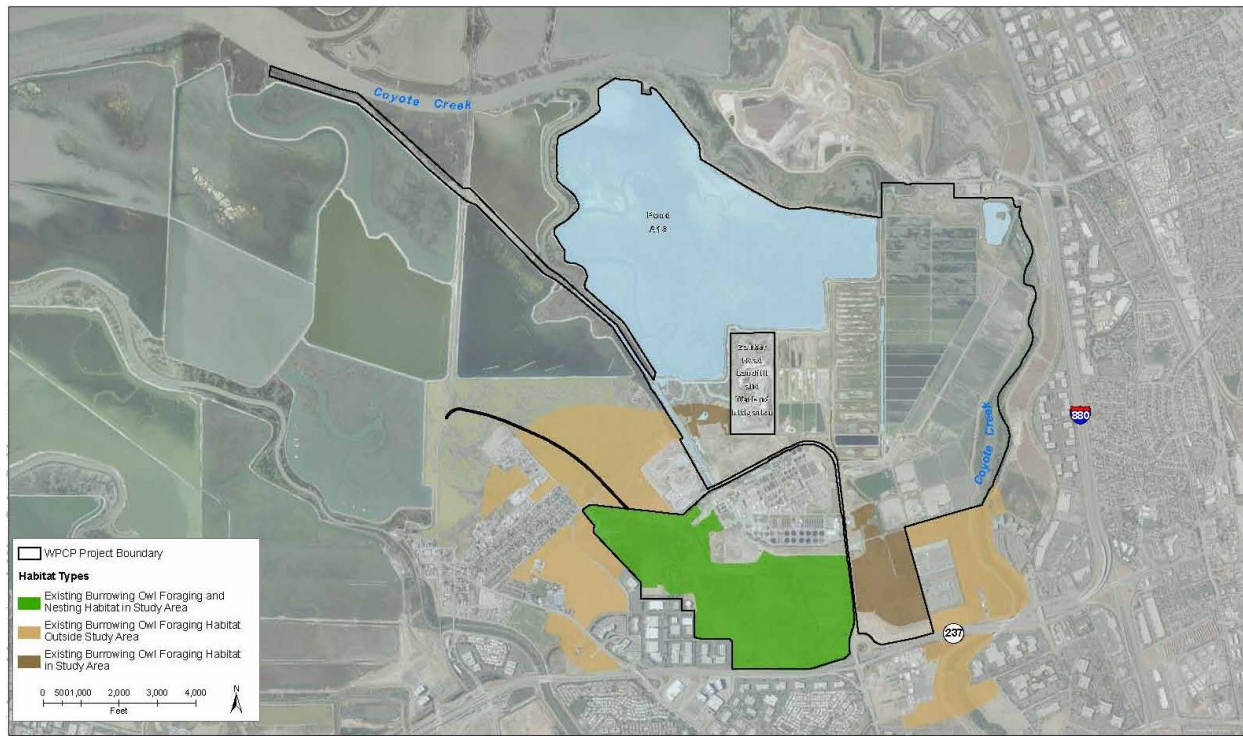
Environmental and permitting requirements can impact project schedule and cost. As such, the assessment criteria includes analysis of how the alignment alternatives may be affected by environmental and permitting requirements. Environmental studies, required by the California Environmental Quality Act (CEQA) and the National Environmental Protection Act (NEPA) analyze project impacts under various categories including water, land, habitat, transportation, etc. Potential environmental impacts and associated mitigation measures identified through the CEQA and NEPA determination process can greatly impact the project's overall design, schedule, and cost.

SJ/SC RWF Buffer Lands:

Although an in-depth environmental analysis was not completed for the alignment study, one notable environmental area in the study region is the SJ/SC RWF buffer lands. This land, which surrounds the SJ/SC RWF on three sides, includes habitat for the burrowing owl (See Figure 3-1). The draft Environmental Impact Report (EIR) for the SJ/SC RWF master plan, completed in January 2013, identified the area as designated burrowing owl habitat, which would prohibit construction from occurring within the habitat area. As such, the alignment options were constrained to exit the SVAWPC via Los Esteros Road or Zanker Road rather than crossing the buffer lands.

If the project is moved forward prior to the SJ/SC RWF defining a more precise habitat area, it is possible that the pipeline could be installed crossing the bufferlands. This would require communication and coordination with the SJ/SC RWF. This TM does not consider a potential pipeline corridor through the buffer lands.

Figure 3-1: Owl Habitat from SJ/SC RWF Master Plan EIR



References:

1. City of San Jose, *San Jose/Santa Clara Water Pollution Control Plant Master Plan Draft Environmental Impact Report*, January 2013.

Creek Right of Way:

The District researched US Army Corps of Engineers (Corps) guidelines for construction in a creek right-of-way. Although the District was unable to obtain a copy of the guidelines, it was noted in an email to RMC that the Corps requires trees to be located 15 feet clear of the outboard toe of levees. The District imposes the same requirement on utilities that longitudinally encroach into creek right-of-way. As such, the available space within the creek right-of-ways is of particular importance. It should be noted that this alignment assessment did not perform a detailed analysis of the dimensions of the creek levees and determine available space. The review of creek alignment relied on google earth and spot site visits to develop an opinion on potential creek alignments constructability. Except for the creek sections discussed in Section 3.1, generally, the creek levees and outboard space do not appear wide enough to accommodate a large diameter pipe.

3.10 Pipeline Length

Each of the five alignments were overlaid onto Google Earth to approximate the path and length of the pipeline. In order to reach each of the three targeted end-points (Los Gatos Recharge Ponds and the Injection Wells), the main pipeline alignments needed to either extend a smaller diameter branch pipeline to the Injection Well target area or pass through them. The total lengths of the five options varied from 14.2 miles to 17.4 miles. Although cost estimates were

not included in the scope of this alignment study, it should be noted that generally the longer an alignment, the more expensive it will be to construct.

If the District is successful in constructing the pipeline through the SJ/SC RWF bufferlands, it is anticipated that up to 3,000 linear feet of large diameter pipe could be removed from the Major Streets and Major and Minor Streets alignments.

3.11 Total Number of Trenchless Crossings

Several of the assessment criteria include avoiding existing infrastructure (e.g., high-pressure gas mains, Caltrans highways, County expressways, etc.). However, due to the developed nature of the Santa Clara valley, a pipeline alignment will cross existing infrastructure. Trenchless technologies are valuable engineering tools in such situations where crossing existing infrastructure is unavoidable.

In many cases, trenchless construction is more costly than traditional open cut construction. However, use of trenchless technologies allows for permissible crossings of existing infrastructure and waterways that may not be allowed with traditional open cut construction. The assessment criteria includes the potential number of trenchless crossings for a particular alignment. Trenchless crossings were assumed for all Caltrans right of ways, County expressways, railroad or light rail, creeks or rivers, and large infrastructure like Hetch Hetchy water transmission pipeline.

3.12 Schedule – Duration of Construction

Project design and construction schedules can be impacted by a number of factors. Schedules depend on the length and type of pipe, type of construction (e.g., open cut, above ground, tunneling), permitting (e.g., Caltrans, Santa Clara County, railroads), environmental requirements, local requirements (e.g., noise restrictions), and other factors.

As the District's goal is to implement the IPR program by 2020, delivery schedule (design and construction schedules) is a key alternative assessment criteria. As part of the assessment, we looked at the anticipated average construction rate (feet per day) and anticipated permit requirements. For the purpose of this memorandum, we assumed a production rate of 50 feet per day. A longer alignment length and higher number of trenchless crossings was considered to negatively impact to both the design and construction schedule.

3.13 Maintenance

Access for future pipeline maintenance was analyzed for each of the alternative alignments. Typically, the alignments were developed to avoid private properties and difficult-to-access locations. Although this alignment assessment did not determine exact locations within identified corridors, it is recommended that appurtenances requiring access and maintenance (e.g., isolation valves, blow-offs, air valves) are located in safe and accessible locations such as road shoulders or edge of sidewalks.

4 Sunnyvale Connection

Although the City of Sunnyvale Water Pollution Control Plant (Sunnyvale WPCP) does not currently produce purified water, the SCVWD in conjunction with Apple Inc. is planning to construct a pipeline from the Sunnyvale WPCP to the new Apple Inc. campus at the intersection of Wolfe Road and Homestead Road. The planned 20-inch pipeline project is anticipated to begin construction in 2016.

The termination point of the new pipeline is within a few miles of the injection well areas. As such, this alignment study also included analysis of five alignments to deliver approximately 10

MGD from the Sunnyvale WPCP to the Injection Well sites or connection to the main pipeline from the SVAWPC to the Los Gatos Recharge Ponds. Efforts in locating a Sunnyvale connection to the main pipeline focused on the extreme north of the major pipeline alignment to avoid using capacity in the planned Wolfe Road pipeline and to the extreme south of the Wolfe Road pipeline in order to use as much of the planned pipeline capacity as possible. See Attachment B for an illustration of the proposed Sunnyvale Connection alignments. An analysis table is included in Attachment C.

5 Assessment Analysis and Preliminary Recommendations

Section 3 above summarized the alignment criteria used to assess the five alternative alignment identified in Section 2. Attachment C is a summary of the score for each alignment for each of the identified criterion. Scoring under each criterion ranged from 1 to 5 with 5 being the most favorable score. Each assessment criteria was also assigned an importance factor to weight each assessment criteria in importance relative to the other criteria. Draft importance factors and scoring were developed by the RMC team as a starting point to support discussions with District staff. Total length and number of trenchless crossings were weighed heavily and criteria such as Future Maintenance and Utility Coordination were considered to be less important.

The resulting weighted criterion scores were summed and compared. The top three highest scoring alignments (from highest score to lowest) are:

1. Alignment 5: Major & Minor Streets
2. Alignment 4: Major Streets
3. Alignment 1: Creeks

It is envisioned that the District will review the importance factors and scores for each assessment criterion to validate the preliminary assessment results. Assignment of different importance factors will likely change the resulting top three alignment alternatives to be carried forward for further evaluation. It is also expected that the preferred alignment will change based upon future preliminary design and environmental work which will further investigate utilities, easement acquisition, environmental impacts, stakeholder input, etc.

6 Next Steps

Following identification of the top three alignments, the project team will setup meetings with the City and County jurisdictions where pipelines would traverse to present alternative alignments and obtain feedback on constraints and preferred corridors. Meeting notes will be prepared and this assessment methodology TM will be updated to reflect input from the Cities and County.

This TM will then support the next phase of work that is beyond this Project scope. Recommended steps beyond the current project scope of services include:

- Alternative alignment hydraulic analysis
- Intermediate and/or injection wells pump station siting and layout, if applicable
- Identification of easement requirements, if any
- Pipeline materials evaluation and design criteria development
- Estimates of alternative costs
- Additional utility research

- Environmental constraints analysis for any creek alignment or pipelines in RWF bufferland
- Review of permitting requirements
- Additional stakeholder collaboration with jurisdictional agencies for street alignments

These additional tasks will support next phase of project development before finalizing the selection of a preferred alternative.

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