



City of Tigard

Tigard Workshop Meeting – Agenda

TIGARD CITY COUNCIL

MEETING DATE AND TIME: May 20, 2014 - 6:30 p.m.

MEETING LOCATION: City of Tigard - Town Hall - 13125 SW Hall Blvd., Tigard, OR 97223

PUBLIC NOTICE:

Times noted are estimated.

Assistive Listening Devices are available for persons with impaired hearing and should be scheduled for Council meetings by noon on the Monday prior to the Council meeting. Please call 503-639-4171, ext. 2410 (voice) or 503-684-2772 (TDD - Telecommunications Devices for the Deaf).

Upon request, the City will also endeavor to arrange for the following services:

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- Qualified bilingual interpreters.

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<http://live.tigard-or.gov>

Workshop meetings are cablecast on Tualatin Valley Community TV as follows:

Replay Schedule for Tigard City Council Workshop Meetings - Channel 28

- Every Sunday at 12 a.m.
- Every Monday at 1 p.m.
- Every Thursday at 12 p.m.
- Every Friday at 10:30 a.m.

SEE ATTACHED AGENDA



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MEETING LOCATION: City of Tigard - Town Hall - 13125 SW Hall Blvd., Tigard, OR 97223

6:30 PM

- **EXECUTIVE SESSION:** The Tigard City Council may go into Executive Session. If an Executive Session is called to order, the appropriate ORS citation will be announced identifying the applicable statute. All discussions are confidential and those present may disclose nothing from the Session. Representatives of the news media are allowed to attend Executive Sessions, as provided by ORS 192.660(4), but must not disclose any information discussed. No Executive Session may be held for the purpose of taking any final action or making any final decision. Executive Sessions are closed to the public.

1. WORKSHOP MEETING

1. Call to Order- City Council
2. Roll Call
3. Pledge of Allegiance
4. Council Communications & Liaison Reports
5. Call to Council and Staff for Non-Agenda Items

2. RIVER TERRACE FINANCE STRATEGIES UPDATE - 6:35 p.m. - estimated time

3. COUNCIL LIAISON REPORTS

4. NON AGENDA ITEMS

5. **EXECUTIVE SESSION:** The Tigard City Council may go into Executive Session. If an Executive Session is called to order, the appropriate ORS citation will be announced identifying the applicable statute. All discussions are confidential and those present may disclose nothing from the Session. Representatives of the news media are allowed to attend Executive Sessions, as provided by ORS 192.660(4), but must not disclose any information discussed. No Executive Session may be held for the purpose of taking any final action or making any final decision. Executive Sessions are closed to the public.

6. ADJOURNMENT - 7:35 p.m. - estimated time

AIS-1664

2.

Workshop Meeting

Meeting Date: 05/20/2014

Length (in minutes): 60 Minutes

Agenda Title: River Terrace Finance Strategies Update

Prepared For: Toby LaFrance, Financial and Information Services

Submitted By: Toby LaFrance, Financial and Information Services

Item Type: Update, Discussion, Direct Staff **Meeting Type:** Council Workshop Mtg.

Public Hearing: No

Publication Date:

Information

ISSUE

Update Council on the progress of the River Terrace Master Plans and Finance Plan for Water and Sewer.

STAFF RECOMMENDATION / ACTION REQUEST

Staff will present the draft master plan addenda for the sewer and water systems in River Terrace and the related financing strategies. Staff is seeking input from Council.

KEY FACTS AND INFORMATION SUMMARY

The purpose of this briefing is two-fold: (1) brief Council on the water and sewer master plan addenda for River Terrace, and (2) review the city's water and sewer funds both with and without River Terrace, identify funding gaps, and discuss possible financing strategies for each infrastructure system. Assuming this approach works for Council, staff will present similar information at a briefing in June on River Terrace parks and transportation, followed by a third briefing in July on River Terrace stormwater. If there are no outstanding issues or questions at the end of each briefing, staff will ask Council to adopt each of the master plan addenda by Resolution a few weeks after the briefing on that addendum.

The one exception to this will be the River Terrace Transportation System Plan (TSP) Addendum. This addendum requires a Comprehensive Plan Amendment and, as such, needs to be adopted through a legislative process. Since the River Terrace Community Plan (RTCP) also requires adoption by legislative process, staff recommends holding adoption hearings on the RTCP and the River Terrace TSP Addendum at the same time later this year. Please note: each master plan addendum includes a project list and planning level project costs, but does not include a specific finance strategy. The comprehensive River Terrace finance strategy will be developed and included as part of the RTCP.

I. Water and Sewer Master Plan Addenda

In 2010, the City of Tigard updated its Water System Master Plan (WSMP) and Sanitary Sewer Master Plan (SSMP). The WSMP addresses water supply capacity needs and guides water system infrastructure improvements in the Tigard Water Service Area. The SSMP evaluates wastewater flows based on land uses, establishes gravity sewer pipe sizes, and serves as a guide for all capital sewer projects within the city. The 2010 SSMP update was developed in concert with Clean Water Services (CWS), the agency responsible for all pump stations, wastewater treatment, force mains, and large gravity sewer pipes (24-inch diameter and greater).

Since the adoption of the WSMP and SSMP updates in 2010, the West Bull Mountain Concept Plan (WBMCP) was completed and adopted by Washington County and the city. The area now known as River Terrace (and formerly known as West Bull Mountain) was also annexed to the city. The attached master plan addenda update the WSMP and SSMP respectively to accommodate the water and sewer needs anticipated in River Terrace and contribute to the city's broader goal of completing the River Terrace Community Plan.

The 2010 WSMP update addressed River Terrace's overall water supply capacity needs, but did not address how water service would be delivered to this area. The attached water master plan addendum addresses this issue. A summary of capital improvement project recommendations and costs can be found on Pages 8 and 9 of this addendum. The recommended improvements are also illustrated on Figure 7, which can be found on the very last page of the addendum. Two of the three pressure zones in the River Terrace area can be easily and effectively served by the extension of existing distribution and transmission lines. In order to serve the remaining pressure zone (River Terrace Zone 550), the city will need to provide more water storage in addition to new transmission lines. The recommendation is to construct a three million gallon storage reservoir on the city-owned Cach property, which was purchased for this purpose to meet existing storage deficiencies in this area.

The 2010 SSMP update did not include River Terrace sewer needs in its analysis. The attached sewer master plan addendum resolves this issue. A summary of capital improvement project recommendations and costs can be found on Pages 16 - 18 of this addendum. The recommended improvements are also illustrated on Figure 9, which can be found on the very last page of the addendum. Due to topography, the River Terrace area was split into two sewer service sub-basins identified as River Terrace North and River Terrace South. A small area within each sub-basin will be able to gravity flow to existing trunk lines. However, the majority of the area will need to utilize pump stations and force mains to gain access to existing trunk lines. Recommendations for the River Terrace North sub-basin include a 9.3 mgd (million gallons per day) pump station in the northwest corner, 7 mgd of which will serve South Cooper Mountain. Recommendations for the River Terrace South sub-basin include revising the service area for the existing South Bull Mountain Pump Station to serve the southeastern portion of River Terrace as well as the construction of a 2.5 mgd pump station in the southwest corner.

II. Water and Sewer Funds and Financing Strategies

During the January Workshop, staff provided Council with background on the workplan and

community outreach process for the financing strategies portion of the River Terrace Community Plan. During that workshop, Council provided direction to work on financial strategies for all infrastructure projects in River Terrace with a focus on financing infrastructure needed for development in the first five years.

In this workshop, staff will present progress on the financing strategies by focusing on two infrastructure systems: Sewer and Water. The attached Water and Sewer Financing Strategies outline the base scenario for each system without River Terrace and then follows by illustrating how River Terrace impacts the system and outlines preliminary financing strategies for the impacts.

OTHER ALTERNATIVES

Council can choose not to provide direction on the master plan addenda or the financing strategies.

COUNCIL GOALS, POLICIES, APPROVED MASTER PLANS

River Terrace
Park land acquisition (strategy, funding, land dedication)
Complete Community Plan, zoning, adopted master plans
Growth/Annexation
Successfully complete River Terrace Community Plan

DATES OF PREVIOUS COUNCIL CONSIDERATION

The financing strategies team met with Council on January 21, 2014.
Council approved the contract for the River Terrace Community Plan (which includes the financing strategy) on June 25, 2013.

Attachments

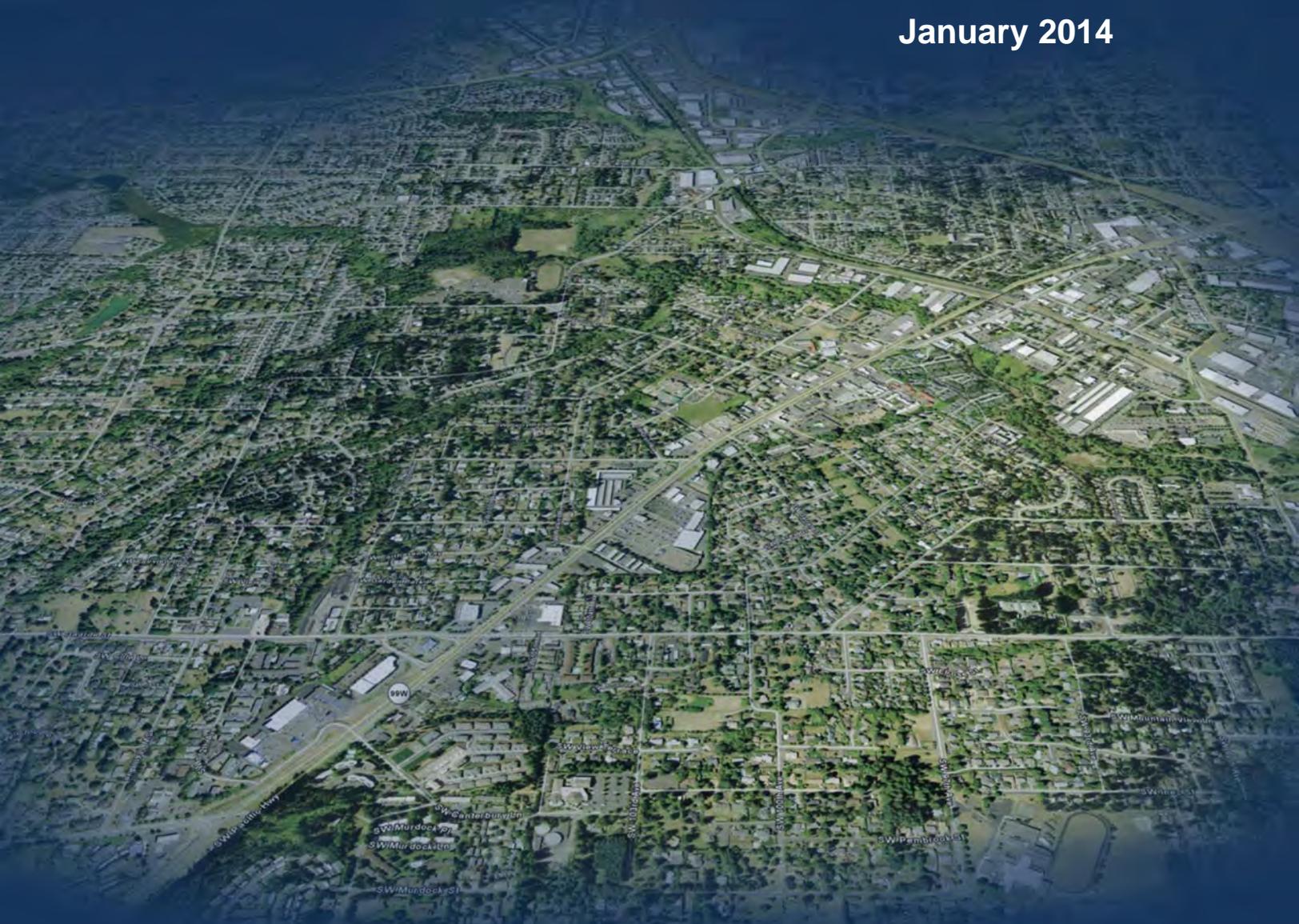
[Water System Master Plan Addendum](#)
[Sewer System Master Plan Addendum](#)
[Water and Sewer Financing Summaries](#)

Item 2 - Attach 1



Water System Master Plan Addendum

January 2014



ACKNOWLEDGEMENTS

We would like to thank the many citizens, staff, and community groups who provided extensive input into the development of this Water Plan Addendum. Special thanks are due to the members of the River Terrace Technical Advisory Committee and Stakeholder Working Group.

CITY STAFF

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Prepared by Murray, Smith & Associates, Inc.
January 2014

Brian M. Ginter, P.E.
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SUMMARY OF RECOMMENDATIONS

The focus of this Water System Master Plan Addendum is on providing water service to the River Terrace Community, which is a new area that the City of Tigard's 2010 Water System Master Plan addressed only for overall water supply capacity needs. The proposed changes do not affect the 2010 Water System Master Plan except for minor modification of the forecasted system-wide water demands.

The River Terrace Community is divided into the three pressure zones extending across the area, for the purposes of analysis, identified as the 410 Zone, 713 Zone and 550 Zone. Recommendations for the 410 Zone include construction of a transmission loop extending north to south across the River Terrace area, connecting to existing transmission piping at SW Barrows Road and at SW Beef Bend Road. Recommendations for the 550 Zone include new transmission, storage and pumping facilities. An analysis of water service recommendations and alternatives is provided in the following pages.

II. BASIS OF PLANNING AND WATER DEMAND PROJECTIONS

This Water Plan Addendum follows the City of Tigard’s 2010 Water System Master Plan and assumes 2.48 persons per dwelling unit. The City of Tigard projects 2,587 dwelling units within River Terrace for an estimated build-out population of 6,416 in 2035.

River Terrace Water Demands

Projected water demands in million gallons per day (mgd) for the River Terrace Community are calculated for this addendum by multiplying projected River Terrace population at build-out by estimated per capita demands. Water facilities recommended to serve River Terrace are sized to meet ultimate capacity needs at build-out as discussed later in this addendum. Per capita water demands are as follows, consistent with the 2010 Water System Master Plan:

- Average Day Demand (ADD) = 110 gallons per capita per day (gpcd)
- Peak Day Demand (PDD) = 231 gpcd

The River Terrace water demand at build-out is allocated to the city’s 410, 713 and 550 pressure zones according to the percentage of River Terrace land at elevations similar to those of existing Tigard water customers in these pressure zones. Proposed pressure zone boundaries within the River Terrace Community are illustrated on Figure 4. The distribution of River Terrace water demands by zone is as follows:

- 410 Zone = 50 percent
- 713 Zone = 10 percent
- 550 Zone = 40 percent

Forecasted River Terrace water demands at build-out are summarized in Table 1.

Table 1
River Terrace Projected Water Demand at Build-Out

Pressure Zone	ADD (mgd)	PDD (mgd)
410	0.35	0.74
713	0.07	0.15
550	0.28	0.59
TOTAL	0.70	1.48

III. SYSTEM ANALYSIS AND RIVER TERRACE WATER SYSTEM CAPACITY

In order to provide water service to the River Terrace Community, the city must evaluate necessary supply and storage capacity as well as transmission piping.

Water Supply Capacity

The city is currently developing a large, long-term supply source through the Lake Oswego-Tigard Water Partnership. The forecasted River Terrace build-out peak demand comprises an insignificant fraction of this supply source capacity. No additional supply facilities are anticipated to serve River Terrace.

Storage Capacity

The city's 2010 Water System Master Plan defined criteria for assessing adequate storage capacity in each of Tigard's pressure zones. Required storage capacity is divided into three major components – operational storage, fire flow storage and emergency storage – which are defined as follows:

- Operational Storage – 25 percent of PDD
- Fire Flow Storage – land use with highest fire flow requirement within the zone
 - Residential
 - Low Density = 1,500 gallons per minute (gpm) for 2 hours
 - Medium Density = 2,500 gpm for 2 hours
 - High Density = 3,000 gpm for 3 hours
 - Commercial and Industrial
 - 3,000 gpm for 3 hours
- Emergency Storage – 2 times ADD

Based on these criteria, adequate storage is available in the 410 and 713 pressure zones to serve the relatively small additional demands from River Terrace. Storage capacity assessment in the 550 Zone depends upon the selected River Terrace 550 water service alternative as discussed later in this memo.

River Terrace Proposed Water System Facilities

410 Zone

The Tigard 410 Zone serves a majority of existing Tigard customers. Large diameter transmission piping has been extended west with development of the Bull Mountain area in anticipation of the ultimate extension of the 410 Zone to serve the River Terrace area. It is recommended that existing 18-inch diameter piping on SW Roy Rogers Road at SW Scholls Ferry Road to the north and on SW Beef Bend Road near SW 150th Avenue to the south be extended as new 20-inch diameter pipe west into River Terrace. The existing 18-inch

diameter piping to the north was recently installed in SW Scholls Ferry Road to serve the River Terrace area.

Given the likelihood that the earliest development in the 410 Zone may not all occur near the north or south connections to existing 410 Zone transmission, provisions should be made for extending service into the 410 Zone areas in advance of major transmission piping in SW Roy Rogers Road. It is recommended that a new pressure reducing valve (PRV) station be constructed near the intersection of SW Bull Mountain Road and SW Roy Rogers Road to allow for interim service and for future supply redundancy to this area.

Conceptual level cost estimates for the recently installed 18-inch diameter transmission piping, the proposed 20-inch diameter transmission piping, and the proposed PRV station are presented later in this addendum. Cost estimates are based on an assumed transmission main alignment which generally follows SW Roy Rogers Road from existing transmission piping south to the proposed River Terrace rights-of-way shown on Figure 4. These proposed River Terrace rights-of-way will carry transmission piping west to SW 150th Avenue at SW Woodhue Street and south on SW 150th Avenue to existing transmission piping on SW Beef Bend Road.

713 Zone

A small area of the River Terrace Community northwest of SW 150th Avenue and SW Woodhue Street will be served by the Tigard 713 Zone as shown on Figure 4. It is recommended that this area be served by extending distribution mains from existing 8-inch and 12-inch diameter piping on SW 150th Avenue. No additional transmission piping or other facilities are anticipated to serve this area.

550 Zone Service Alternatives

The existing Tigard 550 pressure zone is divided into sub-zones 550A through 550H which form a partial ring at the base of Bull Mountain. Establishment of these sub-zones in the Tigard water system allowed customers at this elevation to be served as development occurred without constructing looped transmission piping all the way around Bull Mountain at this elevation. Large diameter transmission piping has been extended through each of these sub-zones to facilitate completion of a transmission loop around Bull Mountain with the development of the River Terrace Community. Due to incomplete transmission piping in some parts of the 550 sub-zones, completing this transmission loop may not be the most effective way to serve customers in River Terrace. Two facility alternatives were developed to provide service to the River Terrace portion of the 550 Zone. These alternatives are illustrated on Figures 5 and 6.

- **Alternative 1** – construct two missing 550 transmission connections near King City and complete transmission loop through River Terrace

- **Alternative 2** – construct 550 pump station and reservoir to deliver water from existing 410 Zone Menlor Reservoir and connect River Terrace transmission piping to existing 550 Zone transmission

For both Alternatives 1 and 2, approximately 8,000 lineal feet (LF) of 16-inch diameter mains would provide north-south transmission through the River Terrace 550 Zone. The alignment of this transmission piping would follow proposed rights-of-way through River Terrace with connections to existing 550 Zone piping at three locations: SW Venezia Terrace, SW Bull Mountain Road and SW 161st Avenue. This proposed 550 transmission piping is illustrated on Figure 6.

Alternative 1 would require additional transmission piping within River Terrace and between existing sub-zones 550A, 550G and 550H. Within River Terrace, transmission piping described in the previous paragraph would be extended approximately 4,000 LF south and west from SW 161st Avenue to connect to existing 12-inch piping at SW 150th Avenue and SW Woodhue Street. In order to complete 550 Zone transmission around the west side of Bull Mountain, sub-zone 550A must be connected with 550H east of SW Colyer Way and sub-zone 550H must be connected with 550G east of SW Peachtree Drive near King City. Both of these connections require potentially complex crossings of Clean Water Services (CWS) designated stream corridors outside of existing public right-of-way. In addition to construction feasibility issues, significant land acquisition would likely be required to facilitate construction of stream crossings.

Alternative 2 uses proposed River Terrace 550 Zone transmission piping to connect existing sub-zones 550A, 550B and 550C. The expanded West Bull Mountain 550 Zone would be supplied by a proposed reservoir on the city-owned Cach properties. A new pump station adjacent to the city's 410 Zone Menlor Reservoir would supply the proposed Cach Reservoir. Until the proposed pump station is completed, the reservoir could be filled by an existing temporary pump station at the Menlor site which was constructed for the city's Pump Station 10 expansion project. Alternative 2 would also require installation of transmission piping from the proposed Cach Reservoir site to connect to existing 550B piping on SW 158th Terrace at SW Baker Lane. Proposed transmission piping from 550B to the proposed reservoir site would require crossing a CWS designated stream corridor in the city-owned Cach Park Natural Area. Unlike Alternative 1, no property acquisition is anticipated to facilitate construction of this stream crossing.

Recommendation: Alternative 2

It is recommended that the River Terrace Community 550 Zone be served from a new reservoir and pump station as described in Alternative 2. Alternative 2 would provide adequate fire and emergency storage within the 550 Zone rather than relying on pressure reducing valves to provide supply from the 713 Zone reservoirs which have inadequate existing capacity to serve forecasted 550 Zone demands as presented in the 2010 Water Plan.

Proposed 550 Zone Cach Reservoir Storage Capacity

The proposed Cach Reservoir, required for recommended 550 Zone service Alternative 2, must be sized to provide adequate storage capacity for sub-zones 550A, 550B, 550C and the River Terrace 550 Zone area. Projected demands for sub-zones 550A through C in 2030 are taken from the 2010 Tigard Water System Master Plan. River Terrace 550 build-out demands are presented in Table 1 of this addendum.

Storage capacity criteria are consistent with the 2010 Water Plan as described earlier in this addendum. Required fire flow capacity is 3,000 gpm for 3 hours based on the proposed school in the River Terrace 550 Zone. It is recommended that the Cach Reservoir have an approximate capacity of 3.0 million gallons (MG) as summarized in Table 2.

**Table 2
Proposed 550 Zone Cach Reservoir Capacity**

West Bull Mt 550 Zone	ADD (mgd)	PDD (mgd)	Required Storage (MG)			
			Operational	Fire	Emergency	TOTAL
550A	0.09	0.19	0.05		0.18	
550B	0.34	0.71	0.18		0.68	
550C	0.24	0.50	0.13		0.48	
River Terrace	0.28	0.59	0.15		0.56	
TOTAL	0.95	1.99	0.51	0.54	1.9	2.95

Notes:

1. Sub-zone 550A and 550C demands are taken from the 2010 Water System Master Plan demand tables for the year 2030.
2. Sub-zone 550B 2030 demands have been re-calculated for this Addendum to exclude land which is now part of the River Terrace Community.
3. Operational storage is estimated as 25 percent of PDD.
4. Fire storage is based on a required fire flow of 3,000 gpm for 3 hours due to the proposed school in the River Terrace 550 Zone.
5. Emergency storage is estimated as 2 times ADD.

Proposed 550 Zone Pump Station Capacity

The proposed 550 Zone pump station at the Menlor Reservoir site should have adequate firm capacity to supply PDD for the proposed West Bull Mountain 550 Zone. Firm capacity is defined as the total pump station capacity with the largest pump out of service. This criterion for pump station sizing is consistent with the city's 2010 Water System Master Plan. As shown in Table 2, total PDD for the West Bull Mountain 550 Zone, a combination of 550A, B, C and River Terrace sub-zones, is 1.99 mgd or 1,382 gpm. It is recommended that the proposed 550 pump station on the Menlor site have an approximate firm capacity of 1,400 gpm.

The existing temporary pump station at the Menlor Reservoir site has a single pump with a 1,500 gpm design capacity. The temporary pump station is equipped with a variable frequency drive (VFD). Although this pump station is capable of supplying adequate flow to

the proposed Cach Reservoir it lacks the redundancy provided by multiple pumps, thus a permanent pump station is required to replace the existing station.

Future Service to Urban Reserve Areas

Water service to the Urban Reserve Area (URA), URA6C (North), URA 6C (Middle) and URA 6C (South) assumes that the recommended 410-foot pressure transmission piping for the River Terrace area is constructed. All three URA areas are at an elevation that can be served directly from the 410-foot pressure zone. Existing storage facilities and proposed transmission piping for the River Terrace area are adequate to extend the water distribution piping grid to these areas for water service. It is anticipated that looped 8-inch to 12-inch diameter piping will be adequate for residential development in these areas. Larger transmission piping may be required if high density residential, commercial or industrial development is planned in these areas.

IV. CAPITAL IMPROVEMENT PLAN

Summary of Recommendations and Conceptual Level Costs

It is recommended that water service be provided to the River Terrace Community by extending transmission and distribution mains from the City of Tigard's existing 410, 713 and 550 pressure zones. The 713 Zone includes only a small area of the River Terrace area that can be effectively served by extending existing distribution mains with no additional transmission required. Proposed piping would be placed in public rights-of-way to be dedicated as part of the River Terrace development. Proposed public rights-of-way are illustrated on Figure 4.

Adequate storage is available in the 410 and 713 Zones to serve proposed customers in River Terrace. It is recommended that a 3.0 MG storage reservoir be constructed to serve the River Terrace 550 Zone as part of a larger West Bull Mountain 550 Zone which would include the existing 550A, 550B and 550C sub-zones. This proposed 550 Zone reservoir would be constructed on the city-owned Cach properties. The reservoir would be filled through a new pump station with a firm capacity of 1,400 gpm located at the 410 Zone's Menlor Reservoir site. Until the proposed pump station is completed, the proposed Cach Reservoir may be filled from an existing temporary pump station on the Menlor site with a design capacity of 1,500 gpm. Service from the proposed Cach Reservoir would also require installation of transmission piping from the reservoir site to existing 550B piping on SW 158th Terrace at SW Baker Lane.

Conceptual level costs for proposed water facilities to serve the River Terrace Community are presented in Table 3. Cost estimates represent opinions of cost only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for construction, regulatory factors, final project scope, project schedule and other factors. The American Association of Cost Engineers (AACE) classifies cost estimates depending on project definition, end usage and other factors. The cost estimates presented here are considered Class 4 with an end use being a study or feasibility evaluation

and an expected accuracy range of -30 percent to +50 percent. This range represents the potential variability of project costs and should not be applied directly to the estimates presented in Table 3. Estimated costs include approximate construction costs and an allowance for administrative, engineering and other project related costs. Unit costs for transmission piping are based on unit costs presented in the 2010 Tigard Water System Master Plan.

Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News-Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. For purposes of future cost estimate updating, the current ENR CCI for Seattle, Washington is 10135 (November 2013).

**Table 3
River Terrace Proposed Water Facilities Conceptual Cost Estimates**

Proposed Facility	Qty	Unit	Unit Cost	Total Conceptual Cost
410 Zone:				
18-inch Transmission Main	2,500	LF	-	\$1,398,500 ⁽¹⁾
20-inch Transmission Mains	15,200	LF	\$400	\$6,080,000
550 Zone to 410 Zone PRV	1	LS	\$200,000	\$200,000
713 Zone:				
None	-	-	-	-
550 Zone (Alternative 2):				
16-inch Transmission Mains through River Terrace	8,000	LF	\$350	\$2,800,000
3.0 MG Cach Reservoir	1	LS	\$5,400,000	\$5,400,000
16-inch Transmission from Reservoir to 550B	1,700	LF	\$350	\$595,000
1,400 gpm (firm capacity) Pump Station	1	LS	\$1,100,000	\$1,100,000

Note:

1. This cost is the City of Tigard's budgeted amount for the installation of this pipe.

CITY OF BEAVERTON

URBAN RESERVE 6C (NORTH)

AREA 64 (2002)

RURAL RESERVE 5C

URBAN RESERVE 6C (MIDDLE)

AREA 4 (2011)

UNDESIGNATED

AREA 63 (2002)

URBAN RESERVE 6C (SOUTH)

URBAN RESERVE 6D

LEGEND

- RIVER TERRACE COMMUNITY STUDY AREA
- TIGARD CITY LIMITS
- 10' CONTOURS

SW VANDERMOST RD

SW SCHOLLS FERRY RD

SW 15TH AVE

SW BARROWS RD

SW ROSHAK RD

SW 150TH AVE

SW BULL MOUNTAIN RD

SW BULL MOUNTAIN RD

SW WOODHUE ST

SW BEEF BEND RD

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SCALE IN FEET

SOURCE:
CONTOURS - CLEAN WATER SERVICES.
AERIAL PHOTO - ESRI ARCGIS ONLINE (JULY 2010).
WATER SYSTEM - CITY OF TIGARD (DEC 2010).
ALL OTHER BASEMAPPING METRO/LRIS (NOV 2013).

FIGURE 2

TIGARD
CITY OF TIGARD
RIVER TERRACE COMMUNITY PLAN
STUDY AREA

January 2014

MSA Murray, Smith & Associates, Inc.
Engineers/Planners
121 S.W. Salmon, Suite 200 PHONE 503.235.9000
Portland, Oregon 97204-2919 FAX 503.235.9022

13-1484

CITY OF BEAVERTON

URBAN RESERVE 6C (NORTH)

RURAL RESERVE 5C

URBAN RESERVE 6C (MIDDLE)

UNDESIGNATED

URBAN RESERVE 6C (SOUTH)

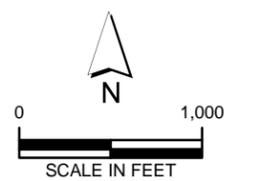
URBAN RESERVE 6D

LEGEND

- RIVER TERRACE COMMUNITY STUDY AREA
- URBAN RESERVE AREA
- TIGARD CITY LIMITS
- 10' CONTOURS

ZONING:

- COMMUNITY COMMERCIAL (CC)
- LOW DENSITY RESIDENTIAL (R-4.5)
- MEDIUM DENSITY RESIDENTIAL (R-7)
- MEDIUM-HIGH DENSITY RESIDENTIAL (R-12)
- HIGH DENSITY RESIDENTIAL (R-25)



SOURCE:
 CONTOURS - CLEAN WATER SERVICES.
 AERIAL PHOTO - ESRI ARCGIS ONLINE (JULY 2010).
 WATER SYSTEM - CITY OF TIGARD (DEC 2010).
 ALL OTHER BASEMAPPING METRO/LRIS (NOV 2013).

FIGURE 3

CITY OF TIGARD
 RIVER TERRACE COMMUNITY PLAN
 RIVER TERRACE ZONE DESIGNATIONS

January 2014

Murray, Smith & Associates, Inc.
 Engineers/Planners

121 S.W. Salmon, Suite 200 PHONE 503.235.9000
 Portland, Oregon 97204-2919 FAX 503.235.9022

13-1484

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CITY OF BEAVERTON

SW SCHOLLS FERRY RD

SW 15TH ST

SW BARROWS RD

RESERVOIR NO.3A
CAP: 2.5 MG
OE: 412'

RESERVOIR NO.3B
CAP: 0.8 MG
OE: 412'

SW 132ND ST
PUMP STATION
(NO 12)

MENLOR
CAP: 3.5 MG
OE: 410'

OLD HIGH TOR
CAP: 0.2 MG
OE: 713'

HIGH TOR B
CAP: 1 MG
OE: 713'

HIGH TOR
PUMP STATION #1
(NO 8)

HIGH TOR A
CAP: 1.1 MG
OE: 713'

URBAN RESERVE 6C
(NORTH)

RURAL
RESERVE 5C

URBAN RESERVE 6C
(MIDDLE)

SW BULL MOUNTAIN RD

SW ROSHAK RD

HIGH TOR
PUMP STATION #1
(NO 8)

560-FT NO 2
(PRICE)
CAP: 3 MG
OE: 560'

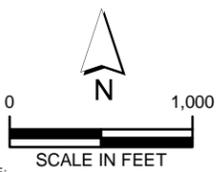
UNDESIGNATED

URBAN RESERVE 6C
(SOUTH)

URBAN RESERVE 6D

SW BEEF BEND RD

SW WOODHUE ST



SOURCE:
CONTOURS - CLEAN WATER SERVICES.
AERIAL PHOTO - ESRI ARCGIS ONLINE (JULY 2010).
WATER SYSTEM - CITY OF TIGARD (DEC 2010).
ALL OTHER BASEMAPPING METRO/LRIS (NOV 2013).

LEGEND

- RIVER TERRACE COMMUNITY STUDY AREA
- PROPOSED RIGHT-OF-WAY
- URBAN RESERVE AREAS
- TIGARD CITY LIMITS
- 12" EXISTING WATER MAIN
- 10' CONTOURS
- PRESSURE ZONES (HGL):**
 - 410
 - 530
 - 550
 - 713
 - 830



FIGURE 4

CITY OF TIGARD
RIVER TERRACE COMMUNITY PLAN
PRESSURE ZONE BOUNDARIES

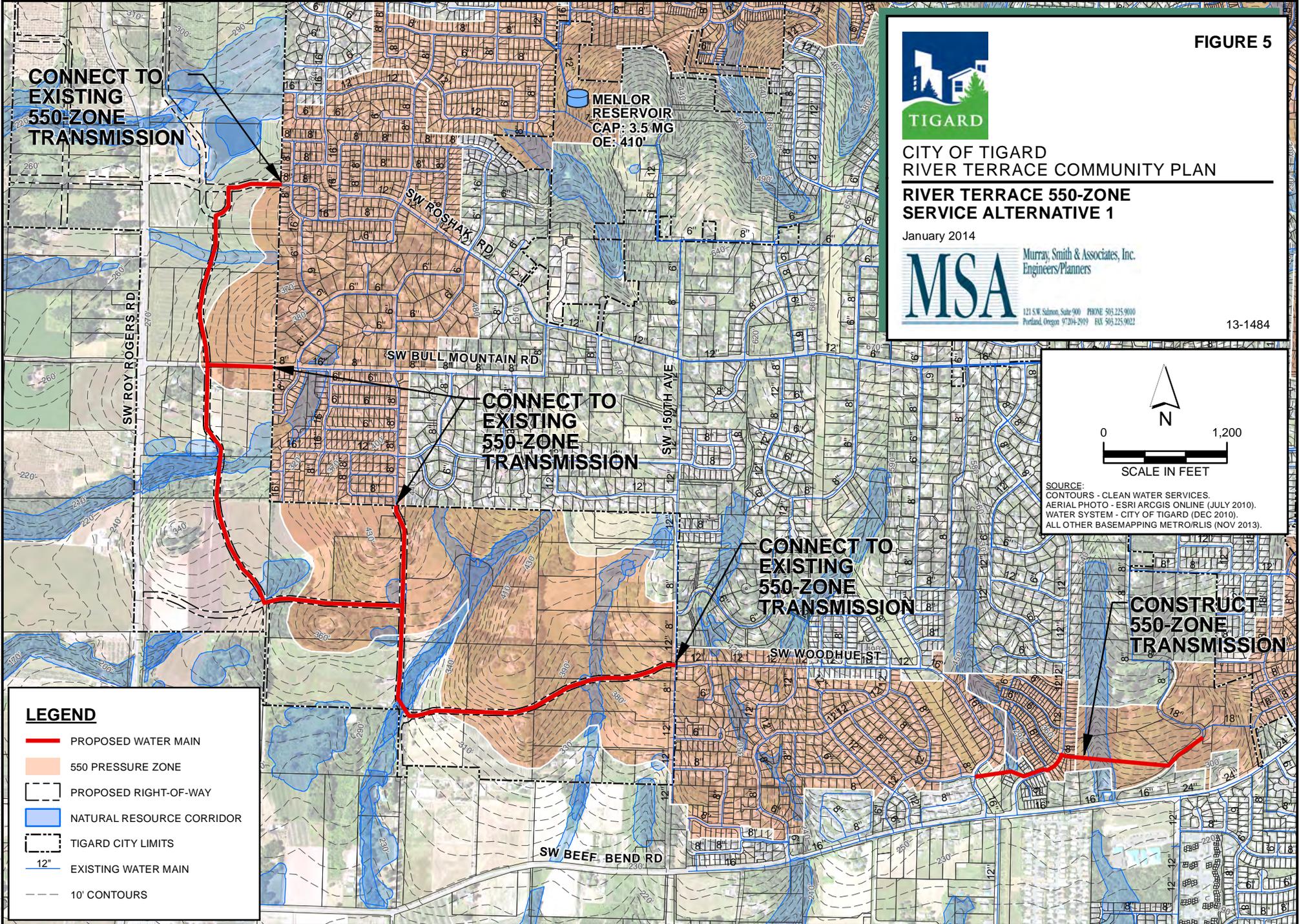
January 2014



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C:\PDX_Proj\cadd\131484 - Tigard River Terrace\GIS\CITY OF TIGARD FIGURES\WATER FIGURES\131484-OR-FIGURE 4 - PRESSURE ZONE BOUNDARIES.mxd 4/18/2014 4:14:35 PM DKH



CONNECT TO EXISTING 550-ZONE TRANSMISSION

MENLOR RESERVOIR
CAP: 3.5 MG
OE: 410'

CONNECT TO EXISTING 550-ZONE TRANSMISSION

CONNECT TO EXISTING 550-ZONE TRANSMISSION

CONSTRUCT 550-ZONE TRANSMISSION

LEGEND

- PROPOSED WATER MAIN
- 550 PRESSURE ZONE
- PROPOSED RIGHT-OF-WAY
- NATURAL RESOURCE CORRIDOR
- TIGARD CITY LIMITS
- 12" EXISTING WATER MAIN
- 10' CONTOURS



FIGURE 5

**CITY OF TIGARD
RIVER TERRACE COMMUNITY PLAN
RIVER TERRACE 550-ZONE
SERVICE ALTERNATIVE 1**

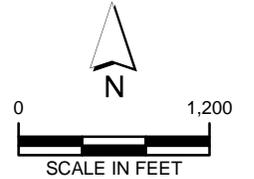
January 2014



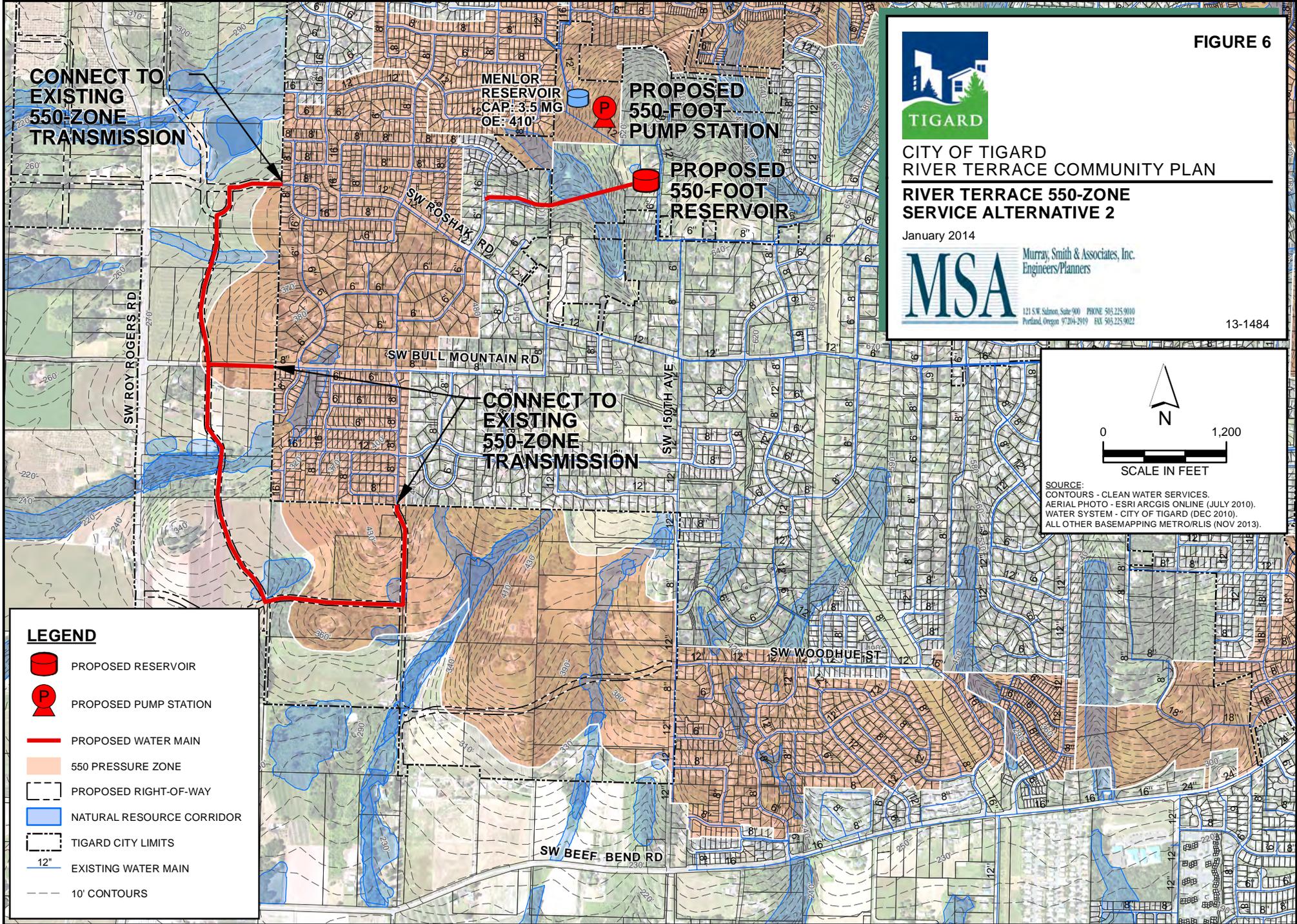
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13-1484



SOURCE:
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WATER SYSTEM - CITY OF TIGARD (DEC 2010).
ALL OTHER BASEMAPPING METRO/RLIS (NOV 2013).



CONNECT TO EXISTING 550-ZONE TRANSMISSION

MENLOR RESERVOIR
CAP: 3.5 MG
OE: 410'

PROPOSED 550-FOOT PUMP STATION

PROPOSED 550-FOOT RESERVOIR

CONNECT TO EXISTING 550-ZONE TRANSMISSION

LEGEND

-  PROPOSED RESERVOIR
-  PROPOSED PUMP STATION
-  PROPOSED WATER MAIN
-  550 PRESSURE ZONE
-  PROPOSED RIGHT-OF-WAY
-  NATURAL RESOURCE CORRIDOR
-  TIGARD CITY LIMITS
-  12" EXISTING WATER MAIN
-  10' CONTOURS



FIGURE 6

CITY OF TIGARD
RIVER TERRACE COMMUNITY PLAN
RIVER TERRACE 550-ZONE
SERVICE ALTERNATIVE 2

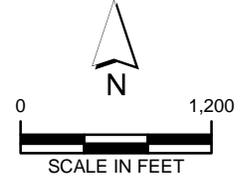
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SOURCE:
CONTOURS - CLEAN WATER SERVICES
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ALL OTHER BASEMAPPING METRO/LRIS (NOV 2013).

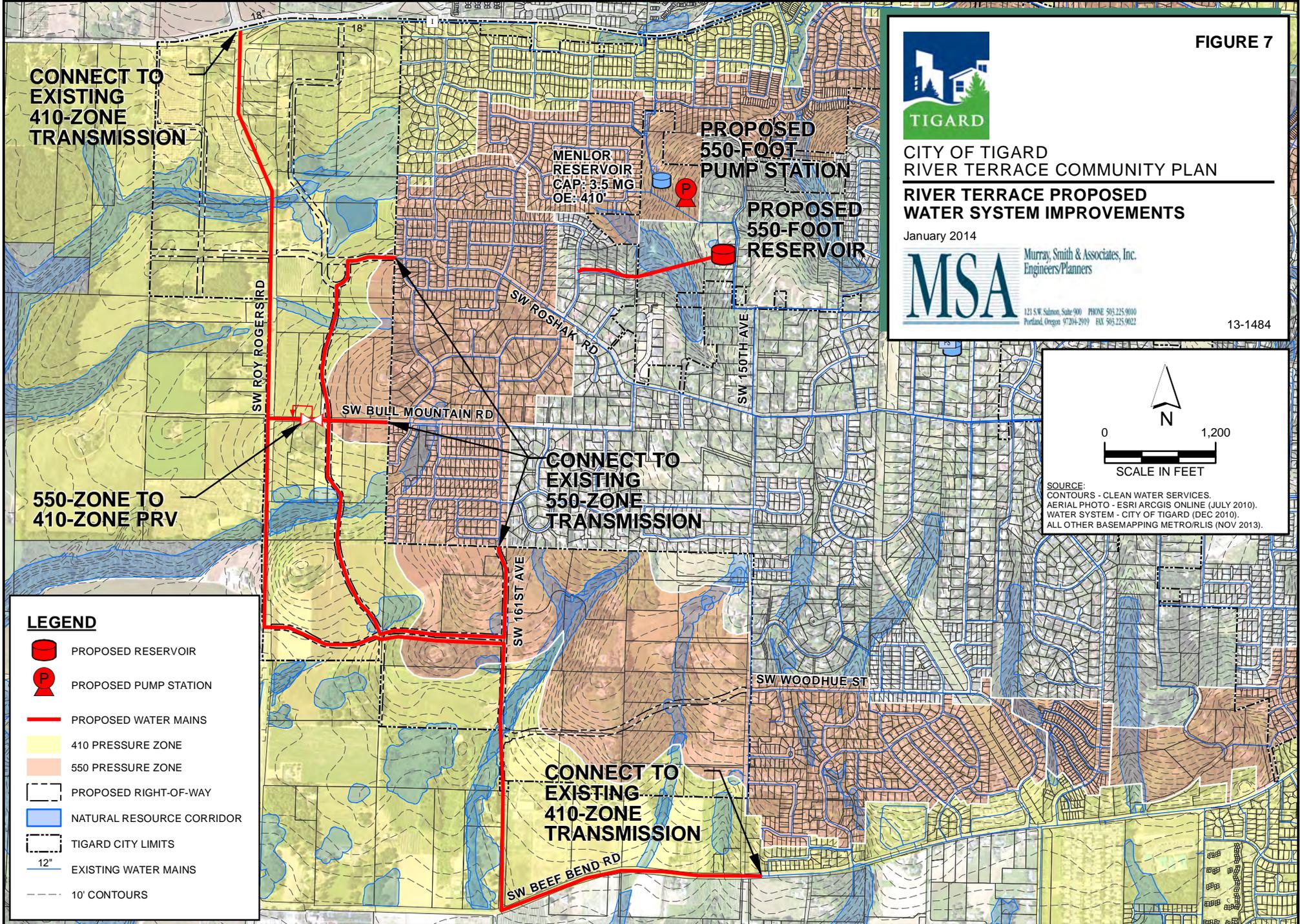


FIGURE 7

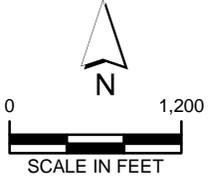


TIGARD
CITY OF TIGARD
RIVER TERRACE COMMUNITY PLAN
RIVER TERRACE PROPOSED
WATER SYSTEM IMPROVEMENTS
January 2014

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13-1484



SCALE IN FEET

SOURCE:
CONTOURS - CLEAN WATER SERVICES
AERIAL PHOTO - ESRI ARCGIS ONLINE (JULY 2010).
WATER SYSTEM - CITY OF TIGARD (DEC 2010).
ALL OTHER BASEMAPPING METRO/RLS (NOV 2013).

LEGEND

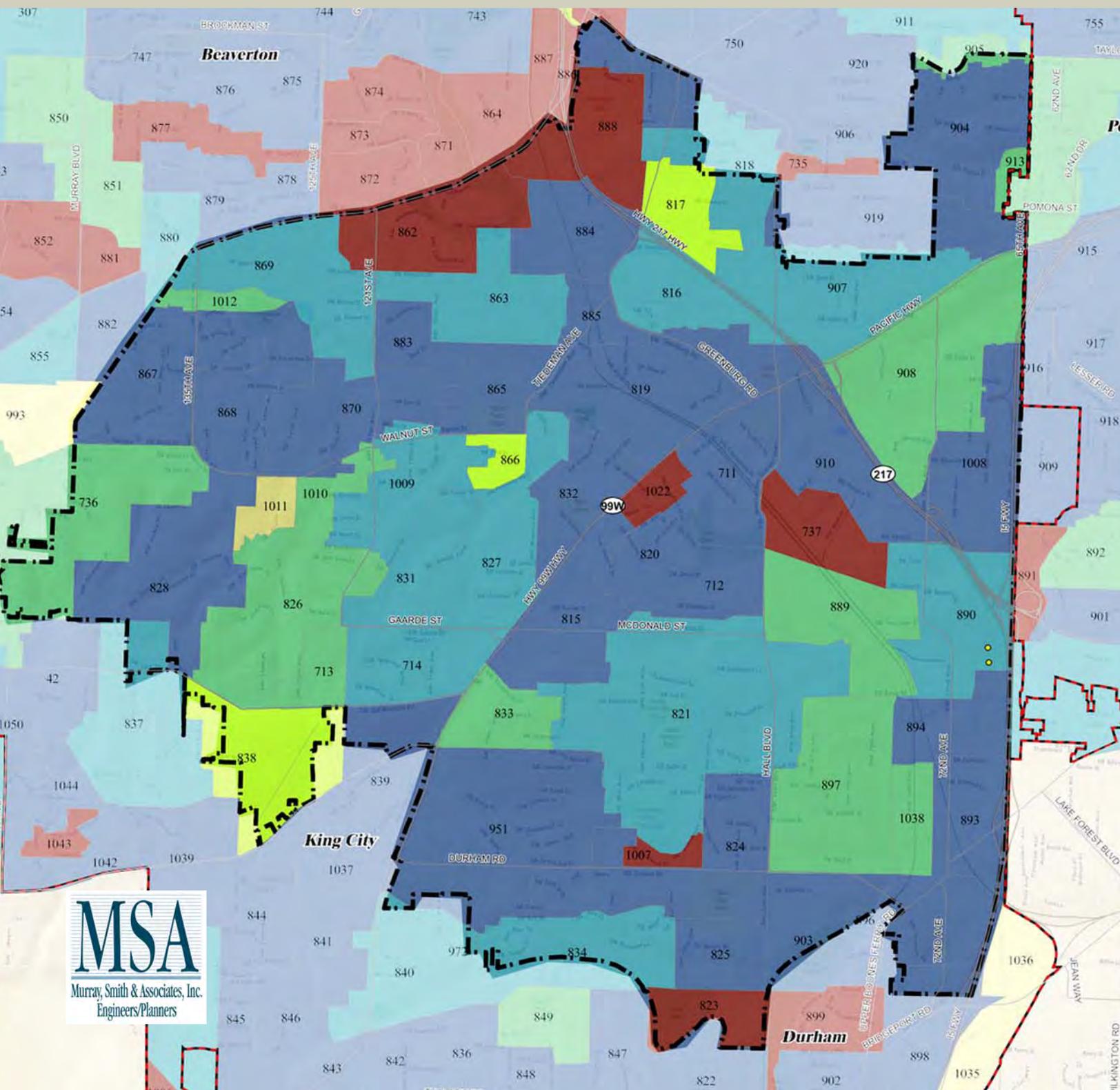
-  PROPOSED RESERVOIR
-  PROPOSED PUMP STATION
-  PROPOSED WATER MAINS
-  410 PRESSURE ZONE
-  550 PRESSURE ZONE
-  PROPOSED RIGHT-OF-WAY
-  NATURAL RESOURCE CORRIDOR
-  TIGARD CITY LIMITS
-  12" EXISTING WATER MAINS
-  10' CONTOURS



City of Tigard, Oregon

Sanitary Sewer Master Plan Addendum

January 2014



ACKNOWLEDGEMENTS

We would like to thank the many citizens, staff, and community groups who provided extensive input into the development of this Plan. Special thanks are due to the members of the River Terrace Technical Advisory Committee and Stakeholder Working Group.

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January 2014

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SUMMARY OF RECOMMENDATIONS

The focus of this Sanitary Sewer Master Plan Addendum is on providing sewer service to the River Terrace Community, which is a new area that the City of Tigard's 2010 Sanitary Sewer Master Plan does not address. The only proposed change that affects the 2010 Sanitary Sewer Master Plan includes the recommendation to remove the Pleasant View and Meyers Farm pump stations from service following development of the River Terrace Community.

For the purposes of analysis, the River Terrace Community was split into two sub-basins identified as River Terrace North and River Terrace South. Recommendations for the River Terrace North sub-basin include a proposed pump station in the northwest corner of the area, north of the tributary natural resource corridor and adjacent to the western boundary of the current Urban Growth Boundary (UGB). Recommendations for the River Terrace South sub-basin include revising the service area for the existing South Bull Mountain Pump Station to serve part of the River Terrace Community as well as the construction of one proposed pump station within the sub-basin. A detailed analysis of sewer service recommendations as well as feasible alternatives is provided below.

I. INTRODUCTION

In 2010, the City of Tigard updated the community's Sanitary Sewer Master Plan, hereafter referred to as the SSMP. The SSMP is the document that develops flows based on land use zoning and establishes gravity sewer pipe sizes, serving as a guide for all capital sewer projects within the city. The 2010 SSMP update was developed in concert with Clean Water Services (CWS), the agency responsible for all pump stations, wastewater treatment and large gravity sewer pipes (24-inch diameter and greater). The 2010 SSMP update, which did not address the River Terrace area, was adopted by the Tigard City Council on September 14, 2010.

Since the adoption of the SSMP update in 2010, the West Bull Mountain Concept Plan (WBMCP) was completed and adopted by Washington County and the city. The area now known as River Terrace (and formerly known as West Bull Mountain) was also annexed to the city. This addendum provides an update to the SSMP specific to the River Terrace study area, identified in Figures 1 and 2, and contributes to the city's broader goal of completing a River Terrace Community Plan.

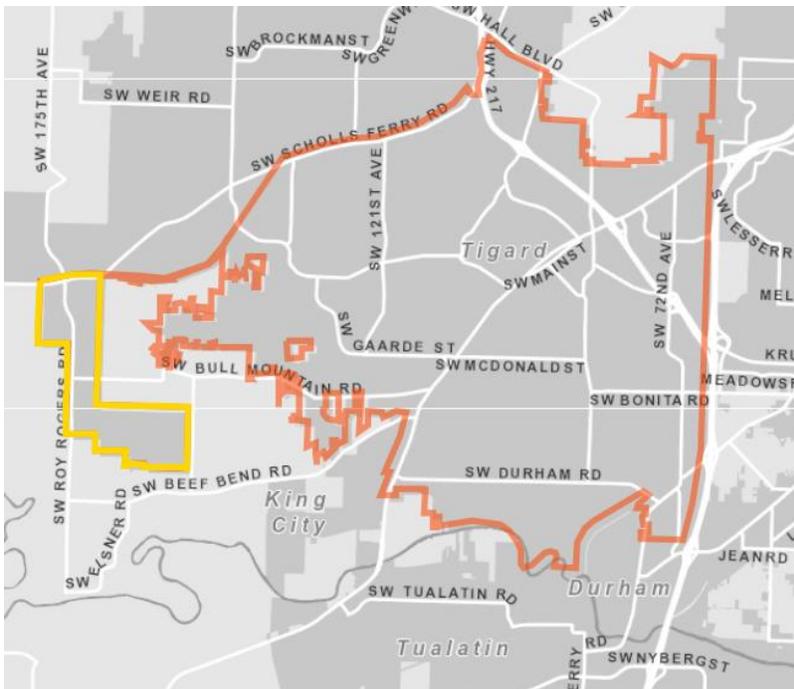


Figure 1 River Terrace Study Area (Outlined in Yellow)

The WBMCP wastewater element presented a description and comparison of two conceptual wastewater system infrastructure alternatives for the West Bull Mountain planning area. This SSMP Addendum refines the WBMCP, including an analysis of service alternatives for specific areas within the River Terrace area.

II. BASIS OF PLANNING AND FLOW DEVELOPMENT

Basis of Planning

All flows for the River Terrace Community were generated assuming full development in the UGB areas and build out development in the Urban Reserve Areas (URA), which follows the planning assumptions from the CWS Summary of Future Flow Generation, Rock Creek and Durham Sanitary Sewer Basins (CH2M Hill, 2013). Unit flow factors used to develop the average dry weather flow (ADWF) in the SSMP also match CWS land use-based flow factors.

Wet weather flows are developed by adding an infiltration and inflow (I/I) factor to the calculated dry weather, sanitary flows. The city's master plan identified an I/I flow factor of 1,650 gallons per acre per day (gpad) for currently undeveloped areas and applied a factor of 4,000 gpad for sizing trunk sewers. However, given the relatively large size of this growth area, using 4,000 gpad results in oversized sewer pipes. In an effort to coordinate with the CWS planning work, a single rate of 2,500 gpad was used for estimating the I/I flows as well as trunk sizing. This flow rate was applied to the gross UGB areas and 65 percent of the gross URAs. For smaller basin planning, the city and/or CWS may require facilities to be designed based on an I/I flow factor of 4,000 gpad.

River Terrace Flow Development within the UGB

This SSMP Addendum follows the 2010 Sanitary Sewer System Master Plan and assumes 2.4 persons per dwelling unit. The City of Tigard projects 2,587 dwelling units within the River Terrace Community by build out in 2035.

The River Terrace Community was divided into specific zoning areas by the city, including low to high residential densities, a commercial development in the north and a school in the south. The number of dwelling units per acre designated in each residential zone varies from 4.5 to 25 dwelling units/acre. An overview of the zoning layout for the UGB area is provided in Figure 3.

A flow per dwelling unit was developed based on the population density and the average unit capita flow factor. The 2010 Sanitary Sewer Master Plan uses an ADWF factor of approximately 180 gallons per day per dwelling unit (gpd/DU). This factor was calculated by taking the average unit capita flow factor for single and multi-family residents, approximately 75 gallons per capita per day (gpcd), and applying it to the population density of 2.4 persons per dwelling unit. This flow per dwelling unit is congruent with the CWS residential ADWF factors from the Summary of Future Flow Generation, Rock Creek and Durham Sanitary Sewer Basins document (CH2M Hill, 2013).

The ADWF for the residential areas was estimated by multiplying this flow factor by the total number of projected dwelling units by build-out.

For the commercial zone, the ADWF was calculated using the 2010 Sanitary Sewer Master Plan unit flow factor of 3,660 gpad. Since the 2010 Sanitary Sewer Master Plan did not include a unit flow factor for a school use, the school use ADWF was calculated using the CWS land use flow factors of 1,050 gpad. ADWF for the commercial zone and school use were estimated by multiplying the ADWF factor in gpad by the net area. To align with CWS planning, the net area was estimated by taking the gross area less the existing right-of-way (ROW), estimated at 5 percent of the gross area.

The 2010 Sanitary Sewer Master Plan uses an I/I flow factor of 4,000 gpad for project sizing and 1,650 gpad for modeling purposes. CWS current planning efforts assume an I/I flow of 2,500 gpad. To be consistent with CWS current efforts the I/I flow for the residential and commercial zones and school use were developed by applying the flow factor of 2,500 gpad to the gross area. The 20-acre lot that is designated for a proposed school is not identified on the proposed River Terrace Community zoning map, but was subtracted from the gross single and multi-family residential areas. Flows developed for the River Terrace Community within the UGB are provided in Table 1.

**Table 1
River Terrace Flow Development within UGB**

Zone	Gross Area (Acres)	Net Area (Acres)	Dwelling Units	ADWF Factor	ADWF⁽¹⁾ (mgd)	I/I Flow (mgd)
Single and Multi-Family Residential	466.6	-	2,587	180 (gal/DU day)	0.47	1.17
Commercial	17.8	16.9	-	3,660 (gpad)	0.06	0.04
School	20.0	19.0	-	1,050 (gpad)	0.02	0.05

Note:

1. A peaking factor was not applied to the ADWF.

River Terrace Flow Development within the Urban Reserve Areas 6C

Estimation of the ADWF for the URAs, which are not currently zoned for development, was based on the values for the CWS land use class designation of Exclusive Farm or Forest Use (EFU) with an ADWF factor of 1,750 gpad. The 2010 Sanitary Sewer Master Plan did not include an ADWF factor for this land use designation. The ADWF was estimated by multiplying the land use flow factor by the net URA acreage. Net buildable acreage in the three URAs comply with CWS planning such that the net area is 65 percent of the gross area less the existing ROW, estimated at 5 percent of the gross area. I/I flows were developed by applying the CWS I/I flow factor of 2,500 gpad to 65 percent of the gross area. Flows developed for the URAs 6C (North), (Middle) and (South) are provided in Table 2.

**Table 2
River Terrace Flow Development within URAs**

Zone	Gross Area (Acres)	Net Area (Acres)	ADWF Factor (gpad)	ADWF⁽¹⁾ (mgd)	I/I Flow (mgd)
URA 6C (North)	140.0	86.5	1,750	0.2	0.2
URA 6C (Middle)	162.5	100.3	1,750	0.2	0.3
URA 6C (South)	205.0	126.6	1,750	0.2	0.3

Note:

1. A peaking factor was not applied to the ADWF.

III. HYDRAULIC MODEL

The Durham hydraulic model previously completed by CWS incorporated all of the above information to provide an analysis of the capacity of the existing system and impacts from the new River Terrace Community. Discharging flows to the north from the River Terrace Community routes flows through the CWS Fanno Interceptor while discharging flows to the south from the River Terrace Community sends flows through the Upper Tualatin Interceptor.

Modeling results confirmed known capacity limitations in the Barrows Road trunk to the north, which established a practical limitation on the flow through that pipeline. The flow modeling and recommendations associated with this planning effort closely aligns with CWS plans for directing flows.

IV. SYSTEM ALTERNATIVES EVALUATION

River Terrace Sub-Basin Service Delineation Alternatives

The River Terrace Community is naturally divided into two areas, one draining to the north and one draining to the south. Splitting the area into two sub-basins to follow the existing terrain is necessary to avoid excessively deep sewers. The two sub-basins are designated as River Terrace North (RTN) and River Terrace South (RTS). Two delineation alternatives to separate the north and south sub-basins were evaluated.

- Alternative 1 separates the sub-basins along SW Bull Mountain Road.
- Alternative 2 separates the areas at the ridge south of SW Bull Mountain Road.

The main differences between the two alternatives include average pipe depths and lengths. The first alternative includes an average pipe depth of 10 feet for approximately 4,000 linear feet (LF) while the second alternative includes an average pipe depth of 30 feet for approximately 6,000 LF. The additional area from Alternative 2 (bounded by SW Bull Mountain Rd and the ridge to the south) does not drive additional pipe depths to the RTS sub-basin. A comparison of the two delineation alternatives is shown in Figure 4.

Recommendation: River Terrace Sub-Basin Service Delineation

It is recommended that the River Terrace Community be divided along SW Bull Mountain Road (Alternative 1) since the average pipe depth and lengths are more practical compared to the depth and lengths from Alternative 2.

River Terrace Sub-Basin Sewer Service Alternatives

This service evaluation assumes that infrastructure will be contained within the existing UGB area. Gaining approval to locate infrastructure in URA lands, outside of the current UGB, requires the service provider to demonstrate to Washington County that:

1. The service cannot be provided from within the UGB, and
2. It does not affect the existing land use purpose.

Underground pipes outside the UGB have been successfully permitted in the past, though the process is somewhat longer, but a pump station outside the UGB has yet to be permitted.

All sewer service alternatives discussed for the River Terrace North and South sub-basins will adhere to previously recommended alternatives discussed in this addendum. Sewer service provided for the URAs 6C (North), (Middle) and (South) will be discussed later in this addendum.

To route the gravity sewer lines within the River Terrace North and South sub-basins, different aspects regarding the existing area were taken into consideration. These criteria include: existing and proposed roads, protected natural resource areas (e.g. natural resource corridors), potential development and pipe depth.

River Terrace North Sub-Basin

The majority of the RTN sub-basin cannot be drained by gravity sewer lines into an existing trunk sewer due to the topography sloping away from existing sewer trunk lines. The exception is a small area of land immediately south of Scholls Ferry Road and Barrows Road. This area will drain by gravity via an existing 12-inch stub to the 21-inch pipe recently installed in Scholls Ferry Road, which was sized to accommodate build-out flows from RTN, the City of Beaverton's South Cooper Mountain area, and URA lands. The existing 8-inch pipe further to the east in SW Barrows Rd has been identified by CWS to require upsizing to accommodate build-out flows from RTN, the City of Beaverton's South Cooper Mountain area, and URA lands.

Due to topography, the rest of the RTN sub-basin must be served by a pump station located along the western boundary of the UGB at the natural low point of the service area. Three proposed gravity sewer lines are identified to provide service to the sub-basin. The projected flows for each of these trunks are provided in Table 3.

**Table 3
River Terrace North Sub-Basin Flow Development Summary**

	Gross Area (Acres)	Dwelling Units	ADWF (mgd)	I/I Flow (mgd)	PWWF⁽¹⁾ (mgd)
Gravity Segment 1	37.3	216	0.04	0.09	0.22
Gravity Segment 2	99.8	542	0.16	0.25	0.78
Gravity Segment 3 ⁽²⁾	199.9	1,135	0.27	0.50	1.62
Gravity Segment 4	80.7	505	0.09	0.20	0.50
Gravity Segment 5	43.1	147	0.03	0.11	0.43 ⁽³⁾
Scholls Cntry Est PS ⁽⁴⁾	-	-	-	-	0.24

Note:

1. Peak factor of 3.3, from ASCE's Peak Factor vs. Average Flow graph applied to the ADWF. Peak Wet Weather Flow (PWWF) taken from the sum of the peak ADWF and I/I flow.
2. Gravity Segment 3 values are representative of the entire River Terrace North sub-basin, less the area within the River Terrace North sub-basin draining to Barrows Rd Trunk.
3. Includes flow from Scholls Country Estates pump station
4. Scholls Country Estates Pump Station build out peak wet weather flows from the Siting Study for River Terrace Pump Stations and Force Mains Report for CWS (MSA, 2013).

Two low points were identified in the sub-basin along the UGB boundary, one to the north of the creek tributary and one to the south. However, after further analysis, the location to the south of the tributary results in the pump station and trunk sewers being slightly deeper. Additionally, the location south of the tributary does not allow the pump station to serve the City of Beaverton's South Cooper Mountain area, which is necessary per the CWS Sewer Master Plan.

As development occurs, the Scholls Country Estates pump station will be taken offline and its existing service area will flow by gravity into the RTN Pump Station (PS). A proposed force main will be routed northward along existing and proposed right-of-way, where possible, to discharge into an existing manhole at Scholls Ferry Road. A detailed layout of the RTN proposed sewer service is shown in Figure 5.

Flows from both the RTN area and the City of Beaverton are anticipated to drain to the RTN PS, resulting in a large increase from initial flows to build out flows. To accommodate this growth, the sizing of the proposed pump station equipment and facility will be phased. The initial phase will include construction of the primary facility components to provide service for the projected build out flows, but pumping equipment will be sized for initial flow conditions. This approach avoids oversized equipment, which is problematic from an operational standpoint, and minimizes the construction efforts associated with future capacity expansions. The future phase will include build out conditions and equipment for flows from additional areas such as the URA 6C (North) and flows from Scholls Country Estates PS. Upon completion of the RTN PS, gravity sewer lines from the City of Beaverton and Scholls Country Estates PS will lead to this pump station.

Table 4 provides an understanding of pipe size relative to full capacity and minimum slope. This table was used to determine gravity sewer line sizes based on capacity for both the River Terrace North and South sub-basin alternatives. Table 5 provides conceptual cost estimates for the RTN proposed sewer service.

**Table 4
Pipe Size and Capacity**

Size (in.)	Minimum Slope (ft/100 ft)	Capacity (gpm)	Capacity (mgd)
8	0.40	344	0.5
10	0.28	522	0.8
12	0.22	752	1.1
15	0.15	1,126	1.6
18	0.12	1,638	2.4
21	0.10	2,255	3.3
24	0.08	2,880	4.2

Recommendation: River Terrace North Sub-Basin

Based on information currently available, it is recommended that a single pump station be located north of the natural resource corridor and along the western edge of the UGB. As the design is further developed and additional data becomes available, such as geotechnical borings, depth of rock may drive an alternate location or potentially render a single pump station infeasible.

**Table 5
River Terrace North Service Alternatives Cost Estimates**

	Depth (ft)	Length (LF)	Flow ⁽¹⁾ (gpm)	Size ⁽²⁾ (in.)	Cost/LF	Total Cost ⁽⁶⁾
Gravity Segment 1	10	1,300	154	8	\$138 ⁽³⁾	\$180,000 ⁽⁴⁾
Gravity Segment 2	10	1,700	539	12	\$167 ⁽³⁾	\$305,000 ⁽⁴⁾
Gravity Segment 3	10	900	1,124	15	\$189 ⁽³⁾	\$178,000 ⁽⁴⁾
Gravity Segment 4	10	1,000	348	10	\$152 ⁽³⁾	\$170,000 ⁽⁴⁾
Gravity Segment 5	10	1,600	302	8	\$138 ⁽³⁾	\$229,000 ⁽⁴⁾
Force Main	-	2,000	1,124	12	\$150	\$314,000 ⁽⁴⁾
Pump Station	-	-	8.6 ⁽⁵⁾ mgd	-	-	\$3,487,000 ⁽⁶⁾
Scholls Ferry Trunk Extension	-	-	-	-	-	\$942,000 ⁽⁷⁾
Barrows Rd Trunk Upsizing	-	-	-	-	-	\$170,000 ⁽⁸⁾
Construction Sub-Total						\$5,974,000
Engineering Legal and Administrative (ELA) costs, 25 percent allowance Construction Sub-Total Costs						\$1,494,000
Construction and ELA Sub-Total						\$7,468,000
30 percent contingency of ELA costs						\$2,240,000
Total Cost						\$9,708,000

Note:

1. Peak factor of 3.3, from ASCE's Peak Factor vs. Average Flow graph applied to the ADWF. Peak Wet Weather Flow (PWWF) taken from the sum of the peak ADWF and I/I flow.
2. Size based on full pipe capacity and minimum slope from Table 4 of this memorandum.
3. Cost/LF from Appendix R of the 2009 Sanitary Sewer Master Plan Update CWS Table 1: Unit Costs for Gravity Sewers, \$/LF, ENR value for this table was 8602 from November 2008. Costs were scaled to reflect an ENR value of 9664 from January 2014.
4. No easement costs added to gravity segments and force main sewer lines within existing or proposed ROW. Easement assumed to be 20' wide with a cost of \$25/LF.
5. Capacity of pump station based on build out flows, with 7 mgd of build out flow from the City of Beaverton.
6. Costs reflect construction conditions typical of the area and do not include provisions for rock or other potential impacts, such as addressing significant groundwater.
7. This cost is the City of Tigard's budgeted share for the installation of this pipe.
8. This cost is the City of Tigard's estimated share for the upsizing of this pipe.

River Terrace South Sub-Basin

Due to multiple natural resource corridor areas dividing the RTS sub-basin, the sub-basin was split into five sub-areas for analysis. A detailed layout of the RTS sub-areas is shown in Figure 6. A summary of ADWF, I/I flows and PWWF for the RTS sub-areas are provided in Table 6. Descriptions and analysis relative to alternatives to serve these five sub-areas are outlined below.

**Table 6
River Terrace South Sub-Areas Flow Development Summary**

River Terrace South Sub-Areas	Gross Area (Acres)	Dwelling Units	ADWF (mgd)	I/I Flow (mgd)	PWWF ⁽¹⁾ (mgd)
1	41.6	168	0.03	0.10	0.2
2	85.2	389	0.07	0.21	0.4
3	11.2	28	0.01	0.03	0.1
4 ⁽²⁾	52.8	161	0.05	0.13	0.3
5	100.4	603	0.11	0.25	0.6
Pleasant View PS ⁽²⁾	-	-	-	-	0.5 ⁽³⁾
Meyers Farm PS ⁽³⁾	-	-	-	-	0.3 ⁽⁴⁾

Note:

1. Peak factor of 3.3, from ASCE's Peak Factor vs. Average Flow graph applied to the ADWF. Peak Wet Weather Flow (PWWF) taken from the sum of the peak ADWF and I/I flow.
2. River Terrace South Sub-Area 4 includes the 20 acre designated school lot.
3. Pleasant View Pump Station build out peak wet weather flows from the Siting Study for River Terrace Pump Stations and Force Mains Report for CWS (MSA, 2013).
4. Meyers Farm Pump Station build out peak wet weather flows from the Siting Study for River Terrace Pump Stations and Force Mains Report for CWS (MSA, 2013).

Alternatives for Sub-Areas 1 and 2

The South Bull Mountain PS currently serves approximately 300 acres east of the RTS sub-basin situated north of SW Beef Bend Road and east of SW 150th Avenue. The South Bull Mountain PS has a maximum capacity of 2.4 MGD yet currently serves a peak flow of only 1.2 MGD. To maximize the existing capacity of this pump station, a portion of the RTS sub-basin, specifically RTS sub-areas 1 and 2, can potentially be served by this pump station.

In doing so, this will create capacity issues in the South Bull Mountain PS. Expanding the capacity of the South Bull Mountain PS is not considered practical due to its small existing footprint, surrounding sensitive environmental considerations, and somewhat challenging access to the adjacent SW Beef Bend Road. Thus two feasible alternatives were evaluated to alleviate this capacity issue.

- Alternative 1 sends flows from Pleasant View PS that currently routes to the South Bull Mountain PS, to the new RTS sub-area 4.
- Alternative 2 sends both flows from Pleasant View PS and Meyers Farm PS that currently route to the South Bull Mountain PS, to the new RTS sub-areas 4 and 5 respectively.

A comparison of the remaining capacity of South Bull Mountain PS is provided in the following table.

Table 7
Remaining Capacity of South Bull Mountain Pump Station
Based on Peak Wet Weather Flows

Area	PWWF (mgd)	Cumulative PWWF (mgd)	Remaining Capacity S. Bull Mountain Pump Station ⁽¹⁾ (mgd)
1	0.2	0.2	1.0
2	0.4	0.6	0.6
Pleasant View PS ⁽²⁾	0.5	1.1	0.1
Meyers Farm PS ⁽³⁾	0.3	1.4	-0.2

Note:

1. South Bull Mountain PS allowing approximately 1.2 mgd of additional peak flow.
2. Pleasant View Pump Station build out peak wet weather flows from the Siting Study for River Terrace Pump Stations and Force Mains Report for CWS (MSA, 2013).
3. Meyers Farm Pump Station build out peak wet weather flows from the Siting Study for River Terrace Pump Stations and Force Mains Report for CWS (MSA, 2013).

An 8-inch sewer line approximately 2,000 LF exists at the southeast corner of the RTS sub-basin, allowing for immediate sewer service to sub-areas 1 and 2. However, the 8-inch sewer line located in SW Beef Bend Road just west of the South Bull Mountain PS establishes the hydraulic limitation. This sewer line has an existing peak flow of approximately 50 gallons per minute (gpm) based on the model, while having a capacity of roughly 250 gpm at full pipe capacity. Therefore, this sewer line can only accommodate approximately 200 gpm of additional flow. Peak flows were calculated for RTS sub-areas 1 and 2 to better understand how the capacity in the 8-inch sewer line along SW Beef Bend Road limits the area that can be served without driving a pipe size increase. The flows calculated are provided in the table below.

Table 8
Remaining Capacity of 8-inch Sewer Line Based on Peak Wet Weather Flows

Sub-area	Gross Area (Acres)	Dwelling Units	ADWF (gpm)	I/I Flows (gpm)	PWWF ⁽¹⁾ (gpm)	Remaining Capacity 8-inch sewer line ⁽²⁾ (gpm)
1	41.6	168	21	72	142	58
2	85.2	389	49	148	308	-108
1 and 2	126.8	557	70	220	450	-250

Note:

1. Peak factor of 3.3, from ASCE's Peak Factor vs. Average Flow graph applied to the ADWF. Peak Wet Weather Flow (PWWF) taken from the sum of the peak ADWF and I/I flow.
2. 8-inch sewer line along SW Beef Bend Road allowing 200 gpm of additional peak flow. Capacity based on full pipe flow.

Under current development, the 8-inch sewer line along SW Beef Bend Road can only accommodate RTS sub-area 1. Given this information, there are two feasible sub-alternatives to consider.

- Alternative 2a would be to leave the 8-inch sewer line along SW Beef Bend Road as is and only have flows from RTS sub-area 1 route to South Bull Mountain PS. Flows from RTS sub-area 2 will then have to route to the west of the RTS sub-basin.
- Alternative 2b would be to increase the capacity of the 8-inch sewer line to accommodate additional flows from both RTS sub-areas 1 and 2 to eventually lead to South Bull Mountain PS. The pipeline hydraulic capacity will need to be increased by approximately 220 gpm to flow at full capacity.

Recommendation: River Terrace South Sub-Areas 1 and 2

It is recommended that the South Bull Mountain PS serve RTS sub-areas 1 and 2 while flows from both Pleasant View and Meyers Farm PS flow to RTS sub-areas 4 and 5 respectively. This approach also allows for some development within the existing South Bull Mountain service area without requiring changes to the existing South Bull Mountain PS.

Alternatives for Sub-Areas 3, 4 and 5

The remaining sub-areas to be served within the RTS sub-basin, sub-areas 3, 4 and 5, cannot be feasibly served by gravity as the topography slopes away from the existing sewer system, which also does not have adequate capacity. To provide service to the remaining RTS sub-areas, two feasible alternatives were evaluated.

- The first alternative (identified as RTS-1) would be to construct one pump station in the southwest corner of sub-area 5. This location requires approximately 2,000 LF of sewer pipe from the southwest corner of sub-area 5 to the southwest corner of sub-area 4 at an average depth of 20 feet, with a maximum depth of approximately 40 feet.
- The second alternative (identified as RTS-2) would be to construct two pump stations, one in the southwest corner of sub-area 5 and one in the southwest corner of sub-area 4. This location requires approximately 1,000 LF of sewer pipe from the east corner of sub-area 5 to the west corner of sub-area 5 at an average depth of 10 feet. This alternative also requires an additional force main approximately 700 LF from the southwest corner of sub-area 4 to the east corner of sub-area 5.

In both alternatives, a force main will be routed south along Roy Rogers Road and east along Beef Bend Road past the South Bull Mountain PS. This route is preferred due to its ease of access and no intermediate high points, which create operational challenges.

The comparison of alternatives RTS-1 and RTS-2 is shown in Figure 7. A comparison of alternatives RTS-1 and RTS-2 conceptual level cost estimates are provided in Tables 9, 10A and 10B.

**Table 9
RTS-1 and RTS-2 Common Gravity Line Segment Cost Estimates**

RTS-1 and RTS-2 Common Segments	Depth (ft.)	Length (LF)	Flow (gpm)	Size⁽¹⁾ (in.)	Cost/LF	Total Cost⁽⁴⁾
Gravity Segment 1	10	600	326	8	\$138 ⁽²⁾	\$98,000 ⁽³⁾
Gravity Segment 2	10	700	31	8	\$138 ⁽²⁾	\$115,000 ⁽³⁾
Gravity Segment 3	10	1,700	358	10	\$152 ⁽²⁾	\$301,000 ⁽³⁾
Gravity Segment 4	15	1,800	101	8	\$167 ⁽²⁾	\$317,000 ⁽³⁾
Gravity Segment 5	10	400	236	8	\$138 ⁽²⁾	\$66,000 ⁽³⁾
Gravity Segment 6	17	900	338	10	\$182 ⁽²⁾	\$187,000 ⁽³⁾
Gravity Segment 7	25	1,000	550	12	\$721 ⁽²⁾	\$722,000 ⁽³⁾
Pump Station 1 Force Main	-	10,100	1,220	12	\$150	\$1,515,000 ⁽³⁾

Note:

1. Size based on full pipe capacity and minimum slope from Table 4 of this memorandum.
2. Cost/LF from Appendix R of the 2009 Sanitary Sewer Master Plan Update CWS Table 1: Unit Costs for Gravity Sewers, \$/LF, ENR value for this table was 8602 from November 2008. Costs were scaled to reflect an ENR value of 9664 from January 2014. 20% contingency added to Cost/LF for gravity segments with depths greater than 10' for underground rock encounters.
3. No easement costs added to gravity segments and force main sewer lines within existing or proposed ROW. Easement assumed to be 20' wide with a cost of \$25/LF.
4. Costs reflect construction conditions typical of the area and do not include provisions for rock or other potential impacts, such as addressing significant groundwater.

Table 10A
RTS-1 Cost Estimates

	Depth (ft.)	Length (LF)	Flow (gpm)	Size ⁽¹⁾ (in.)	Cost/LF	Total Cost ⁽⁵⁾
Gravity Segment 8A	20	1,700	561	12	\$238 ⁽²⁾	\$430,000 ⁽³⁾
Gravity Segment 9A	20	1,000	671	12	\$238 ⁽²⁾	\$264,000 ⁽³⁾
Pump Station 1	-	-	1.8 mgd	-	-	\$832,000 ⁽⁵⁾
Construction Sub-Total ⁽⁴⁾						\$4,847,000
Engineering Legal and Administrative (ELA) costs, 25% allowance of Construction Sub-Total Costs						\$1,212,000
Construction and ELA Sub-Total						\$6,059,000
30% contingency of ELA costs						\$1,818,000
Total Cost						\$7,877,000

Note:

1. Size based on full pipe capacity and minimum slope from Table 4 of this memorandum.
2. Cost/LF from Appendix R of the 2009 Sanitary Sewer Master Plan Update CWS Table 1: Unit Costs for Gravity Sewers, \$/LF, ENR value for this table was 8602 from November 2008. Costs were scaled to reflect an ENR value of 9664 from January 2014.
3. No easement costs added to gravity segments and force main sewer lines with existing or proposed ROW. Easement assumed to be 20' wide with a cost of \$25/LF.
4. Construction sub-total includes sub-total of common segments from Table 9.
5. Costs reflect construction conditions typical of the area and do not include provisions for rock or other potential impacts, such as addressing significant groundwater.

**Table 10B
RTS-2 Cost Estimates**

	Depth (ft.)	Length (LF)	Flow (gpm)	Size ⁽¹⁾ (in.)	Cost/LF	Total Cost ⁽⁴⁾
Gravity Segment 8B	12	1,000	561	12	\$180 ⁽²⁾	\$205,000 ⁽³⁾
Gravity Segment 9B	10	1,000	671	12	\$167 ⁽²⁾	\$193,000 ⁽³⁾
Pump Station 2 Force Main	-	700	561	12	\$150	\$105,000 ⁽³⁾
Pump Station 1	-	-	1 mgd	-	-	\$486,000 ⁽⁴⁾
Pump Station 2	-	-	0.8mgd	-	-	\$396,000 ⁽⁴⁾
Construction Sub-Total ⁽⁵⁾						\$4,706,000
Engineering Legal and Administrative (ELA) costs, 25 percent allowance of Construction Sub-Total Costs						\$1,177,000
Construction and ELA Sub-Total						\$5,883,000
30 percent contingency of ELA costs						\$1,765,000
Total Cost						\$7,648,000

Note:

1. Size based on full pipe capacity and minimum slope from Table 4 of this memorandum.
2. Cost/LF from Appendix R of the 2009 Sanitary Sewer Master Plan Update CWS Table 1: Unit Costs for Gravity Sewers, \$/LF, ENR value for this table was 8602 from November 2008. Costs were scaled to reflect an ENR value of 9664 from January 2014.
3. No easement costs added to gravity segments and force main sewer lines with existing or proposed ROW. Easement assumed to be 20' wide with a cost of \$25/LF.
4. Costs reflect construction conditions typical of the area and do not include provisions for rock or other potential impacts, such as addressing significant groundwater.
5. Construction sub-total includes sub-total of common segments from Table 9.

Recommendation: River Terrace South Sub-Areas 3, 4 and 5

Construction of a single pump station, as described in Alternative RTS-1, is recommended due to system operational benefits of not having to double-pump wastewater, requiring additional power. Additionally, labor hours and maintenance costs are significantly reduced by minimizing the number of pump stations.

Urban Reserve Area Sewer Service Recommendations

Service provided for the URAs 6C (North), 6C (Middle) and 6C (South) assumes the construction of the recommended alternatives for the River Terrace North and South sub-basin are complete. A description of the sewer service recommendations for the URAs are presented below.

- URA 6C (North) can largely be served by the pump station within the RTN sub-basin. One small area along the western edge that is separated by a ravine will require a small pump station in order to provide sewer service.
- URA 6C (Middle) can be served by a proposed pump station in the southwest corner of the area. This pump station can connect to the existing sewer line along the west

boundary of RTS sub-area 5 through a force main, which may be up to 12 inches in diameter. This planned approach slightly increased the size of the gravity line segments within the RTS sub-area 5, specifically gravity segment 7, from a 12-inch line to a 15-inch line. Alternatively, the flow from this area could potentially route to the north depending on development sequencing.

- URA 6C (South) can be served by a proposed pump station in the southwest corner of the area. The existing 12-inch gravity line (segment 7), running north to south within RTS sub-area 5, can be extended further south to tie into the new URA 6C (South) PS so that the existing PS in RTS sub-area 5 can be taken offline. This extended gravity line would then increase from a 12-inch to a 15-inch gravity sewer line. The URA 6C (South) PS would discharge through a force main, bypassing the existing 8-inch line along SW Beef Bend Road and continuing beyond South Bull Mountain PS to 137th Avenue where there is adequate capacity.

An overview of the recommendations for serving URAs 6C (North), 6C (Middle) and 6C (South) is shown in Figure 8.

V. CAPITAL IMPROVEMENT PLAN

Summary of Recommendations and Conceptual Level Costs

The recommended improvements for the River Terrace Community are shown in Figure 9. Proposed improvements for the River Terrace North and South sub-basins are discussed in the following section.

River Terrace North Sub-Basin

It is recommended that the RTN sub-basin be served by one pump station as shown in Figure 9. This pump station should be located to the north of the tributary to avoid deep sewer lines, provide a feasible location to serve URA 6C (North) in the future, and serve the South Cooper Mountain Annexation Area within the City of Beaverton to the north. It is also recommended that the Scholls Country Estates PS to the northeast of the sub-basin be taken offline as development occurs in the RTN sub-basin. The capacity of the pump station and pipe sizes are based on build out flows from the RTN sub-basin, URA 6C (North), Scholls Country Estates PS and the City of Beaverton. A layout of the recommended service for the area as well as the entire River Terrace Community is shown in Figure 9. Conceptual level cost estimates for the recommended alternatives are provided in Table 11.

**Table 11
River Terrace North Sub-Basin Recommended Service Cost Estimate**

	Depth (ft)	Length (LF)	Flow (gpm)	Size ⁽¹⁾ (in.)	Cost/LF	Total Cost ⁽⁵⁾
Gravity Segment 1	10	1,300	154	8	\$138 ⁽²⁾	\$180,000 ⁽³⁾
Gravity Segment 2	10	1,700	405	10	\$152 ⁽²⁾	\$278,000 ⁽³⁾
Gravity Segment 3	10	900	1,124	15	\$189 ⁽²⁾	\$178,000 ⁽³⁾
Gravity Segment 4	10	1,000	348	10	\$152 ⁽²⁾	\$170,000 ⁽³⁾
Gravity Segment 5	10	1,600	302	8	\$138 ⁽²⁾	\$229,000 ⁽³⁾
Force Main	-	2,000	1,597	12	\$150	\$314,000 ⁽³⁾
Pump Station	-	-	9.3 ⁽⁴⁾ mgd	-	-	\$3,746,000 ⁽⁵⁾
Construction Sub-Total						\$5,122,000
Engineering Legal and Administrative (ELA) costs, 25 percent allowance of Construction Sub-Total Costs						\$1,281,000
Construction and ELA Sub-Total						\$6,403,000
30 percent contingency of ELA costs						\$1,921,000
Total Cost						\$8,324,000

Note:

1. Size based on full pipe capacity and minimum slope from Table 4 of this memorandum.
2. Cost/LF from Appendix R of the 2009 Sanitary Sewer Master Plan Update CWS Table 1: Unit Costs for Gravity Sewers, \$/LF, ENR value for this table was 8602 from November 2008. Costs were scaled to reflect an ENR value of 9664 from January 2014.
3. No easement costs added to gravity segments and force main sewer lines with existing or proposed ROW. Easement assumed to be 20' wide with a cost of \$25/LF.
4. Capacity of pump station based on build out flows, with 7 mgd of build out flow from the City of Beaverton.
5. Costs reflect construction conditions typical of the area and do not include provisions for rock or other potential impacts, such as addressing significant groundwater.

River Terrace South Sub-Basin

It is recommended that a portion of the RTS sub-basin specifically RTS sub-areas 1 and 2, be served by the existing South Bull Mountain PS. It is also recommended that RTS sub-areas 3, 4 and 5 be served by a new pump station in the southwest corner of RTS sub-area 5. The Pleasant View PS and Meyers Farm PS should be taken offline upon development within RTS sub-areas 3, 4 or 5, and flows from these two pump stations should be routed through RTS sub-areas 4 and 5 respectively to the new pump station in sub-area 5. The capacity of the pump station and pipe sizes are based on build out flows from the RTS sub-basin area, Pleasant View PS, Meyers Farm PS and URA 6C (Middle). Gravity Segment 7 was sized to accommodate URA 6C (Middle) build out flows. A layout of the recommended service for the area as well as the entire River Terrace Community is shown in Figure 9. Conceptual level cost estimates for the recommended alternatives are provided in Table 12.

**Table 12
River Terrace South Sub-Basin Recommended Service Cost Estimate**

	Depth (ft.)	Length (LF)	Flow⁽¹⁾ (gpm)	Size⁽²⁾ (in.)	Cost/LF	Total Cost⁽⁵⁾
Gravity Segment 1	10	600	326	8	\$138 ⁽³⁾	\$98,000 ⁽⁴⁾
Gravity Segment 2	10	700	31	8	\$138 ⁽³⁾	\$115,000 ⁽⁴⁾
Gravity Segment 3	10	1700	358	10	\$152 ⁽³⁾	\$301,000 ⁽⁴⁾
Gravity Segment 4	15	1800	101	8	\$167 ⁽³⁾	\$317,000 ⁽⁴⁾
Gravity Segment 5	10	400	236	8	\$138 ⁽³⁾	\$66,000 ⁽⁴⁾
Gravity Segment 6	17	900	338	8	\$182 ⁽³⁾	\$187,000 ⁽⁴⁾
Gravity Segment 7	25	1,000	1,099	15	\$749 ⁽³⁾	\$750,000 ⁽⁴⁾
Gravity Segment 8A	20	1,700	515	10	\$221 ⁽³⁾	\$402,000 ⁽⁴⁾
Gravity Segment 9A	20	1,000	625	12	\$238 ⁽³⁾	\$264,000 ⁽⁴⁾
Pump Station 1 Force Main	-	10,100	1,724	12	\$150	\$1,515,000 ⁽⁴⁾
Pump Station 1	-	-	2.5 mgd	-	-	\$1,124,000
Construction Sub-Total						\$5,139,000
Engineering Legal and Administrative (ELA) costs, 25 percent allowance of Construction Sub-Total Costs						\$1,285,000
Construction and ELA Sub-Total						\$6,424,000
30 percent contingency of ELA costs						\$1,928,000
Total Cost						\$8,352,000

Note:

1. Peak factor of 3.3, from ASCE's Peak Factor vs. Average Flow graph applied to the ADWF. Peak Wet Weather Flow (PWWF) taken from the sum of the peak ADWF and I/I flow.
2. Size based on full pipe capacity and minimum slope from Table 4 of this memorandum.
3. Cost/LF from Appendix R of the 2009 Sanitary Sewer Master Plan Update CWS Table 1: Unit Costs for Gravity Sewers, \$/LF, ENR value for this table was 8602 from November 2008. Costs were scaled to reflect an ENR value of 9664 from January 2014.
4. No easement costs added to gravity segments and force main sewer lines with existing or proposed ROW. Easement assumed to be 20' wide with a cost of \$25/LF.
5. Costs reflect construction conditions typical of the area and do not include provisions for rock or other potential impacts, such as addressing significant groundwater.

CITY OF BEAVERTON

SW SCHOLLS FERRY RD

SW 15TH AVE

SW BARROWS RD

URBAN RESERVE 6C (NORTH)

SW VANDERMOST RD

RURAL RESERVE 5C

URBAN RESERVE 6C (MIDDLE)

SW ROY ROGERS RD

SW BULL MOUNTAIN RD

SW ROSHAK RD

SW 150TH AVE

UNDESIGNATED

SW BULL MOUNTAIN RD

SW WOODHUE ST

URBAN RESERVE 6C (SOUTH)

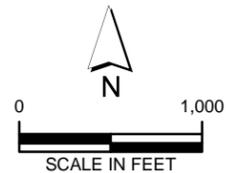
SW BEEF BEND RD

URBAN RESERVE 6D

LEGEND

-  STUDY AREA
-  PROPOSED RIGHT-OF-WAY
-  TIGARD CITY LIMITS
-  RIVER TERRACE COMMUNITY AREA
-  URBAN RESERVE AREA
-  10' CONTOURS

C:\PDX_Proj\csl\1484 - Tigard River Terrace\GIS\CITY OF TIGARD, FIGURES\SEWER SYSTEM\ADDENDUM\13-1484-OR-FIGURE 2 - STUDY AREA.mxd 4/18/2014 4:21:53 PM DKH



SOURCE:
 CONTOURS - CLEAN WATER SERVICES.
 AERIAL PHOTO - ESRI ARCGIS ONLINE (JULY 2010).
 WATER SYSTEM - CITY OF TIGARD (DEC 2010).
 ALL OTHER BASEMAPPING METRO/LRIS (AUG 2013).



CITY OF TIGARD
 RIVER TERRACE COMMUNITY PLAN
 RIVER TERRACE STUDY AREA

January 2014



FIGURE 2

CITY OF BEAVERTON

URBAN RESERVE 6C (NORTH)

RURAL RESERVE 5C

URBAN RESERVE 6C (MIDDLE)

UNDESIGNATED

URBAN RESERVE 6C (SOUTH)

URBAN RESERVE 6D

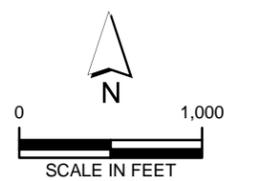
LEGEND

-  RIVER TERRACE COMMUNITY STUDY AREA
-  PROPOSED RIGHT-OF-WAY
-  URBAN RESERVE AREA
-  TIGARD CITY LIMITS

ZONING:

-  COMMUNITY COMMERCIAL (CC)
-  LOW DENSITY RESIDENTIAL (R-4.5)
-  MEDIUM DENSITY RESIDENTIAL (R-7)
-  MEDIUM-HIGH DENSITY RESIDENTIAL (R-12)
-  HIGH DENSITY RESIDENTIAL (R-25)

C:\PDX_Proj\GIS\City of Tigard River Terrace\GIS\CITY OF TIGARD FIGURES\SEWER SYSTEM\ADDENDUM\3-1484-OR-FIGURE 3 - ZONING.mxd 4/18/2014 4:29:25 PM DKH



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 CONTOURS - CLEAN WATER SERVICES.
 AERIAL PHOTO - ESRI ARCGIS ONLINE (JULY 2010).
 WATER SYSTEM - CITY OF TIGARD (DEC 2010).
 ALL OTHER BASEMAPPING METRO/LIS (AUG 2013).

FIGURE 3



CITY OF TIGARD
 RIVER TERRACE COMMUNITY PLAN
 RIVER TERRACE ZONE DESIGNATIONS

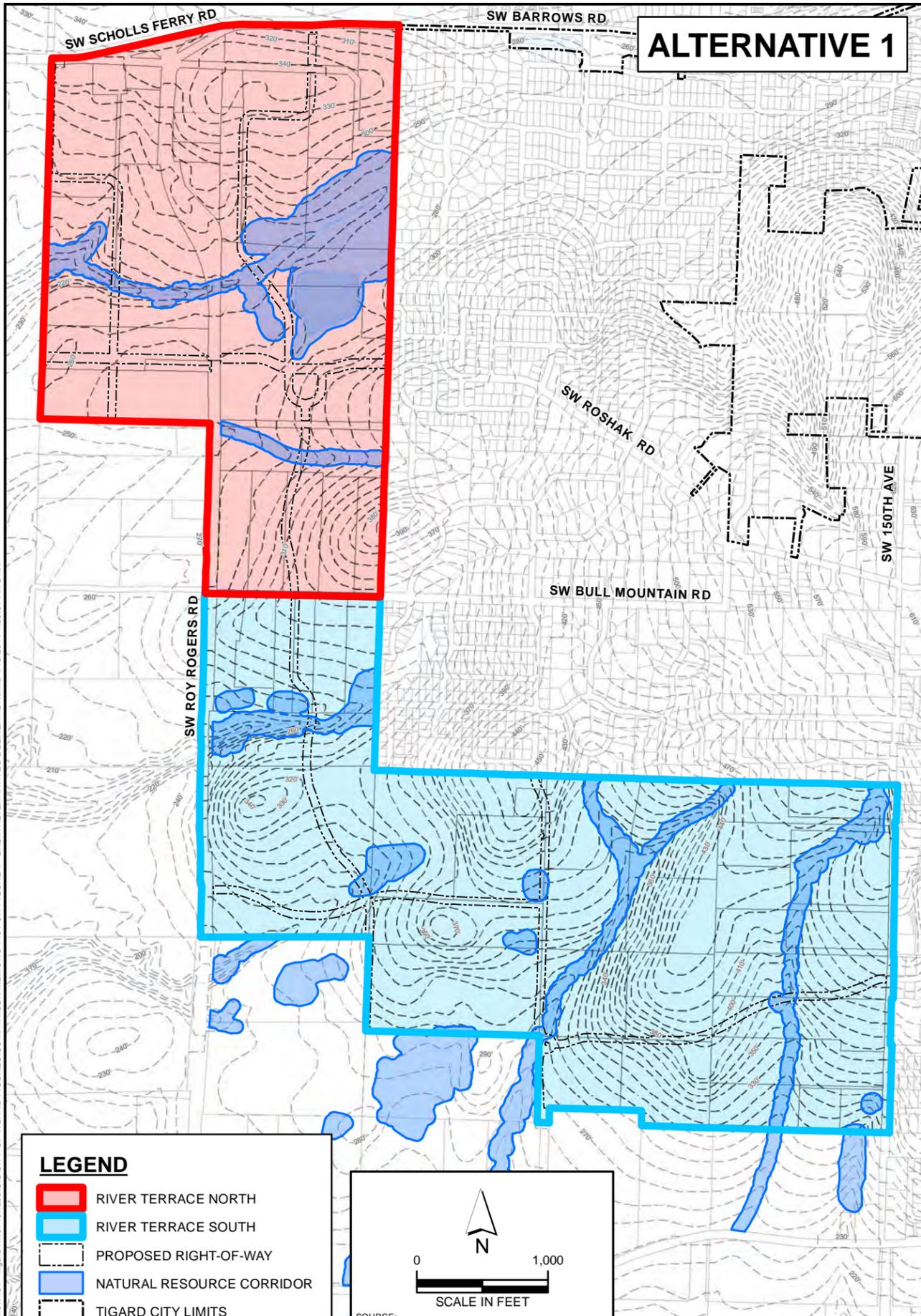
January 2014



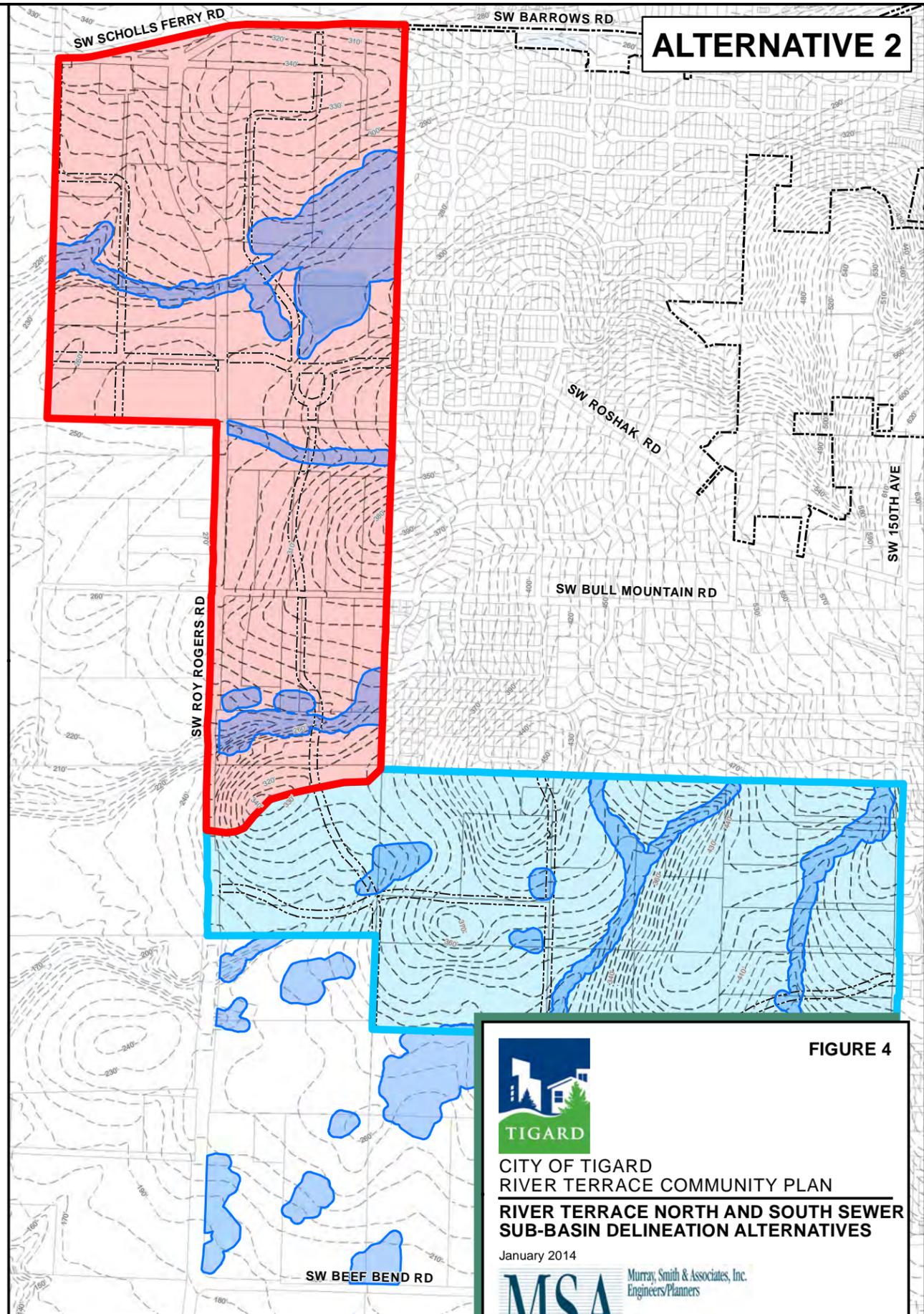
121 S.W. Salmon, Suite 500 PHONE 503.235.9000
 Portland, Oregon 97204-2919 FAX 503.235.9022

13-1484

G:\PDX_Projects\131484 - Tigard River Terrace\GIS\CITY OF TIGARD FIGURES\COMPARISON MEMO\131484-OR-FIGURE 4 - BASIN ALTERNATIVES DELINEATION.mxd 4/18/2014 4:33:31 PM DKH



ALTERNATIVE 1



ALTERNATIVE 2

LEGEND

- RIVER TERRACE NORTH
- RIVER TERRACE SOUTH
- PROPOSED RIGHT-OF-WAY
- NATURAL RESOURCE CORRIDOR
- TIGARD CITY LIMITS
- 10' CONTOURS


 0 1,000
 SCALE IN FEET

SOURCE:
 CONTOURS - CLEAN WATER SERVICES
 AERIAL PHOTO - ESRI ARCGIS ONLINE (JULY 2010).
 WATER SYSTEM - CITY OF TIGARD (DEC 2010).
 ALL OTHER BASEMAPPING METRO/RLIS (AUG 2013).

FIGURE 4



CITY OF TIGARD
 RIVER TERRACE COMMUNITY PLAN
 RIVER TERRACE NORTH AND SOUTH SEWER
 SUB-BASIN DELINEATION ALTERNATIVES

January 2014



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 Engineers/Planners

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13-1484

LEGEND

-  PROPOSED PUMP STATION
-  TRUNK LINE
-  FORCE MAIN
-  PROPOSED RIGHT-OF-WAY
-  NORTH SUB-BASIN SERVICE BOUNDARY
-  SEGMENT NUMBER
-  NATURAL RESOURCE CORRIDOR
-  RIVER TERRACE NORTH AREA
-  TIGARD CITY LIMITS
-  10' CONTOURS

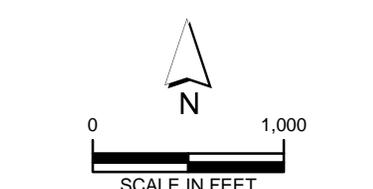
**RIVER TERRACE NORTH AREA
TRIBUTARY TO SW SCHOLLS
FERRY RD TO DRAIN TO
BARROWS RD TRUNK**

**PROPOSED
PUMP STATION**

**SCHOLLS COUNTRY
ESTATES
PUMP STATION**

**EXISTING SCHOLLS
COUNTRY ESTATES
PUMP STATION BASIN**

G:\PDX_Projects\1311484 - Tigard River Terrace\GIS\CITY OF TIGARD\FIGURES\COMPARISON MEMO\1311484-OR-FIGURE 5 - COMPARISON MEMO RTN (8.5x11).mxd 4/21/2014 11:18:16 AM DKH



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SOURCE:
CONTOURS - CLEAN WATER SERVICES.
AERIAL PHOTO - ESRI ARCGIS ONLINE (JULY 2010).
WATER SYSTEM - CITY OF TIGARD (DEC 2010).
ALL OTHER BASEMAPPING METRO/LIS (AUG 2013).

FIGURE 5



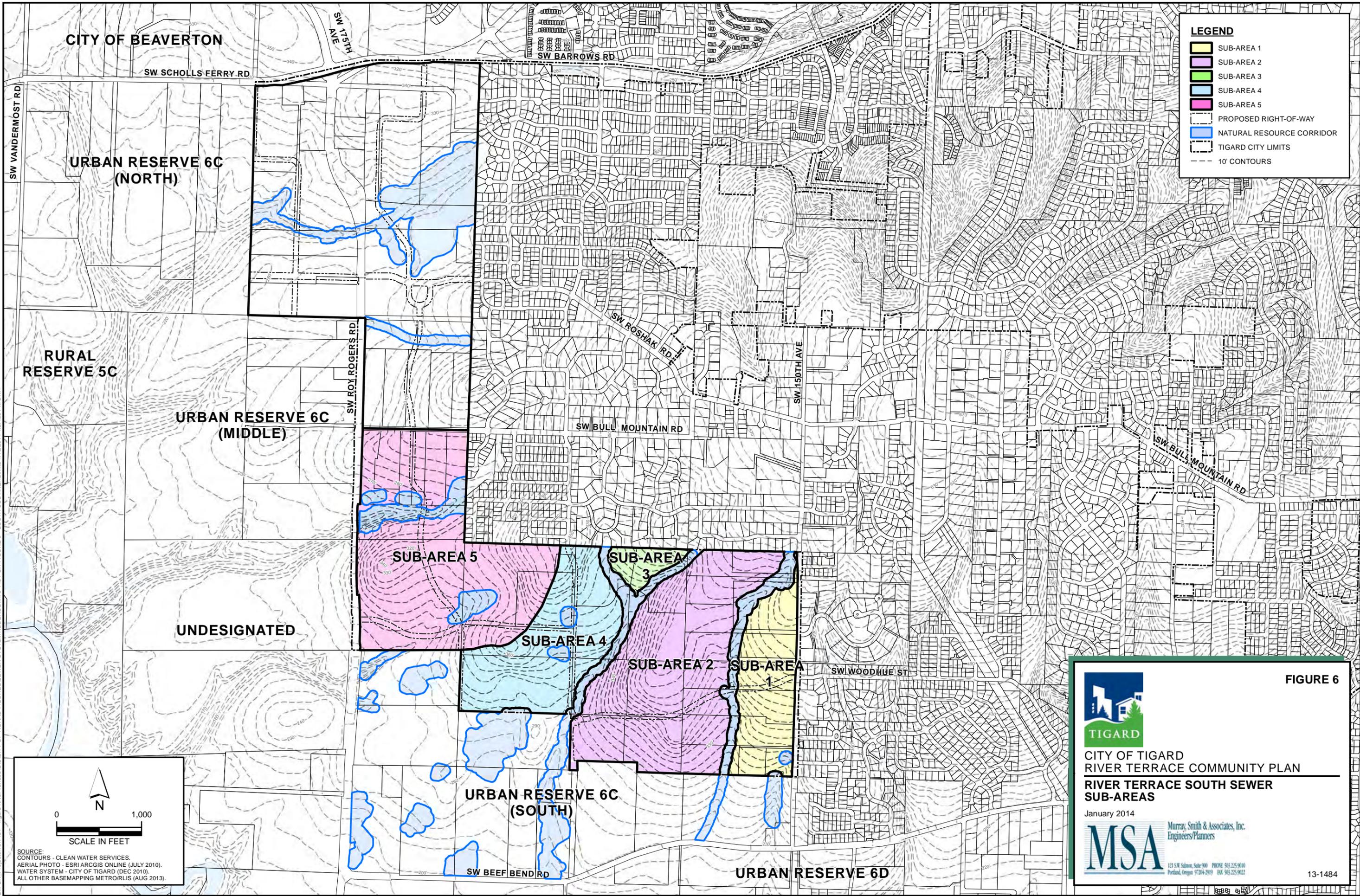
**CITY OF TIGARD
RIVER TERRACE COMMUNITY PLAN
RIVER TERRACE NORTH SUB-BASIN
SEWER SERVICE**

January 2014



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Engineers/Planners

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Portland, Oregon 97204-2919 FAX 503.225.9022



LEGEND

- SUB-AREA 1
- SUB-AREA 2
- SUB-AREA 3
- SUB-AREA 4
- SUB-AREA 5
- PROPOSED RIGHT-OF-WAY
- NATURAL RESOURCE CORRIDOR
- TIGARD CITY LIMITS
- 10' CONTOURS

0 1,000
SCALE IN FEET

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SOURCE:
CONTOURS - CLEAN WATER SERVICES.
AERIAL PHOTO - ESRI ARCGIS ONLINE (JULY 2010).
WATER SYSTEM - CITY OF TIGARD (DEC 2010).
ALL OTHER BASEMAPPING METROLR/LS (AUG 2013).

FIGURE 6



CITY OF TIGARD
RIVER TERRACE COMMUNITY PLAN
RIVER TERRACE SOUTH SEWER
SUB-AREAS

January 2014



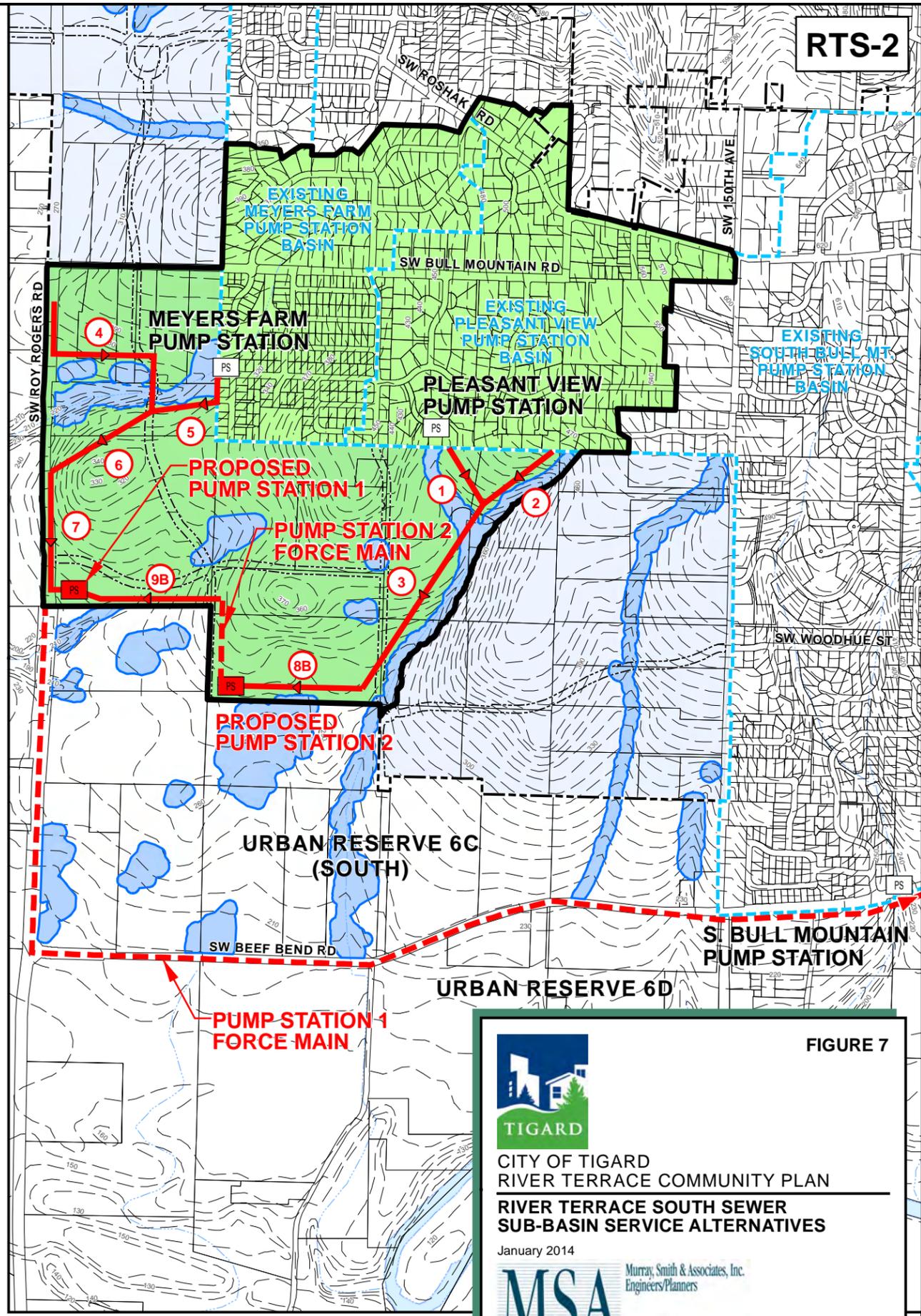
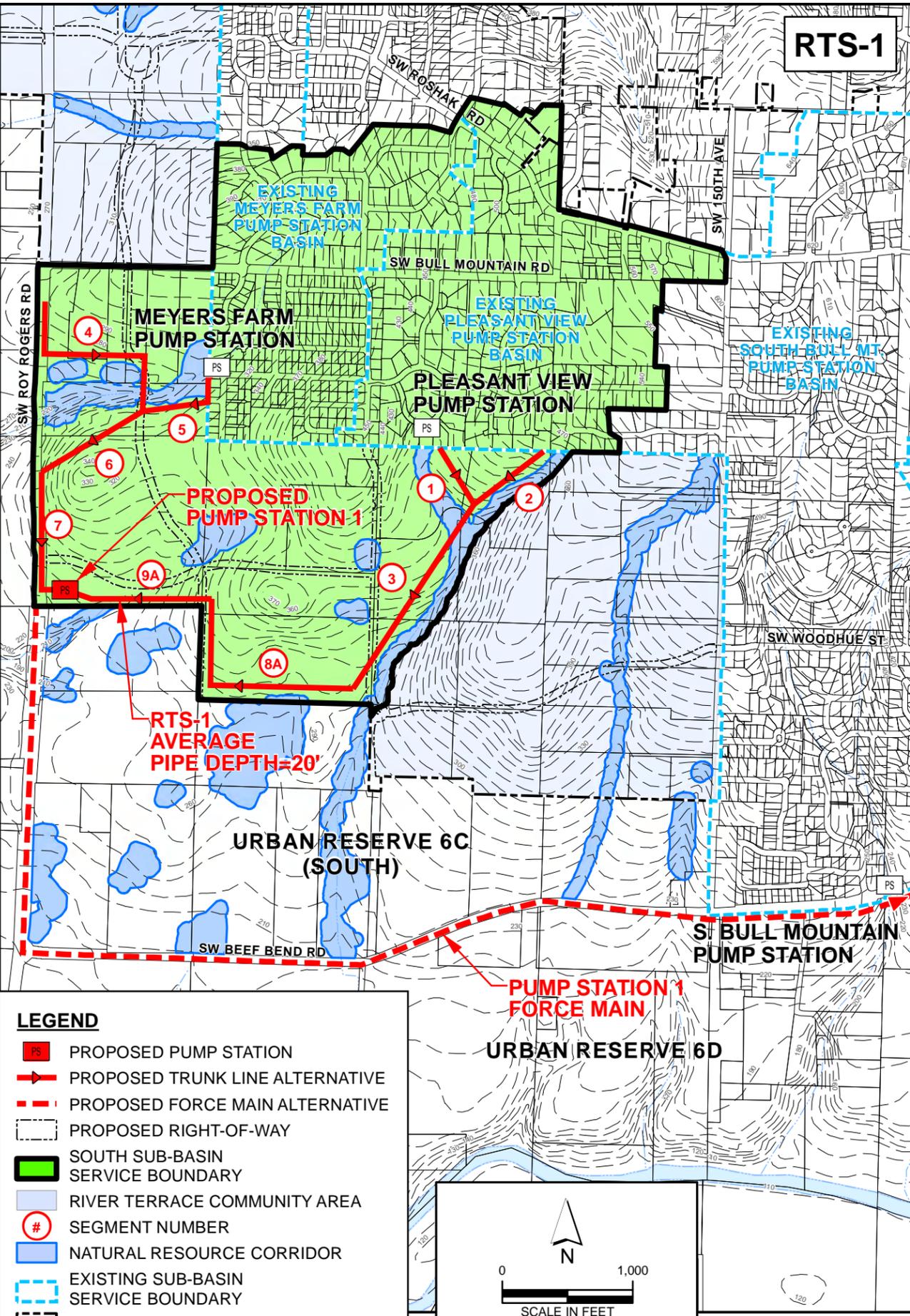
121 S.W. Salmon, Suite 200 PHONE 503.235.9000
Portland, Oregon 97204-2919 FAX 503.235.9022

13-1484

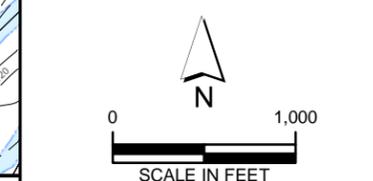
C:\PDX_Proj\csl\131484 - Tigard River Terrace\GIS\CITY OF TIGARD, FIGURES\SEWER SYSTEM\ADDENDUM\13-1484-OR-FIGURE 6 - SOUTH SUB-AREAS.mxd, 4/18/2014, 4:27:36 PM DKH

RTS-1

RTS-2



- LEGEND**
- PS PROPOSED PUMP STATION
 - PROPOSED TRUNK LINE ALTERNATIVE
 - - - PROPOSED FORCE MAIN ALTERNATIVE
 - PROPOSED RIGHT-OF-WAY
 - SOUTH SUB-BASIN SERVICE BOUNDARY
 - RIVER TERRACE COMMUNITY AREA
 - # SEGMENT NUMBER
 - NATURAL RESOURCE CORRIDOR
 - EXISTING SUB-BASIN SERVICE BOUNDARY
 - TIGARD CITY LIMITS
 - 10' CONTOURS



SOURCE:
 CONTOURS - CLEAN WATER SERVICES.
 AERIAL PHOTO - ESRI ARCGIS ONLINE (JULY 2010).
 WATER SYSTEM - CITY OF TIGARD (DEC 2010).
 ALL OTHER BASEMAPPING METRO/RLIS (AUG 2013).

FIGURE 7



CITY OF TIGARD
 RIVER TERRACE COMMUNITY PLAN
 RIVER TERRACE SOUTH SEWER
 SUB-BASIN SERVICE ALTERNATIVES
 January 2014



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13-1484

G:\PDX_Projects\131484 - Tigard River Terrace\GIS\CITY OF TIGARD FIGURES\COMPARISON MEMO\131484-CP-FIGURE 7 - COMPARISON MEMO.RTS.mxd 4/21/2014 11:16:36 AM DKH

CITY OF BEAVERTON

SW SCHOLLS FERRY RD

SW 15TH AVE

SW BARROWS RD

AREA NOT SERVED BY REGIONAL FACILITY - WILL REQUIRE SEPARATE PUMP STATION

URBAN RESERVE 6C (NORTH)

RTN PUMP STATION

NO SEWER SERVICE AND/OR NO DEVELOPABLE LAND

URBAN RESERVE 6C (MIDDLE)

URA 6C (MIDDLE) PROPOSED PUMP STATION

FORCE MAIN TO RTS

PROPOSED PUMP STATION 1 REMOVED UPON URA 6C (SOUTH) DEVELOPMENT

EXTENDED GRAVITY LINE FROM RTS-1 PUMPSTATION

URA 6C (SOUTH) PROPOSED PUMP STATION

URBAN RESERVE 6C (SOUTH)

SW BEEF BEND RD

SW BULL MOUNTAIN RD

SW ROSHAK RD

SW 150TH AVE

SW WOODHUE ST

SW BULL MOUNTAIN RD

S. BULL MOUNTAIN PUMP STATION

LEGEND

- PS PROPOSED PUMP STATION URA 6C (MIDDLE)
- PS PROPOSED PUMP STATION URA 6C (SOUTH)
- - - PROPOSED FORCE MAIN URA 6C (MIDDLE)
- PROPOSED TRUNK URA 6C (SOUTH)
- PROPOSED RIGHT-OF-WAY
- URBAN RESERVE AREA
- DEVELOPED RIVER TERRACE COMMUNITY
- TIGARD CITY LIMITS
- 10' CONTOURS

C:\PDX_Proj\cadd\131484 - Tigard River Terrace\GIS\CITY OF TIGARD_FIGURES\SEWER SYSTEM\ADDENDUM\13-1484-OR-FIGURE 8 - URA ALTERNATIVES.mxd 4/18/2014 4:28:51 PM DKH

0 1,000
SCALE IN FEET

SOURCE:
CONTOURS - CLEAN WATER SERVICES
AERIAL PHOTO - ESRI ARCGIS ONLINE (JULY 2010)
WATER SYSTEM - CITY OF TIGARD (DEC 2010)
ALL OTHER BASEMAPPING METRO/LIS (AUG 2013)

FIGURE 8



CITY OF TIGARD
RIVER TERRACE COMMUNITY PLAN
URBAN RESERVE AREA
SEWER SERVICE ALTERNATIVES
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CITY OF BEAVERTON

URBAN RESERVE 6C (NORTH)

URBAN RESERVE 6C (MIDDLE)

URA 6C (MIDDLE) PROPOSED PUMP STATION

MEYERS FARM PUMP STATION

PLEASANT VIEW PUMP STATION

PROPOSED RTS PUMP STATION 1 REMOVED UPON URA 6C (SOUTH) DEVELOPMENT

URBAN RESERVE 6C (SOUTH)

URA 6C (SOUTH) PROPOSED PUMP STATION

RIVER TERRACE NORTH AREA TRIBUTARY TO SW SCHOLLS FERRY RD TO DRAIN TO BARROW RD TRUNK

SCHOLLS COUNTRY ESTATES PUMP STATION

LEGEND

- PROPOSED PUMP STATION
- PROPOSED TRUNK LINE ALTERNATIVE
- PROPOSED FORCE MAIN ALTERNATIVE
- EXISTING PUMP STATION
- PROPOSED RIGHT-OF-WAY
- RIVER TERRACE NORTH
- RIVER TERRACE SOUTH
- URBAN RESERVE AREA
- NATURAL RESOURCE CORRIDOR
- TIGARD CITY LIMITS
- 10' CONTOURS

FIGURE 9

CITY OF TIGARD
RIVER TERRACE COMMUNITY PLAN
PROPOSED SEWER SERVICE

January 2014

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13-1484

G:\PDX_Projects\131484 - Tigard River Terrace\GIS\CITY OF TIGARD, FIGURES\SEWER SYSTEM\ADDENDUM\3-1484-OR-FIGURE 9 - COMPOSITE.mxd 4/19/2014 4:30:13 PM DKH

Item 2 - Attach. 3

Preliminary Water and Sewer Funding Analysis: Findings and Strategies for River Terrace

4/28/2014

		WATER
1. Funding Trend Expected without River Terrace	1.1	Lake Oswego/Tigard Water Partnership Commitments in Place
	1.2	City bond proceeds of up to \$51 million needed by FY 2020
	1.3	Water fund must exceed 1.15 minimum coverage, plus establish Debt Service Reserve Fund equal to 1 year of debt service
	1.4	Utility rate increases are planned to meet these requirements
	1.5	Water utility customer accounts outside River Terrace estimated to increase from 19,875 (FY 2015) to 20,236 (FY 2020); 0.45% avg. annual growth rate
	1.6	Annual O&M requirements are estimated to decrease from \$8.4 M (FY 2015) to \$7.9 M (FY2020) without River Terrace
	1.7	Annual avg. water rate revenue per account is estimated to increase from \$454 to \$495 per year (between FY 2015 and FY 2020)
	1.8	Available resources from water system development charges (SDCs) for capital projects expected to increase from \$2.9 million (FY 2015) to \$8.1 million (FY 2020)
2. Funding Impacts with River Terrace	2.1	Anticipate 280 to 460 net new dwelling units added in total between FY 2016-17 and FY 2020-21
	2.2	River Terrace is not expected to significantly impact City water rates or O&M costs
	2.3	No change compared with baseline unless city chooses to assist developers in constructing new water transmission lines in River Terrace
	2.4	Available resources from water SDCs for capital projects (city-wide) expected to range from \$8.1 to \$14 million FY 2020
3. Draft Funding Strategies for River Terrace	3.1	City water SDC fund balance could help fund or finance capital projects in River Terrace
	3.2	City can also use pay-as-you-go CIP funding for smaller projects
4. Potential Public Facility Plan Projects for River Terrace (by FY 2020)	Potential City-Led Projects	
	4.1	Pressure Reducing Valve (design & construction)
	4.2	3.0 MG Cach Reservoir (design/construction)
	4.3	Design of transmission mains in 550 and 410 zones
	Potential Public-Private Projects	
4.4	16-inch transmission mains in 550 zone (design starting in 2016; construction subject to development agreements and SDC credits)	
4.5	20-inch transmission mains in 410 zone (design starting in FY 2016; construction subject to development agreements and SDC credits)	

PRELIMINARY SUMMARY FINDINGS: WATER

The City of Tigard's Water Fund is being programmed to make major investments per the LO-Tigard Water Partnership. Prior and planned rate increases should adequately address revenue requirements and enable the city to proactively construct capital projects that benefit existing and future customers, including those in River Terrace. Development Agreements could be utilized to allow private (developer) construction of water lines (eligible for SDC credits).

Preliminary Water and Sewer Funding Analysis: Findings and Strategies for River Terrace

4/28/2014

SANITARY SEWER	
1. Funding Trend Expected without River Terrace	<p>1.1 City currently maintains 167 miles of sanitary system lines</p> <p>1.2 Utility accounts estimated to increase from 18,162 (FY 2015) to 18,736 (FY 2019-20) outside River Terrace; assumes 0.45% avg. annual growth rate</p> <p>1.3 Annual sewer O&M requirements expected to increase from \$1.8 M (FY 2015) to \$2.2 M (FY 2020) without River Terrace</p> <p>1.4 City CIP projects include \$8.5 million over next 5 years, including: Krueger Creek Bench View Slope Stabilization; Dairy Dell Creek Sewer Interceptor (line, trail, boardwalk, roadway); East Tigard Sewer Replacement Program</p> <p>1.5 Sewer fund is shrinking from \$4.1 million in FY 2014 to (\$3.0 million) by FY 2019, a \$7.0 million decrease or approximately \$1.4 million per year. The use of remaining reserves to pay for operations and CIP projects is estimated to result in a negative Sewer fund balance in FY 2017.</p> <p>1.6 Tigard should consider local city-wide sewer surcharge to allow city to fund its operational and capital needs in the Sanitary Sewer Fund. The City of Tigard Budget Committee has recommended hiring an outside firm to assist with this analysis.</p> <p>1.7 Available resources from sewer system development charges (SDCs) for capital projects are nominal with or without River Terrace</p>
2. Funding Impacts with River Terrace	<p>2.1 Anticipate 280 to 460 net new dwelling units added in total between FY 2016 and FY 2020 (June)</p> <p>2.2 River Terrace is not expected to significantly impact sewer rates, but O&M costs may increase slightly as new lines require inspection</p> <p>2.3 No change in debt service compared with baseline scenario; city not likely to have resources available to assist with sewer lines in River Terrace</p> <p>2.4 Available resources from sewer SDCs for capital projects are nominal with or without River Terrace (less than \$100,000 over next 5 years)</p>
3. Draft Funding Strategies for River Terrace	<p>3.2 City may need to delay CIP projects and implement an areawide utility surcharge to maintain positive fund balance with or without River Terrace</p> <p>3.3 City could utilize pay-as-you-go CIP funding for sewer gravity line design; but will need to rely on Clean Water Services (CWS) and developers to fund and construct sewer improvements in River Terrace</p>
4. Potential Public Facility Plan Projects for River Terrace (by FY 2020)	<p>Potential City-Led Sanitary Sewer Projects</p> <p>4.1 Sewer gravity main lines design</p> <p>CWS Sanitary Sewer Improvements</p> <p>4.2 North Pump Station (design underway, construction in FY 2015-16)</p> <p>4.3 South Pump Station (design and construction potentially by FY 2019-20)</p> <p>Potential Public-Private Projects</p> <p>4.4 Potential for interim gravity line connection to new development may be available per CWS approval</p>

PRELIMINARY SUMMARY FINDINGS: SEWER

The City of Tigard's Sanitary Sewer Fund is financially challenged with or without River Terrace, and a local city-wide surcharge is recommended. The city will need to coordinate with CWS to ensure that planned pump stations and force mains serving River Terrace are constructed in a timely manner. The city's limited financial resources may be focused on design of gravity main lines. Development Agreements can be utilized to allow private (developer) construction of gravity lines (eligible for SDC credits, subject to approval by CWS).